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-1 Summary

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, Geodesy 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
EEWS	Earthquake Early Warning System
EMDC	The Emergency Management Department of the Capital City
EOST	la Ecole et Observatoire des Sciences de la Terre
EWS	Early Warning System
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
WS	Workshop
WMO	World Meteorological Organization

Table of Contents

Chapter 1 Summary

1.1 Outline of the Project

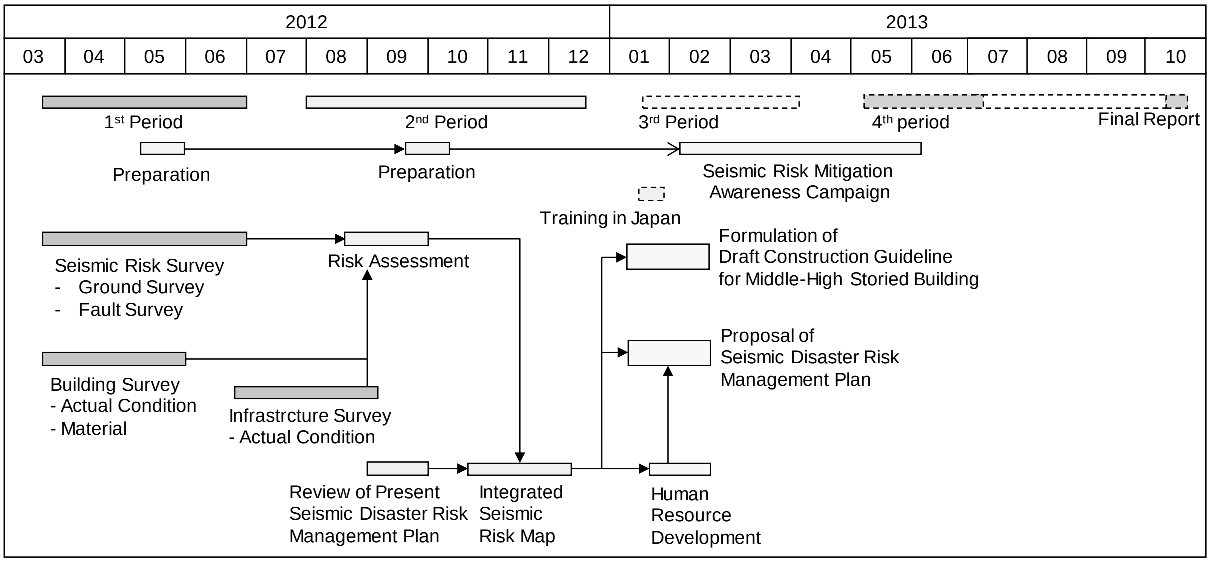
Project title:	The Project for Strengthening the Capacity of Seismic Disaster Risk Management in Ulaanbaatar City, Mongolia (hereinafter referred as "the Project")
Counterpart:	Ulaanbaatar City, Emergency Management Department of Ulaanbaatar
Implementation period:	February 2012 – October 2013
Implementation area:	Whole Ulaanbaatar city

The objective of the project is 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. And remarkable outcomes of the project are as follows;

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

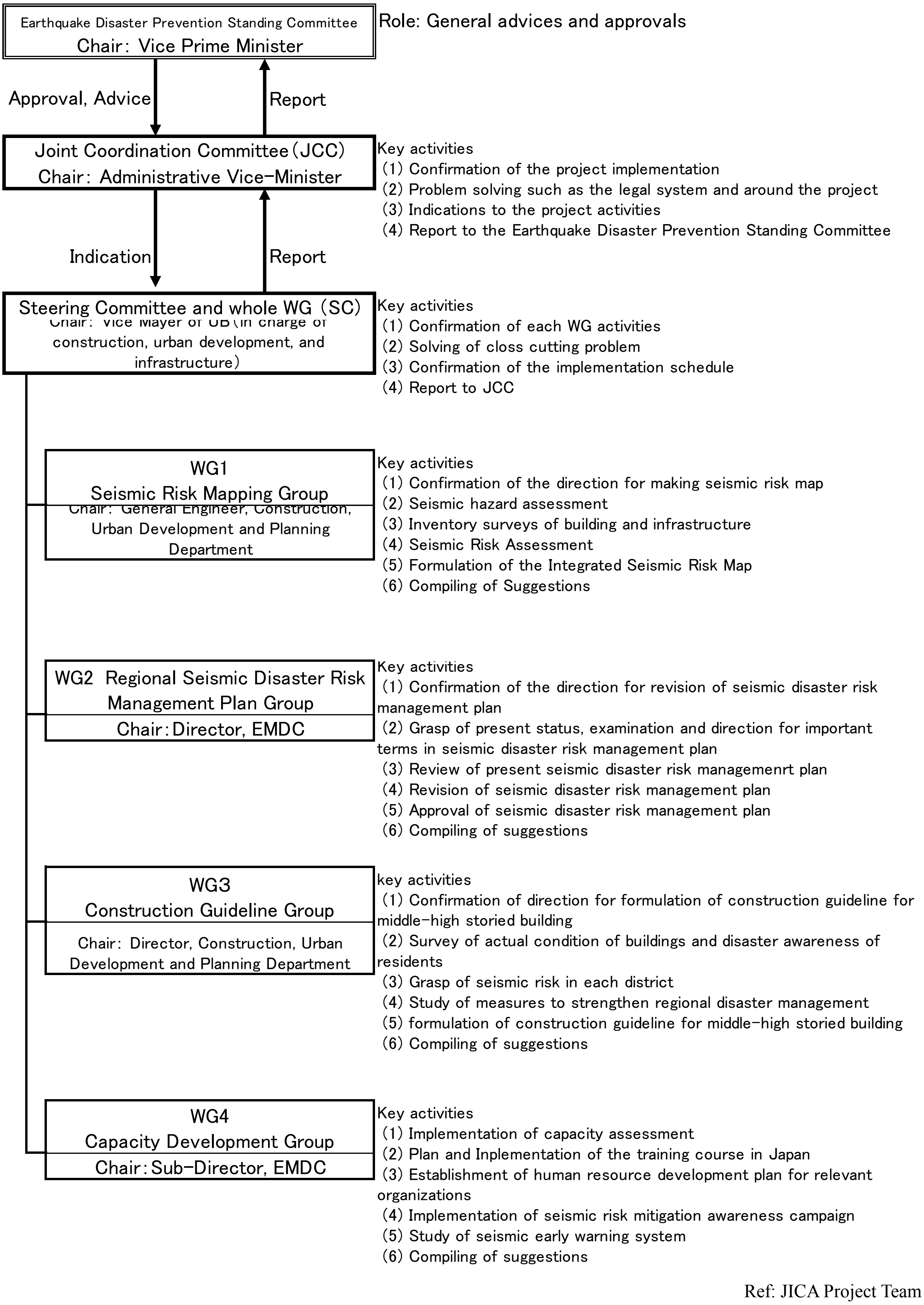
1.2 Project Schedule and Implementation Organization

Fig. 1.2.1 and Fig. 1.2.2 show the schedule and implementation organization of the project, respectively.



Ref: JICA Project Team

Fig. 1.2.1 Outline of Project Schedule



Ref: JICA Project Team

Fig. 1.2.2 Implementation Organization

Chapter 2 Ground Survey

2.1 Formulation of Landform Classification Maps

In order to understand the micro topographical characteristics of the study area, a Red Relief Image Map (RRIM, developed by Asia Air Survey Co., Ltd.) was created using 30 m mesh ASTER GDEM digital elevation data.

In the study area, the microtopography can be mainly classified as:

- Mountains: including hills: generally composed of hard rock mass.
- Terrace: distributed along the Tuul River, developed lower to higher terraces.
- Mountain footslope: spread from footslope of mountains, distributed along the left bank of Tuul River. Composed of talus deposits.
- Valley basin: lowland along valleys, including alluvial fans.
- Flood plain: lowlands developed along the Tuul River and the Herlen River.
- Riverbed: river beds of the Tuul River, the Herlen River. Including old river channels, natural levees, backswamps.

2.2 Results of Ground Survey

2.2.1 Outline of Ground Survey

The ground surveys were conducted for confirming the ground composition of the study area as well as deriving the necessary parameters for ground modeling. The surveys were conducted in whole UB city including remote districts. Surveys conducted were boring survey including standard penetration test and soil test for 10 holes, PS logging at boring test points, and surface wave exploration and microtremor measurement at 50 survey points.

2.2.2 Survey Results

(1) Boring Survey (includes SPT and Groundwater Level)

The ground is mainly composed of sand and gravel in the central city of UB. Those in remote districts are dominated by lean clay, and sandy clay with gravel. The mean N value is 30 or above, while those in remote districts are 20 or above.

(2) Particle Size Distribution of Soils

Soil test shows that soil at boring points mainly consists of poorly graded gravel with sand, poorly graded gravel with sand and clay, clayey gravel, clayey sand with gravel, and so on.
The data sheets of particle size distribution test, grain size accumulation curves were summarized in Supporting Material 3.3.

(3) PS Logging

- The strata are mainly composed of gravel, the S wave velocity value is above 290 m/s excludes the top surface at UB_BO_03 in UB central city.
- Low velocity value of 155 m/s obtained in sand deposits in the upper strata at site NH_01 hole. However, in same sand deposit in the upper layers at site BR_01 and BR_02, the values are larger than 250 m/s. Clay layer in the lower part of NH_01 and at site NH_02 is larger than 200 m/s.

(4) Surface Wave Exploration

The results of surface wave exploration were used to determine AVS30 value of the ground model. It was found that the AVS30 values are ranging from 322.2m/s to 1008.2m/s.

(5) Microtremor Measurement

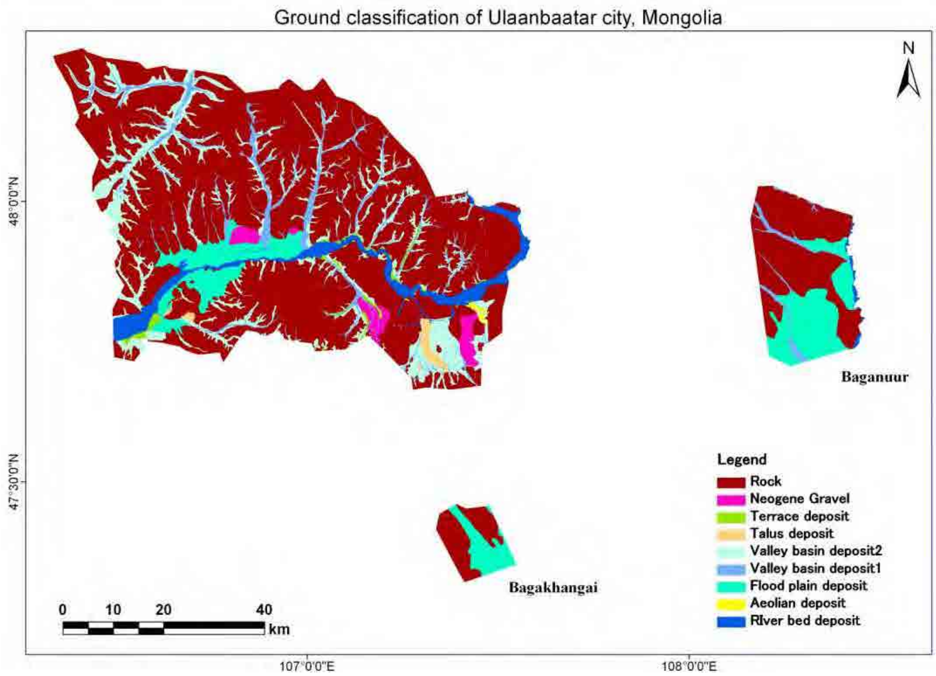
The ratio of the vertical component with horizontal component was calculated from the microtremor measuring result (waveform record), which was used for ground classification. The natural period of ground was calculated from the H/V predominant value of frequency. The dominant period of ground is ranging from 0.03s to 0.59s

2.3 Ground Model

2.3.1 Ground Classification

Based on the existing geological map field survey results and ground survey, the study area was classified as follows.

- Riverbed deposits: including riverbed deposits, old river channel, natural levees and backswamp. The N value is larger than 20. Holocene deposits and deposited by wind shows same characteristics as fluvial deposits.
- Flood plain deposits: most of the city area of the UB city is located on this deposit. Mainly composed of sand and gravel. The N value ranges from 20 to 60.
- Valley basin deposits: deposits distributed along the valley basins of the tributaries of the Tuul River and Herlen River. N value is above 20.
- Terrace, fan and talus deposits: Rarely distributed along downstream of the Tuul river. Estimated same as the valley basin deposits based on its composition.
- Neogene mud: composed of reddish, yellowish and mixed mud, gravel, sand, low consolidated conglomerate, gravel loam, sandy loam. N value is larger than 50.
- Base rock: the part excludes above classification, distributed in mountainous area. The geology is older than Neogene.



Ref : Created by JICA Project Team based on Geological maps of NGIC

Figure 2.3.1 Ground classification map of UB city

2.3.2 Ground Model

(1) AVS30

According to PS logging results conducted at the boring survey points and surface wave exploration at each point, S wave average velocity from surface to depth of 30 m was calculated. Taking into consideration the dispersion of the data, statistically average-1.28σ (90% confidence interval) was chosen as the representative value, which is ranging from 277.6m/s to 703.0m/s.

(2) Ground Classification

The ground is classified as, *Ground Type 1* if *TG*<0.2, *Ground Type 3* if *TG*>0.6, and the others are *Ground Type 2*. Based on this classification, mountain, neogene mud, terrace, fan and talus deposits are categorized as *Ground Type 1*, while others as *Ground Type 2*.

(3) Ground Model

After ground classification, the results were converted to polygons on ArcGIS, and then converted as the center point of each 250 m mesh grid. The total grid number is 75,403 in the study area. The ground model was constructed with the ID number of whole grids and obtained location information (latitude and longitude), AVS30 value, Ground Type and liquefaction index, which will be mentioned after.

Chapter 3 Implementation Process and Results of Seismic Hazard Assessment and Seismic Risk Assessment

3.1 Evaluation Policy

In both seismic hazard assessment and seismic risk assessment, it is required that state-of-the-art technology be duly reflected in the project and procedure transferred to CPs be fully conductible so that CPs can carry out the assessments by themselves after completion of the project. Outline of each assessment is described below.

(1) Seismic Hazard Assessment

Empirical method that employs attenuation formula for ground motion prediction, is used in this project, in order to correspond to future findings related to active faults. Seismic zone model in this project is the current one proposed by RCAG. Attenuation formula will be selected considering the compatibility to the existing hazard evaluation and to the risk evaluation of various type of structures of concern.

(2) Seismic Risk Assessment for Buildings

The Limit Strength Method (LSM) is used to evaluate building damage state accurately. Since ground motion is modeled by the response spectrum at site and building is modeled by skeleton curve of the equivalent single degree of freedom system in LSM, further revisions in ground motion and in building will be easily reflected to the evaluation. Calculation procedure is also relatively simple and the result is stable compared to the dynamic response analysis. This means that the technical transfer can easily be done.

(3) Seismic Risk Assessment for Infra-structures

All the bridges have their seismic risk evaluated separately based on the static analysis and dynamic response analysis of some representative bridges. In the static analysis and dynamic response analysis, Japanese software is utilized with data assembled in UB city. Damages to structures such as roads, water lines, sewage, electric lines are evaluated by the product of the length and damage rate that is given corresponding to the ground motion intensity.

Though pipeline for heating in out of scope of this project, the risk evaluation procedure will be arranged, since it is a critical structure for support lives in UB city, especially in the winter time.

(4) Assessment of Fire Following Earthquake

Japanese method is used to evaluate the number of break out and the area of fire spreading for collapsed buildings and uncollapsed ones. It is noted that the method will differ corresponding to the area of concern, namely, urbanized area or Ger area. Causes of ignition will be identified after site investigation.

3.2 Seismic Hazards Evaluation

3.2.1 Ground Motion Evaluation

A deterministic method for ground motion evaluation was conducted under the maximum earthquake estimated on the target fault. Kanno et al., (2006) is considered an appropriate attenuation relation for ground motion prediction in this project.

(1) Source Fault Model

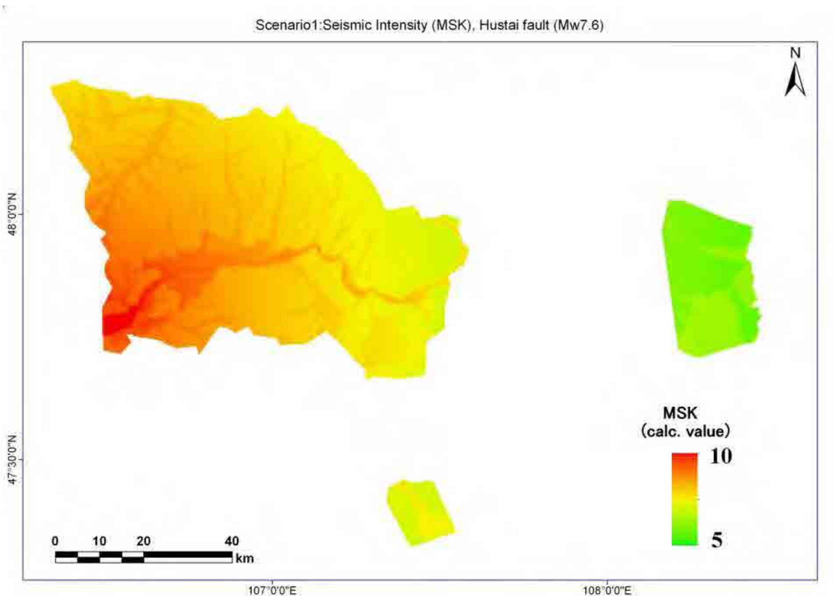
According to previous studies about the active faults around UB city (Demberel, 2011, RCAG report), the source model was constructed for Hustai fault, Emeelt fault and Gunjiin fault, whose parameters are summarized in Table 3.2.1. Two scenarios were employed; scenario 1: rupture of Hustai fault (Mw7.6) and scenario 2: the maximum value of the results by the rupture of Emeelt fault (Mw7.0) and that of Gunjiin fault (Mw6.6).

Table 3.2.1 Parameters of the fault models

Fault segment		Location		Length	Width	Depth from ground surface	Dip angle	Dip to	Max Mw
Name of segment	Tip of segment	Lon	Lat						
Hustai_1	Hustai_1_1	105.70442	47.39615	18.6	21.2	15	45	SE	7.6
	Hustai_1_2	105.79451	47.55174						
Hustai_2	Hustai_2_1	105.79507	47.57951	28.5	21.2	15	45	SE	
	Hustai_2_2	106.11590	47.71708						
Hustai_3	Hustai_3_1	106.09456	47.71963	23.6	21.2	15	45	SE	
	Hustai_3_2	106.36787	47.82438						
Hustai_4	Hustai_4_1	106.40933	47.81339	9.3	21.2	15	45	SE	
	Hustai_4_2	106.53182	47.82535						
Emeelt	Emeelt_1	106.70842	47.78515	30.1	21.2	15	45	NE	7.0
	Emeelt_2	106.49649	48.01542						
Gunjiin	Gunjiin_1	107.07920	47.96992	18.0	15.0	15	90	–	6.6
	Gunjiin_2	107.24081	48.09007						

Ref: JICA Project Team

In Scenario 1, MSK intensity ranged from 5.65 to 10.12 (Figure 3.2.1), while the Scenario 2 that ranged from 5.16 to 10.14. In the central city area of UB, there is no remarkable difference between Scenario 1 and 2. For example, in the Sukhbaatar square, Scenario 1 shows intensity 8.6 while Scenario 2 shows intensity 8.7. After converting to 12 scale MSK intensity, in the central city area, Scenario 1 and 2 both shows scale VIII to IX.



Ref: JICA Project Team

Figure 3.2.1 MSK intensity distribution of the Scenario 1

3.2.2 Evaluation of Ground Liquefaction

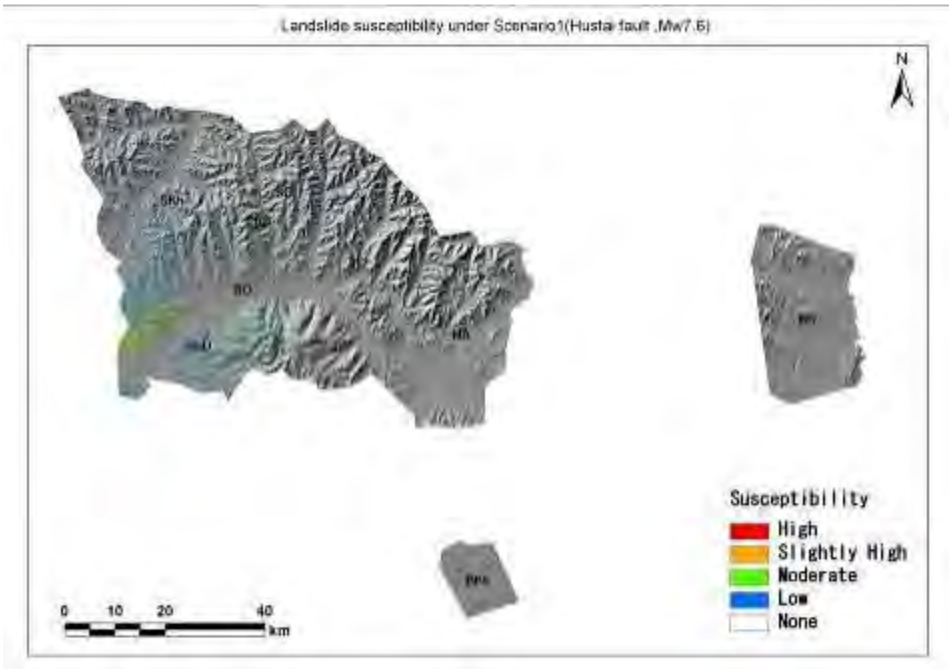
This project employed a subsidiary method using geomorphology/geology and liquefaction history to evaluate liquefaction potential. The judgment of ground density results shows the soil layer which located within the possibility of liquefaction. The N value is about larger than 20. However, sites where the grain size is out of the possible liquefaction range were observed to have low possibility of liquefaction or no liquefaction.

3.2.3 Landslide Susceptibility Evaluation

For the earthquake-induce landslide, the occurrence of landslides will be influenced by earthquake (PGA, intensity) as well as causative factors of the slopes, such as slope and curvature. Since there is no landslide data, an appropriate method that only uses the PGA from earthquake scenario, and topographical factors derived from elevation data, Uchida et al., (2004) was used.

Based on evaluation, the susceptibility ranks were set as high, relatively high, moderate, and low.

In the case of Scenario 1, high susceptibility ranked meshes are distributed in the Songino mountains, which located on the western side of the city (Figure 3.2.2). The northwest faced slope meshes in the northern slopes of the southern mountain areas of the city shows relatively high susceptibility. In addition, low-susceptibility ranked slope meshes are sparsely distributed in the northern mountain areas.



Ref: JICA Project Team

Figure 3.2.2 Landslide susceptibility of Scenario 1

In Scenario 2, the high ranked susceptibility meshes are concentrated in western mountainous and the mountainous area along the Gunjiin fault in eastern side of Ulaanbaatar city. In the mountainous area along the Emeelt fault, high and relatively high meshes are observed. Furthermore, there are some high and relatively high meshes in the southern mountainous area of the city, along the northwestern faced slopes. Note that rare meshes of low ranked slopes are also observed.

3.3 Seismic Risk Evaluation for Buildings

Based on the investigation of seismic strengthening by UB city, hearing survey for some companies, amendment capacity assessment and material testing, building inventory was established combining the database provided by UB city and that by UBMPS. In this project, the Limit Strength Method (LSM) is employed to evaluate the damage to buildings.

Damage to building is summarized in Table 3.3.1. Since peak ground velocity dominates the damage to buildings, scenario 1 gives larger damage, especially in Ger area.

Table 3.3.1 Result of damage evaluation for buildings

	Schenario 1		Schenario 2	
	Urban area	Ger area	Urban area	Ger area
Collapse Rate	48%	81%	22%	29%

Ref: JICA Project Team

3.4 Risk Assessment for Transportation and Lifeline Structures

Inventory data was established based on the results of JICA project "The Project for Construction of Ajilchin Flyover in Ulaanbaatar City", collected design drawings and testing reports, and reports of capacity assessment. Field survey was also conducted to 8 bridges. Inventories for road and lifeline structures ware established from the GIS database supplied by UB city, which includes some attributes such as length, diameter, material and so on. Empirical equation was employed to evaluate damages for road and lifeline structures.

Damage to road, bridges and lifeline structures are summarized in Table 3.4.1. Damage to lifeline structures are dominated by ground conditions so that effect of the scenario on the results is not large. It is noted the potential of liquefaction is extremely low.

Table 3.4.1 Result of damage road, bridges and lifeline structures

	Scenario 1	Scenario 2
Number of damage in roads	66	60
Number of damage in bridges (for 68 bridges)	28	22
Number of damage in water supply	68	44
Total of damage Length of sewage	191	176
Number of damage in heating water supply	97	59
Number of Damage in electric poles(Damage rate))	845(2.8%)	352(1.2%)

Ref: JICA Project Team

3.5 Risk Assessment for Fire Following Earthquake

3.5.1 Method of Fire Breakout Risk and Fire Spread Risk

The number of fires breakout is therefore sum of fires from collapsed and not collapsed buildings.

The number of fire breakout from collapsed buildings is calculated as the fire breakout ratio of collapsed building multiple numbers of collapsed buildings. The fire breakout ratio used here is made by Tokyo Fire Department. The number of fire breakout from non-collapsed buildings is calculated as the fire breakout ratio from collapsed building multiple numbers of non-collapsed buildings. The fire breakout ratio is determined for each building use respectively.

Fire Spread Risk Evaluation Method using "Inflammable area ratio" This method is based on the ratio of inflammable zone area against whole area. Development of fire spread risk in Ger area is developed as same as fire break out method.

3.5.2 Estimation of number of fire breakout and number of houses burned by fire spread

Earthquake Fire risk is very dependent to seasons, time, and weather conditions. Therefore 2 cases of conditions are set to assess the risk of fire for 2 earthquake scenarios; case 1: earthquake occurs in the evening in winter when wind velocity is 10m/s, and case 2: earthquake occurs at noon in summer when mind velocity is 3m/s.

Results of the estimation are summarized in Table 3.5.1. It is noted that the risk of fire following is high in Ger area surrounding the central urban area.

Table 3.5.1 Result of fire risk estimation

	Scenario 1		Scenario 2	
	Case 1: Winter 18:00	Case 2: Summer 18:00	Case 1: Winter 18:00	Case 2: Summer 18:00
Number of fire break out	114	107	91	46
Number of burned buildings	7,601	4,334	6,341	1,711
Number of casualties	48	27	40	6

Ref: JICA Project Team

Chapter 4 Earthquake Disaster Prevention Plan

4.1 Earthquake Disaster Scenario

Since earthquake disasters differ according to the occurrence conditions and it is necessary to establish measures to withstand the complex situations, it is important to examine what will happen in time series. Therefore, some earthquake scenarios are established and examined in this chapter.

It is assumed that earthquake occurs in winter time considering the situation of usage of fire equipment and difficulty in conducting the emergency actions. In the scenario, following items are properly contained; Action of headquarter, rescue and firefighting, evaluation, supply of food , water, power and heating in the emergency response phase, and, restarting of education, supply of temporary and permanent housings, treatment of debris and reconstruction of lives in the recovery phase. Table 4.1.1 shows the scenario of disaster management headquarter.

Table 4.1.1 Earthquake Scenario for UB city Disaster Management Headquarter

Building Damage	・UB City Hall does not collapse.・Bookshelves are scattered・PC fall down from desks・Window grass are broken and scattered・Elevators stop
Lifeline Damage	・Electricity cut off （At least Day1）・Water suspended(Toilet cannot use for some time)・Telephones are congested・Mobile phones are also congested
Casualty	・Officers in city hall are few because of off of office hour. Few officers injured・Officers may suffer human damage in their home.

Day1-Day3	Disaster Response Activity	Improvement
	・There are some officers still working at 6 o'clock even office hour is until 5 o'clock. City Hall suddenly began shaking. .It was big shaking such as Hall may collapse. But Hall is not collapse fortunately. Bookshelves are fall down; PC is also fall down from desks. Many apartment houses are collapsed and raising cloud of dust. It was twilight when the earthquake occurred, but was in the dark gradually.There are no light in city and only the head lights of congested cars, but lights are not moving at all. ・Disaster countermeasures headquarter is established and also UB city headquarter is established when national wide disaster occurs according the Disaster Countermeasures Act issued 10th of July, 2009. Disaster countermeasure headquarter is not located in city hall and it is established in EMDC office. I am not in charge of disaster management but consider that I should take action as senior officer. City mayor is not in city hall and not able to contact to mayor. I think Disaster Countermeasure Headquarter should be started by the senior officers in city hall and dispatch my staff to other senior officers to gather in front of city hall. Following indicated the situation that will come up after and comments for improvement	
	Set up of Disaster Countermeasures Headquarter ・Manual of operations and list of contact persons are not prepared. ・Emergency contact list and tools are not equipped. How to calling together. ・Is it permitted to set up UB city disaster countermeasures headquarter? Who decide to set up HQ?	・Manual of Operation of HQ. ・Convened drills of HQ ・Convocation standard and its well-known ・Prepare of Information collection tool
	Set up of Disaster Countermeasures Headquarter ・There is no branch of EMDC in UB City Hall. Who will be secretariat of HQ? ・Where is HQ place? City Hall is not collapsed but certain damage occurs and need to check its safety. ・Telephones are congested・Mobile phones are also congested ・Put desks and chairs in parking space in front of City Hall with Tent. ・Dark, cold ・Light up only Headquarter by Car light. ・Documents are scattered on the floor and difficult to find documents needed.	・Emergency Assessment of Damage Buildings ・Need of stock Emergency Generator, Tent, Heating , Food ・City Hall building must be construct strong enough against expected earthquake and fixing of furniture
	Operation of Headquarter ・Requests and complaints comes from peoples. Officers have to correspond and cannot operate other issues. ・National level organizations frequently request the situation reports. It makes difficulty to implement necessary operation.	

Ref: JICA Project Team

4.2 Comprehensive Risk Map

Earthquake information database consists of ground motion intensity and ground damage risk as well as of building inventory data, lifeline structure inventory data and so on. Results of building damage estimation, infra- and lifeline structure damage estimation, fire spreading estimation and so on will be included in the database, so that they can be shown in the comprehensive risk map.

Risk map is constructed on the ArcGIS system that can gives user friendly operation. Outline of establishing and operation of the system and example of display are shown in

Figure 4.2.1, Figure 4.2.2, and Figure 4.2.3, respectively.

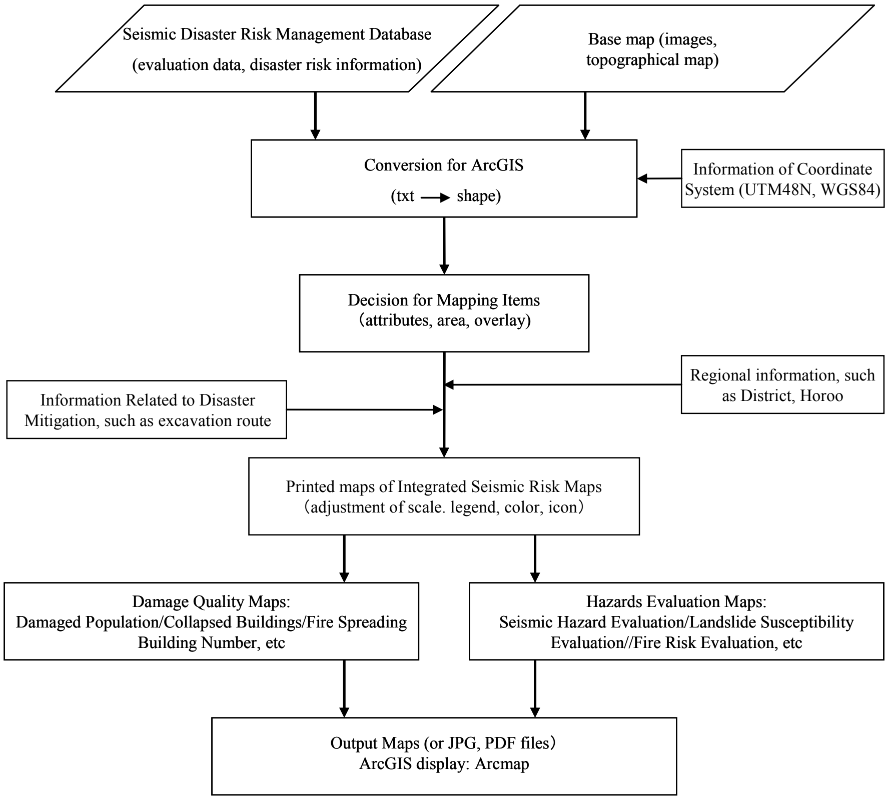


Figure 4.2.1 Flow for drawing integrated seismic risk map

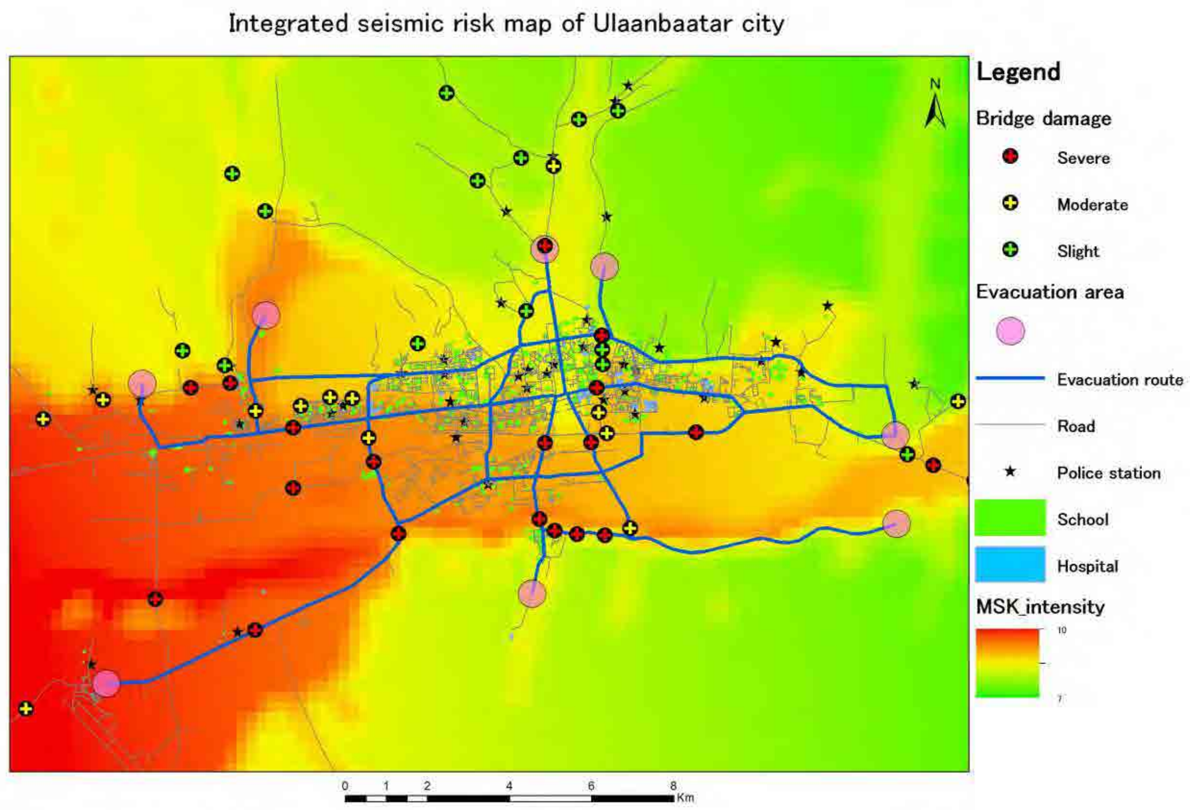


Figure 4.2.2 Comprehensive risk map for UB city (MSK intensity)

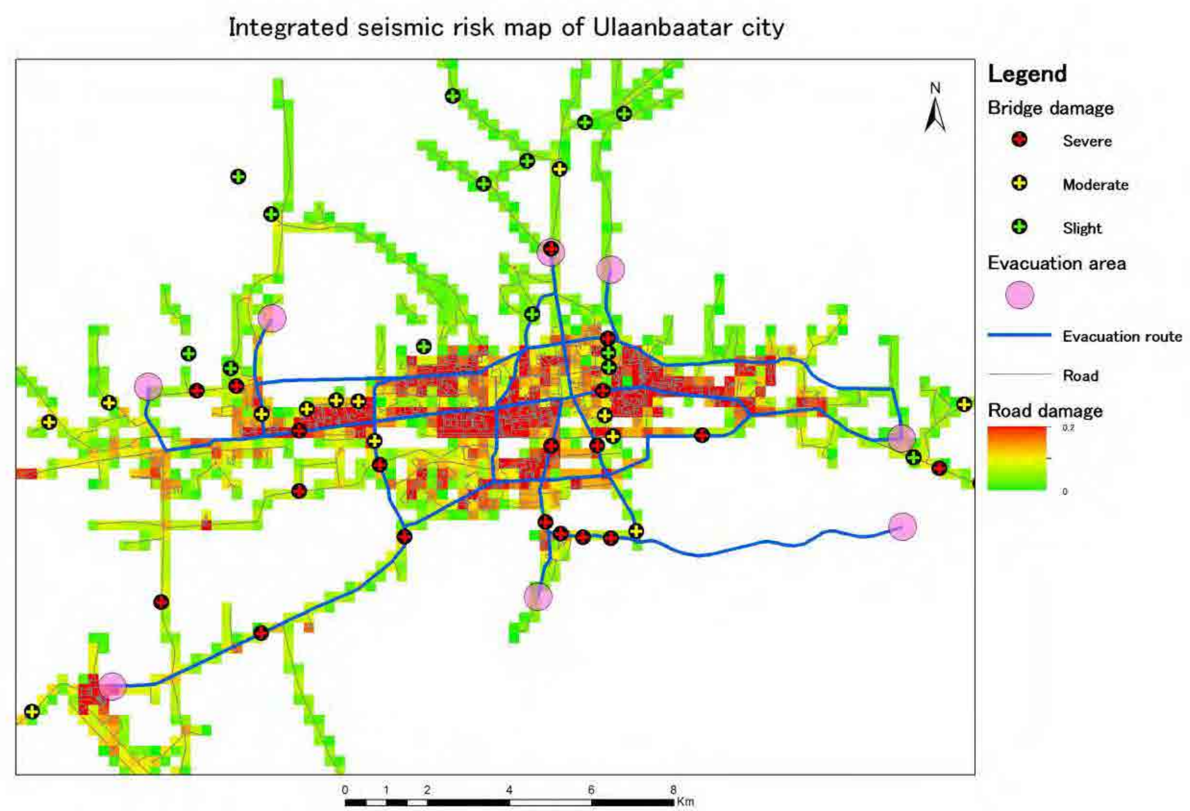


Figure 4.2.3 Comprehensive risk map for UB city (Damage to roads)

4.3 Comprehensive Risk Map

(1) The analysis of the Earthquake Disaster Prevention Plan of UB city

There are the Earthquake Disaster National Capacity Strengthening Plan in National level and the Disaster Prevention Plan of UB city. The Earthquake Disaster Prevention Plan is one of 27 separated plans among the Disaster Prevention Plan of UB city. The analysis of the Earthquake Disaster Prevention Plan of UB city is implemented from the state of the Plan, disaster awareness survey, risk evaluation and earthquake scenario.

- Wide-ranging countermeasures are covered in the Plan. These are mainly the countermeasures which are responsible to implement by Emergency response section of UB city.
- The target of disaster reduction (how much damage will be reduced by implement the plan), the role of stakeholder, issued to be taken and its action plan are not clearly described.
- Earthquake is very uncommon for UB Citizens and most peoples have not experienced big earthquake. Evacuation, firefighting, living after disaster is all out of expectation. Therefore Proper action can not to be expected to be taken by citizens. Education and Awareness of fundamental earthquake disaster are needed to be done not only for citizens but also private sectors and governmental staff.
- Considerable building damage may occur. Emergency response capacity may deteriorate by suffering damage on important facilities such as governments, schools, hospitals.
- There is risk of fire damage in Ger area.
- Break of roads which are especially important for emergency response activities because of bridge damage by earthquake.

(2) Items needed to be reviewed y

Following items are the items to be reviewed and indicated detail proposal are presented.

- The object and role of stakeholders should be clearly described.
- The plan is recommended to reconstruct as several separate chapters that individual countermeasures are categorized by implementing organizations.
- Countermeasures directly reduce earthquake damage
  - ✓ Strengthening of buildings especially school buildings, buildings of emergency response organizations such as firefighting stations and hospitals
  - ✓ Countermeasures of fire protection in Ger area
- Countermeasures to reduce obstruct factors of disaster response activities
  - ✓ Education and awareness for citizens
  - ✓ Role of evacuation places and necessary condition such as scale of open space, evacuation buildings and function to be requested as evacuation place
  - ✓ Plan of Important road network which are used for emergency and recovery activities
- Countermeasures to promote disaster activities
  - ✓ Manual of operation of disaster related organization
  - ✓ Disaster damage information network
  - ✓ Professional experts network

(3) Review and Modification of the Plan

Reviewing is periodically done every March. On March of this year revise procedure is done. This revised plan 2013 is in data book of this report. Lessons learned from the training in Japan and project team proposal to UB counterpart are reflected in the new plan 2013.

- Target of damage reduction, role of stakeholder (Government, Residents and Private Sectors)
- Emergency assessment of damaged buildings
- Emergency medical care such as triage of injured persons

Chapter 5 Priority of Projects Implementation

5.1 Concept of Prioritization

It is needed to put first priority to select the project of high possibility of implementation and project of high efficiency to reduce earthquake damage because occurrence of earthquake is not predictable. Priority of project implementation is examined for the projects by necessity of project and possibility of implementation.

5.1 Project Priority

Table 5.1.1 shows items, present recognition, needs, possibility, financial load, total priority of projects.

Table 5.1.1 List of Project Priority

ITEMS		IMPORTANT ITEMS	PRESENT RECOGNITION	NEED	POSSIBILITY	FINANCIAL LOAD	TOTAL PRIORITY
Disaster Countermeasures	Seismic Upgrading Measures for Buildings	Important Buildings	・Many buildings constructed in 1950 are still existing. ・Seismic code is not revised much ・ It may be not possible to exhibit the function.	Very high	・Reinforcement or reconstruction ・Decision making is possible in public organization	・Number of buildings are limited ・Public subsidies are needed by political decision	・Very high ・5 years
		Public Buildings	・Many buildings are masonry constructed in 1950 or precast panel 8-9 floors buildings	High	・Reinforcement or reconstruction ・Decision making is possible in public organization	・Number of buildings are limited ・ Decision making is possible in public organization	・High 10 years
		Old apartment houses	・Many buildings are masonry constructed in 1950 or precast panel 8-9 floors buildings ・Redevelopment projects are ongoing according Urban Master Plan of UB city	Very high	・Redevelopment project ・Number of subjects is big	・ Cost burden is high because of private properties	Very high 2030 target
	Fire Proof Countermeasures	Buildings(houses) in Ger area	・Ger and wooden houses are existed. ・60% of population are in Ger area ・Redevelopment projects and land readjustment projects are on going	Very high	・Reinforcement, Redevelopment project ・Number of subjects is big	Cost burden is high because of private properties	Very high 2030 target
	Keep of Road function	Road Structures	・Damages are expected in some bridges along main roads	High	・Reinforcement or reconstruction	・・Number of bridges expect to suffer damage are limited	・High ・5 years
		Obstacle from building collapse to road traffic	・Old buildings constructed along important roads. ・Space may remain because of width of roads in UB city ・There is high risk of Impassable of the Emergency cars by chronic traffic congestion.	High	・Designation of Emergency Important roads ・Restriction of Illegal extension of buildings Traffic control needed	・Relocation compensation might be needed for Illegal extension relocation	High 10 years
			・New airport plan is ongoing	High			Follow the new airport plan

	Strengthening of Lifeline	Electricity, Water, Heating System	・Possibility of Supply failure is high in whole area of city ・No supply of water, sewage, heating system in Ger area. ・Apartment houses are depended on water, sewage, heating system in central area. Even risk of life should be considered in winter season.	High	・Sequential Replacement of pipeline to Earthquake-proof pipe	・Cost is depended the length of replacement. ・Cost is covered by water, sewage, and heating charge systems.	High 2030 target
	Disaster Prevention Education	Basic knowledge, Response abilities Preparedness for disasters	・Basic knowledge earthquake awareness is not high. ・Autonomous activities difficult to be expected	Very high	・Disaster education curriculum ・Exercise	・Cost is low ・Continued implementation	Very high Continued implementation
	Manuals	Response abilities	・Items are listed but practical explanation and procedure are needed	High	・Not difficult ・Each division should develop own Manual	・Low	High 1-2 years
	Strengthening Information System	Grasping damages	・There is old system, but does not work now. ・Disaster Information System is developed in this spring. ・Equipment and system for Information Collection are needed to prepare.	Very high	・New technology is needed to develop Camera for city view, Speaker for information ・Transmission ・Early warning system of Earthquake is needed to develop	Cost is large, but not huge	Very high ・Projects are ongoing
		Disaster Medical Care	・Disaster medical care is not developed. ・Support by International Red Cross and Crescent is ongoing	Very high	・Training of Disaster Medical Experts need	Cost is not large	・Very high ・Project is ongoing
		Architectures	・Emergency Assessment of Damaged Building is not developed	High	Criteria for assessment will be developed in UB city	low	High 1-2 years
		Recovery of Life line	・Fear of lack of Contractors for repair and recovery	High	・Pre Cooperation Agreement	Low	High 1-2 years
Earthquake Disaster Management Plan	Target of disaster damage reduction The role of government, citizens and private sectors		・Systematic Disaster Management Plan was started recently and system for planning and reviewing system are prepared. ・Target of disaster damage reduction is not written. ・The role of government, citizens and private sectors is not written the Stakeholder of disaster management	High	・Depends on whether the plan is for government use only or the plan is for stakeholders such as government , citizens and private sectors	Low	High Revise every year
Proposal	Concept and Method are shown as Guideline among high priority items		Concept of Disaster Medical Care	Training of Disaster Medical Experts			
			The role of government, citizens and private sectors	The role of government, citizens and private sectors in the Earthquake Disaster Management Plan			
			Guideline for Urban Planning on Disaster Prevention	The guideline for planning and implement projects to promote In a planned manner			
			Guideline for Emergency Assessment for Damaged Buildings	The Guideline for check the safety of damaged building			
			Aseismic guideline for mid-and high-rise buildings to mitigate earthquake disaster	Guideline for mid-and high-rise buildings to mitigate earthquake disaster			

Chapter 6 Aseismic Guideline for Mid- and High-rise Buildings to Mitigate Earthquake Disaster

The guideline was established by collaboration of PT and CP. For example, CP described the status of the buildings in UB and outline of seismic capacity assessment of existing buildings. On the contrary, examination of the risk assessment, illustration of Ultimate Capacity Method and overview of capacity upgrading in Japan were described by PT. It is noted that categorization of building importance and determination of importance factor was conducted based on the discussion between both parties. Technical transfer of Ultimate Capacity Method was also done through workshop activity.

Contents of the guideline are summarized below;

Chap. 1	**Preface**: Role of the guideline, target buildings and contents are overviewed.
Chap. 2	**Current issues**: Status of the buildings and the results of risk assessment are explained, followed by the arrangement of issues for capacity upgrading. The reflection of the issues to the guideline is also described.
Chap. 3	**Target performance of buildings**: Importance of the buildings is determined from the viewpoint of disaster risk reduction. Target performance is given according to the importance.
Chap.4	**Capacity evaluation of existing buildings**: The procedure to evaluate seismic capacity is illustrated, followed by the modeling method and application of the existing assessment by UB city to this evaluation.
Chap. 5	**Upgrading measures**: Three methods such as strengthening, relocation and rebuilding are selected with technical guidance of each measure.
Chap 6.	**Promotion policy for upgrading**: After investigating the existing promotion measures, promotion policy is proposed for future upgrading.
Chap 7.	**Suggestions**: Suggestions for the items that are out of the scope but useful for future upgrading are summarized.

Chapter 7 Environmental and Social Consideration

7.1 Issues on Disposal of Rubbles after Earthquake

(1) Waste Disposal System of UB

- Public corporation of UB City operates 4 municipal waste disposal plant. Collection and transportation of waste is conducted by private corporations of each district.
- All the waste excluding hazardous waste is landfilled without separating flammables and nonflammables. Construction waste is also treated as general waste.
- Most of the waste in UB City is landfilled at Narangiin Enger Disposal Site which was granted by the Japanese Government and started its operation in 2009.. The plant is located 10km northwest of urban area having design capacity of approximately 27.8 ha or 272ｍ3 and life of 11 years.
- Since the landfills are not soil-covered, fire often breaks out and strong wind scatters waste.
- Illegal dumping is common especially in Ger area and arise environmental issues.
- There are waste-pickers who pick up valuables in the landfills.

(2) Issues on Disposal of Rubbles after Earthquake

The estimated volume of rubbles due to Scenario I Earthquake is 12.14 million m^3. Dominant source of the rubbles are structures built of stone-masonry, reinforced concrete and bricks. 2.43 million 10ton-dumptrucks are required to transport the total rubbles.

Table 7.1.1 Estimated Volume of Rubbles due to Scenario I Earthquake

	District	Volume of Rubbles(m^3)
1	Bayanzurh	2,703,075
2	Songinohairhan	2,575,282
3	Bayangol	2,389,881
4	Han Uur	1,753,198
5	Chingeltei	1,468,810
6	Sukhbaatar	1,256,678
7	Nalaikh	981
	Baganuur	-
	Bagakhangai	-
	Total	12,147,904

While prompt and systematic disposal of large amount of rubbles will be required, the following issues are thought to emerge.

- Since waste disposal is conducted by private corporations, removal of rubbles and regular waste collection will not work effectively.
- Residents will disorderly start moving rubbles to vacant lot or river area without permission.
- It is assumed that some rubbles be urgently landfilled at Narangiin Enger Disposal Site, however, additional plant will be needed since the total volume of the rubbles is much larger than its capacity.
- Hazardous substance will cause health problems of workers and nearby residents.

(3) Proactive Measures and Program for Restoration/recovery Period

Taking the above into consideration, the following measures should be taken.

- In addition to the prior conclusion of cooperation agreement with private waste disposer, UB City should assign roles of organizations concerned such as Road Bureau in advance. UB City should also conclude cooperation agreement on regional rubble disposal with each district as well as surrounding cities.
- Temporary rubble storage site should be selected in advance and will be informed through the media/cellphone properly during restoration period. Observation of illegal damping will be also necessary.

- Prior selection of candidate site for landfill of rubbles should be done considering restriction of possible waste, method, impact to surrounding such as fire, offensive odors, soil pollution, groundwater pollution, scattering, noise and vibration to transportation road and involuntary resettlement. Obtaining prior consent of neighboring residents is necessary.
- Sprinkling watering to temporary rubble storage site is required for anti-scattering of hazardous substance of rubbles. UB City should provide masks to workers and neighboring residents to prevent health problem.
- Recycling wood materials, rebars and others will be done by utilizing waste-pickers systematically in order for reuse of rubbles.

7.2 Human-waste Treatment

(1) Current Situation of Human-waste

Sewage in UB City is treated in one treatment plant, i.e. Central Sewage Treatment Plant, and discharged to Tuul river. In Ger area, untreated domestic wastewater is discharged to soil and people use simple pit latrine.

(2) Issues of Human-waste Treatment after Earthquake

It is thought that large number of apartment buildings will collapse and water and sewerage system will not function properly. This would disable the uses of most toilets in the affected apartment area. Evacuated people and residents of undamaged area are supposed to use toilets nearby Ger area or install simple pit latrine in yard to use. Envisaged issue would be difficulties in excavating ground due to frozen top soil in winter. In summer, residual urine in the damaged apartments would cause serious offensive odor as well as health problem.

(3) Possible Measures

- UB City should in advance grasp the number of potential portable toilets which normally are used for event and conclude corporative agreement with other owners. UB City also promotes utilization of practice bags as portable toilet.
- Urgent public toilet can be provided by installing stilt toilet above riverbed to directory discharge to river flows or drop urine to sewerage manholes and such.
- Establishment of mutual-aid based favorable community is necessary in borrowing toilets in Ger area.

7.3 Dangerous Facilities and Hazardous Substance Disposal

(1) Current Situation

- Major dangerous facilities in UB City are thermal power stations, chemical factories, metal processing factories, leather factories, gas stations and so others.
- There is no integrated facility to dispose hazardous substance. No waste disposal plant in UB City accepts hazardous substance. Despite that designated hazardous substances are to be properly disposed based entrepreneur-pays-principle, illegal disposal of hazardous industrial and medical waste is found commonly.

(2) Concerns during Earthquake Disaster

- Due to insufficient seismicity of dangerous facilities, there is fear that fire and environmental pollution caused by leakage of hazardous substance.
- Post-earthquake confusion would complicate issues on hazardous waste disposal, i.e. dumping into illegal area, temporal rubble storage area and waste disposal plant.

(3) Necessary Measures

- Establishment of rules stipulating dangerous facilities to possess certain level of seismicity as well as mandatory daily/regular inspection is required in order to minimize pollution of surrounding soil and groundwater. It is also necessary to maintain soundness of storage tanks of gas station close to Ger area to avoid occurrence of fire and fire spreading.
- It is needed to ensure emitter’s proper disposal and strict controls on illegal disposal/dumping.

7.4 Asbestos Issue

(1) Usage of Asbestos and Related Laws

- As asbestos is easily obtainable in Mongolia, people's awareness to its risk seems low.
- Asbestos is used as heat insulating materials in blast furnace at thermal power stations, heating hot water pipelines and others.
- In general houses, asbestos is used as sealing materials of window flame against cold. Some families put asbestos plate on stoves for heat insulation.
- While Mongolia had no restrictive law on asbestos until July 2010 when the Government issued order number 192 to restrict use of asbestos, it was canceled in the following year, June 2010.

(2) Issues after Earthquake

- Improper usage of asbestos contained in rubbles would put people at risk of inhaling powder dust.
- It is concerned that affected residents would make improper use of asbestos when they lose their home due to collation of apartment buildings and relocate to Gers or construct temporary housings.

(3) Countermeasures

- UB City should provide education to residents on awareness of the risk of asbestos, appropriate usage of asbestos exposed by demolition of housings and strong possibility of health hazard to be occurred due to deteriorated/damaged asbestos used for building materials.
- When disposing rubbles, assuming that rubbles contain asbestos, water sprinkling and use of masks are necessary.

7.5 Issues on Resettlement in Recovery Stage

(1) Anticipated Resettlement

UB City would encounter to plan resettlement of residents in order to:

- Implement anti-earthquake urban planning such as road-expansion program
- Execution of restriction of inhabitable area and improvement plan of Ger area in order for accomplishment of recovery program.
- Enforce evacuation from partially-collapsed housings/apartments
- Avoid significant adverse environmental impact due to hazardous substance leaked from surrounding facilities
- Regulate disorder expansion of Ger area due to relocation of homeless sufferers

(2) Considerations in Resettlement Program

When involuntary resettlement is necessary due to above situation, UB City should implement the program taking consideration of the following items.

- Ensuring proper information disclosure on resettlement program to residents
- Sufficient consultation with stakeholders such as affected residents and communities
- Enforce evacuation from partially-collapsed housings/apartments
- Avoid significant adverse environmental impact due to hazardous substance leaked from surrounding facilities
- Execution of prior survey and study corresponding to the items in Table 7.5.1 complying with laws and regulations of Mongolia and UB city

Table 7.5.1 Items to be considered in survey and study for resettlement program

(1)	Air pollution	(14)	Involuntary resettlement
(2)	Water pollution	(15)	Local economies, such as employment, livelihood, etc.
(3)	Soil pollution	(16)	Land use and utilization of local resources
(4)	Waste	(17)	Social institutions such as social infrastructure and local decision-making institutions
(5)	Noise and vibrations	(18)	Existing social infrastructures and services
(6)	Ground subsidence	(19)	Poor, indigenous, or ethnic people
(7)	Offensive odors	(20)	Misdistribution of benefits and damages
(8)	Geographical features	(21)	Local conflicts of interest
(9)	Bottom sediment	(22)	Gender
(10)	Biota and ecosystems	(23)	Children's rights
(11)	Water usage	(24)	Cultural heritage
(12)	Accidents	(25)	Infectious diseases such as HIV/AIDS
(13)	Global warming		

Source: JICA GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS, April 2010

[List of References]

- Basic design study report on the project for improvement of waste management in Ulaanbaatar City, JICA, 2007.5
- Preparatory survey report on the Ulaanbaatar water supply development project in Gachuurt in Mongolia, JICA, 2010.3
- Strengthening the capacity for solid waste management in Ulaanbaatar city final report, JICA, 2012.9
- JICA GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS, April 2010

Chapter 8 Disaster Education and Capacity Development

In the Project, following capacity development activities were conducted, and materials and programs used in those activities are arranged for future capacity development in Mongolia. In formulating capacity development plan, keep in mind for further additional components of knowledge and techniques after the project.

8.1 Capacity Development of the training course in Japan

As part of supporting capacity building of relevant organizations, training for persons involved in the Project to be conducted in Japan was conducted. The objective of the training course in Japan is that trainees obtain understandings for Japanese seismic disaster management so that smooth implementation of the Project will be achieved. Also it is paid attention that the techniques and knowledge are utilized in the Project, therefore all participants should be selected from WG members of this project or direct staffs of WG members.

Furthermore, implementation period of the training course was set that the trainees can attend the relevant events including the Great Hanshin-Awaji earthquake memorial event to be held on January 17, and also visit Hokkaido to learn seismic disaster management during midwinter. The detail plan was not decided by only WG4 in charge of disaster education, so that the letter of intent and draft schedule are distributed to all WG member, then the training contents was fixed.

8.2 Capacity Development throughout WG activities

In this project, 4 WG are activated. Each WG has held study meetings for capacity development not only for WG member but also other persons who has interested in the special knowledge and techniques.

The study meetings of earthquake hazard, building risk evaluation, road and bridge risk evaluation, lifeline risk evaluation, fire risk, earthquake disaster management plan, disaster education have been held.

8.3 Study Meeting for EMDC staffs

Furthermore, according to the agreement with the EMDC general affairs director, three study meetings of earthquake risk and measures for EMDC staffs were held in 2013.

8.4 Technology transfer of public awareness activity on DRR

By the president order, the efforts of earthquake disaster response have been strengthened in nationwide from 2010. NEMA and EMDC conduct evacuation drills regularly (last week of March (28 March 2013), international day for DRR (12 October 2012)). Also EMDC conducts evacuation drill and response training at school in cooperation with Red Cross and Educational sector of UB city.

On the other hand, present activity mainly focuses disaster response such as evacuation drill, rescue, first aid, firefighting so far, and basic knowledge of earthquake and preparation activities are not enough conducted due to lack of instructors' knowledge and experiences, and lack of materials. Furthermore, most of UB citizens have never experienced massive earthquake with damage in past, therefore they couldn't participate activities with concrete image of earthquake risk and the situation after earthquake.

8.4.1 Implementation of the Public Awareness Campaign on Seismic Disaster Risk Reduction

The campaign was eventually conducted on 29-30 May 2013 at "Victory Square" in Ulaanbaatar for Ulaanbaatar citizens, Officials involved in DRM. Organizers are EMDC, UB city, and JICA Project Team. Co-organizers are Mongolia Red Cross, Mongolian Academy of Sciences, UB City Health Department, UB City Education Department, and National Audit Office. And cooperative organizations are Nomin HD Co., Mongolia Insurance Company, and Utilis.Sas (Open Mongolia).

The four kinds of programs, *i.e.*, "Competition", "Experience", "Exhibition", and "Seminar" were conducted in the Campaign.

Preliminary round was conducted in each of the 4 target districts, Sukhbaatar district, Bayangol district, Chingeltei district, and Songinohairkhan district. Then, one school selected from each district participated in the final round on 29 May. Four programs; Bucket brigade, jack-up rescue race, blanket stretcher transportation competition and memory competition of emergency bag goods are conducted.

The campaign provided the various experience programs, such as "shaking table" experimentally developed by the EMDC for the campaign, firefighting training used water extinguisher, making paper dishes, dice games, vibration education teaching material "Paper Bururu", leaning of furniture fall prevention, first aid practice in case of emergency including artificial respiration, and rope works to help in the event of a disaster. Furthermore, as one of the experience programs, self-propelled earthquake simulator, "Jishin The Vuton" was brought from Japan and provided opportunity for experiencing ground motion with simulation video in accordance with the earthquake data recorded in the past.

As the exhibition program, emergency items and equipment are introduced. They included emergency response first aid set, first aid supplies, sample disaster prevention goods in Japan, survival food, emergency food, emergency response vehicles, search and rescue equipment, and various fire extinguishers. Also pull-tab canned beef and dried meat, unique emergency food in Mongolia which was discussed in the preparatory meetings were introduced. In JICA Project team booth, many people interested in portable radio with hand-cranked power generator and windup LED light as disaster prevention goods of Japan. Besides, in the exhibition booths in EMDC, Mongolian Academy of Sciences, Education Department and JICA Project team, introduction of their DRR activities and/or explanation of the earthquake and possible damages in UB city were provided.

Further, the picture and essay contest on earthquake disaster risk reduction was conducted along with the campaign activities for getting more participation and involvement in the event. The awarded pictures (refer to the table) were exhibited at the venue. Also awarded ceremony was conducted for the prize winners for the picture and the essay contest at the closing ceremony.

As one of the campaign activities, a seminar for seismic disaster risk reduction was conducted aiming at enhancing DRR knowledge and sharing outcomes of the Project. Also, it was considered the implementation of seminar could help getting more participants of the campaign. The target participants of the seminar were the school teachers and district officers in charge of disaster risk management and total 300 persons were attended. In the seminar, a lecture on the technical knowledge of the earthquake was provided by a representative from Mongolian Academy of Science at the beginning. Then, lectures on the estimated earthquake damage in UB city and impact to the life of the people were made by the project team members based on the outcomes of the Project activities.

Chapter 9 Recommendations

9.1 Disaster reduction related Laws, System and organizations

- Mass Media, Red Cross, Academia Society and also Economic become member of the Disaster Prevention Standing Committee or its sub-committee.
- To establish sub committees to make advice disaster policy making under the Disaster Prevention Standing Committee such as "Earthquake Disaster Research Council" or "Academic Research Sub Committee".
- Member of the Council or Sub Committee, not only seismologist but also experts from Geology, Civil Engineering, Architecture, Mechanical Engineering in Engineering field, Sociology, Economics, Law in field of Arts, Disaster Medical and Education are recommended to participate to cover the fields which may suffer earthquake damage to promote holistic countermeasures in disaster management.

9.2 Proposal for Earthquake Disaster Management Plan

- To show the target of damage reduction
- To describe as government, residents and private sectors are the stakeholders and they shoulder their responsibility implement for target of disaster reduction.
- Representative of citizens and private sectors to the process of reviewing the plan as the stakeholders of disaster management of UB city.
- To open the plan for public to have common understanding to implement the issues indicated in the plan.
- To examine the schedule and priority of implementation of the plan. By showing the schedule and priority, it becomes understanding of stakeholders.
- To set up the checking procedures of progress of the plan.

9.3 Financial Actions, Enactment of Disaster related Laws and Regulations for Implementation of the Plan

(1) Financial actions

- Considering necessity of projects for disaster mitigation, priority of the projects and schedule of projects plan should be made to obtain the project budget allocation.

(2) Enactment of disaster related law

- Disaster related laws should be enacting as soon as possible according to the order by National Security Council.
- Regulations and standards need for implementation of project should be enacted.

(3) Regulations for implementation of the plan

- Publication of the plan is needed to citizens to understand the limitation of assistance from government that what assistants will be able to get or may difficult to get when disaster occurs and to understand that citizens have own role against disaster without having over expectation to government.
- Publication of the plan is needed to citizens to understand the role of community and importance of preparedness for disaster.

9.4 Communication and Reporting System during Disasters

- Implementation of the external evaluation of the BCP and quake resistance for the system under development.
- Creation of educational materials such as brochures and videos about the early warning system.
- Development of a highly effective system by the modulation mechanism of voice transmission.
- System construction proposal to install early warning systems on local cities in Mongolia.

9.5 Establishment of Seismograph Network System

- Installing various devices for quickly estimation of seismic scale

9.6 Emergency Response System

(1) Result of damage estimation

- To promote the earthquake resistance of important facilities
- To strengthen the earthquake resistance of the bridges across the main roads
- For prevention of road blockage, quakeproof strengthening of roadside building, prevention of falling objects, and the road facility straddle.
- To set up seismic storage tank as fire protection.
- To develop the operating rules and specification of important road disaster.

(2) Establishment of the experts network in charge of emergency response

- To develop information network and helicopter transportation system for wide area disaster medical system
- To develop emergency medical expert including triage skill

(3) Safety check of buildings

- To develop the emergency safety check system for safety check of the affected buildings, and to train experts.

(4) Network of lifeline construction officials for emergency res recovery

- To set up a committee by lifeline and related industries, and to develop a national support system for disaster.

(5) School

- To make and train disaster response manual of on/off time, and operation manual of evacuation center

9.7 Land Use and Development of Regulations

- To promote a development of new town, rebuilding of aging housing complex, permanent housing of the gel region, land readjustment to make the development of the city district road, etc., as planed "City Planning".
- To formulate a disaster urban planning from the point of view of enhancement disaster prevention in urban, and be consistent with the city master plan.

9.8 Earthquake Resistance of Buildings and Infrastructures

- Review of the aseismic design standards
- Improvement of construction quality by training of skilled workers
- The promotion of public awareness to the building earthquake resistance at residents level
- Creation of mechanisms for residents to wish funded for earthquake resistance by themselves
- Earthquake resistance for preferential important buildings

9.9 Community Based Disaster Management

- Acquisition of knowledge of earthquake and disaster management in disaster related organizations
- Promotion of disaster management awareness activities at residents level
- Sharing contents of training course in Japan
- Promotion of school disaster education at school level
- Promotion of disaster management educational activities via mass media
- Promotion of disaster management awareness activities in cooperation with private companies
- Development and maintenance of earthquake experience facilities
- Compilation of past earthquake experiences of Mongolia