April 2016

JICA ERAKV NEWS No. 1

The Project for Assessment of EARTHQUAKE DISASTER RISK for the Kathmandu Valley in Nepal

Contents

JICA PROJECT ERAKV NEPAL - JAPAN

INTRODUCTION

The project “The study on Earthquake Disaster Mitigation”, conducted by JICA in 2002, estimated the damage with several scenario earthquakes. More than ten years have passed since the project, and population and the number of buildings have increased without not enough countermeasures against the earthquake disaster. In this circumstance, the Government of Nepal (GoN) requested the assistance from the Government of Japan, and this project was adopted.

On April 25, 2015, just before the commencement of the project, the Gorkha Earthquake of Mw7.8 (USGS) occurred. The experts from this project urgently visited Kathmandu from 6th May as on Page 2. During the visit, the team investigated the damage of buildings, the needs from the GoN for recovery and reconstruction, and had series of discussions wtih counterparts.

Though the Gorkha Earthquake caused heavy damages both in and out of Kathmandu Valley, the damage was relatively small compared with other earthquakes having similar magnitude. It is recognized by both JICA and GoN that the quick recovery and reconstruction with the concept of Build Back Better (BBB) is an urgent issue and, in the meantime, it is necessary to promote the Disaster Risk Reduction (DRR) for the future earthquake. This project modified its contents as shown on Contents 3 so as to achieve above concept, and has been proceeding.






TEAM MEMBER

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Regional DM Planning/ Reconstruction Planning

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Community Based Disaster Risk Management

Overall Aim

To reduce the earthquake disaster risk through effective and sustainable measures to be taken based on the disaster risk assessment.

Project Goal

To implement the earthquake risk assessment for future scenario earthquakes with considering the earthquake environment after the Gorkha Earthquake, and to develop the Disaster Management(DM) plan for concrete and effective promotion on disaster risk management for future earthquakes.

Project Output

• Output 1

Seismic hazard analysis based on scenario earthquakes utilizing the latest knowledge and creation of detailed ground model for Kathmandu Valley.

• Output 2

Seismic risk assessment based on the results of seismic hazard analysis (Output 1), and summarize as damage estimation by considering several occurrence scenes (time, date, season, etc.) for buildings and infrastructure damage and human and economic loss.

• Output 3

Enhancement of technical skills for updating risk assessment results in accordance with the social environment change in the future.

• Output 4

To formulate BBB recovery and reconstruction plan utilizing the results of hazard analysis, and DM plan based on the results of seismic risk assessment for the pilot municipalities.

Implementing Agencies

MoUD, MoHA, MoFALD, and DMG

Pilot Municipalities

1) Lalitpur Sub-Metropolitan City

2) Bhaktapur Municipality,

3) Budhanilkantha Municipality

Duration

Approx. 3 Years

(from May 2015 to April 2018)


Deepak PAGENI
Civil Engineer


Nirdesh SHRESTHA
GIS Engineer


Subhechha SHARMA
Interpreter /
Civil Engineer


Sangita ADHIKARI
Secretory

Gorkha Earthquake and Emergency Survey

The JICA Project Team carried out an urgent damage survey after the Gorkha Earthquake in order to understand seismic damage and the needs of GoN for recovery and reconstruction. The damage survey was carried out in the Kathmandu Valley and in Sindhupalchowk District which suffered the most severe damage due to the earthquake. Damage to the buildings built of adobe, bricks or RC frame, high storey buildings, and roads were investigated. A detailed damage survey was carried out in Sankhu and Bhaktapur.


1


2


3


4

1. Damage Survey in Sankhu
2. Survey of collapsed RC Buildings
3. Discussion for modification of the project with JS of MoUD
4. 1st JCC Meeting

Quick Response Activities after the Gorkha Earthquake

Construction of Cut Model from June to August 2015

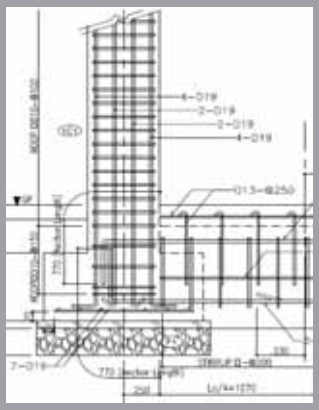

Example of the Section


Image of the Cut Models


Constructed RC Model

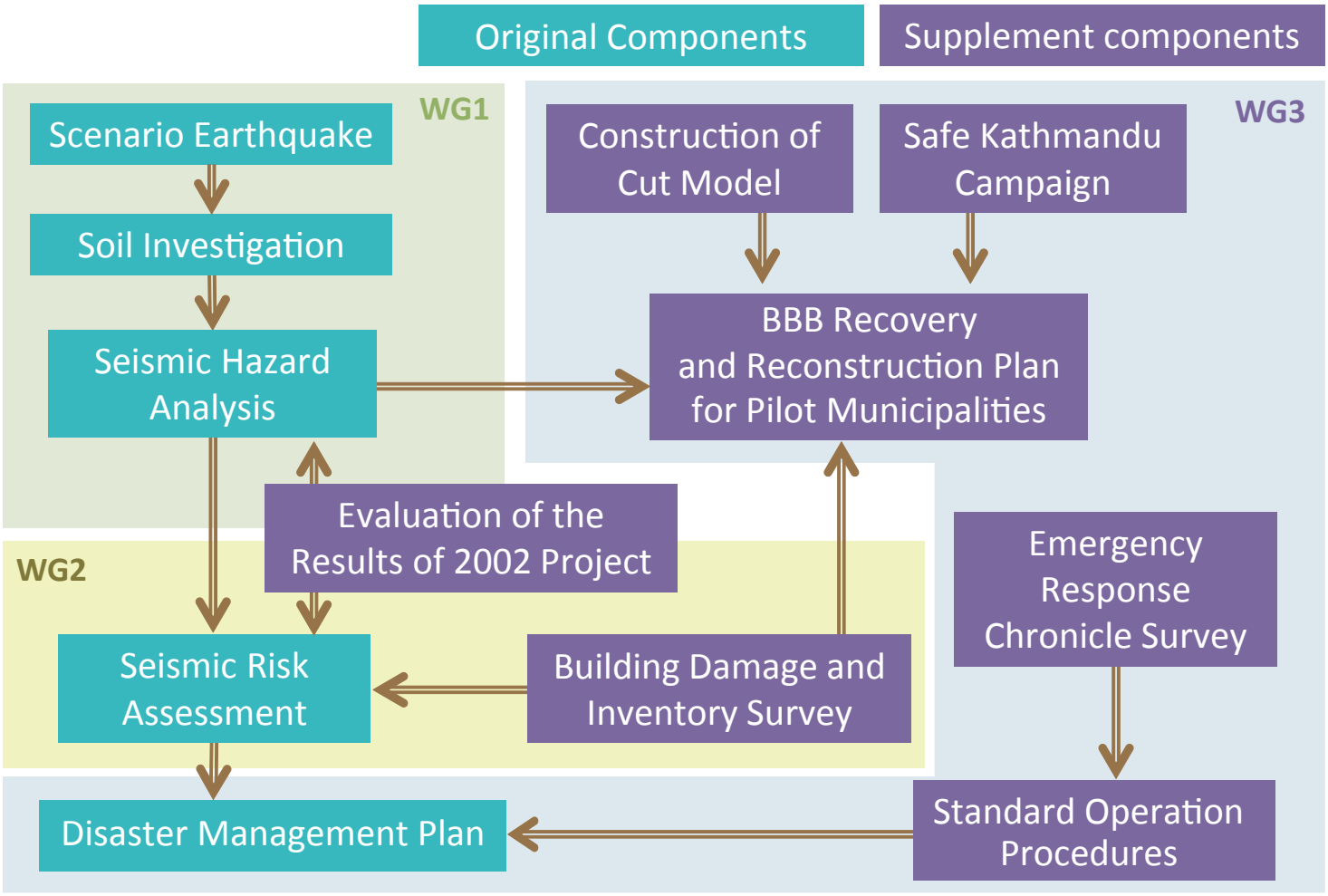
The JICA Project Team members provided explanation about the quake-resistant model houses, Japanese earthquake resistant method and its technical history with Cut Models.

More than 800 people including Secretary of MoUD, President of JICA visited the site on 2 days event. After the event, Himani Shah, Former Crown Princess also visited, and many Nepali News published about the model.


2 days Event
(24, 25 June 2015)

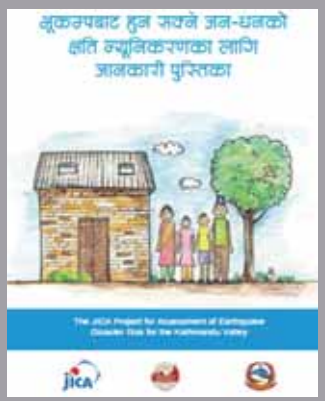
Modification of Project Components

Originally, this project was planned for Seismic Hazard Analysis, Seismic Risk Assessment and DM plan based on the Risk Assessment. However, in order to correspond to the needs after the Gorkha Earthquake, following activities were added in the 1st Joint Coordinating Committee (JCC) meeting held on 18th June, 2015.



Safe Kathmandu Campaign in August 2015

Explanation of the Earthquakes Mechanism



Cover of the Brochure

Workshop in Lalitpur Sub Metropolitan City

"The Safe Kathmandu Campaign", which is for enhancing community awareness for Disaster Risk Reduction, was conducted in the middle of August with approx.200 participants in three pilot municipalities. Necessity of retrofitting and issue for cost, lack of information, request of support from the government, and so on was widely discussed. "The Radio program" and distribution of "the Brochure of the earhquake resistance" was also conducted.

Activities of 3 WGs

WG1
Sesmic Hazard Analysis

1st Meeting on 7 Aug 2015

The Outline and Framework for the acitivities were discussed.
The progress of the Microtremor measurement was introduced.

2nd Meeting on 9 Nov 2015

The progress including Scenario Earthquake and Soil Modelling was explained. The importance of technical transfer was shared among participants.

WG2
Sesmic Risk Assessment

1st Meeting on 27 July 2015

The Outline and Framework for the acitivities were explained from the JICA Project Team and discussed among participants.

2nd Meeting on 8 Feb 2016

The progress of Data collection for Buildings, Infrastructures, Lifelines, social economic situation was explained
The necessity of more detail data was shared among participants.

WG3
Pilot Activities

1st Meeting on 5 Aug 2015

The Outline and Framework of the Recovery and Reconstruction plan was explained. The schedule, image of plan was discussed, as some recovery works has already started.

2nd Meeting on 1 Mar 2016

(Draft) Recovery and Reconstruction Plan was introduced.
The implementation method and budget was recognized as the main issue to be discussed more.

Joint Working Group and JCC Meetings

1st JCC Meeting on 6 Dec 2015

The Project component was modified (Contents 3), and 3 pilot municipalities were determined.




1st JWG Meeting on 6 Dec 2015

1st Joint Working Group (JWG) meeting was organized to share the works of each working group before the JCC meeting.The Development Commissioner of KVDA chaired the meeting. The presentation was prepared by the JICA Project Team, and the comprehensive ideas including the themes of 3 WGs were discussed.




2nd JCC Meeting on 16 Dec 2015

The activities of WGs were presented by Nepali representative of each WG. Scenario Earthquakes were determined. The framework for Recovery and Reconstruction Plan was confirmed.




2nd JWG Meeting on 11 April 2016

2nd JWG meeting focused on the progress of Seismic Hazard Analysis, especially for calculation of PGA(Peak Ground Acceleration of seismic motion at ground surface) for the Scenario Earthquakes. The importance of PGA for Risk Assessment and Disaster Management was shared among participants.



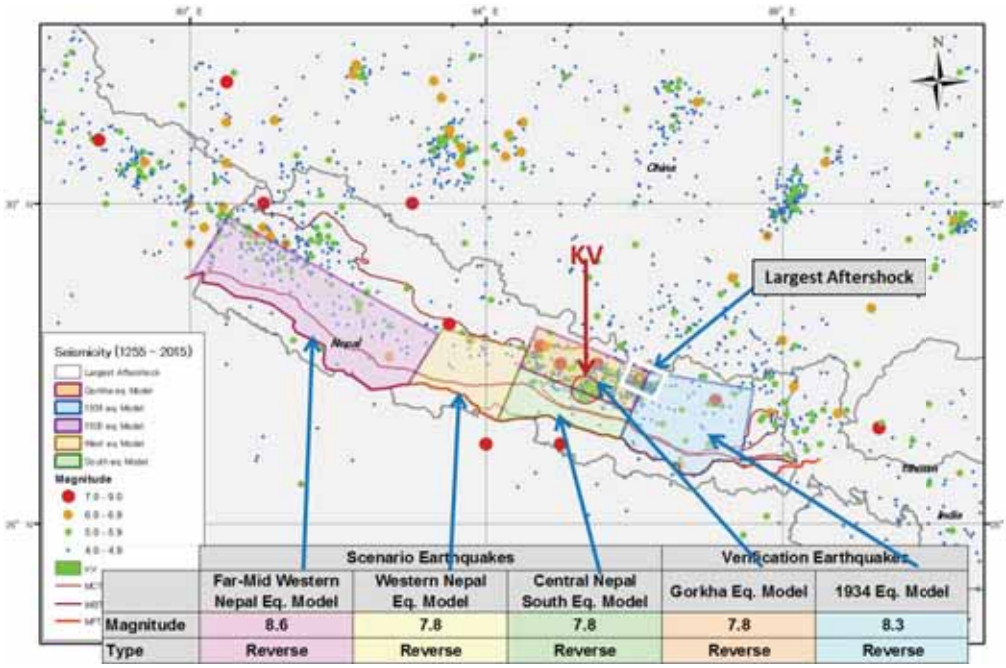

3rd JCC Meeting on May 2016 (Scheduled)

Result of Hazard Analysis and Recovery and Reconstruction Plan in Pilot Activities will be discussed.

Result of the Seismic Hazard Analysis

Seismic Hazard Analysis was conducted to provide the basic information for disaster risk management for future earthquakes. The scenario earthquakes were determined at first and the ground motion of Kathmandu valley was then estimated. The peak ground acceleration at the bedrock of KV was estimated by attenuation formula and the peak ground acceleration at ground surface was evaluated by one dimensional equivalent linear analysis with the waveform recorded in Gorkha earthquake, adjusted according to bedrock PGA, as input.

Scenario Earthquake



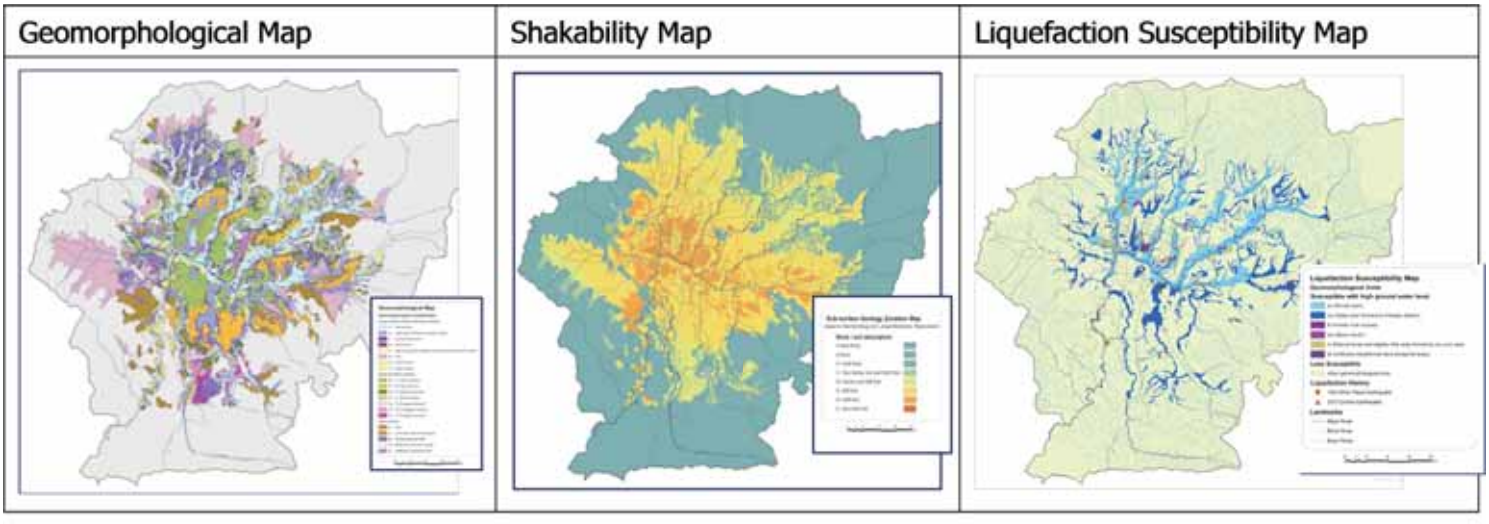
	Scenario Earthquakes			Verification Earthquakes	
	Far-Mid Western Nepal Eq. Model	Western Nepal Eq. Model	Central Nepal South Eq. Model	Gorkha Eq. Model	1934 Eq. Model
Magnitude	8.6	7.8	7.8	7.8	8.3
Type	Reverse	Reverse	Reverse	Reverse	Reverse

The possible earthquakes affecting the Kathmandu Valley were investigated in order to prepare for the future earthquakes. They were derived from the following information; active faults, crustal movement, historical earthquakes and current seismic activity.

During the process, the opinions of national and international experts along with the DMG were taken into account. As a result, the following 3 scenario earthquakes were set; 1) Far- Mid Western Nepal Eq., 2) Western Nepal Eq., and 3) Central Nepal South Eq. In addition, the information of the past earthquakes is effective for verification. Therefore, the information due to the 1934 Nepal-Bihar Earthquake, and the main shock and the largest aftershock of the 2015 Gorkha Earthquake will be used.

Seismic Microzonation Maps

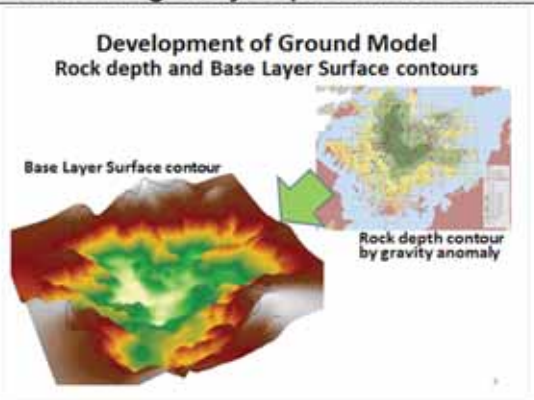
The several ground condition maps were developed, which represent the characteristics of the geomorphology in the Kathmandu Valley with respect to ground shaking caused by earthquakes. First, the Geomorphology Map was prepared, examining the terrain and sedimentary environment. Based on the Geomorphology Map and results of the Array Microtremor Survey, the Shakability Map, the Susceptibility Maps for Liquefaction and Slope failure were developed.



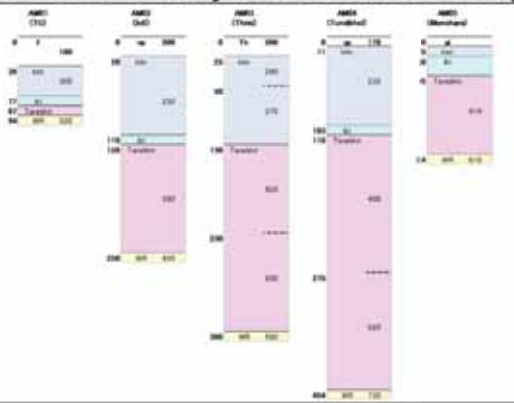
Ground Modelling

Since the sub-surface ground affects remarkably to the strength of the ground motion, the structure and physical properties of it should be identified, in order to assume the seismic hazard. The Kathmandu Valley has its maximum depth to rock layer around 600m. The details of the characteristics of the sub-surface ground have not been investigated sufficient so far. The following are the main portion of the investigation in this project. First of all, based on around 450 boring data, the gravity exploration result data, 25 geological cross-sections, estimating the situation in the direction of the depth of the geology were produced. Simultaneously, the Microtremor Survey of 540 Single Points, including existing 200 points, 75 locations of L-Shape Array, and 5 Triangular Array, gave the S-wave velocities for the geologic structure. Although it cannot be still enough, based on above information and survey, a detailed ground model (structure and properties) for each 250 m x 250 m could be set.

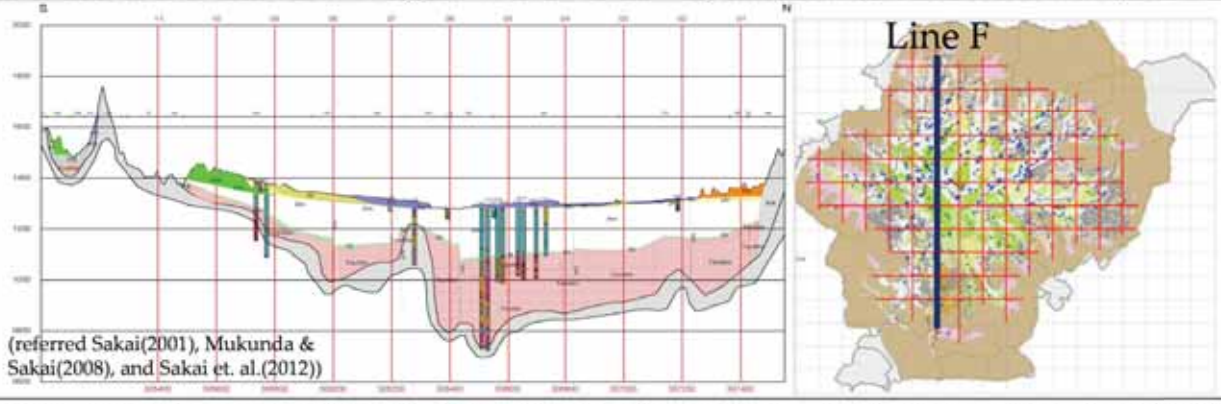
Rock Depth distribution based on the boring data and gravity exploration results



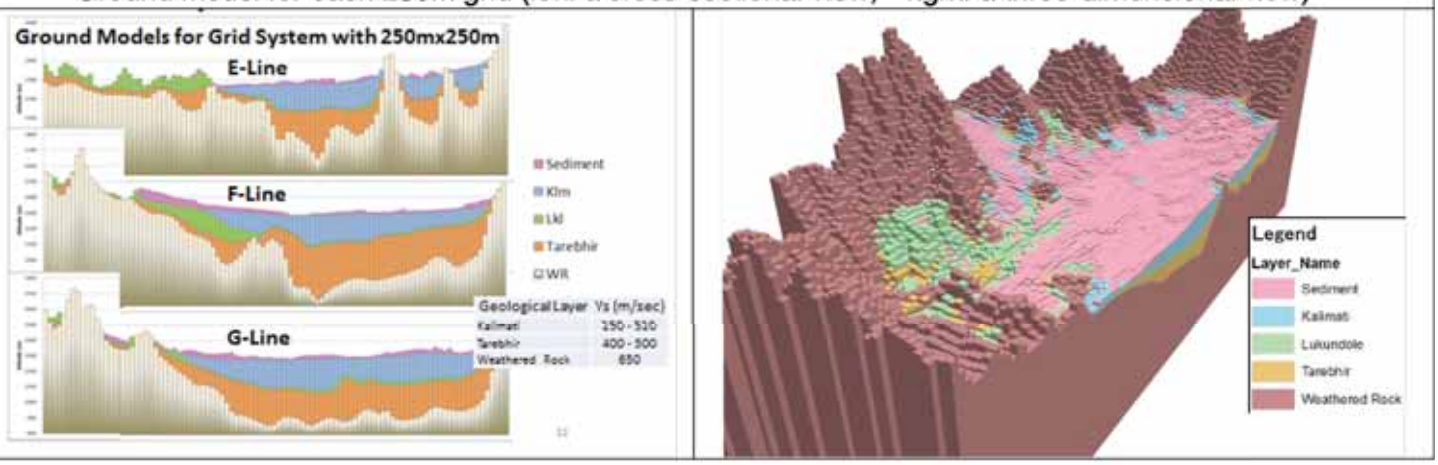
S-wave velocity setting for the geological layers based on the Array Microtremor Survey



Geological cross-section based on the ground and the survey data, totally 25 cross sections, for E-W &N-S.



Ground model for each 250m grid (left: a cross-sectional view, right: a three-dimensional view)



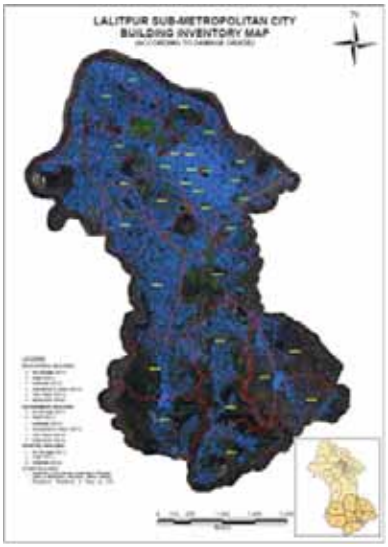
Currently, based on the set scenario earthquakes and the ground model, the calculation of ground motion is to be prepared. After completion, it will become the input information for the risk assessment, further as a target of disaster management planning.

Progress of the Seismic Risk Assessment

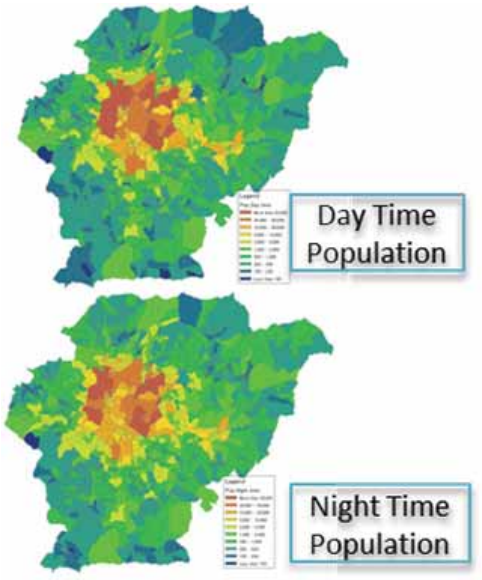
WG2 performs the seismic risk assessment based on the diverse information collected in the activity now underway and the result of seismic hazard analysis prepared by WG1. The major targets of the assessment are buildings, road network, bridges, water and sewage pipelines, electricity system and telecommunication system. The results will be summarized in maps by each sector such as building, infrastructure, lifelines, human damage and economic losses.

Data collection and Geo-Database Development

The Team is collecting necessary data for earthquake risk assessment, and modifying them by comparing with data from the 2002 JICA Project. The survey for the building inventory and damage from the Gorkha Earthquake is almost completed. Data collection for infrastructure and lifeline damages, human damage and economic loss are being carried on.



The result of Building Inventory & Damage Survey



Day-Night Time Population Up to Ward Level

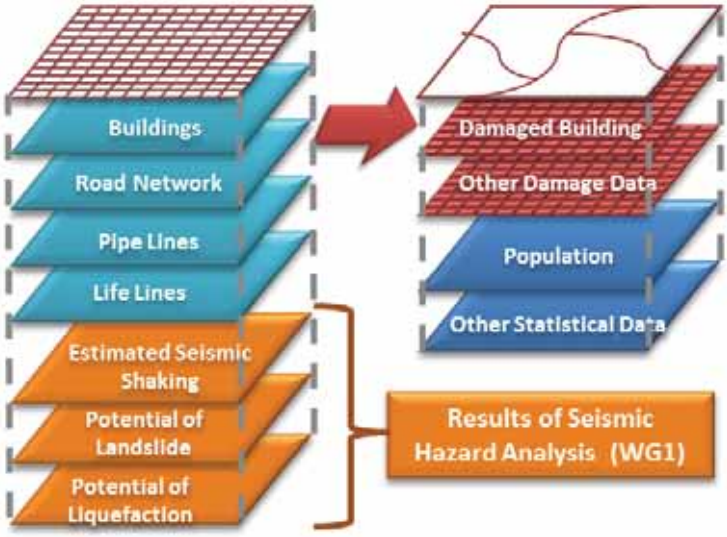
Approach of Seismic Risk Assessment

Damage Assessment of Building, Infrastructure and Lifeline

The damage of buildings, infrastructure and lifeline are estimated quantitatively based on the results of seismic hazard analysis prepared by WG1 using GIS (Geographical Information System).
Basically, the damage assessment is conducted using 250m-mesh grid as minimum segments of analysis. For the human damage assessment, boundary-based analysis will be applied.

Damage Estimation of Buildings, Infrastructure and Lifeline (Grid-Based Analysis)

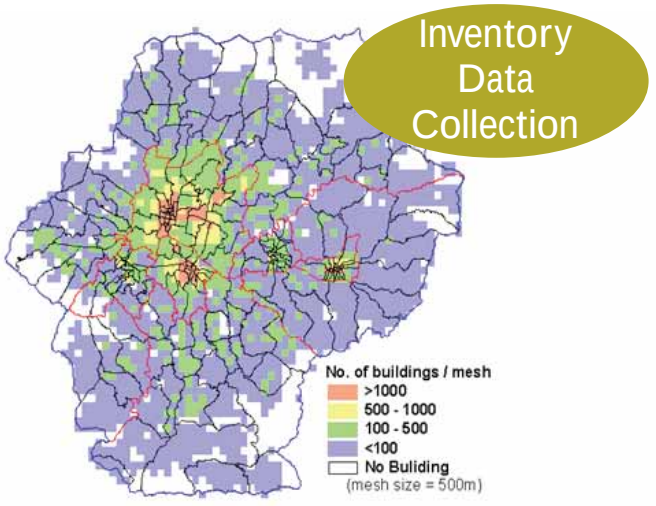
Estimation of Human Damage (Boundary-Based Analysis)



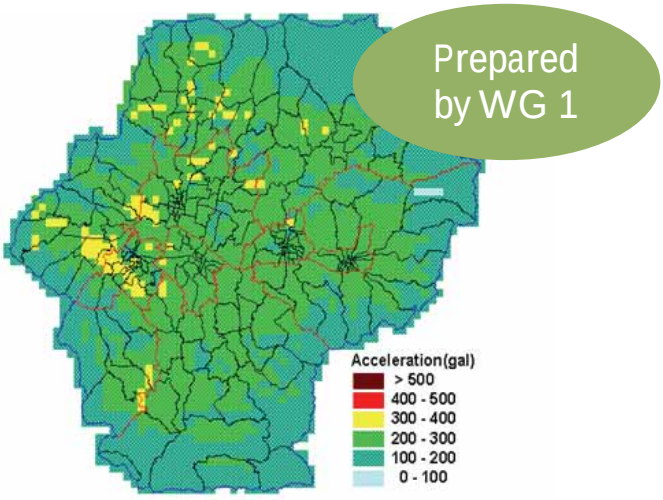
Human Damage and Economic Loss assessment based on Earthquake Occurrence Scene

The occurrence time of earthquake, such as weekday, weekend, daytime, night and season, will be considered subjected to the availability of data. For the purpose of DM plan, risk assessment will be carried out for 2016 and 2036. The estimation of 2036 is further divided into two cases; one with countermeasures taken during the period and another without the countermeasures.

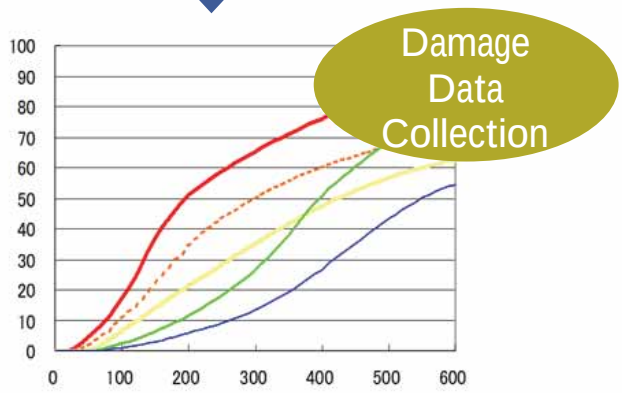
Damage Assessment Flow (Draft)
- Case of Building Damage & Human Damage -



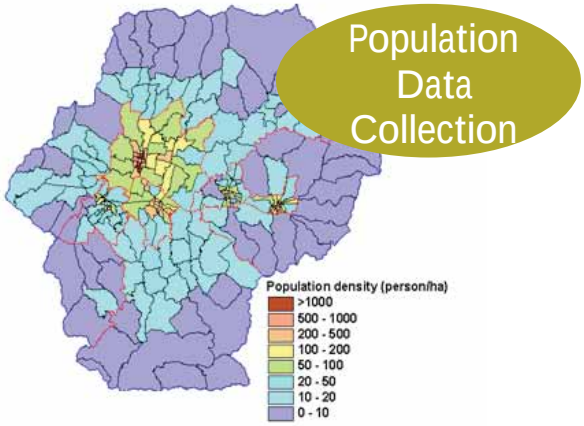
Building Distribution



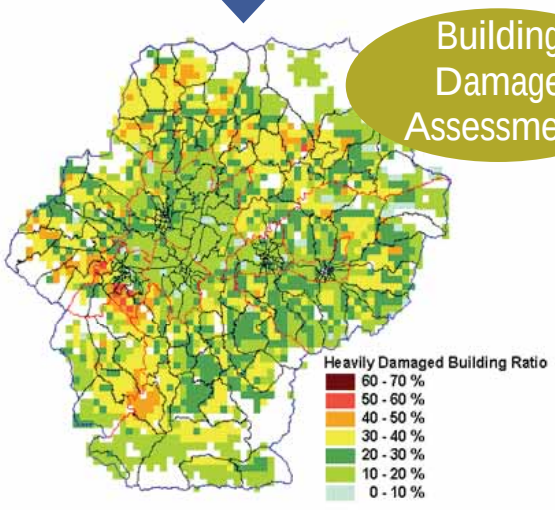
Peak Ground Acceleration



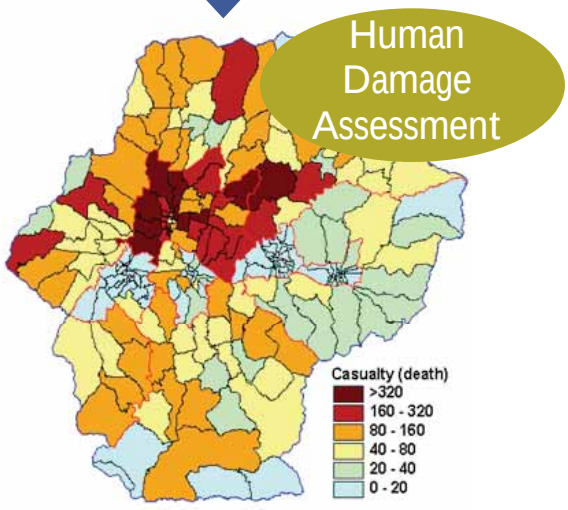
Building Damage Function (Fragility Curve)



Population Distribution



Damaged Building Rate



Number of Casualty

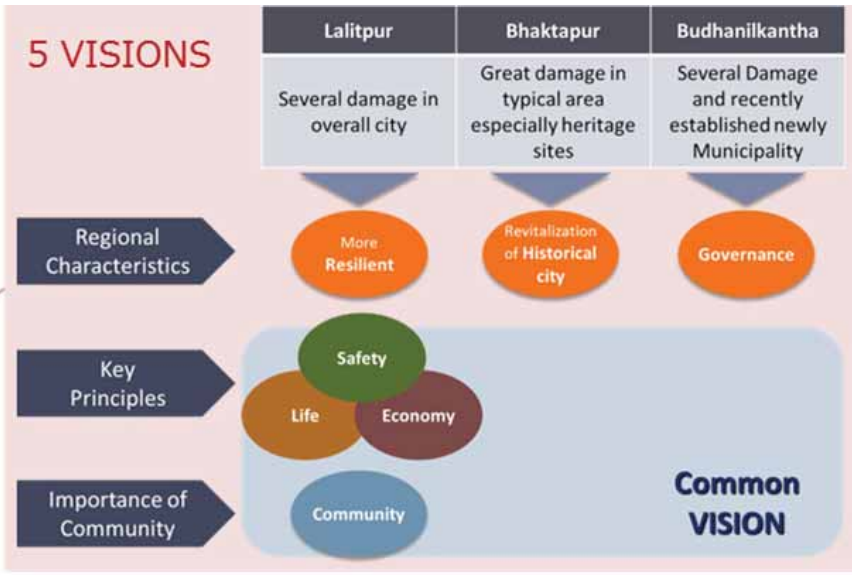
Note: All of the figures are output image, NOT the results of this project, taking from The Study on Earthquake Disaster Mitigation in the Kathmandu Valley, Kingdom of Nepal, JICA 2002

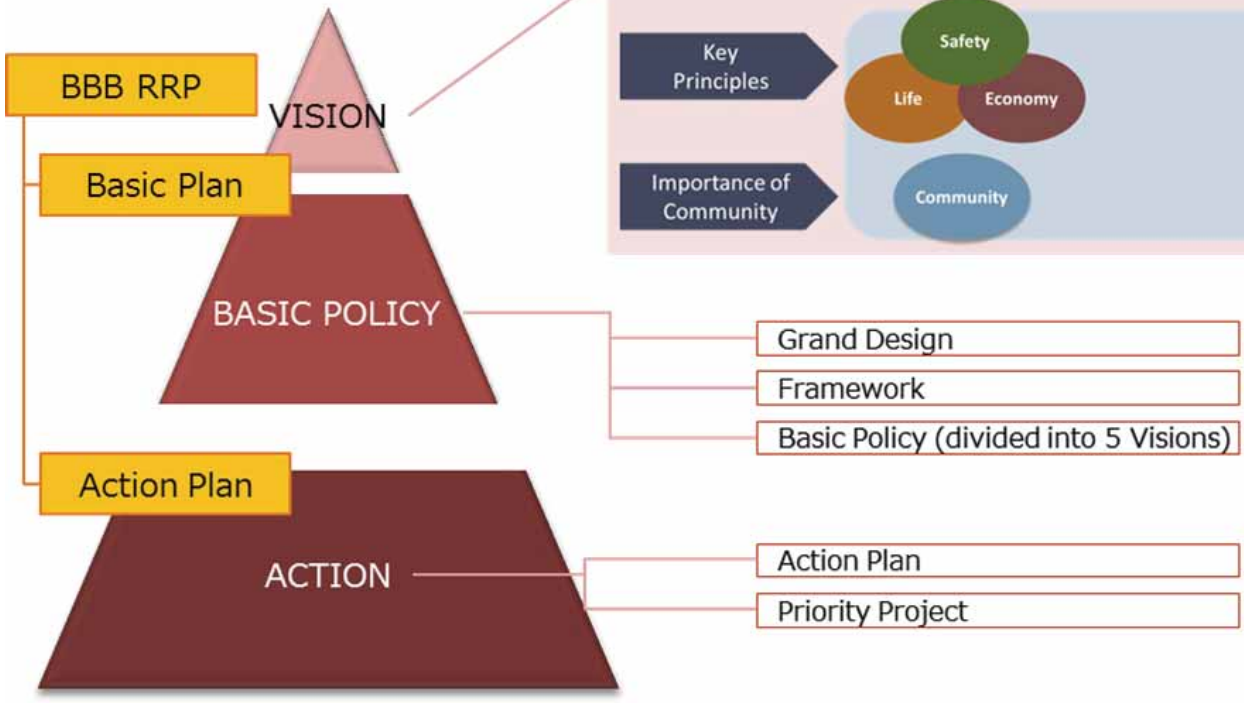
Output of the BBB Recovery and Reconstruction Plan

Municipalities affected by the Gorkha earthquake must conduct the necessary actions towards the recovery. To build more resilient society, the concept of “BBB” is essential. The BBB Recovery and Reconstruction plan (RRP) shall contribute as the Master plan with necessary measures and actions including integrating DRR into development in order to implement reconstruction smoothly and quickly for Lives of victims, industry and Economy, urban planning for Safety and resilience. Furthermore, this plan shall contribute to clarify the role and responsibilities, and to accelerate the coordination among all stakeholders. The Project is supporting to formulate the RRP for 3 Pilot Municipalities(Shown on the Right Map) and the plans will be finalized in May 2016.

Structure of BBB RRP

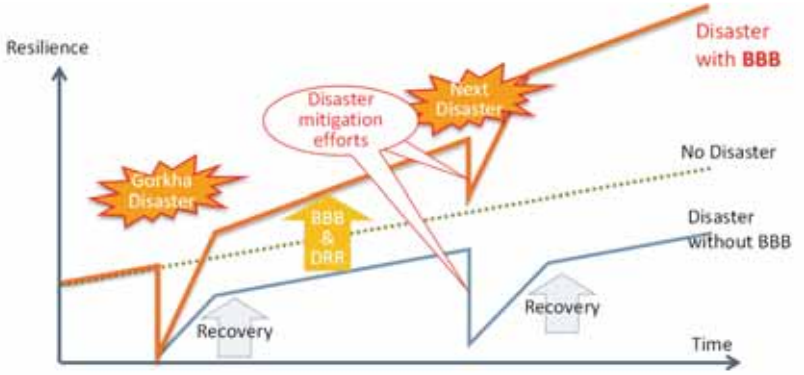
The RRP consists of the Basic Policy and Action Plan based on the Vision. The basic plan shows the entire image of the reconstruction such as vision and grand design based on the damage status and direction for future development. Each Vision is divided into several policies, and each policy includes the list of necessary countermeasures and actions for detail Action Plans. In order to achieve the policies, the Action Plan includes the responsible organizations in the municipality in consideration with the National or District organizations.



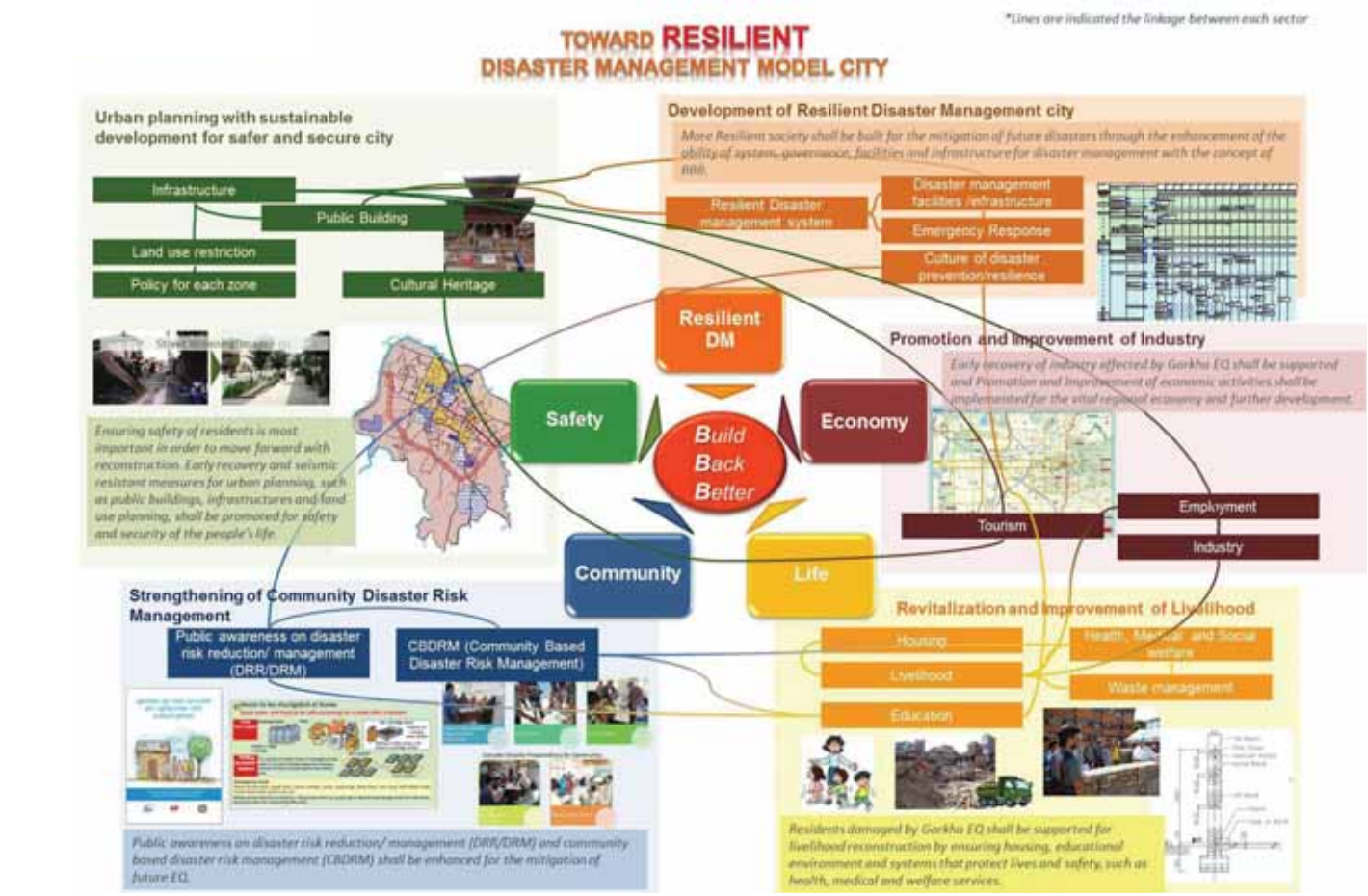


Primary Vision "Build Back Better(BBB)"

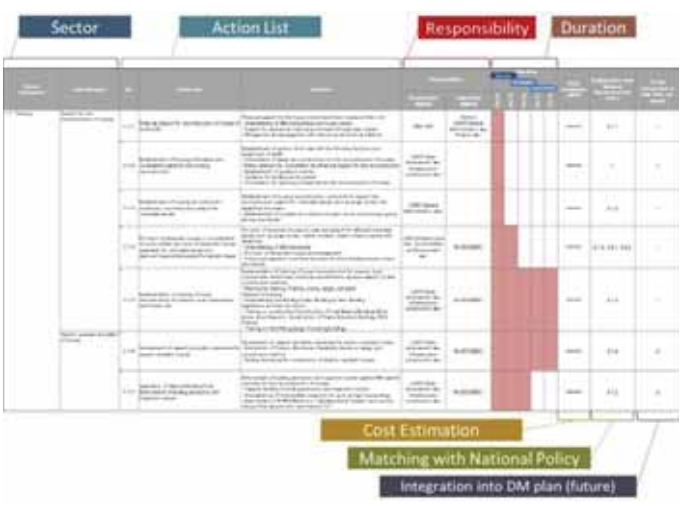
The "BBB" concept is an approach to build more resilient society during the reconstruction phase, including physical restoration of infrastructure, revitalization of livelihood, industry and economy, and the restoration of local culture and environment. With lessons learned from the disaster experiences, "BBB" concept is recognized as one of the four priorities for action of the "Sendai Framework for Disaster Risk Reduction (2015-2030, SFDRR) ", adopted in Sendai, Japan 2015.



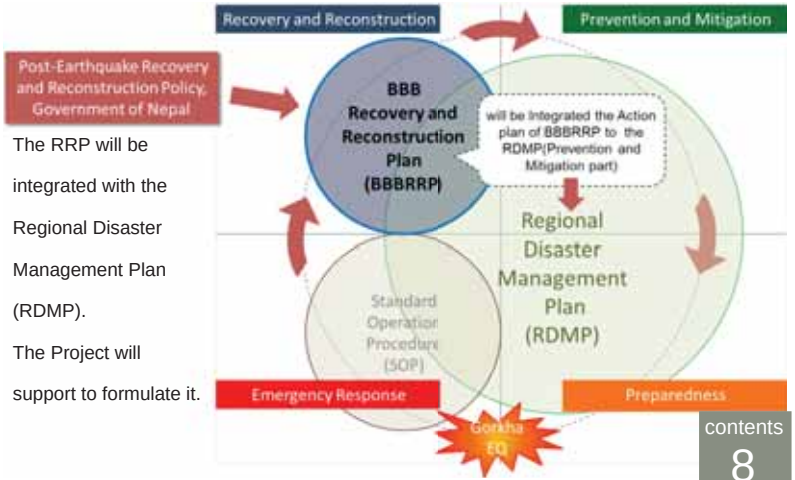
Grand Design (e.g. Lalitpur Sub-Metropolitan City)



Framework of Action Plan



Integration to DM plan (What's the Next)



The RRP will be integrated with the Regional Disaster Management Plan (RDMP). The Project will support to formulate it.

Counterpart Training in Japan

The JICA ERAKV Project scheduled three times counterpart training in Japan, and 2 of them has completed as below.

1st Counterpart Training

(24 Oct 2015 - 8 Nov 2015)

BBB Recovery and Reconstruction and Disaster Management System

11 participants from MoUD, MoFALD including 2 participants from Pilot municipalities, MoHA and DUDBC

1. Seminar at GRIPs (University)
2. Ministry of Land, Infrastructure, Transport and Tourism
3. Miyagi Prefecture (Tohoku)
4. National Research Institute for Earth Science and Disaster Prevention

<Objectives>

1)To become able to propose measures for recovery and reconstruction planning and disaster management planning in each level of government

2)To become able to propose measures for Strengthening the cooperation among organizations in Kathmandu Valley

3)To become able to propose measures for Concrete initiatives, activities for recovery, reconstruction and DM Planning

2nd Counterpart Training

(15 Mar 2016 - 27 Mar 2016)

Seismic Hazard and Risk Assessment

12 participants from MoUD, MoFALD, MoHA, DMG and DUDBC

1. Tokyo Rinkai Disaster Prevention Park
2. Japan Meteorological Agency
3. Damaged area from the Earthquake in 2011 in Sendai (Tohoku)
4. Honjo life safety learning center

<Objectives>

1) To become able to propose measures for "Seismic Hazard Analysis" of the future earthquake in Kathmandu Valley.

2) To become able to propose measures for "Seismic Risk Assessment" based on the Hazard analysis in Kathmandu Valley.

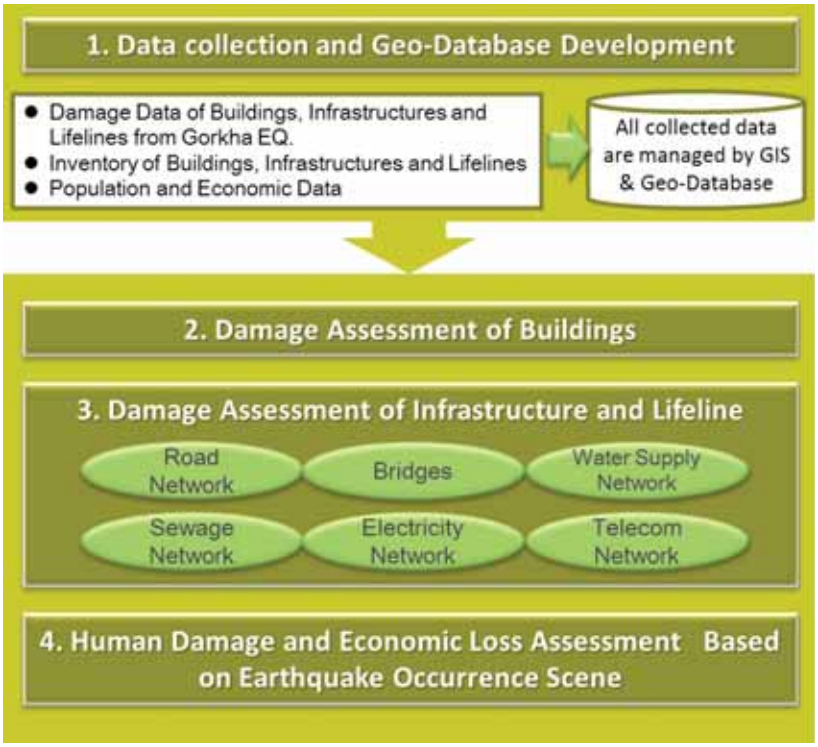
3) To increase knowledge on "total disaster risk management", and become able to propose measures for utilizing the result of Seismic risk assessment into the BBB reconstruction from the Gorkha Earthquake and disaster risk management.

Further Schedule

Result of Seismic Hazard Analysis (Contents 6)

BBB Recovery and Reconstruction Plan (Contents 8)

Seismic Risk Assessment for Buildings, Infrastructure Lifeline, and Social and Economic Impact (Contents 7)



Formulation of Disaster Management (DM) Plan with Community based Disaster Risk Management(CBDRM) Activities and Standard Operation Procedure (SOP) for 3 Pilot Municipalities and Guildeline for formulation of DM Plan.

Image of Guideline for DM Plan

Image of SOP

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The Project for Assessment of
EARTHQUAKE DISASTER RISK
for the Kathmandu Valley in Nepal

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