THE MASTER PLAN STUDY ON IMPROVEMENT AND REHABILITATION OF ROAD NETWORK IN ULAANBAATAR IN MONGOLIA

FINAL REPORT

SUMMARY

March 1999

PACIFIC CONSULTANTS INTERNATIONAL
YACHIYO ENGINEERING CO., LTD

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF INFRASTRUCTURE DEVELOPMENT
OF GOVERNMENT OF MONGOLIA
ULAANBAATAR CITY GOVERNMENT

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The following exchange rate is applied in this report:
US$ 1.00 = Tug 838.46 = Yen 140.45
Yen 1.00 = Tug 5.97
(July 1, 1998)

PREFACE

In response to a request from the Government of Mongolia, the Government of Japan decided to conduct the Master Plan Study on Improvement and Rehabilitation of Road Network in Ulaanbaatar in Mongolia and entrusted to study to the Japan International Cooperation Agency (JICA).

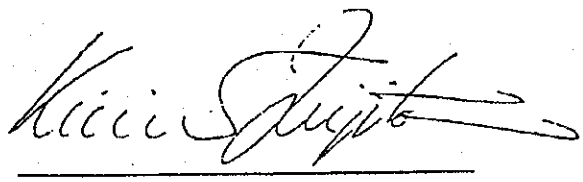
JICA selected and dispatched a study team headed by Mr. Koki Kaneda of Pacific Consultants International and consisting of PCI and Yachiyo Engineering Co., Ltd. to Mongolia, between January 1998 and March 1999.

The team held discussions with the officials concerned of the Government of Mongolia and conducted field surveys in the study area. Upon returning to Japan, the team conducted further studies and completed this final report.

I hope that this report will contribute to the realization of recommended projects and to the enhancement of friendly relationship between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Mongolia for their close cooperation extended to the study team.

March 1999



Kimio Fujita
President
Japan International Cooperation Agency

March 1999

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir:

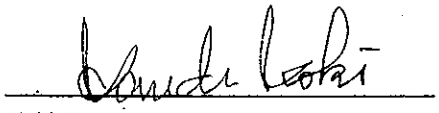
We are pleased to submit herewith the Final Study Report of the Master Plan Study on Improvement and Rehabilitation of Road Network in Ulaanbaatar in Mongolia. The study was conducted by the team of Pacific Consultants International and Yachiyo Engineering Consultant Co., LTD during the months from January 1998 to March 1999 under the contract with Japan International Cooperation Agency.

Generally, the road network plan should be prepared based on the City Master Plan. The previous Ulaanbaatar city master plan is under review by the city government and the revised plan is expected to be finalized after the completion of this road master plan study. The Mongolian side and the study team formulated the socio-economic frameworks for the target year of 2020. The road development master plan for 2020 was determined in those frameworks. Then, feasibility studies were conducted for projects selected from the master plan, and prioritized projects with their technical and economic viability were proposed.

In view of the necessity of the road network development, we recommend that the Government of Mongolia will implement the selected projects at the earliest opportunity.

We wish to express our sincere gratitude to your Agency, Ministry of Foreign Affairs, Ministry of Construction, and Ministry of Transport of Japan. We also wish to express our deep gratitude to the officials concerned of Ministry of Infrastructure Development of Mongolia, the Road Department and Ulaanbaatar City of Mongolia as well as to the Embassy of Japan and JICA Office in Mongolia for close cooperation and assistance extended to the study team.

Very truly yours,



Koki Kaneda
Team Leader
Master Plan Study on Improvement and Rehabilitation
of Road Network in Ulaanbaatar in Mongolia

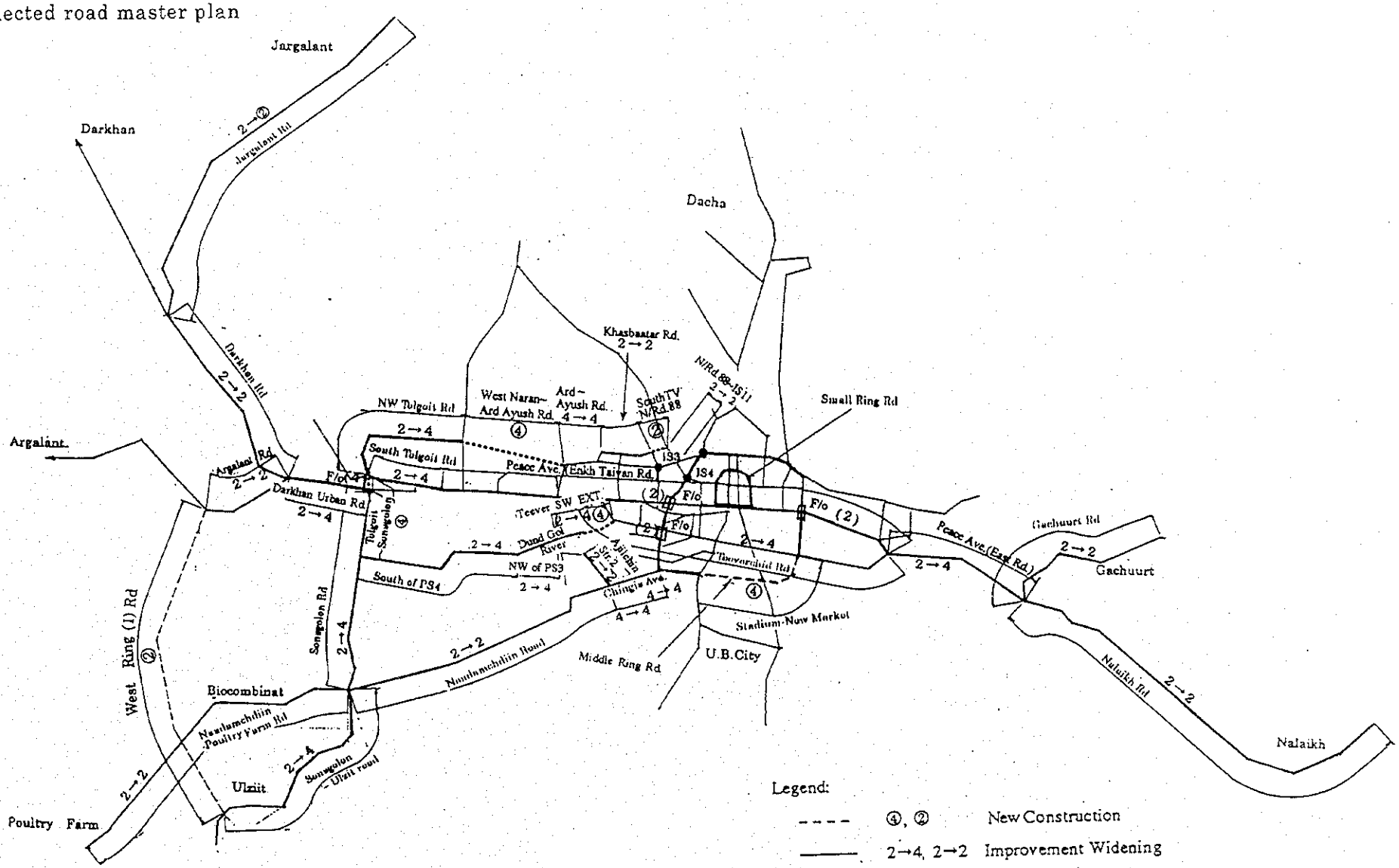
Location Map

PROJECT SUMMARY

Name of Study	The master plan study on Improvement and Rehabilitation of Road Network in Ulaanbaatar in Mongolia
Counterparts Agency	Road Department and Ulaanbaatar City Government
Objectives	Determine a **road development master plan** for 2020 and **feasibility study** of high priority projects
Study area	Greater Ulaanbaatar area for the master plan and urban streets for the feasibility study

Traffic in 1998	The maximum volume was 35,000 vehicles per day on the central section of Peace Avenue
Traffic in 2020	The maximum volume will be 65,000 vehicles per day at the same section. Traffic congestion will be found in the west and south parts of the city.
Public transport	Passengers on service of bus & trolley will increase 1.54 times (1.97% per annum) in 2020. An amount of US$23 million was estimated for years by 2005 for vehicle replacement.

The selected road master plan



Required Traffic Lane for Best Alternative R7 Future Road Network in 2020

Projects under the feasibility study (Cost in 1998 Prices)

Route	Construction	Fin. cost	B/C ratio	EIRR	NPV
Central	2 Years.	5.6 million	1.54	14.7 %	2.1 million
North	4	35.3	0.71	6.4 %	-6.7
South	6	46.7	1.10	11.3 %	2.9
Ring	3	18.4	1.03	10.5 %	0.4

PRIORITY PROJECTS

Priority projects were selected by taking into consideration of various factors including financial constraints in the country, changes in land use along the route, opening of the new central market.

Priority projects	Fin. Cost in 1998 prices
1.The western part of Central Route in railway crossing and adjacent roads toward the north	5.6 million
2.The widening of the Teeverchid Rd. for 8.4km in South Route	17.0
3.A fly-over construction at East Cross Intersection of Ring Road	2.4
Total	US$ 25.0 million

Recommendations

Technical matters

1. Increase revenues by raising taxes on fuels and vehicle registration by stage
2. Develop a routine maintenance system of roads in Ulaanbaatar
3. Strengthen of quality control and supervising system in works on roads
4. Restructure in road administration of Ulaanbaatar
5. Improve contractors in technical performance and assets and equipment
6. Develop the road inventory filing system with its periodic reviewing
7. Restructure public corporation of bus and trolley, including staged increases of user fares
8. A request for ADB, World Bank or JICA in financial aid for having advisors in Transport Coordination Department of the city government

Political matters

1. Develop a master plan of roads in long term, maintain right of ways for the future and set up legal background in land acquisition
2. Utilization of empty lands for temporary water ponds subject for exemption from land taxes with legislative supports.
3. The government of Mongolia should clarify procedures to determine the priority of projects in road network improvement in Ulaanbaatar among other feasible projects claimed by respective agencies.

OUTLINE OF THE STUDY

Name of Study	: The Master Plan Study on Improvement and Rehabilitation of Road Network in Ulaanbaatar in Mongolia
Study Period	: January 1998 – March 1999
Counterpart Agency	: Road Department in Ministry of Infrastructure Development and City Government of Ulaanbaatar

1. Background

The Greater Ulaanbaatar (GUB) comprises of Ulaanbaatar City and 6 satellite towns extending the territory for 4,700 sq. km with a population of 630,000 (1998). Most part of the territory is occupied by mountains and hills with the elevation of 1,300 - 2,000 m above sea level. The territory of urbanized Ulaanbaatar (UUB) is stretching for 30km in east to west in the area of 150 sq. km (about 3% of that of GUB) with 540,000 inhabitants (about 86% of that of GUB). Transport in UUB depends, mainly, on vehicles.

2. Objectives

Since 1993, the vehicles registered have increased at an annual growth rate of 7%. After the collapse of the USSR in 1989, the country's economy is facing difficulties and the maintenance of roads was not carried out properly during the last 10 years. The objectives of the Study are to establish a long-term road development plan for year 2020, and to conduct a feasibility study (F/S) for high priority projects in order to implement the most appropriate long term road network plan.

3. Study Area

The study area covered GUB including satellite towns of Nalaikh, Gachuurt, Ulziit, Biocombinat, Poultry Farm and Jargalant. However, roads in Urbanized Ulaanbaatar were taken in the master plan study and feasibility study.

. Study Outlines

4.1 Basic Approach

Using the existing road master plan, a super long term road development plan (R1) was first determined. Examining the R1, six alternative master plans (R2-R7) were produced and evaluated, resulting in the selection of the plan (R7) for 2020. Feasibility study was carried out for project components of R7. As the amount was too heavy for the realization by Mongolian government. priority projects were selected from FS projects and recommended for earlier implementation.

4.2 Process to the Determination of the Long Term Master Plan

(1) Road Inventory Surveys

Roads in Ulaanbaatar were classified as right:

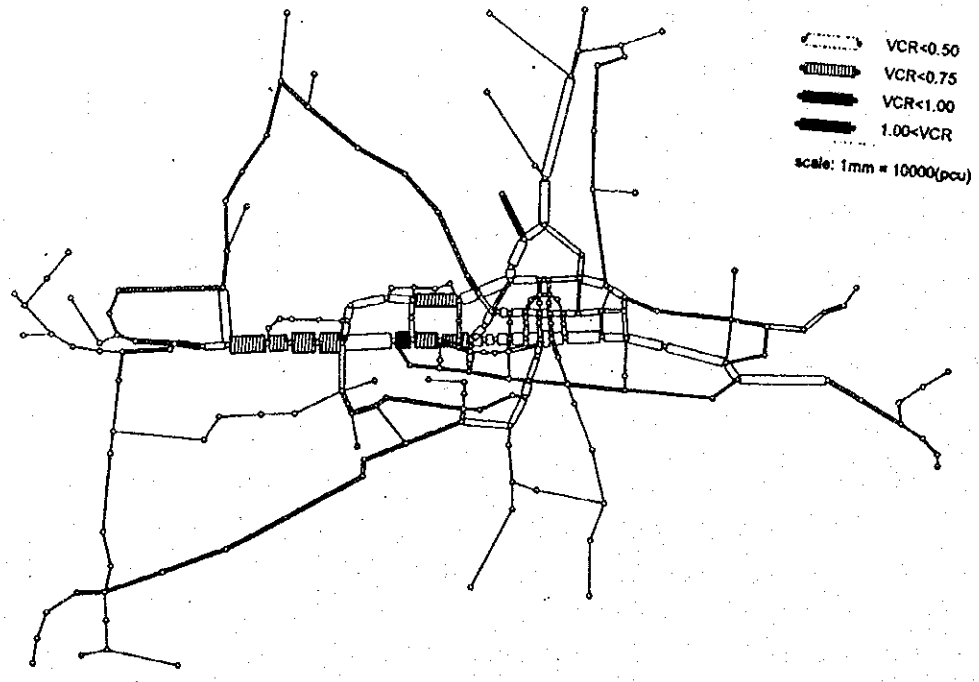
National Road	76.5
Regional Road	78.0
City Road	168.8
Others	94.9
Total	418.2

Inventory surveys were conducted for roads of 227 km, bridges of 32 and intersections of 10. They were grouped in four categories by referring to HDM methods. Of roads 227 km in total surveyed, 20 km were recorded as in 'bad condition'. Deterioration of roads were accelerating during the months of the study.

Most bridges were constructed by RCT type, while only 3 bridges were made of PC type. Of those, 4 bridges were found in bad conditions.

(2) Traffic Surveys

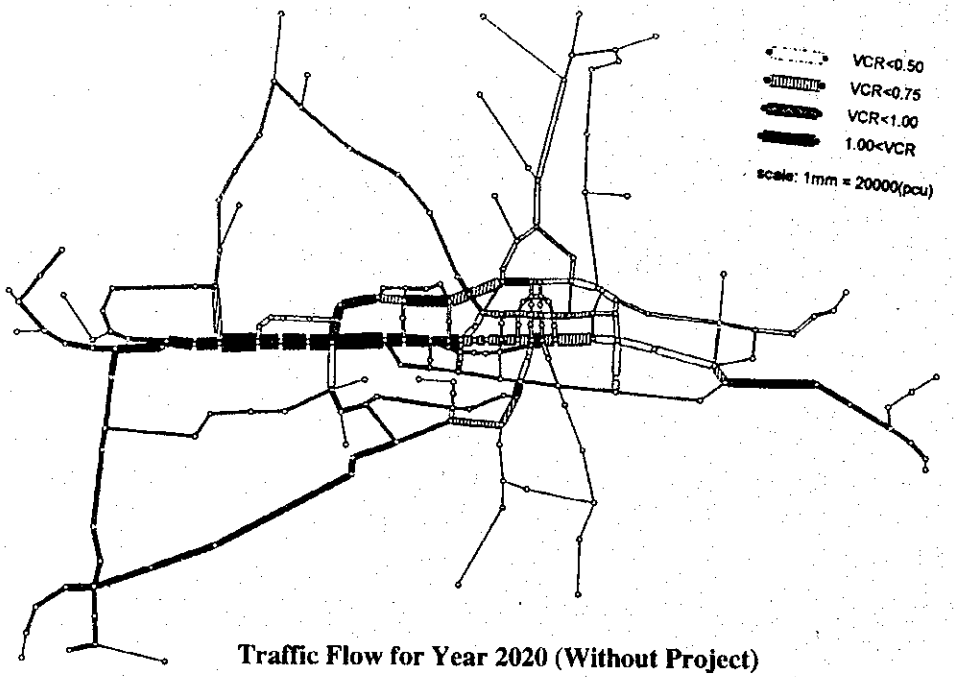
Traffic surveys of 8 types were conducted in May – June 1998. The largest traffic volume was counted on a section of Peace Avenue at 35,000 vehicles per day.



Traffic Flow for Year 1998

(3) Traffic Forecast

The study area was delineated into 52 zones and traffic forecasts were conducted. The traffic flow in 1998 showed no congestions. While roads in 1999 assuming the opening of the new central market showed increases in traffic on Teeverchid Road and other adjacent roads, but heavy congestion was not forecast. The forecast in 2020 showed a volume of 65,000 on the central section of Peace Avenue and traffic congestion was found on roads in the west and south part of Ulaanbaatar.



Traffic Flow for Year 2020 (Without Project)

(4) Public Transport in Future

At present, passengers on the public transport service occupy 80 % of the total person trips. The public transport users in 2020 were forecast to increase by 1.54 times than 1998, which means the annual average rate of increase at 1.97 % during those years. In order to sustain the service, two vehicle replacement plans were proposed and EIRR was calculated. The plan which incorporated in a gradual phase out of trolleys showed a higher return of 34% with an estimated cost of $104.6 million in 1998 prices. When the first stage up to 2005 of this plan is taken up, renewal of 150 buses, 53 trolleys and rehabilitate power lines on roads of 18km is necessary with a total cost of US$23.3 million.

(5) Design Standards

Mongolia adopted the standards originated from the Russians in the past. It was agreed to use some from AASHTO and the Japanese ones. The maximum design speed on roads in the urban area was determined at 60km, lane numbers were set at 2, 4and 6 with the traffic volume of 9,000, 37,000 and 56,000 respectively.

(6) Cost Estimate of Alternative Long Term Plans

Alternative long term road plans (R2-R7) were formulated with different plans of new construction and improvement for years up to 2020. Financial cost (million US$) was estimated for each plan.

	Outline	Financial cost
R2	Principal road network plan for long term period. All main roads are expanded to be 4 lanes	246
R3	Reduced the northern route to 2 lanes. New road at the south side of TV stations. Improvement of Rd No 88 for 0.4 km	228
R4	Reduce the southern route at 2 lanes.	230
R5	Reduce the Naadamchidiin road at 2 lanes	231
R6	Reduce the Naadamchidiin road at 2 lanes. Northern route will connect from west Naran to Ardayush by 4 lanes. Expand Teeverchid street to Peace avenue at the west end. The roads of South of PS4 and PS3 are 2 lanes	238
R7	Modification of R6 Khasbaatar road shall be 2 lanes	226

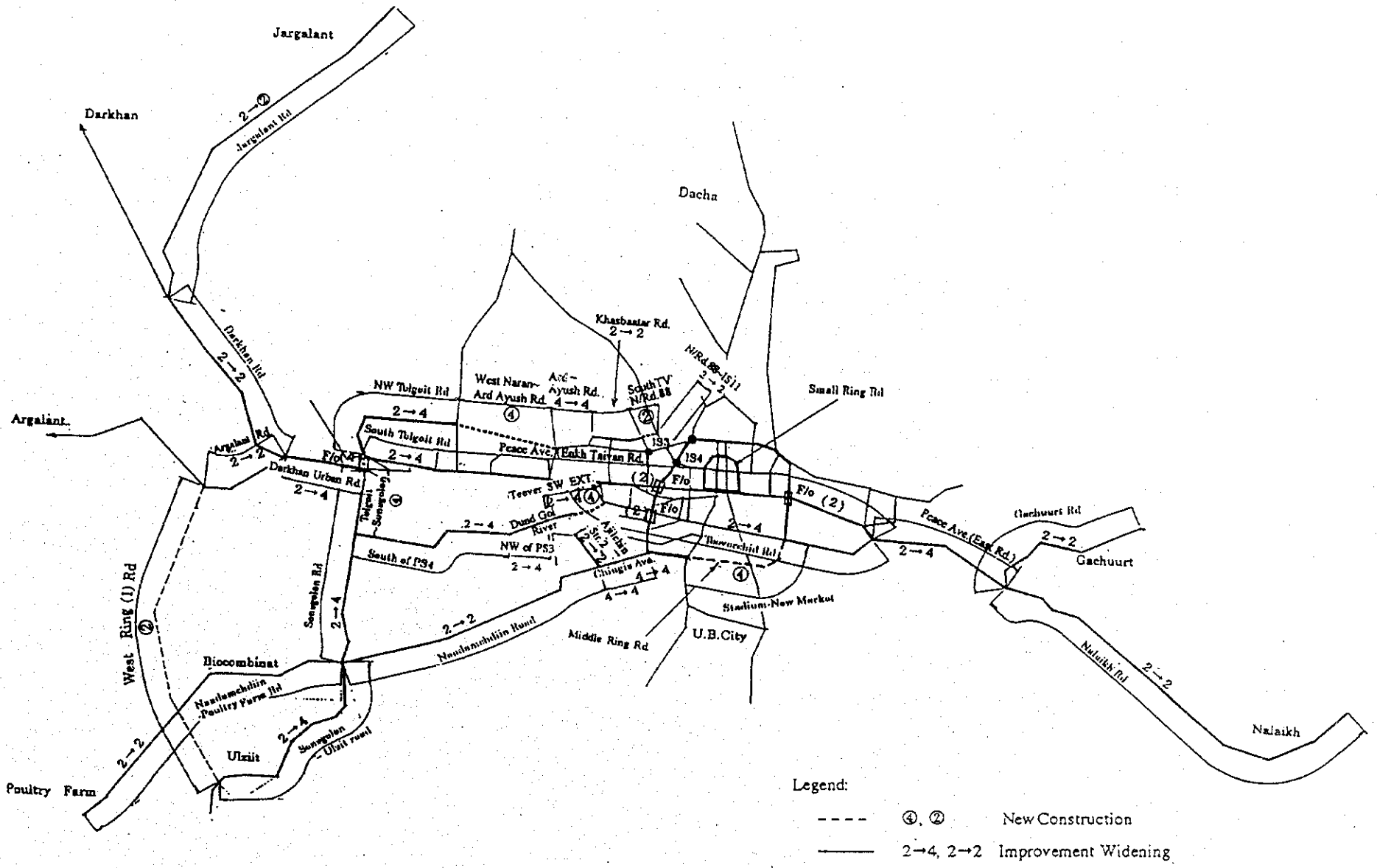
(7) Economic Evaluation and Others

Economic evaluation was conducted for 6 alternative plans in terms of forecast traffic in 2020 and the average annualized cost. Evaluation in other aspects including the relocation problem of habitants in the corridor was also conducted.

Evaluations of Alternative Plans (R2 - R7) (Unit million US $)

Future Road Network	Total Economic Cost	Annualized Economic Cost	Annual Economic Benefit			General Assessment		
			VOC Savings	Time Savings	Total Savings	Economic Cost	B/C ratio	Environ & Relocation
R2	236.1	27.7	33.3	3.1	36.4	D, largest	D, 1.311	D, least
R3	218.9	25.7	32.8	3.1	35.9	B, normal	B, 1.396	B, normal
R4	220.4	25.9	33.2	3.1	36.3	B, normal	B, 1.402	A, better
R5	221.8	26.1	31.8	3.0	34.8	C, lager	D, 1.336	C, less
R6	228.0	26.8	33.7	3.2	36.8	D, largest	C, 1.374	C, less
R7	216.8	25.5	33.1	3.1	36.2	A, least	A, 1.423	B, normal

Notes: Rank , A; Good, B; Fair, C; Poor, D; Bad (Costs and Benefits are in US$'000)



Required Traffic Lane for Best Alternative R7 Future Road Network in 2020

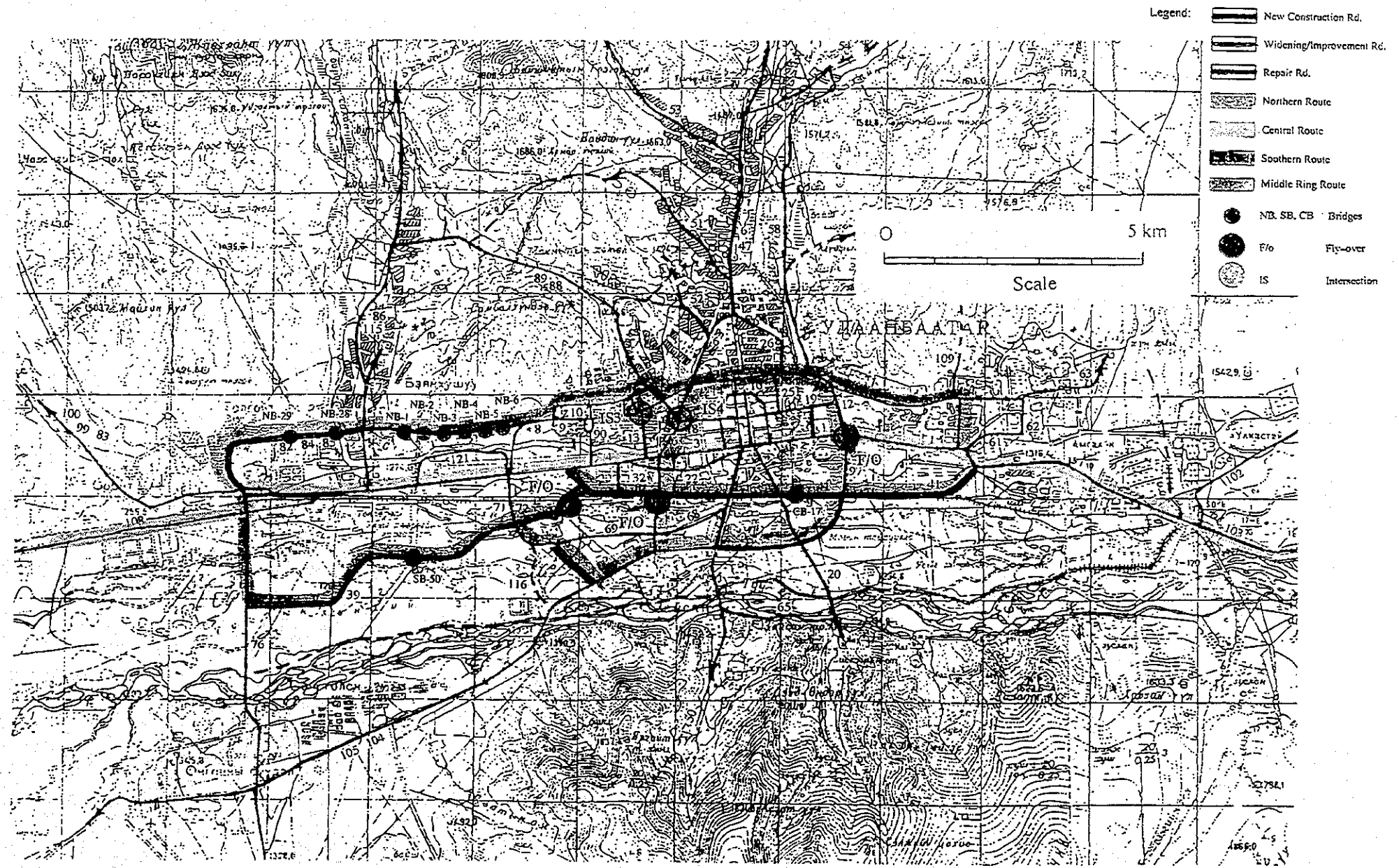
(8) Funding Sources for Road Development

In 1997, revenue of the Mongolian budget was US$267 million and her expenditure was US$366 million. From that, US$ 5 million were allocated as the road budget and 10% of which US$ 0.5 million were received by UB city. The amounts are too short to cover maintenance activities.

Budgets for the country and roads are estimated for years in future under some assumptions and it is thought there will be surplus over the expenditure with which the country can pay back new loans for roads annually.

4.3 Feasibility Study for the Selected Plan R7

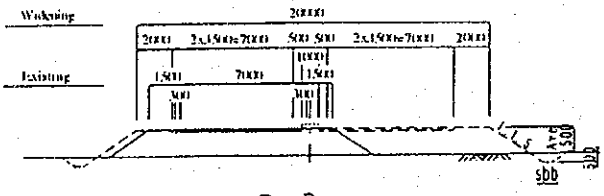
Feasibility study was conducted for the components of the long term plan R7, in which basic approach was to utilize mostly the existing road facilities. Improvement and rehabilitation were considered, while new construction was included in minimum necessity.



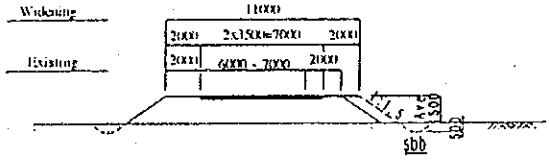
Location Map for FS Project

(1) Preliminary design

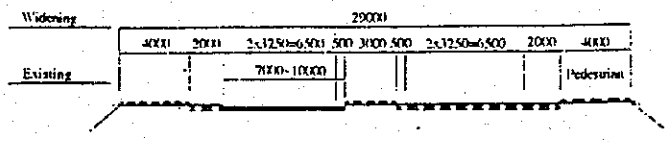
Improvement and Widening of roads were designed by using the criteria agreed with Mongolian side, and quantities were calculated. Existing bridges subject for widening would remain after repair works, while a new 2 lane bridge was designed to be constructed in parallel. Drainage system in the city was found decreasing the capacity because of negligence of maintenance and cleaning. Open side drains were designed at places necessary, particularly on roads in newly developing areas.



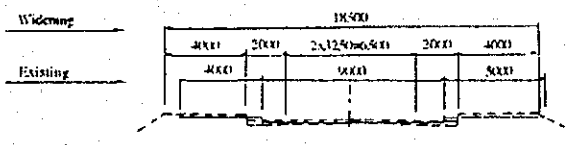
Type D
for category A Regional Road (2 - 4 Lanes)



Type E
for category A Regional Road (2 - 2 Lanes)



Type F
for category B Primary Road (2 - 4 Lanes)



Type G
for category B Primary Road (2 - 2 Lanes)

Cross Section for Improvement and Widening

(2) Machines and Equipment

Most of machine and equipment supplied in previous aid projects from Japan. could be utilized for implementation of projects under this study, however equipment for concrete work and cranes are necessary.

(3) Construction Period

Construction Schedule for All Projects

	Cost (MUS$)	Ratio	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year
Central Route	5.6	5.3%	~~10.0%~~	35.0%	55.0%					
			0.5%	1.9%	2.9%					
North Route	35.3	33.3%				~~10.0%~~	10.0%	30.0%	30.0%	20.0%
						3.3%	3.3%	10.0%	10.0%	6.7%
South Route	46.7	44.1%		~~5.0%~~	10.0%	20.0%	~~20.0%~~	20.0%	15.0%	10.0%
				2.2%	4.4%	8.8%	8.8%	8.8%	6.6%	4.4%
Ring Road	18.4	17.4%			~~10.0%~~	5.0%	35.0%	50.0%		
					1.7%	0.9%	6.1%	8.7%		
Total	106.1	100.0%	0.5%	4.1%	9.1%	13.0%	18.2%	27.5%	16.6%	11.1%

Notes —— Design ~~——~~ construction

(4) Cost Estimation for F/S Projects

Summary of Cost of F/S Projects (Unit: million US$)

	F/S Project	Total Length (km)	Local Currency Portion	Foreign Currency Portion	Total Cost
1	Central Route	25.43	1.3	4.3	5.6
2	Northern Route	26.26	6.7	28.6	35.3
3	Southern Route	28.76	9.1	37.6	46.7
4	Middle Ring Route	16.48	3.3	15.1	18.4
	(Sub-Total for All Routes)	96.93	20.1	84.6	104.7
5	Repair of Ajilchin Street 2	1.10	.1	.4	.6
6	Intersection Improvement	(10places)	.1	4.3	4.4
7	New Drainage Facilities	1.10	1.9	2.8	4.6
8	Construction and rehabilitation of bus stops	(2places)	.4	.3	.7
9	Environmental Protection		.1	1.2	1.2
	(Sub-Total)		2.5	9.0	11.5
	Total		22.6	93.6	116.2

(5) Economic Evaluation of F/S Projects

It can be seen from this table that all the routes (except the Northern Route) are economically feasible. The economic performance of Central Route is highest followed by the Southern Route.

Summarized Results of Economic Evaluation

Route	Economic Cost (in MUS$)	B/C	IRR	NPV
Central Route	4.9	1.54	14.7%	2.1
Northern Route	31.6	0.71	6.4%	-6.7
Southern Route	41.6	1.10	11.3%	2.9
Middle Ring Route	16.4	1.03	10.5%	0.4
All Routes	93.4	0.94	9.3%	-3.1

B/C : Benefit-Cost Ratio ;IRR : Internal Rate of Return ;
NPV : Net Present Value in million US$

(6) Environmental Impact Assessment

Mitigation of air pollution is necessary to enforce reducing exhaust gas from vehicles, to act traffic demand management and to establish greenbelts along the road. For reducing noise and vibration during the construction, noise cover for machines and low noise producing equipment such as vibrator driver (instead of pile driver) should be used, where the additional cost was estimated at US$43,000.

(7) Road Maintenance

Annual maintenance cost was estimated for different road groups as in the followings.

Priory		Length of road	Expected yearly maintenance cost (Assumed: $5/ m2-year:width 10m)
1.	The roads for public bus routes	158km	1,580,000*5= US$7.9 million
2.	Busy roads	About 60km	600,000*5= US$3.0 million
3.	Political important roads	About 20km	200,000*5= US$1.5 million
4.	District roads	95km	950,000*5= US$4.7 million

(8) High Priority Projects

High priority projects were selected from the result of F/S for the components of the long term plan, R7, at a cost of US$25 million in 1998 prices.

Projects	Cost/Term	Reasons	Remarks
Improvement of irregular Cross section with railway at western part of Enkh Taivan and development of road for the access to northern route.	US$ 5.6 million 3years	The largest efficiency is ensured by small cost. It will contribute to solve the forecasted traffic congestion in the Central route and to prevent accidents with railway.	The efficiency may become larger after the completion of the northern route in future. **EIRR=14.7%**
Widening of Teeverchid Road (Length:8.4km)	US$ 17.0 million 4years	First, this widening is effective for the solution of traffic congestion immediately due to the opening of new central market in 1999. Second, this project has a position as the part 1 of Southern route, which should be completed as the alternative route of the congested central route in 2020.	Recently the development of the land along the road is in good progress and the acquisition of land is becoming difficult. **EIRR=11.3%**
Fly-over on East cross intersection	US$ 2.4 million 3years	This is a part of Middle Ring Road and the flyover will contribute to the solution of traffic congestion due to the opening of new central market.	Although the B/C of Middle Ring Road reaches minimum requirement, the East Cross intersection is considered in urgent need of improvement for reducing the future traffic congestion in city center area. **EIRR=10.5%**
Total Cost	US$ 25.0 million		

(9) Public Transport System

The followings are recommended to sustain the public transport system in future.

1. Re-organization between companies and within each company.
2. Raising of fare step by step. Reduction of the scope of people applicable to free bus service. Actions by conductors to delete the nonqualified passengers.
3. Introduction of new ticket system for allowing free transfer among routes and others.
4 Sale of the existing and new bus routes to private sectors should be considered.
5. Government and city office should take measures to increase the efficiency of bus operation. (e.g. bus exclusive lane, improvement of bus stop, etc.)

(10) Recommendations

1) Technical Matters

1. Increase revenues by raising taxes on fuels and vehicle registration by stage
2. Develop a routine maintenance system of roads in Ulaanbaatar
3. Strengthen of quality control and supervising system in works on roads
4. Restructure in road administration of Ulaanbaatar
5. Improve contractors in technical performance and assets and equipment
6. Develop the road inventory filing system with its periodic reviewing
7. Restructure public corporation of bus and trolley, including staged increases of user fares
8. A request for DAB, World Bank or JICA in financial aid for having advisors in Transport Coordination Department of the city government

2) Political Matters

1. Develop a master plan of roads in long term, maintain right of ways for the future and set up egal background in land acquisition
2. Utilization of empty lands for temporary water ponds subject for exemption from land taxes with legislative supports.
3. The government of Mongolia should clarify procedures to determine the priority of projects in road network improvement in Ulaanbaatar among other feasible projects claimed by respective agencies.

Table of Contents

List of Tables

List of Figures

ABBREVIATION

AADT	Average Annual Daily Traffic
ADB	Asian Development Bank
a.g. rate	annual growth rate
ave.	average
Ave.	Avenue
BCH	Vedomstvennye Stroitelnye Normy (Translated from Russian: Departmental Construction Norms)
BNbD..	Barilgyn Norm ba Durem (Translated from Mongolian: Construction Norms and Regulations)
BOD	Biochemical Oxygen Demand
Brg.	Bridge
CBD	Central Business District
CBR	California Bearing Ratio
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
Corp.	Corporation
D	Diameter
DCSCs	District Construction and Service Companies
DEIA	Detailed Environmental Impact Assessment
Dept.	Department
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
Fig.	Figure
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
GUB	Greater Ulaanbaatar
HDM	Highway Design and Maintenance Standards Model
IBRD	International Bank of Reconstruction and Development
IEE	Initial Environmental Examination
IS	Intersection
LG	Local Government
M$	US$ in miilion
MER	Ministry of External Relations
MID	Ministry of Infrastructure Development
MNE	Ministry of Nature and Environment
MT	Tugrug in million
NO2	Nitrogen Dioxide
NUUTS	Company Name
OD	Origin-Destination
PS	Power Station
Pop.	Population
R1	Road Network Plan Alternative 1
R2	Road Network Plan Alternative 2
R3	Road Network Plan Alternative 3
R4	Road Network Plan Alternative 4
R5	Road Network Plan Alternative 5
R6	Road Network Plan Alternative 6
R7	Road Network Plan Alternative 7
RD	Road Department
Rd.	Road
SACO N&E	State Administrative Central Organization, Nature and Environment
SO2	Sulfer Dioxide
SniP	Stroitelnye Normy i Pravila (Translated from Russian: Construction Norms and Regulations)
Str.	Street
TCD	Transport Coordination Department, Government of Ulaanbaatar
TDS	Total Dissolved Solid
Tug, Tg, tug,	Tugrug (Mongolian Currency)
UB	Ulaanbaatar
UBCMO	Ulaanbaatar City Mayor's Office
UUB	Urbanized Ulaanbaatar Area
VCR	Volume Capacity Ratio
VOC	Vehicle Operation Cost
WB	World Bank

Chapter 1 Introduction

1.1 Background of the project

(1) General

In response to the request of the Government of Mongolia, the Government of Japan decided to conduct the Master Plan Study on Improvement and Rehabilitation of Road Network in Ulaanbaatar (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, undertook the Study in close relation with the authorities concerned of the Mongolia.

JICA organized the Study Team to conduct the Study. The Study Team carried out the study in close cooperation with the Mongolian authorities from January 1998 till March 1999.

This report comprises the results of the Study including analysis and recommendations for the road network and priority projects in Ulaanbaatar City.

(2) Ulannbaatar

Ulaanbaatar, the capital city of Mongolia has a territory of 4,700 sq. km and a population of 630,000 (1998). It is about one fourth of the whole population of Mongolia. Most part of the territory is occupied by mountains and hills with the elevation of 1,300 - 2,000 m above sea level.

Greater Ulaanbaatar (GUB) comprises of Ulaanbaatar City and 6 satellite towns of Nalaikh, Gachuurt, Ulziit, Biocombinat, Poultry Farm and Jargalant. The territory of urbanized Ulaanbaatar (UUB) is just 150 sq. km (about 3% of that of GUB) with 540,000 inhabitants (about 86% of that of GUB). The city has a long but narrow shape stretching for 30 km from the east to the west with a width of 5 km. The Tuul river flows along the foot of Bogdo mountain on the southern part of the city. Mountain slopes with almost no vegetation dominate the northern side of the city.

Transport in UUB depends, mainly, on vehicles. The railway is used only for inter-city services. Since 1993, the traffic volume has increased at an annual growth rate of 7%. The share of the public transport such as bus and trolley-bus is about 80% of the total passenger demand in UUB.

However, the development of road network, as the social infrastructure, is lagging behind the increase of the number of vehicles and traffic. After the collapse of the USSR in 1989, the country's economy is facing difficulties and the maintenance of roads was not carried out properly during the last 10 years. There are many damaged places that could have been remedied at an earlier stage with fewer expenses, but they were left unremedied. As a result, a number of such places require more expenses than earlier.

1.2 Objectives of the Study

The objectives of the Study are :

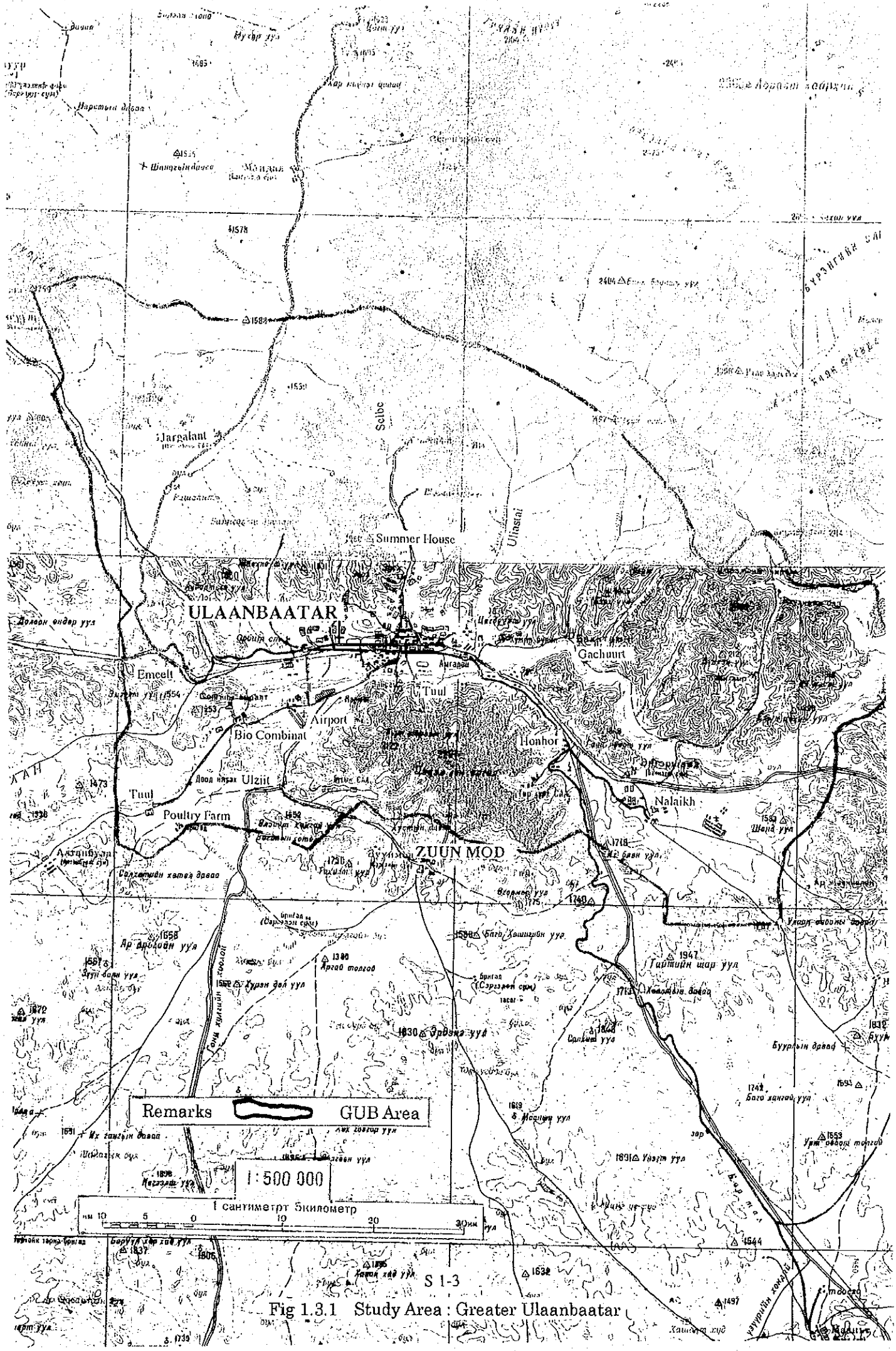
1) to establish a long-term road development plan for year 2020;

2) to conduct a feasibility study (F/S) for high priority projects in order to implement the most appropriate long term road network plan.

3) to pursue technical transfer of study procedures to counterparts.

1.3 Study Area

The study area, besides the city's urban area, includes the areas of the six satellite towns, namely, Nalaikh, Gachuurt, Ulziit, Biocombinat, Poultry Farm and Jargalant as shown in Figure 1.3.1 and Figure 1.3.2.



S 1-3

Fig 1.3.1 Study Area : Greater Ulaanbaatar

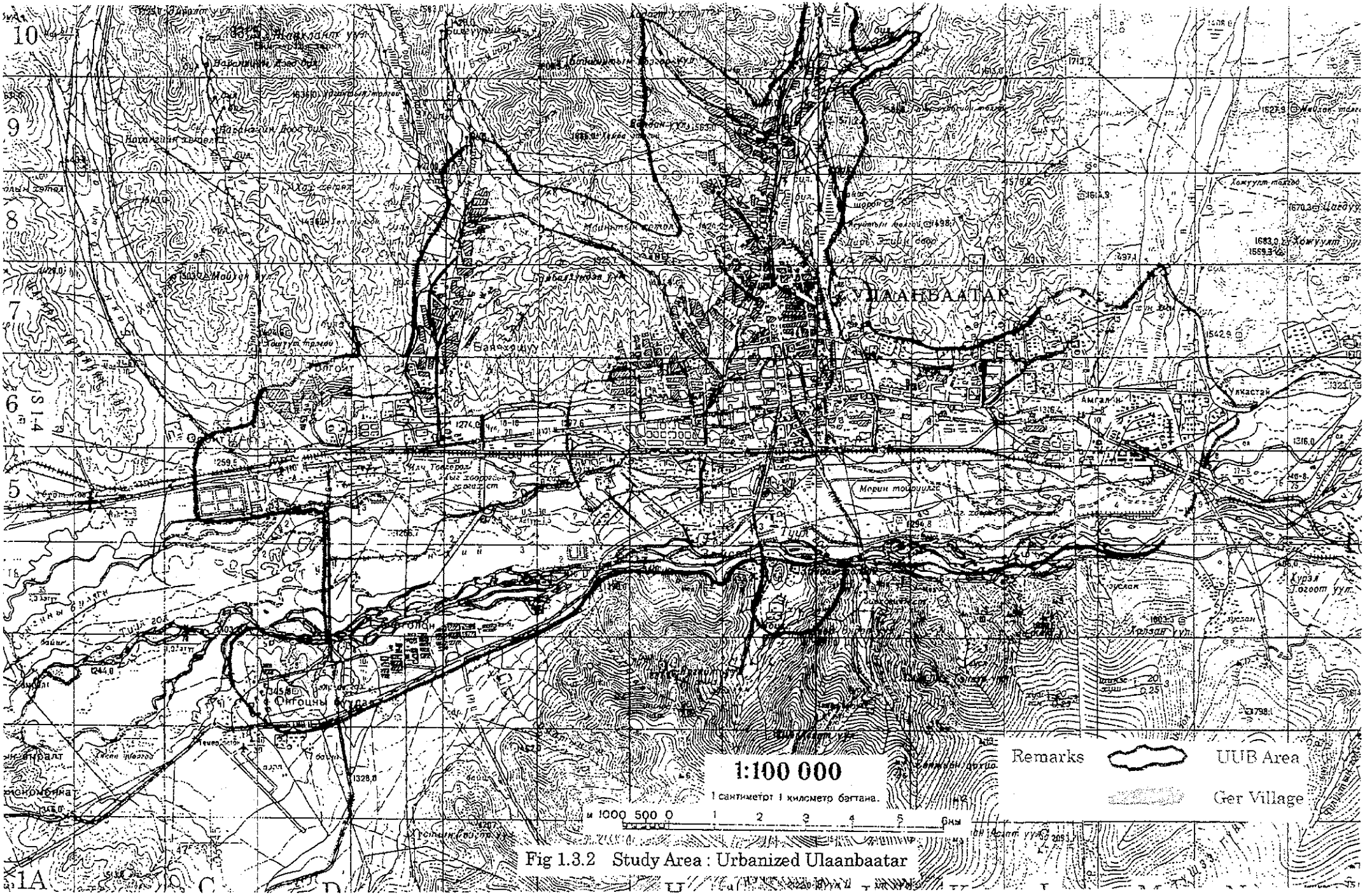


Fig 1.3.2 Study Area : Urbanized Ulaanbaatar

Chapter 2 ROAD ADMINISTRATION

2.1 Road Administration in Mongolia

Roads in Mongolia are administratively classified into the following four categories by the road law enacted in 1998:

- International roads are those connecting foreign countries under international agreements.
- National roads are those connecting the capital city with prefectural capitals (aimag centers), and prefecture capitals with other local towns and border.
- Local roads are those connecting districts, towns and villages within a prefecture (aimag).
- Industrial roads are roads inside areas owed by enterprise and organizations.

The Road and Transport Department of Ministry of Infrastructure Development is in charge of formulation of the road development policy in Mongolia as shown in Fig.2.1.1. The staff consists of 8 persons including the minister, a member of the Cabinet.

The Road Department is a government implementing agency responsible for planning and construction of international and national roads, their maintenance and management as well as drafting out of development policy.

The staff consists of 60 persons including 32 engineers (as of January, 1998). The organization charts of the Ministry of Infrastructure Development and Road Department (Government Agency) are shown in Fig. 2.1.2 and 2.1.3. (As of December, 98)

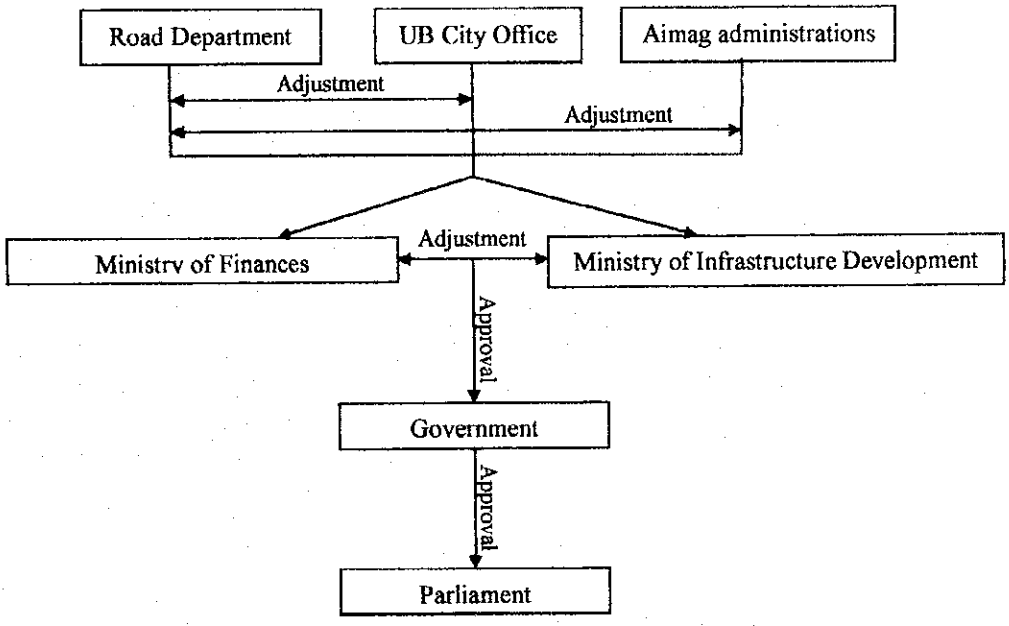


Figure 2.1.1 Formation of Road Planning

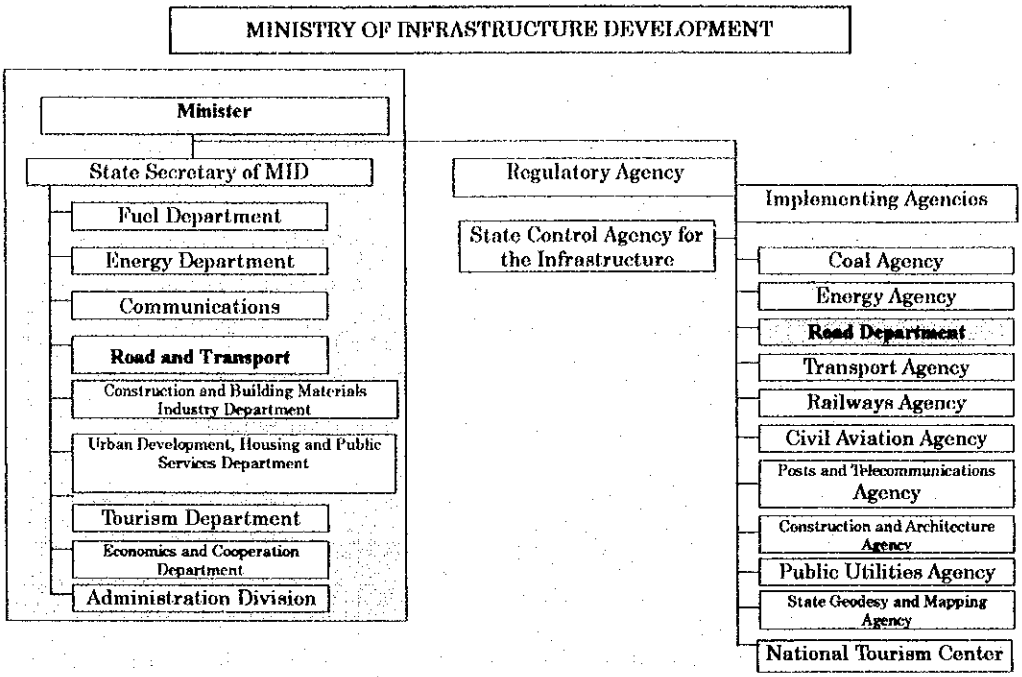


Figure 2.1.2 Organization Chart of the Ministry of Infrastructure Development

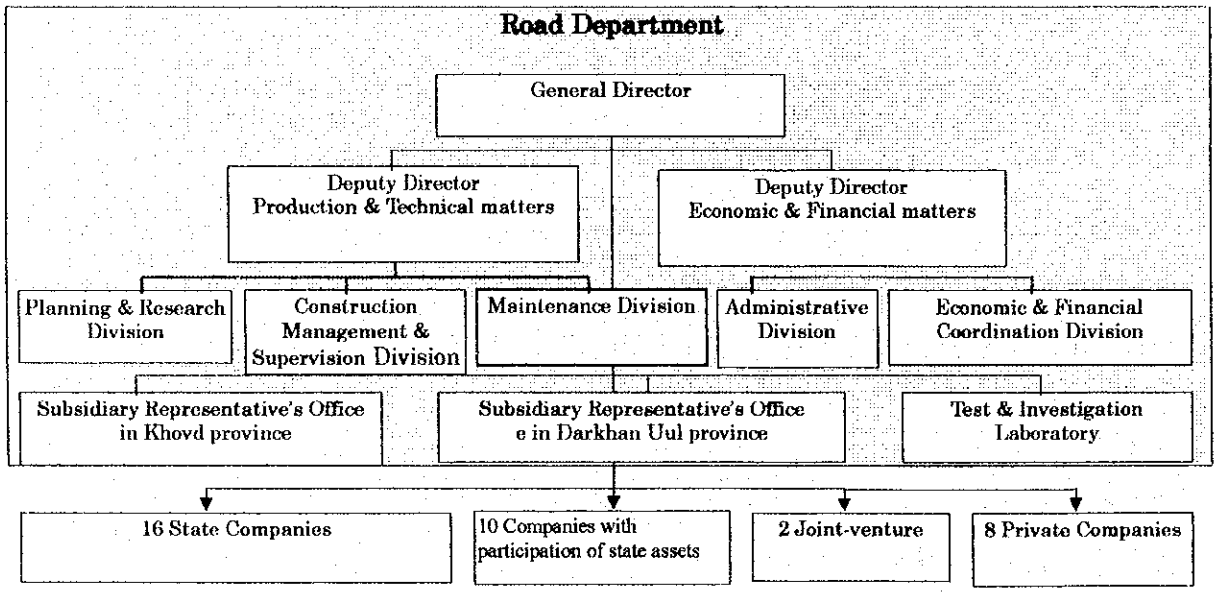


Figure 2.1.3 Organization Chart of the Road Department (Government Agency)

2.2 Road Administration in Ulaanbaatar

The Ulaanbaatar City Government conducts construction and maintenance of roads in Urbanized Ulaanbaatar city, Nalaikh and Baganuur. The Road Department which is in charge of the road fund extended some part of fund to Ulaanbaatar city roads until establishment of the road law in 1998. The Road Department is still giving technical advises via persons specialized in road field.

Therefore, some in the Road Department were nominated as the counter-part staff to this study.

The Ulaanbaatar City Government consists of two organizations except the city assembly, one is responsible for the determination of policies under a Vice Mayor and the other for their execution under a General Manager (refer to Fig. 2.2.1). Incidentally, just one person is in charge of road construction and maintenance works (*) in the city's execution organization.

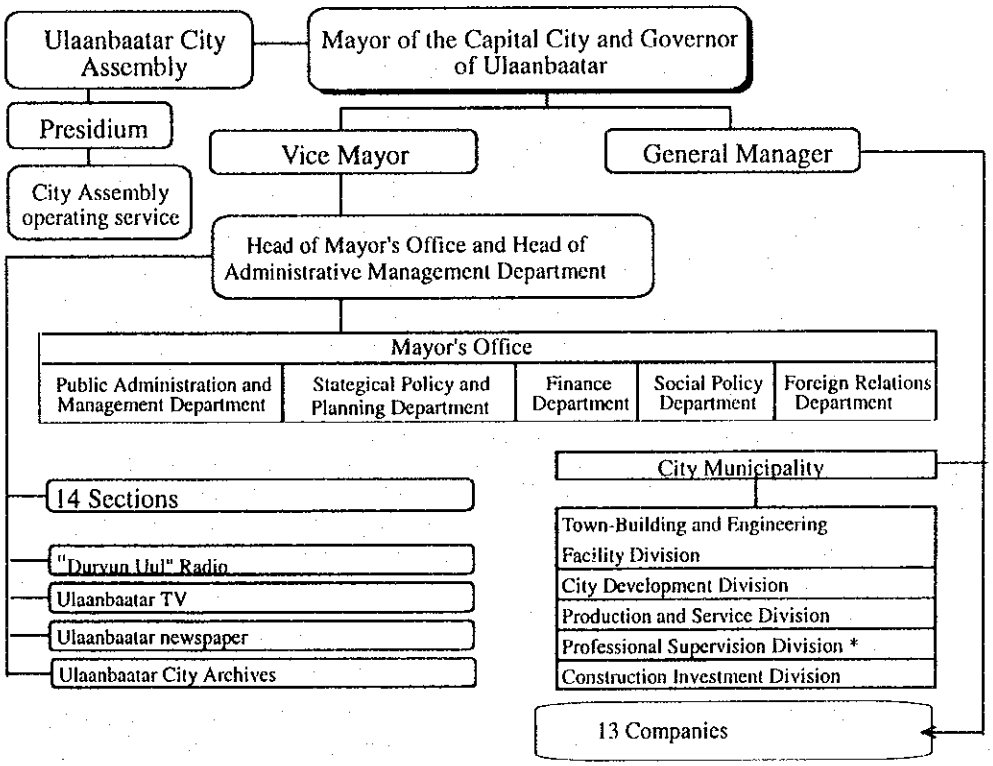


Figure 2.2.1 Organization Chart of Ulaanbaatar City

Part 1

Current Condition of Ulaanbaatar City and Formulation of Road Network Plan

Chapter 3 General Condition of the Study Area

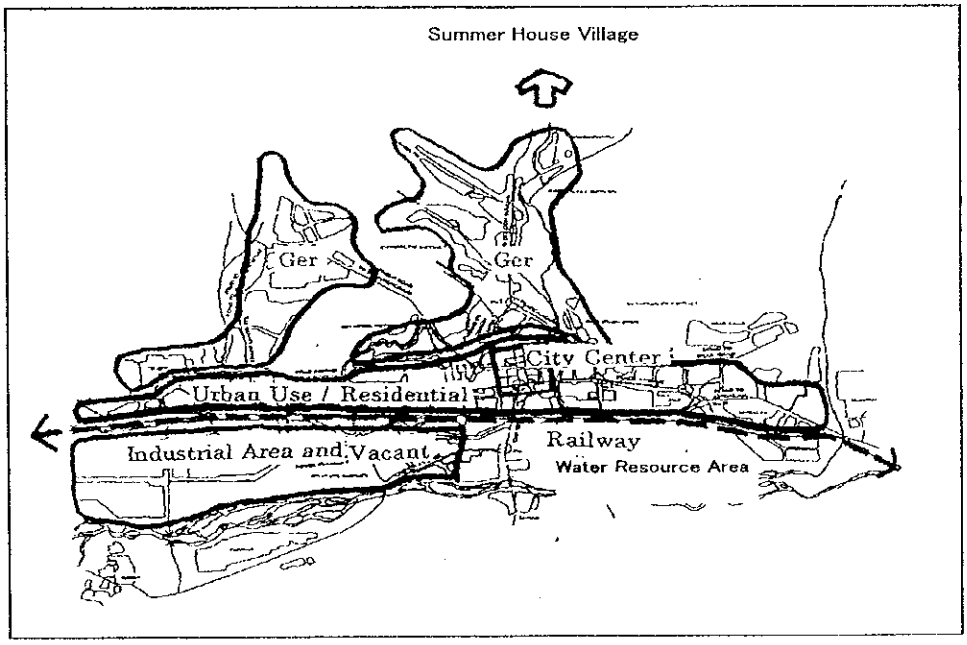
3.1 General Condition of Ulaanbaatar City

Ulaanbaatar is located in Tuv aimag (central prefecture) and is composed of 9 administrative duuregs* (districts) of which two duuregs are remote for more than 100 km from the city center.

Urbanized Ulaanbaatar (UUB) is nestled in the valley of Tuul river, which flows from the east to the west. Apartment housing and commercial areas are expanding from the northern side of the river bank to the rolling hills in the north.

Urbanization had expanded to the east and the north during the 1950s and 1960s, followed by rapid development to the west in the 1970s and 1980s. The most part of the land in the southern side of the Railways was used for industrial zones. A land use plan was formulated in 1987, but their implementation was not realized because of the change in economic system in the early part of the 1990s. At present the City has been studying a new master plan which will be finalized in July or August of 1999.

It has a population of 540,000 as of 1998. State institutions, apartment blocks and business facilities are located on a 20 km - long and 2 km - wide strip of land on the northern bank of Tuul river. There are multi-story apartment houses built after the 1950s, but because of their shortages in supply capacity, a large number of felt tent-houses called as "ger" has spread in disorder on the northern mountain slopes, some of which have gradient of more than 10%.



* Note: Duuregs are divided into khoroos, but citizens of Ulaanbaatar are more familiar with khroolo and refer to 21 khoroolols (apartment blocks) each with its own index number.

The railway along Tuul and Dundgol rivers passes, almost rectilinearly, in the center of the city. The area to the south of railway used to be flooded by Tuul river, but, with the gradual development of the city from the center, it has turned to become an industrial area. There is a water source area in the south-east part of the city and sewage treatment facility and warehouses are located in the south-west part. However, there are enough spaces to be developed in future within the city. At present, the railway divides the city into the southern and northern parts and creates an obstacle for the development of the city's southern part.

3.2 Problems of the City

Ger settlements are growing in number on the northern mountain slopes without any development of infrastructure, which have aggravated environmental deterioration. Streets in ger lots are not surfaced; drainage network is not developed; waterlines are not developed. Rain in these areas flows down to the city center in a straight way and cause flooding and traffic obstacles.

The summer house area stretching for 30 km along Selbe river to the north has environmental problems caused by inadequate development of the infrastructure. Natural conditions of mountain slopes of the valley have been deteriorated also because of no protection works over there.

Increases in population and various socio-economic activities have generated issues to be solved in the coming years. They are roads and traffic, garbage and sewage disposal, air pollution and water supply, etc, The water resource area in the south-eastern part of the city was assessed by the JICA study in 1995 to be usable to drink at present. Water in 170,000m^3 is pumped out daily from the wells surrounding the city. However, additional 60% of the water supply is required in the city for 2020. Power stations in the southern part are notorious as a source of air pollution in the UB.

3.3 Natural Environment

UB city is located almost in the center of Mongolia, 48°N latitude and 107°E longitude, at an elevation of 1,350 m above sea level.

The average annual temperature in Ulaanbaatar is (-) 2.2°C, the average monthly temperature is (-) 20°C in the most cold period from December to January and turns into plus in the period between April and October. The average monthly minimum temperature becomes plus just during the three months in between June and August.

The average annual precipitation is 276 mm most of which falls during the period of June - September, especially, in July and in August rains are making up 85% of the total annual amount. Sometimes, it happens that snow falls during this summer season. Snow falls in winter just a few cm. It could be cleaned with a broom etc., but if left uncleaned it freezes and becomes

difficult to remove. When the temperature goes (-) 5°C, the rate of friction against the iced snow surface of road increases, and although it slips a little bit, vehicles can run with normal tires.

There is a protected area of Bogd Khan mountain with a peak of 2268 m above the sea level in the southern part of the city. There are three rivers of Tuul, Selbe and Dund running across the city and the water in Selbe and Dund rivers are almost dried during the 80% of a year. But, when it rains, flash flood water comes down from the highlands. The roads due to insufficient drainage facilities turn into ditches, and because of swift stream running to the southward direction, the traffic on some sections of the main roads interrupts for several hours. On the other hand, ger settlements, especially in the northern part, spoil the beautiful scenery of mountain ranges which is a feature of UB city.

Chapter 4 Current Condition of Roads

4.1 General Condition of Roads

The length of roads in Mongolia and Ulaanbaatar is shown below:

Table 4.1.1 Length of the Roads in Mongolia and in Ulaanbaatar

Mongolia		Ulaanbaatar	
Class	Length(km)	Class	Length(km)
National Road	11,250	National Road	76.5
Local Road	38,000	Regional Road	78.0
Others	150,000	City Road	168.8
		District/Special Road	94.9
		Residential Road (336,362m2)	(67.3)
		Natural roads	(35.5)
Total	200,000	Total : excluding ( )	418.2

Source: Road Department and Ulaanbaatar City, November 1998

While the paved roads in Mongolia are less than 3%, the roads in UUB are mostly paved. However, because of their insufficient maintenance and repair, their condition is worsening with every passing day.

The fluctuation of pavement temperature is about 80°C because it is cooled up to (-) 40°C in winter and heated up to (+) 40°C in summer. Because of this, severe expansion and shrinkage of joints of cement concrete pavement takes place. As for the asphalt pavement, it becomes stiffened like glass during extremely cold temperature in winter and shrinkage cracks appear with intervals varying from several meters to several ten meters in both vertical and horizontal directions.

The road surface becomes better in winter because of filling up of unevenness with snow and strengthening of sub-base course due to freezing, and riding comfort becomes better in winter as compared to summer. When the temperature turns into plus during day time in February, iced snow melts, and it becomes slippery, resulting in low travel speeds. Hardened snow on road sides often cause problems. Reduction of the effective width of roads due to iced snow on the both sides of carriage way, leading to traffic jams was observed in the winter time.

4.2 Compilation of Road Inventory Tables

The survey was conducted for 82 roads with the total length of 227 km, 32 bridges and 10 intersections. The results of the survey on the existing condition were summarized as inventory tables backed up with photos. (Separate volume).

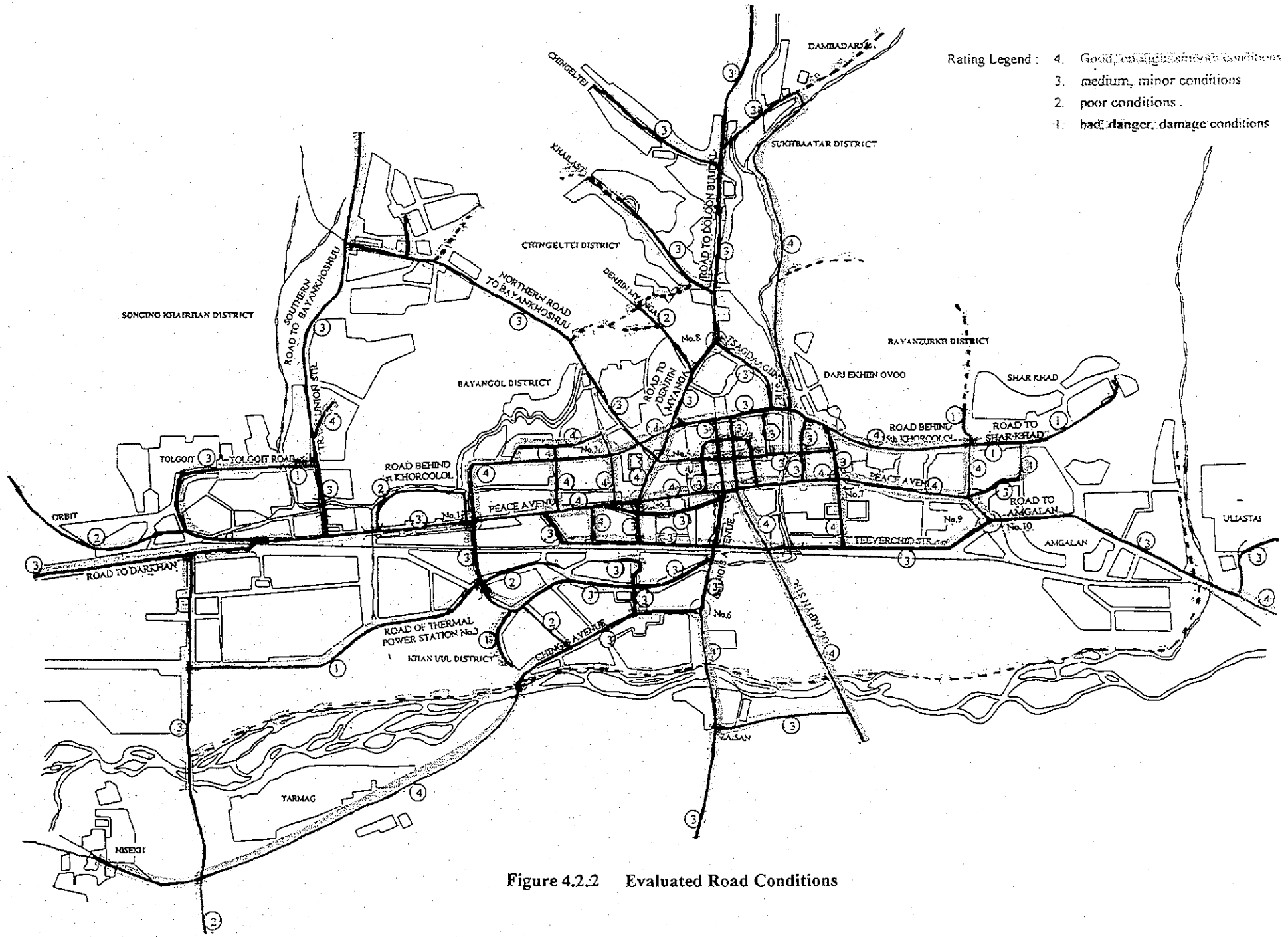


Figure 4.2.2 Evaluated Road Conditions

Figure 4.2.2 shows the actual condition of UUB roads evaluated according to HDM and classified into 4 categories. From the total 227 km roads just 20 km was evaluated as bad.

Most of bridges in the city are of RCT type and just 3 bridges of PC type. Most of them were built during the 1960s – 1980s. There are 4 bridges with greater damages. (C and D in Table 4.2.10)

Table 4.2.10 Summary of Overall Evaluation of Bridges

Bridge No.	Bridge Name	Overall Evaluation Item & Rating Point (R/P)					Total Point (R/P)*(W/F)	Evaluation
		Durability		Load Capacity	Function			
		Super str.	Sub str.		Constructed	Effe. Width		
4	Arslant	2	3	3	3	1	3.6	C
5	Uliastai	1	1	3	3	3	2.5	B
6	Uliastai	1	1	3	3	1	2.3	A
7	Uliastai	1	1	3	3	1	2.3	A
10	Bayanzurkh	2	2	3	3	1	3.3	B
11	Zaisan hill (west)	2	2	1	3	1	2.7	B
12	14-th khoroolol	1	1	3	3	1	2.3	A
13	Peace	2	1	3	3	3	3.2	B
14	Yarmag	1	1	3	3	3	2.5	B
15	Yarmag	2	2	3	3	3	3.5	C
16	Tolgoit	1	1	3	1	1	2.1	A
17	Dood Selbe	2	2	3	3	1	3.3	B
18	Dund gol (deed)	3	1	1	3	1	3.1	B
19	Ikh Tenger	1	2	1	1	1	1.8	A
20	Ikh Tenger (dood)	2	2	1	1	1	2.5	B
21	Zaisan hill	1	3	1	3	1	2.3	A
22	Metalist professional school	1	2	3	3	1	2.6	B
23	Behind TPS No.3	2	1	3	3	1	3	B
24	Sonsgolon	1	1	3	3	3	2.5	B
27	Gurvaljin	2	2	3	1	1	3.1	B
28	Baruun Naran	2	1	3	1	3	3	B
29	Baruun Naran	2	1	3	1	3	3	B
32	Khailaast	1	1	1	1	1	1.5	A
33	Chingeltei	2	1	1	1	1	2.2	A
35	Selbe (deed)	2	1	3	3	1	3	B
36	Selbe (dood)	2	1	3	1	1	2.8	B
37	Selbe (dund)	1	3	3	3	1	2.9	B
39	Dambadarjaa	2	2	1	1	1	2.5	B
40	Dambadarjaa	2	3	1	1	1	2.8	B
45	Zaisan hill (east)	2	1	1	3	1	2.4	A
48	Milk processing plant	3	3	3	1	1	4.1	C
50	Baruun Uul ditch	4	4	3	1	3	5.3	D

Notes: Overall evaluation
A : Sound (point 1.5~2.5)
B : Fairly Sound (point 2.5~3.5)
C : Unsound/Lack of Safety (point 3.5~4.5)
D : Danger (point 4.5~5.5)

Out of 10 intersections covered by the survey, six are of rotary type. In the result of the survey, it was concluded the rotary type intersection on the east exit of the 3rd district road (No.3) and irregular type intersection in front of Geser temple (No.4) needs improvement. Despite high traffic volume, 4 intersections on the Enkh Taivan Avenue (No.1,2,5 and 7) were considered as having no problem.

4.3 Current Road Conditions to 6 Satellite Towns

a. Nalaikh

The road to Nalaikh is in 2-lane width and of cement-concrete pavement. It was built 37 years ago under the grant aid of China starting from the 12th km point (toll-house) from UB, and now its joints are greatly damaged. Since the possibility for the development of the territories along the road is high, an urgent repair of this road is recommended.

b. Gachuurt

The village is connected with a 2-lane asphalt road. The condition of the road is fair. Development of industries is not recommended there, since the village is located at the upstream side of the city and the development has a possibility for water pollution.

c. Ulziit

The asphalt road continues up to the village in 2 lanes. A snowdrift was observed in winter on the both sides of the road on a small pass on the way.

d. Bio-combinat

The town is connected with UUB with asphalt roads passing by Buyant Ukhaa airport of UB city. The road has, in part, some sections with quite damaged asphalt pavement.

e. Poultry Farm

The farm is connected with UUB with the same road as Bio-combinat. The paved section of which ends at this farm. There are many damaged places on the section between Bio-combinat and the farm. Poultry Farm, Ulziit and Bio-combinat combined together have good prospects as an area for the development of industries.

f. Jargalant

The village is located on the backside of the UUB northern mountain. To get to the village, it is necessary to drive through the road towards Darkhan until the 37 km point, then turn to the right to the unpaved road and take a detour. The condition of the asphalt pavement of the road to Darkhan itself is not good. Above that, the condition of the unpaved road from the 37 km point is very poor. The state farm of

the period of socialism is operated now in a smaller capacity. Although a construction of a road is required for the shipment of agricultural products, it was concluded more rational, from the economic view-point, to consider the possibility for introduction, for the moment, of rail - bus system, and when the production grows to a certain level, consider the possibility for construction of a road. In case of construction of this road, it would be better to consider at the same time the possibility of connecting this road via Guntiin Pass, to the road along the Selbe river bank in a ring road pattern.

g. Selbe river road

The road to the northern summer house area was out of the scope of works of this Study. It is found utilization of summer houses is decreasing and congestion of commuting traffic as it is in the past is not observed at present.

4.4 Drainage Facilities

Most of the road drainage facilities in the city are old. The Peace avenue and Chingis avenue, the main roads constructed with the assistance of China and the Soviet Union in the year 1956, are equipped partially with open ditches, but their designed capacity is not enough. Besides the road drainage facilities, there are big canals in the city designed as anti-flood facilities. All are not maintained properly.

Chapter 5 Traffic Survey

5.1 Traffic Survey

Eight types of traffic surveys were carried out during May – June, 1998 as shown in Table 5.1.1. Two Local Consultants were selected through competitive bidding for all traffic surveys except the Bus Passenger Survey, which was carried out by the JICA Study Team themselves.

Table 5.1.1 Description of Traffic Survey Works

S. No	Type of Survey	Survey Quantity	Survey Duration (hrs / days)	Remarks	Survey Period
1	Vehicle-Owner Interview Survey	About 4000 Veh.-owners (target sample rate = 12%)	N.A.	7 vehicle types	June 5 to June 23, 1998
2	Cordon Line Survey	4 locations	16 hrs / 1day	6 vehicle types	June 8 to June 11, 1998
3	Screen Line Survey	2 screen line (6 Loc. per line)	16 hrs / 1day	7 vehicle types	June 3 to June 4, 1998
4	Turning Movement Counts at Intersections	10 locations	16 hrs / 1day	4 vehicle types	June 10 to June 12, 1998
5	Travel Speed Survey	5 route - Road 1 route - Trolley Bus 4 route - Bus	- peak & off-peak hours	cars, buses and trolleys	June 15 to 20, 1998
6	Axle-Load Survey	4 locations	16 hrs / 1day	only trucks	June 8 to June 11, 1998
7	Bus Passenger and Trip Surveys	27 bus routes & 8 trolley routes	16 hrs / 1day	buses & trolleys	May 25 to May 29, 1998
8	Classified Traffic Count Survey	10 locations	16 hrs / 1day	7 vehicle types	June 3 to June 4, 1998

N.A. : Not applicable. 16 hrs = 6:00 to 22:00

(1) Vehicle-Owner Interview Survey

This survey was carried out by the home interview method for both passenger and goods vehicles to collect data related to vehicle usage on a weekday. Travel data like number of trips made by vehicle per day, their origin and destination, purpose of trips, etc. were recorded.

Vehicles for survey were randomly selected from the database maintained by the Traffic Police Department. This database records the name of the owner, his address, type of vehicle, color, date of registration, etc., and is updated every year. However, after checking this database, it was found that the owner's address was known for only 27,003 vehicles out of the total 36,598 registered vehicles. The vehicles to be surveyed were randomly selected from those vehicles whose address was known. An overall sampling rate of 11.26% was achieved. In case of trucks the sampling rate was low (6.90%) because owner's address was not known for about 71% of trucks.

Table 5.1.6 shows the travel characteristic of cars and trucks.

Table 5.1.6 Travel Characteristics of Cars and Trucks

S. No.	Item	Cars			Trucks
		Private	Company	Total	
1	Vehicles surveyed	2,373	561	2,934	609
2	Total trips	10,836	2,816	13,652	2,433
3	Total distance traveled/day (in km)	62.5	70.6	64.1	96.4
4	Avg. trip length (in km)	12.5	12.9	12.6	22.4
5	Avg. occupancy	2.54	2.41	2.52	-

One of the main objectives of carrying out the vehicle owner interview survey was to know the pattern of inter-zonal traffic movement. These patterns are generally summarized in form of OD tables (origin – destination tables) which were prepared from this survey.

(2) Cordon Line Survey

The survey was carried out to collect data about traffic entering and leaving Ulaanbaatar city in order to estimate traffic flow between the study area and outer areas. The survey was conducted by the roadside interview method and items such as origin and destination of trips, trip purpose, type of commodity carried etc. were recorded. Traffic volume for 6 type of vehicles (car, microbus, bus, ordinary truck, heavy truck, truck-trailer) was also counted at these locations.

Vehicles were randomly picked at the survey points for interview and an overall sampling rate of 65.56 % was achieved. O-D tables were prepared from the survey data. Through traffic was found to be almost negligible.

(3) Screen Line Survey

The purpose of the survey is to obtain data regarding the traffic volume on major roads. To conduct the survey, two screen lines were drawn; one along the river Selbe in the north-south direction and the other in the east-west direction along the river Tuul. 6 survey points were identified on each screen line; thus the total number of survey points is 12. Seven types of vehicles (car, microbus, bus, trolley bus, ordinary truck, heavy truck, truck-trailer) were surveyed.

As expected, traffic volume was highest on Peace avenue at 34,522 veh/16hr followed by Chingis avenue at 22,319 veh/16hr. The overall share of large vehicles was found to be about 12.2 %.

(4) Turning Movements Counts at Intersections

This survey was carried out to collect traffic volume data at 10 traffic intersections by turning direction. Traffic volume was recorded by 4 vehicle types (car, bus, trolley bus, truck) and by turning direction. Intersection traffic was found to be highest at IS-5 (Intersection of Peace

Avenue and Chingis Street) with 46,000 veh/day followed by IS-1 (Intersection of Peace Avenue and Ajilchin Street).

(5) Travel Speed Survey

This survey was carried out to obtain travel time and speed data on main roads. The travel speed for car was measured by running the car along the survey route and measuring time by a stopwatch. In case of bus and trolley bus, the speed was measured by riding on a vehicle along the route and measuring time by a stopwatch. Three runs were carried out in each morning time (between 7:00 to 10:00), afternoon (10:00 to 17:00) and evening time (17:00 to 20:00) in both directions. Both travel speed and running speed were measured. The average travel speed of car, bus and trolley bus was found to be 42, 24 and 18 km per hour respectively.

(6) Axle Load Survey

The purpose of the survey was to obtain basic data for pavement design. The survey points were same as that of Cordon Line survey. Vehicles in both directions were randomly picked at the survey points for measurement and an overall sampling rate of 87.6 % was achieved. The average maximum single axle load was found to be 4.7 ton and the average of total axle load was 9.5 ton.

(7) Classified Traffic Count Survey

This survey was carried out at 10 locations to obtain traffic volume data by vehicle type. Seven types of vehicles (car, microbus, bus, trolley bus, ordinary truck, heavy truck, truck-trailer) were surveyed. The share of large vehicles was found to be about 14.3 % for all the points.

(8) Public Transport Service

1) Public Service

Public transport service in regular size vehicles is operated by 3 bus companies and one trolley company, all are owned by Ulaanbaatar Government. In addition private companies also participate in daily bus route service. Registered route operation, number of vehicles and trips are in Table 5.2.1.

Table 5.2.1 City Bus Companies

	Comp 1	Comp 2	Comp 3	Trolley	Private	Total
Buses	100	128	98	134	68	528
Route	9	7	5	8	6	35
Trips	1136	1164	598	1030	593	4521

Source: Transport Coordination Dept. (June 1998)

Private minibuses are also in operation mostly to Central Market, which have 20 routes, 337 registered vehicles and 2047 trips in total. Buses are also operated privately to 6 satellite towns with 15 vehicles and 116 trips in total.

2) Passenger Surveys on Bus and Trolleys

-1Passengers on and off bus stops

Passenger numbers between the get-on bus-stop and the get-off stop on city buses are surveyed on two buses on each route, one in the morning and the other in the afternoon in the direction to city center.

-2 Counting buses and passengers on the bus

Cordon points are determined at 7 locations where the number of buses is counted by rote, hour and direction. Passenger volume on selected buses passing the point is surveyed also. Data at cordon points and passengers on and off at bus stops are used to estimate the daily passengers of each route.

3) Survey Results

It is found the total trips of all types of buses and trolleys are 5,800 round trips carrying 935,000 passengers in a weekday. City buses and trolley buses transport 888,000 passengers, while the service capacity is estimated at 880,000, with which it is considered, in summary, supply and demand are equal in 1998. The average ride distance per passenger is 4.4 km per ride on city bus and trolley. The following table is the summary of passenger volumes.

Table 5.2.4 Summary of Bus Surveys in May 1998

Item		Passengers in both directions	Bus round trips
Bus Corp. 1- 3	1)	570,226	2,474
Trolley Corp.	1)	173,385	783
Private Corp.	1)	64,959	390
Prime-med school children	2)	80,000	-
Sub-total		888,570	3,647
Mini bus 3)		40,940	2,047
Satellite Villages 3)		5,820	116
Total		935,330	5,810

Source: 1) Surveyed by JICA Survey Team
2) Transport Coordination Dept., May 1998
3) The survey team's estimates by using data of TCD

Passenger volumes of all service types are aggregated on roads: one with the existing central market and the other with the market moved near to East Cross Road junction. They are shown in Figure 5.2.3 and Figure 5.2.4. It seems that daily passengers on public service would increase in volume by 5-15% on roads near the East Cross intersection when the new central market opens.

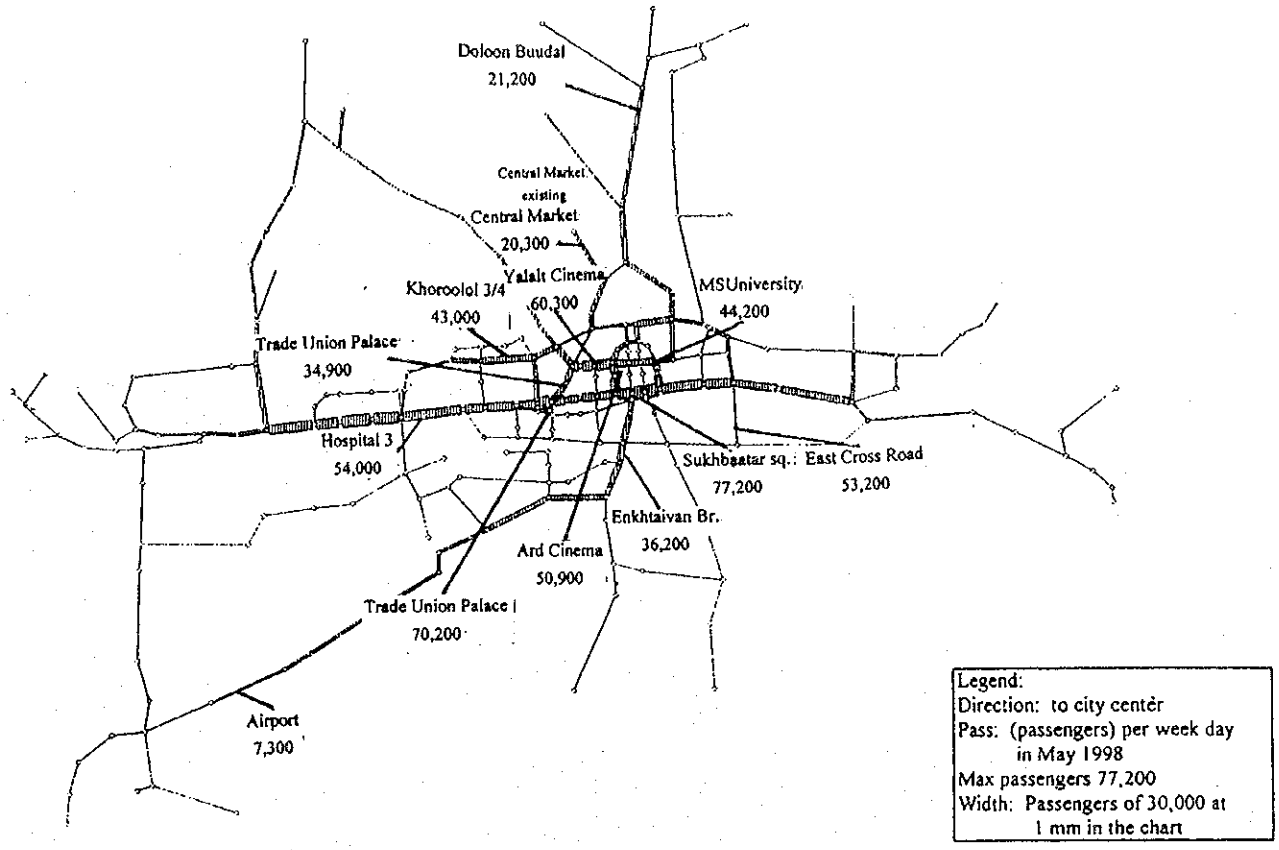


Figure 5.2.3 Passenger Volumes in Total of Bus, Trolley and Minibus, 1998

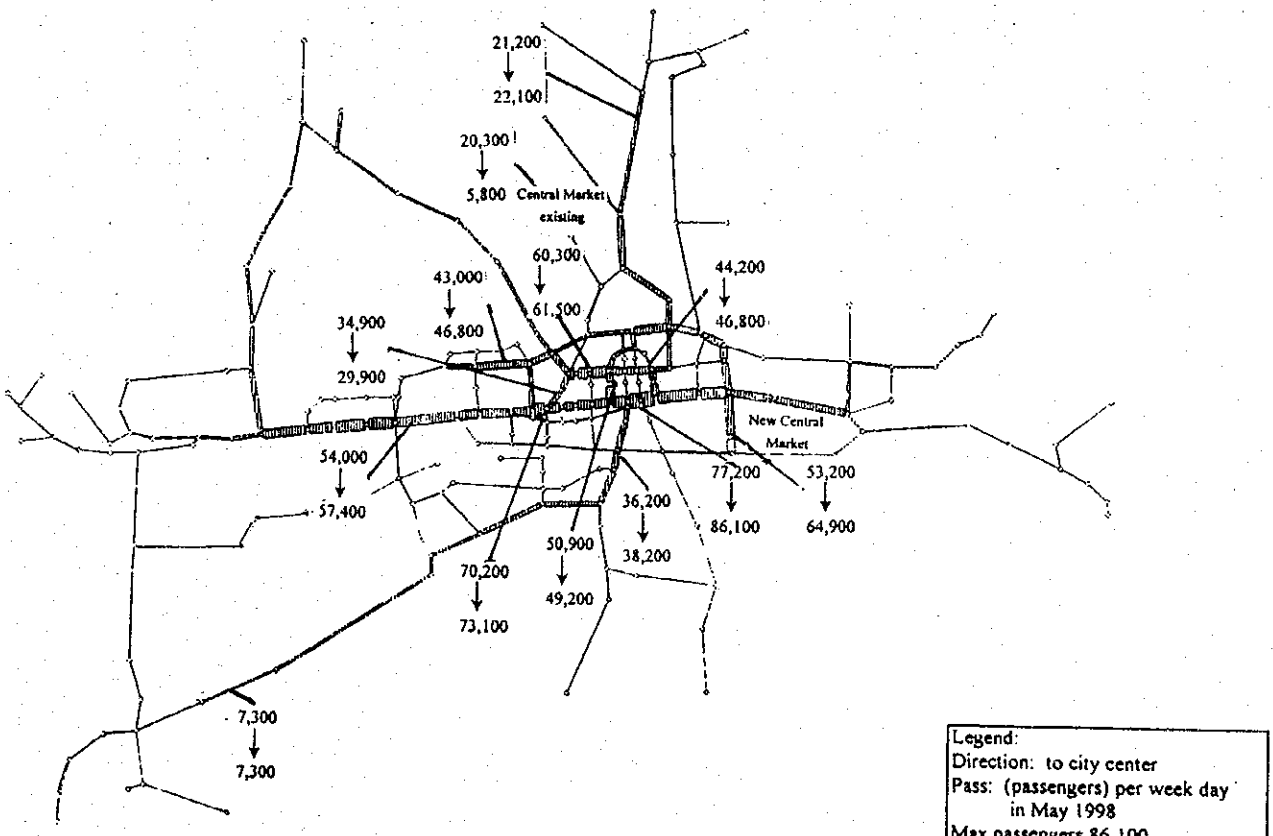


Figure 5.2.4 Passenger Volumes in Total of Bus, Trolley and Minibus, 1999 (with New Market Opened)

5.2 Traffic Accident

Fig.5.3.1 show the places and numbers of traffic accidents in 1997 which were presented by Traffic Police. Major intersections on Enkh Taivan Avenue had a larger number of accidents, as well as other junctions of Geser Temple, Existing Central Market, Zun Ail and others. The Ard Ayush Road had the largest number of accidents reported in Traffic Police in 1997. Generally traffic accidents increase in winter because of frozen road surfaces.

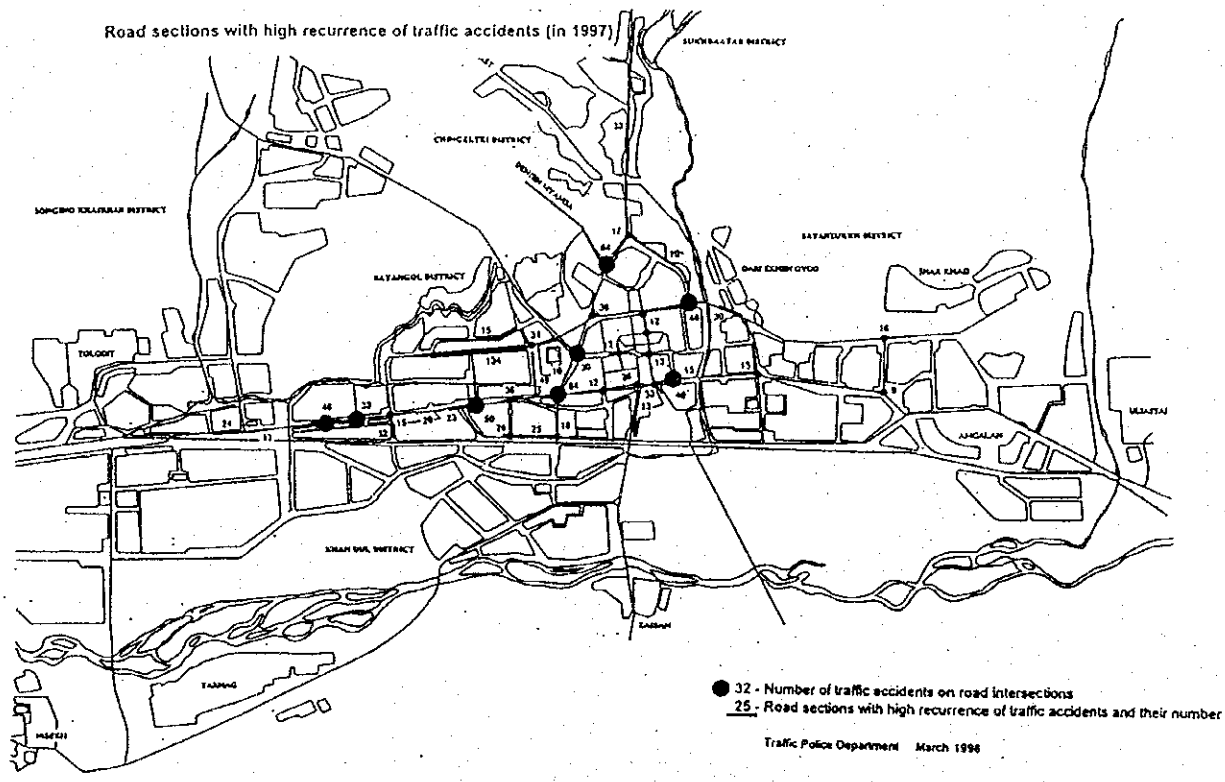


Figure 5.3.1 Traffic Accidents at the Trunk Roads and Intersections in the City

Chapter 6 Initial Environmental Examination

6.1 Legislation

6.1.1 Laws

Historically, Mongolia has adopted and ensured the implementation of several environmental laws. These laws are classified under four packages, as shown in Figure 6.1.1. In this figure, each box shows one package.

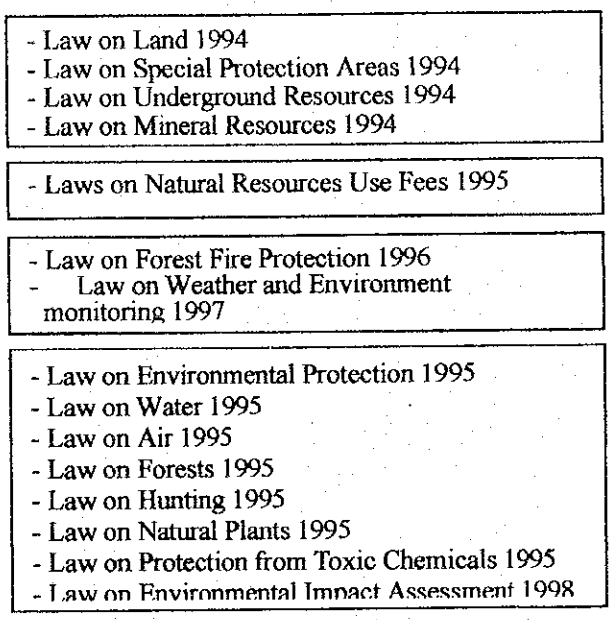


Figure 6.1.1 Basis Structure of Environmental Laws in Mongolia

6.1.2 Environmental Impact Assessment (EIA) Law

The Environmental Impact Assessment Law based on the Mongolian Constitution, the Law on Environmental Protection and relevant laws, establish the procedures for EIA including Protection Plan, Monitoring Program, etc.

Ministry of Nature and Environment (MNE) is the screening agency for national highway projects and, the Prefecture government/Ulaanbaatar City for local road projects.

Although Ulaanbaatar City is responsible for local road projects, the EIA for projects/studies sponsored by foreign agencies (such as this Study) is under the charge of the Ministry of Nature and Environment.

6.1.3 Environmental Quality Standards in Mongolia

In July, 1998, new standards on air and water quality were enacted. There are no national standards on soil pollution and noise. However, norms currently practiced in other countries

such as Malaysia, Thailand etc. are used to assess and regulate sanitation condition of soil and acceptable level of noise in residential areas.

6.2 Present Situation of the Study Area

6.2.1 Socioeconomic Environment

1) Resettlement

A compensation system for involuntary resettlement is regulated in the Mongolian Law on Land. Since the Law on Land was enacted in 1994, no rates have been formulated for compensation amount by the Land Department of UB City. However, UB City has started admitting use of the land with people by issuing certificate and registration. At present, most households traditionally living in ger area do not have such certificate nor registration.

2) Economic Activities

The power industry represented by 3 large-scale thermal power plants in the city is of importance. The building industry is active in speculative private housing, and private offices and hotels are under construction. These activities of power and building industry are strengthening the role of UB as the country's prime focus for financial and commercial services. Private establishments in the field of trade and service such as kiosks, shops, hotels, restaurants, bars and disco clubs have increased significantly in recent years.

3) Public facilities

There are few data available for commonly used public facilities and their locations. Since transition to the market economy started, small kiosks along the streets and in public places such as bus stops have increased dramatically, as shown in Table 6.3.1.

Table 6.3.1 UB Statistics on Local Communities

	Unit	1992	1993	1994	1995	1996	1997
Grocery stores, Market	Number	149	173	234	288	368	506
Industrial goods stores	Number	52	51	55	58	68	133
Restaurant, Bars	Number	41	87	144	187	273	155
Kiosks	Number	0	255	521	1,085	2,324	2,500
Schools, Hospitals	Number	141	139	136	134	142	139

Source: UB City Statistics, April 1998

4) Cultural Property

Mongolian law on protection of items of historical and cultural value protects the cultural properties which are of significance to the science, history and culture of Mongolia. There are 11 items (such as monuments, temples, tombs and gates) under state protection, 18 items under UB City protection, and 22 items under district protection.

5) Solid Waste

Most of the waste is disposed at 3 central dumpsites: Dari Ekh, Ulaanchuluut, and Morin Davaa. The District Construction and Service Companies (DCSCs) are able to obtain permission to dump certain wastes, especially construction waste, outside the three dumpsites. Waste from construction and demolition processes is dumped either at the central dumpsites or along the roads. Recycling is limited and not organized at all.

6.2.2 Environmental Pollution

1) Air pollution

The most significant sources of air pollution in Ulaanbaatar are listed below:

1. 3 thermal power stations produce over 2,500 million kW of electricity and burn nearly 5.0 million tons of coal annually. The power stations' ash-basin occupies an area of 65 hectares.
2. More than 30 thousands of vehicles discharge noxious gases into atmosphere.
3. 28 thousands gers and thousands of dwellings contaminate the atmosphere by burning annually over 260 thousand tons of coal and 180 thousand cubic meters of wood.
4. Over 250 large and small steam boilers designed for heating and production purposes consume all together 400 tons of coal per year.

The major pollutants are sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and dust. Concentrations of sulfur dioxide and nitrogen dioxide in UB atmosphere often exceed the permissible level. Air pollution in winter is 3-5 times more than in summer.

2) Water pollution

At the upper stream of the Tuul river the parameters such as Biochemical Oxygen Demand (BOD), NH_4-N increase in summer and decrease in winter due to the melting snow and rainfall. Though the water quality at the upper stream is high, it becomes worse as the stream goes down. In tributaries of the Tuul river such as the Dundgol river, the Selbe river, the water quality is somewhat inferior to the Tuul river.

3) Soil Contamination

The most polluted soil in the UB City is located along the railway. The pollution is caused by emission of gas and water from industrial area along the railway. The concentration is high in the southern and central areas of the city. Radiation of heavy metal and toxic gas from power stations have been contaminating their surroundings.

4) Noise and Vibration

There are many sources of environmental noise and vibration in UB, including factories, power stations, other production, vehicles, trains, airplanes, commercial facilities such as markets, bars, construction work, etc.

Field survey of noise and vibration: During the IEE study there were measured Leq, Lmax, L_{50} of noise and Leq, Lmax, L_{10} of vibration at 8 roadside sites in UB City. Noise levels were in the range 64 to 70 dB and were higher than the Japanese standard. Vibration levels were considerably smaller than the Vibration Request Limit for Roads Side Areas in Japan and were below threshold of vibration sensation.

6.3 Screening / Scoping

Screening/Scoping checklists are evaluated in accordance with the JICA Guideline and in consideration of conditions specific to Mongolian environment such as severe climate, permafrost and localised torrential downpour. The evaluation items of EIA extracted from Screening/Scoping are as follows.

Table 6.4.2 Items of EIA on the Feasibility Study

Items	Grounds
Environmental Items	
- Resettlement	Resettlement will occur due to road construction.
- Economic activities	Road construction will cause economic changes.
- Traffic and public facilities	Influence on schools, hospitals, etc.
- Cultural property	Care should be paid in selecting routes.
- Waste	Construction waste will occur.
- Groundwater	Care should be paid in the intake field of groundwater.
- Hydrological situation	Effect of flood should be studied.
- Landscape	Harmony with surrounding nature should be considered.
- Air pollution	Effect of increase in traffic volume should be studied.
- Water pollution	Construction in the river may contaminate water.
- Noise and vibration	Impact during and after construction should be studied.
Others	
- Environmental protection plan	Noise, etc.
- Environmental monitoring program	Air pollution, water pollution, noise, etc.

Chapter 7 Establishment of Future Framework

7.1 City Master Plan

There were two kinds of City Development Master Plan for Ulaanbaatar. The First one was established in 1987 with the assistance of the USSR (hereinafter called as 87 MP). They proposed the detailed city plan for the urban area in the scale of 1:10,000 or 1:25,000. The second one was the review of the first one in 1993 (hereinafter called as 93 MP), however it was conducted only for the development of city road network and showed a simple proposal for the development of the public transport without forecast of the future traffic volume. While, the government of Ulaanbaatar City is now preparing a new city master plan.

7.2 Master Plan in 1987

The 87 MP proposed the following plan of land use:

1) To utilize the area to the south of the railway as industrial and water resource zones.
2) To utilize the area to the north of the railway as a residential, office, etc. area
3) To set a new power station on the north-east side of the city.
4) The development of the city road network was as follows:

in UUB	in GUB
· Grid pattern roads	· A large ring road around Bogd Khan Mountain
· Bypass on the dike of Tuul River in the super long-term plan after 2010	· Connection of the road to the south of Bogd Khan mountain with the Argalant area
· Branch roads in the northern ger area	· A smaller-scale ring road in the western area

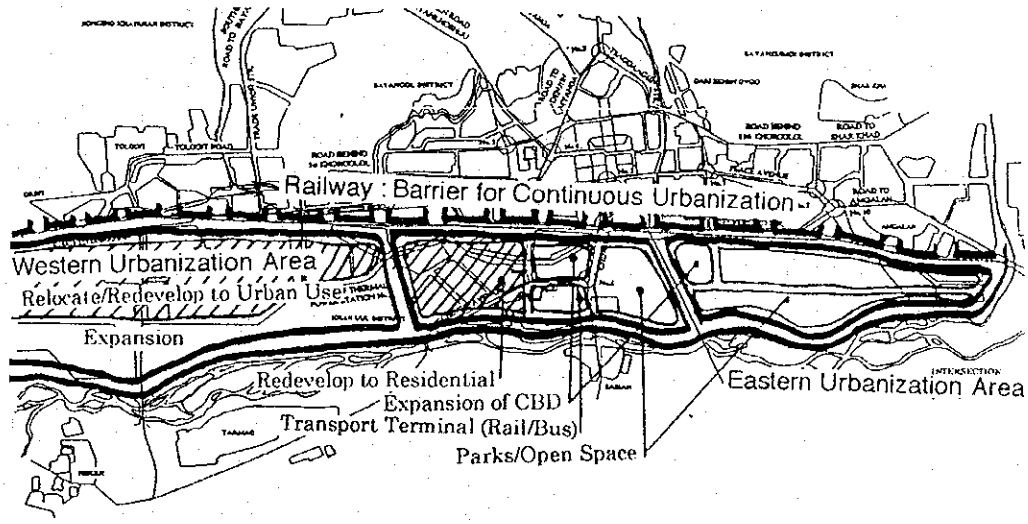


Figure Urbanized Ulannbaatar

5) The development of the satellite towns and villages was assumed as follows:

Satellite towns	Population in 2010	(For reference) Actual in 1997
Argalant	33,000	
Nalaikh	25,000	25,000
Poultry Farm	18,000	2,000
Bio-combinat	12,000	3,200
Jargalant	7,000	6,000
Gachuurt	5,000	4,000
Ulziit	(out of scope)	3,600

6) The population frameworks in 87 MP were as follows :

Table 7.2.1 Population Framework of 87 MP

	87 MP	anual.growth rate	Actual	anual.growth rate
1986	492,900		503,000	
1995	625,000	2.67%	616,900	2.29%
1997	-		571,700*	
2000	700,000	2.29%		
2010	800,000			
	(700,000*)			

Note: * means for UUB only

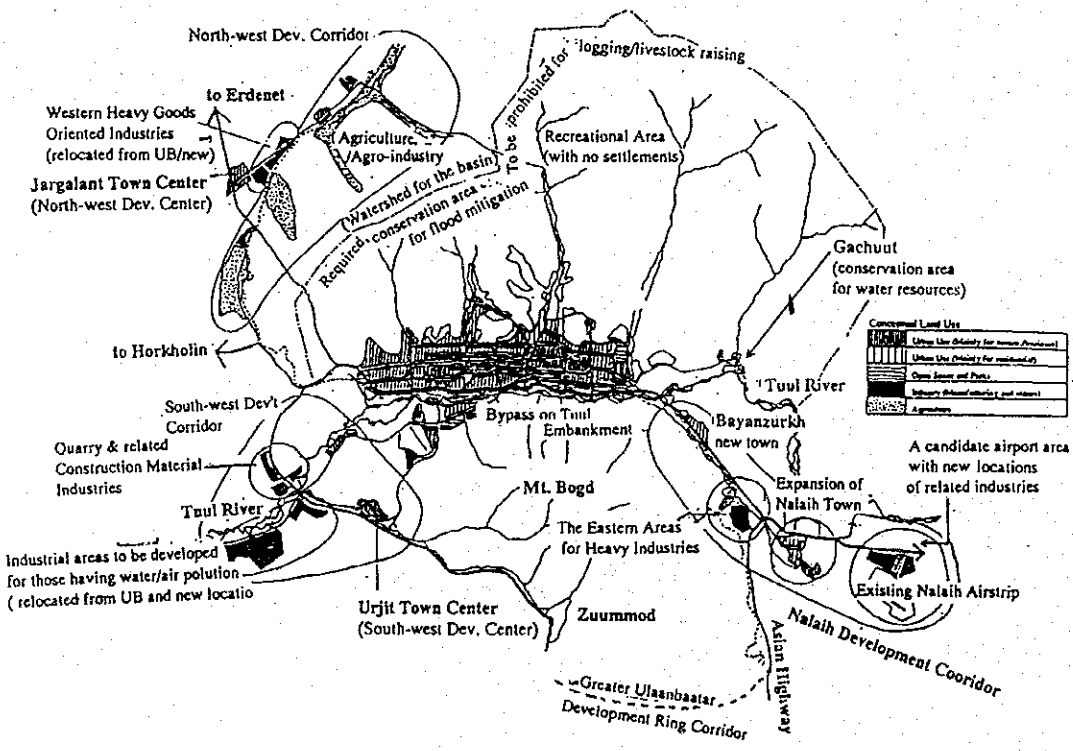


Figure 7.6.1 Conceptual Land Use and Transportation Network in Long Term

7.3 Future Population Framework

Changes in the population growth in the country and in Ulaanbaatar are shown in the table below:

Table 7.3.1 **Population of Nation and Ulaanbaatar, 1960-1997**

	Nation		Ulaanbaatar		
year	Pop.	a.g.*	Pop.	a.g.*	share/Nation
1960	968,100		152,200		15.7%
1970	1,265,400	2.7%	294,400	6.8%	23.3%
1980	1,682,000	2.9%	415,800	3.5%	24.7%
1985	1,900,600	2.5%	485,300	3.1%	25.5%
1990	2,149,300	2.5%	555,200	2.7%	25.8%
1991	2,187,200	1.8%	562,600	1.3%	25.7%
1992	2,215,000	1.3%	575,000	2.2%	26.0%
1993	2,250,000	1.6%	594,000	3.3%	26.4%
1994	2,280,000	1.3%	608,600	2.5%	26.7%
1995	2,317,500	1.6%	616,900	1.4%	26.6%
1996	2,353,300	1.5%	629,200	2.0%	26.7%
1997	2,387,100	1.4%	649,800	3.3%	27.2%

Source : Statistical Year book Mongolia (SSOM.1998)

The natural population increasing ratio and the social immigration ratio are shown on the Figure 7.3.1 below. Based on that, the annual population increasing ratio was forecasted to be 2.1%, 1.7% and 1.6% for 2005, 2010 and 2020 respectively.

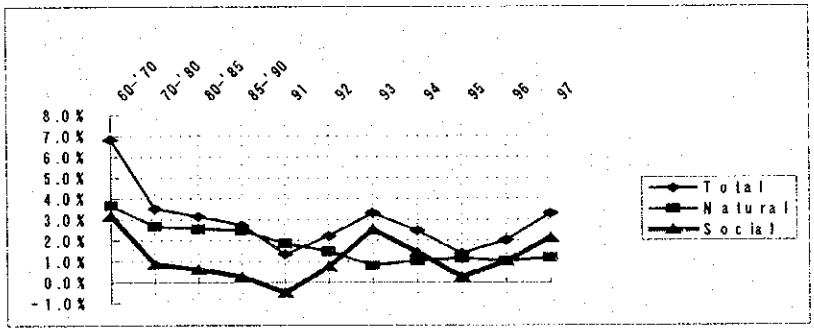


Figure 7.3.1 Population Growth Ratios of Ulaanbaatar, 1960-1997

7.4 GDP

The changes in growth of GDP in Mongolia is shown below:

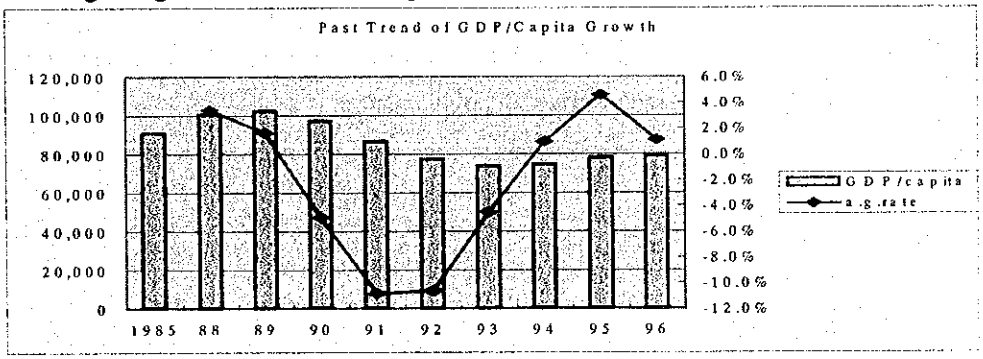


Figure 7.4.2 Changes in GDP per capita, 1985-1986 (In 1993 prices, Tug)

As it is shown below, the UB city GDP is twice of that of the country.

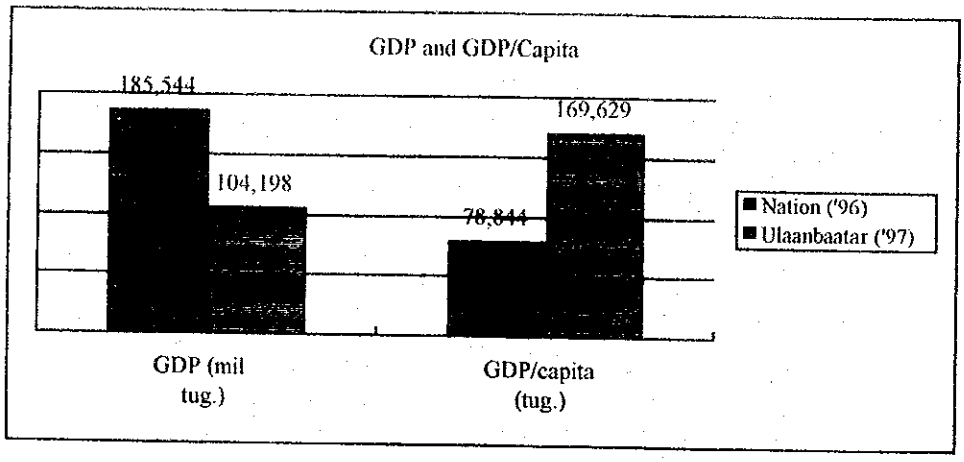


Figure 7.4.3 GDP per capita, Nation and Ulaanbaatar, 1997 (In 1993 prices, Tug)

7.5 Future Socio-Economic Framework

The future socio-economic framework was established as it is shown in Table 7.5.1 through the discussion of the above-mentioned data with the Mongolian side.

Table 7.5.1 Socio-Economic Framework of the Study Area

	1998	2000	2005	2010	2020
Population	617,500	655,000	725,000	790,000	925,000
	-	2.2%	2.1%	1.7%	1.6%
GRDP per capita	169,629	183,000	207,000	234,000	302,000
		2.5%	2.5%	2.5%	2.6%
GRDP	104,198	120,000	150,000	185,000	279,000
		4.85%	4.6%	4.3%	4.2%

Note: -GRDP per capita Tug. of 1993 prices
- GRDP Million Tug. of 1993 prices
- Percentages means the average annual growth rate from the previous year

7.6 Proposals on Land Use

Basic policy on land use up to 2020 was discussed with the UB city authorities on March 10,1998.

Issues which caused problems during the discussions are shown in the left column and proposed solutions by the Study Team are shown in the right column.

Issues	Proposed solutions by the Study Team
Gers on the northern mountain slopes should be removed to reduce negative environmental deterioration.	Ger population in zones in northern slopes are forecast to decrease.
Water resource area in the south-east part of the city occupies about 3,000 ha. It is	A planned Ring Road should pass its north-west part. Partial development of the area, just inside of the Ring

about 20% of the territory of UUB.	Road, is recommended to ensure the spaces for future development of the city.
2 power stations cause about 20% of air pollution in UUB.	It is desirable to relocate them to Baganur area. However it is not accepted from its huge cost, and expected to keep them at their present locations.
A railway is dividing UUB into 2 separate southern and northern parts. It is now barriers for the development of UUB.	Relocation on the north dike of Tuul river was recommended. But Mongolian side has decided to keep the railway in its present location.
Places to be relocated of the existing factories inside of the city should be developed in order to reduce the environmental deterioration.	As one of the solutions, development of the railway junction in Khonkhor area is recommended. However Mongolian side expected the development should focus in the Nalaikh town.
Current international airport of UB is too near to the city area. Also its topographic conditions are not suitable to manage future demands as an international airport.	Redevelopment of the Nalaikh Airbase is recommended as a New International Airport. Mongolian side explained that they are expecting to develop a new airport to the south-west of Zuunmod. However it is out of scope of works of the Study, and the proposal was not evaluated.

7.7 Zoning

GUB is composed of 9 administrative districts (Duuregs). And it is divided into 111 small districts (Khoroo). The Government of Ulaanbaatar defines 99 khoroos as UUB as shown in Table 7.7.1.

Table 7.7.1 UB Districts in Study Area

S. No.	Name of District	No. of Blocks (khoroos)	No. of Khoroos in UUB
1	Bayangol	19	19
2	Chingeltei	18	17
3	Sukhbaatar	16	16
4	Bayanzurkh	19	18
5	Khan Uul	13	9
6	Songino	21	20
7	Nalaikh	5	
	GUB Total	111	99
8	Banaguur		Remote districts
9	Bagakhangai		

The Study Team divided GUB into 52 zones and established the future socio-economic framework for 2005, 2010 and 2020 for each zone with consideration of the agreed plan for future land use.

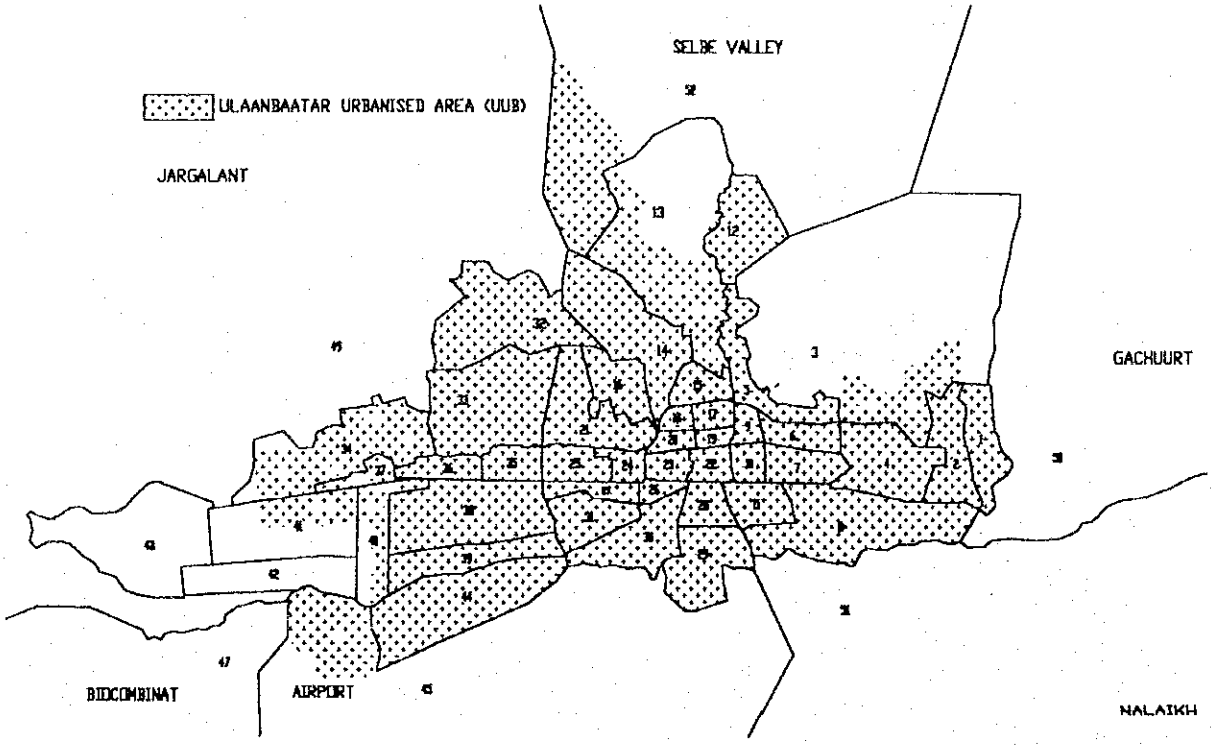


Fig 7.7.1 Zoning of GUB