

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
ADMINISTRADORA BOLIVIANA DE CARRETERAS (ABC)

**THE STUDY
ON
PREVENTIVE MEASURES
AGAINST
ROAD DISASTERS ON MAIN NATIONAL ROADS
IN
THE REPUBLIC OF BOLIVIA**

**FINAL REPORT
SUMMARY**

OCTOBER 2007

**CENTRAL CONSULTANT INC.
in association with
EARTH SYSTEM SCIENCE CO., LTD.**

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Preface

In response to a request from the Government of the Republic of Bolivia, the Government of Japan decided to conduct a study on Preventive Measures against Road Disasters on Main Roads in the Republic of Bolivia and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Akiomi Shimazu of Central Consultant INC., and consists of Central Consultant INC. and Earth System Science Co., Ltd. between October 2005 and October 2007.

The team held discussions with the officials concerned of the Government of the Republic of Bolivia and conducted the study. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Bolivia for their close cooperation extended to the study.

October 2007

EIJI HASHIMOTO
Deputy Vice President
Japan International Cooperation Agency

Letter of Transmittal

We are pleased to submit to you the study report on Preventive Measures against Road Disasters on Main Roads in The Republic of Bolivia.

This Study was conducted by Central Consultant Inc., in association with Earth System Science Co., Ltd., under a contract to JICA, during the period of October, 2005 to October, 2007. In conducting The Study, we have examined the features of Capacity Development in the area of road disaster prevention with due consideration to the present situation of The Republic of Bolivia and formulate the Plan of Preventive Measures against Road disasters on Main Roads in The Republic of Bolivia.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA and Administradora Boliviana de Carreteras (ABC). We would also like to express our gratitude to the officials concerned of The Ministry of Foreign Affairs, The Vice-Ministry of Transport and The Embassy of Japan in The Republic of Bolivia throughout our study.

We hope this study will contribute to the further promotion of the administration of road disaster prevention in Bolivia.

October 2007

Very truly yours,


AKIOMI SHIMAZU

Leader

The study on Preventive Measures
against Road Disasters
on Main National Roads
in the Republic of Bolivia

BRIEFING

I OUTLINE OF THE STUDY IMPLEMENTATION

Chapter 1 Introduction

The purpose of the study is to support capacity development in road disaster prevention in Bolivia through the following;

- building an appropriate road inspection and maintenance system
- cultivating the necessary human resources through the following activities:
 - road disaster hazard diagnosis
 - formulation of slope repair and disaster countermeasure works
 - design supervision, estimation and construction supervision of slope countermeasure works and road structures

Chapter 2 Outline of the Study Implementation

Assistance is provided to Administradora Boliviana de Carreteras (ABC) to implement the following items.

- (1) Formation of Capacity Development Plan
- (2) Support of Capacity Development through Preparation of Road Disaster Inventory, Establishment of Database System, Preparation of Road Disaster Prevention Management Manual, Technology Transfer through Implementation of Pilot Works and Activity for Awareness of Road Disaster Prevention

The study has been conducted from October 2005 to August 2007. Implementation organization consisted of the task team of ABC and the Steering Committee of upper institutions. The task team has a role of substantial work supported by advice from JICA study team. The task team was composed of engineers and administrators from each department headed by general manager and head of maintenance department.

II CURRENT SITUATION ON ROAD ADMINISTRATION

Chapter 3 General Condition of Roads

The general situation in Bolivia regarding roads has been studied in society, natural environment and road network, with particular attention given to the natural features of Bolivia, such as topography, geology and climate, that are closely related to road disasters.

Chapter 4 Current Situation Survey on Road Administration and Disaster Prevention

The situation of road administration has been studied in organization, financial state, road maintenance system, development plan and IIRSA.

In Bolivia the concept of road disaster prevention which aims to protect the road from disasters before the occurrence is not recognized well socially. And ABC herself does not have organization, system and budget for disaster prevention, but for maintenance of roads. Due to the lack of the budget, restoration after the occurrences is treated as full demand.

As for the daily maintenance the micro-empresas organized in local village bases are in charge by manpower works such as road cleaning, weeding, repairing potholes of pavement, keeping drainage etc.

III FORMATION OF CAPACITY DEVELOPMENT PLAN

Chapter 5 Formation of Capacity Development Plan on Road Disaster Prevention Management

(1) Formation of Overall Capacity Development Plan

The super goal of the CD plan is designated as “Road Disaster are Reduced in Bolivia” and the overall goal as “Continuous Road Disaster Preventive Management is Executed in ABC”. The proposed 7 projects are as follows; ①Establishment of Road Disaster Preventive Department (unit),②Road Disaster Preventive Technology Improvement,③Establishment of Road Disaster Preventive Management System, ④Improvement of Emergency Response in Disaster Prevention,⑤Road Information Enhancement and Discloser,⑥Improvement of Tender Procedures in Road Disaster Prevention,⑦formulation of Strategy Program of Disaster Prevention Budget.

(2) Scope of the CD Plan in the JICA Study

The scope of implementation of the CD Pan in the JICA Study in the context of the overall implementation plan is lay in the project 1 to project 3, mainly coincide with project 2. As the most fundamental tools, preparation of road disaster inventory, establishment of database system and preparation of road disaster prevention management manual have been designated. And for technology transfer at the site, implementation of pilot works has been planned. And for activity for awareness of road disaster prevention, holding seminars has been planned.

IV CAPACITY DEVELOPMENT ACTIVITIES IN THE JICA STUDY

Chapter 6 Site Survey and Creation of Road Disaster Registration System

The road disaster inventory aims to be a fundamental tool for the road maintenance system by recording the disasters and by storing them in the designated format which covers the road net under ABC.

A register of 259 selected hazard spots was created. The disaster inventory was firstly prepared as the diagnosis card for critical spots and then additional information is to be added in the occasions of disaster happenings. On the prevalence to all national roads, the newly established UPD (Road Disaster Prevention Unit) is in charge of the administration with close relation to regional offices of ABC.

Chapter 7 Database System for Road Disaster Prevention

For the systematic utilization of stored and accumulated data, the system is composed of M.S.Access and GIS (Geographical Information System) under discussions with ABC counterpart and JICA study team. And the data of 259 critical spots diagnosed in the inventory has been installed into the system. And the data of trials in Route 3 was added to the disaster inventory.

Chapter 8 Road Disaster Prevention Management Manual

The manual has been prepared taking into consideration, in particular, the implementation system of road maintenance management in Bolivia which consists of the micro-empresas (micro companies), the Supervisors, ABC Regional Offices, ABC Head Office and keeping in mind of feasibility.

The manual consists of following five guides;

- | | |
|-----------|--|
| Guide I | Determination of High Hazard Control Sections |
| Guide II | Disaster Prevention Works in Routine Maintenance |
| Guide III | Management for Imminent Danger |
| Guide IV | Emergency Response |
| Guide V | Disaster Prevention Measures |

The full text of the manual is attached in separate volume

The manual has been revised through the trial use on one section of route 3 under La Paz Regional Office in the period of July 2006 to April 2007. And the manual is to be authorized by the board of directors of ABC.

V TECHNOLOGY TRANSFER AND AWARENESS OF DISASTER PREVENTION

Chapter 9 Implementation of Pilot Project

The goal is capacity development in the area of disaster prevention through the execution of pilot works, by means of training in surveys, planning, design, cost estimation, preparation of contract documents, bidding and assessment, work supervision etc.

The site is located at km426+300 on route 7 in Bermejo area, Santa Cruz. In this site the river flows nearby at the road foot and some embankment shoulder failure occurs. Accordingly the protection works from the river flow and the countermeasure works for embankment failure are planned,

The pilot works was scheduled for 4 months from the beginning of October 2006 to the end of January. However in consequent of unexpected sharp change of the subsurface topography and the abnormal climate condition and the traffic close of connecting road of this year, the completion was delayed to the middle of March counting 5.5 months

Through the execution of the pilot works, training for live treatments of problems in disaster prevention works have been experienced with new countermeasures of the crib works applied in the pilot works.

Chapter 10 Awareness of Road Disaster Prevention Management

Totally 4 seminars including preliminary one have been held in La Paz and in Santa Cruz for all stakeholders of roads. The seminars have covered introduction of Japan practice, explanation of the CD plan of the study, disaster related experiences in Bolivia, site visit for the pilot works. And discussions on appropriate technical support with institutional management, close relationship among UPD and related agencies at central and local levels, securing appropriate manpower, prevalence of road disaster prevention manual, holding periodic seminar etc. have been made.

To hold seminars is proved to make important role to enlighten the necessity of disaster prevention activity for all stakeholders of roads.

VI EVALUATION ON THE CAPACITY DEVELOPMENT ACTIVITIES

Chapter 11 Monitoring and Evaluation on the Development Project

The purpose of the monitoring and evaluation were to facilitate the capacity development for ABC staff concerned through the CD activities designated in the JICA project.

Monitoring (1) was undertaken from September to October 2006 and Monitoring (2) from January to February 2007, respectively. Terminal evaluation was conducted from May to June 2007 by the ABC-JICA evaluation team.

In the course of monitoring necessary adjustment and amendment have been done on each CD activity items.

At the monitoring(2) approval of CD Plan, establishment of the disaster prevention unit and incorporation into POA which are part of the first and second items have been authorized..

Chapter 12 Terminal Evaluation Results

Relevance, effectiveness and impact of the study have been evaluated as very high or mostly achieved

through the overall monitoring and evaluation carried out on the base of five evaluation criteria. . However, efficiency and sustainability have been deemed as moderately low being affected by lack of full-time participation to the activity. For keeping and developing sustainability, introduction of system of assistance by experienced donors will be important in this stage of just established organization which does not have experiences on the disaster prevention management.

VII CONCLUSIONS AND RECOMMENDATIONS

Chapter 13 Conclusions and Recommendations

The CD Plan and the fundamental tools have been prepared for implementation of road disaster prevention management for all national roads. The most important concern is that how ABC will enhance and sustain these activities regarding road disaster preventive management using knowledge and know-how obtained after termination of the study.

SEPARATE VOLUME

ROAD DISASTER PREVENTION MANAGEMENT MANUAL

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Abbreviation

AASHTO	American Association of State Highway and Transportation Officials
ABC	Administradoda Boliviana de Carreteras
AC	Asfalt Concrete
ANDINO	Grupo Andino
BID	Banco Inter-americano de Desarrollo
BM	Banco Mundial
CAF	Corporación Andina de Fomento
CD	Capacity Development
CN	Cuenta Nacional de Carreteras
CNCV	Cuenta Nacional de Conservacion Vial
EIA	Environmental Impact Assessment
E/N	Exchange of Notes
FONPLATA	Fondo Financiero para el Dasarrollo de la Cuenca del Plata
GDP	Gross Domestic Product
GIAS	Geographical Information and Analysis System
GNI	Gross National Income
HIPC	Highly Indebted Poor Countries
IDB (BID)	Banco Inter-americano de Desarrollo
IEE	Initial Environmental Examination
IIRSA	Iniciativa para la Integración de la Infraestructura Regional Sudamericana
INE	Instituto Nacional de Estadística
JICA	Japan International Cooperation Agency (Agencia de Cooperación Internacional de Japón)
KfW	Kreditanstalt fur Wiederaufbau
M/D	Minutes of Discussions
MERCOSUR	Mercado Común del Sur
PASA	Plan of Execution and Environmental Monitoring
PC	Prestressed Concrete
PCM	Project Cycle Management
PDM	Project Design Matrix
PL-480	Public Law 480
PMRD Database	Preventive Measure against Road Disasters Database
POA	Programacion Operativa Anual
PPM	Program for Prevention and Mitigation
PROEX	Brazilian Development Bank
PROVIAL	Programa de Conservacion Vial con Microempresas
RC	Reinforced Concrete
SAM	Management Administration System
SNC	Servicio Nacional de Caminos
SEARPI	Servicio de Encauzamiento de Aguas y Regularización del Río Rirai
SENAMHI	Servicio Nacional de Meteorologia e Hidrologia
SEPCAM	Servicio Prefectural de Caminos
TGN	Tesoro General Nacional
UPD	Unidad de Prevencion de Desastres
VIPFE	Viceministerio de Inversion Publica y Financimient Externo



Route 3 – 126.5km

A cliff of steeply dipping jointed sandstone. Rock fall will occur by block separation. Outcrop continues from 2.3 km to 3.1 km.



Route 3 – 299.0km

Outcrop of gently dipping reddish brown sandstone and siltstone. Steep cliffs of massive sandstones are formed by erosion of les.



Route 7 – 270.9km

Large-scale landslide. Stability of the sliding block should be investigated.



Route 4 – 119.2km

Severe disaster site of debris flow, where the existing bridge was destroyed. Existence of natural dam, which caused by slope failure along the tributary stream, is supposed.



Route 16

General View.



Route 16 – 196.8km

A disaster site of debris flow. The volume of debris is estimated at 200m³.



Route 16 – 248.3km

Large-scale rock fall of massive jointed sandstone, which caused by block separation along the downhill-dipping joint plane.



A Typical Measure - Gabion



Micro-empresa in Working (Cutting Grasses)



Disaster Spot Survey

Disaster spot survey on the way to Chulumani. (January 2006)



Fallen Rocks

Brmejo, SCZ on Route 7 (February 2007)



Site of Collapsed Rocks and Mud
Bermejo, SCZ on Route 7 (February 2007)



Collapse of Road Caused by Rain Water
Bermejo, SCZ on Route 7 (February 2007)



Waiting Line of Vehicles due to Road Close
Angostura, SCZ on Route 7 (February 2007)



Site Survey Meeting
(December 2005)



PCM Meeting
(December 2005)



Interview
(December 2005)



Working in the Study Office
(February 2006)



Preparatory Seminar
for Road Disaster Prevention (La Paz)
(February 2006)



Counterpart Meeting
(May 2006)



Manual Meeting with Regional Office
Engineers
(June 2006)



Manual Meeting
(June 2006)



Site Briefing on Disaster Registration
Recording
(January 2007)



Micro-Empresas

Simple Rain Gauge Monitoring Orientation Meeting with Micro-Empresas (July 2006)



Pilot Works Design Meeting

(August 2006)



Proceedings of the first seminar

October 9-10, 2006



First Seminar on Road Disaster Prevention

La Paz October 9-10, 2006



Pilot Works Site before Start

Bermejo, SCZ on Route 7



Pilot Works during Construction

River revetment work (November 2006)



Pilot Works after Completion
(March 2007)



Discussin Meeting on the Pilot Works
At SCZ Regional Office (February 2007)



Site Visit in the 2nd Seminar
Bermejo, SCZ on Route 7 (June 2007)



Steering Committee
September 4, 2007



Road Disaster Prevention Management Manual



Action Plan of UPD for road disaster prevention management

Chapter 1 |Introduction

(1) Background of the study

Bolivia is a landlocked country where the main means of transport is by land. The land is topographically composed of high land, valley, low land in which major cities are distributed respectively. And the Inter-ocean axis of IIRSA connecting the Pacific Ocean and the Atlantic Ocean is passing through Bolivia. Most of the roads which connect major cities run through mountainous area of the Andes. This often leads to traffic suspension due to road disasters such as collapse of slopes in rainy season of November-March every year. Consequently suspension of product distribution brings big negative influences to socio-economic activities of Bolivia.

In Bolivia the concept of road disaster prevention which aims to protect the road from disasters before the occurrence is not recognized well socially. And ABC herself does not have organization, system and budget for disaster prevention, but for maintenance of roads. Due to the lack of the budget, restoration after the occurrence is treated as full demand.

On long-term view, introduction of the concept of prevention before occurrence by finding signal of danger is more effective socio-economically than treatment after occurrence in this circumstances the support of capacity development for road disaster prevention has been requested to Japan which has accumulated experiences in the road administration of this field

(2) Objectives of the study

The purpose of the study is to support capacity development in road disaster prevention in Bolivia through the following;

- building an appropriate road inspection and maintenance system
- cultivating the necessary human resources through the following activities:
 - road disaster hazard diagnosis
 - formulation of slope repair and disaster countermeasure works
 - design supervision, estimation and construction supervision of slope countermeasure works and road structures

(3) Study Areas

The study area is located in mountainous and hilly terrain, as shown in [Figure 1.1](#), and covers a total length of 948km, being, from the north, 164km along Route 16, 275km along Route 3, 172km along Route 4 and 337km along Route 7, where there is risk of slope disaster.

BOLIVIA

THE STUDY ON PREVENTIVE MEASURES
AGAINST ROAD DISASTERS ON MAIN NATIONAL ROADS



- (1) Route 3: Cotapata - Yucumo (275km)
- (2) Route 4: Colomi - Ivirgarzama (172km)
- (3) Route 7: Epizana - El Torno (337km)
- (4) Route 16: Charazani - Apolo (164km)

Figure 1.1 Study Area

Chapter 2 Outline of the Study Implementation

(1) Outline of the Study

The purpose of this study is to support capacity development in the area of road disaster prevention in Bolivia.

Assistance is provided to Administradora Boliviana de Carreteras (ABC) to implement the following items.

- (1) Formation of Capacity Development Plan
- (2) Preparation of Road Disaster Inventory as a technical element
- (3) Preparation of Road Disaster Prevention Manual as a technical element
- (4) Support of Capacity development through the implementation of pilot works.
- (5) Activity for concept of disaster prevention through seminars
- (6) Revision of the Capacity Development Plan and the Road Disaster Prevention Manual

The implementation flowchart is shown in [Figure 2.2](#) with the total work schedule in [Figure 2.1](#).

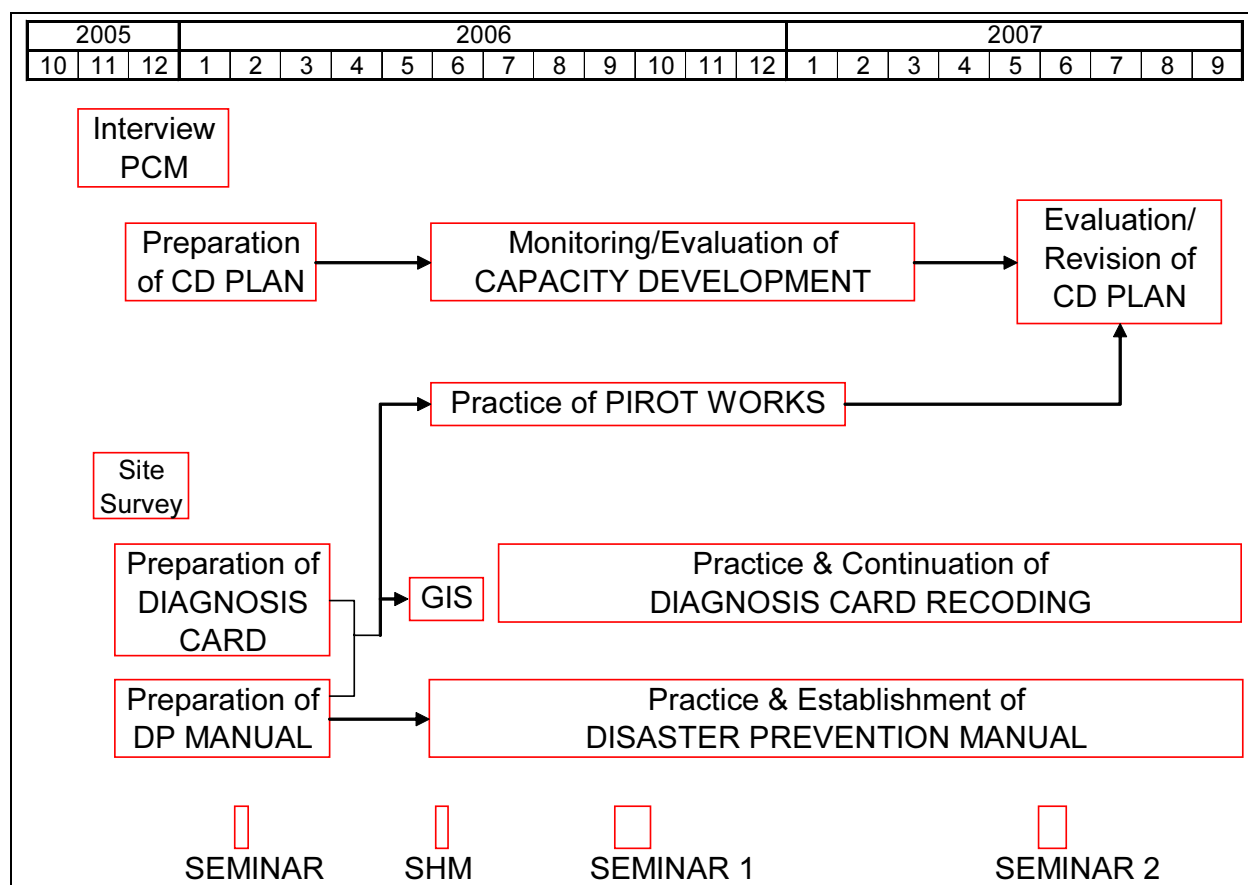


Figure 2.1 Total Arrangement of Work Schedule

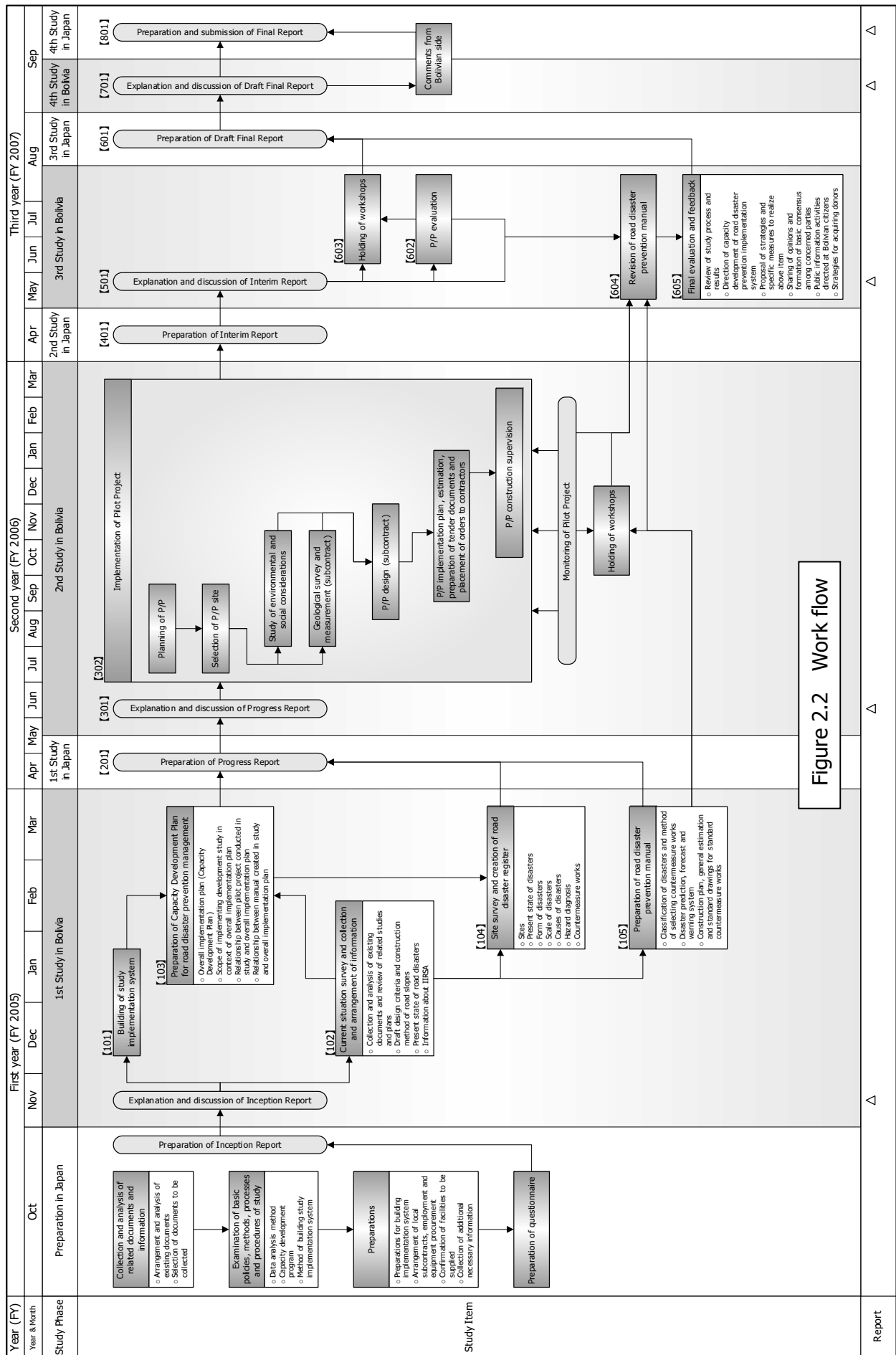


Figure 2.2 Work flow

(2) Implementation System of the Study

The organization of ABC is shown in [Figure 2.3](#). ABC is in charge of administration of national roads in Bolivia under supervision of Viceministerio de Transportes, Ministerio de Servicio y Obras Publicas ABC is composed of the headquarter office in La Paz and ten regional offices. The length of national road under administration is over 15,000 km. The number of staffs are about 280. The role of ABC staff is, not for direct construction by self power, but financial administration and supervision on new construction, road improvement and maintenance. The large portion of the budget is from foreign aid.

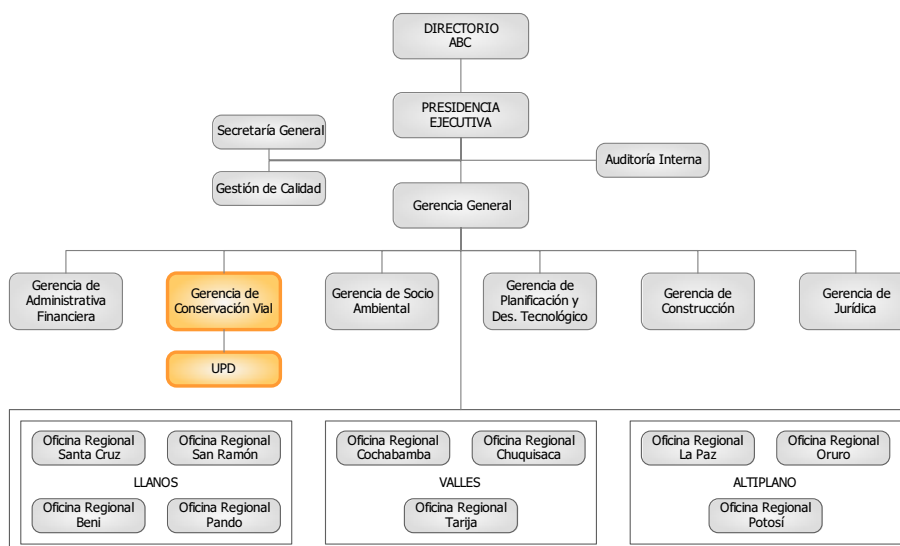


Figure 2.3 Organization of Administradora Boliviana de Carreteras (ABC)

The implementation system for the study is shown in [Figure 2.4](#). The task team has a role of substantial work supported by advice from JICA study team. The task team is composed of engineers and administrators from each department headed by general manager and head of maintenance department. The orientation of the study is supervised by the steering committee.

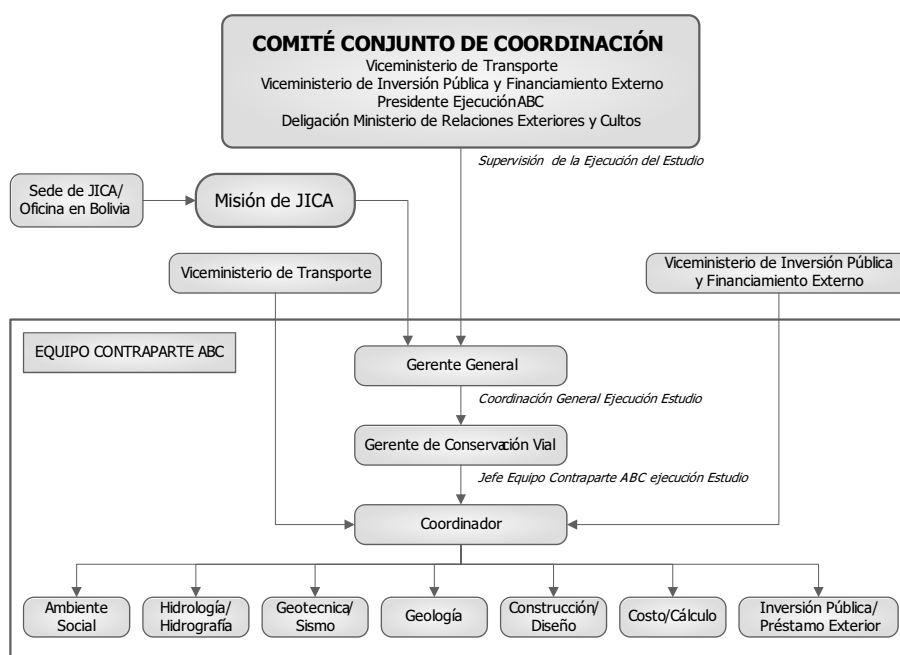


Figure 2.4 Organization of the Steering Committee and the Task Team

Chapter 3 General Condition of Roads

(1) Natural Conditions

Chapter 3 describes the general situation in Bolivia regarding roads (society, natural environment and road network), with particular attention given to the natural features of Bolivia, such as topography, geology and climate, that are closely related to road disasters. The natural conditions are dealt with in details in a separate report of the progress report.

The geologic condition in Bolivia is shown in [Figure 3.1](#). The geological investigation area is located in the East Andes Range, the Sub-Andes Zone and Amazonian Lowland. In this area, sedimentary rocks of the Paleozoic, Mesozoic and Cenozoic Era are distributed. And igneous rocks are not exposed here.

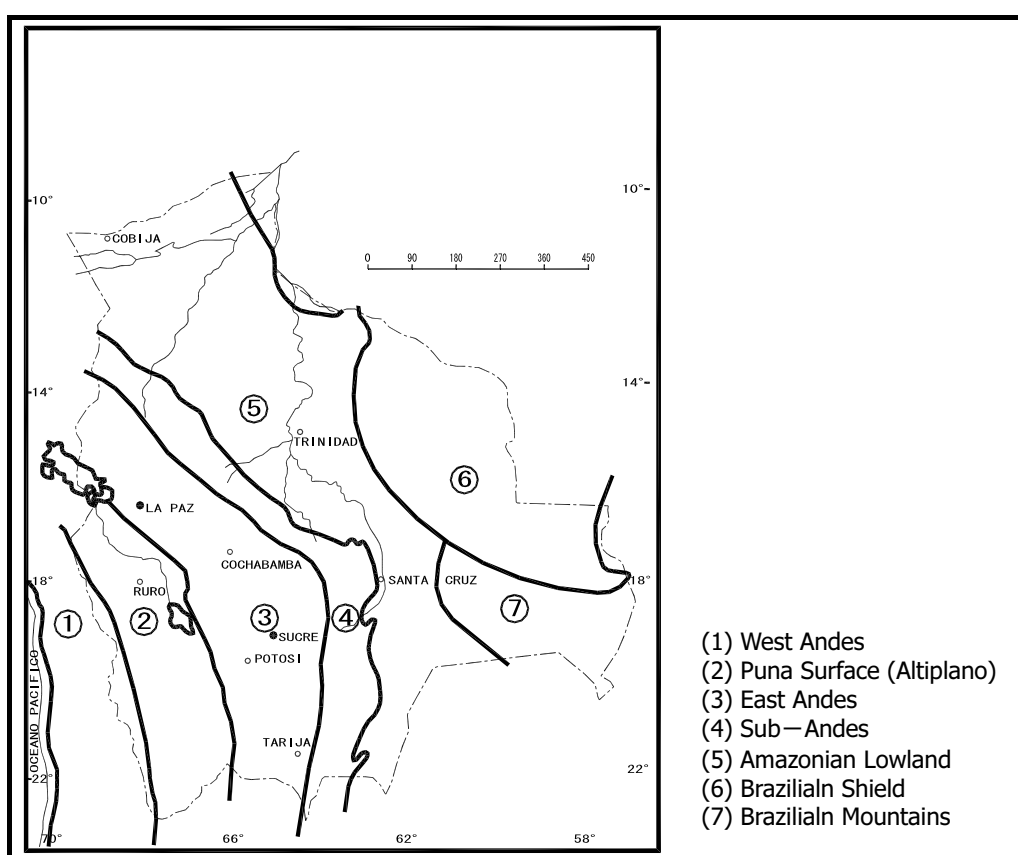


Figure 3.1 Geologic Province Map of Bolivia

The annual rainfall distribution in Bolivia is shown in [Figure 3.2](#) and the relation to the project area is indicated in [Table 3.1](#). It tells that quite large amount of rainfall is concentrated in a part of Route 4, around El Sillar district due to topographical feature of the area. On the other hand rainfall amount in the area of route 7 and route 16 is not much. There is some tendency of deviation in rainfall distribution in Bolivia in comparison to the case of Japan in which large amount rainfall is averagely observed in every part of the land due to typhoon pass. In general the number of slope failures increase by rainfall amount bases, however in this case of dry area some exceeding from annual averages might bring slope failures in which slope has a tendency to keep its critical angle of stability according to the climate of the area.

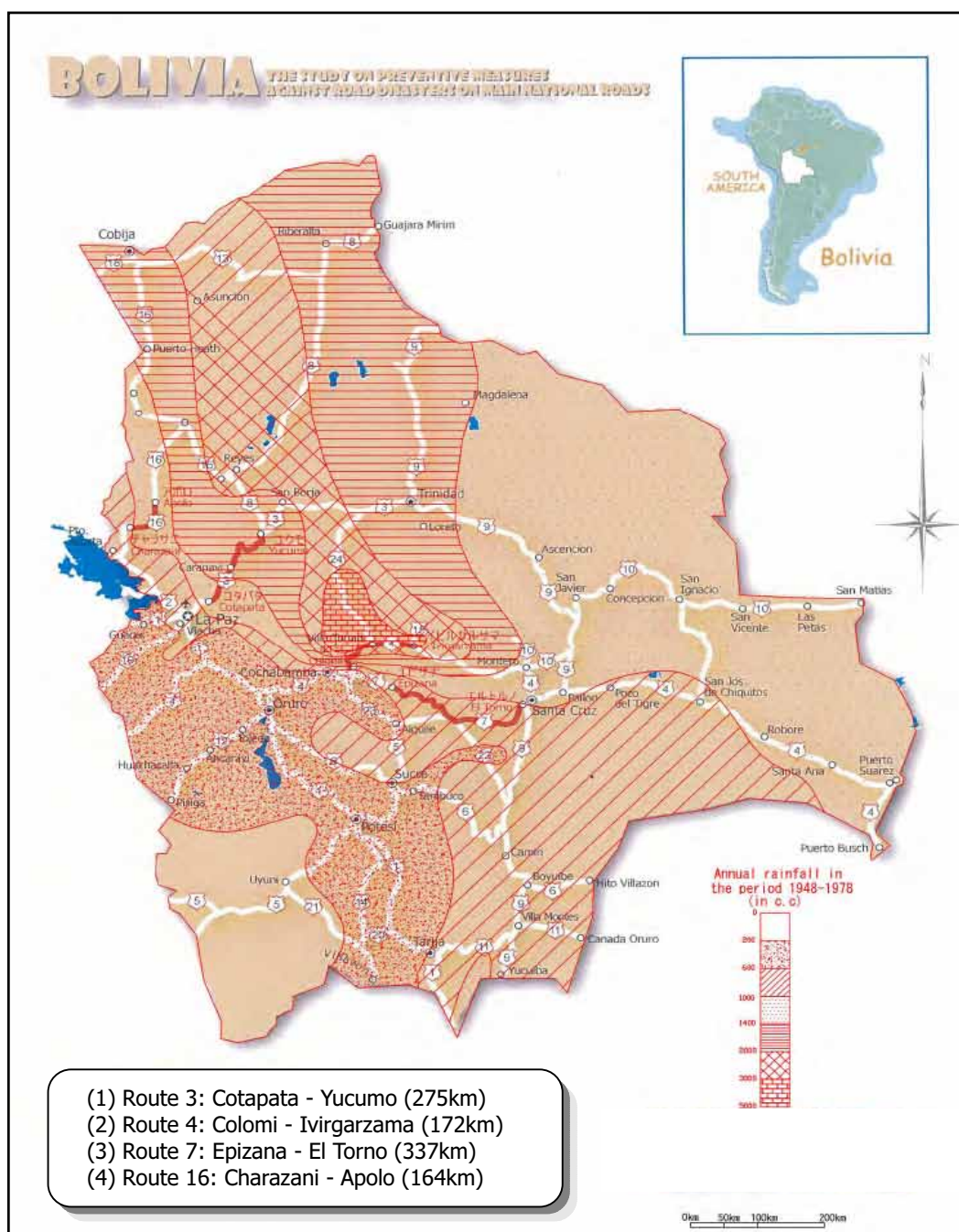


Figure 3.2 Annual Rainfall in Bolivia

Table 3.1 Rainfall in the Project Area

annual rainfall	0~200	200~600	600~1000	1000~400	1400~2000	2000~3000	3000~5000
Route16			●	●			
Route3				●	●		
Route4				●	●	●	●
Route7			●				

(2) State of the Roads

The highway network system managed by ABC is shown in the project location map at the beginning of this report. Table 3.2 shows the state of overall road construction in Bolivia, including regional roads other than trunk roads.

Of the total 67,076km of roads, ABC manages 15,665km of trunk roads (approx. 23%). With only 28% (4,395km) of trunk roads paved, top priority is given to paving the export corridor. Promotion of industry by construction of all-weather roads, including other regional roads, is an urgent issue.

Table 3.2 State of roads in Bolivia (as of December 2005)

(km)

Region	National Highway				State Highway				Municipal Roads				Total			
	Paved	Gravel	Earth	Total	Paved	Gravel	Earth	Total	Paved	Gravel	Earth	Total	Paved	Gravel	Earth	Total
La paz	668	814	985	2,467	63	2,442	17	2,522	19	1,428	3,870	5,317	750	4,684	4,872	10,306
Chuquisaca	214	400	335	949	0	950	379	1,329	4	539	3,337	3,880	218	1,889	4,051	6,158
Tarija	383	457	339	1,179	44	841	222	1,107	12	2,066	1,333	3,411	439	3,364	1,894	5,697
Cochabamba	664	406	209	1,279	66	2,493	1,507	4,066	2	1,518	1,425	2,945	732	4,417	3,141	8,290
Santa cruz	1,427	820	1,905	4,152	5	1,011	2,491	3,507	12	604	4,568	5,184	1,444	2,435	8,964	12,843
Oruro	576	566	56	1,198	0	570	126	696	6	431	3,319	3,756	582	1,567	3,501	5,650
Potosí	260	1,046	477	1,783	0	598	927	1,525	2	989	7,461	8,452	262	2,633	8,865	11,760
Beni	169	1,045	892	2,106	8	100	1,032	1,140	0	312	1,096	1,408	177	1,457	3,020	4,654
Pando	33	289	230	552	0	88	453	541	0	34	591	625	33	411	1,274	1,718
Total	4,394	5,843	5,428	15,665	186	9,093	7,154	16,433	57	7,921	27,000	34,978	4,637	22,857	39,582	67,076

Source: Gerencia de Planificación y Desarrollo Tecnológico del ABC

Chapter 4 Current Situation Survey on Road Administration and Disaster Prevention

Chapter 4 reports on the road administration system of the ABC (Administradora Boliviana de Carreteras), the public corporation responsible for road management. This chapter describes the relationship between the management organization, finance, management system and road improvement plan and the IIRSA (Integration of Regional Infrastructure in South America).

(1) Organization and Financial State

Following the introduction of a decentralization policy in 1995, the ABC road management enforcement system changed from direct management with equipment and personnel, to the current system of consignment to the private sector where it is run by a small, elite staff. New road construction and road improvement are carried out with funds from overseas donors. On the other hand, the maintenance costs of national highways are met from domestic funding (partial appropriation of tolls and hydrocarbon taxes). Financial source and spent budget of ABC are shown in Table 4.1 and Table 4.2.

Table 4.1 Financial source breakdown of ABC budget
(in thousand U.S. dollars)

Fiscal year	2002		2003		2004	
Budget / Implited	Budget	Implited	Budget	Implited	Budget	Implited
Domestic source	54,873	18,360	24,584	9,803	43,912	2,562
CN	17,282	1,733	11,389	4,118	21,550	2,562
APLOCAL	37,591	16,627	13,195	5,685	22,362	
Foreign source	141,141	96,527	184,554	126,658	218,048	185,614
Collateral	2,793	504	2,676	200	5,461	2,976
CAF	57,901	37,170	74,552	49,293	81,801	70,550
PROEX	28,624	22,667	23,098	17,251	39,929	36,713
BM	21,599	15,468	50,783	39,092	58,854	48,592
BID	16,520	12,677	19,731	13,533	11,353	4,451
KFW	3,105	4,444	2,520	1,911	483	481
PL-480						
NPG						
EXIMIBANK	3,966		2,022	423	4,497	490
FONPLATA			6,576	4,661	8,712	8,452
OPEC					1,169	892
JBIC						
Japan	5,285	3,231	1,096	294	442	507
Others	1,348	366	1,500		5,347	11,510
Total	196,014	114,887	209,138	136,461	261,960	188,176

Source: ABC

Table 4.2 Spent breakdown of ABC budget

(in thousand U.S. dollars)

Fiscal year	2002		2003		2004	
Budget / Implted	Budget	Implted	Budget	Implted	Budget	Implted
Personnel cost	6,077	3,100	4,686	3,936	4,448	4,448
Fixed Expense	24,270	21,302	41,417	28,386	37,762	27,183
Road Investment	196,014	114,887	209,138	136,461	261,960	188,176
Construction	156,795	93,011	155,152	113,643	202,114	151,153
Plan/Design	4,014	1,394	2,319	510	3,721	1,318
Maintenance	22,645	10,654	49,736	21,643	54,385	34,802
Restrtaion	12,559	9,827	1,931	666	1,741	905
Total	226,360	139,288	255,241	168,784	304,172	219,809

Source: ABC

(2) Situation of Road Maintenance

The administration role of construction, improvement and large maintenance such as periodical repair of pavements is concentrated in the headquarter of ABC owing financial source from foreign aids of loan. The daily or ordinary maintenance of national roads is executed by the ten regional offices distributed in every prefecture. For the ordinary maintenance, the maintenance administration system of the World Bank is introduced where the road network is divided into 35 sections (tramos) and for each section one-year-base contract of administration of maintenance is made with private sectors. AS for the daily maintenance the micro-empresas organized in local village bases are in charge by man power works such as road cleaning, weeding, repairing potholes of pavement, keeping drainage etc. The organization of maintenance in regional office is shown in [Figure 4.1](#).

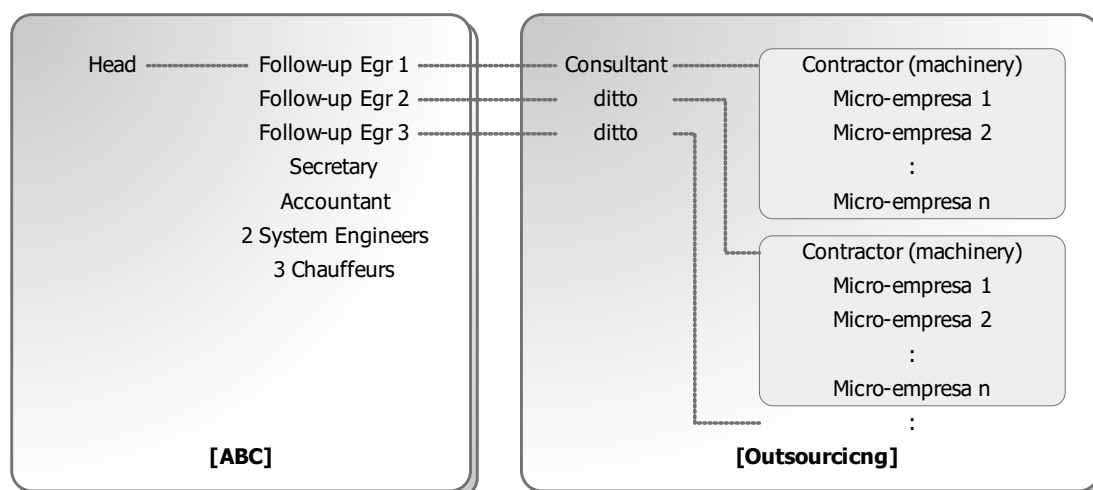


Figure 4.1 Organization of maintenance in regional office

(3) Situation on approaching to Road Disaster Prevention

As for disaster records, there has been no accumulation of records in ABC headquarter. It is similar situation in the regional offices and no attempts have been made to uniform data system and to collect disaster records although the consultant (supervisor) has prepared road inventory periodically which contains the data of road conditions of pavements, retaining walls, etc.

In Bolivia the concept of road disaster prevention which aims to protect the road from disasters before the occurrence is not recognized well socially. And ABC herself dose not have organization, system and budget for disaster prevention, but for maintenance of roads. Due to the lack of the budget, restoration after the occurrences is treated as full demand.

Generally some directors or engineers of ABC and concerned really recognize the importance of the road disaster prevention. Partly information on risk spots and road inventory are prepared by the consultant (supervisor) in regional offices. It will be effective to develop those systems for establishment of disaster prevention.

(4) Development Plan and IIRSA

A national road improvement plan has been formulated with priority given to consistency with the development axis (Figure 4.2) proposed in IIRSA. However, no organizations, systems or standards relating to road disasters exist as yet in the IIRSA or national improvement plan.

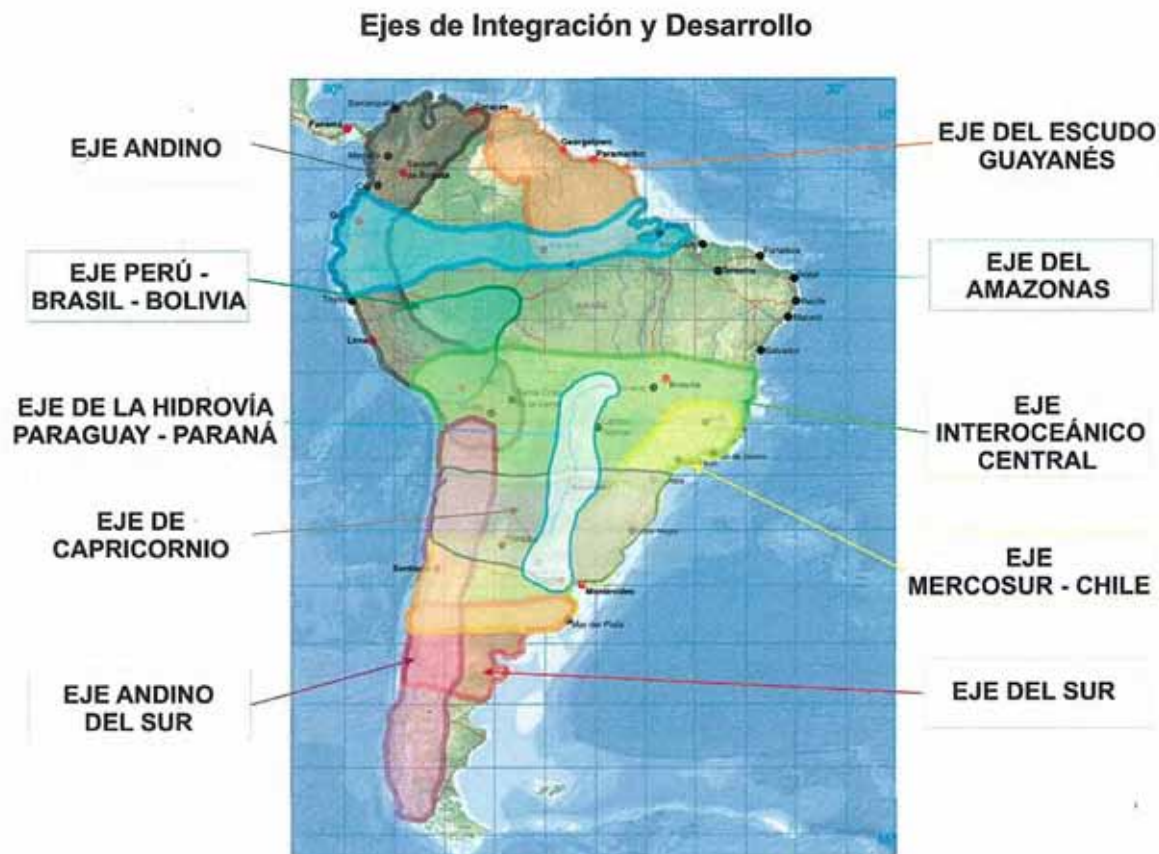


Figure 4.2 General Development Plan of IIRSA (10 axes)

Chapter 5 Formulation of Capacity Development Plan on Road Disaster Prevention Management

(1) Formulation of the Overall Capacity Development Plan

Problems in the ABC relating to implementation of the road disaster prevention management project were selected and analyzed jointly with the ABC counterparts, based on the project-participation-type analysis method of PCM (Project Cycle Management) meetings and interviews with concerned parties. The problems were analyzed on an individual level (ABC staff), organizational level (ABC headquarters and regional offices) and system/social level ([Table 5.1](#)).

Next, after the objectives analysis (resolution of problems) of analyzed and classified problems, it is compiled into 9 items as the objectives analysis ([Table 5.2](#)).

When formulating the overall implementation plan, after clarifying the definition of capacity and the main body involved as shown in [Figure 5.1](#), 7 projects shown in [Figure 5.2](#) were selected, taking into consideration the objectives and means defined in the objectives analysis ([Table 5.3](#)). Each project can be solely independent in term of execution but there are relatively many relations and connections among them. The super goal of the CD plan is designated as “Road Disaster are Reduced in Bolivia” and the overall goal as “Continuous Road Disaster Preventive Management is Executed in ABC”. The proposed 7 projects are explained briefly in [Table 5.4](#).

Table 5.1 Problems in promoting road disaster prevention management in ABC (individual, organization, system/society in level)

Overall Goal	problems	Cause of problems			System/society Level
		Individual Level	Organization Level		
		ABC staffs	<ul style="list-style-type: none"> •Overall organization of ABC •Each department relating to road disaster preventive management in ABC •Regional offices of ABC 	<ul style="list-style-type: none"> •All person and organization engaging in disaster preventive management •Law, Act, regulation relating to road disaster prevention •regal system, organization, culture and custom in ABC stimulated 	
	1. Insufficient public awareness with regard to the social role and activities carried by ABCS	<ul style="list-style-type: none"> •Lack of technology in disaster prevention for person in charge •Lack of communication among each department •Insufficient opportunities of training and seminar in disaster prevention •Poor opportunities to exchange information between other organizations 	<ul style="list-style-type: none"> •Lack of appealing importance of disaster prevention to the public 	<ul style="list-style-type: none"> •Less recognition of benefit to prevent disasters in advance for political decision makers 	
	2. Lack of knowledge on road disaster preventive management	<ul style="list-style-type: none"> •Lack of technology in disaster prevention for person in charge •Lack of communication among each department •Insufficient opportunities of training and seminar in disaster prevention •Poor opportunities to exchange information between other organizations 	<ul style="list-style-type: none"> •No existence of department or unit for disaster preventive management •No experts and engineers having disaster technology •Insufficient basic data and information in disaster prevention •No assessment study on risk evaluation for possible disaster prone sections •No preparation of design standard and manuals for disaster prevention investigation and preventive measures •No database on past disaster with detailed information 	<ul style="list-style-type: none"> •Few organizations disseminating information and educating disaster prevention technology and knowledge in Bolivia •Lack of experiences in disaster prevention for engineers in construction companies and consultants 	
	3. No establishment of road disaster preventive management system	<ul style="list-style-type: none"> •Lack of knowledge on disaster preventive management system •No existence of engineers having specific technology in disaster prevention 	<ul style="list-style-type: none"> •No existence of department or unit executing disaster preventive management •No establishment of ordinal system of disaster preventive management •No establishment of recording system of disaster conditions •No existence of manuals of disaster preventive management •No establishment of database on disaster preventive management •Insufficient system of monitoring and communication during disasters •No establishment of relationship with outside exterior organizations •No establishment of follow-up and evaluation system of disaster preventive measures 	<ul style="list-style-type: none"> •No national decree stipulating establishment of new executing department or unit in ABC •Insufficient relationship among each organization relating to disaster preventive management 	
Continuous Road Disaster Preventive Management is executed in ABC	4. No planned execution of road disaster preventive measures	<ul style="list-style-type: none"> •Lack of knowledge of disaster preventive measures 	<ul style="list-style-type: none"> •No existence of mid-long term plan designating disaster preventive measures along national highways •Rare opportunities to plan annual disaster preventive measures into POA •No establishment of design criteria on disaster preventive measures •Delay of completion of construction due to payment postponement •Insufficient experience of preparation of tender document and technical specification 	<ul style="list-style-type: none"> •Insufficient budget for disaster preventive measures •No existence of company specialized in disaster prevention technology in Bolivia 	
	5. Inadequate response to emergency of road disasters	<ul style="list-style-type: none"> •Lack of knowledge of disaster preventive management 	<ul style="list-style-type: none"> •No existence of experts and engineers applying to emergency disaster response in ABC •No smooth execution of emergent disaster preventive measures in ABC •No preparation of manuals for emergency response during disaster •No establishment of skill of preparation of specification of emergent preventive measures 	<ul style="list-style-type: none"> •No reliable securement of budget for emergency response •Insufficient collaborative relationship with SEPROM •No permission of nominated tender in emergency cases 	
	6. No existence of early warning and evacuation system	<ul style="list-style-type: none"> •Insufficient knowledge of warning and evacuation 	<ul style="list-style-type: none"> •No establishment of warning and evacuation system •No preparation of manuals on warning and evacuation •Insufficient communication system on warning information to the public •Poor development of communication network system for early warning of emergency disaster •No establishment of alarming system of emergency conditions 	<ul style="list-style-type: none"> •Insufficient collaborative relationship with military, police, local entities concerned •No establishment of legal back-up system to declare emergency crisis 	
	7. No experience of preparation of technical specifications and performance of tendering	<ul style="list-style-type: none"> •Lack of preparation capability of technical specification 	<ul style="list-style-type: none"> •No smooth performance of preparation of tender document and technical specification •No preparation of standard documents in tendering •No smooth execution of tender evaluation by contract committee 	<ul style="list-style-type: none"> •No local empowerment in tender and contract to regional offices •No selection of turn-key method for urgent works of preventive measures 	
	8. No simple procedure and prompt transaction in tender		<ul style="list-style-type: none"> •Waste of time in approval and procedures in tendering •No clarification of responsibility at each position •Long time process in issue of payment certificate 	<ul style="list-style-type: none"> •No local empowerment in tender and contract to regional offices •No right to direct operation of overseas credit fund 	
	9. Insufficient budget for road disaster prevention		<ul style="list-style-type: none"> •Not planned obtainment Several of overseas assistant fund •No strategy plan to obtain new financial fund 	<ul style="list-style-type: none"> •Occasional delay of National Annual Budget •Occasional cancellation of Local Contribution Budget •No legal background of obtainment of budget for enhancement f disaster preventive organization 	

Table 5.2 (1) Result of Objectives Analysis

<p>1. Public awareness of social role and activities carried by ABC are enhanced</p> <ul style="list-style-type: none"> 1) <i>Disaster prevention activities of ABC are widely disseminated to the public</i> 2) <i>Proper behavior and reaction in emergency disasters for local residents and road users are instructed to the public</i> 3) <i>Seminars on road disaster prevention with collaboration of societies and universities are hold to the public</i> 4) <i>Ordinary people participate in meeting to discuss and kake decision on disaster prevention matter</i> 5) <i>ABC disaster preventive activities by ABC are acknowledged through Web-site and monthly bulletin</i>
<p>2. Technology and Knowledge on road disaster preventive management are improved</p> <ul style="list-style-type: none"> 1) <i>Disaster preventive management department or unit is established</i> 2) <i>Experts and engineers specialized in disaster prevention are trained</i> 3) <i>Disaster preventive technology and knowledge are collected and accumulated</i> 4) <i>Data and information on disaster preventive management such as maps and geological data are compiled</i> 5) <i>Technology on inspection and evacuation in road disaster prevention are collected and stored</i> 6) <i>Database on risk points along national highway network is established</i> 7) <i>Attendance to seminars and training courses is easily available</i> 8) <i>Design standard and criteria on disaster preventive measures are established</i> 9) <i>Database on past disaster records along national highway is established</i> 10) <i>Cooperative relationship with other organizations are established</i>
<p>3. Road disaster preventive management system is established</p> <ul style="list-style-type: none"> 1) <i>Road preventive management system is well established</i> 2) <i>Recording system on disaster conditions is established</i> 3) <i>preventive management system is established (utilization of supervisor and micro-enterprise)</i> 4) <i>Manuals on road disaster preventive management is prepared</i> 5) <i>Database on disaster prevention information is established</i> 6) <i>Monitoring and communication system on road disasters is established</i> 7) <i>Cooperation system with exterior organizations is established</i> 8) <i>Follow-up and evaluation system on disaster preventive measures is established</i>
<p>4. Road disaster preventive measures are executed on schedule</p> <ul style="list-style-type: none"> 1) <i>Mid-long term master plan on disaster preventive measures along national highway is formulated</i> 2) <i>Annual preventive measures are planned on POA (large scale preventive measure not applied to maintenance works)</i> 3) <i>Management skill of disaster preventive measures is established (investigation, plan, design, upervision,etc.)</i> 4) <i>Design criteria of disaster preventive measures is prepared</i> 5) <i>No delay of payment for preventive works takes place</i> 6) <i>Smooth preparation of tender documents and specification is executed</i> 7) <i>Some companies having disaster preventive technology exist</i> 8) <i>Road disaster preventive fund is established and executed as planned</i> 9) <i>Legal condition for executing disaster preventive works is established</i>
<p>5. Emergency response to road disasters is rapidly executed</p> <ul style="list-style-type: none"> 1) <i>Budget for emergency disaster measures is secured</i> 2) <i>System of emergency response to disaster is established</i> 3) <i>Manuel on Emergency response is prepared</i> 4) <i>Cooperative relationship with SEPCOM is established</i> 5) <i>Technical working group for applying emergency measures is made up in ABC</i> 6) <i>Approved tender at emergency disaster is introduced</i> 7) <i>Preparation capability on technical specification on disaster emergency is established</i>

Table 5.2 (2) Result of Objectives Analysis

<p>6. Warning and evacuation system is established</p> <ul style="list-style-type: none"> 1) <i>warning and evacuation system is established</i> 2) <i>Manual on warning and evacuation is prepared</i> 3) <i>Warning information is provided to road users on time</i> 4) <i>Cooperative structure with military, police and local entities concerned is established</i> 5) <i>Communication network on early warning system is established</i> 6) <i>Legal back-up system on declaration of emergency crisis is established</i> 7) <i>Preparation skill of technical specification on emergency disaster preventive measures is established</i> 8) <i>Emergency warning communication system is established</i>
<p>7. Preparation of technical specifications and performance of tendering are conducted</p> <ul style="list-style-type: none"> 1) <i>Tender documents and technical specifications is smoothly prepared</i> 2) <i>Standard documents relating to tendering is prepared</i> 3) <i>Working in contract committee is smoothly conducted</i> 4) <i>Local empowerment of tendering and contract procedures is transfer to provincial offices</i> 5) <i>Turn-key method is partly adopted</i> 6) <i>Legal framework accelerating process is established</i>
<p>8. Administrative procedures are simplified</p> <ul style="list-style-type: none"> 1) <i>Procedures in tendering and approval are simplified (ISO, direct movelization of budget, etc.)</i> 2) <i>Local empowerment of tendering and contract procedures is transfer to provincial offices</i> 3) <i>Area and range of responsibility are clarified</i> 4) <i>Procedures for payment certificate is simplified</i>
<p>9. Budget for disaster prevention enterprise is secured</p> <ul style="list-style-type: none"> 1) <i>Payment from National Annual Budget is secured</i> 2) <i>Payment from Local Contribution Budget is secured</i> 3) <i>Budget for enforcement of organization is secured</i> 4) <i>Financing of Overseas Assistant Fund is progressed as scheduled</i> 5) <i>Strategy on securement for new financial resources is formulated</i>

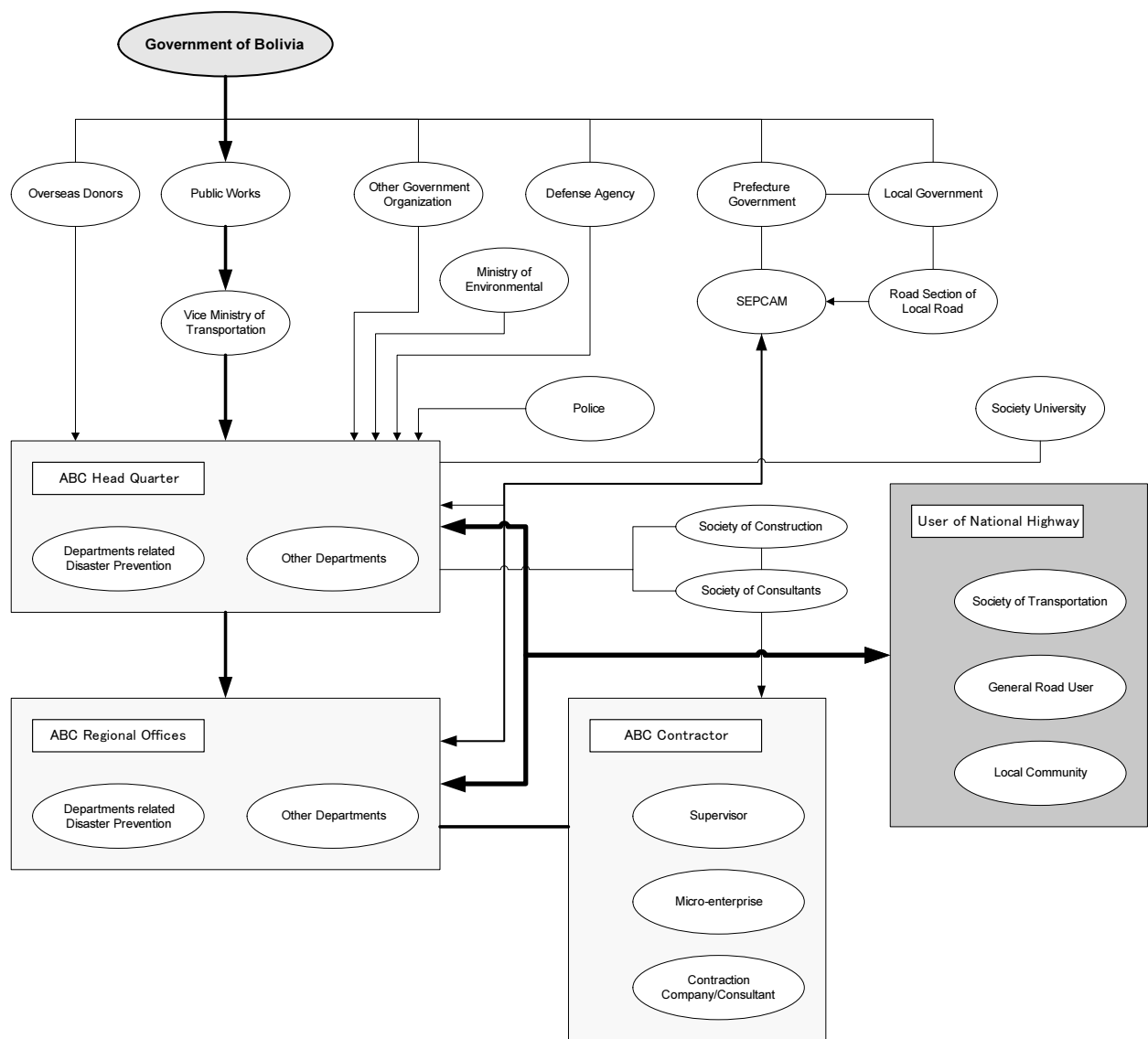


Figure 5.1 Relationship between ABC and Stakeholder relating to Road Disaster Prevention

Table 5.3 Definition and Main Body of Capacity Development
for Road Disaster Prevention Management in ABC

Definition of CD		<Individual>	<Organization>	<System society>
Main actors of CD				
Public Sector	HQ of ABC	<u>Senior officers</u> · can identify problems on road disaster prevention management concretely. · can plan and conduct adequate road disaster preventive measures <u>Technical personnel</u> · have specialized knowledge and technology on road disaster prevention · can make technical judgment based on knowledge obtained · can plan, execute and evaluate disaster preventive measures · can prepare tendering documents property	<u>Departments relating to disaster prevention</u> · Disaster prevention department (Unit) can execute disaster prevention enterprises as leading position · Disaster prevention department (unit) has disaster prevention experts and engineers and execute disaster works · SNC has each manual on disaster preventive management and use them constantly · Mid-long term disaster preventive plan are formulated and executed as planned · Equipment, materials and basic data necessary for disaster preventive works are settled and can be utilized anytime. · Cooperative relationship is well established and emergency response is conducted smoothly <u>Financial, and legal departments</u> · Establishment of disaster preventive management department (unit) is acknowledged legal · System and staffs for execution of urgent disaster preventive measures are established · Bourget of disaster prevention can be obtained constantly	<u>Presidential office</u> · Legal framework to facilitate disaster preventive works is established <u>Ministry of finance</u> · National Annual Budget, National Road Management Budget and local Contribution Budget are completely secured · Budget and emergency disaster preventive fund are secured separately <u>Preandino (CAF)</u>
	ABC provincial offices			· the same as HQ of SNC
	SEPCOM	<u>Persons in charge of road disaster prevention</u> · have basic knowledge on road disaster prevention	<u>SEPCOM disaster prevention divisions</u> · Concrete problems on road disaster prevention can be recognized	<u>Prefecture Governments</u>
Private sectors	Contractors for ABC	<u>Engineers of construction company</u> · similar to supervisors,	<u>Construction Companies</u> · Importance of road disaster prevention can be recognized	<u>Society of construction</u>
		<u>Supervisors (personnel contract)</u> · have basic knowledge on road disaster prevention · can inspect road disaster slope condition, prepare disaster record sheet and manage them · can instruct micro-enterprises technology in road disaster prevention		
		<u>Micro-enterprises (Small scale employees)</u> · can do assistant works of road disaster preventive management	<u>Association of Micro-enterprises</u>	<u>PROVAIL (WB, CAF)</u>
	Transportation companies	<u>Society representatives</u> · Chamber of transportation, Driver' union (CNCB, etc.)	<u>Truck association, etc.</u>	<u>Administrative transportation organization</u>
Nonprofit organization		<u>Local residents</u> · Importance of road disaster preventive management is recognized <u>Societies, Universities concerned</u> · Training and seminar on disaster prevention can be held periodically	<u>Community</u>	

: Main actors of CD

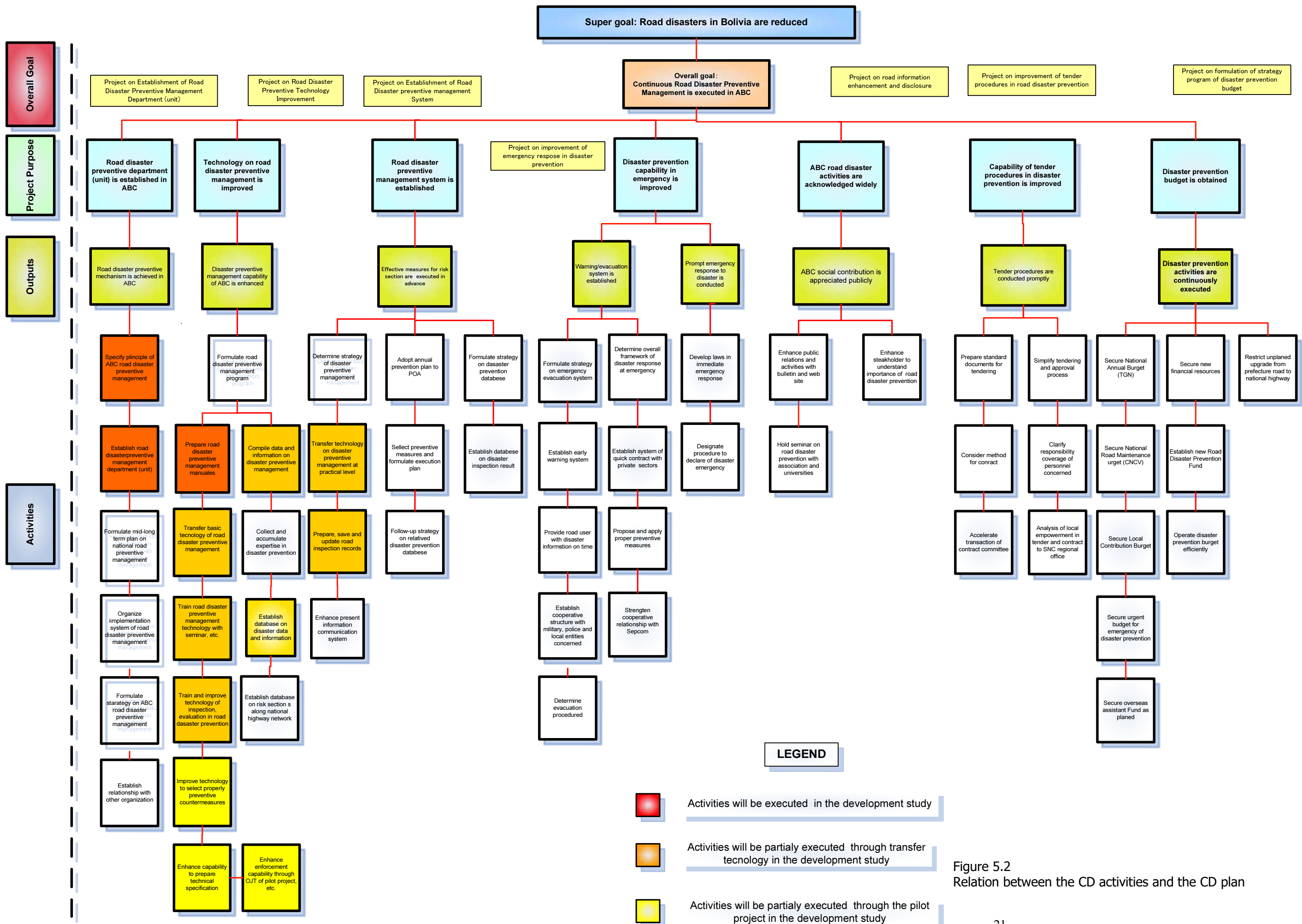


Figure 5.2
Relation between the CD activities and the CD plan

Table 5.4 Brief Explanation of the proposed projects:

<p><Project-1: Project on Establishment of Road Disaster Preventive Department (unit)></p> <p>This is identified as the priority No.1 project within seven (7) projects proposed in the CD plan. The project goal is to establish the implementation body like a department or a unit for specializing in road disaster preventive management in ABC. The department or the unit is chiefly expected to play an important role as a leader in execution and one of the information centers for disaster preventive management in ABC. It is necessary that some experts and engineers including project manager, geological/geotechnical engineers, and hydrologist, and design/cost evaluation engineers, financial and judicial experts participate in the project.</p>
<p><Project-2: Project on Road Disaster Preventive Technology Improvement></p> <p>The project goal is to aim at improving technology in the field of road disaster preventive management in ABC. The main activities of the project are technology transfer, provision of basic information and building up database in road disaster preventive management to ABC personnel concerned. The project shall be a foundational base in the case of executing sequential Project-3 and Project-4.</p>
<p><Project-3: Project on Establishment of Road Disaster Preventive Management System></p> <p>The project goal is to establish the road disaster preventive management system in ABC. After completion of the system building, risk sections along all national highways will be identified and proper countermeasures against road disasters will be clarified and carried out before occurrence of disasters. Moreover, disaster records and inspected information on road slopes will be compiled as a database in the project.</p>
<p><Project-4: Project on Improvement of Emergency Response in Disaster Prevention></p> <p>The project aims at improving the emergency response to road disasters which including the establishment of warning / evacuation system and the prompt emergency response system to disasters. In establishing the warning / evacuation system, it is considered that introduction of early warning system and setting up cooperative relation with military, police and local entities concerned, etc. are the most important matters to do immediately. On the other hand, emergency response includes quick adoption of the private sectors, selection and proposal of proper measures, strengthening relation with SEPCOM, and development of legal system on declare of disaster emergency.</p>
<p><Project-5: Project on Road Information Enhancement and Disclosure></p> <p>The project goal is to enhance the public awareness and disclose information concerning the contents of activities and the social contribution by ABC in road disaster preventive management. The major tasks are wide dissemination of information to the public through the bulletin and Website of ABC, holding seminars and training courses in cooperation of societies and universities, and communication with stakeholders, and so on.</p>
<p><Project-6: Project on Improvement of Tender Procedures in Road Disaster Prevention></p> <p>This project aims at improving tender procedures more effectively with upgraded transaction ability. It is considered that the causes of delaying the tender are not only poor preparation of tender documents concerning road disaster preventive measures and long-time signing process, but also delay of consultation progress with the contract evaluation committee in ABC. At present, owing to some overseas technical assistant projects, such as the ISO9000 achievement project by WB and the administrative improvement project by CIDA, the part of the above –mentioned problems have been improved gradually rather than before.</p>
<p><Project-7: Project on formulation of Strategy Program of Disaster Prevention Budget></p> <p>The purpose of this project is to obtain surely the road disaster budget for road disaster preventive management and is one of the most important projects proposed in the CD plan. National Annual Budget (TGN), National Road Maintenance Budget (CNCV), Local Contribution Budget, and Overseas Assistance Fund, etc. are considered as target budgets and funds. On the other hand, new additional financial resource, for example, “Road Disaster Preventive Fund” is conceivable to be one of the promising funds to be obtained. In promoting the project, adequate judgment and proper action taking into account political and social conditions are strongly required.</p>

Table 5.5 explains project goal, expected evaluation, main actors of activities, contents of activities and inputs, respectively. As for the overall schedule of the CD plan, The 7 projects are planned to be conducted within 3 years. With regard to evaluation of 7 selected projects, a matrix was created showing relevance, social impact, feasibility, sustainability, anticipated adverse effects, ABC views and overall assessment (Table 5.6).

Table 5.5 (1) Outline of Proposed Projects

Project Name	Project Purpose	Outputs	Main Body of Activities	Activities	Inputs
1 Project on Establishment of Road Disaster Preventive Management department (unit)	Road disaster Preventive department (unit) is established in ABC	Road disaster preventive mechanism is achieved in ABC	<ul style="list-style-type: none"> · Road disaster prevention department (unit) and staff 	<ul style="list-style-type: none"> · Specify principle of ABC road disaster preventive management · Establish road Disaster preventive management department (unit) · Formulate mid and long term plan on national road preventive management · Organize implementation system of road disaster preventive management · Formulate strategy on ABC road disaster preventive management · Establish relationship with other organizations 	<ul style="list-style-type: none"> · Transfer technology by experts and engineers · Enhance capability with seminars and training · Provide instrument and material
2 Project on Road Disaster Preventive Technology Improvement	Technology on road disaster preventive management is improved	Disaster preventive management capability of ABC is enhanced	<ul style="list-style-type: none"> · Road disaster prevention department (unit) and staff · Other Departments and staff · Regional offices and staff and supervisors 	<ul style="list-style-type: none"> · Formulate road disaster preventive management program · Prepare road disaster preventive management manuals · Transfer basic technology of road disaster preventive management by experts · Obtain road disaster preventive management technology with seminar, etc. · Train and improve technology on inspection and assessment of hazardous section in disaster · Improve technology to select properly preventive measures · Improve technology to select properly preventive measures · Enhance enforcement capability through OJT through pilot project, etc. · Compile data and information on disaster preventive management · Collect and accumulate expertise in disaster prevention · Establish database on past disaster data and information · Establish database on risk section along national highway network 	<ul style="list-style-type: none"> · Transfer technology by experts and engineers · Enhance capability with seminars and training · Provide instrument and material · Enhance enforcement capability through OJT through pilot project, etc.
3 Project on establishment of road disaster preventive management system	Road disaster preventive management system is established	Effective measures for risk sections are executed in advance	<ul style="list-style-type: none"> · Road disaster prevention department (unit) and staff · Other Departments and staff · Regional offices and staff, and supervisors and micro-enterprises 	<ul style="list-style-type: none"> · Determine strategy of disaster preventive management · Transfer technology on disaster preventive management at practical level · Prepare, save and update road inspection records periodically · Enhance present information communication system · Include annual prevention plan in POA · Select preventive measures and formulate execution plan · Follow-up disaster prevention and upgrade evaluation system · Formulate strategy on relative disaster prevention database · Establish database on disaster inspection result 	<ul style="list-style-type: none"> · Transfer technology by experts and engineers · Enhance capability with seminars and training · Prepare road disaster preventive management manuals · Provide instrument and material · Enhance enforcement capability through OJT through pilot project, etc.

Table 5.5 (2) Outline of Proposed Projects

Project Name	Project Purpose	Outputs	Main Body of Activities	Activities	Inputs
4 Project on improvement of emergency response in disaster prevention	Disaster prevention capability in emergency is improved	<ul style="list-style-type: none"> Warning/evacuation system is established Prompt emergency response to disaster is conducted 	<ul style="list-style-type: none"> Road disaster prevention department (unit) and staff Other Departments and staff Regional offices and staff, and supervisors and micro-enterprises SEPCOM 	<ul style="list-style-type: none"> Formulate strategy on emergency evacuation system Establish early warning system Provide road user with disaster information on time Establish cooperative relation with military, police and local entities concerned Determine evacuation procedures Determine overall framework of disaster response at emergency Establish system of emergency mobilization of private sectors Propose and apply proper preventive measures Strengthen cooperative relation with SEPCOM Develop laws in immediate emergency response Designate procedure to declare of disaster emergency 	<ul style="list-style-type: none"> Transfer technology by experts and engineers Enhance capability with seminars and training Prepare road disaster preventive management manuals Provide instrument and material Enhance enforcement capability through OJT through pilot project, etc.
5 Project on road information enhancement and disclosure	ABC road disaster activities are acknowledged widely	<ul style="list-style-type: none"> ABC social contribution is appreciated publicly 	<ul style="list-style-type: none"> Road disaster prevention department (unit) and staff Other Departments and staff 	<ul style="list-style-type: none"> Enhance public relations and activities with bulletin and Web site Hold seminar on road disaster prevention with associations and universities Hold seminar on road disaster prevention with associations and universities 	<ul style="list-style-type: none"> Transfer technology by experts and engineers Enhance capability with seminars and training
6 Project on improvement of tender procedures in road disaster prevention	Capability of tender procedures in disaster prevention is improved	<ul style="list-style-type: none"> Tender procedures are conducted promptly 	<ul style="list-style-type: none"> Road disaster prevention department (unit) and staff Other Departments and staff 	<ul style="list-style-type: none"> Prepare standard documents for tendering Consider method for contract Accelerate transaction by contract committee Simplify tendering and approval process Clarify responsibility coverage of personnel concerned Analysis of local empowerment in tender and contract to ABC regional offices 	<ul style="list-style-type: none"> Introduction of ISO (WB) Execution of PRI(CAF,WB) Execution of administrative improvement project(ACDI) <p>Some contents of the project have been already completed</p>
7 Project on formulation of strategy program of disaster prevention budget	Disaster prevention budget is obtained constantly and assuredly	<ul style="list-style-type: none"> Disaster prevention activities are continuously executed 	<ul style="list-style-type: none"> Executive administration Department Financial department Legal department Regional offices 	<ul style="list-style-type: none"> Secure National Annual Budget (TGN) Secure National Road Maintenance Budget (CNCV) Secure Local Contribution Budget Secure urgent budget for emergency of disaster prevention Secure Overseas Assistant Fund as planned Secure new financial resource Establish new Road Disaster Prevention Fund Operate disaster prevention budget efficiently Restrict unplanned upgrade from prefecture road to national highway 	<p>It is hard to complete the project without any cooperation of related organizations</p>

Table 5.6 Evaluation of Proposed Projects

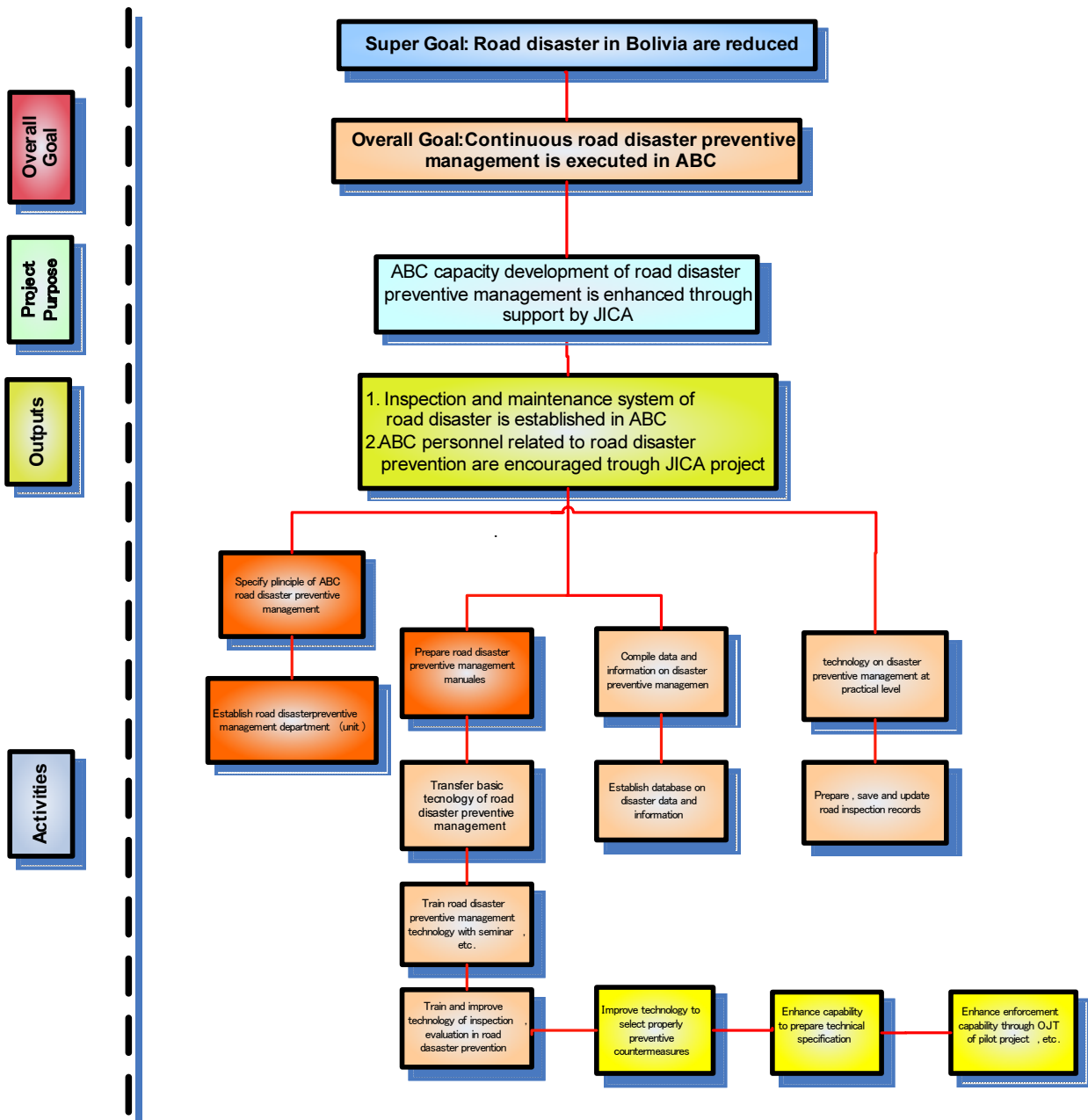
Name of project	Project Establishment of Road Preventive Management Department (unit)	Project on Disaster Technology Improvement	Project Establishment of Road Disaster preventive management System	Project on improvement emergency response in disaster prevention	Project on information enhancement and disclosure	Project on improvement of tender procedures in road disaster prevention	Project on formulation of strategy program of disaster prevention budget
Project purpose	Road disaster preventive department (unit) is established in ABC	Technology on road disaster preventive management is improved	Road disaster preventive management system is established	Disaster prevention capability in emergency is improved	ABC road disaster activities are acknowledged widely	Capability of tender procedures in disaster prevention is improved	Disaster prevention budget is continuously obtained
Outputs	Road disaster preventive mechanism is achieved in ABC	Disaster preventive management capability is enhanced	Effective measures for risk section are executed in advance	Warning/evacuation system is established Prompt emergency response to disaster is conducted	ABC social contribution is appreciated publicly	Tender procedures are conducted promptly	Disaster prevention activities are continuously executed
Relevance	Center for disaster preventive management is established	Lack of disaster preventive technology is improved	Accidents induced by natural disasters are reduced due to establishment of disaster preventive management	Social and economic loss is reduced due to emergency prompt response	Social liability is obtained due to increase of transparency of ABC	Management efficiency of tendering is improved due to smooth procedures	Funds are secured and disaster preventive management is executed without any trouble
Social impact	Great impact to ABC and SEPCOM	Small social impact due to technical transferring project	Greatly social impact due to reduction of road disasters	Greatly social and economic impact due to prompt emergency impact	Middle scale impact due to increase in awareness of road disaster preventive activities by ABC		
Possibility of achievement	High possibility because of fundamental agreement inside ABC	High possibility to achieve because of high-level staff in ABC	High possibility to achieve because of well functioned organization of ABC H.Q and provincial offices	Middle in possibility to achieve legal system, secure budget and cooperate with other agencies.	High possibility to achieve due to availability of web-site and monthly bulletin	Some parts of project have been proceeding with assistance of WB, CAF and Canadian government	It is uncertain to achieve because of possible influence from political issue
Independence possibilities	Possible to operate by ABC after completion of project. It is necessary to secure adequate budget.	Sustainability of disaster preventive technology is secured due to well information sharing	Sustainability of project is secured due to well cooperative relationship with ABCs and supervisors and micro-enterprises	Emergency budget is secured and relationship with SEPCOM is necessary	Sustainability is maintained with well function of disaster preventive department (unit)		
Expected negative influence	No negative influence	No negative influence	No negative influence	In the case of not being responsible, system is not functional	Effective of project is dependent on contents of article presented	No negative influence	There are some possibilities for ABC to be exploited for political purposes
ABC' view	Technical assistance from donor countries is requested	Technical assistance from donor countries is requested	Technical assistance from donor countries is requested	Technical assistance from donor countries is requested	ABC can carry out independently	At present, reformation program is under going backupt by WB, CAF and CIDA	Political judgment is necessary for decide when it starts
Comprehensive evaluation	Prompt execution is needed	After establishment of disaster prevention department, prompt execution is needed	After establishment of disaster prevention department, prompt execution is needed	After establishment of disaster prevention department, prompt execution is needed	After establishment of disaster prevention department, prompt execution is needed	Part of proposed project has been already conducting	It is important to start immediately but necessary to judge timing of execution

(2) Scope of the CD Plan in the JICA Study

The scope of implementation of the CD Plan in the JICA Study in the context of the overall implementation plan is lay in the project 1 to project 3, mainly coincide with project 2 as indicated in Figure 5.2. And the position of the road disaster prevention manual the pilot works were confirmed, and proposals concerning promotion of the overall implementation plan were summarized.

The framework of CD plan activities carried out in the JICA project is shown in Figure 5.3 and Table 5.7. These activities target ABC's capability enhancement at the personnel, organizational, and social and institutional levels.

Table 5.8 presents the contents of CD activities and the implementation schedule of JICA experts in charge in the JICA project. The Project Design Matrix (PDM₀) of the CD support for this study is shown in Table 5.9.



Legend



Activities will be executed in the development study



Activities will be partially executed through transfer technology in the development study



Activities will be partially executed through the pilot project in the development study

Figure 5.3 Framework of CD activities

Table 5.7 Framework of Capacity Development Plan

CD objectives	Target of CD	Expected effectiveness by CD	Type of CD	Applied method to CD
Individual level	<ul style="list-style-type: none"> • Staff of each department in ABC • Staff of each regional office in ABC • Supervisors • Micro enterprise • SEPCOMs • Private sectors (Contractors, Unions and associations) 	<ul style="list-style-type: none"> • Technology transfer of road disaster preventive management • Establishment of road disaster preventive management system • Enhancement capability to plan, manage and inspect preventive measures • Enhancement of capability to prepare technical specification for tendering • Strength of technology in warning/evacuation • Promotion of Information sharing and exchanging among ABC 	<ul style="list-style-type: none"> • Technical knowledge and skill on road disaster preventive management • Ability to judge in road disaster preventive management on technical basis • Practical skill to plan, execute and evaluate road disaster preventive measures 	<ul style="list-style-type: none"> • Transfer technology by experts • Participation in training courses and seminars • Preparation of road disaster registration records • Preparation of manuals • Execution of road disaster registration recording based on manual • On the job training of planning, management and evaluation on disaster measures at pilot project
Organizational level	<ul style="list-style-type: none"> • Each department in ABC • Each regional office in ABC • SEPCOMs 	<ul style="list-style-type: none"> • Encouragement of disseminating capability of disaster preventive management to outside of ABC • Establishment of execution organization of disaster preventive management • Establishment of training system for specialists in disaster preventive management • Strength of risk evaluation system on critical section along national networks • Enhancement of capability of warning and evacuation • Establishment of information communication system • Enhancement of ability to prepare, renew and store road disaster registration records • Establishment system of emergency response • Smooth mobilization of "Contract evaluation committee" • Formulation of manuals, guidelines and design standard • Building up databases on technical information • Establishment of cooperative relationship with other agencies • Formulation of middle-long term disaster preventive plan • Improvement to prepare tendering document and specification • Simplification of tendering documentation • Formulation of obtainment of fund and budget 	<ul style="list-style-type: none"> • Capacity to promote road disaster prevention in ABC • Specialist with technology and skill in road disaster preventive management in ABC • Capability to formulate disaster preventive plan and obtain fund/budget • Materials and data necessary for performance • Information, intellectual property, technical know-how • Facilitating skill in managing ,regulations and system in ABC • Cooperative system with outside agencies 	<ul style="list-style-type: none"> • Establishment disaster preventive management department/unit and enhancement of its management • Transfer technology by experts • Development of capacity with Participation in workshops and seminars • Establishment of road disaster preventive management and technology support • Provision of technical manuals, guidance and standards • Support of establishment of database • Technical specification, support of improvement of tendering
System/ society level	<ul style="list-style-type: none"> • All agencies and persons related road disaster prevention • People, local and industrial societies • Low and regulation, policy, etc. • Act, national policy • Organization structure, authority 	<ul style="list-style-type: none"> • Approval of CD plan by ABC president • Establishment of disaster preventive unit • Recognition of importance of disaster prevention • Update and establishment of laws and regulations • Securing of national budget of disaster prevention • Effectively allocation and mobilization by Loan credit • Establishment of definitely cooperative relationship with other agencies. 	<ul style="list-style-type: none"> • ABC ACT, other regulations • Road disaster related laws • Tendering regulation, related laws • Infrastructure, machine, etc. • Donor's cooperative system • Cooperation with other agencies 	<ul style="list-style-type: none"> • Institutional reform in ABC • Enactment and revision of laws relating disaster prevention • Awareness of disaster information to the public with Web-site and newsletter. • ABC's role and obligation at emergency crisis • Holding Periodical donor's meeting • Holding stakeholder meeting

Note: • Items in red can be identified as the CD activities in the JICA project, including transfer technology to ABC individuals and provision of technical know-how and skill concerning road disaster registration recording and manuals to ABC.

• Quality control of documentation and transaction, WB proceeding at present, is main task by WB. JICA may support it indirectly.

• Support for improvement of procurement system in tendering will be planned by WB in the project of BO-3630.

Table 5.8 The Contents and Implementation Schedule of CD activities in JICA project

<Items of CD activities>	JICA expert in charge	Target persons of CD activities	2006								2007					
			May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
<Support for CD activities by JICA experts>																
1) Specify principle of ABC road disaster preventive management	Capacity development 1, 2	・Counterparts (CD)														
2) Establish road disaster preventive management department (unit)																
3) Prepare road disaster preventive management manuals	Disaster prevention manual	・Counterparts manual)														
4) Transfer basic technology of road disaster preventive management	Road disaster prevention, Design, Natural condition, Geologist	・Persons in ABC headquarters														
5) Training road disaster preventive management technology with seminars.	Road disaster prevention, Design, Manual, Geologist	・Persons in ABC headquarters ・Persons in ABC regional offices/ SEPCOM ・Contractors														
6) Train and improve technology of inspection, evaluation in road disaster prevention	Natural condition survey	・Persons in ABC headquarters														
7) Compile data and information on disaster preventive management		・Persons in ABC regional offices/contractors														
8) Establish database on disaster data and information																
① Instruct onsite road disaster registration recording (OJT)	Natural condition survey	・Persons in ABC headquarters ・Persons in ABC regional offices/contractors														
② Establish road disaster registration database	Database/GIS	・Counterparts (GIS)														
③ Formulate road disaster preventive management		・Persons in ABC regional offices														
9) Transfer technology on disaster preventive management at practical level																
① Explain manuals to related agencies	Disaster prevention manual	・Persons in ABC headquarters ・Persons in ABC regional offices														
② Revise manual		・Counterparts manual) ・Persons in ABC regional offices														
③ Transfer road disaster preventive management using manual (OJT)		・Persons in ABC regional offices/contractors														
10) Prepare, save and update road inspection		・Micro enterprises														
<Support for CD activities through pilot project>																
11) Improve technology to select properly preventive countermeasures																
① Geological investigation for selection of preventive measures	Natural condition survey	・Persons in ABC headquarters ・Persons in ABC regional offices/contractors														
② Methodology of disaster measures selection	Design, Natural condition survey															
12) Enhance capability to prepare technical specification																
① Topographic survey	Natural condition survey	・Persons in ABC regional offices ・Persons in ABC regional offices/contractors														
② design	design															
③ pilot project	Construction plan/cost estimate/supervisor															
13) Enhance enforcement capability through OJT of pilot project, etc.																
① Support tender of topographic/geological survey	Natural condition survey	・Persons in ABChadquarters ・Persons in ABC regional offices/contractors														
② Plan/execute/analysis geological investigation																
③ Support tender of design of measures	Design															
④ Design road disaster preventive measures																
⑤ Plan of disaster construction management and estimate construction cost	Construction plan/cost estimate/supervisor															
⑥ Support order of pilot work																
⑦ Execute construction supervision of pilot works																
⑧ Inspect completion of pilot work																

Table 5.9 PDM₀ of CD activities in JICA project

Project Name: Capacity Development (CD) activities for ABC road disaster preventive management Duration of project: October 19, 2005 to the middle of June, 2007 (21months)

Ver.No:PDM₀
As of May 24, 2006

Main Body of Activities: Headquarters and regional office of ABC, and other related persons

Narrative Summary	Objectively Verifiable indicators	Means of Verification	Important Assumption
<p>Super Goal: Road disasters in Bolivia are reduced.</p> <p>Overall Goal: Continuous road disaster preventive management is executed in ABC</p>	<ul style="list-style-type: none"> Long term blockade caused by natural disasters is reduced along national highways in Bolivia. Budget for road disaster preventive management is secured annually. 	<ul style="list-style-type: none"> Report on road disasters by maintenance department and/or regional offices in ABC Financial report by financial department in ABC 	<ul style="list-style-type: none"> ABC's inner structural is not changed drastically.
<p>Project purpose: ABC Capacity Development of road disaster preventive management is enhanced through support by JICA experts.</p>	<ol style="list-style-type: none"> ABC's principle in road disaster preventive management is defined (ABC president's approval of the CD plan) Transfer technology in road disaster preventive management is achieved effectively in ABC. Knowledge and know-how related to road disaster preventive management is accumulated in ABC. Road disaster preventive management is conducted based on the manual constantly in ABC. 	<ol style="list-style-type: none"> Official document to prove ABC president's approval of the CD plan. (ABC president's signature) CD evaluation report (JICA experts) interview records Official document to prove ABC president approval of the manual (ABC president's signature) Road disaster registration records, road disaster inspection sheets, road disaster database, rainfall observation records and interview records. 	<ul style="list-style-type: none"> Counterparts are secured continuously during the project.
<p>Outputs:</p> <ol style="list-style-type: none"> Road inspection and maintenance system of road disaster is established in ABC. ABC personnel having knowledge and skill in road disaster preventive management are encouraged through JICA project. 	<ol style="list-style-type: none"> Road disaster preventive management unit is established and its executing system is fixed Manuals and databases on road disaster preventive management are fully equipped. Critical and highly risk points along national highways are revealed routinely by road disaster registration recording and inspection, and prompt response is improved Transfer technology is achieved by training and seminar to ABC staff concerned. 	<ol style="list-style-type: none"> Member list of road disaster preventive management department/unit, activity report. Road disaster preventive manuals, road disaster database Road disaster registration records, report of countermeasures to road disasters, evaluation checking list Evaluation check list, questionnaire survey to seminar participants, interview records, construction record 	<ul style="list-style-type: none"> Cooperation from ABC headquarters and regional offices is secured continuously during the project. Opportunity to obtain technology is secured.
<p>Activities:</p> <ol style="list-style-type: none"> Specify principle of ABC road disaster preventive management (ABC president approval) Establish road disaster preventive management department (unit) Prepare road disaster preventive management manuals Transfer basic technology of road disaster preventive management Training road disaster preventive management technology with seminars. Train and improve technology of inspection, evaluation in road disaster prevention Compile data and information on disaster preventive management Establish database on disaster data and information Transfer technology on disaster preventive management at practical level Prepare, save and update road inspection Improve technology to select properly preventive countermeasures Enhance capability to prepare technical specification Enhance enforcement capability through OJT of pilot project, etc. 	<p>Inputs:</p> <p><Japan> Personnel [JICA Project team] Team Leader/Road Disaster Prevention 10.27 M/M Deputy Team Leader/Capacity Development 9.44 M/M Design for Road Disaster Prevention 5.27 M/M Disaster Prevention Manual 8.17 M/M Geologist for Collapse Mechanism 2.00 M/M Natural Condition Survey 4.10 M/M Construction Planning and Cost Estimation 10.77 M/M Environmental Assessment 2.30 M/M Capacity Development 7.17 M/M Database/GIS 1.00 M/M Total 60.49 M/M</p> <p>Holding of training and seminar 3 times</p> <p>Transfer technology through pilot project (slope failure at road shoulder and frame work for slope stability) 2 types of structure measures</p> <p>Provision of materials GIS software 1 set</p>	<p><ABC in Bolivia> Personnel [ABC headquarters (Counterparts)] Chief coordinator 1 person Coordinator 1 person Planning and research department 3 persons Social environmental department 2 persons Construction department 2 persons Maintenance department 1 person Financial department 1 person Justice department 1 person Total 12 persons</p> <p>Provision of facilities 1 set</p>	<p>Preconditions:</p> <ul style="list-style-type: none"> No political conflict takes place.

(2) Practice of Road Disaster Inventory

The disaster inventory was firstly prepared as the diagnosis card for critical spots and then additional information is to be added in the occasions of disaster happenings. The trials for the disaster inventory recordings were carried out along the Route 25 under La Paz Regional Office of ABC in a rainy season of November 2006 – April 2007. From these experiences the registration format of the inventory has been revised partly in distance indication or adding explanation notes etc.

On the prevalence to all national roads, formulation of guideline on disaster registration system consisting of appointment of administrator, establishment of the system, emergency response, input of disaster registration records, transmittance of the records to UPD, renewal of the system is to be conducted. The newly established UPD (Road Disaster Prevention Unit) is in charge of these administration.

Chapter 7 Database System for Road Disaster Prevention

(1) Establishment of Database System for Road Disaster Inventory

Chapter 7 describes establishment of database system for the diagnosis data and disaster records to be added in the occasion of disasters. For the systematic utilization of stored and accumulated data, the system is composed of M.S.Access and GIS (Geographical Information System) under discussions with ABC counterpart and JICA study team. And the data of 259 critical spots diagnosed in the inventory has been installed into the system.

An example of displayed window of the database is shown in [Figure 7.1](#) and an example of the data input form of register of road disaster is shown in [Figure 7.2](#).

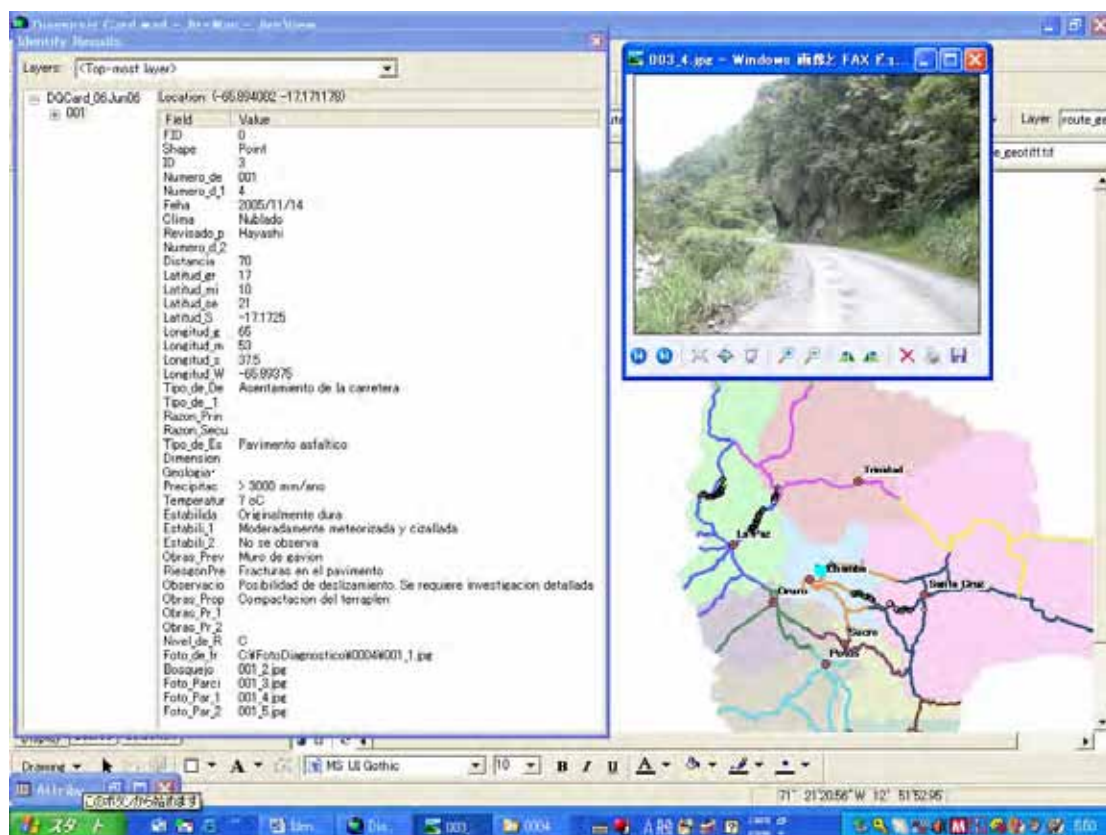


Figure 7.1 Example of the Identity Result Window

Microsoft Access - [DIAGNOSTIC CARD]

Registro de Desastres en Carreteras

Número 0019_0080_05300_060422 Fecha de Llamado: 2006 05 27
 Llamado por: XORE

Oficina Regional: La Paz Latitud: 17° 40' 00" S Latitud Decimal: -17.6667
 Número de ruta: 0019 Longitud: 64° 43' 00" W Longitud Decimal: -64.7167
 Número de sección: 0000
 Punto de Inicio: BOLLALACA RUTA 33111
 Km del punto de inicio: 05300 Km Fecha de Ocurrencia: 2006 04 22

Tipo de Desastre: Embankment Failure Dimensión del Desastre: Failure of Shoulder
 Razón Elemental: Deslizamiento
 Razón Contribuyente: Rampa fuerte
 Tipo de Estructura: Camino ripado

Periodo de obstrucción: From 2006 04 02 To 2006 05 21 60 Dias
 Periodo de Reducción a un solo carril de tráfico: From 2006 04 02 To 2006 04 05 3 Dias

Método por Rehabilitación: Drenaje subterráneo Costo Estimado por Rehabilitación: 330,000 B\$
 Costo Pagado por Rehabilitación: 420,000 B\$

Observaciones:
 No se encuentra la boca de salida del drenaje subterráneo.

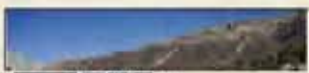


Figure 7.2 Example of the Data Input Form of Register of Road Disaster

(2) Practice of the system

The trials of road disaster registration were conducted for the route 3 under La Paz Regional Office and the data was added to the disaster inventory.

On the prevalence of disaster registration system to all national roads, the records to be added on the occasion of disasters are to be put into the database system for systematic utilization. The newly established UPD is in charge of the administration.

Chapter 8 Road Disaster Prevention Management Manual

(1) Preparation of Road Disaster Prevention Management Manual

The principle of the manual is to be the guide for ABC action on disaster prevention (action before disaster) and the guide keeping vehicles and passengers safe .

The manual consists of following five guides;

Guide I	Determination of High Hazard Control Sections
Guide II	Disaster Prevention Works in Routine Maintenance
Guide III	Management for Imminent Danger
Guide IV	Emergency Response
Guide V	Disaster Prevention Measures

In the composition of the manual examples from Japan and other countries were collected as reference materials, but the specific contents were created through discussions and joint authorship with the ABC counterparts, taking into consideration, in particular, the implementation system of road maintenance management in Bolivia which consists of the micro-empresas (micro companies), the Supervisors, ABC Regional Offices, ABC Head Office and keeping in mind of feasibility.

The flow chart of the manual in relation to each guide is as shown in [Figure 8.1](#).

The full text of the manual is attached in [separate volume](#) of which short guide is introduced in [Table 8.1](#). And an example of inspection card for the micro empresas is shown in [Figure 8.2](#).

Table 8.1 Short Guide for the Manual

<u>Guide I Determination of High Hazard Control Sections</u> This is a guide to recognize critical sections (hazardous sections) on the national highways before hand. The critical sections are recorded in common format in every 50 meters interval. For common base, types of disasters (in 6 types) and risk levels (in 4 levels) are defined. High Hazard Control Sections (SCMA) and High Risk Control Sections (SCAR) are designated for the guide II after.
<u>Guide II Disaster Prevention Works in Routine Maintenance</u> This is a guide for ordinary maintenance in order to find the sign of disaster in early stage as possible (cracks, displacements etc.). Routine maintenance is relied on the micro-empresas on front line and the supervisors who manage them. A simple manual to detect anomalies are prepared for the micro-empresas.
<u>Guide III Management for Imminent Danger</u> This is a guide indicates responses and actions which should be taken in emergency cases before the disaster and the mid disaster. Early warning system for wide area is established in order to perceive imminent danger by the observation of precipitation along the national highways. The guide introduces a simple rain gauge as the warning device which is installed at all the Micro-empresas stations, and is monitored daily by the Micro-empresas.
<u>Guide IV Emergency Response</u> The guide shows emergency and recovering activities of mid-disaster and post-disaster. The guide introduces information collection and communication, organization in emergency, emergency inspection, emergency measures, temporary restoration and disaster record. The flow of Information to road users in case of road close is also included.
<u>Guide V Disaster Prevention Measures</u> This is a guide for design of prevention measures as well as investigation for design of prevention measures. Principal methods for prevention measures are described in disaster types. Drainage works for surface water and groundwater are important and recommendable as effective and economical prevention measures.

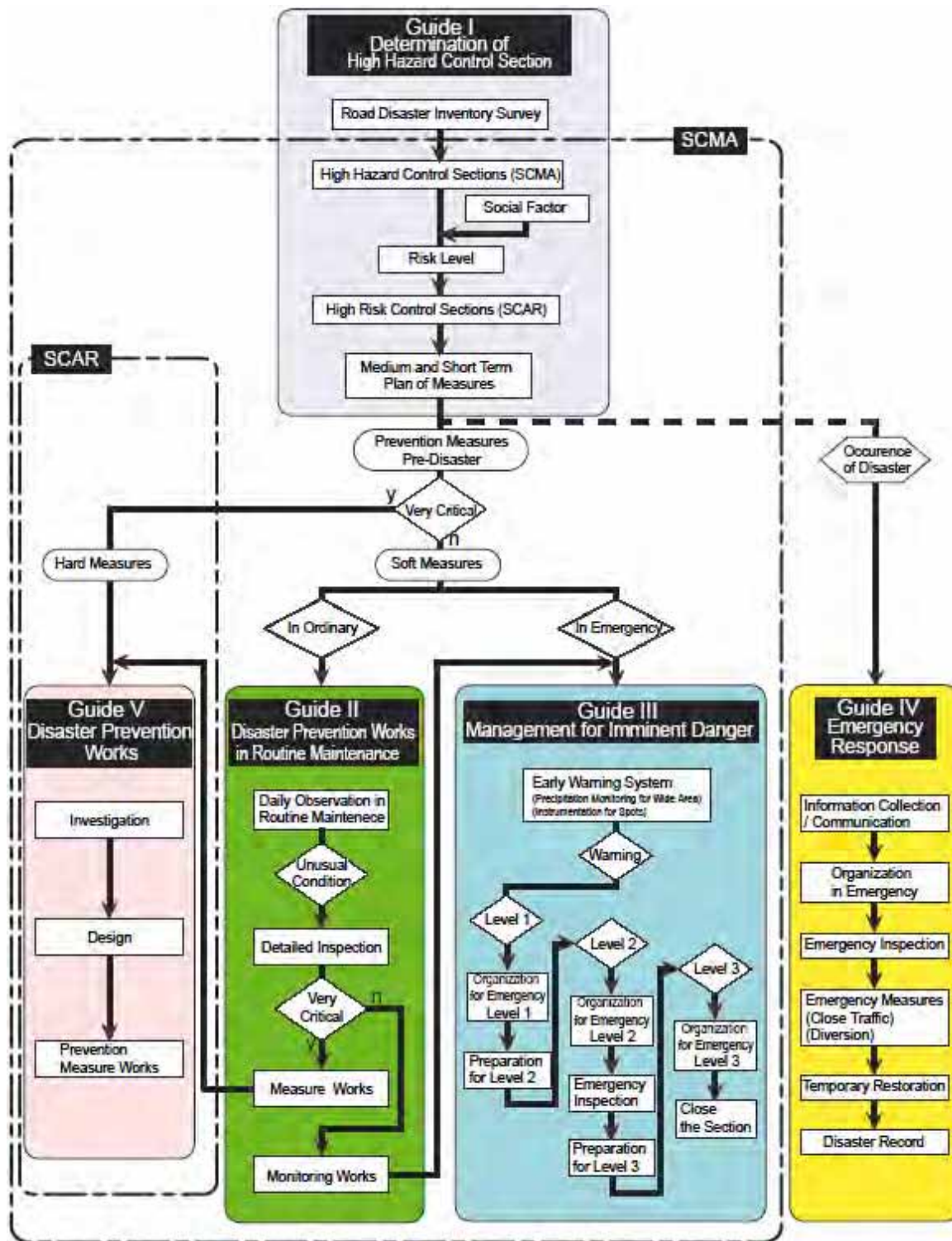


Figure 8.1 Flowchart of Road Disaster Prevention Management Manual

PREVENCIÓN DE DESASTRES EN CARRETERA
MANTENIMIENTO RUTINARIO Y ALERTA TEMPRANA

¡Necesita cuidado! ¡Signos de desastre!	
Posibilidad de Derrumbe (DR) / Caída de rocas (CR)	
<ul style="list-style-type: none"> - Caída sucesiva de rocas pequeñas o piedras. - Grietas que pueden ser vistas en el talud. - Emana Agua del talud. - Sonido de raíces rompiéndose. 	
Posibilidad de Falla de Terraplén (FT)	
<ul style="list-style-type: none"> - Grietas / subsidencia en la superficie de la carretera. - Se pueden ver Agrietamientos / inclinación del muro de contención. - Agua fluye sobre la superficie de la carretera y se acumula en un solo lugar. - Los desagües longitudinales se deforman. 	
Posibilidad de Deslizamiento (DS)	
<ul style="list-style-type: none"> - Árboles y postes de energía se inclinan. - Se puede ver Agrietamiento / inclinación del muro de contención. - Grietas / subsidencia en la superficie de la carretera. - Brotos de agua en el talud. - Alfientes o agua de arroyos cercanos se vuelven caños y fangosos. 	
Posibilidad de Flujo de Mazamorra (FM)	
<p><i>En arroyos cercanos a la carretera.</i></p> <ul style="list-style-type: none"> - Se pueden oír Sonidos de bajotono. - Lodo mal oliento (en descomposición). - Nivel de agua del arroyo se vuelve menor aunque haya llovido. - Agua del arroyo se vuelve fangosa y hay Madera flotando en el agua. 	
<p>Si usted encuentra reacciones anómalas como las que mencionamos anteriormente por favor contáctese con el Supervisor. (Debe siempre revisar la carretera)</p>	

Julio 2006, manual de prevención de desastres en carretera, Guía II mantenimiento rutinario.

Figure 8.2 Sample Manual of Road Disaster for Micro-empresas

(2) Practice of the manual

The trial use of the manual has been executed on one section of route 3 under La Paz Regional Office in the period of July 2006 to April 2007. The simple rain gauges have also been installed along the section. The manual has been revised through the trials in technical contents and in institutional system in use or some phrase expressions.

The examples of the trial results are shown in [Figure 8.3](#) (Disaster Inventory Inspection), in [Figure 8.4](#) (Critical Spots and SCMA along Route 3) and in [Figure 8.5](#) (Recording Form of Rain Gauge Monitoring).

And then the manual are to be inspected and revised through the site use in all roads under ABC for more accomplished stage.

FORMULARIO DE REGISTRO DE LLUVIAS

OFICINA REGIONAL: La Paz MES DE REGISTRO: Diciembre
 TRAMO REGIONAL: Cotapata, Cacabani, Guisqibey ENCARGADO DE REGISTRO: Luis Araya
 SUPERVISOR DEL TRAMO: Ing. René Berzain ESTACION: Entre Rios No. 52

DIA	TIEMPO TRANSCURRIDO (HORAS)																								OBSERVACIONES (FENOMENOS SUCCEDIDOS, MAGNITUD DE ESTOS, ETC.)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
1																										
2																										
3																										
4			X	X	X	X	X	X	X	X	60mm															
5																										
6										X	11mm															
7																										
8							X	X	X	X	X	11mm														
9						X	X	X	X	X	X	20mm														
10					X	X	X	X	X	X	11mm															
11																										
12																										
13																										
14																										
15								X	X	X	X	60mm														
16																										
17																										
18										X	10mm															
19																										
20			X	X	X	X	X	X	X	X	X	60mm										X	X	20mm		
21																										
22													X	10mm												
23				X	X	X	X	X	X	20mm																
24			X	X	X	X	5mm																			
25																										
26																										
27	X	10mm														X	X	X	7mm							
28								X	10mm																	
29																										
30							X	X	X	X	X	X	80mm													
31																X	5mm									

X REGISTRO DE LLUVIA SIN DATOS DE PRECIPITACION NUM REGISTRO DE LAS LLUVIAS CON DATOS DE PRECIPITACION

Figure 8.5 Recording Form of Rain Gauge Monitoring

(1) Basic Course of Pilot Project

```
graph TD; START([START]) --> Y1_1[Conduct a road disaster survey]; Y1_1 --> Y2_1[Select sites]; Y2_1 --> Y2_2[Provide ordering assistance for and conduct surveying work and geological survey (by sub-contracting)]; Y2_2 --> Y2_3[Provide ordering assistance for and conduct design work (by sub-contracting)]; Y2_3 --> Y2_4[Execution plan and estimation (assistance for ABC)]; Y2_4 --> Y2_5[Provide ordering assistance for and implement pilot works (by commission) and supervise work]; Y2_5 --> Y3_1[Promote continuity in approach to road disaster prevention measures]; Y3_1 --> END([END]); Y1_1 -.-> Y1_Label[First year]; Y2_1 -.-> Y2_Label[Second year]; Y2_5 -.-> Y2_Label; Y3_1 -.-> Y3_Label[Third year]; Y2_4 -.-> IEE[Environmental and social considerations study (IEE)];
```

The flowchart illustrates a three-year approach to road disaster prevention measures. It begins with a 'START' oval, leading to the first year's activity: 'Conduct a road disaster survey'. This leads to the second year, which includes 'Select sites', 'Provide ordering assistance for and conduct surveying work and geological survey (by sub-contracting)', 'Provide ordering assistance for and conduct design work (by sub-contracting)', 'Execution plan and estimation (assistance for ABC)', and 'Provide ordering assistance for and implement pilot works (by commission) and supervise work'. An 'Environmental and social considerations study (IEE)' is conducted during the second year, feeding into the 'Execution plan and estimation' step. The third year's activity is 'Promote continuity in approach to road disaster prevention measures', which leads to the 'END' oval. The years are labeled on the right side of the chart.

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(2) Site Location and Ordering Process of Pilot Works

The site is located at km426+300 on route 7 in Bermejo area, Santa Cruz. In this site the river flows nearby at the road foot and some embankment shoulder failure occurs. Accordingly the protection works from the river flow and the countermeasure works for embankment failure are planned,

The executed work schedule is shown in Table 2.3.4. During the course of May through August 2006, preparation of ordering documents (technical specifications) for topographical and geological survey, the ordering of them, the evaluation for them, preparation of ordering documents (technical specifications) for designing, the ordering of it, the evaluation for it, cost estimation for the works and preparation of bidding documents (specifications, bid of quantities etc.) were performed with the participation of ABC counterpart staff.

In September the bidding for the construction contract of pilot works were executed in which prequalification process (P/Q) to select proper number of bidders was introduced due to time limitation of JICA budget resources. The contract for the construction work was made in the end of September 2006 with Bolivian enterprise.

(3) Construction Works executed

The pilot works was scheduled for 4 months from the beginning of October 2006 to the end of January. However in consequent of following process the completion was delayed to the middle of March counting 5.5 months

The original Plan:

Items of works: River Protection Works (Inverted T Retaining Wall), Reinforced Earth Wall Works for embankment shoulder failure, Concrete Retaining Wall for rolling stones, Drainage Works and Pavement Works

Construction Period: 4 months (October 2006 ~ January 2007)

Modified Plan:

Items of works: River Protection Works (Inverted T Retaining Wall), Concrete Retaining Wall Works and Crib Works (Counter Embankment Works) for embankment shoulder failure, Drainage Works and Pavement Works

Construction Period: 5.5 months (October 2006 ~ Middle of March 2007)

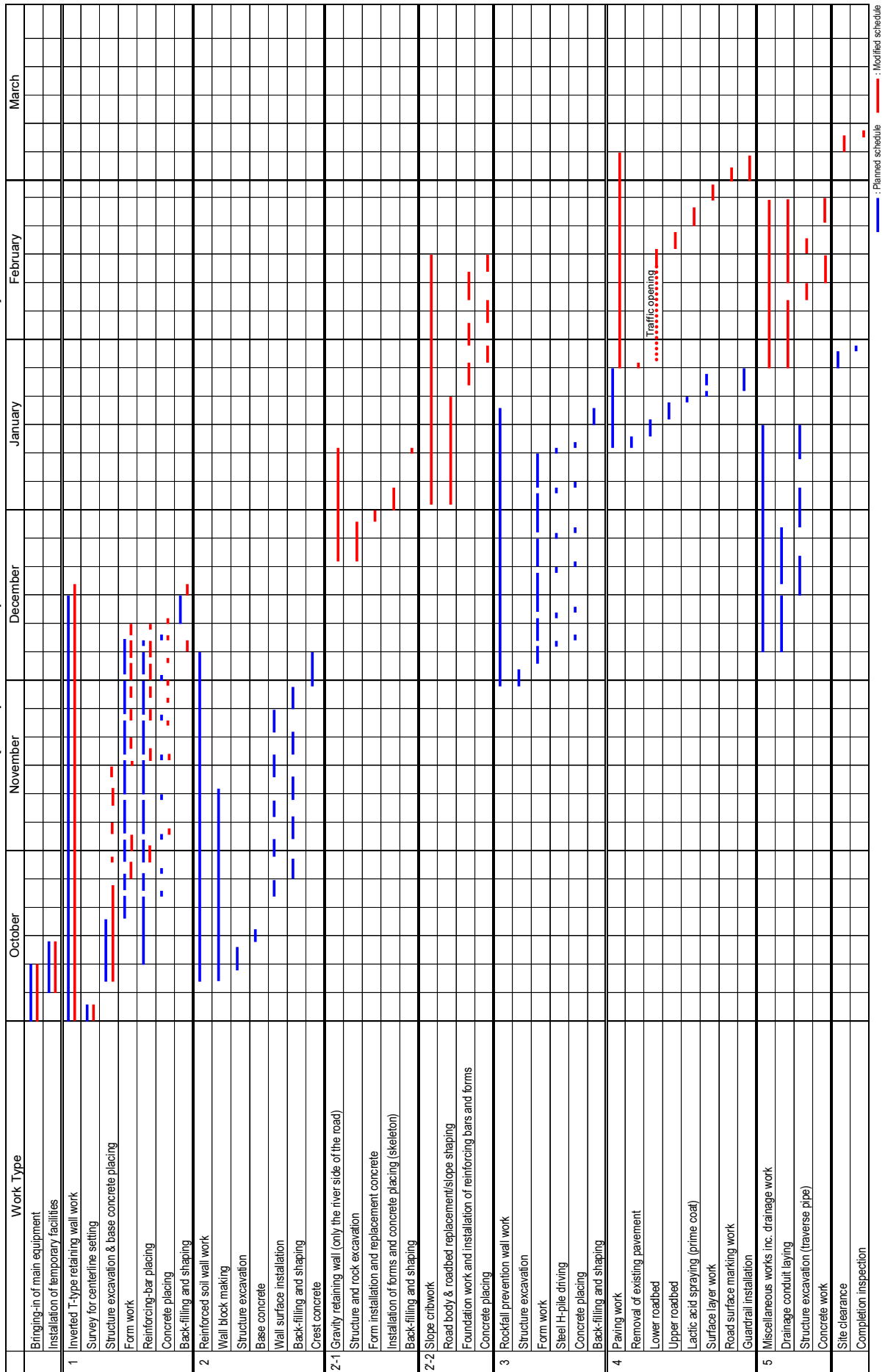
Cause of the modification:

- Sharp change of the subsurface topography (subsurface ground line suddenly dropped in at the downstream part of the site) made unable to execute parallel works of river protection and reinforced earth wall works originally planed casing big delay of work period.
- Change of subsurface position at downstream part caused the increase of foundation concrete volume of the river protection works
- Change of subsurface position made unable to excavate the foot of road embankment in use. Consequently the shallow part (upstream part) is changed to ordinary concrete retaining wall and deeper part (down stream part) is changed to crib woks of counterweight embankment, considering quick procurement of materials and cost performance

- The abnormal climate condition and the traffic close of connecting road of this year caused very low rate of operation of work efficiency. This also caused omission of the concrete retaining wall for rolling stones.

The construction Schedule with planned and modified is shown in Table 9.1. The final plan and profile of the pilot works are shown in Figure 9.2 and in Figure 9.3 respectively. And also photos before and after the construction are in Photo 9.1 and Photo 9.2 respectively.

Table 9.1 Construction Schedule (comparison of planned and modified schedules)



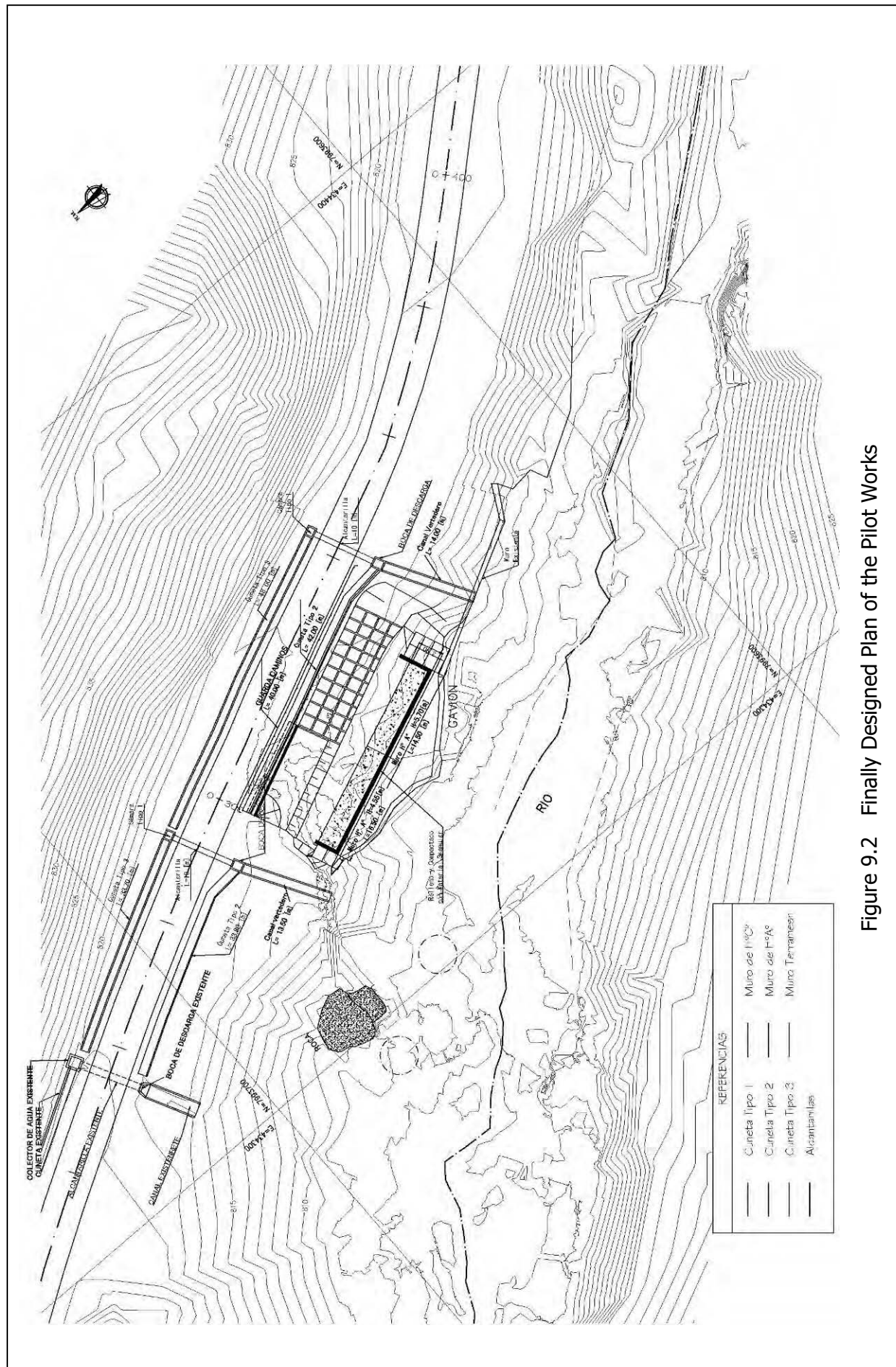
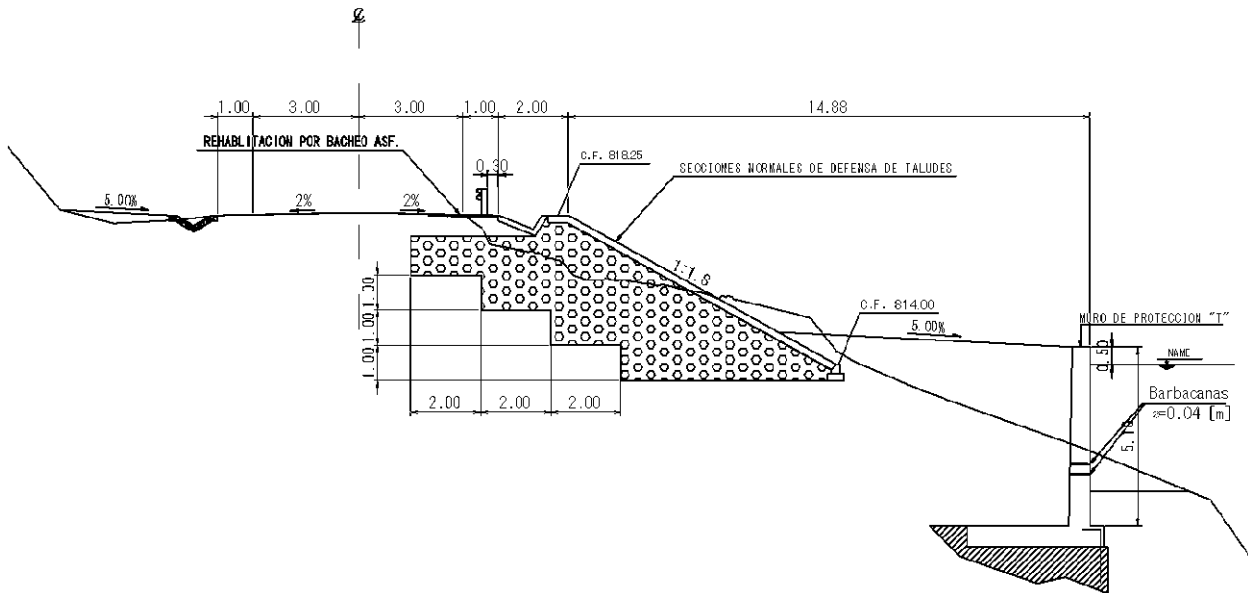


Figure 9.2 Finally Designed Plan of the Pilot Works

PROG. 426+320

Cota Rasante: 818.05



PROG. 426+310

Cota Rasante: 818.19

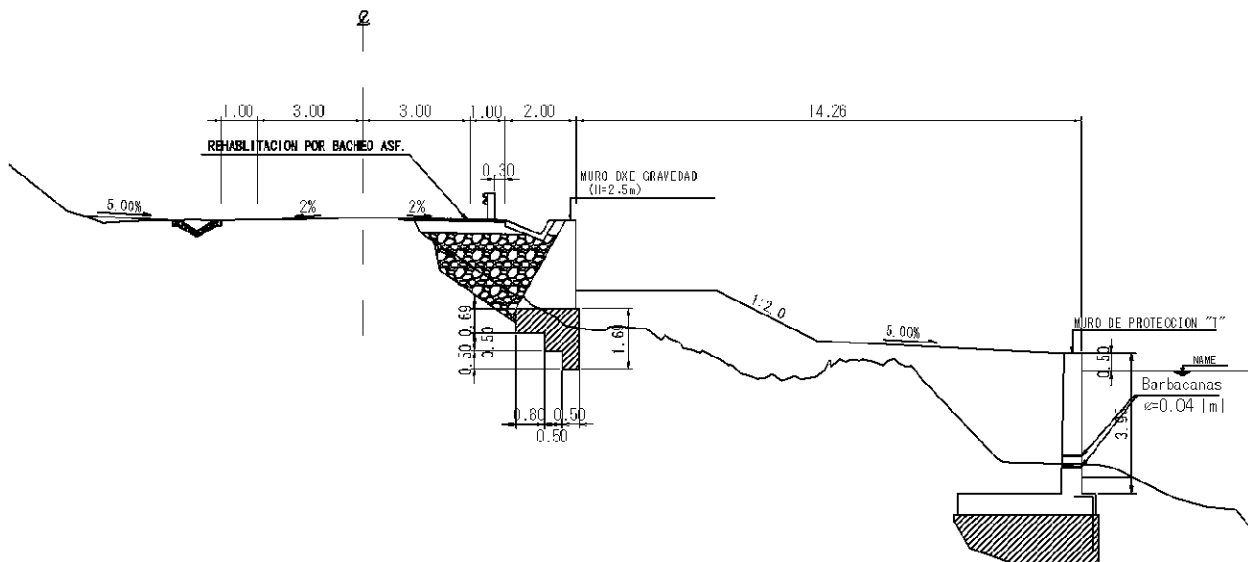


Figure 9.3 Finally Designed Profile of the Pilot Works



Photo 9.1 Before construction



Photo 9.2 After completion

(4) Problems in slope protection works experienced through the pilot works

The following problems have been experienced.

- Geological survey and accuracy of subsurface line, and it's influence to designing
- Decision making in design changes in relations to site condition change during construction
- Relevancy in contract change and quickness in contract procedure
- Contract reaction to abnormal situations (climate, surrounding influencing factors) with some frequency

Among them, the treatment and measures taken towards to the items appeared during construction works such as geology and sub-topography has been analyzed and recorded in the report, the manual and the second seminar.

In particular the crib works applied in the pilot works are recommendable countermeasures for slope protections in Bolivia with no special machineries and materials.

Chapter 10 Awareness of Road Disaster Prevention Management

Briefing of the seminars are tabulated as follows.

Table 10.1 List of Seminars

	Time / Place	Contents	Participants	Attendance
Preliminary Seminar	Feb. 10, 2006 La Paz	Japanese practice for road disaster prevention	ABC staff (Head, Regional)	35
Stakeholder Meeting	June 5, 2006 La Paz	Introduction of the CD study and progress	All Sectors	50
First Seminar	Oct. 9-10, 2006 La Paz	Case studies of road disaster prevention	All Sectors	210
Second Seminar	June 14-15, 2007 Santa Cruz	Newly established CPD unit The CD study (final) Site Visits on Pilot Works	All Sectors	107

Active interests on the matter of road disaster prevention have been appeared in exchange of discussions through the last 4 meetings of seminars. In the stakeholder meeting and the first seminar in particular, all sectors concerned such as ABC, SEPCAM, SENAMHI, institutions of foreign aid, Bolivian Associations for Roads, Civil Association of Universities, Road Users (Bolivian Drivers Association) have participated. According to the survey by questionnaire the activity of this CD Plan Study to prevent disasters beforehand has been met their entire support by all participants. And moreover discussions on appropriate technical support with institutional management, close relationship among UPD and related agencies at central and local levels, securing appropriate manpower, prevalence of road disaster prevention manual, holding periodic seminar etc. have been made.

To hold seminars is proved to make important role to enlighten the necessity of disaster prevention activity for all stakeholders of roads.



Photo 10.1 The First Seminar



Photo 10.2 Site Visit in the Second Seminar

Chapter 11 Monitoring and Evaluation on the CD Activities

(1) Outline of Monitoring/Evaluation

The purpose of the monitoring and evaluation were to facilitate the capacity development for ABC staff concerned through the CD activities designated in the JICA project.

ABC evaluation team and JICA experts in charge of CD planning have been conducted jointly the monitoring and evaluation. The executing body is shown in [Figure 11.1](#).

[Table 11.1](#) shows the contents and methodology of the monitoring and evaluation.

Monitoring (1) was undertaken from September to October 2006 and Monitoring (2) from January to February 2007, respectively. Terminal evaluation was conducted from May to June 2007 by the ABC-JICA evaluation team.

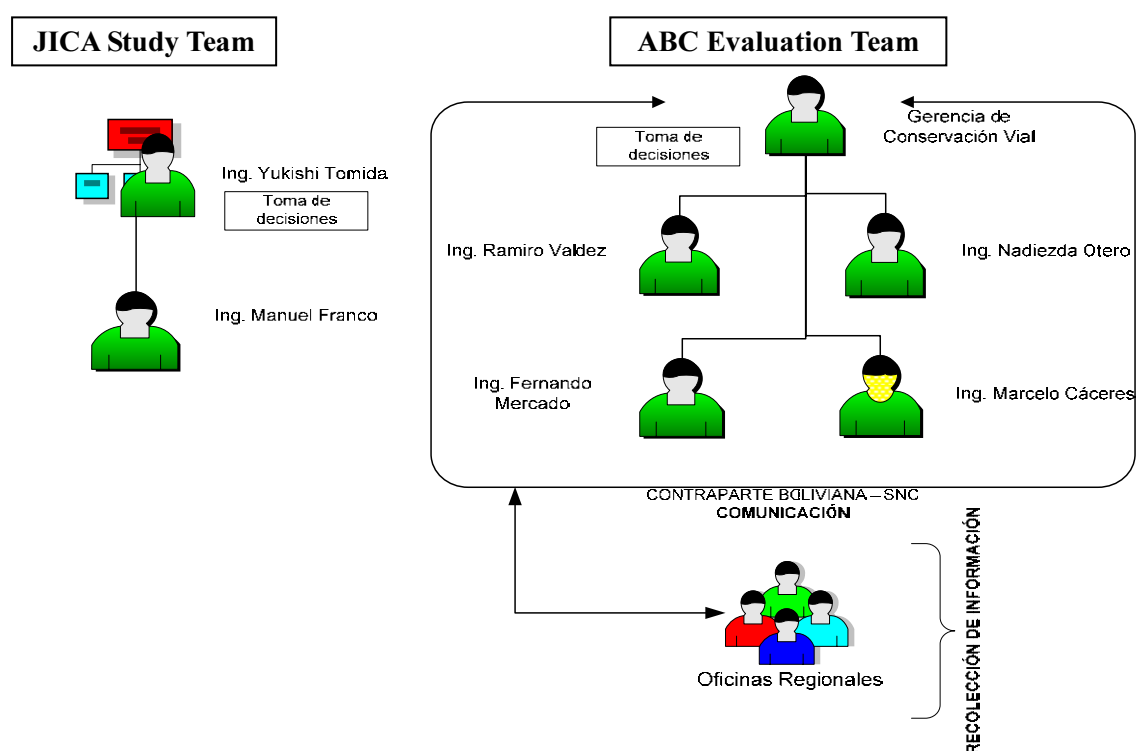


Figure 11.1 Organization Chart of Monitoring and Evaluation Team in JICA Project

(2) Monitoring/Evaluation Results

The monitoring results are shown in [Table 11.2](#) for monitoring (1) and in [Table 11.3](#) for monitoring (2) respectively. In the course of monitoring necessary adjustment and amendment have been done on each CD activity items.

At the monitoring (2) approval of CD Plan, establishment of the disaster prevention unit and incorporation into POA which are part of the first and second items have been authorized.

Table 11.1 Contents and Method of Monitoring/Evaluation of CD Activities in JICA Project

<Items of CD activities>	JICA expert in charge	Target persons of CD activities	Contents of CD activities	Index of monitoring/evaluation	
<Support for CD activities by JICA experts>					
1) Specify principle of ABC road disaster preventive management	Capacity development 1, 2	・Counterparts(CD)	Formulation of the CD plan	ABC president approval of the CD plan	
2) Establish road disaster preventive management department (unit)				Member list of road disaster preventive management department (unit) add its activity report	
3) Prepare road disaster preventive management manuals	Disaster prevention manual	・Counterparts manual	Formulation of manual	ABC president approval of manual	
4) Transfer basic technology of road disaster preventive management	Road disaster prevention, Design, Natural condition, Geologist	・Persons in ABC headquarters	Transfer technology of disaster prevention	Interview record CD activity evaluation report	
5) Training road disaster preventive management technology with seminars.	Road disaster prevention, Design, Manual, Geologist	・Persons in ABC headquarters ・Persons in ABC regional offices/ SEPCOM ・Contractors		Seminar text book Participant list Questionnaire survey result	
6) Train and improve technology of inspection, evaluation in road disaster prevention	Natural condition survey	・Persons in ABC headquarters ・Persons in ABC regional offices/ contractors		Identification of risk section in road disaster	Interview record
7) Compile data and information on disaster preventive management			Judgment of critical points in road disaster	Interview record	
8) Establish database on disaster data and information					
① Instruct onsite road disaster registration recording (OJT)	Natural condition survey	・Persons in ABC headquarters ・Persons in ABC regional offices/ contractors	Preparation and renewal of road disaster registration records	Interview record/guideline of preparation of road disaster records	
② Establish road disaster registration database	Database/GIS	・Counterparts(GIS)	Establishment of road disaster database	Road disaster database	
③ Formulate road disaster preventive management		・Persons in ABC regional offices	Formulation of road disaster preventive management	Interview records	
9) Transfer technology on disaster preventive management at practical level					
① Explain manuals to related agencies	Disaster prevention manual	・Persons in ABC headquarters ・Persons in ABC regional offices	Practice of road disaster preventive management using with manual	Interview records/seminar text book	
② Revise manual		・Counterparts manual) ・Persons in ABC regional offices	Resistor of manual	Interview records/comments from ABC headquarters, regional offices	
③ Transfer road disaster preventive management using manual (OJT)		・Persons in ABC regional offices/ contractors	Practice of road disaster preventive management using with Manual	Interview records/guideline of manual	
10) Prepare, save and update road inspection		・Micro enterprises		Interview records Road disaster registration records	
<Support for CD activities through pilot project>					
11) Improve technology to select properly preventive countermeasures					
① Geological investigation for selection of preventive measures	Natural condition survey	・Persons in ABC headquarters ・Persons in ABC regional offices/ contractors	Geological investigation in road disaster	Interview records CD activity evaluation report	
② Methodology of disaster measures selection	Design, Natural condition survey		Selection of road disaster preventive measures	Interview records CD activity evaluation report	
12) Enhance capability to prepare technical specification					
① Topographic survey	Natural condition survey	・Persons in ABC regional offices ・Persons in ABC regional offices/ contractors	Preparation of specification of topographic/geological survey	Interview records CD activity evaluation report	
② Design	Design		Preparation of specification on design of measures	Interview records CD activity evaluation report	
③ Pilot project	Construction plan/cost estimate/supervisor		Preparation of specification on pilot works	Interview records CD activity evaluation report	
13) Enhance enforcement capability through OJT of pilot project, etc.					
① Support tender of topographic/geological survey	Natural condition survey	・Persons in ABC headquarters ・Persons in ABC regional offices/ contractors	Decision of items to order	Interview records CD activity evaluation report	
② Plan/execute/analysis geological investigation			Geological investigation	Interview records CD activity evaluation report	
③ Support tender of design of measures	Design		Decision of items to order	Interview records CD activity evaluation report	
④ Design road disaster preventive measures			Design concept, applied method	Interview records CD activity evaluation report	
⑤ Plan of disaster construction management and estimate construction cost			Construction management plan, cost estimate	Interview records CD activity evaluation report	
⑥ Support order of pilot work			Decision of items to order	Interview records CD activity evaluation report	
⑦ Execute construction supervision of pilot works	Construction plan/cost estimate/supervisor		Construction management method		Interview records CD activity evaluation report
⑧ Inspect completion of pilot work			Completion inspection		Interview records CD activity evaluation report

Remarks: CD evaluation report will be prepared by each JICA expert.

Monitoring (1): Sep-Oct, 2006. Monitoring (2): Jan-Feb, 2007. Final evaluation: May-June, 2007.

Table 11.2 Monitoring (1) Result

<Items of CD activities>	Monitoring (1) result	
	Present condition of monitoring (1)	Future response
<Support for CD activities by JICA experts>		
1) Specify principle of ABC road disaster preventive management	ABC counterpart team submitted proposal to get an approval of the CD plan on May 24, 2006, but they had not received any answer until October 11, 2006.	Activity to get an approval of the CD plan will be continue
2) Establish road disaster preventive management department (unit)	ABC counterpart team submitted evaluation report on establishment of road disaster preventive department/unit on October 5, 2006	Activity to get an approval will be continuing.
3) Prepare road disaster preventive management manuals	Road disaster preventive management manual (the 2nd draft) was completed and distributed its copies to related person in ABC headquarters.	Modification of manual will be made by ABC counterparts until February 2007. The manual is planned to be approved by ABC president by June, 2007.
4) Transfer basic technology of road disaster preventive management	Indoor transfer technology had been completed. As next stage, field transfer technology will be conducted.	Field trial of manual and road disaster registration recording will be done at SNC La Paz regional office. The pilot project has been conducting on national highway No.7 in Santa Cruz.
5) Training road disaster preventive management technology with seminars.	The first seminar was held on October 9 to 10, 2006. Many persons participated it including not only road related people but also people from different fields (Total participants:209 persons)	The 2nd seminar is planned to be held at Santa Cruz, focusing on outcomes of the JICA project.
6) Train and improve technology of inspection, evaluation in road disaster prevention	SNC engineers concerned understand concept and idea of Hazard.	Long term technology transfer is needed.
7) Compile data and information on disaster preventive management	Only partial transfer technology was done.	ditto
8) Establish database on disaster data and information		
① Instruct onsite road disaster registration recording (OJT)	Field briefing was done on June 28, 2006. Disaster registration recording can not be done due to dry season.	Based on disaster registration records prepared, this matter will be discussed.
② Establish road disaster registration database	GIS database was completed at the end of June 2006. Transmitted test of information had been done.	Based on disaster registration records prepared, the database will be built.
③ Formulate road disaster preventive management	GIS database was completed by the end of June 2006. Registration of transfer of license is necessary from JICA project team to ABC	Registration of license of GIS will be supported by JICA project team.
9) Transfer technology on disaster preventive management at practical level		
① Explain manuals to related agencies	Outline of manual was explained at the first seminar.	The 2nd draft of manual will be distributed to each person concerned of ABC regional offices.
② Revise manual	The manual preparation team is under examination of contents of manual	The manual preparation team will inquire manual availability.
③ Transfer road disaster preventive management using manual (OJT)	Field training was done for persons concerned from ABC headquarters and La Paz regional office on July 12, 2006.	Checking by slope stability inspection and simple rainfall observation will be made.
10) Prepare, save and update road inspection	Disaster inspection and disaster registration recording have been conducted yet.	The execution will be expected from November, 2007, because of starting rainy season.
<Support for CD activities through pilot project>		
11) Improve technology to select properly preventive countermeasures		
① Geological investigation for selection of preventive measures		
② Methodology of disaster measures selection	Core boring was applied as investigation method.	Relevance of the applied investigation will be evaluated after the completion of the pilot project.
12) Enhance capability to prepare technical specification	Disaster preventive measure was selected based on manual. It took long time to evaluate construction cost.	Database of unit price must be necessary for the smooth evaluation on design works.
① Topographic survey		
② Design	These were done with out any problem.	Relevance of the pilot work will be evaluated after the completion of the pilot project.
③ Pilot project	It took more time than expected to estimate construction cost because of no existence of available data and references.	Relevance of design work will be evaluated after the completion of the design work.
13) Enhance enforcement capability through OJT of pilot project, etc.	It took long time to prepare specification because of including slop stability construction work.	Preparation of standard draft and design for criteria will be necessary for slope stability construction works.
① Support tender of topographic/geological survey		
② Plan/execute/analysis geological investigation	There is no particular problem.	Relevance of the tendering in design work will be evaluated after the completion of the pilot project.
③ Support tender of design of measures	Boring core and logs were checked at the site.	Exact location of fresh rock under the ground will be evaluated in comparison of that of planning stage.
④ Design road disaster preventive measures	It took longer time than expected to prepare technical specification of proposed retaining wall and slop stability measures.	Relevance of design work will be evaluated after the completion of the design work.
⑤ Plan of disaster construction management and estimate construction cost	Design software was not well utilized by the local consultant because of insufficient its knowledge and experience.	Preparation of standard draft and design for criteria will be necessary for slope stability construction works.
⑥ Support order of pilot work	It took longer time than expected to design the structural measures because of no data and references of cost estimate. A lot of small mistakes in design calculation were found in design output.	Establishment of database of unit price must be necessary.
⑦ Execute construction supervision of pilot works	PQ was introduced for prompt tendering	Tendering in disaster preventive measures will be evaluated after the completion of the pilot work.
⑧ Inspect completion of pilot work		

Remarks: CD evaluation report will be prepared by each JICA expert.

Monitoring (1): Sep-Oct, 2006. Monitoring (2): Jan-Feb, 2007. Final evaluation: May-June, 2007.

Table 11.3 Monitoring (2) Result

<Items of CD activities>	Monitoring (2) result	
	Present condition of monitoring (2)	Future response
<Support for CD activities by JICA experts>		
1) Specify principle of ABC road disaster preventive management	The CD plan was approved officially by ABC president on February 22, 2007.	JICA project team will support ABC continuously to accelerate the CD plan.
2) Establish road disaster preventive management department (unit)	Establishment of disaster preventive Unit was approved officially by ABC president on February 22, 2007.	JICA project team will support ABC continuously to accelerate establishment of the unit.
3) Prepare road disaster preventive management manuals	Modification and additional matters of the manual have not been completed by February, 2007.	Modification of manual will be made by ABC counterparts until May 2007. The manual is planned to be approved by ABC president by June, 2007.
4) Transfer basic technology of road disaster preventive management		
5) Training road disaster preventive management technology with seminars.		
6) Train and improve technology of inspection, evaluation in road disaster prevention		
7) Compile data and information on disaster preventive management		
8) Establish database on disaster data and information		
① Instruct onsite road disaster registration recording (OJT)	Because the supervisor in charge was changed, additional field briefing was conducted for new one on January 30, 2007.	Preparation of disaster registration recording will be urgently needed due to being in rainy season.
② Establish road disaster registration database		
③ Formulate road disaster preventive management		
9) Transfer technology on disaster preventive management at practical level		
① Explain manuals to related agencies		
② Revise manual	ABC preparation manual team and persons of each regional office have examined the contents of the manual with comments.	The 3rd Draft will be produced taking the comments into account.
③ Transfer road disaster preventive management using manual (OJT)	ABC preparation manual team checked the trial result.	The checked items will be included in the manual.
10) Prepare, save and update road inspection	Data exchange of the inspection result was finished and data has been put into the GIS database.	The items to be improved will be included in the manual.
<Support for CD activities through pilot project>		
11) Improve technology to select properly preventive countermeasures		
① Geological investigation for selection of preventive measures		
② Methodology of disaster measures selection		
12) Enhance capability to prepare technical specification		
① Topographic survey		
② Design		
③ Pilot project		
13) Enhance enforcement capability through OJT of pilot project, etc.		
① Support tender of topographic/geological survey		
② Plan/execute/analysis geological investigation	The base rock revealed at construction stage is partly different from its original expectation.	This lesson learned will be included in the manual.
③ Support tender of design of measures		
④ Design road disaster preventive measures		
⑤ Plan of disaster construction management and estimate construction cost		
⑥ Support order of pilot work		
⑦ Execute construction supervision of pilot works	Monitoring on quality control, work schedule, and securing safe performance and environmental issue has been conducting during the pilot work. Partial change in applied measures and initial work schedule has to be changed due to unexpected fresh rock distribution and reduction of work days by exceeding rainfall in this season.	Evaluation system must be built in road disasters for quick response to emergency crisis.
⑧ Inspect completion of pilot work		

Remarks: CD evaluation report will be prepared by each JICA expert.

Monitoring (1): Sep-Oct, 2006. Monitoring (2): Jan-Feb, 2007. Final evaluation: May-June, 2007.

Chapter 12 Terminal Evaluation Results

The terminal evaluation on the study was carried out jointly by the ABC evaluation team and JICA experts between May 21 and June 19, 2007. The team applied to using “Management tool for development assistance: Monitoring & Evaluation by FASID” as the evaluation method for the study which is based on five evaluation criteria (relevance, effectiveness, efficiency, impact and sustainability).

The terminal evaluation results can be summarized in Table 12.1 and the outline of them is as follows;

Relevance, effectiveness and impact of the study are regarded as **<very high>** or **<mostly achieved>**. The study purpose described on PDM_e has been well achieved excluding some parts of technical transfers to individual in ABC in spite of confusion during or after the national presidency election and ABC’s replacement of SNC, which resulted in changes in high level officers and retirement / dismissal of more than half of staff in ABC. The most notable outcome is that the CD plan has been authorized by ABC president as the basic plan of ABC’s road disaster preventive management. Subsequently, the road disaster prevention unit has been established with adequate budget allocation from CNCV and introduction of disaster preventive measures into POA. Under these circumstances, ABC commenced formally the activities of the road disaster preventive management on May 25, 2007. For the better implementation of the activities by ABC, the study has already provided ABC with some useful and practical materials such as road disaster prevention manual, road disaster registration system, GIS based road disaster information system and simple rainfall observation tools.

Another remarkable outcome of the study is steadily raising awareness of road disaster preventive management, which might have been achieved over road related persons concerned of ABC and other agencies through the seminars and the stakeholder meeting. As other indirect efficiencies accomplished, BID presents his intention to provide urgent assistant budget and some other government organizations in Bolivia have tendency to start establishing disaster prevention unit gradually.

On the other hand, both efficiency and sustainability of the study can be regarded as **<Moderately low>**. The main reasons for above mentioned “moderately low” are considered to be confusion of ABC during and after the national election and ABC’s replacement of SNC in organization, part-time assignment of ABC’s counterparts and lack of technology and information in road disaster preventive management in ABC, etc. However, it is surly believed that the activity of the road disaster prevention unit will be well functioned because the unit has already officially authorized on May 25, 2007 in accordance with the CD plan.

The most important concern is that how ABC will enhance and sustain these activities regarding road disaster preventive management using knowledge and know-how obtained after termination of the study.

Table 12.1 Conclusion of the terminal evaluation

Evaluation criteria	Level evaluated	Main reasons to be evaluated	Background of evaluation
Relevance	Very high	<ul style="list-style-type: none"> • ABC has high intention to promote road disaster preventive management in spite of new organization established on October 27, 2006. • "The National Development Plan" designated in 2006 gives a first strategic priority to inland transportation. This means Bolivia Government recognizes the importance of development of and securing the national highway networks at national level. • In the recent years, many sediment-related road disasters occurred in Bolivia, not only road related persons but also ordinary people become aware of the importance of road disaster preventive management. • Nowadays, major donors such as WB, BID and CAF, become likely to pay attention to road disaster prevention management. 	<ul style="list-style-type: none"> • ABC's president approved aggressively the CD plan, establishment of disaster unit and introduction of preventive measures to POA as the ABC's formal basic plan for the risk management. • Development of and securing the national highways hold significant position at the national development plan. • A large number of sediment-related disasters took place along national highways No.4 and 7 from October 2006 to March 2007. These disaster events enabled people in Bolivia to understand the importance of disaster prevention management. • The current loan projects at national highway No.3, No4 and No.7 financed by WB, IDB and CAF include road risk management items, respectively.
Effectiveness	Mostly achieved	<ul style="list-style-type: none"> • The CD plan, establishment of road disaster prevention unit and introduction of disaster measures to POA have been authorized by ABC's president. This means that ABC has been ready to start road prevention management at any time. • Effective technology transfer was not performed. because of lack of ABC's basic knowledge and information on disaster preventive management, and also part-time assignment of ABC's counterparts. • Road disaster prevention manual, road disaster registration system and GIS road disaster information system have been already prepared. Next steps for this matter is to make them prevail to all ABC's regional offices. • ABC requests main donors to accept loan projects concerning road disaster preventive management. 	<ul style="list-style-type: none"> • The CD plan, establishment of the unit and introduction of preventive measures to POA have been approved officially on January 22, 2007. • The reasons for insufficient technology transfer resulted from part-time assignment of the counterparts, lack of basic knowledge and information, etc. • At least, the systems and tools to promote road disaster preventive management by ABC itself have been already equipped in the study. • ABC submitted application of technical cooperation project to the Government of Japan in August 2006.
Efficiency	Slightly low	<ul style="list-style-type: none"> • In spite of confusion by national president election and change to ABC in governmental structure, the study was managed to be carried out continuously. • Three kinds of different disaster prevention measures were applied to the pilot project, concrete cribwork was the first trial in Bolivia so ABC and other agency personnel concerned were very much interested in this measures. • The study provided principal materials to promote road disaster prevention management in ABC (the CD plan, disaster prevention unit, disaster prevention management manual, road disaster inventory, GIS disaster information system) • Because counterparts were not full-time assigned, sufficient technology transfer was not able to be undertaken through the study, especially in person to person transfer. 	<ul style="list-style-type: none"> • Although more than half of counterparts left ABC during the study period, fortunately main counterparts were able to continue working with the JICA study team. • Road disaster prevention measures, especially in concrete cribwork and appropriate supervision by JICA expert at construction stage, were so attractive to engineers in Bolivia. • Supervisors and micro-enterprise employees contracted by ABC supported field trials devotedly conducted by JICA experts. • The main reasons for insufficient transfer technology resulted from sudden dismissal happened in ABC and part-time assignment of ABC's counterparts.
Impact	Very high	<ul style="list-style-type: none"> • Rising of awareness in road disaster prevention management has been achieved through the seminar and the stakeholder meeting. • The study gave motivation to other agencies to become interested in establishment disaster prevention unit for risk management. • ABC has been offered concerning loan project in road disaster prevention management by donors 	<ul style="list-style-type: none"> • Experiences in road disaster preventive management in Japan, contents of the CD plan were introduced at the stakeholder meeting and the first seminar. For instance, participants at the first seminar accounted for more than 200 persons. • The importance of road disaster preventive management becomes aware to the public by manse of dissemination of press and internet. • BID proposed a 500 million US\$ loan project in road disaster prevention management. (November, 2006)
Sustainability	Moderately low	<ul style="list-style-type: none"> • Since the CD plan and establishment of disaster unit have been authorized by ABC president, the execution system for ABC's road disaster prevention management is judged to be almost completed. • The budget for road disaster prevention management is scheduled from National Road Maintenance budget (CNCV). • Basic data and information on road disaster such as occurrence date, location, scale, type preventive measures are not systematically accumulated in ABC. Also technology in road disaster preventive management has nor beer well developed in ABC. • For better implementation of the CD plan, enhancement of partnership between JICA and other donors is needed. 	<ul style="list-style-type: none"> • There were no CD plan and execution unit in terms of road disaster preventive management in ABC by the time of the commencement of the study. • ABC intends to allocate CNCV budget for mobilization of the unit. • Since ABC does not have so much technology in road disaster preventive management, the ABC staff should be definitely trained to up-graded and enhance their capabilities concerning those fields. • Disaster preventive is one of the fields which JICA will lead and contribute effectively to Bolivia. In fact, donor meetings was held two times in the past under leadership of JICA and got mutual consensus among them.

Chapter 13 Conclusions and Recommendations

13.1 Conclusions

This study, in circumstances of ceaseless occurrence of natural disasters in main national road net, drastic reform and re-construction in road disaster prevention system not by temporary restoration approach in mind, aims at forming of long-term and sustainable guideline ; i.e. forming of policy support oriented master plan in road disaster prevention.

The study has implemented through OJT for counter-part organization in collaboration with JICA study team and also has contained support of capacity development activities in the study period. The conclusions which have been lead through the study are described hereinafter.

1. Formation of Capacity Development Plan:

The study aims at supporting the capacity development of ABC (Administradora Boliviana de Carreteras) in the area of road disaster prevention in which the over-all capacity development of the head office of ABC, the regional offices, SEPCAM's in relation in individual level, organization level, system society level is included.. The Capacity Development Plan (CD Plan) has been prepared as scheduled. The implementation of the study has been carried out in such way in which substantial works for preparing CD plan have been executed by ABC task team with assistance of JICA study team. In spite of big difficulties to keep themselves constantly into the study in which members of task team served concurrently with their ordinary and emergency jobs or with personnel transfers in big wave of institution reform (SNC to ABC), the active leadership of top officers has given incentive to break the barrier in preparing the CD Plan with understandings of importance of disaster prevention administration. As continuous steps the preparation of mid-long term program is necessary as the compass of CD Plan implementation.

The proposed CD Plan, as the super goal "road disasters in Bolivia are reduced", consists of following 7 projects.

- Project 1: Project on Establishment of Road Disaster Preventive Department (unit)
- Project 2: Project on Road Disaster Preventive Technology Improvement
- Project 3: Project on Establishment of Road Disaster Preventive Management System
- Project 4: Project on Improvement of Emergency Response in Disaster Prevention
- Project 5: Project on Road Information Enhancement and Discloser
- Project 6: Project on Improvement of Tender Procedures in Road Disaster Prevention
- Project 7: Project on formulation of Strategy Program of Disaster Prevention Budget

2. Authorization of CD Plan – POA & UPD:

The proposed CD Plan with 7 projects which was the result of capacity development activity participated by ABC counterpart members was authorized on February 22nd, 2007. Accordingly the CD Plan has been introduced to ABC action plan and to POA (Annual Implementation Plan). And also new organization for the project 1 was established as UPD (Unidad de Prevencion de Desastres) on May 28th, 2007. By this procedure independent and institutional system of management for road disaster prevention has been established. And on July 27th, 2007 outline of the action plan has been prepared by which the orientation of the UPD activities has been indicated.

3. Accompanied Outputs of the study:

Besides of preparation of CD plan, the study covered the following activities which are of parts of project 2 and project 3. The outputs are to be fundamental tools in disaster prevention activities in ABC and the taking root of the tools in ABC head office and regional offices is to be strong power for promoting smoothly of CD Plan

(1) Preparation of Road Disaster Prevention Management Manual

As the most fundamental tool for road disaster prevention management, the manual which consists of 5 guides has been prepared (in separate volume) in accordance with present road maintenance system. The main subject of the manual is prevention prior to occurrences Acting items together with ordinary routine maintenance has been emphasized. In relation to disasters, emergency management and prevention works have also been introduced.

Guide I Determination of High Hazard Control Section

Guide II Disaster Prevention Works in Routine Maintenance

Guide III Management for Imminent Danger

Guide IV Emergency Response

Guide V Disaster Prevention Works

(2) Creation of Road Disaster Inventory and Database System (GIS)

As the most fundamental tool for preparing disaster prevention planning, the road disaster inventory has been prepared for the 4 routes in the study. And also for systematic utilization of the data, database system with GIS (Geographical Information system) has been established.

ABC is now operating road traffic information system. In same manner the road disaster information will be treated for road users.

(3) Above mentioned manual and road disaster inventory are ready to apply for all national roads through the trials experienced in La Paz Regional Office. As for the information transmission system, it has been testified between ABC head office and La Paz Regional Office.

(4) Implementation of Pilot Works and Technology Transfer

Pilot works have been carried out on a site of Route 7 by the source of JICA fund. Through the works on site a live technical transfer has been introduced on the job training base and with proper technical judgment especially experienced in slope works. New countermeasure of crib works has also been introduced. In particular the crib works applied in the pilot works was the first trials in Bolivia and it's appliance with no special machineries and materials has been evaluated excellent among road engineers.

(5) Activity for awareness of disaster prevention management through seminars

Four seminars including the preliminary one have been held for enlightenment of the concept of disaster prevention (to treat before the occurrence of disasters for total socio-economic benefit). Participated number and discussions tell the effectiveness of seminars for awareness of disaster prevention. On the occasion of the 2nd seminar of June 2007, the site visit was carried out on the pilot works site and disaster spots around (route 7) by the heavy rainy season of this year (El Nino phenomenon) where active exchange of comments and opinions were made among participants. Through these seminars the importance of prevention beforehand has been recognized in the

socio-economy sense by the introductory examples of Japanese experiences and discussions have been made on importance of appropriate technical support with institutional management, close relationship among UPD and related agencies at central and local levels, securing appropriate manpower, prevalence of road disaster prevention manual, holding periodic seminar etc.

4. Ready to implement:

Through above mentioned activities, CD Plan and the fundamental tools have been prepared for implementation of road disaster prevention management for all national roads. For forward implementation the preparation of mid-long term program is necessary as the compass of CD Plan and also individual and institutional support is quite important for promoting of CD Plan

5. Application for technical assistance:

In August, 2006 the government of Bolivia requested the government of Japan technical assistance project of capacity development for road disaster prevention for further sustainability support after the JICA study along with CD Plan in the range of project 2 and project 3. The project 2 and project 3 cover technical side issues on part of which the JICA study has treated and these projects are to be most fundamental part for technical improvement and advancement

6. Donors cooperation:

In the course of formation of the CD Plan, the summary has been discussed with international donors CAF, BM, BID in several opportunities and the necessities of cooperation have been understood. For obtain partnership among donors it is important that UPD shows ownership and leadership in CD plan promotion by distinguishing among the issues carried on by self power and the issues to be supported by donors.

7. Evaluation of the study:

Relevance, effectiveness and impact of the study have been evaluated positively through the terminal evaluation. However, efficiency and sustainability have been deemed as moderately low. In the present days the implementation system has been established through the authorization of CD Plan, incorporation to POA, establishment of UPD, authorization of the road disaster prevention management manual. For the sustainability improvement it will be established by the continuity of technical improvement, accumulation of the disaster records, awareness to the stakeholders etc.

8. Present Capacity in the area of road disaster prevention in Bolivia:

Before the introduction of the study, ABC has acted only for restoration after the disaster occurrences, not for risk management or disaster prevention, resulting lack of concept of introducing prevention measures or prevention works in national roads. The improved points and points to be improved through the results of capacity development support study are pointed out hereinafter.

<Improved points through the study>

- (1) Establishment of Implementation System for disaster prevention management
The CD Plan which was the result of capacity development activity was authorized in the ABC action plan. Accordingly the CD Plan was incorporated to POA from 2007. By this procedure

management system for disaster prevention has been established as ordinary management.

- (2) Establishment of UPD and commencement of CD Plan
UPD, proposed organization in project 1 of CD Plan, has established in ABC and the system for disaster prevention has established as ordinary management. This means that the project 1 of CD Plan has practically started and this will lead early realization of following projects 2~7.
- (3) Preparation of manuals and Database System
Manuals and database system for road disaster prevention management have been prepared. Those are road disaster prevention management manual, guide of road disaster record, GIS management system for road disaster inventory and observation system for simple rain gauges. Those are now in the practical stage.
- (4) Improvement of technical capability of counterpart personnel for disaster prevention
Through the CD support activities, technology transfer of technical element of disaster prevention such as diagnosis/evaluation of hazard, selection of countermeasures, design of prevention works, disaster record database and data renewals, preparation of technical specifications, etc. has been made to the counterpart personnel. Through these technology transfer the practical capability for disaster prevention management has been improved.
- (5) Enlightenment on road disaster prevention management for road stakeholders
Through the seminars and stakeholder meetings, concept of road disaster prevention management has been enlightened for road stakeholders. In the stakeholder meeting in particular, all sectors concerned from road management bodies to road users have participated. The importance of road disaster prevention management have been understood not only for ABC staff but also for SEPCAM, institutions of foreign aid, Bolivian associations for road, road users.
- (6) Strengthen of coordination among ABC
The coordination between each department has not been enough inside ABC. Through the PCM meetings and collaboration works with specialists concerned in this CD activities, “Merit obtained through working with partnership” has been experienced. In preparation of the seminars counterpart acts on partnership with other departments in planning and administration

<Points to be improved>

- (1) Raising of technical capability of disaster prevention
There has been the knowledge, know-how and experiences on road construction/maintenance in ABC, however those on disaster prevention management have not accumulated yet. It is necessary to thoroughly raise technical capability of disaster prevention along with CD Plan.
- (2) Accumulation and joint ownership of knowledge/data
Data, knowledge and experiences are limitedly owned by individual base in ABC, not by common base.
System for common and sharing base utilization of those will be necessary. For first step practice it will be useful to enlighten common utilization of data, knowledge and experiences in ABC by practicing and continuing the system of road disaster inventory or simple rain gauge observation

- (3) **Public Relations and Awareness on disaster prevention activities**
ABC is known as the organization for road administration by the people, however its activities and contributions to public are not recognized well. It will be important to act on explanation/awareness of road disaster prevention activities and their effects to the people for improvement of transference, status and morale in ABC. These public relations and awareness will effectively be carried out by media activity such as internet or web side.
- (4) **Enhancement of partnership among donors**
Disaster prevention management is considered as newly recognized area, and it will be important to work more actively on donors, CAF, BM.BID,JICA etc., for their partnership. For this activities the system of acceptance and specific plan of road disaster prevention of ABC will be needed.

13.2 Recommendations

The capacity development for road disaster prevention will be progressed on long term activity and by steady walks. The realization of CD Plan relies on strong will and leadership of ABC top management for the execution, continuous partnership of government and donors, the people's understandings on importance of road disaster prevention. Recommendations on effective execution of CD Plan and secure sustainability are described hereinafter.

1. Personnel Fulfillment of the Road Disaster Prevention Unit (UPD)

In Bolivia road net is the basic infrastructure for the national development and road development is raised as top ranked strategy in the "National Development Policy, 2006" ABC is upper organization for development and administration of national road net for the purpose of securing traffic development and safety. Accordingly road disaster prevention management is one of important area for ABC in line with development and maintenance of road net. In Bolivia prefectural and municipal road net have same problems on disaster prevention and ABC's role in national road net is important to show proper and senior model in disaster prevention management.

UPD is the firstly established organization in charge of road disaster prevention management of national road in ABC and accordingly in charge of execution of CD Plan. As stated in the plan, personnel at the beginning is composed of 7 members (including project manager) in full time work base. And for the organization positioning, considering of cross role of risk management at emergency, budgetary treatment and awareness for stakeholders, UPD is to be directly under president office.

2. Formation of Mid-long term program and Utilization of human resources in ABC

The first work of UPD is to formulate mid-long term program in CD Plan. The work is to be completed in 6 months after the UPD establishment in which for the proposed 7 projects PDMs are to be set up in specific target and outputs, items/contents of activities, method of activities, inputs, preconditions, index of evaluations. As the unit has many obligations to do since its commencement, it is recommended that the unit create internal task-force teams backing up the unit's activities. The task-force teams should be composed of highly experienced persons from each department as part of utilization of human resources in ABC.

For the project 4,5,6 and 7, since they have not been covered by the CD support activity in the study, it is important to launch the task-force team for formation of the program and also it will be useful for preparing specific action plan and for encouraging incentives inside ABC.

3. Continuation of recording of the road disaster inventory

The road disaster inventory is the most fundamental tool for preparing disaster prevention planning. Periodical and steady recording in the road disaster inventory is to be continued and be spread to all national roads for grasping systematically of risk spots which varies in time to time. The guide for disaster inventory has been revised to be easy recording by supervisors through the trials in La Paz regional office. In prevalence to all national roads the site training will be needed for the supervisors in regional offices. The records will be collected in UPD every month for the base materials of risk management.

4. Proper revision of Road Disaster Prevention Management Manual

In practicing of the manual, the inspection works for disaster prevention are to be added to the ordinary maintenance works by micro-empresas. The inspection works by micro-empresas have been tried through the trial in La Paz regional office and the contents of the manual have been revised to be easily used by the micro-empresas of no special knowledge in disaster prevention. When the inspection works spread to all national roads, early treatment will become possible by finding the signs of disaster to prevent from expanding to large disasters. By routine inspection works the half of presently occurring disasters will be avoided beforehand.

For prevalence of the manual, it is important to notify of the authorization by ABC to users concerned.

The use of the manual is to be continued for further improvement. And then the manual are to be inspected and revised every 2 years through the site use in all national roads for more accomplished stage. In the manual simple rain gauge has been introduced for actual judgment level in warning for disasters. The observation by the rain gauge has also been tried by micro-empresas successfully. This system should also be spread to all national roads for risk management by UPD.

5. Collecting of technical materials

For the improvement of technical capability of disaster prevention, beside of the manual and road disaster inventory in the study, such technical materials of field good examples of preventive works, work method catalogues, technical specifications, materials for estimation etc. will be collected and accumulated for proper applications to preventive measures. For these works it is essential for UPD to ask cooperation of department concerned.

6. Accumulation of prevention works experiences

UPD is necessary to make OJT training program for ABC staff in the road disaster prevention works in each region for specific and practical technical training. In Bolivia many prevention works seems to temporary measures such by gabions. Permanent measures such as concrete crib works, sabo dam + dikes, land slide preventive works, rock-shed works, wire net works etc. have not experienced. For promoting prevention measures, there are two categories; one is “preventive measures” by catching factors of disaster and deciding of treatment, the other is “permanent measures” to stop disasters hereafter. For permanent measures it will be effective to learn from the experiences in preventive measures advanced countries (for examples utilization of grant aid project of Japan).

7. Prevalence of disaster preventive technique

For prevalence of disaster prevention technique, time and investment are necessary. For applying national budget it must be necessary to appeal toward politicians, governmental officers concerned and the people

of Bolivia of the concept and necessity of disaster prevention. ABC acts as the leader of road administration and its technical aspects and she has potential role/duty to make technology transfer of her techniques already possessing or learning to SEPCAM's or local engineers. Through these activities it will be possible to raise technical potential and status of ABC herself.

For awareness or prevalence of disaster prevention technique, seminars for stakeholders and dispatching information by web-site or periodical must be useful. By coordination with universities, those techniques could be incorporated in curriculum/citizens course. E-learning will also be useful for busy participants. This awareness activity aims at talking to stakeholders or people general for raising social recognition of ABC. These prevalence activities should be programmed in one of UPD activities.

8. Formulation of mid-long term program and securing continuous budget

Road disaster prevention needs quite long management span from the experience in Japan and the plans have to vary time to time like toward life creatures. In the sense, steady acquisition of budget is indispensable to promote the projects. For securing budget, formation of mid-long term program is most important for clear account. At present ABC does not establish the budget category of disaster prevention and in the occasion of emergency the expense for the disaster restoration is covered by CN (Cuenta Nacional de Carreteras) or donors source. Hereafter for continuous management of road disaster prevention, creation of "disaster prevention management budget" is necessary and also the necessity of the category should be recognized by donors. Owing to high consciousness of donors toward disaster prevention, securing budget will be opened through strong will and specific program of ABC.

9. Enhancement of partnership among donors

The CD Plan includes all management of disaster prevention of ABC and its range of activity lies wide. For realization of CD Plan, only the resources inside ABC are not enough to cover the area, requiring technical and financial backup of donors. The activities for obtaining donors support are needed in early stage. In June of 2007, UPD explained the donor's counterpart in ABC about the CD Plan and cooperation in areas. Hereafter it is important for ABC to hold periodical meeting (every two months) with donors for partnership among donors.

10. Necessity for continuously monitoring and evaluation

In implementation of the CD Plan, to secure the outputs of the activities, monitoring and evaluation from the beginning to the end of the project should be implemented continuously based on the PDM method with five (5) evaluation criteria: relevance, efficiency, effectiveness, impact and sustainability. By this procedure effectiveness and sustainability will be secured and if some inexpedience are found during project duration, modification of track will become possible.

11. Sustainability in technical cooperation project

Technical assistance in the field of road construction and maintenance has been promoting by mainly WB, BID and CAF in the South America. However, in the field of road disaster prevention proper assistance has not been made but recently only partial assistance for risk survey in specific new construction. In the terminal evaluation for the CD support study, the present system has been evaluated as "moderately low" in sustainability. Taking account of the factor that soon after UPD has established in ABC and that the disaster prevention management has been incorporated in POA, sustainability will be secured with fulfillment of items below.

- (1) Investment of specific role and duty to UPD and disposition of full-time staff for management implementation. UPD should preferably be positioned directly under the president (in view of independent department in near future).
- (2) Establishment of “Disaster Prevention Management Budget” for constant implementation of road disaster prevention management.
- (3) Early formation of mid-long term program as compass of CD Plan implementation (until November 2007). In the formation works human resources of ABC should be utilized fully as task force teams.
- (4) Utilization of donors support. Recently donors have interests toward the field of road disaster prevention. In the field of road disaster prevention, difficulty lies that single investment only of prevention works has not been effective in total road net. Hereafter in order to draw donors interests, it is necessary for UPD to show ownership utilizing the CD Plan. If both of technical assistance program and disaster prevention projects from preventive measures advanced countries are realized, by synergetic effects technical transfer will be much progressed. (In August, 2006 the government of Bolivia requested the government of Japan technical assistance project of capacity development for road disaster prevention for further sustainability support).

12. Development of road disaster prevention management in Andes region

The study has been implemented aiming at improvement of road disaster prevention management technique in Bolivia. For countries in South America which national roads pass through the Andes mountain chain, “secure road traffic safe” is common issue. Considering the development of Andes countries (IIRSA or ANDINO), the improvement of road disaster prevention management capacity will be most useful for their development, consequently connecting to presence of Bolivia. Accordingly ABC, carrying out steadily the CD Plan, is strongly desirable in near future to be the organization to act as the “Road Disaster Prevention Information Center” of Andes region.