Government of Ulaanbaatar City,
Emergency Management Department of the Capital City
Japan International Cooperation Agency (JICA)

Mongolia
The Project for Strengthening the Capacity of Seismic Disaster Risk Management in Ulaanbaatar City
Final Report

Volume-3 Supporting Report
Volume-4 Databook

October 2013

Asian Disaster Reduction Center, Urban Disaster Research Institute
Tokyo Electric Power Services Co., Ltd.

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Abbreviations

ADB	Asian Development Bank
ADRC	Asian Disaster Reduction Center
ALACGaC	Agency of Land Affairs, Construction, Geodecy and Cartography
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer, Global Digital Elevation Model
CA	Capacity Assessment
CBS	Cellphone Broadcast System
CP	Counterpart
DF/R	Draft Final Report
EMDC	The Emergency Management Department of the Capital City
EOST	la Ecole et Observatoire des Sciences de la Terre
F/R	Final Report
GDP	Gross Domestic Product
GIS	Geographic Information System
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit
HFA	Hyogo Framework for Action
HRW	Human Rights Watch
IC/R	Inception Report
ISC	International Seismological Centre
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
M	Japan Meteorological Agency (JMA) magnitudes
Ml	Richter magnitudes
Ms	Surface magnitudes
Mw	Moment magnitudes
M/M	Minutes of Meetings
MHFC	Mongolian Housing Finance Corporation
MRTCUD	Ministry of Roads, Transport, Construction and Urban Development
MSK	Medvedev-Sponheuer-Karnik intensity scale
MUST	Mongolian University of Science and Technology
NEMA	National Emergency Management Agency
NGIC	Mongolian National Geo-information Center
NGO	Non-Governmental Organization
PGA	Peak Ground Acceleration
PR/R	Progress Report
R/D	Record of Discussions
RC	Reinforced Concrete
RCAG	Research Center of Astronomy and Geophysics of Mongolian Academy of Sciences

SC	Steering Committee
UB	Ulaanbaatar
UBMPS	The Study on City Master Plan and Urban Development Program of Ulaanbaatar City
UN	United Nations
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UN-HABITAT	United Nations Human Settlements Programme
USD	United States Dollar
USGS	United States Geological Survey
WB	World Bank
WG	Working Group
WMO	World Meteorological Organization

Table of Contents

Chapter 1 Outline of the Project

1.1 Project Title

The Project for Strengthening the Capacity of Seismic Disaster Risk Management in Ulaanbaatar City, Mongolia (hereinafter referred as "the Project")

1.2 Background of the Project

Mongolia, a landlocked country in East and Central Asia, whose population is 2.81 million, GDP per citizen is 2,562USD and area is 1.56 million km^2, is prone to some natural hazards such as heavy rain, storm, and flood.

In Ulaanbaatar (hereinafter referred as "UB"), the capital of Mongolia, the number of unfelt earthquakes has been increasing since 2005, especially its trend has been more obvious after 2009. A French research institute pointed out in 2010 that UB City and its suburbs are surrounded by 4 faults including newly discovered ones which might cause the earthquakes of Magnitude 7 (M7) level. Also according to the 2000 simulation by National Academy of Mongolia, it is predicted that approximately 300 buildings and 60,000 citizens would be affected if the M7 level earthquake hits UB City.

In this situation, the Government of Mongolia requested Japanese Government to carry out the "Project for Strengthening the Capacity of Seismic Disaster Risk Management in UB City" in 2010. Since the request terms were multipronged and further survey were necessary, Japan sent a mission for information gathering in July, 2011 in order to recognize government's activity for disaster reduction and to build the project. In the survey, after discussion with Mongolian organizations, it was confirmed that Japan will cooperate in making an integrated seismic risk map and in the map-based disaster reduction activity. Also confirmed is that the organizations for disaster reduction activity have been established; for example National Emergency Management Agency (NEMA) in 2004 and UB urban development division seismic measure department in 2010.

Based on the survey mentioned above, the detailed survey for planning was performed from Sep. to Oct., 2011 to examine the terms of cooperation, followed by the agreement regarding the scope of project, project terms, and the organization for implementation. The agreement was confirmed by Minute of Meeting (M/M), and Record of Discussion (R/D) was signed and exchanged in Nov. 2011. The Project is carried our by "Technical Cooperation Project for Development" according to the M/M and R/D.

1.3 Objectives of the Project

To strengthen the capacity for seismic disaster risk management in UB City and to transfer relevant skills and technologies to personnel concerned with the Project

1.4 Remarkable Outcomes of the Project

- Formulation of integrated seismic risk map for UB,
- Revision of regional seismic disaster risk management plan,
- Preparation of the draft construction guideline for middle-high storied building considering seismic disaster risk resilient urban development and
- Capacity development of the relevant authorities and citizens in seismic disaster risk management

1.5 Project Area

Ulaanbaatar City

Chapter 2 Outline of the Survey

2.1 Implementation Structure

(1) Relevant Government Offices and Organizations

(i) Counterpart (hereinafter referred as "CP")

Ulaanbaatar City, Emergency Management Department of Ulaanbaatar (hereinafter referred as "EMDC")

(ii) Authorities Concerned

a. Central Government

- National Emergency Management Agency (NEMA)
- National Security Council of Mongolia
- Department of Policy for Urban Development and Land Affairs, Ministry of Road, Transportation, Construction and Urban Development (MRTCUD)
- Administration of Land Affairs, Construction, Geodesy and Cartography, MRTCUD
- Department of Road, Transportation Policy Development, MRTCUD
- Department of Financing and Cooperation Department, MRTCUD
- Information, Communications Technology and Post Authority
- General Agency for Specialized Inspection

b. Ulaanbaatar City

- City Development Policy Department
- Road Department
- Construction, Urban Development and Planning Department
- Land Administration Department
- Urban Planning, Architecture and Designing Institute
- Engineering Facilities
- Administration Department

c. Others

Mongolia Academy of Sciences

(2) Structure of the JICA Mission

The project is implemented by the Mission consists of the following Experts and allocated work period of each member are summarized as Table 2.1.1.

Table 2.1.1 Experts Assigned to the Project

Assignment	Name	Affiliation
Project Leader/Disaster Risk Management Planning/Capacity Development	ARAKIDA Masaru	ADRC
Deputy Leader/Seismic Risk Assessment/Earthquake and Structural Engineering	FUKUSHIMA Seiichiro	TEPSCO
Road and Infrastructure Seismic Engineering	KOJIKA Kenpei	TEPSCO
Road and Infrastructure Seismic Engineering	TAKAHASHI Makoto	TEPSCO
Building Administration and Seismic Resilient Urban Planning	OGAWA Yujiro	
GIS Database/Telecommunication System Engineering	HASI Bateer	AJIKO
Mapping	KAMIMURA Koichi	AJIKO
Mapping	FUJITA Yashihide	AJIKO
Disaster Prevention Education	KODAMA Miki	ADRC
Coordination/Assistant in Disaster Risk Management Planning/Environmental and Social Considerations	KOBAYASHI Hiroshi	TEPSCO

Note:
ADRC: Asian Disaster Reduction Center,
TEPSCO: Tokyo Electric Power Services Co., LTD.
AJIKO: Asia Air Survey Co., LTD.

(3) Project Implementation Structure

To implement the project with smooth coordination, Steerring Comittiee (hereinafter rederred as “SC”) and for working groups (hereinafter referred as “WG”) are set up. The project implementation structure is shown in is as Figure 2.1.1.

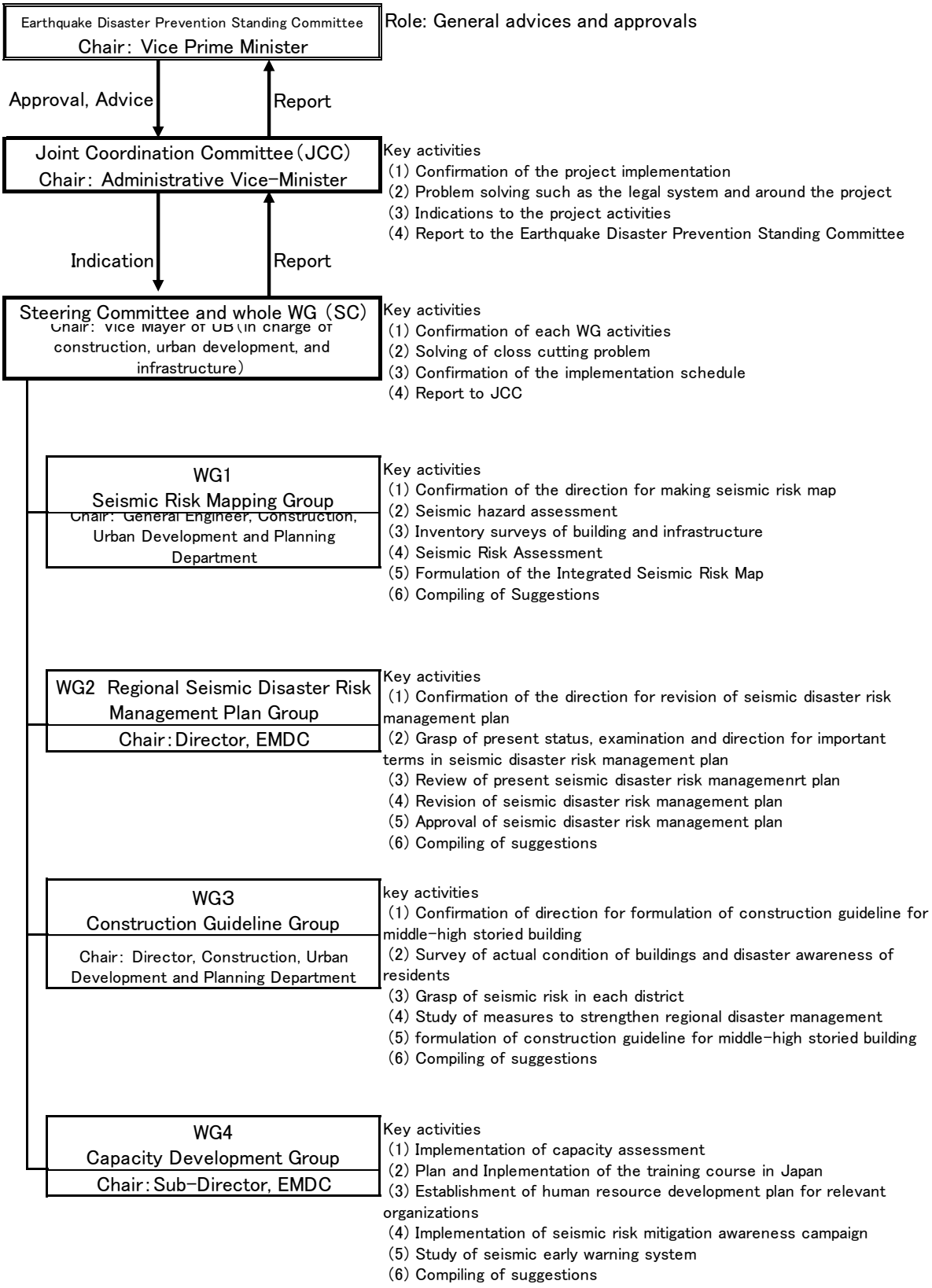


Figure 2.1.1 Structure of the Project Implementation

2.2 Implementation Plan and Schedule

(1) Project Implementation Plan

To achieve the purpose of the project, the project will be implemented according to the following outline.

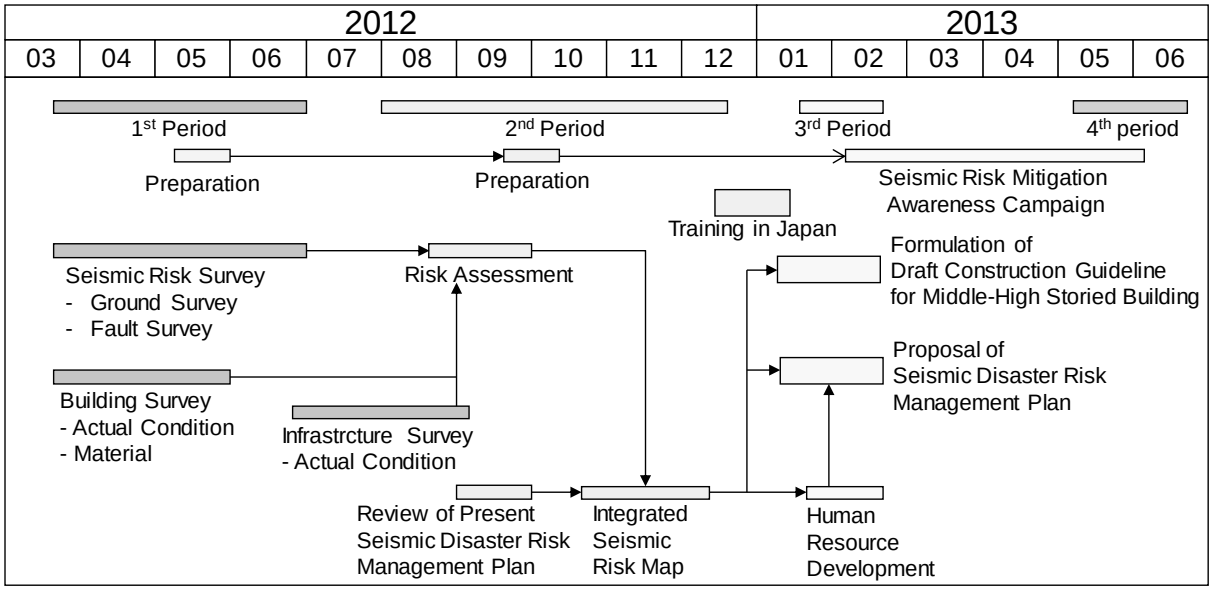


Figure 2.2.1 Project outline

(2) Project Implementation Schedule

Project implementation flowchart and work plan are shown in Figure 2.2.2 and Table 2.2.1 respectively.

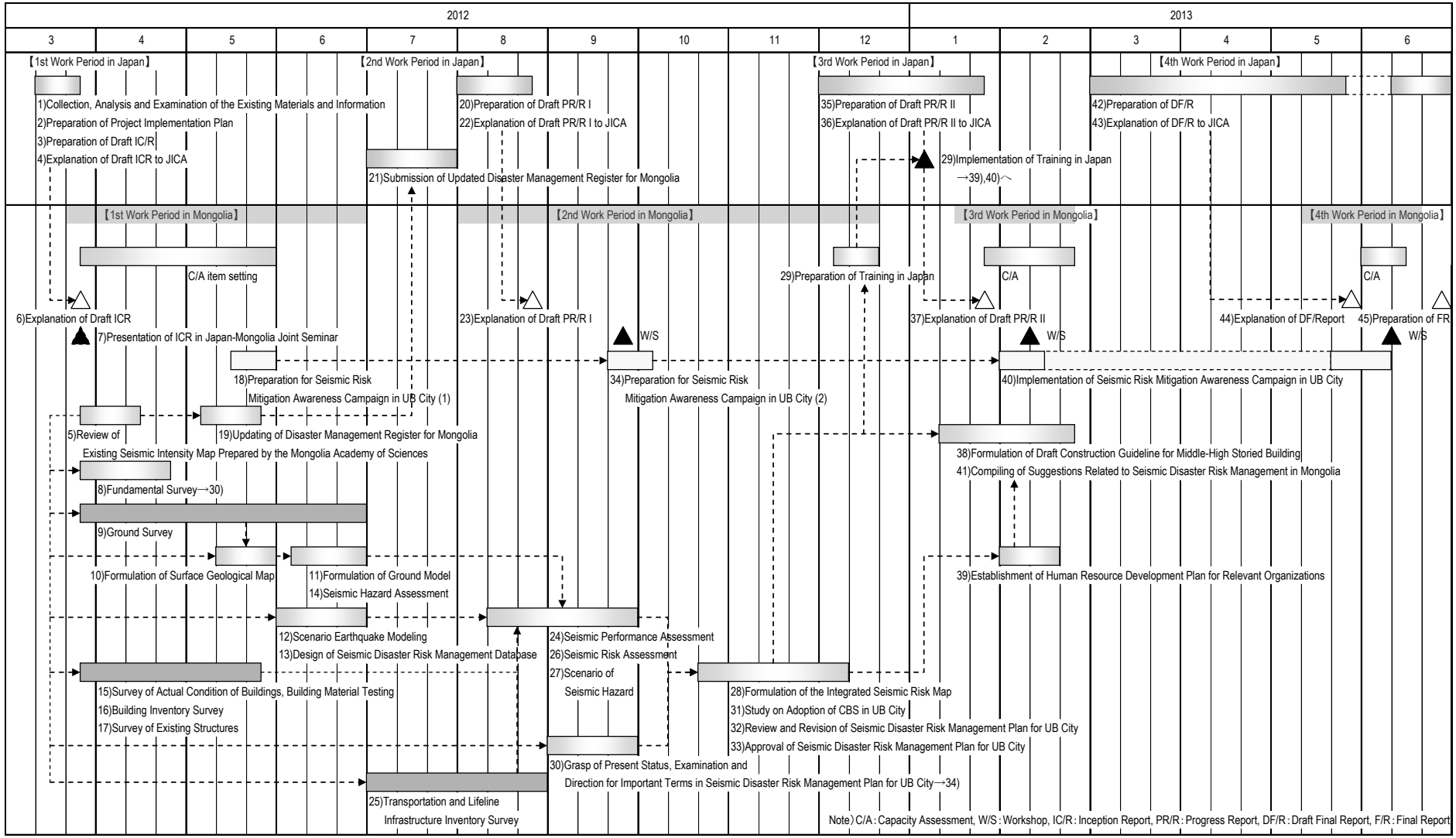


Figure 2.2.2 Project Implementation Flowchart

Table 2.2.1 Work Plan

Work \ Period	2012										2013					
	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
【1st Work Period in Japan】																
1)Collection, Analysis and Examination of the Existing Materials and Information	□															
2)Preparation of Project Implementation Plan	□															
3)Preparation of Draft IC/R	□															
4)Explanation of Draft Inception Report to JICA	△															
【1st Work Period in Mongolia】																
5)Review of Existing Seismic Intensity Map Prepared by the Mongolia Academy of Sciences		□														
6)Explanation of Draft Inception Report		△														
7)Presentation of Inception Report in Japan-Mongolia Joint Seminar		▲														
8)Fundamental Survey		□														
9)Ground Survey		□	□	□												
10)Formulation of Surface Geological Map			□													
11)Formulation of Ground Model				□												
12)Scenario Earthquake Modeling				□												
13)Design of Seismic Disaster Risk Management Database				□												
14)Seismic Hazard Assessment				□												
15)Survey of Actual Condition of Buildings, Building Material Testing		□	□													
16)Building Inventory Survey		□	□													
17)Survey of Existing Structures		□	□													
18)Preparation for Seismic Risk Mitigation Awareness Campaign in UB City (1)			□													
19)Updating of Disaster Management Register for Mongolia			□													
【2nd Work Period in Japan】																
20)Preparation of Draft Progress Report I						□										
21)Submission of Updated Disaster Management Register for Mongolia					□											
22)Explanation of Draft Progress Report I to JICA						△										
【2nd Work Period in Mongolia】																
23)Explanation of Draft Progress Report I						△										
24)Seismic Performance Assessment						□	□									
25)Transportation and Lifeline Infrastructure Inventory Survey					□	□										
26)Seismic Risk Assessment						□	□									
27)Scenario of Seismic Hazard						□	□									
28)Formulation of the Integrated Seismic Risk Map								□	□							
29)Implementation of Training in Japan										□	△					
30)Grasp of Present Status, Examination and Direction for Important Terms in Seismic Disaster Risk Management Plan for UB City							□									
31)Study on Adoption of CBS in UB City								□	□							
32)Review and Revision of Seismic Disaster Risk Management Plan for UB City								□	□							
33)Approval of Seismic Disaster Risk Management Plan for UB City								□	□							
34)Preparation for Seismic Risk Mitigation Awareness Campaign in UB City (2)							□									
【3rd Work Period in Japan】																
35)Preparation of Draft Progress Report II										□	□					
36)Explanation of Draft Progress Report II to JICA											△					
【3rd Work Period in Mongolia】																
37)Explanation of Draft Progress Report II											△					
38)Formulation of Draft Construction Guideline for Middle-High Storied Building											□	□				
39)Establishment of Human Resource Development Plan for Relevant Organizations											□	□				
40)Implementation of Seismic Risk Mitigation Awareness Campaign in UB City											□	□	┈	┈	□	
41)Compiling of Suggestions Related to Seismic Disaster Risk Management in Mongolia											□	□				
【4th Work Period in Japan】																
42)Preparation of Draft Final Report													□	□	□	□
43)Explanation of Draft Final Report to JICA																△
【4th Work Period in Mongolia】																
44)Explanation of Draft Final Report																△
45)Preparation of Final Report																□

Chapter 3 Fundamental Survey

3.1 Disaster reduction related policies, plans, laws, development regulations, anti-earthquake (seismic) standards, organizations, communities in Mongolia and UB City

Earthquake disaster Management actions of Mongolia and Ulaanbaatar City are summarized based on 1st field survey term. Document No. shown in this clause are corresponded to the Table 3.1.1.

Tabel 3.1.1 List of collected documents related disaster reduction related policies plans, laws, development regulations, anti-earthquake (seismic) standards, organizations, communities in Mongolia and UB City

No.	Title	Organization	Outline
3-1-1	Parliament Law of Mongolia on Disaster Protection 2005.6.20	Parliament	English version of Mongolian Disaster Protection Law issued on 20th of June 2003
3-1-2	NEMA EMDC Organization Chart	NEMA, EMDC	Flow Chart of Disaster related organizations in Mongolia and UB city
3-1-3	Earthquake Disaster Prevention Standing Committee	Earthquake Disaster Prevention Standing Committee	Establishment and regulation of the committee and it brief explanation
3-1-4	Earthquake Risk Reduction prescription by National Security Council	National Security Council	Concrete prescription for earthquake risk reduction by National Security Council
3-1-5	Earthquake Disaster National Capacity Strengthening Plan	Earthquake Disaster Prevention Standing Committee	Plan by Earthquake Disaster Prevention Standing Committee consist from 27 items with duration , organization in charge
3-1-6	Order of Earthquake Disaster Risk Reduction to Emergency Management Agency of Prefectures, Capital city, Districts and Governmental policy of earthquake disaster risk reduction	NEMA	Document describes implementation of plans based on The Earthquake Disaster National Capacity Strengthening Plan
3-1-7	Earthquake Disaster Prevention Plan of UB city (1/3) Disaster Preparedness	EMDC	Earthquake Disaster Disaster Preparedness Plan of UB city
3-1-8	Earthquake Disaster Prevention Plan of UB city (2/3) Emergency Response	EMDC	Earthquake Disaster Emergency Responce Plan of UB city
3-1-9	Earthquake Disaster Prevention Plan of UB city (3/3) Recovery	EMDC	Earthquake Disaster Recovery Plan of UB city
3-1-10	Country Study for Japan's Official Assistance to the Mongolia	JICA Research Institute	Policy, important points and important notice of assistant for Mongolia are mentioned.
3-1-11	Mongolia Country Report 2006	ADRC	Member country report of Asian Disaster Reduction Center, Disaster related information is reported (Japanese version)
3-1-12	Mongolia Earthquake Disaster Peer Review Survey by Asian Disaster Reduction Center	JICA	Peer Review Report about Disaster Awareness and capacity building activities report done at December 2010
3-1-13	Mongolia Country Report 2010	ADRC	Member country report of Asian Disaster Reduction Center, Disaster related information is reported (English version)
3-1-14	Year book of UB city Fire Department 2011	UB city Fire Department	Year book of Fire in 2011

※Number of document correspond to【Ref. No】in document.

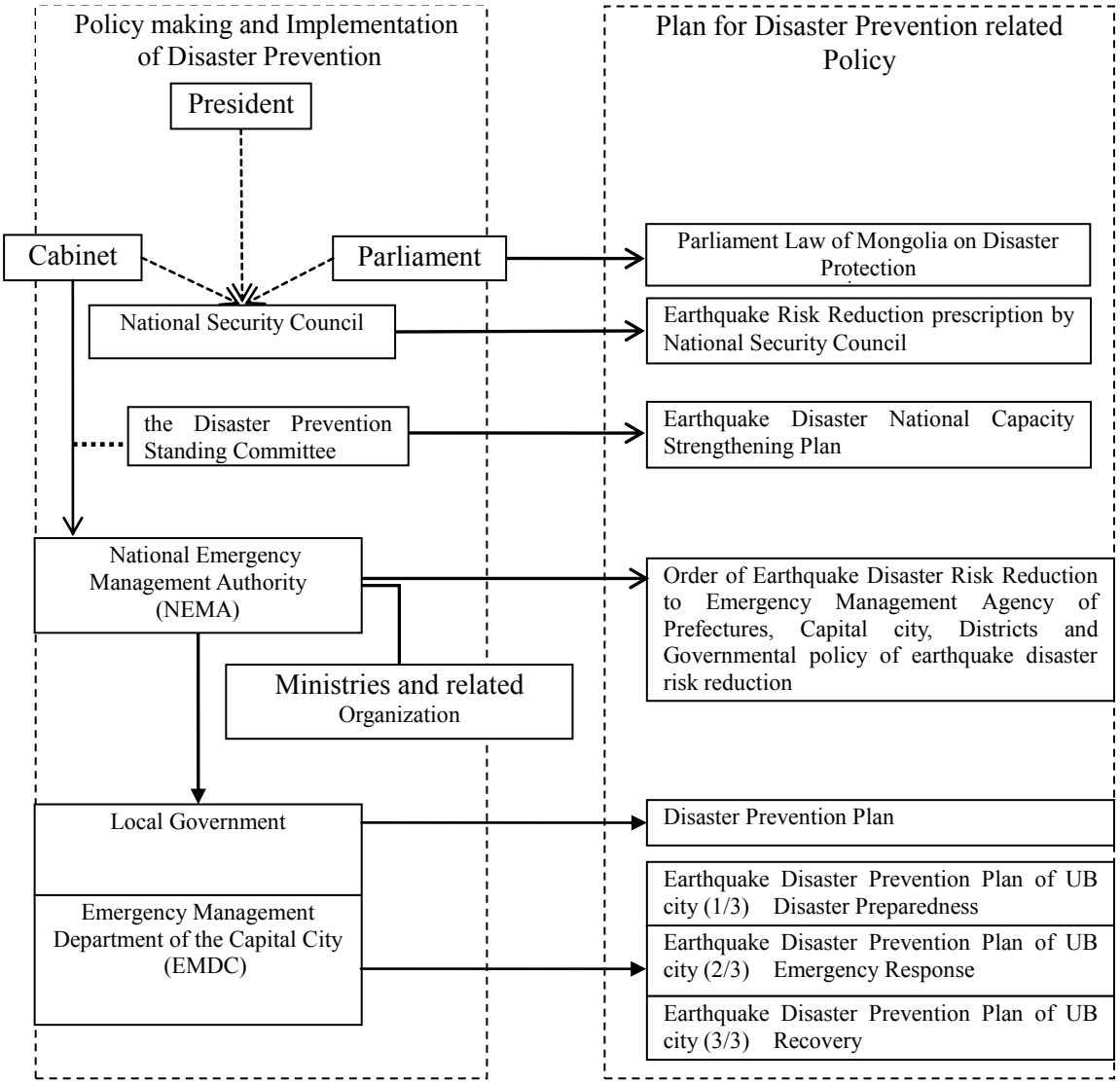
3.1.1 Disaster Prevention Policy

Central government and local governments in Mongolia have disaster management sections according article 13.to article 26. of Parliament Law of Mongolia on Disaster Protection 【Ref. 3-1-1】(refer 3.1.3).

In national level, National Emergency Management Authority which National Defense Committee, Fire Agency and National Storage Agency were unified was established according National Resolution No 1. (issued on 7th of January 2002). In local governments (21 prefectures and UB city), similar sections were established. In UB city, EMDC (Emergency Management Department of Capital City) was established【Ref. 3-1-2】.

In addition, there are two important council and committee related to policy making of Earthquake Disaster Prevention. One is the National Security Council which members are only President of Mongolia, Prime Minister of Mongolia and Chairman of Parliament and this council has big role to push forward the disaster prevention and management in Mongolia. The other is the Disaster Prevention Standing Committee. This committee is vi the Cabinet which chairman is the 1st vice minister and other members are from related ministries and organizations. This standing committee plays the role of policy making in the Cabinet.

It is shown as follow.



(1) Governmental policy of earthquake disaster risk reduction settled by National Security Council 【Ref. 3-1-4】

In this document, the order to the Parliament of Mongolia, to order to Cabinet of Mongolia, policy of earthquake disaster reduction are indicated and consist of order to the Pariament, Cabinet, Minutes of the Council.

1) Order to Parliament of Mongolia
   a) Ensure drastic Legal arrangement to promote cooperation and holistic management among related organizations which engage earthquake disaster risk reduction and disaster prevention and engage national security
   b) Regal environment and necessary fund to reconstruct and ensure safety of building
2) Order to Cabinet of Mongolia
   a) Work out plan to redevelopment plan of buildings which prohibits using poor sanitary or dangerous situation and promotes its improvement according international standard.
   b) Make earthquake disaster risk near UB city known to residents, and arrange industrial area, service area and residential area by preparing highway and power network. Take countermeasures to reduce population concentration by construct university campus.
   c) Implement periodical national wide disaster training and evaluate its result to upgrading earthquake disaster prevention knowledge and skill.
   d) Submit situation report related to "Earthquake Disaster Risk Reduction National Plan" and other determined issues on 22th of January of each year.
   e) Recognize and promote implementation of "Earthquake Disaster National Capacity Strengthening Plan". (11th of February 2011)
   f) Order to Ministry of Roads, Transport, Construction and Urban Development (MRTCUD), Governor of Prefectures, Mayor of UB city, Emergency Management Agency of Mongolia, Academy of Science (Research Centre of Astronomy & Geophysics, hereinafter called RCAG) to implement Earthquake Disaster National Capacity Strengthening Plan within decided date. (29th of March, 2011, Order No.8)
3) Agreements between Ministries and Organizations
   a) Cooperate with foreign professional organizations, prepare Intensity Map and evaluate possibility of building development in the earthquake potential areas to improve earthquake observation equipment and capacity building and upgrade management capacity to International level. [relevant organization; Governor of Prefectures, Mayor of UB city, Academy of Science (RCAG)]
   b) Prepare funding resource for geophysical survey in and around of capital city and construct geophysical observation base in assumed epicenter area. [relevant organization; Ministry of finance, Academy of Science (RCAG)]
   c) Cost for equipment for search and rescue activities and reconstruction cost of old buildings and facilities should be included in national budget.. [relevant organization; Ministry of finance, Academy of Science (RCAG)]
   d) Research institute for seismology, building material, structure research institute should be established. [relevant organization; Ministry of Roads, Transport, Construction and Urban Development, UB city mayor]
   e) Implement seismic-capacity evaluation for residential houses, public facilities, industrial and service facilities and inventory survey for all buildings and complete building database. Implement earthquake disaster risk evaluation in Capital and major cities and prepare cost for the evaluation. Legal arrangement to cooperate among related organization to promote plan should be prepared. [relevant organization; Ministry of Finance, Ministry of Justice, Prefectural Governor, UB city Mayor]
   f) Set plan for prevention, emergency response, recovery plan, disaster reduction action plan and official and unofficial training plan for earthquake disaster and implement these plans. [relevant organization; MEMA, EMDC, District Chief, Prefectural Governor, UB city Mayor]
   g) Set plan for safety procedure standard and manuals for Infrastructure facilities which need to continue operation in case of disaster such as power plants, power distribution station, hot-water

heating station, train station, communication, radio and kinder garden, schools, hospitals, chemical, bacteria examination facilities. [relevant organization; Ministry of Roads, Transport, Construction and Urban Development, Ministry of Health]

h) Prepare emergency warning system and early warning system to transfer disaster information rapidly from epicenter such as Siren. Implement search and rescue, damage reduction, evacuation exercise more than once a year. [relevant organization; Ministry of Finance, NEMA, UB city Mayor, Academy of Science (RCAG)]

i) Promote to set up business continuity plan for private sectors and give necessary guide. [relevant organization; EMDC]

j) Confirm operation plan and equipment procurement situation for temporary houses, emergency foods, field hospitals and medical service. Request to get approval evaluation for warehouses, temporary airports. [relevant organization; EMDC, Civil Aviation Authority]

k) Pay effort to avoid illegal violation of Building and Urban Development Law, Urban Planning Law and regulations. Especially in UB city, building construction which violate UB Urban Planning stop its construction and restrict land deal which violate regulation of minimum distance of adjoin buildings. [relevant organization; Prefectural Governor, General Agency for Specialized Inspection)

l) Set up high-rise building planning standard which indicate suitable number of floors of buildings in Earthquake Disaster Risk Zone in respect prefectures and UB city and keep this rule. (Ministry of Roads, Transport, Construction and Urban Development)

m) Topography map, Cadastral Map which used in emergency situation keep renewed and will be revised. (NEMA, UB Mayor's Office)

4) Minutes of National Security Council

a) Review Urban Development Plan and disaster prevention countermeasures should be included sufficiently.

b) Promote residential area and sub-center development to mitigate over concentration of population in UB city and revise infrastructure plan such as highway road, electric power network

c) Review facility plan of network infrastructure such as road, heating, electricity, water supply and sewage system.

d) Implement random sampling seismic-capacity evaluation of district and residential area and get first result of seismic-capacity evaluation of UB city building.

e) Complete national wide seismic-capacity evaluation of building in 2012. Commission private sectors to perform the survey with NGO and residents be able to participate.

f) Earthquake Disaster Prevention Plan will be reviewed according to the need.

g) Insufficient seismic capacity buildings will be demolished and reconstruct.

h) Develop risk management experts by university and research institutes in and out of Mongolia.

i) Review local government development plan and make Intensity Map in 2012.

j) Implement schools and kinder gardens seismic-capacity evaluation and according to results, action should be taken such as demolition or retrofit.

5) Order of 29th of March, 2011

a) Implement Earthquake Risk Evaluation of UB city.

b) Explain earthquake activity in UB city

c) Survey Faults and make Intensity Map of residential area. Implement survey to identify low risk area to settle sub center and new town.

d) Promote quality and strength evaluation of residential buildings.

e) Implement random sampling seismic-capacity evaluation of district and residential area and get first result of seismic-capacity evaluation of UB city building.

f) Prepare equipment to survey the quality of buildings and allocate sufficient staff to evaluate more than 10 buildings at same time.

g) Complete seismic-capacity evaluation of whale buildings in UB city in 2012 and building quality information should be disclosed to society.

h) Proposal of "Early Warning System" should be prepared with cooperation of mobile phone providers, TV, Radio and FM stations based on internal capacity.

i) Implement countermeasures to protect citizens from earthquake disaster risk. These will be

emergency back, water, whistle, medicine, portable light, winter clothes and tools.

j) Advise for families living in houses to prepare Ger, tents, small stove, hoods, clothes with manuals explain how to prepare.

k) Standardize table durable to collapse building and introduce them to kinder garden, schools, office.

l) Following articles should be add and get authorization within decided time.

- Sub center and new residential area should be included
- Construct highway and rail road between UB city and Kharkhorin and between UB city and Darkhan to supply comfortable modern transportation service.
- Develop economic industry in Tuul and Argalant city and to prepare new residential area will be provided to support UB city.

(2) Order of Earthquake Disaster Risk Reduction to Emergency Management Agency of Prefectures, Capital city, Districts【Ref. 3-1-6】

This document is issued on 23th of January 2012 from NEMA. In this document, following 3 items are indicated. National Security Council decided Governmental policy of earthquake disaster risk reduction【Ref. 3-1-4】. the Disaster Prevention Standing Committee was set up and the committee issued Earthquake Disaster National Capacity Strengthening Plan (30th of March, 2011)【Ref. 3-1-5】. Order to local governments to improve earthquake disaster response capacity. Request to submission of progress report on June and December of each year.

1) Existing regulations, standards, manuals should be reviewed according to the regulations enacted by central government and should report countermeasures for earthquake risk reduction once a year or half year.
2) Prepare an intensity map, develop sub center and new town, prepare emergency stock in each house, prepare several ten thousands hood, houses, winter clothes stock, prepare plan for evacuation, transportation, allocation of residents. Implement evacuation exercise on 4th Wednesday of every March and holding events on United Nations disaster reduction day.
3) Notify above order authorities concerned and state of progress should be reported to NEMA Emergency Management Center at 1st week of June and December.

3.1.2 Earthquake Disaster Prevention Plan

(1) National Earthquake Disaster Prevention Plan 【Ref. 3-1-5】

National Earthquake Disaster Prevention Plan authorized on 30th of March, 2011 is shown below. As the earthquake disaster risk management project has started soon in Mongolia, many of items in this plan are urgent and targeted period for completion are set in 2 or 3 years.

Table 3.1.2 Earthquake Disaster National Capacity Strengthening Plan

	Project	Period	Organizations
1	Hazard Map in UB city, budget allocation of procurement of necessary equipment	2011-2012	UB city, Academy of Science (RCAG)
2	Earthquake Hazard Map in Baganuur district, Bagahangai district and Nalaih district (by UB city budget)	2011	
3	Impremention of seismic-capacity evalunation for 40% of apartment houses, factories, public facilities, service facilities in UB city.	2011-2013	UB city, General Agency for Specialized Inspection
4	Database of apartment houses, factories, public facilities, service facilities in UB city	2011-2012	UB city,
5	Database of apartment houses, factories, public facilities, service facilities in major cities and central area of prefectures	2011-2013	Governor of prefecture
6	Reconstruction plan of old buildings based on survey indicated in item No.3.	2011-2012	UB city,
7	Add a couse to study earthquake and responce in School and	From	Ministry of Education and

	Project	Period	Organizations
	Kinder garden.	Academic year of 2012	Culture, NEMA
8	Disaster training for dsaster releted organizations in 3 to 4 prefectures in every year. Disaster training including residents in 1 or 2 prefectures in every year.	Every year	NEMA, UB city, Governor of prefecture
9	Development of Lectures and training program for residents	Every year	NEMA
10	Precise earthquake survey in 300km of Ub city and Estimate expected damage in UB city. Select new town area, government office area, buckup base in case of disaster occures.	2011-2012	UB city, Academy of Science, NEMA
11	Study past experience of big earthquake in forgein countries and reflect to Mongolia	2011-2012	Earthquake Disaster Standing Committee
12	Budgetting for the activities of National Disaster Prjects Coordination Permanent Committee	2011	Earthquake Disaster Standing Committee
13	Reflect Disaster Prevention,Air Pollution, Reduction of over congested central area, new town construction and issue about Infrastructure to draft of Urban Redevelopment Law. Draft should be submitted National Congress of spring,2011	2011	MRTCUD, UB city,
14	Introdue draft of Emergency Management Law	2011-2012	Official Residence of the President、National Security Council, NEMA
15	Enact legal system of reconstruction on old apartment houses	2011-2012	MRTCUD, UB city,
16	Revision of Building Code and international level of building inspection system	2011-2014	MRTCUD, General Agency for Specialized Inspection
17	Budgetting of 2011 government budget to stock of food for 100000peoples for 1 month and its storege buildinds	2011	Ministry of Finance ,UB city, NEMA
18	Survey for Capital relocation of UB city	2011-2013	UB city, Academy of Science
19	Budgetting for capacity building of experts in Earthquake Disaster field	2011	NEMA, Ministry of Finance Ministry of Education and Culture
20	Hazard Mapping in major cities and central area of prefectures	2013～	Academy of Science, Governor of prefecture
21	Formation of Early Warning System Project	2011-2013	Academy of Science, NEMA,
22	Budget allocation of earthquake observation equipment in Dundgobi, Selenge and Bayanhongor	2011	Ministry of Education and Culture
23	Extention work of Military Hospital, Formation of Portable Hospital of 5000 to 10000 victims of earthquake disaster	2012-2013	Ministry of Defense、Ministry of Finance, NEMA
24	Creat Search and Resque Dog	2011-2012	NEMA, Ministry of Finance
25	Budget allocation of 4 sets of temporaty buridge, Earthquake Experience Mobile.	2011-2012	UB city, Ministry of Finance ,NEMA
26	Strengthening of brood stock and construction of unti-seismic brood bank center	2011-2012	Ministry of Health、Ministry of Finance ,NEMA、UB city,
27	Budget allocation for regional medical center in Khovd, Uvurkhangai, Orkhon and Dornod Extention work of brood center in Garkhanuul General Hospital Budget allocation for renewal of blood center machinary in Sukhbaatar, Khentii and Tuv General Hospitals	2011-2012	NEMA, Ministry of Finance

Ref：【No.3-1-5】Earthquake Disaster National Capacity Strengthening Plan

(2) Earthquake Disaster Prevention Plan in UB city 【Ref : No.3-1-7, 3-1-8, 3-1-9】

Earthquake Disaster Prevention Plan of UB city is made based on Earthquake Disaster National Capacity Strengthening Plan. Plan has made to responding 3 phases.

First is earthquake disaster prevention and preparedness for disaster response such as training (plan in this phase is called as Earthquake Disaster Prevention and Preparedness Plan). In this plan targeted time of each item is defined. This plan is shown in Table 3.1.3. Second is Earthquake Disaster Response Plan and each item are listed according time sequences after events occur. This plan is shown in Table 3.1.4 and Figure 3.1.1. Third is Earthquake Disaster Recovery Plan after disasters occur and each item is listed according time sequences after events occur. This plan is shown in Table 3.1.5 and Figure 3.1.2.

Table 3.1.3 Earthquake Disaster Prevention and Preparedness Plan in UB city

	Plan	Period	Organization
1. Strengthening of actions related disaster reduction survey, training and search and rescue			
1.1	Strengthening of actions related disaster reduction survey, training and search and rescue	2010- 2012	Governor's Office, Governmental Organizations, NGO, General Agency for Specialized Inspection
1.2	Exchange information between International Expert organization and grow domestic engineers	2010-2012	Governor's Office, General Agency for Specialized Inspection
1.3	**Contents Under Investigation**	2010-2012	Governor's Office
1.4	Hold training course to skill up of UB EMDC	2011-2012	Governor's Office, EMDC
1.5	Hold training exercise of people evacuation by UB Governor's Office and local administrative organizations	2011-2012	Governor's Office, EMDC
1.6	Hold training exercise of emergency medical care	2011-2012	Governor's Office, Department of Health, Red Cross General Agency for Specialized Inspection
1.7	Hold training exercise of School Emargency Response and First Aid	2011-2012	EMDC, Department of Education
2. Evaluation of Earthquake Damage, Intensity Map			
2.1	Review Intensity Map of UB city and reflect to the Urban Panning, Building Design	2010-2012	Governor's Office, Academy of Sciences, General Agency for Specialized Inspection
2.2	Strengthening checking of drawing of newly constructing buildings and quality of buildings	2010-2012	General Agency for Specialized Inspection, EMDC, Construction, Urban Development and Planning Department
2.3	Keep the quality control of old buildings which has not been taken earthquake countermeasures. 27 buildings which have risk of collapse and insufficient human habitation condition will be demolished. Make plan for redevelopment and solve the problems with residents participatory approach.	2010-2012	EMDC, Construction, Urban Development and Planning Department, Governor's Office; Lifeline Section
2.4	Check utilization of public apartments and service facilities construced efore 1970.	2010-2012	General Agency for Specialized Inspection, EMDC, EMDC, Construction, Urban Development and Planning Department
3. Risk Evaluation			
3.1	Implement Earthquake Risk in UB city and create database.	2010-2012	Governor's Office, RCAG, Department of Education, EMDC, Construction, Urban

	Plan	Period	Organization
			Development and Planning Department
3.2	Seismic-Capacity Evaluation of National Schools and National Universities and Dormitories in UB city must be surveyed.	2010-2012	General Agency for Specialized Inspection
3.3	Seismic-Capacity Evaluation of Health Facilities must be surveyed	2010-2012	Governor's Office: Lifeline Section
3.4	Seismic-Capacity Evaluation of Health Facilities must be surveyed	2011-2012	General Agency for Specialized Inspection
3.5	Validate manufacturing technology, product quality and standard of reinforced concrete	2011-2012	General Agency for Specialized Inspection
3.6	Manage the manufacturing technology and product quality of road and bridge construction parts.	2010-2012	General Agency for Specialized Inspection
3.7	Check displacement of heat piping on and underground. Check function of shut off bulb. Check vacuum pump and displacement of foundation one a half year.	2010-2012	Government Enterprise
4. Disaster Prevention, Emergency Response and Recovery			
4.1	Make search and rescue plan, disaster reduction plan and recovery plan for Earthquake Disaster.	2010-2012	Governor's Office, EMDC
4.2	Provide necessary machine and equipment for search and rescue plan, disaster reduction plan and recovery plan by gratuitous assistance or project base.	2010-2012	Governor's Office, EMDC
4.3	Hold training course for residents about Earthquake Prevention, Search and Rescue to disseminate sufficient knowledge.	2010-2012	Governor's Office, EMDC, 、Department of Education

Ref :【No.3-1-7】Earthquake Disaster Prevention and Preparedness Plan of UB city（1/3）
Earthquake Disaster Prevention and Preparedness Plan

Table 3.1.4 Earthquake Disaster Response Plan in UB city

	Actions	Period	Organization in charge
1	Start necessary actions directly and check the stability of communication equipment and report to chief when earthquake occurs	10 min.	101、105、(11)310005 Fire, Rescue Telephone Number
2	105,101Corps start rescue activities at major government buildings	15 min.	Emergency Corp 、105 head
3	Rescue team, fire fight team on duty start rescue activities on Governor's office	30 min.	Captain of Search and Rescue Team
4	Check Telecommunication equipment and start information communication when earthquake occurs	30 min.	Communication Department
5	Keep order and guard materials and take measures for traffic safety	30 min.	Bureau of Public Order,
6	After check telecommunication equipment, call up emergency team by "Disaster 105" / off duty	1.5 hours	101、105、(11)310005
7	Special committee members and Corps of Disaster response have to assemble On duty - Off duty -	 15 min. 1.5 hours	Directors
8	Start medical care at Hospitals able to use	1.5 hours	Department of Health, EMDC, Construction, Urban Development and Planning Department
9	Supply information of safety of people and secondary disaster	2 hours	Public Relations
10	Clarify area of damaged by disaster sending reconnaissance	2 hours	EMDC
11	Special committee make report of disaster damage	2 hours	Public Relations
12	Try to prevent of freezing of heating system of houses by residential union	2.5 hours	Governor's Office,
13	Take measures to prevent infectious disease at affected side	2.5 hours	Governor's Office, Department of Health, Veterinary Bureau
14	Prepare Buck Up office of UB city office	4 hours	Military Headquarter
15	When Power supply suffers damages when earthquake occurs, get damage and electricity will be supply priory to main user	3.5 hours	UB Power Distribution Station
16	When water supply suffers damage when earthquake occurs, get damage and water will be supply priory to main user	3.5 hours	Governor's Office, Bureau of Water Supply
17	Radiation leak and poisonous material leak occur by earthquake disaster, take countermeasures to reduce	3.5 hours	EMDC, General Agency for Specialized Inspection
18	Safety of oil storage, gas station, gasoline handling sectors and extinguish fire.	3.5 hours	EMDC, Bureau of Public Order,
19	Machinery and equipment for search and rescue are mobilized, Take initiative	4 hours	Governor's Office, Military Headquarter
20	Identify troubles and damages, take necessary action and supply heating system	4.5 hours	Governor's Office, Hot Water Supply Station
21	Prepare evacuation places, clothes, food and others also lead medical care in case of earthquake occurs	6 hours	Governor's Office,
22	Measures to let people evacuate when huge area affected by earthquake	6 hours	Governor's Office, Construction, Urban Development and Planning Department、Department of Public Transportation, Bureau of Public Order, Department of Road, Military Headquarter
23	Identify Body and lead funeral	24 hours	Governor's Office, Bureau of Public Order, Bureau of Public Health, Bureau of Registration
24	Assemble information from each Districts, report to Special Committee and get order	6 hours	EMDC,

Ref :【No.3-1-8】Earthquake Disaster Prevention and Preparedness Plan of UB city（2/3）
Earthquake Disaster Response Plan

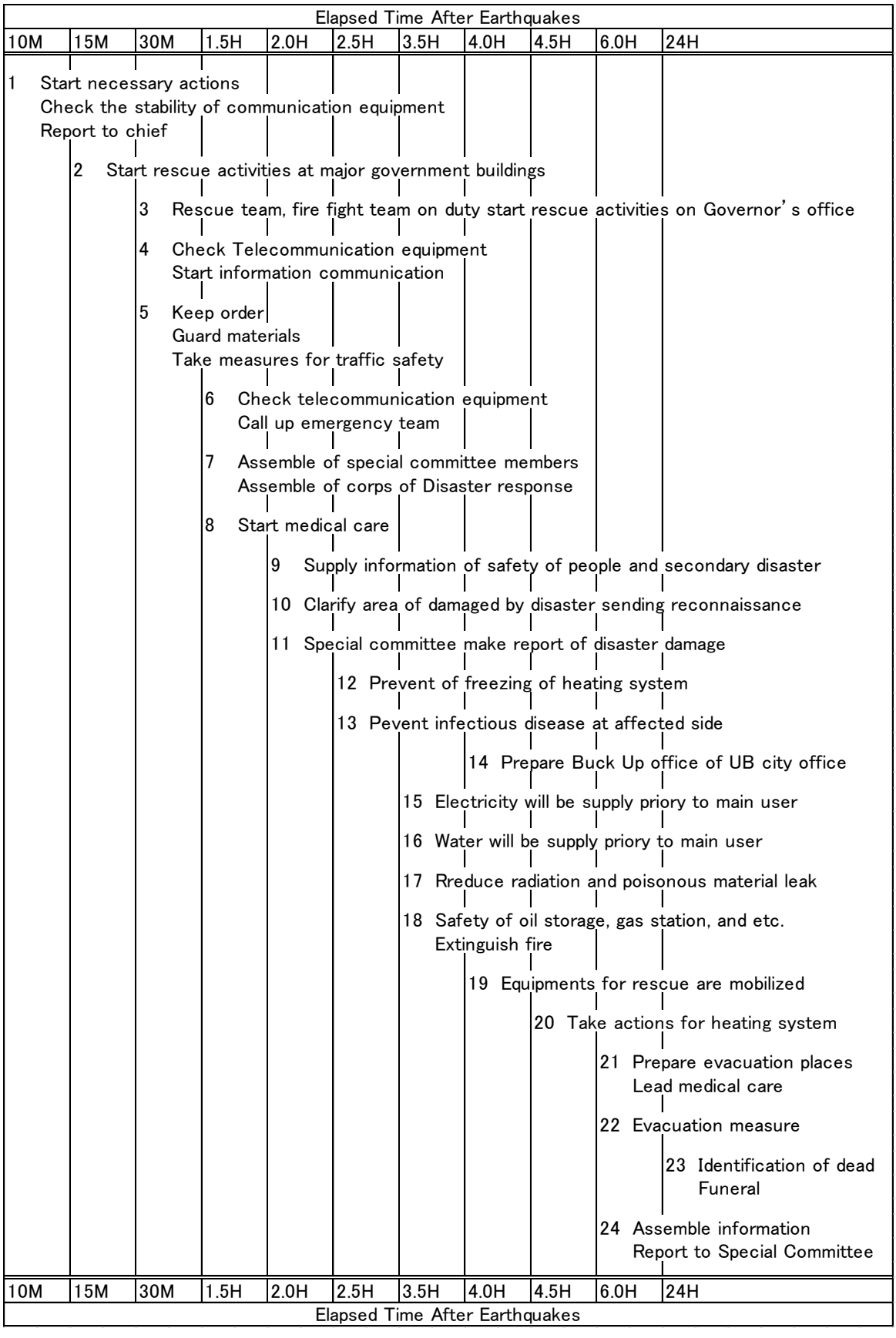


Figure 3.1.1 Time Series of Emergency Response

Table 3.1.5 Earthquake Disaster Recovery Plan in UB city

	Actions	Period	Organization in charge
1	Check Damage Level of Buildings by Earthquake Disaster	72 hours	EMDC, Governor's Office, General Agency for Specialized Inspection Construction, Urban Development and Planning Department
2	Supply Food, Machines, Equipment, Fuels for Recovery Team	72 hours	Governor's Office, EMDC,
3	Take reinforcement measures to the facilities gives high grade medical care	7 hours	Governor's Office, EMDC, Bureau of Public Health, General Agency for Specialized Inspection
4	Start main retrofitting work for utility facilities	72 hours	Governor's Office, EMDC,
5	Start recovery work for water supply, electricity, heating system and sewage system	7 hours	Governor's Office, EMDC,
6	Acceptance and deriver assisting materials from International organization	7 hours	Governor's Office, EMDC,
7	Start to design urban redevelopment plan	7 days	Governor's Office, EMDC, Construction, Urban Development and Planning Department
8	Clean up debris after search and rescue activity and disinfect activity area	7 days	Governor's Office, Construction, Urban Development and Planning Department, Department of Health, Veterinary Bureau
9	Check usable schools and kinder gardens after earthquake disaster and start repairmen	14 days	Governor's Office, EMDC, Construction, Urban Development and Planning Department
10	Demolish unrecoverable facilities and keep open area	14 days	Governor's Office EMDC, Construction, Urban Development and Planning Department
11	Designate temporary debris space and reduce effect to environment	10 days	Bureau of Natural Conservation. EMDC, Construction, Urban Development and Planning Department
12	Set up plan of recovery works for reusable facilities damaged by earthquake	30 days	Governor's Office, General Agency for Specialized Inspection, Construction, Urban Development and Planning Department
13	Start to design urban redevelopment plan for open spaces after clean up debris. Budgets for new road and infrastructures will be prepared by National fund and oversea assistance	1Year	Governor's Office, EMDC,
14	Industrial facilities, residents and public facilities will be provided by private investment	180 days	Governor's Office, Construction, Urban Development and Planning Department, Private Sectors

Ref :【No.3-1-9】Earthquake Disaster Prevention Plan of UB city（3/3）
Earthquake Disaster Recovery Plan

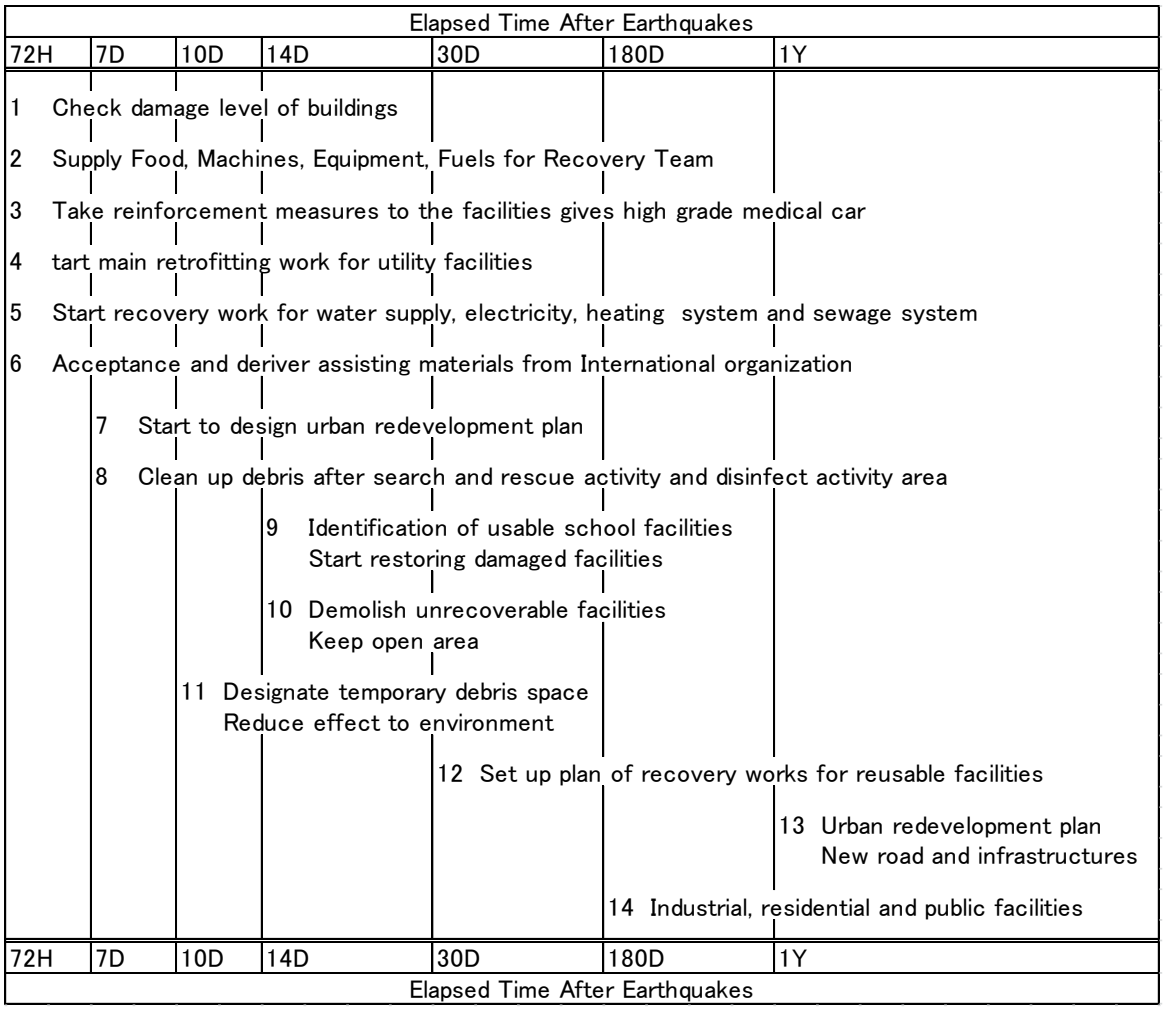


Figure 3.1.2 Time Series of Recovery Action

3.1.3 Earthquake disaster related laws

Basic law related earthquake disaster countermeasures in Mongolia is Parliament Law of Mongolia on Disaster Protection issued on 20th of June 2001【Ref. 3-1-1】. Disaster Management is independent from other Ministries and responsibilities and duties of disaster management staff are clearly defined. Articles are listed below.

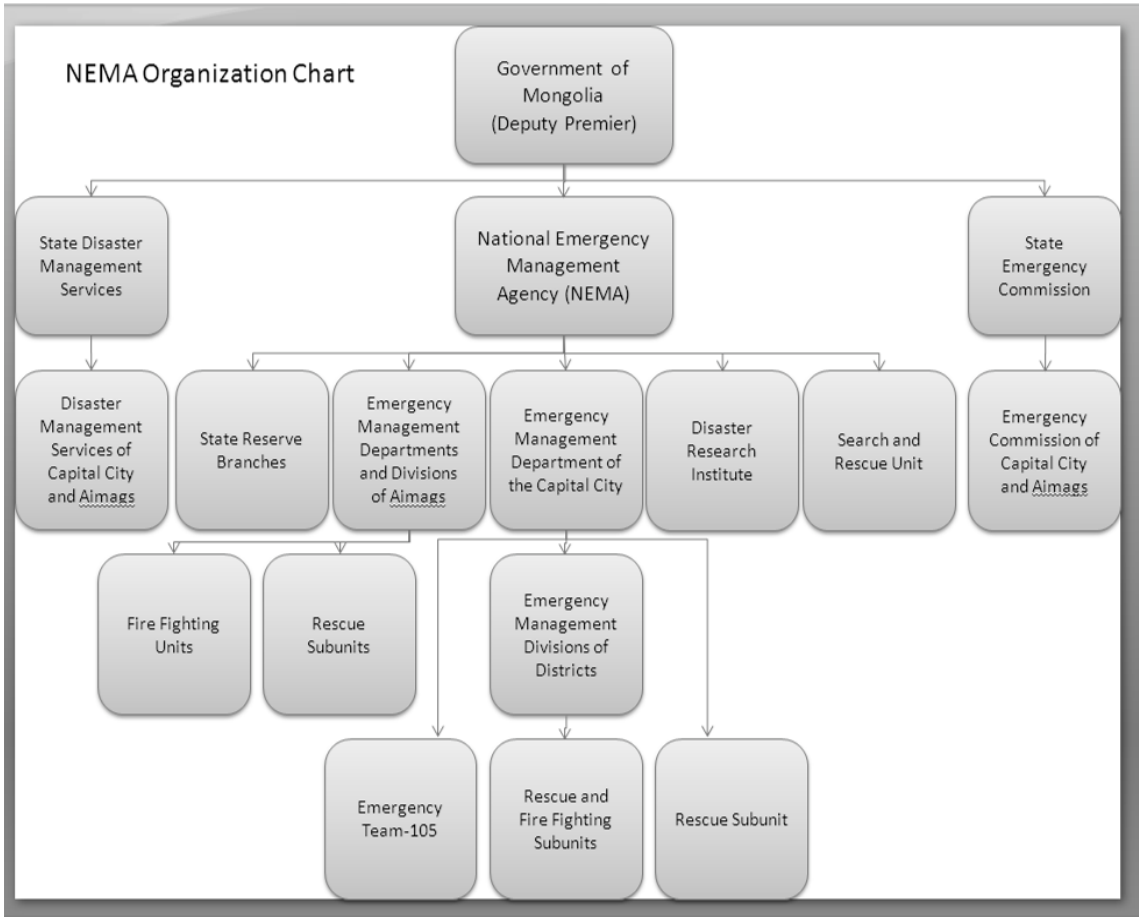
Article 1. Purpose of the Law
Article 2. Legislation on Disaster Protection
Article 3. Framework of Law
Article 4. Definitions
Article 5. Main principles of Disaster Protection Activities
Article 6. Ensuring Transparency in Disaster Protection Activities
Article 7. Disaster Protection Training
Article 8. Levels of Disaster Protection Readiness
Article 9. Shifting to the Disaster Protection Readiness Level
Article 10. Determining the Area of the Territory Affected by a Disaster
Article 11. Communication s and Warning System of the Disaster Protection
Article 12. Disaster Assessment
Article 13. Structure of Disaster Protection Organizations
Article 14. Structure of Disaster Protection Management
Article 15. State Administrative Organization in charge of Disaster Protection
Article 16. Disaster Protection Service and Its Management

Article 17. State Disaster Protection Service
Article 18. General Directives and Duties of the State Disaster Protection Service
Article 19. Disaster Protection Operational Staff
Article 20. Disaster Protection Resources
Article 21. Rescue units, Teams and Branches
Article 22. The Powers of the Government
Article 23. The Powers of the Prime Minister
Article 24. The Full Power of State Administrative Organization in Charge of Disaster Protection
Article 25. The Full Power of the Head of State Administrative Organization
Article 26. The Full Power of Governors of Aimag, Capital City, Soum, District, Bag and Khoroo
Article 27. The Duties of Entities and Enterprises
Article 28. The Duties of Citizen
Article 29. The Disaster Protection Serviceman
Article 30. The Rights of the Disaster Protection Serviceman
Article 31. The Duties of the Disaster Protection Serviceman
Article 32. The rank, uniform and insignias of the disaster protection serviceman
Article 33. Guarantee for Discharging of Duties of Disaster Protection Organization and Its Serviceman
Article 34. The Pension and Benefits of the Disaster Protection Serviceman
Article 35. Financing of Disaster Protection Activity

3.1.4 Disaster related organizations and communities in Mongolia

(1) Chart of disaster management organizations in Mongolia and National Emergency Management Agency(NEMA）

Chart of disaster management organizations【Ref. 3-1-2】 is shown in Figure3.1.3. National Emergency Management Authority which National Defense Committee, Fire Agency and National Storage Agency were unified was established according National Resolution No 1. (issued on 7th of January 2002). NEMA is in charge of Disaster Prevention, Search and Rescue, Emergency Response and Recovery and also in charge of disaster related legal and policy making organization. There are branch office in 21 prefectures and UB city to draw and implement plan and project in field.

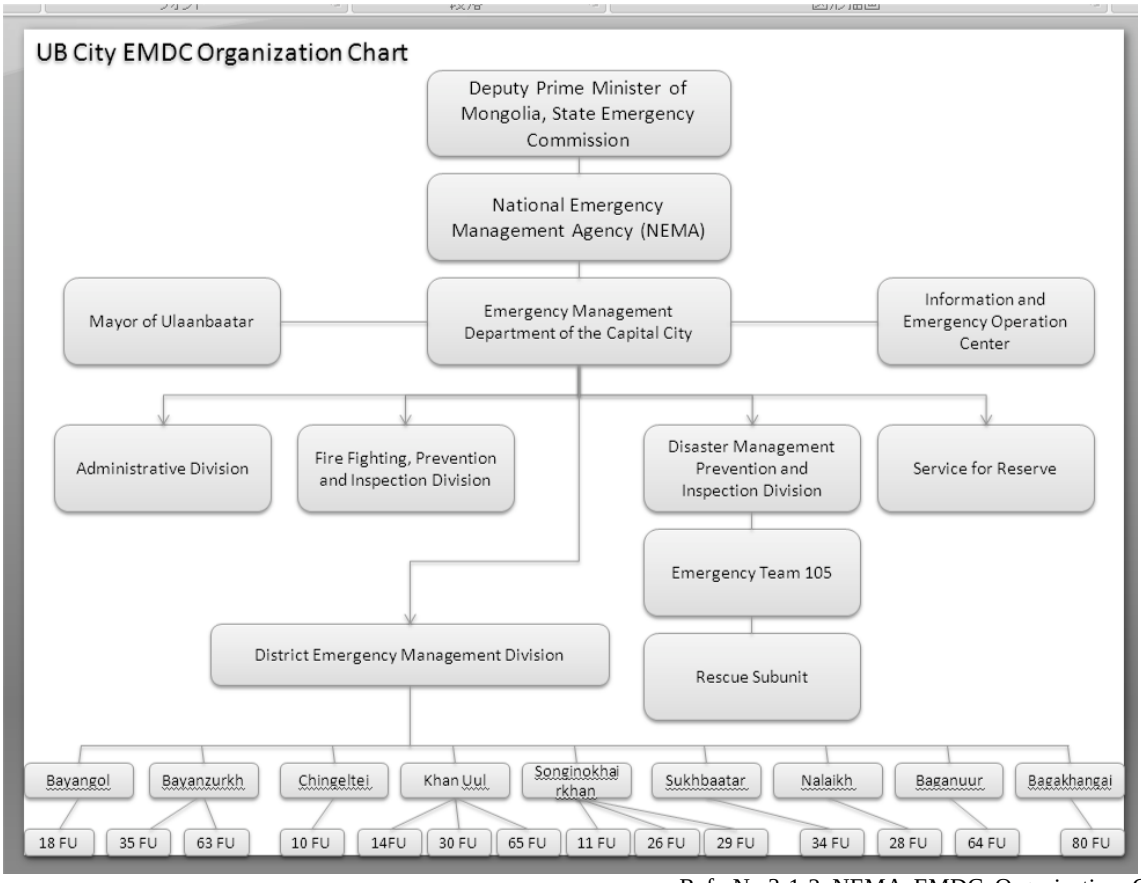


Ref: No.3-1-2 NEMA EMDC Organization Chart

Figure 3.1.3 Disaster Management Organizations in Mongolia

(2) Chart of disaster management organizations in UB city and Emergency Management Department of Capital City (EMDC）

Chart of disaster management organizations in UB city is shown in Figure 3.1.4. EMDC is in charge to make plan and to implement corresponding to NEMA. Disaster Prevention Plan (annual revise of the plan in every January) and risk management and its implementation.



Ref: No.3-1-2 NEMA EMDC Organization Chart

Figure 3.1.4 Disaster Management Organizations in UB city

Other organizations related earthquake disaster management are briefly described below.

1) Ministry of Roads, Transport, Construction and Urban Development (MRTCUD), Department of Policy for Buildings, houses and public utilities

Department of Policy for Buildings, houses and public utilities is in charge of policy making for law, regulations and standards and revised Housing Law in February 2011 from view point of disaster management. Definition of houses which is prohibited to enter and use by designated by General Agency for Specialized Inspection was add in the revised law.

2) MRTCUD, Agency of Land Affairs, Construction, Geodesy and Cartography (ALACGaC)

ALACGaC is the implementation agency of MRTCUD, and technical standards, inspection of building permission, policy making and building standards including earthquake hazard map. ALACGaC is planning to revise Hazard Map after Intensity Mapping by Mongolia Academy of Sciences completes and authorized and also planning to make seismic-capacity evaluation criteria.

3) General Agency for Specialized Inspection

General Agency for Specialized Inspection is in charge of Inspection of buildings and road structures and evaluation of seismic –capacity of all structures. 260 buildings constructed after 1970's are now under inspection by simple method to be demolished or not based on revised housing law in February 2011 and survey report made by construction urban development and planning agency of capital city. General Agency for Specialized Inspection also in charge of issuing of building permission, inspection of utility facilities such as Sewage, Oil facility, Urban Planning and other and all data are kept.

4) Construction Urban Development and Planning Agency of UB city

It was established in April 2010. Main duty is revising of Earthquake Map, Seismic-Capacity Evaluation of apartment houses in UB city. 42 apartment houses were done, On July 2011, 20

buildings were surveyed.

5) Road Department of UB city
It is Road bridges maintenance and management implementation organization. General Agency for Specialized Inspection makes road maintenance and Road Department implements survey and repair.

6) UB Railroad
UB Railroad is private sector which Mongolia and Russia are subscribers implements maintenance of railroad bridges.

7) Mongolia Academy of Sciences
It is research institute of Aerospace and Geography in Mongolia. Most information related earthquake and geology are integrated in this institute. Recently Academy puts effort on Earthquakes and Faults study. Academy has very strong relation with National and UB city government.

3.1.5 Community Based Disaster Prevention Organizations

Most close administrative unit is Kholoo, which is lower lever of District. There is no community based disaster prevention organization. Only UN HABITAT organized community organization in Pilot Project Area. It may work as similar organization as Community Based Disaster Prevention Organizations.

The questionnaire survey is now undergoing in our project to understand community base organization and its role in Mongolia. Questionnaire sheet were delivered at July 2012.

3.2 History and state of measures against seismic disasters, disaster reduction related educations and publicity activities in UB City

3.2.1 Measures against Earthquake Disaster in UB city

Earthquake Disaster National Capacity Strengthening Plan is the starting line of Earthquake Disaster in 2009. Therefore earthquake disaster measures is now incunabulum and just started.

(1) National Measures of Earthquake Disaster Prevention

Earthquake Disaster Prevention Measures is as follow. Sign of aggregation is an item number of Earthquake Disaster National Capacity Strengthening Plan

- Earthquake Hazard Map（1,2）
- Impremention of seismic-capacity evalunation (3)
- Reconstruction plan of old buildings (6)
- Select new town area, government office area, buckup base in case of disaster occures (10)
- Revision of Building Code (16)
- stock of food and its storege buildinds (17)
- Extention work of Military Hospital and Formation of Portable Hospital (23,26)
- Early Warning System (21)

(2) UB city Earthquake Disaster Measures

Following measures also started in UB city to responding National Plan. Sign of aggregation is an item number of Earthquake Disaster Prevention Plan of UB city.

- Earthquake Disaster Evalucation, Intensity Map (2.1～2.4)
- Earthquake Risk Evaluation (3.1～3.7)
- Disaster Prevention, Emergency Response, Recovery (4.1,4.2)

3.2.2 Disaster Reduction related Educations and Publicity Activities in UB city

Disaster Education and Training Program is promoted based on the article 7. of Parliament Law of Mongolia on Disaster Protection【Ref. 3-1-1】. Practical program are Disaster Education in School, Local Government Disaster Exercise including residence participation, Training course for Residence according to the article 7,8,9 in the Earthquake Disaster National Capacity Strengthening Plan【Ref. 3-1-5】.

Also various activities started since 2011 according to the order that “Implement evacuation exercise on 4th Wednesday of every March and holding events on United Nations disaster reduction day” from Earthquake Disaster Prevention Standing Committee【Ref. 3-1-6】.

(1) Earthquake disaster simulation exercise "Exercise Gobi Wolf" from February to April of 2012 in cooperation with the Center for Excellence in Disaster Management and Humanitarian Assistance (COE-DMHA) of United States Pacific Command (USPACOM) with Earthquake Disaster Prevention Seminar, Workshop for Emergency Response and Recovery, Planning and implementation of Simulation.

(2) Earthquake Disaster Evacuation Exercise for Residents at 22nd of March, 2012 at Chingeltey District with evacuation exercise and workshop.

(3) Disaster Prevention Exercise in cooperation with Ministry of Education (Schools)
Case 1: School Disaster Prevention Exercise on February 2011 in cooperation with ADRC

Case 2: School Disaster Education Program at Chingeltey District No.23 School on March 2012

(4) Mongolia Red Cross Activities
Development of Disaster Education Materials
Training of 80 Disaster Leaders
Education of more than 300 Disaster Volunteers

Figure 3.2.1 Recent disaster education and publication activities in Mongolia

3.2.3 Collected Documents related History and State of Measures against Earthquake Disasters, Disaster Reduction related Educations and Publicity Activities in UB City

ADRC country report 2006 and 2010 (Asian Disaster Reduction Center) 【Ref. Ref: No.3-1-11】

3.3 The state and plan of land use and urban development plan of UB City

3.3.1 Legal system of land use planning and urban development planning

(1) Law of Mongolia on Land

Law of Mongolia on land was issued on 1994 and revised on 2002 and 2008. Right of owner ship , right of possessory, right of use are clearly defined. Ownership of land is only allowed to National and Mongolian people. Possessory and use of land is only allowed over Mongolian people who are over 18years old, Organizations and Private Sectors. Foreign and International organizations, Foreign corporations, Foreign Capital corporations are able to use land under certain object, period and condition. For land ownership, detail is decided in Law on Allocation of Land to Mongolian Citizens for Ownership. For land possessory, it is decided in details.

(2) Urban Development Law

Urban Development Law was issued on 1988 and revised on 1998 and 29th of May 2008. Legalistic objective, responsibility and development permission requirements and etc. of Zoning system and master plan are clearly defined.

(3) Law on Allocation of Land to Mongolian Citizens for Ownership

Right of land owner ship of Mongolian citizens was authorized by Law on Allocation of Land to Mongolian Citizens for Ownership issued 2002. Land use is limited only residence, pasturage and other for land allowed to own (by Articles 4). Land ownership area for Mongolia citizens which by free once a life was revised from 700m^2/family to 700m^2/person in case of UB city by revision of may 2008.

(4) Housing Law

Housing Law was issued on 1999 and revised on 2003 and 2006. Fundamental standard for planning and design for residential facilities, Housing Development Fund (HDF) and its usage, maintenance of apartment houses are regulated.

National Congress decides residential policy and central government plan the residents arrangement plan and implement housing financing system. Housing related ministries prepare housing plan and resident housing arrangement standard and also implement and monitoring of housing related law and regulations. UB city prepares master plan for housing arrangement and get approval from municipal council, and decide the budget of each Housing Development Fund and submit residential action area plan.

(5) Law on the Property of Shared-ownership of Residential Buildings and Legal Status of the Condominium Association

The law is commonly known by Condominium law and issued on July 2003 and revised on 2005.

Condominium means shared-ownership of property which used by owners and defined as an apartment building consists more than 4 resident units which resident units and common space is shared by owners. Ownership and owners organizations are stipulated in article 142 and 143 of civil law. Ownership organization is established to exercise shared-ownership right, ensure the safety of apartment building, protection of owner's rights and benefits. For land of apartment and adjacent land , ownership right and management right are recognized as right of shared-property by revision of law on 2005. It means that right of possessory belongs to ownership organization.

(6) Urban and Village Planning and Construction Standard

Technical standard for Urban Planning , Engineering standard for Building are decide in the standard. Plan and design are examined according these standard. As these standard are based on Russian standard, it cannot apply to Ger area. In this standard, Residential Planning , General Public Facility Planning, Urban, Village and Road Network Planning and Urban Infrastructure Network Planning are included. Also Fire Prevention is included in Planning Guideline and Technical Guideline.

(7) Zoning of law of Mongolia on land and Urban Development law
Zoning of law of Mongolia on land and Urban Development law are shown in Table 3.3.1

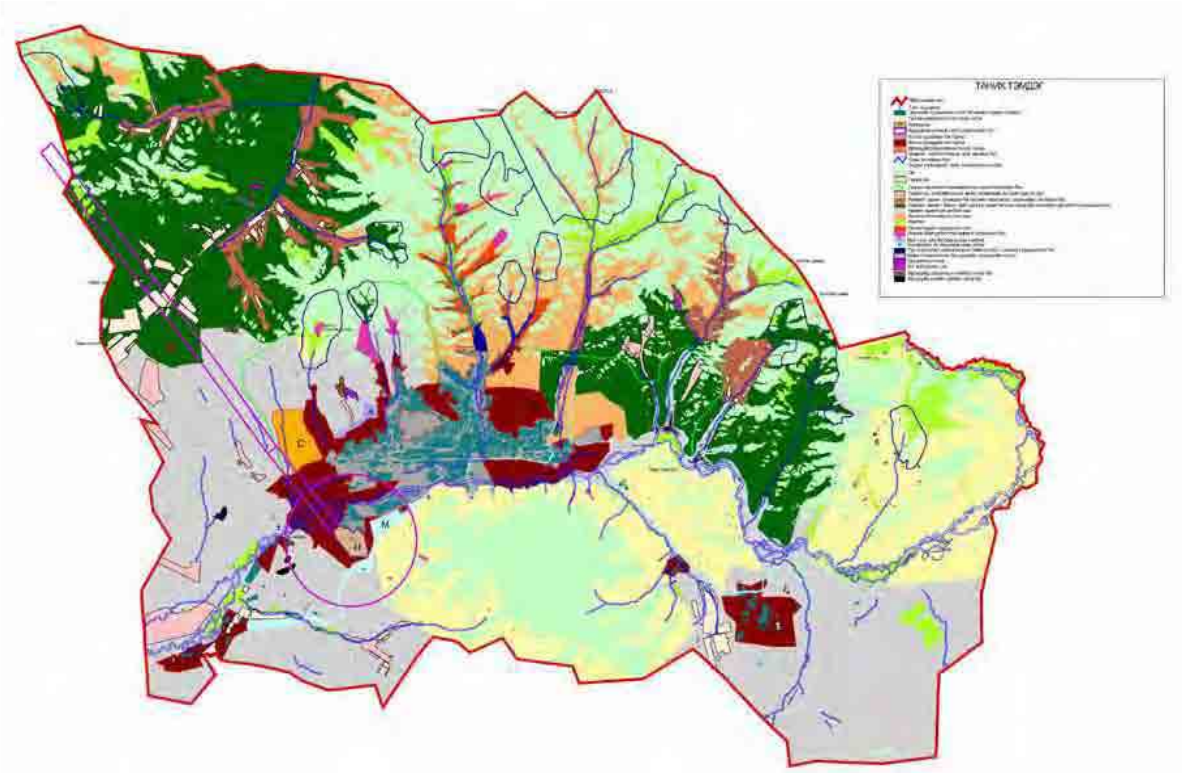
Table 3.3.1 Zoning of law of Mongolia on land and Urban Development law

law of Mongolia on land		Urban Development law	
10.1.1. Aglicaltural land	Grazing land, Agriculture land	13.1.5 Agriculture	Grazing land, Agriculture land
10.1.2. Land of cities, villages and other urban settlements	Urban, Village, other Settlements, Mining and Industrial	13.1.1 Residential and public zone	Settlments・Urban Facilities
		13.1.2 Industrial zone	Industrial, Utilities, Warehouses
		13.1.4 Greenary recreational and tourism zone	Greennary of urban suburbs, recreational facilities, natural conservation area, national park, histrical heritages, tourism zone
		13.1.6 Summer housing zone	Summer housing without Infrastructures
10.1.3. Land under roads and network	Transportation, Power, Heating, Water Supply, Information Network	13.1.3 Engineering supply network, road and transportation zone	Transportation, Infrastructures, Utilities (Power supply, Heating, Water supply, Sewage, Waste, Information Network)
10.1.4. Land with forest resources	Forest	13.1.4 Greenary recreational and tourism zone	Greennary of urban suburbs, recreational facilities, natural conservation area, national park, histrical heritages, tourism zone
10.1.5. Land with water resources	Water surface (Lake, Marsh, Pond, River)	13.1.4 Greenary recreational and tourism zone	Greennary of urban suburbs, recreational facilities, natural conservation area, national park, histrical heritages, tourism zone
10.1.6 Land for special use	Cemetery, Funeral Hall, Refuse Dump	13.1.7 Special purpose zone	National Defence, Deplomacy

Ref : UBMPS Final Report

3.3.2 The state and plan of land use

(1) The state of land use
Present land use of whole city of UB is shown in Figure 3.3.1



Ref : The Feasibility Study on City Master Plan and Urban Development Program of Ulaanbaatar City(UBMPS)
Figure 3.3.1 Present states of land use in UB city

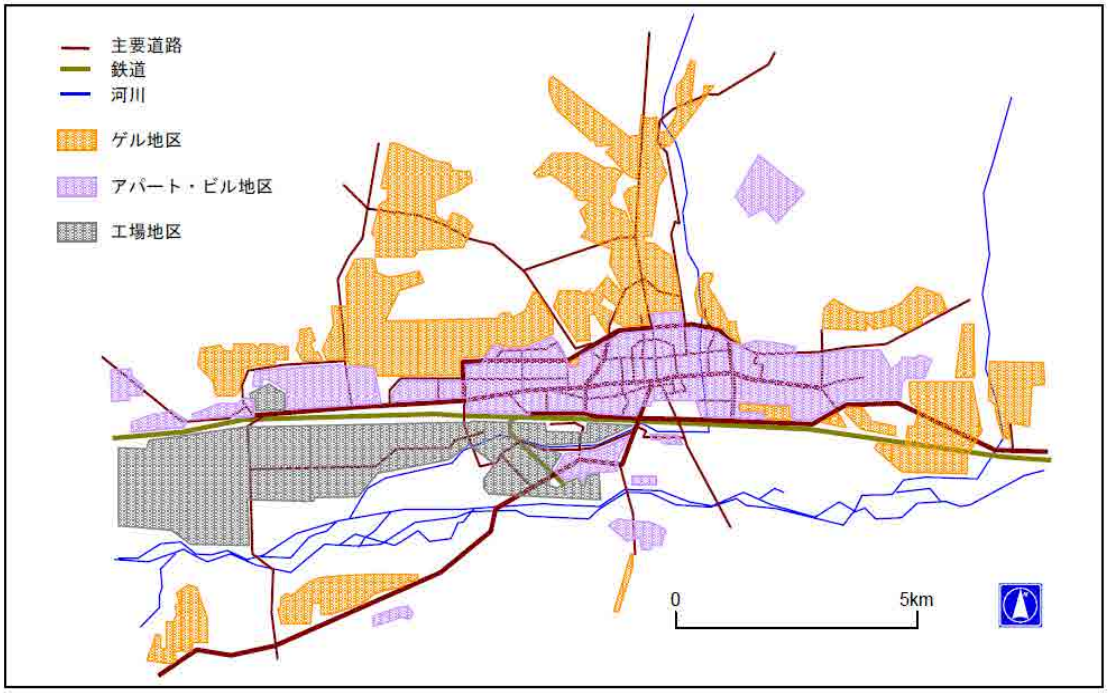
(2) The Problem of Land Use

In 1992, Mongolia shifted from socialism to market economy and land use reformation to permit transferable land ownership since 2003. But urban planning and urban development system arrangement was remained. As built-up area of UB city could not absorb population increase which UB population was 650 thousand became 1220 thousands in 2012, 40% of population live in Ger area without urban infrastructures. Ger area is still expanding from central area to suburbs.

Apartment houses that major buildings in built-up area of UB city were mostly constructed during era of socialism from 1921 to 1992 and these buildings are getting old.

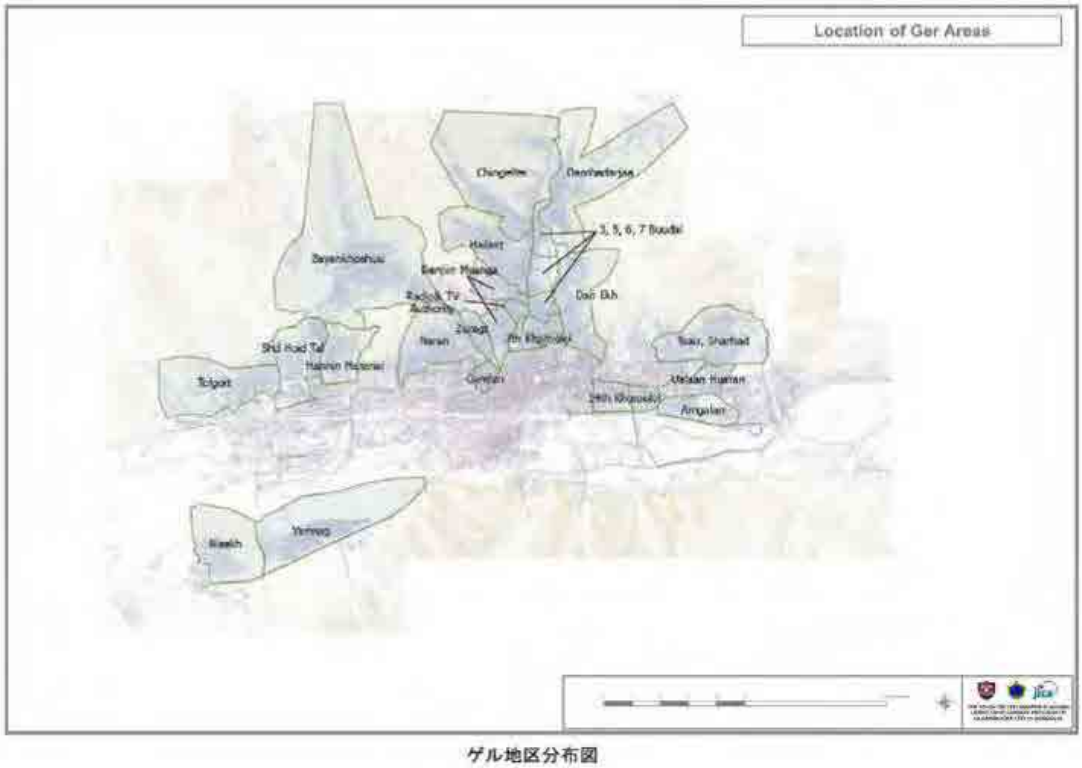
Major road network in central area of UB city was constructed with sufficient width but sub road network is not sufficient in central area. For street level road network, it seems not designed based on urban planning . Especially in Ger area, there is no road in side of Ger area and only between wooden fences of houses used as road without any pavement.

Based on these observation, it is very important and urgent to implement the planned improvement. Newtown planning , reconstruction of old apartment houses, land readjustment of Ger area with promoting to rebuild Ger to permanent houses and road network plan. These problems are also important as Disaster Prevention Urban Planning to promote anti-seismic retrofitting of buildings, ensuring of evacuation place an evacuation road, earthquake fire countermeasures and earthquake countermeasures.



Ref : The Feasibility Study on City Master Plan and Urban Development Program of Ulaanbaatar City(UBMPS)

Figure 3.3.2 Distribution of Ger area in UB city at the Feasibility Study



Ref : UBMPS Final Report

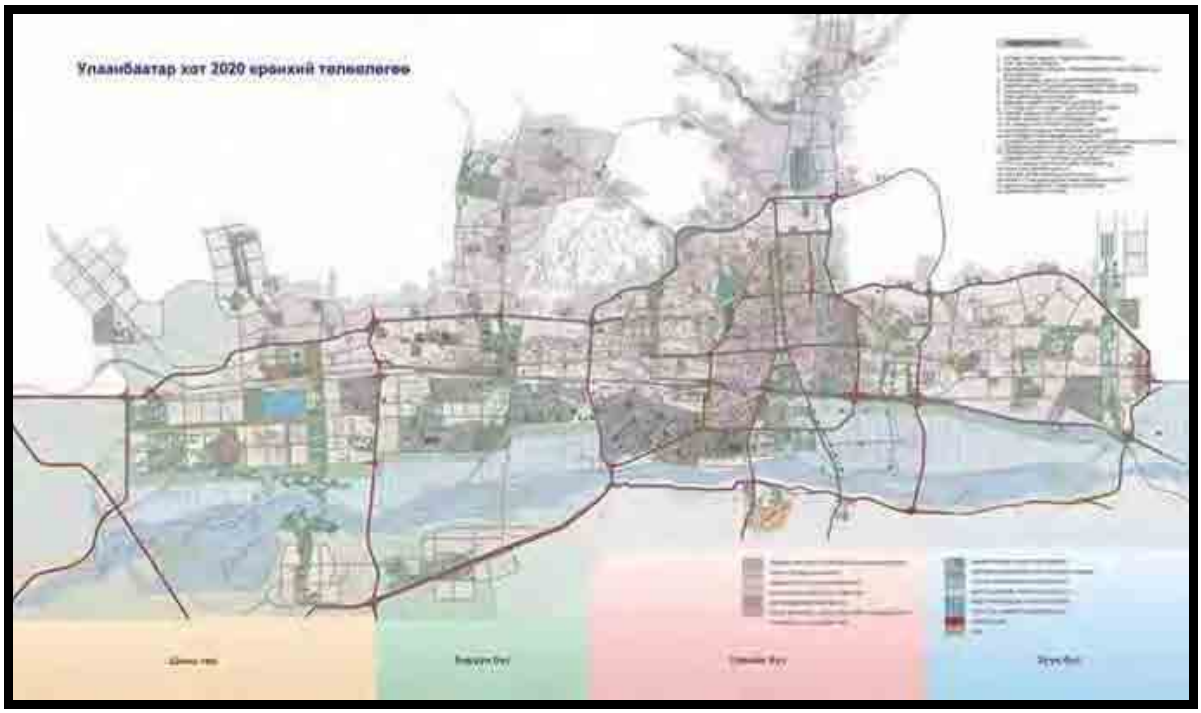
Figure 3.3.3 Distribution of Ger area in UB city at Final Report

(3) Land Use Plan

UB city urban planning master plan started in 2001 targeting year 2020. This plan is physical special plan responding to UB city urbanization and rapid mobilization and also proper vision for environmental countermeasures for water resources conservation based on International standard. But

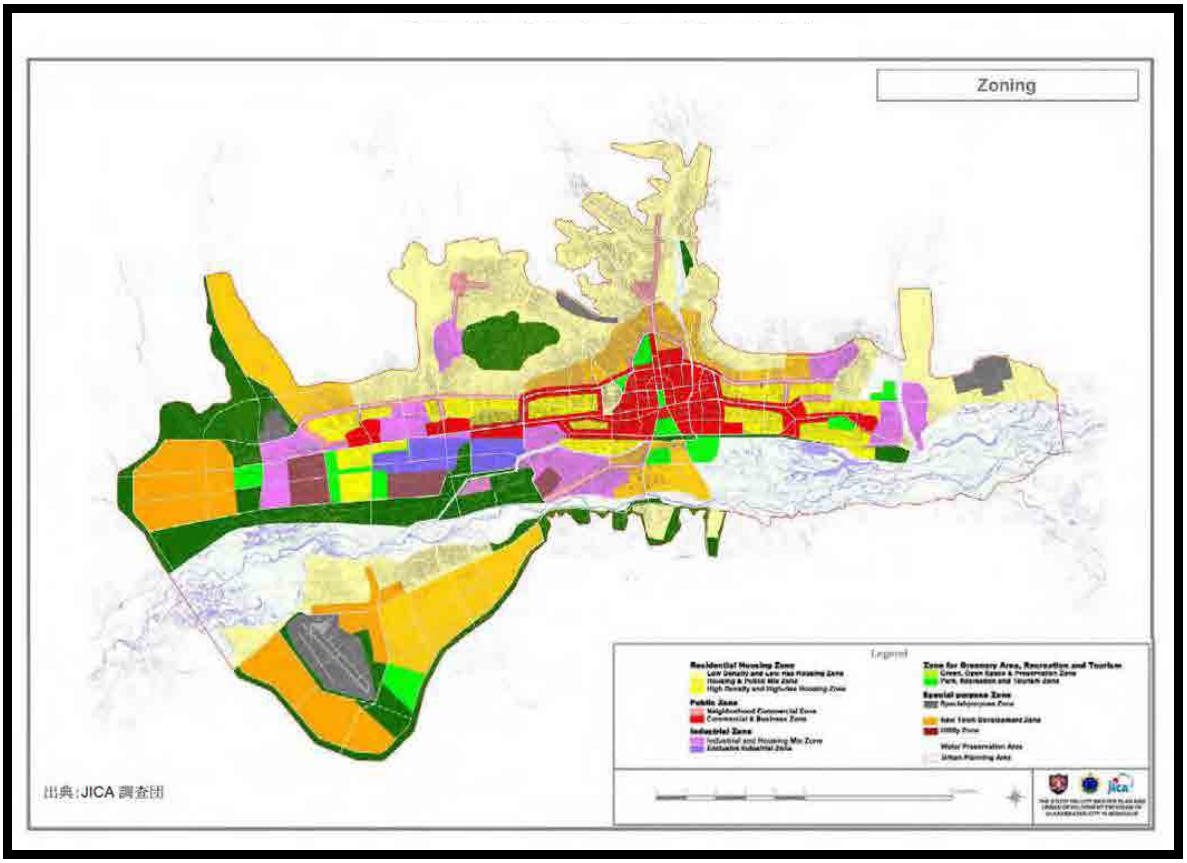
on the other hand, there are some scope of consideration related urban planning topics related comprehensive urban growth management and proper land use based on privatization. Figure 3.3.4 shows the land use plan targeted year 2020.

From this view points, The Study on City Master Plan and Urban Development Program of Ulaanbaatar City (UBMPS) was implemented from March 2007 to February 2009 by JICA. Figure 3.3.5 shows the land use plan targeted year 2030. Urban Promotion Area and Urban Control Area is shown in Figure 3.3.6 and land use zoning is proposed shown in Table 3.3.2 and Table 3.3.3.



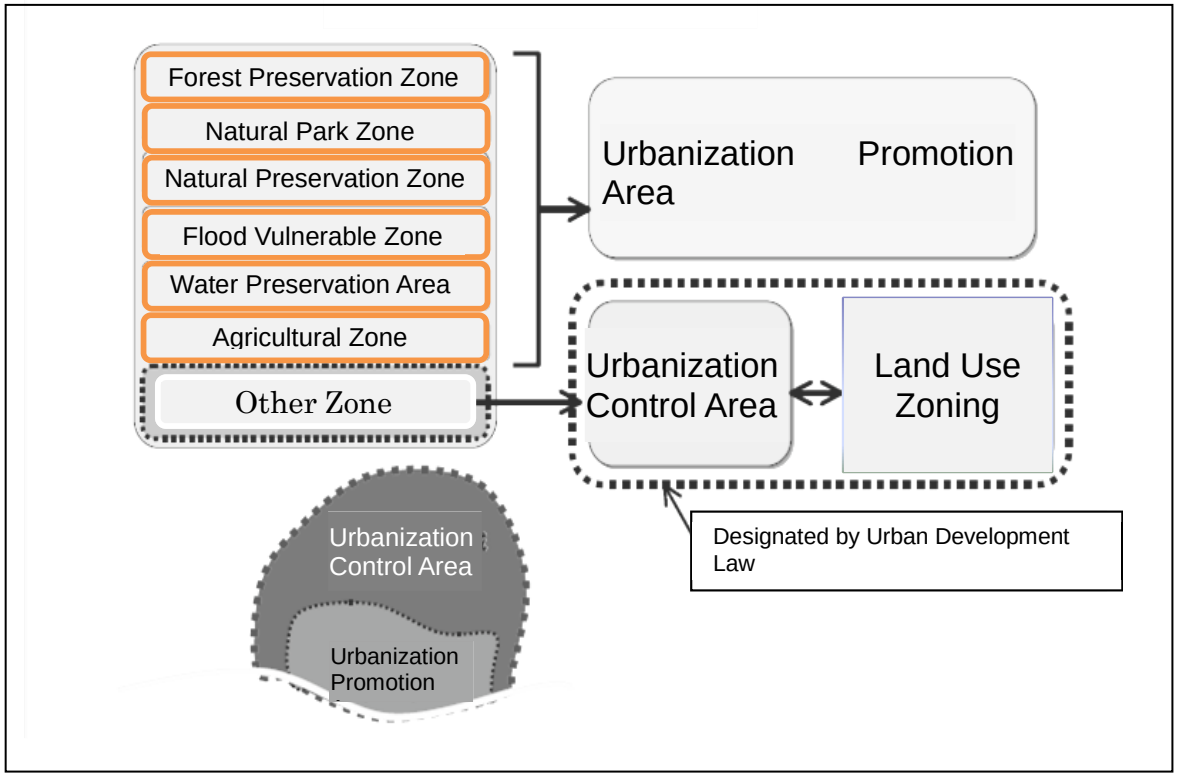
Ref: The Feasibility Study on City Master Plan and Urban Development Program of Ulaanbaatar City(UBMPS)

Figure 3.3.4 Land use plan in UB city Urban Planning Master Plan 2020



Ref : UBMPS Final Report

Figure 3.3.5 Land use plan in UB city Urban Planning Master Plan 2030



Ref : UBMPS Final Report

Figure 3.3.6 Frame of land use in master plan targeted year 2030

Table 3.3.2 Proposed Zoning System (land use zoning)

Main Use	Zoning	Area			
		ha	%	ha	%
Resident	Low Density and Low-rise Housing Zone	5,902	21.3	10,255	37.1
	Housing and Public Mix Zone	2,879	10.4		
	High Density and High-rise Housing Zone	1,473	5.3		
Commercial and Public	Neiborhood Commercial Zone	648	2.3	2,303	8.3
	Commercial and Business Zone	1,665	6.0		
Industrial	Industrial and Housing Mix Zone	1,529	5.5	1,990	7.2
	Exclusive Industrial Zone	461	1.7		
Green	Green, Open Space and Preservation Zone	3,646	13.2	4,317	15.6
	Park, Recreation and Tourism Zone	671	2.4		
Other	Agricultural Zone	-	-	8,812	31.8
	Special-purpose Zone	867	3.1		
	Utility Zone	443	1.6		
	Environmental Conservation Zone	-	-		
	Water Preservation Area	5,559	20.1		
	New Town Development Zone	1,943	7.0		
Total		27,677	100.0	27,677	100.0
Urban Promotion Area		18,472	66.7	18,472	66.7
Water Preservation Area and Environmentally Protected Area		9,204	33.3	9,204	33.3

Ref : UBMPS Final Report

Table 3.3.3 Political Zoning

Zoon		Explanation	Related Law
S1	Highly utilized zoon	Promote high density land use for area of Central Business District and Sub City Center. Limitation of height is up to 80m	Fire Law, Building Code
S2	Environmental conservation and appearance zoon	Conserve historical and cultural building and whole appearance	Historical, Cultural Conservation Law
S3	Historical and cultural conservation zoon	Conserve historical and cultural property for citizens and sightseeing	
S4	Parking restricted zoon	Parking control and check illegal parking zoon and promote public and private parking space. For this purpose, 1. Private investment initiative, require parking space for the building floor.	Parking Law , Building Code
S5	New airport town zoon	Formation of comprehensive new town near newly planned airport to promote International class hotels, International logistics, Aviation related industries, Private sectors related housing and human capacity building facilities	Urban Development Law

Ref : UBMPS Final Report

3.3.3 Urban development Plan

Here, ongoing project related urban development plans are introduced

(1) Hundred Thousand Housing Construction Project

Mongolian government promoted 40 thousands housing construction project aiming year 2009 from 2006. Following this project, Government continuing hundred thousand housing construction project since 2010. In 40 thousands housing construction project, all type of housing construction such as redevelopment of Ger area, development of new town project, private initiative apartments construction project, individual housing have been progressed based on 5 strategies (new town development, land use of central zoon, living environment improvement of Ger area, Housing market and housing financing strengthening, Construction industry and construction material industry development). As the result 33982 housing units were constructed from 2004 to first half of 2009.

Table 3.3.4 indicates number of housing construction with each project types (new town development, Ger area development and reformation in central area). *mark in table indicates that it is progress.
Basic strategy of UB city is at first redevelop central area of UB city and then expand to suburbs. There is a plan to reconstruct Ger area in suburbs to international level individual residential houses but it will be much later.

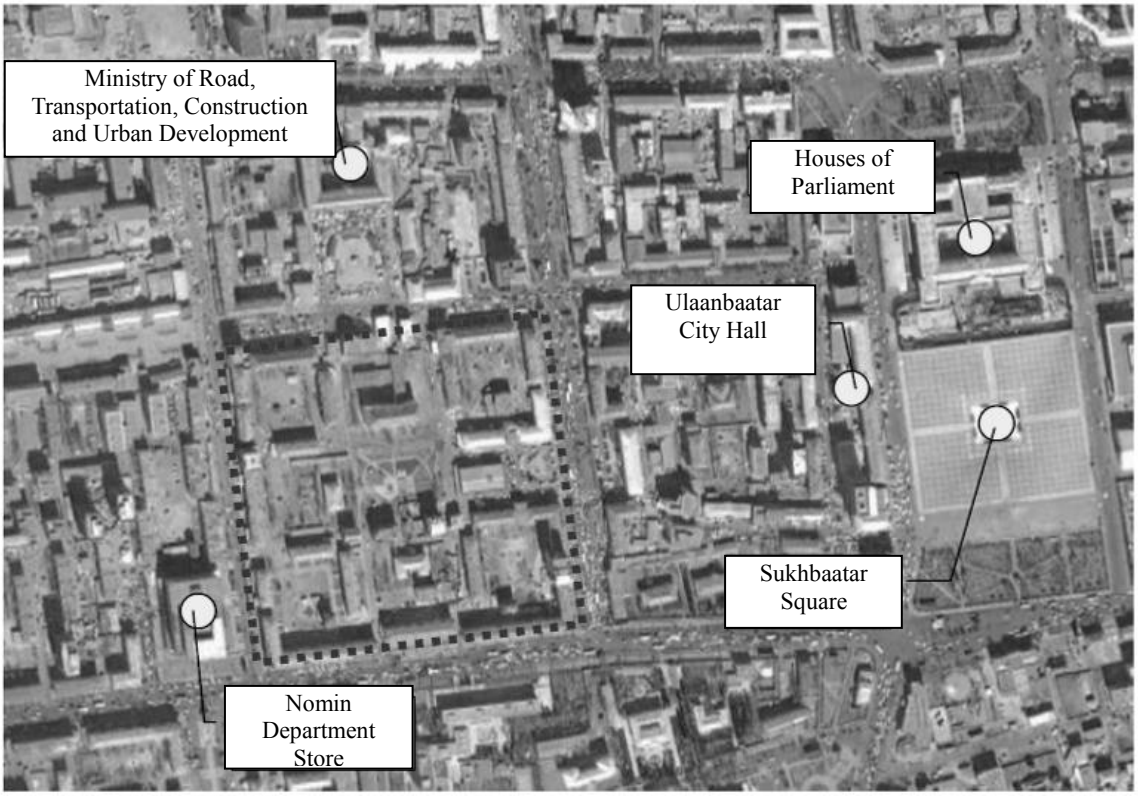
Table 3.3.4 Hundred Thousand Housing Construction Project

	No	Area	Plan		Number of housing and population in 2010-2015	
			Housing Units	Population	Housing Units	Population
New town development	1	Buyant-Ukhaa khoroolol	10,200	42,000	9,200	38,600
	2	Bayangolyn am residential area	18,000	75,600	12,000	50,400
	3	City new center	10,300	50,000	1,500	6,300
	4	Urgakh Naran khoroolol	10,750	45,000	3,500	14,700
	5	Yamag khoroolol-1	7,000	29,400	6,000	25,200
		Yamag khoroolol-2				
	6	Zuun Selbe khoroolol	4,500	15,000	1,000	4,200
	7	Residential area along the road to Nalaikh	83,000	350,000	2,000	8,400
		Center 6 District Subtotal	143,750	607,000	35,200	147,800
		Suburbs 3 District Subtotal	13,195	54,780	6,000	25,200
		Subtotal	156,945	661,780	41,200	173,000
Apartment construction in Ger area development	1	Khanyn material ger area	11,600	49,000	2,300	9,700
	2	Military Town	5,930	25,000	1,500	6,300
	3	7 micro khoroolol	9,400	40,000	1,000	4,200
	4	14th khoroolol（14 Distrct）	15,000	65,000	7,500	31,500
	5	7th khoroolol（7 District）	10,956	46,000	8,000	33,600
	6	Radio and TV Tower ger area	4,200	17,000	4,000	16,800
	7	Denjiin 1000 ger area	6,100	27,000	500	2,100
		Subtotal	63,180	269,700	24,800	104,200
Redevelopment of Central Area:		Subtotal			9,000	37,800
UB City		Total	220,131	931,480	75,000	315,000

Ref : UBMPS 3rd year Report

(2) Redevelopment of Central Area

ALACGaC offered the list of apartment buildings which has insufficient seismic-capacity and facility level are also insufficient compare present requested level. First redevelopment model project is NOMIN department store and adjacent area. 1st floor of the apartments buildings are shops and shop owner had illegal extension work on pedestrian.



Ref: The Feasibility Study on Capacity Development in Urban Development Sector in Mongolia

Figure 3.3.7 Central area redevelopment project area

(3) Construction of apartments in Ger redevelopment Area

There are 7 plans of construction of apartments in Ger development area listed in Table 3.3.4. Among 6 of them, already projects started and 63000 resident units for 270 thousand people will be provided. Also from 2010 to 2015, 25000 resident units for 104 thousand peoples will be provided. Listed projects are authorized but among them, 14th Khoroolol. 7 micro Khoroolol and Radio and TV tower Ger area started relocation negotiation and/or building construction.

Figure 3.3.8 is the 14th Khoroolol redevelopment project authorized as detail plan and planned population is 36400, entrepreneur is MRTCUD and Mongolia Housing Finance Corporation (MHFC) and project period is 2008 to 2012. Phase 1 block construction is almost completed. In other blocks private sectors which get tender started negotiation or relocations with residents.

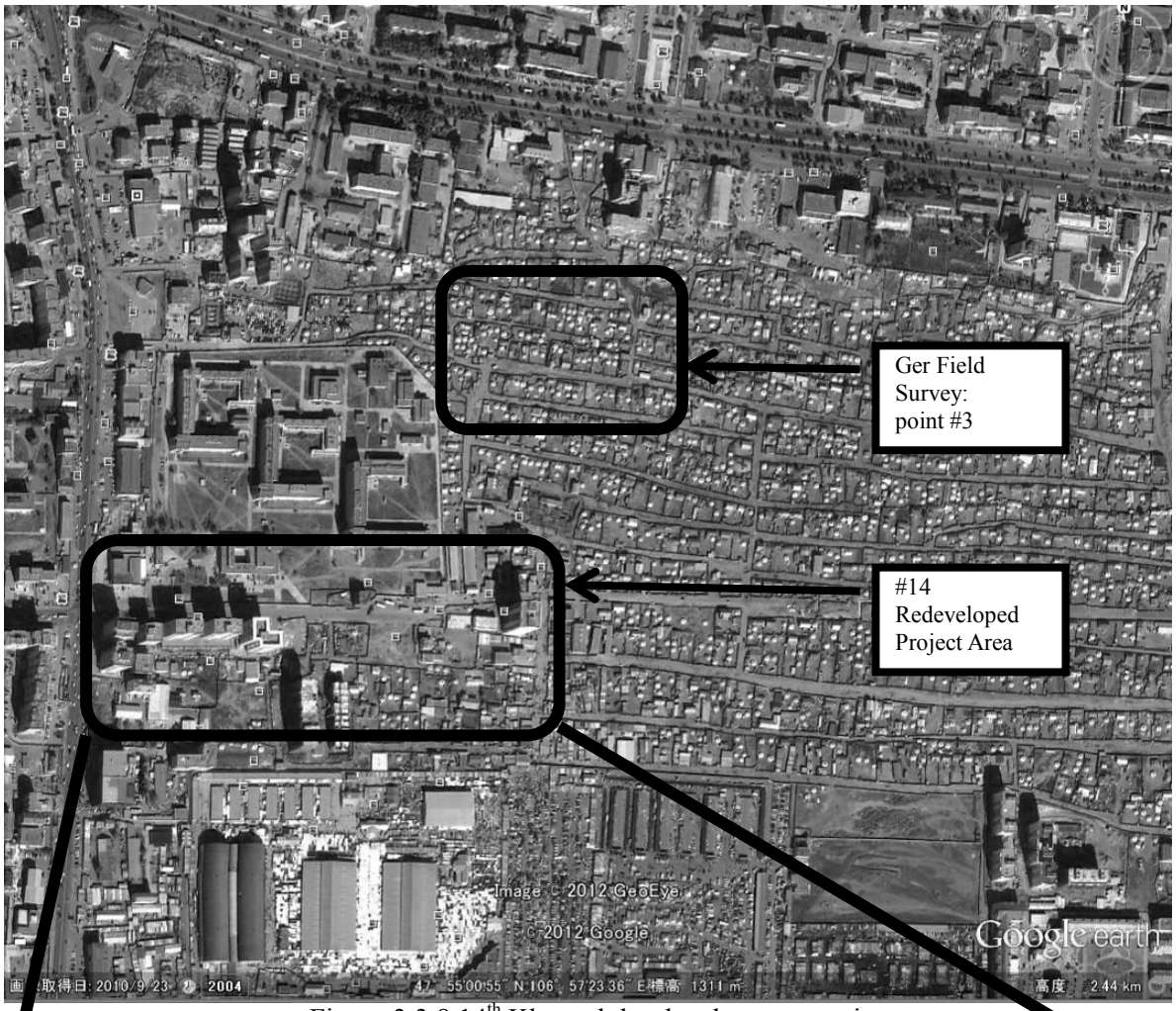


Figure 3.3.8 14th Khoroolol redevelopment project

Ref: The Feasibility Study on Capacity Development in Urban Development Sector in Mongolia

Figure 3.3.9 14th Khoroolol redevelopment project plan

3.3.4 The documents related the state and plan of land use and urban development plan of UB City

The documents related the state and plan of land use and urban development plan of UB City are collected as shown in Table 3.3.5.

Table 3.3.5 List of collected documents related the state and plan of land use and urban development plan of UB City

No	Title	Organization
3-3-1	The Study on City Master plan and Urban Development Program on Uraanbaatar City (UBMPS) Final Report 2009.10	JICA UBMPS
3-3-2	The Study on City Master plan and Urban Development Program on Uraanbaatar City (UBMPS) Final Report vol. 1 Summary 2009.03	JICA UBMPS
3-3-3	The Feasibility Study on City Master Plan and Urban Development Program of Ulaanbaatar City (UBMPS) 2006.12, Japanese version	JICA
3-3-4	Report of the project formulation mission for the Project on Capacity Development in Urban Development Sector in Mongolia	JICA
3-3-5	UNUR AREA FLOOD PROTECTION COMMUNITY ACTION PLAN 2011.1	UN-HABITAT Mongolia Office
3-3-6	MONGOLIA Community-Led Ger Area Upgrading in Ulaanbaatar City Project	As above
3-3-7	Land Planning and Management Review(Output 1.1) 2010.7	As above
3-3-8	Land Planning and Management Review(Output 1.5) 2010.7	As above
3-3-9	Urban Poverty Profile A Snapshot of Urban Poverty in Ger Areas of Ulaanbaator City (Output 1.3) 2010.7	As above
3-3-10	Service Distribution and Infrastructure Review (Output 1.2) 2010.7	As above
3-3-11	Citywide Pro-Poor Ger Area Upgrading Strategy of Ulaanbaatoa City (Output 1.6) 2010.10	As above
3-3-12	Guidelines for Upgrading of Middle Ger Areas (Output 2.2) 2010.10	As above
3-3-13	Guidelines for Upgrading of Middle Ger Areas (Output 2.3) 2010.10	As above
3-5-14	Peri-Urban Ger Areas Land Readjustment Action Plan -Ulaanbaatoar(Output3.1) 2010.9	As above
3-3-15	Middle Ger areas Incremental Upgrading Action Plan -Ulaanbaatar (Output 3.2) 2010.9	As above
3-3-16	Central Gear-areas Redevelopnemt Action Plan (Output 3.3) 2010.10	As above
3-3-17	Urban Investment and Financing Review, Cost Recovery Review, City Wide Pro-poor Output 4.1 and 4.3) 2010.12	As above
3-3-18	Institutional Review, MUB Financial Management Review (Output 4.2,4.4) 2010.12	As above
3-3-19	Tgear-area Impruvement Financing Strategy (Output 4.5) 2010.12	As above
3-3-20	Toolkit for Sustainable Cities: Approach and Strategies (Output 5.1a) 2010.9	As above
3-3-21	Toolkit for Participatory Urban Decision-making (Output 5.1b) 2010.9	As above
3-3-22	Toolkit for Community Action Planning (Output 5.1c) 2010.9	As above
3-3-23	Toolkit for Community Contracting (Output 5.1.d) 2010.8	As above
3-3-24	Institutional and Policy Reform Berief (Output 6.6) 2010.12	As above
3-3-25	Up-scaling and National Replication Strategy (Output 6.7) 2010.12	As above

3.4 Geography, geology, meteorology, soil condition and underground water of UB City

Mongolia is an inland nation located in eastern part of Eurasian continent. The topographical feature of Mongolia is higher in its west and lower in its east. Mongolia is mainly composed of three types of landscapes, mountains in the north and western region, basin area among them and plateau in the south and eastern region. In the southwestern part and western part of Mongolia is occupied by the Altay mountains and Hangai mountains, respectively, both are reached 4,000 m above see level. On the other hand, the elevation being lower to 500-1,000 m in the central to eastern step land. In the southern part of the nation is Gobi desert region. The capital city Ulaanbaatar is located in central northern part of the country (Figure 3.4.1).

Figure 3.4.1 Topography of Mongolia (after HRW World Atlas)

3.4.1 Topography and Geology

The capital city Ulaanbaatar is comprised of 9 administrative districts (Figure 3.4.2), occupying a total area of 4,704.4 km^2 (Statistics Department of Ulaanbaatar). In which, the Bagahangai and Baganuur districts are located far from the city area, being as satellite districts of the capital.

The capital city Ulaanbaatar and its surroundings are as the southern end of the Hentei ranges, composed of mountains and hills and basins among them (Figure 3.4.3). The city area of Ulaanbaatar is mostly distributed along bank of the Tuul river, which rises in the Hentei ranges and flows west through the Ulaanbaatar city, most of the settlement located on the right bank of the river. The city area is a basin surrounded by 4 mountains. In the south, is the national park of Bogd Khan mountain (2,391 m), shows comparable steep slope topography. In the eastern part, is the Bayanzurkh mountain (1,793 m), in west is the Songinokhairhan mountain (2,300 m) and in the north is the Chengeltei mountain (2,300 m). Compared to the Bogd Khan mountain, the mountains and hills in the northern side of the city area show gentle slope. Most of administrative office of national and capital city, universities and colleges are distributed along the Tuul River. However, Ger area, traditional Mongolian Ger (house) and low stories buildings distributed along the tributaries of the Tuul River, on the terraces and gentle slops northern side of the city.

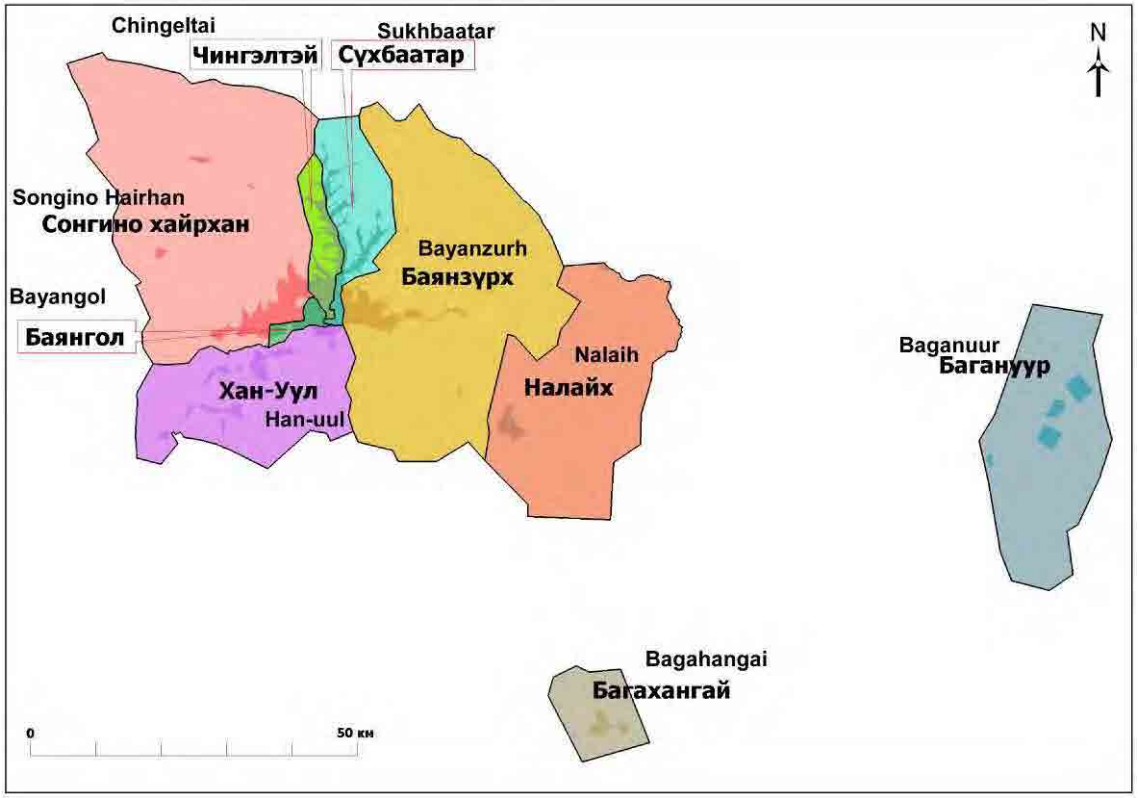


Figure 3.4.2 Administrative districts of Ulaanbaatar city (Statistics Department of Ulaanbaatar)

The satellite district, Baganuur district is located on the right bank of upper stream of the Herlen River that raises from the Hentei ranges. In this district, the elevation along the river is about 1,330 m but rise high to 1,750 m in the northern mountain areas. Another satellite district, the Bagahangai district is a gentle slope hilly area with small scale channels. The elevation is about 1,500-1,600 m in this district.

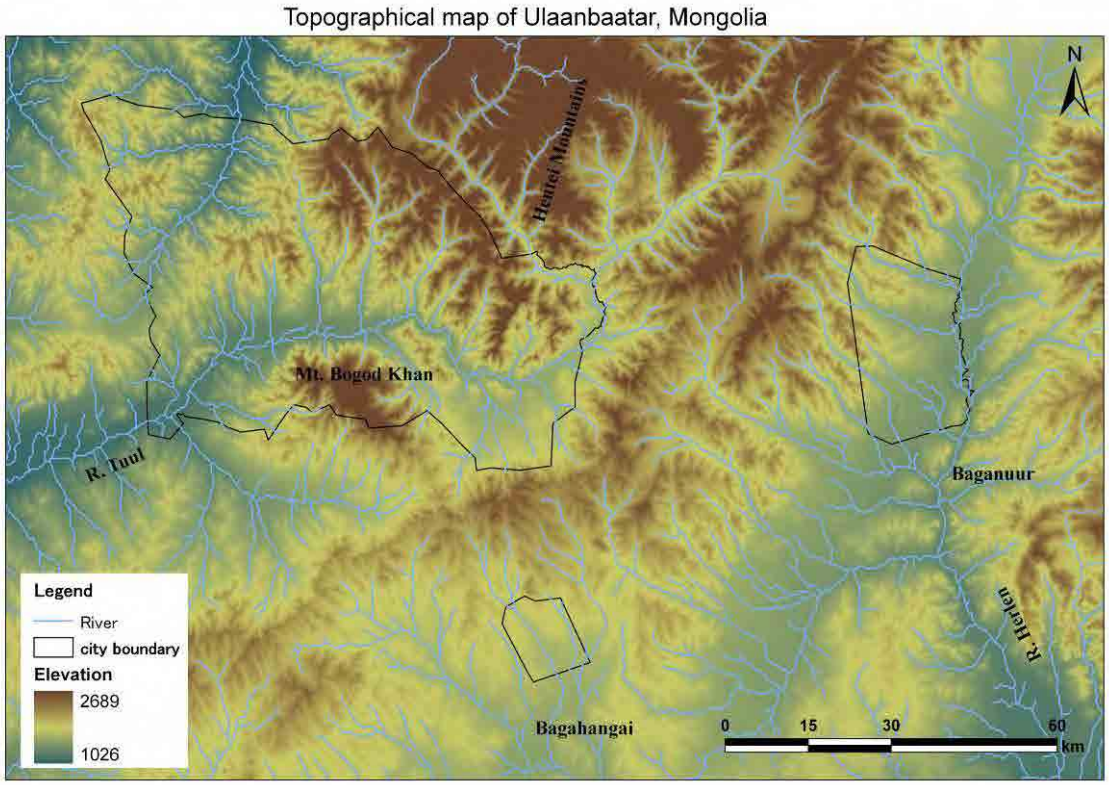


Figure 3.4.3 A Topography of Ulaanbaatar (crated form Aster GDEM, river lines is from USGS)

The geology of Mongolia is divided northern domain and southern domain by the Main Mongolian lineament. In the northern domain, it is mainly composed of pre-Cambrian and lower Paleozoic rocks, while the southern domain is composed of Lower to upper Paleozoic rocks (Figure 3.4.4, Badarch *et al.*, 2002).

The capital city Ulaanbaatar belongs to the northern domain of the geological unit. The geology of Ulaanbaatar city and its surroundings, from older order, is composed of lower Paleozoic Hara Formation, middle-upper Paleozoic Hentei Formation, Mesozoic granite, Cretaceous Zuunbayan Formation and Cenozoic sediments (Takahashi *et al.*, 2004). Along the Tuul River and its tributaries, it was covered by sediments of sands, gravels and mud that transported by the rivers. Moreover, sands and gravels deposited on terraces and on small scale alluvial fans.

As above description, the geology of city area of Ulaanbaatar is characterized by sands and gravels that mainly transported by the Tuul River, while the mountain and hilly areas are composed of older rocks.

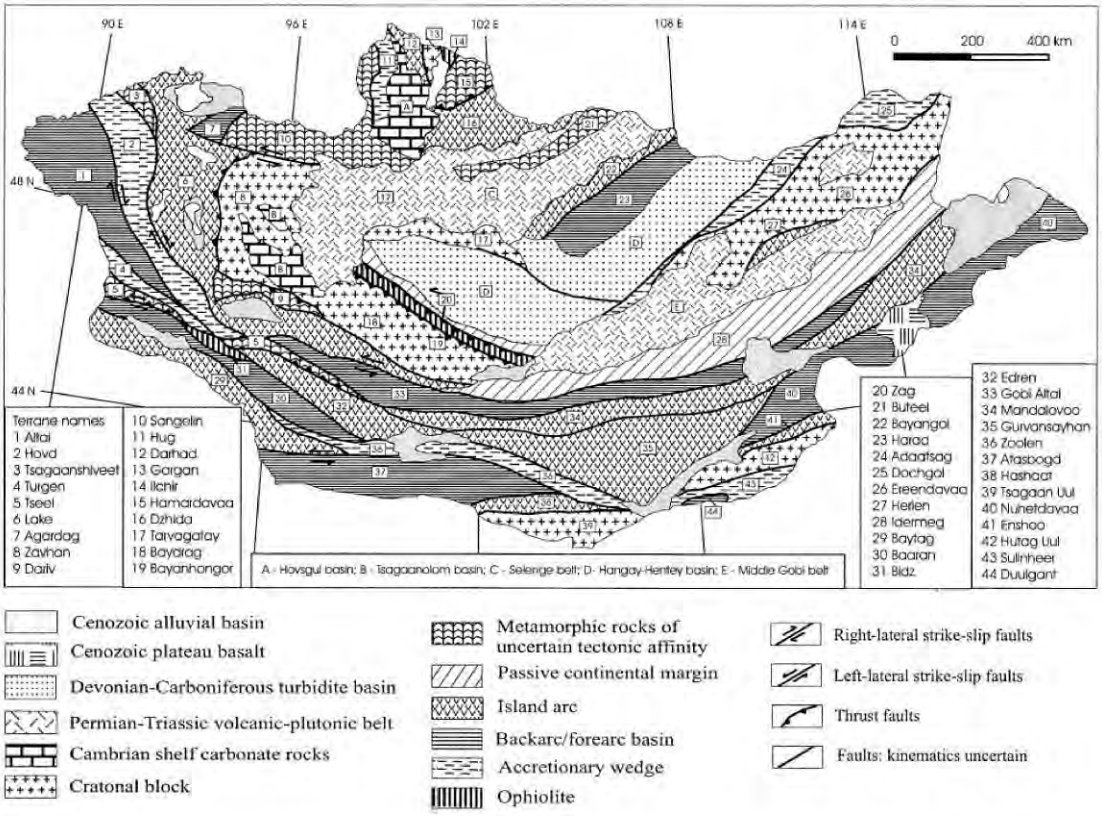


Figure 3.4.4 Tectonostratigraphic map of Mongolia (Badarch *et al*.., 2002)

The Figure 3.4.5 shows the 1:1,000,000 geological map from Mongolian National Geo-information center (NGIC). The geology of Ulaanbaatar and its surroundings is characterized by pre-Cambria, covered by lower to middle and upper Paleozoic rocks. All of these rocks are covered by lower to upper Mesozoic rocks. A wide range of granite intruded these rocks. However, along the Tuul River and Herlen River, the geology is mainly composed of Cenozoic sediments. Thus, it is clear that younger sediments distributed along the rivers, most of the area of Ulaanbaatar city and it surroundings are composed of older rocks.

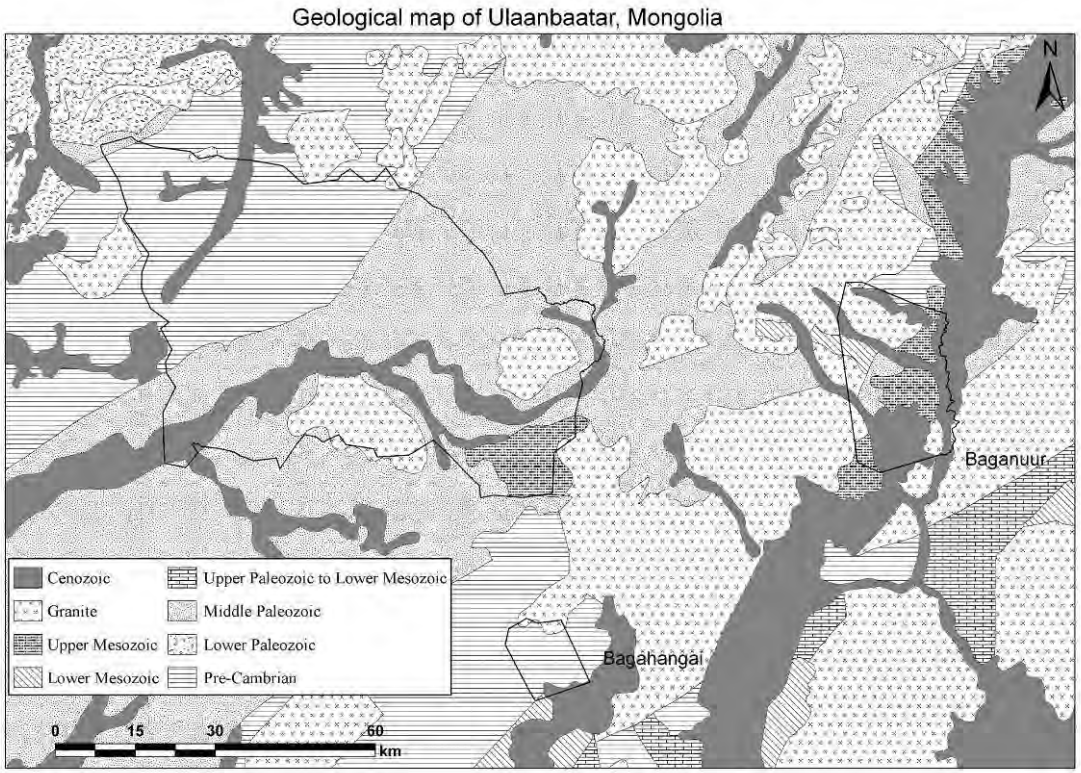


Figure 3.4.5 Geology of Ulaanbaatar and its surroundings (after NGIC)

3.4.2 Climate

Almost all of the Mongolian territory belongs to same climate classification, say typical continental subarctic climate or steppe climate. The climate of Ulaanbaatar city has distinctive four seasons, characterized by dry and short summer (from June to August), cold and long winter (from November to April) and sharp fluctuation of spring and autumn.

Table 3.4.1 shows the annual temperature, precipitation of Ulaanbaatar city within recent 10 years (based on data from Ulaanbaatar Meteorological Station; Statistical department of Ulaanbaatar). The average temperature of Ulaanbaatar city is about 0℃. However, the temperature varies very violent, such as the average maximum temperature is 35℃ while the average minimum temperature is -34℃. Table 3.4.2 shows the monthly average temperature and precipitation within 30 years (from 1971 to 2001; data from Ulaanbaatar Meteorological Station, based on WMO). The highest value of average maximum temperature is in July, and the next is in June (Figure 3.4.6). The average minimum temperature is in January and the next is in December. About the precipitation, annual amount is about 270 mm. The monthly average of precipitation is highest in August, 76.3 mm and the next is in July, 65.7 mm. However, in December, January and February, the precipitation is very low, only 2-3 mm.

However, considerable abnormal climate has been observed recent years. For example, according to the climate situation of 2011, it recorded 31.8℃ on August 10, and recorded -39℃ on January 26 and 27, and the sever cold continued from December to February (Weather, Environment institute of Mongolia).

Table 3.4.1 Temperature and precipitation of Ulaanbaatar city in recent 10 years
(Statistics department of Ulaanbaatar)

Year	Average temperature (℃)	Max temp. (℃)	Min Temp (℃)	Precipitation (mm)
2001	－0.2	34.0	－39.5	204.2
2002	0.3	34.6	－35.0	190.8
2003	－0.3	33.0	－34.2	286.7
2004	0.4	36.0	－31.6	256.9
2005	－0.3	36.5	－35.4	258.5
2006	0.3	33.0	－37.3	257.8
2007	2.0	38.0	－26.8	181.7
2008	0.9	34.8	－33.8	161.3
2009	0.3	33.3	－33.6	274.1
2010	－0.3	38.3	－35.7	236.0
Mean value	0.3	35.2	－34.3	230.8

Table 3.4.2 Monthly average temperature of Ulaanbaatar city (based on WMO)

Month	Average temp (℃)	Max temp (℃)	Min temp (℃)	Average precipitation (mm)
Jan	－19.7	－14.4	－25.0	2.0
Feb	－15.3	－8.9	－21.6	1.9
Mar	－7.3	－0.8	－13.8	3.3
Apr	1.8	8.7	－5.2	8.4
May	9.7	17.1	2.3	13.4
Jun	14.3	20.8	7.8	50.9
Jul	15.9	21.8	10.0	65.7
Aug	13.5	19.3	7.6	76.3
Sept	8.0	14.4	1.5	32.1
Oct	1.8	8.1	－4.6	8.3
Nov	－8.9	－3.4	－14.4	4.9
Dec	－16.8	－11.9	－21.6	3.2

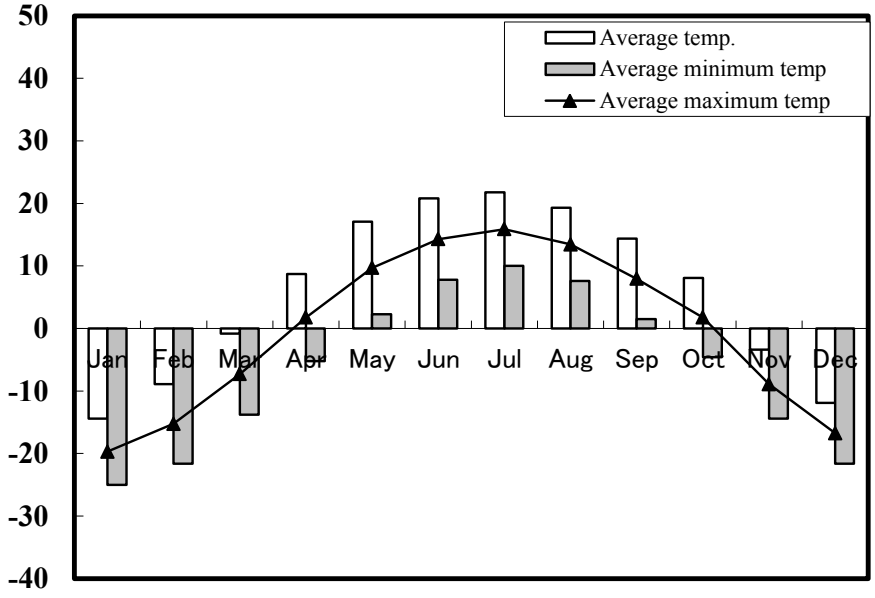


Figure 3.4.6 Monthly average temperature of Ulaanbaatar city (based on WMO)

3.4.3 Ground condition and groundwater

According to topography and geology, most of the area of Ulaanbaatar city is occupied by hard rock except younger sediments like sands and gravels along the floodplain and on the terraces of the Tuul River.

Figure3.4.7 shows the soil classification of Mongolia by NGIC. Here, we estimated the ground condition based on soil type even though the soli map is different form ground map. According to the soil type map, Ulaanbaatar city and its surroundings are can be classified to mountain, low mountains and rolling hill soil, soil of humid areas and riparian soil. In the mountainous area, the ground can be estimated hard rock based on geological map. However, along the rivers and channels, the ground estimated to be sand, gravel and mud.

Within the Ulaanbaatar city area, we collected an engineering geological map (Figure 3.4.8, from Research Center of Astronomy and Geophysics, Mongolian Academy of Sciences. Hereafter called RCAG). According to this map, mud deposits distributed intermittently along the main stream of the Tuul River, alluvial deposits distributed along the main stream and tributaries. Except these deposits, and part area that are not classified, the remains are composed of base rock ground. Figure 3.4.9 shows the base rock depth of Ulaanbaatar city area (After RCAG). Along the Tuul River, the depth of base rock is about 30 m and some area reached more than 80 m. However, in the mountainous area, the base rock depth is shallower than 10 m and along the valley basin is about 10-30 m.

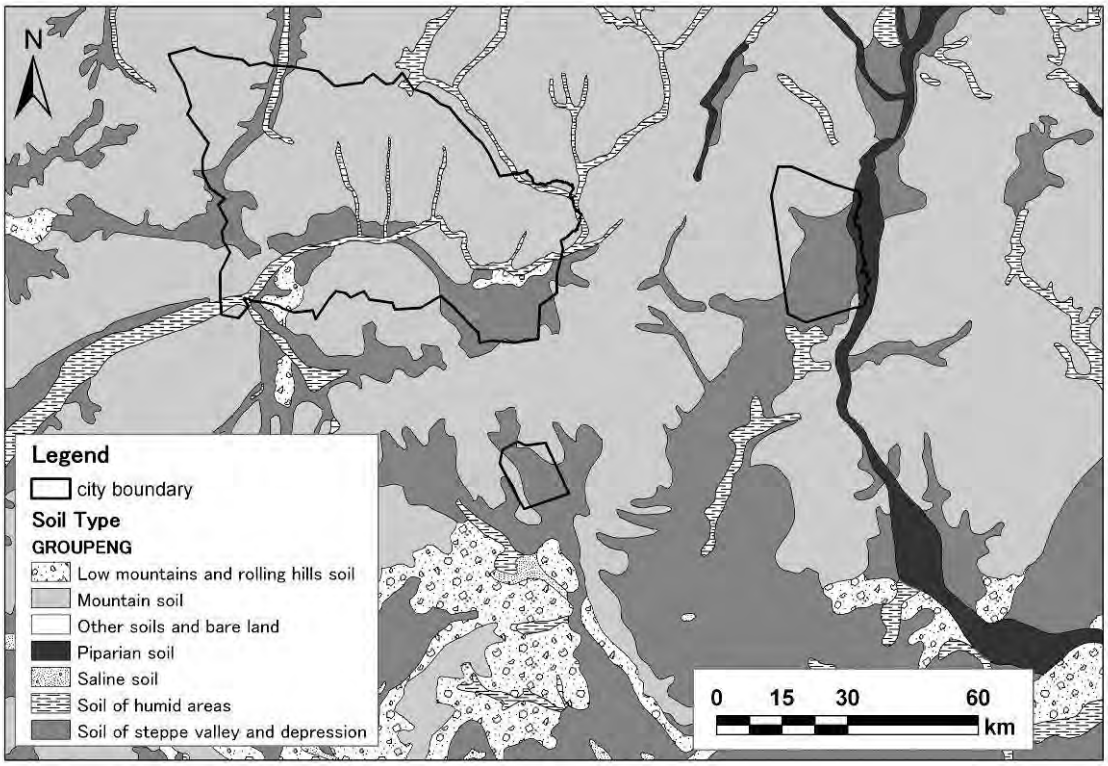


Figure 3.4.7 Soil type map of Ulaanbaatar its surroundings (after NGIC)

Figure 3.4.8 Engineering geological map of Ulaanbaatar city area (After RCAG)

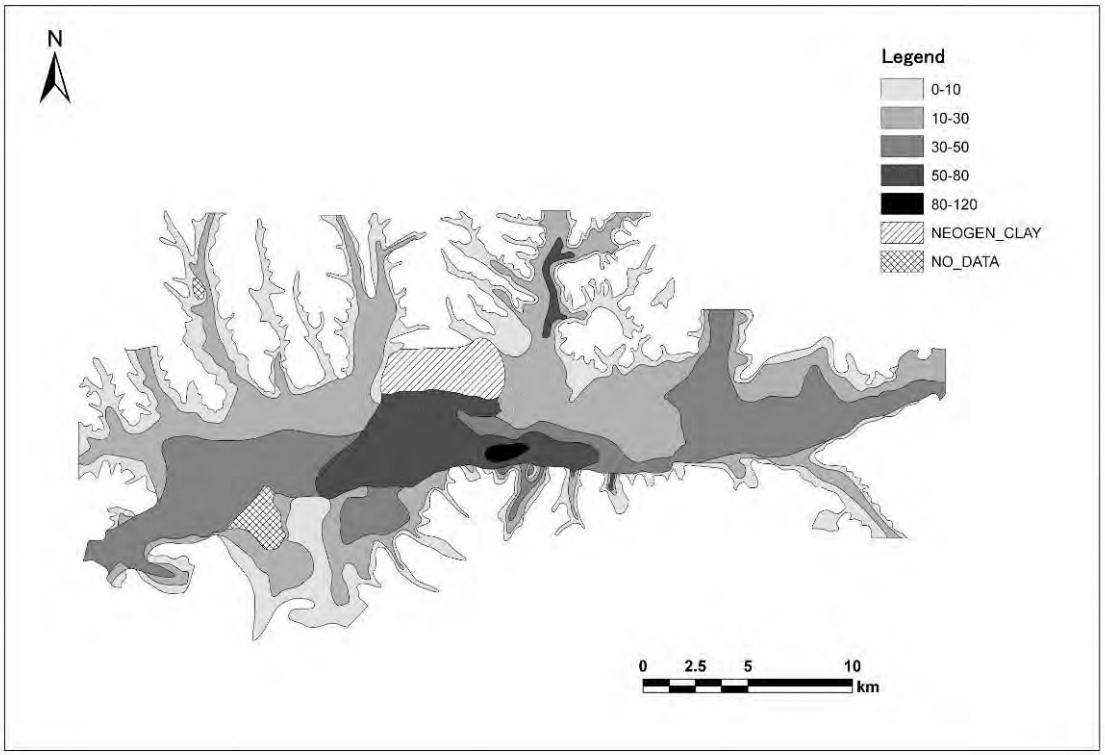


Figure 3.4.9 Base rock depth map of Ulaanbaatar city area (After RCAG)

About the groundwater data sets of Ulaanbaatar city, there are two data sets has been collected, one is from JICA (1995) project of [The Study on Water Supply in Ulaanbaatar and Surroundings] summarized the groundwater level (Figure 3.4.10), another is a groundwater velocity map of NGIC (Figure 3.4.11). According to Figure 3.4.10, the groundwater level of Ulaanbaatar city is about 1,320

m by elevation in the eastern part of the city, and about 1,265m in the western part of the city. These groundwater levels were about under ground 10-20 m compared to ground surface. Figure 3.4.11 shows the groundwater flow based on NGIC. According to this map, Ulaanbaatar city and its surroundings, the groundwater flow velocity is higher in mountainous area, about 50-100 mm/a, while the velocity in low land is about 5-10 mm/a. Along the Tuul River and the Herlen River, the flow is complex, may be cause affected by surface flow. In the satellite district Bagahangai, the groundwater flow is lower than 5 mm/a.

Above two date sets are both old. The data set of JICA (1995) was collected in 1993 and 1994, while the groundwater flow map of NGIC was compiled from the 1981 report of Mongolian-Russian scientist, so the date was considered to be collected before 1981.

To confirm the groundwater level of Ulaanbaatar, especially in the city area, we used the 1,500 boring which included groundwater level in 4,076 boring data provided from RCAG, ,created groundwater level map of the city area (Figure 3.4.12). According to this map, in the northern area of the city, the groundwater level is deep and lower in the southern part of the city.

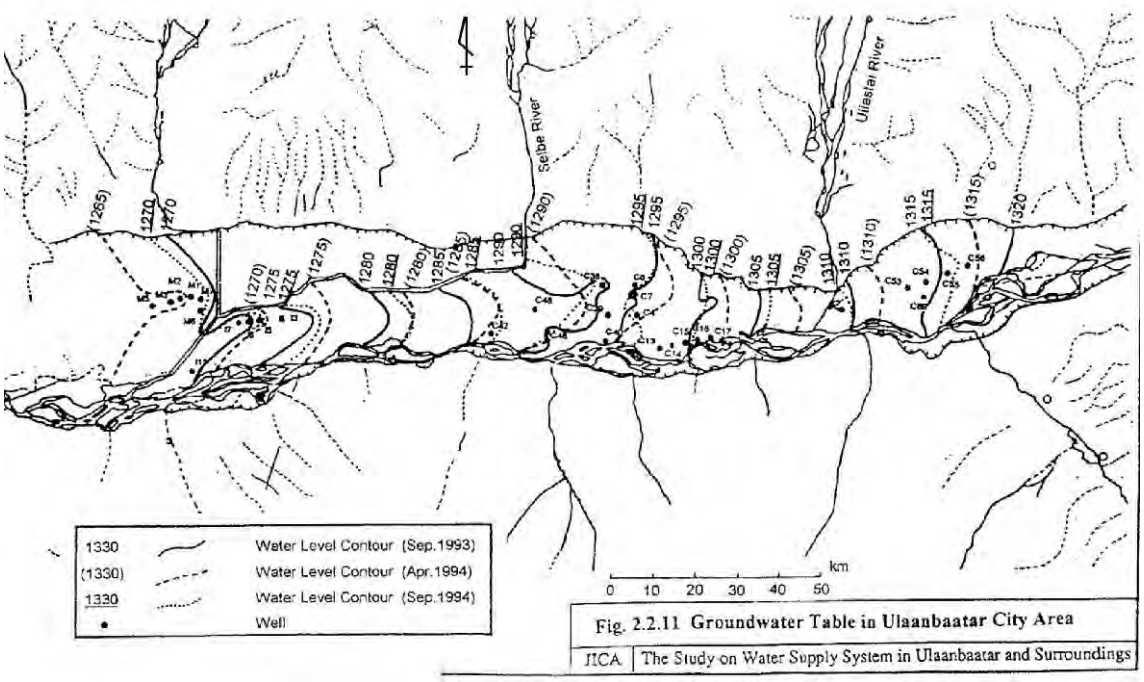


Figure 3.4.10 Contour map of groundwater level in Ulaanbaatar city area (JICA, 1995)

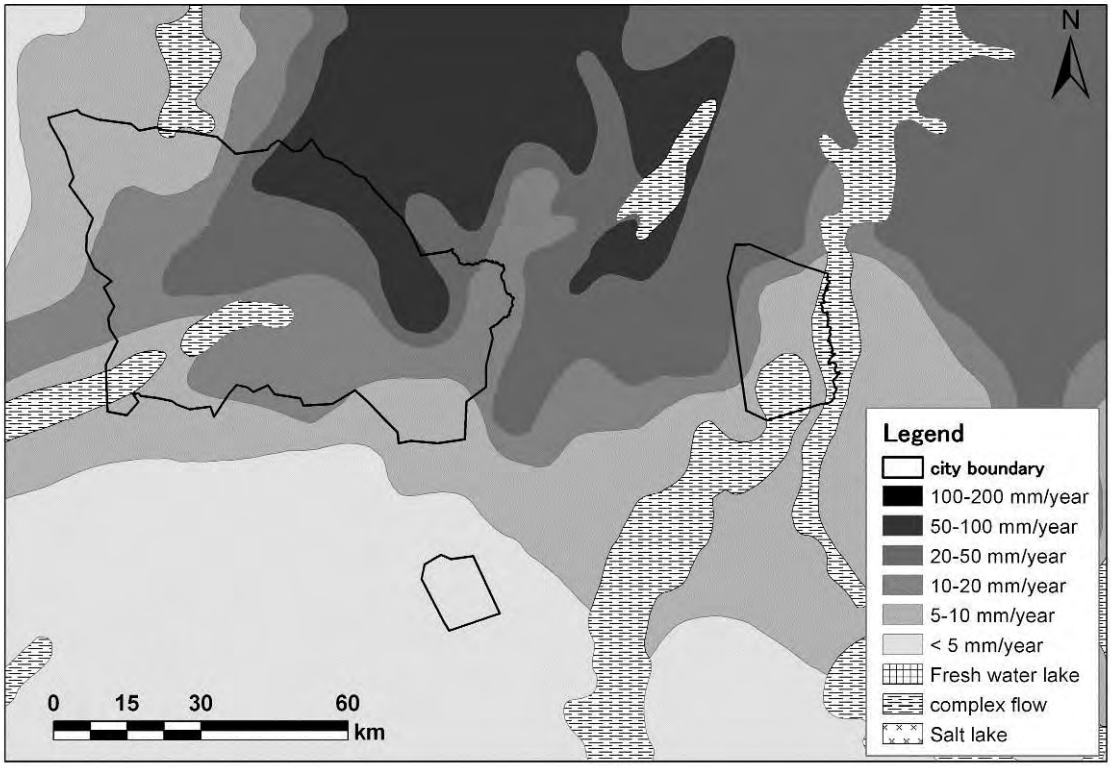


Figure 3.4.11 Groundwater flow of Ulaanbaatar and its surroundings (NGIC)

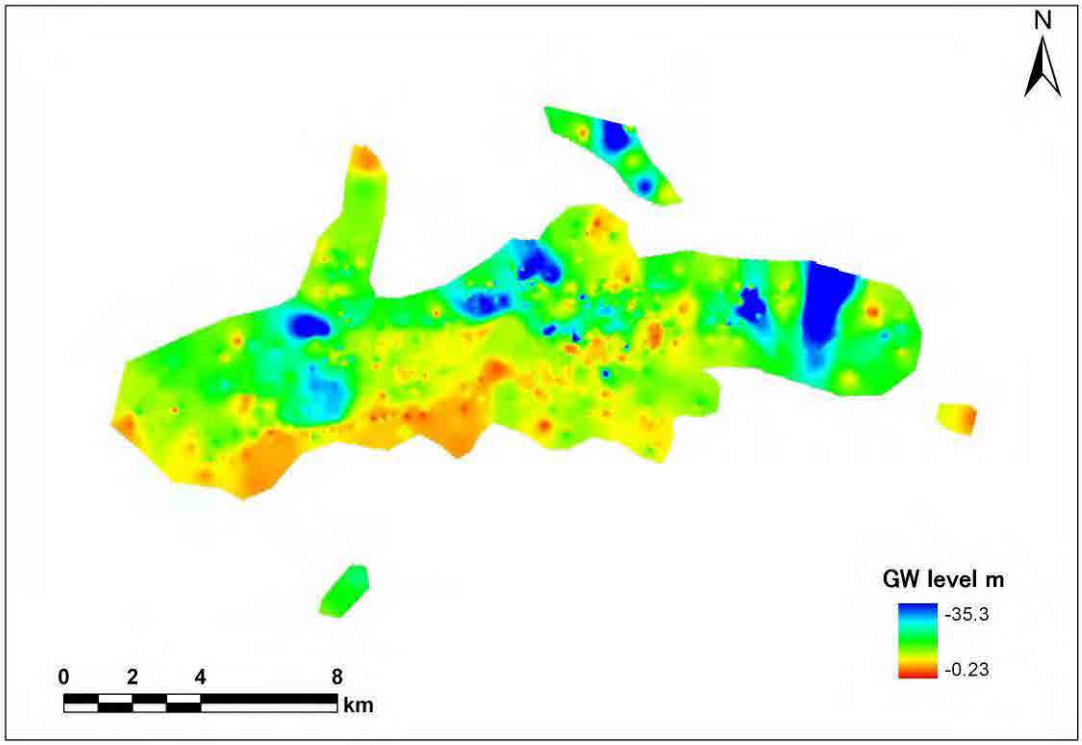


Figure 3.4.12 Groundwater level of Ulaanbaatar city area

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- USGS (United States Geological Survey):HydroSHEDS Download Site HP
- http://gisdata.usgs.gov/website/HydroSHEDS/viewer.php
- WMO, World Weather information service:http://worldweather.wmo.int/119/c00229.htm

3.5 Existing survey material and amendment field survey for the active faults in and around UB City

Several active faults, such as shown in Figure 3.5.1, recognized around Ulaanbaatar city. These active faults have been studied mainly by RCAG using geomorphological and geophysical methods. Below is description about main active faults in and around Ulaanbaatar city, Hustai, Emeelt, Avdar uul and Gunjiin faults, based on related materials and additional field survey.

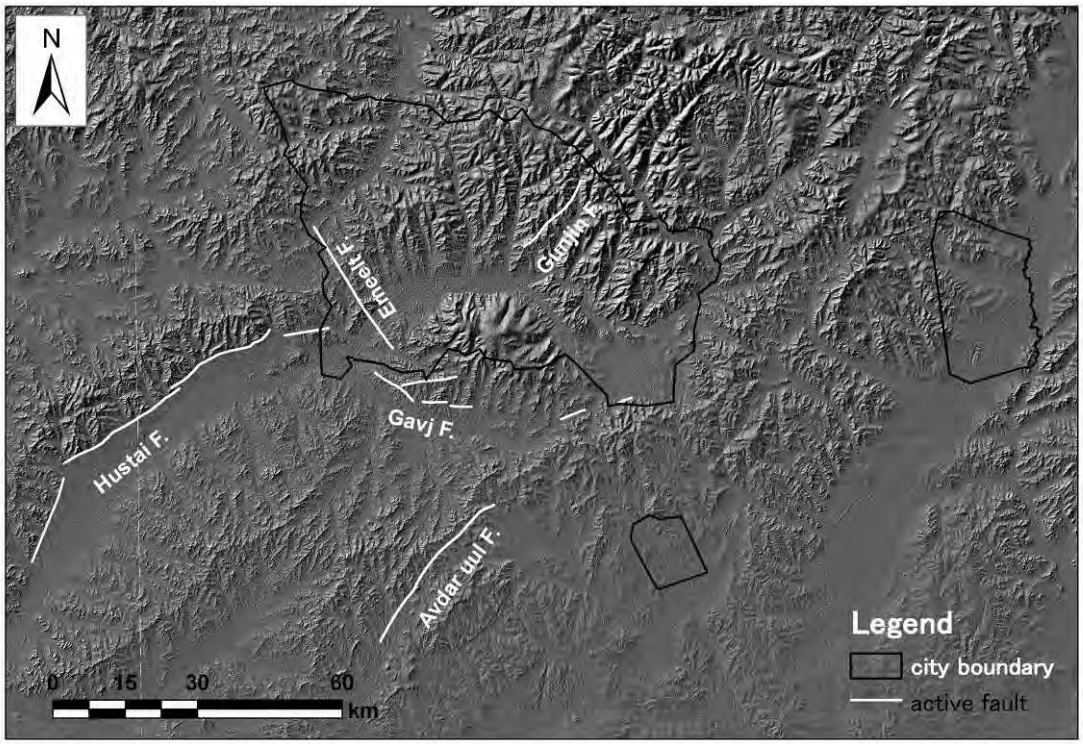


Figure 3.5.1 Active faults in and around Ulaanbaatar city
(background is shaded map created from Aster DEM, fault traces are based on RCAG)

3.5.1 Hustai fault

- Location: Extending to southwest from about 30 km southwest from central Ulaanbaatar city.
- Strike: NE-SW
- Dip: SE
- Length: 80 km (RCAG report, 2012, Dujardin *et al*., 2012)

The Hustai fault is the biggest one among the active faults around Ulaanbaatar city. The fault is extending to southwest from the site which 30 km southwest distance from the center of Ulaanbaatar city. The Hustai fault is considered as a normal fault dipping to southeast, accompanying with left-lateral sense (Ferry *et al*., 2012). According to Demberel (2011), the length of the fault is about 92 km with 4 segments. About the activity of the fault, Demberel (2011) reported there was no historical earthquake within 500 years except a M4+ earthquake recorded in 1974. However, according to Ulziibat *et al*. (2011), earthquake activity is being increased from 2009 to 2010 on the eastern end of the fault.

About the length of the fault, RCAG report (2012) suggested 70-80 km and Dujardin *et al.*(2012) reported it is 80 km. Figure 3.5.1 shows the fault surface trace according to Demberel (2011), RCAG report (2012) and topographical interpretation based no satellite image from Google Earth. The total length is about 80 km.

Figure 3.5.2 shows the active fault topography detected from satellite images. The fault is just being the boundary of Hustai range and its southern side plain. Springs, offset of channels could be observed along the fault trace.

To observe fault topography of the Hustai fault, we conducted field survey along the fault on April 13, 2012. Very clear active fault topography could be observed along the fault, the granite Hustai range standing behind the fault trace (Figure 3.5.3). Similar active fault topography is also observed continuously along the boundary of mountain and plain. Trench surveys has been conducted by RCAG in 2008 and 2010, confirmed the activity of the fault (Figure 3.5.4). However, the recent event, recurrence interval of the fault is under discussion by RCAG.

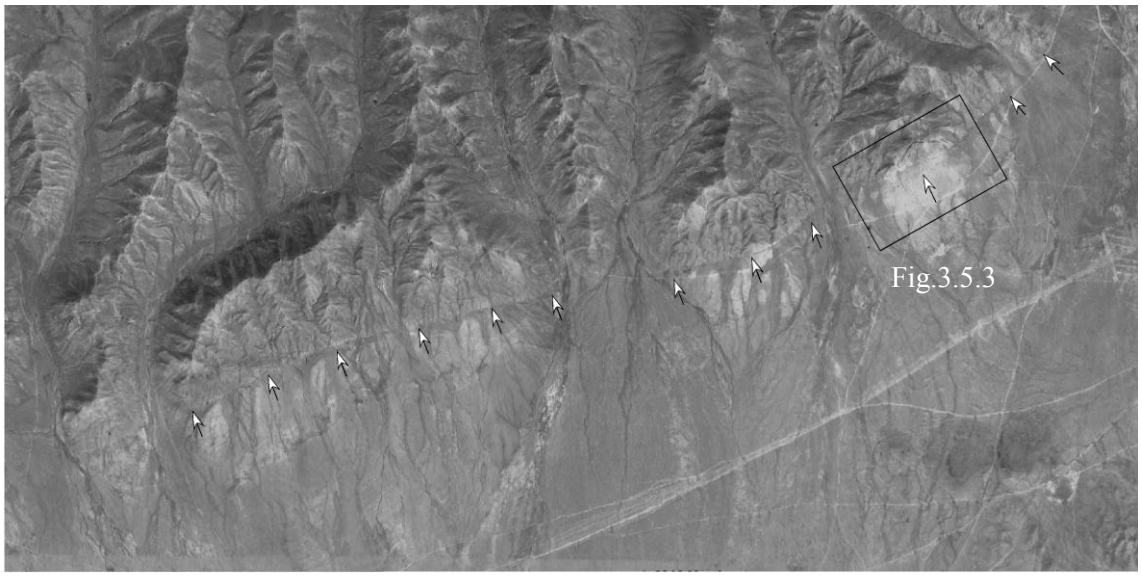


Figure 3.5.2 The Hustai fault seen on satellite images. Arrows indicate fault trace.
（Satellite images are from Google Earth）

Figure 3.5.3 Outcrop of the Hustai fault (view from southeast. The fault is as the boundary of granite range and the plain in front of the range. Arrow indicates active fault trace).

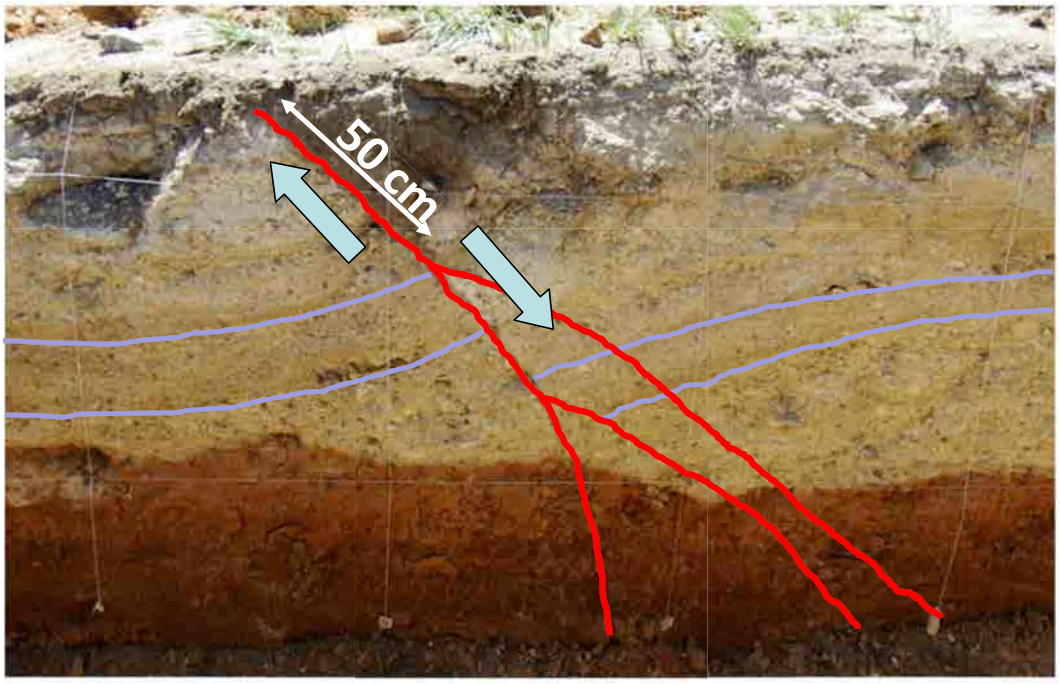


Figure 3.5.4 Trench survey of Hustai fault by RCAG (provided by RCAG)

3.5.2 Emeelt fault

- Location: southwest 15 km from Ulaanbaatar city.
- Strike: NW-SE
- Dip: NE
- Length: About 30 km (RCAG report, 2012)

Based on seismometers records, the seismicity being active along the fault since 2005, and a clear active fault surface traces were confirmed by field survey conducted by RCAG and France universities (Université Montpellier 2; Université de Strasbourg). According to Demberel (2011), the fault trace is about 40 km long and the deformation is wide. Moreover, it is considered that the seismic fault reached to surface by recent faulting. However, about the recent activity and recurrence of the fault is now under studying by the RCAG. According to the trench survey conducted by the RCAG and France universities, the fault is a reverse fault and dipping to northeast, 1-2 events with 1 to several meters deformation could be detected from deformation of old channel sediments (Dujardin *et al*., 2012). Ulziibat *et al*., (2011) also revealed that the concentrating seismic swarm of from 2005 to 201 in western Ulaanbaatar city is along the Emeelt fault, indicating the activity of this fault.

Clear linear fault topography could be confirmed on satellite images (Figure 3.5.5). We conducted field survey along the fault trace on April 13, 2012. We observed fault saddle (Figure 3.5.6) and linear fault valley (Figure 3.5.7) on the middle site of the fault.

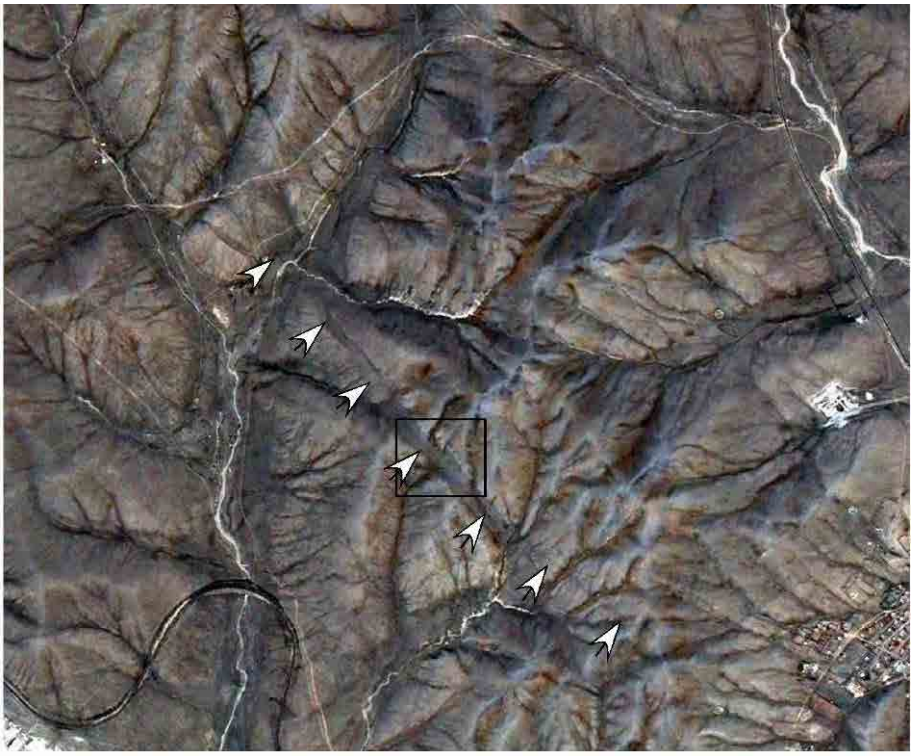


Figure 3.5.5 Emeelt fault on satellite image (Satellite image is LandsatETM+7 true color images merged with Spot 5, provided by the RCAG)

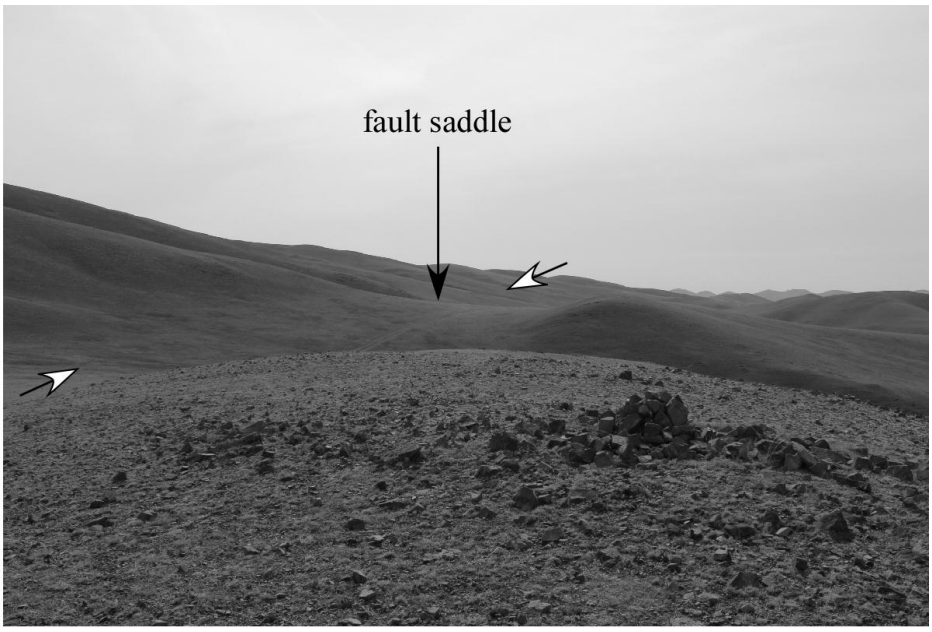


Figure 3.5.6 Fault crest of the Emeelt fault (View to east, arrow indicates fault trace)

Figure 3.5.7 Fault topography of the Emeelt fault (View to west, arrow indicates fault trace)

3.5.3 Avdar Uul fault

- Location: Extending to southwest from 50 km south from Ulaanbaatar city
- Strike: NE-SW
- Dip: unknown
- Length: about 40 km (RCAG report,2012)

About the Avdar uul fault, except RCAG report (2012), no research reports and papers were confirmed. For observe fault topography, we conducted field survey for this fault on May 1, 2012.
On satellite image, the fault topography is appeared clearly and springs distributed along the fault (Figure 3.5.8). According to the RCAG report (2012), on February 22, 1980, a M4.2 earthquake occurred vicinity of this fault, considered to be the activity of the fault.

In the field survey, we observed fault topography on western tip (Figure 3.5.9) of the fault and also on western part (Figure 3.5.10) of the fault. The northern side of the fault is being higher, swamps created along the fault due to the groundwater near fault trace dammed by the fault. However, because we did not reach the fault trace, we could not observe the springs. Moreover, we can not confirm deformation of alluvial fan of those small channels from satellite image.

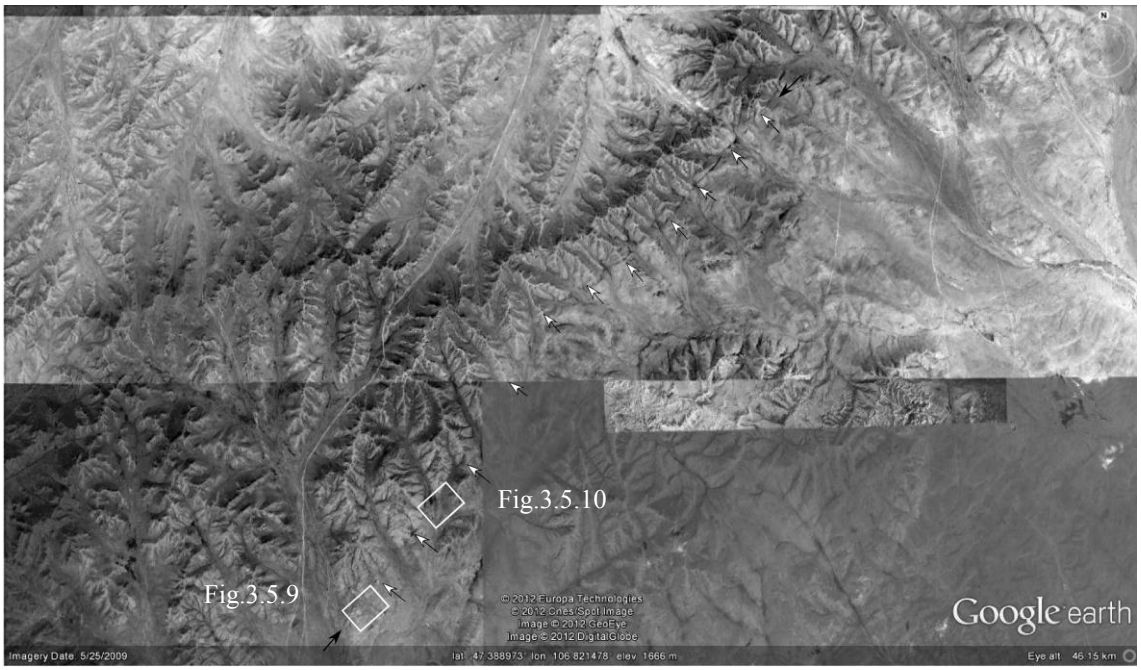


Figure 3.5.8 Fault topography on satellite image (from Google Earth)

Figure 3.5.9 Western tip of the Avdar uul fault (View to south, arrow indicates fault trace)

Figure 3.5.10 Fault topography of the Avdar uul fault (View to north, arrows indicated the fault trace)

3.5.4 Gunjiin fault

- Location: Extending to northeast from 5km northeast distance from Ulaanbaatar city
- Strike: NE-SW
- Dip: unknown
- Length: 15-20 km (RCAG report, 2012)

The Gunjiin fault is a right-lateral active fault which extending to northeast-southeast direction from 5 km northeast from Ulaanbaatar city (Demberel, 2011). It is considered that the cumulated right-lateral deformation is reached 25 m. On the satellite image, the fault topography is seen somewhat clear (Figure 3.5.11). Trench survey conducted by the RCAG revealed at least 2 events occurred on the fault. However about the recent activity and recurrence interval is under study.
We conducted field survey on May 1, 2012, for confirm fault topography of the fault. We observed clear fault topography on the southwestern extension from the trench site conducted by the RCAG (Figure 3.5.12), it was confirmed that the eastern side of the fault is uplifted.

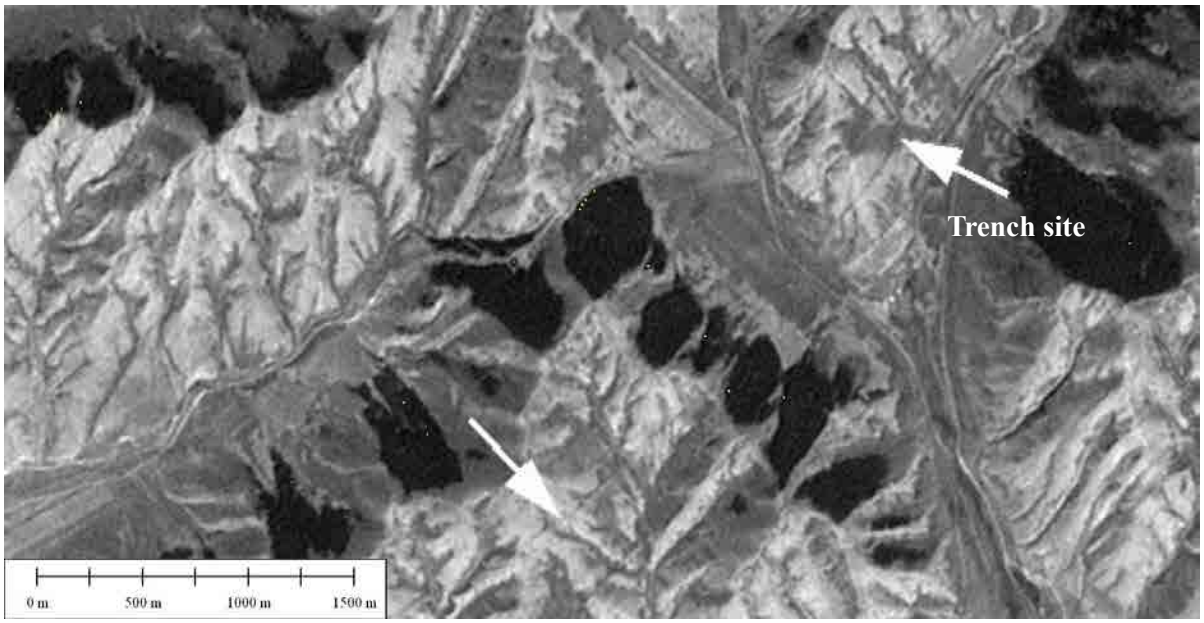


Figure 3.5.11 Gunjiin fault seen on Satellite image (provided by RCAG).

Figure 3.5.12 Fault topography of the Gunjiin fault
(View to southwest, arrow indicates fault trace)

References

- Demberel (2011): Vp/Vs ratio and seismic activity structure of Ulaanbaatar area, the capital city of Mongolia, Comprehensive Nuclear Test-Ban Treaty, Science and Technology, 2011, 8-10, June, Vienna.
- Dujardin J. R., M. Bano, M. Gillard, A. Schlupp, M. Munkhuu, T-A, Nyambayar (2012): Characterization of the Emeelt active fault by 2D and 3D GPR survey for seismic hazard assessment of Ulaanbaatar, capital city of Mongolia, Geophysical Research Abstracts, Vol.14, EGU 2012-8027-2, EGU General Assembly, 2012
- Ferry M, A.Schlupp, U. Munkhuu, M. Munschy and S.Fleury (2012):Tectonic Morphology of the Hustai Fault (Northern Mongolia), Vol.14, EGU 2012-5803, EGU General Assembly, 2012
- RCAG Report (2012):Seismic activity around Ulaanbaatar city, presented by Dr. Ulziibat, March 20, 2012 at RCAG
- Ulziibat M, Yoann C and Sukhbaatar U (2011): Unexpected high seismic activity observing near the Ulaanbaatar area, capital city of Mongolia: improved relocation by using array-based earthquake location technique, Comprehensive Nuclear Test-Ban Treaty, Science and Technology, 2011

3.6 Earthquake/Strong ground motion observation data, earthquake wave data, investigation material of historical earthquake including disaster damage data by past earthquakes

Although seismicity of Mongolia is not so active compare to regions of plate boundary, such like Circum-Pacific seismic belt, but it is a quiet active seismic region as an inland. Figure 3.6.1 plotted the epicenters of earthquakes occurred from 1900 to June 2012.In Mongolia, its west and western regions are very active in seismicity, in which huge earthquakes over Mw8.0 occurred in these region, such as Bolnay earthquake in 1905, Gobi-Altay earthquake in 1957. These earthquakes were considered to be the largest scaled one ever occurred inland (Suzuki, 2009). This active seismicity was considered to be the stress transportation to Altay mountains, due to collision of Indian plate and Eurasian plate. However, including Ulaanbaatar, the eastern part of Mongolia is not so activity in seismicity.

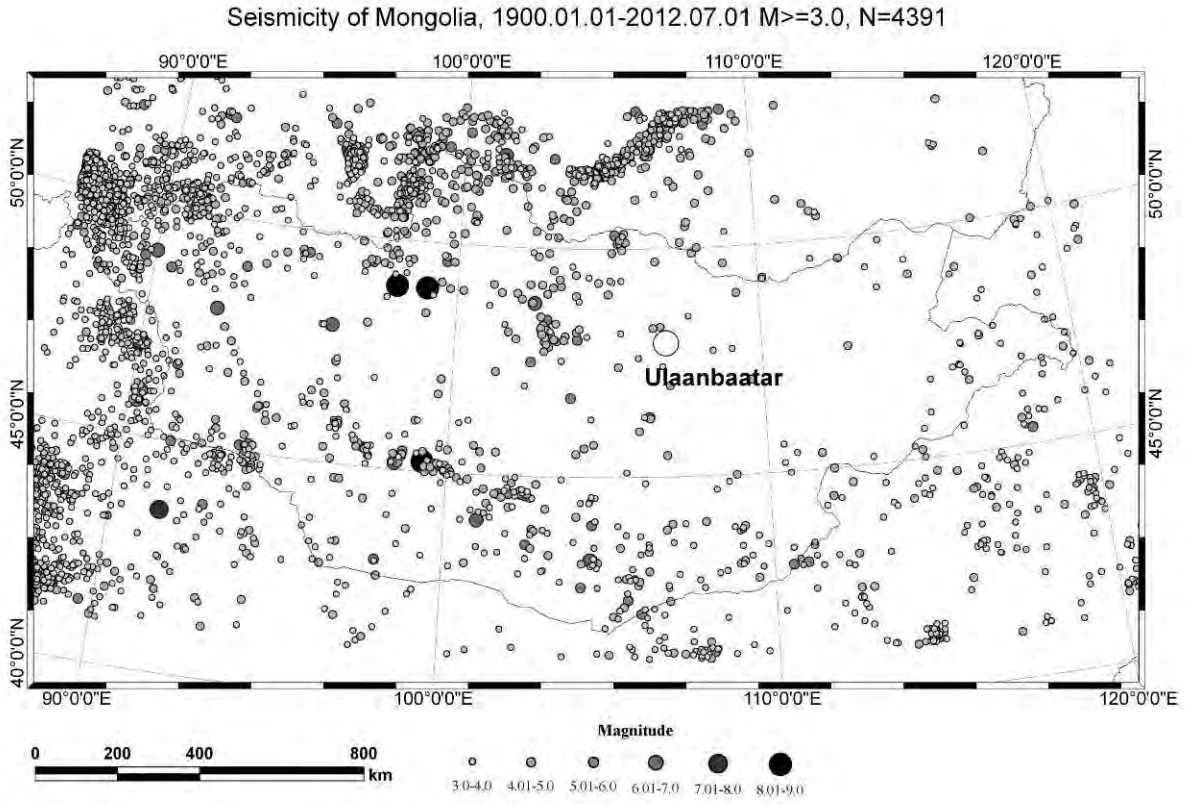


Figure 3.6.1 Seismicity of Mongolia and its surroundings (created from earthquake catalogue of ISC)

About Ulaanbaatar city and its surroundings, it has been attracting attention due to active seismicity from 2005, according to RCAG report (2012) (Figure 3.6.2). Especially in the western part of the city, a northwest-southeastern directed swarm of micro earthquakes were observed, which was considered as the activity of Emeelt active fault (Figure 3.6.3). Figure 3.6.4 show the seismicity around Ulaanbaatar city based on RCAG earthquake catalogue. Although there is no large earthquake, from 1900 to 2011, a total of 2,792 earthquakes, magnitude larger than ML1.5 occurred in the area. The earthquake catalogue data was attached in appendix.

However, about wave form data, we got only data from one seismic station of ULN. Moreover, there was no historical earthquake in Ulaanbaatar city has been reported, and no related materials have been found.

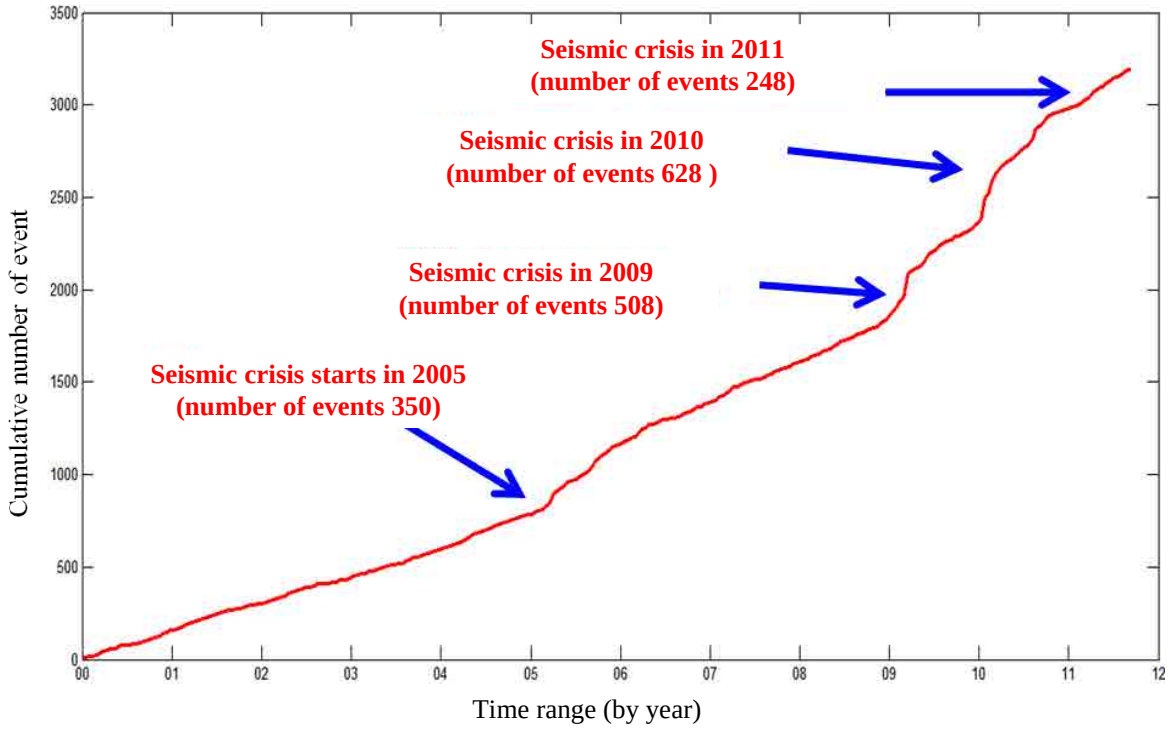


Figure 3.6.2 Seismicity around Ulaanbaatar city (provided by RCAG)

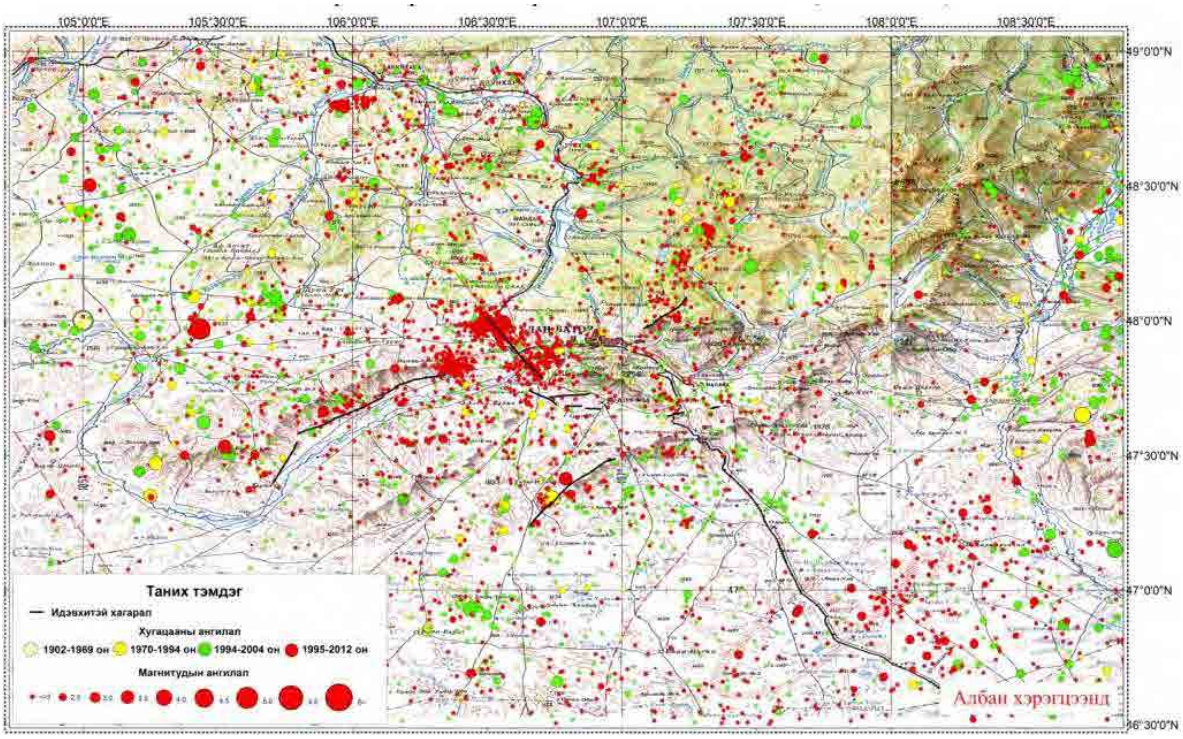


Figure 3.6.3 Earthquake distribution around Ulaanbaatar city (provided by RCAG)

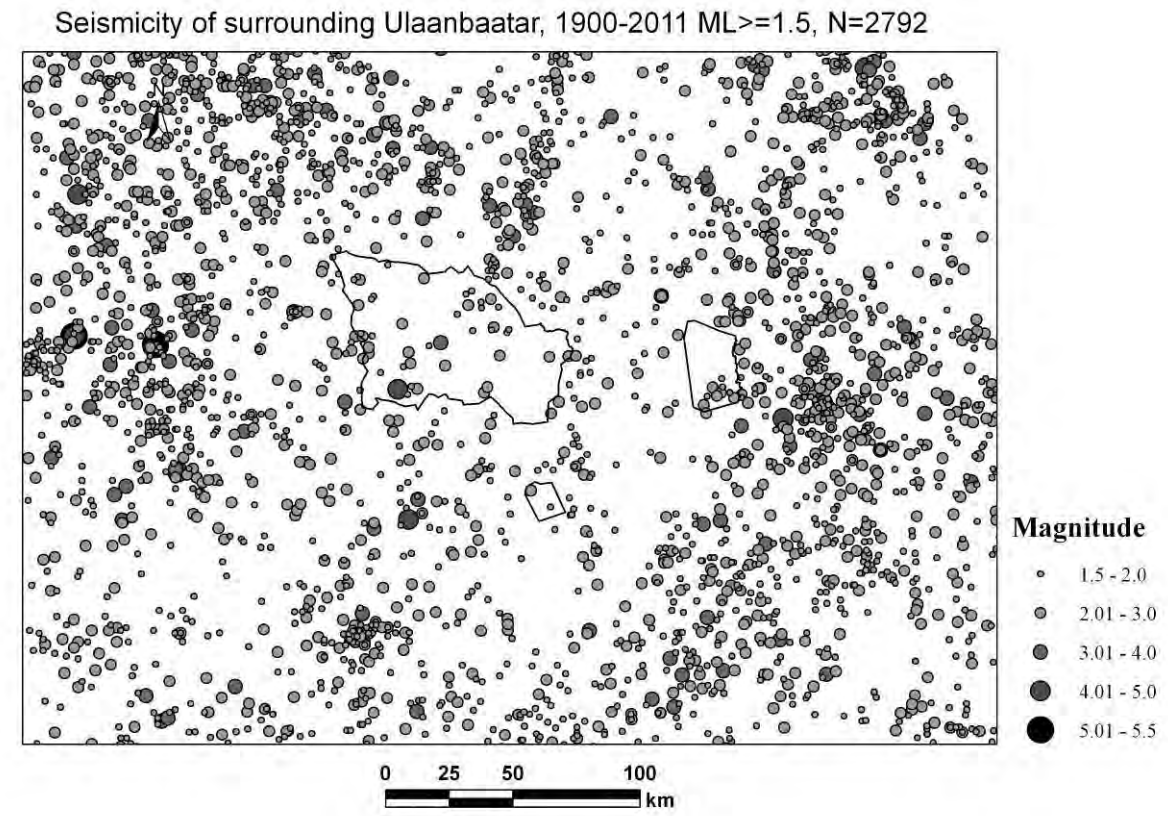


Figure 3.6.4 Seismicity around Ulaanbaatar city (plotted data from RCAG)

References:

Suzuki Yasuhiro (2009): Geomorphological study on the greatest intraplate surface ruptures and their causative active faults in Mongolia, Reports of Grants-in-Aid for Scientific Research, 2009

3.7 Population, residential buildings, public buildings, infrastructures, and others

3.7.1 Population

Population of UB city is assessed 1206.6 thousand at 2011, and its breakdown is summarized as Table 3.7.1. Figures in the parenthesis are ratios of population to the total. Structure of population in each district is almost identical, *i.e.* population under 16-years is a little under 30%, that of working age is a little under 70%, and aging population is a little under 10%.

The population in each year from 1981 and its transient are shown in Table 3.7.2 and Fig. 3.7.1, respectively. It can be seen that steep increments in population occurred in 1988 and 1999. Also observed is that population increment rate has become high since 2002.

Table 3.7.1 Breakdown of population in UB city (unit: thousand)

AGE	UB	BN	BKh	BG	BZ	NA	SKh	SB	KhU	CHD
Under 16	321.1 (27)	7.7 (29)	1.1 (30)	47.4 (25)	76.5 (27)	9.9 (30)	71.7 (28)	35.0 (25)	30.6 (26)	41.2 (27)
Working Age	810.9 (67)	17.6 (65)	2.4 (65)	132.6 (69)	192.3 (68)	20.7 (64)	169.9 (66)	91.2 (66)	81.2 (68)	103 (67)
Elderly People	74.6 (6)	1.7 (6)	0.2 (5)	12.1 (6)	14.5 (5)	1.9 (6)	15.5 (6)	11.7 (8)	8.1 (7)	8.9 (6)
Total	1206.6 (100)	27.0 (100)	3.7 (100)	192.1 (100)	283.3 (100)	32.5 (100)	257.1 (100)	137.9 (100)	119.9 (100)	153.1 (100)

UB : Ulaanbaatar
BN : Baganuur BKh : Bagakhangai BG : Bayangol
BZ : Bayanzurkh NA : Nalaikh SKh : Songinokhairkhan
SB : Sukhbaatar KhU : Khan-Uul CHD : Chingeltei

ref. UB Statistics

Table 3.7.2 Population in UB city in each year (unit: thousand)

Year	UB	BN	BKh	BG	BZ	NA	SKh	SB	KhU	CHD
1981	388.9	3.4	0.0	120.4	59.3	18.9	0.0	126.3	60.6	0.0
1982	397.0	4.2	0.0	128.7	58.0	18.9	0.0	139.3	57.9	0.0
1983	403.7	5.3	0.0	137.1	58.9	19.4	0.0	125.9	57.1	0.0
1984	408.9	5.9	0.0	143.9	58.6	19.6	0.0	124.1	56.8	0.0
1985	417.1	6.8	0.0	150.4	58.3	19.8	0.0	125.4	56.4	0.0
1986	425.4	8.3	0.0	163.1	56.4	19.6	0.0	124.8	53.2	0.0
1987	436.6	9.3	0.0	178.1	55.6	20.3	0.0	121.0	52.3	0.0
1988	500.5	10.6	0.0	198.2	64.0	21.7	0.0	147.2	58.8	0.0
1989	519.3	11.9	0.0	202.0	68.3	22.4	0.0	154.5	60.2	0.0
1990	536.6	12.9	3.0	211.0	75.8	23.6	0.0	151.9	58.4	0.0
1991	557.0	13.6	4.7	215.7	84.8	24.8	0.0	154.7	58.7	0.0
1992	575.0	15.9	5.9	104.0	87.5	25.5	115.0	75.5	60.9	84.8
1993	588.0	16.3	5.7	107.1	95.8	23.4	118.1	78.6	57.8	85.2
1994	596.0	16.6	5.5	110.8	100.4	21.4	119.7	78.8	56.9	85.9
1995	612.1	16.9	5.2	113.8	102.2	22.0	123.7	82.3	56.4	89.6
1996	624.9	17.6	5.3	115.7	104.8	22.9	125.2	84.1	55.8	93.5
1997	638.4	19.1	5.0	118.7	107.2	22.3	127.3	85.4	57.8	95.6
1998	652.2	20.3	5.0	119.6	110.5	21.7	130.7	89.4	58.5	96.5
1999	760.1	21.1	3.5	137.5	147.4	23.6	154.3	92.2	271.4	104.4
2000	773.6	20.7	3.5	141.0	149.6	23.4	158.6	95.5	72.6	108.7
2001	790.8	21.4	3.5	143.8	153.4	23.4	162.4	97.7	74.0	111.2
2002	821.8	22.2	3.6	147.5	160.6	24.1	169.0	101.7	76.9	116.2
2003	869.9	23.2	3.6	153.6	172.8	24.7	182.2	106.2	81.1	122.5
2004	915.5	24.6	3.7	158.1	184.7	25.7	195.7	112.5	84.1	125.4
2005	952.4	25.3	3.8	160.5	196.1	26.5	204.6	117.2	87.9	130.5
2006	987.2	25.7	3.8	160.8	211.6	27.3	211.1	123.1	90.9	132.9
2007	1025.2	26.0	3.9	165.1	221.6	28.1	220.3	129.5	94.7	136.0
2008	1067.4	25.9	3.7	169.3	235.2	29.1	232.3	133.1	98.8	140.0
2009	1106.7	25.9	3.6	174.9	250.2	30.2	241.4	135.1	104.2	141.2
2010	1161.8	26.9	3.6	185.1	266.0	31.5	252.3	136.9	112.1	147.4
2011	1206.6	27.0	3.7	192.1	283.3	32.5	257.1	137.9	119.9	153.1

UB : Ulaanbaatar

BN : Baganuur BKh : Bagakhangai BG : Bayangol

BZ : Bayanzurkh NA : Nalaikh SKh : Songinokhairkhan

SB : Sukhbaatar KhU : Khan-Uul CHD : Chingeltei

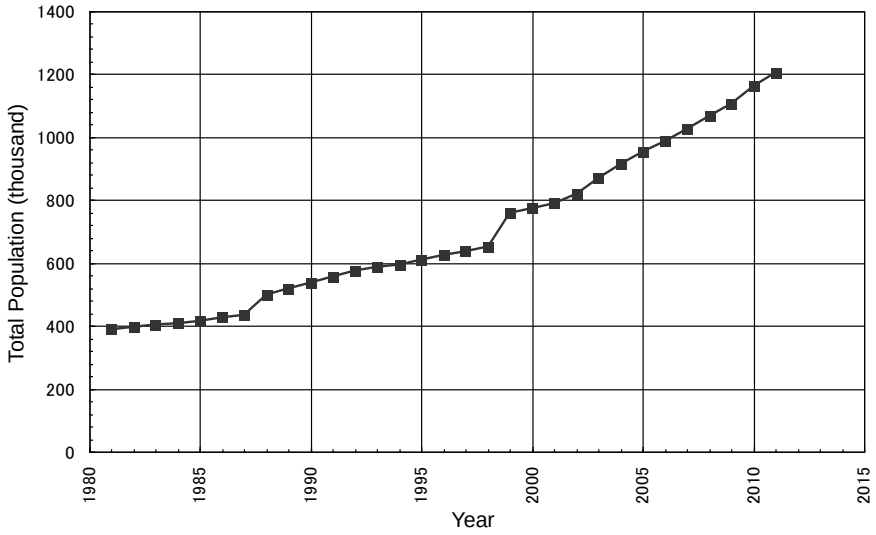


Figure 3.7.1 Transient of population in UB city (unit: thousand)

3.7.2 General buildings

Data related to general buildings are provided by UB master plan project and by UB city. The data includes 190,036 buildings, in which 57,848 buildings are relatively large with building area of 10 square meters or more, and the rests are small ones such as storage, garage and so on. Figure 3.7.2 shows the distribution of buildings in the central area of UB city from the database described above. It is seen that included in the database are not only apartment houses in the central area but also small houses in Ger area.

Figure 3.7.2 Distribution of general buildings in UB city (central area)

The database contains the shape data and attribute of each building, which are under rearrangement and examination.

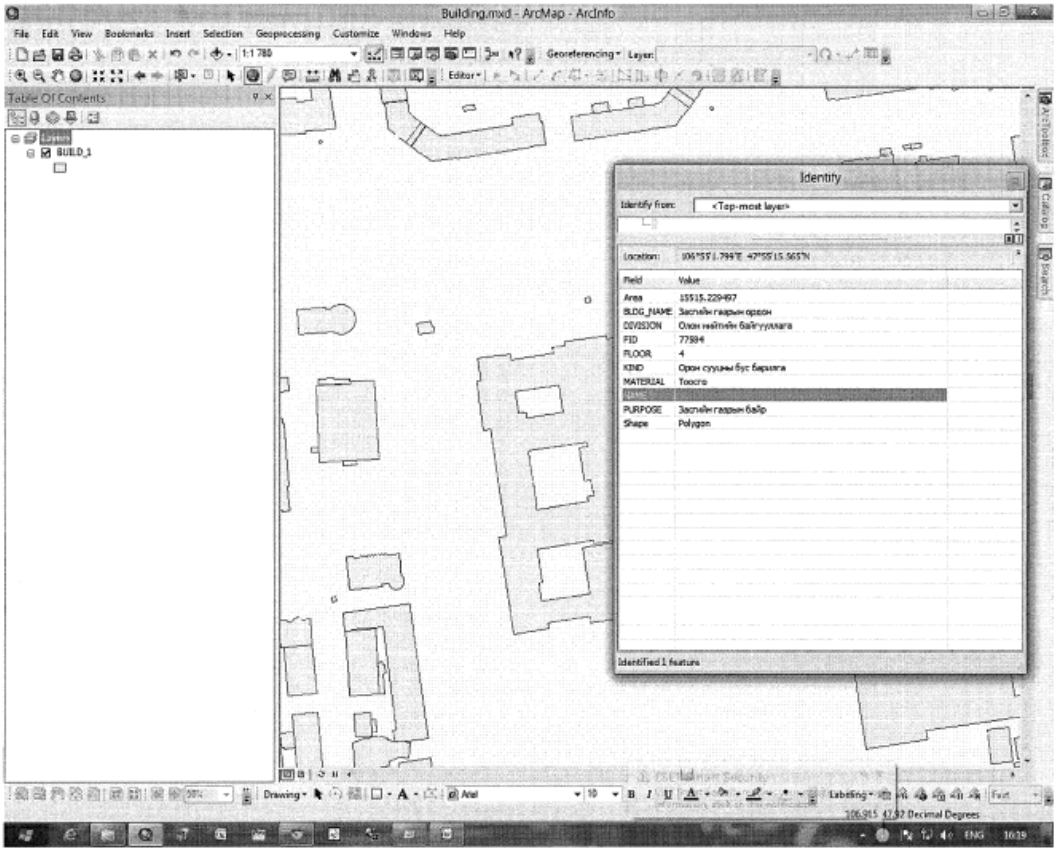


Figure 3.7.3 Example of building data

3.7.3 Public buildings

(1) School

Table 3.7.3 shows the number of facilities relevant to school. Regarding to the number of rooms to the population of one thousand, the maximum of 7.25 in Sukhbaatar district is almost double of the minimum of 3.38 in Chingeltei district.. Also, regarding to the number of gymnasia to the population of one thousand, the maximum of 0.54 in Bagakhangai district is almost eight times of the minimum of 0.07 in Songinokhairkhan district.

One of the important functions of school facilities in case of disaster is to receive the refugees, and it can be said that the capacity of function largely differs by districts.

Table 3.7.3 Number of facilities relevant to school in UB

ITEM	UB	BN	BKh	BG	BZ	NA	SKh	SB	KhU	CHD
School	205	3	1	43	38	4	21	52	21	22
School Bldgs.	275	7	3	54	59	9	35	56	26	26
rooms	4841	131	20	960	1012	112	600	1000	488	518
Gym.	164	4	2	30	35	4	17	36	22	14

UB : Ulaanbaatar
BN : Baganuur BKh : Bagakhangai BG : Bayangol
BZ : Bayanzurkh NA : Nalaikh SKh : Songinokhairkhan
SB : Sukhbaatar KhU : Khan-Uul CHD : Chingeltei

(2) Hospital

Outline of hospitals in UB is summarized in Table 3.7.4. Some medical centers, such as an emergency medical center, a dental and neurological disorder institute, a blood transfusion center, an infectious disease institute and an occupational disease study center are established for special medical treatment, whose organization is shown in Table 3.7.5.

Expert units, such as an emergency treatment unit, an ambulatory pharmacy, an ambulatory blood transfusion unit, an ambulatory infection prevention unit, an infectious prevention expert, expert treatment unit, are organized for the disaster response.

Table 3.7.4 Hospitals in UB

District	Hospital Name	Officials	Doctors	Nurses	Beds
Sukhbaatar	General Hospital No.1	614	122	226	544
	Maternity Hospital No.1	248	44	67	240
	Sukhbaatar Dist. General Hospital	155	28	39	185
	Dermatology Hospital	143	40	33	170
	Subtotal	**1,160**	**234**	**365**	**1,139**
Chingeltei	Chingeltei Dist. Health Unit	298	91	87	167
	Hospital for Special Gov. Officials	243	66	78	196
	Maternity Hospital No.2	104	26	19	75
	Subtotal	**645**	**183**	**184**	**438**
Khanuul	Khanuul Dist. Health Unit	208	72	67	68
	OrgilSanetorium	163	15	22	300
	District Hospital District	82	20	24	115
	Rehabilitation Hospital	60	16	12	120
	Tuul Village Hospital	23	4	5	15
	Name unknown	123	22	11	100
	Subtotal	**659**	**148**	**141**	**718**
Bayanzurkh	General Hospital No.2	403	86	143	195
	Infectious Disease Hospital	730	179	185	510
	CancerInstitute	385	95	120	190
	Bayanzurkh Dist. Health Unit	142	28	54	250
	General Hospital No.4	408	95	126	276
	Mental Disease Hospital	425	71	105	450
	Gachuurt Village Hospital	19	2	4	15
	Khonkhor Village Hospital	21	3	4	12
	Maternity Hospital No.3	100	23	24	45
	Subtotal	**2,633**	**582**	**765**	**1,943**
Bayangol	Maternal and Child Health Center	1,000	208	396	658
	Infant Sanatorium	113	13	43	90
	Railroad Hospital	327	76	113	210
	Trauma Hospital	513	91	173	420
	General Hospital No.3	614	122	226	400
	Subtotal	**2,567**	**510**	**951**	**1,778**
Songinokhairkhan	Songinokhairkhan Dist. Health Unit	342	105	84	138
	District Hospital	92	18	32	115
	Dependency Treatment Hospital	26	5	6	50
	Jargalant Village Hospital	30	6	7	15
	Subtotal	**490**	**134**	**129**	**318**
Nalaik	Nalaikh Dist. Health Unit	291	55	86	135
Baganuur	Baganuur Dist. Health Unit	264	56	82	135
Bagakhangai	District Hospital	26	3	8	15
Total		**8,735**	**1,905**	**2,711**	**6,619**

Table 3.7.5 Special Hospitals in UB

Hospital Name	Officials	Doctors	Nurses
Emergency Medical Center	230	73	11
dental and neurological disorder institute	72	22	22
blood transfusion center	49	11	15
infectious disease institute	104	34	
occupational disease study center	85	24	14
合計	540	164	62

(3) Refuge

Location of refuges and pharmacies is put into database and shown on the map as illustrated in Fig. 3.7.4. Moreover, refuges in suburbs and five evacuation routes from the central UB to suburbs are planned as shown in Figs. 3.7.5 and 3.7.6.

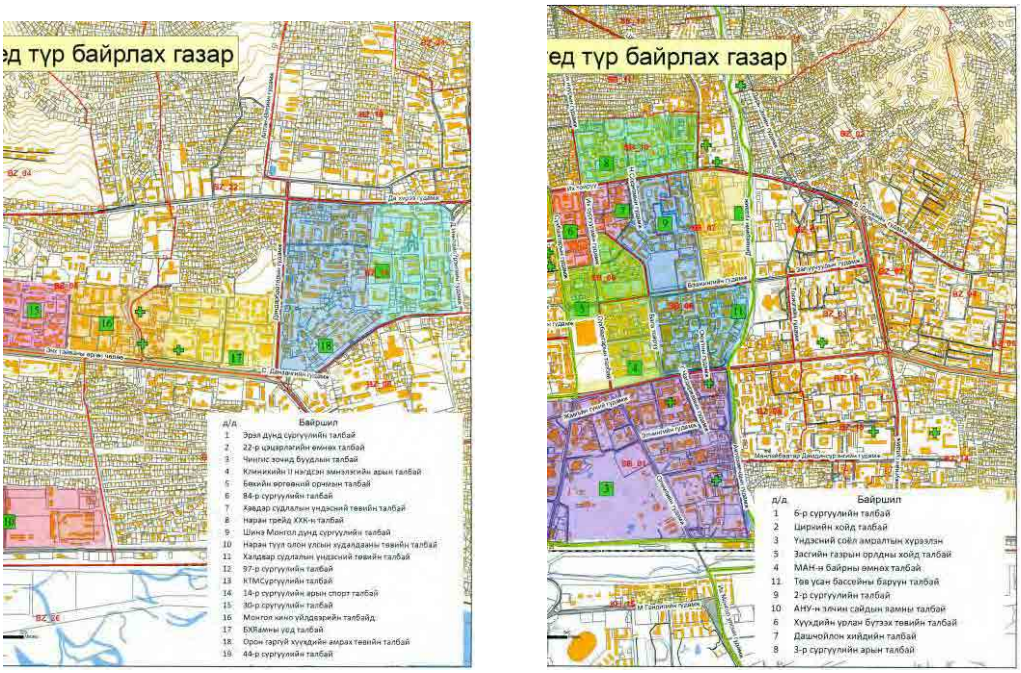


Figure 3.7.4 Example of mapping of refuges

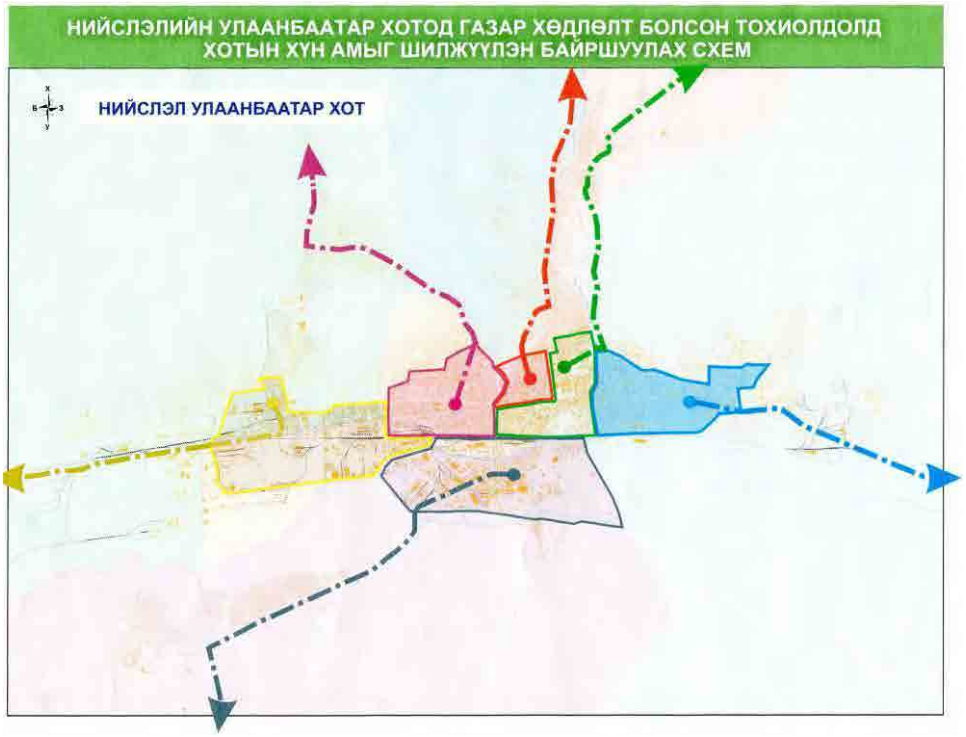


Figure 3.7.5 Evacuation routes from central UB to suburbs

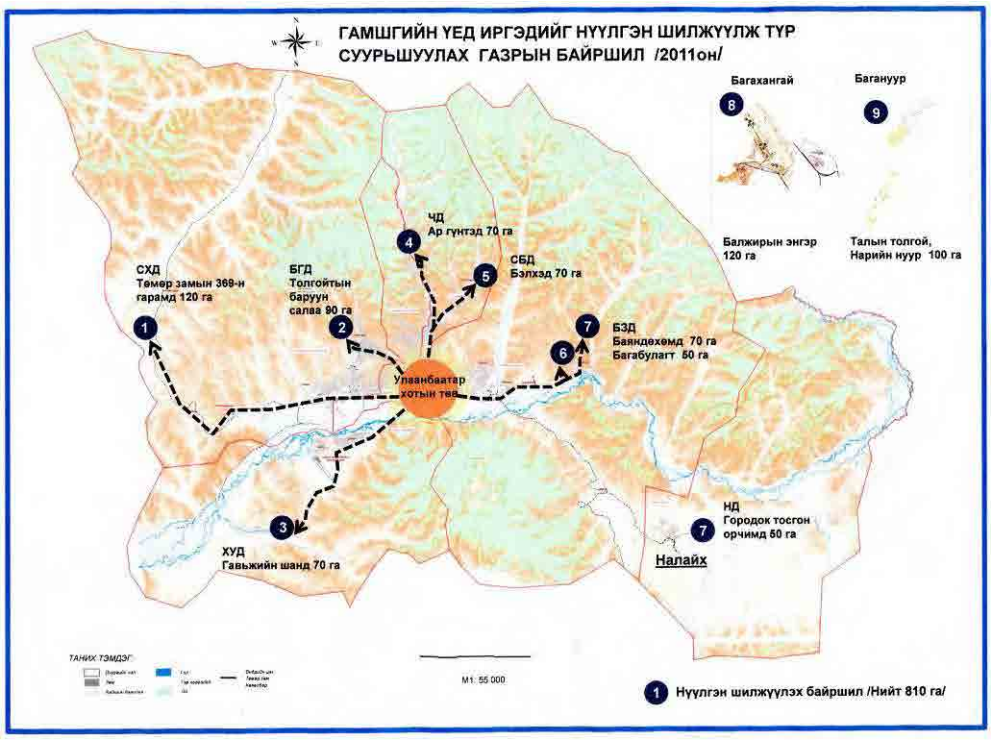


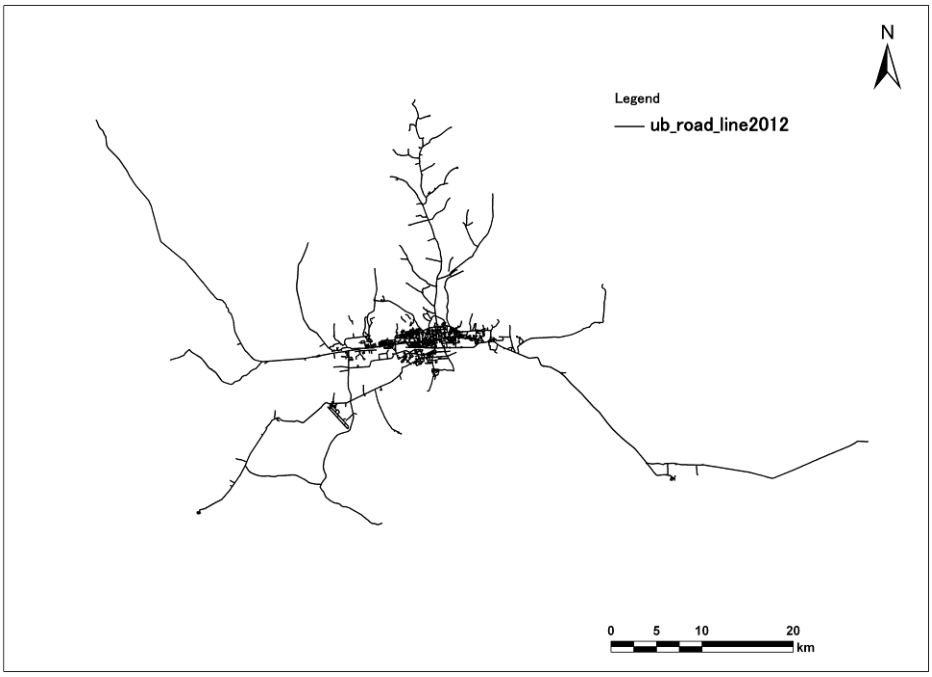
Figure 3.7.6 Location of refuges in suburbs of UB

3.7.4 Infrastructures

(1) Road

The road network of Ulaanbaatar City is shown in Figure 3.7.7. The total length of the road is 842km with 110km road of more than four-lane, 308km road of two-lanes and the remaining 424km road of less than two-lane. The road in the urban area is paved and the damage and subsidence of road surface can be seen somewhere, may because of adequate maintenance. The road could be flooded when in heavy rain due to the insufficient drainage capacity.

The traffic jam occurred often on the main road, especially in the morning and evening rush hours. Ulaanbaatar City has 118,573 private cars in 2010 and the traffic jam can be partly attributed to the lack of parking area and the delayed establishment of traffic management system. The road in ger area is generally unpaved and the natural earthen road is narrow and rough, which may cause the problem for emergency vehicles in case of disaster.



Ref: UB construction urban development and planning agency

Figure 3.7.7 Road Network of Ulaanbaatar City

(2) Bridge

It has been confirmed that there are 67 bridges in Ulaanbaatar City by the investigation from "The Project for Construction of Ajilchin Flyover in Ulaanbaatar City" project. The major characteristics of the bridges are listed in Table 3.7.6 and their location is shown in Figure 3.7.8. Among the 67 bridges, there are 11 bridges constructed in 1960s, 7 in 1970s, 15 in 1980s, 7 in 1990s and 23 after 2000. Most of the bridges built before 1990 were constructed by the cooperation from former Soviet Union and China. The defects in construction and the deterioration are observed.

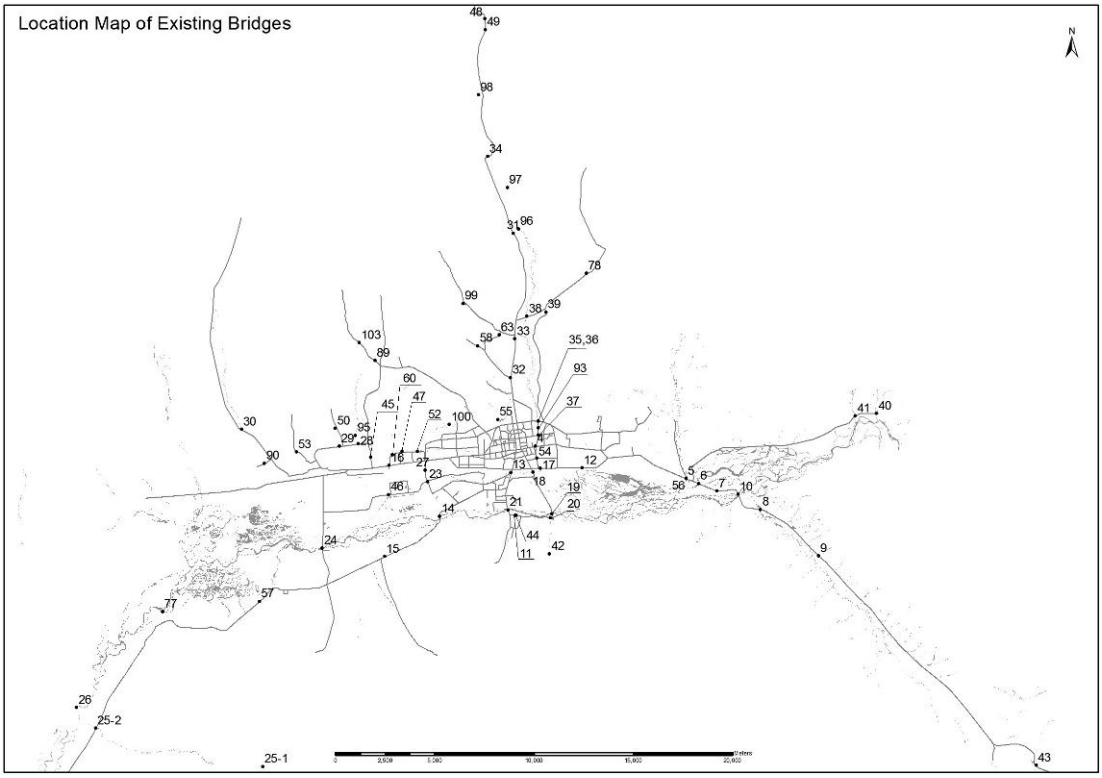
The longest bridge is 339.5m. There are 9 bridges whose lengths exceed 100m, 28 bridges whose length more than 25m and less than 100m and 30 bridges which is less than 25m. Most of the bridges are reinforced concrete bridges.

Table 3.7.6 Bridge List of Ulaanbaatar City

No.	ID No.	Name of bridge	Parameter		Construction year	Type
			Length (m)	Width (m)		
1	4	Arslantai Bridge	34.2	24.7	1962	RC girder
2	5	Uliastai tsaad Bridge /Left/	96.2	10.0	1967	RC girder
3	6	Uliastai tsaad Bridge	6.0	9.0	1985	RC
4	7	Uliastai tsaad Bridge	17.5	9.0	1963	RC
5	8	Bridge over the Hol river	20.4	11.0	1963	RC girder
6	9	Chuluut am Bridge	11.0	11.0	1963	RC girder
7	10	Bayanzurkh Bridge	252.6	11.8	1967	RC girder
8	11	Zaisan West am Bridge	18.0	8.4	1971	RC girder
9	12	Bridge in front of the 14th khoroo	2.6	24.6	1963	RC
10	13	Enkhtaivan Bridge	339.5	16.8	1961	RC girder
11	14	Yarmag Bridge	259.4	12.4	1961	RC girder
12	15	Yarmag Bridge to Airport	9.6	11.0	1961	RC slub
13	16	Tolgoit Parallel Bridge	36.0	17.2×2	1987	RC girder
14	17	Selbe dund Bridge	51.0	24.1	2002	RC girder
15	18	Dund gol Deed Bridge	50.2	12.8	1975	RC girder
16	19	Ikh Tenger Bridge	258.0	15.5	1994	RC girder
17	20	Ikh Tenger dwon stream Bridge	12.0	8.1	1979	RC girder
18	21	Zaisan Bridge	224.0	12.3	1971	RC girder
19	23	Dund gol Dood Bridge	67.0	12.9	1975	RC girder
20	24	Sonsgolon Bridge	289.4	10.4	1971	RC girder
21	25-1	Turgen river Bridge-1	40.0	13.5	1987	RC girder
22	25-2	Turgen river Bridge-2 (closed to traffic)	36.0	13.3		RC girder
23	26	Poultry farm Bridge	256.0	10.7	1989	RC girder
24	27	Gurvaljin Bridge	108.0	28.5	1989	RC girder
25	28	Naran Bridge	36.3	13.5	1986	RC girder
26	29	Bridge behind of Meat Factory	54.0	13.5	1986	RC girder
27	30	Nairamdal Bridge	16.6	8.0	1986	RC girder
28	31	Rashaant Bridge	12.0	10.0	1991	RC
29	32	Khailaast Bridge	18.1	25.3	1987	RC girder
30	33	Chingeltei Bridge	18.0	24.0	1987	RC girder
31	34	Sharga Morit Bridge	50.4	9.2	1982	RC girder
32	35	Selbe gol Deed Parallel Bridge -1	45.5	10.5	1963	RC girder
33	36	Selbe gol Deed Parallel Bridge -2	45.5	10.5	1982	RC girder
34	37	Bridge for behind of Chinggis hotel	34.2	16.0	1990	RC
35	38	Dambadarjaa Bridge	60.0	11.0	1995	RC girder
36	39	Dambadarjaa naad Bridge	24.0	13.8	1990	RC girder
37	40	Gachuurt Bridge	30.0	9.0	1984	RC girder
38	41	Gachuurt Bridge	18.0	10.3	1984	RC girder
39	43	Nalaikh Bridge	27.0	9.6		RC
40	44	Zaisan East Bridge	12.0	8.2	1973	RC girder
41	45	Milk factory Bridge	15.8	23.8	1996	multi box
42	46	Baruun-uul Dithc Bridge	27.7	25.2	1986	multi box
43	47	Bridge over the ditch west behind the 1st khoroolol	9.2	10.7	2007	RC
44	48	Bridge to Khandgait-Sanzai	9.0	11.0	2004	RC girder
45	49	South Bridge to Khandgait-Sanzai	9.0	11.0	2004	RC girder
46	50	Tolgoit ger area road Bridge	18.0	6.0	2004	RC
47	52	Bridge behind the 1st district	17.9	9.9	2006	Steel Combined
48	53	Naran river Bridge	27.7	11.1	2009	RC
49	54	Damdinsuren street Bridge over the Selbe river	67.8	19.5	2009	RC
50	55	Bridge over the ditch west of the 39-th secondary	10.0	10.5	2010	RC

No.	ID No.	Name of bridge	Parameter		Construction year	Type
			Length (m)	Width (m)		
		school				
51	56	New right side Bridge of the Uliastai river Bridge to become parallel	96.2	10.0	2010	RC
52	57	Morin/Horse/Hill Bridge	27.0	11.8	2009	RC
53	58	Khailaast 1.1 km length road Bridge-1	9.0	9.0	2011	RC
54	60	Bridge behind 1st khoroolol over drainage ditch	24.0	12.0	2000	RC girder
55	63	Bridge on Chingeltei - KhaiIaast Road	24.0	9.2	2003	RC girder
56	77	Wooden bridge rehabilitation work for front side of the Songino's nursing station	206.0	6.2	2005	Wooden
57	78	Belkh river's RC bridge direction to Dambadarjaa-Belkh road	18.0	10.1	1995	RC
58	89	Bridge for Bayanhoshuu ger area	24.8	11.5	2004	RC
59	90	RC bridge Direction to the Orbit-Takhilt	27.0	11.0	2007	RC
60	93	Golden park bridge of selbe river RC bridge	45.0	11.6	2008	RC
61	95	Songino khairkhan district 4th and 5th khoroo's borderline road	36.0	12.4	2011	RC
62	96	Shadivlan, for Selbe bridge	54.1	13.3	2011	RC
63	97	Goodoin bridge	36.0	6.4		RC
64	98	Upper bridge of Sharga morit	27.0	7.0		RC
65	99	Upper bridge of Chingeltein am	9.0	7.3	2004	RC
66	100	behind the 4th khoroolol flood channel's bridge	13.4	6.7	2004	RC
67	103	Bridge for Bayanhoshuu ger area(north) under construction	17.3	11.6	2011	RC

Ref: The Project for Construction of Ajilchin Flyover in Ulaanbaatar City



Ref: The Project for Construction of Ajilchin Flyover in Ulaanbaatar City

Figure 3.7.8 Location of bridge in Ulaanbaatar City

(3) Railway

The railway of Mongolia consists of a main north-south line, 7 branch lines from the main line and a freight line in the north-east connecting to Siberian railway. The total length of Mongolia railway is about 1800km with the north-south line, 1,118km, from the border of Russia to China. The railway is not electrified and almost all of them are single-track railways. The railway is operated by the Mongolian Railway, a State Owned Share Holding Company (Russia 50% and Mongolia 50%). The railway provides not only the domestic transportation but also the international transportation from Moscow to Beijing.

The railway is an important transportation means in Mongolia both for passengers and goods. Since Mongolia is a landlocked country and there is no seaport, the railway also plays a big role in overseas trading for import and export, especially for Russia and China. The Ulaanbaatar station is a core and the biggest station in Mongolia for both passengers and goods. The annual transportation volume of Mongolia railway is shown in Table 3.7.7.

Table 3.7.7 Annual transportation volume of Mongolia railway

Item	Year			
	2008	2009	2010	2011
Passenger (thou)	4,359	3,118	3,516	3,832
International	185	127	144	165
Domestic	4,174	2,991	3,372	3,667
Cargo (Kilo-ton)	14,647	14,172	16,804	18,448
International	6,631	6,515	8,500	9,874
Domestic	8,016	7,656	8,304	85,74

Ref: Mongolia statistics

It becomes high priority now to upgrade Mongolia transportation infrastructure due to the economic growth and the expansion of mining industry. Mongolia has planned to construct new railways to connect the large scale mine and to ensure a transportation route to the seaport in the third country making use of the railway network of Russia and China. The new railway contraction plan, i.e. State Policy on Railway Transportation endorsed by The State Great Hural of Mongolia on 24 June 2010, is as follows and shown in Figure 3.7.9.

Phase 1：(about 1100km)

- Dalanzadgad – Tavantolgoi - Tsagaan suvraga - Zuunbayan (400km)
- Sainshand - Baruun-Urt (350km)
- Baruun-Urt - Khuut (140km)
- Khuut - Choibalsan (150km)

Phase 2：(about 900km)

- Nariinsukhait - Shiveekhuren (45.5km)
- Ukhaa hudag - Gashuunsukhait (267km)
- Khuut –-Tamsagbulag - Numrug (380km)
- Khuut - Bichigt (200km)

Ref: Regional cooperation in road, transport sector,
http://www.unescap.org/ttdw/common/TIS/CorridorStudy/EGM_Uiwang/9.Mongolia_ppt.pdf
Figure 3.7.9 Mongolia railway construction plan

(4) Airport

The main international airport in Mongolia is Chinggis Khaan International Airport, located about 15km south-west of Ulaanbaatar. The airport was built in 1957 and had the name of Buyant Ukhaa Airport. The airport has its present name from 2005 as the commemoration of the 800 years anniversary of the foundation of the country.

The airport was renovated in 1997 with financial support of ADB and has a 3,100m runway. Besides MIAT Mongolian Civil Air Transportation Corporation, Aeroflot Russian Airlines, Air China, Korean Air etc. operate scheduled flights connecting to Moscow, Beijing, Tokyo, Seoul and Berlin, etc. The annual passenger and cargo transportation volume is shown in Table 3.7.8.

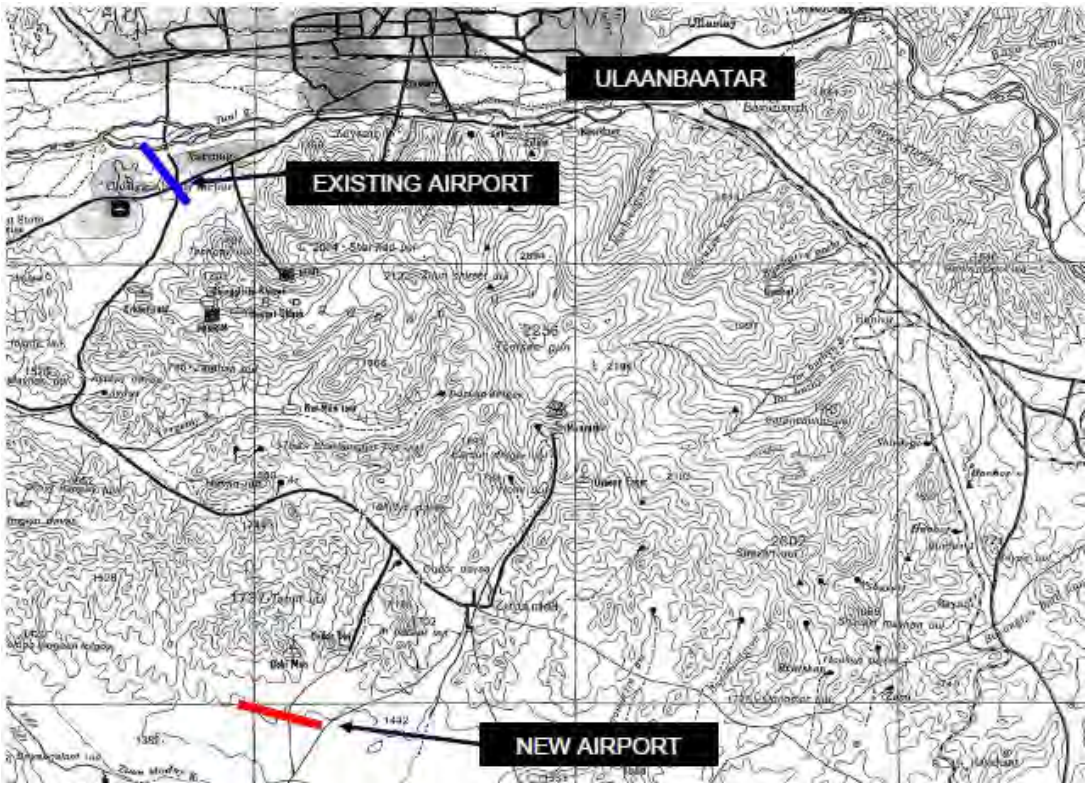
Since the area of the extended line of runway is mountain range, the takeoff and landing is always from north and easily affected by the meteorological conditions such as strong wind. Delay and cancellation of flight occur frequently and the worst service rate of a month could be as low as 75%. On the other hand, the increase of the needs for international passengers and cargo is foreseen because of the rapid growth in manufacture and mining sectors as the results of market economy since 1990s.

Mongolia is planning to construct a new airport with 28.8 billion yen loan from Japanese government. The new airport, with a 3,600m runway, will be at a plain area and about 50km south of Ulaanbaatar. The airport has been started in May 2012 and expected to be completed in March 2016. The location of Chinggis Khaan International Airport and new airport are shown in Figure 3.7.10

Table 3.7.8 Annual transportation volume of Chinggis Khaan International Airport

Item	Year			
	2008	2009	2010	2011
Passenger (thou)	366	309	398	574
International	263	236	277	379
Domestic	103	73	121	195
Cargo (ton)	1,183	700	988	2,109
No. of takeoff and landing	8,519	8,442	11,796	14,692

Ref: Mongolia statistics



Ref: Regional cooperation in road, transport sector,
http://www.unescap.org/ttdw/common/TIS/CorridorStudy/EGM_Uiwang/9.Mongolia_ppt.pdf

Figure 3.7.10 Location of Chinggis Khaan International Airport and new airport

(5) River-structure

Tuul river, total length of 704km and about 50 thousands km2 basin area, flows through the south of Ulaanbaatar city. In 1966, the river flooded and caused 20 lives and affected 10 thousands households. After the flood, about 30km cobble river bank was constructed at the right side of the river. The bank is 2m high with the width of 1.5m at the top and 3-4m at the bottom. Another river, Selbe rive, a tributary of the Tuul river and about 20m in width, flows through the center of the city and has a concrete bank at the two sides and concrete prevention works for river bed scour.

According to the master plan for Ulaanbaatar water supply, drawn up by the cooperation of former Soviet Union in 1970s, there was a plan to build a dam at Tuul river with 1,000m length and 70-80m height, but was not implemented.

(6) Water supply and sewage

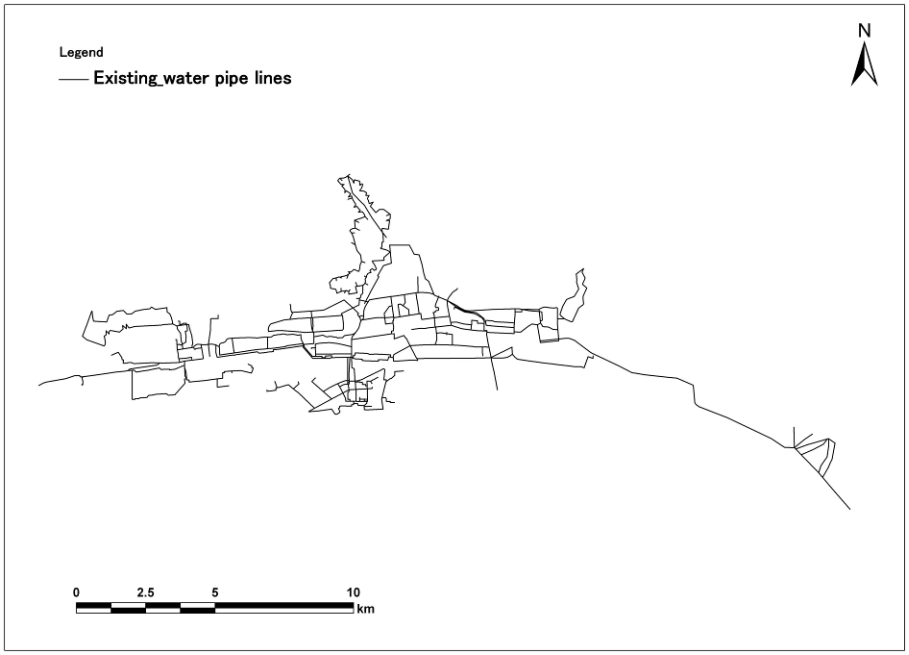
Water supply in Ulaanbaatar city has two types; one is piped water supply for apartment area, which provides water to each household, and another is bulk water supply for ger area, where the residents

need to go to the water supply station to buy the water. The water supply and sewerage processing is operated by the Water Supply and Sewerage Authority of Ulaanbaatar City (USUG).

The water resource for Ulaanbaatar is Tuul river. Underground water is pumped up through the well (30-70m depth) along the Tuul river and accumulated at 4 impoundment, from which the water is supplied after sterilization.

The wastewater of Ulaanbaatar is processed at central sewerage disposal center, which has a daily treatment capability of 220,000m3. The sewerage treatment covers the apartment area. The ger area has no sewerage disposal system. The wastewater from factories and households are separately collected but treated together.

The detail water supply and sewerage network data is under request from USUG. Based on the data from the Study on City Master Plan and Urban Development Program of Ulaanbaatar City (UBMPS), the water supply and sewerage network are shown in Figure 3.7.11 and Figure 3.7.12, respectively.



Ref: UBMPS GIS data

Figure 3.7.11 Water supply network of Ulaanbaatar City

Ref: UBMPS GIS data

Figure 3.7.12 Sewerage network of Ulaanbaatar City

(7) Power Systems

The power system of Mongolia is shown in Figure 3.7.13, which consists of four independent electric power systems: Central Energy System (CES), Western Energy System (WES), Eastern Energy System and Altai-Uliastai energy system in addition to Dalanzadgad combined heat and power plant (CHP) and other diesel fuel and renewable energy sources. The total power generation capacity is 897MW with 91.8% from thermal power, 5.1% from diesel, 3.0% from hydraulic power and 0.1% from renewal energy such as wind and solar. There are 7 thermal power plants in Mongolia and their capacity is summarized in Table 3.7.9.

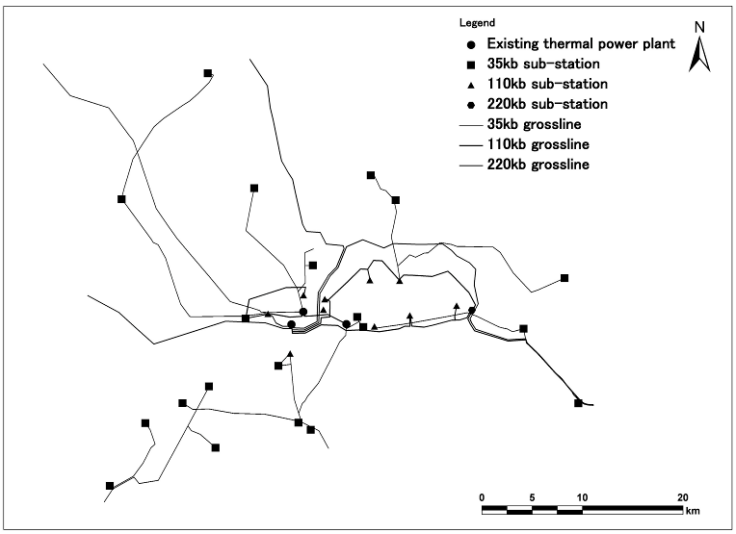
Ref: The Current State of Energy Sector in Mongolia, Development Trends,
http://www.mzv.cz/file/760235/Energy_sector_situation_policy_Eng.pptx

Figure 3.7.13 Power system of Mongolia

Table 3.7.9 Annual transportation volume of Chinggis Khaan International Airport

Power Plant	Capacity	B:boiler/T-G:Turbin generator	Year of operation
No.2 thermal power plant	21.5 MW	4B, 3T-G	1961
No.3 thermal power plant	148 MW	13B, 6T-G	1970
No.4 thermal power plant	580 MW	8B, 6T-G	1983
Darkhan thermal power plant	48 MW	9B, 4T-G	1965
Erdenet thermal power plant	28.8 MW	7B, 3T-G	1987
Choibalsan thermal power plant	36 MW	6B, 4T-G	1967
Dalanzadgad thermal power plant	6 MW	2B, 2T-G	2000
Total capacity	868.3 MW		

The Central Energy System, consisting five power generation companies, one transmission company and four distribution companies, provides the electricity, heat and steam to Ulaanbaatar, the other cities in the area as well as Erdenet, Baganuur and Darkhan industrial complex. The No.2, No.3 and No.4 thermal power plant located within Ulaanbaatar city and the No4. Power Plant is the largest cogeneration plant in Mongolia and provides 70% of electricity and 65% of heat to the city. The power plant and transmission and distribution network of Ulaanbaatar based on the UBMPS data is shown in Figure 3.7.14.



Ref: UBMPS GIS data

Figure 3.7.14 Power station and transmission and distribution network

(8) Gas

There is no piped gas supply system in Ulaanbaatar now. The Mongolia Government promotes the use of Liquefied Petroleum Gas (LPG) for both transportation and households. There are several private companies supply LPG to households and factories and the use of LPG for household will be increased in the future.

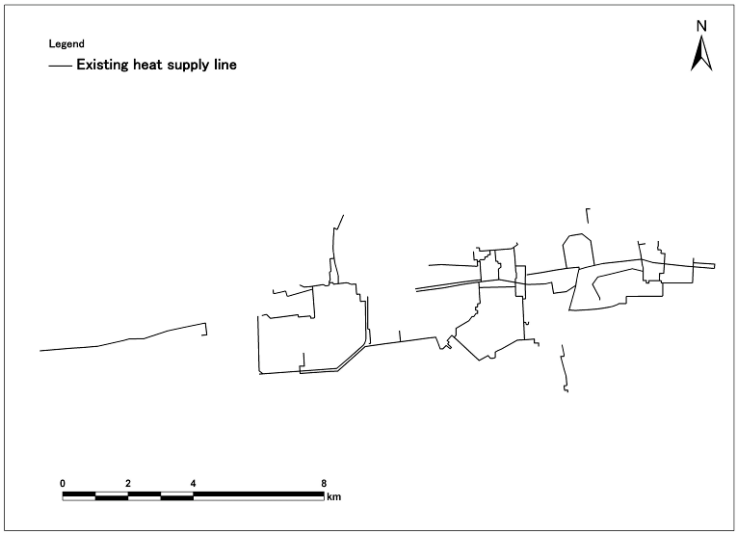
(9) Wire telephone, cellular phone

Ulaanbaatar is located in the inland basin and it is said it is the coldest city in the world. The annual average temperature is -13.0 degree and the monthly average in the winter from November to March is -22.3 to -9.0 degree with the lowest temperature of -40.0 degree. The heater is needed for 8 months from 15 September to 15 May.

The population of Ulaanbaatar is about 1.1 million with about 40% of them living in apartment and the remaining 60% living in ger area. While the heater of apartment is provided by the three thermal

power plants and more than 1,000 heat boiler, the heater of ger area is provided by stoves of each house.

The heat supply network from the data of UBMPS is shown in Figure 3.7.15.



Ref: UBMPS GIS data

Figure 3.7.15 Heat supply network of Ulaanbaatar

(10) Fixed-line phone and mobile phone

There are two companies, Mongolia TeleCom (MT) and Mongolian Railways Communications (RailCom), which provide fixed-line phone services. Both companies possess lines before 2007. After the establishment of the state owned line company, Information and Communication Networking Company (ICNC) in 2004, the line of MT was transferred to ICNC.

MT, privatized in 1995, is the biggest fixed-line phone provider in Mongolia, provides video phone and broadband service as well. RailCom is a joint enterprise of Mongolia and Russia government and provides public telephone, long-distance telephone and internet access services.

The number of fixed-line phone and mobile phone users of Ulaanbaatar is shown in Table 3.7.10.

Table 3.7.10 Number of fixed-line phone and mobile phone users and penetration rate

Year	Fixed line users	Total households	Penetration rate (%)	Mobile phone users	Total population	Penetration rate (%)
2005	70,613	215,727	32.7	441,170	965,300	45.7
2006	67,611	226,917	29.8	580,308	994,300	58.4
2007	66,275	234,743	28.2	930,011	1,031,200	90.2
2008	67,774	251,758	26.9	1,364,323	1,071,700	127.3
2009	63,839	273,182	23.4	1,798,566	1,112,300	161.7
2010	65,327	294,416	22.2	2,102,864	1,151,500	182.6

Ref: UB statistics department HP

The mobile phone users increased dramatically in recent years as shown in Table 3.6.5. The coverage area of mobile phone is expanded gradually and reached 84% at the end of 2010. The penetration rate of Ulaanbaatar is as high as 180% at the end of 2010. The total mobile phone users of the whole country in 2010 is 2.76 million and the penetrate rate is 100.4%.

The mobile phone service is provided by four mobile network operators, ie. Mobicom, Skytel, Unitel and G-Mobil. The Mobicom, a joint venture company of Sumitomo Corporation (44.4%), KDDI Corporation(44.4%) and NEWCOM (11.2%), has the top share now.

3.7.5 Others

The data on dangerous material facilities is under collection via EMDC. The Other important facilities, such as school, hospital, and evacuation center has been described in section 3.6.3.

3.8 Transportation, logistics and regional economics in and around UB City

Mongolia is a landlocked country. There is no seaport and river water way is very limited because of the harsh weather. The domestic and international transportation means are road, railway and air flight. After the market economy started in 1990s, Mongolia has a rapid growth in economy in recent years, but the construction of transportation infrastructure is relatively behind the growth.

The public transportation means of Ulaanbaatar is route bus, trolleybus and microbus. The numbers of route and distance of the bus of Ulaanbaatar are shown in Table 3.8.1 and Table 3.8.2, respectively.

Table 3.8.1 Number of routes of route bus

Year	No. of routes	City bus	Private bus	Trolleybus	Microbus	Long distance bus
2005	106	16	16	3	62	9
2006	112	9	24	3	67	9
2007	110	9	24	3	65	9
2008	117	9	30	3	65	10
2009	132	17	32	3	67	13
2010	125	20	31	3	53	18

Ref: UB statistics department HP

Table 3.8.2 Number of routes of route bus

Year	Total length	Bus	Trolleybus	Microbus	Long distance bus
2005	2954	856.7	70.9	1570	456.4
2006	3073.2	872.4	70.9	1673.5	456.4
2007	2938.8	859.7	70.9	1551.8	456.4
2008	3288.6	990.5	67.3	1725.2	505.6
2009	4003.5	1348.1	69.7	1899.2	686.5
2010	3768.9	1390.5	69.7	1426.2	882.5

Ref: UB statistics department HP

As the result of economy growth, more and more family become to have a car. The number of vehicles of Ulaanbaatar is shown in Table 3.8.3 from which it can be seen that the private car doubled from 2005 to 2010. On the other hand, the traffic jam is becoming a sever issue because of road condition, lagged traffic management system, lack of sensitivity to comply traffic rules and the lack of parking area. Ulaanbaatar is considering to build subways to solve the problem.

Table 3.8.3 Number of vehicles of Ulaanbaatar

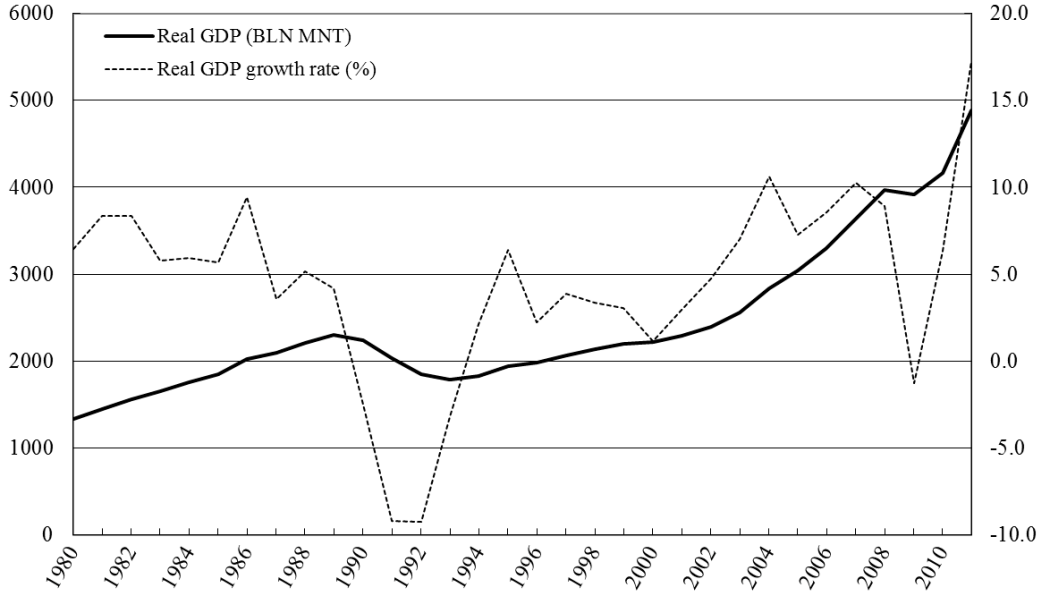
Year	Total Number	Car	Truck	Bus	Tank	Special use
2005	73740	54316	10954	6130	587	1753
2006	79135	58069	11987	6281	650	2148
2007	92706	69502	14265	6440	647	1852
2008	106848	79000	16702	7673	829	2644
2009	131447	100143	19856	8084	822	2542
2010	162710	118573	32344	9304	168	2321

Ref: UB statistics department HP

The main industry of Mongolia before 1990s is stock farming, after 2005 mining became the major industry because of the exploitation of its rich reserves on gold, copper and coal, etc. The main export goods are mineral and stock products and the main export counterparts are China, Canada, USA,

Russia and Italy. The main import goods are oil products, car, machinery equipment, medical products and daily goods and the main counterparts are Russia, China, Japan, Korea and USA.

Mongolia has a continuous growth of economy in recent years. The real GDP growth rate is shown in Figre 3.8.1 from which it can be seen that the GDP growth rate of 2011 is 17.3%. The composition ratio of GDP is Mining and quarrying 23%, agriculture and fishing 16%, wholesale and retail 15%, manufacture 8%, transportation 8%, real estate 6%, communication 4% and the others 20%. The GDP of Ulaanbaatar contributes a big portion to the national GDP and it is about 65% in 2011. The nominal GDP of Ulaanbaatar is shown in Table 3.8.4.



Ref: UB statistics department HP

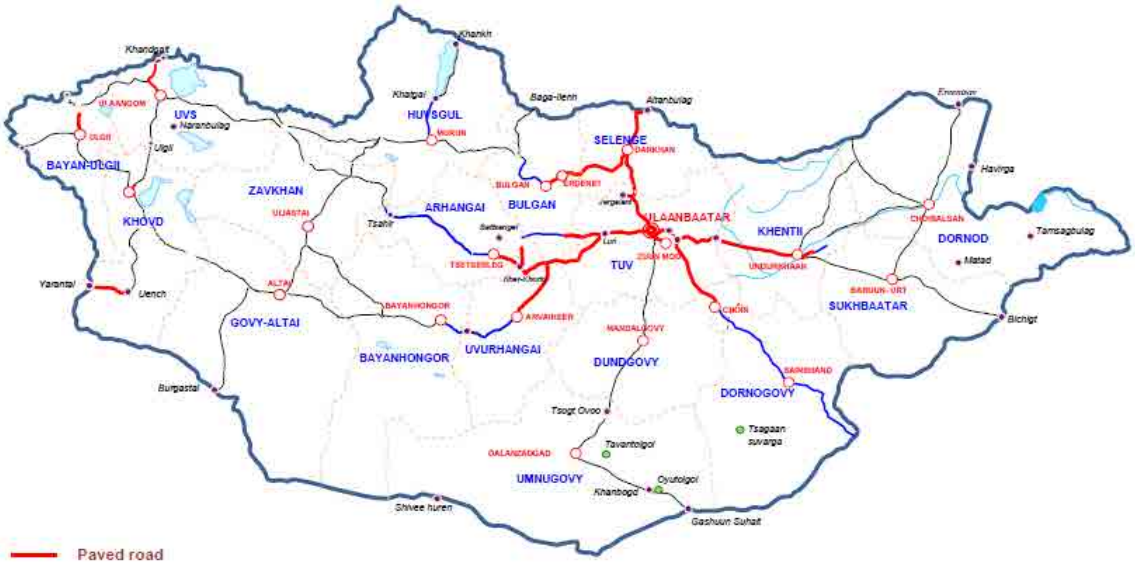
Figure 3.8.1 Heat supply network of Ulaanbaatar

Table 3.8.4 Nominal GDP of Ulaanbaatar

Year	GDP (BLN MNT)	Ratio to the total(%)	GDP per capita (THOUS MNT)
2005	1762	57.9	1860.8
2006	2173.4	54	2218.3
2007	2535.8	51.2	2503.9
2008	3594.9	54.8	3419.2
2009	3913.9	59.4	3584.1
2010	5225.9	62.1	4616.9
2011	6991.3	64.6	5819.8

3.9 Information on main road network connecting metropolis and other large cities in and around Mongolia

The total length of road of Mongolia is about 49,250km with state road of 11,219km and local road of 38,031km. The state road is mainly to link the capital city of Ulaanbaatar and Aimag center or among the Aimag centers. And the local road is mainly to connect the Aimag center and its surrounds. For state road, the paved road is 2,120km (19%), gravel road 1,440km (13%), improved earth road 1,400km (12%) and natural earth road 6,240km (56%). For local road, the paved road is 477km (1%), gravel road 521km (1%), improved earth road 499km (1%) and natural earth road 36,534km (97%). The main road network of Mongolia is shown in Figure 3.9.1.



Administration level	Paved road		Unpaved road			Total
	Concrete	Asphalt	Gravel	Improved earth	Earth road	Total
STATE	38.87	2 081.8	1 440.7	1 403.0	6 254.5	11 218.9
LOCAL	54.8	421.8	521.24	499.0	36 534.4	38 031.2
TOTAL	93.67	2 503.6	1 961.9	1 902.0	42 788.9	49 250.0

Ref: Regional cooperation in road, transport sector,
http://www.unescap.org/ttdw/common/TIS/CorridorStudy/EGM_Uiwang/9.Mongolia_ppt.pdf

Figure 3.9.1 Main road of Mongolia

As for the road of Mongolia connecting to its surrounding countries, the road from Ulaanbaatar to the border of Russia is paved road and that to the border of China is under construction. From 1990, Mongolia participated the Asian highway program promoted by the United Nations Economic and Social Commission for Asia and the Pacific ((UNESCAP) and the planned 3 highways, which connects Russia and China, is shown in Figure 3.9.2.

Ref: Prefeasibility Study of AH32, http://www.unescap.org/ttdw/common/TIS/AH/files/prefeasibility_mongolia.pdf

Figure 3.9.2 Asian highway plan of Mongolia

Chapter 4 Result of Ground Survey

Result of ground survey is summarized in Chapter 1 of Volume-4: Databook.