NATIONAL RECONSTRUCTION AUTHORITY
FEDERAL DEMOCRATIC REPUBLIC OF NEPAL

THE PROJECT ON REHABILITATION AND RECOVERY FROM NEPAL EARTHQUAKE

FINAL REPORT (OUTPUT 1～3)

APPENDIX

OCTOBER 2017

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS GLOBAL CO., LTD.
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(October, 2017)

List of Appendices

Appendix 4-1 Results of Slope Failure Analysis

Appendix 4-2 Curriculum of Hazard Map Related Workshops and List of Participants

Appendix 6-1 Kathmandu Valley Resilience Plan (KVRP)

Appendix 7-1 MOU for the preparation of the PDDP

Appendix 7-2 Rehabilitation and Recovery Plan (RRP) in Gorkha District

Appendix 7-3 Rehabilitation and Recovery Plan (RRP) in Sindhupalchowk District

Appendix 8-1 Brochure of Minimum Requirements for masonry

Appendix 8-2 Brochure of Minimum Requirements for RCC

Appendix 9-1 Out Line Design of Hospital

Appendix 9-2 Out Line Design of Bridge

Appendix 9-3 Out Line Design of Water Transmission System

Appendix 4-1: Results of Slope Failure Analysis

Figure 1　Slope failure analysis by quantification theory

The result of quantification theory 2 in Gorukha

Item	Classification	Category	Gorkha		
			Category score※1	Range 範囲	Partial correlation coefficient 偏相関係数
Slope inclinatio (degree)	0～10 below	1	−0.45	1.37	0.090
	10～20 below	2	−0.69		
	20～30 below	3	−0.66		
	30～40 below	4	−0.06		
	40～50 below	5	0.59		
	50～60 below	6	0.67		
	60～70 below	7	0.51		
	70～80 below	8	0.14		
	80～90 below	9	0.12		
Slope direction (8 direction)	N	1	−0.12	0.55	0.03
	NE	2	0.08		
	E	3	0.16		
	SE	4	0.33		
	S	5	0.13		
	SW	6	−0.06		
	W	7	−0.22		
	NW	8	−0.21		
Relationship with MCT	Inside MCT	1	1.58	2.13	0.13
	North 0～10km below	2	−0.20		
	North 10～20km below	3	−0.55		
	North 20～30km below	4	−0.46		
	North 30km or more	5	−0.43		
	South 0～10km below	6	−0.38		
	South 10～20km below	7	0.04		
	South 20～30km below	8	0.44		
Distance from hypocenter	0～10km below	1	−0.20	0.10	0.05
	10～20km below	2	−0.20		
	20～30km below	3	−0.30		
	30km or more	4	—		

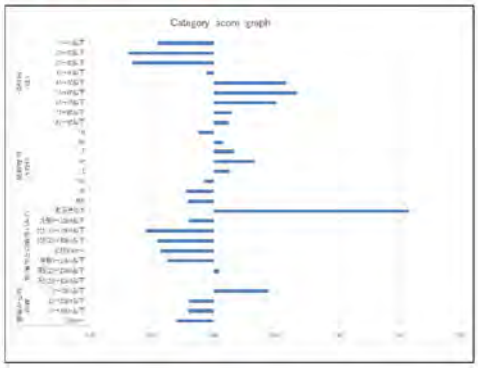
※1：Analysis results based on the quantification theory 2

***** The result of determination *****

Actual group	Disdriminated group axis 1	axis 2	total
第1群(Non_Ls)	793, 896	193, 921	987, 817
%	[80. 4]	[19. 6]	[100. 0]
第2群(Ls)	2, 971	9, 167	12, 138
%	[24. 5]	[75. 5]	[100. 0]

The percentage of correct answers

正判別率 = 0. 80



The result of quantification theory 2 in Shindhupalchok

Item	Classification	Category	Shindhupalchok		
			Category score※1	Range 範囲	Partial correlation coefficient 偏相関係数
Slope inclinatio (degree)	0～10 below	1	−0.89	2.79	0.15
	10～20 below	2	−0.81		
	20～30 below	3	−0.71		
	30～40 below	4	−0.07		
	40～50 below	5	1.30		
	50～60 below	6	1.90		
	60～70 below	7	1.60		
	70～80 below	8	0.75		
	80～90 below	9	0.00		
Slope direction (8 direction)	N	1	−0.30	1.04	0.06
	NE	2	−0.06		
	E	3	0.20		
	SE	4	0.68		
	S	5	0.25		
	SW	6	−0.15		
	W	7	−0.29		
	NW	8	−0.36		
Relationship with MCT	Inside MCT	1	0.39	1.54	0.05
	North 0～10km below	2	0.05		
	North 10～20km below	3	0.16		
	North 20～30km below	4	−0.18		
	North 30km or more	5	−1.16		
	South 0～10km below	6	−0.16		
	South 10～20km below	7	−0.59		
	South 20～30km below	8	0.00		
Distance from hypocenter	0～10km below	1	0.06	1.00	0.09
	10～20km below	2	−0.03		
	20～30km below	3	−0.94		
	30km or more	4	0		

※1：Analysis results based on the quantification theory 2

***** The result of determination *****

Actual group	Disdriminated group axis 1	axis 2	total
第1群(Non_Ls)	720, 613	245, 735	966, 348
%	[74. 6]	[25. 4]	[100. 0]
第2群(Ls)	10, 049	19, 491	29, 540
%	[34. 0]	[66. 0]	[100. 0]

The percentage of correct answers

正判別率 = 0. 74

Source: JICA Project Team

Appendix 4-2: Curriculum of Hazard Map Related Workshops and List of Participants

Table 1 List of Participants in the Workshop for Hazard Map Utilization

SN	Position held	Affiliated Organization	Address of organization
1	Geologist	DMG	Lainchour, Kathmandu
2	Sub-Engineer	DWIDM	Pulchowk, Lalitpur
3	Architect	DLPIU, DUDBC	Manthali, Ramechhap
4	Engineer	DLPIU, DUDBC	Sindhuli, Sindhuli
5	Architect	DLPIU, DUDBC	Darbung, gorkha
6	Engineer	DLPIU, DUDBC	Charikot, Dolakha
7	Engineer	DLPIU, DUDBC	Sindhupalchowk, Chautara
8	Engineer	DLPIU, DUDBC	Dhunche, Rasuwa
9	Engineer	DLPIU, DUDBC	Dhading
10	Engineer	DLPIU, DUDBC	Hetauda, Makwanpur
11	Engineer	DLPIU, DUDBC	Kavrepalanchok
12	Architect	DLPIU, DUDBC	Bidur, Nuwakot
13	Engineer	DLPIU, DUDBC	Siddhicharan, Okhaldhunga
14	Engineer	CLPIU	Kathmandu
15	Engineer	DTO, DDC	Kavrepalanchok
16	Engineer	DTO, DDC	Okhaldungha
17	Engineer	DTO, DDC	Dhading
18	soil cons. Eng.	DSCWM	Kathmandu
19	survey officer	SD	Kathmandu

Source: JICA Project Team

Table 2 Detail Schedule of the Workshop on Hazard Map Utilization

		Date	Title or Program	Content
1	Sun	1/22/2017	Opening	Prof. Dr. Tara Nidhi Bhattarai, member steering committee, NRA
			Introduction of Workshop, RRNE HM and other project.	**Lecture:** Background, Purpose, and the contents of the Workshop.
				Demonstration / Exercise: HM prepared by RRNE and other project.
2	Mon	1/23/2017	Geological factor	**Lecture:** The geological and geotechnical characters of Nepal, Gorkha districts and Sindhupalchok district.
				Demonstration / Exercise: Displaying GIS data of RRNE project in QGIS.
3	Tue	1/24/2017	Slope factor	**Lecture:** Terrain slope, MCT, geological structure, the slope direction, and the distance from the epicentre are considered in the hazard maps.
				Demonstration /Exercise: Slope and Aspect analysis in QGIS.
4	Wed	1/25/2017	Selection and analysis of factors	**Lecture**: The factor causing a landslide was selected and analysed for preparation of the Hazard maps.
				Demonstration / Exercise: Preparing the factors to be including Hazard analysis. Buffering and Editing attributes in QGIS.
5	Thu	1/26/2017	Weighting and Quantification of the factors	**Lecture**: Weighting and Quantification of the factors.
				Demonstration / Exercise: Weighting and Quantification of the factors. Creating features in QGIS.

		Date	Title or Program	Content
6	Fri	1/27/2017	Generating Landslide Hazard Maps	**Lecture**: Generating Landslide hazard Maps.
				Demonstration / Exercise: Generating Landslide Hazard Maps. Converting and joining features in QGIS.
	Sat	1/28/2017	Off	
	Sun	1/29/2017	Off	
7	Mon	1/30/2017	Field Survey	Field trip to Sindhupalchok district.
8	Tue	1/31/2017	Field Survey	
9	Wed	2/1/2017	Hazard in field surveyed area	**Lecture**: Summarizing hazard condition at field survey area. Limitation and the accuracy of the hazard map.
				Demonstration / Exercise: Discussion regarding hazard map considering Field survey area. Editing in QGIS.
10	Thu	2/2/2017	Summary	**Lecture**: Recommended action for utilizing hazard maps.
				Demonstration /Exercise: Hazard map utilization. Creating map Layout in QGIS.

Source: JICA Project Team

Table 3 List of Participants in the Workshop on the Outline of Hazard Map Preparation

No	Position held	Affiliated Organization	Address of organization
1	Survey Officer	SD	Minbhawan, Kathmandu
2	soil cons. Eng.	DSCWM	Kathmandu
3	Architect	DLPIU, DUDBC	Manthali, Ramechhap
4	Engineer	DLPIU, DUDBC	Charikot, Dolakha
5	Engineer	DLPIU, DUDBC	Sindhupalchowk, Chautara
6	Engineer	DLPIU, DUDBC	Dhunche, Rasuwa
7	Engineer	DLPIU, DUDBC	Dhading
8	Engineer	DLPIU, DUDBC	Hetauda, Makwanpur
9	Engineer	DTO, DDC	Kavrepalanchok
10	Engineer	DLPIU, DUDBC	Siddhicharan, Okhaldhunga
11	M.Sc. Eng. Geology	TC, TU	Ghantaghar, Kathmandu
12	M.Sc. Eng. Geology	TC, TU	Ghantaghar, Kathmandu
13	Engineer	DLPIU, DUDBC	Kavrepalanchok

Source: JICA Project Team

Table 4 Detail Schedule of the Workshop on Hazard Map Preparation

Day		Date	Title or Program	Content
1	Tue	2/28/2017	Opening	Prof. Dr. Tara Nidhi Bhattarai, member steering committee, NRA.
			Introduction and basic concept of the hazard map.	**Lecture:** Background, Purpose, and the contents of the Workshop. Basic concept, structure, and basic knowledge on the hazard map.
				Demonstration / Exercise: Landslide area Map of Gorkha and Sindhupalchok. Displaying GIS Data of RRNE Project in QGIS.
2	Wed	3/1/2017	Understanding of the contents for the hazard maps	**Lecture:** Information to be collected in field survey.
				Demonstration / Exercise: Date, Accuracy, cost of the satellite image. Displaying Hazard Map of RRNE Project in QGIS.
3	Thu	3/2/2017		**Lecture:** Information to be collected in field survey (continued).
				Demonstration /Exercise: Accuracy and necessary modification of the Topographic map. Generating Landslide Hazard Maps.
4	Fri	3/3/2017		**Field trip to Balephi – Jalbire area of Sindhupalchok district.**
	Sat	3/4/2017	Off	
5	Sun	3/5/2017	Preparation of the hazard map in the pilot area	**Lecture**: Hazard map making in the pilot area.
				Demonstration / Exercise: Input and modification of the GIS data using QGIS.
6	Mon	3/6/2017		**Lecture**: Hazard map making in the pilot area (Continued).
				Demonstration / Exercise: Input and modification of the GIS data using QGIS (Continued).
7	Tue	3/7/2017		**Lecture**: Hazard map making in the pilot area (Continued).
				Demonstration / Exercise: Input and modification of the GIS data using QGIS (Continued).
8	Wed	3/8/2017		**Lecture**: Hazard map making in the pilot area (Continued).
				Demonstration / Exercise: Input and modification of the GIS data using QGIS (Continued).
9	Thu	3/9/2017		**Lecture**: Hazard map making in the pilot area (Continued).
				Demonstration / Exercise: Input and modification of the GIS data using QGIS (Continued).
10	Fri	3/10/2017	Summary	**Lecture**: Necessary information and contents for the Hazard Map.
				Demonstration /Exercise: GIS operation of the Hazard Map and creating layout in QGIS.
			Closing	Representative from JICA, Nepal and NRA.

Source: JICA Project Team

Appendix-6-1: Kathmandu Valley Resilience Plan (KVRP)

Japan International Cooperation Agency (JICA)

The Project on Rehabilitation and Recovery
from Nepal Earthquake

KATHMANDU VALLEY RESILIENCE PLAN

October 2017

ORIENTAL CONSULTANTS GLOBAL CO., LTD.
Pacific Consultants Co., Ltd.
MOHRI, ARCHITECT & ASSOCIATES, INC
CTI Engineering International Co., Ltd.
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Table of Contents

Page

EXECTUTIVE SUMMARY

1. Necessity of Kathmandu Valley Resilience Plan (KVRP) 1
2. What is the KVRP? 1
3. Basic Principles and Goals of KVRP 2
4. Vulnerability Assessment 3

CHAPTER 1 INTRODUCTION 1-1
1.1 Background 1-1
1.2 Incorporating the Sendai Framework for Disaster Risk Reduction (2015 – 2030) 1-2
1.3 Necessity of the Kathmandu Valley Resilience Plan 1-3
1.3.1 Rationale for the Development of the KVRP 1-3
1.3.2 Institutionalization of KVRP 1-3
1.3.3 Functions of the KVRP 1-5
1.4 Development Mechanism of the KVRP 1-5
1.5 Organization of the KVRP 1-6

CHAPTER 2 SITUATION ANALYSIS OF THE KATHMANDU VALLEY 2-1
2.1 Overview of the Kathmandu Valley 2-1
2.1.1 Administration Structure 2-1
2.1.2 Natural Condition 2-2
2.1.3 Socio-economic Framework 2-2
2.1.4 Road and Transport Network 2-6
2.2 Kathmandu Valley Development Concept 2-7
2.2.1 Kathmandu Valley Development Authority (KVDA) 2-7
2.2.2 Strategic Development Master Plan (SDMP) for Kathmandu Valley 2015-2035 2-8
2.2.3 Disaster Management System at the KV Level 2-8
2.2.4 Risk Sensitive Land Use Plan (RSLUP) 2-9
2.3 Key National Act, Policy and Plan 2-10
2.3.1 National Development Policy 2-10
2.3.2 Disaster Management Act, Policy, and Plan 2-14

CHAPTER 3 BASIC CONCEPT OF THE KATHNANDU VALLEY RESILIENCE PLAN 3-1
3.1 Envisaged Natural Disaster Risks 3-1
3.1.1 Historical Records of Natural Disasters in the KV 3-1
3.1.2 Envisaged Natural Disaster Risk in the KVRP 3-2
3.2 Principles of Building the Kathmandu Valley Resilience 3-5
3.2.1 Basic Principles 3-5
3.2.2 Vision 3-6
3.2.3 Goals 3-7
3.3 Target Year of the KVRP 3-7
3.4 Update Disaster Management Policies and Measures 3-8
3.5 Measures for Building the Kathmandu Valley Resilience 3-8
3.5.1 Measures for Building the Kathmandu Valley Resilience 3-9
3.5.2 Combination of Measures 3-9
3.5.3 Promotion of Measures in an Efficient Manner 3-9
3.5.4 Promotion of Measures in Accordance with Social Characteristics 3-10

CHAPTER 4 VULNERABILITY ASSESSMENT 4-1
4.1 Vulnerability Assessment Method 4-1
4.2 Summary of Risk Assessment Results 4-2
4.3 Preparation for the Worst Case Scenarios 4-3

CHAPTER 5 PROMOTING INITIATIVE FOR BUILDING THE KATHMANDU VALLEY RESILIENCE 5-1
5.1 Sector Measures 5-1
5.1.1 Housing and Building 5-1
5.1.2 Urban Planning and Land Use 5-9
5.1.3 Open Space and Emergency Evacuation Space 5-18
5.1.4 Transportation Network 5-31
5.1.5 Lifelines (Water Supply and Sanitation) 5-39
5.1.6 Tourism and Cultural Heritages 5-43
5.2 Cross-Sectoral Measures 5-46
5.2.1 Social Consideration on Disaster Management 5-46
5.2.2 Capacity Development on Disaster Management 5-49
5.2.3 Partnership with Relevant Organization and Private Sector 5-53

CHAPTER 6 RECOMMENDATIONS AND CONCLUSION 6-1
6.1 Introduction 6-1
6.2 Findings and Recommendations 6-1
6.2.1 Establishment of laws and institutions in disaster management 6-1
6.2.2 Reduction of building damage from natural disasters 6-1
6.2.3 Review of design standards 6-2
6.2.4 Reinforcement of Infrastructure 6-2
6.2.5 Promotion of risk sensitive land use planning 6-2
6.3 Conclusions 6-3

APPENDIX I: VULNERABILITY ASSESSMENT AND PROPOSED COUNTERMEASURES TO AVOID THE WORST CASE EVENTS IN THE KATHMANDU VALLEY 1

APPENDIX II: PROPOSED COUNTERMEASURES BY ORGANIZATION TO AVOID THE WORST EVENTS 1

APPENDIX-III: PROPOSED PRIORITY LISTS OF BRIDGES, HOSPITALS AND SCHOOLS TO BE SEISMIC RESISTANT STRUCTURE 1

APPENDIX-Ⅳ: MEETINGS AND ACTIONS CONDUCTED FOR DEVELOPMENT OF THE KVRP 1

List of Tables

Page

Table 2.1.1 Population and Population Growth Rate by District in the KV 2-3
Table 2.1.2 Population Projection from 2016 to 2031 by District in the KV 2-3
Table 2.1.3 Road length by Classification and by District in the Kathmandu Valley 2-6
Table 2.1.4 Number of Bridges in the KV 2-7
Table 2.3.1 Strategy for Assuring Urban Safety and Resilience 2-13
Table 2.3.2 20-year timeframe for The National Plan of Action for Safer Building Construction 2-17
Table 4.1.1 Vulnerability Assessment Method 4-1
Table 4.2.1 Estimated Building Damage caused by the Scenario Earthquake of CNS-3 4-2
Table 4.2.2 Estimated Bridge Damage caused by the Scenario Earthquake 4-2
Table 4.3.1 Worst-Case-Scenarios 4-3
Table 5.1.1 Estimated Number of Damaged Buildings caused by the Scenario Earthquake in the Kathmandu Valley 5-2
Table 5.1.2 Building Approval Process 5-5
Table 5.1.3 Classification of Evacuation Open Spaces in Japan 5-19

List of Figures

Page

Figure 1.3.1 Implementation Structure of SDMP and Role of KVRP 1-4
Figure 1.4.1 Organization Structure for Development of KVRP 1-6
Figure 2.1.1 Jurisdiction of the Kathmandu Valley 2-1
Figure 2.1.2 Average Monthly Temperature and Precipitation in Kathmandu 2-2
Figure 2.1.3 Population Density by Municipality/VDC in KV, 2001 2-4
Figure 2.1.4 Population Density by Municipality/VDC in KV, 2011 2-4
Figure 2.1.5 Location of Bridges at Strategic Roads (SRN) 2-7
Figure 2.2.1 Framework of related organizations 2-9
Figure 3.1.1 Location of Past Earthquakes (earthquakes (> 4.0 ML) recorded between 1994 and August 2013) 3-2
Figure 3.1.2 Scenario Earthquakes Fault Model 3-3
Figure 3.1.3 PGA Distribution of Scenario Earthquake: Central Nepal South Scenario Earthquake (x2/3) 3-4
Figure 3.1.4 MMI Distribution of the Scenario Earthquakes: Central Nepal South Scenario Earthquake (x2/3) 3-5
Figure 3.4.1 PDCA Cycle in KVRP 3-8
Figure 5.1.1 Building Distribution by Classification in 2015 5-2
Figure 5.1.2 Seismic Risk Assessment for Building: Number of Damaged Building 5-3
Figure 5.1.3 Seismic Risk Assessment for Building: Damaged Building Ratio 5-3
Figure 5.1.4 Seismic Risk Assessment for School Building 5-4
Figure 5.1.5 Seismic Risk Assessment for Health Building 5-5
Figure 5.1.6 Estimated Damaged Building Ratio by Grid in the KV 5-10
Figure 5.1.7 Estimated Number of Damaged Building by Grid in the KV 5-11
Figure 5.1.8 Estimated Disaster Risks of Liquefaction in the Kathmandu Valley 5-12
Figure 5.1.9 Estimated Disaster Risks of Landslide in the Kathmandu Valley 5-13
Figure 5.1.10 Locations of Priority Areas for Promoting Resilient Structural Measures 5-14
Figure 5.1.11 Image of Land Pooling Project in Gongabu 5-16
Figure 5.1.12 Catchment Area of Evacuation Open Spaces 5-21
Figure 5.1.13 Distribution of Community Evacuation Open Spaces 5-22

Figure 5.1.14 Distribution of Regional Evacuation Open Spaces 5-22
Figure 5.1.15 Analysis of Demand and Capacity of Evacuation Open Spaces by Ward 5-23
Figure 5.1.16 Distribution of Proposed Disaster Management Base 5-24
Figure 5.1.17 Distribution of Proposed Disaster Management Base and Evacuation Open Spaces ... 5-30
Figure 5.1.18 Estimated Number of Damaged Buildings along Major Roads in the KV 5-32
Figure 5.1.19 Seismic Risk Assessment for Bridges 5-35
Figure 5.1.20 Typical Cross Section of National Emergency Transportation Road 5-36
Figure 5.1.21 Typical Cross Section of Primary Emergency Transportation Road 5-36
Figure 5.1.22 Typical Cross Section of Secondary Emergency Transportation Road 5-37
Figure 5.1.23 Proposed Emergency Transportation Road Network 5-39
Figure 5.1.24 Estimated Damage of Water Supply Pipeline by Gild 5-40
Figure 5.1.25 Estimated Damage of Swage Pipeline by Gild. 5-41
Figure 5.1.26 Conceptual Diagram for Emergency Evacuation in Historical Area 5-46
Figure 5.2.1 Coordination Mechanism of the Public and Private Sector in Disaster Risk Reduction 5-56

List of Acronyms

ADB	Asian Development Bank
ADRC	Asian Disaster Reduction Center
BBB	Build Back Better
BCM	Business Continuity Management
BCP	Business Continuity Plan
CARE	Cooperation for American Relief Everywhere
CBS	Central Bureau of Statistics
CDO	Chief District Officer
CDRMP	Comprehensive Disaster Risk Management Program
CEO	Chief Executive Officer
CNDRC	Central Natural Disaster Relief Committee
CSO	Civil Society Organization
DDC	District Development Committee
DDRC	District Disaster Relief Committee
DLPIU	District Level Project Implementation Units
DOA	Department of Archaeology
DOLIDAR	Department of Local Infrastructure Development and Agricultural Roads
DOR	Department of Road
DPRP	Disaster Preparedness and Response Plan
DRMP	Disaster Risk Management Plan
DUDBC	Department of Urban Development and Building Construction
EC	Executive Committee
EMI	Earthquakes and Megacities Initiative
ERAKV	Earthquake Risk Assessment for Kathmandu Valley
GDP	Gross Domestic Product
GESI	Gender Equity and Social Incursion
GFFO	German Federal Foreign Office
GON	Government of Nepal
GTZ	German Technical Cooperation Agency
IASC	Nepal Interagency Standing Committee
ICIMOD	International Center for Integrated Mountain Development
INGO	International Non-governmental Organization
JICA	Japan International Cooperation Agency
KMC	Kathmandu Metropolitan City
KV	Kathmandu Valley
KVDA	Kathmandu Valley Development Authority
KVRP	Kathmandu Valley Resilience Plan
LDRC	Local Disaster Relief Committee
LWS	Lutheran World Service
LSMC	Lalitpur Sub Metropolitan City

MMI	Modified Mercalli Intensity
MOAD	Ministry of Agriculture Development
MOF	Ministry of Finance
MOFA	Ministry of Foreign Affairs
MOFALD	Ministry of Federal Affairs and Local Development
MOHA	Ministry of Home Affairs
MOUD	Ministry of Urban Development
NBC	National Building Code
NDRF	National Disaster Response Framework
NGO	Non-governmental Organization
NPC	National Planning Commission
NPR	Nepalese Rupee
NPO	Non-profit Organization
NRA	National Reconstruction Authority
NRCS	Nepal Red Cross Society
NSC	National Seismological Centre
NSET	National Society for Earthquake Technology
NSDRM	National Strategy for Disaster Risk Management
NUDS	National Urban Development Strategy
OBC	Other Backward Classes
PDCA	Plan-Do-Check-Act
PGA	Peak Ground Acceleration
RC	Reinforced Concrete
RDRC	Regional Disaster Relief Committee
RRNE	Rehabilitation and Recovery from Nepal Earthquake
RSLUP	Risk Sensitive Land Use Plan
SC	Steering Committee
SCF	Save the Children Fund
UMN	United Mission to Nepal
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNDP	United Nations Development Programme
USGS	United States Geological Survey
VDC	Village Development Committee
WCDRR	UN World Conference on Disaster Risk Reduction
WFP	World Food Programme
WMO	World Meteorological Organization

EXECTUTIVE SUMMARY

1. Necessity of Kathmandu Valley Resilience Plan (KVRP)

Nepal is a disaster prone country due to its geographical, geomorphic and meteorological features, including earthquakes, landslides and flooding. Large scale disasters have happened in the past. Most recently, the Nepal Earthquake 2015 caused tremendous human loss and enormous economic, social and cultural damage in the country.

In order to avoid repeating efforts for the recovery and reconstruction from damages, it is important to make preparations for large scale disasters in advance during normal time. This is particularly important in the Kathmandu Valley, which is the capital region, administrative, cultural and economic centre of the country, with a total population of over 2.5 million.

In light of the lessons learned from the Nepal Earthquake 2015, a comprehensive measure against large scale disasters with the possibility of the worst case scenarios would be significantly important. These measures are not only limited within the scope of narrowly defined disaster prevention or reconstruction, but also included a far-sighted development policies for the Kathmandu Valley with an eye on the distant future.

2. What is the KVRP?

Resilience is defined as "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions"[1]. Resilience is, therefore, a comprehensive notion on disaster management, rather than narrow scope of disaster prevention or reconstruction.

Following this definition, the KVRP has the following functions:

- The KVRP is a comprehensive policy framework for disaster prevention and mitigation in preparation for large scale natural disasters that may occur at any moment.
- The KVRP includes vulnerability assessment to large scale natural disasters, and sets priorities and proper measures in advance, with the aim of building land and society resilient to large scale natural disasters.
- In order to avoid repeating efforts for the recovery and reconstruction from tremendous damage after large scale disasters, the KVRP is a preparation of the Build-Back-Better (BBB) concept for large scale disasters in advance during normal times.

[1] 2009 UNISDR Terminology on Disaster Risk Reduction", Geneva, May 2009. Sendai Framework for Disaster Risk Reduction 2015 – 2030, p. 9.

- The KVRP is an overall development guideline for the Kathmandu Valley promoting resilience-related policies and measures.
- The KVRP is a supportive document attached to Strategic Development Master Plan (SDMP) for Kathmandu Valley 2015-2035. The time frame of the KVRP is same with the one of SDMP from 2017 to 2035. Monitoring and updating the plan should be conducted every 5 years by the government.

3. Basic Principles and Goals of KVRP

Mainstreaming disaster risk reduction in the development process is the main task of the KVRP. In this process, existing policies and initiatives, plans and programs should be integrated into the concept of disaster risk management. The KVRP is applied to the concept of "BBB" to understand the underling risks and build appropriate measures for national and local governments.

Damages from large-scale disasters vary depending on the preparedness of society. In order to avoid repeating efforts over years for the recovery and reconstruction from tremendous damage caused by large-scale disasters, it is important to make preparations in advance during normal times. In order to promote initiatives for building Kathmandu Valley resilience, the KVRP adopts four (4) basic principles[2]:

i. Prevent human loss by any means;
ii. Avoid fatal damage to important functions for maintaining administration as well as social and economic systems;
iii. Mitigate damage to property of the citizenry and public facilities; and
iv. Achieve swift recovery and reconstruction.

Based on the basic principles, the operational goals[3] to be achieved are shown as follows:

1) Protect human lives to the utmost extent even in the event of a large-scale natural disaster.
2) Ensure prompt rescue and first-aid activities and provision of medical care from immediately after a large-scale natural disaster.
3) Secure indispensable administrative functions from immediately after a large-scale natural disaster.
4) Secure indispensable information communication functions from immediately after a large-scale natural disaster.
5) Prevent functional disturbance in economic activities even after the occurrence of a large-scale natural disaster.

[2] Government of Japan, Fundamental Plan for Natural Resilience – Creating a Strong and Resilient Country, (June 3, 2014). P. 4.
[3] Ditto, P. 13 - P. 18.

6) Secure minimum networks for electricity, gas, water and sewerage, fuel and transport required for people's lives and economic activities even after the occurrence of a large-scale natural disaster, and seek early recovery of these networks.
7) Prevent any uncontrollable second disaster.
8) Develop conditions that enable swift recovery and reconstruction of local society and economy even after the occurrence of a large-scale natural disaster.

4. Vulnerability Assessment

Under the eight operational goals, the KVRP identifies a number of worst case scenarios that should never happen in the Kathmandu Valley. The worst case scenarios in the operational goals from one to four are exemplified in table below.

Table Worst Events under Operational Goals (4 operational goals)

	Operation Goals		Worst events that should never happen
1	Protect human lives to the utmost extent even in the event of a large-scale natural disaster.	1	A large number of casualties due to large-scale and multiple collapses of buildings and transportation facilities in urban areas.
		2	Collapse of facilities used by the general public.
		3	Prolonged and wide-area flooding in urban areas due to abnormal weather, etc.
		4	A large number of casualties due to a large-scale sediment disaster (deep-seated landslide), etc., which may also increase the vulnerability of the regional land over years.
		5	A large number of casualties due to a delay in evacuation caused by the failure of information transmission, etc.
2	Ensure prompt rescue and first-aid activities and provision of medical care from immediately after a large-scale natural disaster (including responses required in the absence of such activities).	1	Prolonged suspension of supply of food, drinking water and other vital goods, after a large–scale natural disaster.
		2	Concurrent occurrence of isolation of many towns and villages for long periods due to damage of transportation network.
		3	Absolute lack of rescue and emergency activities due to damage to the police, fire services, etc.
		4	Prolonged suspension of energy supply for rescue/emergency and medical activities.
		5	Paralysis of medical services due to damage to and/or severe lack of medical facilities and personnel, and disruption of routes for offering support.
		6	Outbreak of plagues or infectious diseases on a large scale in disaster-affected areas.
3	Secure indispensable administrative functions from immediately after a large-scale natural disaster.	1	A decline in public safety due to deterioration of the functions of local police.
		2	Frequent serious traffic accidents.
		3	Dysfunction of the central government in the capital region.
		4	Significant deterioration of the functions of local governments due to damage to personnel and facilities.
4	Secure indispensable information communication functions from immediately after a large-scale natural disaster.	1	Paralysis and prolonged suspension of information transmission due to suspension of power supply, etc.
		2	Circumstances where various important mail is left undelivered due to prolonged suspension of postal services
		3	Circumstances where disaster information cannot be delivered to people who need it due to suspension of TV and radio broadcasting.

Source: Fundamental Plan for National Resilience – Creating a Strong and Resilient Country, and JICA Project Team

5. Measures to Avoid the Worst Events

- Combine structural measures, such as developing disaster prevention facilities, enhancing the earthquake resistance of facilities and securing replacement facilities, and non-structural measures concerning emergency drills and disaster prevention education, depending on disaster risks and regional circumstances.

- Implement measures in combination of self-help efforts, mutual assistance and public help, with the public sector (central and local governments) and the private sector (residents and private business, etc.) properly cooperating with each other and sharing roles in particularly serious, urgent or dangerous situations.

- Devise comprehensive measures that work for disaster prevention and mitigation in an emergency situation but also are utilized even at normal times.

- Sector measures are: 1) transportation, 2) lifelines (water supply and energy), 3) open space, 4) urban development and land use, 5) housing and building, 6) tourism and cultural heritage, 7) public service delivery and administrative functions, 8) disaster management and human resource development, and 9) partnership with relevant organizations and the private sector.

- KVRP is comprehensive policy guideline and measures to reduce the damage from future natural disasters. It is confirmed that KVRP reinforces the enforcement of relevant policies and plans of the concerned ministries, such as NaPA-2072, Local Self-Governance Act 2055, DRRMP concerned Act: Natural Calamity Act 2039, and SDMP.

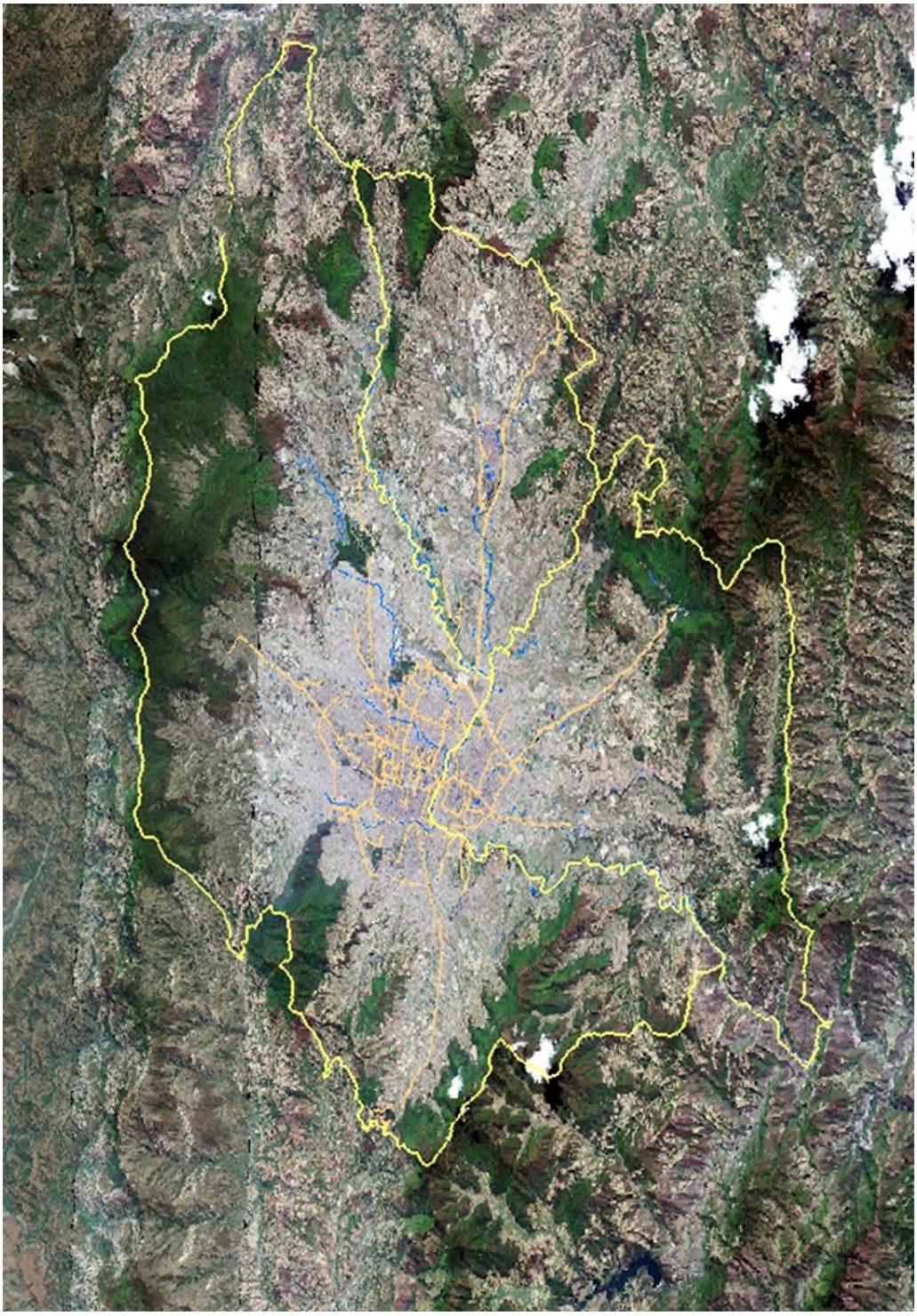

Figure Area of the Kathmandu Valley

CHAPTER 1 INTRODUCTION

1.1 Background

On 25th April 2015, a magnitude 7.8 earthquake hit the central Nepal (USGS 2015). While its epicentre was in the Gorkha District, which is approximately 80 km northwest of Kathmandu, the capital city of Nepal, devastating damage was recorded in fourteen districts across the country, including three districts in the Kathmandu Valley (KV), due to several aftershocks. The total number of deaths was more than 8,800, the number of injuries was 22,000; and there were approximately 602,000 fully damaged and 285,000 partially damaged houses[4]. Moreover, approximately more than 3,300 landslides occurred due to the earthquake and the landslides damaged a large number of roads and bridges.

The Government of Nepal (GON) estimated the total economic damage caused by the earthquake was approximately USD 10 billion, which was more than half of the nation's Gross Domestic Product (GDP) in 2012-2013 (USD 19.2 billion). Furthermore, the estimated real GDP growth of Nepal in 2014-2015 would be 3.8%, which was underestimated by 0.8% as a result of the earthquake[5]. It is expected that the earthquake has caused a serious negative impact to the socio-economy of Nepal.

Under these conditions, JICA dispatched a fact finding mission to Nepal in order to understand the status quo and conduct a needs assessment for the rehabilitation and reconstruction in the country. Then, JICA and the GON agreed on the implementation of the Project on Rehabilitation and Recovery from the Nepal Earthquake. The purpose of the Project is to support the process of early rehabilitation and reconstruction of the affected areas and the formulation of a disaster resilient society by referring to the experience and lessons learned from the disasters in Japan.

In order to formulate a disaster resilient society, JICA supports the preparation of Kathmandu Valley Resilience Plan (KVRP) to emphasize the importance of promoting measures for Building the Kathmandu Valley Resilience. Through incorporating the concept of Build Back Better (BBB)[6], into the KVRP, the Kathmandu Valley would eventually reduce the risk of disaster and provide a more disaster-resilient society in the future.

[4] These data were as of February 2016
[5] It is estimated by the Asian Development Bank.
[6] The concept of BBB is one of the priority actions in the Sendai Framework for Disaster Reduction (2015-2030)

1.2 Incorporating the Sendai Framework for Disaster Risk Reduction (2015 – 2030)

The importance of promoting disaster risk reduction efforts on international, national, local and community levels has been recognized in the UN-World Conference on Disaster Risk Reduction (WCDRR). The third WCDRR was held at Sendai in Japan in March 2015 and Sendai Framework for Disaster Risk Reduction (SFDRR) was endorsed by all the member countries, including Nepal. The SFDRR aims to achieve the following outcome over the next 15 years:

> *"The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries"*[7].

In order to attain the expected outcome, the goal of the SFDRR is as follows:

> *"Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structure, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience."*[8]

In order to achieve these goals, the SFDRR determined the priorities for action in four areas[9]:

Priority 1: Understanding disaster risk
Priority 2: Strengthening disaster risk governance to manage disaster risk
Priority 3: Investing in disaster risk reduction for resilience
Priority 4: Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.

The KVRP follows these priority areas proposed by the SFDRR. In the International Donors Conference held on the 25th of June 2015, two months after the Nepal Earthquake, the Prime Minister of Nepal reiterated the efforts of the government to consider the notion of "Build Back Better" for the entire reconstruction process. It is important to consider future disasters and the need for better managed urban development that is responsive to the increasing population and urbanization of the country, particularly in the capital region of the Kathmandu Valley.

The SFDRR emphasises that resilient recovery and reconstruction are imperative for sustainable development. To maintain a path toward sustainable development, DRR efforts require predictable technical and financial resource commitments for planning, implementation, and performance management. At national levels, governments must have the capacity to develop policies and mechanisms that ensure the integration of disaster risk reduction and sustainable development.

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[7] United Nations , The Sendai Framework for Disaster Reduction (2015-2030), P. 12,
[8] Ditto, P. 12,
[9] Ditto, P. 14

1.3 Necessity of the Kathmandu Valley Resilience Plan

1.3.1 Rationale for the Development of the KVRP

Nepal is a disaster prone country due to its geographical, geomorphic and meteorological features, including earthquakes, landslides and flooding. Large scale disasters have happened in the past. Most recently, the Nepal Earthquake 2015 caused tremendous human loss and enormous economic, social and cultural damage in the country.

In order to avoid repeating efforts for the recovery and reconstruction from damages, it is important to make preparations for large scale disasters in advance during normal time. This is particularly important in the Kathmandu Valley, which is the capital region, administrative, cultural and economic centre of the country, with a population of over 2.5 million in 2011.

In light of the lessons learned from the Nepal Earthquake 2015, a comprehensive measure against large scale disasters with the possibility of the worst scenarios would be necessary. These measures are not only limited within the scope of narrowly defined disaster prevention or reconstruction, but also included development policies for the Kathmandu Valley with an eye on the distant future. Through such initiatives for building a resilient land and society, Nepal can achieve sustainable growth and develop bright future.

The JICA ERAKV project conducted vulnerability assessment for the Kathmandu Valley with three scenario earthquakes. They are: (1) Far-Mid Western Scenario Earthquake, (2) Western Nepal Scenario Earthquake and (3) Central Nepal South Scenario Earthquake. From the view point of disaster management, it is reasonable to set the scenario earthquake to affect more severe than Gorkha Earthquake, Accordingly, the ERAKV selected (3) Central Nepal South Earthquake with correction factor (x2/3) as scenario earthquake for the vulnerability assessment for the KV. The KVRP follows same scenario earthquake as envisaged natural disaster risk in the Kathmandu Valley.

1.3.2 Institutionalization of KVRP

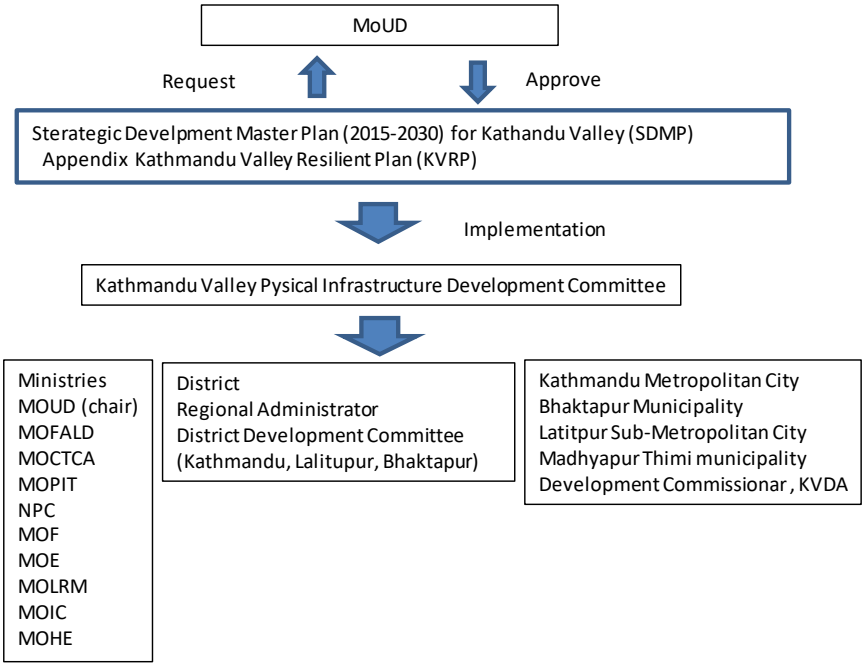
KVRP formulation is a new challenge for Nepal to incorporate the Sendai Framework for Disaster Risk Reduction (2015-2030). There is no legal background for the formulation of the Plan. KVDA is formulating the Strategic Development Master Plan (SDMP) for Kathmandu Valley 2015-2035 based on KVDA act on 1988[10]. The SDMP includes the Comprehensive Physical Development Plan of Kathmandu Valley and addressed disaster management as a strategy of “climate change and disaster risk resilient approach”[11]. After the event of earthquake in 2015, KVDA focused on enhancing ‘resilience’ of cities and prioritized concept of ‘build back better’ (SDMP, p.7-6).

[10] This act was made effective only on 2012 due to overlapping the roles between KVDA and the municipalities given under Local Self Government Act. These overlapping roles had to be clarified and KVDA was given as an authority to be responsible for integrated urban development in the case of Kathmandu Valley as a single ecological planning unit through the KVDA act.

[11] KVDA, Strategic Development Master Plan (2015-2035) for Kathmandu Valley, Chapter 6

After discussion of KVRP's concepts and roles with the KVDA, the KVDA agreed to include KVRP as an Appendix of SDMP for guidance for the construction of safety of Kathmandu Valley for a long term perspective[12]. SDMP is still under reviewed by MOUD for approval and KVRP will be a part of the SDMP.

As for implementation of the SDMP, "KVDA has the major task to prepare and implement a strategic development plan that will provide a basis for constituent local authorities to conduct local level planning in a coordinated and comprehensive manner[13]". Therefore, the SDMP will be referred to as planning guidance for local level planning formulation. Figure 1.3.1 illustrates implementation structure of SDMP and role of KVRP.



Source: Strategic Development Master Plan, Kathmandu Valley Development Authority (KDVA), and JICA Project Team

Figure 1.3.1 Implementation Structure of SDMP and Role of KVRP

KVDA is under MOUD and entrusted to prepare SDMP and development plans in the KV that can be used as a basis to control urban growth. Local authorities are under MOFALD and their roles and functions are prescribed by the Local Self Government Act. Some confusions and duplications make difficulty to implement SDMP in a proper systematic manner. Accordingly, KVDA with relevant ministries and local authorities work together for achieving resilient society. With the recent transformation to a federal government system, KVDA also needs to be recognized as a federal/ regional agency.

[12] Minutes of Meeting of the 2nd Joint Coordination Committee Meeting held on April 20, 2017
[13] KVDA, Strategic Development Master Plan (2015-2035) for Kathmandu Valley, Chapter 7

1.3.3 Functions of the KVRP

According to UNISDR, resilience is defined as "*the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of the hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions*"[14]. This definition implies that resilience is a more comprehensive notion on disaster management, rather than narrow scope of disaster prevention or reconstruction.

The KVRP is defined as the following:

- The KVRP is a comprehensive policy framework for disaster prevention and mitigation in preparation for large-scale natural disasters that may occur at any moment.
- The KVRP includes vulnerability assessment to large-scale natural disasters, and sets priorities and proper measures in advance, with the aim of building land and society resilient to large-scale natural disasters.
- In order to avoid repeating efforts for the recovery and reconstruction from tremendous damage after large-scale disasters, the KVRP is a preparation with the BBB concept for large scale disasters in advance during normal times.
- The KVRP is an overall development guideline for the KV promoting resilience-related policies and measures.

1.4 Development Mechanism of the KVRP

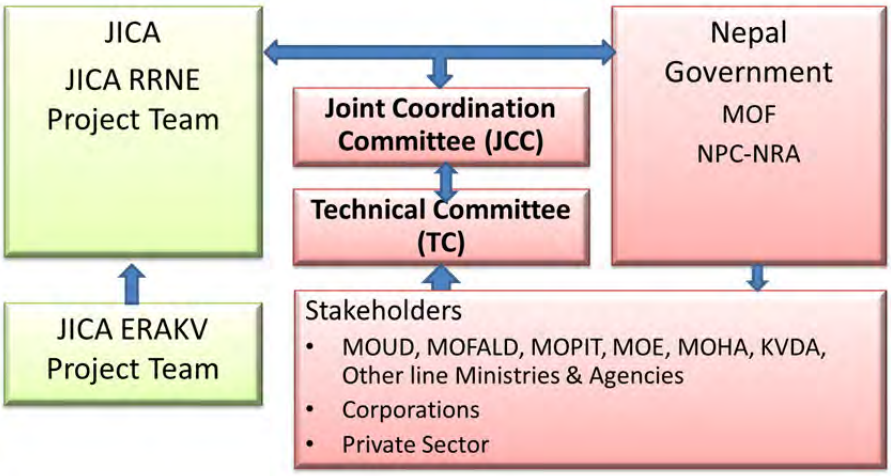
The KVRP was developed by the initiative of JICA project team with the coordination of the Government of Nepal. The overall organization structure for development of the KVRP is shown in Figure 1.4.1.

Envisaged natural disaster risk analysis in the KV is based on the results of the JICA project for the Assessment of Earthquake Disaster Risk for the Kathmandu Valley (ERAKV). For the purpose of the preparation of the KVRP, a technical committee headed by the National Reconstruction Authority (NRA) was established. The JICA Project Team contributed input in various stages of the KVRP development process. The technical committee members are shown below:

- National Reconstruction Authority (NRA)
- National Planning Commission (NPC)
- Office of the Prime Minister and Council of Ministers (OPMCM)
- Ministry of Water Supply and Sanitation (MOWSS)
- Ministry of Urban Development (MOUD)
- Ministry of Federal Affairs and Local Development (MOFALD)

[14] UNISDR, Terminology on Disaster Risk Reduction, Geneva, May 2009; Sendai Framework for Disaster Risk Reduction (2015 – 2030), p. 9.

- Ministry of Physical Infrastructure and Transportation (MOOIT)
- Ministry of Home Affairs (MOOA)
- Ministry of Energy (MOE)
- Ministry of Supplies (MOS)
- Ministry of Defence (MOD)
- Ministry of Information and Communication (MOIC)
- Ministry of Industry (MOI)
- Ministry of Education (MOED)
- Ministry of Culture, Tourism and Civil Aviation (MOCTCA)
- Kathmandu Valley Development Authority (KVDA)



Source: JICA Project Team

Figure 1.4.1 Organization Structure for Development of KVRP

1.5 Organization of the KVRP

The KVRP consists of six chapters as outlined below:

Chapter 1 present's background of the JICA supported Project on Rehabilitation and Recovery from Nepal Earthquake (RRNP). The KVRP is one of the outputs of the RRNP. In corporation with the Sendai Framework for Disaster Risk Reduction, the KVRP aims to build resilient land and society with the concept of BBB.

Chapter 2 analyses the current situation of Kathmandu Valley, including natural, socio-economic characteristics and the administrative structure. It also gives a brief explanation of the existing institutional and planning systems for the Kathmandu Valley and key national policies for urban development and disaster management.

Chapter 3 discusses the envisaged natural disaster risk in the KV based on the results of JICA project for Earthquake Risk Assessment for the Kathmandu Valley (ERAKV). This chapter also discusses the

basic concept of the KVRP, including vision, goals, target year and basic policies for promoting initiatives for building the KV resilience.

Chapter 4 provides methodology of vulnerability assessment based on worst case events that should never happen in the KV. The worst case scenarios are referred to the lessons learned from disasters in Japan. The results of the vulnerability assessment are shown in Appendix-1.

Chapter 5 presents guiding principles and countermeasures to avoid the worst events caused by envisaged natural disaster. The countermeasures include sectoral measures and cross sectoral measures as well as structural and non-structural measures. It further explains key proposals by sector.

Chapter 6 presents recommendation and conclusion, including monitoring process of the KVRP.

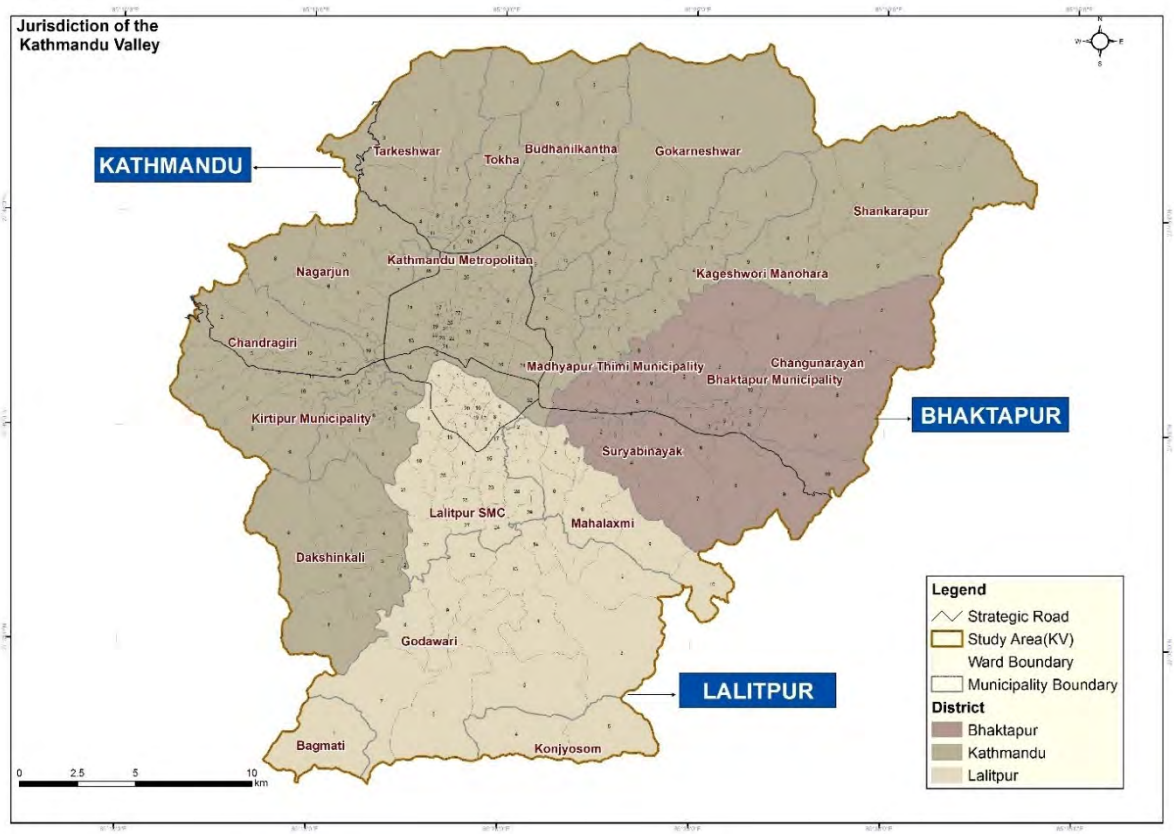
CHAPTER 2 SITUATION ANALYSIS OF THE KATHMANDU VALLEY

2.1 Overview of the Kathmandu Valley

2.1.1 Administration Structure

Since its declaration as a federal republic in 2008, Nepal has been using three government levels; federal government, district governments and local governments (either municipalities or Village Development Committees (VDC)). According to new Constitution of Nepal 2015, the country was administratively divided into seven Provinces and 77 Districts. There is no provincial government until now.

The Kathmandu Valley is the capital region, which includes three districts: Kathmandu, Bhaktapur and Lalitpur Districts. It covers an area of 721 sq. km. covering entire Kathmandu and Bhaktapur districts and approximately 50% land area of Lalitpur district. There are 22 municipalities in the KV. The Kathmandu Valley Development Authority (KVDA) was formally established in 2012 under the Kathmandu Valley Development Authority Act. The KVDA is responsible for formulation of urban planning and land use regulation in the KV.



Source: Central Bureau of Statistics (CBS)

Figure 2.1.1 Jurisdiction of the Kathmandu Valley

2.1.2 Natural Condition

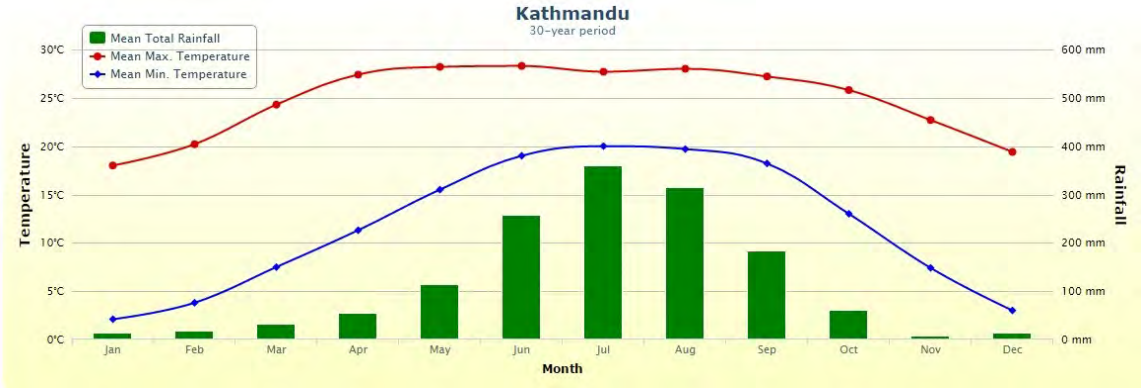
(1) Geology and Topography

Nepal is a landlocked country, surrounded by India and China. It is located in the middle of the Hindu-Kush Himalayan Region with decreasing elevations from north to south: the highest altitude is 8,848 meters from the mean sea level at Mt. Everest in the north and the lowest is 60 meters at Jhapa in the south. Nepal is known for three geographic regions, i.e., Mountain, Hill and Terai.

The Himalayas is one of the highest mountain ranges that Nepal has, and it is considered as one of the most active fragile mountain ranges in the world. This is because it still has been rising through the continental collision between the Indian and Eurasian Plates, and the rocks of the Himalayas are geologically weak. The frequent seismic movement and monsoon rainfalls make the mountain range even more prone to landslides. Thus, Nepal, which includes the Kathmandu Valley, is considered extremely vulnerable to land-related disasters, such as earthquakes and landslides.

(2) Weather and Climate

There are various climate types in Nepal. The World Meteorological Organization (WMO) describes that the Kathmandu Valley is in a mild subtropical climate with an average high temperature is around 27C from April to September and the average low temperature is below 5C from December to February (WMO 2014). There are four seasons in KV, winter, spring, summer and fall (rainy season). During the rainy season, the KV experiences an average rainfall of 20cm to 35cm (WMO 2014). Although spring is mild, summer can be humid and winter can be severe and cold.



Source: WMO 2014

Figure 2.1.2 Average Monthly Temperature and Precipitation in Kathmandu

2.1.3 Socio-economic Framework

(1) Population

According to the National Census, Nepal had a total population of 26.5 million in 2011 and the overall annual growth rate was 1.44% during the period between 2001 and 2011. The total population

of the Kathmandu Valley was about 2.5 million in 2011, which include 1.7 million in the Kathmandu District, 305,000 in the Bhaktapur District and 468,000 in the Lalitpur District. The Kathmandu Valley occupies 9.5% of the national population. The population figures increased significantly in the last decade especially in the KV. The annual population growth rates were 6.12% in Kathmandu District, 3.51% in Bhaktapur District and 3.86% in Lalitpur, which were significantly higher than the national average of 1.44% during the period (CBS 2011).

Table 2.1.1 Population and Population Growth Rate by District in the KV

	Population		Ratio in Nepal	Annual Population Growth Rate
	2001	2011		
Nepal	23,151,423	26,494,504	100%	1.44%
3 Districts	1,645,091	2,517,023	9.50%	5.30%
Kathmandu	1,081,845	1,744,240	6.58%	6.12%
Bhaktapur	225,461	304,651	1.15%	3.51%
Lalitpur	337,785	468,132	1.77%	3.86%

Source: National Population and Housing Census 2011, CBS

The future population by district was estimated in the Census 2011, in which the total population will increase from 2.5 million in 2011 to 3.3 million in 2021 and 3.8 million in 2031. The annual population growth rates in the KV are much higher than the national average during the period.

Table 2.1.2 Population Projection from 2016 to 2031 by District in the KV

	2011	2016	2021	2026	2031
Nepal	26,494,504	28,431,494	30,378,055	32,144,921	33,597,032
3 Districts	2,517,023	2,877,255	3,264,532	3,565,726	3,845,746
Kathmandu	1,744,240	2,011,978	2,309,890	2,522,103	2,729,056
Bhaktapur	304,651	340,066	377,660	408,472	436,533
Lalitpur	468,132	525,211	585,982	635,151	680,157

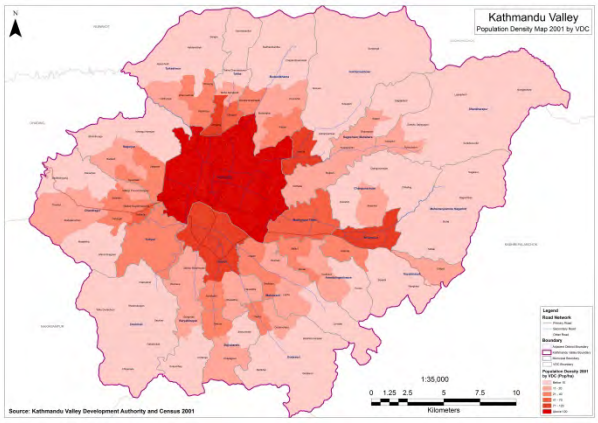
Source: National Population and Housing Census 2011, CBS

(2) Population Density

The population densities in 2011 are: 44.16 people per hector for the Kathmandu District, 25.66 people per hector for the Bhaktapur District, and 12.16 people per hector for the Lalitpur District (CBS, 2011). Figure 2.1.3 and Figure 2.1.4 show the population density by municipalities/VDCs in 2001 and 2011, respectively. In 2001, Kathmandu Metropolitan City (KMC) was the only municipality with a population density of more than 100 people per hector. In 2011, the number of municipalities/VDCs with a population density of more than 100 people per hector increased to seven municipalities/ VDCs. They are KMC (197 people per hector), Bhaktapur Municipality (125 people per hector), Lalitpur Sub-metropolitan City (LSMC) (146 people per hector), and four other VDCs.

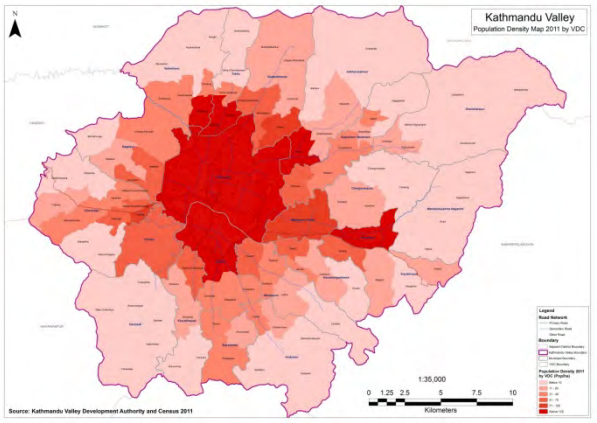
Although all of them are located around KMC, Bhaktapur Municipality is the only one located relatively far from KMC,

Comparing the population densities between 2001 and 2011, the number of municipalities/VDCs with a population density higher than eleven people per hector increased from 54 to 61. This pattern shows clearly that urbanization has rapidly expanded to the outskirts of KMC. Additionally, the overall population densities have increased in most of the municipalities/VDCs from 2001 to 2011.



Source: National Population and Housing Census 2001, CBS

Figure 2.1.3 Population Density by Municipality/VDC in KV, 2001



Source: National Population and Housing Census 2011, CBS

Figure 2.1.4 Population Density by Municipality/VDC in KV, 2011

(3) Human Development Index

According to the "Nepal Human Development Report 2014 -Beyond Geography Unlocking Human Potential-" by the National Planning Commission (NPC), the Human Development Index (HDI) of Nepal was 0.490 in 2014, whereas the HDIs in Kathmandu, Bhaktapur, and Lalitpur districts were 0.632, 0.573, and 0.601, respectively. These figures indicate that the HDI in the KV are higher than the national average. Some of the measures that determine the HDI levels are explained as below.

- The average life expectancy at birth in Nepal was 68.60 in 2011. Although for Bhaktapur (70.48) and Lalitpur (70.3) it was longer than the national average, the one for the Kathmandu District was slightly shorter (68.55).
- The adult literacy rates in the KV are higher than that of the national rate (59.57%). The Kathmandu District had the highest adult literacy rate of 84.04%, while Lalitpur district was the second highest with 79.68% and the Bhaktapur District was the fourth highest with 78.13%.
- The average schooling years in Nepal are only 3.90 years. The average schooling years in the KV are much longer (7.05 years in Kathmandu District, 6.19 years in Bhaktapur District and 6.47 years in Lalitpur District). These figures imply that the residents in the KV are more likely to continue their education than those in other areas of the country.

(4) Society

The Nepalese are known for their multi-ethnic, -linguistic, and -religious cultures and societies. In the National Census 2011, 125 caste/ethnic groups were reported. Among those, the largest number of the population is ethnically classified as Chhetri (4.4 million or 16.6% of the total population), followed by Brahman-Hill (12.2%), Magar (7.1%), Tharu (6.6%), Tamang (5.8%), Newar (5.0%) and so on.

In the KV, the caste/ethnic composition of each district is slightly different from the national average. All three districts in the KV seem to have larger ratios of Brahman-Hill and Newar population than Chhetri.

Brahman-Hill is known in Nepali as Bahuns, who inhabit in middle hill areas. Bahuns itself is categorized into two groups: Purbiya (eastern) and Kumai: whereas both of them are further categorized into many other sub-caste. Traditionally, Brahmin caste is priests, educators and preachers of Hinduism. This caste follows Hinduism culture, rituals and festivals. Brahmans act as family priests, as well as officiate at shrines and temples and at rituals associated with major festivals. They are also engaged in other occupations like farming, agriculture, business, teaching etc. Besides that they have a high literacy rate and often being engaged in government offices.

Newar is the historical inhabitants of the KV. They are known for their contribution to culture, art, literature, trade and cuisine. They are highly specialized in agriculture, farming, making clay pots, stone sculpture, wood carving, making metal statues, architecture, painting etc. Fine brickworks and wood carving are the marks of Newar architecture. Some of the examples are temples, stupas, monuments in Kathmandu, Lalitpur and Bhaktapur Dubar Squares.

Though the poverty ratio of Urban Kathmandu (11.47 %) is lower than in Nepal (25.16 %), urban poverty is becoming more pervasive (Poverty in Nepal 2010/11, CBS). According to UNSD, the proportion of the urban population living in slums has been increased from 1.2 million in 1990 to 2.8 million in 2014. They are more vulnerable against disasters due to location of slums in marginal area, and the poor quality of housings.

(5) Economy and Industry

According to the World Factbook[15], Nepal's estimated GDP (purchasing power parity) was $67.14 billion in 2014, which was increased by about $3.5 billion from 2013. The per capita GDP was $2,400 in 2014, which was ranked 199th in the world. It can be said that Nepal is one of the poorest countries in the world.

Some of the major industries in Nepal are tourism, carpets, textiles, small rice, jute, sugar, oil seed mills, cigarettes, as well as cement and brick production. The World factbook reported that the GDP of Nepal in 2014 was generated in the following sectors: 30.7% of the GDP from the primary sector, 13.6% from the secondary sector, and 55.7% from the tertiary sector (CIA 2014). Rate of tourism in

[15] https://www.cia.gov/library/publications/the-world-factbook/geos/np.html

GDP was 8.1% in 2015, and is forecast to rise by 6.5% in 2016, and to rise by 5.0% pa to 9.5% of GDP in 2026. (Travel & Tourism Economic Impact 2016 Nepal)

On the other hand, according to the National Census 2011, about 64.3% of the total population engaged in the primary sector, 9.3% in the secondary sector and 20.8% in the tertiary sector in 2011 (CBS 2014).

2.1.4 Road and Transport Network

Table 2.1.3 shows the road length by classification in the Kathmandu Valley. The KV has 2,002.84 km of roads in total, including 516.27 km of Strategic Road Network (SRN), 159.97 km of urban roads, and 1326.60km of rural roads. The SRN, which runs through entire Nepal, is identified by the Department of Road (DOR), and links major cities/towns and adjoins districts. The District Transport Infrastructure Coordination Committee (DTICC) in coordination with District Development Committee (DDC) identified 72 rural roads with a length of 433.33 km as District Road Core Network (DRCN), and the remaining 893.27 km were classified as village roads. The DRCN is the important network within a district serving areas of production and markets, and connecting with each other or with the main highways. Meanwhile, road network has been updated including the Kathmandu Outer Ring Road (39 km), which will pass through major suburb core areas of the Kathmandu Valley.

Table 2.1.3 Road length by Classification and by District in the Kathmandu Valley

(km)

Road Classification	Road length in the KV	By type of surface			By district		
		Black Top	Gravel	Earthen	Road length in Kathmandu	Road length in Bhaktapur	Road length in Lalitpur
Strategic roads (SRN)	516.27	315.74	86.03	114.50	267.79	115.09	133.39
Urban roads	159.97	140.51	2.50	16.96	97.26	6.10	56.61
Rural roads 1 (DRCN)	433.33	145.12	100.47	187.74	209.52	21.15	202.66
Rural roads 2 (Village roads)	893.27	131.98	203.75	557.54	503.71	171.05	218.50
Total	2,002.84	733.35	392.75	876.74	1,078.29	313.39	611.16

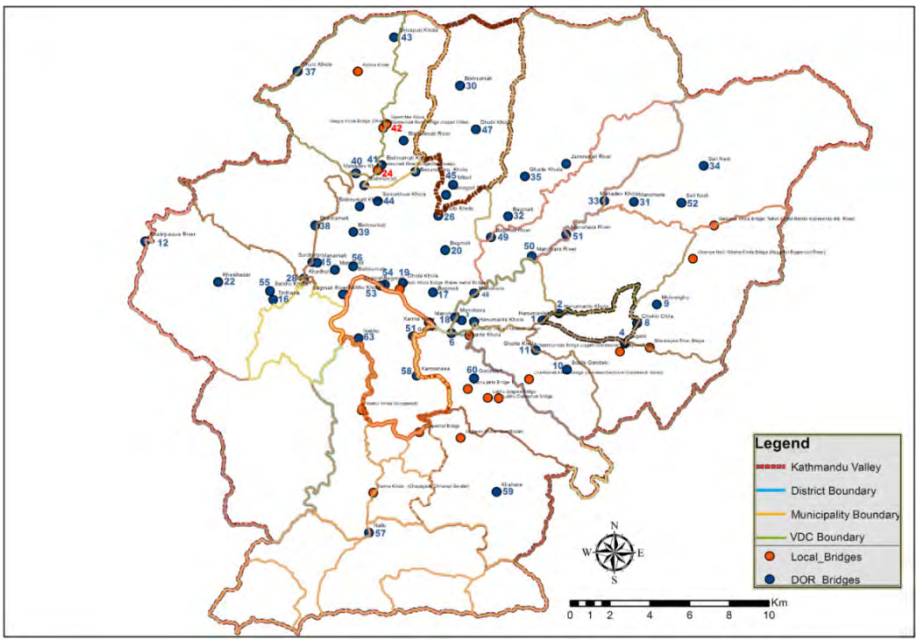
Source: District Transport Master Plans (DTMP) of Kathmandu District, Bhaktapur District, and Lalitpur District

Regarding the bridges, the DOR has developed the Bridge Management System (BMS) for the improvement in the bridge inventory management, systematic planning and prioritization for the bridge sector investments. According to this database, the total number of bridge is 63. On the other hand, there are 88 bridges along the SRN in the KV. Updating the data of these bridges by DOR in cooperation with the Department of Local Infrastructure Development and Agricultural Roads (DOLIDAR) is necessary. Following table and figure shows the number and location of the bridges described in the DOR database.

Table 2.1.4 Number of Bridges in the KV

Management	Number of Major Bridges	Number of Bridges (Existing Database)
DOR	70	61
DOLIDAR (Local Bridges)	18	2
Total	88	**63**

Source: DOR, DOLIDAR



Source: DOR, JICA Study

Figure 2.1.5 Location of Bridges at Strategic Roads (SRN)

2.2 Kathmandu Valley Development Concept

2.2.1 Kathmandu Valley Development Authority (KVDA)

The KVDA was formed with the primary mandate of preparing and implementing the physical development plan for the KV. It was officially announced on 13th April 2012 and formally started its activities from 27th April 2012. The KVDA was formed under the Kathmandu Valley Development Authority Act 1988, replacing former Kathmandu Valley Town Development Committee (KVTDC). The KVDA is governed by Kathmandu Valley Physical Development Committee (KVPDC), apex body chaired by the Honourable Minister of Urban Development, with members consisting of four other ministers and nine secretaries of the GON, Chief Executive Officers of all municipalities and Chairpersons of three DDCs. The council of Minister's appoints Development Commissioner for KVDA and also the Development Commissioner's for 3 valley districts for 4 years tenure.

The scope of the KVDA is to look after urban development and planning issues in all municipalities and VDCs in the KV. The KVDA's mission is “to establish the Kathmandu Valley as a Safe, Clean,

Organized, Prosperous and Elegant National Capital"[16], which shall promote the idea of liveable city with the synergy and harmonization of nature, society and culture. In an aggregate, KVDA is directly involved in better urban planning and management through plans, actions and coordination within KV.

2.2.2 Strategic Development Master Plan (SDMP) for Kathmandu Valley 2015-2035

The KVDA drafted the Strategic Development Master Plan (SDMP) in 2015 and the plan is the process of obtaining approval from the government. The SDMP addresses the needs of a 'new' envisioned KV, considering the existing and emerging trends of urbanization, environment and the current social and economic situations.

In the context of disaster management, the KVDA developed the Comprehensive Physical Development Plan of Kathmandu Valley which includes following components:

1. Regeneration of Historic Core & Compact Settlement Area
2. Management of Urban Sprawl with the up-gradation and expansion of urban infrastructure
3. Development of New Towns with the provision of new urban infrastructure
4. Preservation of Natural Resources, Cultural and Religious Heritages, Agricultural Land
5. Development of Integrated Urban Services Centre
6. Environmental Protection and Management
7. Management of Open Spaces, Parks, Barren Land
8. River Basin Protection and Management
9. Disaster Risk Reduction and Management
10. Public Private Partnership in Infrastructure Development and Management
11. Promotion and Utilization of Renewable Energy
12. Solid waste management (with SWMTSC, Municipalities)
13. Kathmandu Valley Resilient Plan

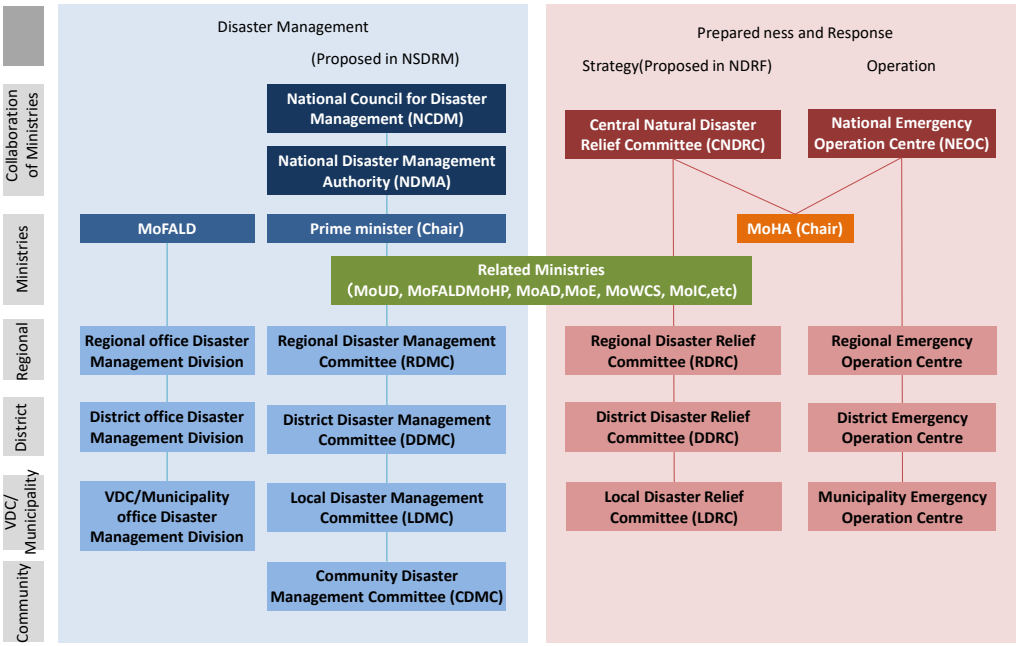
The KVRP is coordinating with the KVDA for aligning the Plan into the SDMP which is guidance for the construction of safety of Kathmandu Valley for a long term perspective.

2.2.3 Disaster Management System at the KV Level

Disaster Management basically concerns about the Pre and Post disaster management. The framework of related organizations to Earthquake Disaster management is summarized in Figure 2.2.1. In the KV, various agencies are responsible for disaster management and planning. Like other districts of the country, all three districts of the KV have District Disaster Relief Committee (DDRC), established under Natural Calamity Relief Act 1982. Each district prepares their own Disaster Preparedness and

[16] SDMP 2015, P1-10

Response Plan (DPRP)[17] and conducts activities as per the plan with local governments. Meanwhile, District Disaster Management Committees (DDMC) under National Strategy for Disaster Risk Management (NSDRM) 2009 of three districts is in charge of disaster management of the Valley. They conduct activities in cooperation with Local disaster management Committees (LDMCs) and Community Disaster Management Committees (CDMCs).



Source: JICA Project Team

Figure 2.2.1 Framework of related organizations

2.2.4 Risk Sensitive Land Use Plan (RSLUP)

The Risk Sensitive Land Use Plan (RSLUP) basically concerns with main streaming of the risk reduction strategies and their implementation actions for creating the safe urban society through risk assessment. The RSULP is prepared to guide the by-laws of the Kathmandu Valley and impose the restriction and development based on the outcomes. The basic concept of RSLUP is to prepare risk sensitive land use plan on the basis of multi-hazard assessment[18]. UNDP's Comprehensive Disaster Risk Management Program (CDRMP) has been supporting for preparation of RSLUP and capacity development of Nepalese planners to main stream risk sensitive planning.

[17] Lalitpur DPRP was prepared in January 2012 by Lalitpur Disaster Relief Committee. Bhaktapur DPRP was prepared in August 2011 by Bhaktapur Disaster Relief Committee

[18] Scenario earthquakes to analyse disaster risk in the KV used by the RSULP are different from the earthquakes used by the JICA study of ERAKV. KV RP is based on the risk assessment conducted by the ERAKV.
In terms of earthquake disasters, the following figures are applied in the RSLUP: Scenario 1: PGA=500-105 (1833 Sindhupalchok Earthquake), Scenario 2: PGA=215-50 (1934 Nepal Bihar Earthquake), Scenario 3: PGA=705-97 (Main Bundary Thrust), Scenario 4: PGA=980-100 (Chobhar Local Earthquake). In Scenario 4, there is possibility that some of the areas may be exposed to larger PGA than that envisaged in the KVRP (see section 3.1.2).

In 2010, Kathmandu Metropolitan City (KMC) under the support from German Federal Foreign Office (GFFO) prepared the RSLUP for KMC with a collaborative undertaking between KMC, the Earthquakes and Megacities Initiative (EMI), the National Society for Earthquake Technology - Nepal (NSET Nepal) and Deutsches Komitee Katastrophen Vorsorge (DKKV). Later in 2015, UNDP/CDRMP supported the KVDA to prepare the RSLUP for the Kathmandu Valley. The project's outcomes are to prepare the comprehensive risk sensitive land use plan for the KV, to develop municipal and VDC level RSLUP in the KV, to revise and update existing by-laws, and to implement capacity development of stakeholders on RSLUP. The vision of RSLUP is "Building Resilient communities through Integrated Development of Kathmandu Valley"[19] with the mission of 'Fostering Sustainable Land Use Management for Heritage Conservation, Social Inclusion and Ecological Balance'[20].

The RSLUP has prepared the guidelines of land use zoning which has to be prepared mandatorily by each municipality or VDC through community participation. The RSLUP provides planning hierarchies with two zones: “Development Zones” are delineated based on their characteristics on density and urban growth; and “Colour Zones” basically reflects level of availability of vacant land yet to be developed. Based on the planning hierarchies mentioned above, he RSLUP provides risk sensitive land use policies and regulations for future development in the KV. Under the basis of prepared RSLUP, the by-laws are updated with building code compliance. It also recommends the institutional setup, roles and responsibilities of different stakeholders for preforming monitoring and evaluation of the RSLUP application. Moreover, the CDRMP in course of preparing RSLUP have organized series of training and capacity building programs to planners, architects and engineers to familiarize with the concept of RSLUP and its implications. The plan is still in draft phase[21] and with the approval from KVDA under cabinet decision, the plan will get legal mandate.

2.3 Key National Act, Policy and Plan

2.3.1 National Development Policy

(1) Three Year National Plan 2013/14 – 2015/16

The Approach paper written by the National Planning Commission (NPC) in July 2013 portrays the long term vision of the Thirteenth Plan as the means to attain the millennium development goals (MDGs) and further development commitments and to promote the status of the country from a least-developed status to that of a developing nation in the next decade.

[19] UNDP, “Kathmandu Valley Risk Sensitive Land Use Plan (RSLUP)”, December 2015, p.50

[20] Ditto, p.50

[21] RSLUP is now under process of approval by the cabinet. According to KVDA, the SDMP will be finalized incorporating with the RSLUP. Under the comprehensive land use plan based on risk assessment by the RSLUP, each municipality in the KV will prepare their risk sensitive land use plans.

Long term vision of the plan is “to upgrade Nepal from a least developed country to a developing country by 2022”

Objective: To bring about a positive change in the living standards of the general public by reducing the economic and human poverty prevalent in the nation Goal: The main goal is to decrease the proportion of the population living below the poverty line to 18%. The plan describes additional goals and indicators in detail.

Strategy: The strategies of the plan will improve key areas in the country that will strengthen the infrastructure, economy, livelihood, and overall circumstances for the population. The developmental planning and the results of the planning will also fortify the resiliency of the population and reduce risk factors against disasters.

1. Achieve inclusive, broad-based and sustainable economic growth by enhancing the contributions of the private, government and cooperative sectors to the development process.
2. Develop physical infrastructure.
3. Enhance access to social services and improve the use and quality of those services.
4. Enhance good governance in the public and other sectors.
5. Empower targeted groups and sectors both socially and economically.
6. Implement development programmes which support climate change adaption.
7. Priorities pursuant to achieving its objective, the Approach Paper to the Thirteenth Plan have identified the following priority areas.
    - Developing hydropower and other energies
    - Increasing the productivity, diversification and commercialization of the agricultural sector
    - Developing the basic education, health, drinking water, and sanitation sectors
    - Promoting good governance
    - Developing roads and other physical infrastructure
    - Developing the tourism, industrial, and trade sectors, and
    - Protecting natural resources and the environment
    - Strengthening Community Level Capacities

(2) National Urban Policy (2064) 2007

The National Urban Policy was approved by the cabinet decision on 2007, whereas it took a whole year continuous consultation and interaction for the finalization. The policy was enacted to address the urban planning and development issues in a coordinated manner. The policy has identified several urban issues of Nepal like, unbalanced urban structures, weak Urban-Rural linkage, environment deterioration, urban poverty, weak municipal institutions, lack of clarity in national policies and so. The policy clearly states the achievement of three basic objectives,

- Development of infrastructure services and direct investment to achieve balanced urban form

- Improve the livelihood of urban population through creation of clean, secure and prosperous urban environment
- To make the local bodies capable of managing urban issues effectively through delegation of the power, institutional strengthening and cooperation between agencies working in urban issues.

The policy stated that the conservation of KV's cultural heritage and develop furthermore as a touristic and city endowed with natural environment. It also states the shifting of activities outside the valley, which do not comply with the above vision (Strategy 3.1.7). In its strategy 3.2.8 it talks about the encouragement to establish well-facilitated compact towns and settlements by discouraging scattered settlements to preserve from the loss of natural resources. The strategy 3.2.9 talks about the establishment of the system, which helps to develop and implement Disaster Management Plan to protect from the probable loss of lives and properties. Furthermore, the policy has also proposed various strategies for effective urban management through institutional capacity building, to implement urban plans and programs, to carry integrated urban planning and monitoring, to develop effective urban management system. Under 24 strategies for achieving target objective, the policy has proposed several working policies for each strategy. Basically in case of urban planning, policy states the formulation of land use plan and guides the development as per the plan. Similarly in case of Disaster Management, the working policies like development of safe and sustainable building construction system affordable to everyone, prohibition of construction in hazard areas, community mobilization in disaster management etc. have been stated.

Similarly, the other urban issues like urban economy, urban environment, urban management, urban system, urban form and structure institutional capacity building etc. have been properly dealt with. However, the policy is silent on the post-disaster management situation and has not pointed on the urban reconstruction and recovery after disaster. It has also missed the important aspect of creating resilient urban area, however, it has well mentioned about the implementation of building codes, disaster preparedness, and community mobilization for disaster management.

(3) National Urban Development Strategy (NUDS) 2017

MOUD compiled the National Urban Development Strategy in 2015 and it was approved by the cabinet in 2017. The objective of the NUDS is to develop medium and long term strategic visions of a desirable national/regional urban system based on existing trends and regional resource potentialities. In the context of disaster management, the NUDS describes major issues of urban safety and resilience as follows: 1) Internalization of safety and resilience issues in urban development and management, 2) Building codes not in place or not enforced in all municipalities and 3) Low level of resilience to different types of hazards, Lack of information on climate change in urban areas of different ecological region. Strategies and activities for assuring urban safety and resilience are shown in Table 2.3.1.

Table 2.3.1 Strategy for Assuring Urban Safety and Resilience

Strategies	Activities
S50. Promote multi-hazard approach in dealing with disasters including climate change	Prepare risk sensitive resource mapping identifying high risk areas in all urban areas based on available information, and existing building regulations
	Develop rapid hazard appraisal technique to identify hazards and prepare multi-hazard map of all urban areas
	Incorporate disaster risk management component in urban development plans
	Generate information on climate change in urban areas of different ecological regions
	Formulate National Adaptation Plan (NAP) on urban settlements and infrastructure
S51. Promote integrated safer settlement	Allow settlement and urban infrastructure development only in safer location having greater comparative advantages—while excluding risk prone and environmentally sensitive areas
	Integrate the complementarity between National Building Code and Building Regulations
S52. Establish system of periodic review to strengthen building code, building regulations and guidelines and planning by-laws on the basis of lessons learnt with mechanisms to enforce and monitor them in all urban areas	Conduct periodic review of building code/regulations/guidelines and planning by-laws
	Increase technical capacity of the local bodies to enforce building code/regulations/guidelines and planning by-laws
	Prepare simplified building guidelines and planning by-laws that can be understood at grass root level
	Facilitate mandatory enforcement and periodic monitoring of land use regulation, building code/regulations/guidelines and planning by-laws in all urban areas
S53. Build back better after any disaster	Prepare guidelines for retrofitting private & public buildings and enhance technical capacity of municipalities to provide retrofitting services
	Provide technical support for safer building practices at household level
	Monitor structural and functional changes in the buildings
S54. Establish institutional framework for DRM	Establish institutional framework and Standing Operating Procedures identifying key actors and their roles and responsibilities for and during any disaster
	Develop adequate capacity, legislative base and financing mechanisms for the institutional framework to function immediately after any disaster
S55. Enhance preparedness and adaptive capacity of the government and local bodies	Develop capacity building tools and training programs
	Enhance human resource and institutional capacity of the government and local bodies
S56. Build awareness and capability of the community and civic bodies based on volunteerism to reduce vulnerability	Prepare awareness material, educative tools and infrastructure and capacity building tools for communities and civic bodies
	Plan and implement appropriate periodic drills through community organizations and civic bodies

Source: National Urban Development Strategy 2017

(4) Local Self Governance Act 1999

The Local Self Governance Act 1999 under MOFALD promotes the concept of local authorities to manage environment-friendly development within the decentralized framework. The Act accentuates the interrelationship between the development process, environment, and disaster and encourages the DDCs, Municipalities, and VDCs to resolve problems through their own action. While the Act empowers local authorities, the associated guidelines and budgetary allocations are lacking.

2.3.2 Disaster Management Act, Policy, and Plan

(1) Natural Calamity Relief Act of 1982

The Natural Calamity Relief Act (also referred to as the Natural Disaster Relief Act) is considered the first well-structured disaster management policy in Nepal. The Act mandates MOHA as the lead agency for immediate rescue and relief work and disaster preparedness activities.

MOHA oversees the overall disaster response activities and coordinates the preparedness and rehabilitation initiatives as deemed by the Work Division Regulation 2064. The Act arranged for the formation of the Central Natural Disaster Relief Committee (CNDRC), Regional Disaster Relief Committee (RDRC), District Disaster Relief Committee (DDRC), and Local Disaster Relief Committee (LDRC). The Act provides Disaster Relief funds for use in disaster response.

(2) National Strategy for Disaster Risk Management, 2009

The foundation of the National Strategy for Disaster Risk Management (NSDRM) by MOHA 2009 is based on the Hyogo Framework for Action (HFA) and the strategy is utilized by the GON as the national framework to protect, grow, and promote national heritage and physical infrastructure. The document incorporates prevention, mitigation, preparedness, response and recovery while designating responsibilities to the Ministries during the different disaster phases. The policy framework, legal provisions, and institutional structures adopted by the government are analysed from a disaster management perspective.

The Long-term Mission of Strategy is to provide guidance and ensure effective disaster management through development, implementation, and effective preparedness for mitigation, disaster risk reduction and occurrence of disasters. The strategy identifies the following sub-categories or sub-missions to help achieve the long-term mission.

1. Develop and restructure institutional structures
2. Strengthen policy-wide and legal arrangements to ensure stakeholders' participation while adhering to an integrated policy and the decentralized implementation process
3. Create an environment which allows the central to household level along with the State to prepare and apply disaster risk reduction and preparedness plans
4. Mainstream disaster reduction into an overall development process together with sectoral development and poverty reduction plans

Five priority actions and associated activities are outlined in the plan.

1. Ensure that disaster risk reduction is a national and local priority with a strong institutional basis for implementation
2. Identify, assess and monitor disaster risks and strengthen an early warning system
3. Improve knowledge management to build a culture of Safety and Resilience
4. Reduce the underlying risk factors

5. Enhance preparedness for effective response. Sector activities are focused on to support the five priorities and disaster preparedness, mitigation and response.

The strategy further describes the challenges of the various hazards, ministry and department roles, sector strategies, the legal framework and formation of organizations in the national, regional, district and local levels.

(3) National Disaster Response Framework (NDRF), 2013

MOHA with technical support from UNDP developed the National Disaster Response Framework (NDRF) 2013 to provide a clear, concise, and comprehensive framework for the country to deliver a more effective and coordinated national response in the event of a large-scale disaster. National disaster response is defined as the "actions taken immediately before, during, and after a disaster or directly to save lives and property; maintain law and order; care for sick, injured, and vulnerable people; provide essential services (lifeline utilities, food, shelter, public information, and media); and protect public property[22]." The framework limits the scope to preparedness and emergency response at the national, regional, district and VDC/local level.

The NDRF succinctly explains the disaster response in the National System, the International Assistance process, the coordination structure for National and International Assistance, Special Operation arrangements and the National Framework.

The NDRF describes the overall framework for the country which integrates the levels of government and committees.

1) District and local level information is received by the lead agencies, and operational activities are conducted according to the matrix which is specified below.
2) The CNDRC, RDRC, and DDRC organize emergency meetings in coordination with Government agencies, international, and national NGOs dependent on the need.
3) The emergency operation centres on the national, regional, district, and municipality levels and will coordinate with the various organizations to foster effective disaster response activities.
4) The Disaster Management Division of MOHA and the identified organizations will support the disaster response management according to mandate and scope.

The NDRF outlines disaster response activities with a time line, operational activities and the responsible lead agency. The activities are described for national and international response.

[22] NDRF, P.3

(4) Act to Provide Reconstruction of the Earthquake Affected Structures

The Legislature-Parliament endorsed the Reconstruction Authority Bill in December 16, 2015 and published it in Nepal Gazette in December 20, 2015 to form An Act to Provide Reconstruction of the Earthquake Affected Structures. The act mandates establishment of National Reconstruction Authority (NRA), the leading agency for the reconstruction of the earthquake-affected structures. The act prescribes that NRA will remain 5 years and will be updated for one additional year depending on the progress of the reconstruction. The act also prescribes the establishment of National Reconstruction Advisory Council (NRAC) and Steering Committee (SC), both of which are chaired by the Prime Minister and the Executive Committee (EC) to execute the reconstruction works, chaired by the government appointed Executive Officer.

The Major roles and responsibilities of NRA assigned as per the act are as follows:

1) Verify the damage and determine the earthquake affected areas
2) Develop, approve and manage prioritized reconstruction programmes and action plans
3) Develop necessary agencies and supervise reconstruction projects
4) Obtain and allocate land for settlement development, land pooling and resettlement
5) Conduct a technical survey for damaged physical structures, order and instruct the removal of physical structure and reimburse the incurred cost as a loan to the government except for those individuals under poor economic conditions
6) Responsible for operational and financial arrangement for housing development and settlement issues
7) Coordinate with stakeholders related to reconstruction among GON, donor agencies such as Non-Governmental Organizations (NGOs) and International Non-Governmental Organizations (INGOs), and Civil Society Organization (CSOs) to implement the programmes
8) Capacity building for the stakeholders of reconstruction activities
9) Fiscal arrangement of the programmes and activities for reconstruction
10) Direct civil servants to conduct necessary activities for executing the functions of NRA

NRA is responsible for the approval of the budget in coordination with the Ministry of Foreign Affairs (MOFA) and Ministry of Finance (MOF) and the use of funds is decided by the EC. The available funds for reconstruction from the Earthquake are as follows:

1) Money received from the Government of Nepal
2) Money obtained from the Prime Minister Natural Disaster Relief Fund
3) Money received from any organizations, institutions, or individuals
4) Money received from foreign individuals, governments or international organizations or institutions in cash or kind, or money received from programmes
5) Money received from any other sources

(5) National Plan of Action for Safer Building Construction (NaPA)-2072 (Draft)

Government of Nepal and Development partners shared the bottlenecks to comply with the National Building Code (NBC) in Nepal due to complex institutional and legal arrangement, financial constraint and low awareness of citizens. In order to design the holistic approach regarding to Safer Building Construction (SBC), Nepal Risk Reduction Consortium (NRRC) Flagship 5 member organizations lead the development of National Plan of Action for Safer Building Construction (NaPA).

Objective of NaPA is to create disaster resilient building structures through different initiatives of Safer Building Construction across the nation and its goal is to mainstream all dimensions of SBC in all levels of governance through internalization, adaptation and enforcement resulting into behavioural change in local community within 20 years timeframe. At the end of 20 years, it is targeted that the entire process and dimensions of SBC will be internalized and put in place in the mind-set of all people and institutions of Nepal.

The specific objectives of the National Plan of Action are:

- To identify the list of works/actions to be carried out across the nations by different agencies at central, district and local level for ensuring Safer Building Construction.
- To devise the various strategies to create conducive environment for implementation of actions outlined in National Plan of Action for Safer Building Construction.
- To prepare a doable, clear and informative National Plan of Action with required timeline, resources and institutional set up.

Table 2.3.2 20-year timeframe for The National Plan of Action for Safer Building Construction

		Phase I			Phase II		Phase III					Phase IV										
		Time Frame																				
STR	Work Stream	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Remarks
A	Immediate earthquake reconstruction and response																					
B	Policy and Regulation																					
C	Codes and Guidelines (Drafting and Revision)																					
D	Risk Sensitive Land Use Planning and Building Bye Laws																					
E	Capacity Building																					
F	Physical Facility Support																					
G	Awareness, Education and Demand creattion																					
H	Internalization, adaptation and Enforcement																					
I	Quality Assurance and Monitoring																					
J	Retrofitting and Regeneration																					

Source: JICA Project Team

For the reconstruction of the 2015 Nepal earthquake affected districts, National Reconstruction Authority (NRA) was established. Safer re-construction of damaged buildings in the affected districts are supported through the mechanism set up at the local level to expedite the reconstruction with

Build Back Better concept. It is expected that many municipalities as well as VDCs are keen to implementing building codes in the aftermath of the earthquake. There will be significant amount of efforts required to support Building Permit System and overall safer building construction.

CHAPTER 3 BASIC CONCEPT OF THE KATHNANDU VALLEY RESILIENCE PLAN

3.1 Envisaged Natural Disaster Risks

In the Kathmandu Valley (KV), an earthquake is predicted to occur in the near future and once such large-scale natural disaster happens, wide area of the KV will be damaged significantly. Therefore, this Kathmandu Valley Resilience Plan (KVRP) is based on vulnerability assessment for envisaged large-scale natural disasters.

This Chapter cites the result of the envisaged natural disaster risks analysis which was conducted by the JICA Project for Earthquake Risk Assessment for the Kathmandu Valley (ERAKV).

3.1.1 Historical Records of Natural Disasters in the KV

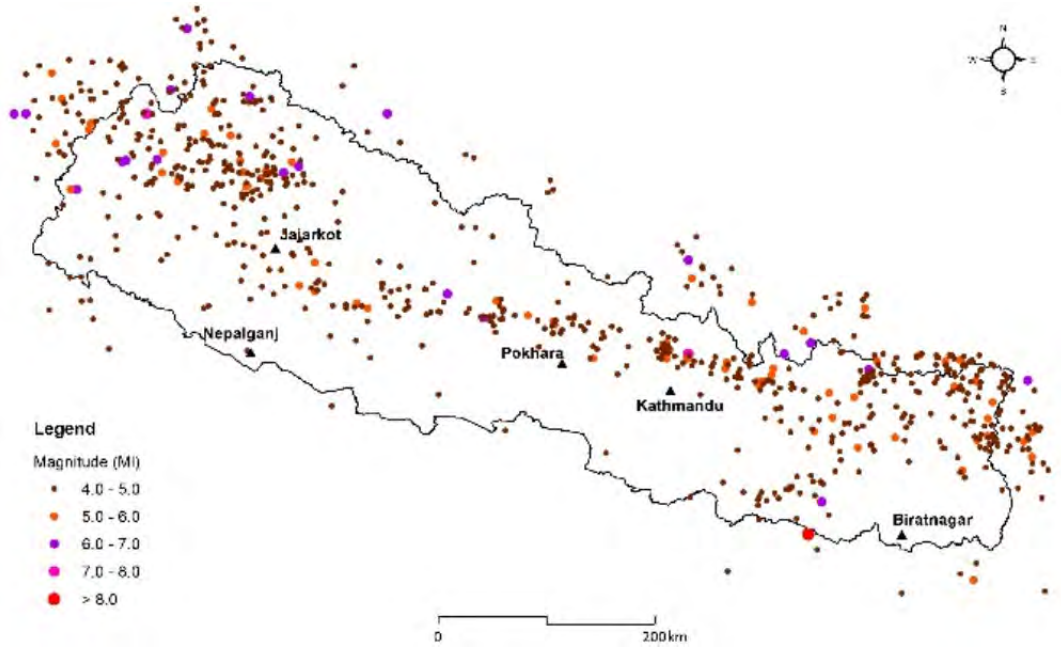
Nepal has experienced various disasters in the past, such as earthquakes, landslides, flooding in the rainy season, wildfires in the dry season, and avalanches and snowstorms in the mountain region.

(1) Earthquake

The National Seismic Centre under the Department of Mines and Geology indicated that one of the oldest earthquakes recorded in Nepal occurred in 1255. The record reported that the earthquake destroyed “many houses and temples and killing one third to one fourth [of the] population in the KV (National Seismic Centre 2011). Then, earthquakes occurred in 1408, 1681 and 1810. Although, most of the historical records did not specify the number of casualties and damaged buildings, one of the largest earthquakes occurred in 1833, which had the estimated magnitude of 7.0, and killed about 7,500 people near the KV. It is also estimated that more than 4,000 houses were destroyed in Kathmandu, Bhaktapur, Patan, and Banepa, and about 18,000 buildings were damaged across the country.

Since the 1800s, there were at least 20 large earthquakes occurred in Nepal[23]. The largest earthquake in the history of Nepal occurred in 1934 with a magnitude of 8.3. Although the epicentre was in eastern Nepal, 4,300 people were killed in the KV (the total death of the earthquake was 8,500). It also damaged more than 2 million buildings including temples. Out of which, 81,000 buildings were completely destroyed. Even in Kathmandu, a total of 55,000 buildings were affected and 12,500 of them were completely destroyed.

[23] Research Centre for Disaster Mitigation of Urban Cultural Heritage of Ritsumeikan University and the Institute of Engineering of Tribhuvan University



Source: JICA Project Team (ERAKV)

Figure 3.1.1 Location of Past Earthquakes (earthquakes (> 4.0 ML) recorded between 1994 and August 2013)

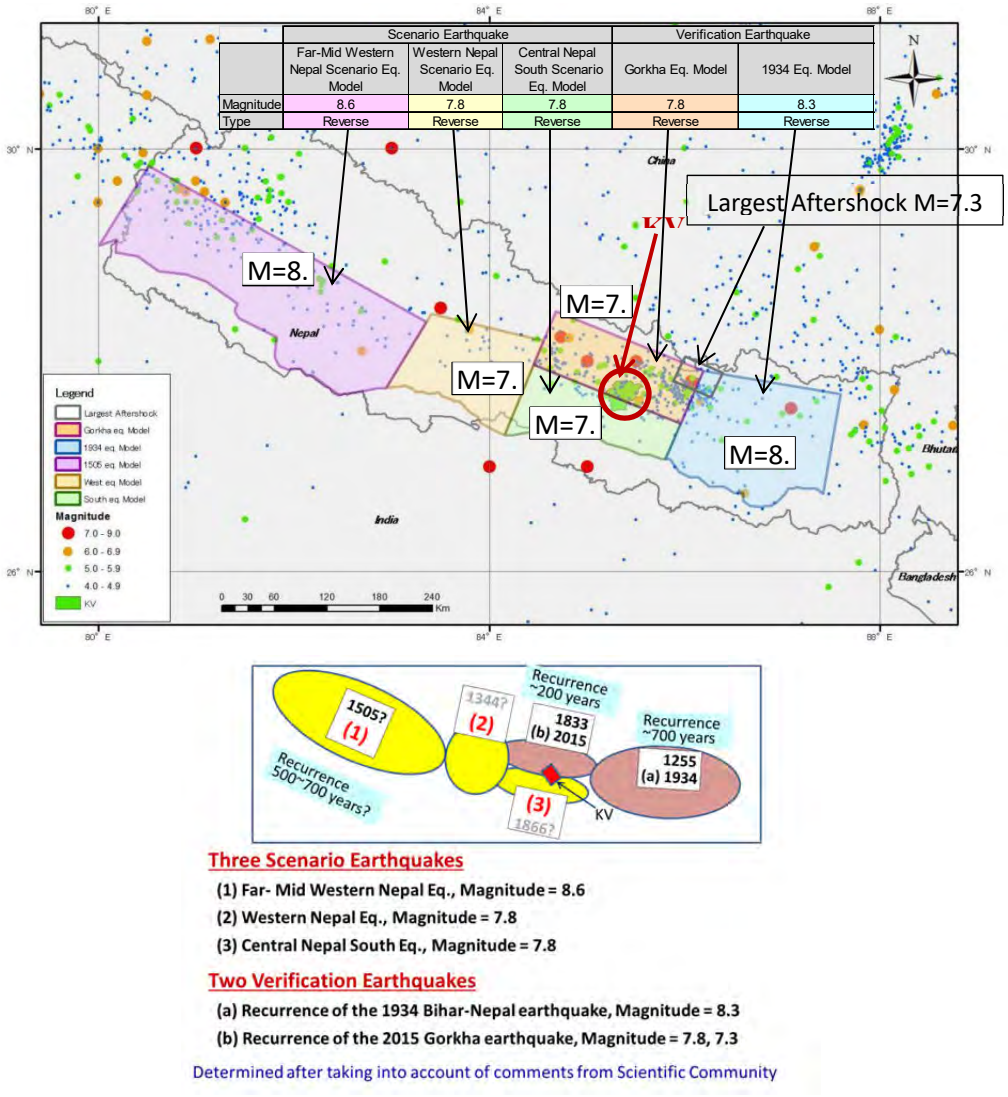
(2) Flooding and landslides

Nepal is prone to landslides and flooding due to its geological and geographical features. There are more than 6,000 rivers and streams which flow with high velocity through the steep and high-angle topography in the country, and the land is covered by unstable soil such as black clay. Additionally, the Himalayan ranges which are covered with snow, and intense rainfall during rainy season has worsened the situation, particularly in the Terai region. Every year, a number of people, agricultural lands and products, and human settlements have been damaged by floods and landslides. For instance, "Nepal experienced a devastating flood in the Terai region in 1993, which took the life of 1,336 people and affected 487,534 people" (MOFALD 1999). Additionally, the flooding in 1999 caused an economic loss of NPR 360 million, while 9,000 families and more than 177 hectors of agricultural lands were affected.

3.1.2 Envisaged Natural Disaster Risk in the KVRP

The ERAKV conducted vulnerability assessment for the KVRP with three scenario earthquakes. They are: (1) Far-Mid Western Scenario Earthquake, (2) Western Nepal Scenario Earthquake and (3) Central Nepal South Scenario Earthquake, and verify (a) Recurrence of the 1934 Bihar-Nepal Earthquake, (b) Recurrence of the 2015 Gorkha Earthquake.

The fault model of scenario earthquakes in the ERAKV is shown Figure 3.1.2.

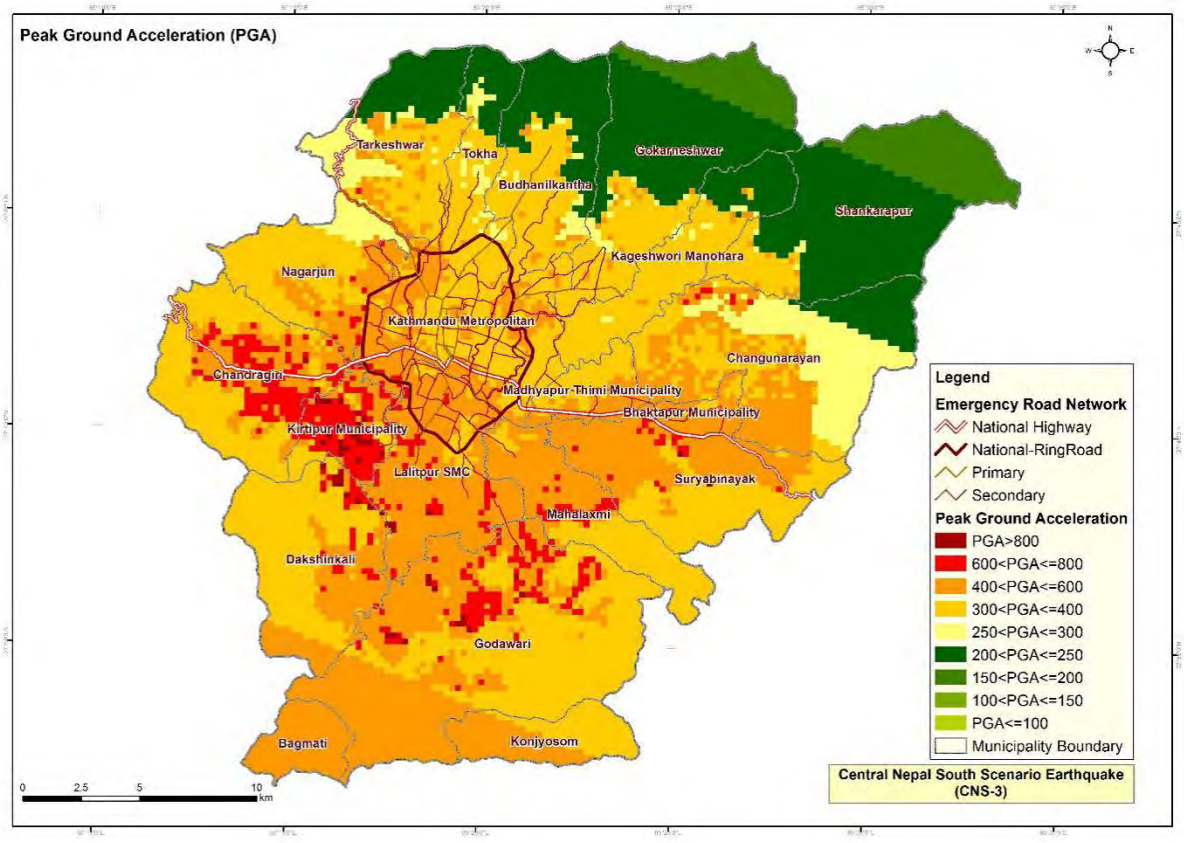


Source: JICA Project Team (ERAKV)

Figure 3.1.2 Scenario Earthquakes Fault Model

The calculations of earthquake motion at peak ground acceleration (PGA) for scenario earthquakes are shown in Figure 3.1.3. The calculated PGA at ground surface for the Gorkha earthquake was 400 ~ 800 gal. The observed PGA was, however, 150 ~ 200 gal. Accordingly, the calculated PGA of Gorkha Earthquake was extremely larger than the observed one. Based on this phenomenon, the ERAKV adopted correction factor for estimation of the earthquake motion in the Kathmandu Valley.

For the Central Nepal South Scenario Earthquake, the source fault is adjacent to the fault of the Gorkha earthquake. Accordingly, the condition of source or path effect to the Kathmandu Valley resembles and the Central Nepal South Scenario Earthquake can be adopted by using the Gorkha earthquake case study. The correction factor (x2/3) was used for PGA calculation for Central Nepal South Scenario Earthquake based on the similarity of the source area to the Gorkha earthquake. The PGA distribution for the KV based on the scenario earthquake is shown in Figure 3.1.3.

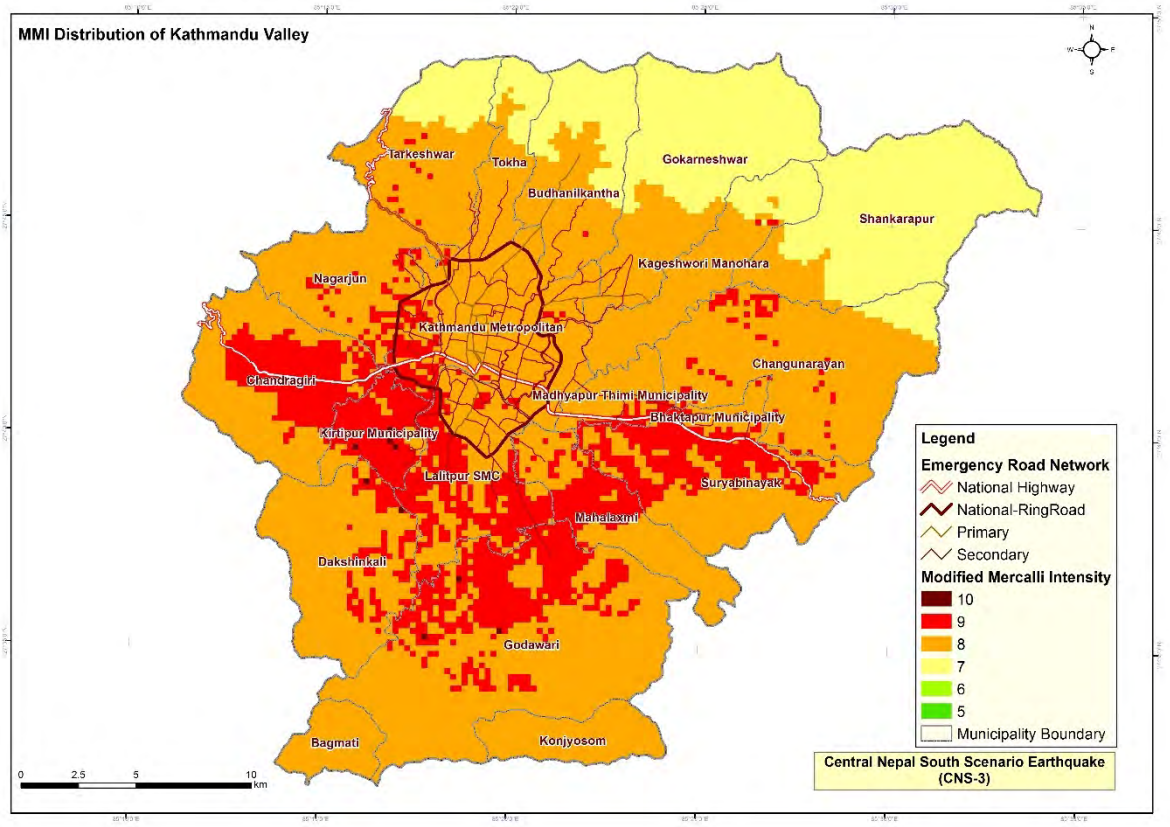


Source: JICA Project Team (ERAKV)

Figure 3.1.3 PGA Distribution of Scenario Earthquake: Central Nepal South Scenario Earthquake (x2/3)

From the view point of disaster management, it is reasonable to set the scenario earthquake to affect more severe than the Gorkha earthquake. Some people may think that important infrastructures including bridges, governmental buildings, schools and hospitals should keep their functions in case of any earthquakes. Accordingly, the Central Nepal South Scenario Earthquake with correction factor (x2/3) is selected as scenario earthquake in the ERAKV. The KVRP follows same scenario earthquake and analyse envisaged disaster risk in the KV.

Seismic intensity is the most popular index of earthquake motion. Among several intensity scales in the world, the MMI (Modified Mercalli Intensity) scale is most popularly used in many countries. Seismic intensity is not directly related to PGA but several empirical relations are proposed. Figure 3.1.4 shows the MMI distribution of the scenario earthquakes used in the KVRP.



Source: JICA Project Team (ERAKV)

Figure 3.1.4 MMI Distribution of the Scenario Earthquakes: Central Nepal South Scenario Earthquake (x2/3)

3.2 Principles of Building the Kathmandu Valley Resilience

3.2.1 Basic Principles

Nepal has been repeatedly hit by a number of large-scale disasters due to its geographical, geomorphic and meteorological features. Large-scale disasters have happened when people least expected them and have caused tremendous human loss and enormous economic, social and cultural damages. Most recently, a magnitude 7.8 earthquake hit central Nepal on 25 April 2015. While its epicentre was in the Gorkha District, which is approximately 80 km northwest of Kathmandu, the Kathmandu Valley (KV) recorded devastating damage due to the several aftershocks. The damages of the earthquake covered residential and government buildings, heritage sites, schools, health posts, rural roads, bridges, the water supply system and agricultural land[24]. Even hundreds of historical and cultural monuments were destroyed or suffered extensive damage.

Damage from large-scale natural disasters varies significantly depending on the preparedness of society. In order to avoid repeating ex post facto measures, i.e., making efforts over years for the

[24] National Planning Commission, "Nepal Earthquake 2015: Post Disaster Needs Assessment", 2015

recovery and reconstruction from tremendous damage after being hit by large-scale disasters, it is important to make preparations in advance during normal times.

In view of the lessons learned from the Nepal Earthquake 2015, it is needed to prepare a comprehensive policies and measures to avoid the possibility of the worst case scenarios caused by large-scale natural disasters, incorporating land development policy in the Kathmandu Valley. These measures are not limited within the scope of narrowly defined disaster prevention, but include a far-sighted development policy with an eye on the distant future. Through such initiatives, the Kathmandu Valley can overcome disaster risks and achieve sustainable growth.

The KVRP promotes initiatives for building the Kathmandu Valley resilience with the aim of creating a safe and secure land and society. The basic principles of the KVRP are, therefore, as follows:

i. Prevent human loss by any means.
ii. Avoid fatal damage to important functions for maintaining administration as well as social and economic systems.
iii. Mitigate damage to property of the citizenry and public facilities.
iv. Achieve swift recovery and reconstruction.

Through promoting public-private initiatives to promote the secure social and economic systems that will never dysfunction in any event, the lives and property of residents and social and economic activities should be protected. At the same time, both the public and private sectors need to enhance their capacity to address changes in circumstances and increase their productivity and efficiency. Such initiatives will also contribute to Nepal's economic growth. .

3.2.2 Vision

The KVDA formulated Strategic Development Master Plan (SDMP) for the Kathmandu Valley (2015-2035). The vision of the SDMP is [to achieve] "Kathmandu Valley: A Liveable Region by Enhancing the Interdependence of Nature, Community and Culture"[25]. This vision is further elaborated through the mission "to establish Kathmandu Valley as a Safe, Clean, Organized, Prosperous and Elegant National Capital"[26]. The vision and mission of the SDMP clearly mentions that safety of peoples' life and property from natural disasters is one of the priority actions to be achieved in the Kathmandu Valley for the next 20 years.

Mainstreaming disaster risk reduction in the development process is the main task of the KVRP. In this process, existing policies and initiatives, plans and programs should be integrated into the concept of building resilient land and society. The KVRP indicates the policy framework for disaster risk management in all stages of disaster management cycle, including preparedness, mitigation,

[25] KVDA, Strategic Development Master Plan (SDMP) for the Kathmandu Valley (2015-2035), p. 1-10.
[26] Ditto, p. 1-10

response, relief, and reconstruction from envisaged large-scale natural disasters. The KVRP applies to the underling risks and build appropriate measures in federal, district and local governments.

In order to promote measures for disaster prevention and mitigation in large-scale natural disasters, it is necessary to conduct vulnerability assessment to large-scale natural disasters, set priorities and take proper measures in advance, with the aim of building the Kathmandu Valley resilient to large-scale natural disasters. At the same time, it is necessary to increase the capacity of residents so that they can protect themselves and their lives by themselves.

3.2.3 Goals

Based on the basic principle and vision for the KVRP, the operational goals to be achieved are shown as follows:

1) Protect human lives to the utmost extent even in the event of a large-scale natural disaster.
2) Ensure prompt rescue and first-aid activities and provision of medical care from immediately after a large-scale natural disaster.
3) Secure indispensable administrative functions from immediately after a large-scale natural disaster.
4) Secure indispensable information communication functions from immediately after a large-scale natural disaster.
5) Prevent functional disturbance in economic activities even after the occurrence of a large-scale natural disaster.
6) Secure minimum networks for electricity, gas, water and sewerage, fuel and transport required for people's lives and economic activities even after the occurrence of a large-scale natural disaster, and seek early recovery of these networks.
7) Prevent any uncontrollable second disaster.
8) Develop conditions that enable swift recovery and reconstruction of local society and economy even after the occurrence of a large-scale natural disaster.

3.3 Target Year of the KVRP

The KVRP proposes a comprehensive policy framework for disaster prevention and mitigation in preparation for envisaged large scale natural disasters that may occur at any moment. The time frame of the KVRP the same as SDMP[27] from 2017 to 2035. Monitoring and updating the plan should be conducted every 5 years by the relevant government agency with participation of relevant stakeholders.

[27] The time frame of SDMP is 20 years from 2015 to 2035.

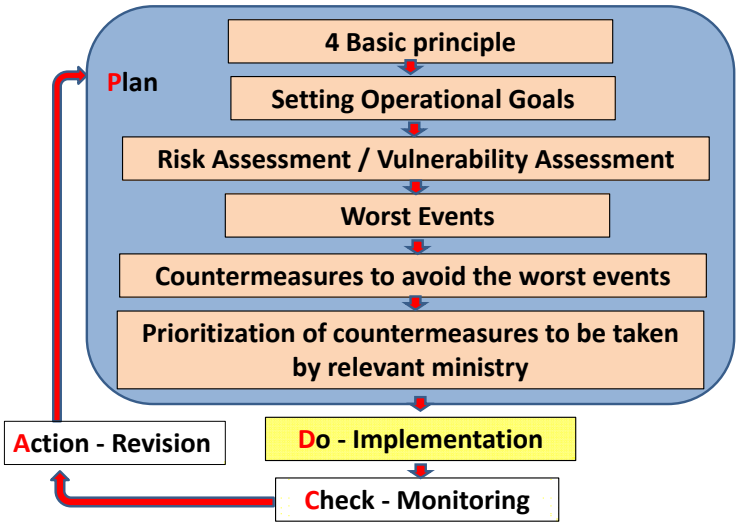
3.4 Update Disaster Management Policies and Measures

Disaster management policies and measures must be periodically reviewed and updated, which include:

a. Monitoring the disaster management policies and measures, vulnerability assessment methods, introducing progress management such as PDCA (Plan-Do-Check-Act) cycle as illustrated in Figure 3.4.1;

c. Developing a policy and standards for recovery of roads and bridges following an earthquake disruption; and

d. Indicating the number of hours/days that people in a community can expect to wait before major relief arrives, and the number of days/months that people can expect to wait before the restoration of roads and municipal services.



Source: JICA Project Team

Figure 3.4.1 PDCA Cycle in KVRP

3.5 Measures for Building the Kathmandu Valley Resilience

Based on the principles of the Kathmandu Valley resilience, initiatives for making the KV more resilient to large-scale natural disasters can be promoted, utilizing the experience obtained through the Nepal Earthquake 2015 and other disasters. Such initiatives will contribute to disaster prevention and mitigation, swift recovery and reconstruction from disasters and enhancement of Nepali sustainable economic growth.

Envisaged disaster risk may affect the lives of the residents and the economy in the Kathmandu Valley. Earthquakes are predicted to occur in the near future and once such large-scale natural disasters happen, a wide area of the KV will be damaged significantly. Therefore, this KVRP aims to promote

federal government, in collaboration with local governments and the private sector, for building the Kathmandu Valley resilience against large-scale natural disasters in advance. In order to promote resilient land and society, the following measures should be considered.

3.5.1 Measures for Building the Kathmandu Valley Resilience

1) Implement measures to avoid the worst events caused by envisaged disaster that should never happen.
2) Develop measures in terms of a long-term perspective.
3) Encourage economic growth by strengthening resilience to disasters.
4) Enhance resilience and recovery power by strengthening social and economic systems.
5) Implement measures by using the power of government and systems of private sector and society.

3.5.2 Combination of Measures

1) Promote measures by combining structural and non-structural measures. The structural measures include developing disaster prevention facilities, enhancing the earthquake resistance of facilities and infrastructure. The non-structural measures include implementation of emergency drills, disaster prevention education, and developing a social system in disaster management.
2) Combine measures of self-help efforts, mutual assistance and public help, with the collaboration of public sector (the central and local governments) and the private sector (residents and private sectors) properly cooperating with each other and sharing roles particularly in serious, urgent or dangerous situations.
3) Devise comprehensive measures to work effectively not only for an emergency period but also even for normal times.

3.5.3 Promotion of Measures in an Efficient Manner

1) Prioritize measures to be implemented, taking into account regional characteristics, such as a rapid urbanization in the KV. It is also important to prioritize relevant measures through the effective use of limited financial sources.
2) Utilize private sector to maximize the effect by use of limited financial sources.
3) Contribute to effective and efficient maintenance and management of facilities.
4) Promote building consensus among relevant stakeholders.

5) Promote research and development based on scientific knowledge and make efforts for disseminating the outcomes.

3.5.4 Promotion of Measures in Accordance with Social Characteristics

1) Strengthen the functions of the communities, which play important roles to promote initiatives for building resilient society.
2) Implement measures taking into consideration of vulnerable people, such as women, elderly, children, disabilities, tourists, etc.

CHAPTER 4 Vulnerability Assessment

4.1 Vulnerability Assessment Method

Based on the results of risk assessment for scenario earthquake conducted by the ERAKV, the KVRP conducted vulnerability assessment for the KV. The vulnerability assessment identifies measures to avoid the worst case scenario by sector. Targeted sectors are: 1) transportation, 2) water supply, 3) open space, 4) urban development and land use, 5) housing and building, and 6) tourism and cultural heritage. The vulnerability assessment also include cross sectoral measures: 7) social consideration, 8) disaster management and human resource development, and 9) partnership with relevant organizations and the private sector.

The assessment method is illustrated in Table 4.1.1. In order to avoid the worst case scenario, measures are examined through the perspectives of: i) structural and non-structural measures; ii) redundancy and iii) collaboration between the government and the private sector.

Table 4.1.1 Vulnerability Assessment Method

The worst case scenarios	Sector						Cross Sector		
	1) Transportation and Bridges	2) Water Supply	3) Open space	4) Urban development and land use	5) Housing and building	6) Tourism and cultural heritages	7) Social Considerations	8) Disaster management and human resource development	9) Partnership with relevant organization and private sector
1-1 A large number of casualties due to large-scale and multiple collapses of buildings and transportation facilities in urban areas.	Measures to avoid the worst case scenario, measures are examined through the following perspectives: • Structural & Non-structural measures • Redundancy • Collaboration between the government sector and the private sector								
1-2	Ditto								
8-3	Ditto								
8-4	Ditto								

Source JICA Project Team

4.2 Summary of Risk Assessment Results

The ERAKV provides four scenarios for earthquake damage and two earthquake occurrence scenes, day time and night time, for 2016 and 2030. The evaluated items are buildings, infrastructure (road, bridge, water supply, sewage, power and telecommunication network) and human casualties. For the purpose of KVRP formulation, risk assessment results are derived from the most influential case of CNS-3[28]. The estimated building damage is shown in the following table.

Table 4.2.1 Estimated Building Damage caused by the Scenario Earthquake of CNS-3

Type of Building		Number of Damaged Building by Damage Level (DL)			Total
		DL 2	DL 3	DL 4 & 5	
Total Building	No.	70,426	67,418	199,463	444,554
	%	15.8	15.2	44.9	100.0
School Building	No.	960	875	2,486	4,321
	%	16.8	15.3	43.4	100.0
Health Building	No.	97	94	235	426
	%	16.6	16.1	40.2	100.0
Government Building	No.	80	73	186	339
	%	16.7	15.3	38.9	100.0

Note: Damage level 4 and 5 indicate the building, with heavily damage or completely collapse.
Source: JICA Project Team (ERAKV)

The results show that more than 44% of total buildings in the Kathmandu Valley will be heavily damaged and/or totally collapsed by the scenario earthquake. Similarly, more than 43% of school buildings, 40% of health buildings and 39% of government buildings will be heavily damaged and/or totally collapsed.

As for damage of bridges, 31 multi-span bridges (71%) out of 45 bridges will be heavily damaged by the scenario earthquake, especially old bridges. As for other infrastructure, the water supply network will suffer minimum damage because of the replacement of the old pipe line to new one.

The table shows the summary of bridge damage.

Table 4.2.2 Estimated Bridge Damage caused by the Scenario Earthquake

Senario Earthquake	Damage Level			Total
	Slight	Moderate	Heavy	
Bridge (Multi-span bridges with RC pier)				45
CN-3	2	11	32	45
	4.44%	24.44%	71.11%	100.00%

Source: JICA Project Team (ERAKV)

[28] Central Nepal South Scenario Earthquake (M-7.8) Normal attenuation 2/3

The ERAKV estimates nearly 35,700 causalities and 139,900 injuries and more than 1.6 million of evacuees in Kathmandu Valley caused by the scenario earthquake. This is the worst case scenario.

4.3 Preparation for the Worst Case Scenarios

The risk assessment results show that the building damage is very huge, and about 200,000 buildings will be heavily damaged and/or totally collapsed, which is nearly half of the total building stock in the KV. It is clear that high priority should be given to building and infrastructure sectors to reduce the damage caused by an earthquake. In addition, the tourism sector have a high priority for improvement, because Nepal's main source of foreign income comes from the tourism sector. KVRP identifies 33 worst case scenarios as shown in Table 4.3.1 and five priority areas in the view of: protecting human lives, avoiding critical damage to administrative / social / economic systems, mitigating and preventing the expansion of damage to properties / facilities, and to achieve swift recovery in the event of large-scale natural disasters .

Table 4.3.1 Worst-Case-Scenarios

Fundamental Goals		Operation Goals		Worst events that should never happen
I. Prevent human loss by any means. II. Avoid fatal damage to important functions for maintaining administration as well as social and economic systems. III. Mitigate damage to property and facilities and prevent expansion of damage. IV. Achieve swift recovery and reconstruction.	1	Protect human lives even in the event of a large-scale natural disaster.	1	A large number of casualties due to large-scale and multiple collapses of buildings and infrastructure.
			2	A large number of casualties due to collapse of facilities used by the general public.
			3	A large number of casualties due to delay of evacuation caused by failure of information transmission.
			4	A large number of casualties due to lack of evacuation facilities
	2	Ensure prompt rescue and first-aid activities and provision of medical care from immediately after a large-scale natural disaster.	1	Prolonged suspension of supply of food, drinking water and other vital goods.
			2	Isolation of many settlements for long periods due to interruption of transportation network.
			3	Difficulty of rescue and emergency response activities due to significant damage of relevant organizations.
			4	Prolonged suspension of energy supply for emergency response activities including medical services.
			5	Paralysis of medical services due to damage and lack of medical facilities and personnel.
			6	Outbreak of epidemics or infectious diseases in disaster-affected areas.
	3	Secure administrative functions of federal and local governments from immediately after a large-scale natural disaster.	1	A decline in public safety due to damages of police facilities and personnel.
			2	Serious traffic accidents due to lack of traffic control.
			3	Dysfunction of the federal government due to significant damages in their facilities.

Fundamental Goals		Operation Goals		Worst events that should never happen
			4	Deterioration of the functions of local governments due to significant damage to their personnel and facilities.
	4	Secure information communication functions from immediately after a large-scale natural disaster.	1	Paralysis of information communication system due to suspension of power supply.
			2	Circumstances where disaster information cannot be delivered promptly due to suspension of TV and radio broadcasting.
	5	Prevent functional disturbance in economic activities (including supply chains) even after a large-scale natural disaster.	1	Decline in companies' productivity caused by disruption of supply chains.
			2	Suspension of energy supply necessary for social economic activities.
			3	Long term stagnation of tourism industry due to damages to important cultural and historical heritages
			4	Dysfunction of major transportation network due to damages by a disaster
			5	Fatal damage to major airport caused by a disaster. .
			6	Circumstances where dysfunction of financial services.
			7	Stagnation of stable food supply.
	6	Secure lifeline (electricity, water, sewerage and fuel) and economic activities even after a large-scale natural disaster.	1	Suspension of power supply networks and oil supply chains.
			2	Prolonged suspension of water supply,
			3	Prolonged suspension of sewage treatment facilities.
	7	Prevent of any uncontrollable second disaster.	1	Traffic paralysis due to the collapse of buildings along emergency roads.
			2	Large-scale spread and leakage of hazardous materials caused by a large–scale natural disaster.
			3	Expansion of damage due to devastation of farmland and forests
	8	Develop conditions that enable swift recovery and reconstruction of local society and economy even after the occurrence of a large-scale natural disaster.	1	Delay of recovery and reconstruction work significantly due to delay of treatment of disaster waste.
			2	Delay of recovery and reconstruction work significantly due to shortage of personnel.
			3	Delay of recovery and reconstruction works significantly due to collapse of local communities.
			4	Delay of recovery and reconstruction work significantly due to damage to core infrastructure.

Note) Highlighted areas are priory area for improvement for next 20 years.

Source: Fundamental Plan for National Resilience – Creating a Strong and Resilient Country, and JICA Project Team

CHAPTER 5 PROMOTING INITIATIVE FOR BUILDING THE KATHMANDU VALLEY RESILIENCE

5.1 Sector Measures

As mentioned chapter 4, five worst events are selected as a high priority area for improvement for the next 20 years. They are:

1.1 A large number of casualties due to large-scale and multiple collapses of buildings and infrastructure.

1.2 A large number of casualties due to collapse of facilities used by the general public.

1.4 A large number of casualties due to lack of evacuation facilities

2.2 Isolation of many settlements for long periods due to interruption of transportation network.

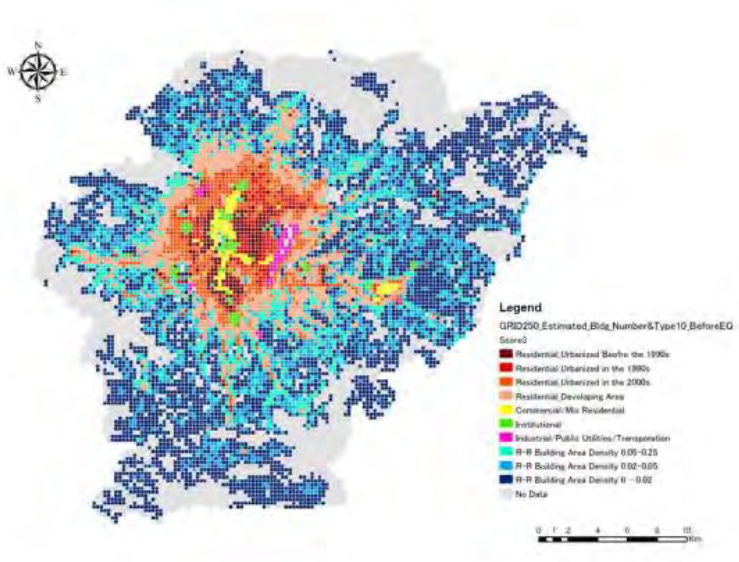
5.3 Long term stagnation of tourism industry due to damages to important cultural and historical heritages

5.1.1 Housing and Building

(1) Guiding Principal

Kathmandu Valley (KV) is a capital region and densely populated urban area. Along with the urban area, there are many historical buildings and world heritage sites in the KV. Figure 5.1.1 shows building distribution by classification in 2015. The number of buildings in KV amount to 440,000 buildings, of which 44.4% is masonry structure and more than 92% is non-engineered buildings[29]. Accordingly, it can be said that the KV is vulnerable to earthquakes.

[29] ERAKV



Source: JICA Project Team (ERAKV)

Figure 5.1.1 Building Distribution by Classification in 2015

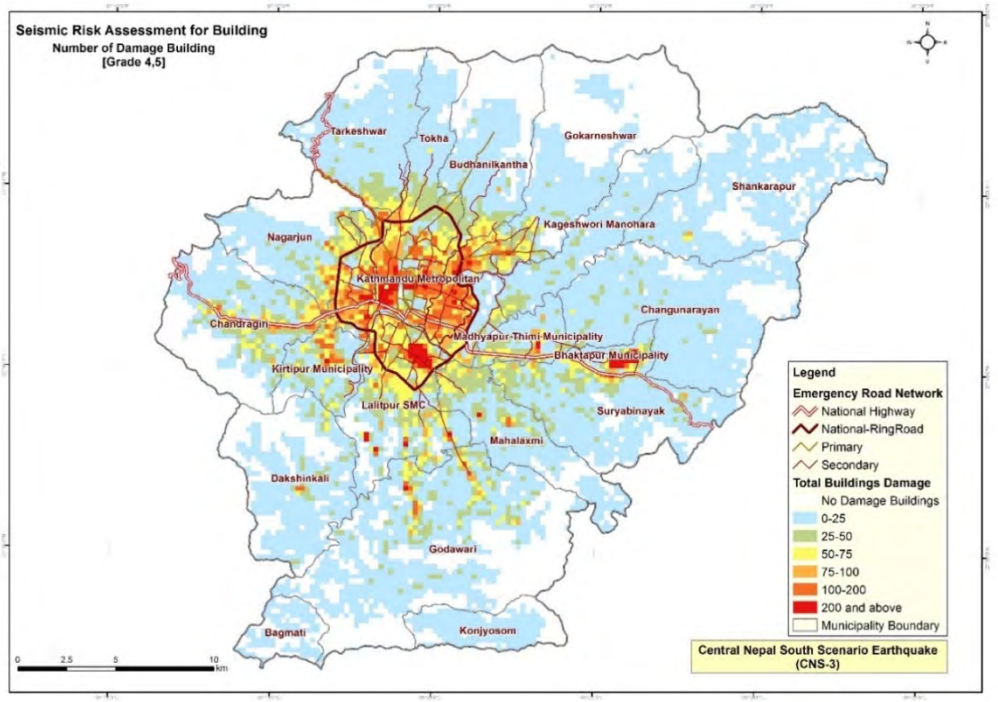
Table 5.1.1 show estimated number of damaged buildings caused by the scenario earthquake in the Kathmandu valley. According to the estimation, about 199,000 buildings in the KV will be heavily damaged or collapsed by the scenario earthquake. Especially, more than 90% of adobe and brick structured buildings will be heavily damaged and 74% of stone masonry with mud mortar buildings will be also heavily damaged. The total damage ratio of the buildings in the Valley is estimated to be more than 44%.

Table 5.1.1 Estimated Number of Damaged Buildings caused by the Scenario Earthquake in the Kathmandu Valley

Type of Building Structure	Adobe	Stone or Brick Masonry with Mud Mortar Joint	Stone or Brick Masonry with Cement Mortar Joint	Non-Engineered RC	Engineered RC	Others	Total
Number of buildings in 2016	9,232	63,375	125,084	209,496	29,769	7,598	444,554
Number of Damaged Buildings (Damage Level 4 & 5) * in 2016 based on Scenario Ground Motion**	8,282	47,166	58,816	73,708	8,184	3,487	199,643
Ratio of Damaged Buildings (Damage Level 4 & 5) * in 2016 based on Scenario Ground Motion**	89.7%	74.4%	47.0%	35.2%	27.5%	45.9%	44.9%

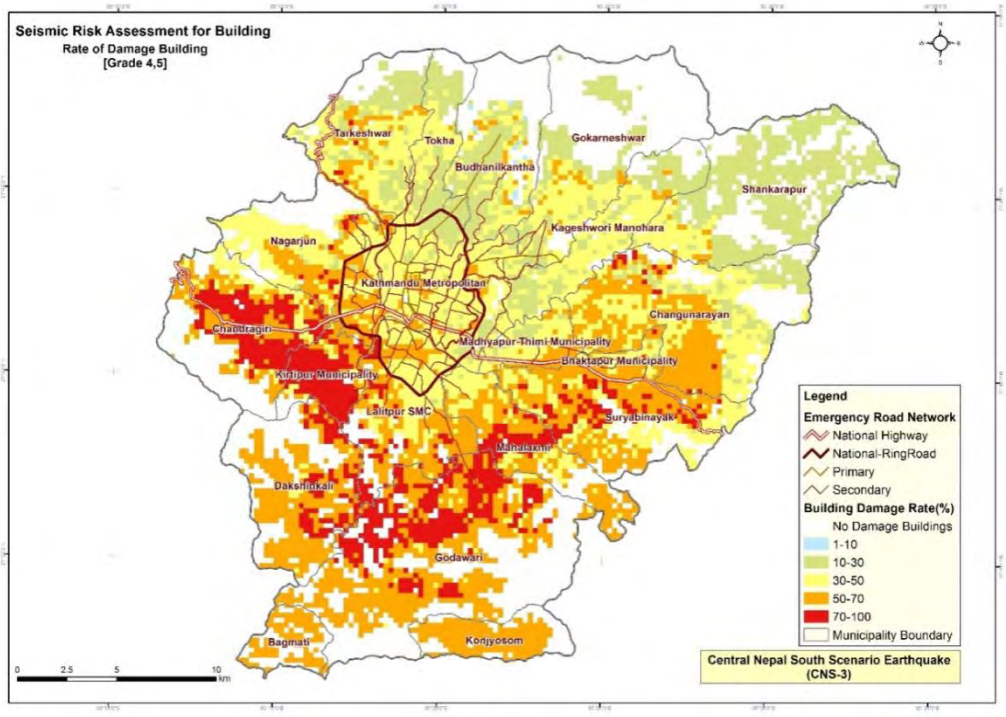
Note: * According to EMS-98, damage of building is classified into 5 grades. Grade 4 shows very heavy damage with serious failure of wall, partial structural failure of roofs and floors. Grade 5 shows total or nearly total of collapse of building.
** Central Nepal South Scenario Earthquake (x2/3)
Source: JICA ERAKV Project, 2017

Figure 5.1.2 shows distribution of heavily damaged and totally collapsed buildings (damage level 4 & 5) by grid in the KV. It is estimated that the areas within the ring road will have large number of heavily damaged buildings due to densely populated urban areas.



Source: JICA Project Team (ERAKV)

Figure 5.1.2 Seismic Risk Assessment for Building: Number of Damaged Building

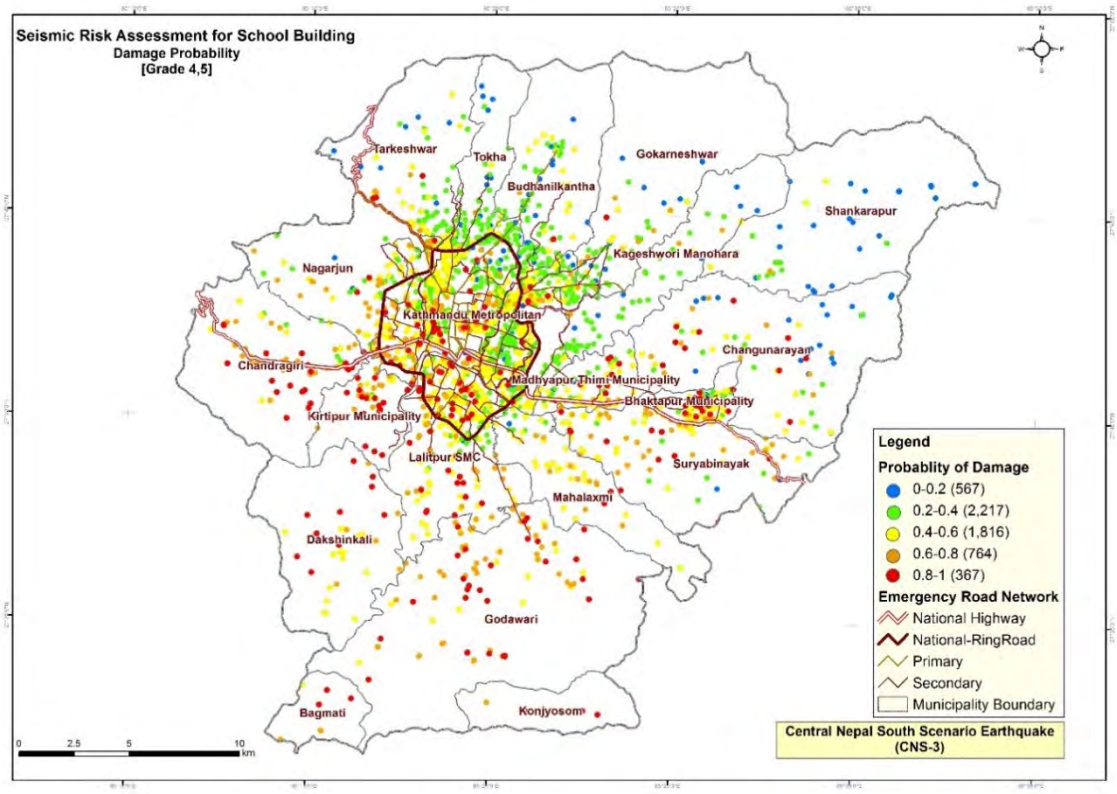


Source: JICA Project Team (ERAKV)

Figure 5.1.3 Seismic Risk Assessment for Building: Damaged Building Ratio

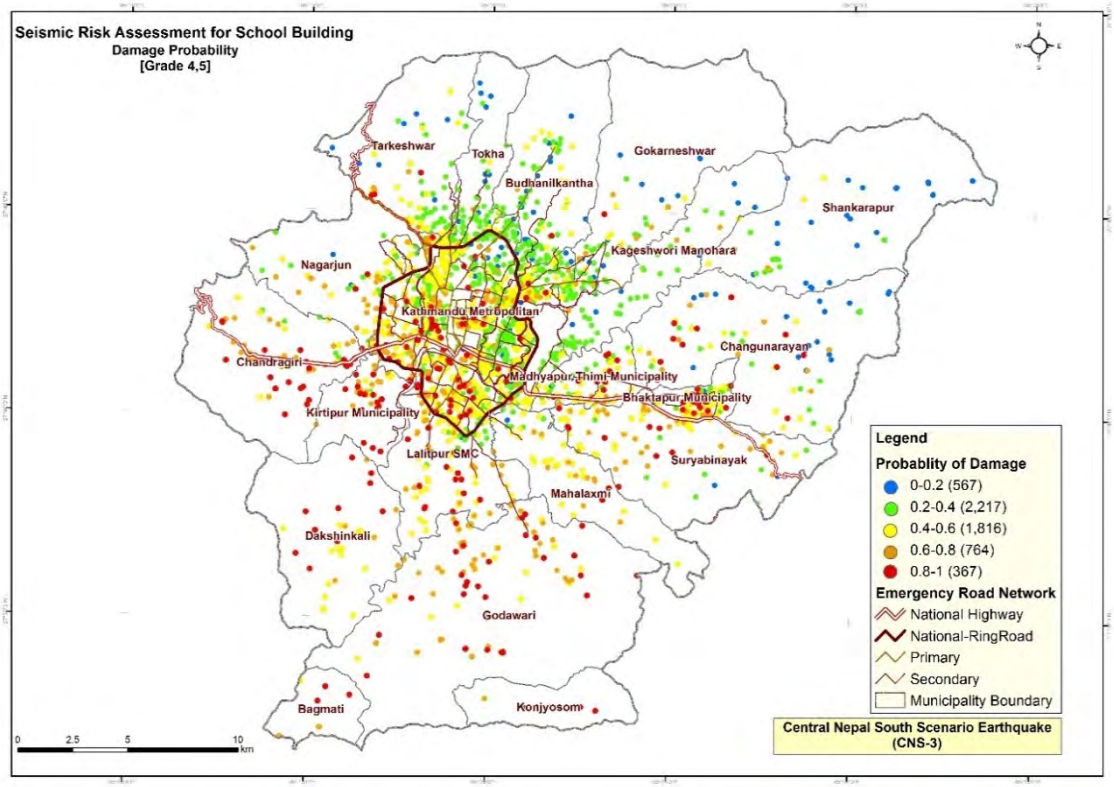
Figure 5.1.3 shows distribution of damaged building ratio. According to this figure, the areas with high ratio of damaged building are mostly located in the southern part of the KV, where are occupied by vulnerable buildings.

The ERAKV carried out seismic risk assessments for school buildings (Figure 5.1.4) and for health buildings (Figure 5.1.5). According to the estimation of damage probability, nearly 2,500 school buildings (43%) among 5,730 total schools in the KV would be heavily damaged. A total of 230 health facilities (40%) among 580 in the KV would be heavily damaged. Public buildings, such as hospitals, schools and others, are necessary to be seismic resistance structures, because those buildings are used as emergency response facilities after the disaster.



Source: JICA Project Team (ERAKV)

Figure 5.1.4 Seismic Risk Assessment for School Building



Source: JICA Project Team (ERAKV)

Figure 5.1.5 Seismic Risk Assessment for Health Building

Reduction of building collapse caused by the earthquake is important to avoid the worst case scenario, because secondary damage will occur in association with building collapse. For example, the number of causalities and injuries will be increased in accordance with the number of collapsed buildings. Therefore, seismic resistant building is the first priority in the KV.

To promote seismic resistant buildings, the design documents and construction should be properly examined by the local government. The construction permits should be issued by the government after the review of drawings. The capacity of government officials for the building construction approval process should be encouraged, and also some training sessions and technical support for construction workers are required. Both the structural measures, such as seismic resistance building construction, and the non-structural measures, such as capacity building of government officials and training for construction workers, are necessary to the encourage safety of buildings from disaster. Table 5.1.1 shows the building approval process by local government.

Table 5.1.2 Building Approval Process

Process	Description
1. Receive application	Applicants first purchase an application form from the municipal/ VDC office; at this point, they will have consultations on procedures from the building officers. Then, they will apply to Municipal/VDC office.
2. Check by the architectural department	The department will be checking the application form along with the building by-laws.
3. Check by the structural department	Check whether the structure is designed to follow the national building code

Process	Description
4. Register for tax	Registration with the revenue office of the municipality/VCD
5. Notification to the neighbours	Ward office notifies neighbours about the construction for agreement/disagreement
6. Issuing construction permission	Building permission will be issued if neighbours does not show disagreement

Note: Prepared by JICA Study Team based on discussions with Lalitpur and Bhaktapur Municipalities.

Source: 1) Building By-laws, Related to Construction in Municipalities and Urbanizing VDCs of Kathmandu Valley 2008 (2064)

2) Fundamental Byelaws relating to Settlement Development, Urban Planning and Building Construction, 2015

(2) Measures to avoid the Worst Case Scenario

Priority measures 1

In order to avoid the worst case scenario 1.1: "Casualties due to large-scale and multiple collapses of buildings and infrastructure in urban areas", the following measures shall be taken:

- **[Promote earthquake-resistant structural measures]:** In the urban area, some actions and measures to promote earthquake-resistant structure of buildings are necessary to avoid a large number of casualties due to the collapse of buildings
- **[Develop structural safety measures]:** Regarding houses and buildings along arterial roads, structural safety measures should be taken, especially for high-rise buildings which are subject to long-period ground motions.

Priority measures 2

In order to avoid the worst case scenario 1.2: "Collapse of facilities used by the general public", the following measures shall be taken:

- **[Promotion of safe building construction]:** An integrated "National Plan of Action on Safer Building Construction (NaPA)" needs to be developed by the government of Nepal.
- **[Strengthening earthquake-resistant measures in the facilities used by general public]:** Earthquake-resistant safety measures should be taken in the facilities used by general public, including government offices, schools, and medical facilities in the public sector as well as shopping centres, hotels and bus terminals in the private sector.

In order to avoid the worst case scenario 2.5: "Paralysis of medical services due to damage to and/or severe lack of medical facilities and personnel, and disruption of routes for offering support", the following measures shall be taken:

- **[Ensure seismic resistance building]:** In order to provide sufficient medical function at the event of a large-scale disaster, seismic reinforcement work should be provided for hospitals and emergency facilities.

In order to avoid the worst case scenario 3.1: "A decline in public safety due to the damage of police facilities and personnel", the following measures shall be taken:

- **[Implementation of seismic reinforcement work for police and correction facilities]:** Seismic reinforcement work and/or some measures against correction facilities are encouraged to maintain public safety even after a large-scale disaster.

In order to avoid the worst case scenario 3.3: "Paralysis of medical services due to damage to and/or severe lack of medical facilities and personnel, and disruption of routes for offering support", the following measures shall be taken:

- **[Promotion of seismic reinforcement for federal government facilities]:** Conduct seismic reinforcement work for government facilities to enable the function of emergency response, and rehabilitation and recovery from a disaster.

In order to avoid the worst case scenario 3.4: "Paralysis of medical services due to damage to and/or severe lack of medical facilities and personnel, and disruption of routes for offering support", the following measures shall be taken:

- **[Seismic reinforcement work for public facilities]:** Promote seismic reinforcement work for public facilities, including local government offices, schools and other social welfare facilities that can be used as emergency evacuation facilities in case of a disaster.
- **[Seismic reinforcement work for the facilities of police and fire fighting]:** Promote seismic reinforcement work for the facilities of police and fire fighting in order to function sufficiently in rescue and recovery activities in the case of large-scale natural disasters.

Priority measures 3

In order to avoid the worst case scenario 5.3: "Long term stagnation of tourism industry", the following measures shall be taken:

- **[Earthquake-resistance measures at hotels]:** It is encouraged to enforce earthquake-resistance measures at hotels and tourism spots to provide safety to tourists.

In order to avoid the worst case scenario 7.1: "Direct damage and traffic paralysis due to collapse of buildings along emergency roads", the following measures shall be taken:

- **[Enforcement of building code]:** In order to avoid the collapse of buildings along major roads, the local governments should promote some measures and actions to enforce the building code.

(3) Key Proposal

As described as the guiding principles, the combination of hardware (direct) and software (indirect) measures should be necessary to improve the quality of housing and buildings.

Priority measures 1

- **Designation, diagnosis, and retrofitting of Vulnerable Buildings**

  Detailed diagnosis and careful retrofitting of the historical and cultural heritage buildings are significantly important to preserve cultural value. By the same token, public buildings, such as government offices, schools and hospitals which are especially important to maintain public life, should be carefully examined in terms of seismic resistance. Based on the result of the diagnosis, restoration or retrofitting should be done to ensure earthquake resistance. Thus, safety and public services would be secure after a disaster. Reconstruction would be also conducted smoothly.

- **Designation of Vulnerable Urban Area**

  It is not realistic to designate all vulnerable buildings, including houses, due to quite a few numbers of buildings. Therefore, vulnerable areas should be identified based on vulnerability analysis done by the JICA Team. There are five to six areas where many old buildings, high-density areas, and areas with weak soil conditions are designated. For those areas, massive damage would be wreaked by an earthquake. Prior policy and measures should be taken to improve the seismic resistance of buildings in those areas. Those areas may apply area redevelopment schemes such as land pooling which is developed in Kathmandu Valley. Designation of evacuation sites and implementation of evacuation drills are also effective to avoid worst case scenarios.

Priority measures 2 and Priority measures 3

- **Examination of National Building Code (NBC) and Revision**

  A newly constructed building in urban areas needs to be approved prior to the construction by a local authority. To ensure the reliability of NBC, the contents should be examined as to have a seismic resistance for any type of structure of buildings. The examination should include the comparative study of damage by past earthquakes and the envisaged scenario earthquake. How to promote the NBC for all urban areas of the nation should be also examined. And then, the building code/regulations should be improved including a minimum standard for all type of structures.

- **Enforcement of NBC and Capacity Building of Local Government Officers**

The NUDS 2017 clearly mentions that the implementation system of NBC should be properly established to promote urban safety and resilience[30]. Technical officers of local governments should use the NBC when they approve an application of new building construction to check the safety of the structure. Training should be conducted to improve the technical skills of the officers and a system of supporting local governments should be established. Documents for building approval and approval processes should be standardized.

- **Improve Capacity of Construction Companies, Carpenters and Masons**

  The technical knowledge and construction skills of construction companies and carpenters should be improved. Construction based on the architectural drawing is essential for the constructors. Training programmes for local carpenters should be recommended. At the same time, the registration of contractors who have enough construction ability is also effective to achieve the construction of safe buildings.

- **Awareness for Construction of Seismic Resistant Building**

  It is also important for residents to understand the safety of seismic resistant housing, community facilities, and so on. The awareness of seismic resistant building would also contribute to reduction of illegal building construction.

5.1.2 Urban Planning and Land Use

(1) Guiding Principles

Urban Planning is an essential tool for assuring resilience of a city. Increasing population and urban sprawl without proper land-use control has been enlarging the risk against disasters in the Kathmandu Valley. Future urban development should avoid those locations vulnerable to natural disasters. The areas with high risk from disasters in existing built-up areas require proper countermeasures to reduce the risk. Urban planning and land use control should contribute to safe and sustainable development in the Kathmandu Valley.

The main strategy of urban planning is summarized in "the 20 Years Strategic Development Master Plan (2015 - 2035) for Kathmandu Valley (SDMP)[31]", and the guideline for comprehensive land use plan considering disaster risk is described in "Risk Sensitive Land Use Plan of Kathmandu Valley (RSLUP)[32]". These two plans, SDMP and RSLUP, are the practical basis of the KVRP. Along with

[30] NUDS 2017, p. 22

[31] As urban planning approaches, "Undertake planning at two Levels: Macro (Valley Level) and Micro (Municipal Level) is one of the major strategies recommend in Chapter 6 of the document. The necessity of the KVRP is also described in 6.1.1 (P.6-6).

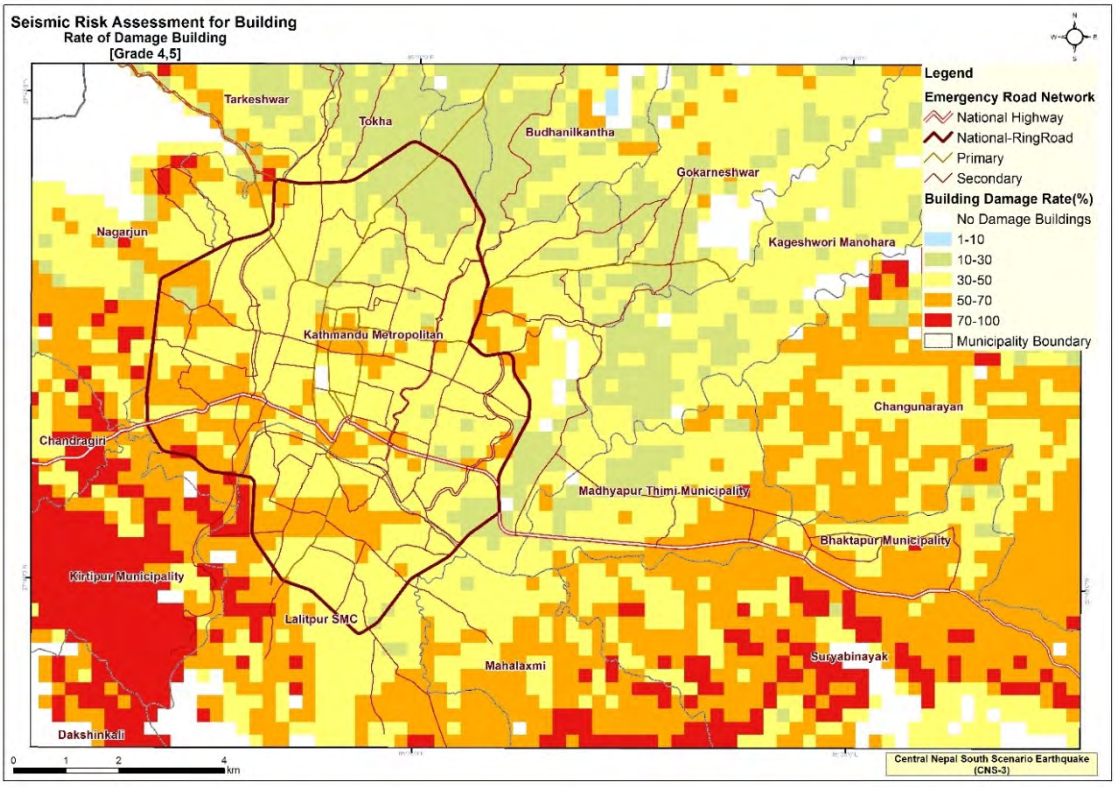
[32] Guideline for Risk Sensitive Land Use Plan is summarized in "12. Development of Planning Zones for Kathmandu Valley" and "13. RSLUP Implementation Guideline" of the report. Permissible building in each zone

these plans prepared by KVDA, KVRP uses the results of disaster risk assessment conducted by ERAKV and identifies priority areas to conduct structural and non-structural measures for reducing the disaster risk.

The current disaster risk is analysed through the assessment of damages caused by the envisaged scenario earthquake. There are four types of vulnerable areas in the KV: i) the area with high rate of damaged buildings; ii) the area with a large number of damaged buildings; iii) the area with high risk of liquefaction; and iv) the area with high risk of landslide.

1) The Area with High Rate of Damaged Buildings:

Figure 5.1.6 shows the distribution of damaged building ratio by 250m by 250m grid in the KV. According to this figure, the areas with high rate of damaged buildings (over 60%) are mainly located in the southern suburbs of the Kathmandu Valley, especially, Kirtipur and Karyabinayak municipalities. These areas, therefore, will need to take some structural and non-structural measures for reducing the disaster risk, such as the reinforcement of buildings and capacity development of disaster management in local governments and communities.



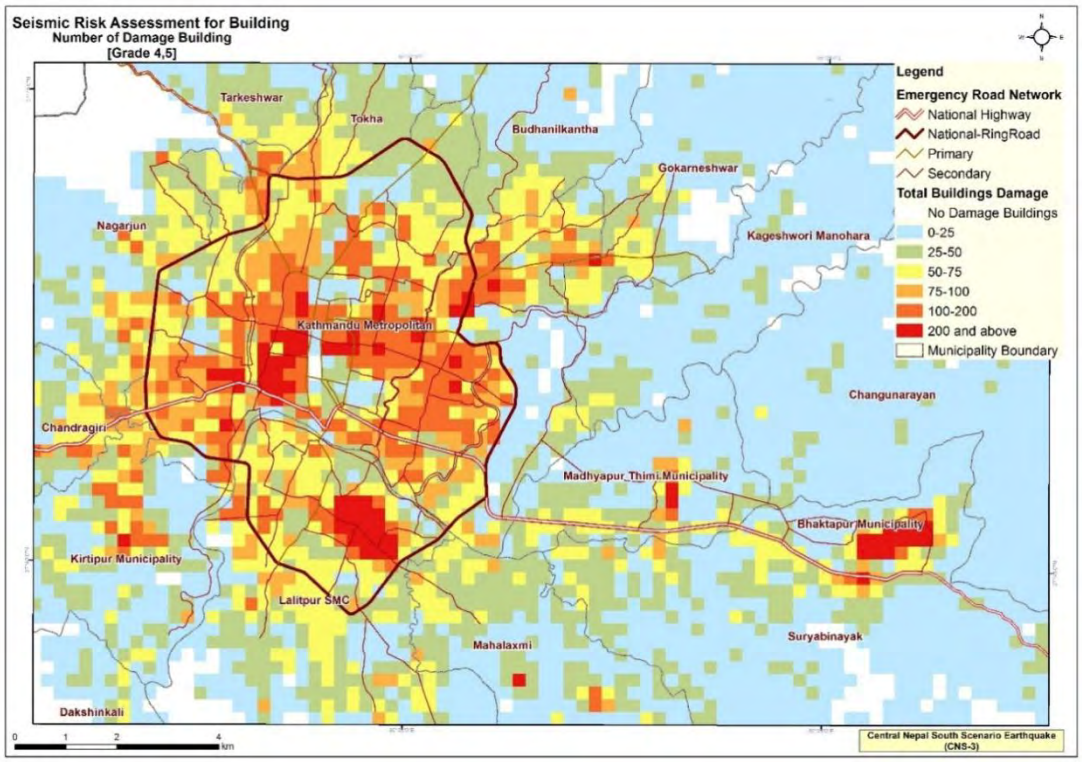
Source: JICA Project Team (Damage assessment data by JICA the Project for Assessment of Earthquake Disaster Risk of Kathmandu Valley in Nepal)

Figure 5.1.6 Estimated Damaged Building Ratio by Grid in the KV

is described by combination of land use zone and Colour zones (Red: Avoid, Yellow: Control, and Green: Promote).

2) The Area with Large Number of Damaged Buildings:

Figure 5.1.7 shows the number of damaged buildings in a 250m by 250m grid in the KV. According to this figure, the areas with a large number of damaged buildings (over 200 buildings) are mainly located in historical areas, i.e., three Durbar Squares and historical satellite cities of Lalitpur and Kirtipur including Khokana (Lalitpur), Panga (Kirtipur), and Bungamati (Lalitpur). The historical areas are vulnerable to natural disasters, because they are occupied by many old buildings without proper reinforcement. These areas, therefore, will need to take some structural and non-structural measures for reducing the disaster risk, such as the reinforcement of buildings, development of an evacuation space, as well as capacity development of disaster management in local governments and communities.

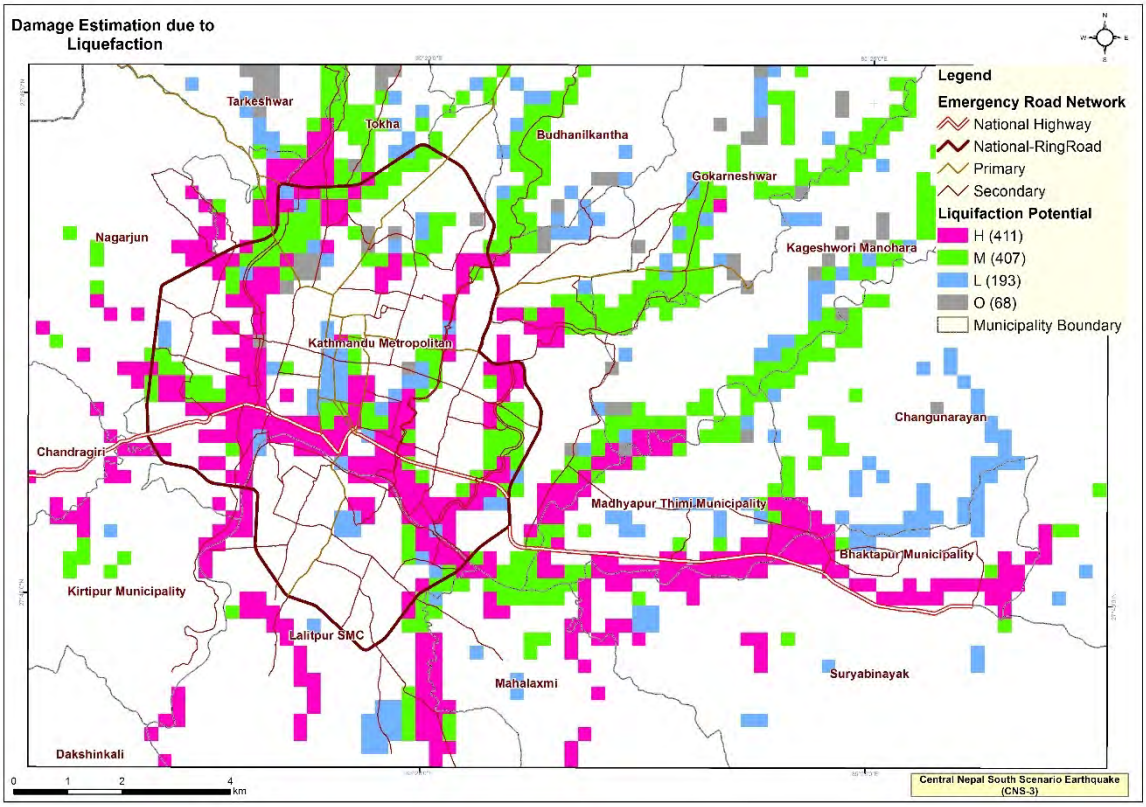


Source: JICA Project Team (Damage assessment data by JICA the Project for Assessment of Earthquake Disaster Risk of Kathmandu Valley in Nepal)

Figure 5.1.7 Estimated Number of Damaged Building by Grid in the KV

3) The Area with High Risk of Liquefaction

Earthquakes often induce other secondary disasters, such as liquefaction and landslides. The ERAKV analyses the risk of liquefaction based on the geomorphology surface data. Figure 5.1.8 Estimated Disaster Risks of Liquefaction in the Kathmandu Valley shows the high risk areas of liquefaction, which is likely to happen in the central part of Kathmandu Valley. The results suggest that the past development took place in the central part of the KV and expanded outward, although the area has high liquefiability. These areas, therefore, will need to take some structural and non-structural measures for reducing the disaster risk, such as land use control and development guidelines.

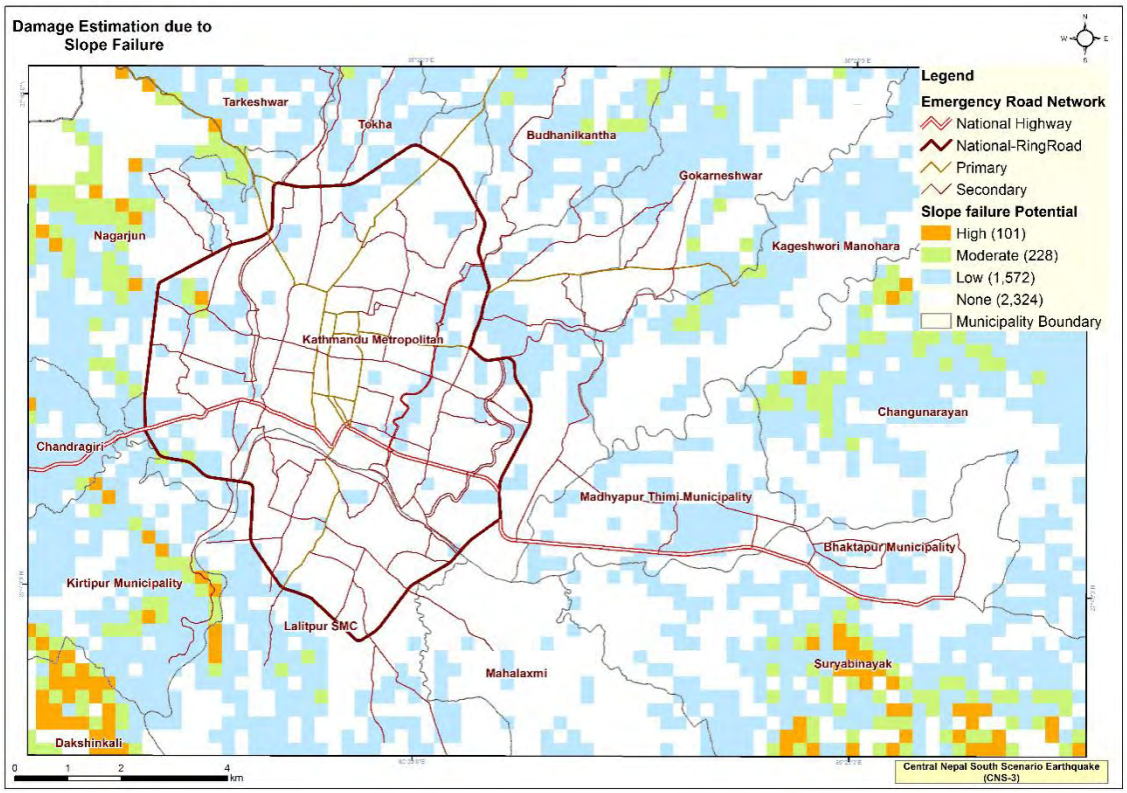


Source: Built-up Area: SDMP, High Hazardous Area: JICA the Project for Assessment of Earthquake Disaster Risk of Kathmandu Valley in Nepal

Figure 5.1.8 Estimated Disaster Risks of Liquefaction in the Kathmandu Valley

4) The Area with High Risk of Landslide

Figure 5.1.9 shows the high risk area of landslides, which are mostly located along the edge of steep hilly areas. These areas are expected to be urbanized in the future and, therefore, will need to take some structural and non-structural measures for reducing the disaster risk, such as land use control and development guidelines.

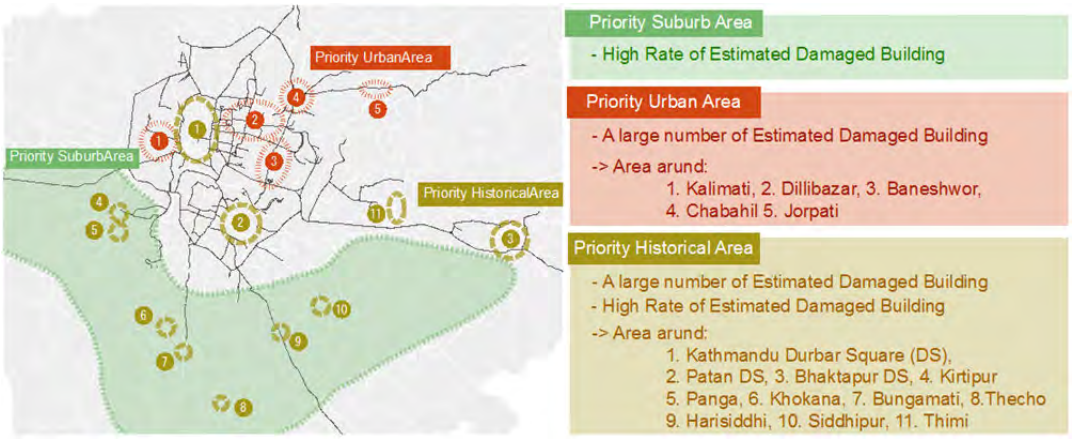


Source: Built-up Area: SDMP, High Hazardous Area: JICA the Project for Assessment of Earthquake Disaster Risk of Kathmandu Valley in Nepal

Figure 5.1.9 Estimated Disaster Risks of Landslide in the Kathmandu Valley

The locations of high priority areas for reducing disaster risk are shown in Figure 5.1.10. Some structural measures should be taken in the high risk areas, considering their social, physical and historical characteristics. In densely populated urban areas, individual reinforcement of the building cannot reduce the risk of the area. Thus, urban planning and area development are more efficient and effective tools to build the area with resilience. In the suburban areas, on the other hand, individual reinforcement of buildings can contribute to reducing risk. In historical areas, where conservation of cultural heritages is important, individual reinforcement of the buildings and area development should be combined.

Meanwhile, non-structural measures shall be examined in the areas where a large number of buildings damaged by a disaster are expected. In order to avoid devastating situations, the capacity development of the community and local government is necessary. In addition to the above mentioned earthquake disaster resilient measures, the high hazardous areas of earthquake induced disasters including liquefaction and landslide need to avoid development or take resilience measures.



Source: JICA Project Team

Figure 5.1.10 Locations of Priority Areas for Promoting Resilient Structural Measures

(2) Measures to avoid the Worst Case Scenario

Countermeasures to avoid the worst case scenarios are shown in the following:

Priority measures 1

In order to avoid the worst case scenario 1.1: "A large number of casualties due to multiple collapses of buildings and infrastructure", the following measures shall be taken:

- **[Identification of vulnerable area]:** The scientific research identifying the vulnerable areas is necessary. The ERAKV and RSLUP identified vulnerable areas from natural disasters[33]. Both governments and local communities should recognize the vulnerable areas and proper measures should be taken.
- **[Setting Priority area for promoting resilience]:** In the identified vulnerable areas, priority areas for promoting resilience shall be selected.
- **[Promotion of area planning in priority area]:** In the priority areas, area planning with countermeasures and actions to reduce risk shall be adopted. One uniform measure cannot be adapted in every area. Consideration of an area's character is necessary. Measures to reduce risk for dense urban areas and suburban areas cannot be the same. Historical areas would require measures which can keep the historical character of the area. People in charge of urban planning need to know a variety of options regarding countermeasures and actions, and select preferable ones for each area.

[33] According to KVDA, the long-term development plan for the Kathmandu Valley (SDMP 2015-2035) will be finalized incorporating with the results of RSLUP. This KVRP, on the other hand, uses the results of JICA ERAKV Project. It is recommended that KVDA should review the studies of RSLUP, ERAKV and KVRP, and prepare land use planning as a guideline and development framework for the KV. Based on the land use guidelines prepared by KVDA, land use plans will be prepared by each municipality.

Priority measures 2

In order to avoid the worst case scenario 1.4: "A large number of casualties due to lack of evacuation facilities," the following measures shall be taken:

- **[Promotion of preparedness]:** Especially in the areas where a high number of damaged buildings are estimated, preparation activities related to evacuation, such as the preparation of an evacuation plan and development of open spaces needs to be promoted.

Priority measures 3

In order to avoid the worst case scenario 2.2: "Isolation of many settlements for long periods due to interruption of road network," the following measures shall be taken:

- **[Ensure emergency road network connecting with remote areas]:** Some of the settlements will be isolated due to road blockage by the collapse of buildings. The development and strengthening of emergency road network to connect with these remote areas are necessary.

Priority measures 4

In order to avoid the worst case scenario 5.3: "Long term stagnation of tourism industry due to damages by a disaster," the following measures shall be taken:

- **[Promotion of safety measures in historical areas]:** Tourism is a key industry in Nepal. In order to avoid fatal damage to the tourism industry, some safety measures should be taken in the historical area, as well as for national heritages.

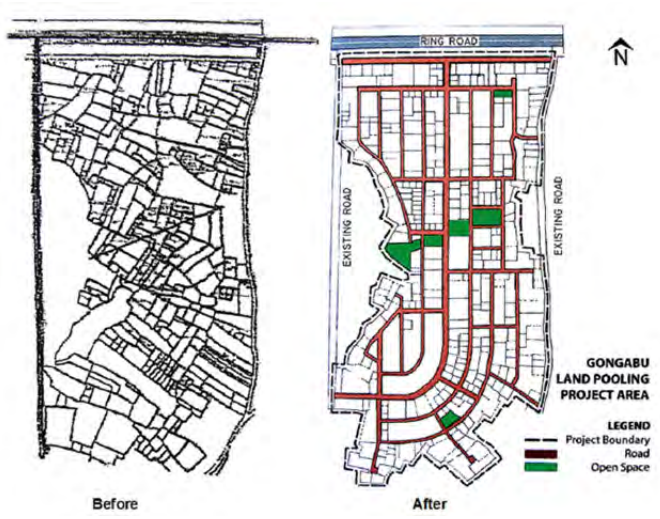
In order to avoid the worst case scenario 8.4: "Delay of recovery and reconstruction works significantly due to damage to core infrastructure," the following measures shall be taken:

- **[Implementation of cadastral survey and other required activities]:** Clarification of land boundary (e.g. cadastral survey) is one of the important actions for prompt recovery and reconstruction from a disaster. It is necessary to conduct a cadastral survey or other required activities even during a non-disaster time.
- **[Designation of future development area]:** For avoiding the recreation of vulnerable areas after a disaster, future development areas for promoting development should be designated even during a non-disaster time.

(3) Key Proposal

Priority measures 1

- **Development Measures in Suburban Area**
  - Strengthening of building: Strengthening of each building with earthquake resistance can contribute to reducing the disaster risk, especially in suburban areas in the KV. In the suburb areas where urban expansion is expected, promotion of earthquake-resistant structural measures shall be effective to promote resilient land and society.
  - Land pooling project in urban expansion area: In the areas where urban expansion is expected, proper urban planning is essential to achieve resilience to natural disasters. Land pooling projects with the development of infrastructures and open spaces are useful tools to promote resilient land development. Land pooling projects in the KV are mainly promoted by KVDA. Figure 5.1.11 shows the concept of land pooling project.



Source: Inclusive Cities: Resilient Communities, Third United Nations Conference on Housing and Sustainable Urban Development (Habitat III), Nepal National Report, MOUD, 2016

Figure 5.1.11 Image of Land Pooling Project in Gongabu

  - Ensuring safety of the area along proposed outer ring road: An outer ring road is proposed by KVDA. The southern part of the proposed outer ring road is located in the areas vulnerable to natural disasters, where a high rate of damaged building from the scenario earthquake is estimated to occur, according to the ERAKV. Accordingly, the area along the outer ring road should be developed with seismic resistance to avoid multiple collapses of the buildings facing the outer ring road.
  - Ensuring redundancy of access roads to settlements: There are very limited road networks in the Kathmandu Valley. Once the main access road is damaged by disaster,

transportation of rescue and supply of vital goods would be difficult. Then, the settlements will be isolated and rescue and recovery activities would be significantly delayed. Accordingly, the development of alternative roads is required for assuring redundancy.

- **Development Measures in Urban Area**
  - Promotion of BBB Concept in Urban Development: Reducing disaster risk in urban development is crucial, while it will take a long time for securing the resilience of land and buildings. It is important to adopt the concept of BBB (Build Back Better) in urban development, which promotes urban development to avoid recurrent efforts of recovery and reconstruction from disasters. Urban development with the concept of BBB needs to be promoted by the initiative of government entities, such as MOUD and KVDA.
  - Promotion of Mixed Use Land Pooling project: Re-development of the mixed use land pooling project would be able to reduce the disaster risk significantly. The project shall be implemented with the development of road/infrastructure and open space for assuring the safety of the area. This type of land pooling project would be implemented in existing built-up areas, although current land pooling projects in the KV are implemented mainly in the areas of farmland. Accordingly, the redevelopment type of land pooling project need consensus building among the residents and the strong initiative of the government. As an incentive to the residents, the value of the property would be increased due to the well-developed infrastructure and public spaces.
- **Land Use Control in Hazardous Areas of Liquefaction and Landslide**

  Land use control should be conducted to avoid disordered development in high hazardous areas of liquefaction and landslide. Since future urbanization is projected to expand outward towards the fringe of the Kathmandu Valley, the development of high slope-instability areas should be prevented to minimize loss and damage from disasters. Since population growth in Kathmandu Valley is unavoidable, any new development shall be required to follow development regulation enacted by the governments, including measures against disasters.

Priority measures 2

- **Promotion of Non-structural Measures**

  The areas where are expected to have a large number of buildings would be damaged by the disaster are required to promote non-structural measures to reduce the risk to natural disasters. The non-structural measures include capacity development of human resources and strengthening governance though the implementation of drills and training on disaster management.

Priority measures 3

Please refer to 5.1.4 Transportation Network section.

Priority measures 4

- **Development Measures in Historical Area**
  - Designation of Historical Conservation Area: The historical areas can be designated as "historical conservation area". In these areas, both national and local governments should support for promoting seismic resistant retrofitting with conservation of the landscape.
  - Area planning in historical conservation area: The area planning is to assure both safety from disaster and protection of the historical landscape. The area planning shall include the development of evacuation routes, space and facilities. Each building is required to follow the development guideline in the area planning when it is renovated or rebuilt.
  - Strengthening of individual building: promotion of earthquake-resistant structural measures for each building. Especially, assuring the seismic resistance of the buildings facing evacuation routes and main roads, where many people walk, will contribute to mitigate human losses.
  - Rebuilding traditional housing of "Choka": Newari style housing with a courtyard called "Choka" in Mealies is one of the traditional housing styles, especially seen in the historical areas of the Kathmandu Valley. This traditional style of housing represents the culture and lifestyle of the Newari. These housings shall be rebuilt for securing its cultural value and safety to disaster. Especially, the traditional housings facing the major streets need to be rebuilt to maintain the historical and cultural value for the promotion of tourism. The government should consider to providing a subsidy to the rebuilding of traditional housing. Some schemes of rebuilding of traditional housings are the inclusion of "Social housing", following the guideline of the preservation of historical buildings, securing the safety of the area by development of safe open space sand evacuation passes.

5.1.3 Open Space and Emergency Evacuation Space

(1) Guiding Principles

In urban areas open space can be used as disaster management base and/or emergency evacuation space for people during large-scale natural disasters. Cities should ensure the safety for all citizens and visitors, and have sufficient places to support evacuation and effective disaster management activity when a large–scale disaster happens.

There are two types of functions in the open spaces during a disaster situation:

- Disaster management function: open spaces serve as temporary functions to support rescue, recovery and reconstructions activities, and
- Evacuation function: open space provides affected people with a tentative space for maintain their living for a short period.

During normal times, open spaces in urban areas are mainly used for recreation purposes which serves urban amenity to people. During the time of a disaster, open space is used for different purposes, such as evacuation and rescue activities. Open spaces with disaster management function are to be connected with the emergency road network in order to secure the transport of necessary goods for rescue, recovery and reconstruction activities.

1) Lessons from Japan's Classification

In the Japanese open space structure for after-disaster function, there are two major purposes, namely disaster management and evacuation. Based on the land extent, function, and covered area, they are classified as shown in Table 5.1.3.

Table 5.1.3 Classification of Evacuation Open Spaces in Japan

Category		Emergency Function	Usual Function
Disaster Management	**Wide-area Disaster Management Base** Disaster Management for the Nation or a Metropolitan Area beyond Administrative Boundaries (50 ha)	• Recovery & Reconstruction Operation • Base Camp for Disaster Relief Team • Transportation Base (Logistics Hub) • Stock/Supply of Relief Goods • Centre for Volunteer Activities	• Regional or Urban Park • Training for emergency relief teams • Education of disaster prevention and evacuation drill for citizens • Research for disaster prevention
	Regional Disaster Management Base Regional Emergency Responses (10 ha)	• Recovery & Reconstruction Activities • Base for Disaster Relief Teams • Transfer Station for relief goods • Stock/Distribution of relief goods • Supporting function for Evacuation Zone	
Evacuation	**Wide-area Evacuation Zone** Coverage: 2km radius (for School District) (10 ha)	• Evacuation Shelter and Temporary House with Livelihood Support • Storage and Distribution of relief goods • Supporting Function for Emergency Evacuation Base	• Regional or Urban Park • Evacuation drill for community
	Emergency Evacuation Zone Coverage: 500 m radius (for Small Community Unit) (0.5-2 ha)	• Emergency Evacuation Zone and Livelihood Support • Distribution of relief goods for community	• Usual Community Park • Community center

Note: Summarized by the JICA study team based on the Japanese Disaster Management Base and Evacuation Zone.

2) Proposed Classification for Kathmandu Valley

The Japanese classification is referred to, and the idea is applied to Kathmandu Valley. The 83 open spaces[34] designated by MOHA should be re-organized and the additional open spaces should be proposed to cover the whole populated area in the Kathmandu Valley.

[Disaster Management Function]

- **Main Disaster Management Base:** Multiple Usages: Dealing with an extensive disaster required for the smooth and accurate operation of recovery for the nation.
- **Regional Disaster Management Base:** Multiple Usages for emergency responses and supporting **evacuation** for the region
- **Special Disaster Management Open Spaces: S**ingle or multiple usage for specific functions, open spaces where is not appropriate for camp/settlement. (Logistics, Debris Collection, Military Installation, Dead-body Management, etc.)

[Evacuation Function]

- **Regional Evacuation Open Space: "**Camp/Settlement" with some required facilities for evacuation (Medical Care, Vulnerable Assistance, Storage and Distribution, etc.)
- **Community Evacuation Open Space:** Single usage for "Camp/Settlement" (with originally suggested function or/**and** minimum required facilities (Rescue tools, First-aid kit, etc.)

3) Evacuation

First, the people should gather at a temporary meeting place (e.g., nearby park). In the case of Kathmandu Valley, they have small open spaces even in the dense historical area, which is called Choke, Pati, etc. Small parks and those traditional open spaces are used for emergency evacuation. It is recommended for each community to identify emergency meeting place during normal time.

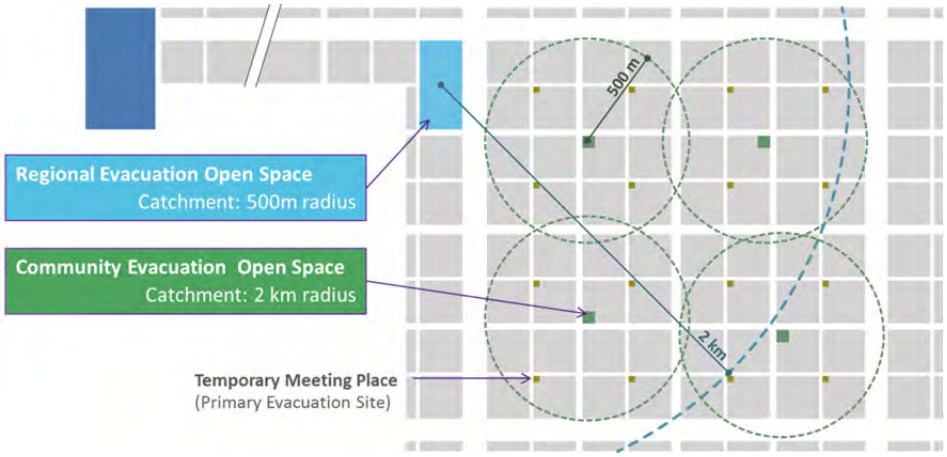
Immediate evacuation routes connect from the household/temporary meeting place to the "Community Evacuation Open Space", where a minimum evacuation site is secured. It would be expected to be designated by consultation within the community.

Then, the evacuation routes should be connected to "Regional Evacuation Open Spaces". The local government together with the community should designate the evacuation open spaces and routes.

To achieve the evacuation sequence, the catchment areas of "Evacuation Open Spaces" are set by distances achievable by walking. The catchment area of the "Community Evacuation Open Spaces" is

[34] Ministry of Home Affairs (MoHA), Government of Nepal and International Organization for Migration (IOM), *"Report on Identification of Open Spaces for Humanitarian Purposes in Kathmandu Valley"*, (May 2013)

a 500m radius, and "Regional Evacuation Open Spaces" is a 2km radius. The conceptual diagram of the layout of evacuation open spaces at community and regional levels is shown in Figure 5.1.12.



Source: JICA Project Team

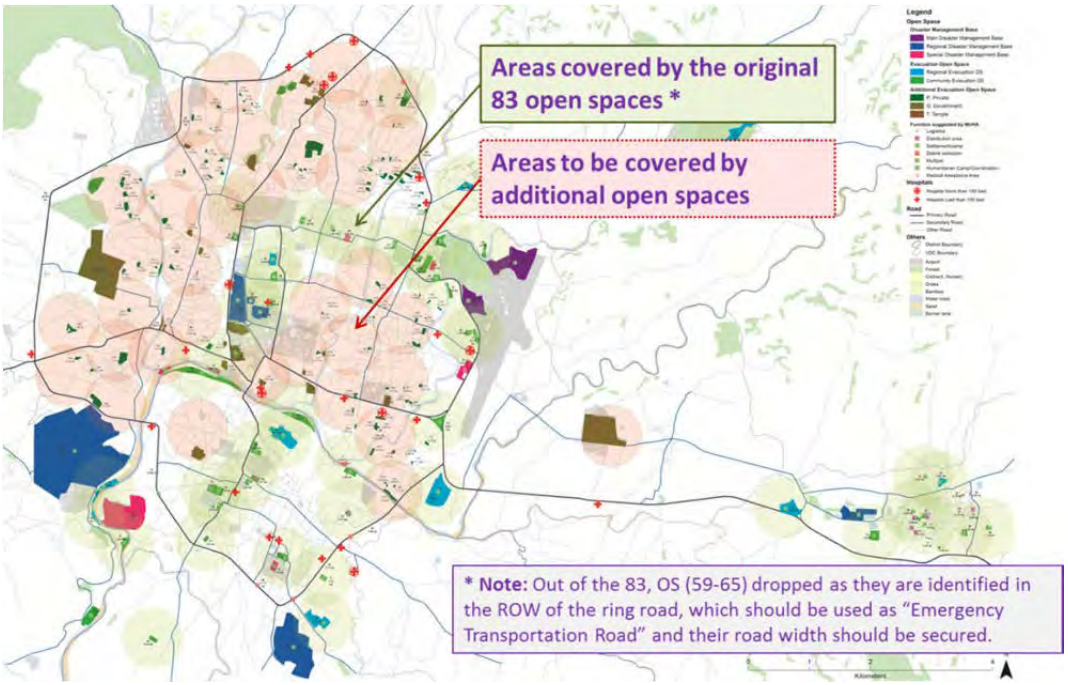
Figure 5.1.12 Catchment Area of Evacuation Open Spaces

4) Distribution of Evacuation Open Spaces

Community Evacuation Open Spaces

In addition to the 83 open spaces[35], 115 open spaces for Community Evacuation Spaces are identified by the JICA Study Team. Distribution of additional open spaces needed at community level is shown in Figure below.

[35] The original 83 open spaces include the buffer zone of the ring road. The JICA Study Team proposed to drop them from the open spaces since the ring road will be used for emergency transport function and the width of the road is required for that use, and will not be available as evacuation spaces.

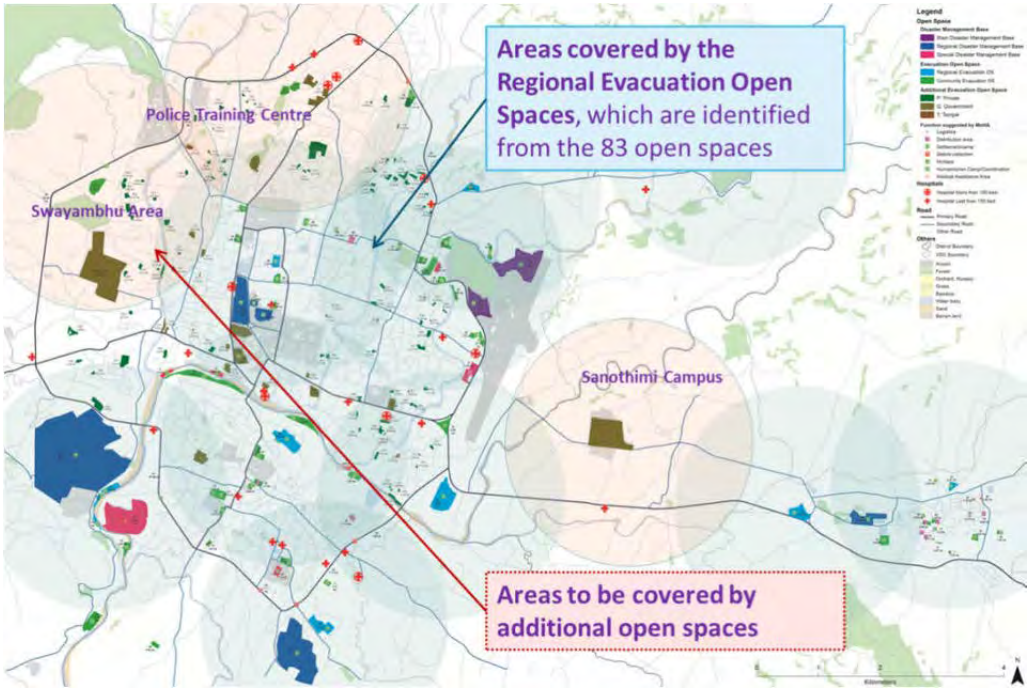


Source: JICA Project Team

Figure 5.1.13 Distribution of Community Evacuation Open Spaces

Regional Evacuation Open Spaces

Some open spaces are selected and should function for Regional Evacuation Open Spaces, and three additional open spaces are identified by the JICA Study Team to cover whole populated areas in the KV.

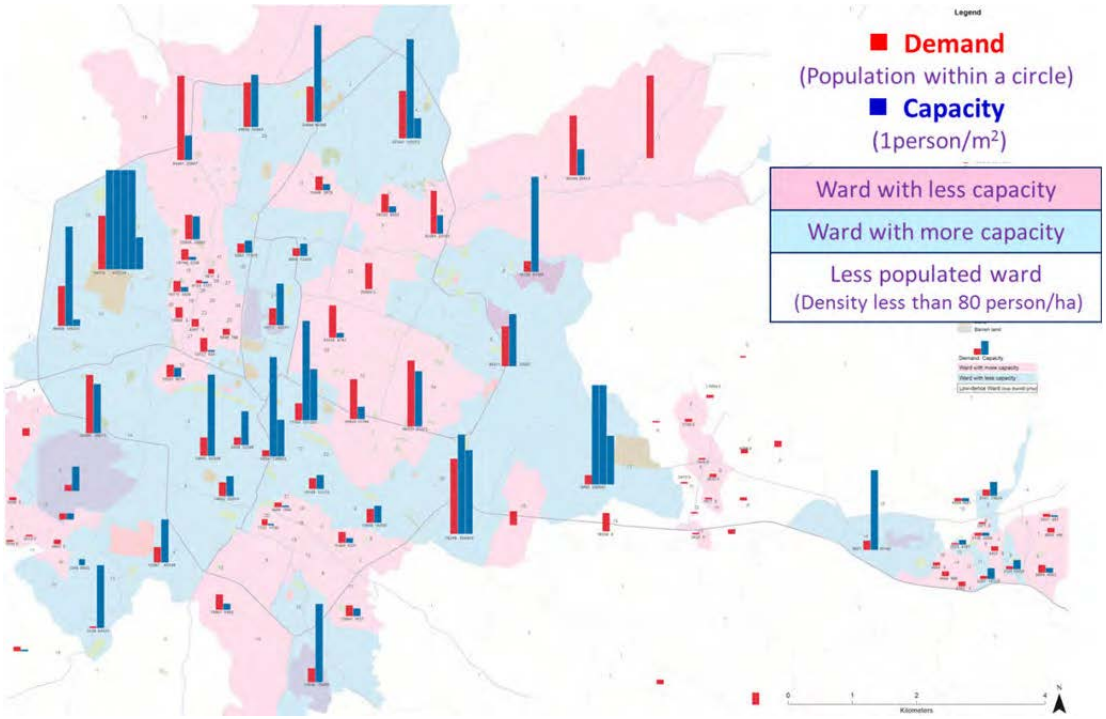


Source: JICA Project Team

Figure 5.1.14 Distribution of Regional Evacuation Open Spaces

5) Evacuation Demand and Capacity

Analysis on demand and capacity of evacuation open space was conducted by the JICA Study Team. Figure 5.1.15 shows the result by ward in the populated areas of Kathmandu Valley. The map shows that about half of the wards with red colour do not have enough capacity due to highly populated urban conditions. It is difficult to satisfy the demand of evacuation open space for all wards. The residents who live in the wards with low capacity of evacuation open space can reach adjacent wards, where there is enough evacuation capacity.



Source: JICA Project Team

Figure 5.1.15 Analysis of Demand and Capacity of Evacuation Open Spaces by Ward

6) Disaster Management

Disaster Management Bases are selected from the original 83 open spaces designated by MOHA.

Main Disaster Management Open Spaces

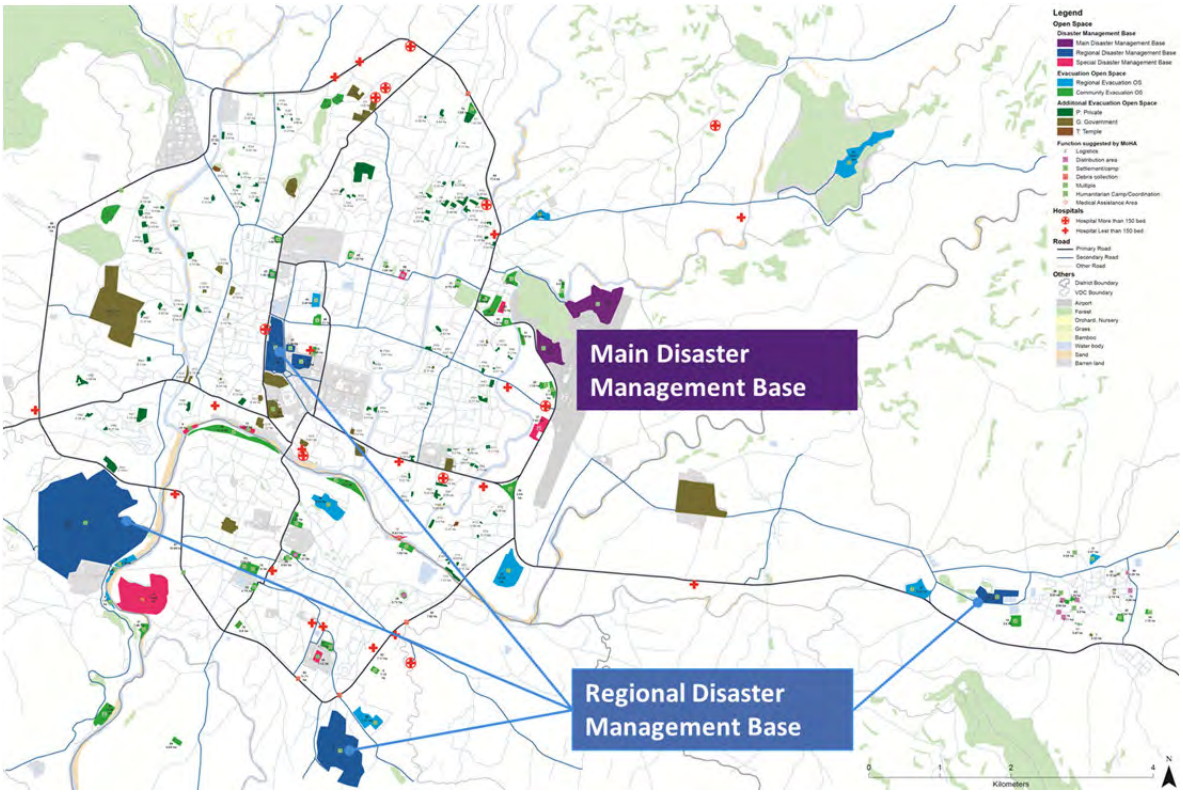
The airport, and a golf club site (Royal) are selected for the consideration of holding goods and personnel, including international support.

Regional Disaster Management Base

The open spaces in the centre of Kathmandu (Bhirkuti Mandap, Rastriya Sabha Griha, and Ratna Park), are selected to mainly manage Kathmandu Metropolitan City. This is also important for after disaster management for the nation due to their close proximity to the government offices.

Tribhuvan University is also selected for the western area of Kathmandu Valley. Due to its large campus site, it should be used for national level disaster management for enormous earthquake disasters.

In addition to these sites in Kathmandu Metropolitan City, NARC is selected to cover Lalitpur and Birendra Sainik School is selected to cover Bhaktapur.



Source: JICA Project Team

Figure 5.1.16 Distribution of Proposed Disaster Management Base

These disaster management bases should be connected with the emergency transportation network for effective transportation of vital goods and emergency activities.

(2) Measures to avoid the Worst Case Scenario

Priority measures 1

In order to avoid the worst case scenario 1.1: "Casualties due to large-scale and multiple collapses of buildings and infrastructure in urban areas", the following measures shall be taken:

- **[Develop structural safety measures]** - Regarding open spaces, structural safety measures should be taken for inside or around the open spaces not to receive heavy damage and to secure enough space for evacuation and/or disaster management functions.
- **[Strengthen seismic-resistant measures in public facilities]** – Seismic-resistant safety measures need to be undertaken for public facilities, including government offices,

education, and medical and social welfare facilities, since some of the open spaces in the KV are located with those public facilities. Efforts for prevention and reduction of damages need to be strengthened, especially in densely populated urban areas.

- **[Development of cooperation system in disaster management]:** A broad-based collaboration system in disaster management is to be encouraged, such as collaboration among ministries and agencies as well as between the public and private sectors, since they have to control after-disaster situations using disaster management bases and open spaces.
- **[Development of temporary shelters/evacuation facilities]:** In order to provide temporary evacuation facilities or make-shift tents for affected people from a large –scale disaster, open spaces have to be reserved in populated urban areas.

In order to avoid the worst case scenario 1.3: "A large number of casualties due to delay in evacuation caused by failure of information transmission", the following measures shall be taken:

- **[Providing information promptly]**: It is necessary to provide information on disaster management, including open spaces designated as emergency evacuation space for prompt evacuation in disaster.
- **[Improvement of evacuation transportation network]:** It is necessary to avoid possible delay of evacuations which are expected to be caused by traffic jams and road blocks after the occurrence of a disaster. Evacuation routes should be identified in normal times.

Priority measures 2

In order to avoid the worst case scenario 1.4: "A large number of casualties due to lack of evacuation facilities", the following measures shall be taken:

- **[Preparation of emergency evacuation plan]:** Emergency evacuation plan in urban areas should be prepared by local governments, which includes the locations of evacuation facilities and evacuation routes, taking into account the accommodated capacity of each evacuation facility and population of its catchment area. Emergency evacuation open spaces should be allocated accordingly.
- **[Development of evacuation open space]:** The emergency evacuation open space can be classified into two types in terms of size of the catchment area: (i) regional evacuation open space with the catchment area of about 2km radius from the facility (proper size of open space is approx.10 ha); and neighbourhood/community evacuation open space with the catchment area of 500 m radius from the facility (proper size of opens is approx. 0.5 – 2.0 ha).
- **[Preparation of a management plan for the evacuation facilities]:** Preparation of a management plan for evacuation facilities, including the emergency operation of first-aid and rescue after a large-scale disaster, and maintenance in normal period.

In order to avoid the worst case scenario 2.1: “Prolonged suspension of supply of food, drinking water and other vital goods”, the following measures shall be taken:

- **[Development of supply system]:** Development of procurement and supply systems in coordination among local governments, federal governments and private sectors. Open space will be places for distribution and storage.
- **[Drills for transportation of emergency supplies]: Carry out drills for** transportation of emergency supplies by public-private collaboration, and open spaces are the place to conduct those drills.

In order to avoid the worst case scenario 2.3: “Difficulty of rescue and emergency response activities due to significant damages of relevant organizations”, the following measures shall be taken:

- **[Strengthening capacity of disaster management]:** It is necessary to strengthen the capacity of rescue and emergency activities, including police, fire fighting and other disaster management agencies. In addition, a variety of actions are needed, such as the strengthening of community-based disaster management organizations development of a disaster medical assistance team, and ensuring human resources for the restoration of emergency transportation roads.

In order to avoid the worst case scenario 2.5: “Paralysis of medical services due to damage to and/or severe lack of medical facilities and personnel, and disruption of routes for offering support”, the following measures shall be taken:

- **[Provision of medical function in the disaster area]:** It is necessary to provide a place for medical functions at disaster management bases and evacuation open spaces.

In order to avoid the worst case scenario 2.6: “Outbreak of epidemics or infectious diseases in disaster-affected areas”, the following measures shall be taken:

- **[Hygiene and infection control]:** It is necessary to provide a system for prompt elimination and disposal of sewage from the evacuation open spaces.

In order to avoid the worst case scenario 3.3: “Dysfunction of the central government in the capital region of the Kathmandu Valley”, the following measures shall be taken:

- **[Maintain necessary function of the central government]:** Open spaces can be used for disaster management bases for the national government or/and administrative functions after large disaster.

In order to avoid the worst case scenario 3.4: Significant deterioration of the functions of local governments due to damage to personnel and facilities”. The following measures shall be taken:

- **[Maintain necessary function of local government]:** Open spaces can be used for disaster management bases for the local government or/and administrative functions after large disaster.
- **[Store power at evacuation sites and anti-disaster bases]:** At evacuation open spaces and disaster management bases, it is expected that evacuees are accommodated in case of emergency. Electricity is indispensable in these facilities for the daily lives for evacuees.

In order to avoid the worst case scenario 4.2: Circumstances where disaster information cannot be delivered to people who need it due to suspension of TV and radio broadcasting", the following measures shall be taken:

- **[Ensure TV and radio broadcasting]:** TV and radio play significant role as people's means to obtain disaster-related information. Evacuation open spaces should have TVs or radios for public use.
- **[Alternative information system]:** Open spaces can be used for a place of information gathering and sending. A conventional notice board is also useful under an emergency situation.

In order to avoid the worst case scenario 5.1: "Decline in companies' productivity caused by disruption of supply chains", the following measures shall be taken:

- **[Measures for logistics supply]:** Effective measures for enhancing disaster resilience of logistic facilities should be promoted. Open spaces can be used for distribution bases of goods. In addition, open spaces should have storage to secure emergency goods.

In order to avoid the worst case scenario 8.1: "Circumstances where recovery and reconstruction are delayed significantly due to delay in treatment of a large amount of disaster waste", the following measures shall be taken:

- **[Need effective disaster waste management]:** It is necessary to promote the securing of stock yards for provisional storage of a large amount of disaster waste, and some of open spaces can be used for the stock yards of disaster waste.

(3) Key Proposal - Designation of Disaster Management Base and Emergency Evacuation Open Space

Open spaces to be used for disaster management and emergency evacuation in the KV should be designated by the Ministry of Home Affairs (MOHA) in collaboration with KVDA and related local authorities. Recently, 83 open spaces have been identified in the gazetted document titled "Kathmandu Valley Open Space / Open Space Report" (15th May 2013) prepared by MOHA with the support of International Organization for Migration (IOM). It is proposed that these open spaces can be used for humanitarian purposes in the events of large-scale disasters.

In terms of disaster management, open spaces have the function of disaster management and evacuation spaces. The disaster management function can be achieved through the following facilities and open spaces:

Priority measures 1

Please refer to 5.1.1 Housing and Building section.

Priority measures 2

- **Main Disaster Management Base**

  A large-scale open space should be designated as the main disaster management base in the KV. It has multiple usages dealing with an extensive disaster, which is required for smooth and accurate operation during the recovery from disaster. The main disaster management base is located nearby the international airport, and multiple functions are required such as after-disaster operation, logistic hub, humanitarian coordination, vulnerable population assistance, etc. It also receives relief supplies from international donors.

- **Regional Disaster Management Base**

  Basically, at least one regional disaster management base should be located in each region, and it should have multiple functions of emergency responses and evacuation. Emergency administrative operation shall be located at the base after a disaster.

- **Special Disaster Management Open Spaces**

  Some open spaces should have a specific function with logistics, debris collection, military installation and rescue operation in case of emergency. Those special disaster management open spaces are designated in the 83 open spaces.

  The evacuation open spaces can be classified into the following two types of open spaces in terms of their catchment area:

  1) Evacuation Open Space at District Level

  Open space has a function of evacuation within the catchment area of 2km radius. The main functions of this open space are camp/settlement after a disaster, where space is available for long-term evacuation. Therefore, this open space has disaster management functions with medical care, assistance for vulnerable people, storage and distribution. The ideal size of this open space is approximately 10ha. At least one evacuation open space is needed in each district.

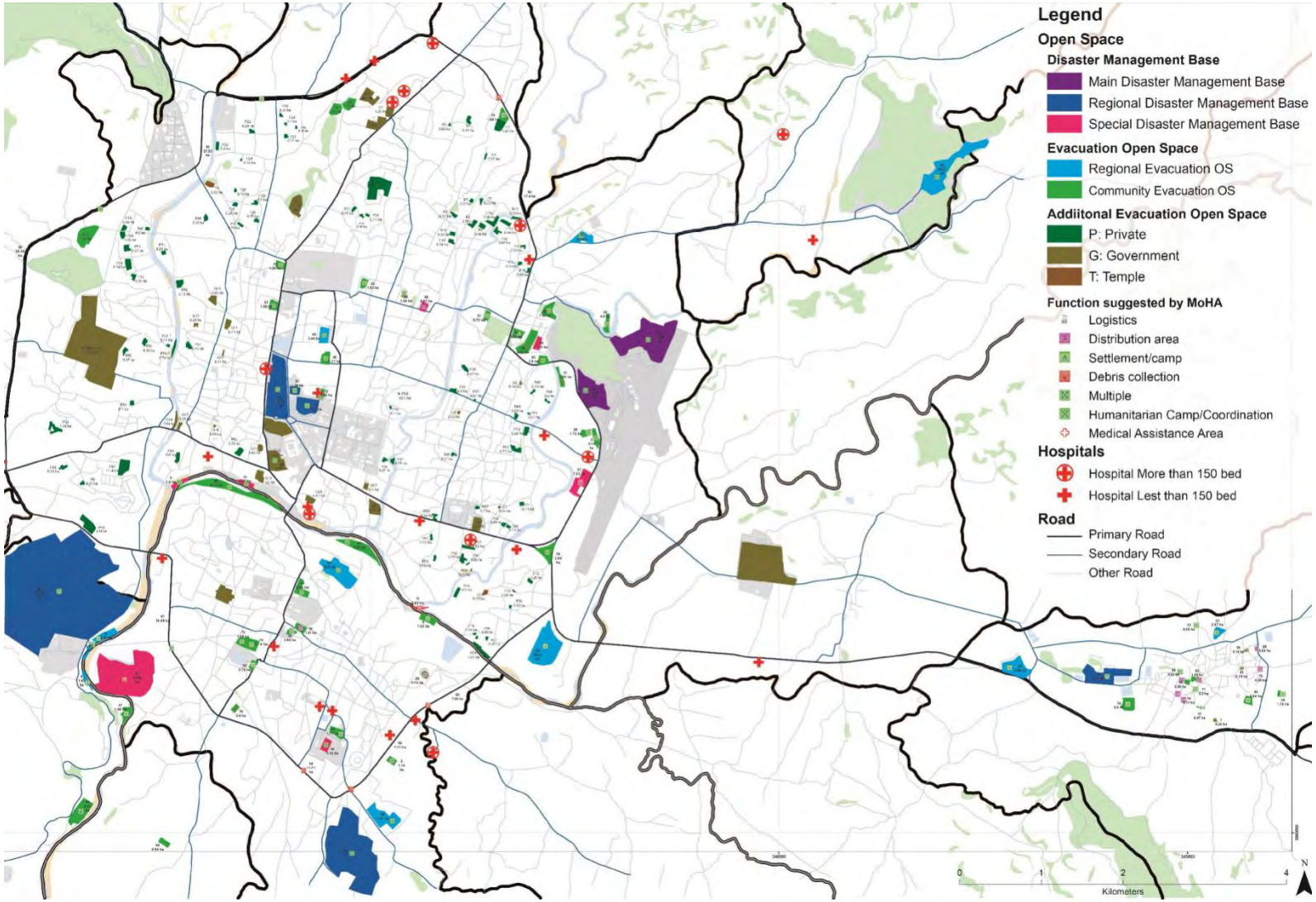
  2) Evacuation Open Space at Community Level

  Open space has a function of evacuation with the catchment area of 500m radius. The main functions of this open space are camp/settlement immediately after a disaster, which is

available for relatively short-term of evacuation. This open space has been equipped with rescue tools and first-aid kits. The ideal size of this open space is 0.5ha to 2ha. It functions as a place for community-based relief and disaster management activities even in normal times.

The overall systems of disaster management bases and evacuation open spaces are shown in **Figure 5.1.17**. By securing those facilities and open spaces, the city can reduce disaster risk.

Source: JICA Project Team



Source: JICA Project Team

Figure 5.1.17 Distribution of Proposed Disaster Management Base and Evacuation Open Spaces

5.1.4 Transportation Network

(1) Guiding Principles

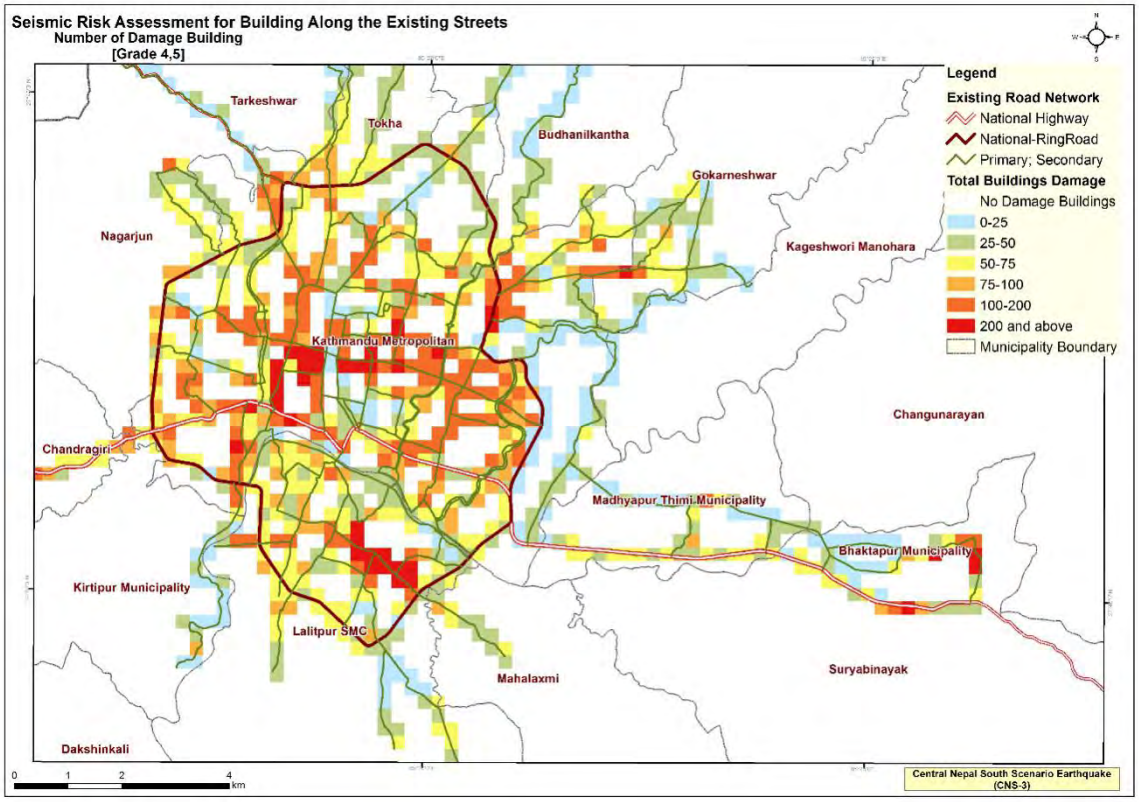
With regard to transportation networks in the KV, where social, economic and central administrative functions are all concentrated, proper disaster preparedness and response efforts should be ensured. Such efforts should not be limited to structural measures, such as the development of disaster resistant transportation facilities, but should include non-structural measures, such as the enhancement of traffic control, designation of emergency roads, strengthening of training, and promotion of research and development of a disaster resistant mechanism.

With regard to arterial roads and transportation hubs which support the economic activities of the KV and even national economy, alternate transportation routes and hubs should be ensured to avoid the worst case scenario that the arterial roads may be disrupted and the hubs may become dysfunctional due to a large-scale natural disaster. In particular, alternate transportation routes for the east-west Aranico Highway, which is the core of the economic activities, would be necessary.

When developing alternative transportation routes and hubs, the relevant government agencies should develop necessary structural measures. At the same time, sufficient non-structural measures such as the strengthening of collaboration with other agencies and provision of training should be prepared, so that alternate transportation routes and hubs can function promptly after the occurrence of a disaster.

Disaster response capacity needs to be strengthened, including human resource development and improvement of materials and equipment, so that roads and transportation can be reopened and recovered promptly. Information sharing and collaboration between the public and private sector are needed in order to ensure prompt response and recovery from a disaster. For this purpose, the designation of an emergency road network is essential to ensure access routes to affected areas and the transportation of vital goods for rescue and recovery from disaster.

Figure 5.1.18 shows the number of damaged buildings along the major roads caused by scenario earthquake. According to this figure, it can be said that Ratna Park Path / Bag Bazar road and Pulchowk Gabhal road / Tyagal Lalitpur road have a large number of damaged buildings along the roads.



Source: JICA Project Team

Figure 5.1.18 Estimated Number of Damaged Buildings along Major Roads in the KV

(2) Measures to avoid the Worst Case Scenario

The measures to avoid the worst case scenarios in transportation caused by large-scale natural disasters are shown in the following:

Priority measures 1

In order to avoid the worst case scenario 1.1: "Casualties due to large-scale and multiple collapses of buildings and infrastructure in urban areas", the following measures shall be taken:

- **Identification of infrastructure vulnerable to disaster** - As for transportation facilities, steady research to identify facilities vulnerable to large-scale disaster needs to be carried out in terms of long-term viewpoint. Especially, vulnerability assessment of bridges is important to ensure an emergency road network.

- **[Develop structural safety measures]:** Regarding houses and buildings along emergency roads, structural safety measures should be taken especially in high-rise buildings, which are subject to long-period ground motions.

In order to avoid the worst case scenario 1.3: "A large number of casualties due to delay in evacuation caused by failure of information transmission", the following measures shall be taken:

- **[Improvement of evacuation transportation network] -** It is necessary to avoid possible delays of evacuations which are expected to be caused by traffic jams after the occurrence of a disaster.

In order to avoid the worst case scenario 2.1: "Prolonged suspension of supply of food, drinking water and other vital goods," the following measures shall be taken:

- **[Secure transportation route after disasters] -** Secure transport routes in order to supply food, drinking water and other vital goods in the affected area of a large-scale disaster

Priority measures 2

In order to avoid the worst case scenario 2.2: "Isolation of many settlements for long periods due to interruption of road network," the following measures shall be taken:

- **[Ensure emergency road network connecting to remote areas]:** Some of the settlements will be isolated after a large-scale disaster. Thus, it is necessary to develop and strengthen the emergency road network to connect with these remote areas.
- **[Develop transport information system]:** Obtaining accurate transportation information in case of a large-scale disaster to promote rescue activities promptly.

In order to avoid the worst case scenario 3.2: "Serious traffic accidents due to lack of traffic control," the following measures shall be taken:

- **[Collection of accurate traffic information]:** It is necessary to collect traffic information promptly after a large-scale disaster, which include locations of road closres, traffic jams, traffic light failures, etc.
- **[Installation of power source devices in traffic signals]:** Promotion of the installation of power source devices for traffic signals to prevent congestion and accidents caused by the failure of signals due to blackout

In order to avoid the worst case scenario 3.3: "Dysfunction of the federal government due to significant damages of their facilities," the following measures shall be taken:

- **[Strengthening infrastructure in the capital region]:** Making efforts for disaster prevention measures, such as seismic resistance for roads, bridges, power supply and water supply facilities. In order to maintain road transport function, eliminate power poles, especially along emergency roads, is needed.

In order to avoid the worst case scenario 3.4: "Significant deterioration of the functions of local governments due to damage to personnel and facilities," the following measures shall be taken:

- **[Strengthening of infrastructure in the vicinity of local government facilities]:** Significant deterioration of the functions of local governments can be caused not only due to damage to the personnel and facilities but also by damage to infrastructure in the vicinity of government facilities. Thus, steady efforts for disaster prevention measures for infrastructure should be taken.

In order to avoid the worst case scenario 5.4: "Dysfunction of the major road transport networks, such as the disruption of road arteries in the Kathmandu Valley," the following measures shall be taken:

- **[Disaster prevention measures for transportation facilities]:** Disaster prevention measures for major transportation facilities should be undertaken to maintain social and economic activities even after a disaster.
- **[Secure road network]:** Disruption of road networks would cause enormous damage to the economy. Thus, relevant ministries and agencies need to collaborate and to make efforts to secure road transport networks even in the case of large-scale disasters.

In order to avoid the worst case scenario 7.1: "Traffic paralysis due to collapse of buildings along emergency roads," the following measures shall be taken:

- **[Prompt collection of disaster information]:** In order to avoid secondary disasters, information on the damage after a disaster should be promptly collected to promote emergency response and recovery activities
- **[Prompt collection of road traffic information]:** It should be ensured that accurate road traffic information should be promptly collected after a disaster and possible measures should be taken to prevent secondary disasters.

In order to avoid the worst case scenario 8.4: "Delay of recovery and reconstruction works significantly due to damage to core infrastructure," the following measures shall be taken:

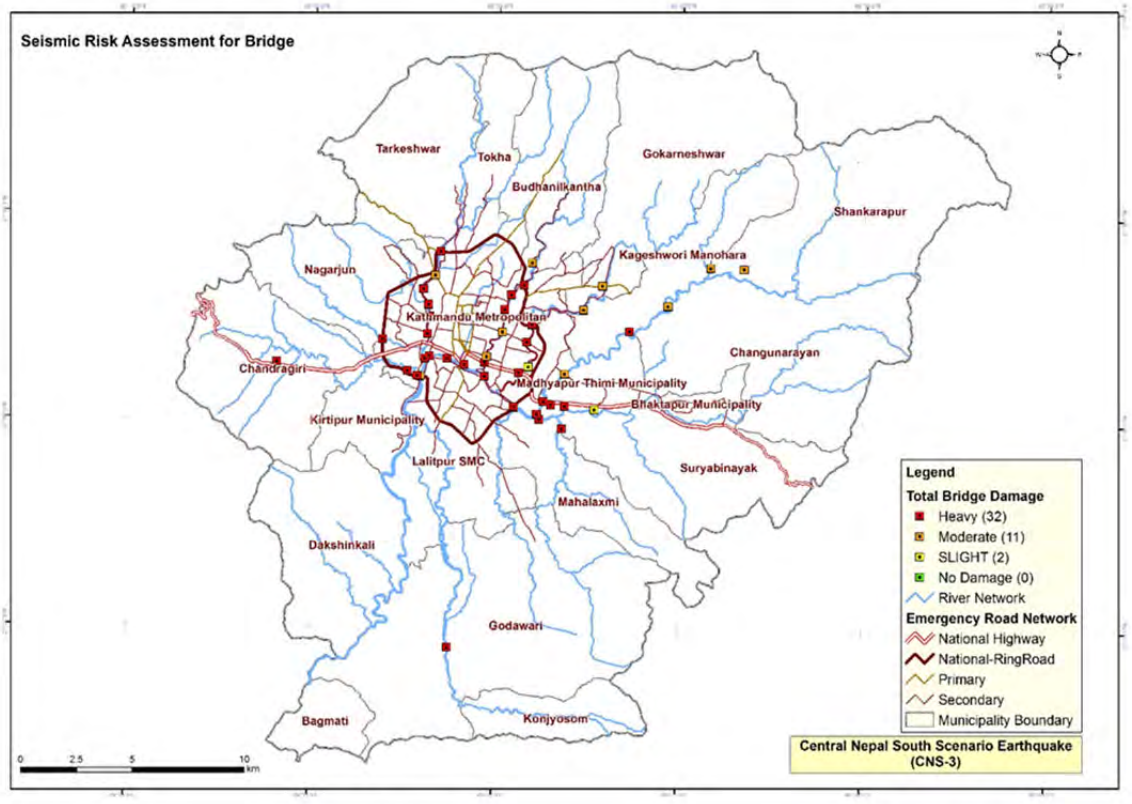
- **[Development of core infrastructure with seismic resistance]:** It has taken considerable time and cost to recover core infrastructure, if it is damaged significantly by a disaster. Thus, construction of a core infrastructure with the concept of BBB should be promoted.
- **[Coordination among relevant ministries, agencies and local governments to reconstruct damaged infrastructure]:** In order to promote recovery and reconstruction of damaged infrastructure from a disaster, it is necessary to enhance coordination among relevant ministries, agencies and local governments.

(3) Key proposal

Priority measures 1: Bridge

As mentioned in chapter 4, the bridge damage results of risk assessment from ERAKV of CNS-3 will be suffered damage the greater part of bridges by earthquake. The result of seismic risk assessment

for bridge which examined 45 bridges by KRAKV project is shown in Figure 5.1.19. It is important to conduct retrofitting and rebuilding of the bridge to function as emergency transportation roads. Therefore, these bridges should be carefully examined in terms of seismic resistance.



Source: JICA Project Team (ERAKV)

Figure 5.1.19 Seismic Risk Assessment for Bridges

Priority measures 2-1: Emergency Transportation Road

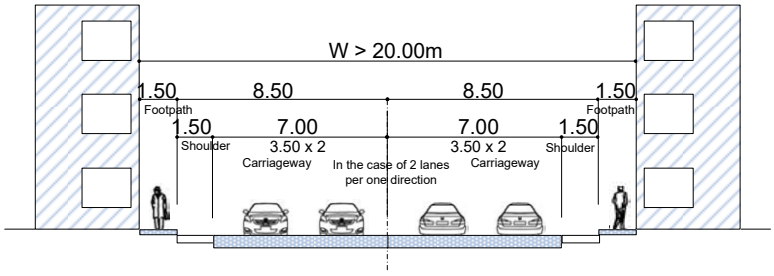
The emergency transportation roads should be designated by MOPIT in association with MOHA to prepare for large-scale natural disasters. The functions of emergency transportation roads are: (i) to transport rescue teams promptly; (ii) to transport injured people to hospitals or emergency facilities; (iii) to transport relief supplies; and (iv) to transport debris after a disaster. In order to ensure the function of the emergency transportation road, it is necessary to ensure the earthquake-resistance of the buildings located along the emergency roads to avoid collapse of the buildings.

The emergency roads are classified into the following three categories:

1) National Emergency Transportation Road

It is national trunk road to connect the Kathmandu Valley with other regions of the country, even after a disaster. It connects major disaster prevention complexes, such as government offices, emergency hospitals and major evacuation open spaces. The Kathmandu Ring Road and Araniko Highway – Tribhuvan Highway are considered to be national emergency transportation roads. Although there is no standard of minimum width for the national emergency road in Nepal, it

needs more than 20m in width to ensure the mobility of emergency vehicles. A typical cross section of secondary emergency transportation road is illustrated below.

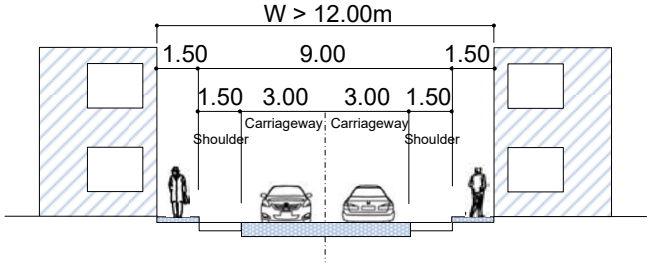


Source; JICA Study Team in cooperation with The Project on Urban Transport Improvement for Kathmandu Valley

Figure 5.1.20 Typical Cross Section of National Emergency Transportation Road

2) Primary Emergency Transportation Road

The primary emergency transportation road is a major trunk road within the Kathmandu Valley. It connects primary disaster prevention bases and evacuation open spaces at the district level. It is major transportation route for relief supplies in the case of an emergency. The minimum width for the primary emergency transportation road needs to be more than 12m in width to ensure the mobility of emergency vehicles. It is the complementary function to the national emergency transportation roads. A typical cross section of secondary emergency transportation road is illustrated below.



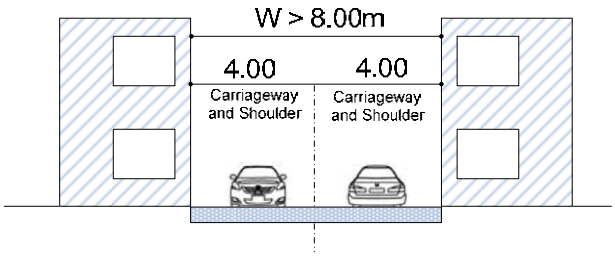
Source; JICA Study Team in cooperation with The Project on Urban Transport Improvement for Kathmandu Valley

Figure 5.1.21 Typical Cross Section of Primary Emergency Transportation Road

3) Secondary Emergency Transportation Road

The secondary emergency transportation has the function of connecting disaster prevention bases and regional evacuation open spaces. It is a route for the transportation of relief supplies as well as for the evacuation of people in the case of an emergency. The minimum width for the secondary emergency transportation road needs to be more than 8m in width to ensure the mobility of emergency vehicles. It is the complementary function to the primary emergency transportation roads. A typical cross section of secondary emergency transportation road is

illustrated below.



Source; JICA Study Team in cooperation with The Project on Urban Transport Improvement for Kathmandu Valley

Figure 5.1.22 Typical Cross Section of Secondary Emergency Transportation Road

Priority measures 2-2: Management of Emergency Transportation Road

The emergency transportation road in the KV district needs to function without restricting emergency transportation immediately after the occurrence of a disaster, such as an earthquake. For this reason, in the case of shutting off road traffic because of a disaster, it is necessary to eliminate road obstacles by prioritizing certain roads over others. It is necessary for road administrators of MOPIT (DOR etc.) to inspect the conditions of ETR after a disaster, and to ensure the safety of road traffic while cooperating with related organizations. In addition, the improvement of pavement is imperative as soon as possible on roads that are not made of all-weather pavement.

1) Emergency Patrol

After a disaster, road administrators such as MOPIT should conduct an emergency patrol on ETR to be managed, grasp the passing propriety of ETR and the condition of the disaster, and also take emergency measures for secondary disaster prevention. For emergency patrols, priority should be given to grasping a comprehensive survey on the outward way, and grasp of the affected areas and prevention of secondary damage on the homeward way. In the case of damage or the possibility of a secondary disaster of an ETR, it shall be necessary to implement traffic regulation prohibiting full traffic according to its condition. In addition, in case the elimination of road obstacles is necessary, each road administrator works together to request cooperation and strive to secure necessary staff and equipment.

2) Emergency Information Communication

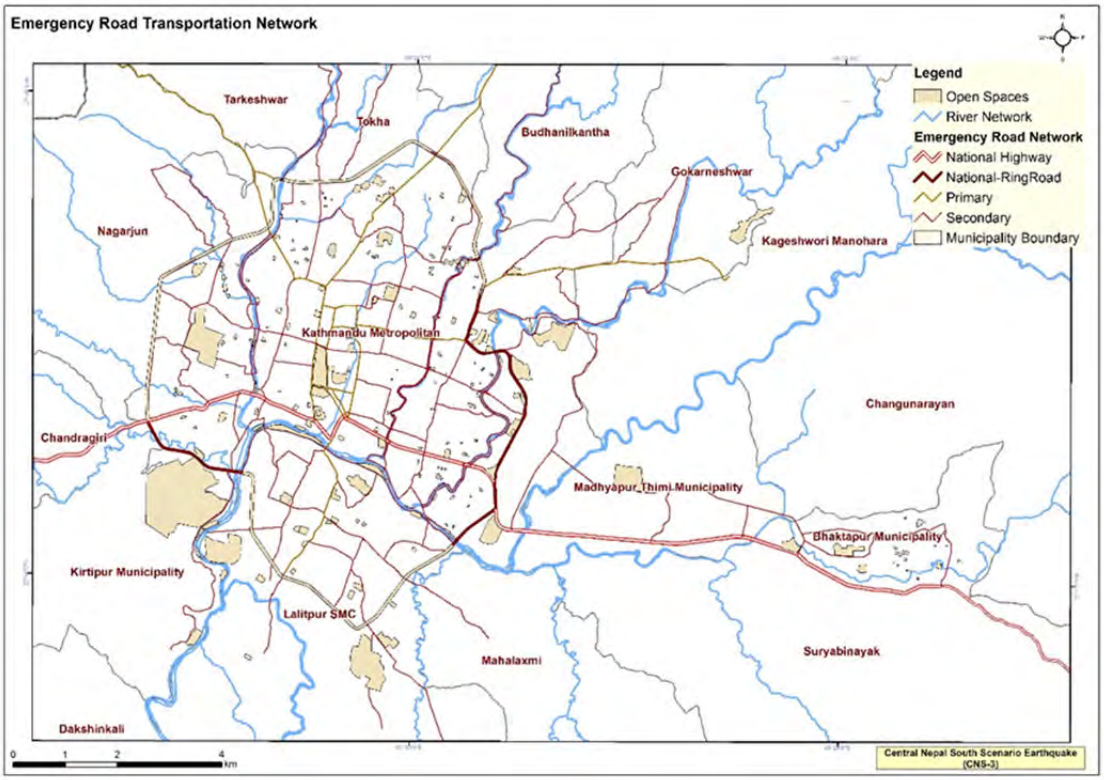
The road/transportation information collected by MOPIT should be communicated to relevant organizations as necessary to share information. In order to reduce the hardships on restoration support road administrators and road users, road/traffic information should be displayed on the road signboard (variable message signboard: VMS) and should be widely and generally provided through cooperating homepages and various media. Information exchange between road administrators and the KV district/out-of-district municipalities should be established according to the "Road/traffic Information Communication Manual (provisional name)" to be formulated in

future. In addition, the NRA which leads the activities of recovery and reconstruction should work with each road administrator and police department to collect the road/traffic information and provide the information related to securing emergency transport to the related organizations. Since the emergency information communication schemes are also useful for normal road/traffic management, it is desirable to develop hardware and software (e.g. disaster prevention/road traffic camera/monitoring system) from the viewpoint of the road inspection and the road traffic control during the normal period.

3) Elimination of Road obstacles

When the emergency transportation roads have been affected by the traffic of vehicles due to a disaster or obstacles, the road administrators of MOPIT should promptly eliminate road obstacles and secure traffic such as emergency vehicles. When the damage has occurred over a wide range and with many sections requiring the elimination of road obstacles, the road administrators must make adjustments with the related organizations and determine the order of priority in consideration of the disaster situation and the importance of the route. Based on those assessments, they shall perform the elimination of road obstacles systematically. Basically, the order of the elimination of road obstacles for the emergency transportation road will be in the order of 1)National ETR, 2)Primary ETR and 3)Secondary ETR, but in the case where the damage extends all over the KV District, Araniko Highway, Tribhuvan Highway and Kathmandu Ring Road need to preferentially open to road traffic. As reported in the "KV Urban Transportation Master Plan (KUTMP)", the elimination of road obstacles secures two lanes in principle, but if it's unavoidable due to the disaster situation, one lane shall be secured and a passing-by section shall be constructed. In the case of the elimination of road obstacles, if it is difficult for the road administrators of MOPIT to remove traffic obstacles, it should promptly request cooperation from the traffic police and/or Nepalese Army. In the event of a major disaster, emergency transportation roads are restricted to transporting seriously ill patients and the transportation of restoration/reconstruction supplies. In order to avoid confusion in emergencies, it is necessary to inform road users/residents of their existence in normal times.

The proposed emergency transportation road network in the Kathmandu Valley is shown in Figure 5.1.23.



Source: JICA Project Team

Figure 5.1.23 Proposed Emergency Transportation Road Network

5.1.5 Lifelines (Water Supply and Sanitation)

(1) Basic Principles

The Department of Water Supply and Sewerage (DWSS) is a lead agency to supply water and sanitation, which are critical factors for survival in the initial stages of a disaster. People affected by disasters are generally much more susceptible to illness and death from disease, which are intimately related to inadequate sanitation, inadequate water supplies and the inability to maintain good hygiene.

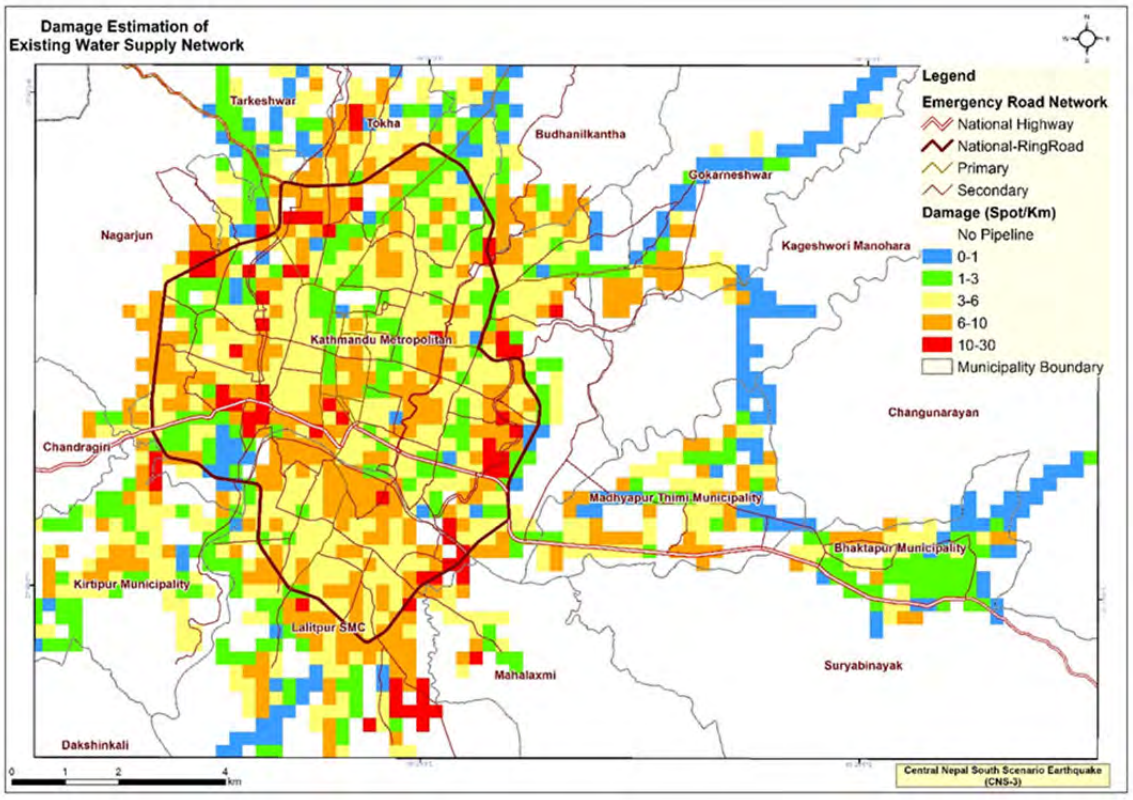
The water supply and hygiene (WASH) programmes in disaster management was prepared by the DWSS in 2016. The main objectives of the WASH are to reduce the transmission and exposure of diseases through the promotion of: (i) good hygiene practices; (ii) provision of safe drinking water: (iii) reduction of environmental health risks; and (iv) conditions that allow people to live with good health, dignity, comfort and security[36].

Better disaster response in public health can be achieved through better preparedness. Such preparedness is the result of the capacities, relationships and knowledge developed by governments,

[36] Department of Water Supply and Sewerage, Contingency Plan, 2016, p.6

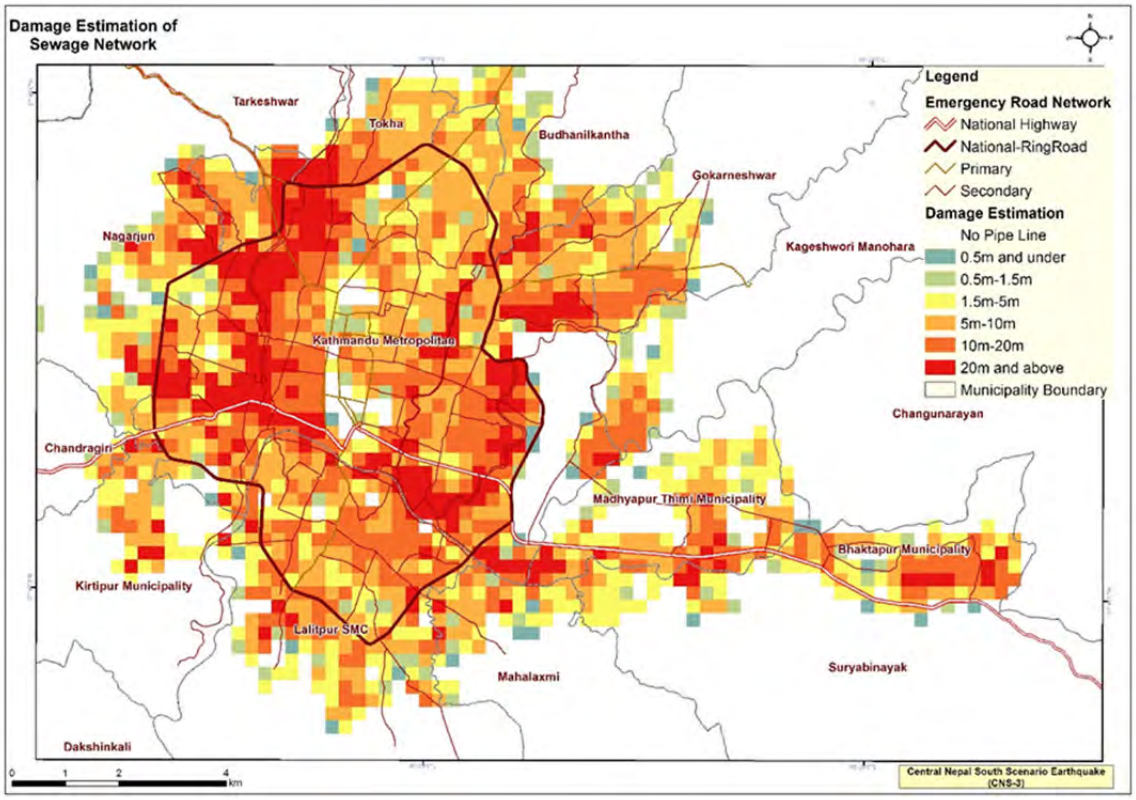
civil society organizations, communities and individuals to respond effectively to disasters. Preparedness includes contingency planning, business continuity plan (BCP), stockpiling of equipment and supplies, emergency services and stand-by arrangements, personnel training and community-level training and drills.

Figure 5.1.24 shows estimated damage of water supply pipeline by grid and Figure 5.1.25 shows estimated damage of sewage pipeline by grid. Inadequate WASH services can indeed cause disasters in post disaster situations. It is necessary to increase the resilience of WASH services during natural disasters by knowing the risks and managing them through preventive and preparedness measures.



Source: JICA Project Team

Figure 5.1.24 Estimated Damage of Water Supply Pipeline by Gild



Source: JICA Project Team

Figure 5.1.25 Estimated Damage of Swage Pipeline by Gild.

(2) Measures to avoid the worst case scenario

The measures to avoid the worst case scenarios in water supply and sewerage which are essential for human life in the event of large-scale natural disaster are shown in the following:

Priority measures 1

In order to avoid the worst case scenario 1.1: "prolonged suspension of supply of food, drinking water and other vital goods," the following measures shall be taken:

- **[Reinforcement of water supply system]:** Seismic reinforcement work for water supply facilities should be implemented in order to continue the service after a disaster. At the same time, diversified measures for possible water sources, such as ground water, rain water, and recycled water, should be examined.

In order to avoid the worst case scenario 2.6: "Outbreak of epidemics or infectious diseases in disaster-affected areas," the following measures shall be taken:

- **[Establish hygiene and infection control]:** Building a system for prompt elimination and disposal of waste from the living spaces of disaster victims.

- **[Earthquake-resistant work for sewerage facilities]:** Seismic reinforcement work for sewerage facilities is necessary to provide sewerage service even after a large-scale disaster.
- **[Preparation of BCP in DWSS]:** Business Continuity Plan (BCP)for sewerage should be promoted by DWSS in collaboration with local governments

In order to avoid the worst case scenario 6.3: "Prolonged suspension of sewerage treatment facilities," the following measures shall be taken:

- **[Promotion of seismic reinforcement for sewerage facilities]:** Seismic reinforcement work for sewerage facilities is necessary to maintain service even after a large-scale disaster.

(3) Key Proposal

Water Supply

A. Storage of a minimum required amount of water to protect human lives in case of disaster.
   - To secure the life supporting water and supply clean water in order not to expand epidemics and infectious diseases.
   - To prioritize the water supply to hospitals, welfare facilities and evacuation centres

B. Preparation of a water supply plan for recovery immediately after a natural disaster

C. Water supply facilities with earthquake-resistance
   - To make a plan for updating and creating earthquake-resistant water supply facilities
   - To make the essential water supply facilities (intake, raw water transmission pipe, water treatment plant, distribution pipe and the reservoir) and main pipes earthquake-resistant
   - To prioritize the earthquake-resistance of water supply facilities in order to decrease water failure areas
   - To establish the high priority facilities, such as hospitals, welfare facilities and evacuation centres in order to supply water and publicize them to the inhabitants

Sewerage

A. Strengthening of the existing sewerage systems against earthquake disasters.

B. Emergency recovery and repair of the existing sewerage facilities after a disaster

C. Implementation of a business continuity plan (BCP) in sanitation service

D. Emergency sanitation for temporary/semi-permanent toilets provided in camps and evacuation facilities

5.1.6 Tourism and Cultural Heritages

(1) Guiding Principals

Tourism is an important industry in Nepal's economy and it is the key source of earning foreign currency and revenue. According to the World Travel and Tourism Council (WTTC), the total direct contribution of tourism sector to Nepal's GDP was NPR 75.6 billion, contributing 4.2% of the whole national economy in 2014.

Strengthening the tourism sector is directly related to building a resilient society in Nepal. In the Ministry of Culture, Tourism and Civil Aviation (MOCTCV), there is Department of Tourism (DOT), which is responsible for the development of policies, strategies, regulation and quality control of the tourism industry. The Department of Archaeology '(DOA) is the prime organization for the archaeological research and protection of the cultural heritage of the country. Protection and maintenance of archaeological sites are the main concerns of the DOA. The Nepal Tourist Board (NTB) is a national organization in the form of partnership between the government and the private sector in the tourism industry.

When the earthquake hit Nepal in April 2015, the government agencies could not get enough information about visitors, although they received numerous inquiries from many countries. There is no cooperation in disaster response and management among tourism related organizations. Strengthening the capacity of disaster response and management is needed in Nepal's tourism sector.

There are 7 World Heritage sites in the Kathmandu Valley: Durbar squares of Kathmandu, Patan and Bhaktapur, and religious sites of Swayambhu, Bauddhanath, Pashupati and Changu Narayan. These monuments were defined as the outstanding cultural traditions of the Newars, manifested in their unique urban settlements, with intricate ornamentation displaying outstanding craftsmanship. It is important to preserve the historical and cultural value and to maintain the traditional architectures, landscape and activities as living heritage for the people who work for tourism sector.

The World Heritage sites in the KV were affected by the April 2015 earthquake. After the disaster, the DOA established the Earthquake Response Coordination Office (ERCO) and it made a strong effort for the reconstruction of historical heritages under the coordination of UNESCO. However, there is no clear policy for disaster prevention such as earthquake resilient work in the historical and cultural heritage sites. Furthermore, in order to reduce damage of heritage sites, it is necessary to reinforce the structure of buildings located in the vicinity of the historical site. It is also necessary to prepare disaster management plans including evacuation plans for visitors in case of an emergency.

In order to preserve the historical buildings and cultural landscape in the KV, involvement of local residents/community is essential. Education and awareness programmes on cultural heritage intended to educate local residents are necessary to disseminate the value and relationship with their life. At the same time, the community-based disaster risk management activities are necessary to preserve the historical and cultural landscape as a tourism resource.

(2) Measures to avoid the Worst Case Scenario

In order to avoid the worst case scenario 1.3: "A large number of casualties due to delay of evacuation caused by failure of information transmission", the following measures shall be taken:

- **[Providing disaster information promptly]:** In the case of the event of a disaster, it is necessary to provide information of the disaster promptly and effectively from relevant government offices to citizens and visitors by using diversified means, such as radio, TV and other communication tools.

- **[Encouragement of Local Community]:** Local community of a tourism site is required to implement disaster prevention training such as an evacuation drill. These training situations and drills are necessary to protect the lives of local residents as well as protect tourists' safety.

Priority measures 1

In order to avoid the worst case scenario 5.3: "Long term stagnation of tourism industry due to damage to important cultural historical heritages," the following measures shall be taken:

- [Promotion of safety measures in cultural and historical heritages]: Tourism is a key industry in Nepal. In order to avoid fatal damage to the tourism industry, some safety measures should be taken in the cultural and historical heritages, which include promotion of retrofitting for both safety and preservation of the historical and cultural value.

- [Earthquake-resistance measures at hotels]: It is encouraged to enforce earthquake-resistance measures at hotels and tourism spots to provide safety to tourists.

- [Dissemination of safety plan to tourists]: It is necessary to provide a safety plan for visitors and tourists, which includes locations of information centres, major government facilities, evacuation routes and facilities in case of emergency.

- [Providing awareness programmes of safety measures for tourism business operators]: Awareness programs of safety measures should be provided to tourism business operators during normal times to prevent or reduce damage in cultural and historical heritage sites.

(3) Key Proposals

Priority measures 1

- **Establishment of Information Network among Relevant Organizations**

  It is important to develop a network that uses cross-reference information among tourism-related organizations. For climbers and trekkers in particular, an information network is necessary that can be searched from every data source such as trekking agents,

guides, hotels and so on for emergency case in disaster.（MOCTCA）

- **Dissemination of Safety Information to Visitors**

  Information for disaster prevention and response shall be provided to all tourists. The information for disaster prevention includes road conditions, landslides, weather, banda, etc. and the disaster response information includes evacuation, with whom and how the tourists have to contact, are needed. The information shall be delivered through not only the internet but also leaflets at hotels, restaurants and/or travel agencies. (MOCTCA, District Tourism Office, Tourism organizations etc.)

- **Development of Local Community(s)**

  It is required to comprehend the concept of conservation of cultural heritages, tourism development, development of local community(s) and disaster prevention. Implementation of educational programmes on cultural heritage, tourism and disaster prevention to local residents is needed with the aim of creating community based development. As a part of community based activities, disaster prevention (evacuation and evacuation guidance drill, appropriate reinforcement method against earthquake etc.) and tourism activation and development shall be implemented. Establishment of ordinances by local communities about cultural landscape conservation is strongly expected. (MOCTCA, District offices, community groups regarding Hanuman Dhoka, Patan and Bakhtapur)

- **Development of Operational Handbook for Rehabilitation of Cultural Heritages**

  Regarding particularly important monuments (World Heritage sites), it is necessary to develop an operational handbook focusing on how to rehabilitate the monuments based on the existing protection laws of the DOA as well as fostering experts regarding the rehabilitation of historical monuments, not only administrative officers but also technical persons. It is important for rehabilitation projects of historical monuments to be supervised by well-trained technical experts. (DOA of MOCTCA)

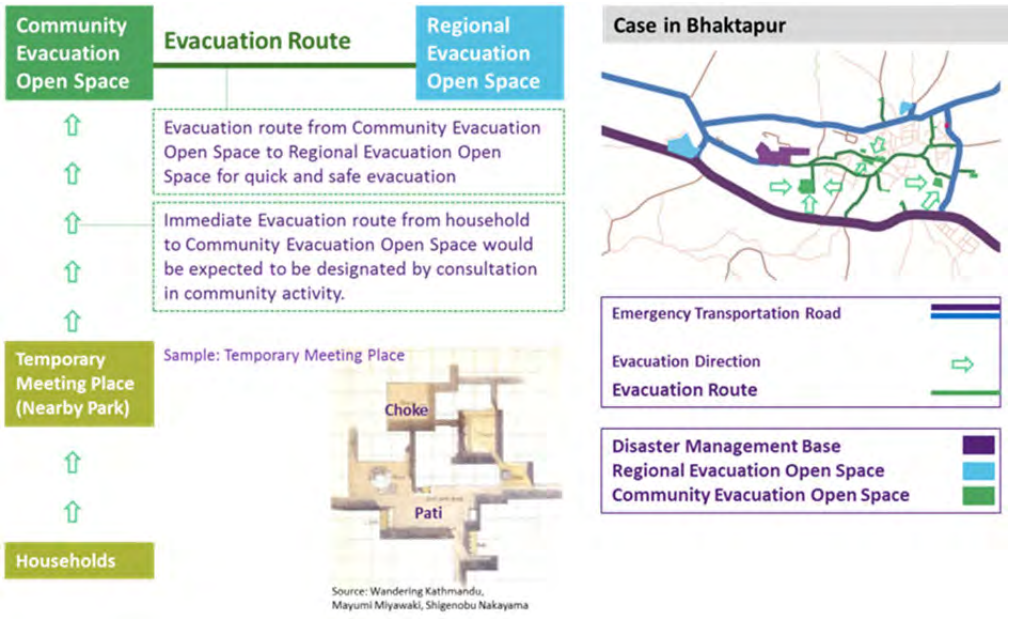
- **Human Resource Development**

  When developing the inventory for damage survey, both the DOA and local governments have recognized the lack of quality and quantity of human resources. Some of the issues in the process of inventory development included: 1) classification method of damage levels was not perfectly standardized; and 2) the result of classification depends on surveyors even though they are trained before being dispatched. Then, the reliability of the inventory should also be an important issue. In addition, because the vision of inventory development is not unified between the central and local governments, the DOA would face difficulty in integrating the results of the survey. The DOA needs an experienced structure engineer in the field of conservation of cultural heritages. In order to develop the amendment of the conservation ordinance, the DOA is in a complex dilemma of authenticity and reinforcement against a next possible earthquake. Basically the DOA places the priority on authenticity;

however, the department is not able to analyse it based on the evaluation of seismic capacity.

- **Necessity of Disaster Prevention Plan of Historical Conservation Area**

  It is necessary to develop disaster prevention plans for heritage sites for coming disasters. There is no expertise in this sector in Nepal, and so international knowledge has to be applied. The DOA also understands that traditional techniques have not been properly inherited by the next generation. In order to nurture technicians, official technical/vocational training for the heritage conservation including wood carving would be needed.



Source: JICA Project Team

Figure 5.1.26 Conceptual Diagram for Emergency Evacuation in Historical Area

5.2 Cross-Sectoral Measures

5.2.1 Social Consideration on Disaster Management

(1) Guiding Principle

A natural disaster may hit everyone in the KV in the future regardless of his or her sex, age, caste/ethnicity or socio-economic status, but its effect may not be the same to everyone. Some are more prepared and resilient, therefore capable to respond to an adverse situation better and recover from the disaster more quickly than others. For example, a family living in a closely knit community with adequate food sufficiency is more likely to cope with a disaster better and recover faster than an

elderly migrant worker living alone without enough food stock nor anyone to fall back on. Some communities and individuals are more vulnerable to a disaster than others.

To build resilience in the society, it is important to understand who and where vulnerable people are and what actions should be taken in the event of disasters as well as to carry out awareness raising and capacity building programmes targeting the vulnerable population so that they will be more prepared for and resilient to future disasters.

Kathmandu Valley, which covers the Kathmandu, Bhaktapur and Lalitpur Districts, is the most urbanized and densely populated area in Nepal. According to the 2011 National Census the population of these three districts exceeds 2.5 million, which is nearly 10% of the country's population of 26.5 million. The annual population growth rate of the KV is around 4.3% in the past decade, which is significantly higher than the national average of 1.4% during the same period, indicating a large influx of population from rural areas into the KV. Although the poverty incidence in the KV is as low as 9% (the national average is 25.2%), rapid and unsustainable population growth has produced a segment of urban poor.

Nepal is multi-ethnic and multi-language country. 2011 National Census lists 125 caste/ethnic groups and 123 languages. In the KV 116 out of 125 caste/ethnic groups are reported, which also indicates a large number of inflow of population from all corners of the country. Although the KV comprises of many caste/ethnic groups, nearly 80% of the population are from four groups: Newar (26.9%), Hill-Brahman (20.4%), Chhetri (19.8%) and Tamang (11.2%).

Various studies point out that Dalit, who has long been discriminated against and excluded as lower caste, is still the most vulnerable caste/ethnic group in Nepal[37]. In the KV, Dalit constitutes only 2.8 % of the population, which is much lower than the national composition of 13.6%.

The Nepal Foundation of Indigenous Nationalities (NFIN) lists 59 ethnic groups as indigenous nationalities called "Janajati". In the KV, Janajati makes up to 50.9% of the population. Janajatis are further categorized into five groups based on their socio-economic status: (1) Advantaged Group, (2) Disadvantaged Group, (3) Marginalized Group, (4) Highly marginalized Group, and (5) Endangered Group. In the KV each group represents 27.2%, 10.1%, 13.2%, 0.5% and 0.0% of the population, respectively. Newar, which is the largest ethnic group in the KV, belongs to the Advantaged Group while Tamang, the fourth largest caste/ethnic group in the KV, belongs to the Marginalized Group. In addition, there are Madheshi and other communities who are categorized as Other Backward Classes (OBCs). This group constitutes 2.6% in the KV.

In some urban areas in the KV people from different caste/ethnic groups are living side by side and people's life style is influenced not only by their caste/ethnic identity but also by their socio-economic status such as education level, types of job, financial status, etc. Even though distinction based on caste/ethnic groups may be less prominent in urban areas than in rural areas, Dalit, Janajati (especially

[37] World Bank and DFID, "Unequal Citizens: Gender, Caste and Ethnic Exclusion in Nepal", (January 2006),

those who belong to endangered, highly-marginalized and marginalized groups), Madeshi and OBCs should be recognized as vulnerable communities.

In addition to the above mentioned caste/ethnic groups, people at a certain age cycle such as infants and young children, pregnant women and elderly people, people living with disabilities (PLWD), people of extreme poverty such as street children, working children, homeless, and those living in slum areas or on river banks are often marginalized and excluded.

(2) Key Proposals

In the process of implementing policies and programmes described in the KVRP, it is important to ensure "gender equality and social inclusion (GESI) with a specific orientation towards the most vulnerable," which is one of the guiding principles of recovery strategies addressed in the Nepal Earthquake 2015: Post Disaster Needs Assessment published by the National Planning Commission. To follow this principle, it is essential to draw necessary measures for each programme separately, considering various aspects such as target area, stakeholders, resources, monitoring process, and others.

The following are some of the issues and counter-measures which should be considered so that GESI is reflected in the process.

A. Identification of Vulnerable People in the Target Area

At the planning stage it is necessary to know who the stakeholders are and among them who and where the vulnerable communities are. If appropriate, Stakeholder Analysis and Social Mapping, which are two useful tools to understand relationships among stakeholders and to identify vulnerable communities, should be conducted in a participatory manner.

B. Communication and Information Sharing

It is often the case that important information is circulated only among the elite or the powerful, which may or may not be intentionally so. In Nepal as well as many other countries, it is rare to see women or people from marginalized groups in a public hearing or meeting. It is therefore important to take necessary measures so that information will reach everyone concerned, including those identified as people from vulnerable communities. When preparing an information, education and communication (IEC) plan, effective methods of communication and information sharing with vulnerable communities should also be considered.

C. Coordination with Non-governmental Organizations (NGOs)

Many of the programmes described in the KVRP will be initiated by the government or governmental agencies. However, in some cases it is effective to coordinate with NGOs and civil society organizations which have expertise in certain areas such as gender, child rights, street children, child labour, people living with disability, and others. Some of the organizations also have good skills in awareness raising and community facilitation, which are often needed to

encourage the community, especially people from vulnerable communities, to get involved in recovery and reconstruction programmes.

5.2.2 Capacity Development on Disaster Management

(1) Guiding Principle

It is important to enhance the capacity of organizations to be responsible for disaster management, including public and private sectors and civil society. Conventionally, the disaster management mainly focuses on relief and response during an emergency phase. However, preparedness for disaster during ordinary days become more and more important to reduce the loss of life and assets and to reduce the cost for post disaster recovery and reconstruction efforts. In this regard, the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) mentioned that DRR is a series of efforts to reduce economic and physical loss in case of disasters and strengthening disaster risk governance for all phases in disaster management cycle, such as prevention, mitigation, preparedness, response, recovery and rehabilitation.

In order to implement the comprehensive disaster risk management, relevant government agencies involved in disaster risk reduction need to: 1) establish an effective organization structure to make prompt decisions for emergency response, 2) develop the capacity of the response to disasters through training and emergency drills, 3) secure human resources in charge of DRR, and 4) understand the importance of comprehensive risk reduction activities.

Even in an emergency period, the government officials are needed to provide basic public services, such as disaster relief and rescue operations. Each individual official needs to identify specific roles required in emergency responses and disaster relief operations.

Additionally, it is necessary to promote efforts to support DRR initiatives by the communities and residents themselves. After a disaster, some communities may be isolated due to the disruption of the transportation network. The first 72 hours after a disaster are the most critical. During this period, all the DRR efforts should be taken, including ‘public-help’, an effort to be taken by government, ‘self-help’, self-resilience efforts for own life, and ‘mutual-help’, a mutual assistant within the community.

(2) Measures to avoid the worst case scenario

In order to avoid the worst case scenario 1.2: “A large number of casualties due to the collapse of facilities used by the general public”, the following measures should be taken:

- **[Strengthening the capacity of organizations to be responsible for disaster response]**: The **c**apacity of the relevant agencies to be responsible for disaster response need to be strengthened through the enhancement of necessary equipment and human resource development activities, such as various types of training and drills.

In order to avoid the worst case scenario 1.3: "A large number of casualties due to the delay of evacuation caused by the failure of information transmission", the following measures should be taken:

- **[Providing disaster information promptly]:** In the case of an event of a disaster, it is necessary to provide information on the disaster promptly and effectively from relevant government offices to citizens and visitors by using diversified means, such as radio, TV and other communication tools.
- **[Utilization of information technology]:** It is encouraged to utilize information technology to expedite the collection and dissemination of disaster information
- **[Strengthening of capacity of local government]:** Strengthening of human resources capacity for effective utilization of collected information at local government level, which is a primary body of provision for disaster

In order to avoid the worst case scenario 2.3: "Difficulty of rescue and emergency response activities due to significant damages of relevant organizations", the following measures should be taken:

- **[Strengthening capacity of disaster management]:** It is necessary to strengthen the capacity of rescue and emergency activities, including police, fire fighting and other disaster management agencies. In addition, a variety of actions are needed, such as the strengthening of community-based disaster management organizations, development of a disaster medical assistance team, and ensuring human resources for restoration of emergency transportation roads.
- **[Standardization of disaster response activities among organization]:** Each relevant organization has its own mandate, operational process and equipment for disaster response which is different from each other. It is necessary to standardize disaster response activities and an information communication system to strengthen rescue and emergency activities.
- **[Implementation of joint drill practices]:** Implementation of joint drills to encourage disaster response activities among relevant stakeholders.

In order to avoid the worst case scenario 3.3: Dysfunction of the federal government due to significant damages of their facilities", the following measures should be taken:

- **[Ensure information and communication systems]:** Each federal ministry and agency needs to ensure emergency communication systems, so that the federal government can continue its emergency duties even under a deteriorated environment.

In order to avoid the worst case scenario 4.2: "Circumstances where disaster information cannot be delivered promptly due to suspension of TV and radio broadcasting", the following measures should be taken:

- **[Alternative information communication system]:** Development of an alternative information communication system in the cases where TV and radio broadcasting is suspended due to damage from a disaster.

In order to avoid the worst case scenario 5.7: "Stagnation of stable food supply", the following measures should be taken:

- **[Establishment of secure food supply system]:** Secure food supply systems are encouraged even at the event of a large-scale disaster. It is necessary to prepare BCPs for food business operators to provide a secure food supply.

In order to avoid the worst case scenario 5.7: "Delay of recovery and reconstruction works significantly due to collapse of local communities", the following measures should be taken:

- **[Enhancement of capability of community]:** It is necessary for the local governments to enhance the capacity of communities to promote the recovery and reconstruction activities by their initiatives. For this purpose, it is necessary to conduct disaster prevention drills, training and education to share the knowledge of disaster management during the non-disaster time.

(3) Key proposals

A. Capacity Development of Disaster Management Organizations

Disaster management organizations should have an effective structure to conduct appropriate response activities and to coordinate among relevant agencies. They need to clarify their tasks and roles in a disaster. It is also necessary for the public institutions to regularly develop and improve the information communication system for ensuring sufficient communication in case of emergency.

It is necessary to prioritize actions required in an emergency. Disaster management organizations need to protect citizens' lives, and then their livelihoods and properties. In addition, the prompt dissemination of information is required to conduct evacuation, if necessary. For effective communication in case of emergency, it is necessary to improve the information communication system even in a normal period.

Training sessions and drills for emergency responses should be conducted in the normal time to prepare for a disaster that may happen any time in the future. The effectiveness of actions and measures prescribed in disaster management plans can be verified through the training and drills. The disaster management plans should be regularly reviewed by using a practical PDCA (Plan-Do-Check-Act) cycle.

B. Improvement of Disaster Management Technology

Improvement of disaster management technology is important to reduce the risk from natural disasters. Some of the technology is:

- Development of GIS technology (data collection of terrain, weather, disaster records, etc.)
- Establishment of GIS database
- Preparation of hazard maps (landslide risk assessment and flood risk assessment)
- Establishment of early warning system (cyclone, flood, landslide)
- Dissemination of awareness of disaster prevention for local residents

C. Promotion of Disaster Management at Community Level

The community plays a vital role in reducing the impact of a disaster. Once a disaster occurs, the community needs to respond to the disaster until rescue or emergency response is provided. Community-based disaster management is a key in reducing vulnerability to disasters. Enhancing the capacity of the community is essential in disaster risk reduction.

The spirit of "mutual-help", which means that protecting their safety from natural disasters by the mutual assistance of the community, can be fostered through community-based disaster management activities. In order to build a disaster resilient community, it is required to strengthen the capacity of the residents in disaster risk management, especially with involvement of women in DRR activities, through partnerships with government institutions. It is also important to designate emergency evacuation areas in the community.

D. Human Resources Development in Public Organizations

Public organizations need to prepare training programmes to encourage the staff to promote DRR activities during normal time. It is desirable that public officials who are once appointed in the DRR section should participate in the training and to improve their skills and knowledge of emergency response. These public officials can take the initiative in DRR activities.

E. Promotion of Self-help Efforts

Self-help is a concept to prepare DRR *in advance* such as the stockpiling of emergency vital goods and preparation of actions for evacuation in case of disaster. People need to prepare food, water and sanitation supplies for at least three days In addition, it is crucial to collect information for safe and rapid evacuation, including the location of special help, the nearest evacuation site and its route, the means of transportation and the time spent evacuating.

F. Promotion of Disaster Education

The promotion of disaster education is needed at schools and in the community. Disaster education provides a basic knowledge of natural disasters and risk reduction measures. It also provides the knowledge of socially vulnerable people, including senior citizens, handicap people, pregnant women and children, who need special assistance at the event of disasters.

G. Establishment of Information Dissemination System

In case of an emergency, the local government needs to issue a warning message including a possible evacuation order in a proper manner. After receiving the message, the residents take

action for evacuation. However, a warning message cannot be delivered sufficiently due to communication disturbance during disaster. Accordingly, it is necessary to: (a) conduct education and training of DRR for local residents during normal times; (b) prepare a proper information dissemination system to deliver a warning message to the residents; and (c) assist the residents in conducting safe and swift evacuation, if necessary.

5.2.3 Partnership with Relevant Organization and Private Sector

(1) Guiding Principle

There are many stakeholders in disaster management in Nepal. The Ministry of Home Affairs (MOHA) is designated as the nodal organization to be responsible for post-disaster relief and rescue; it is to receive support from other ministries, international aid organizations, NGOs and civil society. The National Reconstruction Authority (NRA) was newly established in April 2016 aiming to conduct rehabilitation and reconstruction work from the 2015 earthquake. Recently, a new Disaster Management Act has been drafted but its promulgation is still contingent on approval by the parliament. The new Act will shift the policy orientation from a relief and rescue to a disaster preparedness by main-streaming DRR into a national development agenda.

The Government of Nepal should take an initiative for DRR with the partnership of other stakeholders, including the private sector, civil society, volunteers, community groups, and the academic community. In order to reduce the damage caused by natural hazards, all actors involved in DRR need to understand the importance of proactive implementation of comprehensive risk reduction and preparedness initiative in addition to post disaster efforts. However, there is a limitation to cover all the activities by the efforts of the public sector, from the initial preparedness, post disaster response and rescue, and to the long-term recovery and reconstruction.

Non-state stakeholders such as the private sector, academia and civil society provide support to the public institutions in DRR in accordance with the national policy, law and regulation. It is necessary to maintain a good relationship between the public sector and private sector and have the common understanding by sharing policy, orientation and information.

The private sector will play an important role in DRR in close partnership with the government and citizens. The private sector is able to take a great role to develop effective disaster prevention technologies and promote public-private risk-sensitive investment. It is significant to promote efforts such as establishing disaster prevention facilities, maintaining infrastructure and deteriorated structure by utilizing a PPP scheme, and improving the environment for stimulating private investments. Additionally, the private sector takes a key role to deliver stable food and energy supply, and to provide a means of livelihood.

(2) Measures to avoid the worst case scenario

In order to avoid the worst case scenario 1.1: "A large number of casualties due to multiple collapses of buildings and infrastructure", the following measures should be taken:

- **[Development of a cooperation system in disaster management]:** In order to avoid a large number of casualties in the event of a large-scale disaster, a broad-based collaboration system in disaster management is necessary, such as collaboration among government ministries and agencies as well as between public and private sectors.

In order to avoid the worst case scenario 1.3: "A large number of casualties due to delay of evacuation caused by failure of information transmission", the following measures should be taken:

- **[Providing disaster information promptly]:** In case of the event of a disaster, it is necessary to provide information of a disaster promptly and effectively from relevant government offices to citizens and visitors by using diversified means, such as radio, TV and other communication tools.

In order to avoid the worst case scenario 2.1: "Prolonged suspension of supply of food, drinking water and other vital goods", the following measures should be taken:

- **[Development of emergency supply system]:** The development of procurement and supply systems of food, drinking water and other vital goods in coordination among federal and local government agencies and private sectors.
- **[Implement drills for delivery of emergency supplies]:** Carry out drills and training for the transportation of emergency supplies in collaboration with the private sector.

In order to avoid the worst case scenario 2.3: "Difficulty of rescue and emergency response activities due to significant damages of relevant organizations", the following measures should be taken:

- **[Collaboration for emergency activities among relevant stakeholders]:** Emergency activities need to be coordinated among relevant stakeholders, including local government, ministry of defense, police, fire fighting, ministry of home affairs, etc. It is also necessary to collaborate with the private sector for the implementation of emergency activities,

In order to avoid the worst case scenario 5.1: "Decline in companies' productivity due to disruption of supply chains", the following measures should be taken:

- **[Encourage to establish BCP in public and private enterprises]:** It is encouraged to establish a BCP in each company to continue their business effectively even after a large-scale disaster.

- **[Promote to establish BCP across multiple companies]:** In addition to individual BCP at each company, it is necessary to promote the establishment of BCP across multiple companies in order to secure supply chains in the event of a large-scale natural disaster.

In order to avoid the worst case scenario 5.2: "Suspension of energy supply necessary for socio-economic activities", the following measures should be taken:

- **[Implement joint drill]:** Relevant organizations and enterprises should carry out joint drills against disasters, focusing on measures and actions to ensure energy supply chains.

In order to avoid the worst case scenario 5.6: "Circumstances where dysfunction of financial services", the following measures should be taken:

- **[Maintain banking and financial system]:** The central bank and other financial institutions need to establish their own BCP as well as securing redundancy of systems and enhancement of the earthquake resistance to their facilities

In order to avoid the worst case scenario 5.7: "Stagnation of stable food supply", the following measures should be taken:

- **[Collaboration among food supply operators]:** In order to maintain food supply even in the event of a large-scale disaster, food business operators should build effective food supply systems with collaboration and cooperation among relevant stakeholders.

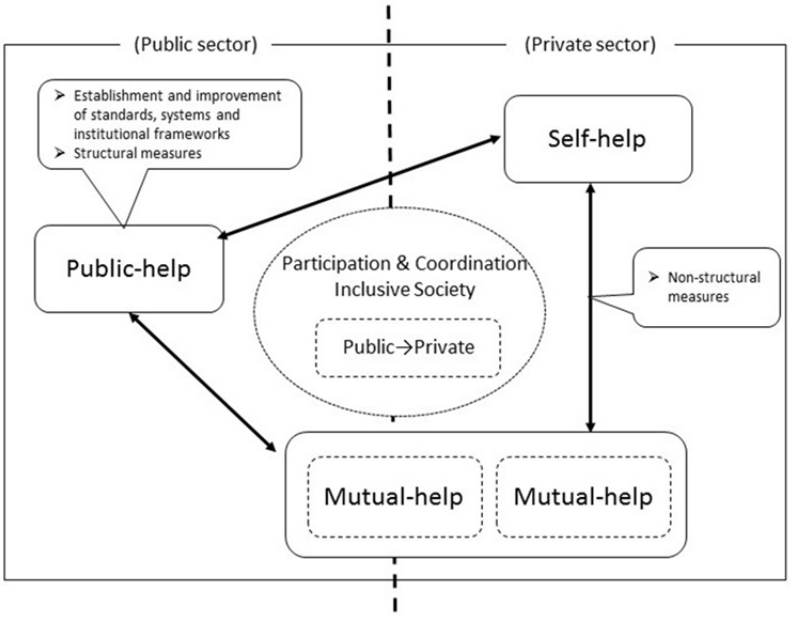
In order to avoid the worst case scenario 6.1: "Suspension of power supply networks and oil supply chains", the following measures should be taken:

- **[Introduction of diverse energy sources]:** Diversification of energy supply sources should be sought to ensure stable power supply even in case of disaster.

(3) Key proposal

A. The Public and Private Partnership

The public sector includes federal ministries and local governments. The private sector includes business entities, academia and research institutions, voluntary organizations, and community-based organizations. In addition, the civil society plays an important role. It is necessary to consider a coordination mechanism between the public and private sectors to promote the DRR activities. Disaster drills and exercises are good opportunities to promote disaster awareness among these stakeholders. Figure 5.2.1 shows the DRR framework for enhancing disaster resilience by the effort of self-help (measures by individuals to protect their own lives and assets), mutual-help (measures by communities, enterprises and volunteer organizations to protect their safety) and public-help (measures by the central and local governments).



Source: Ryosuke Aota, Yoshiteru Murosaki and Kihiko Hokugo, *(2015)* "The Role of Private Sector and "Public-Private Partnership in Disaster Reduction".

Figure 5.2.1 Coordination Mechanism of the Public and Private Sector in Disaster Risk Reduction

B. Utilization of Resources in the Private Sector

The private sector, such as industry and academia, has their own technology, skill and knowledge regarding DRR. It is informative to clarify disaster-related organizations and human resources in order to effectively use equipment, materials and human resources required for DRR as well as utilize think-tank functions in the private sector.

The private sector is expected to take a great role in DRR, including public awareness of natural disasters, improvement of skills and technology of rescue, implementation of disaster drills and exercise. It needs a system and a method in promoting various stakeholders which allows them to support affected people in cooperation with the public institutions.

C. Preparation of Business Continuity Plans (BCP)

The business sector might have both direct and indirect impact from a disaster. Ensuring supply chains are essential to continue business activities. Without securing supply chains, a disaster could affect economic disruption in the entire region or country. Business Continuity Plan (BCP) is a plan prepared by an organization to ensure the continuity of the pivotal functions of business after a disaster. Disruption of business activities on which the local population earns a living causes a big impact on society. It should be applied to all entities not only private enterprises but also the public organizations.

In the Kathmandu Valley, BCPs of enterprises, especially supply chain such as Oil Corporation and Food Corporation, need to be formulated by the initiative of Ministry of Industry, and

Federation of Nepalese Chambers of Commerce and Industry. Education and training programs to enhance the capacity of disaster management in the private sector are also needed as well as the preparation of BCPs. In addition, tourism is a key industry in the Kathmandu Valley. It is necessary to formulate BCPs in the tourism sector to continue business activities.

Business continuity management (BCM) is another important tool in disaster management. BCM is "management activities at normal times including formulation, maintenance and updating of BCP, securing the budget and resources to realize business continuation, implementation of measures, education and training to spread the initiatives, inspection, and continuous improvement". BCM is not a mere plan but a continuous initiative, and is placed as a strategic management-level activity. Accordingly, private enterprises and public organizations need to prepare BCM at normal times.

CHAPTER 6 RECOMMENDATIONS AND CONCLUSION

6.1 Introduction

The KVRP is a model to urge systematic efforts to assess the vulnerability of the KV to large scale natural disasters. The KVRP is formulated based on the results of the ERAKV, which is an earthquake hazard and risk assessment study carried out by another JICA Team. ERAKV developed four scenario earthquakes in the KV and the KVRP selected the most influential scenario earthquake to the KV. A vulnerability assessment includes sectors such as transportation, lifelines, disaster management, urban development; social and economic systems; and a system to develop sectoral and cross-sectoral measures to make the KV resilient to avoid the worst case scenario after an earthquake.

The KVRP is the first planning document in Nepal to address constructing a resilient society against natural disasters, incorporating the Sendai Framework for Disaster Risk Reduction (2015-2030). The KVRP's challenge is how to link development and disaster management and promote investment in disaster management activities in annual government spending. The countermeasures of the disaster risk reduction activities should incorporate each ministry and agency in annual plans. During the formulation of the KVRP, the JICA Team identified some findings and recommendations as shown below:

6.2 Findings and Recommendations

6.2.1 Establishment of laws and institutions in disaster management

KVRP is a new planning concept in Nepal. There is no disaster management related laws and regulations to specify the KVRP as a formal planning document. The Government of Nepal The JICA RRNE Team formed a technical committee with the support by the JICA RRNE Team, chaired by NRA, to discuss disaster risk reduction in the KV and the importance of KVRP. Further, there is no focal organization in charge of disaster management under the current structure of the Government of Nepal. It is recommended that a new organization, the so-called National Disaster Management Authority (NDMA), or another newly established organization should be responsible for all aspects of disaster management including preparedness, response, and rehabilitation and reconstruction.

6.2.2 Reduction of building damage from natural disasters

The ERAKV estimated that more than 44% of the buildings in the KV will be heavily damaged by the scenario earthquake. Many existing houses constructed by adobe, mud mortar with brick, and stone mortar, show extremely high damage rates. Those vulnerable buildings need to be reconstructed following the building code, proper construction method and quality control. The other buildings with RC structure are to be examined in terms of level of seismic resistance. New buildings should

be constructed in accordance with the national building code with appropriate construction methods and quality control. Although the government formulated the "National Plan of Action for Safer Building Construction (NaPA)-2072 (Draft)" for the construction of new buildings, there is no guidelines for the reconstruction and reinforcement of existing vulnerable buildings. The Nepal government should formulate a policy to enhance the building reconstruction scheme.

6.2.3 Review of design standards

Based on the estimation of building damage caused by the scenario earthquake in ERAKV, the design standard should be carefully reviewed by the government such as DUDBC. In order to review the design standard, more careful studies and discussions among relevant stakeholders are required. In the case of the 2015 Gorkha Earthquake, many high-rise buildings were damaged in the KV, even though the KV is quite far away from the epicentre. This is probably related to the characteristics of the Gorkha Earthquake and soil structure in the KV. Accordingly, a further discussion on high-rise building construction in the KV is required.

6.2.4 Reinforcement of Infrastructure

According to the vulnerability evaluation of existing infrastructure in the KV conducted by ERAKV, some 32 bridges out of 45 multi-span bridges with RC pier are identified as vulnerable and will be heavily damaged by the scenario earthquake. More detailed examination of bridges should be conducted by qualified structural engineers and the identified vulnerable bridges need to be reconstructed or reinforced with seismic resistant structures. New construction of bridges should take into consideration the importance of a seismic resistance structure even in the design stage.

6.2.5 Promotion of risk sensitive land use planning

The RSLUP has prepared the guidelines of land use zoning in the KV which has to be prepared by each municipality through community participation. Under the basis of prepared RSLUP, the by-laws should be updated with building code compliance. It also recommends the institutional set up, roles and responsibilities of different stakeholders for preforming monitoring and evaluation of the RSLUP application. The RSLUP is still in the draft phase and with the approval from KVDA under cabinet decision, the plan will get legal mandate.

RSLUP is a useful resource to prepare risk sensitive land use plans in the KV. After approval of the RSLUP, risk sensitive land use plans should be prepared by each municipality and the bye laws should be updated in accordance with the RSLUP's risk sensitive regulations to avoid, control or promote development based on the categories of "Colour Zones." The KVRP, on the other hand, enumerates various countermeasures to reduce disaster risks in large-scale natural disasters, with focusing on already developed or urbanized areas in the KV. It can be said that the RSLUP provides micro level of risk sensitive planning and KVRP provides more comprehensive policy guidelines to

develop resilient land and society in the KV. Therefore, the measures enumerated in the KVRP should be implemented in the “Land Use Zones” with reference to the RLSUP.

6.3 Conclusions

The KVRP reorganizes various policies of disaster management that have been undertaken independently by each ministry and agency into a comprehensive policy framework under common goals. It emphasizes the measures to avoid the worst case scenario that should never happen in future. The policy recommendations presented here will enhance infrastructure resilience and protect the economy. Relevant ministries, departments and agencies are required to prepare their own resilient plan under the framework of the KVRP.

To establish a resilient society, it is indispensable to collect the efforts of all related parties, including federal, district and local governments and the private sector. In addition, each citizen needs to understand the basic concept of disaster risk reduction, i.e., self-help efforts, mutual assistance in the community, and public help by the government. Such a concept or culture regarding disaster risk reduction will be the basis for building a resilient society.

In order to promote resilient plans, the federal government must establish law or act to formulate the resilient plans at federal, provincial and local levels. The federal government will take the initiative to develop a national resilient plan and promote the development of provincial and local levels of resilient plans, based on the lessons learned from the KVRP. For this purpose, the establishment of a new organization to be responsible for comprehensive disaster risk reduction in Nepal is necessary.

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Appendix I: Vulnerability Assessment and Proposed Countermeasures to avoid the Worst Case Events in the Kathmandu Valley

The Vulnerability Assessment and Proposed Countermeasures to avoid the Worst Case Events in the Kathmandu Valley were formulated with reference to Fundamental Plan for National Resilience in Japan.

Operation Goal 1:

Protect human lives even in the event of a large-scale natural disaster

1-1) Worst Event: A large number of casualties due to multiple collapse of buildings and infrastructure	Relevant Organization*
Countermeasure [**Promotion of earthquake-resistant structural measures]** ➢ In urban area, some actions and measures to promote earthquake-resistant structure of buildings are necessary to avoid a large number of casualties due to collapse of buildings	DUDBC, MoUD, MoFALD, LGs, MoED
Countermeasure [Identification of vulnerable infrastructure] ➢ Some researches to identify vulnerable infrastructure to a large-scale disaster need to be carried out, especially for transportation facilities such as roads and bridges.	MoPIT KVDA, MoUD
Countermeasure [Development of structural safety measures] ➢ Regarding houses and buildings along arterial roads, structural safety measures should be taken, especially high-rise buildings which are subject to long-period ground motions.	KVDA DUDBC, MoPIT
Countermeasure [Development of cooperation system in disaster management] ➢ In order to avoid a large number of casualties in the event of a large-scale disaster, a broad-based collaboration system in disaster management is necessary, such as collaboration among government ministries and agencies as well as between public and private sectors.	MoHA, OPMCM
(Key Performance Indicator) - Proportion of seismic resistance building - Estimated building corruption ratio under the envisaged earthquake - Preparation of disaster management plan in local governments - Identification of vulnerable infrastructure and buildings to disaster	

1-2) Worst Event: A large number of casualties due to collapse of facilities used by the general public	Relevant Organization
Countermeasure [Promotion of safe building construction] ➢ An integrated "National Plan of Action on Safer Building Construction" needs to be developed by the government of Nepal.	DUDBC MoUD, LGs, MoFALD
Countermeasure [Strengthening earthquake-resistant measures in the facilities used by general public] ➢ Earthquake-resistant safety measures should be taken in the facilities used by general public, including government offices, schools, and medical facilities in the public sector as well as shopping center, hotels and bus terminal in the private sector.	MoPIT, MoUD, DUDBC, KVDA, MoED
Countermeasure [Strengthening capacity of organizations to be responsible for disaster response] ➢ Capacity of the relevant agencies to be responsible for disaster response need to be strengthen through enhancement of necessary equipment and human resource development activities, such as various types of training and drills.	MoHA LGs, MoD
(Key Performance Indicator) - Proportion of seismic resistance building, including federal and local government buildings, hospitals, schools, shopping centers, hotels, bus terminals, etc. - Implementation of disaster management training and drills in relevant agencies	

1-3) Worst Event: A large number of casualties due to delay of evacuation caused by failure of information transmission.	Relevant Organization
[Providing disaster information promptly] ➢ In case of event of a disaster, itis necessary to provide information of disaster promptly and effectively from relevant government to citizens and visitors by using diversified means, such as radio, TV and other communication tools.	MoHA, MoIC, MoCTCA
[Utilization of information technology] ➢ It is encouraged to utilize information technology to expedite collection and dissemination of disaster information	MoHA (NEOC),MoIC
[Strengthening of capacity of local government] ➢ Strengthening of human resources capacity for effective utilization of collected information at local government level, which is a primary body of provision for disaster	MoFALD, LGs, MoHA,
(Key Performance Indicator) - Radio station to broadcast disaster information - Disaster Information transmission system	

1-4) A large number of casualties due to lack of evacuation facilities	Relevant Organization
[Development of temporary shelters or evacuation facilities] ➢ If people lost their houses caused by a large-scale disaster, it is necessary to provide temporary shelters or evacuation facilities for a certain period of time.	MoHA, LGs, MoFALD
[Preparation of emergency evacuation plan] ➢ The emergency evacuation plan will be prepared by local government and the plan includes locations of evacuation facilities and evacuation route, taking into account capacity of each evacuation facility and population of its catchment area.	LGs, MoFALD, KVDA, MoHA
[Development of evacuation open space] ➢ Open spaces for emergency evacuation need to be designated by local government with endorsement from MoHA. The open space for emergency evacuation can be classified into at least two types in terms of size of open space and the catchment area: i.e., regional evacuation open space and neighborhood evacuation open space. This open space should be developed in densely populated urban area.	LGs , KVDA, MoHA, MoFALD
[Seismic retrofitting of the evacuation facilities] ➢ The designated evacuation facilities should be safe from large-scale disaster with seismic-resistance retrofitting.	LGs, MoFALD, KVDA, MoHA, DUDBC, MoED
[Preparation of management plan of the evacuation facilities] ➢ Preparation of management plan for evacuation facilities, including emergency operation of first-aid and rescue after large-scale disaster as well as maintenance in normal period.	LGs, MoFALD, KVDA, MoHA, MoED
(Key Performance Indicator) - Provision of open space for emergency use - Provision of evacuation facilities	

Operation Goal 2:

Ensure prompt rescue and first-aid activities and provision of medical care from immediately after a large-scale natural disaster

2-1) Prolonged suspension of supply of food, drinking water and other vital goods	Relevant Organization*
[Secure transportation rout after disaster] ➢ It is necessary to secure transport rout to supply emergency goods, such as food, drinking water and other vital goods to the affected people after a large-scale disaster	MoHA (Police) MoPIT (DoR, DoTM), MoFALD
[Reinforcement of water supply system] ➢ Seismic reinforcement works for water supply facilities should be implemented in order to continue the service after a disaster. At the same time, diversified measures for possible water sources, such as ground water, rain water, recycled water, should be examined.	LGs, KUKL, DWSS, MoWSS

[Promote private sector initiative in disaster response] ➢ Strengthen the capabilities of private sector in disaster response, including development of logistic facilities, which function as storage and supply hub of foods and other vital goods in emergency period.	MoS, Public/Private Enterprises
[Prompt delivery of emergency goods] ➢ Provide sufficient information to the relevant organizations about the guidelines for delivery of food, drinking water and other vital goods in case of emergency.	MoHA, MoFALD, MoS, MoIC
[Development of emergency supply system] ➢ Development of procurement and supply systems of food, drinking water and other vital goods in coordination among federal and local governments agencies and private sectors.	MoC, FNCCI, MoS
[Implement drills for delivery of emergency supplies] ➢ Carry out drills and trainings for transportation of emergency supplies in collaboration with private sector.	MoC, MoS FNCCI,
(Key Performance Indicator) - Coverage of water supply pipe line with seismic resistance - Volume of Stockpile of food for emergency - Volume of stockpile of fuel for emergency - Establishment of association of food supply - Establishment of association of fuel supply	

2-2) Isolation of many settlements for long periods due to interruption of road network	Relevant Organization
[Ensure emergency road network connecting with remote areas ➢ Some of the settlements will be isolated after a large-scale disaster. Thus, it is necessary to develop and strengthen emergency road network to connect with these remote areas.	MoPIT (DoR, DoTM)
[Development of emergency supply system] ➢ In case of a large-scale disaster, sufficient foods cannot be procured, especially in remote areas. Thus, it is necessary to make further development of necessary activities, such as increase of storage of emergency supplies.	MoHA, MoS, MoFALD
[Development of transportation information system] ➢ Obtaining accurate transportation information in case of a large-scale disaster to promote rescue activities promptly.	MoHA (Traffic Police, Police, APF), MoD, MoPIT
(**Key Performance Indicator)** - Coverage of seismic reinforcement of infrastructure, such as bridges - Locations of road blockade caused by disaster - Location of stockpile of emergency goods	

2-3) Difficulty of rescue and emergency response activities due to significant damages of relevant organizations	Relevant Organization
[Strengthening capacity of disaster management] ➢ It is necessary to strengthen capacity of rescue and emergency activities, including police, fire fighting and other disaster management agencies. In addition, a variety of actions are needed, such as strengthening of community-based disaster management organization, development of disaster medical assistance team, and ensuring human resources for restoration of emergency transportation roads.	MoHA, MoD, OPMCM, MoFALD
[Standardization of disaster response activities among organization] ➢ Each relevant organization has its own mandate, operational process and equipment for disaster response which is different each other. It is necessary to standardize disaster response activities and information communication system to strengthen rescue and emergency activities.	MoHA MoD OPMCM
[Implementation of joint drill practices] ➢ Implementation of joint drills to encourage disaster response activities among relevant stakeholders.	MoFALD MoHA
[Collaboration for emergency activities among relevant stakeholders] ➢ Emergency activities need to be coordinated among relevant stakeholders, including local government, ministry of defense, police, fire fighting, ministry of home affairs, etc. It is also necessary to collaborate with private sector for implementation of emergency activities,	MoHA MoFALD, OPMCM

(**Key Performance Indicator**) - Number of fire fighter by local government - Number of police by local government - Equipment for disaster response activities - Past record of drill and training for disaster response in local government - Standardization of emergency communication tool	

2-4) Prolonged suspension of energy supply for emergency response activities including medical services	Relevant Organization
[Establish stockpiling facilities through coordination among relevant stakeholders] ➢ It is necessary to make coordination among relevant ministries and agencies to establish stockpiling facilities of emergency rescue equipment, oil, food and vital goods for an event of large-scale disaster.	MoS, MoHA, MoHealth
[Develop emergency supply system of energy] ➢ Development of emergency distribution system of energy for medical and emergency response facilities to avoid long term interruption of energy supply during disaster events.	MoHA MoS, Public/Private Enterprises
(**Key Performance Indicator**) - Stockpiling of equipment for emergency response	

2-5) Paralysis of medical services due to damage and lack of medical facilities and personnel	Relevant Organization
[Collaboration of medical facilities in case of emergency] ➢ In case of an event of large-scale disaster, it possibly happens that huge number of injured persons due to the disaster may exceed capacities of emergency treatments in hospitals. Therefore, it is necessary to examine desirable provisions of medical functions in case of emergency.	MoHealth
[Ensure seismic resistance in medical facilities] ➢ In order to provide sufficient medical function at an event of large-scale disaster, seismic reinforcement works should be provided for hospitals and emergency facilities.	MoH, MoUD, DUDBC
[Preparedness for emergency disaster response] ➢ Some key hospitals would be designated as emergency hospital at an event of large-scale disaster. These hospitals should take appropriate measures, such as sufficient water storage and emergency power supply.	MoH
[Provision of medical function in the disaster area] ➢ It is necessary to provide measures for immediate provision of medical function in the disaster affected areas. Disaster medical assistance team (DMAT) should be organized to response to large-scale disaster event. The DMAT will be distributed to key hospitals at an event of large-scale disaster.	MoHA, MOH
[Ensure transportation route for emergency supplies] ➢ It is necessary to develop some measures to ensure transportation routes for emergency supplies to hospitals.	MoHA, MoPIT, MOH
(Key Performance indicator) - Development of disaster medical assistance team (DMTA) in hospital - Designation of key hospitals in preparation of emergency responses	

2-6) Outbreak of epidemics or infectious diseases in disaster-affected areas	Relevant Organization
[Promote immunization system] ➢ Promotion of vaccination to prevent outbreak and spread of infectious diseases even from normal time.	MoH, LGs
[Establish hygiene and infection control] Building a system for prompt elimination and disposal of waste from the living space of disaster victims.	LGs, MoH, DWSS, MoWSS
[Earthquake-resistant work for sewerage facilities] ➢ Seismic reinforcement works for sewerage facilities is necessary to provide sewerage service even after a large-scale disaster.	DWSS, MoWSS MoFALD, LGs

[Preparation of BCP in DWSS] ➢ Business Continuity Plan (BCP)for sewerage should be promoted by DWSS in collaboration with local governments	DWSS, MoWSS
(Key Performance Indicator) - Preparation of BCP in DWSS - Proportion of sewerage facilities with seismic resistance	

Operation Goal 3:

Secure administrative functions of federal and local governments from immediately after a large-scale natural disaster

3-1) A decline in public safety due to damages of police facilities and personnel	Relevant Organization
[Promotion of information sharing on damages] ➢ Strengthening information sharing on damages to police and correction facilities among relevant organizations.	MoHA
[Implementation of seismic reinforcement works for police and correction facilities] ➢ Seismic reinforcement works and/or some measures against correction facilities are encouraged to maintain public safety even after a large-scale disaster.	MoFALD, DUBDC, MoUD, MoHA
[Implementation of public safety measures] ➢ In order to maintain public safety after a large-scale disaster, the government should promptly issue special order to continue the relevant duties of police.	MoHA, MoFALD, LGs
(Key Performance Indicator) - Seismic resistant building of correction facilities - Number of police officers	

3-2) Serious traffic accidents due to lack of traffic control	Relevant Organization
[Collection of accurate traffic information] ➢ It is necessary to collect traffic information promptly after a large-scale disaster, which include locations of road close, traffic jam, traffic light failures, etc.	MoHA (Traffic Police), LGs, MoPIT
[Installation of power source devices in traffic signals] ➢ Promotion of installation of power source devices to traffic signals to prevent congestion and accidents caused by failure of signals due to blackout	MoHA (Traffic Police), LGs, MoEnergy MoPIT
(Key Performance Indicator) - Number of traffic signals equipped with power source devices	

3-3) Dysfunction of the federal government due to significant damages of their facilities	Relevant Organization
[Maintain important functions of the federal government] ➢ Dysfunction of the federal government will cause significant impact on response and rehabilitation activities after a large-scale disaster. It is indispensable for the federal government to maintain or secure necessary functions in any case of disaster.	MoHA, OPMCM, MoFALD
[Preparation of BCP in the federal government] ➢ Business continuity plan (BCP) should be established in respective federal ministries and agencies to function even after a large-scale disaster event.	NPC, OPMCM Respective Sector Ministries
[Promotion of seismic reinforcement for federal government facilities] ➢ Conduct seismic reinforcement works for government facilities to enable to functions of emergency response, and rehabilitation and recovery from a disaster.	DUDBC MoUD

[Ensure information and communication systems] ➢ Each federal ministry and agency needs to ensure emergency communication systems, so that the federal government can continue its emergency duties even under deteriorated environment.	OPMCM, MoHA, MoIC
[Strengthening infrastructure in the capital region] ➢ Making efforts for disaster prevention measures, such as seismic resistance for roads, bridges, power supply and water supply facilities. In order to maintain road transport function, it is needed to eliminate power poles especially along emergency roads.	MoPIT (DoR) MoWSS, MoE
(Key Performance Indicator) - Provision of BCPs in federal ministries and agencies - Stockpiling of fuel for emergency power generation in federal buildings.	

3-4) Deterioration of the functions of local governments due to significant damages to their personnel and facilities	Relevant Organization
[Maintain necessary function of local government] ➢ It is necessary for local government to conduct their roles to conduct immediate response and rehabilitation activities in case of a large-scale disaster.	MoFALD, LGs
[Establishment of business continuity plans (BCPs) in local governments] ➢ Each local government needs to prepare BCP to continue their duties and services even after large-scale disaster.	MoFALD, LGs
[Seismic reinforcement work for public facilities] ➢ Promote seismic reinforcement work for public facilities, including local government offices, schools and other social welfare facilities that can be used as emergency evacuation facilities in case of disaster.	MoE, DUDBC, MoUD, MoUD, MoFALD
[Seismic reinforcement work for the facilities of police and fire fighting] ➢ Promote seismic reinforcement work for the facilities of police and fire fighting in order to function sufficiently in rescue and recovery activities in case of large-scale natural disasters.	MoFALD, LGs, MoHA, DUDBC
[Strengthening of infrastructure in the vicinity of local government facilities] ➢ Significant deterioration of the functions of local governments can be happened due to not only damages to the personnel and facilities but also damages to infrastructure in the vicinity of government facilities. Thus, steady efforts for disaster prevention measures for infrastructure should be taken.	MoPIT(DoR), MoFALD
(Key Performance Indicator) - Proportion of public facilities with seismic resistance - Establishment of BCPs in local governments	

Operation Goal 4:

Secure indispensable information communication functions from immediately after a large-scale natural disaster

4-1) Paralysis of information communication system due to suspension of power supply.	Relevant Organization
[Conduct vulnerability assessment of information communication system] ➢ Vulnerability assessment of information communication system against suspension of power supply should be implemented from normal time to prepare for a large-scale disaster.	MoIC, MoEnergy
[Ensure security of power supply system] ➢ In order to prevent prolonged power outages, some efforts should be taken to ensure security of power supply system.	MoE
[Enhancement of information communication system] ➢ In order to ensure rescue activities even in the case where private lines are interrupted, relevant agencies need to enhance their information communication system.	MoHA
(Key Performance Indicator) - Regulations for telecommunications business - Progress of information communication system	

4-2) Circumstances where disaster information cannot be delivered promptly due to suspension of TV and radio broadcasting	Relevant Organization
[Ensure TV and radio broadcasting] ➢ TV and radio play significant role to deliver information in case of disaster. Thus, some disaster management measures for secure radio and TV broadcasting facilities should be encouraged.	MoIC
[Alternative information communication system] ➢ Development of alternative information communication system in the cases where TV and radio broadcasting is suspended due to damages from a disaster.	MoIC, MoHA
(Key Performance Indicator)	

Operation Goal 5:

Prevent functional disturbance in economic activities (including supply chains) even after a large-scale natural disaster

5-1) Decline in companies' productivity due to disruption of supply chains.	Relevant Organization
[Encourage to establish BCP in public and private enterprises] ➢ It is encouraged to establishment BCP in each company to continue their business effectively even after a large-scale disaster.	MoI FoNCCI, Public and private enterprises
[Promote to establish BCP across multiple companies] ➢ In addition to individual BCP at each company, it is necessary to promote for establishment of BCP across multiple companies in order to secure supply chains at the event of a large-scale natural disaster.	MoI, FoNCCI , MoS
[Promote strengthening of distribution facilities] ➢ It should be promoted effective measures for enhancing disaster resilience of distribution facilities to maintain supply chain after a large-scale disaster.	MoHA MoS,
(Key Performance Indicator) - Provision of BCPs in private enterprises - Vulnerability assessment of distribution facilities - Provision of emergency transportation network	

5-2) Suspension of energy supply necessary for socio-economic activities	Relevant Organization
[Promote backup power system] ➢ It is necessary to prepare BCP by Nepal Oil Corporation (NOC) to strengthen a backup system for energy supply in case of disaster.	MoS MoE
[Improve capacity of energy supply] ➢ Individual factories and business operators should make efforts to introduce necessary measures to prepare for an event of disaster, such as installation of private generators and stockpiling of sufficient fuel.	MoS MoE, MoI
[Implement joint drill] ➢ Relevant organizations and enterprises should carry out joint drills against disasters, focusing on measures and actions to ensure energy supply chains.	MoS, MoFALD, MoHA
[Prioritization of energy supply in advance] ➢ After an event of a large-scale disaster, energy supply would be limited due to damages of the facilities. Therefore, prioritization of energy supply should be determined in advance.	MoS, Public Enterprise
(Key Performance Indicator) - Provision of BCPs in oil supply companies - Implementation of drills and trainings for preparation of emergency	

5-3) Long term stagnation of tourism industry due to damages by a disaster	Relevant Organization
[Promotion of safety measures in cultural and historical heritages] ➢ Tourism is a key industry in Nepal. In order to avoid fatal damages to tourism industry, some safety measures should be taken in the cultural and historical heritages, which include promotion of retrofitting for both safety and preservation of the historical and cultural value.	MoCTCA, MoUD
[Earthquake-resistance measures at hotels] ➢ It is encouraged to enforce earthquake-resistance measures at hotels and tourism spots to provide safety to tourists,	MoCTCA, DUDBC
[Dissemination of safety plan to tourists] ➢ It is necessary to provide safety plan for visitors and tourists, which includes locations of information center, major government facilities, evacuation routes and facilities in case of emergency.	MoCTCA, MoHA
[Providing awareness programs of safety measures for tourism business operators. ➢ Awareness program of safety measures should be provided to tourism business operators during normal time to prevent or reduce damages in cultural and historical heritage sites.	MoCTCA
(Key Performance Indicator) - Proportion of seismic resistance building at and vicinity of cultural and historical heritage sites - Provision of safety measures to visitors and tourists	

5-4) Dysfunction of the major transportation networks due to damages by a disaster	Relevant Organization
Disaster prevention measures for transportation facilities] ➢ Disaster prevention measures for major transportation facilities should be undertaken to maintain social and economic activities even after a disaster.	MoHA MoPIT
[Secure road network] ➢ Disruption of road network would cause enormous damage to the economy. Thus, relevant ministries and agencies need to collaborate and to make efforts to secure road transport network even in the case of large-scale disaster.	MoPIT (DoR), OPMCM
(Key Performance Indicator) - Development of road networks for ensuring redundancy - Provision of disaster resilience measures for transportation facilities to continue economic activities	

5-5) Fatal damage to major airports caused by a disaster	Relevant Organization
[Securing airport functions] ➢ It is necessary to review damages of airport immediately after a large-scale disaster and to recover functions of airports in cooperation with relevant organizations. .	MoCTCA, MoD
[Centralize air control and information management system] ➢ Airport is a distribution hub of emergency goods after a large-scale disaster. It is necessary to centralize air control and information management of emergency goods supported by international donors.	MoCTCA MoHA, MoD
(Key Performance Indicator) - Provision of early recovery plan for airport from disasters - Designate airport as a centre for emergency and rescue activities - Designate airport as a transportation hub of critical materials	

5-6) Circumstances where dysfunction of financial services	Relevant Organization
[Maintain banking and financial system] ➢ The central bank and other financial institutions need to establish their own BCP as well as securing redundancy of systems and enhancement of the earthquake resistance to their facilities	MOF NRB, NPC

(Key Performance Indicator) - Establishment of BCPs by financial institutions - Securing of backup sites for system centers - Installation of private generators to system centers and other important bases	

5-7) Stagnation of stable food supply	Relevant Organization
[Establishment of secure food supply system] ➢ Secure food supply system are encouraged even at an event of large-scale disaster It is necessary to prepare BCPs for food business operators to provide secure food supply. .	MoS, Public and private enterprises
[Collaboration among food supply operators] ➢ In order to maintain food supply even in the event of a large-scale disaster, food business operators should build effective food supply systems with collaboration and cooperation among relevant stakeholders.	MoS, Public and private enterprises
(Key Performance Indicator) - Establishment of systems for collaboration and cooperation in food business operators - Establishment of BCPs in food business operators.	

Operation Goal 6:

Secure lifeline (electricity, water, sewerage and fuel) and economic activities even after a large-scale natural disaster

6-1) Suspension of power supply networks and oil supply chains	Relevant Organization
[Enhancement of the capacity of emergency power supply] ➢ It is necessary to enhance the capacity of emergency power supply to maintain people's lives. At the same time, prompt restoration measures of power after a disaster should be sought.	MoE
[Promote earthquake-resistant measures in oil tanks] ➢ Enhancing earthquake resistance work for oil tanks to prevent significant damages from a large-scale natural disaster.	MoS
[Promotion of stockpiles of petroleum] ➢ In order to reduce the impact on power supply, some efforts for securing stockpiles of petroleum and liquefied petroleum gas should be promoted.	MoS
[Introduction of diverse energy sources] ➢ Diversification of energy supply sources should be sought to ensure stable power supply even in case of disaster.	MoE, MoI
(Key Performance Indicator) - Progress of anti-seismic measures for oil tanks - Preparation of BCPs for oil companies - Amount of national stockpiles of oil and LPG (liquefied petroleum gas):	

6-2) Prolonged suspension of water supply	Relevant Organization
[Promotion of seismic reinforcement for water supply facilities] ➢ It is necessary to promote seismic reinforcement work for water supply facilities to provide drinking water after a large scale disaster.	MoWSS
[Development of post disaster water supply restoration system] ➢ A broad-based backup system should be developed to ensure prompt restoration of water supply after a large-scale disaster, and effective use of water resources should be considered.	MoWSS
(Key Performance Indicator) - Proportion of water pipes which meet seismic-resistance standards: - Establishment of renovation plans	

6-3) Prolonged suspensions of sewerage treatment facilities.	Relevant Organization
[Promotion of seismic reinforcement for sewerage facilities] ➢ Seismic reinforcement works for sewerage facilities are necessary to maintain the service even after a large-scale disaster.	DWSS, MoWSS, LGs
[Promotion of disaster resilient septic tank] ➢ Private wastewater septic tanks are promoted to replace with disaster-resilient septic tanks and the registration system of disaster-resilient septic tanks needs to be developed.	MoWSS, LGs
[Collaboration for sustainable seismic resilient system] ➢ In order to establish sustainable seismic resistant system for sewerage facilities, strengthening of the management system should be sought in collaboration among stakeholders.	MoUD MoWSS, LGs
(Key Performance Indicator) - BCP of the stakeholders to maintain sewage systems after disaster - Implementation of anti-seismic measures for sewerage treatment facilities - Registration system of septic tanks	

Operation Goal 7:

Prevention of any uncontrollable secondary disaster

7-1) Traffic paralysis due to collapse of buildings along major roads	Relevant Organization
[Enforcement of building code] ➢ In order to avoid collapse of buildings along major roads, the local governments should promote some measures and actions to enforce the building code.	DUDBC MoUD, MoFALD, LGs
[Prompt collection of disaster information] ➢ In order to avoid secondary disaster, information of damages after disaster should be collected promptly to promote emergency response and recovery activities	MoPIT MoHA, MoUD
[Prompt collection of road traffic information] ➢ It should be ensured that accurate road traffic information should be collected promptly after a disaster and possible measures should be taken to prevent secondary disaster.	MoHA MoPIT
(Key Performance Indicator)	

7-2) Large-scale spread and leakage of hazardous materials caused by a disaster	Relevant Organization
[Prevention of health hazard] ➢ Federal government should develop some policies and guidelines to prevent health hazards and damages to the environment caused by leakage or spread of hazardous materials after large-scale disaster.	MoPE, MoHA, MoFALD
(Key Performance Indicator) - Location of storage of hazardous materials	

7-3) Expansion of damage due to devastation of farmland and forest	Relevant Organization
[Maintain farmland and natural resources] ➢ To encourage local communities to maintain farmland and other natural resources after a disaster.	MoAD, MoFSC
(Key Performance Indicator) - Area of forests or farmland maintaining watershed protection functions	

Operation Goal 8:

Develop conditions that enable swift recovery and reconstruction of local society and economy even after a large-scale natural disaster.

8-1) Delay of recovery and reconstruction works significantly due to delay of treatment of disaster waste	Relevant Organization
[Need effective disaster waste management] ➢ It is necessary to promote securing stock yards for provisional storage of a large amount of disaster waste.	LGs MoFALD, MoHA
[Establish disaster waste disposal plans] ➢ Local governments in association with relevant stakeholders need to be encouraged to prepare disaster waste disposal plans to conduct recovery and reconstruction promptly.	LG, MoHA, MoFALD
(Key Performance Indicator) - Identification of possible stock yards of disaster waste - Establishment of disaster waste disposal plans - Development of waste disposal technologies - Implementation of surveys to identify hazardous materials:	

8-2) Delay of recovery and reconstruction works significantly due to shortage of personnel	Relevant Organization
[Ascertain environmental safety for workers] ➢ With the aim of securing personnel in the construction industry who will engage in the work for recover and reconstruction after a disaster, the working environment should be carefully reviewed and ascertained security. .	MoHA, MoPE, Ministry of Labor and Employment
[Taking some security measures] ➢ Some security measures should be undertaken after the event of a disaster to avoid deterioration of functions of police and fire services, due to damage to their personnel and facilities.	MoHA, LG, MoFALD

8-3) Delay of recovery and reconstruction works significantly due to collapse of local communities	Relevant Organization
[Enhancement of capability of community] ➢ It is necessary for the local governments to enhance the capacity of communities to promote recovery and reconstruction activities by their initiatives. For this purpose, it is necessary to conduct disaster prevention drill, training and education to share he knowledge of disaster management from normal time.	MoHA, MoFALD

8-4) Delay of recovery and reconstruction works significantly due to damage to core infrastructure	Relevant Organization
[Development of core infrastructure with seismic resistance] ➢ It has taken considerable time and cost to recover core infrastructure, if it is damaged significantly by a disaster. Thus, it should promote to construct core infrastructure with the concept of BBB.	MoPIT, MoUD
[Coordination among relevant ministries, agencies and local governments to reconstruct damaged infrastructure] ➢ In order to promote recovery and reconstruction of damaged infrastructure from a disaster, it is necessary to enhance coordination among relevant ministries, agencies and local government.	MoHA, OPMCM MoPIT, LG
[Implementation of cadastral survey and other required activities] ➢ Clarification of land boundary (*e.g.* cadastral survey) is one of the important actions to prompt recovery and reconstruction from a disaster. It is necessary to conduct cadastral survey or other required activities even from normal time.	MoHA, MoLRM MoFALD, LG
(Key Performance Indicator) - Proportion of bridges with seismic resistance: - Progress of cadastral surveys:	

Abbreviation

APF	Armed Police Force
DUDBC	Department of Urban Development & Building Construction), under MoUD
DoR	Department of Road, under MoPIT
DoTM	Department of Transport Management
DWSS	Department of Water Supply and Sewerage
FoNCCI	Federation of Nepalese Chambers of Commerce and Industry
KUKL	Kathmandu Upatyaka Khanepani Limited
KVDA	Kathmandu Valley Development Authority
LGs	Local Governments
MoAD	Ministry of Agriculture Development
MoCTCA	Ministry of Culture, Tourism and Civil Aviation
MoD	Ministry of Defence
MoE	Ministry of Energy
MoED	Ministry of Education
MoF	Ministry of Finance
MoFALD	Ministry of Federal Affairs and Local Development
MoFSC	Ministry of Forest and Soil Conservation
MoH	Ministry of Health
MoHA	Ministry of Home Affairs
MoI	Ministry of Industry
MoIC	Ministry of Information and Communication
MoLRM	Ministry of land Reform and Management
MoPE	Ministry of Population and Environment
MoPIT	Ministry of Physical Infrastructure and Transport
MoS	Ministry of Supplies
MoUD	Ministry of Urban Development
MoWSS	Ministry of Water Supply and Sewerage
NEOC	National Emergency Operation Center, under MoHA
NRB	Nepal Rastra Bank
NPC	National Planning Commission
OPMCM	Office of the Prime Minister and Council of Ministers

Appendix II: Proposed Countermeasures by Organization to Avoid the Worst Events

1. Ministry of Urban Development (MoUD)

1-4) A large number of casualties due to multiple collapse of buildings and infrastructure	Relevant Organization*
[**Promotion of earthquake-resistant structural measures for buildings]** ➢ In urban area, some actions and measures to promote earthquake-resistant structure of buildings are necessary to avoid a large number of casualties due to collapse of buildings	DUDBC, MoUD, MoFALD, LGs, MoED
[Identification of vulnerable infrastructure] ➢ Some researches to identify vulnerable infrastructure to a large-scale disaster need to be carried out, especially for transportation facilities such as roads and bridges.	MoPIT KVDA, MoUD
(Key Performance Indicator) - Proportion of seismic resistance building - Estimated building corruption ratio under the envisaged earthquake - Preparation of disaster management plan in local governments - Identification of vulnerable infrastructure and buildings to disaster	

1-5) A large number of casualties due to collapse of facilities used by the general public	Relevant Organization
[Promotion of safe building construction] ➢ An integrated "National Plan of Action on Safer Building Construction" needs to be developed by the government of Nepal.	DUDBC MoUD, LGs, MoFALD
[Strengthening earthquake-resistant measures in the facilities used by general public] ➢ Earthquake-resistant safety measures should be taken in the facilities used by general public, including government offices, schools, and medical facilities in the public sector as well as shopping centre, hotels and bus terminal in the private sector.	MoPIT, MoUD, DUDBC, KVDA, MoED
(Key Performance Indicator) - Proportion of seismic resistance building, including federal and local government buildings, hospitals, schools, shopping centres, hotels, bus terminals, etc. - Implementation of disaster management training and drills in relevant agencies	

Action

- Review of vulnerability assessment results done by JICA Team.
- Understanding existing situations of buildings including federal and local government.
- Review of standards and guidelines for scenario earthquake proposed by JICA Team.
- Identification vulnerable buildings including federal and local government.
- Promote seismic resistance to reinforce or rebuilding of including federal and local government.
- Preparation of five year plan to promote strengthened seismic resistance for buildings including federal and local government.

2-5) Paralysis of medical services due to damage and lack of medical facilities and personnel	Relevant Organization
[Ensure seismic resistance in medical facilities] ➢ In order to provide sufficient medical function at an event of large-scale disaster, seismic reinforcement works should be provided for hospitals and emergency facilities.	MoH, MoUD, DUDBC
(Key Performance indicator) - Development of disaster medical assistance team (DMT) in hospital - Designation of key hospitals in preparation of emergency responses	

Action

- Review of vulnerability assessment results done by JICA Team and identification of priority area.
- Preparation of emergency response plan
- Implementation of drill and training
- Conclude agreements among private sector to secure removal of debris, transportation of goods and storage
- Implementation of seismic reinforcement for hospitals and emergency response facilities.
- Establishment of Disaster Medical Assistance Team (DMA) in hospitals.

3-1) A decline in public safety due to damages of police facilities and personnel	Relevant Organization
[Implementation of seismic reinforcement works for police and correction facilities] ➢ Seismic reinforcement works and/or some measures against correction facilities are encouraged to maintain public safety even after a large-scale disaster.	MoFALD, DUBDC, MoUD, MoHA
(Key Performance Indicator) - Seismic resistant building of correction facilities - Number of police officers	

3-3) Dysfunction of the federal government due to significant damages of their facilities	Relevant Organization
[Promotion of seismic reinforcement for federal government facilities] ➢ Conduct seismic reinforcement works for government facilities to enable to functions of emergency response, and rehabilitation and recovery from a disaster.	DUDBC MoUD
(Key Performance Indicator) - Provision of BCPs in federal ministries and agencies - Stockpiling of fuel for emergency power generation in federal buildings.	

3-4) Deterioration of the functions of local governments due to significant damages to their personnel and facilities	Relevant Organization
[Seismic reinforcement work for public facilities] ➢ Promote seismic reinforcement work for public facilities, including local government offices, schools and other social welfare facilities that can be used as emergency evacuation facilities in case of disaster.	MoE, DUDBC, MoUD, MoUD, MoFALD
(Key Performance Indicator) - Proportion of public facilities with seismic resistance - Establishment of BCPs in local governments	

Action

- Confirmation of current status of police buildings and correction facilities.
- Preparation of emergency response plan.
- Preparation of information collection methods just after the disaster.
- Promotion of seismic resistance structure for government facilities.
- Preparation of BCP by federal ministries and agencies.
- Promotion of seismic resistance structure for transport infrastructure.
- Preparation of disaster management plan and its implementation plan.

5-3) Long term stagnation of tourism industry due to damages to important cultural and historical heritages	Relevant Organization
[Promotion of safety measures in cultural and historical heritages] ➢ Tourism is a key industry in Nepal. In order to avoid fatal damages to tourism industry, some safety measures should be taken in the cultural and historical heritages, which include promotion of retrofitting for both safety and preservation of the historical and cultural value.	MoCTCA, MoUD
(Key Performance Indicator) - Proportion of seismic resistance building at and vicinity of cultural and historical heritage sites - Provision of safety measures to visitors and tourists	

Action

- Review of vulnerability assessment done by JICA Team
- Understanding of cultural and historical heritages which have high risk of corruption.
- Preparation of emergency response plan and emergency repair plan.
- Understanding of roads and open spaces which can be used for evacuation routes and sites in tourist sites.
- Formulation of disaster evacuation plan.
- Formulation of disaster risk reduction plan and its implementation plan.
- Implementation of disaster risk reduction for historical heritage site.
- Promotion of retrofitting for both safety and preservation of the historical and cultural value.

6-3) Prolonged suspensions of sewerage treatment facilities.	Relevant Organization
[Collaboration for sustainable seismic resilient system] ➢ In order to establish sustainable seismic resistant system for sewerage facilities, strengthening of the management system should be sought in collaboration among stakeholders.	MoUD MoWSS, LGs
(Key Performance Indicator) - BCP of the stakeholders to maintain sewage systems after disaster - Implementation of anti-seismic measures for sewerage treatment facilities - Registration system of septic tanks	

Action

- Promotion of seismic resistance for sewerage facilities.
- Formulation of Business Continuity Plan (BCP).
- Development of the registration system for septic tanks.

7-1) Traffic paralysis due to collapse of buildings along emergency roads	Relevant Organization
[Enforcement of building code] ➢ In order to avoid collapse of buildings along major roads, the local governments should promote some measures and actions to enforce the building code.	DUDBC MoUD, MoFALD, LGs
[Prompt collection of disaster information] ➢ In order to avoid secondary disaster, information of damages after disaster should be collected promptly to promote emergency response and recovery activities	MoPIT MoHA, MoUD
(Key Performance Indicator)	

Action

- Preparation of information collection and distribution methods.
- Preparation of emergency response plan.
- Making it obligatory to take seismic diagnosis.
- Establishment of subsidy institutions for seismic retrofitting.

8-4) Delay of recovery and reconstruction works significantly due to damage to core infrastructure	Relevant Organization
[Development of core infrastructure with seismic resistance] ➢ It has taken considerable time and cost to recover core infrastructure, if it is damaged significantly by a disaster. Thus, it should promote to construct core infrastructure with the concept of BBB.	MoPIT, MoUD
(Key Performance Indicator) - Proportion of bridges with seismic resistance: - Progress of cadastral surveys:	

Action

- Review of vulnerability assessment done by JICA Team.
- Implement vulnerability assessment, if necessary.
- Preparation of emergency response plan and implement drill and training.
- Conclude agreements among governments and private sectors,
- Promote seismic resistant of road and bridges.

2. Ministry of Physical Infrastructure and Transport (MoPIT)

1-1) A large number of casualties due to multiple collapse of buildings and infrastructure	Relevant Organization*
[Identification of vulnerable infrastructure] ➢ Some researches to identify vulnerable infrastructure to a large-scale disaster need to be carried out, especially for transportation facilities such as roads and bridges.	MoPIT KVDA, MoUD
[Development of structural safety measures] ➢ Regarding houses and buildings along arterial roads, structural safety measures should be taken, especially high-rise buildings which are subject to long-period ground motions.	KVDA DUDBC, MoPIT
(Key Performance Indicator) - Proportion of seismic resistance building - Estimated building corruption ratio under the envisaged earthquake - Preparation of disaster management plan in local governments - Identification of vulnerable infrastructure and buildings to disaster	

1-2) A large number of casualties due to collapse of facilities used by the general public	Relevant Organization
[Strengthening earthquake-resistant measures in the facilities used by general public] ➢ Earthquake-resistant safety measures should be taken in the facilities used by general public, including government offices, schools, and medical facilities in the public sector as well as shopping centre, hotels and bus terminal in the private sector.	MoPIT, MoUD, DUDBC, KVDA
(Key Performance Indicator) - Proportion of seismic resistance building, including federal and local government buildings, hospitals, schools, shopping centres, hotels, bus terminals, etc. - Implementation of disaster management training and drills in relevant agencies	

Action

- Review of vulnerability assessment results done by JICA Team
- Understanding existing situations of road, bridge, pedestrian bridge, and other facilities related to road.
- Review of standards and guidelines for scenario earthquake proposed by JICA Team
- Identification vulnerable road and bridges and land use along the road
- Promote seismic resistance to reinforce or replace of the road infrastructure
- Promote seismic resistance structure along the road including building and road infrastructure
- Preparation of five year plan to promote strengthen seismic resistance for road infrastructure

Key Performance Indicator

- Proportion of seismic resistance of bridges
- Proportion of seismic resistance building long the road
- Identification of vulnerable infrastructure and buildings
- Preparation of disaster management plan for the MoPIT

2-7) Prolonged suspension of supply of food, drinking water and other vital goods	Relevant Organization*
[Secure transportation rout after disaster] ➢ It is necessary to secure transport rout to supply emergency goods, such as food, drinking water and other vital goods to the affected people after a large-scale disaster	MoHA (Police) MoPIT (DoR, DoTM), MoFALD
(Key Performance Indicator) - Coverage of water supply pipe line with seismic resistance - Volume of Stockpile of food for emergency - Volume of stockpile of fuel for emergency - Establishment of association of food supply - Establishment of association of fuel supply	

2-8) Isolation of many settlements for long periods due to interruption of road network	Relevant Organization
[Ensure emergency road network connecting with remote areas ➢ Some of the settlements will be isolated after a large-scale disaster. Thus, it is necessary to develop and strengthen emergency road network to connect with these remote areas.	MoPIT (DoR, DoTM)
[Development of transportation information system] ➢ Obtaining accurate transportation information in case of a large-scale disaster to promote rescue activities promptly.	MoHA (Traffic Police, Police, APF), MoD, MoPIT
(Key Performance Indicator) - Coverage of seismic reinforcement of infrastructure, such as bridges - Locations of road blockade caused by disaster - Location of stockpile of emergency goods	

Action

- Review of vulnerability assessment results done by JICA Team and identification of priority area.
- Preparation of emergency response plan
- Implementation of drill and training

- Conclude agreements among private sector to secure removal of debris, transportation of goods and storage

Key Performance Indicator

- Coverage of seismic reinforcement of infrastructure, such as bridges
- Locations of road blockade caused by disaster
- Location of stockpile of emergency goods

3-2) Serious traffic accidents due to lack of traffic control	Relevant Organization
[Collection of accurate traffic information] ➢ It is necessary to collect traffic information promptly after a large-scale disaster, which include locations of road close, traffic jam, traffic light failures, etc.	MoHA (Traffic Police), LGs, MoPIT
[Installation of power source devices in traffic signals] ➢ Promotion of installation of power source devices to traffic signals to prevent congestion and accidents caused by failure of signals due to blackout	MoHA (Traffic Police), LGs, MoEnergy MoPIT
(Key Performance Indicator) - Number of traffic signals equipped with power source devices	

3-3) Dysfunction of the federal government due to significant damages of their facilities	Relevant Organization
[Strengthening infrastructure in the capital region] ➢ Making efforts for disaster prevention measures, such as seismic resistance for roads, bridges, power supply and water supply facilities. In order to maintain road transport function, it is needed to eliminate power poles especially along emergency roads.	MoPIT (DoR) MoWSS, MoE
(Key Performance Indicator) - Provision of BCPs in federal ministries and agencies - Stockpiling of fuel for emergency power generation in federal buildings.	

3-4) Deterioration of the functions of local governments due to significant damages to their personnel and facilities	Relevant Organization
[Strengthening of infrastructure in the vicinity of local government facilities] ➢ Significant deterioration of the functions of local governments can be happened due to not only damages to the personnel and facilities but also damages to infrastructure in the vicinity of government facilities. Thus, steady efforts for disaster prevention measures for infrastructure should be taken.	MoPIT(DoR), MoFALD
(Key Performance Indicator) - Proportion of public facilities with seismic resistance - Establishment of BCPs in local governments	

Action

- Identification existing transportation facilities
- Preparation of emergency response plan
- Preparation of information collection methods just after the disaster
- Implementation of traffic control, especially electricity cut traffic light intersection after the disaster
- Preparation of BCP by private and government sector
- Promotion of seismic resistance structure for transport infrastructure
- Preparation of disaster management plan and its implementation plan

Key Performance Indicator

- Number of traffic signals equipped with power source devices
- Provision of BCPs in federal ministries and agencies
- Proportion of public facilities with seismic resistance
- Establishment of BCPs in local governments
- Formulation of emergency response plan in federal governments
- Formulation of disaster management plan in federal government

5-4) Dysfunction of major transportation network due to damages by a disaster	Relevant Organization
[Disaster prevention measures for transportation facilities] ➢ Disaster prevention measures for major transportation facilities should be undertaken to maintain social and economic activities even after a disaster.	MoHA MoPIT
[Secure road network] ➢ Disruption of road network would cause enormous damage to the economy. Thus, relevant ministries and agencies need to collaborate and to make efforts to secure road transport network even in the case of large-scale disaster.	MoPIT (DoR), OPMCM
(Key Performance Indicator) - Development of road networks for ensuring redundancy - Provision of disaster resilience measures for transportation facilities to continue economic activities	

Action

- Review of vulnerability assessment done by JICA Team
- Preparation of emergency response plan and emergency repair plan
- Identification of alternate transportation means
- Formulation of disaster risk reduction plan and its implementation plan
- Implementation of disaster risk reduction for transportation infrastructure

Key Performance Indicator

- Development of road networks for ensuring redundancy
- Provision of disaster resilience measures for transportation facilities to continue economic activities

7-1) Traffic paralysis due to collapse of buildings along emergency roads	Relevant Organization
[Prompt collection of disaster information] ➢ In order to avoid secondary disaster, information of damages after disaster should be collected promptly to promote emergency response and recovery activities	MoPIT MoHA, MoUD
[Prompt collection of road traffic information] ➢ It should be ensured that accurate road traffic information should be collected promptly after a disaster and possible measures should be taken to prevent secondary disaster.	MoHA MoPIT
(Key Performance Indicator)	

Action

- Preparation of information collection and distribution methods
- Preparation of emergency response plan

8-4) Delay of recovery and reconstruction works significantly due to damage to core infrastructure	Relevant Organization
[Development of core infrastructure with seismic resistance] ➢ It has taken considerable time and cost to recover core infrastructure, if it is damaged significantly by a disaster. Thus, it should promote to construct core infrastructure with the concept of BBB.	MoPIT, MoUD
[Coordination among relevant ministries, agencies and local governments to reconstruct damaged infrastructure] ➢ In order to promote recovery and reconstruction of damaged infrastructure from a disaster, it is necessary to enhance coordination among relevant ministries, agencies and local government.	MoHA, OPMCM MoPIT, LG
(Key Performance Indicator) - Proportion of bridges with seismic resistance: - Progress of cadastral surveys:	

Action

- Review of vulnerability assessment done by JICA Team
- Implement vulnerability assessment, if necessary
- Preparation of emergency response plan and implement drill and training
- Conclude agreements among governments and private sectors
- Promote seismic resistant of road and bridges

Key Performance Indicator

- Proportion of bridges with seismic resistance:
- Progress of cadastral surveys:

3. Ministry of Home Affairs (MoHA)

1-1) A large number of casualties due to multiple collapse of buildings and infrastructure	Relevant Organization*
[Development of cooperation system in disaster management] ➢ In order to avoid a large number of casualties in the event of a large-scale disaster, a broad-based collaboration system in disaster management is necessary, such as collaboration among government ministries and agencies as well as between public and private sectors.	MoHA, OPMCM
(Key Performance Indicator) - Proportion of seismic resistance building - Estimated building corruption ratio under the envisaged earthquake - Preparation of disaster management plan in local governments - Identification of vulnerable infrastructure and buildings to disaster	

1-2) A large number of casualties due to collapse of facilities used by the general public	Relevant Organization
[Strengthening capacity of organizations to be responsible for disaster response] ➢ Capacity of the relevant agencies to be responsible for disaster response need to be strengthen through enhancement of necessary equipment and human resource development activities, such as various types of training and drills.	MoHA LGs, MoD
(Key Performance Indicator) - Proportion of seismic resistance building, including federal and local government buildings, hospitals, schools, shopping centres, hotels, bus terminals, etc. - Implementation of disaster management training and drills in relevant agencies	

1-6) A large number of casualties due to delay of evacuation caused by failure of information transmission.	Relevant Organization
[Providing disaster information promptly] ➢ In case of event of a disaster, itis necessary to provide information of disaster promptly and effectively from relevant government to citizens and visitors by using diversified means, such as radio, TV and other communication tools.	MoHA, MoIC, MoCTCA
[Utilization of information technology] ➢ It is encouraged to utilize information technology to expedite collection and dissemination of disaster information	MoHA (NEOC),MoIC
[Strengthening of capacity of local government] ➢ Strengthening of human resources capacity for effective utilization of collected information at local government level, which is a primary body of provision for disaster	MoFALD, LGs, MoHA,
(Key Performance Indicator) - Radio station to broadcast disaster information - Disaster Information transmission system	

1-4) A large number of casualties due to lack of evacuation facilities	Relevant Organization
[Development of temporary shelters or evacuation facilities] ➢ If people lost their houses caused by a large-scale disaster, it is necessary to provide temporary shelters or evacuation facilities for a certain period of time.	MoHA, LGs, MoFALD
[Preparation of emergency evacuation plan] ➢ The emergency evacuation plan will be prepared by local government and the plan includes locations of evacuation facilities and evacuation route, taking into account capacity of each evacuation facility and population of its catchment area.	LGs, MoFALD, KVDA, MoHA
[Development of evacuation open space] ➢ Open spaces for emergency evacuation need to be designated by local government with endorsement from MoHA. The open space for emergency evacuation can be classified into at least two types in terms of size of open space and the catchment area: i.e., regional evacuation open space and neighbourhood evacuation open space. This open space should be developed in densely populated urban area.	LGs , KVDA, MoHA, MoFALD
[Seismic retrofitting of the evacuation facilities] ➢ The designated evacuation facilities should be safe from large-scale disaster with seismic-resistance retrofitting.	LGs, MoFALD, KVDA, MoHA, DUDBC, MoED
[Preparation of management plan of the evacuation facilities] ➢ Preparation of management plan for evacuation facilities, including emergency operation of first-aid and rescue after large-scale disaster as well as maintenance in normal period.	LGs, MoFALD, KVDA, MoHA, MoED
(Key Performance Indicator) - Provision of open space for emergency use - Provision of evacuation facilities	

Action

- Review of vulnerability assessment results done by JICA Team

- Understanding existing situations of housings
- Review of standards and guidelines for scenario earthquake proposed by JICA Team
- （e.g. Identification of vulnerable housings）
- Promote seismic resistance to reinforce or rebuilding of housings
- Promote seismic resistance structure for housing and buildings, such as integrated construction plan along the road including buildings.
- Preparation for five year plan to promote strengthened seismic resistance for housings/ buildings.
- Improvement of capability buildings for reduction and management on natural disaster risks.
- Establishment for information telecommunication methods on disaster prevention, such as radio.
- Ensuring open spaces for the time of emergency.

2-1) Prolonged suspension of supply of food, drinking water and other vital goods	Relevant Organization*
[Secure transportation rout after disaster] ➢ It is necessary to secure transport rout to supply emergency goods, such as food, drinking water and other vital goods to the affected people after a large-scale disaster	MoHA (Police) MoPIT (DoR, DoTM), MoFALD
[Prompt delivery of emergency goods] ➢ Provide sufficient information to the relevant organizations about the guidelines for delivery of food, drinking water and other vital goods in case of emergency.	MoHA, MoFALD, MoS, MoIC
(Key performance Indicator) - Coverage of water supply pipe line with seismic resistance - Volume of Stockpile of food for emergency - Volume of stockpile of fuel for emergency - Establishment of association of food supply - Establishment of association of fuel supply	

2-2) Isolation of many settlements for long periods due to interruption of road network	Relevant Organization
[Development of emergency supply system] ➢ In case of a large-scale disaster, sufficient foods cannot be procured, especially in remote areas. Thus, it is necessary to make further development of necessary activities, such as increase of storage of emergency supplies	MoHA, MoS, MoFALD
[Development of transportation information system] ➢ Obtaining accurate transportation information in case of a large-scale disaster to promote rescue activities promptly.	MoHA (Traffic Police, Police, APF), MoD, MoPIT
(Key Performance Indicator) - Coverage of seismic reinforcement of infrastructure, such as bridges - Locations of road blockade caused by disaster - Location of stockpile of emergency goods	

2-9) Difficulty of rescue and emergency response activities due to significant damages of relevant organizations	Relevant Organization
[Strengthening capacity of disaster management] ➢ It is necessary to strengthen capacity of rescue and emergency activities, including police, fire fighting and other disaster management agencies. In addition, a variety of actions are needed, such as strengthening of community-based disaster management organization, development of disaster medical assistance team, and ensuring human resources for restoration of emergency transportation roads.	MoHA, MoD, OPMCM, MoFALD

[Standardization of disaster response activities among organization] ➢ Each relevant organization has its own mandate, operational process and equipment for disaster response which is different each other. It is necessary to standardize disaster response activities and information communication system to strengthen rescue and emergency activities.	MoHA MoD OPMCM
[Implementation of joint drill practices] ➢ Implementation of joint drills to encourage disaster response activities among relevant stakeholders.	MoFALD MoHA
[Collaboration for emergency activities among relevant stakeholders] ➢ Emergency activities need to be coordinated among relevant stakeholders, including local government, ministry of defence, police, fire fighting, ministry of home affairs, etc. It is also necessary to collaborate with private sector for implementation of emergency activities,	MoHA MoFALD, OPMCM
(Key Performance Indicator) - Number of fire fighter by local government - Number of police by local government - Equipment for disaster response activities - Past record of drill and training for disaster response in local government - Standardization of emergency communication tool	

2-10) Prolonged suspension of energy supply for emergency response activities including medical services	Relevant Organization
[Establish stockpiling facilities through coordination among relevant stakeholders] ➢ It is necessary to make coordination among relevant ministries and agencies to establish stockpiling facilities of emergency rescue equipment, oil, food and vital goods for an event of large-scale disaster.	MoS, MoHA, MoHealth
[Develop emergency supply system of energy] ➢ Development of emergency distribution system of energy for medical and emergency response facilities to avoid long term interruption of energy supply during disaster events.	MoHA MoS, Public/Private Enterprises
(Key Performance Indicator) - Stockpiling of equipment for emergency response	

2-11) Paralysis of medical services due to damage and lack of medical facilities and personnel	Relevant Organization
[Collaboration of medical facilities in case of emergency] ➢ In case of an event of large-scale disaster, it possibly happens that huge number of injured persons due to the disaster may exceed capacities of emergency treatments in hospitals. Therefore, it is necessary to examine desirable provisions of medical functions in case of emergency.	MoHealth
[Ensure seismic resistance in medical facilities] ➢ In order to provide sufficient medical function at an event of large-scale disaster, seismic reinforcement works should be provided for hospitals and emergency facilities.	MoH, MoUD, DUDBC
[Provision of medical function in the disaster area] ➢ It is necessary to provide measures for immediate provision of medical function in the disaster affected areas. Disaster medical assistance team (DMAT) should be organized to response to large-scale disaster event. The DMAT will be distributed to key hospitals at an event of large-scale disaster.	MoHA, MOH
[Ensure transportation route for emergency supplies] ➢ It is necessary to develop some measures to ensure transportation routes for emergency supplies to hospitals.	MoHA, MoPIT, MOH
(Key Performance indicator) - Development of disaster medical assistance team (DMTA) in hospital - Designation of key hospitals in preparation of emergency responses	

Action

- Review of vulnerability assessment results done by JICA Team and identification of the priority areas.
- Preparation of emergency response plans
- Implementation of drill and training
- Conclusion of agreements among / with private sectors to secure removal of debris, transportation of goods and storage
- Provision of medical functions in the disaster areas

3-1) A decline in public safety due to damages of police facilities and personnel	Relevant Organization
[Promotion of information sharing on damages] ➢ Strengthening information sharing on damages to police and correction facilities among relevant organizations.	MoHA
[Implementation of seismic reinforcement works for police and correction facilities] ➢ Seismic reinforcement works and/or some measures against correction facilities are encouraged to maintain public safety even after a large-scale disaster.	MoFALD, DUBDC, MoUD, MoHA
[Implementation of public safety measures] ➢ In order to maintain public safety after a large-scale disaster, the government should promptly issue special order to continue the relevant duties of police.	MoHA, MoFALD, LGs
(Key Performance Indicator) - Seismic resistant building of correction facilities - Number of police officers	

3-2) Serious traffic accidents due to lack of traffic control	Relevant Organization
[Collection of accurate traffic information] ➢ It is necessary to collect traffic information promptly after a large-scale disaster, which include locations of road close, traffic jam, traffic light failures, etc.	MoHA (Traffic Police), LGs, MoPIT
[Installation of power source devices in traffic signals] ➢ Promotion of installation of power source devices to traffic signals to prevent congestion and accidents caused by failure of signals due to blackout	MoHA (Traffic Police), LGs, MoEnergy MoPIT
(Key Performance Indicator) - Number of traffic signals equipped with power source devices	

3-3) Dysfunction of the federal government due to significant damages of their facilities	Relevant Organization
[Maintain important functions of the federal government] ➢ Dysfunction of the federal government will cause significant impact on response and rehabilitation activities after a large-scale disaster. It is indispensable for the federal government to maintain or secure necessary functions in any case of disaster.	MoHA, OPMCM, MoFALD
[Ensure information and communication systems] ➢ Each federal ministry and agency needs to ensure emergency communication systems, so that the federal government can continue its emergency duties even under deteriorated environment.	OPMCM, MoHA, MoIC
(Key Performance Indicator) - Provision of BCPs in federal ministries and agencies - Stockpiling of fuel for emergency power generation in federal buildings.	

3-4) Deterioration of the functions of local governments due to significant damages to their personnel and facilities	Relevant Organization
[Seismic reinforcement work for the facilities of police and fire fighting] ➢ Promote seismic reinforcement work for the facilities of police and fire fighting in order to function sufficiently in rescue and recovery activities in case of large-scale natural disasters.	MoFALD, LGs, MoHA, DUDBC
(Key Performance Indicator) - Proportion of public facilities with seismic resistance - Establishment of BCPs in local governments	

Action

- Identification existing transportation facilities
- Preparation of emergency response plans
- Preparation of information collection methods right after the disaster
- Implementation of traffic controls, especially in the case of cutting electricity of traffic lights at intersections after and due to the disaster.
- Preparation of BCP by both sectors of the private and the public.
- Promotion of seismic resistance structures for transport infrastructures
- Preparation of disaster management plans and its implementation plans
- Preparations of response guidelines as well as the implementation structure to maintain security.

4-1) Paralysis of information communication system due to suspension of power supply.	Relevant Organization
[Enhancement of information communication system] ➢ In order to ensure rescue activities even in the case where private lines are interrupted, relevant agencies need to enhance their information communication system.	MoHA
(Key Performance Indicator) - Regulations for telecommunications business - Progress of information communication system	

4-2) Circumstances where disaster information cannot be delivered promptly due to suspension of TV and radio broadcasting	Relevant Organization
[Alternative information communication system] ➢ Development of alternative information communication system in the cases where TV and radio broadcasting is suspended due to damages from a disaster.	MoIC, MoHA
(Key Performance Indicator)	

Action

- Reviews of electrical telecommunication facilities and the technological standards.
- Preparation of information telecommunication measures by various media.

5-1) Decline in companies' productivity caused by disruption of supply chains.	Relevant Organization
[Promote strengthening of distribution facilities] ➢ It should be promoted effective measures for enhancing disaster resilience of distribution facilities to maintain supply chain after a large-scale disaster.	MoHA MoS,

(Key Performance Indicator) - Provision of BCPs in private enterprises - Vulnerability assessment of distribution facilities - Provision of emergency transportation network	

5-2) Suspension of energy supply necessary for socio-economic activities	Relevant Organization
[Implement joint drill] ➢ Relevant organizations and enterprises should carry out joint drills against disasters, focusing on measures and actions to ensure energy supply chains.	MoS, MoFALD, MoHA
[Prioritization of energy supply in advance] ➢ After an event of a large-scale disaster, energy supply would be limited due to damages of the facilities. Therefore, prioritization of energy supply should be determined in advance.	MoS, Public Enterprise
(Key Performance Indicator) - Provision of BCPs in oil supply companies - Implementation of drills and trainings for preparation of emergency	

5-3) Long term stagnation of tourism industry due to damages to important cultural and historical heritages	Relevant Organization
[Dissemination of safety plan to tourists] ➢ It is necessary to provide safety plan for visitors and tourists, which includes locations of information centre, major government facilities, evacuation routes and facilities in case of emergency.	MoCTCA, MoHA
[Providing awareness programs of safety measures for tourism business operators. ➢ Awareness program of safety measures should be provided to tourism business operators during normal time to prevent or reduce damages in cultural and historical heritage sites.	MoCTCA
(Key Performance Indicator) - Proportion of seismic resistance building at and vicinity of cultural and historical heritage sites - Provision of safety measures to visitors and tourists	

5-4) Dysfunction of major transportation network due to damages by a disaster	Relevant Organization
[Disaster prevention measures for transportation facilities] ➢ Disaster prevention measures for major transportation facilities should be undertaken to maintain social and economic activities even after a disaster.	MoHA MoPIT
(Key Performance Indicator) - Development of road networks for ensuring redundancy - Provision of disaster resilience measures for transportation facilities to continue economic activities	

5-5) Fatal damage to major airports caused by a disaster	Relevant Organization
[Centralize air control and information management system] ➢ Airport is a distribution hub of emergency goods after a large-scale disaster. It is necessary to centralize air control and information management of emergency goods supported by international donors.	MoCTCA MoHA, MoD
(Key Performance Indicator) - Provision of early recovery plan for airport from disasters - Designate airport as a centre for emergency and rescue activities - Designate airport as a transportation hub of critical materials	

Action

- Review of the vulnerability assessment, conducted by JICA Team
- Preparation of emergency response plans and emergency repair plans
- Identification of alternative transportation means
- Formulation of disaster risk reduction plans and its implementation plans
- Implementation of disaster risk reduction for transportation infrastructures
- Preparation of an early recovery plan for airports after havocs.

7-1) Traffic paralysis due to collapse of buildings along emergency roads	Relevant Organization
[Prompt collection of disaster information] ➢ In order to avoid secondary disaster, information of damages after disaster should be collected promptly to promote emergency response and recovery activities	MoPIT MoHA, MoUD
[Prompt collection of road traffic information] ➢ It should be ensured that accurate road traffic information should be collected promptly after a disaster and possible measures should be taken to prevent secondary disaster.	MoHA MoPIT
(Key Performance Indicator)	

7-2) Large-scale spread and leakage of hazardous materials caused by a large-scale natural disaster	Relevant Organization
[Prevention of health hazard] ➢ Federal government should develop some policies and guidelines to prevent health hazards and damages to the environment caused by leakage or spread of hazardous materials after large-scale disaster.	MoPE, MoHA, MoFALD
(Key Performance Indicator) - Location of storage of hazardous materials	

Action

- Preparation of information collection and distribution methods
- Preparation of emergency response plan
- Preparation of guidelines to protect human health and environments without any harm against expansion of toxic materials.

8-1) Delay of recovery and reconstruction works significantly due to delay of treatment of disaster waste	Relevant Organization
[Need effective disaster waste management] ➢ It is necessary to promote securing stock yards for provisional storage of a large amount of disaster waste.	LGs MoFALD, MoHA
[Establish disaster waste disposal plans] ➢ Local governments in association with relevant stakeholders need to be encouraged to prepare disaster waste disposal plans to conduct recovery and reconstruction promptly.	LG, MoHA, MoFALD
(Key Performance Indicator) - Identification of possible stock yards of disaster waste - Establishment of disaster waste disposal plans - Development of waste disposal technologies - Implementation of surveys to identify hazardous materials:	

8-2) Delay of recovery and reconstruction works significantly due to shortage of personnel	Relevant Organization
[Ascertain environmental safety for workers] ➢ With the aim of securing personnel in the construction industry who will engage in the work for recover and reconstruction after a disaster, the working environment should be carefully reviewed and ascertained security. .	MoHA, MoPE, Ministry of Labour and Employment
[Taking some security measures] ➢ Some security measures should be undertaken after the event of a disaster to avoid deterioration of functions of police and fire services, due to damage to their personnel and facilities.	MoHA, LG, MoFALD

8-3) Delay of recovery and reconstruction works significantly due to collapse of local communities	Relevant Organization
[Enhancement of capability of community] ➢ It is necessary for the local governments to enhance the capacity of communities to promote recovery and reconstruction activities by their initiatives. For this purpose, it is necessary to conduct disaster prevention drill, training and education to share the knowledge of disaster management from normal time.	MoHA, MoFALD

8-4) Delay of recovery and reconstruction works significantly due to damage to core infrastructure	Relevant Organization
[Coordination among relevant ministries, agencies and local governments to reconstruct damaged infrastructure] ➢ In order to promote recovery and reconstruction of damaged infrastructure from a disaster, it is necessary to enhance coordination among relevant ministries, agencies and local government.	MoHA, OPMCM MoPIT, LG
[Implementation of cadastral survey and other required activities] ➢ Clarification of land boundary (e.g. cadastral survey) is one of the important actions to prompt recovery and reconstruction from a disaster. It is necessary to conduct cadastral survey or other required activities even from normal time.	MoHA, MoLRM MoFALD, LG
(Key Performance Indicator) - Proportion of bridges with seismic resistance: - Progress of cadastral surveys:	

Action

- Review of vulnerability assessment, done by JICA Team
- Implement vulnerability assessment, if necessary
- Preparation of emergency response plan and implement drill and training
- Conclude agreements among governments and local government
- Preparation of guidelines determined by BCP.
- Enhancement of community's response capabilities on disaster prevention.

4. Department of Urban Development & Building Construction (DUDBC)

1-1) A large number of casualties due to multiple collapse of buildings and infrastructure	Relevant Organization*
[Promotion of earthquake-resistant structural measures for buildings] ➢ In urban area, some actions and measures to promote earthquake-resistant structure of buildings are necessary to avoid a large number of casualties due to collapse of buildings	DUDBC, MoUD, MoFALD, LGs
[Development of structural safety measures] ➢ Regarding houses and buildings along arterial roads, structural safety measures should be taken, especially high-rise buildings which are subject to long-period ground motions.	KVDA DUDBC, MoPIT
(Key Performance Indicator) - Proportion of seismic resistance building - Estimated building corruption ratio under the envisaged earthquake - Preparation of disaster management plan in local governments - Identification of vulnerable infrastructure and buildings to disaster	

1-2) A large number of casualties due to collapse of facilities used by the general public	Relevant Organization
[Promotion of safe building construction] ➢ An integrated "National Plan of Action on Safer Building Construction" needs to be developed by the government of Nepal.	DUDBC MoUD, LGs, MoFALD
[Strengthening earthquake-resistant measures in the facilities used by general public] ➢ Earthquake-resistant safety measures should be taken in the facilities used by general public, including government offices, schools, and medical facilities in the public sector as well as shopping centre, hotels and bus terminal in the private sector.	MoPIT, MoUD, DUDBC, KVDA
(Key Performance Indicator) - Proportion of seismic resistance building, including federal and local government buildings, hospitals, schools, shopping centres, hotels, bus terminals, etc. - Implementation of disaster management training and drills in relevant agencies	

Action

- Review of vulnerability assessment results, done by JICA Team
- Understanding current statuses of earthquake-resistant on existing housings and buildings.
- Review of standards and guidelines for scenario earthquake, proposed by JICA Team
- Identification relevant vulnerabilities on existing housings and buildings.
- Promote seismic resistance to reinforce or rebuild existing housings and buildings.
- Preparation of five year plan to promote seismic resistance for reinforcing and rebuilding existing housings and buildings.

3-1) A decline in public safety due to damages of police facilities and personnel	Relevant Organization
[Implementation of seismic reinforcement works for police and correction facilities] ➢ Seismic reinforcement works and/or some measures against correction facilities are encouraged to maintain public safety even after a large-scale disaster.	MoFALD, DUBDC, MoUD, MoHA
(Key Performance Indicators) - Seismic resistant building of correction facilities - Number of police officers	

3-3) Dysfunction of the federal government due to significant damages of their facilities	Relevant Organization
[Promotion of seismic reinforcement for federal government facilities] ➢ Conduct seismic reinforcement works for government facilities to enable to functions of emergency response, and rehabilitation and recovery from a disaster.	DUDBC MoUD
(Key Performance Indicator) - Provision of BCPs in federal ministries and agencies - Stockpiling of fuel for emergency power generation in federal buildings.	

3-4) Deterioration of the functions of local governments due to significant damages to their personnel and facilities	Relevant Organization
[Seismic reinforcement work for public facilities] ➢ Promote seismic reinforcement work for public facilities, including local government offices, schools and other social welfare facilities that can be used as emergency evacuation facilities in case of disaster.	MoE, DUDBC, MoUD, MoUD, MoFALD
[Seismic reinforcement work for the facilities of police and fire fighting] ➢ Promote seismic reinforcement work for the facilities of police and fire fighting in order to function sufficiently in rescue and recovery activities in case of large-scale natural disasters.	MoFALD, LGs, MoHA, DUDBC
(Key Performance Indicator) - Proportion of public facilities with seismic resistance - Establishment of BCPs in local governments	

Action

- Identification existing public facilities, including local government offices, schools and other social welfare facilities
- Promotion of seismic reinforcement for federal government facilities
- Promotion of seismic reinforcement for the facilities of police and fire fighting

5-3) Long term stagnation of tourism industry due to damages to important cultural and historical heritages	Relevant Organization
[Earthquake-resistance measures at hotels] ➢ It is encouraged to enforce earthquake-resistance measures at hotels and tourism spots to provide safety to tourists,	MoCTCA, DUDBC
(Key Performance Indicator) - Proportion of seismic resistance building at and vicinity of cultural and historical heritage sites - Provision of safety measures to visitors and tourists	

Action

- Review of vulnerability assessment done by JICA Team
- Preparation of seismic resistance building at and vicinity of cultural and historical heritage sites
- Preparation of the earthquake response measures for hotels and tourism spots.
- Formulation of disaster risk reduction plan and its implementation plan

7-1) Traffic paralysis due to collapse of buildings along emergency roads	Relevant Organization
[Enforcement of building code] ➢ In order to avoid collapse of buildings along major roads, the local governments should promote some measures and actions to enforce the building code.	DUDBC MoUD, MoFALD, LGs
(Key Performance Indicator)	

Action

- Preparation of information collection and distribution methods
- Preparation of emergency response plans

5. Ministry of Federal Affairs and Local Development (MoFALD)

1-1) A large number of casualties due to multiple collapse of buildings and infrastructure	Relevant Organization*
[**Promotion of earthquake-resistant structural measures for buildings]** ➢ In urban area, some actions and measures to promote earthquake-resistant structure of buildings are necessary to avoid a large number of casualties due to collapse of buildings	DUDBC, MoUD, MoFALD, LGs
(Key Performance Indicator) - Proportion of seismic resistance building - Estimated building corruption ratio under the envisaged earthquake - Preparation of disaster management plan in local governments - Identification of vulnerable infrastructure and buildings to disaster	

1-2) A large number of casualties due to collapse of facilities used by the general public	Relevant Organization
[Promotion of safe building construction. ➢ An integrated "National Plan of Action on Safer Building Construction" needs to be developed by the government of Nepal.	DUDBC MoUD, LGs, MoFALD
(Key Performance Indicator) - Proportion of seismic resistance building, including federal and local government buildings, hospitals, schools, shopping centres, hotels, bus terminals, etc. - Implementation of disaster management training and drills in relevant agencies	

1-3) A large number of casualties due to delay of evacuation caused by failure of information transmission.	Relevant Organization
[Strengthening of capacity of local government] ➢ Strengthening of human resources capacity for effective utilization of collected information at local government level, which is a primary body of provision for disaster	MoFALD, LGs, MoHA,
(Key Performance Indicator) - Radio station to broadcast disaster information - Disaster Information transmission system	

1-4) A large number of casualties due to lack of evacuation facilities	Relevant Organization
[Development of temporary shelters or evacuation facilities] ➢ If people lost their houses caused by a large-scale disaster, it is necessary to provide temporary shelters or evacuation facilities for a certain period of time.	MoHA, LGs, MoFALD
[**Preparation of emergency evacuation plan**] ➢ The emergency evacuation plan will be prepared by local government and the plan includes locations of evacuation facilities and evacuation route, taking into account capacity of each evacuation facility and population of its catchment area.	LGs, MoFALD, KVDA, MoHA
[**Development of evacuation open space**] ➢ Open spaces for emergency evacuation need to be designated by local government with endorsement from MoHA. The open space for emergency evacuation can be classified into at least two types in terms of size of open space and the catchment area: i.e., regional evacuation open space and neighbourhood evacuation open space. This open space should be developed in densely populated urban area.	LGs , KVDA, MoHA, MoFALD
[**Seismic retrofitting of the evacuation facilities**] ➢ The designated evacuation facilities should be safe from large-scale disaster with seismic-resistance retrofitting.	LGs, MoFALD, KVDA, MoHA, DUDBC, MoED
[**Preparation of management plan of the evacuation facilities**] ➢ Preparation of management plan for evacuation facilities, including emergency operation of first-aid and rescue after large-scale disaster as well as maintenance in normal period.	LGs, MoFALD, KVDA, MoHA, MoED
(Key Performance Indicator) - Provision of open space for emergency use - Provision of evacuation facilities	

Action

- Review of vulnerability assessment results done by JICA Team
- Assessment of current earthquake resistance status for houses and buildings
- Review of a basic policy and guidelines against predicted earthquake proposed by JICA Team
- Assessment of earthquake vulnerability of house and buildings
- Promotion of seismic resistance buildings by aseismic reinforcement or rebuilding
- Implementation of systematic improvement in densely populated urban areas
- Development of a green space and a park development
- Development of evacuation place and roads
- Formulation of the five year plan in promoting seismic resistance houses and buildings

2-1) Prolonged suspension of supply of food, drinking water and other vital goods	Relevant Organization*
[Secure transportation rout after disaster] ➢ It is necessary to secure transport rout to supply emergency goods, such as food, drinking water and other vital goods to the affected people after a large-scale disaster	MoHA (Police) MoPIT (DoR, DoTM), MoFALD
[Prompt delivery of emergency goods] ➢ Provide sufficient information to the relevant organizations about the guidelines for delivery of food, drinking water and other vital goods in case of emergency.	MoHA, MoFALD, MoS, MoIC
(Key Performance Indicator) - Coverage of water supply pipe line with seismic resistance - Volume of Stockpile of food for emergency - Volume of stockpile of fuel for emergency - Establishment of association of food supply - Establishment of association of fuel supply	

2-2) Isolation of many settlements for long periods due to interruption of road network	Relevant Organization
[Development of emergency supply system] ➢ In case of a large-scale disaster, sufficient foods cannot be procured, especially in remote areas. Thus, it is necessary to make further development of necessary activities, such as increase of storage of emergency supplies	MoHA, MoS, MoFALD
(Key Performance Indicator) - Coverage of seismic reinforcement of infrastructure, such as bridges - Locations of road blockade caused by disaster - Location of stockpile of emergency goods	

2-3) Difficulty of rescue and emergency response activities due to significant damages of relevant organizations	Relevant Organization
[Strengthening capacity of disaster management] ➢ It is necessary to strengthen capacity of rescue and emergency activities, including police, fire fighting and other disaster management agencies. In addition, a variety of actions are needed, such as strengthening of community-based disaster management organization, development of disaster medical assistance team, and ensuring human resources for restoration of emergency transportation roads.	MoHA, MoD, OPMCM, MoFALD
[Implementation of joint drill practices] ➢ Implementation of joint drills to encourage disaster response activities among relevant stakeholders.	MoFALD MoHA
[Collaboration for emergency activities among relevant stakeholders] ➢ Emergency activities need to be coordinated among relevant stakeholders, including local government, ministry of defence, police, fire fighting, ministry of home affairs, etc. It is also necessary to collaborate with private sector for implementation of emergency activities,	MoHA MoFALD, OPMCM
(Key Performance Indicator) - Number of fire fighter by local government - Number of police by local government - Equipment for disaster response activities - Past record of drill and training for disaster response in local government - Standardization of emergency communication tool	

2-6) Outbreak of epidemics or infectious diseases in disaster-affected areas	Relevant Organization
[Earthquake-resistant work for sewerage facilities] ➢ Seismic reinforcement works for sewerage facilities is necessary to provide sewerage service even after a large-scale disaster.	DWSS, MoWSS MoFALD, LGs
(Key Performance Indicator) - Preparation of BCP in DWSS - Proportion of sewerage facilities with seismic resistance	

Action

- Review of vulnerability assessment results done by JICA Team and identification of priority areas
- Preparation of emergency response plan
- Preparation of emergency food supply plan (food, drinking water and daily necessity)
- Enhancement of capacity development in police and fire service
- Implementation of disaster drills and exercise
- Conclusion of a partnership agreement between the government and transport businesses
- Promotion of earthquake resistance buildings in police and fire service
- Establishment of communication infrastructure for information providing system

- Promotion of seismic reinforcement on sewerage system
- Formulation of Business Continuity Plan (BCP) for sewerage system

3-1) A decline in public safety due to damages of police facilities and personnel	Relevant Organization
[Implementation of seismic reinforcement works for police and correction facilities] ➢ Seismic reinforcement works and/or some measures against correction facilities are encouraged to maintain public safety even after a large-scale disaster.	MoFALD, DUBDC, MoUD, MoHA
[Implementation of public safety measures] ➢ In order to maintain public safety after a large-scale disaster, the government should promptly issue special order to continue the relevant duties of police.	MoHA, MoFALD, LGs
(Key Performance Indicator) - Seismic resistant building of correction facilities - Number of police officers	

3-3) Dysfunction of the federal government due to significant damages of their facilities	Relevant Organization
[Maintain important functions of the federal government] ➢ Dysfunction of the federal government will cause significant impact on response and rehabilitation activities after a large-scale disaster. It is indispensable for the federal government to maintain or secure necessary functions in any case of disaster.	MoHA, OPMCM, MoFALD
(Key Performance Indicator) - Provision of BCPs in federal ministries and agencies - Stockpiling of fuel for emergency power generation in federal buildings.	

3-4) Deterioration of the functions of local governments due to significant damages to their personnel and facilities	Relevant Organization
[Maintain necessary function of local government] ➢ It is necessary for local government to conduct their roles to conduct immediate response and rehabilitation activities in case of a large-scale disaster.	MoFALD, LGs
[Establishment of business continuity plans (BCPs) in local governments] ➢ Each local government needs to prepare BCP to continue their duties and services even after large-scale disaster.	MoFALD, LGs
[Seismic reinforcement work for public facilities] ➢ Promote seismic reinforcement work for public facilities, including local government offices, schools and other social welfare facilities that can be used as emergency evacuation facilities in case of disaster.	MoE, DUDBC, MoUD, MoUD, MoFALD
[Seismic reinforcement work for the facilities of police and fire fighting] ➢ Promote seismic reinforcement work for the facilities of police and fire fighting in order to function sufficiently in rescue and recovery activities in case of large-scale natural disasters.	MoFALD, LGs, MoHA, DUDBC
[Strengthening of infrastructure in the vicinity of local government facilities] ➢ Significant deterioration of the functions of local governments can be happened due to not only damages to the personnel and facilities but also damages to infrastructure in the vicinity of government facilities. Thus, steady efforts for disaster prevention measures for infrastructure should be taken.	MoPIT(DoR), MoFALD
(Key Performance Indicator) - Proportion of public facilities with seismic resistance - Establishment of BCPs in local governments	

Action

- Identification of current earthquake resistance status of police stations and correctional facilities
- Preparation of emergency response plan
- Preparation of information collection methods in the aftermath disaster

- Preparation of the BCP formulation guideline by the local government
- Promotion of seismic resistance Promotion of seismic reinforcement on school and social welfare facilities functioning an operational base of emergency response
- Preparation of disaster management plan and its implementation plan

5-2) Suspension of energy supply necessary for socio-economic activities	Relevant Organization
Implement joint drill] ➢ Relevant organizations and enterprises should carry out joint drills against disasters, focusing on measures and actions to ensure energy supply chains.	MoS, MoFALD, MoHA
(Key Performance Indicator) - Provision of BCPs in oil supply companies - Implementation of drills and trainings for preparation of emergency	

Action

- Review of vulnerability assessment done by JICA Team
- Preparation of emergency response plan and emergency repair plan
- Identification of alternative transportation means
- Formulation of disaster risk reduction plan and its implementation plan
- Securing energy supply chain by the relevant organizations and enterprises
- Conduct of the joint emergency drills and exercises for disaster
- Implementation of disaster risk reduction for transportation infrastructure

7-1) Traffic paralysis due to collapse of buildings along emergency roads	Relevant Organization
[Enforcement of building code] ➢ In order to avoid collapse of buildings along major roads, the local governments should promote some measures and actions to enforce the building code.	DUDBC MoUD, MoFALD, LGs
(Key Performance Indicator)	

7-2) Large-scale spread and leakage of hazardous materials caused by a large-scale natural disaster	Relevant Organization
[Prevention of health hazard] ➢ Federal government should develop some policies and guidelines to prevent health hazards and damages to the environment caused by leakage or spread of hazardous materials after large-scale disaster.	MoPE, MoHA, MoFALD
(Key Performance Indicator) - Location of storage of hazardous materials	

Action

- Development of the guidelines on preventive measures for health hazards and environmental pollution from flowing out and spread-out of hazardous materials in a large-scale disaster.
- Securing an appropriate storage area for hazardous materials
- Preparation of information collection and distribution methods
- Preparation of emergency response plan

8-1) Delay of recovery and reconstruction works significantly due to delay of treatment of disaster waste	Relevant Organization
[Need effective disaster waste management] ➢ It is necessary to promote securing stock yards for provisional storage of a large amount of disaster waste.	LGs MoFALD, MoHA
[Establish disaster waste disposal plans] ➢ Local governments in association with relevant stakeholders need to be encouraged to prepare disaster waste disposal plans to conduct recovery and reconstruction promptly.	LG, MoHA, MoFALD
(Key Performance Indicator) - Identification of possible stock yards of disaster waste - Establishment of disaster waste disposal plans - Development of waste disposal technologies - Implementation of surveys to identify hazardous materials:	

8-2) Delay of recovery and reconstruction works significantly due to shortage of personnel	Relevant Organization
[Taking some security measures] ➢ Some security measures should be undertaken after the event of a disaster to avoid deterioration of functions of police and fire services, due to damage to their personnel and facilities.	MoHA, LG, MoFALD

8-3) Delay of recovery and reconstruction works significantly due to collapse of local communities	Relevant Organization
[Enhancement of capability of community] ➢ It is necessary for the local governments to enhance the capacity of communities to promote recovery and reconstruction activities by their initiatives. For this purpose, it is necessary to conduct disaster prevention drill, training and education to share the knowledge of disaster management from normal time.	MoHA, MoFALD

8-4) Delay of recovery and reconstruction works significantly due to damage to core infrastructure	Relevant Organization
[Implementation of cadastral survey and other required activities] ➢ Clarification of land boundary (e.g. cadastral survey) is one of the important actions to prompt recovery and reconstruction from a disaster. It is necessary to conduct cadastral survey or other required activities even from normal time.	MoHA, MoLRM MoFALD, LG
(Key Performance Indicator) - Proportion of bridges with seismic resistance: - Progress of cadastral surveys:	

Action

- Review of vulnerability assessment done by JICA Team
- Implement vulnerability assessment, if necessary
- Preparation of emergency response plan and implement drill and training
- Conclusion or an agreements among governments and private sectors
- Improvement of earthquake resistance performance of roads and bridges

6. Kathmandu Valley Development Authority (KVDA)

1-1) A large number of casualties due to multiple collapse of buildings and infrastructure	Relevant Organization*
[Identification of vulnerable infrastructure] ➢ Some researches to identify vulnerable infrastructure to a large-scale disaster need to be carried out, especially for transportation facilities such as roads and bridges.	MoPIT KVDA, MoUD
[Development of structural safety measures] ➢ Regarding houses and buildings along arterial roads, structural safety measures should be taken, especially high-rise buildings which are subject to long-period ground motions.	KVDA DUDBC, MoPIT
(Key Performance Indicator) - Proportion of seismic resistance building - Estimated building corruption ratio under the envisaged earthquake - Preparation of disaster management plan in local governments - Identification of vulnerable infrastructure and buildings to disaster	

1-2) A large number of casualties due to collapse of facilities used by the general public	Relevant Organization
[Strengthening earthquake-resistant measures in the facilities used by general public] ➢ Earthquake-resistant safety measures should be taken in the facilities used by general public, including government offices, schools, and medical facilities in the public sector as well as shopping centre, hotels and bus terminal in the private sector.	MoPIT, MoUD, DUDBC, KVDA
(Key Performance Indicator) - Proportion of seismic resistance building, including federal and local government buildings, hospitals, schools, shopping centres, hotels, bus terminals, etc. - Implementation of disaster management training and drills in relevant agencies	

1-4) A large number of casualties due to lack of evacuation facilities	Relevant Organization
[**Preparation of emergency evacuation plan**] ➢ The emergency evacuation plan will be prepared by local government and the plan includes locations of evacuation facilities and evacuation route, taking into account capacity of each evacuation facility and population of its catchment area.	LGs, MoFALD, KVDA, MoHA
[**Development of evacuation open space**] ➢ Open spaces for emergency evacuation need to be designated by local government with endorsement from MoHA. The open space for emergency evacuation can be classified into at least two types in terms of size of open space and the catchment area: i.e., regional evacuation open space and neighbourhood evacuation open space. This open space should be developed in densely populated urban area.	LGs , KVDA, MoHA, MoFALD
[**Seismic retrofitting of the evacuation facilities**] ➢ The designated evacuation facilities should be safe from large-scale disaster with seismic-resistance retrofitting.	LGs, MoFALD, KVDA, MoHA, DUDBC, MoED
[**Preparation of management plan of the evacuation facilities**] ➢ Preparation of management plan for evacuation facilities, including emergency operation of first-aid and rescue after large-scale disaster as well as maintenance in normal period.	LGs, MoFALD, KVDA, MoHA, MoED
(Key Performance Indicator) - Provision of open space for emergency use - Provision of evacuation facilities	

Action

- Review of vulnerability assessment results conducted by JICA Team
- Understanding existing situations of road, bridge, pedestrian bridge, and other facilities related to road.

- Review of standards and guidelines for scenario earthquake proposed by JICA Team
- Conducting risk assessment to identify vulnerability on road, bridges and the land that faces a road
- Promotion of seismic resistance by reinforce or replacement of the road infrastructure
- Promotion of seismic resistance structure facing a road including building and road infrastructure
- Preparation of five year plan to promote strengthen seismic resistance for road infrastructure
- Preparation of the disaster management plan in the local government
- Implementation of safety countermeasure in a public facility that many citizens use such as shopping malls, accommodation facilities, bus terminal.
- Preparation of an emergency evacuation plan
- Development of evacuation open space
- Promotion of earthquake resistance on evacuation facilities.
- Conducting emergency drills and exercises with relevant agencies.

7. Ministry of Culture, Tourism and Civil Aviation (MoCTCA)

1-3) A large number of casualties due to delay of evacuation caused by failure of information transmission.	Relevant Organization
[Providing disaster information promptly] ➢ In case of event of a disaster, itis necessary to provide information of disaster promptly and effectively from relevant government to citizens and visitors by using diversified means, such as radio, TV and other communication tools.	MoHA, MoIC, MoCTCA
(Key Performance Indicator) - Radio station to broadcast disaster information - Disaster Information transmission system	

Action

- Review of vulnerability assessment results done by JICA Team
- Understanding current status of historical and cultural heritage area and tourism sites
- Review of a basic policy and guidelines against predicted earthquake proposed by JICA Team
- Implementation of a seismic risk evaluation to historical and cultural heritage area and tourist sites
- Preparation of Business Continuity Plan (BCP) in the radio station for broadcasting prompt accurate information in the event of disaster
- Establishment of communication infrastructure for information providing system
- Implementation of disaster drills and exercise

5-3) Long term stagnation of tourism industry due to damages to important cultural historical heritages	Relevant Organization
[Promotion of safety measures in cultural and historical heritages] ➢ Tourism is a key industry in Nepal. In order to avoid fatal damages to tourism industry, some safety measures should be taken in the cultural and historical heritages, which include promotion of retrofitting for both safety and preservation of the historical and cultural value.	MoCTCA, MoUD
[Earthquake-resistance measures at hotels] ➢ It is encouraged to enforce earthquake-resistance measures at hotels and tourism spots to provide safety to tourists,	MoCTCA, DUDBC

[Dissemination of safety plan to tourists] ➢ It is necessary to provide safety plan for visitors and tourists, which includes locations of information centre, major government facilities, evacuation routes and facilities in case of emergency.	MoCTCA, MoHA
[Providing awareness programs of safety measures for tourism business operators. ➢ Awareness program of safety measures should be provided to tourism business operators during normal time to prevent or reduce damages in cultural and historical heritage sites.	MoCTCA
(Key Performance Indicator) - Proportion of seismic resistance building at and vicinity of cultural and historical heritage sites - Provision of safety measures to visitors and tourists	

5-5) Fatal damage to major airports caused by a disaster	Relevant Organization
[Securing airport functions] ➢ It is necessary to review damages of airport immediately after a large-scale disaster and to recover functions of airports in cooperation with relevant organizations. .	MoCTCA, MoD
[Centralize air control and information management system] ➢ Airport is a distribution hub of emergency goods after a large-scale disaster. It is necessary to centralize air control and information management of emergency goods supported by international donors.	MoCTCA MoHA, MoD
(Key Performance Indicator) - Provision of early recovery plan for airport from disasters - Designate airport as a centre for emergency and rescue activities - Designate airport as a transportation hub of critical materials	

Action

- Review of vulnerability assessment done by JICA Team
- Preparation of business continuity plan and early recovery plan for
- Formulation of BCP and early recovery plan in order to sustain the functions of airports
- Examination of alternative transportation
- Formulation of disaster risk reduction plan and its implementation plan
- Implementation of disaster countermeasure at major airports
- Formulation of evacuation plan evacuation guidance as well as examination of evacuation route and place at the tourism site
- Understanding actual condition of historical and cultural heritage resource which are assumed to collapse and damage by earthquake
- Implementation of seismic strengthening for the cultural heritage resource
- Understanding actual condition of unused accommodations (hotels, guesthouse, and lodging) and commodious unused ground
- Development of information provision system in the event of disaster
- Installation of information boards regarding evacuation place and evacuation guidance written in both Nepali and English
- Description of safety tips and evacuation support plan for travellers and foreigners in a travel guidebook and brochures
- Formulation of evacuation support plan and manual for tourists and foreigners
- Preparation of emergency medical treatment manual for travellers and foreigners

- Examination of evacuate and transportation route for emergency relief goods by air at the large-scale disaster

8. Ministry of Supplies (MoS)

2-1) Prolonged suspension of supply of food, drinking water and other vital goods	Relevant Organization*
[Promote private sector initiative in disaster response] ➢ Strengthen the capabilities of private sector in disaster response, including development of logistic facilities, which function as storage and supply hub of foods and other vital goods in emergency period.	MoS, Public/Private Enterprises
[Prompt delivery of emergency goods] ➢ Provide sufficient information to the relevant organizations about the guidelines for delivery of food, drinking water and other vital goods in case of emergency.	MoHA, MoFALD, MoS, MoIC
[Development of emergency supply system] ➢ Development of procurement and supply systems of food, drinking water and other vital goods in coordination among federal and local governments agencies and private sectors.	MoC, FNCCI, MoS
[Implement drills for delivery of emergency supplies] ➢ Carry out drills and trainings for transportation of emergency supplies in collaboration with private sector.	MoC, MoS FNCCI,
(Key performance Indicator) - Coverage of water supply pipe line with seismic resistance - Volume of Stockpile of food for emergency - Volume of stockpile of fuel for emergency - Establishment of association of food supply - Establishment of association of fuel supply	

2-2) Isolation of many settlements for long periods due to interruption of road network	Relevant Organization
[Development of emergency supply system] ➢ In case of a large-scale disaster, sufficient foods cannot be procured, especially in remote areas. Thus, it is necessary to make further development of necessary activities, such as increase of storage of emergency supplies	MoHA, MoS, MoFALD
(Key Performance Indicator) - Coverage of seismic reinforcement of infrastructure, such as bridges - Locations of road blockade caused by disaster - Location of stockpile of emergency goods	

2-4) Prolonged suspension of energy supply for emergency response activities including medical services	Relevant Organization
[Establish stockpiling facilities through coordination among relevant stakeholders] ➢ It is necessary to make coordination among relevant ministries and agencies to establish stockpiling facilities of emergency rescue equipment, oil, food and vital goods for an event of large-scale disaster.	MoS, MoHA, MoHealth
[Develop emergency supply system of energy] ➢ Development of emergency distribution system of energy for medical and emergency response facilities to avoid long term interruption of energy supply during disaster events.	MoHA MoS, Public/Private Enterprises
(Key Performance Indicator) - Stockpiling of equipment for emergency response	

Action

- Review of vulnerability assessment results done by JICA Team and identification of priority area.

- Preparation of emergency response plan
- Identification on the current sharing capability on food, drinking water and other important goods in case of urgent.
- Assessment of vulnerability on logistic facilities
- Establishment of logistic facilities to become as a hub to storage, supply and distribute foods and other important goods in case of urgent.
- Installation of water supply line with earthquake protection
- Strengthening the private sector's capability in case of urgent.
- Implementation of trainings for urgent foods transportation collaborating with a private sector.
- Preparation of a guideline on transportation in order to distribute foods, drinking water and other important goods in case of urgent.
- Establishment of Partnership between a private and a public sectors such as the federal and local governments
- Establishment of association of food supply
- Establishment of association of fuel supply
- Implementation of earthquake strengthening of various infrastructures such as bridges
- Establishment of localization system on roadblocks in case of disasters
- Ensuring storage places for urgent goods.
- Development urgent electricity distribution systems for the emergent service facilities such as medical facilities.
- Establishments some arrangements on priority supply of energy for medical and urgent related service facilities.

5-1) Decline in companies' productivity caused by disruption of supply chains.	Relevant Organization
[Promote to establish BCP across multiple companies] ➢ In addition to individual BCP at each company, it is necessary to promote for establishment of BCP across multiple companies in order to secure supply chains at the event of a large-scale natural disaster.	MoI, FoNCCI , MoS
[Promote strengthening of distribution facilities] ➢ It should be promoted effective measures for enhancing disaster resilience of distribution facilities to maintain supply chain after a large-scale disaster.	MoHA MoS,
(Key Performance Indicator) - Provision of BCPs in private enterprises - Vulnerability assessment of distribution facilities - Provision of emergency transportation network	

5-2) Suspension of energy supply necessary for socio-economic activities	Relevant Organization
[Promote backup power system] ➢ It is necessary to prepare BCP by Nepal Oil Corporation (NOC) to strengthen a backup system for energy supply in case of disaster.	MoS MoE
[Improve capacity of energy supply] ➢ Individual factories and business operators should make efforts to introduce necessary measures to prepare for the event of disaster, such as installation of private generators and stockpiling of sufficient fuel.	MoS MoE, MoI

[Implement joint drill] ➢ Relevant organizations and enterprises should carry out joint drills against disasters, focusing on measures and actions to ensure energy supply chains.	MoS, MoFALD, MoHA
[Prioritization of energy supply in advance] ➢ After an event of a large-scale disaster, energy supply would be limited due to damages of the facilities. Therefore, prioritization of energy supply should be determined in advance.	MoS, Public Enterprise
(Key Performance Indicator) - Provision of BCPs in oil supply companies - Implementation of drills and trainings for preparation of emergency	

5-7) Stagnation of stable food supply	Relevant Organization
[Establishment of secure food supply system] ➢ Secure food supply system are encouraged even at an event of large-scale disaster It is necessary to prepare BCPs for food business operators to provide secure food supply. .	MoS, Public and private enterprises
[Collaboration among food supply operators] ➢ In order to maintain food supply even in the event of a large-scale disaster, food business operators should build effective food supply systems with collaboration and cooperation among relevant stakeholders.	MoS, Public and private enterprises
(Key Performance Indicator) - Establishment of systems for collaboration and cooperation in food business operators - Establishment of BCPs in food business operators.	

Action

- Review of vulnerability assessment done by JICA Team
- Assessment of vulnerability of existing distribution facilities
- Preparation of emergency response plan and emergency repair plan
- Establishment of a disaster risk reduction plan and its implementation plan
- Implementation of disaster risk reduction for transportation infrastructure
- Establishment of urgent transportation network.
- Formulation of BCP guidelines for private sectors/enterprises.
- Establishment of the relevant Business Continuity Plan (BCP) sharing with multiple enterprises.
- Strengthening relevant distribution facilities of supply chains against earthquake
- Preparation of BCP for Nepal Oil Corporation (NOC)
- Improvement of private generator installation and fuel storage in individual factories and business operators
- Priority setup in advance and coordination in terms of energy supply
- Preparation of BCPs for other oil supply companies.
- Implementation of trainings to prepare in case of emergent states

6-1) Suspension of power supply networks and oil supply chains	Relevant Organization
[Promote earthquake-resistant measures in oil tanks] ➢ Enhancing earthquake resistance work for oil tanks to prevent significant damages from a large-scale natural disaster.	MoS
[Promotion of stockpiles of petroleum] ➢ In order to reduce the impact on power supply, some efforts for securing stockpiles of petroleum and liquefied petroleum gas should be promoted.	MoS

(Key Performance Indicator) - Progress of anti-seismic measures for oil tanks - Preparation of BCPs for oil companies - Amount of national stockpiles of oil and LPG (liquefied petroleum gas):	

Action

- Review of vulnerability assessment done by JICA Team
- Understanding the current status on petroleum and liquefied petroleum gas
- Improvement of earthquake resistance for oil tanks
- Improvement of national stockpile status for petroleum and liquefied petroleum gas (LPG), including a private sector.
- Formulation of BCP guidelines for other oil companies.

9. Ministry of Information & Communications (MoIC)

1-3) A large number of casualties due to delay of evacuation caused by failure of information transmission.	Relevant Organization
[Providing disaster information promptly] ➢ In case of event of a disaster, itis necessary to provide information of disaster promptly and effectively from relevant government to citizens and visitors by using diversified means, such as radio, TV and other communication tools.	MoHA, MoIC, MoCTCA
[Utilization of information technology] ➢ It is encouraged to utilize information technology to expedite collection and dissemination of disaster information	MoHA (NEOC),MoIC
(Key Performance Indicator) - Radio station to broadcast disaster information - Disaster Information transmission system	

Action

- Review of vulnerability assessment results done by JICA Team
- Review of standards and guidelines for scenario earthquake proposed by JICA Team
- Establishment of accurate collection and dissemination of the disaster information and communication systems.
- Developing information technology in in disaster information collection and dissemination.
- Nurturing of human resources and developing capacity in disaster information collection and dissemination.
- Enforcement and upgrade of the information devices and facility in police and fire service.

4-1) Paralysis of information communication system due to suspension of power supply.	Relevant Organization
[Conduct vulnerability assessment of information communication system] ➢ Vulnerability assessment of information communication system against suspension of power supply should be implemented from normal time to prepare for a large-scale disaster.	MoIC, MoEnergy
(Key Performance Indicator) - Regulations for telecommunications business - Progress of information communication system	

4-2) Circumstances where disaster information cannot be delivered promptly due to suspension of TV and radio broadcasting	Relevant Organization
[Ensure TV and radio broadcasting] ➢ TV and radio play significant role to deliver information in case of disaster. Thus, some disaster management measures for secure radio and TV broadcasting facilities should be encouraged.	MoIC
(Key Performance Indicator)	

Action

- Review of vulnerability assessment result
- Conducting a vulnerability assessment on the information and communication system.
- Implementation of disaster countermeasure in TV and radio broadcast facilities.

10. Department of Water Supply and Sewerage (DWSS)

2-1) Prolonged suspension of supply of food, drinking water and other vital goods	Relevant Organization*
[Reinforcement of water supply system] ➢ Seismic reinforcement works for water supply facilities should be implemented in order to continue the service after a disaster. At the same time, diversified measures for possible water sources, such as ground water, rain water, recycled water, should be examined.	LGs, KUKL, DWSS, MoWSS
(Key Performance Indicator) - Coverage of water supply pipe line with seismic resistance - Volume of Stockpile of food for emergency - Volume of stockpile of fuel for emergency - Establishment of association of food supply - Establishment of association of fuel supply	

2-6) Outbreak of epidemics or infectious diseases in disaster-affected areas	Relevant Organization
[Establish hygiene and infection control] Building a system for prompt elimination and disposal of waste from the living space of disaster victims.	LGs, MoH, DWSS, MoWSS
[Earthquake-resistant work for sewerage facilities] ➢ Seismic reinforcement works for sewerage facilities is necessary to provide sewerage service even after a large-scale disaster.	DWSS, MoWSS MoFALD, LGs
[Preparation of BCP in DWSS] ➢ Business Continuity Plan (BCP)for sewerage should be promoted by DWSS in collaboration with local governments	DWSS, MoWSS
(Key Performance Indicator) - Preparation of BCP in DWSS - Proportion of sewerage facilities with seismic resistance	

Action

- Review of vulnerability assessment results done by JICA Team and identification of priority areas.
- Preparation of emergency response plan
- Evaluation of vulnerability on service water systems
- Strengthening for water supply facilities against earthquakes.
- Installation of water supply line with earthquake protections.

- Establishment on a five year plan in order to maintain, manage and quakeproof water supply facilities
- Understanding of a current status of waste disposal management
- Establishment of waste disposal system in case of disaster.
- Understanding of the current conditions on sewage treatment system.
- Assessment of vulnerability on sewage system
- Strengthening sewage system facilities with earthquake protection.
- Establishment of a five year plan on seismic strengthening for sewage system.
- Preparation on Business Continuity Plan (BCP) to properly maintain the sewage system in the DWSS and local governments.

6-3) Prolonged suspensions of sewerage treatment facilities.	Relevant Organization
[Promotion of seismic reinforcement for sewerage facilities] ➢ Seismic reinforcement works for sewerage facilities are necessary to maintain the service even after a large-scale disaster.	DWSS, MoWSS, LGs
(Key Performance Indicator) - BCP of the stakeholders to maintain sewage systems after disaster - Implementation of anti-seismic measures for sewerage treatment facilities - Registration system of septic tanks	

Action

- Review of vulnerability assessment done by JICA Team
- Understanding of relevant current conditions on sewage line facilities, sewage treatment facilities and water-purifier tanks
- Assessment of vulnerability on sewage line facilities, sewage treatment facilities and water-purifier tanks
- Improvement of sewage line facilities, sewage treatment facilities and water-purifier tanks
- Preparation of relevant Business Continuities Plans (BCPs) depending on various stakeholders
- Preparation and establishment on a registration system for water-purifier tanks

11. Ministry of Education (MoED)

1-1) A large number of casualties due to multiple collapse of buildings and infrastructure	Relevant Organization*
[**Promotion of earthquake-resistant structural measures for buildings]** ➢ In urban area, some actions and measures to promote earthquake-resistant structure of buildings are necessary to avoid a large number of casualties due to collapse of buildings	DUDBC, MoUD, MoFALD, LGs
(Key Performance Indicator) - Proportion of seismic resistance building - Estimated building corruption ratio under the envisaged earthquake - Preparation of disaster management plan in local governments - Identification of vulnerable infrastructure and buildings to disaster	

1-2) A large number of casualties due to collapse of facilities used by the general public	Relevant Organization

[Strengthening earthquake-resistant measures in the facilities used by general public] ➢ Earthquake-resistant safety measures should be taken in the facilities used by general public, including government offices, schools, and medical facilities in the public sector as well as shopping centre, hotels and bus terminal in the private sector.	MoPIT, MoUD, DUDBC, KVDA
(Key Performance Indicator) - Proportion of seismic resistance building, including federal and local government buildings, hospitals, schools, shopping centres, hotels, bus terminals, etc. - Implementation of disaster management training and drills in relevant agencies	

1-4) A large number of casualties due to lack of evacuation facilities	Relevant Organization
[**Seismic retrofitting of the evacuation facilities**] ➢ The designated evacuation facilities should be safe from large-scale disaster with seismic-resistance retrofitting.	LGs, MoFALD, KVDA, MoHA, DUDBC, MoED
[**Preparation of management plan of the evacuation facilities**] ➢ Preparation of management plan for evacuation facilities, including emergency operation of first-aid and rescue after large-scale disaster as well as maintenance in normal period.	LGs, MoFALD, KVDA, MoHA, MoED
(Key Performance Indicator) - Provision of open space for emergency use - Provision of evacuation facilities	

Action

- Review of vulnerability assessment results done by JICA Team.
- Confirmation of existing position of schools as evacuation facilities.
- Understanding existing situations of schools used by the evacuation facilities.
- Review of standards and guidelines for scenario earthquake proposed by JICA Team.
- Identification vulnerable schools used by the evacuation facilities.
- Promote seismic resistance to reinforce or rebuild of schools used by the evacuation facilities.
- Preparation of five year plan to promote strengthened seismic resistance for schools used by the evacuation facilities.
- Promotion of disaster risk reduction and resilience education.

12. Ministry of Health (MoH)

2-4) Prolonged suspension of energy supply for emergency response activities including medical services	Relevant Organization
[Establish stockpiling facilities through coordination among relevant stakeholders] ➢ It is necessary to make coordination among relevant ministries and agencies to establish stockpiling facilities of emergency rescue equipment, oil, food and vital goods for an event of large-scale disaster.	MoS, MoHA, MoHealth

2-5) Paralysis of medical services due to damage and lack of medical facilities and personnel	Relevant Organization
[Collaboration of medical facilities in case of emergency] ➢ In case of an event of large-scale disaster, it possibly happens that huge number of injured persons due to the disaster may exceed capacities of emergency treatments in hospitals. Therefore, it is necessary to examine desirable provisions of medical functions in case of emergency.	MoHealth
[Ensure seismic resistance in medical facilities] ➢ In order to provide sufficient medical function at an event of large-scale disaster, seismic reinforcement works should be provided for hospitals and emergency facilities.	MoH, MoUD, DUDBC
[Preparedness for emergency disaster response] ➢ Some key hospitals would be designated as emergency hospital at an event of large-scale disaster. These hospitals should take appropriate measures, such as sufficient water storage and emergency power supply.	MoH
[Provision of medical function in the disaster area] ➢ It is necessary to provide measures for immediate provision of medical function in the disaster affected areas. Disaster medical assistance team (DMAT) should be organized to response to large-scale disaster event. The DMAT will be distributed to key hospitals at an event of large-scale disaster.	MoHA, MOH
[Ensure transportation route for emergency supplies] ➢ It is necessary to develop some measures to ensure transportation routes for emergency supplies to hospitals.	MoHA, MoPIT, MOH
(Key Performance indicator) - Development of disaster medical assistance team (DMTA) in hospital - Designation of key hospitals in preparation of emergency responses	

2-6) Outbreak of epidemics or infectious diseases in disaster-affected areas	Relevant Organization
[Promote immunization system] ➢ Promotion of vaccination to prevent outbreak and spread of infectious diseases even from normal time.	MoH, LGs
[Establish hygiene and infection control] Building a system for prompt elimination and disposal of waste from the living space of disaster victims.	LGs, MoH, DWSS, MoWSS
(Key Performance Indicator) - Preparation of BCP in DWSS - Proportion of sewerage facilities with seismic resistance	

Action

- Review of the result of the vulnerability assessment conducted by JICA Team and identification of the priority areas.
- Preparation of an emergency response plans
- Establishment of disasters of stockpile warehouses and preparation of an emergency rescue device and equipment, gasoline and light diesel oil, foods, daily necessaries in cooperation with stakeholders.
- Evaluation of the current condition on hospitals and health care facilities.
- Conducting risk assessment to identify vulnerability of hospitals and health care facilities.
- Identification of emergency transportation roads.
- Consideration of an emergency transportation road to certainly carry medical supplies to the hospital in the large-scale of disaster.

- Designation of the Disaster Centre Hospital.
- Development of an emergency water supply plan and installation of emergency electrical generators in the Disaster Centre Hospital.
- Organizing the Disaster Medical Assistance Team (DMAT)
- Promotion of vaccination as preventive measure for an outbreak of pandemic in the event of disaster.
- Development of disaster waste management to correct and dispose debris and hazardous waste for health, safety and prompt post-disaster rescue operations.
- Implementation of drills and trainings
- Conclusion of agreements among / with private sectors to secure removal of debris, transportation of goods and storage
- Provision of medical services in the disaster areas
- Preparation of the disaster management plan in the MoH.

13. Ministry of Energy (MoE)

3-3) Dysfunction of the federal government due to significant damages of their facilities	Relevant Organization
[Strengthening infrastructure in the capital region] ➢ Making efforts for disaster prevention measures, such as seismic resistance for roads, bridges, power supply and water supply facilities. In order to maintain road transport function, it is needed to eliminate power poles especially along emergency roads.	MoPIT (DoR) MoWSS, MoE
(Key Performance Indicator) - Provision of BCPs in federal ministries and agencies - Stockpiling of fuel for emergency power generation in federal buildings.	

Action

- Identification of existing power supply.
- Preparation of emergency response plan
- Preparation of information collection methods just after the disaster
- Preparation of Business Continuity Plans (BCP) by both private and government sectors and continuous improvement of the relevant BCP with regular reviews by relevant organizations in order to improve their BCP capabilities.
- Promotion of seismic resistance structure for power supply system
- Preparation of disaster management plan and its implementation plan

4-1) Paralysis of information communication system due to suspension of power supply.	Relevant Organization
[Conduct vulnerability assessment of information communication system] ➢ Vulnerability assessment of information communication system against suspension of power supply should be implemented from normal time to prepare for a large-scale disaster.	MoIC, MoEnergy
[Ensure security of power supply system] ➢ In order to prevent prolonged power outages, some efforts should be taken to ensure security of power supply system.	MoE

(Key Performance Indicator) - Regulations for telecommunications business - Progress of information communication system	

Action

- Evaluation on Vulnerability assessment of information communication system in the case of long-term power outages.
- Reviews of electrical telecommunication facilities and the technological standards.
- Preparation of information telecommunication measures by various media.
- Improvement of private generator installation as well as preparation for measures on priority supply of power & fuel.

5-2) Suspension of energy supply necessary for socio-economic activities	Relevant Organization
[Promote backup power system] ➢ It is necessary to prepare BCP by Nepal Oil Corporation (NOC) to strengthen a backup system for energy supply in case of disaster.	MoS MoE
[Improve capacity of energy supply] ➢ Individual factories and business operators should make efforts to introduce necessary measures to prepare for an event of disaster, such as installation of private generators and stockpiling of sufficient fuel.	MoS MoE, MoI
(Key Performance Indicator) - Provision of BCPs in oil supply companies - Implementation of drills and trainings for preparation of emergency	

Action

- Review of vulnerability assessment done by JICA Team
- Preparation of emergency response plan and emergency repair plan
- Improvement of private generators installation in relevant individual factories and business operators as well as stockpiling of sufficient fuels.
- Formulation of disaster risk reduction plan and its implementation plan
- Implementation of disaster risk reduction for energy supply
- Provision of BCPs in oil supply companies
- Implementation of drills and trainings for preparation of emergency

6-1) Suspension of power supply networks and oil supply chains	Relevant Organization
[Enhancement of the capacity of emergency power supply] ➢ It is necessary to enhance the capacity of emergency power supply to maintain people's lives. At the same time, prompt restoration measures of power after a disaster should be sought.	MoE
[Introduction of diverse energy sources] ➢ Diversification of energy supply sources should be sought to ensure stable power supply even in case of disaster.	MoE, MoI
(Key Performance Indicator) - Progress of anti-seismic measures for oil tanks - Preparation of BCPs for oil companies - Amount of national stockpiles of oil and LPG (liquefied petroleum gas):	

Action

- Review of vulnerability assessment done by JICA Team
- Evaluation of resistance properties in terms of power facilities.
- Strengthen of electric power plant, transmission network and grid system
- Installation of various renewable energies in order to diversify energy supply sources.
- Preparation of BCPs for National Oil Cooperation (NOC) and other oil and gas related companies.
- Improvement of national stockpiles of oil and LPG (liquefied petroleum)

14. Local government (LGs)

1-1) A large number of casualties due to multiple collapse of buildings and infrastructure	Relevant Organization*
[**Promotion of earthquake-resistant structural measures for buildings]** ➢ In urban area, some actions and measures to promote earthquake-resistant structure of buildings are necessary to avoid a large number of casualties due to collapse of buildings	DUDBC, MoUD, MoFALD, LGs
(Key Performance Indicator) - Proportion of seismic resistance building - Estimated building corruption ratio under the envisaged earthquake - Preparation of disaster management plan in local governments - Identification of vulnerable infrastructure and buildings to disaster	

1-2) A large number of casualties due to collapse of facilities used by the general public	Relevant Organization
[Promotion of safe building construction. ➢ An integrated "National Plan of Action on Safer Building Construction" needs to be developed by the government of Nepal.	DUDBC MoUD, LGs, MoFALD
[Strengthening capacity of organizations to be responsible for disaster response] ➢ Capacity of the relevant agencies to be responsible for disaster response need to be strengthen through enhancement of necessary equipment and human resource development activities, such as various types of training and drills.	MoHA LGs, MoD
(Key Performance Indicator) - Proportion of seismic resistance building, including federal and local government buildings, hospitals, schools, shopping centres, hotels, bus terminals, etc. - Implementation of disaster management training and drills in relevant agencies	

1-3) A large number of casualties due to delay of evacuation caused by failure of information transmission.	Relevant Organization
[Strengthening of capacity of local government] ➢ Strengthening of human resources capacity for effective utilization of collected information at local government level, which is a primary body of provision for disaster	MoFALD, LGs, MoHA,
(Key Performance Indicator) - Radio station to broadcast disaster information - Disaster Information transmission system	

1-4) A large number of casualties due to lack of evacuation facilities	Relevant Organization
[Development of temporary shelters or evacuation facilities] ➢ If people lost their houses caused by a large-scale disaster, it is necessary to provide temporary shelters or evacuation facilities for a certain period of time.	MoHA, LGs, MoFALD

[**Preparation of emergency evacuation plan**] ➢ The emergency evacuation plan will be prepared by local government and the plan includes locations of evacuation facilities and evacuation route, taking into account capacity of each evacuation facility and population of its catchment area.	LGs, MoFALD, KVDA, MoHA
[**Development of evacuation open space**] ➢ Open spaces for emergency evacuation need to be designated by local government with endorsement from MoHA. The open space for emergency evacuation can be classified into at least two types in terms of size of open space and the catchment area: i.e., regional evacuation open space and neighbourhood evacuation open space. This open space should be developed in densely populated urban area.	LGs , KVDA, MoHA, MoFALD
[**Seismic retrofitting of the evacuation facilities**] ➢ The designated evacuation facilities should be safe from large-scale disaster with seismic-resistance retrofitting.	LGs, MoFALD, KVDA, MoHA, DUDBC, MoED
[**Preparation of management plan of the evacuation facilities**] ➢ Preparation of management plan for evacuation facilities, including emergency operation of first-aid and rescue after large-scale disaster as well as maintenance in normal period.	LGs, MoFALD, KVDA, MoHA, MoED
(Key Performance Indicator) - Provision of open space for emergency use - Provision of evacuation facilities	

Action

- Review of vulnerability assessment results conducted by JICA Team
- Conducing risk assessment to identify earthquake resistance condition and vulnerability of houses and buildings
- Review of a basic policy and guidelines against predicted earthquake proposed by JICA Team
- Estimated building corruption ratio under the envisaged earthquake
- Promotion of seismic resistance buildings by aseismic reinforcement or rebuilding
- Implementation of systematic improvement in densely populated urban areas
- Development of a green space and a park development
- Development of evacuation place and roads
- Formulation of the five year plan in promoting seismic resistance on a public facility such as the federal and local government buildings, schools and hospitals.
- Formulation of the five year plan in promoting seismic resistance houses and buildings
- Implementation of safety countermeasure in public facility that many citizens use such as shopping malls, accommodation facilities, bus terminal.
- Preparation of disaster management plan in the local governments
- Developing capacity of organizations which are responsible in disaster response
- Planning and conducting emergency drills and exercises.
- Nurturing human resources who are responsible in disaster risk management in the local governments.
- Development of temporary shelters or evacuation facilities
- Promotion of seismic retrofitting of the evacuation facilities
- Preparation of the evacuation facilities management plan
- Development of the disaster information dissemination system

2-1) Prolonged suspension of supply of food, drinking water and other vital goods	Relevant Organization*
[Reinforcement of water supply system] ➢ Seismic reinforcement works for water supply facilities should be implemented in order to continue the service after a disaster. At the same time, diversified measures for possible water sources, such as ground water, rain water, recycled water, should be examined.	LGs, KUKL, DWSS, MoWSS
(Key performance Indicator) - Coverage of water supply pipe line with seismic resistance - Volume of Stockpile of food for emergency - Volume of stockpile of fuel for emergency - Establishment of association of food supply - Establishment of association of fuel supply	

2-12) Outbreak of epidemics or infectious diseases in disaster-affected areas	Relevant Organization
[Promote immunization system] ➢ Promotion of vaccination to prevent outbreak and spread of infectious diseases even from normal time.	MoH, LGs
[Earthquake-resistant work for sewerage facilities] ➢ Seismic reinforcement works for sewerage facilities is necessary to provide sewerage service even after a large-scale disaster.	DWSS, MoWSS MoFALD, LGs
(Key Performance Indicator) - Preparation of BCP in DWSS - Proportion of sewerage facilities with seismic resistance	

Action

- Review of vulnerability assessment conducted by JICA Team
- Identification of the current conditions on sanitary drainage, wastewater treatment plants and water-purifier tanks.
- Conducting risk assessment to identify vulnerability on sewage line facilities, sewage treatment facilities and water-purifier tanks
- Promotion of earthquake resistance on sewage line facilities, sewage treatment facilities and water-purifier tanks
- Promoting BCP formulation and operation in cooperation with several companies as the alliance.
- Preparation and establishment on a registration system for water-purifier tanks

3-1) A decline in public safety due to damages of police facilities and personnel	Relevant Organization
[Implementation of public safety measures] ➢ In order to maintain public safety after a large-scale disaster, the government should promptly issue special order to continue the relevant duties of police.	MoHA, MoFALD, LGs
(Key Performance Indicator) - Seismic resistant building of correction facilities - Number of police officers	

3-2) Serious traffic accidents due to lack of traffic control	Relevant Organization
[Collection of accurate traffic information] ➢ It is necessary to collect traffic information promptly after a large-scale disaster, which include locations of road close, traffic jam, traffic light failures, etc.	MoHA (Traffic Police), LGs, MoPIT
[Installation of power source devices in traffic signals] ➢ Promotion of installation of power source devices to traffic signals to prevent congestion and accidents caused by failure of signals due to blackout	MoHA (Traffic Police), LGs, MoEnergy MoPIT
(Key Performance Indicator) - Number of traffic signals equipped with power source devices	

3-4) Deterioration of the functions of local governments due to significant damages to their personnel and facilities	Relevant Organization
[Maintain necessary function of local government] ➢ It is necessary for local government to conduct their roles to conduct immediate response and rehabilitation activities in case of a large-scale disaster.	MoFALD, LGs
[Establishment of business continuity plans (BCPs) in local governments] ➢ Each local government needs to prepare BCP to continue their duties and services even after large-scale disaster.	MoFALD, LGs
[Seismic reinforcement work for the facilities of police and fire fighting] ➢ Promote seismic reinforcement work for the facilities of police and fire fighting in order to function sufficiently in rescue and recovery activities in case of large-scale natural disasters.	MoFALD, LGs, MoHA, DUDBC
(Key Performance Indicator) - Proportion of public facilities with seismic resistance - Establishment of BCPs in local governments	

Action

- Preparation of an emergency response plan
- Development of information collection methods in the aftermath of disaster
- Establishment of business continuity plans (BCPs) in the local governments
- Promotion of seismic reinforcement on school and social welfare facilities functioning an operational base of emergency response
- Conducting seismic reinforcement work for the facilities of police and fire fighting
- Preparation of disaster management plan and its implementation plan

6-3) Prolonged suspensions of sewerage treatment facilities.	Relevant Organization
[Promotion of seismic reinforcement for sewerage facilities] ➢ Seismic reinforcement works for sewerage facilities are necessary to maintain the service even after a large-scale disaster.	DWSS, MoWSS, LGs
[Promotion of disaster resilient septic tank] ➢ Private wastewater septic tanks are promoted to replace with disaster-resilient septic tanks and the registration system of disaster-resilient septic tanks needs to be developed.	MoWSS, LGs
[Collaboration for sustainable seismic resilient system] ➢ In order to establish sustainable seismic resistant system for sewerage facilities, strengthening of the management system should be sought in collaboration among stakeholders.	MoUD MoWSS, LGs

(Key Performance Indicator) - BCP of the stakeholders to maintain sewage systems after disaster - Implementation of anti-seismic measures for sewerage treatment facilities - Registration system of septic tanks	

Action

- Review of vulnerability assessment conducted by JICA Team
- Identification of the current conditions on sanitary drainage, wastewater treatment plants and water-purifier tanks.
- Conducting risk assessment to identify vulnerability on sewage line facilities, sewage treatment facilities and water-purifier tanks
- Promotion of earthquake resistance on sewage line facilities, sewage treatment facilities and water-purifier tanks
- Promoting BCP formulation and operation in cooperation with several companies as the alliance.
- Preparation and establishment on a registration system for water-purifier tanks

7-1) Traffic paralysis due to collapse of buildings along emergency roads	Relevant Organization
[Enforcement of building code] ➢ In order to avoid collapse of buildings along major roads, the local governments should promote some measures and actions to enforce the building code.	DUDBC MoUD, MoFALD, LGs
(Key Performance Indicator)	

Action

- Preparation of information collection and distribution methods
- Preparation of an emergency response plans
- Assessment of conformation to the building standards of roadside buildings.
- Assessment of buildings which violate the building standards.
- Provision of guidance to renovation, rebuilding, and seismic reinforcement for unqualified buildings which do not meet to the building standards.

8-1) Delay of recovery and reconstruction works significantly due to delay of treatment of disaster waste	Relevant Organization
[Need effective disaster waste management] ➢ It is necessary to promote securing stock yards for provisional storage of a large amount of disaster waste.	LGs MoFALD, MoHA
[Establish disaster waste disposal plans] ➢ Local governments in association with relevant stakeholders need to be encouraged to prepare disaster waste disposal plans to conduct recovery and reconstruction promptly.	LG, MoHA, MoFALD
(Key Performance Indicator) - Identification of possible stock yards of disaster waste - Establishment of disaster waste disposal plans - Development of waste disposal technologies - Implementation of surveys to identify hazardous materials:	

8-2) Delay of recovery and reconstruction works significantly due to shortage of personnel	Relevant Organization
[Taking some security measures] ➢ Some security measures should be undertaken after the event of a disaster to avoid deterioration of functions of police and fire services, due to damage to their personnel and facilities.	MoHA, LG, MoFALD

8-4) Delay of recovery and reconstruction works significantly due to damage to core infrastructure	Relevant Organization
[Coordination among relevant ministries, agencies and local governments to reconstruct damaged infrastructure] ➢ In order to promote recovery and reconstruction of damaged infrastructure from a disaster, it is necessary to enhance coordination among relevant ministries, agencies and local government.	MoHA, OPMCM MoPIT, LG
[Implementation of cadastral survey and other required activities] ➢ Clarification of land boundary (e.g. cadastral survey) is one of the important actions to prompt recovery and reconstruction from a disaster. It is necessary to conduct cadastral survey or other required activities even from normal time.	MoHA, MoLRM MoFALD, LG
(Key Performance Indicator) - Proportion of bridges with seismic resistance: - Progress of cadastral surveys:	

Action

- Review of vulnerability assessment done by JICA Team
- Estimation of disaster waste quantity.
- Development of disaster waste management plan
- Ensuring of temporary storage site for disaster waste.
- Development of waste disposal technologies
- Conducting surveys to identify hazardous materials
- Nurturing human resources related with recovery and reconstruction.
- Enhancement of partnership with local building contractors
- Promotion of earthquake resistance of police and fire service buildings
- Conducting a land registry investigation in order to enable to quickly identify a boundary line after the disaster.

15. Office of the Prime Minister and Council of Ministers (OPMCM)

1-1) A large number of casualties due to multiple collapse of buildings and infrastructure	Relevant Organization*
[Development of cooperation system in disaster management] ➢ In order to avoid a large number of casualties in the event of a large-scale disaster, a broad-based collaboration system in disaster management is necessary, such as collaboration among government ministries and agencies as well as between public and private sectors.	MoHA, OPMCM
(Key Performance Indicator) - Proportion of seismic resistance building - Estimated building corruption ratio under the envisaged earthquake - Preparation of disaster management plan in local governments - Identification of vulnerable infrastructure and buildings to disaster	

Action

- Review of vulnerability assessment results done by JICA Team
- Assessment of current earthquake resistance status for buildings along arterial roads
- Review of a basic policy and guidelines against predicted earthquake proposed by JICA Team
- Promotion of seismic resistance buildings by aseismic reinforcement or rebuilding
- Formulation of the five year plan in promoting seismic resistance buildings
- Sharing the DRR role in close partnership with the government and private sectors
- Formulation of Business Continuity Plan (BCP) in private sectors
- Development of effective disaster prevention technologies by private sectors
- Promotion of the public-private risk-sensitive investment
- Formulation of Disaster Risk Management Plan in the local government

2-3) Difficulty of rescue and emergency response activities due to significant damages of relevant organizations	Relevant Organization
[Strengthening capacity of disaster management] ➢ It is necessary to strengthen capacity of rescue and emergency activities, including police, fire fighting and other disaster management agencies. In addition, a variety of actions are needed, such as strengthening of community-based disaster management organization, development of disaster medical assistance team, and ensuring human resources for restoration of emergency transportation roads.	MoHA, MoD, OPMCM, MoFALD
[Standardization of disaster response activities among organization] ➢ Each relevant organization has its own mandate, operational process and equipment for disaster response which is different each other. It is necessary to standardize disaster response activities and information communication system to strengthen rescue and emergency activities.	MoHA MoD OPMCM
[Collaboration for emergency activities among relevant stakeholders] ➢ Emergency activities need to be coordinated among relevant stakeholders, including local government, ministry of defence, police, fire fighting, ministry of home affairs, etc. It is also necessary to collaborate with private sector for implementation of emergency activities,	MoHA MoFALD, OPMCM
(Key Performance Indicator) - Number of fire fighter by local government - Number of police by local government - Equipment for disaster response activities - Past record of drill and training for disaster response in local government - Standardization of emergency communication tool	

Action

- Review of vulnerability assessment results done by JICA Team and identification of priority areas.
- Preparation of emergency response plan
- Enhancement of the community-based-disaster-response-capacity
- Capacity development in rescue activity and emergency response of the relevant organizations including a police and a fire services
- Fostering of community-based-organization for DRR
- Standardization of emergency communication tool
- Implementation of disaster drills and exercise

- Development of disaster emergency medical team
- Ensuring human resource for early recovery of traffic routes for emergency transportation
- Standardization of emergency response and communication tool among the relevant organizations which have different mandate, operational process and equipment for disaster response in order to enhance the ability of rescue work and emergency response

3-3) Dysfunction of the federal government due to significant damages of their facilities	Relevant Organization
[Maintain important functions of the federal government] ➢ Dysfunction of the federal government will cause significant impact on response and rehabilitation activities after a large-scale disaster. It is indispensable for the federal government to maintain or secure necessary functions in any case of disaster.	MoHA, OPMCM, MoFALD
[Preparation of BCP in the federal government] ➢ Business continuity plan (BCP) should be established in respective federal ministries and agencies to function even after a large-scale disaster event.	NPC, OPMCM Respective Sector Ministries
[Ensure information and communication systems] ➢ Each federal ministry and agency needs to ensure emergency communication systems, so that the federal government can continue its emergency duties even under deteriorated environment.	OPMCM, MoHA, MoIC
(Key Performance Indicator) - Provision of BCPs in federal ministries and agencies - Stockpiling of fuel for emergency power generation in federal buildings.	

Action

- Identification of current status for transportation facilities
- Preparation of emergency response plan
- Preparation of information collection methods in the aftermath of disaster
- Formulation of BCP by the federal ministries and agencies
- Securing emergency communication system among each federal ministry and agency
- Stockpiling of the fuel for securing emergency power generation in the federal buildings
- Provision of BCPs in the federal ministries and agencies
- Preparation of disaster management plan and its implementation plan

5-4) Dysfunction of major transportation network due to damages by a disaster	Relevant Organization
[Secure road network] ➢ Disruption of road network would cause enormous damage to the economy. Thus, relevant ministries and agencies need to collaborate and to make efforts to secure road transport network even in the case of large-scale disaster.	MoPIT (DoR), OPMCM
(Key Performance Indicator) - Development of road networks for ensuring redundancy - Provision of disaster resilience measures for transportation facilities to continue economic activities	

Action

- Review of vulnerability assessment done by JICA Team
- Preparation of emergency response plan and early recovery plan
- Examination of alternative transportation means for emergency relief and equipment

- Formulation of disaster risk reduction plan and its implementation plan
- Implementation of disaster risk reduction for transportation infrastructure

8-4) Delay of recovery and reconstruction works significantly due to damage to core infrastructure	Relevant Organization
[Coordination among relevant ministries, agencies and local governments to reconstruct damaged infrastructure] ➢ In order to promote recovery and reconstruction of damaged infrastructure from a disaster, it is necessary to enhance coordination among relevant ministries, agencies and local government.	MoHA, OPMCM MoPIT, LG
(Key Performance Indicator) - Proportion of bridges with seismic resistance: - Progress of cadastral surveys:	

Action

- Review of vulnerability assessment done by JICA Team
- Implement vulnerability assessment, if necessary
- Preparation of emergency response plan and implement drills and exercises
- Conclusion of an agreement among the government and private sectors
- Strengthening an ability to coordinate disaster recovery and reconstruction activities among the relevant organizations and the local government
- Improvement of earthquake resistance performance of roads and bridges

16. Ministry of Defence (MoD)

1-2) A large number of casualties due to collapse of facilities used by the general public	Relevant Organization
[Strengthening capacity of organizations to be responsible for disaster response] ➢ Capacity of the relevant agencies to be responsible for disaster response need to be strengthen through enhancement of necessary equipment and human resource development activities, such as various types of training and drills.	MoHA LGs, MoD
(Key Performance Indicator) - Proportion of seismic resistance building, including federal and local government buildings, hospitals, schools, shopping centres, hotels, bus terminals, etc. - Implementation of disaster management training and drills in relevant agencies	

Action

- Review of vulnerability assessment results done by JICA Team
- Assessment of current earthquake resistance status for road, bridge, pedestrian bridge, and other facilities.
- Identification of vulnerability to disasters of road, bridges, the way of the land use facing the road.
- Assessment of current earthquake resistance status and vulnerability to disasters of the major buildings (federal and local government buildings, hospitals, schools, shopping centres, hotels, bus terminals, etc.)
- Review of standards and guidelines for scenario earthquake proposed by JICA Team

- Conducting drills and exercises corresponding to various type of disaster.
- Enhancement of responsible ministries and agencies in disaster response by human resource development.
- Support of BCP formulation in private sectors.

2-2) Isolation of many settlements for long periods due to interruption of road network	Relevant Organization
[Development of transportation information system] ➢ Obtaining accurate transportation information in case of a large-scale disaster to promote rescue activities promptly.	MoHA (Traffic Police, Police, APF), MoD, MoPIT
(Key Performance Indicator) - Coverage of seismic reinforcement of infrastructure, such as bridges - Locations of road blockade caused by disaster - Location of stockpile of emergency goods	

2-3) Difficulty of rescue and emergency response activities due to significant damages of relevant organizations	Relevant Organization
[Strengthening capacity of disaster management] ➢ It is necessary to strengthen capacity of rescue and emergency activities, including police, fire fighting and other disaster management agencies. In addition, a variety of actions are needed, such as strengthening of community-based disaster management organization, development of disaster medical assistance team, and ensuring human resources for restoration of emergency transportation roads.	MoHA, MoD, OPMCM, MoFALD
[Standardization of disaster response activities among organization] ➢ Each relevant organization has its own mandate, operational process and equipment for disaster response which is different each other. It is necessary to standardize disaster response activities and information communication system to strengthen rescue and emergency activities.	MoHA MoD OPMCM
(Key Performance Indicator) - Number of fire fighter by local government - Number of police by local government - Equipment for disaster response activities - Past record of drill and training for disaster response in local government - Standardization of emergency communication tool	

Action

- Review of vulnerability assessment results done by JICA Team and identification of priority area.
- Preparation of emergency response plan
- Implementation of drills and training
- Enhancement of the capacity of responsible organizations such as police and fire service in rescue activity and emergency response.
- Fostering and strengthening community-based organization for DRR.
- Preparation of the disaster emergency medical team.
- Securing human resources in recovering the emergency transport route.
- Standardization of emergency response and communication tool among the relevant organizations enabling to conduct efficient operation aligned with conduct of code even they have different mandate, operational process and equipment for disaster response.

5-5) Fatal damage to major airports caused by a disaster	Relevant Organization
[Securing airport functions] ➢ It is necessary to review damages of airport immediately after a large-scale disaster and to recover functions of airports in cooperation with relevant organizations. .	MoCTCA, MoD
[Centralize air control and information management system] ➢ Airport is a distribution hub of emergency goods after a large-scale disaster. It is necessary to centralize air control and information management of emergency goods supported by international donors.	MoCTCA MoHA, MoD
(Key Performance Indicator) - Provision of early recovery plan for airport from disasters - Designate airport as a centre for emergency and rescue activities - Designate airport as a transportation hub of critical materials	

Action

- Review of vulnerability assessment done by JICA Team
- Preparation of the emergency response plan and the early recovery plan.
- Identification of alternative transportation means
- Formulation of disaster risk reduction plan and its implementation plan
- Implementation of disaster countermeasure at major airports
- Formulation of evacuation plan evacuation guidance.
- Formulation of early recovery plan for airport.
- Designation of the major airport functioning the centre for emergency and rescue activities
- Designation of the major airport functioning the transportation hub of critical materials
- Establishment of a network for cooperation with each airport.
- Considering the aircraft control system and information management capable of surely receiving an emergency relief provided by the international humanitarian organizations.

17. Ministry of Water Supply and Sewerage (MoWSS)

2-1) Prolonged suspension of supply of food, drinking water and other vital goods	Relevant Organization*
[Reinforcement of water supply system] ➢ Seismic reinforcement works for water supply facilities should be implemented in order to continue the service after a disaster. At the same time, diversified measures for possible water sources, such as ground water, rain water, recycled water, should be examined.	LGs, KUKL, DWSS, MoWSS
(Key performance Indicator) - Coverage of water supply pipe line with seismic resistance - Volume of Stockpile of food for emergency - Volume of stockpile of fuel for emergency - Establishment of association of food supply - Establishment of association of fuel supply	

2.6) Outbreak of epidemics or infectious diseases in disaster-affected areas	Relevant Organization
[Establish hygiene and infection control] Building a system for prompt elimination and disposal of waste from the living space of disaster victims.	LGs, MoH, DWSS, MoWSS

[Earthquake-resistant work for sewerage facilities] ➢ Seismic reinforcement works for sewerage facilities is necessary to provide sewerage service even after a large-scale disaster.	DWSS, MoWSS MoFALD, LGs
[Preparation of BCP in DWSS] ➢ Business Continuity Plan (BCP)for sewerage should be promoted by DWSS in collaboration with local governments	DWSS, MoWSS
(Key Performance Indicator) - Preparation of BCP in DWSS - Proportion of sewerage facilities with seismic resistance	

Action

- Review of vulnerability assessment results done by JICA Team and identification of priority areas.
- Preparation of an emergency response plan
- Conducting risk assessment to identify the current condition and vulnerability on the water supply system and the sewage facility.
- Promoting an earthquake resistance on the water supply system and the sewage facilities
- Installation of water supply line with earthquake protections. /Installation of an earthquake resistant water pipes.
- Formulation of the five year plan for maintenance management and earthquake resistance of the water supply and the sewerage facilities.
- Formulation and operation of Business Continuity Plan (BCP) for the purpose of ensuring providing water supply and sewage service adequately in both DWSS and the local government.

3-3) Dysfunction of the federal government due to significant damages of their facilities	Relevant Organization
[Strengthening infrastructure in the capital region] ➢ Making efforts for disaster prevention measures, such as seismic resistance for roads, bridges, power supply and water supply facilities. In order to maintain road transport function, it is needed to eliminate power poles especially along emergency roads.	MoPIT (DoR) MoWSS, MoE
(Key Performance Indicator) - Provision of BCPs in federal ministries and agencies - Stockpiling of fuel for emergency power generation in federal buildings.	

Action

- Identification of existing power supply.
- Preparation of an emergency response plan
- Formulation of BCPs in federal ministries and agencies
- Promotion of earthquake resistance on roads, bridges, power supply, and water supply facilities.
- Preparation of a disaster management plan and its implementation plan

6-2) Prolonged suspension of water supply	Relevant Organization
[Promotion of seismic reinforcement for water supply facilities] ➢ It is necessary to promote seismic reinforcement work for water supply facilities to provide drinking water after a large scale disaster.	MoWSS

[Development of post disaster water supply restoration system] ➢ A broad-based backup system should be developed to ensure prompt restoration of water supply after a large-scale disaster, and effective use of water resources should be considered.	MoWSS
(Key Performance Indicator) - Proportion of water pipes which meet seismic-resistance standards: - Establishment of renovation plans	

6-3) Prolonged suspensions of sewerage treatment facilities.	Relevant Organization
[Promotion of seismic reinforcement for sewerage facilities] ➢ Seismic reinforcement works for sewerage facilities are necessary to maintain the service even after a large-scale disaster.	DWSS, MoWSS, LGs
[Promotion of disaster resilient septic tank] ➢ Private wastewater septic tanks are promoted to replace with disaster-resilient septic tanks and the registration system of disaster-resilient septic tanks needs to be developed.	MoWSS, LGs
[Collaboration for sustainable seismic resilient system] ➢ In order to establish sustainable seismic resistant system for sewerage facilities, strengthening of the management system should be sought in collaboration among stakeholders.	MoUD MoWSS, LGs
(Key Performance Indicator) - BCP of the stakeholders to maintain sewage systems after disaster - Implementation of anti-seismic measures for sewerage treatment facilities - Registration system of septic tanks	

Action

- Review of vulnerability assessment done by JICA Team
- Understanding of relevant current conditions on sewer system, sewage treatment facilities and water-purifier tanks
- Conducting risk assessment to identify vulnerability on sewage line facilities, sewage treatment facilities and water-purifier tanks
- Promotion of earthquake resistance on sewage line facilities, sewage treatment facilities and water-purifier tanks
- Preparation of relevant Business Continuities Plans (BCPs) depending on various stakeholders
- Preparation and establishment on a registration system for water-purifier tanks

18. Ministry of Industry (MoI)

5-1) Decline in companies' productivity caused by disruption of supply chains.	Relevant Organization
[Encourage to establish BCP in public and private enterprises] ➢ It is encouraged to establishment BCP in each company to continue their business effectively even after a large-scale disaster.	MoI FoNCCI, Public and private enterprises
[Promote to establish BCP across multiple companies] ➢ In addition to individual BCP at each company, it is necessary to promote for establishment of BCP across multiple companies in order to secure supply chains at the event of a large-scale natural disaster.	MoI, FoNCCI , MoS
(Key Performance Indicator) - Provision of BCPs in private enterprises - Vulnerability assessment of distribution facilities - Provision of emergency transportation network	

Action

- Review of the vulnerability assessment conducted by JICA Team
- Preparation of emergency response plans and emergency repair plans
- Identification of alternative transportation means
- Formulation of disaster risk reduction plans and its implementation plans
- Implementation of disaster countermeasures for transportation infrastructures
- Formulation of BCP guidelines for private sectors/enterprises
- Promoting BCP formulation and operation in cooperation with several companies as the alliance.
- Conducting vulnerability assessment of distribution facilities
- Provision of emergency transportation network

19. Ministry of Land Reform and Management (MoLRM)

8-4) Delay of recovery and reconstruction works significantly due to damage to core infrastructure	Relevant Organization
[Implementation of cadastral survey and other required activities] ➢ Clarification of land boundary (*e.g.* cadastral survey) is one of the important actions to prompt recovery and reconstruction from a disaster. It is necessary to conduct cadastral survey or other required activities even from normal time.	MoHA, MoLRM MoFALD, LG
(Key Performance Indicator) - Proportion of bridges with seismic resistance: - Progress of cadastral surveys:	

Action

- Review of vulnerability assessment, done by JICA Team
- Conducting a cadastral survey in order to enable prompt clarification of a boundary line after the disaster.

20. Kathmandu Upatyaka Khanepani Limited(KUKL)

2-1) Prolonged suspension of supply of food, drinking water and other vital goods	Relevant Organization*
[Reinforcement of water supply system] ➢ Seismic reinforcement works for water supply facilities should be implemented in order to continue the service after a disaster. At the same time, diversified measures for possible water sources, such as ground water, rain water, recycled water, should be examined.	LGs, KUKL, DWSS, MoWSS
(Key performance Indicator) - Coverage of water supply pipe line with seismic resistance - Volume of Stockpile of food for emergency - Volume of stockpile of fuel for emergency - Establishment of association of food supply - Establishment of association of fuel supply	

Action

- Review of vulnerability assessment results done by JICA Team and identification of priority areas.

- Preparation of an emergency response plan.
- Evaluation of vulnerability on water supply systems.
- Strengthening for water supply facilities against earthquakes.
- Installation of earthquake resistant water pipes.
- Formulation of the five year plan for maintenance management and earthquake resistance of the water supply and the sewerage facilities.
- Consideration of a water storage system capable of utilizing groundwater and rainwater as an alternative water sources.

21. Federation of Nepalese Chambers of Commerce and Industry (FoNCCI)

2-1) Prolonged suspension of supply of food, drinking water and other vital goods	Relevant Organization*
[Development of emergency supply system] ➢ Development of procurement and supply systems of food, drinking water and other vital goods in coordination among federal and local governments agencies and private sectors.	MoC, FNCCI, MoS
[Implement drills for delivery of emergency supplies] ➢ Carry out drills and trainings for transportation of emergency supplies in collaboration with private sector.	MoC, MoS FNCCI,
(Key performance Indicator) - Coverage of water supply pipe line with seismic resistance - Volume of Stockpile of food for emergency - Volume of stockpile of fuel for emergency - Establishment of association of food supply - Establishment of association of fuel supply	

Action

- Review of vulnerability assessment results done by JICA Team and identification of priority area.
- Preparation of an emergency response plan.
- Identification of the current potential of feed capacity of food, drinking water and daily necessity in case of emergency.
- Conducting vulnerability assessment on logistic facilities.
- Establishment of logistic hub to supply and distribute an emergency relief (food, drinking water and daily necessity) in disaster.
- Installation of earthquake resistant water pipes.
- Strengthening the capacity in a private sector in emergency situation.
- Conducting emergency transportation drills and trainings in cooperation with a private sector.
- Preparation of a guideline on transportation in order to distribute foods, drinking water and daily necessity in case of emergency.
- Establishment of partnerships between private sector and public sector.
- Establishment of association of food supply.
- Establishment of association of fuel supply.
- Establishment of a storehouse for stockpiling the supplies for disaster.

22. Federation of Labour and Industry (FoLI)

8-2) Delay of recovery and reconstruction works significantly due to shortage of personnel	Relevant Organization
[Ascertain environmental safety for workers] ➢ With the aim of securing personnel in the construction industry who will engage in the work for recover and reconstruction after a disaster, the working environment should be carefully reviewed and ascertained security. .	MoHA, MoPE, Ministry of Labour and Employment

Action

- Review of vulnerability assessment, done by JICA Team
- Conducting vulnerability assessment as needs.
- Preparation of an emergency response plan.
- Conducting emergency drills and trainings.
- Concluding an agreement among the government and the local government
- Preparation of guidelines determined by BCP.
- Enhancement of the capacity of community in disaster risk management and emergency response.

APPENDIX-III: Proposed Priority Lists of Bridges, Hospitals and Schools to be Seismic Resistant Structure

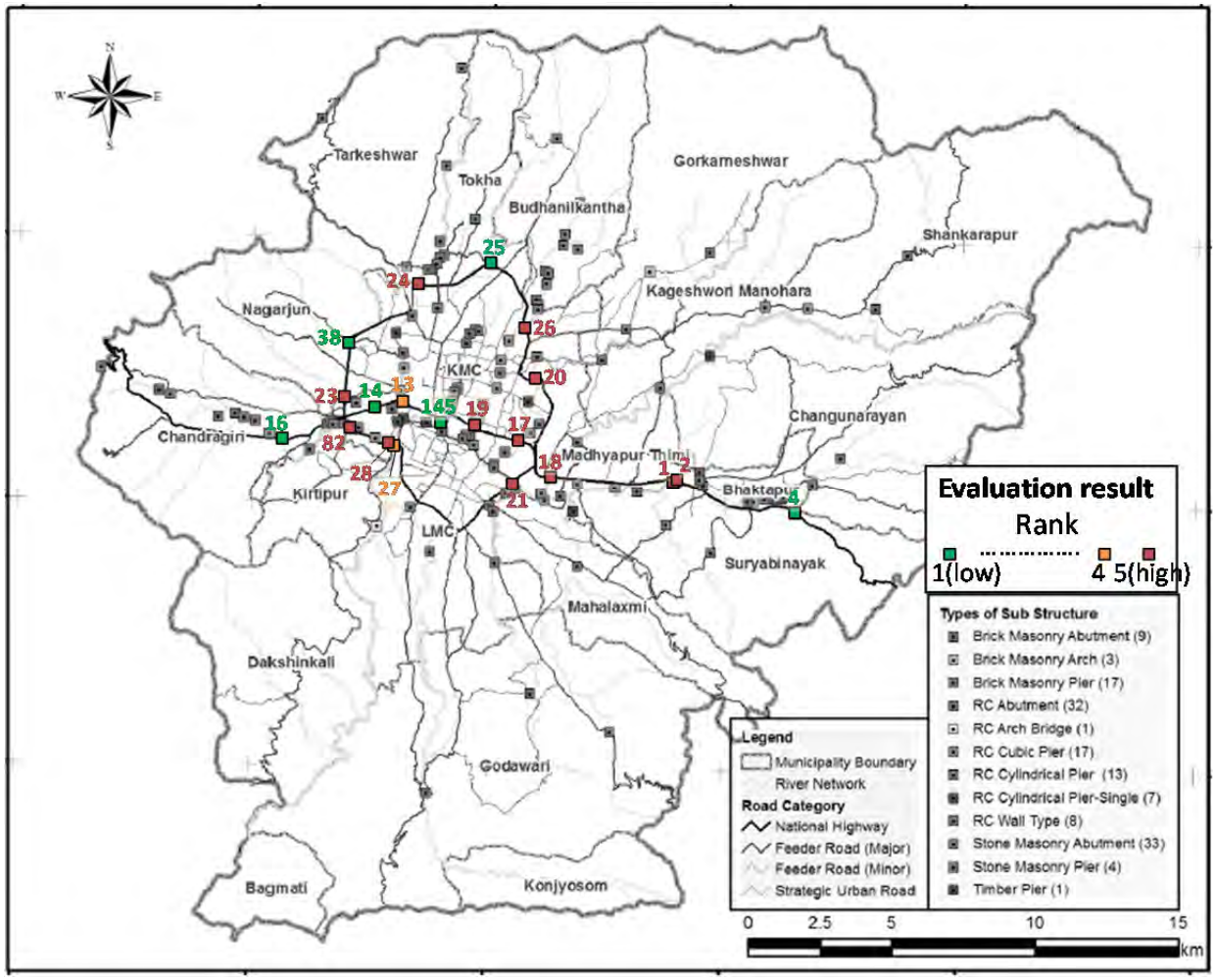
Proposed List of Bridges to be Seismic Resistant Structures[1]

SQ No.	Code of DoR	Road Name	Name of Bridge	Bridge Type	Substructure type	Superstructure Details				Remarks	μr	Evaluation (South 67%)			Priority*	Rank
						Total Length	No. of Span	Span Length	Road Width			μr	Seating length of bridge girders	Final (inc. Scouring)		
1	27-H003-004	Araniko Highway	Hanumante	RCC T-Beam	Single row Cylindrical column	50.4	3	16.8	12.5		6.606	HEAVY	5	**5**	◎	
2	27-H003-032	Araniko Highway	Hanumante	RCC T-Beam	Single row Cylindrical column	50.4	3	16.8	9.1		6.572	HEAVY	5	**5**	◎	
4	27-H003-005	Araniko Highway	Jagate	RCC T-Beam	RC	8.6	1	8.6	7.9					**1**		**1**
13	26-H002-001	Araniko Highway	Bishnumati	RCC T-Beam	Masonry	83.1	8	10.39	13.6					**4**	○	**4**
14	26-H002-002	Araniko Highway	Manamati	RCC Slab	Similar to Single span	12.7	2	6.35	19.6					**1**		**1**
16	26-H002-004	Araniko Highway	Balkhu Khola	RCC T-Beam	RC	33.7	1	33.7	12					**1**		**1**
17	26-H003-002	Araniko Highway	Bagmati	RCC T-Beam	Single row Cylindrical column	84	5	16.8	20.45		3.118	HEAVY	5	**5**	◎	
18	26-H003-003	Araniko Highway	Manohara	RCC T-Beam	Single row Cylindrical column	84	5	16.8	9.5		3.432	HEAVY	5	**5**	◎	
19	26-H003-001	Araniko Highway	Dhobi Khola	RCC T-Beam	Single row Cylindrical column	50.9	3	17.05,16.8 ,17.05	20.52	JICA constructed	3.398	HEAVY	5	**5**	◎	
20	26-H016-001	Kathmandu Ringroad	Bagmati	RCC T-Beam	Single row Cylindrical column	48	3	16	15.5		4.507	HEAVY	5	**5**	◎	
21	26-H016-009	Kathmandu Ringroad	Manohara River	RCC T-Beam	Single row Cylindrical column	112	7	16	15.5		4.329	HEAVY	5	**5**	◎	
23	26-H016-005	Kathmandu Ringroad	Suichatar	RCC Slab	Single row Cylindrical column	13.6	2	6.8	15.6		6.602	HEAVY	5	**5**	◎	
24	26-H016-004	Kathmandu Ringroad	Bishnumati	RCC T-Beam	Single row Cylindrical column	64	4	16	15.5		5.278	HEAVY	5	**5**	◎	
25	26-H016-003	Kathmandu Ringroad	Basundhara Khola	RCC Slab	RC	8.4	1	8.4	17.1					**1**		**1**
26	26-H016-002	Kathmandu Ringroad	Dhobi Khola	RCC T-Beam	Single row Cylindrical column	48	3	16	15.5		4.000	HEAVY	5	**5**	◎	
27	26-H016-008	Kathmandu Ringroad	Bagmati River	RCC T-Beam	Single row Cylindrical column	128	8	16	15.5		2.922	MODERATE	3	**4**	○	
28	26-H016-007	Kathmandu Ringroad	Balkhu Khola	RCC T-Beam	Single row Cylindrical column	42	3	13,16,13	15.5		4.436	HEAVY	5	**5**	◎	
38	26-F078-002	Kathmandu Ringroad	Bhadramati	RCC Slab	Masonry Arch	6.5	1	6.5	8.7					**1**		**4**
82		Kathmandu Ringroad		Single Span RCT	Stone Masonry	14.3	1	14.3	5.4					**5**	◎	**5**
145		Araniko Highway		Single Span RC slab	RCC Abutment	10	1	10	19.1					**1**		**1**

* First priority: ◎, Second priority: ○

Source: JICA Study Team (ERAKV)

[1] Listed bridges were identified from national emergency transportation road, the Kathmandu Ring Road and Araniko Highway and the risk of each bridge was assessed in ERAKV. The result is as of August 2017.



Source: JICA Study Team (ERAKV)

Figure. Location map of bridges in proposed list

Proposed List of Hospitals to be Seismic Resistant Structures

The First Priority Hospitals[2]

Name of Hospital	Operator	Number of Beds	SQ Building (1)	Structure (1)	SQ Building (2)	Structure (2)
T.U. Teaching Hospital	Government	571	Main Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building			
Army Hospital (Shree Birendra Hospital)	Government	490	Main Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame		
Patan Hospital	Government	450	Main Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame		
Kanti Bal hospital	Government	320	Main Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	Brick in Cement	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	Brick in Cement		
Civil Service Hospital	Government	132	Main Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	R.C Frame	Associate Building	R.C Frame
			Associate Building	Brick in Cement	Associate Building	R.C Frame
Bir Hospital	Government	N/A *Total number of admitted patients are 9,087 in 2015.	Main Building	Brick in Cement	Associate Building	R.C Frame
			Associate Building	Brick in Cement	Associate Building	R.C Frame
			Associate Building	Brick in Cement	Associate Building	R.C Frame
			Associate Building	Brick in Cement	Associate Building	R.C Frame
			Associate Building	Brick in Cement		

Source: Nepal Risk Reduction Consortium Flagship Programmes, Annual Report 2072/73 (2015/2016; Department of Health Services)

The Second Priority Hospitals[3]

Name of Hospital	Operator	Number of Beds	SQ Building	Structure	Physical Cap
Sukraraj Tropical and Infectious Disease Hospital	Government	100	Main Building	Load bearing brick wall in cement mortar	Average
			Associate Building	Non engineered reinforced concrete	Average
			Associate Building	Load bearing brick wall in cement mortar; load bearing brick wall in mud mortar	Average
Nepal orthopaedic Hospital	Government	100	Main Building	Engineered reinforced concrete	Average
Gangalal Hospital	Government	>80	Main Building	R.C Frame	
			Associate Building	R.C Frame	
			Associate Building	Brick in Cement	
			Associate Building	Brick in Cement	
			Associate Building	Brick in Cement	
Bhaktapur Hospital	Government	75	Main Building	Load bearing brick wall in cement mortar	Average
			Associate Building	Load bearing brick wall in cement mortar	Average
			Associate Building	Engineered reinforced concrete	Average
			Associate Building	Engineered reinforced concrete	Good
Bhaktapur Cancer Hospital	Government	75	Main Building	Non engineered reinforced concrete	Average
			Associate Building	Engineered reinforced concrete	Good
			Associate Building	Engineered reinforced concrete	Good
			Associate Building	Engineered reinforced concrete	Good
			Associate Building	Load bearing brick wall in mud mortar	Average

Source: JICA Study Team (ERAKV)

[2] MoHP identified the priority hospitals to remain operational after disasters in 2010. The first priority hospitals were listed from those priority hospitals. The buildings made of brick in cement are to be surveyed to promote seismic resistant structure (one of associate buildings of Bir Hospital has been reconstructed in Programme Grand Aid Project).

[3] Second priority hospitals were identified from public hospitals with a number of beds based on the result of ERAKV as of August 2017. Seismic reinforcement work needs to be provided for the buildings with the structure of non-engineered reinforced concrete and brick in cement/mud mortar even though the physical evaluation is good or average.

Proposed List of Schools to be Seismic Resistant Structures[4]

The First Priority Schools

Name of Schools	Operator	Classification	Student	SQ Building	Structure	Physical Cap
Vishwa Niketan Higher Secondary School	Government	Higher Secondary	2200	Main Building	Load bearing brick wall in mud mortar	Poor
				Associate Building	Non engineered reinforced concrete	Average
				Associate Building	Load bearing brick wall in mud mortar	Poor
				Associate Building	Non engineered reinforced concrete	Good
				Associate Building	Load bearing brick wall in mud mortar	Poor
Shree Pashupati Mitra Secondary School	Government	Secondary	2000	Main Building	RC Frame non Engineering	Good
				Associate Building	RC Frame non Engineering	Good
				Associate Building	Bricks with cement mortar	Good
Chamunda Higher Secondary School	Government	Higher Secondary	2000	Main Building	Non engineered reinforced concrete	Poor
				Associate Building	Engineered reinforced concrete	Average
				Associate Building	Load bearing brick wall in cement mortar	Poor
				Associate Building	Non engineered reinforced concrete	Average
				Associate Building	Load bearing brick wall in cement mortar	Poor
Gyanodaya Secondary School	Government	Higher Secondary	2000	Main Building	Non engineered reinforced concrete	Average
				Associate Building	Engineered reinforced concrete	Good
				Associate Building	Engineered reinforced concrete	Good
				Associate Building	Load bearing brick wall in cement mortar; Load bearing brick wall in mud mortar	Poor
Tarun Secondary School	Government	Secondary	1922	Main Building	Load bearing brick wall in cement mortar	Average
				Associate Building	Load bearing brick wall in cement mortar	Poor
				Associate Building	Engineered reinforced concrete	Good
				Associate Building	Engineered reinforced concrete	Good
				Associate Building	Engineered reinforced concrete	Good
				Associate Building	Engineered reinforced concrete	Good

Source: JICA Study Team (ERAKV)

The Second Priority Schools

Name of Schools	Operator	Classification	Number of Student	SQ Building	Structure	Physical Cap
Padma Higher Secondary School	Government	Higher Secondary	1700	Main Building	Load bearing brick wall in limesurkhi mortar	poor
				Associate Building	Engineered reinforced concrete	good
				Associate Building	Load bearing brick wall in mud mortar	poor
				Associate Building	Load bearing brick wall in cement mortar	poor
				Associate Building	Load bearing brick wall in cement mortar	average
				Associate Building	Load bearing brick wall in cement mortar	average
Ratna Rajya Higher Secondary School	Government	Higher Secondary	1650	Main Building	Non engineered reinforced concrete	average
				Associate Building	Non engineered reinforced concrete	good
				Associate Building	Non engineered reinforced concrete	average
				Associate Building	Load bearing brick wall in cement mortar	average
Tilingtar Secondary School	Government	Higher Secondary	1600	Main Building	RC Frame Non Engineering	good
				Associate Building	Bricks with cement Mortar	good
				Associate Building	RC Frame Engineering	good
				Associate Building	Bricks with cement Mortar	good
				Associate Building	Bricks with cement Mortar	good
Shree Janakalyan Higher Secondary School	Government	Higher Secondary	1500	Main Building	Non engineered reinforced concrete	average
				Associate Building	Load bearing brick wall in cement mortar	poor
				Associate Building	Non engineered reinforced concrete	poor
Shivapuri High School	Government	Secondary	1300	Main Building	Engineered reinforced concrete	good
				Associate Building	Engineered reinforced concrete	average
				Associate Building	Load bearing brick wall in cement mortar	average
				Associate Building	Non engineered reinforced concrete	average
Shramik Shanti Higher Secondary School	Government	Higher Secondary	1300	Main Building	Load bearing brick wall in cement mortar	average
				Associate Building	Engineered reinforced concrete	average
				Associate Building	Engineered reinforced concrete; load bearing brick wall in cement mortar	average

Source: JICA Study Team (ERAKV)

[4] Priority schools were identified from public schools with a number of students based on the result of ERAKV as of August 2017. Seismic reinforcement work needs to be provided for the buildings with the structure of non-engineered reinforced concrete and brick in cement/mud mortar even though the physical evaluation is good or average.

APPENDIX-Ⅳ: Meetings and Actions conducted for Development of the KVRP

September 2015, Meeting with NRA

- Discuss on KVRP as a component of RRNE

November 2015, Meeting with KVDA

Mr. Yogeshwar Krishna Parajuli, Development Commissioner.

- Discuss on KVRP as a component of RRNE
- Request from KVDA to develop disaster management parks as a pilot activity under KVRP
- Study on Open Space in KV (Classification, Network, Propose)

January to February, 2016

- Distribution and sharing of KVRP checklists with various stakeholders to collect basic information (figures and data) to use for the KVRP.

March 2016, Meetings with District Offices of Kathmandu, Lalitpur and Bhaktapur

- Confirming PDDP update in the Kathmandu Valley, Kathmandu District, Lalitpur District and Bhaktapur District,
- Kathmandu District: DDC Kathmandu was not able to prepare its first PDDP, while the second PDDP was recently completed. The second PDDP covers the time frame of FY 2072/73-2077/78 (2015/16-2018/19). The PDDP report submitted to DDC Kathmandu has not been able to incorporated disaster management issues, thus the consultant is working on the final draft.
- Lalitpur District: DDC Lalitpur have finalized its second PDDP for the year 2072/73-2077/78 (2015/16-2018/19). First PDDP of the district was prepared for the FY 2058/59-2063/64 (2001/02-2005/6).
- Bhaktapur District: DDC Bhaktapur started formulating its second PDDP and has initiated the process of selection of Consultant. Its first PDDP was for the FY 2059/60-2064/65 (2002/03-2006/7).

31st March, 2016, Meeting with KVDA

Mr. Yogeshwar Krishna Parajuli, Development Commissioner.

- Discuss process of formulation of KVRP
- Explore potential stakeholders in the KVRP formulation.

22nd June, 2016, First Joint Coordination Committee (JCC) meeting

- The Importance of KVRP was recognized by the JCC members and it is agreed that this matter will be continuously discussed in the days to come among JICA/RRNE, NRA, KVDA and other relevant authorities, including MoUD, NPC, MoHA, MoFALD.

30th June, 2016, Meeting with KVDA:

Dr. Bhaikaji Tiwari, Development Commissioner, KVDA
Mr. Bhagawat Bhakta Khokhali, Architect/Urban Planner, KVDA

- Explanation on the contents of Kathmandu Valley Resilience Plan (KVRP) and its formulation process
- Confirmation of Status of Risk Sensitive Land Use Planning (RSLUP) and Status of Strategic Development Master Plan (SDMP)

5th July, 2016, Meeting with MoHA:

Dr. Narayan Bahadur Thapa, Under Secretary, DMD, MoHA
Mr. Baburam Bhandari, Under Secretary, NEOC, MoHA
Mr. Shankar Hari Acharya, Under Secretary, DMD, MoHA

- Explanation on Kathmandu Valley Resilience Plan (KVRP) and its formulation process
- Discussion on Disaster Management Open Space (DMOS) in Lalitpur
- Getting information of Current DM related activities of MoHA and Status of the DRAFT Disaster Management Act
- Discussion on Institutional frame work for KVRP: MoUD is policy level agency and KVDA is implementation level agency

1st August, 2016, Meeting with MoPIT, Planning, Monitoring and Evaluation Division.

Mr. Sunil Babu Pant, Senior Divisional Engineer (SDE) – Under Secretary

- To update regarding the proposed Preparation of Kathmandu Valley Resilience Plan (KVRP) including the assessment of Emergency Road Network and High Risk Bridges.

11st September, 2016, Meeting with MoFALD, Municipality and Environment Management Division, Fire and Disaster Management Section (together with JICA ERAKV Project team)

Mr. Gopi Krishna Khanal, JS
Mr. Rishi Raj Acharya, US

- Incorporation with construction bylaws, norms and building codes are highlighted

12nd September, 2016, Meeting with MoPIT, Construction and Transportation Division

Mr. Niraj Sharma, SDE

- Requested for presentation at Expert Group Meeting on Planning and Assessment of Urban Transportation Systems on 22nd and 23rd September 2016

Meeting with MoFALD, Planning and Foreign Aid Co-ordination Division

Mr. Shankar Nepal, US
Mr. Keshab Subedi, Section Officer

Meeting with MoHA, Disaster Management Division

Mr. Binod KC , JS
Dr. Narayan Bahadur Thapa
Mr. Shankar Hari Acharya

- MoHA introduced itself to be leading ministry to make national strategy and action plan based on the Sendai Framework

Meeting with MoUD, Housing and Building Division

Mr. Shiva Hari Sharma, JS

- Confirming relationship and difference among JICA projects and UNDP Risk Sensitive Land Use Planning project

14th September, 2016, Presentation at 4th JCC of the JICA ERAKV Project

- Confirming utilization of the result of the risk assessment by the JICA ERAKV Project for preparation of KVRP

20th September, 2016, Meeting with Ministry of Health (MoH), Policy, Planning and International Cooperation Division

Mr. Mahendra Prasad Shrestha, Chief Public Health Administrator

- Collecting information on Damage and safety measures for hospitals

Meeting with DUDBC

Er. Ramesh Prasad Singh, Director General

- Relationship with the National Plan of Action for Safer Building Construction (NaPA) was discussed. The opinion on NaPA from DUDBC was NaPA is unclear, not practical, and earthquake part is missing, so cannot be implementation.

21st September, 2016, Meeting with MoE, Planning Division

Mr. Baikuntha Prasad Aryal, Joint Secretary, Planning Division
Mr. Deepak Sharma, Under Secretary, Foreign Aid Coordination Section
Mr. Dhurba Raj Regmi, Under Secretary, Plan and Budget Section
Mr. Laxman Bashayal, Section Officer, Planning and Budget Section

- Collecting information on Disaster education in schools
- Collecting information on Teacher training in DRR

- Collecting information on the role of school as evacuation site

Meeting with Ministry of Population and Environment (MoPE)

Ms. Laxmi Kumari Basnet, JS
Mr. Jhanak Khatri, US, Planning
Mr. Hari Ghimire, US, Administration

- Explanation of KVRP
- Collecting information on the role of Ministry after a disaster: MoPE is for policies and strategies only

22nd and 23rd September, 2016, Presentation at Expert Group Meeting on Planning and Assessment of Urban Transportation Systems

Organizers:

- Kathmandu Valley Development Authority (KVDA)
- Korea Transport Institute (KOTI)
- Ministry of Physical Infrastructure and Transport, Nepal
- Ministry of Urban Development, Nepal
- United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)

21st November 2016, Meeting with MoPIT

Mr. Bhimarjun Adhikari, Chief (JS), Planning Division

- Discussion on counter measures for MoPIT

Meeting with MoUD

Mr. Deependra Nath Sharma, Secretary

Meeting with MoHA

Mr. Krishna Bahadur Raut, JS, Disaster management Division

- Discussion on counter measures for MoHA: Mainly for rescue and response
- Discussion on Disaster Management Park in Open space designated by MoHA, Lalitpur ward-8

22nd November 2016, Meeting with MoUD/CLPIU, DUDBC

Mr. Parikshit Parik Kadariya (SDE) Building Reconstruction Division, DUDBC
Mr. Manoj Nakarmi, Chief, Building Code Section, DUDBC
Mr. Shiva Hari Sharma, JS, MoUD/CLPIU

- Discussion on counter measures for MoUD/CLPIU, DUDBC: relations with Building code and NaPA

- Confirmation on utilization of the result of the risk assessment prepared by the JICA ERAKV Project

Meeting with NRA

Mr. Dwarika Shrestha, JS, Heritage Conservation, Public Building and Infrastructure Division

- Discussion on counter measures for NRA: NRA is not a direct implementing agency but it can coordinate and facilitate the process. After NRA, a New DM Authority has been proposed as initial discussion.

23rd November 2016, Meeting with KVDA

Dr. Bhaikaji Tiwari, Development Commissioner
Mr. Bhagawat Bhakta Khokhali, Architect/Urban Planner
Mr. Keshav Prasad Neupane, Section Officer

- Discussion on counter measures for KVDA: Building by laws and open spaces are developed by KVDA and enforcement by Municipalities. KVRP is mentioned in KV SDMP

24th November 2016, Meeting with MoS (Ministry of Supply)

Mr. Babu Ram Bhusal, US, Planning Division,

- Discussion on counter measures for MoS:
- MoS suggested to add on page no.40, Operation Goal: 2 under the point 2.1 as follows:
  No. 1.Develop and strengthen the capabilities of Public Enterprises in disaster response.
  No. 2.Coordinate and liaise with private sector in disaster response.

Meeting with MoCTCA

Mr. Ghanashyam Upadhaya, JS, Tourism Promotion Division

- Discussion on counter measures for MoCTCA

27th November 2016, Meeting with MoFALD

Mr. Purusottam Subedi, US
Mr. Narayan Risal, US

- Discussion on counter measures for MoFALD: Local and community capacity Development for Disaster management.
- Shared information on National Conference on National Strategy for Resilient Urban Communities (NSRUC) on 28 November, 2016 (Monday) as related document of MoFALD
- Importance of integration among all sectoral ministries is highlighted: NSDRR - MoHA, NUDS- MoUD, Periodic plans - MoFALD etc.)

29th November 2016, Meeting with MoIC

Mr. Kishor Jung Karki, JS

- Collecting information of MoIC: Recent EQ 2015 radio Nepal, Nepal Television and national media were instrumental to communicate message to the public.

30th November 2016, Meeting with MoPIT

Mr. Bhimarjun Adhikari, Chief (JS) Planning Division
Mr. Prabhat Kumar Jha, SDE, Planning Division
Mr. Niraj Sharma, SDE, Transportation Division

- Discussion on designation of emergency road network by MoPIT

Meeting with DUDBC

Mr. Manoj Nakarmi, Chief, Building Code Section

- Discussion was focused on Building Codes, by laws and its enforcement, based on the previous discussion:
  : Building codes to be implement on every houses.
  : 20 yeas target to enforce building codes in Nepal. Currently 5 municipalities in Nepal have been selected to piloting and other also started to initiate the plan.
  : National Plan of Action (NaPA) for Safer Building is being implemented.

4th December 2016, Meeting with KVDA (Outer Ring Road Project)

Mr. Dhruba Pasad Sapkota, S.O, Outer Ring Road Development

- Collecting information on Long-term vision and projects of the Outer Ring Road

5th December 2016, Meeting with DWSS

Mr. Tej Raj Bhatta, Director General
Mr. Manoj Ghimire, DDG, Disaster Management Division

- Discussion on counter measures for DWSS: DWSS is responsible in Rural area, and Urban area of Kathmandu Valley is by the Kathmandu Valley Water Supply Management Board

14th December 2016, Meeting with MoPIT and DOR (together with JICA ERAKV and KUTMP Project)

Mr. Prabhat Kumar Jha, SDE, MoPIT, Planning Division
Mr. Niraj Sharma, SDE, MoPIT, Transportation Management Section
Mr. Rikesh Maharjan, Engineer, MoPIT, Standard, Public Private Partnership and Foreign Aid Section
Dr. Bijaya Jaishi, SDE, DoR, Bridge Branch

- Confirmation of the relationship among three JICA Projects
- Confirmation of method and output images of the risk assessment of bridges which are to be utilized in KVRP

18th January 2017, Meeting with MoHA

Mr. Shankar Hari Acharya, US, NEOC/DMD, MoHA

- Confirmation of his attendance of Technical Committee to be held in February

20th, January, 2017, RRNE meeting with NRA for Technical Committee KVRP

1. Mr. Dwarika Shrestha, Joint Secretary, Heritage Conservation, Public Building and Infrastructure Division (Coordinator, Technical Committee, KVRP)
2. Mr. Raj Kaji Shrestha, Under Secretary- CDE, NRA (Member- Secretary, Technical Committee, KVRP)

Background:

- 5th January, 2017: RRNE submitted a letter to NRA (Secretary Dr. Sanjay Sharma)
- 6th January, 2017: NRA has made decision in regard to the formation of the technical committee as recommended by the JCC and as mentioned in the request letter written to NRA (Coordinator Mr. Dwarika Shrestha, Joint Secretary)
- 10th January, 2017: NRA Sent letter dated 09.01.2017 to the GoN agencies to inform about the formation of Technical Committee.

20th January, 2017

- Meeting with NRA Joint Secretary (Mr. Dwarika Shrestha), Under Secretary (Mr. Raj Kaji Shrestha), to discuss on preparation for technical committee meeting. NRA Agreed to send follow-up letter to most of the agencies not sent members name yet. Issues raised i.e. agenda, subcommittee, project director etc.

23rd January, 2017

- NRA technical committee member secretary (Mr. Raj Kaji Shrestha) signed letter for follow up. Dr Asano and Raj Mukut visited NRA to get updates and agreed to distribute the follow up letters by project side to each agency on behalf of NRA technical committee.

24th and 25th January, 2017

- Dr. Asano sent draft agenda to NRA for technical committee (TC) meeting by email on 25th January, 2017. Hard copy also submitted. Waiting response from NRA, about the agenda and dates for the TC meeting.

27th and 30th January, 2017:

- Dr. Asano and Raj Mukut Bhusal visited most of the agencies agency and distributed the follow up letter.

8th February, 2017

First technical Committee Meeting (Separate MM signed document)

10th February, 2017 Meeting with KVDA and RRNE/JICA– Anamnagar

Mr. Bhagawat Bhakta Khokhali (9841219088), Architect/Urban Planner, KVDA(On behalf of Dr. Bhaikaji Tiwari, KVDA (9851075756), Development Commissioner, KVDA the team met to Mr. Khokhali – as Commissioner was out of office due to urgent business at Parliament)

- Discussion on RRNE project component on' Kathmandu Valley Resilience Plan (KVRP) and process of formulation of KVRP
- Risk Sensitive Land Use Planning (RSLUP) status
- Strategic Development Master Plan (SDMP) status

14th February, 2017 Meeting with Ministry of Home Affairs (MoHA)

Mr. Shankar Hari Acharya, Under Secretary, NEOC/MoHA

14th February, 2017 Ministry of Urban Development (MoUD)

1. Er. Ramesh Prasad Singh, Joint Secretary, MoUD, Kathmandu, Nepal (9851055468)
2. Mr. Suman Salike, SDE, MoUD
   - Feedback on MoUD and DUDBC related countermeasures

15th February, 2017 Ministry of Education (MoED)

Mr. Narayan Prasad Shrestha, Under Secretary, MoE (9851055468)

- To brief regarding the first TC meeting documents and discussions as he could not attend the meeting
- Feedback on MoED related countermeasures

17th February, 2017 OPMCM

Mr. Tulasi Prasad Ghimire, Under Secretary

- Experience sharing about Japan (National DM Agency)
- Role of OPMCM on coordination for KVRP

23rd February, 2017 MoUD

1. Er. Ramesh Prasad Singh, Joint Secretary, MoUD, Kathmandu, Nepal (9851055468)
2. Mr. Suman Salike, SDE, MoUD
   - Feedback on MoUD and DUDBC related countermeasures
   - Discussion about NaPA which still need to be approved by the council of Ministers or Ministerial sub-committee
   - Feedback on MoED related countermeasures (1.2 Promotion of safe building construction – an integrated "National Plan of Action on Safer Building Construction" Needs to be "Approved" NOT to be developed.

Appendix-7-1: MOU for the preparation of the PDDP

MoU: 1March, 2016

MEMORANDUM OF UNDERSTANDING
FORTHE PREPARATION OF PDDP IN GORKHA DISTRICT
BETWEEN GORKHA DISTRICT DEVELOPMENT COMMITTEE AND THE PROJECT ON REHABILITATION AND RECOVERY FROM NEPAL EARTHQUAKE (JAPAN INTERNATIONAL COOPERATION AGENCY)

Based on the Record of Discussions dated 15th June, 2015 on the "Project on Rehabilitation and Recovery from Nepal Earthquake" (hereinafter refer to as the "Project") agreed upon between the Government of Nepal (GON) through the Ministry of Finance (MOF) and National Planning Commission (NPC) and the Government of Japan (GOJ) through the Japan International Cooperation Agency (JICA), the Rehabilitation and Recovery Plans (RRP) in two (2) severely earthquake-hit districts, namely Sindhupalchowk and Gorkha, will be prepared by JICA Study Team in collaboration with the Ministry of Federal Affairs and Local Development (MOFALD), the GON, and District Development Committees (DDC)of the two districts.

Initial discussion on the Rehabilitation and Recovery Plan (RRP) was conducted on July 22nd, 2015 between the Gorkha DDC and the JICA Study Team. The contents of RRP were also discussed between the JICA Study Team and officials of MOFALD on August 18th, 2015.After serial discussions, all parties including Gorkha DDC, the MOFALD and the JICA study team came to a mutual understanding to jointly prepare the Periodic District Development Plan (PDDP) for Gorkha district by the end of August 2016, incorporating necessary rehabilitation and recovery aspects (RRP) with input from JICA study team; PDDP is a statutory development plan endorsed by Local Self-Governance Act, 1999.

Based on the understandings above, JICA study team has proceeded to prepare a draft of the RRP for providing input in the PDDP. GON will be responsible to initiate the process to formally launch the formulation of the PDDP for Gorkha district. This process has not been efficient as expected since overall management has been a common issue between all parties. Based on the situation, all parties agreed on creating the Memorandum of Understanding (MOU) to reconfirm and agree on the expected roles, responsibilities and timelines for the effective formulation of the PDDP of Gorkha district. The MOU also incorporate National Reconstruction Authority (NRA) established for overall reconstruction management as a stakeholder of PDDP revision with role of coordination and monitoring the progress.

Whereas, the project will be implemented within the framework of the Agreement on Technical Cooperation signed on 3rd September, 2003, the Note Verbal exchanged on 30th October, 2015, and the Record of Discussions dated 15th June, 2015;

Whereas, the Japan International Cooperation Agency (JICA) Study Team is herein represented by Mr. Ichiro Kobayashi, Team Leader of the "Project on Rehabilitation and Recovery from Nepal Earthquake";

Whereas, the District Development Committee (DDC) of Gorkha District is herein represented by Mr. Prem Raj Giri, Local Development Officer (LDO) of Gorkha DDC;

Whereas, the Ministry of Federal Affairs and Local Development (MOFALD) is herein represented by Mr. Chhabi Rijal, Under Secretary of Planning Section, MOFALD;

Whereas, the National Reconstruction Authority (NRA) is herein represented by Dr. Bhishma K. Bhusal, Under Secretary, NRA;

Whereas, all parties agree on the role of

JICA Study Team (Technical Cooperation) to be responsible to:

a) Study on draft of RRP (long-term) in Gorkha district as attached annex- A and B;
b) The study will be completed by the end of July, 2016;
c) Make inputs based on study and Japan's experience of rehabilitation and recovery from natural disasters into the PDDP (five-year period) of Gorkhadistrict;
d) Prepare draft of RRP in Gorkha district;
e) Hold discussions with Gorkha DDC to effectively integrate RRP into PDDP;
f) Cover the cost of JICA Study Team;
g) Cover the cost* of additional workshops for draft of RRP as and when necessary, and
h) Cover the cost* of the central event to share the good practice/vision of Gorkha district on PDDP to other districts as and when necessary.

*The breakdown of costs g) and h) shall include:

1) Venue and presentation equipment;
2) Lunch and light refreshments, and
3) Meeting documents.

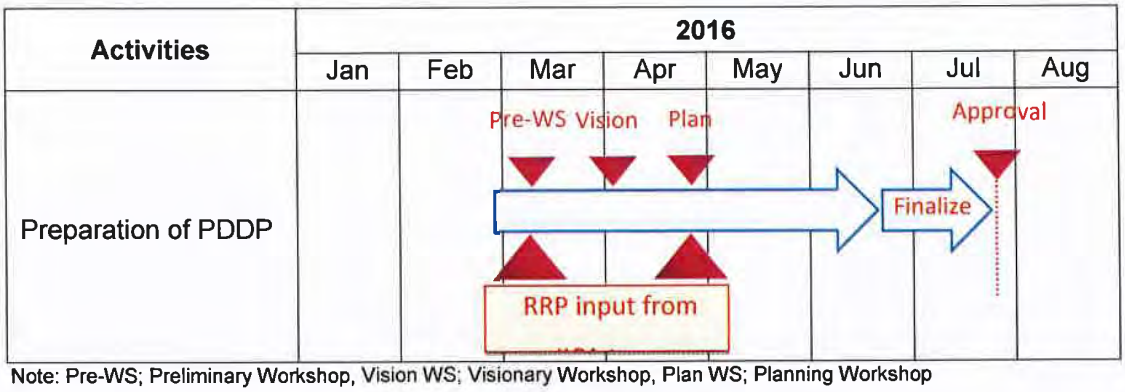
District Development Committee (DDC),Gorkha to be responsible to:

a) Play the central role of overall management taking efficient and effective joint preparation of the PDDP into account between Gorkha DDC and JICA Study Team;
b) Finalize the contract between Gorkha DDC and local consultant assigned for the preparation of PDDP;
c) Provide necessary information to the JICA study team for their drafting of RRP;
d) Implement workshops for PDDP formulation as per the agreed schedule;
e) Reflect the RRP recommendations into PDDP and prepare a draft by the end of June2016based on discussions with JICA study team;
f) Officially finalize the PDDP endorsing by DDC or district council and share amongst stakeholders for effective use, and
g) Share the good practice within MOFALD and provide technical support to other districts as and when necessary.

JICA Study team and DDC also agreed that:

a) PDDP should be prepared in line with guidelines prepared by MOFALD/NPC,
b) Quality of PDDP will be assured in consultation with MOFALD.

Whereas, the formulation schedule for the rehabilitation and recovery plan (RRP) and Periodic District Development Plan (PDDP) is agreed by all parties as below:



Note: Pre-WS; Preliminary Workshop, Vision WS; Visionary Workshop, Plan WS; Planning Workshop

In Witness Where of, the Parties, have caused this Memorandum of Understanding signed in DDC Office, Gorkha district on this1st day ofMarch2016.

By:

Mr. Ichiro Kobayashi
Project Manager,
JICA Study Team,
The Project on Rehabilitation
and Recovery from Nepal Earthquake

By:

Mr. Prem Raj Giri
for Local Development Officer (LDO),
District Development Committee (DDC)
GorkhaDistrict

Witness:

Mr. Chhabi Rijal
Under Secretary, Planning Section
Ministry of Federal Affairs and Local Development

Witness:

Dr. Bhishma K. Bhusal
Under Secretary
National Reconstruction Authority

Annexes

Annex- A

JICA Study Team's Input/Expertise in PDDP and RRP are as follows;

- Rehabilitation and Recovery planning (based on Japan's Experience of rehabilitation and recovery from natural disasters)
- Urban planning
- Land use planning
- Local administration and organization planning
- Community development
- Community-based disaster risk management
- Purchase of satellite images (resolution 1.5m)
- Preparation of topography map by GIS
- Field survey on typical landslide disasters caused by the earthquake
- Preparation of landslide distribution map by the earthquake
- Preparation of landslide hazard map (Hazard assessment)
- Disaster evaluation and disaster management planning
- Social Survey on the earthquake affected areas (VDCs)
- Capacity building

Annex- B

Outline of Rehabilitation and Recovery Plan (draft);

- Duration of the plan matching the timeline of National Reconstruction Authority
- Vision of rehabilitation and recovery in the district
- Policies to aim for vision
- Social and economic framework
- Rehabilitation and recovery directions for public infrastructure / facilities / services
- Rehabilitation and recovery directions for housing, livelihood and industry
- Consideration of directions for group relocation/resettlement and revitalization planning
- Resilient public services and administration and organization framework for disaster risk
- Capacity building for disaster risk management and disaster risk reduction

Minutes between

The Projects on the Rehabilitation and Recovery from Nepal Earthquake, JICA (Japan International Cooperation Agency)

and

The Office of the District Development Committee, Gorkha

for the Amendment of

Memorandum of Understanding (MoU) for the preparation of PDDP of Gorkha District between Gorkha District Development Committee and the Project on Rehabilitation and Recovery from Nepal Earthquake (Japan International Cooperation Agency)

Gorkha, 11th August, 2016

JICA PROJECT
The Project on Rehabilitation and Recovery from Nepal Earthquake

Government of Nepal
Ministry of Federal Affairs & Local Development
District Development Committee Office
Gorkha

Local Development Officer

Mr. Kiyotaka OWADA
For,
Mr. Ichiro KOBAYASHI
Project Manager
JICA Study Team
The Project on Rehabilitation and Recovery from Nepal Earthquake

Mr. Narayan Acharya
Local Development Officer (LDO)
District Development Committee
(DDC), Gorkha District

The Project on Rehabilitation and Recovery from Nepal Earthquake (RRNE) held series of meeting with the office of the District Development Committee (DDC) Gorkha regarding the preparation of PDDP incorporating the RRP. As the continuity of this discussion, meeting with DDC Gorkha and JICA project on Rehabilitation and Recovery from Nepal Earthquake (RRNE) team held on 11th August 2016 at DDC Grokha, decided to amend the following points mentioned in the MoU, which agreed between DDC Gorkha and JICA/RRNE on 1st March, 2016,

Amendment of Contents,

*Amendment 1:*The role of the parties mentioned in the page 2 of the MoU,

JICA Study team (Technical Cooperation) to be responsible to:

b. Complete the study by the end of February, 2017.

Amendment 2: The timeline as mentioned in the page 3 of the MoU, regarding the formulation schedule for the Rehabilitation and Recovery Plan (RRP) and Periodic District Development Plan (PDDP)is agreed by all parties as below,

Activities	2016					2017		
	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Preparation of PDDP		Pre-WS	Vision WS	Plan WS		Finalize	Approval	
		RRP input from JICA team						

Note: Pre-WS; Preliminary Workshop, Vision WS; Visionary Workshop, Plan WS; Planning Workshop

JICA PROJECT The Project on Rehabilitation and Recovery from Nepal Earthquake JICA-Nepal

Government of Nepal Ministry of Federal Affairs & Local Development District Development Committee Office Gorkha

Local Development Officer

MoU: 1March, 2016

MEMORANDUM OF UNDERSTANDING
FORTHE PREPARATION OF PDDP IN SINDHUPALCHOWK DISTRICT
BETWEEN SINDHUPALCHOWK DISTRICT DEVELOPMENT COMMITTEE AND THE PROJECT ONREHABILITATION AND RECOVERY FROM NEPAL EARTHQUAKE (JAPAN INTERNATIONAL COOPERATION AGENCY)

Based on the Record of Discussions dated 15th June, 2015 on the "Project on Rehabilitation and Recovery from Nepal Earthquake" (hereinafter refer to as the "Project") agreed upon between the Government of Nepal (GON) through the Ministry of Finance (MOF) and National Planning Commission (NPC) and the Government of Japan (GOJ) through the Japan International Cooperation Agency (JICA), the Rehabilitation and Recovery Plans (RRP) in two (2) severely earthquake-hit districts, namely Sindhupalchowk and Gorkha, will be prepared by JICA Study Team in collaboration with the Ministry of Federal Affairs and Local Development (MOFALD), the GON, and District Development Committees (DDC)of the two districts.

Initial discussion on the Rehabilitation and Recovery Plan (RRP) was conducted on July 21st, 2015 between the Sindhupalchowk DDC and the JICA Study Team. The contents of RRP were also discussed between the JICA Study Team and officials of MOFALD on August 18th, 2015.After serial discussions, all parties including Sindhupalchowk DDC, MOFALD and the JICA study team came to a mutual understanding by the end of October 2015 to jointly prepare the Periodic District Development Plan (PDDP) for Sindhupalchowk district, incorporating necessary rehabilitation and recovery aspects (RRP) with input from JICA study team; PDDP is a statutory development plan endorsed by Local Self-Governance Act 1999.

Based on the understandings above, JICA study team has proceeded to prepare a draft of the RRP for providing input in the PDDP. GON will be responsible to initiate the process to formally launch the formulation of the PDDP for Sindhupalchowk district. This process has not been efficient as expected since overall management has been a common issue between all parties. Based on the situation, all parties agreed on creating the Memorandum of Understanding (MOU) to reconfirm and agree on the expected roles, responsibilities and timelines for the effective formulation of the PDDP of Sindhupalchowk district. The MOU also incorporate National Reconstruction Authority (NRA) established for overall reconstruction management as a stakeholder of PDDP revision with role of coordination and monitoring the progress.

Whereas, the project will be implemented within the framework of the Agreement on Technical Cooperation signed on 3rd September, 2003, the Note Verbal exchanged on 30thOctober, 2015, and the Record of Discussions dated 15th June, 2015;

Whereas, the Japan International Cooperation Agency (JICA) Study Team is herein represented by Mr. Ichiro Kobayashi, Team Leader of the "Project on Rehabilitation and Recovery from Nepal Earthquake";

Whereas, the District Development Committee (DDC) of Sindhupalchowk District is herein represented by Mr. Krishna Bahadur Shahi, Local Development Officer (LDO) of Sindhupalchowk DDC;

Whereas, the Ministry of Federal Affairs and Local Development (MOFALD) is herein represented by Mr. Chhabi Rijal, Under Secretary of Planning Section, MOFALD;

Whereas, the National Reconstruction Authority (NRA) is herein represented by Dr. Bhishma K. Bhusal, Under Secretary, NRA;

Whereas, all parties agree on the role of

JICA Study Team (Technical Cooperation) to be responsible to:

a) Prepare the TOR of the local consultant(s)to be procured by Sindhupalchowk DDC for preparation of PDDP;
b) The study will be completed by the end of October, 2016;
c) Study on draft of RRP (long-term) in Sindhupalchowk district as attached annex- A and B;
d) Make inputs based on study and Japan's experience of rehabilitation and recovery from natural disasters into the PDDP (five-year period) in Sindhupalchowk district;
e) Prepare draft of RRP (long-term)in Sindhupalchowk district;
f) Hold discussions with the DDC to effectively integrate RRP into PDDP;
g) Cover the cost of JICA study team;
h) Cover the cost* of additional workshops for draft of RRP as and when necessary, and
i) Cover the cost* of the central event to share the good practice/vision of Sindhupalchowk district on PDDP to other districts as and when necessary.

*The breakdown of costs h) and i) shall include:

1) Venue and presentation equipment;
2) Lunch and light refreshments, and
3) Meeting documents.

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a) Play the central role of overall management taking efficient and effective joint preparation of the PDDP into account between Sindhupalchowk DDC and JICA Study Team;
b) Finalize the TOR of the local consultant(s) assigned to prepare the PDDP and proceed to bidding process;
c) Finalize the contract between Sindhupalchowk DDC and abovementioned local consultant(s);
d) Provide necessary information to the JICA study team for their drafting of RRP;
e) Implement workshops for PDDP formulation as per the agreed schedule;
f) Reflect the RRP recommendations into PDDP and prepare a draft by the end of September 2016 based on discussions with JICA study team;
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b) Quality of PDDP will be assured in consultation with MOFALD.

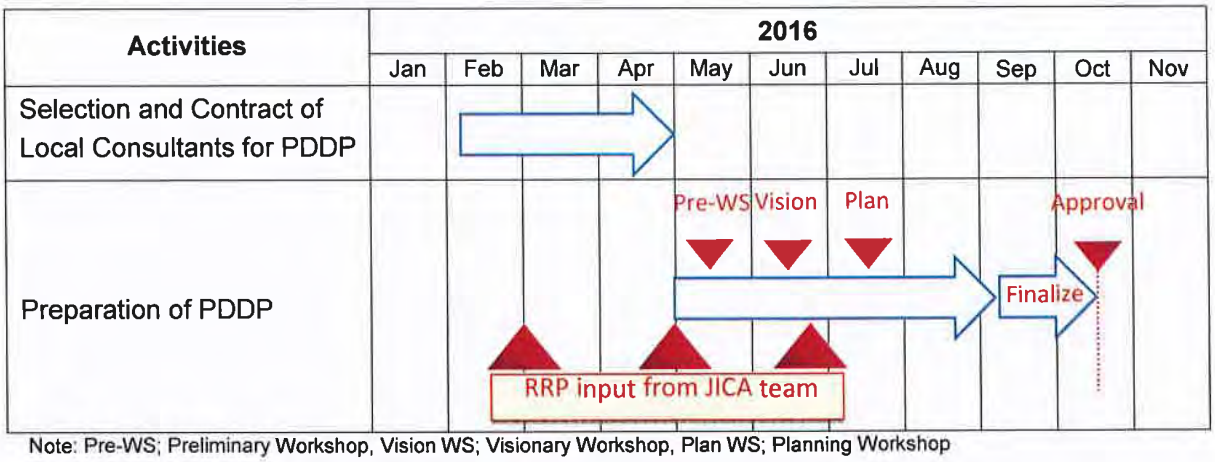
JICA PROJECT
The Project on Rehabilitation and Recovery from Nepal Earthquake JICA-Nepal

Government of Nepal Ministry of Federal Affairs and Local Development

नेपाल सरकार राष्ट्रिय पुनर्निर्माण प्राधिकरण

Government Of Nepal Ministry of Federal Affairs & Local Development Office Of The District Development Committee Sindhupalchowk

Whereas, the formulation schedule for the rehabilitation and recovery plan (RRP) and Periodic District Development Plan (PDDP) is agreed by all parties as below:



Note: Pre-WS; Preliminary Workshop, Vision WS; Visionary Workshop, Plan WS; Planning Workshop

In Witness Whereof, the Parties, have caused this Memorandum of Understanding signed in DDC Office, Sindhupalchowk district on this1st day ofMarch2016.

By:

Mr. Ichiro Kobayashi
Project Manager,
JICA Study Team,
The Project on Rehabilitation
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By:

Mr. Krishna Bahadur Shahi
Local Development Officer (LDO),
District Development Committee (DDC)
SindhupalchowkDistrict

Witness:

Mr. Chhabi Rijal
Under Secretary, Planning Section
Ministry of Federal Affairs and Local Development

Witness:

Dr. Bhishma K. Bhusal
Under Secretary
National Reconstruction Authority

Annexes

Annex- A

JICA Study Team's Input/Expertise in PDDP and RRP are as follows;

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- Urban planning
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- Local administration and organization planning
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- Community-based disaster risk management
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Annex- B

Outline of Rehabilitation and Recovery Plan (draft);

- Duration of the plan matching the timeline of National Reconstruction Authority
- Vision of rehabilitation and recovery in the district
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- Social and economic framework
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- Consideration of directions for group relocation/resettlement and revitalization planning
- Resilient public services and administration and organization framework for disaster risk
- Capacity building for disaster risk management and disaster risk reduction

Appendix-7-2: Rehabilitation and Recovery Plan (RRP) in Gorkha District

Government of Nepal
Ministry of Federal Affairs and Local Development
District Development committee
Gorkha

Gorkha District
BBB Rehabilitation and Recovery Plan
(2073/74-2082/83)

Appendix of Periodic District Development Plan 2073/74-2077-2078

Supported by :
Japan International Cooperation Agency
The Project on Rehabilitation and Recovery from Nepal Earthquake

Table of Contents

CHAPTER 1 INTRODUCTION 1
1.1 Background 1
1.2 Planning Framework 1
1.2.1 Objectives 1
1.2.2 Planning Period 1
1.2.3 Target Area 2
1.2.4 Institutional Arrangement 3
1.2.5 Planning Process 4
1.2.6 Financial Arrangement 6
1.3 Summary of the Damage of the Earthquake 7
1.4 Issues for Rehabilitation and Recovery 8
1.4.1 Introduction 8
1.4.2 Social Development 9
1.4.3 Infrastructure Development 11
1.4.4 Development Regional Economy 12
1.4.5 Institutional Development 15
1.4.6 DRR and Forest Management 15
CHAPTER 2 Basic Policy 17
2.1 Vision 17
2.2 Approach (Build Back Better) 17
2.2.1 Hazard Map Utilization 18
2.2.2 Minimum Requirement for Housing Reconstruction 18
2.3 Framework of Basic Policy 19
2.3.1 Basic Policy 19
2.3.2 Recovery of Daily Life 21
2.3.3 Building Resilient District Structure 21
2.3.4 Recovery and Development of Regional Economy 21
CHAPTER 3 RECOVERY OF DAILY LIFE 22
3.1 Introduction 22
3.2 Reconstruction of Residential Environment 22
3.2.1 Supporting Own Reconstruction of Housing 23
3.2.2 Seismic Resistant and Safety of Houses and Buildings 27
3.2.3 Municipality/VDC Rehabilitation and Recovery Planning and Group Relocation 27
3.2.4 Recovery of Water Supply of Affected Populations 30
3.2.5 Early Treatment of Disaster Waste and Debris 30
3.3 Restoration of Livelihood 31
3.3.1 Diversification of Source of Livelihood 31
3.3.2 Providing Livelihood Assistance for the Vulnerable Population 33
3.4 Recovery and Enhancement of Health and Medical Services 34
3.4.1 Recovery and Enhancement of Medical Service Facilities 34
3.4.2 Enhancement of Health Care Services 35
3.4.3 Collaboration of Health, Medical and Social Welfare Services 35
3.4.4 Support for Victims Who were Seriously Injured by the Earthquake 36
3.5 Recovery and Enhancement of Social Welfare Services 36

3.5.1 Recovery and Enhancement of Social Welfare Services for Affected Vulnerable People 36
3.5.2 Support Activities of Women's Groups 37
3.5.3 Enhancement of Social Welfare Services for Elder People 38
3.6 Recovery and Revitalization of Education 39
3.6.1 Recovery and Seismic Resistance for Schools 39
3.6.2 Enhancement of Disaster Management Education 40
3.6.3 Care for Students 42
CHAPTER 4 BUILDING RESILIENT DISTRICT STRUCTURE 45
4.1 Introduction 45
4.2 Enhancement of Regional Recovery and Disaster Management Capacity 45
4.2.1 Enhancement of Rehabilitation and Reconstruction Framework 46
4.2.2 Enhancement of Administrative Formulation for Effective Disaster Management 46
4.2.3 Improvement of Access to DRR Information for Community and Vulnerable People 49
4.2.4 HRD for Enhancement of Reconstruction and Disaster Management Capability 49
4.2.5 Capacity Building of First-Aid and Search and Rescue Activities 51
4.2.6 Promoting Partnership between Relevant Public Sector and Private Sector for DRM 52
4.2.7 Enhancement of Community Based Disaster Risk Management (CBDRM) 53
4.2.8 Enhancement of Public Awareness of DRR/DRM 54
4.3 Recovery and Development of Resilient Infrastructure 55
4.3.1 Recovery and Development of Seismic Resistance and Safer Road Networks 56
4.3.2 Recovery and Development of Seismic Resistant and Safer Trails 56
4.3.3 Development of Disaster Management Facilities and Designate Emergency Roads 57
4.3.4 Recovery of Resilient Lifeline 59
4.4 Enhancement of Land Use Management and Area Planning 60
4.4.1 Designation of land Use Management such as Restricted Habitation Area 60
4.4.2 Consideration of Forest Preservation and Management 63
CHAPTER 5 RECOVERY AND DEVELOPMENT OF REGIONAL ECONOMY 64
5.1 Introduction 64
5.2 Recovery and Promotion of Agriculture 64
5.2.1 Recovery of Agricultural Buildings, Facilities and Infrastructures 65
5.2.2 Supporting Revitalization of Agricultural Activities 66
5.2.3 Capacity Development for Farmers to Improve Agricultural Technique and Productivity ..66
5.2.4 Improvement of Agricultural Distribution System and Supply Chain 67
5.3 Recovery and Promotion of Tourism 68
5.3.1 Rehabilitation and Development of Tourism Related Infrastructure 70
5.3.2 Revitalize Community Based Tourism to Benefit the Residents 72
5.3.3 Recovery and Development of Regional Tourism Resources 72
5.3.4 Human Resource Development on Tourism 74
5.4 Recovery and Promotion of Trade and Other Industry 74
5.4.1 Recovery and Promotion of Small Industry 74
5.4.2 Human Resource Development for Small and Cottage Industry 75
CHAPTER 6 ACTION PLAN 76
6.1 Intorduction 76
6.2 Formulation Process 76
6.3 Framework of Action Plan 76
6.4 Action Plan 78

6.5 Cross-cutting Priorities.....118
6.5.1 Utilization of Landslide Hazard Map 119
6.5.2 Municipality/Rural Municipality Rehabilitation and Recovery Planning.....122
6.5.3 Formulation of Disaster Risk Management Plan in Municipalities and RMs 126
6.5.4 Development of Logistics Center and Transportation Network for Recovery and DRM....127
6.5.5 Quick Impact Projects (QIPs) by JICA 128

APPENDIX

1. LEGAL AND POLICY FRAMEWORK
2. RESULTS OF WORKSHOPS
3. DISTRICT PROFILE AND EARTHQUAKE DAMAGE
4 .HAZARD ASSESSMENT
5. FOMULATION PROCESS OF PDDP AND RRP
6. ONGOING RECOVERY PROJECT LIST
7. JICA TEAM CONDUCTED SURVEYS AND ACTIVITIES
8. FORMAT OF INFORMATION COLLECTION

List of Acronyms

Acronyms	Official Name (English)
ADB	Asian Development Bank
ADDP	Annual District Development Plan
AED	Automated External Defibrillator
AEPC	Alternative Energy Promotion Center
BBB	Build Back Better
BC	Birthing Centers
CAAN	Civil Aviation Authority of Nepal
CBDRM	Community Based Disaster Risk Management
CBS	Central Bureau of Statistics
CDO	Chief District Officer
CDMC	Community Disaster Management Committee
CEO	Chief Executive Officer
CGI	Corrugated Galvanized Iron
CNDRC	Central Natural Disaster Relief Committee
CSIDC	Cottage and Small Industry Development Committee
CSR	Corporate Social Responsibility
CTEVT	Center for Technical Education and Vocational Training
DAO	District Administration Office
DADO	District Agriculture Development Office
DCC	District Coordination Committee
DCCO	District Coordination Committee Office (Former DDC)
DDC	District Development Committee
DDRC	District Disaster Relief Committee
DEO	District Education Office
DEOC	District Emergency Operation Center
DFO	District Forest Office
DHO	District Health Office
DLCO	District Land Conservation Office
DLRO	District Land Revenue Office
DL-PIU	District Level Project Implementation Unit
DLSA	District Leading Support Agency
DLSO	District Livestock Service Office
DM	Disaster Management
DOE	Department of Education
DOLIDAR	Department of Local Infrastructure Development and Agricultural Road
DOR	Department of Road
DPs	Development Partners
DPRP	Disaster Preparedness and Response Plan
DRR	Disaster Risk Reduction

Acronyms	Official Name (English)
DRM	Disaster Risk Management
DSO	District Survey Office
DTMP	District Transport Master Plan
DTO	District Technical Office
DUDBC	Department of Urban Development and Building Construction
DWCO	District Women and Children Office
E-BPS	Electronic Building Permit Systerm
EPI	Expanded Program on Immunization
EQ	Earthquake
FGD	Focus Group Discussion
FNCCI	Federation of Nepalese Chamber of Commerce and Industry
GCCI	Gorkha Chamber of Commerce and Industry
GDP	Gross Domestic Product
GIS	Geographic Information System
GON	Government of Nepal
GPS	Global Positioning System
GTDC	Gorkha Tourism Development Committee
HDI	Human Development Index
HMIS	Heals Management Information System
HQ	Head Quarters
HRD	Human Resource Development
IDDO	Irrigation Development Division Office
INGO	International Non-Governmental Organization
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
LDO	Local Development Officer
LDMC	Local Disaster Management Committee
LDMP	Local Disaster Management Plan
LDRC	Local Disaster Relief Committee
LDRMP	Local Disaster Risk Management Plan
MLIT	Ministry of Land, Infrastructure, Transportation and Tourism, Japan
MOAD	Ministry of Agriculture Development
MOCTCA	Ministry of Culture, Tourism and Civil Aviation
MOE	Ministry of Education
MOEN	Ministry of Energy
MOENV	Ministry of Environment
MOF	Ministry of Finance
MOFALD	Ministry of Federal Affairs and Local Development
MOH	Ministry of Health
MOHA	Ministry of Home Affairs
MOI	Ministry of Industry

Acronyms	Official Name (English)
MOIC	Ministry of Information and Communication
MOLD	Ministry of Livestock Development
MOUD	Ministry of Urban Development
MOWCSW	Ministry of Women, Children and Social Welfare
NBC	National Building Code
NCDM	National Council for Disaster Management
NDRF	National Disaster Response Framework
NEA	Nepal Electricity Authority
NGO	Non-Governmental Organization
NPR	Nepalese Rupee
NPC	National Planning Commission
NRA	National Reconstruction Authority
NRA-DCC	National Reconstruction Authority- District Coordination Committee
NRRC	Nepal Risk Reduction Consortium
NSDRM	National Strategy for Disaster Risk Management
NST	Nepal Standard Time
NTB	Nepal Tourism Board
NTNC	Nepal Trust for Nature Conservation
ORC	Out Reach Clinic
PDDP	Periodic District Development Plan
PDNA	Post Disaster Needs Assessment
PDRF	Post Disaster Recovery Framework
PGA	Peak Ground Acceleration
PHC	Primary Health Center
PWD	Person with Disability
QIPs	Quick Impact Projects
RAP	Rural Access Programme
RCC	Reinforced Cement Concrete
RDRC	Regional Disaster Relief Committee
RM	Rural Municipality
ROW	Right of Way
RR	Rehabilitation and Recovery
RRNE	Reabilitation and Recovery from Nepal Earthquake
RRP	Rehabilitation and Recovery Plan
RSLUP	Risk Sensitive Land Use Plan
SAR	Search and Rescue
SIP	School Improvement Plan
SOP	Standard Operating Procedure
SWOT	Strength Weakness Opportunity Threat
TOT	Training of Trainer
TPIS-ERP	Transitional Project Implementation Support for Emergency Reconstruction

Acronyms	Official Name (English)
	Projects
UN	United Nations
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
USD	United States Dollar
USGS	United States Geological Survey
VDCs	Village Development Committees
WFP	World Food Programme
WSSDO	Water Supply and Sanitation Division Office

CHAPTER 1 INTRODUCTION

1.1 Background

On 25th April 2015, a magnitude 7.8 earthquake hit Kathmandu Valley and various districts. While its epicentre was around Barpak in the Gorkha District, which is approximately 77 km northwest of Kathmandu, the capital city of Nepal, devastating damage was recorded due to several aftershocks even in Kathmandu Valley (hereinafter, referred to as the earthquake). The earthquake brought heavy damage in a wide range of area. 8,790 people were killed, 22,300 people were injured, approximately 500,000 buildings were totally destroyed, and around 250,000 buildings were partially damaged (PDNA).

JICA conducted a project formulation study as a part of the existing technical cooperation project and commenced "The Project on Rehabilitation and Recovery from Nepal Earthquake" from July 2015. The project includes the formulation of a rehabilitation and recovery plan in the Gorkha District. In cooperation with the JICA Expert Team, the Gorkha DDC formulated the Gorkha District Rehabilitation and Recovery Plan, which reflects the concept of Build Back Better (BBB). This plan was formulated through the formulation process of the Periodic District Development Plan (PDDP) with cooperation among various stakeholders and the JICA Project. With this, Gorkha DDC and JICA believe that the Gorkha District would be able to recover people's daily life step-by-step and develop a more resilient society than the pre-disaster phase and reduce the risk of damage from disasters in the future.

1.2 Planning Framework

1.2.1 Objectives

The objective of the Plan is to clarify the goals, direction and actions of rehabilitation and recovery. In order to smoothly promote more effective recovery actions step-by-step, it is essential to share the vision among all stakeholders including the government, private sector and residents. The Plan will be a milestone which indicates the future direction for the recovery of a safer society and regional sustainable development based on lessons learned from the earthquake and key principles such as "Build Back Better", and "Resilience" which are explained in Chapter 2.

1.2.2 Planning Period

In consideration of the rehabilitation and recovery in the district, basically, it is important to implement the necessary policies and projects step-by-step in the long-term. Therefore, the duration of this rehabilitation and recovery plan is set for ten years, from 2017 to 2026. The target period of the Rehabilitation and Recovery Plan is divided into three phases, namely the recovery period (0-3 years), revitalization period (3-6 years) and development period (7-10 years).

The recovery period is the phase which targets the recovery from earthquake damage such as the removal of debris, reconstruction of damaged housing, and the rehabilitation of infrastructures such as roads, bridges, and water supply. This period also considers the recovery of the livelihood of affected populations through financial support and training for setting up alternative livelihoods, and improving health conditions.

The revitalization period is the phase which targets the reconstruction of the society after the recovery phase. For the infrastructure development, this period focuses on developing disaster resilient infrastructure such as seismic resistant public facilities, transportation and power supply. This period also aims at the physical and institutional development for disaster management such as the establishment of an efficient/redundant information transmission system in case of disaster, and updating district disaster management plans learning from the past experience of disasters.

The development period is the phase which aims at the future growth of the region such as attracting investment for the regional economy, the development of new industry and so on. For pursuing the future development of the region, enhancement of the capacity of disaster management on the government level and community level is essential.

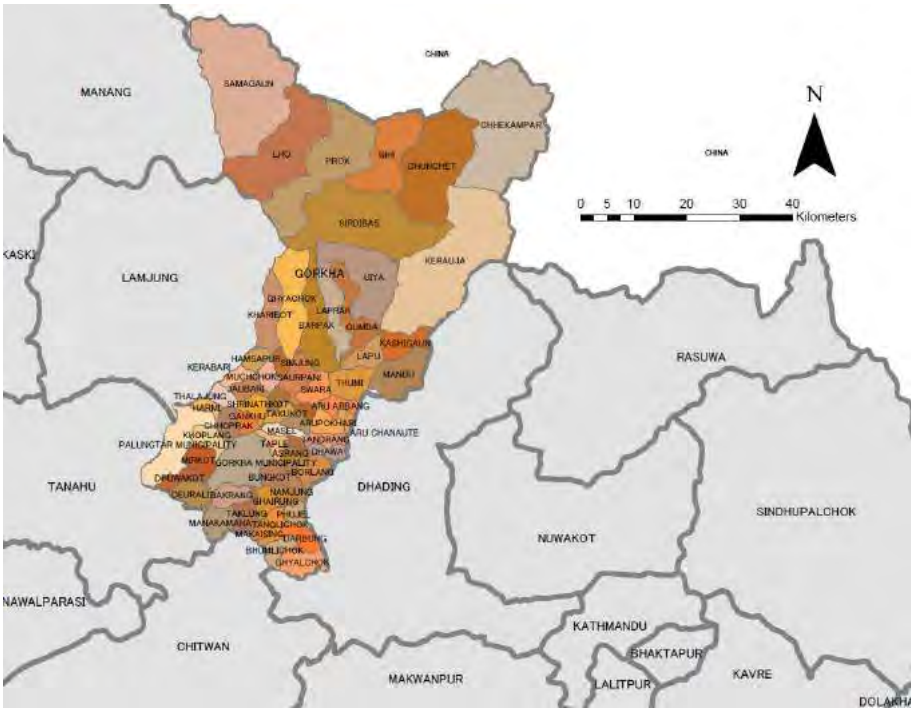
The long term development vision of Gorkha was set out as “Beautiful, Equitable and Prosperous Gorkha through Agriculture, Tourism and Resilient Infrastructure,” in PDDP. Persistent efforts will be necessary to realize this vision and the concept of the vision and the duration of both PDDP and RRP is as shown in the following figure.

Source:JICA Project Team

Figure 1.1 Three Phases of RRP

1.2.3 Target Area

The target area is the entire Gorkha District.



Source:JICA ProjectTeam

Figure 1.2 Map of Gorkha District

1.2.4 Institutional Arrangement

The Nepali Government, together with the international community, carried out a Post Disaster Needs Assessment just after the earthquake to identify the damage cost estimation. The report pointed out that the estimation value of the disaster effects (damages and losses) caused by the earthquake is NPR 706 billion or its equivalent US$ 7 billion and 76% of the total effects represents the value of destroyed physical assets. The Nepali Government initiated the concept of Build Back Better towards the resilience of the society with emphasis on the improvement of the Disaster Risk Reduction system in Nepal.

The government of Nepal proposed the bill to establish the National Reconstruction Authority (NRA) as the leading agency of the reconstruction from the earthquake. The bill prescribes the establishment of the National Reconstruction Committee (NRC) and Steering Committee, both of which are chaired by the Prime Minister. The bill was approved by the parliament in December, 2015. In parallel, the National Planning Commission (NPC) drafted the Post-Earthquake Recovery and Reconstruction Policy to envisage a guideline for the reconstruction and recovery. The rehabilitation and recovery plan on the district level is expected to fulfil important roles as the basis for reflecting the national reconstruction policies to local community people appropriately.

The Gorkha District Rehabilitation and Recovery Plan is a master plan which indicates necessary measures and actions for smooth and step-by-step implementation of reconstruction efforts. It is a comprehensive, medium and long term plan for improving the lives of affected people, industry and economy, as well as for promoting a safer district. The necessity and roles of the Rehabilitation and Recovery Plan in the Gorkha District is shown below.

(1) National Level

1) NRA

The Act Relating to Reconstruction of the Earthquake Affected Structures, 2015 (2072) prescribes the establishment of NRA as a leading agency regarding the reconstruction from the earthquake. The major roles of the NRA are formulation and management of the reconstruction projects, financial management of the funds related to the reconstruction and technical surveys related to housing reconstruction and resettlement. For the detailed roles of the NRA, please refer to Appendix 1.

2) MOFALD

In relation to the formulation of RRP, MOFALD is the agency to be responsible for the management of formulating and financing PDDP in each district. On July 19th 2016, MOFALD issued a letter to fourteen affected districts regarding to integration of RRP into their PDDP planning process. The letter indicated that the districts which were already in the process of formulating the PDDP should develop RRP as an annex. At the time of issuing the letter, the Gorkha District was already in the process of the PDDP formulation process, so this RRP was developed as an annex of the PDDP.

(2) District Level

1) DDC

Local Self Governance Act prescribes that DDC is the administrative body to formulate the PDDP in cooperation with line agencies at the district level. LDO, representative of the DDC is the member of the District Coordination Committee which was established as the district level coordination body prescribed by the Act of Relating to Reconstruction of the Earthquake Affected Structures, 2015 (2072).

2) Line agencies

Reconstruction projects are implemented through line agencies, NRA and development partners. Each line agency in coordination with NRA implements the projects.

1.2.5 Planning Process

The RRP is formulated through the PDDP planning process in order to legitimatise the RRP to ensure its implementation[1]. Local Self-governance Act prescribes that each district shall formulate annual and periodic development plans for the development of its district. The items to be included in the PDDP are as follows:

1) Geographical, economic and natural heritages of the District and present uses.
2) Possibilities of production in various sectors on account of comparative cost benefit.
3) Areas comprising backward castes, tribes and poorer people and various development works done or required to be done in such areas.
4) Income-generating and skills-oriented development works for the women and children.
5) Description of the completed projects under various sectors and provision for the operation and maintenance of them.
6) Various sectoral short-term and long-term development works on the basis of development possibility.
7) Plans on human resource development in various sectors to be formulated by the local people themselves.

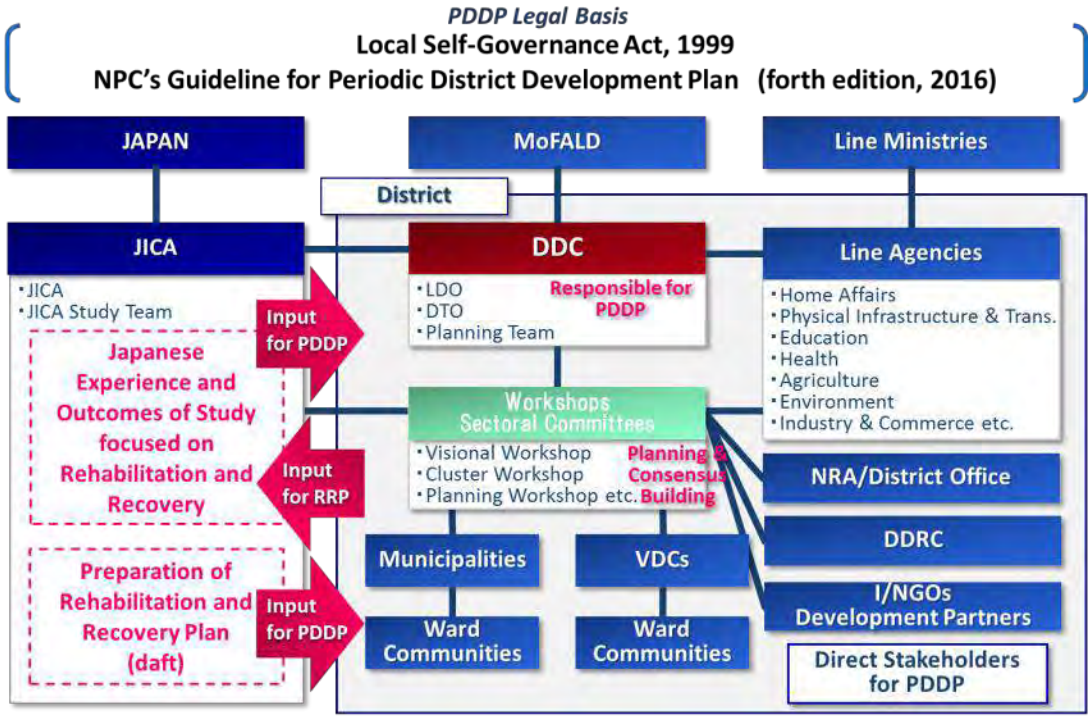
[1] Record of RRP formulation is attached in Appendix 5.

Covering these components, PDDP covers the items below;

1) Profile Analysis

Trend Analysis/SWOT Analysis/Bottleneck Analysis/Spatial Analysis/Cross-cutting issue Analysis/Resource Mapping and financial Analysis

2) Periodic District Development Plan
   (1) District Vision
   (2) Goals, objectives, strategies, outcomes and outputs
   (3) Physical Development Plan
   (4) Environment Management Plan
   (5) Social Development Plan
   (6) Economic Development Plan
   (7) Resource Mobilization Plan
   (8) Institutional Development Plan
   (9) Disaster Management Plan
   (10) Multi-Sectoral Investment Plan



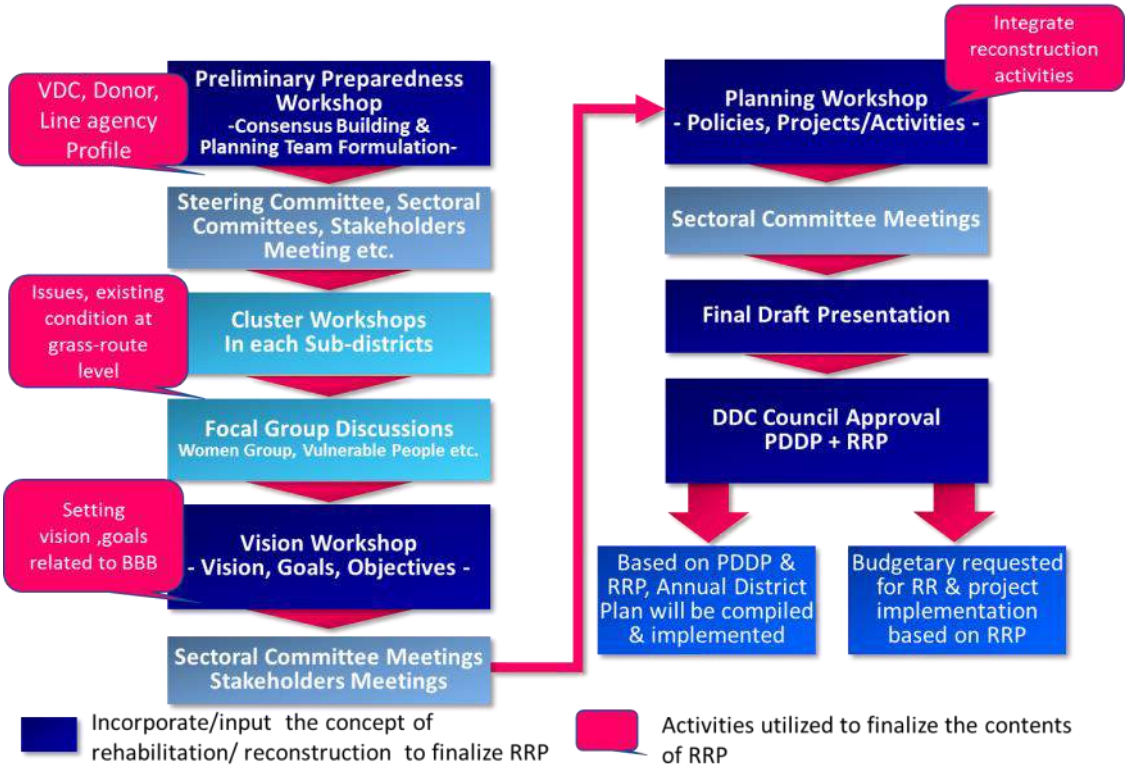
Source:JICA Project Team extracted from Local Self-governance Act

Figure 1.3 Planning Formation of PDDP and RRP

The RRP's information collection process was in line with PDDP and the JICA Expert Team prepared additional forms such as VDC profile, line agency profile, and INGO/Donor profile. The formats used for RRP, please refer to Appendix 8.

The JICA Expert Team also conducted surveys and activities to formulate RRP. Detailed information is summarized in Appendix 7.

JICA Expert Team made the presentations in each PDDP workshop regarding the ideas of RRP, examples of Japan and the findings by the activities such as the preparation of a hazard map, social survey and community's awareness raising activities about landslides.

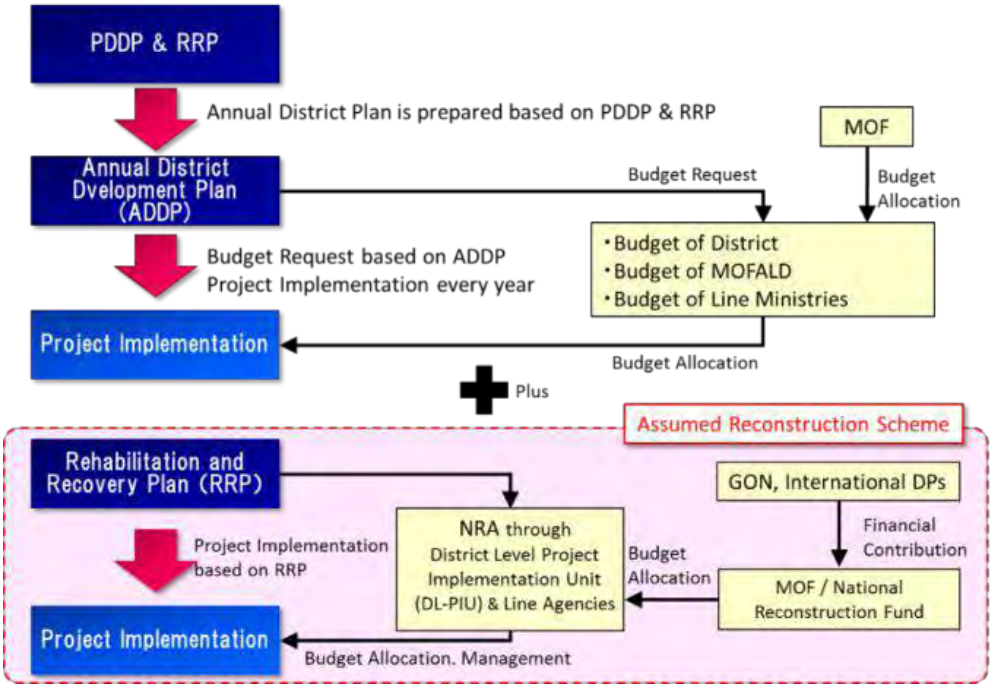


Source:JICA Project Team Extracted from the guideline for PDDP

Figure 1.4 Planning Flow of PDDP and RRP

1.2.6 Financial Arrangement

The following figure indicates the project implementation flow. Based on the formulated plans, an annual development plan will be created to implement identified projects. In addition, the Rehabilitation and Recovery Plan is the master plan indicating the role and responsibilities of all sections of DDC, agencies and institutions related to the implementation of rehabilitation and recovery from the earthquake. It will be the basis to consider necessary budget and strategic implementation of rehabilitation and recovery actions among various stakeholders.



Source:JICA Project Team based on the interview from nepal government officials

Figure 1.5 Project Implementation based on PDDP and RRP

In order to promote rehabilitation and recovery actions, the cooperative framework with communities, inhabitants, I/NGO and government agencies are indispensable. Due to the limitation of the financial and human resources of the public sector, the cooperation of the people of the community and considering reconstruction activities based on the sufficient opinions of communities will be the key for effective recovery. Furthermore, the enhancement of collaboration with I/NGOs, wide-range cooperation and partnership with private sector will enable the realization of better recovery and a more resilient region.

1.3 Summary of the Damage of the Earthquake

According to the assessments by the United Nations (UN) and the Nepali government, 20% of the total population of Nepal resides in the fourteen districts which were designated as heavily affected areas. Meanwhile, the same fourteen districts accounted for more than 90% of the deceased and injured persons as well as heavily affected public facilities and individual housing. Moreover, approximately more than 3,300 landslides occurred including those on the Tibet side, and the landslides damaged a large number of roads and bridges, which is a hindrance to rehabilitation and recovery.

Source:JICA Project Team

Picture 1.1 Barpak VDC after the Earthquake

In particular, Gorkha District was one of the most seriously affected districts by the earthquake. 488 people lost their lives and 1,283 people were

injured. For the building damage, around 77,000 houses collapsed totally and around 12,000 houses were partially damaged. In addition, around 100 public buildings are fully damaged. 2,958 classrooms collapsed fully and 584 classrooms were major damaged. The per capita disaster effect on the Gorkha District is around NPR 210,000 (PDNA).

Key Figure of the earthquake damage

- ✓ 488 persons were killed and, 1,283 persons were injured by the earthquake and landslide.
- ✓ 76,987 houses were totally collapsed, 11,896 houses were partially collapsed and 5,350 houses were slightly damaged.
- ✓ 75 % of classrooms were fully damaged or major damaged which affected more than 50,000 children.
- ✓ About 100 public buildings were free damaged including VDC offices, health posts and district government offices.

For the detailed damage of the earthquake, please refer to Appendix 2.

1.4 Issues for Rehabilitation and Recovery

1.4.1 Introduction

Almost two years have passed since the occurrence of the devastating earthquake and the Gorkha District is in the process of recovering from the earthquake. The recovery process posed three major challenges 1) Recovery of Daily Life, 2) Building the Resilient District and 3) Recovery and Development of Regional Economy.

Throughout the PDDP formulation process, the JICA Expert Team collected the information regarding the issues of reconstruction through the VDC profiles and the result of the cluster workshops. Since the vulnerable population was adversely affected by the earthquake, consideration and empowerment of the vulnerable population should be included in each component of rehabilitation and recovery. In addition, landslides affected the various aspects of rehabilitation and recovery such as loss of human life, blockage of transport networks, resettlement of affected areas and damage of agriculture. Therefore, countermeasures against landslides is a major cross-cutting issue.

A long process of housing reconstruction is the major hindrance for the recovery of daily life for the people in disaster stricken areas. The result of the focus group discussions which is a part of the social survey conducted by the JICA RRNE Project and PDNA indicated that the earthquake adversely affected the especially vulnerable population in the district. For instance, housing damage was severe in poor households which consisted of improper construction against earthquakes[2]. A large number of people lost their livelihood such as seeds of rice and vegetables, and equipment for agriculture due to the collapse of their houses[3].

Economic challenges for the recovery of the housing sectors are mainly due to the high cost of construction material because of the poor transportation and logistics network and the hiring of construction workers. Because of underdeveloped industry in the disaster-stricken areas, a part of the

[2] According to PDNA Vol. A p29, 474,025 totally damaged houses out of 498,852 were low strength masonry.

3 According to PDNA Vol. B p 108, in Gorkha District 98% of damage and 72 % of loss in industrial sector were micro, cottage and small scale industry. Also 99.9% of damage and 98% of loss in commercial sector were of micro, cottage and small scale.

housing reconstruction is implemented by the residents themselves. Households headed by women and the aged suffer from the shortage of a labour force, and their housing reconstruction tends to be delayed. Prolonged living in temporary shelter causes gender-based violence[4] and human trafficking which risks the safety of women.

For daily life and economic activities, severe damage to water resources and water supply causes multi-sector problems. Depletion of water resources and the severe damage of irrigation facilities were reported and both Gorkha District officials and the residents recognized that securing the water is one of the major challenges. Shortage or lack of drinking water from the usual water sources often caused women and children to walk a long distance to fetch water from alternative water sources and deteriorated the sanitary and hygine conditions. Damage to water supply facilities also caused the reduction of agricultural productions, which hinders the economic activities.

As for the regional economy, major industry of Gorkha District is agriculture, tourism and small-medium enterprises. Agricultural sector was damaged due to destruction of irrigation facilities, landslides, and damage of farmers' housings. As a short term, recovery of damaged infrastructure will be the first priority. For the medium to long term, revitalization of regional economy is one of the key challenges since the agriculture and livestock sector in Gorkha District is subsistence sector and Gorkha District has economic and geographic disadvantages for industrialization. The earthquake affected well-known tourism resources both for domestic and foreign tourists in Gorkha District. For instance, Gorkha palace were partially damaged by the earthquake and Manakamna is completely damaged by the earthquake, and damage of trekking routes caused the decrease of foreign tourists. In addition, homestay program utilizing the traditional housing and life style is the source of income in Barpak and Laprak areas which were severely damaged by the earthquake. Recovery should be elaborated not to lose their traditions to be attractive to the tourists. Even though more than 80 % of the population in Gorkha District engage in agriculture as described previously, farmers obtain additional income as seasonal labors of tourism and small and medium enterprises such as shopkeepers and making souvenirs. That means revitalization of the tourism industry benefits most of the population in Gorkha. Utilizing the existing tourism resources to boost the economy is the challenge for Gorkha District in the context of reconstruction.

1.4.2 Social Development

According to the result of PDRF prepared by the NRA, reports from governments and donors, site surveys and social surveys conducted by the JICA RRNE Project Team, the issues of Rehabilitation and Recovery Plan targets to address the vulnerable populations which are adversely affected by the earthquake. The following issues are identified to benefit the population in the Gorkha District.

(1) Housing Reconstruction

The earthquake adversely affected the poor and marginalized households in two ways. Most of their houses were heavily or totally collapsed as their houses were in most cases poorly built with locally available stones or sun baked bricks with mud mortar.

Secondly, many of them cannot afford to rebuild earthquake resistant housing due to the lack of resources. For example, 95% of fully collapsed buildings and 67.7% of partially collapsed housing

4 Based on FGD in the women group in the social survey implemented by the project.

were low-strength masonry housing7. People living in the partially collapsed housing have a high risk of injury and further damage due to heavy rains and storms as well as future earthquakes.

Due to the high demand of reconstruction and fuel deficiency, the cost of materials has been increasing and that makes the reconstruction difficult for poor households[8]. Some construction materials are not easily available at local markets and have to be sent from urban areas. A poor transportation network and its mountainous geographical location makes the construction cost more expensive.

According to the result of the social survey conducted from late January to early February 2016 by the JICA Project Team, a large number of villagers were living in hurriedly built temporarily sheds made of CGI and other materials salvaged from the debris or under tents, and waiting for information and the governmental guidelines for housing reconstruction in order to receive a subsidy from the government. However, the issuing of government guidelines and the setting up of a first enrolment camp has started one year after the earthquake and it is expected to take a long time for the reconstruction of the houses to be completed. As a short term issue, securing the living environment for those who are waiting to be enrolled as beneficiaries and cannot afford to construct a house due to economic reasons is indispensable. Also securing the living environment for those who cannot afford to spend extra money even with subsidies should be considered.

In addition, a number of populations need to be relocated because of the high risk of landslide. Relocation projects for those who do not own lands in disaster safe areas need to be considered as a major issue of housing reconstruction.

(2) Water Resources

Water resource scarcity prevents the people in the Gorkha District from recovering the daily life in various perspectives. The result of the social survey pointed out that the earthquake changed the stream of underground water sources or dried up the water sources in many VDCs. Not only water sources but also water supply infrastructure, such as irrigation facilities and tube wells, were severely damaged. Residents in the affected areas still suffer from the reduction of agricultural production. Fetching the water from further places prevents mainly women from engaging in other economic activities and children from schooling. Securing water sources should be prioritized as a major issue to recover the daily life of affected populations.

(3) Access to Public Services

In the Gorkha District, a large number of public buildings were destroyed by the earthquake. It is reported that damage to the buildings stagnates public service delivery to the people living in the earthquake affected areas.

Damage to hospitals and health posts endangers the conditions of reproductive health and early child care. The result of the social survey indicated the some women in target areas experienced unsafe child delivery due to the unavailability of health care facilities. Lacking in medical facilities

[7] PDNA Vol. B Sector Report P12
[8] Refer to QIPs (Under Survey)

in Gorkha District is one of the major issues in the Gorkha District. Residents have to go to Pokhara or Kathmandu for medical services and this condition is one of the causes of outmigration to other districts.

School buildings were severely damaged all over the Gorkha District since most of the buildings were made from low masonry structures. Currently, school children are studying at temporary school buildings, some of which are half-outside. A poor environment distracts children from studying and cause health problems during the winter. Safer school building reconstruction should be prioritized.

Moreover, public buildings such as VDC buildings, Agriculture Centres, and community halls were damaged. At the VDC level, social welfare activities and self-help activities are organized and these groups usually gather at such buildings. Also the unavailability of community buildings deactivated the self-help women's activities which support social welfare at the VDC level. Early recovery of such buildings will contribute to activate social welfare in the district.

The damage of the public buildings also stagnated the administrative services for the residents due to the collapse of the buildings and loss of the documents. Participants of the cluster workshops reported residents have to travel long distance to process the administrative services because the nearest offices were damaged. Administrative process such as housing reconstructions slowed down because a large number of offices are temporary buildings without proper facilities and government officials become busy with additional workloads related to the reconstruction activities.

1.4.3 Infrastructure Development

Building a more disaster resilient society than pre-earthquake time is the overall concept of BBB. Since the future occurrence of earthquakes is inevitable, reconstruction projects should take DRR into consideration in terms of physical infrastructure and institutional development.

(1) Transport and Logistics Network

It is reported that a large number of the infrastructure such as road, bridge, irrigational facilities, hydropower facilities, and government buildings were damaged by the earthquake and landslide. Recovery of road transportation is the priority of all rehabilitation activities since the recovery of road network will accelerate the process of other rehabilitation and recovery. While international donors initiated the reconstruction works of major road and bridges, most reconstruction of district level road and trails which is directly beneficial for the local population has not been initiated.

In Gorkha District, majority of the road network except for connecting among VDCs are seasonal roads that can be used only during dry season. Even the highway to go to Barpak and Laprak is blocked during the rainy season because of frequent landslide. Road conditions of the highway became worse because of heavy-loaded transportation induced by the reconstruction works. These transportation networks delay the construction activities and lead higher construction prices than urban areas which adversely affect the people living in remote areas. Improving transport network facilitates, the logistics of agricultural products and facilitates the transportation for tourism which can be the potential economic growth. Robust transportation and logistics network will contribute to develop disaster resilient district by realizing earlier recovery from the damage. .

(2) Building Stronger Facilities for Public Service Delivery

The earthquake devastated public facilities such as medical facilities, VDC buildings, Agriculture Service Centers, and schools. The lessons from the earthquake posed the problems of seismic resistance of the public buildings as well as individual housings by seeing the examples that most of the school buildings in Gorkha District were heavily damaged. In addition, the Reconstruction Policy requires that each district should construct at least one emergency community building as shelters during the disaster and for other various community purposes during normal times. The Reconstruction Policy also requires that each district should construct at least one emergency community building as shelters during the disaster and for other various community purposes during normal times.

During the short-term recovery phase, restoration of the government buildings for continuous support of the disaster affected population is essential. For the medium to long term recovery phase, reconstruction of the damaged buildings and reinforcement of the existing buildings with robust structures should be considered. Robust public buildings will prevent the local government from paralysing the public support functions and serve residents as safer shelters in case of disaster.

1.4.4 Development Regional Economy

Currently a large number of productive population especially young men out-migrate to urban areas in Nepal and outside the country such as India and Middle East countries seeking for better employment opportunities[12]. Remittance of these migrant workers is the major source of income in the household in Gorkha District, at the same time the condition slows down the industrialization and economic growth within the district. In the Gorkha District, total number of the population decreased from the effect of the earthquake.

The result of the focus group discussion of the social survey in Bungkot and Barpak points out the existence of certain number of vulnerable population as women in poor economic conditions, aged household and Dalit[13]. Long-term blue print for sustaining the skilled and productive labor force in the district is the key challenge for economic sector.

(1) Diversification of Incomes from Agriculture and Livestock Industry

Agriculture and livestock is the major industry of Gorkha District. Major damage of agriculture and livestock sector was 1) Damage of tools and equipment for agriculture and cattle rearing; 2) Loss of livestock due to collapsed animal housing 3) Damage of agricultural infrastructure such as irrigation facilities and community buildings for farmers 4) Decrease of production of milks and miscarriage of cattle due to the shock of earthquake. The damage of agriculture and livestock sector deprived income source of majority of population. Cash transfer such as to purchase the livestock and agricultural equipment, subsidy for farmers, improvement of cultivation, diversification of crops and vegetation, creating additional income source during agricultural off-season are the key issue to be investigated in the short term.

[12] FGD of residents in Gorkha conducted by JICA RRNE Project

[13] FGD of residents in Gorkha conducted by JICA RRNE Project:
Example of marginalized populations are such as poor women headed household with small children, women in physical and mental illness, widows with children, elderly population, Dalit and persons with disability. FGD members commented " At Barpak, male are the decision maker and moves outside for their economic activities whereas women look after the household activities and their offspring. They added that female are in such a position just because of lack of education, lack of awareness and weak economic status."

In Gorkha District, women mainly engage in agriculture and livestock industry as small-scale subsistance income sources. Women headed households are economically and socially disadvantaged compared to men headed households. Economic development measures targeting to economically challenged populations are regarded as social welfare of the affected populations. Value added scheme of the current industry, and development of the efficient supply chain are long-term issues for development of the region. Industrialization of the region can be the deterrent of outmigration of skilled and educated citizens which currently leave the district for seeking employment opportunities.

(2) Revitalization of Tourism

Major damage of the tourism sector in Gorkha Districts are 1) Damage of internationally-well known trekking routes such as Manaslu routes 2) Damage of hotels and guest houses including home stay 3) Damage of cultural heritages such as Gorkha Palace and Manakamna. In general, it takes a few years to recover the number of tourists after a natural disaster. In case the tourism resources are completely destroyed, the demand for tourists will not be fully recovered compared to the pre-earthquake period. The statistics of tourism sector indicated that total number of the tourists is two thirds that of before the earthquake and some historical sites lessened by 80 % as of January 2016 in Nepal.

Even though it is not officially registered, a large number of the population in the Gorkha District obtains income directly or indirectly from the tourism sector; farmers engage in seasonal labour during the high-season of tourism which is often during the off-season of cultivation. A decline in the number of tourists causes the lay-off of temporary workers in hotels and restaurants who are economically unstable.

Regarding tourism sector as a primal source of regional economy, Gorkha District formulated the Strategic Tourism Action Plan in 2012. The objectives of the Action Plan include developing market oriented tourism products, developing tourism infrastructure for the development of quality and community oriented tourism and develop the capacity of government, private sector, NGO and community for the proper development of the tourism.

According to the project lists compiled by the PDRF, current reconstruction projects are rehabilitation of trekking routes and rehabilitation of lodges. Economic development oriented reconstruction projects have not been developed.

In order to vitalize the tourism industry, it is essential to propose multiple-destination tour projects and tourism infrastructure development which is attractive for foreign tourists such as clean and sufficient accommodations and toilets. This will contribute to the increase the demand of accommodations and adjunct industries such as restaurant and souvenirs. In addition, community-based tourism projects should be included as a priority of reconstruction to be in line with the current policy of Gorkha District.

The JICA Project Team conducted the Barpak Workshop for tourism[14] development and identified principal issues to increase tourist number which are 1) Reopening of Tourist Information Center, 2) Reconstruction of Community Museum, 3) Improvement of trails: Lower Manaslu (Darche Danda) and Rupina La routes, 4) Establishment of tourism committee, 5) Creation of tourism

[14] The Workshop was conducted by JICA RRNE Project on 28th September, 2016 at Barpak VDC. Participants of the Workshop were Barpak VDC Secretary, Homestay Committee, Women Groups, Barpak Tourism Development Committee, Dharche Manasulu Tourism Development Committee, Hotel/Cottage Owners, Forest Community and Community People.

awareness among politicians and local government officers, 6) Implementation of tourism promotion activities, 7) Fundraising for tourism promotion activities and the tourism committee, 8) Promotion of accommodation investment in key locations on trekking routes, 9) Use of internet for tourism promotion: Facebook, Twitter, Free Wi-Fi etc. 10) Limited liquidation of land, 11) Environmental issues, 12) Concerns for modern houses, 13) Concerns for negative images of Barpak: earthquake, landslide etc.

NRA and the Ministry of Culture, Tourism and Civil Aviation are planning to improve the trekking trails (Deurali – Sulikot – Kharchwok – Darche Danda – Sumpe Kharka – Laprak, Barpak – Rupina La – Nyak, refer to following figure) that supplement the existing Manaslu Circuit. Since the plan is mainly focusing on the improvement of trails only, it will be important to develop relevant tourism facilities along trails to realize attractive trekking trails for tourists.

Source: Ministry of Culture, Tourism and Civil Aviation

Figure 1.6 Trekking Trail Network in Lower Manaslu Area

(3) Trade and Other Industries

According to the VDC Profiles and result of the cluster workshops, the outmigration seeking the opportunities of employment is an issue for economic development. Because of insufficient employment opportunities, educated population go abroad to engage as migrant workers. Lacking in the productive labor force is the hindrance for the reconstruction activities such as construction works and industries in the future stage of the development.

An underdeveloped logistic network is a hindrance of developing medium and large scale industry in the Gorkha District. Unfortunately, the damage due to the earthquake deteriorated

the conditions. Recovery of the overall physical infrastructure such as the transport network, water supply, electricity, and communication is the primal solution for revitalization of the industrial sector. Additionally, capacity building for sustaining the skilled and productive labour force in the district is the key challenge for the industrial sector.

1.4.5 Institutional Development

(1) Institutional Arrangements and Human Resource Development

In result of the earthquake, National Reconstruction Authority (NRA) has been established and NRA operates District offices to lead reconstruction activities. In addition to NRA District office, the Reconstruction Policy requires to establish District Coordination Committee to coordinate the recovery works. As for disaster risk management, District Emergency Operation Center (DEOC) was established in Gorkha District in January 2016. Therefore, district level needs to handle several newly established agencies to accelerate reconstruction works.

Currently, due to its complex administrative structures at district level and a large number of stakeholders engaging in recovery activities, coordination among agencies has been inefficient. By reflecting the current conditions of recovery activities, District Disaster Management Plan need to be updated especially roles and responsibilities of each agency. The RRNE project conducted Community-based Disaster Risk Management activities at Laprak VDC and turned out no early warning information dissemination system is designated in Disaster Management Plan, so lessons learned from the CBDRM activities needed to be incorporated into Disaster Management Plan.

During emergency response period and recovery period, information transmission to remote areas was the major challenge. Vulnerable population living in remote area tend to be excluded from the relief distribution, public service delivery and other valuable information due to limited capacity of regional government and limited access of public media.

Capacity building of community people for disaster management is a big challenge in Gorkha District. Because of its geographic condition, mountainous communities have high risk of isolation in case of disaster. Rescue activities and relief distribution cannot be reached to such communities when earthquake and landslide devastates the road transport network. In these cases, community people should be self-sustained for certain amount of time by themselves. VDC Office is often understaffed and managed by VDC Secretary with one or two office assistants. Frequent meetings and work away from the VDC makes VDC Secretary unavailable to the local community. Strengthening of the local body such as VDC Office is important to expedite the recovery and reconstruction measures..

1.4.6 DRR and Forest Management

Human and property loss were caused by the earthquake and landslides in Gorkha. In order to avoid future damage of the disaster, improvement of the DRR system at the district level is essential. In addition, the earthquake increased the risk of large-scale landslides in the entire district. Improvement of DRR system at district level and countermeasure to landslide is the issue of the DRR sector.

Currently, due to its complex administrative structures at district level and a large number of stakeholders engaging in recovery activities, coordination among agencies has been inefficient. As for DRR, MOHA is in charge of District level DDRP, and MOFALD is in charge of LDMP. In addition, DWIDP is in charge of water induced disaster and sediment disaster. By reflecting the current conditions of recovery activities, District Disaster Management Plan need to be updated especially roles and responsibilities of each agency and based on the emerging risks of the landslide caused by the earthquake. RRNE project conducted Community-based Disaster Risk Management activities at Laprak VDC and turned out no early warning information dissemination system is designated in Disaster Management Plan and villagers were not aware of who to contact in case of landslide. Therefore, there is a risk that important information is not shared with the related agencies and information transmission takes time.

During emergency response period and recovery period, information transmission to remote areas was the major challenge. Vulnerable population living in remote area tend to be excluded from the relief distribution, public service delivery and other valuable information due to limited capacity of regional government and limited access of public media.

Insufficient capacity of community people for disaster management is a big issue in Gorkha District. Because of its geographic condition, mountainous communities have high risk of isolation in case of disaster. Rescue activities and relief distribution cannot be reached to such communities when earthquake and landslide blocks the road transport network. In these cases, community people should be self-sustained for certain amount of time by themselves. However, the communities at risk are heavily damaged by the earthquake and impoverished. In such communities, community people often cannot afford to think about and spend time for disaster management activities because they have to survive hand-to-mouth especially in the post disaster phase.

As for the forest management, deforestation caused by rapid increase of demand for construction material and fuel is the challenges. Landslide also caused the damage of forest and its recovery is challenging because the landslide uprooted the forest and loosen the soil which makes forestation activities difficult. Moreover, due to economic challenge, forest encroachment prevails in the district. Recovery and protection of the forest resources are the issues regarding to forest sector.

CHAPTER 2 Basic Policy

2.1 Vision

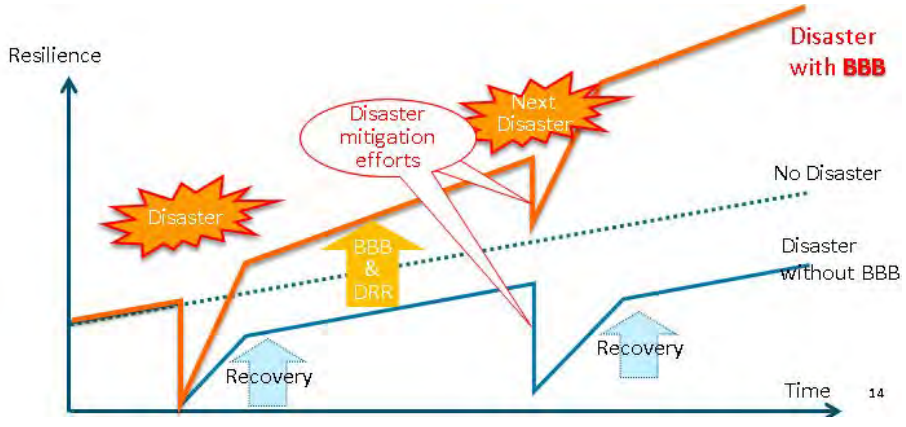
During the Vision workshop in the Gorkha District, participants set the vision as “Beautiful, Equitable and Prosperous Gorkha through Agriculture, Tourism and Resilient Infrastructure”. In order to achieve the vision while achieving the reconstruction from the earthquake, the three major components of Rehabilitation and Recovery vision “Recovery of Daily Life”, “Building Resilient District Structure” and “Recovery and Development of Regional Economy” are indispensable.

2.2 Approach (Build Back Better)

In order to pursue the prosperous, disaster resilient society as a set vision, the RRP applied the approach called “Build Back Better (BBB)”.

BBB is one of the four priority actions of “Sendai Framework for Disaster Risk Reduction (2015-2030)”, adapted in Sendai, Japan 2015, and designed to enhance disaster preparedness for an effective response and to rebuild better in the recovery and rehabilitation phase. To put it differently, learning from past disaster experiences, this concept designs the reconstruction which targets the future onset of disasters by designing and implementing recovery projects which include the viewpoint of disaster management.

The concrete image of the concept of BBB is not only to recover damaged housing and roads to the same standard as before the earthquake, but also to rebuild the district stronger than before the earthquake. In the case of Nepal, a large number of houses were made of stone masonry in mud mortar; if residents rebuild their houses in the same structure, it is reasonable to expect those houses to be heavily damaged in future earthquakes. Therefore, it is recommended to improve the structure to be more seismic-resistant. The concept of BBB implies DRR as an investment for the future development of the country/region. By implementing preventive measures such as building strong housing, roads, public facilities and disaster resilient land use planning, damage from future disasters will be mitigated. This will contribute to future sustainable growth of the economy in the long run.



Source: JICA Expert Team

Figure 2.1 Time-Sequence Concept Diagram of “Build Back Better”

2.2.1 Hazard Map Utilization

The concept of BBB is to introduce and utilize scientific approaches to mitigate the damage of disaster. As a part of JICA RRNE project, the JICA Expert Team created a landslide hazard map for the entire Gorkha District and provided the TOT training sessions to the officers in the disaster affected districts.

These are the major programmes which are introduced in the RRP.

1. Landslide Hazard Assessment and Identification of Hazard Area Evaluation of Land Use and Settlement Area
2. Consideration of Countermeasures and DRR Activities such as Landslide Prevention Infrastructures, Improvement of Lands, and Layout Study of Shelters for Disaster Preparedness etc.
3. Promoting Community Understanding of Landslide Prone Area
4. Detailed Regional Planning, Resettlement Planning of Affected / Landslide Prone Area
5. Consideration of Land Use Restriction / Plan and Building Regulation

Case Study of Laprak VDC, Gorkha District

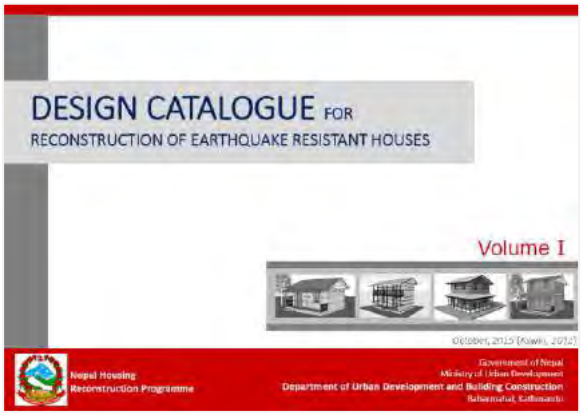
In Laprak VDC in Gorkha District, most of housings were collapsed and people experienced involuntary relocation to the safer upper side of the hill after the earthquake. By the earthquake, 18 persons lost their lives. In addition, there are large cracks on the hill which could be collapsed and affect below areas in the future. JICA Expert Team conducted awareness raising activities in Laprak and instructed them to monitor the cracks to foresee the future landslides.

Approximately 2 years after the earthquake, around 75% people have been returning original village while young households stay at upper side. Beacause their children have to go to schools in upper side area. In addition, an integrated development project for resettlement is under construction on the hill. Although people are recognizing the high risk of the landslide, a number of people will not to move to safer places since they have indigenous, cultural and social linkage in their original lands. Although there are dificcult and complicated problems for reconstruction from the earthquake in Laprak VDC, the landslide hazard map can be used to consider the various countermeasures such as identification of alternative safer sites for agriculture and resettlement nearby the the original village, risk sensitive land use and development of safer vehicle access.

2.2.2 Minimum Requirement for Housing Reconstruction

The result of PDNA indicated that the housing with weak masonry were severely damaged and caused a large number of human loss. Due to lack of a skilled labour force and budget to construct seismic resistant housing, safe housing construction is one of the challenges for rebuilding a resilient society. JICA RRNE Project in cooperation with DUDBC developed the minimum requirement for the housing reconstruction. JICA TPIS-ERP Project provided training to masons in the affected areas and conducted awareness raising activities to the residents about the importance of safe housing reconstruction.

Continuous governmental financial and institutional support is inevitable for the reconstruction of housing in the Gorkha District, especially for those who are living in the remote areas.



Source: Design Catalogue for Reconstruction of Earthquake Resistant Houses: DUDBC,
Guidelines for Housing Reconstruction: JICA Project for the Transitional Project Implementation Support for Emergency Reconstruction Projects

Figure. 2.1 Design Catalogue for Reconstruction of Earthquake Resistant Houses(Left) and Guidelines for Housing Reconstruction(Right)

Source: JICA Project for the Transitional Project Implementation Support for Emergency Reconstruction Projects

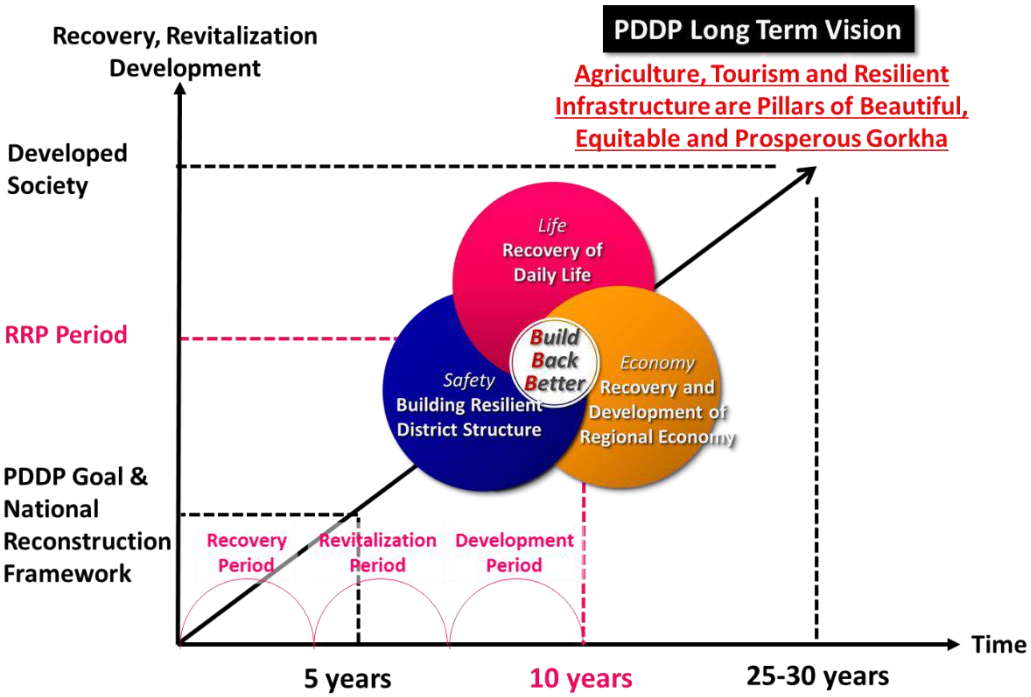
Picture 2.1 House Reconstruction Training for Masons

2.3 Framework of Basic Policy

2.3.1 Basic Policy

The three major policies of the vision are set for the basis of reconstruction for envisaging the vision of restoration. These policies are inter-related as shown in the following figure. In other words, progress of rehabilitation and recovery of one policy.

Figure 2.2 Three Components of the Policies and "Build Back Better"



Source:JICA Project Team

Figure 2.3 Duration and Vision of RRP and PDDP

2.3.2 Recovery of Daily Life

The “Recovery of Daily Life” focuses on getting people’s daily lives back to normal and developing a more resilient environment of their lives. As a large number of people lost their houses, the environment of daily life in which people can live in peace should be recovered on a priority basis including housing reconstruction. At the same time, it is essential in the rehabilitation and recovery process to consider the concept of BBB and aim for a more resilient society in the district. Learning from the experience of the earthquake, appropriate land use to avoid disaster–prone areas should be considered to mitigate the loss and damage of human lives.

A large number of people lost their income source because of physical damage of the earthquake and the regression of industry, such as the tourism sector. In addition to livelihood, the earthquake also affected the health and medical sector, social welfare and education because of the damage to public facilities. These facilities are essential to secure basic human needs, and so a well-designed recovery plan should be formulated. The earthquake severely affected the vulnerable populations such as households headed by women, poor people, and PWD who need support from the public sector to recover their daily lives.

2.3.3 Building Resilient District Structure

“Building Resilient District Structure” pursues safety against disasters by coping with the tangible measures and intangible measures. For tangible measures, the recovery of damaged public infrastructures such as roads, irrigation facilities and hydro power plants should be prioritized since these are the basis of establishing a disaster-resilient society. As for intangible measures, enhancement of the capacity of DRR at the governmental level and community level is indispensable. A coordination mechanism should be enhanced and the roles and responsibilities for disaster management of related agencies need to be clarified. Moreover, as the people in the community are the first responders to a disaster, it is desirable to strengthen community-based disaster risk management (CBDRM) activities based on lessons learned from the earthquake.

2.3.4 Recovery and Development of Regional Economy

The “Recovery and Development of Regional Economy” pursues the revitalization and sustainable growth of the regional economy damaged by the earthquake. In the Gorkha District, the main source of revenue is agriculture, livestock and tourism. All of these sectors take several years to recover. To pursue sustainable economic growth, it is necessary to develop a medium to long term plan in connection with other development plans such as urban planning and land use planning.

CHAPTER 3 RECOVERY OF DAILY LIFE

3.1 Introduction

As mentioned in the previous chapter, recovery of the daily life such as the source of livelihood, public services are essential for all the population in Gorkha. In order to attract a productive population who are an important component of the development, assuring the source of livelihood and public services are the key policies.

Among these components of the daily life, housing reconstruction is the priority and long-process work since this includes the relocation and resettlement for those who are living in highly landslide prone areas. Securing the alternative livelihood for those who were resettled needs to be targeted to recover the daily lives. Vulnerable populations such as women, children, PWD, and marginalized ethnic groups are adversely affected by the current damage of the earthquake, such as damage of the public service and social welfare facilities. Care for these groups is another priority in terms of the recovery of daily life. In order to assure the resumption of public services, reconstruction and restoration of the public buildings should be implemented at the early stage of the reconstruction.

Therefore, the RRP prioritizes the programmes below not only for recovery but also as a fundamental basis of the regional development and habitability for the residents.

Summary of Recovery of Daily Life

Policy	Program	Project
Recovery of Daily Life	**Reconstruction of Residential Environment**	● Rebuilding homes of disaster victims ● Seismic-resistant measures for housing ● Municipality/VDC RRP and relocation ● Water supply restoration
	Restoration of Livelihood	● Livelihood diversification ● Livelihood assistance for vulnerable population
	Recovery and Enhancement of Health and Medical Service	● Medical facility recovery and vitalization ● Healthcare services improvement ● Collaboration among health, medical and social welfare ● Support for injured victims
	Recovery and Enhancement of Social Welfare Service	● Care for vulnerable/marginalized earthquake victims ● Support women's groups activities ● Social welfare for elderly people
	Recovery and Revitalization of Education	● Reconstruction to seismic resistant school ● Promotion of DRR education ● Care for affected students

3.2 Reconstruction of Residential Environment

A large number of houses were seriously damaged from the earthquake. There are still many people who are forced to live in evacuation spaces or temporary houses. Early reconstruction of a safer residential environment is necessary for the recovery of life and livelihood. Especially financial support for reconstruction should be prioritized since people living in disaster affected

areas have pointed out financial issues as one of the hindrances for early reconstruction. In addition, the affected water supply shall be recovered and the development of water resources shall be promoted.

Since a large number of people are still living in the disaster prone areas, proper group relocation to safer areas shall be considered in order to avoid a secondary disaster. Access to the information on housing reconstruction should be deliberated considering high illiteracy rate of the elderly population and marginalized population, and the geographical difficulties of people living in mountainous areas.

3.2.1 Supporting Own Reconstruction of Housing

At the national level, NRA is supporting the housing reconstruction by providing compensation and loans for the earthquake victims who intend to reconstruct their house with one of the required design standards introduced by DUDBC. The challenges for the housing reconstruction is the high material cost due to a poor transport network in the remote areas. Also, the insufficient number of skilled masons is a hindrance for immediate housing reconstruction. In order to cope with housing reconstruction the following actions need to be implemented.

(1) Improve the Access to Information about Governmental Housing Reconstruction, Especially for Isolated and Marginalized Communities

Even though the NRA makes efforts on promoting the governmental guidelines, certain characteristics of people such as less educated people, marginalized population and people living in remote areas do not have enough access to such information. In order to reach to the necessary population, understandable booklets or brochures related to the financial support guideline of NRA should be prepared at the early stage of recovery and workshops or orientation programmes about the guideline is essential. During the process, a special orientation programme for the isolated and marginalized communities in each ward should be considered.

(2) Financial Support for Housing Reconstruction

In the Gorkha District, a large number of housing damaged by the earthquake cannot be eligible for the financial support for housing reconstruction due to the condition of the damage and other reasons. In order to be a benefit for the “grievance population”, further damage surveys can be conducted to identify the missing beneficiaries. Currently, the support for such a population has not yet been decided by NRA. In cooperation with NRA, DDC takes the lead to develop the mechanism for supporting the missing beneficiaries, such as financial support, and VDC secretaries in each affected VDC play roles for identifying the missing beneficiaries and enlisting them. It is desirable to consider extra financial scheme for vulnerable household who cannot reconstruct own housings by the government subsidies.

(3) Technical Support for Evaluation and Monitoring of Housing Reconstruction

After developing the financial support scheme for the beneficiaries, NRA and DUDBC are responsible for the technical support for the housing reconstruction. In order to secure the qualified engineer and technical personnel, they are also responsible for the formulation of the framework for dispatching the technical personnel at VDCs/Municipality level. District level agencies should be responsible for the selection of experts and dispatch them to the VDCs/Municipality.

Early housing reconstruction requires procurement of affordable construction material as well as proper technical personnel. Construction of the logistic hubs at the VDCs/Municipality level is the priority for the early recovery phase and remuneration of necessary technical staff should be secured for six years.

(4) Establishment of Local Resource and Logistic Hubs for Housing Reconstruction

The high cost of construction material is a common challenge in the entire Gorkha District. At the early stage of the housing reconstruction, the RRP should set three logistic resource and logistic hubs as the target for smooth implementation of the housing reconstruction. By utilizing the resource maps and hazard maps prepared by the JICA RRNE Project, NRA is responsible for selecting the location and number of resource centres based on the result of the survey. Design, construction, and management of the hubs and resource centres will be implemented by the NRA district level office and DUDBC.

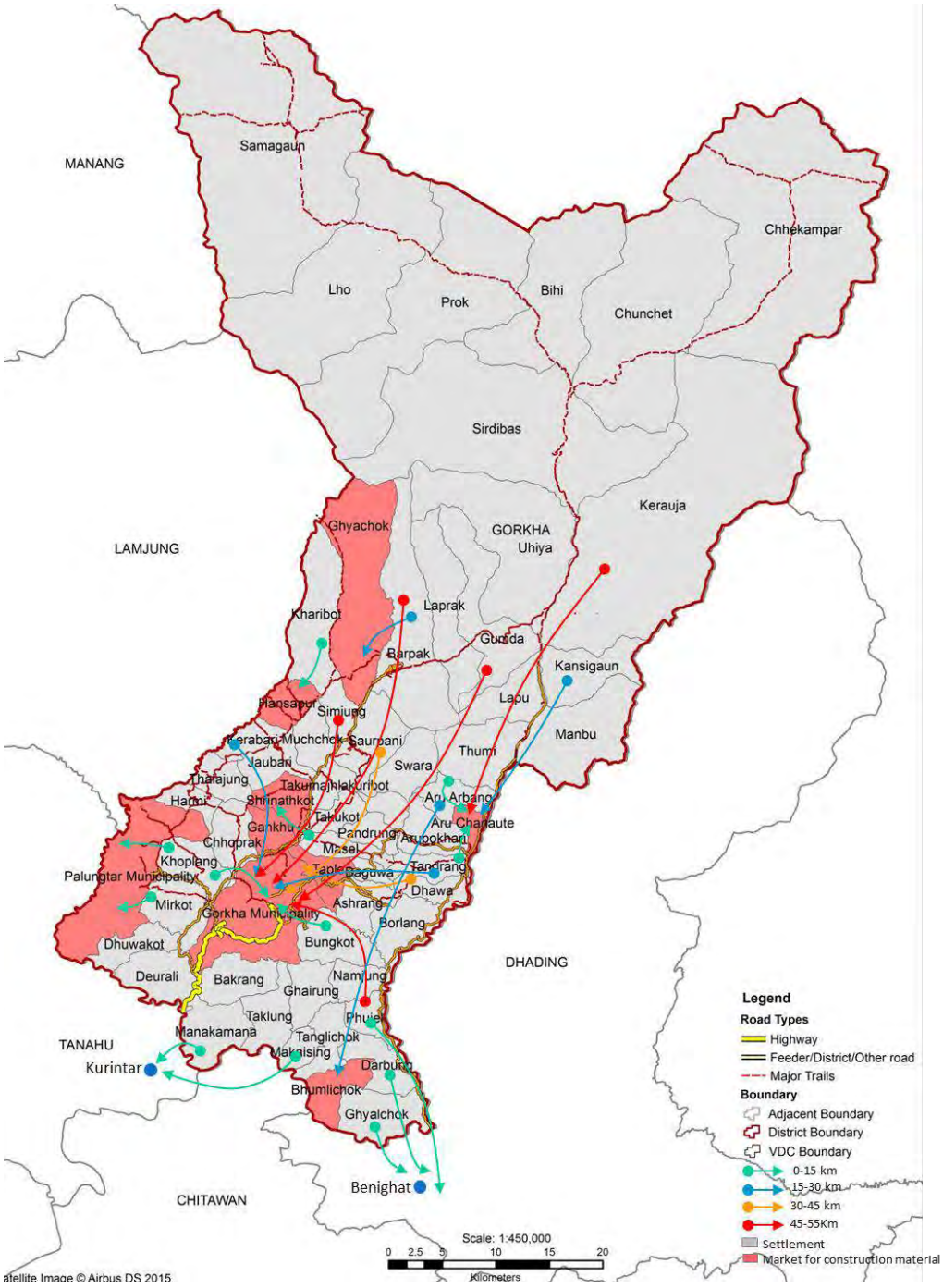
(5) Development of Housing Reconstruction Community

The formation of a house reconstruction group consisting of community people with local masons which is designed to develop the mutual assistance within the community is essential. The results of the social survey and result of the cluster workshops indicated that housing reconstruction is a challenge for households headed by women and elderly people due to a lack in labour force and proper skills for construction. These community groups provide employment opportunities for the trained masons within the community and facilitate the monitoring of the housing reconstruction.

(6) Support for Procuring Affordable and Good Quality Construction Material

Supply of construction materials can be addressed by supporting the private sector (in cooperation with District Chamber of Commerce and Industry) to establish a construction material supply shop/dealer with fair prices of construction material. The high cost of construction materials because of poor transportation and a logistics network is one of the key challenges for promoting rehabilitation and recovery in the district. The following figure indicates the nearest market for construction materials from each VDC based on the questionnaire survey.

According to the survey result, many VDCs are procuring materials at Gorkha Municipality. Though it takes long time, Laprak, Gumba and Simjung which are located in the central area are procuring materials in Gorkha Municipality. In the western area of the district, Palungtar has a construction material market and in the eastern side, there is a material maeket in Aru Chanaute. Since many VDCs are obliged to procure construction materials in remote markets by using seasonal roads, the availability of construction materials should be improved in consideration of establishing local resources and logistic hubs, and developing the road network. In order to reduce the time and cost for the transportation, identification of material supply shops/dealer locations and facilitation for site development should be considered. The information and proper price should be open to residents and contractors. In order to supply the material with fair price, control of artificial shortage of material such as black marketing control is essential. Monitoring and punishment for such violations should be considered.



Source: Questionnaire Survey for VDCs, 2016

Figure. 3.1 The Nearest Market for Construction Material from each VDC

(7) Provision of Temporary Houses for Vulnerable People as Social Welfare

The current scheme of housing reconstruction mainly supports rebuilding the housing with financial assistance. Since this scheme utilizes loans, for those who cannot repay the loan such as households of elderly people, poor economic conditions and people with disabilities should have temporary housing implemented as social welfare. The eligibility criteria and prioritization of the residents need to be considered and community building for the residents of temporary housings is essential to restore the daily lives of the newly moved beneficiaries. The function during the

normal time in such temporary housing should be considered to induce the incentive to construct the facilities.

(8) Implementation of Masons Training for Housing Reconstruction

In order to effectively train the skilled masons, the training design (training course, target, schedule) should be developed. Since various DPs are technically and financially supporting the training, NRA at the district level and DUDBC should coordinate among stakeholders to reach the entire district. The table below is the programme for mason training implemented by JICA TPIS-ERP.

Table 3.1 Programme for stone masonry training implemented by JICA TPIS-ERP

	Item	Rural	Urban
Theory	Earthquake Basic and Preparedness	Common	Common
	Theory on the construction of Slab, Stonecrete and Block	Common	Common
	Site Selection	Common	Common
	Building Structures, Shapes	Common	Common
	Quality of Construction and Construction Materials	Common	Common
	Theory on Construction Technology of RCC Frame Structure	Basic consideration for Earthquake resistant RCC structure	Focused on all components of RCC frame structure including slab and staircase also in details.
	Theory on Load Bearing Masonry Construction Technology	Details on Brick and stone masonry	Not more about stone masonry
	Wooden and Bamboo Building Construction Technology	Common	Common
	Theory on Retrofitting	Common (Intro.)	Common (Introduction)
	Alternative Construction Materials and sustainable development	Common	Common
	Environment and Building Construction	Common	Common
	Video Show: Shake Table	Common	Common
	National Building Code and role of Masons	Common	Common
	JICA Session (Manual for Masons and Design Catalogue)	Common	Common
Practical	Exercise on the construction of Slab, Stone Crete and Block	Common	Common
	Layout Exercise	Focused on Stone and brick masonry	Focused on RCC Frame and Brick Masonry
	Testing of Quality of Construction Materials (Sand, Brick, Cement, Reinforcement)	Common	Common
	Exercise of Construction Technology of RCC Frame Structure	No	Yes
	Exercise on Staircase Construction Technology	No	Yes
	Exercise on Construction Technology of Slab and Projection	No	Yes
	Briefing of RCC exercise	No	Yes
	Exercise of Load Bearing Masonry Construction Technology	Both stone and brick masonry (both cement and mud mortar)	Brick masonry with cement mortar only
	Description of Load Bearing Structure and Minimum Requirements	Both stone and brick masonry (both cement and mud mortar)	Brick masonry with cement mortar only
	Exercise on connecting wall with floor and wooden truss	Yes	No
	Testing of Slab, Brick and Block	Common	Common

Source : JICA TPIS-ERP

3.2.2 Seismic Resistant and Safety of Houses and Buildings

In relation to the housing reconstruction policies, housing and building construction with seismic resistance shall be supported for the possibility of future earthquakes by implementing the following items.

(1) Development of Capacity and Public Awareness for Seismic Resistant Houses

As for understanding the importance of seismic resistant buildings, residents in the affected areas do not have enough knowledge about safer construction methods. Showing the actual seismic resistant model building is effective for better understanding the importance of safer construction. Since some parts of the housing construction is done by the residents, distribution of posters, brochures, pamphlets, books on design and construction methods and workshops to raise the awareness of the residents are necessary.

QIPs-01 Construction of NRA Resource Centre (Construction Training Centre) in Bungkot VDC

Source: JICA Expert Team, QIPs

Figure. 3.2 Construction of NRA Resource Centre (Construction Training Centre) in Bungkot VDC

(2) Application of National Building Code (NBC), Enforcement of Building Permission and Inspection System

JICA RRNE Project and DUDBC updated the NBC for reconstruction of seismic resistant housing and its application to the actual construction is a challenge for housing reconstruction. A mechanism for building permission and inspection at District, Municipality and VDC officials and adoption of E-BPS (Electronic Building Permit System) should be introduced to abide by the NBC for both public and private housing and buildings.

(3) Dissemination on Earthquake Resilient Building Knowledge and Techniques

Earthquake affected populations living in isolated and marginalized communities do not have access to the knowledge of safer construction. In order to reach the communities, NRA and DUDBC are responsible to hold workshops at each ward level to disseminate earthquake resilient building knowledge and techniques, focusing on isolated and marginalized communities.

3.2.3 Municipality/VDC Rehabilitation and Recovery Planning and Group Relocation

By referring to the district level RRP, it is essential to formulate the Municipality/VDC RRP which includes area planning such as group relocation in the disaster prone communities. NRA(DL-PIU) DUDBC Division Office in cooperation with each VDC/Municipality are responsible for formulating the plan. The district level should provide technical support to each VDC/Municipality such as providing the hazard maps. When NRA implements the group relocation, the district level plays the role to identify the damage conditions and current condition of voluntary relocation.

(1) Municipality/VDC Rehabilitation and Recovery Planning

The RRP is formulated in line with formulation of PDDP in order to assure the legitimacy of its implementation and budget arrangement as a long-term plan. The methodology is also applicable to Municipality/VDC level to formulate the RRP in line with the development plan. District level stakeholders for formulating RRP such as NRA, DDC, line agencies and development partners should support the RRP formulation at the Municipality/VDC level. Necessary actions for the formulation are as follows:

- Establish the framework for rehabilitation and recovery planning in each Municipality/VDC
- Consideration of Municipality/VDC rehabilitation and recovery planning among various stakeholder including community people, affected people and vulnerable people
- Consensus building on rehabilitation and recovery planning in each Municipality/VDC
- Merging the formulated plan into Municipality/VDC development plan

(2) Consideration of Group Relocation and Integrated Settlement Development

The communities which were displaced by the earthquake have to be resettled on their own land or in areas appropriate for resettlement. The relocation sites should be deliberately investigated considering the risk of landslides, source of livelihood such as arable lands, and water sources. The process includes the identification of hazardous areas by damage conditions, field survey and analysis, landslide hazard map and current residential areas, etc. Because of the land ownership and livelihood sources, it is observed that communities are still residing and cultivating the land in the landslide prone areas. Before conducing a group relocation, it is desirable to consider several other countermeasures, such as preventing landslides, development of early warning system, and the identification and development of evacuation sites and routes. In case the above mentioned countermeasures are not appropriate, or group relocation is preferable, project on relocation shall be decided.

Source: JICA Expert Team

Figure 3.1 Example of site investigation in the landslide prone areas of Laprak VDC

(3) Preparation of Group Relocation Plan and Integrated Settlement Development Plan

Once the group relocation is inevitable, socio-environmental conditions after resettlement should be considered. This includes land use management with the acquirement of residential sites, land purchase of relocation promoting area, etc. At that time, through extensive consultation and workshops, adequate consensus building process with stakeholders, especially affected people, shall be taken. After these arrangements, the candidate site entails site development and construction of hard infrastructures.

(4) Support for Implementation of Group Relocations in Cooperation with Central Government

Some integrated settlement development projects are ongoing with the support of partner organizations. However, the capacity of developed settlement is not sufficient for people displaced by the earthquake and landslides and a lot of people are still living in vulnerable temporary houses. In addition, some projects are facing hindrances in both the planning and implementation stages. Therefore, when the national government decided to implement relocation, the district should assist in land acquisition for the residents and develop the residential areas.

Source: JICA Project Team

Picture 3.1 Temporary Settlement Area of Displaced People in Laprak VDC

Source: JICA Project Team

Picture 3.2 Integrated Settlement Development Supported by NRNA and NRA in Laprak VDC

3.2.4 Recovery of Water Supply of Affected Populations

Water supply is one of the most critical issues of the damage by the earthquake. Participants of the cluster workshops, results of the social surveys, and the VDC profile mentioned that water sources are imminent challenges.

Because of the earthquake, water sources dried up, or the stream of the water changed, so the agricultural sector was severely affected and residents suffer from a lack of clean drinking water. Fetching the water from remote areas deprives the residents from engaging economic in activities, and interferes in school attendance for children.

(1) Recovery of Water Supply Facilities

In the Gorkha district, lack of the drinking water facilities and supply is one of the most serious problem especially in mountain areas. The recovery of water supply facilities should be prioritized among the infrastructure since water resources is the staple for daily life. In Gorkha district, enhancement of water supply in urban areas such as Gorkha Bazar and Palungtar is urgent.

(2) Investigate the Depletion of Water Sources and Promote Water Resource development

The depletion of water sources and change of water streams prevail all over the district. In order to redevelop water supply, site investigation for new water sources and alternative water sources should be conducted. In the long term, new water supply projects should be formulated based on the result of the survey.

3.2.5 Early Treatment of Disaster Waste and Debris

At the early stage of recovery, disaster waste and debris in the earthquake shall be disposed properly and immediately.

(1) Disposal of Disaster Waste and Debris Properly (implementation of collect and disposal)

Since almost two years have passed since the earthquake, most of the disaster debris has been cleared. A large number of eligible beneficiaries of housing support just started the housing reconstruction, and the amount of the debris will temporally increase. NRA is responsible for the clearance of debris including financial support for those who cannot afford to demolish the housing. Districts and VDC should identify the collapsing houses need to be demolished but have not yet demolished due to financial constraint and formulate debris management plans in coordination with NRA.

(2) Promotion of Recycle for Utilize Reconstruction Activities

Proper recycle of the materials can save the construction cost, although misuse of the material weakens the structure of the housing/building. In order to promote the effective use of the material, brochures of reuse of materials in household or community level should be developed. Local resource centres for the construction material should include available recycle construction materials.

(3) Support of Building Demolition

The local government in collaboration with NRA is responsible for supporting the building demolition. The items for building demolition includes the establishment of community groups for the support of building demolition especially for vulnerable people such as single women,

those with disabilities and the elderly. Local governments should develop schemes for supporting the above mentioned activities. Building demolition equipment should be provided at community level to avoid the injuries by the unsafe demolitions.

3.3 Restoration of Livelihood

Disaster affected people suffer from the loss of income due to the destruction of livelihood equipment and employment opportunities. Economic problems slow down the overall reconstruction activities. The scarcity of water resources is a hindrance of livelihood improvement in terms of lessening subsistence agricultural products and is time consuming for those fetching water. For the needs for short term recovery, support for the recovery of livelihood and generating income sources such as cash for work should be considered. For medium to long term, skill development for increasing the sources of income and production should be considered. The following policies and actions should be promoted for the restoration of livelihood.

3.3.1 Diversification of Source of Livelihood

Populations affected by the earthquake lost their livelihoods because of the collapse of housing, water depletion, landslides, physical injuries and various reasons. Considering the economic development strategy, increasing the sources of livelihood for the affected population strengthens the resilience of the society. The following items are suggested income diversification measures.

(1) Promotion of Cash-for-work on Reconstruction Projects

In order to generate income for the affected population who lost their livelihood by the earthquake, cash-for-work is a desirable measure. In order to promote the implementation of cash-for-work, a policy for the construction of public/community infrastructures for both government and non-government organizations should be established.

Source: JICA Project Team

Picture 3.3 Image of Cash for Work (Rehabilitation of Road) in Barpak VDC

(2) Expanding Livelihood Opportunities for Farmers

In the Gorkha District, a majority of the population are engaged in agricultural activities and farmers are affected by the earthquake such as water source deficiency and landslides. Farmers

also lost livestock due to the collapse of livestock sheds and were force to sell the livestock in order to meet the urgent needs of repairing houses/obtain foods. Therefore, at the early stage of recovery, the following activities are proposed to expand the livelihood opportunities to affected farmers.

- Seed and fertilizer distribution to poor and vulnerable communities
- Selection of poor and vulnerable community on the basis of agreed framework
- Support for the recovery of livestock (Incentive support and livestock distribution)
- Formation of revolving funds to support Cooperatives
- Recovery and development of base facilities such as agro-collection centre
- Distribution of fertilizers through Agro-Cooperatives
- Support in purchasing organic fertilizer
- Construction and operation of seed collection centre
- Promotion of commercial farming (for selling)
- Establishment and development of nursery for improved horticulture and farming
- Operation of nursery through farmers groups / cooperatives

QIPs-19 Livelihood Improvement Project (Targeting Local Women Group), Barpak
QIPs-20 Vegetable Cultivation Technique (Targeting Local Women Group), Khoplang, Mirkot, Simjungm, Muchok, Kharibot, Barpak
QIPs-21 Improvement of Maize Farming Practices, Khoplang, Mirkot, Simjungm


Source: JICA RRNE Project QIPs

Picture 3.1 Hand Over and Goat Rearing Training in Barpak


Source: JICA RRNE Project QIPs

Picture 3.2 Livelihood Improvement Project Targeting Local Women Group

(3) Vocational Training to Expand Employment Opportunities for Reconstruction Work

In order to diversify the source of income, additional vocational training sessions are required. Construction/improvement of the training facilities and ToT for the lecturers of the vocational training courses should be implemented. The course of the training will be investigated based on the needs of

local industries and needs for reconstruction such as electricity, plumbing and so on. In addition, it is necessary to regularize the existing trainings in the training centers and provide special trainings based on the need of the areas.

(4) Human Resource Development for Expansion of Livelihood Opportunities

After construction of the training facilities and training of trainers, livelihood training programmes should be implemented by prioritizing the marginalized population. Suggested topics of the training sessions are as follows:

- Technological transfer (implementing farmers exchange programmes/farm visits etc.)
- Agriculture cultivation technique improvement training for farmers
- Technique for animal husbandry (cattle, goat, sheep, chicken rearing)
- Training for local tourism industry (hotel, lodge, restaurant, visitor centre)
- Support for branding and marketing of local products.

(5) Enhancement of Farmers' Accessibility to the Market and Distribution System

The limited access for farmers to the markets and an underdeveloped logistic system keeps the price of agricultural commodities higher. Some products are more expensive than importing from India. In order to secure the access to the market, in addition to road transport, a farmers' chain in cooperative model (Formulation of framework) should be formed. Conducting an expo for local products on the municipal level regularly is also effective.

(6) Promotion of Traditional Craftsmanship and Use of Biodiversity

Due to the food aid from outside sources during the emergency response period, prevention of the extinction of local breeds, especially after the earthquake, is a challenge. The establishment of a section for local seed storage and distribution should be considered. While diversifying the source of income by introducing new technology, the promotion and protection of traditional craftsmanship and technologies should be considered to conserve the cultural features in each area.

3.3.2 Providing Livelihood Assistance for the Vulnerable Population

The earthquake generated vulnerable populations of not only women, children and PWD but also those who were forced to resettle due to the landslides. Special assistance for those who became mentally ill and physically injured should be considered.

(1) Consideration of Employment Promoting Programme for Supporting Affected Families

The fact-finding study is necessary for the vulnerable population since these populations are isolated and their voices are weaker than other groups of population. Based on the current conditions and needs, an employment promotion programme, such as vocational training e.g., in-house work, can be considered for widows, and persons with mental illness.

(2) Expansion of Livelihood Opportunities at Relocation Areas

A large number of populations in Gorkha are either voluntarily or involuntarily relocated because of the earthquake and landslides. For those who are engaging in agriculture and cottage industries ended up losing their source of livelihood due to relocation. In the remote,

mountainous areas, it is difficult to secure the sufficient land for residents and agriculture. In order to grow the staple foods, development of agriculture land (using a cash-for-work scheme) should be implemented. Formulating the development projects in the relocation sites also contributes to create jobs for those who are relocated.

3.4 Recovery and Enhancement of Health and Medical Services

Many buildings and facilities for health and medical services were damaged by the earthquake. The deterioration of the living environment worsens the health conditions of affected populations such as children, women and elderly populations. Not only should the reconstruction of existing facilities and functions be conducted, but also psychological illness arising from the earthquake be addressed. The following policies and actions should be promoted for the enhancement of health and medical services.

3.4.1 Recovery and Enhancement of Medical Service Facilities

Insufficient medical service facilities were pointed out during the Cluster workshops. People often have to go to Gorkha or Amppipal for better medical services. Medical service is essential as a basis of the lives of the people, and a long-term strategy for enhancing the medical services should be considered.

(1) Recovery of Hospital, Health Centre and Health Post

During the recovery phase, reconstruction of the District Hospital, Ayurved Health Centres/Clinics, PHC (Primary Health Centre) and Health Posts considering seismic measures should be implemented to restore the basic services immediately. For improving the public health, reconstruction and recovery of the Out Reach Clinic and EPI (Expanded Programme on Immunization) Clinics should be prioritized.

QIPs-03 Strengthening of Health and Hygiene through Reconstruction of Amppipal Hospital, Palungtar Municipality, Gorkha
QIPs-14 Recovery of Social Service for Community Health and Social Welfare through Reconstruction of Health Post at Barpak VDC

Source: JICA Expert Team, QIPs

Figure. 3.3 Strengthening of Health and Hygiene through Reconstruction of Amppipal Hospital in Palungtar Municipality

(2) Seismic Diagnosis and Seismic Resistant Measures of Hospital, Health Centre and Health Post

Maintenance and repair of hospitals, health posts/ PHCs with seismic retrofitting are essential in order to avoid damage of the buildings in case of aftershocks during the recovery phase and

revitalization phase. In order to be one of the hubs during the disaster response, seismic diagnosis and retrofitting of intact health posts should be conducted.

3.4.2 Enhancement of Health Care Services

Residents in the Gorkha District point out the insufficient medical services especially in rural areas. Not only rebuilding the medical facilities is needed, but the improvement of the medical services is essential in the short and medium term development in order to retain the productive population in the district.

(1) Provision of Health Care Services to the Pregnant Women, Child Delivery and New-Born Babies

Among the healthcare services, reproductive health service is a priority in the early to medium phase of the recovery because pregnant women and children are susceptible to various diseases. The following items are the actions to be taken regarding to the improvement of reproductive health.

- Enhancement of birthing centres
- Special support programme for safe maternity
- Refreshment training to all female health volunteer for handling delivery and safe maternity
- Distribution of warm cloth/bag for new borne children
- Nutrition health support to new mothers
- Reconstruction and recovery of existing Birthing Centres (BCs)
- Expansion and development of new Birthing Centres
- Establishment and development of Nutrition Rehabilitation Centre in Hospital / PHCs
- Nutritional rehabilitation to newly delivered women and teach about feeding techniques

(2) Enhancement of ORC and EPI Clinics

MoH is currently implementing the programme for the construction and operation of ORC/ EPI Clinics ensuring seismic resistance. 258 clinics are targeted in the entire Gorkha District. The trainings to the health workers on preventive measures for non-communicable disease is essential along with the improvement of the facilities.

(3) Establishment of Mental Health Care Help Desk for Victims

In order to care for the traumatized victims of the earthquake, MoH is implementing a project for the improvement of the Mental Health care section in district hospitals and three Primal Health Centres (PHCs). Along with improving the function of these hospitals, procurement of medicine and specialists in mental healthcare should be secured.

(4) Provision of Health Care Service for Vulnerable People and Deprived/Marginalized People

Even though records of injured people are 1,283 people, the actual number of the injured persons is probably more than on the record because people living in marginalized/remote areas could not go to a hospital. A special outreach to that population is necessary, such as a mobile health clinic.

3.4.3 Collaboration of Health, Medical and Social Welfare Services

Health, medical and social welfare shall be cooperated in order to proceed with effective activities at the time of disaster. This collaboration is also effective in terms of the treatment of the victims of gender-based violence because the hospital accepts the injured women and became a hub for further social protection services.

(1) Establishment of Health, Medical and Social Welfare Network (development of database etc.)

The lack of medical records is a huge hindrance in understanding the condition and formulating a future health development plan. Development of a medical database (Medical stock, health care services, disease record, patient record etc.) should be prioritized for future development planning. And strengthening of HMIS (Heals Management Information System) is also important.

3.4.4 Support for Victims Who were Seriously Injured by the Earthquake

Support for the seriously injured victims by the earthquake should be promoted since these populations suffer from medical expenses and loss of income sources (in the case of an adult).

(1) Medical and Health Support to the Seriously Injured Victims by the Earthquake

The people seriously injured by the earthquake need continuous support. Medical and health support to seriously injured victims by the earthquake for regular check-ups should be planned in the short to medium term.

(2) Rehabilitation Support for Needy Victims

For the physically impaired victims, rehabilitation support for those needy victims such as providing the necessary equipment and training to regain mobility. (Wheelchair/ Equipment).

3.5 Recovery and Enhancement of Social Welfare Services

Social welfare services are stagnated due to the destruction of related government facilities. The earthquake severely affected vulnerable people and deprived/marginalized people. Countermeasures for coping with the issues should be considered. The following policies should be promoted for the enhancement of social welfare services.

3.5.1 Recovery and Enhancement of Social Welfare Services for Affected Vulnerable People

Social welfare services for vulnerable people and deprived/marginalized people shall be promoted by implementing the following items.

(1) Access to Information Regarding to Social Welfare for Vulnerable People

Special attention should be paid to the vulnerable population who do not have access to social welfare due to their educational level, location and poor telecommunications available to them. Methodology to inform the available services should be investigated such as pamphlets mainly composed of pictures and outreaching at the ward level. The target groups of these activities are single women, orphaned children, elderly citizens, people with disabilities and deprived/marginalized people.

(2) Recovery and Development of Livelihood Supporting Function for Vulnerable People

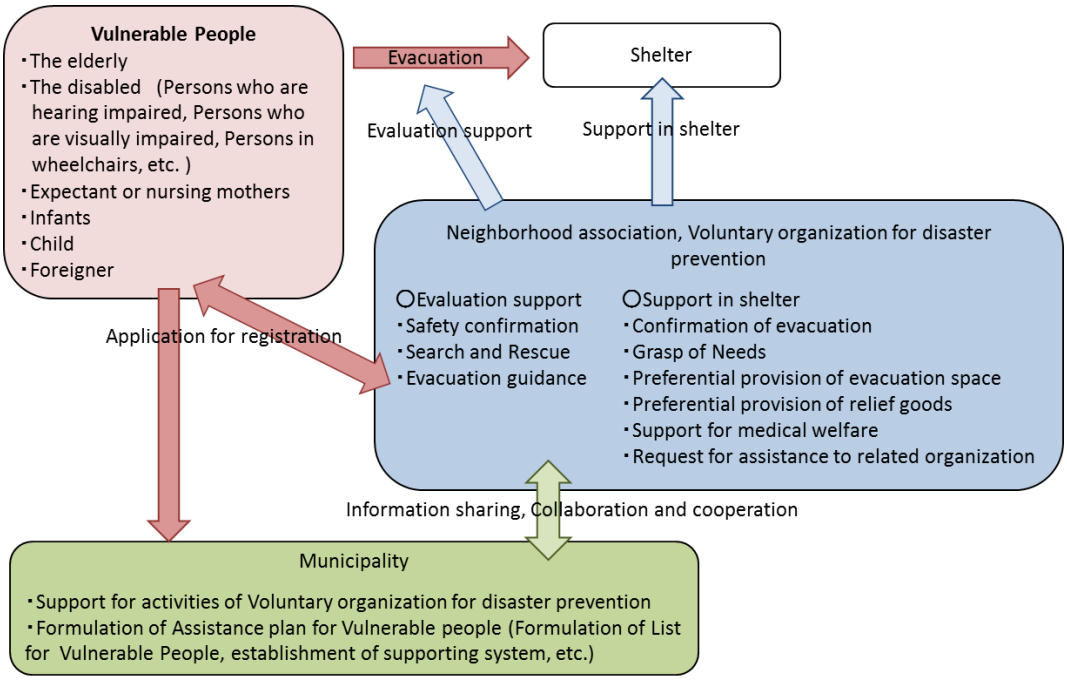
A one stop service for various social welfare services is beneficial for the vulnerable population who has multiple challenges. Establishment of the livelihood supporting desk, supporting facilities and base with which the affected population can consult with are necessary. The table below is the example of help desk established in Japan during Great East Japan Earthquake.

Table 3.1 Example of Various Help Desk

(Example of Fukushima Prefecture, Damaged Area of the Great East Japan Earthquake, Japan)

Help Desk (Consultation Service) for;	
1. Housing	6. Management of Labour
2. Nuclear Radiation	7. Health, Child Rearing and Mother's Milk
3. Nuclear Damage Compensation	8. Volunteer
4. Living Expenses	9. Missing
5. Agricultural Forestry Industries and Fishers	10. Prefectural Administration

Source: Website on Fukushima prefecture, http://www.pref.fukushima.lg.jp/sec/01010d/shinsai-sodanmadoguchi.html#08 (Edited by JICA Project for Assessment of Earthquake Disaster Risk for the Kathmandu Valley)



Source: General Plan of Evacuation Support for Vulnerable People in Ogori City, Japan (Edited by JICA Project for Assessment of Earthquake Disaster Risk for the Kathmandu Valley)

Figure. 3.4 Image of Support for Vulnerable People (Example of Japan)

(3) Supporting Job Training for Expanding Job Opportunities for Vulnerable People

A help desk for livelihood and help desk supporting facilities should be established considering the situation of the vulnerable people. Connecting to the help desk for the social welfare is desirable to be a one-stop for the affected population.

(4) Promoting Participation of Vulnerable People for Policy Making

Vulnerable people are the neediest population who needs the social welfare from the government. In order to assure the proper social welfare services, ensuring the participation of all levels of people in policy making is essential. For example, while formulating the VDC RRP, ensuring bottom-up approach in local policy making should be pursued.

3.5.2 Support Activities of Women's Groups

Because a large number of young male population migrated to foreign countries or Kathmandu, women in the communities are actually supporting the household. Activities of women's groups shall be supported for secure livelihood.

(1) Recovery and Development of Facilities for Supporting Livelihood of Women's Groups

The earthquake devastated public buildings and community buildings which women's groups previously utilized. The condition makes women's group inactive and undesirable for empowering the women in the community. Reconstruction of such community building in combination with activation of women groups is beneficial for women in the communities.

QIPs-13 Recovery of Social Service for Women and Social Welfare through Reconstruction of Women Community Centre at Barpak VDC, Gorkha

(2) Support Activities of Women's Groups

Women in the Gorkha District mainly engage in subsistence agriculture, small-scale livestock and cottage industry. These sectors were affected by the earthquake due to the collapse of the house which was the workplace, and damage by landslide and water deficiency, and damage of livestock cottages. In order to regain the source of livelihood for women, the following activities should be implemented in parallel to the reconstruction of the facilities for women's groups.

- Understanding of the situation and issues of the women's group for the employment opportunity
- Strengthening and establishment of women's group in ward level (Each VDC and Municipalities)
- Establishment of network of Women's Group (Formation of District Level Network)
  Providing employment promoting programmes (skill development support) for women groups
- Providing financial support for women's group activities(micro finance)
- Ensuring meaningful participation of women in each level

QIPs-18 Organizing and Strengthening of Women Group, Barpak VDC, Gorkha

Source: JICA RRNE Project QIPs

Picture 3.3 Establishment and Enhancement of Women Group at Barpak VDC

3.5.3 Enhancement of Social Welfare Services for Elder People

Elderly people are especially vulnerable in the post-disaster phase because of insufficient healthcare facilities and financial support to reconstruct their daily lives, such as a low interest loan. The following items should be implemented for the benefit of the elderly population.

(1) Support Livelihood of Elderly People

Consideration of special support for elderly people such as providing vocational training of non-labour skill improvement training, and enhancement of Job-matching should be considered

as well as cash transfers for those who cannot work as an intensive labourer. Housing arrangement should be also considered because households headed by an elderly person do not have access to loans for housing reconstruction. Construction of eldely home with recretional facilities and rehabilitation support for single elderly persons especially who lost the relatives by the earthquake should also be considered as a social welfare.

3.6 Recovery and Revitalization of Education

As for educational services, most of schools were damaged in the earthquake. It is necessary to recover damaged schools, improve study environments and implement disaster management education for students. Early recovery and the strengthening of disaster management functions for schools shall be promoted. Disaster management education shall be enhanced. Following policies should be promoted for revitalization of education.

3.6.1 Recovery and Seismic Resistance for Schools

In order to recover the school environment for children, immediate recovery and retrofitting of schools should be promoted. A seismic resistant school can function as a temporary evacuation site in the case of earthquakes and other disasters.

(1) Recovery and Reconstruction of Schools

Currently, children who went to the damaged schools are studying in an undesirable environment; small and temporary shed in which they cannot concentrate on studying. The temporary schools cannot protect the children from the severe weather, and this condition affect the health condition of the children if this condition is not improved. Therefore, the recovery of the school should be prioritized by taking the following steps.

1. Damage Investigation (technical) of Schools (nature of damage / preparation of record).
2. Prioritization of school reconstruction.
3. Temporary school building construction (short term measure).
4. Reconstruction of school buildings considering seismic measures and learning conditions (long term measures).

(2) Seismic Diagnosis and Seismic Resistant Measures of Schools

Various sources pointed out that casualties would be much larger if the earthquake occurred during a weekday when children were in school considering the damage condition of the school buildings. In order to mitigate the future damage of the earthquake, seismic diagnosis and retrofitting should be implemented. Items to be implemented are shown below.

1. Dispatch of experts or technicians for seismic diagnosis (checking) of schools
2. Seismic resistant measures, retrofitting and maintenance of partially damaged school buildings
3. Seismic resistant measures, retrofitting and reconstruction of intact school buildings
4. Establishment of a legal system in order to ensure the seismic resistance of private schools (Incentive measure to promote seismic retrofitting of private schools)
5. Technical support to all private schools for ensuring safety

JICA and ADB in cooperation with DOE developed the guidelines for school buildings and designed prototypes. When constructing the new school building it is essential that the construction follows the procedures of the guideline.

Source: Department of Education supported by ADB and JICA

Figure. 3.5 Seismic Resistant Building Guidelines of School and Design of Prototype

3.6.2 Enhancement of Disaster Management Education

Disaster management education shall be enhanced based on lessons learned from the earthquake. Some portion of the adult population with a low educational level can learn from their children if the children can obtain the proper knowledge of disasters.

(1) Enhancement of Education Based on the Experience of the Earthquake

Based on the lessons learned by the earthquake, the disaster management educational programme should be developed. DOE has been investigating the contents of DRR education with development partners.

Table 3.2 Example of School Curriculum for Disaster Management Education in Japan

	Target	Examples of school curriculum		
		1st semester	2nd semester	3rd semester
11-12 years old	・To be able to understand the characteristics of the disaster in area and disaster management system ・To be able to estimate the risk caused by the disaster, to be able to take actions to avoid own risk in the event of a disaster ・To be able to take useful action in consideration of safety of family, friends and the surrounding people in the event of a disaster	◇Natural disasters in our region ◇Comfortable houses and clothes ◇What you can do ◇Evacuation drill(Earthquake)	◇Changes of weather ◇Let's know about the dangers of Flood ◇Our lives and the volcano ◇What would you do when you feel shaking in the town? ◇Evacuation drill(Tsunami)	◇Relevance between information industry and people's lives ◇Various activities in order to protect the safety of the people ◇To be able to prevent injury and simple medical care ◇Political effects of country ◇Preparation for emergency ◇Evacuation drill(Fire)
9-10 years old	・To be able to understand basic knowledge of disaster, to be able to think of contrivance to prevent disasters. ・To be able to have an interest about the dangers caused by the disaster, to be able to consider a way to avoid own risk ・To be able to avoid the risk in cooperation with family, friends and the surrounding people in the event of a disaster.	◇Live safely and town development ◇What would you do when heavy rain, strong wind, thunder happened? ◇Evacuation drill(Earthquake)	◇What would you do when the earthquake happened in the rest time? ◇Evacuation drill(Tsunami)	◇Let's make the original disaster management map ◇Specific examples of our predecessors who committed to the development of the region such as traditional tools, cultural assets and annual events, ◇Evacuation drill(Fire)
7-8 years old	・To be able to have an interest in disaster, to be able to think about safe behavior during disasters. ・To be able to feel danger caused by the disaster, to be able to take the appropriate action by following the adult instruction ・To be able to avoid the danger on own in the event of a disaster, to be able to contact with adults.	◇What would you do when fire happened? ◇Want to know your town more (Involvement of own, people and society) ◇Evacuation drill(Earthquake)	◇What to do when the earthquake happened? ◇Let's try to be able to do by your own ◇Let's go, let's use ◇Evacuation drill(Tsunami)	◇Town exploration ◇Evacuation drill(Fire)

Source: Ministry of Education, Culture, Sports, Science and Technology (Edited by JICA Project for Assessment of Earthquake Disaster Risk for the Kathmandu Valley)

(2) Implementation of Disaster Evacuation Drill and Identification of Safe Area around School

In order to respond the disaster properly, practising evacuation actions repeatedly is essential. It is necessary to conduct an evacuation drill at least once a year for teachers and students to confirm what to do in case of a disaster. Considering the utilization of schools and their playgrounds as evacuation sites for other residents, the designation of evacuation sites and evacuation routes around the schools should be investigated.

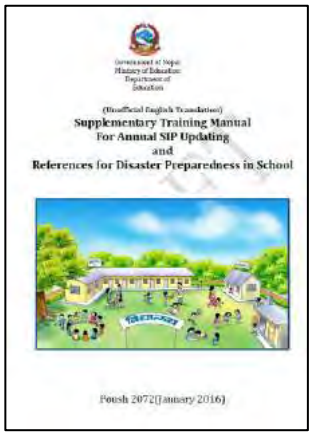
(3) Inclusion of School Safety Measures in the School Improvement Plan (SIP)

Provision of school safety measures in the School Improvement Plan (SIP) should be promoted. The following points are the contents of SIP. Refer to "Supplementary Training Manual for Annual SIP Updating and References for Disaster Preparedness in School, 2072, MoE.

Table 3.3 Disaster Related Topics Covered by Child Friendly School Framework in Nepal

Category	Minimum	Expected
Health	- First aid kit is available at school and the kit contains medicines for first aid and vaccination against parasites	- Availability of first aid kit at school training organization from time to time, for female and male teachers and older children, on first aid treatment
Feeling of Protection	- Information disseminated to children on safety measures to be taken in the event of an earthquake	- Exercises conducted from time to time for both children and teachers on what to do in case of an earthquake
Building & Classrooms	- Earthquake resistant building	- Earthquake Resistant building made of brick and cement

Source: Supplementary Training Manual for Annual SIP Updating and References for Disaster Preparedness in School, DOE, 2016



Source: Supplementary Training Manual for Annual SIP Updating and References for Disaster Preparedness in School, DOE, 2016

Figure. 3.6 Supplementary Training Manual for Annual SIP Updating and References for Disaster Preparedness in School and Sample of Evacuation Route in School

3.6.3 Care for Students

Children studying in the temporary school buildings are susceptible to disease due to undesirable sanitary conditions. Mental health care for those who are traumatized by the earthquake and loss of family members should be considered as a part of social welfare.

(1) Training for Teachers for Care of Students

Training of trainers (TOT) targeting the school teachers should be implemented for improving healthcare and mental care as an implementation of Comprehensive School Safety (CSS)

Contents of training(example)
● Workshop on the planning and practices of disaster management education ● Workshop on sharing experiences of the Gorkha Earthquake ● Training on mental health care, treatment method for injury, etc. ● School level training to teachers and students in each school ● Workshop on the planning and practices of disaster management education ● Workshop on sharing experiences of the Gorkha Earthquake

Table 3.4 Example of Training for Teachers in Japan

(1)Training in school
a. Workshop by researchers and experts of the region b. Workshop on sharing experiences by those who have experienced a disaster c. Workshop on planning and practices of disaster management education d. Briefing of planning and manual formulation of the school disaster management education e. Training by the school disaster management committee f. Workshop of treatment method for injury (cardiopulmonary resuscitation, AED, etc.) by the fire department, etc. g. Comprehensive disaster management drills (including the context confirmation of stockpile warehouse, and training for using the disaster prevention equipment) h. Workshop to understand the importance of life and history of disaster in Japan i. Training on mental health care
(2) Training in external institutions (Expert)
a. Training on school safety performed by the Ministry of Education, Culture, Sports, Science and Technology , Teacher Training Center b. Training for leader by local governments c. Training in disaster prevention experience facilities, etc. d. Holding planning committee for disaster management manual e. Training on emergency life-saving (including AED) f. Participation of comprehensive disaster management drill in region g. Training for fire protection manager h. Experience learning session on disaster volunteer
(3) Joint training with students and parents
a. Handing over the students b. Setting up of shelter c. Creation of disaster management maps d. Facility tours to study the history of past disasters e. Session to listen to the experiences of people who have experienced a disaster f. Training on knowing the business content of the people to protect the safety in the area such as fire department, etc.

Source: Ministry of Education, Culture, Sports, Science and Technology (Edited by JICA Project for Assessment of Earthquake Disaster Risk for the Kathmandu Valley)

(2) Establishment of Mental Care Help Room

To treat students with mental problems, it is desirable that schools have the function for mental care counselling. The DEO targets 605 schools to provide training in six years. After that training period, continuous support for the school is necessary. DEO is responsible for dispatching health technicians to schools as well as providing the training.

(3) Supporting Learning Opportunities for Children Who are Deprived or Living in Remote Areas

Due to the collapse of the schools, it is reported that children in remote areas could not go to school or dropped out of school. The DEO is responsible for identifying the children living in remote areas who cannot benefit from schooling. Based on the result of the fact finding study; educational support for the deprived students and students from remote areas should be considered as a long term plan. Build up case management system for needy children such as financial support should also be considered.

CHAPTER 4 BUILDING RESILIENT DISTRICT STRUCTURE

4.1 Introduction

Damage to road networks affects various aspects of recovery and rehabilitation. Most of the road networks at the district level are unpaved and the condition deteriorates quickly during the emergency recovery phase due to heavy loaded traffic. Blockage of the transport network affected the price of the construction material, as well as the market price of agricultural products and daily goods. Improvement of the transport network can vitalize the economy such as agriculture and tourism, so the long term infrastructure transport planning is vital for sustainable growth.

The landslide disaster caused the loss of human lives, blocked the transportation network and damaged arable lands. Since the earthquake loosened soil and generated cracks in entire Gorkha District, the risk of large-scale landslide increased. Careful attention and countermeasures should be considered during the entire reconstruction period. Building resilience is achieved not only through structural measures but also with non-structural measures such as enhancing the capacity of DRR at the local government level and community level.

Summary: Policies for Building Resilient District Structure

Policy	Programme	Project
Building Resilient District Structure	Enhancement of Regional Recovery and Disaster Management Capacity	● Institutional development for reconstruction ● Institutional development for DRR ● HRD for Reconstruction and DRR ● First-Aid and SAR training ● Public and private partnership for DRR ● Promotion of CBDRM activities ● DRR public awareness activities
	Recovery and Development of Resilient Infrastructure	● Recovery and strengthen road network ● Recovery of trails ● DRR facility development ● Designate emergency roads ● Lifeline restoration
	Enhancement of Land Use Management and Area Planning	● Habitation area control ● Forest conservation and management

4.2 Enhancement of Regional Recovery and Disaster Management Capacity

It is necessary to enhance the recovery and disaster management capabilities for future disasters for resilience. Information transmission to remote areas was a major challenge. Capacity building of community people for disaster management is a big challenge, because mountainous communities have a high risk of isolation in the case of a disaster. Rescue activities and relief distribution cannot be reached within such communities when earthquakes and landslides devastate the road transport network. A recovery and disaster management system and governance for future disasters based on the experiences and lessons learned from the earthquake shall be enhanced. Following the policies and actions should be promoted for the

enhancement of regional recovery and disaster management capacity, and human resource development.

4.2.1 Enhancement of Rehabilitation and Reconstruction Framework

NRA was established after the earthquake to coordinate the reconstruction activities. In order to implement the reconstruction activity smoothly, well-coordinated institutional arrangement at the district level is essential.

(1) Establishment of Reconstruction Framework with Management of Financial Resources

Implementation of the action lists mentioned in RRP utilizes the national level reconstruction budget, district budget and financial support from development partners. Line agencies in the district lead by NRA should establish the framework management the progress of reconstruction projects and financial management at an early stage of the recovery phase.

(2) Promotion of Coordinating Related Organizations

The NRA District Coordination Committee (NRA-DCC) has been established under the Act Relating to Reconstruction of the Earthquake Affected Structures, 2015 (2072) to implement the reconstruction activities at the district level. Since NRA-DCC is newly established organization, development of the coordination mechanism should be considered. The mechanism includes the communication scheme, regular meetings and employment of administrative officers if necessary.

4.2.2 Enhancement of Administrative Formulation for Effective Disaster Management

The Disaster Management system at the district level should be enhanced to be prepared for future disasters. By learning from the past experiences, an institutional arrangement among disaster management related organizations and the construction of public facilities to be used as shelters are the priority.

(1) Reconstruction of Public and Community Buildings Based on Safer Standard

Damage of the public facilities stagnated the response activities such as the provision of public services. Reconstruction of public buildings (government office building, VDC building, community building, and cooperatives) should consider seismic resilient structures. In addition, maintenance and retrofitting of partially damaged government buildings should be implemented. Furthermore, it will be also considerable to conserve the cultural and beautiful landscapes of towns at the time of reconstruction buildings. Because those sceneries may have a great pottential to be the valuable resources for tourism.

QIPs-04 Recovery of Social Service through Establishment of Peace, Order and Security with Reconstruction of Palungtar Area Police Office Buildings in Palungtar Municipality
QIPs-12 Recovery of Social Service for Community and Social Welfare through Reconstruction of Village Development Committee at Barpak VDC
QIPs-16 Recovery of Social Service for Community and Social Welfare through Reconstruction of Village Development Committee at Saurpani VDC

Source: JICA Expert Team, QIPs

Figure. 4.2 Recovery of Social Service through Establishment of Peace, Order and Security with Reconstruction of Palungtar Area Police Office Buildings in Palungtar Municipality (Under Construction)

(2) Development of Vertical Connection (reporting line) and Horizontal Connection (coordination process) on Existing Organization as Disaster Preparedness

The District Disaster Preparedness and Response Plan (DPRP) does not include the administrative communication lines in case of disaster. The information communication network for early warning and damage report should be established. Study of the existing communication gap regarding to vertical and horizontal connection at the time of the Gorkha Earthquake should be implemented and develop the information dissemination flow among disaster management related agencies.

(3) Update of District Disaster Preparedness and Response Plan (DPRP)

The current DPRP was formulated before the earthquake and the situation about DRR has drastically changed after the earthquake. The following are the main items to update DPRP.

- Issues of DRR/Disaster Response
- Institutional arrangement (roles and responsibilities of each organization)
- Hazard risk analysis (utilization of hazard map)
- Information dissemination flow

(4) Formulation of Disaster Risk Management Plan in Municipalities and VDCs

In Gorkha District, not all VDC/Municipalities have formulated LDRMP and due to the earthquake, existing LDRMPs need to be updated. With the support of the Flagship 4 member organization, districts should support the formulation/update of LDRMP such as providing hazard maps for formulating evacuation plan. The JICA RRNE Project provided hazard map and its GIS data covering the entire area of the Gorkha District. The JICA RRNE Project also provided TOT training to NRA DL-PIU officers in Gorkha about the utilization of hazard maps and the creation of hazard map. Hazard map preparation at the VDC level requires field surveys (identifying zones of landslide, flood, lightening, drought, fire etc.). The hazard map includes the mapping of local logistic centres, evacuation sites, Heli pads, temporary shelters/camp sites, etc., with community consultation.

(5) Establishment of Administrative Network with DRR Related Organizations

In addition to DDC, the function of DDRC should strengthen to enhance the district DRR capacities. The following items should be implemented regarding institutional capacity building.

- Strengthening the role of DDRC through regular meetings (Update Recovery activities by DDC)
- Regular meetings of Working Groups (District Clusters) in coordination with DDC (facilitation by DLSA)
- Consideration and establishment of administrative cooperative partnerships among neighbouring districts which can be utilized during/after a disaster for reconstruction and disaster risk reduction and management
- Share the progress of reconstruction work to outside organizations and update bi-annually

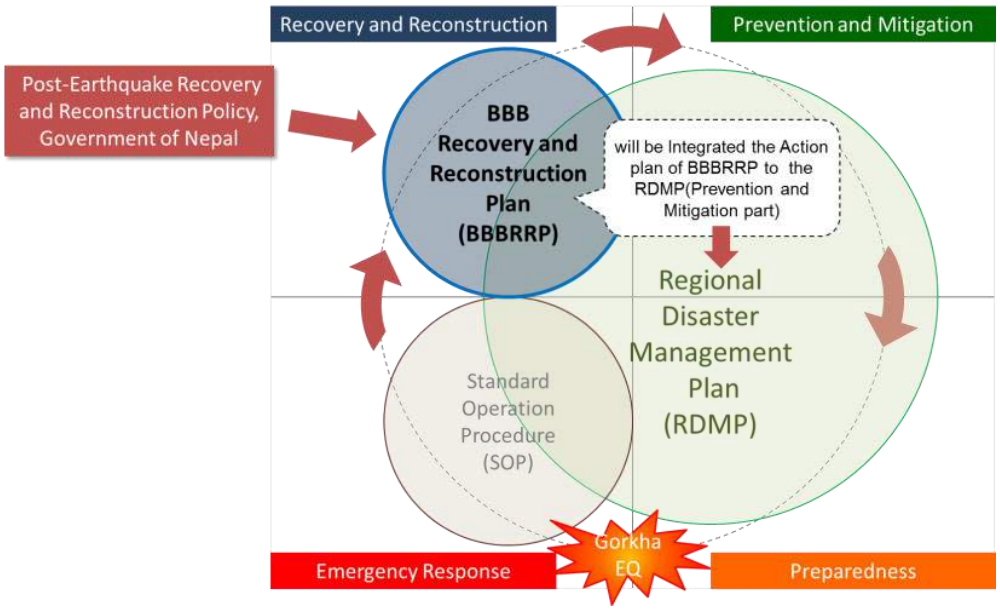
(6) Development of Interactive Information Communication Framework at District Level

As a part of reconstruction activities, PDRF set the policy to establish DEOC in fourteen affected districts and strengthen its function. The activities include development of information collection and a dissemination system from/to the VDCs, municipalities, wards and on the community level and provision of a toll-free telephonic system at DEOC.

(7) Establishment of Decision Making Network for Recovery and Disaster Management

A Local Disaster Management Committee has been established in line with the formulation of the Disaster Response Plan. It is reported that DM committees are not active; for example there is no regular meeting. Therefore, the capacity development of the DM committees is essential and the following measures should be taken.

- Consideration of District Disaster Risk Management Actions with clear decision making and implementation framework
- Regular coordination meetings between DDRC and Local Disaster Management Committees (LDMCs)



Source: JICA Project for Assessment of Earthquake Disaster Risk for the Kathmandu Valley

Figure. 4.3 Position of Disaster Management Plan

4.2.3 Improvement of Access to DRR Information for Community and Vulnerable People

The JICA RRNE Project conducted the CBDRM activities and found out the disaster information dissemination system though the administrative lines were not fully understood by the villagers. Since the premonitory phenomenon of landslides are identified by the community people, awareness raising for bottom-up reporting line is indispensable.

(1) Identification of Means of Information Communication for Community and Vulnerable People

Assuring the access to information to people living in remote areas is the challenge for information transmission. Currently, no roles and responsibilities are designated at Municipality/VDC level, so assignment of the information officer is essential prior to establishing information communication network. It is necessary to identify the issues on information distribution and accessibility for community people and vulnerable people remote areas. In collaboration with VDC, information communication flow should be developed including the utilization of mass media. (radio, television, telecommunications etc.) Additional Mass Outreach Program for the vulnerable population should be promoted with the support of DRR related agencies and developing partners.

(2) Improvement of DRR and Recovery Information System for Community and Vulnerable People

In connection with the activities above, DRR/DRM information sharing methodology should be developed paying careful attention to vulnerable populations.

- Special assistance to vulnerable people (Support system) for information and communication.
- Awareness and orientation programme at community level about information dissemination
- Carry out DRR street drama and community drills at the community level through school activities

(3) Establishment of Reconstruction Information Dissemination System with School-based DRR

In addition to DRR education, school-based DRR activities should be implemented targeting school teachers and students. School-based DRR activities include the establishment of school DM committees, disaster related information collection systems, designation of hub schools for information collection, and strengthening the collaboration among schools.

4.2.4 HRD for Enhancement of Reconstruction and Disaster Management Capability

Human resource development for the enhancement of regional reconstruction and disaster management capability includes the capacity enhancement of government officers and community people.

(1) Establishment of DRR and Reconstruction Organization by Utilizing Existing Groups

In order to effectively reach to large number of beneficiaries, human resource development for the trainers is prerequisite. Development partners have been conducting DRR activities to the district, VDC and community levels. Therefore, the utilization and brush up of former trainees of DRR activities should be implemented. Not only in the public sectors but also provide training to the private sector such as contractors, masons, and carpenters etc., is essential to build a disaster resilient infrastructure.

(2) Human Resource Development for Local Government Officers

Disaster management related government officers are expected to provide trainees to the VDC level and communities in collaboration with development partners. DDRC and DDC will organize

the training sessions to line agencies and VDC secretaries targeting DRR/DRM in the short and medium term.

(3) Capacity Building of Local Disaster Management Committees (LDMCs)

DDRC is responsible for the training of local government officers. Two types of training sessions, training for district level and for VDC level, should be designed. The suggested contents of the training are shown the table below.

Table 4.1 Example of training programmes for LDMCs

Training for government officers	
GIS based mapping and analysis training at district level Capacity development for LDMC	ToT for VDC and community Support to establish LDMCs in VDC and ward level
Training for implementation of CBDRM activities	
Basic knowledge of DRR Basic knowledge about hazard in the district Methodology of Hazard/Risk assessment Vulnerability and Capacity Assessment (VCA)	Field survey Creation of Risk Mapping Formulation of community DM Planning

Source: JICA Expert Team

(4) Formulation of Disaster Management volunteer at VDC level

DM volunteer training at VDC levels will be organized by DDRC, LDMC and each VDC to train the volunteers such as food distribution, evacuation support for elderly person and PWDs, and basic first aid. Developing partners such as NRCS and international NGOs has extensive expertise to train the DM volunteers, so collaboration with them is effective.

(5) Human Resource Development of Private Sector

The training for private sector workers should include the necessary actions to be taken during the disaster including clarification of roles and responsibilities of private sector for preparedness, during and post disaster phases. Collaboration of emergency stockpiling should be promoted in the medium to long term for related industries such as the food industry.

(6) Implementation of District Level Disaster Response Drill

By utilizing the hazard map, information transmission flow and disaster management plan can be prepared. Regular disaster management drills should be conducted for better disaster response. The methodology and scale of the earthquake should be considered based on the lessons learned from the earthquake. The table below shows the example of the preparation and implementation of disaster management drills.

Table 4.2 Activities for the preparation and implementation of the drill

Preparation of the drill	
Determine the type of exercise (see table below) Identify the stakeholders(participants, lecturers)	Develop a scenario of the drill Procure necessary material Train the participants of the drill
Implementation of the drill	
Information transmission exercise Evacuation drill Search and rescue activities First aid activities	Food distribution and shelter management Evaluation session of the drill

Source: JICA Expert Team

Table 4.3 Types of Disaster Management Exercises

Type		Contents (Example)
Classroom learning	Seminar Lecture	Basic knowledge of disaster, Hazard Mapping, Disaster management plan, Lessons learned from past disasters, etc.
	Self Learning	Basic learning from documents/books, e-learning, game etc.
Table Top Exercise (TTX)	Non-discussion style	Self Learning of story simulation, computer game, Training of situation estimated by Instructor-led (Image training)
	Discussion style	DIG, Workshop/Group work ,Discussion, Case method, etc.
CPX(Command Post Exercise)		Simulation of Emergency Response
Field Training Exercise (FTX)		Actual Exercise for emergency response in field such as Fire extinguish, Emergency medical, Traffic Control, Evacuation, Gathering to HQ, Establishment of Emergency Response HQ
Comprehensive Exercise		Full scale exercise (combined TTX & FTX), etc.

Source: JICA Project for Assessment of Earthquake Disaster Risk for the Kathmandu Valley

4.2.5 Capacity Building of First-Aid and Search and Rescue Activities

In order to rapidly execute the rescue activities in the event of a disaster, cooperation with each institution shall be strengthened. Emergency search and rescue is directly connected to damage mitigation in the event of a disaster. Human development for enhancement of disaster management capability is necessary.

(1) Formulation of Standard Operating Procedure (SOP) Which Includes First Aid and SAR Activities

SOP which includes first aid and Search and Rescue Activities (SAR) activities at the district level is formulated for the following contents:

Contents (example)

- Flow chart of standard procedure which indicates who, what, when, how should be done during and after disasters.
- Check list of each stakeholder and each response activity such as search and rescue, medical, food provision, etc.
- Several formats for information collection, etc.
- Formulation of SOP in each municipality and VDC
- First aid training at the VDC and ward level (all municipalities and VDCs)
- Search and rescue training at VDC and Ward level (all municipalities and VDCs).
- Disaster awareness and education to community/schools etc., including first aid training (Implemented by Nepal Army/Armed Police Force)

(2) Development of Damage Information Sharing System among Relevant Stakeholders

Lacking in damage data derives from an immature coordination system among stakeholders and no mechanism to accumulate the plan. Data collection and accumulation is essential for future DRR planning such as the construction of health facilities, evacuation shelter and so on.

Standardized damage information form (Initial Rapid Assessment, Multi Cluster Initial Assessment, Post Disaster Need Assessment, Detailed Infrastructure Damage Assessment etc. with the reference from national/international level) development should be developed in

collaboration with disaster management related agencies. Then, training to the school teachers, government officials, I/NGO staffs regarding the use of IRA , MIRA, PDNA , DIDA and related formats follows. The data accumulation and utilization system should be considered with the lead of DDRC.

(3) Establishment of Emergency Medical and First Aid Stockpiles

During the emergency response phase, people in the affected areas suffered from a deficiency of medical supplies because the transport network was paralysed. Each medical facility should secure the certain number of medical and first aid stock piles. Stock piles in medical facilities should be prepared with the following procedures:

- Estimation of the necessary amount of stockpiles (For both local residents and non-residents at the time of disaster)
- Construction of stockpile warehouses/containers and installation. (at the sub regional level: three major stock piles and at the district level: one major stock piles)
- Allocation of stockpiles at the health post level (increment of necessary first aid kits at health posts)
- Listing up the necessary emergency goods.
- Procure the items of the stockpile

(4) Designation of Disaster Base Hospital, Medical Centre

Among the major hospitals in the district, it is essential to designate disaster base hospitals and medical centres for effectively handling the disaster victims. These designated hospitals are prioritized to improve their function such as seismic resistant measures, stockpiles, communication facilities, etc.

(5) Enhancement of Medical Information System

In the medium to long term, a district medical information system should be developed by utilizing the network of the hospital and unified medical data. DOH is leading the activities for the enhancement of a medical and health care network and information system in the district in cooperation with I/NGOs and private sectors.

(6) Promotion of Inter-Hospital Cooperation during Disasters and Disaster Base Hospitals

In Japan, municipalities make agreements regarding disaster assistance with other municipalities in order to respond efficiently. For the medical and health sectors, urgent injury care, provision of medical equipment and transport of hospitalized persons are carried out with mutual cooperation in the case of a disaster. In the long-term, it is desirable to make agreements with adjacent districts and national level medical facilities.

Contents of Manual (example)

- Mutual collaboration between district hospital and private hospitals (through the medical and health care network).
- Mutual collaboration between DHO and medical clinics/poly clinics/medical institutions etc.
- Mutual collaboration between DHO and I/NGOs working in the health sector.
- Ensuring all time (24/7) availability of ambulance at each hospitals (both private and public sector).

4.2.6 Promoting Partnership between Relevant Public Sector and Private Sector for DRM

Partnership between the relevant public sector and private sector for DRM shall be promoted for efficient resource utilization.

(1) Clarification of Sharing Roles between the Relevant Public Sector and Private Sector

(2) Enhancement of Cooperation System between the Relevant Public Sector and Private Sector

In Japan, local governments make agreements with the private sector about providing assistance during a disaster such as providing food and drink from the warehouse of the food company during the emergency response without a purchasing order and local government reimburses the cost after distributing the material. In Nepal, it is also desirable to study the possibility of cooperation between the public and private sectors during and after disasters and its demarcation.

(3) Enhancement of Capability of Collaboration with the Public Sector and Private Sector

Sharing knowledge between the public and private sectors is the next step of the cooperation. If the collaboration functions effectively, it is desirable to conduct the drills together.

4.2.7 Enhancement of Community Based Disaster Risk Management (CBDRM)

Throughout the implementation of the CBDRM activities in Syaule VDC, the JICA Expert Team observed that the awareness and knowledge of disaster and community-based information dissemination as the challenge for mitigating the damage of disaster. Therefore, CBDRM activities shall be promoted for strengthening DRR/DRM capabilities of community.

(1) Formulation of "Community Disaster Management Committees (CDMCs)"

(2) Formulation of Community DRR/DRM Plans

(3) Formulation of "Community Carte"(Summarized DRR Related Information at Community Level)

(4) Implementation of Community Disaster Management Exercises

CBDRM activities are designed to train the community people to organize "Community Disaster Management Committees (CDMCs)" to prepare and respond to the disaster and train them how to respond in each stage of a disaster. It is desirable to conduct the CBDRM activities in the community of participants since some of the important activities such as making community hazard maps should be developed through the town watching at the community level.

Table 4.4 Example of the contents of CBDRM activities

Content of the CBDRM activities
・Basic information about disaster (earthquake and landslide) ・Methodology to socializing Community -Vulnerability Assessment -Community Resource Mapping -Seasonal Calendar ・Participatory Community Risk Assessment (Town watching to identify the risk/Creation of community hazard map) ・Participatory Disaster Risk Management Planning -Action plan such as evacuation plan, and management of shelter ・Practical training for community (Training of first aid and SAR) ・Methodology for community evacuation exercise -Community early warning -Evacuation -SAR/First Aid -Relief material/distribution -Shelter Management ・Implementation and evaluation of the drill

Source: JICA Expert Team

Source: Flagship 4 Handbook, NRRC

Figure 4.1 Minimum Characteristics for a Disaster Resilient Community in Nepal

4.2.8 Enhancement of Public Awareness of DRR/DRM

Nepal is a landslide prone country even before the earthquake and it is observed that people are so-called "Living with landslide". Throughout the CBDRM activities and interviews with the villagers living in landslide affected areas, it was observed that villagers often underestimate the risk of landslide. It is mainly due to the lack of knowledge of the mechanism of disasters such as landslide and earthquake. Therefore, the enhancement of public awareness about disaster risk reduction/management shall be promoted.

(1) Construction of Monuments to Enhance the Culture of Disaster Prevention Awareness

National Reconstruction and Rehabilitation Policy, 2072 prescribes that each district should construct an earthquake park so as to not forget the tragedy of the disaster for future generations. The contents of the park can be the record of damage, preserved collapsed housing, and other visually attractive items.

> 13.1.2.
> In memory of the district residents, those who deceased and those who were injured during the earthquake, **an earthquake park shall be constructed at a district headquarters or any appropriated place**, in each of the most earthquake affected districts.

Source: National Reconstruction and Rehabilitation Policy, 2072

(2) Development of Handbook of DRR/DRM for Households

(3) Implementation of Awareness-Raising Programmes on DRR/DRM

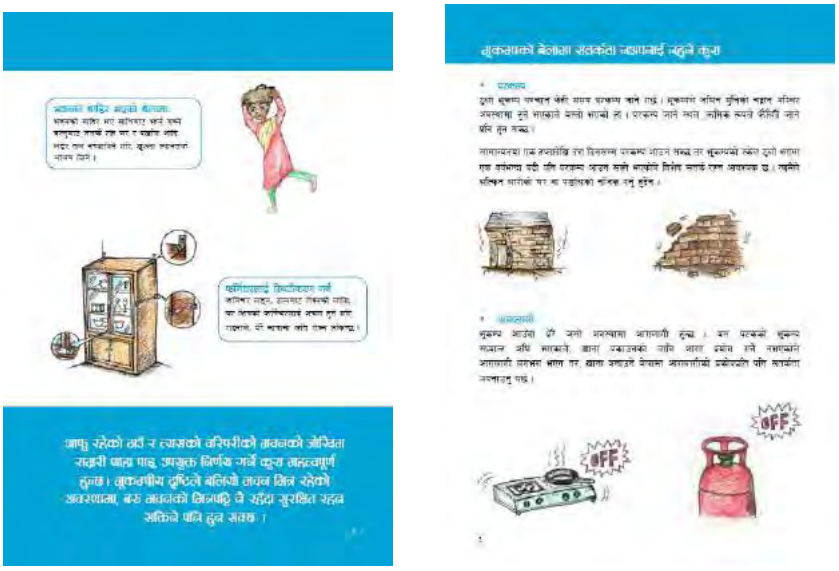
(4) Promotion of Preparation of Emergency Stockpiles by Household Level

In addition to CBDRM activities, awareness raising activities at the household level should be implemented so that individuals can obtain the proper knowledge of disaster. Awareness raising throughout the media such as radio and TV should also be promoted.

Contents for handbook of DRR/DRM for households

- Learning about disasters (earthquake mechanisms, history, disaster risks, etc.)
- To do/Not to do in case of disaster

- Preparedness at household level (Making earthquake resilient houses, preparing emergency stockpiles)



Source: The JICA Project for Assessment of Earthquake Disaster Risk for the Kathmandu Valley

Figure 4.2 Example of Pamphlet for DRR Awareness Raising at Household

Source: JICA Expert Team

Picture 4.1 Disaster Risk Awareness-Raising Activity at Landslide At-Risk Community

4.3 Recovery and Development of Resilient Infrastructure

A large number of the infrastructure such as roads, bridges, irrigation facilities, hydropower facilities, and government buildings were damaged by the earthquake and landslides. In addition, there are a lot of seasonal roads, including among settlements where landslides often hit Abkhaireni-Gorkha highway and road to Barpak and main roads especially in rainy season, which were affected. A robust transportation and logistics network contributes to build safer and more resilient districts. Early recovery and seismic resistance of the infrastructure shall be promoted for the development of safer infrastructure and lifelines. The following policies and actions should be promoted for the development of resilient infrastructure.

4.3.1 Recovery and Development of Seismic Resistance and Safer Road Networks

As shown in the concept of BBB, the recovery and reconstruction of the roads and bridges shall be stronger than before the earthquake. Pavement, slope protection measures and seismic resistant structures should be considered.

(1) Recovery of Roads and Bridges (road network of national, district, municipality and VDC level)

In the early recovery stage, it is essential to prioritize the urgent restoration of the transportation to facilitate the urgent recovery projects. After carrying out investigation on earthquake damaged roads, temporary recovery measures for nationally and regionally important roads (minimum recovery, including debris removal, side protection, etc. to secure people's mobility) should be carried out.

(2) Development of Resilient Road Network

In order to develop the road transport networks, the following items should be implemented.

- Identification of emergency road networks at the district level and municipality/VDC level
- Seismic diagnosis and retrofitting/reconstruction of bridges along the emergency road network
- Upgrade and maintenance of identified road networks (Eg. Road widening, install side drain, side protection, construct retaining walls, road turning management, road mirror installation, etc.)
- Seismic resistance of buildings along designated evacuation routes/emergency roads
- Strict Implementation of RoW along the district core road network
- Regular inspection and maintenance of Emergency Road Network

QIPs-25 Khahare Khola Bridge Construction Project, Srinathkot VDC and Gankhu VDC, Gorkha
QIPs-26 Jhyalla Khola Bridge Construction Project, Muchhok VDC, Gorkha

4.3.2 Recovery and Development of Seismic Resistant and Safer Trails

In the Gorkha District, the majority of the transport networks are categorized as trails and their recovery shall be prioritized in the early stage of recovery to promote housing reconstruction.

(1) Recovery of Trails Including Trail Bridges to Secure Local Transportation

As well as the recovery of the road transportation, the recovery of the trails and bridges need to be prioritized by implementing the following items:

- Implementing surveys on damaged trails and trail bridges
- Repair and maintenance of foot trails
- Reconstruction of trail bridges
- Repair and maintenance of trail bridges
- Construction of temporary crossings
- Recovery of damaged facilities along foot trails. (rest places, shelters etc.)

(2) Developing Trails Network and Securing Alternative Access Routes to Settlement Areas

After implementing the urgent recovery of trails, it is essential to secure alternative access routes in case a landslide has blocked the main route. The route should be considered in the convenience of residents and interconnect with other roads to secure the redundancy of transportation.

4.3.3 Development of Disaster Management Facilities and Designate Emergency Roads

A disaster management base, emergency road network shall be developed for smooth emergency rescue, evacuation and recovery activities for the emergency response phase of the disaster.

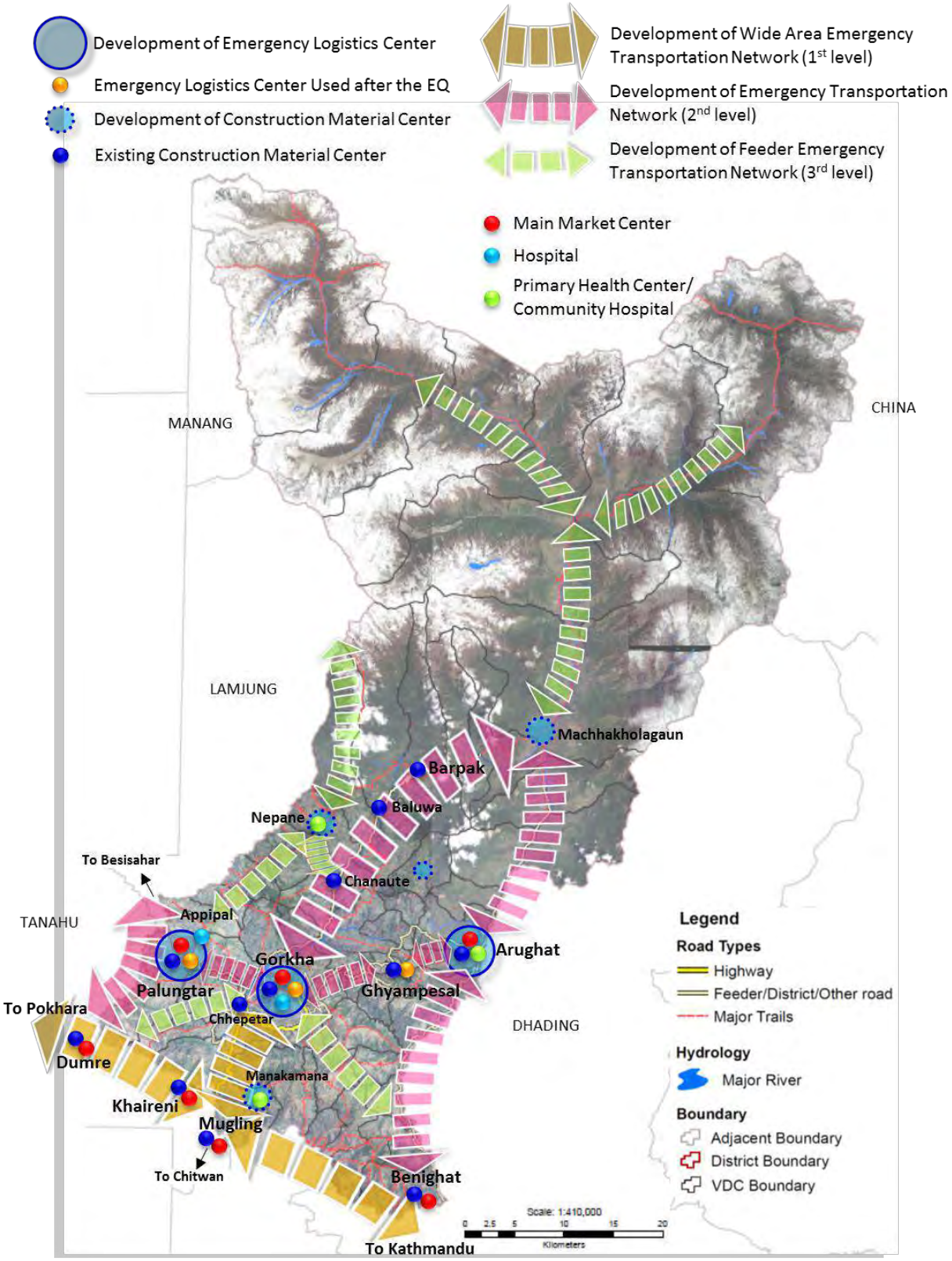
(1) Consideration of Emergency Transportation and Logistics Plan

(2) Development of Disaster Management Base Facilities and Network of Base Facilities

As shown in the figure on the next page, consideration of emergency transport networks and disaster management base facilities are essential to facilitate the early recovery from the disaster.

The map is developed by identifying the important roads and facilities in the area based on damage status, lessons learned from the earthquake and District Transport Master Plan(DTMP) etc., and designate those roads as roads for emergency transportation.

In parallel to developing the transport network, the planning and designation of disaster management base facilities should be implemented. The current facility should be improved by procuring emergency stockpiles and equipment for opening roads to function as the disaster management base. Then the facilities should be connected as a part of network for base facilities from municipalities/VDCs and neighbouring districts.



Source: JICA Project Team, Satellite image: Airbus DS 2015

Figure. 4.4 Image of Emergency Logistics Centre and Emergency Transportation Network Development

(3) Enhancement of Disaster Management Functions of Schools (seismic resistant measures, stockpile, communication facilities etc.)

In parallel with the implementation of school-based DRR, seismic physical development of school buildings such as seismic retrofitting in all schools in the Gorkha District and procuring emergency stockpiles for the students and neighbours of the school. In order to disseminate disaster related information, communication equipment such as loud speakers and handy speakers should also be equipped.

(4) Development of Emergency Road Network Including Alternative Way

In relation to the designation of an emergency transportation road network mentioned in the previous part, emergency road networks should be developed such as the transportation network which will be used in the emergency response phase after an earthquake and improvement of such roads and bridges should be prioritized.

(5) Designation, Development and Dissemination of Evacuation Sites

In order to secure evacuation sites, it is necessary to designate the open spaces as evacuation sites based on land availability, number of residents and visitors in the areas. Once a site is designated, improvement of the site to be utilized for evacuation site entails. The improvement includes installation of sign boards and evacuation maps.

(6) Designation, Development of Temporary Heliports

When the earthquake occurred, major road networks were blocked and a lot of victims were rescued by helicopter. In preparation for future disasters, designation of a heliport site based on land availability and road accessibility from disaster management bases and hospitals/PHC is essential. Land improvement of the temporary heliports will be implemented after the designation.

(7) Development of Stockpile Warehouses, and Ensuring Disaster Stockpile

Learning from the experience that areas severely affected by the earthquake which were isolated for several days, the installation of emergency stockpiles is vital. The following measures are the actions to be taken regarding the installation of emergency stockpiles:

- Development of stockpile warehouses and their installation at the district level.
- Procuring response and rescue equipment (boots, jackets, gloves, ropes, shovels, helmets, life boats etc.)
- Provisioning a fire brigade at all warehouses (sub-district level)/ managed by municipalities and LDMCs
- Record and inventory of each equipment at warehouse
- Training to use fire brigade to local people/ staff
- Ensuring full time operation
- Development of stockpile warehouses and their installation at the VDC level
- Development of stockpile warehouses and their installation at the community level
- Ensuring timely checks and maintenance of stockpiles at all levels

4.3.4 Recovery of Resilient Lifeline

The earthquake devastated lifelines such as water supply, sewage and electric power plants. The recovery of such facilities should also be considered disaster resilience.

(1) Seismic Resistant Measures for Water Pipe Lines and Facilities

In order to strengthen the seismic resistance of the facilities, site investigation of existing water supply facilities will be implemented and the preparation of seismic resistant retrofitting plans

will be carried out based on the results. Seismic resistance measures for existing (important projects on priority basis) water supply projects are also prioritized.

(2) Recovery of Seismic Resistant Sewage Facilities

The priority for the sewage facilities development is recovery and seismic resistance of sewer pipe lines, facilities (drainage, sewage, and sanitation system) at the municipal and town areas. Restoration and seismic resistant retrofitting of sewage facilities in rural areas entails urban areas. Based on the needs of the beneficiaries, the new construction of sewerage treatment systems and sewerage carrier vehicle at the municipal level (feasibility study and necessary development) should be considered. At the household level, the installation of septic tanks with soak pit should be promoted.

(3) Recovery and Strengthening of Electricity Supply System

Since power houses were severely damaged by the earthquake, site investigation to identify the damage of the facilities and the fundamental future amount is necessary. When reconstructing the facilities, seismic resistant building methods should be applied or seismic retrofitting should be applied if the damage was minor.

At the household level, repairing electric meters and the utilization of solar power as a backup of electric supply should be promoted in public facilities. Renewable energy sources such as wind energy should also be considered in the long term plan.

4.4 Enhancement of Land Use Management and Area Planning

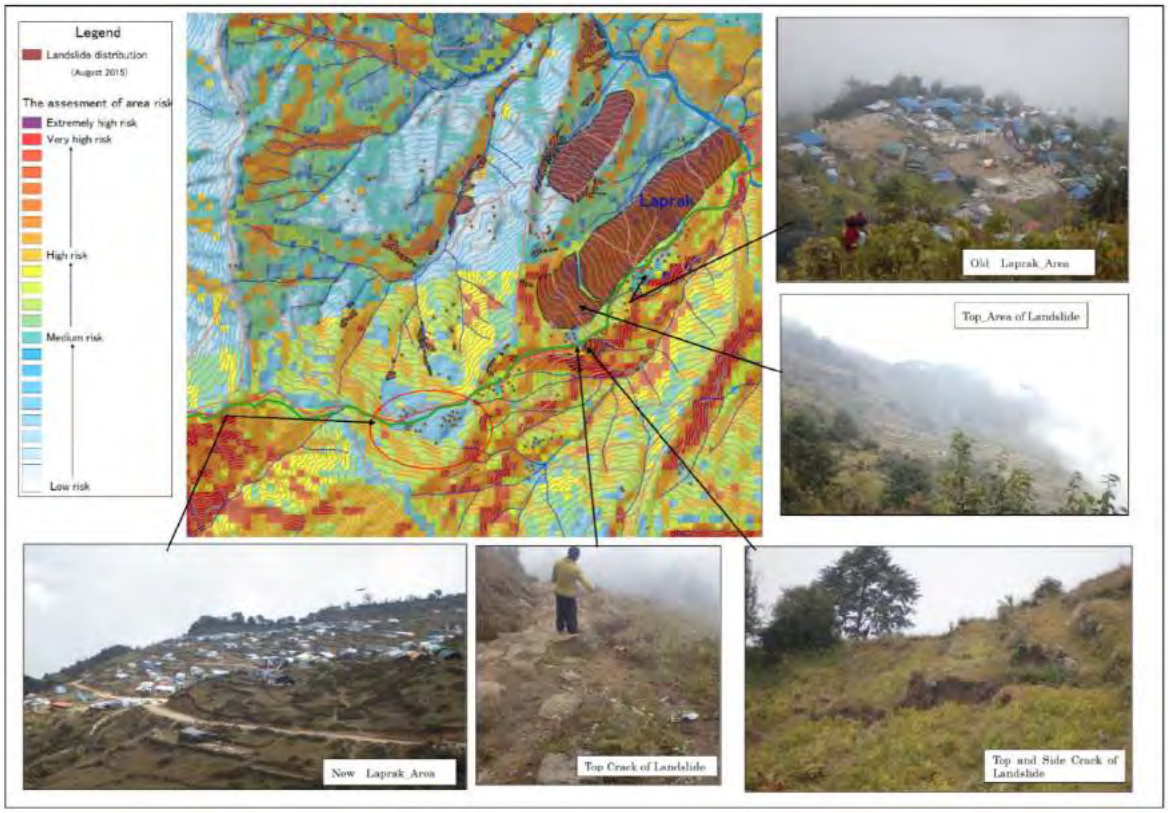
There are still many people who are forced to live in temporary houses or landslide prone areas because of the earthquake. Appropriate land use planning and management based on the disaster risk shall be promoted with building regulations and landslide prevention infrastructures. The following policies should be promoted for the enhancement of land use management and area planning.

4.4.1 Designation of land Use Management such as Restricted Habitation Area

In order to reduce the risk of landslides, land use restriction, in consideration of the disaster prone areas based on hazard assessment referring to hazard maps is the priority in the terms of land use management.

(1) Landslide Hazard Assessment and Identification of Hazard Area

By utilizing the hazard map prepared by the JICA RRNE Project, it is essential to prepare landslide hazard maps in landslide prone areas. Participants of the TOT training carried out by the JICA RRNE Project should instruct district level engineers about the use of Landslide Hazard Maps. Before selecting the site, implementation of field surveys, analysis and identification of hazard areas based on actual conditions should be carried out. The figure below is the example of Laprak VDC identified as a high risk area of landslides.



Source: JICA Expert Team

Figure 4.3 Example of Field Survey with Landslide Hazard Map in Laprak VDC

(2) Risk Assessment of Existing Land Use Based on Disaster Risk

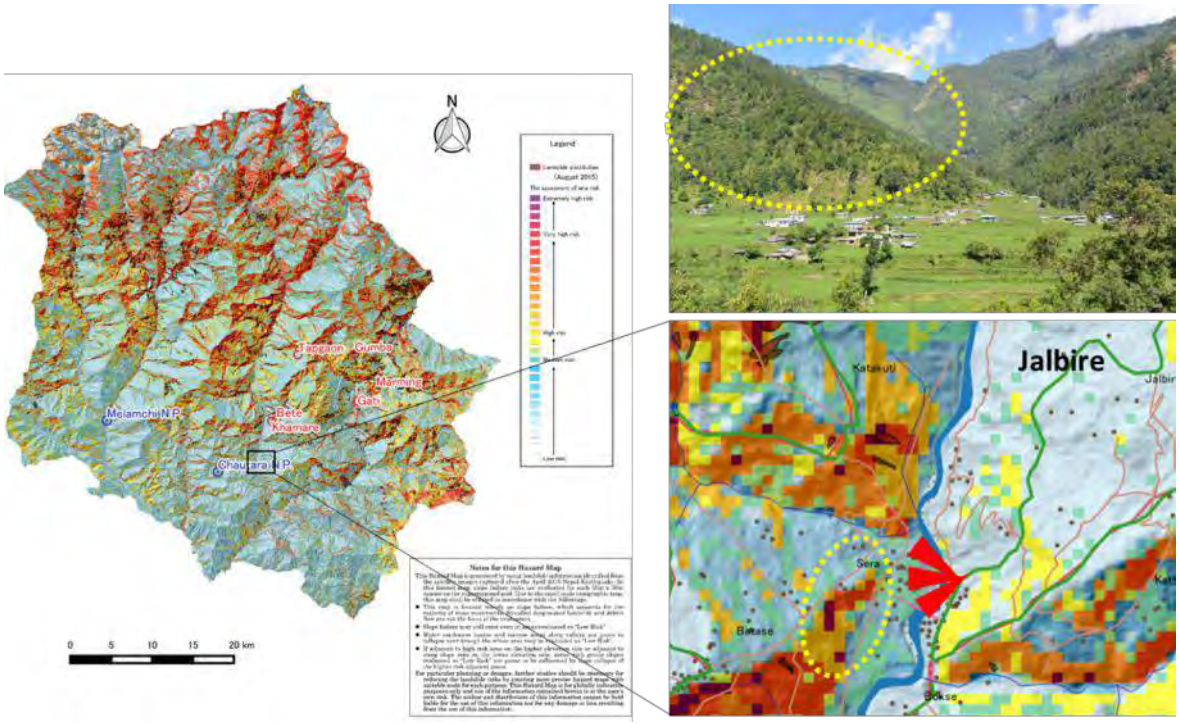
Based on the hazard assessment, the district shall prepare the land use map of the district, municipalities and VDCs. Then, preparation of Risk Sensitive Land Use Plan (RSLUP) of municipalities based on the above mentioned analysis shall be done. (Comparing the hazardous areas and current land use.) This is utilized for the identification of disaster prone areas which is threatening to settlements and human life.

(3) Consideration of Countermeasures of Landslides at Disaster Prone Residential Areas

The hazard map should be utilized to identify landslide hazard areas for the preparation of LDRMP. This is also useful in considering countermeasures for landslide protection on priority basis such as setting a gabion wall, construction of landslide prevention infrastructure and soil improvement, and drainage management etc.

(4) Promoting Understanding of Landslide Prone Areas

Hazard maps are maps to easily identify the landslide risk areas. In this sense, careful interpretation of the hazard map is essential. For example, even though the residential areas are marked as less risky, if a hill over the residential areas is marked as high risk, the residential areas are more likely to be damaged by an earthquake (Please refer to the figure below). NRA officers who are trained in landslide hazard map utilization should be the lecturers to engineers and planners on how to understand the contents of the hazard map. The result will be utilized to install risk maps and signs showing landslide prone areas.



Source: JICA Expert Team

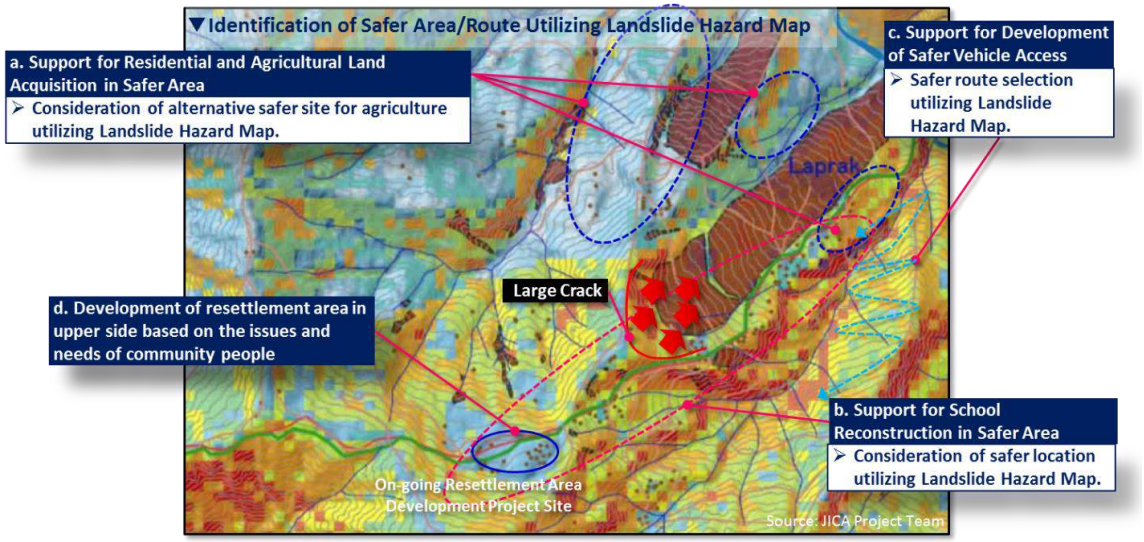
Figure 4.4 Images of Landslide Hazard Assessment (Example in Sindhupalchowk)

(5) Consideration of Land Use Restriction and Building Regulation

When considering the revision of land use and building regulations (on the basis of analysis and comparison of geomorphological maps, hazard analysis and actual damage) construction of the public buildings in high risk areas should be restricted.

(6) Designation of the Areas Necessary to Integrated Settlement Development

Recovery and development planning for landslide high risk areas should consider the above mentioned revised guidelines/regulations. Reconstruction of the settlement buildings should be implemented on the basis of the revised guidelines/ regulations (policy implementation).



Source: JICA Expert Team

Figure 4.5 Example of Laprak VDC (Case Study)

4.4.2 Consideration of Forest Preservation and Management

Due to the increasing need of fire wood and construction materials in the affected areas and landslides, deforestation is an issue in disaster affected areas. Protection against landslides and awareness of forest encroachment shall be considered.

(1) Protection from Landslides Induced by an Earthquake

In order to prevent future landslides, measures such as setting a gabion wall, construction of landslide prevention infrastructure and soil improvement should be implemented.

(2) Plantation at the Landslide Affected Areas

The plantation in the deforestation lands for the purpose of the forest preservation and the risk reduction of the landslide shall be promoted.

(3) Forest preservation and management through sub-watershed level planning (Implementing SABHIAA Model)

As a part of forest protection activities, implementation of landslide protection, forest preservation, land protection, participatory watershed preservation/conservation of water sources/drinking water sources should be introduced by applying the SABHIAA model.

(4) Awareness Programme to Manage Forest Encroachment

Deforestation caused by encroachment is a challenge for forest conservation. Community monitoring systems and awareness raising events for the proper use of forest resources should be planned.

(5) Protection and Management of Forest Resources for Post-Disaster Reconstruction and Disaster Management

The following measures shall be considered for forest preservation and DRM:

- Protection of Bio-Diversity affected by Earthquake such as consideration of protection of wildlife and their habitat
- Awareness raising program to local community people and CFUGs etc.
- Use of fallen trees, old trees, dry woods for reconstruction.
- Training to CFUGs to use above mentioned forest products.
- Management of forest fire such as training to the Community Forest User Groups for prevention of forest fire and equipment and tool management in each CFUGs.
- Private/ commercial forest development such as encouraging private sector in developing commercial forestry at the vacant and bare lands and policy easement for private forest timber business etc.

Source: JICA Project Team

Figure 4.6 Images of Landslide Protection (Right: Example in Japan)