

KYRGYZ REPUBLIC

MINISTRY OF TRANSPORT AND COMMUNICATIONS (MOTC)

**THE PROJECT
FOR CAPACITY DEVELOPMENT
FOR MAINTENANCE MANAGEMENT
OF BRIDGES AND TUNNELS
IN THE KYRGYZ REPUBLIC**

PROJECT COMPLETION REPORT

JANUARY 2016

**JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)**

**CTI ENGINEERING INTERNATIONAL CO., LTD.
CENTRAL NIPPON EXPRESSWAY CO., LTD.**

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KYRGYZ REPUBLIC

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LOCATION MAP OF THE PROJECT

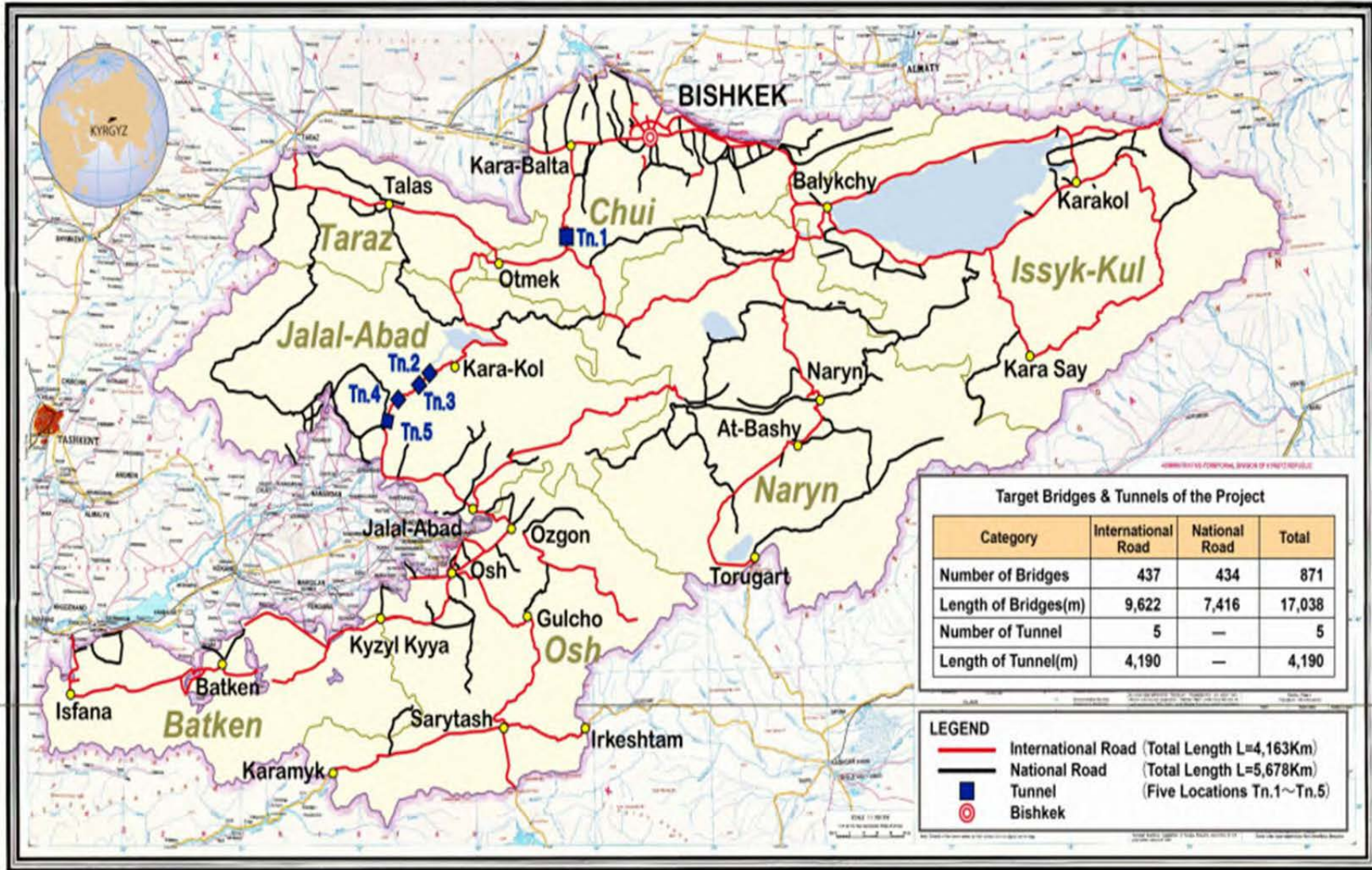


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I Manuals

Volume I. Database System Manual

1. Manual for the Input of Database System
2. Manual for Database System Operation

Volume II. Bridge Maintenance Manual

1. Manual for Routine Maintenance
2. Manual for Inspection
3. Manual for Condition Rating
4. Manual for Repair Method
5. Manual for Short-term Maintenance Management
6. Manual for Long-term Maintenance Management

Volume III. Tunnel Maintenance Manual

1. Manual for Routine Maintenance
2. Manual for Inspection and Condition Rating
3. Manual for Repair Method
4. Manual for Short-term Maintenance Management

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ACRONYMS AND ABBREVIATIONS

AADT	Annual Average Daily Traffic
AC	Asphalt Concrete
ACG	Arabic Coordination Group
ADB	Asian Development Bank
BNT UAD*	Bishkek-Naryn-Torugart Main Roads Management Unit
BO UAD*	Bishkek-Osh Main Roads Management Unit
C/P	Counterpart
CAREC	Central Asian Regional Economic Cooperation
CDS	Country Development Strategy
DEP*	Local Level Roads Management Unit
DI	Design Institute
EBRD	European Bank of Reconstruction and Development
EU	European Union
GOJ	Government of Japan
GOK	Government of Kyrgyz
GOSSTROY	Kyrgyz State Agency on Construction and Regional Development
GPS	Global Positioning System
ICB	International Competitive Bidding
IMF	International Monetary Fund
IPIG	Investment Projects Implementation Group
IR	International Road
IDB	Islamic Development Bank
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
LCC	Life Cycle Cost
LR	Local Road
M/M	Minutes of Meeting
MOTC	Ministry of Transport and Communication
MT	Master Trainer
MTDP	Mid Term Development Program
NGES	Naryn Hydro Electric Station
NR	National Road
PBM	Performance-Based Maintenance
PC	Pre-stressed Concrete
PDM	Project Design Matrix
PLUAD*	Oblast Level Roads management Unit
PO	Plan of Operation
PRSP	Poverty Reduction Strategy Paper
RAA	Road Administration Advisor
RAMS	Road Asset Management System
RC	Reinforced Concrete
R/D	Record of Discussion

RMD	Road Maintenance Department
RSDS	Road Sector Development Strategy
SAPS	Special Assistance for Project Sustainability on Bishkek-Osh Road Rehabilitation Project
UAD*	Main Road Management Unit
UPS	Uninterrupted Power Supply system
USSR	Union of Soviet Socialist Republics
VIMS	Vehicle Intelligent Monitoring System
WB	World Bank
WBS	Work Breakdown Structure

* Abbreviations from Russian language

Chapter 1 Introduction

1.1 Background

The Kyrgyz Republic (hereinafter referred to as “Kyrgyz”) has the road network of about 34,000 km, accounting up to 95% of the passenger and freight traffic. The Ministry of Transport and Communications of the Kyrgyz Republic (hereinafter referred to as “MOTC”) is responsible for the operation and management of international, national and local roads, consisting of 18,803 km, including 1,729 bridges and 5 tunnels in Kyrgyz.

Most of the road network in Kyrgyz was constructed during the Soviet era and, after the country’s full independence on December 25, 1991, road maintenance activities have not been carried out adequately due to the fact that many Soviet technicians left Kyrgyz and funds provided for the road sector were also not sufficient to execute routine maintenance of the road network. The low level of funding for road repair and maintenance has led to an annual loss of approximately 200 km of road surface, and the worsening of the road conditions has hindered smooth trade with the neighboring countries as well as the passenger and freight traffic.

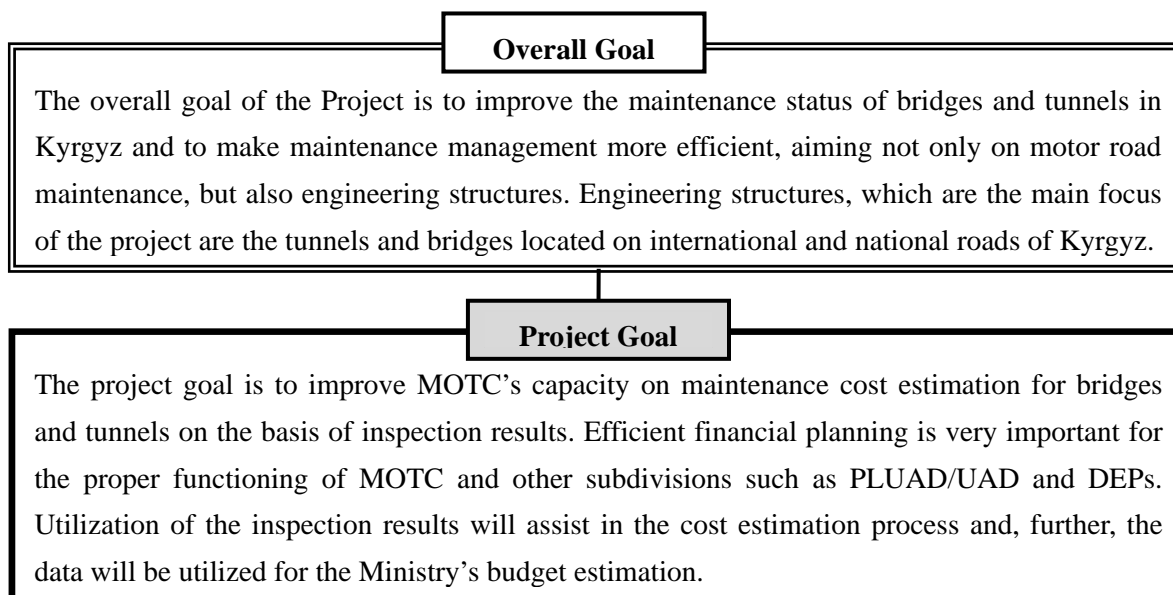
In addition, no plan for the maintenance management of bridges and tunnels based systematic inspection system has been developed. In response to this situation, the Japan International Cooperation Agency (hereinafter referred to as “JICA”) and other donor organizations have been supporting the road sector of Kyrgyz, focusing on road maintenance work.

The Government of Kyrgyz (GOK) had requested the Government of Japan (GOJ) to provide technical cooperation and assistance for the implementation of the “Project for Capacity Development for Maintenance Management of Bridges and Tunnels in the Kyrgyz Republic” (hereinafter referred to as “the Project”). In response, JICA dispatched a detailed planning survey mission to Kyrgyz to discuss the contents of the Project with MOTC and the other authorities concerned, and the Record of Discussion for the Project was executed between MOTC and JICA on February 14, 2013.

1.2 Objectives of the Project

The objectives of the Project are to develop the capacity or basic skills on bridge and tunnel maintenance by the target year of 2013, to formulate the Maintenance Management Plan including budgetary allocation by the target year of 2014, and to improve the Maintenance Management Plan considering Life Cycle Cost (LCC) by the target year of 2015.

The JICA Expert Team has defined the objectives in two levels, Overall Goal and Project Goal, as shown in the following figure.



1.3 Project Area

The project area covers the whole country of Kyrgyz, targeting all of the bridges on international and national roads and the five (5) tunnels in Kyrgyz. The Location Map is shown at the beginning of this Project Completion Report. Indicated on the map are the locations of the five (5) tunnels, the international and national roads, and the number of bridges including total lengths.

1.4 Scope of the Project

There are four (4) main outputs of the Project:

- Output 1: Demarcation of MOTC HQ, RMD, PLUADs/UADs and DEPs is clearly identified with necessary staffing for the maintenance management of bridges and tunnels.
- Output 2: A database system to record information on bridges and tunnels is developed and ready for maintenance planning.
- Output 3: Capacity of DEPs for routine maintenance and capacity of PLUADs/UADs for inspection and condition rating of bridges and tunnels are enhanced.
- Output 4: Capacity of MOTC's HQ, RMD, PLUADs/UADs and DEPs for preparing maintenance management plans on bridges and tunnels is enhanced.

1.5 Project Implementation Schedule

(1) Project Schedule

The Project was started by the JICA Expert Team at the beginning of July 2013 by conducting seminars for groups of master trainers, practice exercises on site, information gathering on bridges and tunnels for database development, etc. The Project consists of the following three (3) phases to achieve the four (4) outputs. Project schedule and progress are shown in Figure 1-1.

(2) Capacity Development System

In order to clarify the division of input between the Kyrgyz side and the Japanese side to improve the effectiveness and sustainability of capacity development of MOTC's staff, the training of Master Trainers (MTs) on bridge maintenance management was provided in accordance with the letter addressed to Deputy Minister Ibraev Keldibek (JKE-08-05 dated 06 August 2013). Running expenses necessary for implementation of the Project, including travel expenses and allowances of training participants, except some, are covered partially by JICA.

MTs who would be the focal persons to be trained by the JICA Expert Team were nominated by the MOTC. Through a series of discussions (see Subsection 5.3), MTs were classified into two (2) categories by their roles as shown in Table 1-1 taking into account the capacity of staff and actual implementation system on maintenance work in Kyrgyz.

Table 1-1 Classification of Master Trainers

MT	Criteria	Major Activities
S	<ul style="list-style-type: none"> • Selected MT, who lectures to other MTs on Planned Inspection and Condition Rating • Staff and/or engineers of RMD, PLUAD #1, BNT UAD and BO UAD 	<ol style="list-style-type: none"> 1) Lecture on Planned Inspection and Condition Rating of Bridges 2) Lecture on Repair Methods for Bridges 3) Preparation of Short-term plan 4) Preparation of Long-term plan
B	<ul style="list-style-type: none"> • Able to carry out both Planned Inspection A and Planned Inspection B • Selected MT as a representative MT from 9 PULAD/UADs, Staff and/or engineers of PLUAD #1, #3, #4, #5, #6, BO UAD, OBI UAD, BNT UAD, and OSI UAD 	<ol style="list-style-type: none"> 1) Inspection and Condition Rating of Bridges 2) Repair Methods for Bridges

Source: JICA Expert Team

(3) Main Activities in Phase-1 (July to December 2013)

The main activities in Phase 1 from July to December 2013 focused on data collection of bridges and tunnels through Preliminary Survey. Platform of the database system for bridge and tunnels was also developed in Phase 1. Trainings on primary inspection of bridges and tunnels were conducted by the JICA Expert Team for the MTs.

(4) Main Activities in Phase 2 (January to December 2014)

The main activities in Phase 2 from January to July 2014 are represented by trial implementation and operation of maintenance work implemented by the MTs based on manuals and knowledge transferred by the JICA Expert Team. Draft Short-term and Long-term Maintenance Management Plan was developed through discussions with the MTs and JICA Expert Team. New organization structure and its demarcation for bridge and tunnel maintenance were proposed by the JICA Expert Team.

(5) Main Activities in Phase 3 (January to December 2015)

Manuals, Database System, Long and Short Term Maintenance Management Plan were reviewed and revised during Phase-3. Concept of Life Cycle Cost (LCC) was introduced by the JICA Expert Team and the Maintenance Management Plan was revised by MTs. Activities on Routine Maintenance and Periodic Inspection stipulated in the maintenance manuals were commenced by the MOTC.

(6) Major Meetings and Workshops during the Project

The important events during the process of project implementation are shown in the Tables 1-2 and 1-3.

Table 1-2 Main Project Meetings and Workshops

Name of Activity	Date	Contents
2013		
Kick-off Meeting	8 July	Confirmation of the Project Implementation Schedule; Confirmation of the availability of Master Trainer
Workshop on Database Development	15 July	Design and Development of Database System
Workshop on Bridge Maintenance	1) 16 July 2) 17 July 3) 18 July 4) 19 July 5) 22 July 6) 23 July 7) 24 July 8) 25 July 9) 26 July 10) 29 July	Preventive Maintenance and Operation of Bridges; Bridge soundness evaluation; Prioritization of Repair; Bridge repair works.
Workshop on Bridge Maintenance	1) 5 August 2) 6 August 3) 7 August 5) 8 August 6) 9 August 7) 12 August 8) 13 August 9) 14 August 10) 15 August 11) 16 August	<ul style="list-style-type: none"> Preventive Maintenance and Operation of Bridges; Types of defects
1 st JCC Meeting	22 August	Confirmation of Work Plan; Amendment of Record of Discussion
Workshop for fact finding	27 August	Discussion of Fact-Finding results of: - Tunnel Maintenance Management Bridge Maintenance Management
Workshop on Institutional Demarcation	12 September 15 October	Discussion of organizational structure
Workshop for Bridge Inspection (Planned Inspection A) led by MTs (*1)	1) 13 September 2) 20 September 3) 25 September 4) 3 October 5) 8 October 6) 9 October 7) 11 October 8) 12 October 9) 16 October 10) 17 October 11) 18 October	<ul style="list-style-type: none"> Primary inspection for Bridge <ul style="list-style-type: none"> - Damage of Bridges in Kyrgyz - Dimension Measurement of bridge member - Sketch Drawing - Photographing Data Input to Database (Excel form)
Kick-off Seminar	16 October	<ul style="list-style-type: none"> Discussion with donors: <ul style="list-style-type: none"> - Outline of the Project

Name of Activity	Date	Contents
		- Main existing issues on maintenance of bridges and tunnels
Workshop	28 October 30 October	Analysis of Maintenance Management of Bridges in Kyrgyz Republic, organizational structure and maintenance management of bridges and tunnels
Workshop on Database Development	4 November 5 November	Development of Database System Input Data
2014		
2 nd JCC Meeting	30 January 2014	<ul style="list-style-type: none"> Revision of project design matrix
Training on VIMS	1) 28 April 2) 29 April 3) 30 April 4) 6 May 5) 7 May	<ul style="list-style-type: none"> VIMS mechanism Equipment installation and speed calibration Road surface measurement Data analysis
Workshop on Bridge Maintenance at Site	1) 8 May in Bishkek 2) 21 May in Osh 3) 10 June in Karakol	Condition rating of imminent and critical bridges
Workshop on Bridge Inspection	1) 29 May 2) 25 June	<ul style="list-style-type: none"> Bridge inspection Rating evaluation Repair method
Workshop on Database Development	9 June	Development of Database System Input Data
Workshop on Cost Estimation	1) 3 July 2) 9 July	Cost Estimation on: <ul style="list-style-type: none"> Replacement Bridge repair: <ul style="list-style-type: none"> Crack injection method Cross-sectional repair method Steel plate installation method
Workshop on Short-Term Bridge Maintenance Plan	16 July	1) Prioritizing of bridge maintenance by: <ul style="list-style-type: none"> Condition rating Required maintenance level 2) Short-Term budget request: <ul style="list-style-type: none"> Calculation of repair and replacement costs 3) Leveling of budget for each year
3 rd JCC Meeting	28 August 2014	<ul style="list-style-type: none"> Collection and input of bridge data Formulation of maintenance management plan <ul style="list-style-type: none"> Short-term plan for maintenance management of bridges Short-term plan for maintenance management of tunnels Formulation of Manuals Revision of Project Design Matrix
Workshop on Detailed Inspection in Bishkek	1) 29 August 2) 2 September 3) 3 September	1) Introduction of equipment for detailed inspection <ul style="list-style-type: none"> Infrared camera Portable drill for carbonation test Schmidt hammer 2) Intended use of each equipment 3) Demonstration of how to use each equipment
Workshop on Detailed Inspection in	6 September	Ditto

Name of Activity	Date	Contents
Osh		
Workshop on Detailed Inspection in Naryn	12 September	Ditto
Workshop for Bridge Inspection (Planned Inspection B) led by MTs (*2)	1) 26 September 2) 1 October 3) 2 October 4) 5 November 5) 6 November 6) 10 November 7) 11 November 8) 13 November 9) 14 November	<ul style="list-style-type: none"> • Detailed inspection for Bridge <ul style="list-style-type: none"> - Infrared Camera - Schmidt Hammer - Carbonation Test - How to Use of Testing Equipment • Purpose of each Test
Workshop on Long term plan	1) 17 October 2) 14 November	1) Introduction of the concept of Life Cycle Cost (LCC) and Life Cycle Design (LCD) 2) Calculation of maintenance costs of bridges for ten and fifty years
Workshop on Database Development	19 November	Development of Database System and Input Data
Workshop on Long-Term Plan and Short-Term Plan	20 November	Integrity of long-term planning and short-term planning
2015		
4 th JCC Meeting	29 January 2015	Organizational structure of bridge maintenance management
Workshop on Database Development	30 January	Development/Improvement of Database System
Workshop on Database Development	10 March	Development/Improvement of Database System
Workshop for Detailed Inspection in Osh	April 15 April 16	1) Detailed inspection and 2) Final Examination
Workshop for Detailed Inspection in RAMS	April 24	Detailed Inspection
Workshop for Detailed Inspection in RAMS	April 27	Site Training for Detailed Inspection
5 th JCC Meeting	28 April 2015	Revision of Project Design Matrix
Workshop for VIMS	April 30 May 5 to 8	1) Lecture for VIMS 2) Site Training for VIMS
Workshop on Inspection B, and Long-term Plan	10 July	1) Discussion and training by the result of Planned Inspection B (trial) 2) LCC concept and how to use the result of Inspection B for Long-term Plan
Workshop on Database Development	15 July	Development/Improvement of Database System
6 th JCC Meeting	20 August 2015	The Joint Terminal Evaluation Report
Workshop on Bridge Maintenance in RAMS	29 October	1) Long-term and Short-term budget planning for bridge 2) Monitoring system after Project
Workshop on Long-term and Short-term	2 November	1) Long-term and Short-term budget planning for bridge in practice

Name of Activity	Date	Contents
budget planning for bridge in RAMS		2) Problematic design of bridges in Kyrgyz Republic
Workshop on Bridge Maintenance in RMD	4 November 3 November	1) Long-term and Short-term budget planning for bridge 2) Approval of the institutional demarcation and staffing demarcation 3) Monitoring system after Project 4) Problematic design of bridges in Kyrgyz Republic 5) Posting information about the project on the website of MOTC
Final Seminar 7 th JCC Meeting	19 November	1) Achievement of the Project including of Recommendations of Terminal Evaluation 2) Handover of the Draft Completion Report to the OTC 3) Final Seminar (Future Requirements on the Maintenance) -Long-term and Short-term Planning for Bridge -Institutional Demarcation -Monitoring after Project -Problematic Design of Bridges in Kyrgyz Republic -Information of the Project on the website of MOTC 4) Presentation on the Japanese Experience on the Maintenance
Workshop on Bridge Maintenance	25 November	1) Institutional Demarcation 2) Database system (Forms for inspection) 3) Problematic Design of Bridges in Kyrgyz Republic 4) Long-term and Short-term Planning for Bridge 5) Monitoring after Project 6) Information of the Project on the website of MOTC
Workshop on Bridge Maintenance in Osh	27 November	1) Institutional Demarcation 2) Database system (Forms for inspection) 3) Problematic Design of Bridges in Kyrgyz Republic 4) Long-term and Short-term Planning for Bridge 5) Monitoring after Project 6) Information of the Project on the website of MOTC

Source: JICA Expert Team

*1 Pertinent to achievement of Indicator-4 in Output-2 and Indicator-4 in Output-3.

*2 Pertinent to achievement of Indicator-4 in Output-3.

Table 1-3 Workshop on Tunnel Maintenance

Name of Activity	Date	Contents	Participants
2013			
Workshop on Tunnel Database	August 16	• Development of Database Information	BO UAD
Workshop on Tunnel Database	August 19~20	• Data Collection for Database • Data Collection for Maintenance Management	BO UAD
Workshop on Daily Maintenance Manual for Tunnel	August 30	• Preparation of Daily Maintenance Manual (Draft)	BO UAD
Workshop on Daily Maintenance Manual for Tunnel	September 5	• Preparation of Daily Maintenance Manual (Draft) • Preparation of Inspection and	BO UAD

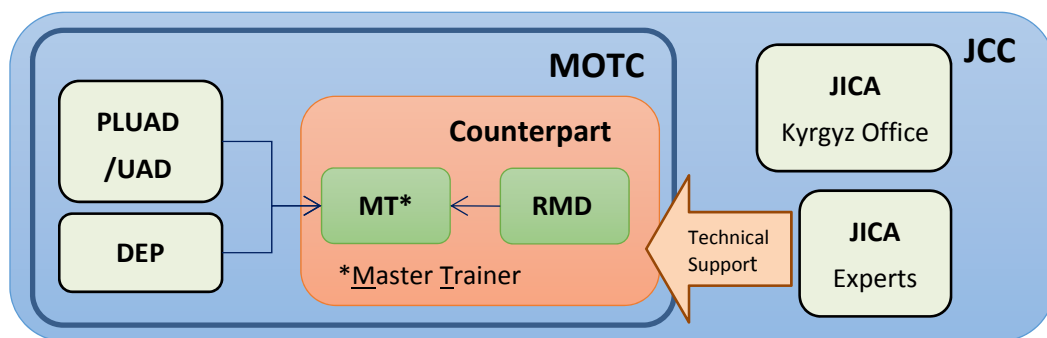
		Evaluation Manual (Draft)	
Workshop on Tunnel Inspection Manual	September 11	<ul style="list-style-type: none"> • Development of Database • Preparation of Daily Maintenance Manual (Draft) • Preparation of Inspection and Evaluation Manual (Draft) 	BO UAD
Workshop for Site Inspection	September 17-18	<ul style="list-style-type: none"> • Confirmation of Current Condition • Periodic Inspection and Evaluation • Recording of Periodic Inspection • Rehabilitation Measures 	DEP 30
Workshop for Rehabilitation Measures	September 25	<ul style="list-style-type: none"> • Study on Rehabilitation Measures 	BO UAD
Workshop on Rehabilitation Manual	October 3	<ul style="list-style-type: none"> • Preparation of Rehabilitation Manual 	BO UAD
Workshop for Site Inspection (2nd)	October 9	<ul style="list-style-type: none"> • Confirmation of Current Condition • Periodic Inspection and Evaluation • Recording of Periodic Inspection 	BO UAD
Workshop on Daily maintenance Manual for Tunnel Facility (1)	October 12	<ul style="list-style-type: none"> • Preparation of Daily Maintenance Manual for Tunnel Facility • Formulation of Tunnel Maintenance Management Plan 	BO UAD
Workshop on Daily maintenance Manual for Tunnel Facility (2)	October 17	<ul style="list-style-type: none"> • Preparation of Daily Maintenance Manual for Tunnel Facility • Formulation of Tunnel Maintenance Management Plan 	BO UAD
Workshop on Tunnel Maintenance Manuals	October 23	<ul style="list-style-type: none"> • Confirmation of Tunnel Maintenance Manuals 	RMD
2014			
Workshop on Revision of Tunnel Maintenance Manual	June 18	Frequency of cleaning works of Kolbaev Tunnel's drainage system revised to "when required".	1) Bazaraliev B. 2) Shopokov E. 3) Abduldaev A. 4) Amamatov A. 5) Kadyraliev J.
Workshop on Maintenance of Tunnel Facilities	June 24	1) Importance of maintenance of facilities 2) Fire safety consciousness	
Workshop on Tunnel Maintenance Plan	June 30	1) Principles of maintenance plan formulation 2) Maintenance prioritization 3) Budget planning	
2015			
Workshop on Tunnel Inspection	June 10	Confirmation on Current Condition of Tunnels	DEP 9
Workshop on Daily Maintenance Manual for Tunnel Facility	June 15	Revision of Daily Maintenance Manual for Tunnel Facility Maintenance Planning	BO UAD
Workshop on Daily Maintenance	June 17	Daily Maintenance for Tunnel Facility Improvement of Daily Maintenance for Tunnel	DEP 9
Workshop for Tunnel Inspection	June 22	Periodic Inspection Daily Inspection	DEP 30, DEP 38

Source: JICA Expert Team

1.6 Organizations for the Project

The main activities of the Project were implemented at the MOTC Headquarters. The beneficiaries of the Project are the staff members of the MOTC Headquarters, the Road Maintenance Department (RMD) of MOTC, 9 PLUADs/UADs, and 57 DEPs. The Project Organization Chart is shown in Figure 1-2.

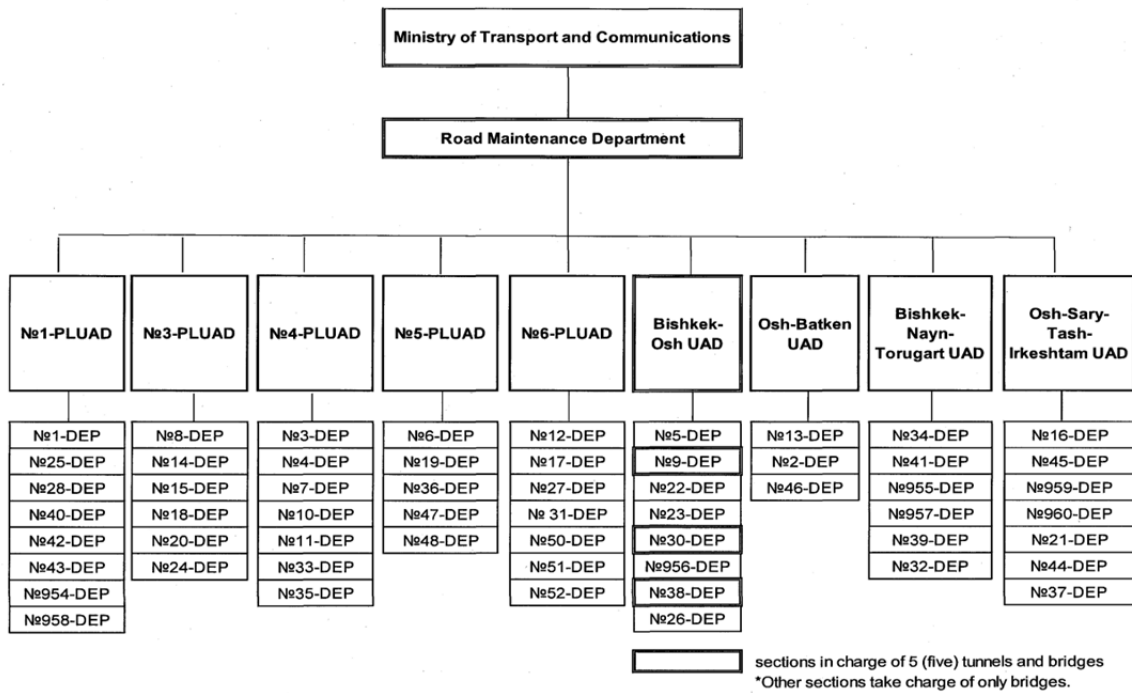
RMD is the main implementation unit for project works and operates under MOTC. Staff members of MOTC and RMD are the counterpart personnel. The Joint Coordination Committee (JCC) was established to facilitate inter-organizational coordination. The JCC is tasked with the approval of annual work plans, review of overall progress, implementation of monitoring and evaluation of the Project, and exchange of opinions on major issues that arise. JICA assists in project implementation through the services of the JICA Expert Team.



Source: JICA Expert Team

Figure 1-2 Project Organization Chart

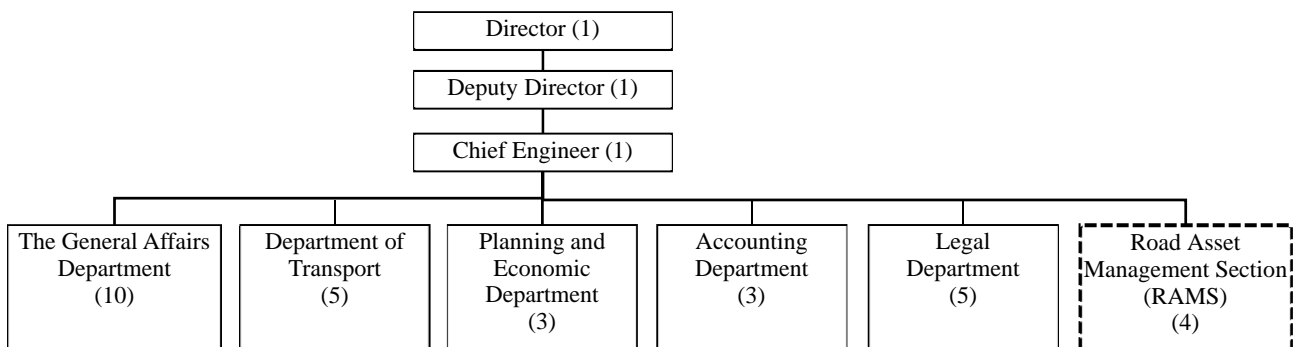
As mentioned above, the RMD will operate under MOTC and has functions to place orders, sign agreements on equipment supply, work implementation, and provision of services aimed at road sector needs. RMD has functions of state customer in development and implementation of the national sector programs, programs of the road sector; construction and reconstruction projects financed from the public budget, etc. It consists of nine (9) regional departments and international road directorates called PLUAD/UAD, namely; PLUAD No. 1, PLUAD No. 3, PLUAD No. 4, PLUAD No. 5, PLUAD No. 6, Bishkek-Osh UAD, Osh-Batken-Isfana UAD, Bishkek-Naryn-Torugart UAD and Osh-Saritash-Irkeshtam UAD. There are 57 DEPs operating under PLUAD/UAD at the local level. The Organizational Chart of RMD is shown in Figure 1-3.



Source: JICA Expert Team

Figure 1-3 Organizational Chart of the Road Maintenance Department (RMD)

The Administrative Section of RMD is managed by the Director, Deputy Director and Chief Engineer. There are five (5) departments in RMD, namely: The General Affairs Department, Department of Transport, Planning and Economic Department, Accounting Department, and Legal Department. Through the Project, Road Asset Management Section was established in March 2015 aiming at data management for road assets. The number of personnel in each department is shown in the Figure 1-4.



Note: Numbers in parentheses indicate the number of personnel.

Source: JICA Expert Team

Figure 1-4 Personnel Chart of the Road Maintenance Department

The Kyrgyz side (the Counterpart) is represented by the Project Director, Project Manager, counterparts and members of the Master Trainer (MT) groups. Names and positions of the counterparts and MTs are given in Table 1-4.

Table 1-4 Members and Assignments of the Kyrgyz Side for the Project

	Name	Office	Title	JCC	Work Plan	Inspection & Evaluation [B]	Maintenance Management Plan [B]	Data Base Development [B]	Inspection & Evaluation [T]	Maintenance Management Plan [T]	Data Base Development [T]
Project Director	Mamaev KubanychbekAbdrahmanovich	IPIG	Director	•							
Project Manager	Nurmanbetov Kadyrbek Rakymbekovich	RMD	Deputy Director (~7/20, 2015)	•	•						
Project Manager	Kayinbaev Nurlan	RMD	Deputy Director (7/22, 2015~)	•							
Counterparts	Nogoev Nurmat	RMD PPAW	Head	•	•						
	Milovatskaya Nina	RMND	Chief Specialist	•							
	SEITALIEV Istambek	RMD RAMS	Head of Section				•				
	Abdyrashiz Kyzy Aigerim	RMD RAMS	Database Specialist				•				
	Bazarialiev Beknazar Toktosunovich	BO UAD	Head of Tunnel Service department					•	•	•	
	Shopokov Erjan	BO UAD DEP9	Head of Kolbaev Tunnel					•	•		
	Chynaliev Erlanbek	BO UAD DEP30	Head of Tunnel Service					•	•		
	Kojobekov Nasyr	BO UAD DEP38	Head of Road Repair section					•	•		
MT-S											
1	Eraliev Nurlan	RMD RAMS	Lead Specialist			•	•	•			
2	Jeldenov Akim	RMD RAMS	Lead Specialist		•	•	•	•			
3	Amanov Kushtarbek	PLUAD#1	Chief Mechanic			•	•				
4	Dubashev Nur	BO UAD	Lead Specialist			•	•				
5	Abyshov Tursunbek	PLUAD#1	Lead Specialist			•	•				
6	Ashyrbaev Bakai	PLUAD#1,DEP#43	Chief Specialist			•	•				
MT-B											
7	Chengelov Baktybek	BNT UAD, DEP-34	Chief Specialist			•	•				
8	Toktonaliev Chyngyz	PLUAD #1, DEP-42	Chief Engineer			•	•				
9	Seitkaziev Baktybek	PLUAD #1, DEP #954	Lead Specialist			•	•				
10	Kulanbaev Askat	PLUAD #3, DEP#20	Chief Specialist			•	•				
11	Nurbaev Farhat	PLUAD #3, DEP #8	Master			•	•				
12	Suranbaev Munarbek	PLUAD #3, DEP#18	Leading Specialist			•	•				
13	Aralbaev Zamir	BNT UAD, DEP #957	Chief Engineer			•	•				
14	Askarbek uulu Kurmanbek	BNT UAD, DEP #955	Chief Engineer			•	•				
15	Bektemirov Nurlan	BNT UAD, DEP-32	Foreman			•					
16	Imanalieva Anara	BNT UAD, DEP-34	Head of Technical Section			•	•				
17	Samakov Taalaibek	PLUAD #4, DEP-35	Chief Engineer			•	•				
18	Omurov Altynbek					•	•				
19	Omukeev Azamat	PLUAD #4, DEP#4	Chief Engineer			•	•				
20	Sadraliev Nurkan	PLUAD#5	Leading Specialist			•	•				
21	Joldoshev Shadybek	PLUAD #6, DEP#50	Chief Engineer			•	•				
22	Janseitov Almaz	PLUAD #6, DEP#52	Chief Engineer			•	•				
23	Junusov Toktogul	OSI UAD	Chief Engineer			•	•				
24	Joroev Janybek	OSI UAD	Chief Engineer			•	•				
25	Turdubaev Alimbek	OSI UAD, DEP#21	Chief Engineer			•	•				
26	Usenov Rajap	OSI UAD, DEP-45,	Chief Engineer			•	•				
27	Maksutov Sulaiman	OSI UAD, DEP-959,	Chief Engineer			•	•				
28	Akmatov Ikramali	OBI UAD	Chief Engineer			•	•				
29	Shaibekov Mustafa	OBI UAD, DEP#13	Chief Engineer			•	•				
30	Anarbaev Erkin	OBI UAD, DEP #46	Chief Engineer			•	•				

IPIG: Investment Projects Implementation Group
RMND: Road Management Department
RMD: Road Maintenance Department

PPAW: Preparation of Production and Acceptance of Work Division
PTD: Production Technical Division
RAMS: Road Asset Management Section

Source: JICA Expert Team

1.7 Joint Coordination Committee

The Joint Coordination Committee (JCC) was established to facilitate inter-organizational coordination. Seven (7) JCC meetings were held during the Project's duration. Progress and achievement of the Project were discussed through the series of meetings.

Table 1-5 Summary of JCC Meetings

JCC	Period	Subjects of Discussion
1 st JCC Meeting	August 22 nd , 2013	Approval of Work Plan with PDM Version 1
2 nd JCC Meeting	January 30 th , 2014	Confirmation of Progress Report (1) and revised PDM Version 2
3 rd JCC Meeting	August 28 th , 2014	Confirmation of Progress Report (2) and revised PDM Version 3
4 th JCC Meeting	January 29 th , 2015	Bridge Maintenance Management Criteria, New organization in RMD
5 th JCC Meeting	April 28 th , 2015	Confirmation of Progress Report (3) and revised PDM Version 4
6 th JCC Meeting	August 20 th , 2015	Progress of Joint Terminal Evaluation Results of the Evaluation
7 th JCC Meeting	November 19 th , 2015	Achievement of the Project including Recommendations of the Joint Terminal Evaluation Handover of the Draft Completion Report and revised PDM Version 5

In accordance with the progress and new findings, Project Design Matrix (PDM) was revised to accommodate actual project condition and approved by JCC members. Following tables indicate record of the revisions in PDM. The Final Project Design Matrix, Version 5, revised in November 2015, is shown in Appendix 1.

Tables 1-6 to 1-11 contain information on the revision of objectively verifiable indicators for the overall goal, for each output, revision of activities, revision of input by the Japanese side, revision of input in equipment and addition of input of training in Japan.

Table 1-6 Revision of Objectively Verifiable Indicator for Overall Goal

Period	Before Revision	After Revision
Revised in November 2015 by 7 th JCC Meeting	A bridge and a tunnel chosen by maintenance management plan based on the nation-wide management criteria which is prepared in the project are repaired / replaced.	1. Routine maintenance of bridges and tunnels is reported and updated at least twice a year by the RMD. 2. Maintenance management plan for bridges and tunnels is formulated annually by the RMD. 3. Budgetary allocation from the maintenance management plan for bridges and tunnels is prepared annually by the RMD. 4. A bridge and a tunnel chosen by maintenance management plan based on the nation-wide management criteria which is prepared in the project are repaired / replaced.
Revised in April 2015 by 5 th JCC Meeting	The number of repaired bridges and tunnels in Kyrgyz is increased to 100% in [December 2015] from the start of the Project.	A bridge and a tunnel chosen by maintenance management plan based on the nation-wide management criteria which is prepared in the project are repaired / replaced.

Table 1-7 Revision of Objectively Verifiable Indicators for Each Output

Period	Before Revision	After Revision
Revised in January 2014 by 2 nd JCC Meeting	2-6. [B] [T] All PLUADs/UADs operate and develop the database (DB) system.	2-6. [B] RMD operates and develops the DB system. [T] BO UAD operates and develops the DB system under the supervision of RMD.
	3-5. [B] 100% of the results of inspection and condition rating implemented by PLUADs/UADs are evaluated to be accurate by RMD [by June 2015].	3-5. [B] 100% of the results of inspection and condition rating implemented by master trainers are evaluated to be accurate by RMD [by June 2015].
	4-3. A long-term plan for maintenance management of bridges in consideration of LCC is prepared by RMD/PLUADs/UADs in accordance with the nationwide management criteria [by June 2015].	4-3. A long-term plan for maintenance management of bridges in consideration of LCC is prepared by RMD in accordance with the nationwide management criteria [by June 2015].
	4-4. [B] A short-term plan with cost estimation for maintenance management of bridges is prepared by RMD/PLUADs/UADs [by June, 2015].	4-4. [B] A short-term plan with cost estimation for maintenance management of bridges is prepared by RMD [by June 2015].
Revised in August 2014 by 3 rd JCC Meeting	4-5. [T] A short-term plan with cost estimation for maintenance management of tunnels is prepared by RMD/PLUADs/UADs by [June 2015].	4-5. [T] A short-term plan with cost estimation for maintenance management of tunnels is prepared by RMD/BO UAD by [June 2015].

Table 1-8 Revision of Activities

Period	Before Revision	After Revision
Revised in January 2014 by 2 nd JCC Meeting	2-7. [B] Staff members of PLUADs/UADs/DEPs collect and input inspection data, condition rating and cost of each bridge.	2-7. [B] Staff members of RMD collect and input data of inspection, condition rating and cost of each bridge.
	3-4. [B] Master trainers implement trainings for staff members of PLUADs/UADs and DEPs for inspection and condition rating.	3-4. [B] Master trainers implement trainings for inspection staff members of PLUADs/UADs and DEPs for inspection.
	3-5. [B] Staff members of PLUADs/UADs/DEPs carry out inspection and condition rating.	3-5. [B] Staff members of RMD/PLUADs/UADs/DEPs carry out inspection, while staff members of RMD carry out condition rating.
	4-3. [B] Trainings for staff of RMD/PLUADs/UADs on detailed survey and cost estimation for preparing a long-term plan for maintenance management of bridges are implemented	4-3. [B] Trainings for staff of RMD on detailed survey and cost estimation for preparing a long-term plan for maintenance management of bridges are implemented.

Period	Before Revision	After Revision
	4-4. [B] Staff members of RMD/PLUADs/UADs are to prepare a long-term plan for maintenance management of bridges.	4-4. [B] Staff members of RMD are to prepare the long-term plan for maintenance management of bridges.
	4-5. [B] Trainings for staff members of RMD/PLUADs/UADs on the preparation of a short-term plan for maintenance management of bridges are to be implemented.	4-5. [B] Trainings for staff members of RMD on the preparation of a short-term plan for maintenance management of bridges are to be implemented.
	4-6. [B] Staff members of RMD/PLUADs/UADs are to prepare the short-term plan for maintenance management of bridges.	4-6. [B] Staff members of RMD are to prepare the short-term plan for maintenance management of bridges.

Table 1-9 Revision of Input by the Japanese Side

Period	Before Revision	After Revision
Revised in January 2014 by 2nd JCC Meeting	9. Local Coordinator	9. Bridge Maintenance Expert (4)/Assistant for Bridge Detail Inspection 10. Local Coordinator
Revised in August 2014 by 3 rd JCC Meeting	9. Bridge Maintenance Expert (4)/Assistant for Bridge Detail Inspection 10. Local Coordinator	9. Bridge Maintenance Expert (4)/Assistant for Bridge Detail Inspection / Assistant for International Roughness Index (IRI) Survey 10. IRI Survey Expert 11. Local Coordinator

Table 1-10 Revision of Input in Equipment

Period	Before Revision	After Revision
Revised in January 2014 by 2nd JCC Meeting	1) Lighting Facility 2) Schmidt hammer- 3 units 3) Test hammer-10 units 4) Crack meter – 10 units Scaffold rent for detail inspection	1) Lighting Facility 2) Schmidt hammer- 3units 3) Test hammer-10 units 4) Infrared camera-1 set 5) Portable drill- 1set (for Carbonation Test)
Revised in August 2014 by 3 rd JCC Meeting	1) Lighting Facility 2) Schmidt hammer- 3units 3) Test hammer-10 units 4) Infrared camera-1 set 5) Portable drill- 1set (for Carbonation Test)	1) Lighting Facility 2) Schmidt hammer- 3units 3) Test hammer-10 units 4) Infrared camera-1 set 5) Portable drill- 1set (for Carbonation Test) 6) VIMS

Table 1-11 Revision of Input of Training in Japan

Period	Before Revision	After Revision
Revised in April 2015 by 5 th JCC Meeting	Inputs other than indicated here will be determined through mutual consultation between JICA and MOTC during the implementation of the Project, as necessary.	3. Trainings in Japan Training in Japan will be implemented twice during the implementation of the Project. The schedule and participants of the training in Japan are as follows: 1) Schedule

Period	Before Revision	After Revision
		1 st training: September 2014 2 nd training: September 2015 2) Participants 5 persons for each training Participants will be chosen from the member of counterparts and master trainers of the Project.

1.8 JICA Expert Team

Members of the JICA Expert Team are as listed in the Table 1-12.

Table 1-12 Members of the JICA Expert Team

	Designation	Name
(1)	Team Leader/Bridge Maintenance Expert (1)	MIZOTA Yuzo
(2)	Deputy Team Leader/Bridge Maintenance Expert (2)	OKAZAKI Akio
(3)	Bridge Maintenance Expert (3)	MIYAUCHI Hidetoshi
(4)	Tunnel Expert (1) (Structure)	HIROI Kazuya
(5)	Tunnel Expert (2) (Facilities)	MIURA Kentaro/ ABE Shintaro TACHI Seiichi
(6)	Database Expert/Assistant for Detailed Bridge Inspection	WATANABE Masatoshi
(7)	Cost Estimator/Detailed Bridge Inspection	KITAMURA Takayoshi
(8)	Coordinator/Bridge Inspection Assistant/Assistant for International Roughness Index (IRI) Survey	OGAWA Junichiro
(9)	Bridge Maintenance Expert (4)	SAWADA Kentaro
(10)	IRI Survey Expert	NAGAYAMA Tomonori

Source: JICA Expert Team

1.9 Training in Japan

The first training in Japan was organized for two (2) weeks from September 11th 2014. It was conducted in Tokyo, Nagoya, and Hokkaido in Japan. The training contents included: (1) lecture on bridge maintenance management in Japan (National level, Prefectural level, and Municipal level), (2) hands-on training on bridge inspection and (3) tour of bridge construction site, etc.

The second training in Japan was organized in October 2015 at Osaka, Nagoya and Tokyo. Bridge and Tunnel Inspection, highway road maintenance and nationwide maintenance management were introduced by the respective host agency. Detailed schedule of the Trainings is provided in Appendix-5.

Chapter 2 Achievement of the Project

2.1 Achievement of the Project Purpose

All of the Master Trainers (MT) for bridge maintenance and the staff of BO UAD for tunnel maintenance attained skills for inspection and condition rating of bridges and tunnels.

The MTs for bridge maintenance held workshops for other personnel of the RMD on inspection and condition rating. Regarding cost estimation for repair works, the MTs acquired the necessary knowledge and skills on how to calculate the cost of repair works. Achievement status of the Project Purpose is given in Table 2-1 below, while the achievement of the Overall Goal is explained in Chapter 9.

Table 2-1 Achievement of the Project Purpose

Project Purpose	Objectively Verifiable Indicators	Means of Verification	Achievement
MOTC's capacity is improved for maintenance cost estimation of bridges and tunnels on the basis of inspection results.	1) Maintenance budget document with breakdowns for bridges and tunnels is prepared by [June 2015].	1) Maintenance budget document for bridges and tunnels	Maintenance budget documents with breakdowns for bridges (2015-2017) were prepared in November 2014. Maintenance budget documents with breakdowns for tunnels (2014-2016) were prepared in October 2013. 100% Achieved.
	2) Data from the newly developed database system is utilized for formulating maintenance budget for bridges and tunnels.	2) Analysis of the quality of data for bridges and tunnels, project report	Data from the newly developed database system is utilized for formulating maintenance budget for bridges and tunnels for 2016. 100% Achieved.

The following facts are supplemental to accentuate the achievement of the Project Purpose:

- Output of the Project contributed to the Road Sector National Development Strategy. The status of bridge condition and required maintenance management cost was introduced into the "Road Sector Development Strategy up to 2025". Total estimated cost for reconstruction of bridges required for the next 3 years based on short-term plan developed by the Project has been mentioned in the Strategy.
- Road Asset Management Section (RAMS) was newly established under the RMD in 2015 as per the recommendation of the Project.
- Budgetary request was prepared based on short-term plan prepared under the Project. Previously this budgetary request used to be prepared without reasonable planning.

- Maintenance Management Cycle was technically and institutionally established deriving from practical output by each agency/organization in accordance with institutional demarcation scheme proposed by the Project.
- One bridge designated by the JICA Project Team as very dangerous was replaced in 2014.
- Maintenance work of Tunnels according to short-term plan has been implemented since 2014.
- Manuals on Database system, Bridge Maintenance and Tunnel maintenance developed under the Project have been utilized as a reference material in the Kyrgyz State University of Construction, Transport and Architecture (KSUCTA) and Bishkek Automobile Road College (BARC) with the purpose to contribute to the project sustainability in terms of capacity development for younger engineers.

2.2 Achievement of Project Outputs

Achievement level of the Project outputs is verified in accordance with the Objectively Verifiable Indicators set forth in the PDM as indicated in Table 2-2 below. According to the verification, it can be evaluated that all of the indicators were satisfactorily achieved to the required extent.

Table 2-2 Achievement of Project Outputs

Output 1:	Demarcation of MOTC HQ, RMD, PLUADs/UADs and DEPs is clearly identified with necessary staffing for the maintenance management of bridges and tunnels.	
	<i>Objectively Verifiable Indicators</i>	<i>Achievement Level</i>
	Demarcation of MOTC HQ, RMD, PLUADs/UADs and DEPs for maintenance management of bridges and tunnels becomes clear and approved by MOTC.	Demarcation of MOTC HQ, RMD, PLUADs/UADs and DEPs for maintenance management of bridges and tunnels was proposed in December 2014 and approved by the RMD in November 2015. 100% Achieved.
	Roles of MOTC HQ, RMD, PLUADs/UADs and DEPs in the maintenance management of bridges and tunnels are implemented.	Roles of MOTC HQ, RMD, PLUADs/UADs and DEPs in the maintenance management of bridges and tunnels are being implemented. 100% Achieved.
Output 2:	A database system to record information on bridges and tunnels is developed and ready for maintenance planning.	
	<i>Objectively Verifiable Indicators</i>	<i>Achievement Level and Progress</i>
	A database system with necessary information for maintenance planning of bridges and tunnels is developed by [July 2015].	A database system with necessary information for maintenance planning of bridges and tunnels was developed in March 2015. 100% Achieved.
	A manual for data input is developed by [July 2015].	A manual for data input was developed in November 2013 and finalized in July 2015. 100% Achieved.
	[B] 30 master trainers for data collection and inputs are trained and certified by [July 2015].	30 master trainers for data collection and inputs for bridges were trained and certified by the Japanese Expert in April 2015. 100% Achieved.
	[B] All the master trainers hold at least three (3) workshops on data collection and input for their responsible sections.	All the master trainers held more than three (3) workshops on data collection and input for their responsible sections. 100% Achieved.
	[T] All staff members trained on data collection	All staff members concerned with the maintenance

	and input passes the final exam.	management of tunnels trained on data collection and input passed the final exam. 100% Achieved.
	[B] RMD operates and develops the database system; [T] BO UAD operates and develops the database system under the supervision of RMD.	RMD developed and has been operating the database system for formulation of the maintenance management plan for bridges. BO UAD developed and has been operating the database system for formulation of the maintenance management plan for tunnels. 100% Achieved.
Output 3:	Capacity of DEPs for routine maintenance and capacity of PLUADs/UADs for inspection and condition rating of bridges and tunnels are enhanced.	
	<i>Objectively Verifiable Indicators</i>	<i>Achievement Level and Progress</i>
	A routine maintenance manual is developed by [B] [November 2014] and [T] [November 2014].	The Bridge Maintenance Manual was developed in July 2014 and a routine maintenance manual for tunnels was developed in October 2013. 100% Achieved.
	Through the review by all the PLUADs/UADs, more than 90% of DEPs are determined to implement routine maintenance of bridges/tunnels in accordance with a newly created routine maintenance manual.	Through the review by all the PLUADs/UADs, all 55 DEPs started implementing routine maintenance of bridges/tunnels in accordance with the newly developed routine maintenance manuals for bridges/tunnels. 100% Achieved.
	[B] 30 master trainers on inspection and condition rating are trained and certified by [June 2015].	30 master trainers on inspection and condition rating of bridges were trained and certified by Japanese Experts in April 2015. 100% Achieved.
	[B] All the master trainers hold at least three (3) workshops on inspection and condition rating for their responsible sections.	All the master trainers held more than three (3) workshops on inspection and condition rating for their responsible sections. 100% Achieved.
	[B] 100% of the results of inspection and condition rating implemented by master trainers are evaluated to be accurate by RMD [June 2015].	100% of the results of inspection and condition rating of 871 bridges implemented by the master trainers were evaluated accurate by the RMD in July 2015. 100% Achieved.
	[T] All the staff members trained on inspection and condition rating of tunnels pass the final exam.	All the staff members (4) trained on inspection and condition rating of tunnels passed the final exam. 100% Achieved.
	[T] 100% of the results of inspection and condition rating implemented by BO UAD/DEPs are evaluated to be accurate by RMD [June 2015].	100% of the results of inspection and condition rating of tunnels implemented by BO UAD/DEPs were evaluated accurate by RMD in 2014. 100% Achieved.
Output 4:	Capacity of MOTC's HQ, RMD, PLUADs/UDAs and DEPs on the preparation of maintenance management plans of bridges and tunnels is enhanced.	
	<i>Objectively Verifiable Indicators</i>	<i>Achievement Level and Progress</i>
	A nationwide management criteria is developed [B] [November 2013] and [T] [November 2013].	Nationwide management criteria were developed for bridges in January 2014 and for tunnels in October 2013. 100% Achieved.
	A repair methods manual is developed by [B] [November 2013] and [T] [November 2014].	A repair methods manual was finalized for bridges in July 2015 and for tunnels in July 2015. 100%

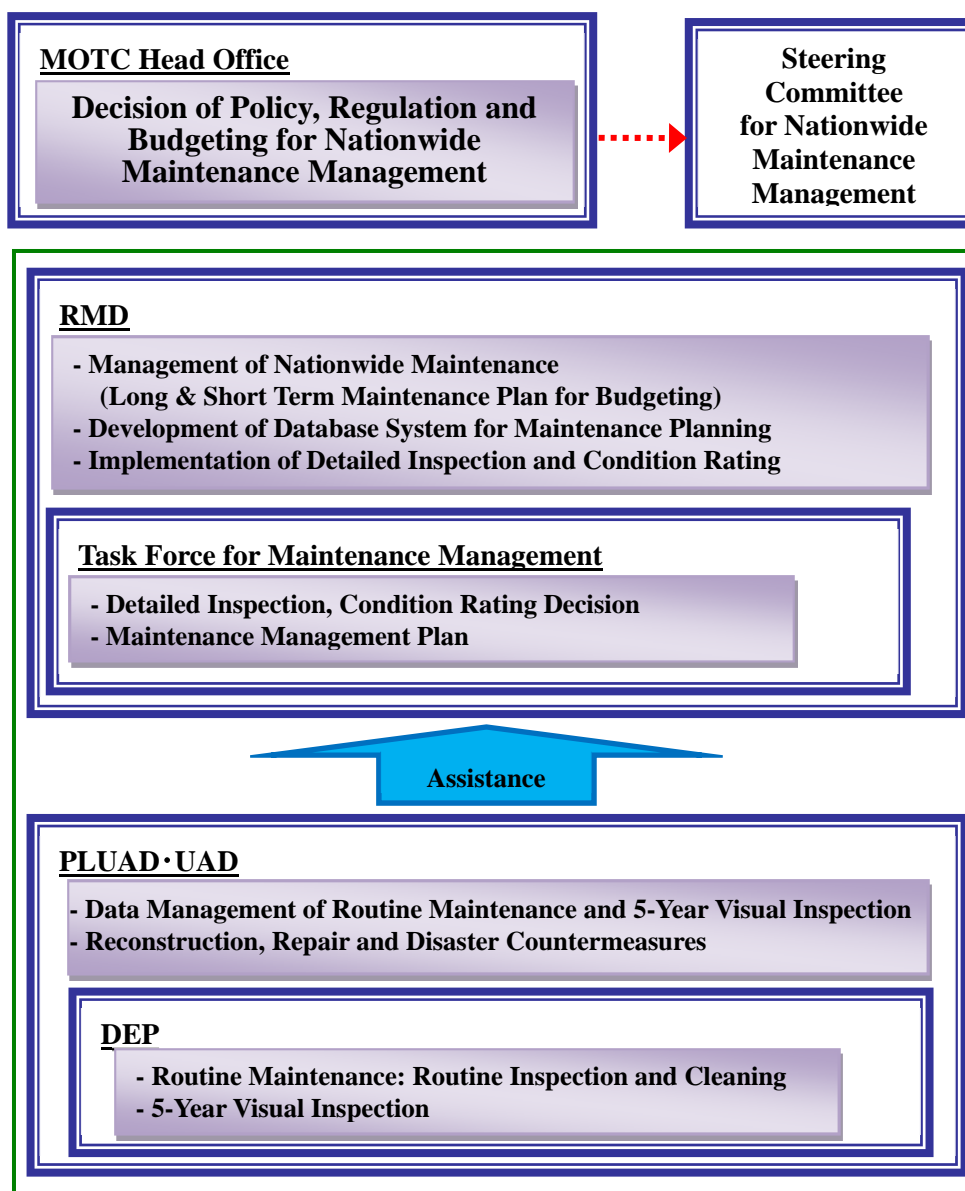
	Achieved.
[B] A long-term plan for maintenance management of bridges in consideration of LCC is prepared by RMD in accordance with the nationwide management criteria [June 2015].	A long-term plan for maintenance management of bridges in consideration of LCC was prepared in accordance with the nationwide management criteria in November 2014 and certified by the RMD in November 2015. 100% Achieved.
[B] A short-term plan with cost estimation for maintenance management of bridges is prepared by RMD [June 2015].	A short-term plan with cost estimation for maintenance management of bridges was prepared in November 2014 and was certified by the RMD in July 2015. 100% Achieved.
[T] A short-term plan with cost estimation for maintenance management of tunnels is prepared by RMD/BO UAD [June 2015].	A short-term plan with cost estimation for maintenance management of tunnels was prepared in September 2013. 100% Achieved.

Chapter 3 Institutional Demarcation of Maintenance Work Roles

3.1 Section Responsible for Maintenance Work (Inspection, Evaluation, Planning, Maintenance Work and Repair)

3.1.1 Demarcation of Organizational Structure of Maintenance Management

The demarcation of responsibilities on maintenance management of bridges and tunnels in MOTC was proposed in December 2014 as shown in Figure 3-1, and approved by the RMD in November 2015.



Source: JICA Expert Team

Figure 3-1 Demarcation of Responsibilities on Maintenance Management of Bridges and Tunnels in MOTC

(1) MOTC Head Office

i) Decision of Policy for Maintenance Management

Targets and objectives of maintenance management were decided. Maintenance management aims at road network, specifically, the bridges and tunnels in order to provide year-round and constant comfort, convenient and safe traffic flow. The objective of the maintenance management is to ensure the designed speed, designed load and traffic volume.

ii) Decision of Maintenance Management Regulations

The regulatory documents such as administrative orders, guidelines, manuals and other legal documents were issued and certified to conduct maintenance management.

iii) Decision of Budgeting for Nationwide Maintenance Management

Budgeting for nationwide maintenance management was decided.

(2) RMD

i) Preparation of Nationwide Maintenance Management Plan and Regulation

The Maintenance Management Plan for the long-term and short-term plans is prepared with required regulations and budgeting for the integrated nationwide management of bridges and/or tunnels to help the authorities decide on the priority of maintenance programs.

ii) Development of Database System

The database system of maintenance management is developed and improved to prepare an adequate plan of maintenance management.

iii) Implementation of Planned Inspection-B (Periodic Detailed Inspection)

Detailed inspection of bridges is implemented the next year of Planned Inspection A subject to Poor and Critical bridges to evaluate the structural soundness and to decide condition rating after visual inspection by the DEPs of PLUAD/UAD.

iv) Setup of Task Force for Maintenance Management

A Task Force for maintenance management is set up in RMD to conduct the above activities effectively. Approximately ten (10) members are appointed to the task force by the RMD and PLUAD/UAD staff including DEP. The task force members will conduct the above activities for a certain period every month, in addition to their regular duties in their offices. Initial inspection is also required for the task force to ensure the appropriateness of quality, fabrication, procurement, construction, etc.

(3) PLUAD/UAD and DEP

i) Implementation of Routine Maintenance Activities

Routine maintenance is conducted to confirm the structural and functional conditions through the patrol and routine inspection by DEP staff as well as to maintain and restore to the original condition

as much as possible through cleaning and replacement of damaged parts of facilities. Routine maintenance is conducted quarterly as a part of road maintenance.

ii) Implementation of Periodical Visual Inspection and Emergency Inspection

Visual inspection of bridges is conducted by DEP once in every 5 years. Emergency inspection is conducted after natural disaster, including but not limited to, heavy rainfall, snow, floods, or earthquake, etc., as well as any man-made disaster. The results of these inspections are reported to RMD through PLUAD/UAD.

iii) Implementation of Repair, Reconstruction and Disaster Countermeasures

The required works for the repair, reconstruction and implementation of disaster countermeasures are planned and conducted within the approved budget. The required works in the next year and the detailed inspection for the repair, reconstruction and disaster countermeasures are proposed to RMD.

iv) Implementation of Data Collection and its Management

The results of routine maintenance, periodical visual inspection and repair, reconstruction and provision of disaster countermeasures are collected and recorded by the staff of PLUAD/UAD and informed to RMD.

(4) Steering Committee for Nationwide Maintenance Management

- Purpose:
- 1) To provide advice on nationwide maintenance management from the technical and financial aspects; and
 - 2) To conduct public information and educational campaigns with regard to the importance of maintenance activities for the road sector.

Chairman: MOTC Staff

Administrative Office: RMD of MOTC

Members: Staff members of MOTC, University, DI and other agencies concerned.

3.2 Proposed Organizational Structure of RMD

3.2.1 Principle of Maintenance Work

Bridge/Tunnel Maintenance process is based on five (5) elements as below.

- 1) Inspection and Condition Assessment
- 2) Planning and Budgeting
- 3) Procurement
- 4) Management and Supervision of Work
- 5) Information and Database Management

Flow chart of five principles of maintenance work is shown in Figure 3-2.

In order to understand current bridge condition(s) it is necessary to gather data from conducting inspection. Based on the collected data and condition assessment, Planning and Budgeting for maintenance work is implemented.

Upon completion of Planning and Budgeting procedures, the procurement of necessary construction materials, equipment and manpower process is implemented. Procurement may possibly be initiated directly by PLUAD/UAD/RMD or via bidding procedures (tendering).

At the time all necessary materials, equipment and personnel are procured, PLUAD/UAD or private contractors commence work activities, such as bridge maintenance, repair/reconstruction or construction.

Record data of each single element (principle) is to be stored in the Database. Inspection results and Condition rating records are required to be stored in the Database. RMD is obliged to regulate the creation and supervision of the Database. RMD inputs all information regarding the contracting organization having prior experience working with MOTC. The above mentioned data contains general information of the contractor including detailed explanation of the work experience and role in previously implemented projects. RMD conducts Management and Supervision of Work. Procurement results and contractor evaluation are to be stored in the Database.

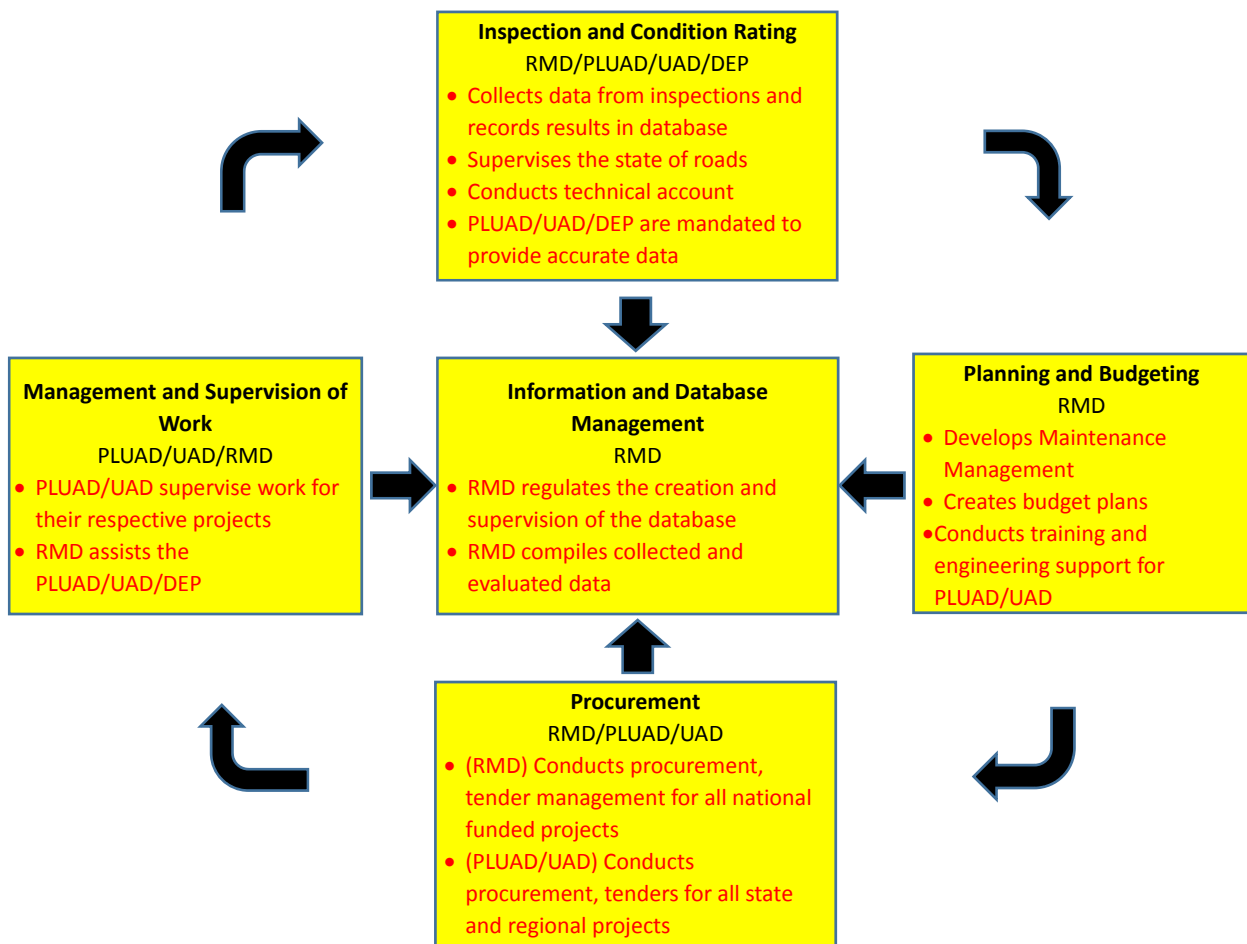


Figure 3-2 Five Principles of Maintenance Work

(1) Inspection and Condition Rating

[Planned Inspection A]

PLUAD/UAD/DEP executes Planned Inspection A (every five years). This consists of the following:

(Visual Inspection)

1. Inspection
2. Condition rating
3. Cost Estimation

Note: DEPs conduct Inspection; PLUAD/UADs conduct Condition Rating and Cost Estimation.

[Planned Inspection B]

RMD executes planned inspection B (Inspection to be implemented next year of Planned Inspection A subject to Poor and Critical bridges.)

Consisting of the following:

(Detailed Survey)

1. Inspection
2. Condition assessment
3. Cost Estimation

RMD assists in providing these inspections with regulation and management.

[Routine Maintenance]

DEP executes Routine Inspections.

The results of routine inspections are reported to PLUAD/UAD and RMD twice a year in the spring and autumn seasons. It is important to emphasize that spring and autumn are the reporting schedule and that routine inspection is on-going throughout the year.

[Initial Inspection]

RMD executes and manages initial inspection for/after newly constructed bridge.

[Emergency Inspection]

In case of natural disaster or manmade catastrophe affecting the bridge structure, visual inspection is needed. DEP executes the Inspection; PLUAD/UAD and RMD execute Condition rating and Cost estimation for repair.

(2) Planning and Budgeting

RMD is the national regulatory agency and maintains positive control of all nationally funded road maintenance projects while coordinating all subordinate agency activities.

Budget plan is based on the results of Inspection and Condition rating stored in the Database system.

RMD conducts training and engineering support for PLUAD/UAD.

(3) Procurement (Tendering)

RMD provides tender management and PLUAD/UAD are responsible for conducting tenders for all maintenance, repairs and construction for areas under their respective control.

At the time all necessary materials, equipment and personnel are procured, PLUAD/UAD or private contractors commence work activities, such as bridge maintenance, repair/reconstruction or construction.

DEP executes tendering for small scale/volume work; PLUAD/UAD executes tendering large scale/volume of work.

(4) Management and Supervision of Work

RMD provides management and additional support to PLUAD/UAD. PLUAD/UAD are directly responsible for the management and supervision of all work conducted by contractors and employees. RMD will assist in Supervision of all national funded projects in The Kyrgyz Republic.

PLUAD/UAD will supervise all activities in their regions. DEP is also mandated to ensure the quality repair of public roads and facilities and ensure that the technical regulation norms and standards are adhered to under the PLUAD/UAD.

RMD further delegates traffic management design to PLUAD/UAD. RMD oversees this. DEP executes small scale/volume work; PLUAD/UAD executes large scale/volume of work.

[Summer Maintenance]

DEP conducts summer cleaning and repair such as the removal of garbage, rock fall, debris etc. from the roadway.

[Winter Maintenance]

DEP also conducts winter routine maintenance such as snow and ice removal etc.

(5) Information and Database Management

Record data of each single element (principle) is to be stored in the Database. Inspection results and Condition rating records are obliged to be stored in the Database. RMD is responsible for the creation and oversight of the database system. All agencies are mandated to provide timely accurate data to the database to ensure the proper communication and tracking of progress of all projects that is to provide means for strategic planning and targeted budget utilization.

RMD inputs all information regarding the contracting organization having prior experience working with MOTC. The above mentioned data contains general information of the contractor including detailed explanation of its' work experience and role in previously implemented projects. RMD conducts Management and Supervision of Work. Procurement results and contractor evaluation are to be stored in the Database.

3.2.2 Departmental Function

Each department as RMD, PLUAD/UAD or DEP clearly understands its functions and responsibilities according to the chart in Table 3-1. Responsibility in actual work under each element needs to be undertaken by each department such as RMD, PLUAD/UAD and DEP as shown in Table 3-3.

Table 3-1 Departmental Function in Five Element

Required Task	DEP	PLUAD/UAD	RMD	Remarks
1. Inspection and Condition Assessment				
(1) Initial Inspection			Execution and Management	RMD executes initial inspection following newly constructed bridges
(2) Planned Inspection A (Visual Inspection) • Inspection • Condition	Conducts inspection	• Condition Assessment • Cost Estimation	Management and Assistance	Agencies to execute visual inspection and items listed in the required task column

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 PROJECT COMPLETION REPORT

Required Task	DEP	PLUAD/UAD	RMD	Remarks
Assessment • Cost Estimation				
(3)Planned Inspection B (Detailed Survey) • Inspection • Condition Assessment • Cost Estimation			RMD Executes and Manages	RMD Manages all maintenance projects and provides technical supervision and support.
Routine Inspection	DEP Conducts Visual Patrol to identify defects and damage. Results of Routine Inspection are reported to PLUAD/UAD in the Spring and Autumn. (twice a Year)		RMD Receives reports of routine inspection results from DEP in Spring and Autumn and enters data into the Database, and uses for Planning and Management purposes.	Note: It is important to emphasize that Routine Inspection is on-going throughout the year. The reporting of these inspections is reported twice a year in spring and autumn.
Emergency Inspection	Conducts inspection	• Condition Assessment • Cost Estimation	Manages and Assists	
2. Planning and Budgeting				
Planning		PLUAD/UAD assists RMD in the planning of architectural and artistic design of public roads.	Creates Budget Plan, Conducts training and engineering support for PLUAD/UAD, plans all maintenance schedules. Accepts and approves all contracted goods, and services.	RMD also plans, provides and manages all programs for the effective and targeted use of the budget and imposes strict regulation to prevent fraud, waste, and abuse of Republic funds.
Technical Accounts		Provides technical accounts.	Assists in the provision of technical accounts.	
Check Points			Installs checkpoints on the international borders of KR and provides for the reception of citizens and the timely processing of applications.	
Regulatory Planning			Imposes regulation of vehicle weight, size, and commodities transported on all roadways and any other regulations related to international and national commerce.	
Study repair/reconstruction methods.			Develops drafting and planning proposals for changes to the public road system and provides	

Required Task	DEP	PLUAD/UAD	RMD	Remarks
			architectural and artistic design of road systems. Provides contract management for all construction, reconstruction and routine maintenance.	
Consultation			Provides consulting services for the use of roads.	
Atlas			Organizes current versions of the national road atlas.	
Emergency Response			Plans and provides emergency mobilization in the event of a natural or man-made disaster.	
Subordinate Agencies			Coordinates all subordinate agency activities.	
3. Procurement (Tendering)				
Tendering		Participates in all tendering for all phases, volume, and all levels of maintenance and construction for roads, bridges and tunnels. Participates in tendering for all state and regionally funded projects.	Provides contract and tendering management. Participates in tendering for all nationally funded projects.	
4. Management and Supervision of Work				
Disbursement of Funds		Prevents fraud, waste and abuse of all allocated funds within the department operating budget.	Manages practices of fraud, waste, and abuse for all agencies.	
Analysis		Conducts analysis of DEP whenever needed. Traffic accident analysis and analysis of areas of high accident rates.		
Training Programs		Implements all training, retraining, and continuing training, and staffing.	Manages and provides assistance in all training programs.	
Information Dissemination		Informs other agencies and the general public of special road conditions.	Receives reports from other agencies and informs the general public of special road conditions.	Primarily in cases of inclement weather, road closures, etc.
Program Development		Continual efforts on the introduction of operative automation, and computer technology as well as communication of scientific achievements and advanced construction technology. Continual progressive	Manages all existing environmental programs and continues to improve.	Note: Both RMD and PLUAD/UAD are mandated to ensure all environmental procedures and laws are complied with. It is further

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Required Task	DEP	PLUAD/UAD	RMD	Remarks
		development of annual projections, technical conditions, repair and maintenance plans.		understood efforts to improve these programs will be pursued by both agencies.
Human Resources		Provides social and health protection of all workers.	Manages HR programs	
Reports and records		Maintains records of all traffic movement and accident data. Ensures proper data collection submitted to RMD.		
Safety	Provides for traffic safety and general vehicle travel on all public roadways.	Provides for the safety of the general motoring public and workers assigned to projects on public roadways.		
Compliance	Oversees compliance with all laws concerning transportation, the utilization of state property, resources, and regulations pertaining to road work and traffic rules in the territory of the Kyrgyz Republic.	Ensures compliance with rules, regulations, laws, environmental policies, technical rules, and standard of quality with all on-going maintenance and construction/reconstruction.	Ensures compliance with all laws and budgetary policies and procedures in accordance with National Legislation and any other policies or rules governing the execution of road repair, maintenance, and construction/reconstruction.	Note: All departments are expected to comply with laws and regulations as well as continual efforts of targeted and efficient utilization of the budget and all assets and resources.
General	Develops proposals for the execution of annual and long-term programs and projects concerning the repair and maintenance, and complex construction projects.		Provision of management and assistance to all agencies when the need arises.	
Fee Collection		Collects fees, tolls, and tariffs related to road, bridge, and tunnel use. Provides logical definition of all fees levied.	Manages and monitors.	
Check Points	Installs checkpoints on the international borders of KR and provides for the reception of citizens and the timely processing of applications.		Manages and monitors.	
State of Roads	Provides for traffic safety and general traffic control on all public roadways.	Controls (state roads) equipment, facilities, roadside services, and all state property, conduct inventories, and provide accurate data collection and Inspection Condition Rating.	Controls National Roads	

Required Task	DEP	PLUAD/UAD	RMD	Remarks
Routine Maintenance Summer and Winter Maintenance and Bridge Repair	Small scale repair and maintenance work.	Large Scale repair and maintenance work.	Manages and Supervises	
Routine Maintenance (summer)	Performs patching, crack sealing, and repair, reconstruction to Roads and Bridges. Executes cleaning, garbage, debris, fallen rock etc.		Manages and Supervises	
Routine maintenance (Winter)	Snow, and ice removal		Manages and Supervises	
5. Information and Database Management				
Input			RMD compiles and inputs all data collection information received from all agencies into the Database System.	
Regulation			RMD regulates the creation and supervision of the Database System.	
Execution and Control			RMD maintains positive operational control of the Database System at all times.	

3.2.3 Bridge Maintenance Planning

Planning of maintenance works mainly includes inspection, condition rating, cost estimation, database formulation, budget planning, etc. Responsibility for planning activities is shared by the Headquarters of RMD, PLUAD/UAD and DEP as summarized in Table 3-2.

Table 3-2 Sharing of Responsibility on the Planning of Maintenance Works

	DEP	PLUAD/UAD	RMD	Remarks
1. Routine Maintenance	E	-	M	To execute site patrol and simplified maintenance
2. Initial Inspection	E	-	E, M	To execute initial inspection for newly constructed bridge
3. Planned Inspection A	E	-	M	To execute visual inspection
Condition Rating	-	E	E, M	To evaluate condition rating
Cost Estimation	-	E	E, M	To estimate the cost for repair/reconstruction
4. Planned Inspection B	-	-	E, M	To execute detailed inspection
Condition Rating				To evaluate condition rating
Cost Estimation				To estimate the cost for repair/reconstruction
5. Emergency Inspection	E	M	M	To execute inspection without planning for emergency
Condition Rating				To evaluate condition rating
Cost Estimation				To estimate the cost for repair/reconstruction

6. Database Formulation	-	-	E, M	To compile collected and evaluated data
7. Maintenance Prioritizing	-	-	E, M	To prepare maintenance priority
8. Preparation of Planning of Budget	-	-	E, M	To prepare required budget
9. Repair Works (Middle Repair, Capital Repair)	E	E,M	M	
10. Reconstruction	-	E	M	
11. Disaster Countermeasure	E	M	M	

Note E: Execution of required works; M: Management of executed works

Activities of PLUAD/UAD such as condition rating and cost estimation could be transferred under the responsibility of DEPs for future cost effectiveness.

3.2.4 Routine Maintenance, Summer/Winter Maintenance, and Bridge Repair

Routine bridge maintenance is divided into two categories; namely routine inspection and routine maintenance. Routine inspection aims at discovering the defects and damages of bridges earlier, mainly by visual patrol. Routine road/bridge maintenance mainly include patch work, crack sealing of road pavement, and small scale repair of bridge structures. Summer and winter maintenance aims at securing traffic safety and road function by clearing garbage, debris, fallen rock and snow, ice, etc. from road surfaces. Routine maintenance and summer/winter maintenance is being executed by DEP because of locally-owned and rapid maintenance activities. All of the repair/reconstruction work is being executed by DEP and PLUAD/UAD due to the volume or work scale under the management and supervision of RMD. Responsibilities in actual work of related organizations are shown in Table 3-3.

Table 3-3 Responsibility in actual work

Required Activities	DEP	PLUAD/UAD	RMD
(1) Routine Maintenance and Summer & Winter Maintenance	Execution	-	Management
(2) Repair / Reconstruction <ul style="list-style-type: none"> ▪ Middle Repair (overlay of pavement) ▪ Capital Repair (resurfacing of pavement, and repair of road structure) 	Execution of Small Scale/Volume Work	- Execution of Large Scale/Volume Work	Management

Note: Summer maintenance: cleaning, painting, rock fall removal
Winter maintenance: snow clearing, removal of avalanche/rock fall debris

3.2.5 Contracting and Supervision of Road Rehabilitation and Construction Work

The bidding/contracting and supervision work is being shared between DEP and PLUAD/UAD due to the volume or work to consolidate construction management. It is more beneficial to transfer these activities from DEP to PLUAD/UAD for securing transparency in the future, after expanding the responsibility of DEP in handling large-scale repair/reconstruction work. It would be better for RMD

to concentrate on maintenance planning rather than construction technique development in the future. Responsibilities in contracting and supervision of work are shown in Table 3-4.

Table 3-4 Responsibilities in contracting and supervision of work

Required Activities	DEP	PLUAD/UAD	RMD
(1) Contracting (Selection of Contractor)	Execution of Small Scale/Volume Work	Execution of Large Scale/Volume Work	Management
(2) Supervision of Construction Work			

3.2.6 Role of RMD, PLUAD/UAD and DEP in Bridge Maintenance Management

Main roles in bridge maintenance management are summarized in Table 3-5.

Table 3-5 Roles in Bridge Maintenance Management

RMD	PLUAD/UAD	DEP
<ul style="list-style-type: none"> ▪ To prepare the plan of bridge maintenance management under MOTC including the annual budget, database, cost estimation method and rule/regulation concerned. ▪ To assist PLUAD/UAD in condition rating and cost estimation. ▪ To implement management of bridges under MOTC including the routine maintenance, repair/reconstruction and contracting/supervision. 	<ul style="list-style-type: none"> ▪ To implement condition rating and cost estimation for maintenance planning. In the future, these roles are better served if transferred to DEP. ▪ To implement tendering for Large-scale rehabilitation and construction work 	<ul style="list-style-type: none"> ▪ To implement routine maintenance, small-scale repair. ▪ To implement condition rating and cost estimation for maintenance planning in the future. ▪ To implement tendering for small scale rehabilitation and construction works.

Oblast based road and bridge maintenance management is advantageous for the locally-owned and quick maintenance activities. In case of oblast based maintenance management, one (1) integrated PLUAD or UAD office under each oblast is available to manage the maintenance work with the existing DEPs. Number of PLUAD/UAD and DEPs in each oblast is shown in Table 3-6.

Table 3-6 Number of PLUAD/UAD and DEPs under Each Oblast

Chui			Talas	Jalalabad			Osh		Batken	Naryn		Issyk kul
PLUAD-1	BO-UAD	BN-UAD	PLUAD-5	BO-UAD	PLUAD-6	BO-UAD	OSI-UAD	OBI-UAD	BN-UAD	PLUAD-3	PLUAD-4	
8 DEPs	1 DEP	3 DEPs	5 DEPs	4 DEPs	7 DEPs	3 DEPs	7 DEPs	3 DEPs	3 DEPs	6 DEP	7 DEPs	
One UAD			One PLUAD	One PLUAD			One UAD		One UAD	One PLUAD		One PLUAD

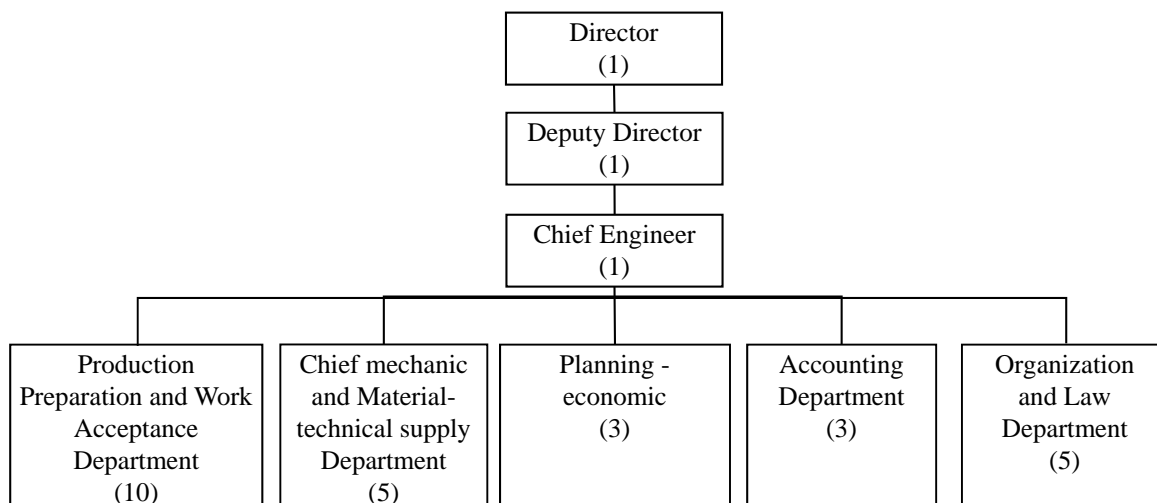
3.3 Number of Staff and Functions of RMD and Other MOTC Offices Concerned

3.3.1 Staff Number of RMD and Other MOTC Offices Concerned

The number of staff members of RMD, PLUAD/UADs and DEPs concerned in public road maintenance is summarized in Figure 3-3, Table 3-7 and Table 3-8, respectively. Fifteen (15) to twenty-eight (28) staff members consisting of (1) Administrative Personnel; (2) Production and Technical Personnel; (3) Accounting and Planning Personnel; and (4) Service Personnel, are available

in each PLUAD/UAD.

Eleven (11) to fifteen (15) staff members consisting of (1) Administrative Personnel; and (2) Service Personnel are employed in each DEP. In addition, twenty-eight (28) staff members employed by MOTC for tunnel toll collection services are assigned in DEP-9 and DEP-30 other than the staff members of DEP shown in Table 3-8.



Note: Figures in parentheses indicate the number of personnel.

Source: JICA Expert Team

Figure 3-3 Personnel Chart of RMD

Table 3-7 Number of Personnel of PLUADs/UADs

Position	PLUAD #1	PLUAD #3	PLUAD #5	PLUAD #6	OBI UAD	BNT UAD	OSI UAD	Bishkek-Osh UAD	PLUAD #4		
Administrative Personnel											
Head	1	1	1	1	1	1	1	Director-General	1	Head	1
Chief Engineer	1	1	1	1	1	1	1	First Deputy Director General	1	Chief Engineer	1
Deputy Head	1	1	-	1	-	1	1	Deputy Director General for Finance	1	Deputy Head	1
Specialist (Secretary)	1	1	1	1	1	1	1	Leading Specialist	1	Specialist (Secretary)	1
Production and Technical Department											
Head Production Section	1	1	1	1	1	1	1	1		1	
Chief Specialist (Chief Mechanic)	1	1	1	1	1	1	1	3		1	
Chief Specialist (Engineer of Traffic Management Service)	1	1	1	1	1	1	1	-		1	
Leading Specialist	2	1	2	2	1	1	1	3		-	
Specialist	1	1		1	1	1	1	-		1	
Accounting, Planning and Programming Department								Material and Technical Resources Provision Department		Planning and Programming Department	
Head (Chief Accountant)	1	1	1	1	1	1	1	1		Department Manager	1
Chief Specialist (Economist)	1	1	1	1	1	1	1	1		Chief Specialist	1
Leading Specialist	1	1	1	1	1	1	1	1		Leading Specialist	1
Junior Service Personnel								Economics Department		Accounting Department	
Driver	3	3	3	2	2	3	3	Head	1	Head (Chief Accountant)	1
Cleaner	1	1	1	1	1	1	1	Chief Specialist	2	Chief Specialist	1
Security Guard	2	2	-	3	1	-	3	Leading Specialist	3	Specialist	1
Storekeeper	1	1	-	-	-	-	1	Accounting Department		Junior Service Personnel	
								Head(Chief Accountant)	1	Driver	2
										Cleaner	1
								Chief Specialist	2	Security Guard	3
								Leading specialist	1		
								Junior Service Personnel			
								Driver	3		
								Cleaner	1		
TOTAL	20	19	15	19	15	16	20	28		20	

Source: JICA Expert Team

Table 3-8 Number of Personnel of DEPs

PLUAD#1								
Position	DEP1	DEP25	DEP28	DEP40	DEP42	DEP43	DEP954	DEP958
Administrative Personnel								
Head	1	1	1	1	1	1	1	1
Chief Engineer	1	1	1	1	1	1	1	1
Chief Accountant	1	1	1	1	1	1	1	1
Head of Production Section	1		1	1			1	1
Chief Specialist	2	1	1	2	2	1	2	2
Leading Specialist	2	1		1			1	1
Specialist (Secretary)	1	1	1		1	1	1	1
Junior Service Personnel								
Driver	1	1	1	1	1	1	1	1
Cleaner	1	1	1	1	1	1	1	1
Security Guard	4	3	3	3	2	4	5	5

PLUAD#3						
Position	DEP8	DEP14	DEP15	DEP18	DEP20	DEP24
Administrative Personnel						
Head	1	1	1	1	1	1
Chief Engineer	1	1	1	1	1	1
Chief Accountant	1	1	1	1	1	1
Head of Production Section	1	1	1	1	1	1
Chief Specialist	1	1	1	1	1	1
Leading Specialist	1	1	1	1	1	1
Specialist (Secretary)	1	1	1		1	1
Junior Service Personnel						
Driver	1	1	1	1	1	1
Cleaner	1	1	1	1	1	1
Security Guard	4	4	5	3	5	5
Storekeeper	1	1	1	1	1	1

PLUAD#4							
Position	DEP3	DEP4	DEP7	DEP10	DEP11	DEP33	DEP35
Administrative Personnel							
Head	1	1	1	1	1	1	1
Chief Engineer	1	1	1	1	1	1	1
Chief Accountant	1	1	1	1	1	1	1
Head of Production Section							1
Chief Specialist		1	1	1	1	1	2
Leading Specialist	1	1	1	1	1	1	2
Specialist (Secretary)	1	1	1	1	1	1	1
Junior Service Personnel							
Driver	1	1	1	1	1	1	1
Cleaner	1	1	1	1	1	1	1
Security Guard	3	3	3	3	3	3	5
Storekeeper	1	1	1	1	1	1	1

PLUAD#5					
Position	DEP6	DEP19	DEP36	DEP47	DEP48
Administrative Personnel					
Head	1	1	1	1	1
Chief Engineer	1	1	1	1	1
Chief Accountant	1	1	1	1	1
Head of Production Section					
Chief Specialist	2	2	2	2	2
Leading Specialist					
Specialist (Secretary)	1	1	1	1	1
Junior Service Personnel					
Driver	1	2	1	1	1
Cleaner	1	1	1	1	1
Security Guard	4	5	4	3	3
Storekeeper	1		1		

PLUAD#6							
Position	DEP12	DEP17	DEP27	DEP31	DEP50	DEP51	DEP52
Administrative Personnel							
Head	1	1	1	1	1	1	1
Chief engineer	1	1	1	1	1	1	1
Chief accountant	1	1	1	1	1	1	1
Head of Production Section							
Chief Specialist	3	2	2	2	2	2	2
Leading Specialist	1	1					
Specialist (Secretary)	1	1	1	1	1	1	1
Junior Service Personnel							
Driver	1	1	1	1	1	1	1
Cleaner	1	1	1	1	1	1	1
Security Guard	3	4	4	5	3	3	3
Storekeeper			1				

Bishkek-Osh UAD								
Position	DEP5	DEP9	DEP22	DEP23	DEP26	DEP30	DEP38	DEP956
Administrative Personnel								
Head	1	1	1	1	1	1	1	1
Chief engineer	1	1	1	1	1	1	1	1
Chief accountant	1	1	1	1	1	1	1	1
Head of Production Section	1	1	1	1	1	1	1	1
Chief Specialist	1	1	1	1	1	1	1	1
Leading Specialist	2	2	2	2		1	2	2
Specialist (Secretary)	1	1	1	1	1	1	1	1
Junior Service Personnel								
Driver	1	1	1	1	1	1	1	1
Cleaner	1	1	1	1	1	1	1	1
Security Guard	4	5	4	5	5	5	5	4

Osh-Batken-Isfana UAD				Bishkek-Naryn-Torugart UAD							Osh-Sary-Tash-Irkeshtam UAD							
Position	DEP2	DEP13	DEP46	Position	DEP32	DEP34	DEP39	DEP41	DEP955	DEP957	Position	DEP16	DEP21	DEP37	DEP44	DEP45	DEP959	DEP960
Administrative Personnel				Administrative Personnel							Administrative Personnel							
Head	1	1	1	Head	1	1	1	1	1	1	Head	1	1	1	1	1	1	1
Chief Engineer	1	1	1	Chief engineer	1	1	1	1	1	1	Chief engineer	1	1	1	1	1	1	1
Chief Accountant	1	1	1	Chief accountant	1	1	1	1	1	1	Chief accountant	1	1	1	1	1	1	1
Head of Production Section		1		Head of Production Section	1	1	1	1	1	1	Head of Production Section	1	1	1	1		1	1
Chief Specialist	1	1	1	Chief Specialist	1	1	1	1	1	1	Chief Specialist	1	1	1	1	2	1	1
Leading Specialist	1	1	1	Leading Specialist						1	Leading Specialist						1	
Specialist (Secretary)	1	1	1	Specialist (Secretary)	1	1	1	1	1	1	Specialist (Secretary)	1	1	1	1	1	1	1
Junior Service Personnel				Junior Service Personnel							Junior Service Personnel							
Driver	1	1	1	Driver	1	1	1	1	1	1	Driver	1	1	1	1	1	1	1
Cleaner	1	1	1	Cleaner	1	1	1	1	1	1	Cleaner	1	1	1	1	1	1	1
Security Guard	2	4	4	Security Guard	5	4	4	6	6	6	Security Guard	2	2	2	2	2	2	2
											Storekeeper	1	1	1	1	1	1	1

Source: JICA Expert Team

3.3.2 Main Functions of RMD and the Other MOTC Offices

(1) Existing Functions under Government Resolution No. 188

Government Resolution No. 188 (Positions in the Department of Roads of the MOTC of the Kyrgyz Republic, September 3, 2010) stipulates the main functions of RMD and PLUAD/UADs as well as DEP. Table 3-9 shows the main functions of each organization on road maintenance concerned abstracted from the above resolution.

Table 3-9 Main Functions of RMD, PLUAD/UAD and DEP on Road Maintenance

	RMD	PLUAD/UAD	DEP
Planning	(Project Preparation) <ul style="list-style-type: none"> Participates in construction, reconstruction and repair projects preparation; provides proper implementation of the works within the framework of the contracts considering traffic safety, construction standards and regulations. (Service Level) <ul style="list-style-type: none"> Determines road service quality and takes measures for its improvement. 	(Annual Budget Estimate) <ul style="list-style-type: none"> Implements work targeted on perspective annual forecasting and planning work of technical conditions of public motor-roads, engineering structures and motorway service objects. 	(Maintenance Plan Proposal) <ul style="list-style-type: none"> Development of proposals regarding perspective and annual program implementation of roads, engineering structure maintenance and repair.
Budget Formulation	(Disbursement) <ul style="list-style-type: none"> Provides efficient and targeted draft of funds for road repair and maintenance and public road structures repair and maintenance. (Cost Estimate) <ul style="list-style-type: none"> Participates in the development of methodology of road repair work price compilation. 		
Implementation	(Supervision) <ul style="list-style-type: none"> Performs engineering supervision of road repair and construction works. Participates in facility commissioning of motor roads, tunnels, bridges and engineering structures. (Taking-Over Certification) <ul style="list-style-type: none"> Determines, confirms scope of executed road-repair and construction works. 	(Quality Control) <ul style="list-style-type: none"> Provides observance of standards for the quality of repair works on roads and engineering structures. Monitors observance of technical norms and standards on the construction, repair and maintenance work of public motor-roads and engineering structures. (Maintenance Equipment) <ul style="list-style-type: none"> Provides efficient and targeted draft of utilization of facilities, buildings, equipment and machinery aimed at the repair and maintenance of motor-roads and engineering structures. 	(Road Repair) <ul style="list-style-type: none"> Timely and qualitative repair and maintenance of public motor-roads, engineering structures and complex motorway service according to staff qualification and work schedule. (Performance) <ul style="list-style-type: none"> Provides high quality repair work of public motor-roads, engineering structures and complex motorway service according to the technical standards and rules.

	RMD	PLUAD/UAD	DEP
Maintenance Management		(Routine and Periodic Maintenance) <ul style="list-style-type: none"> Implement works on routine, mid-life and capital repairs, daily maintenance of motor-roads, engineering structures and complexity of motorway service assigned to the PLUADs/UADs. (Monitoring and Recording) <ul style="list-style-type: none"> Implement monitoring of motor-roads, and engineering structures condition; keeps record of technical conditions, list of structures and their characteristics; 	
Database	<ul style="list-style-type: none"> Responsible for public roads and engineering structures database; 	<ul style="list-style-type: none"> Monitor traffic; creates and develops database of motor-roads condition and engineering structure; 	

Source: JICA Expert Team

(2) Issues on Existing Functions

The following issues have been identified in the current functions regulated in the Government Resolution.

Table 3-10 Issues on Existing Functions of Offices for Road Maintenance

	Issues
Planning	<ul style="list-style-type: none"> Maintenance program to be proposed by DEP seems to be insufficient. Road Service Level related to road maintenance to be determined by RMD has not been defined.
Budget Formulation	<ul style="list-style-type: none"> Responsibilities and undertakings to estimate the budgetary allocation for maintenance cost is not stipulated.
Implementation	<ul style="list-style-type: none"> Responsibility for Construction Supervision has not been efficiently shared between RMD and PLUAD/UAD.
Maintenance Management	<ul style="list-style-type: none"> Responsibility for Routine Maintenance and Periodic Maintenance is not delegated to RMD and DEP.
Database	<ul style="list-style-type: none"> Responsibility for Database Management of RMD is not defined. Data on conditions of structures has not been systematically recorded by PLUAD. DEP is not involved in the data collection for the database.

Source: JICA Expert Team

3.4 Related Activities of Other Development Partners

3.4.1 CAREC Corridor 3 (Bishkek-Osh Road) Improvement Project (Phase 4) by the ADB

ADB and the Government of Kyrgyz Republic have financed 138 million USD for the CAREC Corridor 3 (Bishkek-Osh Road) Improvement Project (Phase 4) implemented from the first quarter in 2014. The project consists of (1) the road improvement works in the section of Bishkek to Kara-Balta (52.5 km) of the Bishkek-Osh Road; and (2) the Pilot project of the Performance-Based Maintenance (PBM) contract.

Road maintenance performed by MOTC has been proven to be ineffective according to the existing

road maintenance unit called DEP in terms of cost due to high overhead and inefficient use of maintenance equipment. However, the private sector procured through a highly transparent bidding system is expected to improve the said situation.

A PBM pilot project is proposed by ADB and the hybrid PBM project (20 km re-pavement and maintenance of 100 km road section from Km 61 to Km 161 of the Bishkek-Osh road corridor) for road maintenance is to be implemented for three (3) years under this Project.

The location of the Pilot Project is limited to Chui Oblast at the moment since about 10 road construction companies are available in Chui Oblast, but not available in remote areas. The maintenance of bridges and tunnel(s) will be excluded from the PBM pilot contract. Selection of the consultant through ICB is currently ongoing.

3.4.2 Road Asset Management Project by the World Bank

Implementation of the Road Asset Management System (RAMS) financed by the World Bank (WB) was carried out from 2013 to 2014. The following four (4) tasks were implemented under MOTC to enhance the road asset management system in Kyrgyz for thirteen (13) months.

- Task 1: Supervision of collection and update of road inventory data and development of options to ensure sustainability for the collection and evaluation of road network data
- Task 2: Development of specifications for road network databank software and advice for the procurement of road network databank software
- Task 3: Development of standardized templates on the preparation of annual and multi-annual reports on road network monitoring, planning and investment requirements
- Task 4: Assessment of financing requirements and options for road maintenance activities by municipalities

Major outputs of the RAMS were;

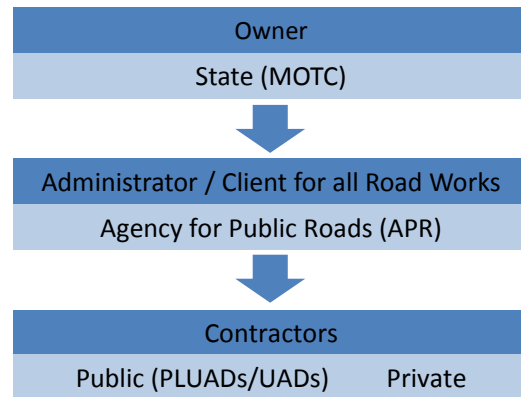
- 1) Latest road inventory data with data of IRI was collected and integrated into new database.
- 2) New road databank software “RONET” was introduced to be procured by MOTC.
- 3) A template for standard annual report regarding road asset was proposed using graph and tables produced by RONET.
- 4) Based on the analysis by using RONET, annual road maintenance cost for current road network in Osh and Jalal-Abad was estimated as 4 million USD and 2 million USD respectively, which are large gaps with current level of expenditure.

3.4.3 Road Sector Reform by EBRD

The Grant Agreement for “Osh-Isfana Road Rehabilitation Project - Implementing Road Sector Reform and Restructuring” was concluded in December 2012 by and between EBRD and the Government of Kyrgyz. The study on “Road Sector Reform” was conducted by the selected consultant and the final report was submitted in September 2013. The Study had recommended the following points to create a consistent structure with clearly assigned responsibilities.

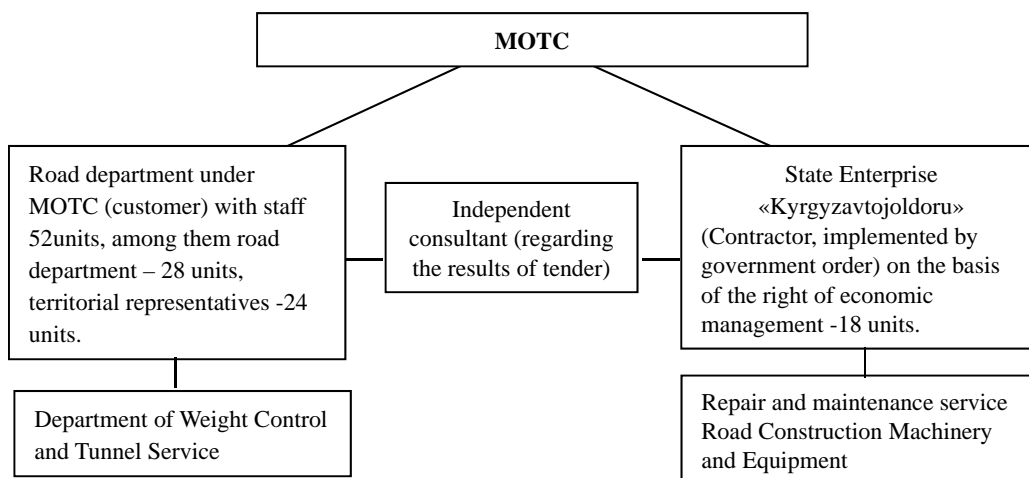
- To assign RMD as a Road Agency under the Ministry of Transport, with service level agreements to report and justify its performance, and certain financial independence is the best option to enhance transparency and accountability;
- To stop direct support to PLUADs and DEPs from the state budget; and
- To re-shape PLUADs/UADs into “oblast-based” organizations to perform as the Contractor.

On the other hand, RMD has developed a detailed reformation plan including the establishment of “Kyrgyzavtojoldoru” which would be a state enterprise undertaking road maintenance as a contractor. The reformation plan is currently under discussion in MOTC. Figure 3-5 shows the concept of Restructuring of RMD proposed by MOTC. Figure 3-6 demonstrates the Prospective Organization of State Enterprise Proposed by RMD.



Source: Consulting Services for Road Sector Reform Second Draft September 2013, EBRD

Figure 3-4 Relationship between organizations proposed by the Study Report



Source: JICA Expert Team

Figure 3-5 Concept of Restructuring of RMD proposed by MOTC



•JACD - Jalal-Abad Construction Department

•RRCSD - Road Repair and Construction State Department

Source: JICA Expert Team

Figure 3-6 Prospective Organization of State Enterprise Proposed by RMD

3.5 Framework of Bridge and Tunnel Maintenance Management

The Maintenance Management Plan consists of long and short-term plans decided on the basis of priority and budget for the maintenance program and/or activity according to the rated condition of bridge or tunnel by the periodical inspection. The Plan is also evaluated by the detailed periodical inspection and also by the emergency inspection required after serious defects by disaster and/or accidents have occurred.

The condition of bridges and tunnels are monitored during the entire year through routine maintenance such as patrol, routine inspection and cleaning activities. The routine maintenance work is to be conducted quarterly, depending primarily on the season, i.e., winter or summer. Winter maintenance from around November to March is generally a critical period for maintaining the condition of bridges and tunnels due to the climate/weather conditions which affect the soundness of bridge and tunnel structures and also hinder adequate maintenance operation.

(1) Bridge Maintenance Management

Generally, bridge maintenance framework consists of Routine Maintenance, Emergency Inspection, Planned Inspection A, Planned Inspection B, Condition Rating Decision, and Preparation of Maintenance Management Plan.

Routine Inspection is to be implemented quarterly, while inspection responsible staff is obliged to check the following items: road surface, expansion joints, drainage, girders, slabs (under surface), substructure, and river banks. Typical damage that might be revealed by routine inspection are as follows: rut, potholes, cracks, partial deformation, displacement, steps, rust emission, free lime, exposed rebar, flaking concrete, scours, settlements, slides, etc. (As to the bridge routine inspection checklist, Forms F and G, please refer to the Attachments.) **871** bridges are to be inspected **semiyearly** by 57 DEPs.

Emergency inspection is expected to be implemented annually and covers around 10 bridges. Planned Inspection A is implemented at the same time mainly by visual inspection in every 5 years and covers around 200 bridges. In total, around **175** bridges are to be inspected annually by 57 DEPs. Forms are given in Subsection 5.4 in this report represent the Recording Sheet of Planned Inspection A.

Planned Inspection B is to be implemented in every 5 years and covers around 30 bridges annually. Recording sheet of Planned Inspection B (Form B1-B3) is shown in Figure 5-12 at Subsection 5.4 annually, RMD inspects around 30 bridges.

Collected inspection data is compiled in the database managed by RMD. Condition rating decision is performed by RMD. Annually, around 1,000 bridges are being rated. On the basis of collected data, RMD prepares the Maintenance Management Plan: Long-Term (10 years), Short-Term (3-years plan for 871 bridges), and also carries out budgeting.

(2) Tunnel Maintenance Management

Generally, tunnel maintenance framework consists of the following items: Routine Maintenance, Emergency Inspection, Periodic Visual Inspection, Condition Rating Decision, and Preparation of Maintenance Management Plan. Routine maintenance is usually implemented every day or once a week (depends on season) and contains mainly cleaning work. Totally, the 5 tunnels are inspected by DEP-9, DEP-30 and DEP-38. As to routine inspection, the inspection form must be completed. Form T1 (shown in Subsection 6.6 Figure 6-4) is the routine inspection form.

Emergency and periodical visual inspections to be recorded in Form T2 (shown in Subsection 6.6 Figure 6-5) are implemented twice a year and cover the 5 tunnels under BO UAD. Tunnel condition rating decision is done by the BO UAD based on the collected data. All of the collected data during the inspections form the database operated by BO UAD. Based on the data collected, BO UAD prepares the Maintenance Management Plan, i.e., the Short-Term Plan (3-year plan for 5 tunnels).

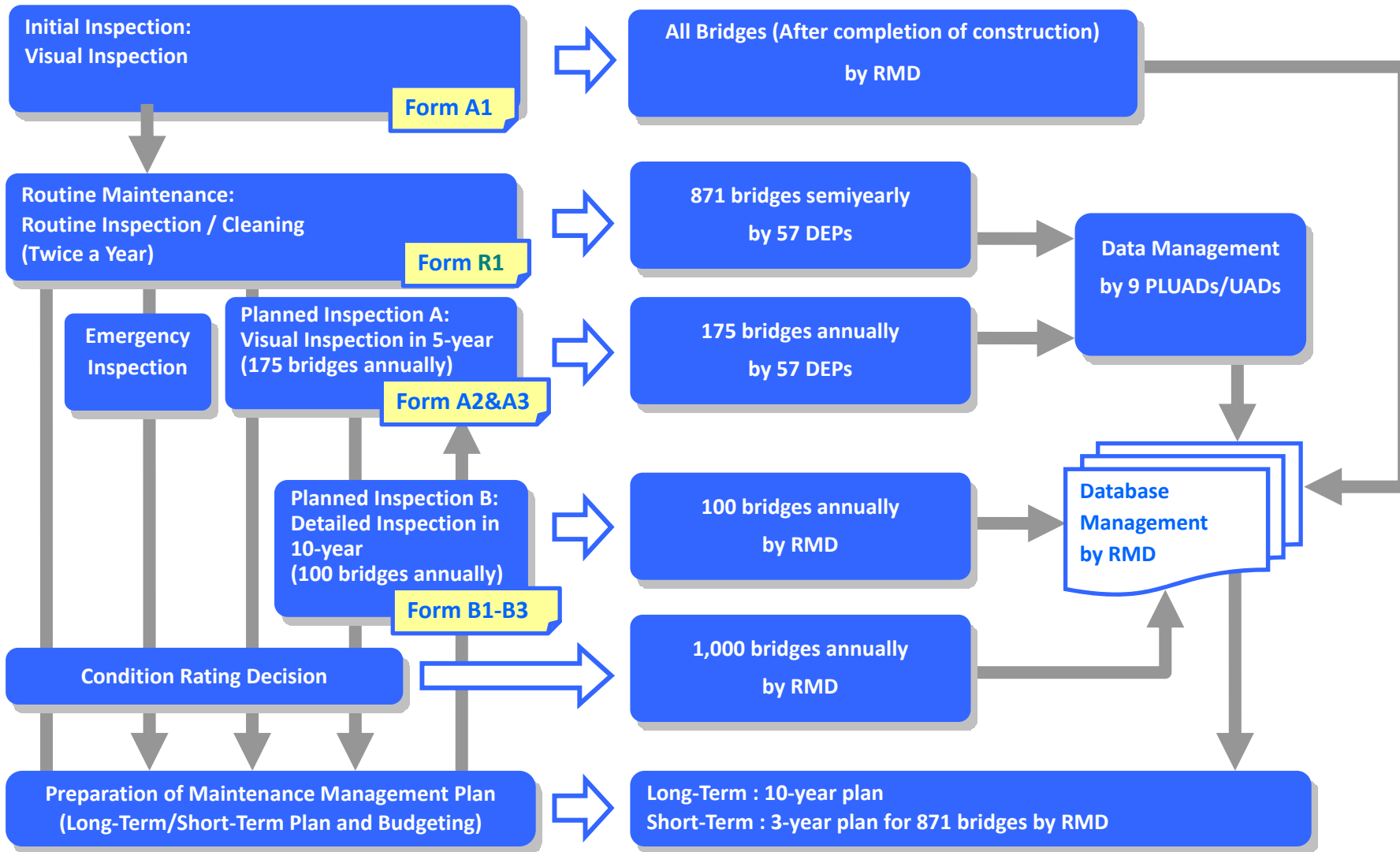
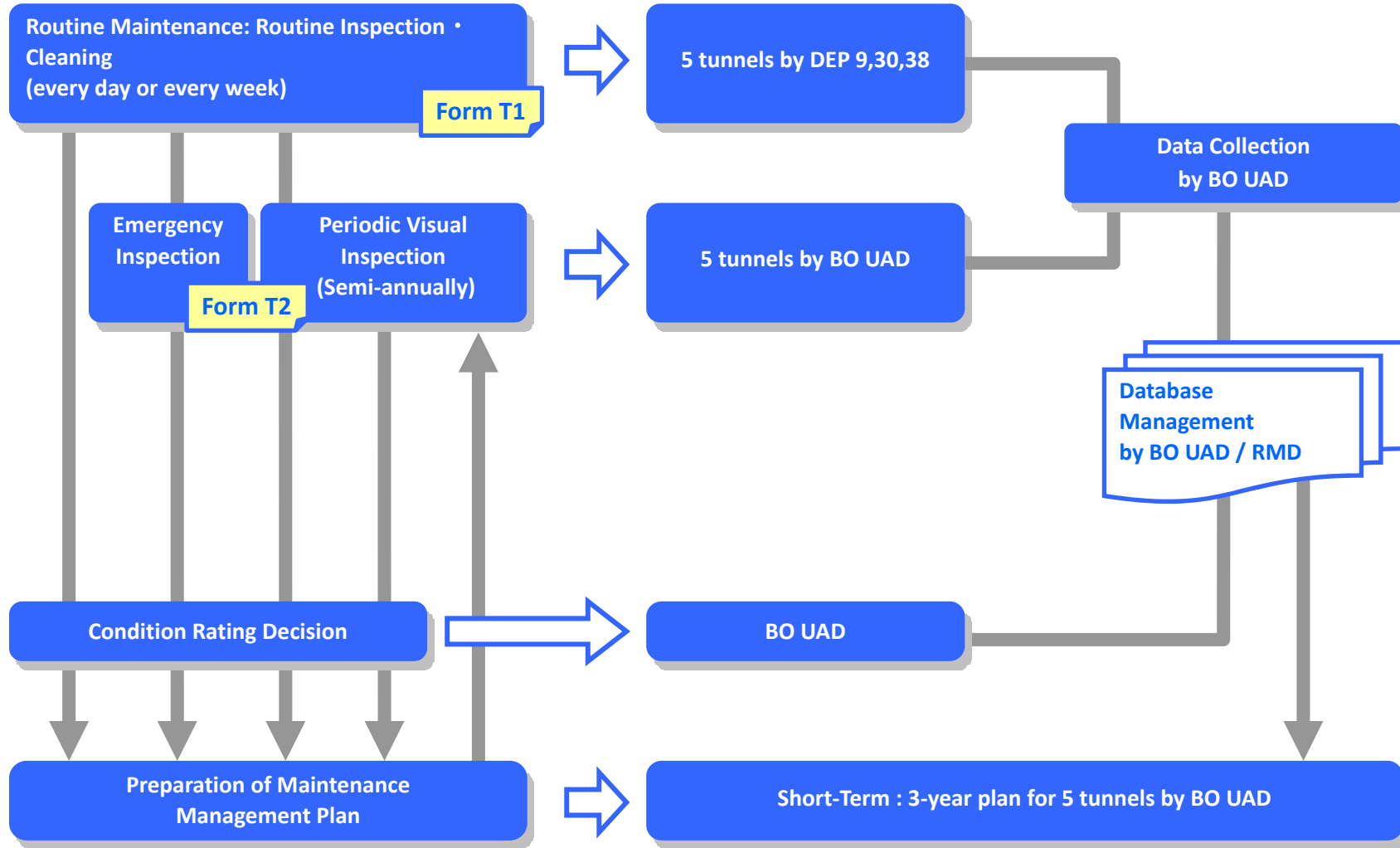


Figure 3-7 Framework of Bridge Maintenance Management

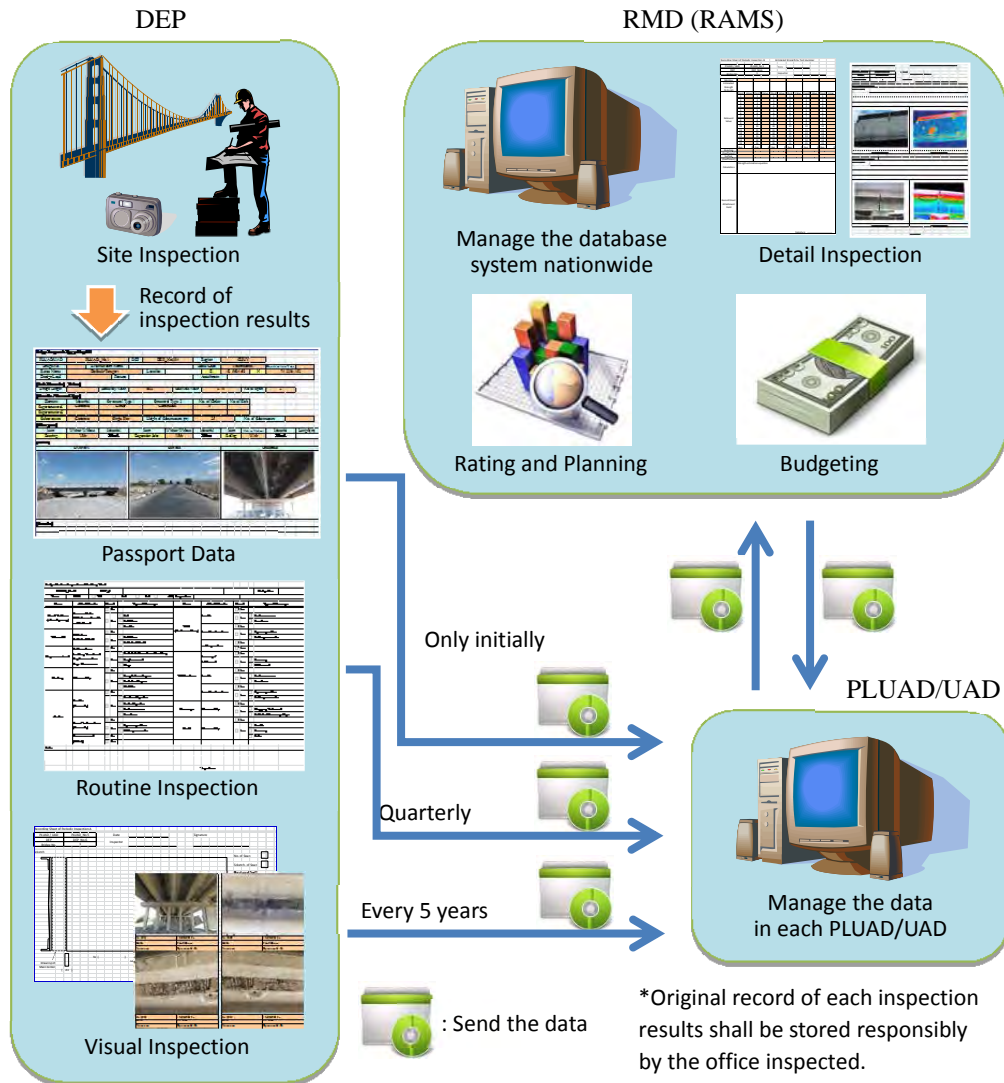


Source: JICA Expert Team

Figure 3-8 Framework of Tunnel Maintenance Management

3.6 Sections Responsible for Database Management (Collection, Input, Analysis of Data)

The roles of each organization regarding management of the database system are shown in Figure 3-9. DEP should be responsible for the collection of data and the implementation of routine and visual inspections. PLUAD/UAD should be responsible for the management of data sent from each DEP, and RMD (RAMS) should be responsible for management of the database system nationwide, detail inspection, rating, planning and budgeting.



Source: JICA Expert Team

Figure 3-9 Sections Responsible for Database Management

Chapter 4 Database Development

4.1 General

The purposes of the database development are to understand the condition of bridges and tunnels in Kyrgyz, and to make use of the information for maintenance and budget plan preparation. Outline of the database and approach to the database development are described in this chapter.

4.2 General Information on Road Inventory in Kyrgyz

The JICA Expert Team conducted road inventory survey in parallel with the basic data collection for bridges and tunnels. Road lengths and number of bridges managed by each DEP that were found by the survey are as indicated in Figure 4-1 and Figure 4-2.

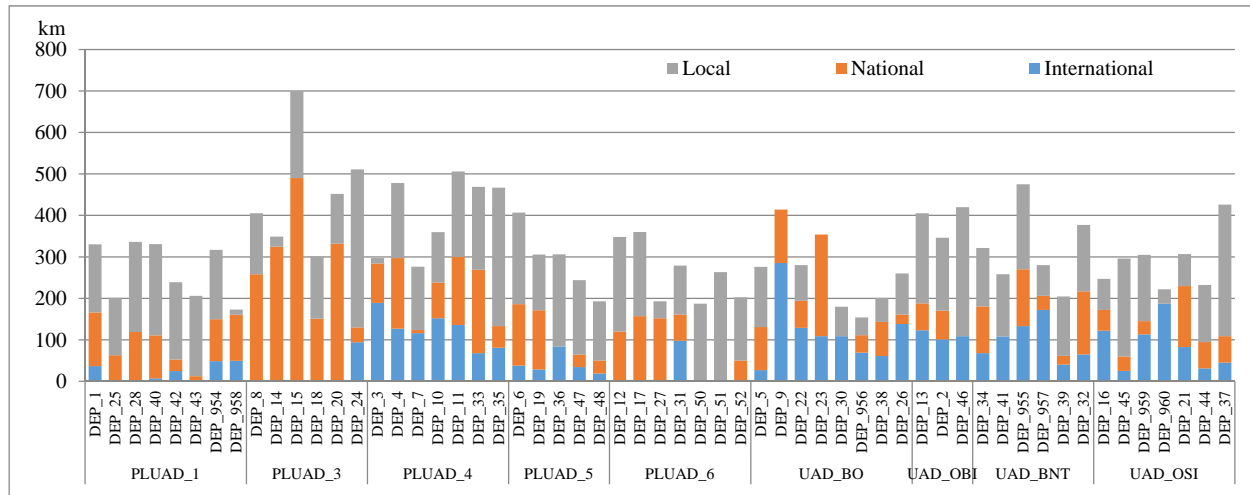


Figure 4-1 Road Lengths Managed in Each DEP

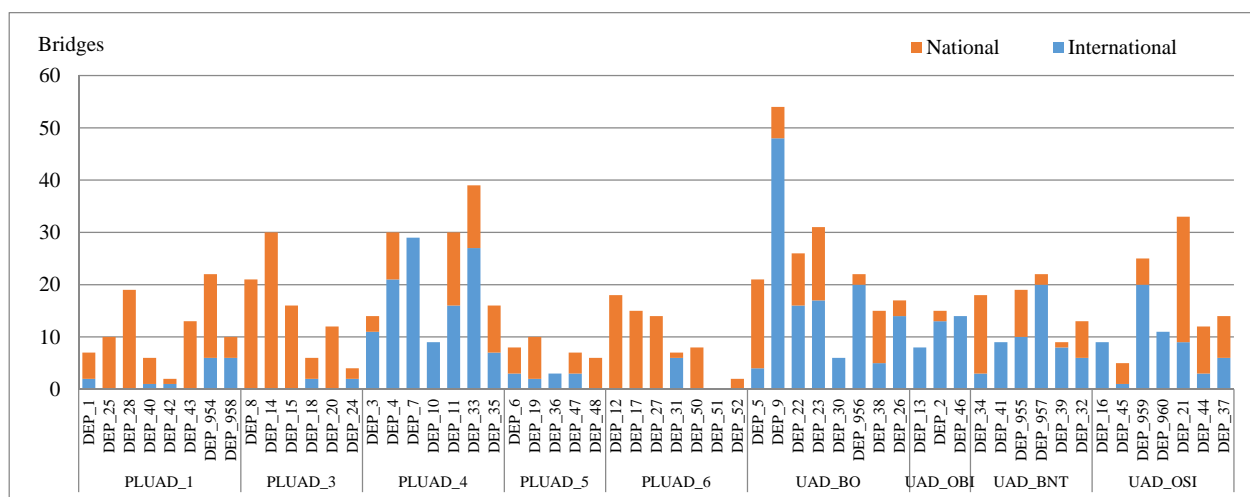


Figure 4-2 Number of Bridges Managed in Each DEP

The average road length managed by each DEP is almost 300km varied from 154 km to 700 km. With regard to the number of bridges managed by DEPs, DEP 51 has no bridge to manage, while conversely DEP 9 manages around 50 bridges on the international road. The number of bridges

currently managed by DEPs varies depending on the topographical condition of the area under the jurisdiction of a specific DEP.

4.3 Development of the Database System

There was no information available providing an overview of bridges in Kyrgyz before the Project. The recording format for inspection and bridge inventory was not integrated among each office. Consequently, it was not possible to verify the accuracy of data.

Moreover, no database on tunnels in Kyrgyz existed before the Project. The reason could have been the fact that there are only five (5) tunnels in Kyrgyz, and all are located on the Bishkek-Osh Road. The organization in charge of tunnel management is the UAD Bishkek-Osh (hereinafter, BO-UAD), and the information on tunnels was thus kept by the BO-UAD. No information on tunnel inspection was recorded, and only the person in charge of each tunnel possessed the data. As a result, such information was not recorded in the format that can be utilized extensively in maintenance and management activities.

In response to such a background, the JICA Expert Team and the local Counterparts discussed the issues as well as necessary improvements, and formulated the format for bridge passport and inspection recording form prior to the collection of basic data on bridges. Passport and inspection recording sheets for tunnels were also formulated through cooperation between the Counterparts and the JICA Expert Team.

The flow of database development is shown in Figure 4-3.

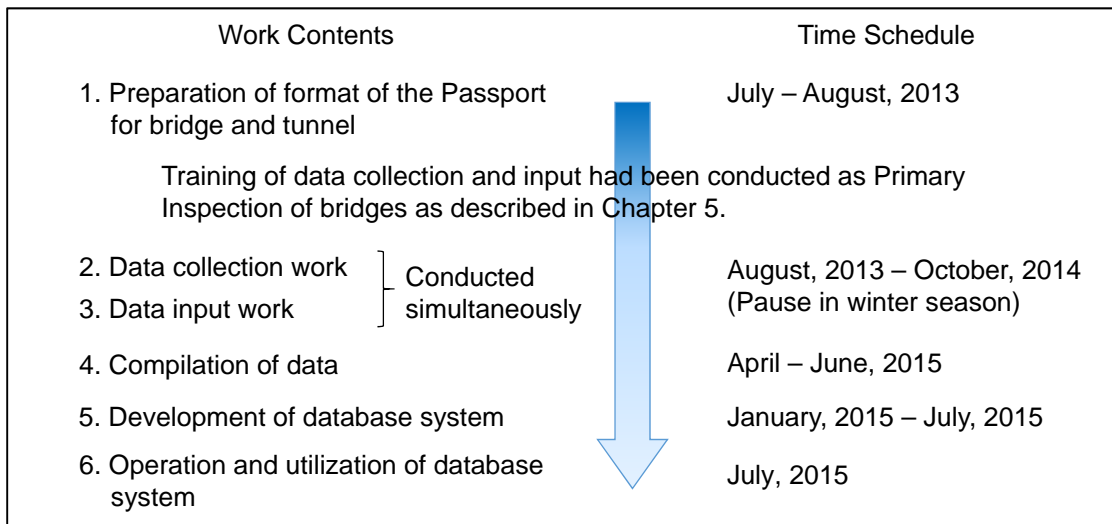


Figure 4-3 Time Schedule of Development of Database System

4.3.1 Preparation of Passport Format

At the beginning of the Project, JICA Expert Team requested every PLUAD/UAD to submit data on the management of bridges. All PLUAD/UADs responded to the request of the JICA Expert Team and submitted the data, but the data format between the PLUAD/UADs and the DEPs was not unified. Recorded items also varied. This issue was discussed between the local Counterpart in RMD and the

JICA Expert Team, and recording items and bridge passport format were settled. The final format developed by the RMD is shown in Figure 4-4.

Bridge Passport in Kyrgyz Republic										
PLUAD/UAD	UAD Bishkek, Osh		DEP	DEP_No.23						
Bridge No.	River/Stream Name		Road Class		International		Construction Year			
Route Name		Bishkek-Osh		Location		E	42° 5604.68	N	74° 2934.152	
Design Load		Feature		Attachment						
[Each Dimension]		[Unit: m]								
Bridge Length	Roadway width		6.00		Sidewalk width		0.75		No. of Span	2.00
[Materials / Structural Type]										
Element	Material	Structural Type 1		Structural Type 2		Structural Type 3		No. of Girder		
Superstructure1	Concrete	Girder		Continuous				5		
Superstructure2	Concrete	Girder		Continuous				5		
Superstructure3	Metal	Girder		Continuous				2		
Substructure	Concrete	Single Pier		Height of Substructure (m)		2.5		No. of Substructure		
[Other parts]										
Item	With or Without	Material	Item	With or Without	Material	Item	With or Without	Material	Length(m)	
Bearing	With	Metal	Expansion Joint	With	Ruber	Railing	With	Metal		
[Picture]										
Overview			Surface			Underside				

Figure 4-4 Bridge Passport Format

4.3.2 Data Collection and Input

After the development of passport format, training on data collection was initiated in July 2013. Details of the data collection training are described in “Chapter 5, Bridge Inspection”. After the training, MTs carried out basic bridge data collection in their respective PLUADs/UADs and input the collected data into computer (refer to Photo 4-1).



Photo 4-1 Data Input Work by MT

MTs and staff from each DEP cooperated and carried out data collection for bridges in Kyrgyz. Total of 871 bridges on international and national roads confirmed as a result of data collection are shown in Table 4-1.

Table 4-1 Bridge Data Collection Status

PLUAD/UAD	International/ National	Number of Bridges	Collection Rate
PLUAD No.1	International	16	100%
	National	73	100%
PLUAD No.3	International	4	100%
	National	85	100%
PLUAD No.4	International	120	100%
	National	47	100%
PLUAD No.5	International	11	100%
	National	23	100%
PLUAD No.6	International	6	100%
	National	58	100%
BO UAD	International	130	100%
	National	62	100%
BNT UAD	International	56	100%
	National	34	100%
OSI UAD	International	59	100%
	National	50	100%
OBI UAD	International	35	100%
	National	2	100%
Total	International	437	100%
	National	434	100%
	Total	871	100%

The staff members including MTs are indicated in Table 4-2 attended the training for Planned Inspection A (data collection and input) conducted by the JICA Expert Team. Data collection was mainly carried out by these MTs in the area of PLUAD/UAD where they belong.

Their skills in data collection and input had achieved the level certified by the Japanese Experts since bridge basic data (passport data) collection was 100% completed.

Table 4-2 Staff members and Progress of Data Collection and Input Work

PLUAD/ UAD	Name of MT (Position)	Training for Inspection A (Data Collection and Input)	Progress of Data Collection and Input
RMD	Eraliev Nurlan (RMD PPAW, Leading Specialist)	○	in charge of managing
	Jeldenov Akim (Road Safety Specialist)	○	
PLUAD #1	Amanov Kushtarbek (PLUAD #1, Leading Specialist)	○	100%
	Abyshev Tursunbek (PLUAD #1, Chief Specialist)	○	
	Ashyrbaev Bakai, (DEP-43, Chief Specialist)	○	
	Seitkaziev Bakyt (DEP-954, Leading Specialist)	○	
	Omuke uulu Urmat (DEP-958, Leading Specialist)	○	
PLUAD #3	Nurbaev Farhat (DEP-8, Master)	○	100%
	Suranbaev Munarbek (DEP-18, Leading Specialist)	○	
	Razakulov Maksatbek (DEP-15, Leading specialist)	○	
	Kulanbaev Askat (DEP-20, Chief Specialist)	○	
PLUAD #4	Musalimov Bakyt (DEP-7, Chief Engineer)	○	100%
	Omukeev Azamat (DEP-4, Chief Engineer)	○	
	Kuchukov Joomart, (DEP-11, Chief engineer)	○	
	Samakov Taalaibek (DEP-35, Chief Engineer)	○	
PLUAD #5	Sadruliev Nurkan (PLUAD#5, Leading Specialist)	○	100%
	Musuraliev Sabyr (DEP-36, Head)	○	
	Imanaliev Mirlan (DEP-6, Chief Engineer)	○	
PLUAD #6	Subanaliev Talantbek (DEP-27, Chief Specialist)	○	100%
	Janseitov Almaz (DEP-52, Chief Engineer)	○	
	Urazov Kubanych (DEP-51, Chief Engineer)	○	
	Azimbaev Adyl (DEP-12, Chief Engineer)	○	
	Atabaev Ilham (DEP-17, Road worker)	○	
	Chargynov Mamatkazy (DEP-31, Master)	○	
	Joldoshev Shadybek (DEP-50, Chief Engineer)	○	
BO UAD	Dubashev Nur, BO UAD (Leading Specialist)	○	100%
OBI UAD	Akmatov Ikramali (OBI UAD, Chief Engineer)	○	100%
	Anarbaev Erkin (DEP-46, Chief Engineer)	○	
	Shaibekov Mustafa (DEP-13, Chief Engineer)	○	
BNT UAD	Aralbaev Zamir (DEP-957, Chief Engineer)	○	100%
	Askarbek Uulu Kurmanbek (DEP-955, Chief Engineer)	○	
	Imanalieva Anara (DEP-34, Head of Technical Section)	○	
OSI UAD	Ismanov Kahraman, (DEP-44, Chief Engineer)	○	100%
	Turdubaev Alimbek, (DEP-21, Chief Engineer)	○	
	Junusov Toktogul (OSI UAD, Foreman)	○	
	Temirov Turdubek (Chief Engineer)	○	
	Joroev Janybek (Chief Engineer)	○	
	Dyikanbaev Maamat (DEP-960, Chief engineer)	○	
	Usenov Rajap (DEP-45, Chief Engineer)	○	
	Maksutov Sulaiman (DEP-959, Chief Engineer)	○	

4.4 Operation and Utilization of the Database

MTs of RMD compiled the data collected from the PLUAD/UADs, and developed the database for bridges in Kyrgyz. Therefore, the current status of bridges in Kyrgyz has been verified by using the

newly developed database. Bridge types in Kyrgyz, number of bridges by length and bridge soundness status in each PLUAD/UAD are shown in Figures 4-5, 4-6 and 4-7.

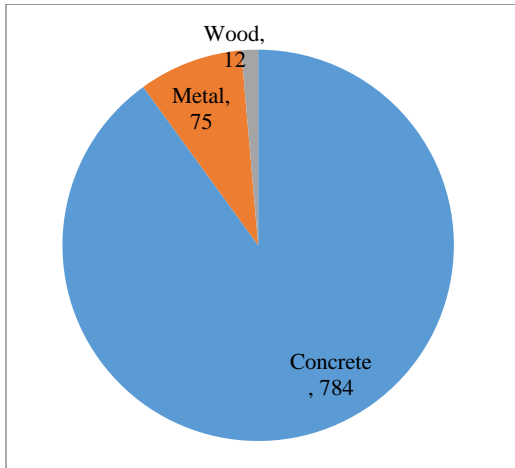


Figure 4-5 Bridge Types in Kyrgyz

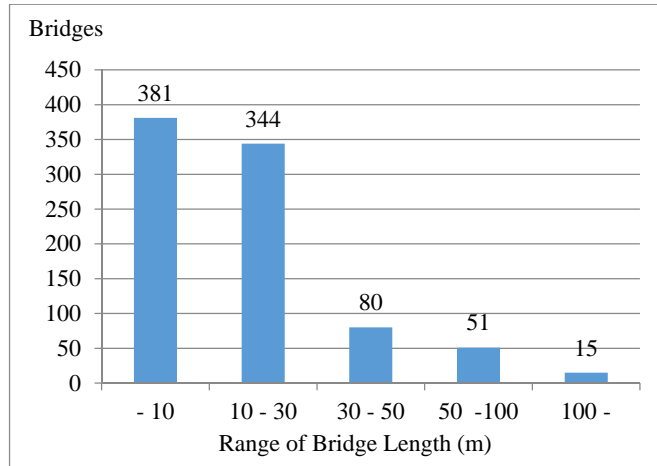


Figure 4-6 Number of Bridges by Length

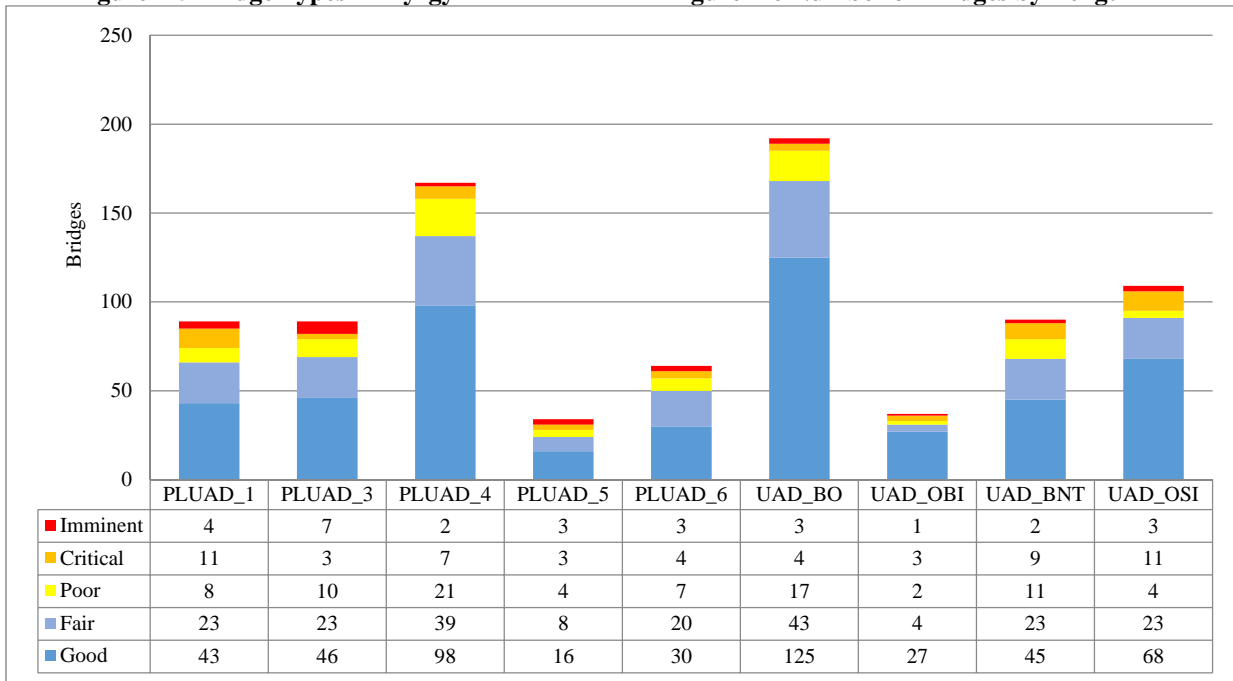


Figure 4-7 Bridge Soundness Status in Each PLUAD/UAD

As shown above, a majority of the bridges in Kyrgyz are mainly constructed of concrete. Most of the span length is less than 30m. The JICA Expert Team has evaluated structural soundness in five (5) classifications (Good, Fair, Poor, Critical, Imminent) based on the basic bridge data. Although most of the bridges have no structural problem, about 10 to 20% of the bridges nationwide may require urgent measures.

4.5 Outline of the Database System

Top page of the Database system for the Host PC version is shown in Figure 4-8.



Figure 4-8 Top page of database system (Host PC version)

Function of the database system is shown below.

- To browse bridge passport data.
- To browse tunnel passport data.
- To record bridge inspection data.
- To manage bridge passport data and inspection result.
- To carry out bridge inspection (only iPad version).

Moreover, there are two types of database system, “Host PC version” and “iPad version”. By creating the iPad version, it has become to be portable of basic information (passport data) to the site, and carry out bridge inspection using iPad. And it is possible to carry out bridge inspection using the iPad. The inspection result data which is recorded by inspection using iPad can be taken in the database system with click the button of “Import Data” (refer to Figure 4-8).

Outline of the database system developed in cooperation with the JICA Expert and the Master Trainers from RMD is given in Figures 4-9 and 4-10.

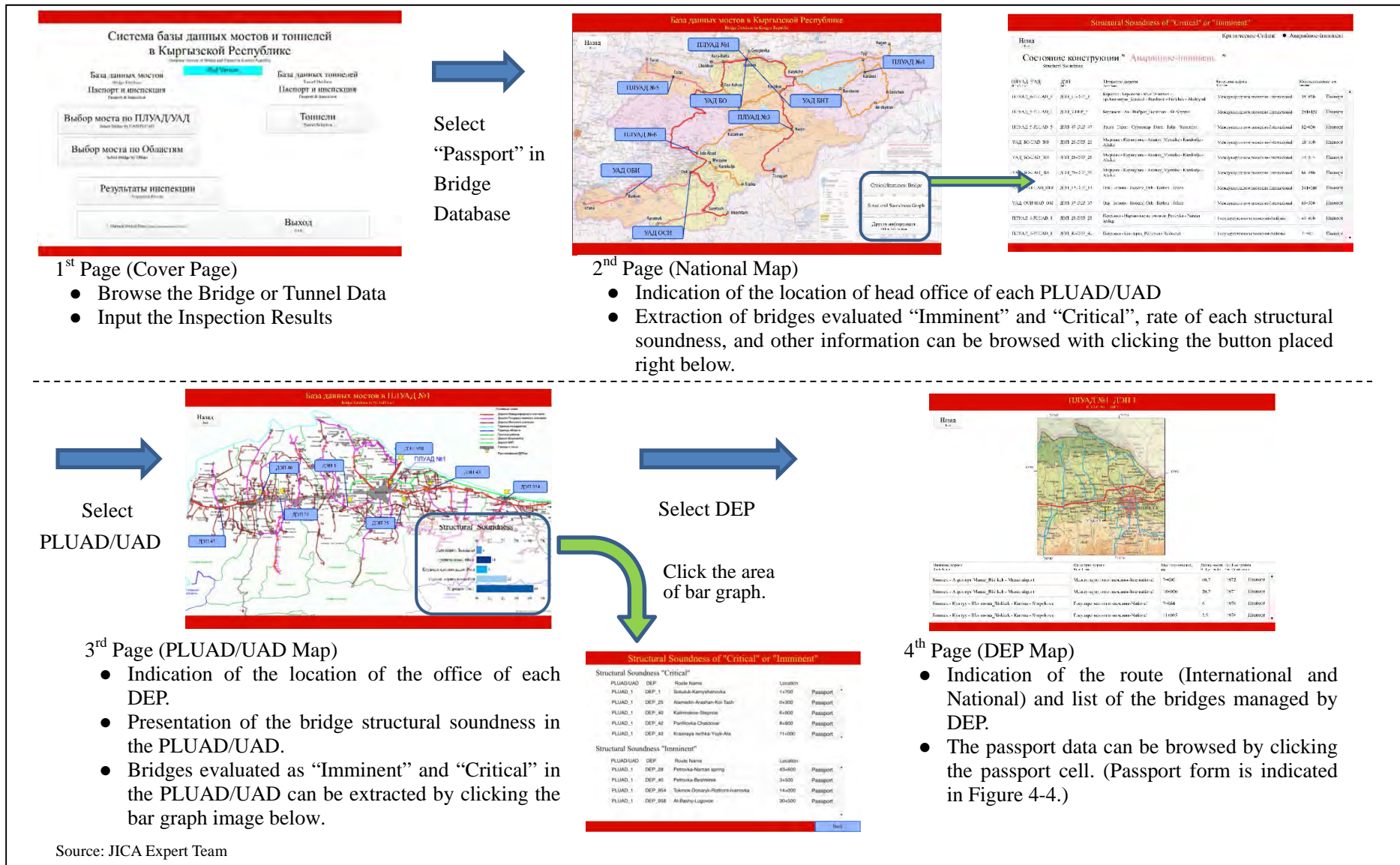


Figure 4-9 Outline of Database System for Bridges

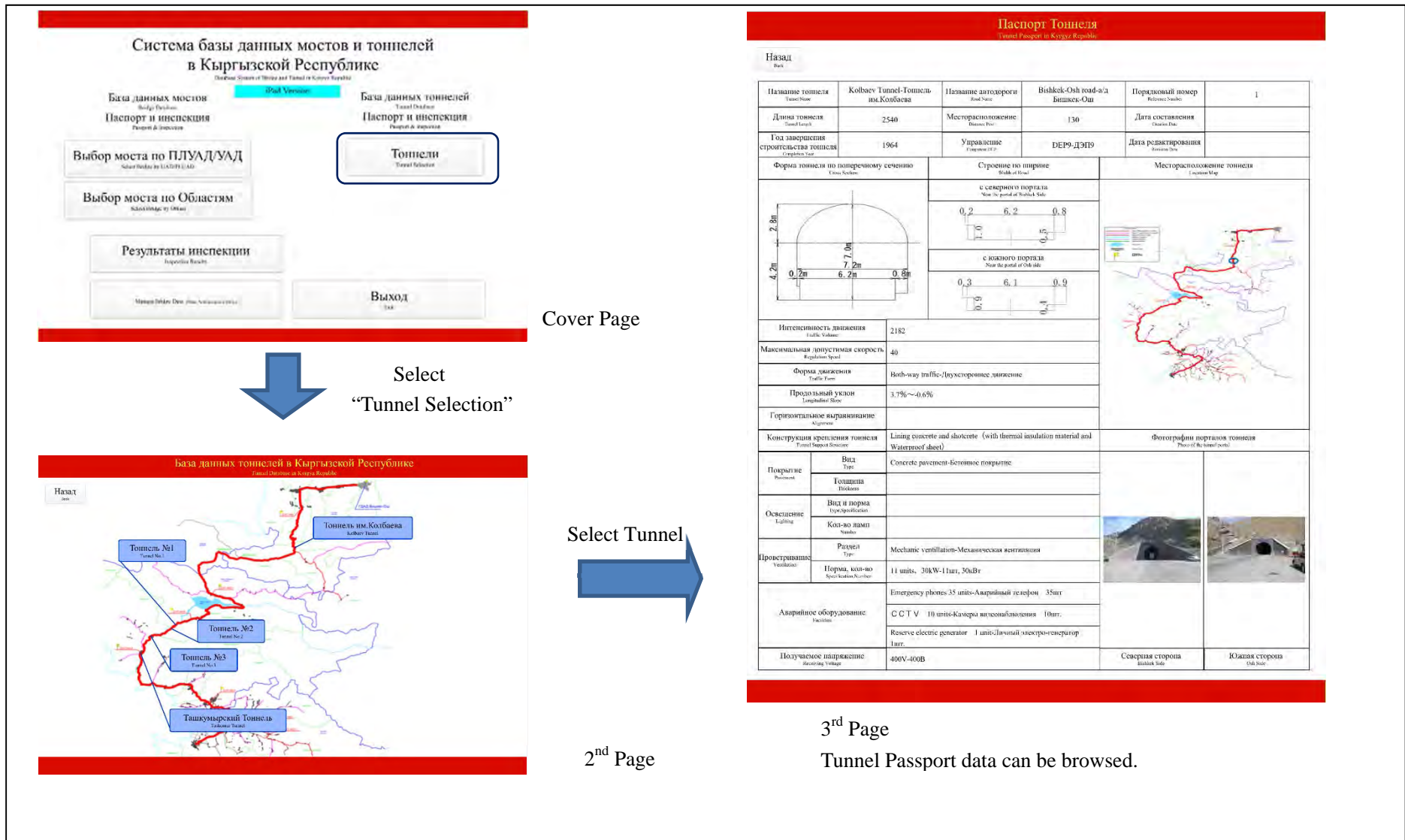


Figure 4-10 Outline of Database System for Tunnels

4.6 Data Input Manual Preparation

MTs prepared the passport data of bridges, on which the collection of basic data had been completed, and formulated the manual for data input into the Database System. MTs summarized the input method to the passport data, and formulated the data input manual. Updating the information in the database is required for RAMS from now on. Therefore, RAMS should operate the Database System with reference to the Manual for the Input and Operation of the Database System for Bridges and Tunnels.

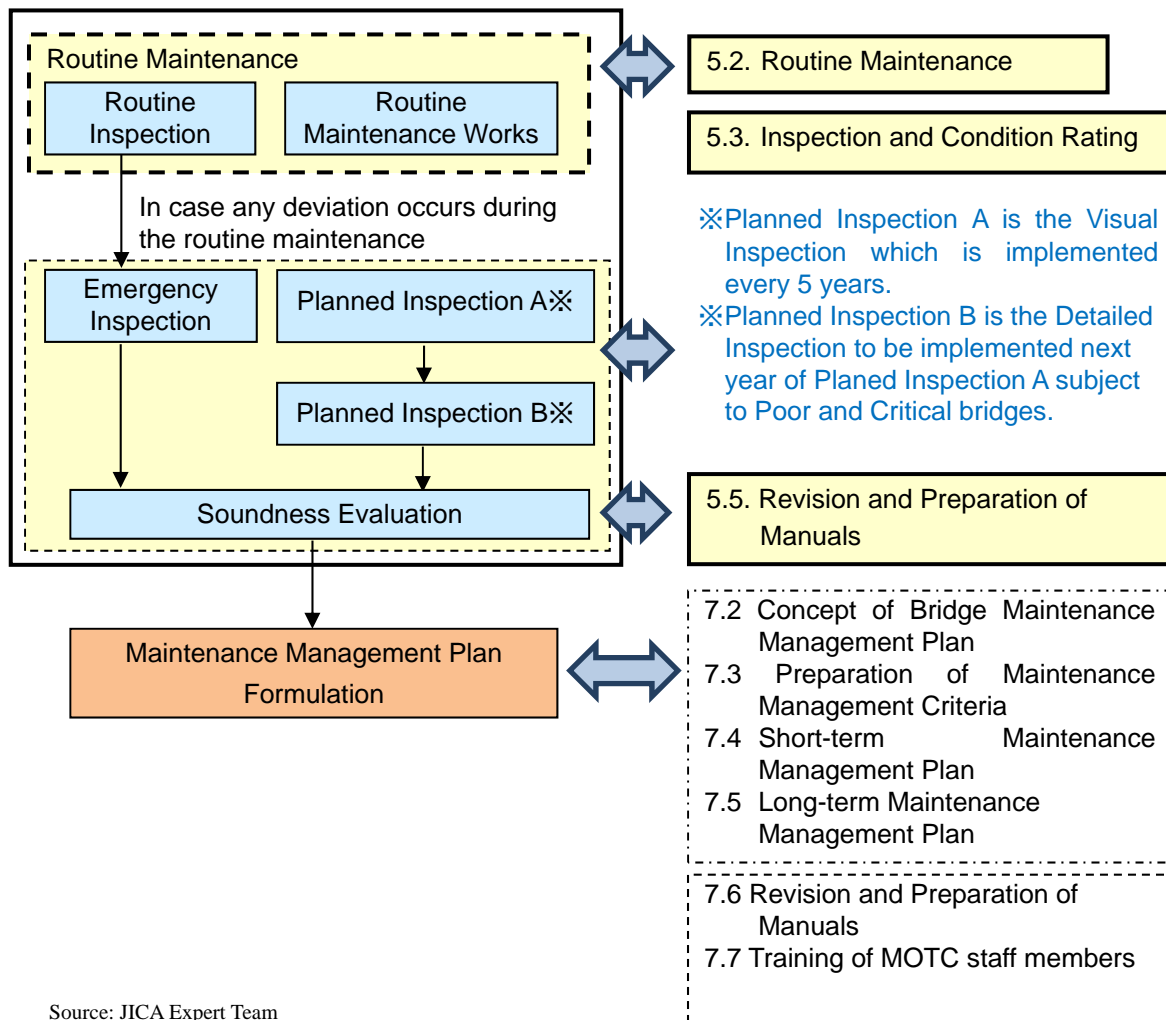
4.7 Database Operation

The JICA Expert Team discussed the Database System with the Counterpart, and formulated the format of passport data, recording inspection sheet, etc. In as much as the Database System has to be operated by the RAMS in MOTC, the RAMS staff members must have a flawless understanding of the system's operation. It is necessary for the Counterpart to designate a person to be in charge of the database operation. Therefore, a RAMS staff was appointed as a person in charge of the database operation.

Chapter 5 Bridge Maintenance Inspection and Condition Rating

5.1 General

Chapter 5, Bridge Maintenance Inspection and Condition Rating, presents the training for Master Trainer/s (MT) and MOTC core staff on Routine Maintenance, Inspection and Condition Rating conducted by the JICA Expert Team. The trained MTs carried out the training of other MOTC staff members nationwide, and through these activities the “Manual for Routine Maintenance” and the “Manual for Inspection and Condition Rating” were developed. An outline of Bridge Maintenance Management is shown in Figure 5-1 below.



Source: JICA Expert Team

Figure 5-1 Bridge Maintenance Management Outline

5.2 Routine Maintenance

5.2.1 General

Routine bridge maintenance shall be performed as part of the overall routine road maintenance operations divided into two categories: (i) Routine Inspection, and (ii) Routine Maintenance Work. The “Routine Inspection” is for the early discovery of defects and damages of road surface, slope, facilities, bridge/culvert, and other road structures, in order to conduct efficient “Routine Maintenance Work”. The purpose of “Routine Maintenance Work” is to conduct routine road maintenance (cleaning, etc.) and functional maintenance (repair, disaster recovery, snow and ice measures, etc.) in order to ensure road safety.

Manual for Routine Road Maintenance was prepared by the JICA Expert Team. Routine road maintenance has been configured and classified in the Manual as shown in Figure 5-2. Preparation of the Routine Road Maintenance Manual was carried out in accordance with the workflow shown in Figure 5-3 with consideration of the following five (5) aspects:

- Understanding of the current situation of routine maintenance including relevant manuals/regulations
- Identification of the issues concerning current routine maintenance
- Required activities for the “Routine Inspection” and “Routine Maintenance Work”
- Proposed organizational structure for routine maintenance work
- Recommendations

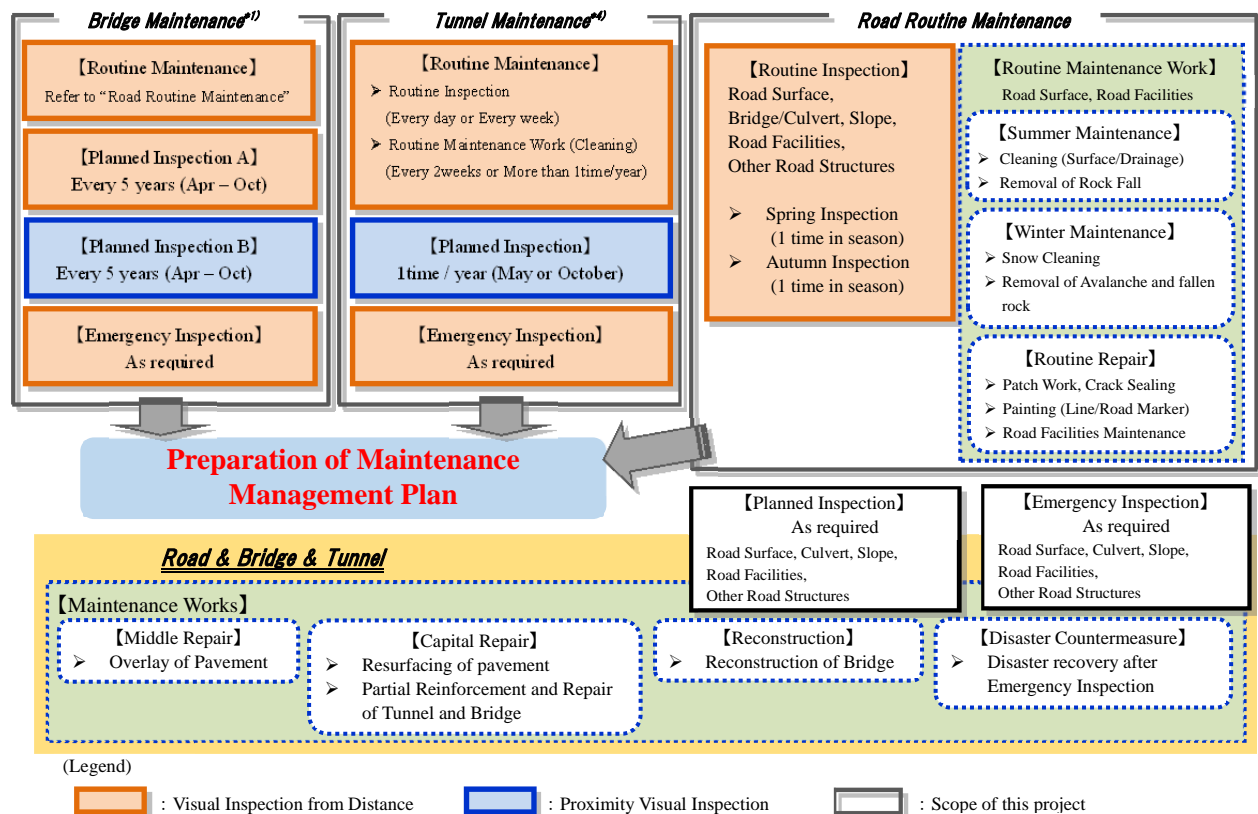


Figure 5-2 Framework of Routine Maintenance

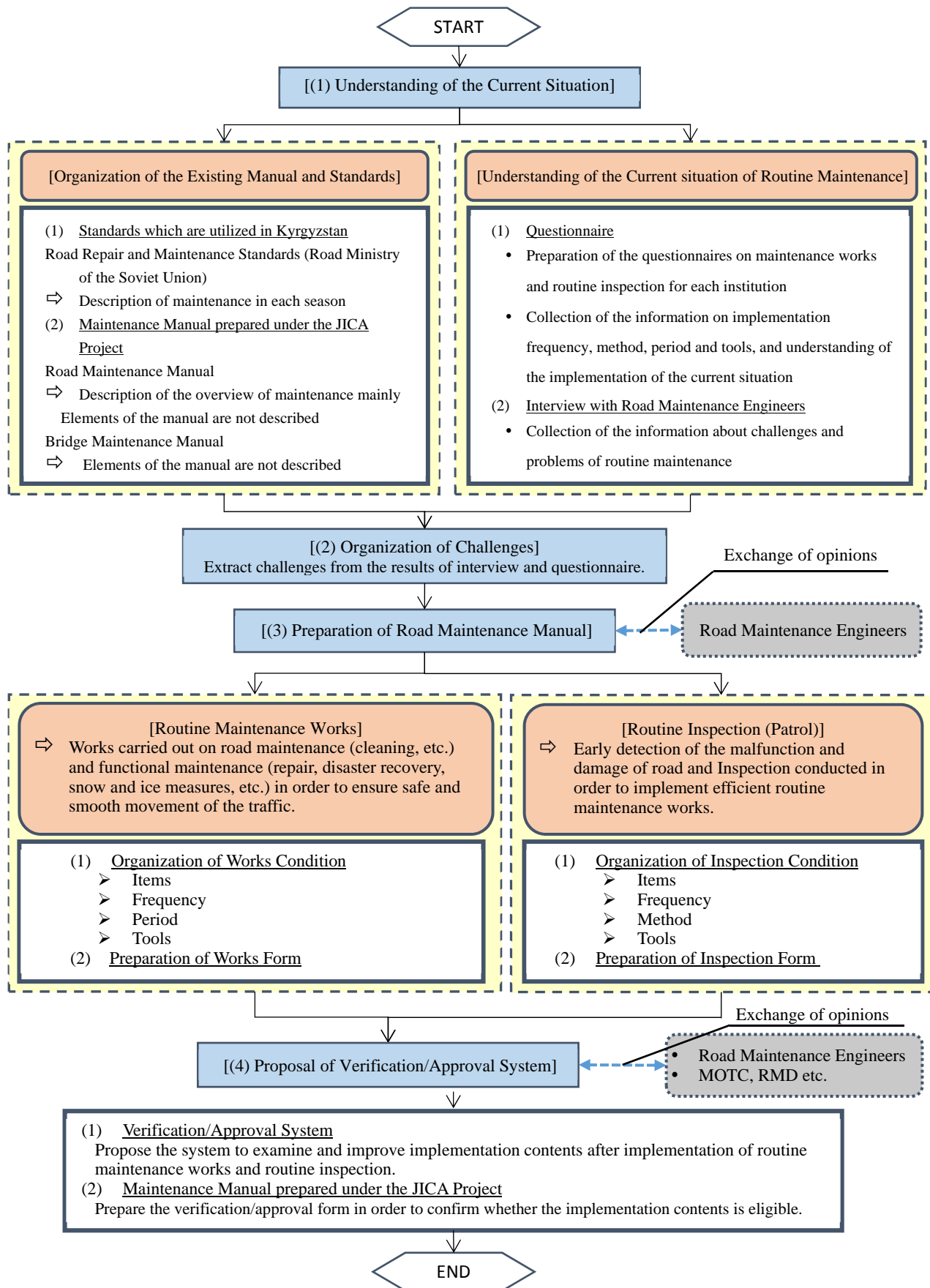


Figure 5-3 Workflow of the Preparation of Routine Maintenance Manual

5.2.2 Understanding of Current Situation of Routine Maintenance

(1) Routine Inspection

The current implementation status of routine inspection in Kyrgyz is shown in Table 5-1 below. “Spring Inspection” and “Autumn Inspection” have been conducted as routine road inspection in Kyrgyz, and no specific inspection was conducted in summer and winter seasons. “Spring Inspection” is conducted to confirm the condition of road surface and facilities by visual inspection from the distance. “Autumn Inspection” is conducted to confirm the result of maintenance work implemented during the year.

In addition, tunnel routine inspection (Table 5-1) is also conducted to confirm cracks and water leakage of tunnel inner surface/portals and the defects of road surface based on the "Manual for Tunnel Maintenance" prepared in this project.

Table 5-1 Current Status of Routine Inspection in Kyrgyz

Items	Period	Contents
Spring Inspection	March - May	Spring inspection is conducted by PLUAD/UAD and DEP to confirm the condition of road defects in/after the winter season.
Autumn Inspection	September – November	Autumn inspection is conducted by PLUAD and DEP to confirm the result of maintenance work implemented during the year.
Tunnel Routine Inspection	Every day or Every Week	Tunnel routine inspection is conducted to confirm cracks and water leakage of tunnel inner surface/portals and the defects of road surface based on the “Manual for Tunnel Maintenance” prepared in this project.

Source: JICA Expert Team

(2) Routine Maintenance Work

The current implementation status of routine maintenance work in Kyrgyz is shown in the table below. According to the interview with BO-UAD, routine maintenance work (Patch Work, Painting, Chip Sealing) is being conducted based on the results of spring inspection in the spring to autumn season. In addition, preparation for the winter season (purchase of sand/salt and preparation of snow removal equipment) is made in the autumn season.

Table 5-2 Bishkek-Osh Road Routine Maintenance

Items	Spring (Mar - May)	Summer (Jun - Aug)	Autumn (Sep - Nov)	Winter (Dec - Feb)	Remarks
Summer and Winter Maintenance (Road Surface, Roadside)	✓	✓	✓	✓	As required
Patch Work	✓	✓			
Painting (Fence, Border Stones)	✓	✓			
Chip Sealing		✓	✓		
Snow Removal				✓	As required
Salt/Sand Pouring				✓	As required

Note: Prepared by the JICA Expert Team based on the interview with BO-UAD.

5.2.3 Identification of Issues Concerning Current Routine Maintenance

Bridge and road maintenance manuals utilized in Kyrgyz are shown in Table 5-3 below. As shown in the table, there are several maintenance manuals in Kyrgyz. However, utilization of these documents in each DEP is not consistent at present, resulting in the different execution of routine inspection and routine maintenance work (Maintenance items, Frequency, Method) among the DEPs.

A questionnaire survey was implemented for the purpose of understanding the implementation status of routine maintenance. Questionnaire on routine maintenance of roads and bridges is given in Figure 5-4 (Routine Inspection for routine patrol) and Figure 5-5 (Routine Maintenance Works for road cleaning, painting, snow removal, etc.).

Table 5-3 Maintenance Manuals Utilized in Kyrgyz

Documents	Issued by	Contents
Technical Rules for Motor Road Repairing Maintenance	Soviet Union, Ministry of Road	Technical standards for the maintenance and repair of the road structure are described.
Technical book on repair of reinforced concrete bridges for operation service of motor roads	Soviet Union, Ministry of Road	Technical standards for widening of small bridges and reinforcement/repair of bridges are described.

Source: JICA Expert Team

Implementation Status Survey Questionnaires of Routine Maintenance of Roads and Bridges

Institution		Position	
Name		Date	

1. Routine Inspection (Routine Patrol)

- Please fill out the check mark(☑) and required contents in the appropriate place.
 (Fill out the appropriate parts in the yellow part.)

1).Frequency of Inspection					
Season	<input checked="" type="checkbox"/>	Period(Ex. Apr-Jun)	Frequency(Ex. 2times/1week)		
(1)Spring					
(2)Summer					
(3)Autumn					
(4)Winter					
2).Inspection Method					
Visual inspection by car					
Visual inspection by walking					
Other					
If you choose "Other", please fill out the inspection method following.					
.					
.					
.					
3).Inspection Items					
Road Surface	Pavement		Slope	Cut or Fill	
	Asphalt Curb			Retaining Wall	
	Drainage			Drainage	
Safety Facility	Guard Fence		Bridge	Bridge Railing	
	Road Surface Marker			Expansion Joint	
	Road Sign			Drainage	
If there is an item other than the above, please fill out below.					
.					
.					
.					
4). Presence or Absence of Routine Maintenance Form.					
Yes			No		
5).Inspection Tools					
Please fill out the items which use routine inspection in following.					
.					
.					
.					
.					
6).Challenges and Problems of present routine Inspection					
Please fill out challenges and problems of present routine inspection in following.					
.					
.					
.					
.					

Figure 5-4 Questionnaire on Routine Maintenance of Roads and Bridges (1)

Implementation Status Survey Questionnaires of Routine Maintenance of Roads and Bridges

2. Routine Maintenance Works (Road Cleaning, Painting, Snow Removal etc.)

For items which are implemented, please fill out the frequency, period, and tools of each season. (Fill out the appropriate parts in the yellow part.)

If there is an item corresponding to other than (1)-(9), please fill out the details in "(10) Other".

1).Implementation Status of Routine Maintenance Works						
Items	Period /Frequency	Spring	Summer	Autumn	Winter	Tools
(1)Cleaning works (Road surface, Roadside etc.)	Period (Ex. Apr-Jun)					
	Frequency (Ex. 2times/1week)					
(2)Patch works	Period					
	Frequency					
(3)Whitewashing	Period					
	Frequency					
(4)Painting (fence, border stones)	Period					
	Frequency					
(5)Asphalt paving, Chip sealing	Period					
	Frequency					
(6)Removal of foreign objects and rockfall	Period	Unregulated				
	Frequency	Unregulated				
(7)Preparation for winter season (Salt, Sand, Chips purchase)	Period					
	Frequency					
(8)Snow removal	Period					
	Frequency	Unregulated				
(9)Salt/Sand pouring	Period					
	Frequency	Unregulated				
(10)Other	Period					
	Frequency					
	Period					
	Frequency					
2).Challenges and Problems of present routine Inspection						
Please fill out challenges and problems of present routine maintenance works in following.						
.						
.						
.						
.						

Figure 5-5 Questionnaire on Routine Maintenance of Roads and Bridges (2)

5.2.4 Required Activities of Routine Inspection

(1) Inspection Items

The inspection items are shown in Table 5-4.

Table 5-4 Inspection Items

Road Surface	Pavement	<ul style="list-style-type: none"> • Crack • Rutting • Pothole • Patching
	Drainage	<ul style="list-style-type: none"> • Damage • Deposition of Dust/Soil
Slope	Natural Slope	<ul style="list-style-type: none"> • Avalanche • Rock Slope Collapse
	Cut / Fill	<ul style="list-style-type: none"> • Crack • Erosion
	Retaining Wall	<ul style="list-style-type: none"> • Crack • Collapse
Road Facilities	Guard Fence	<ul style="list-style-type: none"> • Damage
	Road Surface Marker	<ul style="list-style-type: none"> • Visibility inspection (Paint)
	Road Sign	<ul style="list-style-type: none"> • Damage • Visibility inspection
	Road Lighting	<ul style="list-style-type: none"> • Damage • Visibility inspection (Light)
	Road Signal	<ul style="list-style-type: none"> • Damage • Visibility inspection (Light)
Bridge/Culvert	Bridge Railing	<ul style="list-style-type: none"> • Damage
	Joint Part	<ul style="list-style-type: none"> • Stepped Portion
	Drainage	<ul style="list-style-type: none"> • Damage • Deposition of Dust/Soil
Tunnel *1	Facing Surface	<ul style="list-style-type: none"> • Spalling of Concrete • Water Leakage • Icicles
	Portals	<ul style="list-style-type: none"> • Spalling of Concrete • Water Leakage • Icicles
	Road Surface	<ul style="list-style-type: none"> • Fallen Debris • Water Stagnation/Black Ice • Road Surface Damage

*1: For details of tunnel inspection, refer to the "Manual for Tunnel Maintenance".

Source: JICA Expert Team

(2) Inspection Frequency

The frequency of inspection is shown in Table 5-5.

Table 5-5 Frequency of Inspection

Type	Frequency
Spring Inspection	1 time per season (Apr – May)
Autumn Inspection	1 time per season (Sep – Oct)

(3) Evaluation Criteria

Routine inspection is conducted based on the evaluation criteria and category given below.

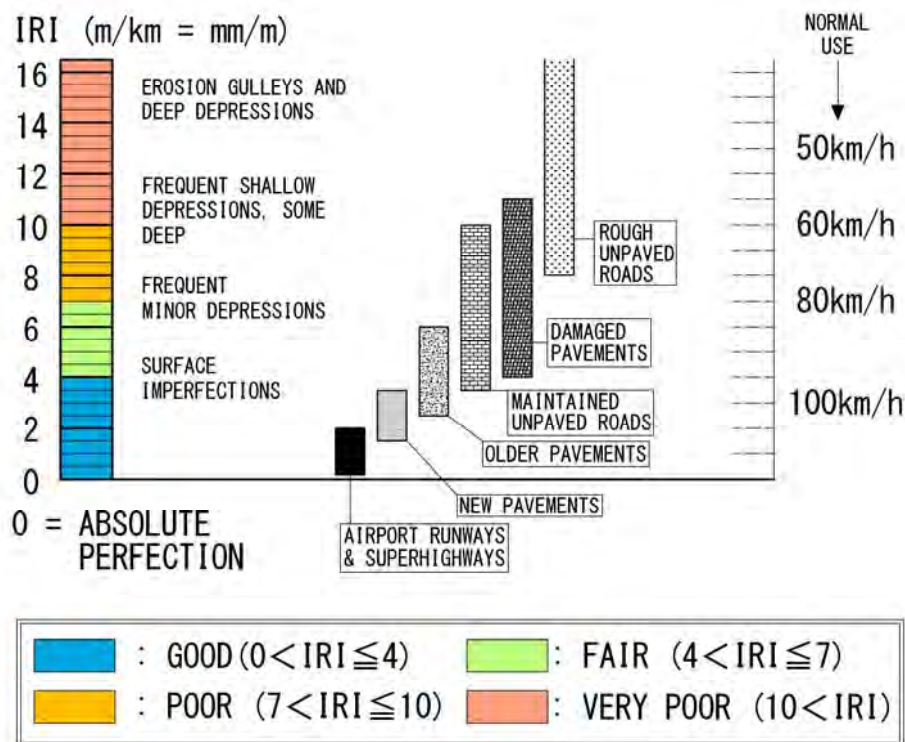
1) Road Surface

I. Evaluation Criteria and Category

Evaluation criteria and category of road surface and drainage are shown below. Road Surface category: if the condition of road surface corresponding to "Poor" or "Very Poor" continues for more than 100m, the check sheet is filled out. Relationship between road surface evaluation and IRI is indicated in Figure 5-6. Drainage ditches: if the drainage ditch which corresponds to "Defect" is confirmed in the routine inspection, the check sheet is filled out. Evaluation Criteria for Drainage ditch is provided in Table 5-7.

Table 5-6 Pavement Condition Rating



Category	Pavement Condition	IRI
Good	No pavement distress (Cracking, Rutting, Potholes, Patching) is confirmed, and road can be driven comfortably and smoothly. (New pavement road and resurfaced road)	$0 < \text{IRI} \leq 3$
Fair	Pavement distress (Cracking, Rutting) is confirmed to be less than 50% of pavement area, and it is possible to drive without reducing driving speed. Multiple fine cracks (Longitudinal crack, Transverse crack, Alligator crack) are confirmed. Rutting is confirmed to be slight by visual inspection. Potholes are partially confirmed.	$3 < \text{IRI} \leq 7$
Poor	Pavement distress (Cracking, Rutting, Potholes) is confirmed to be about 50% to 70% of pavement area causing reduced driving speed. Multiple clear cracks (Longitudinal cracking, Transverse cracking, Alligator cracking) are confirmed. Potholes are visually confirmed. Multiple potholes of depths passable by traffic are confirmed.	$7 < \text{IRI} \leq 10$
Very Poor	Pavement distress (Cracking, Rutting, Potholes) is confirmed to be over 70% of pavement area, and reduced driving speed is necessary or driving is impeded. Clear cracks (Longitudinal cracks, Transverse cracks, and Alligator cracks) are confirmed in a wide range. Rutting is confirmed clearly by visual inspection, and cracks by rutting occurred at pavement. Deep potholes are confirmed in a wide range, and vehicle passage is extremely hampered.	$10 < \text{IRI}$



Reference: Guidelines for Conducting and Calibrating Road Roughness Measurements, World Bank

Figure 5-6 Relationship between Road Surface Evaluation and IRI

Table 5-7 Evaluation Criteria for Drainage Ditch

Category	Drainage Ditch Conditions	
Defect	Drainage function is significantly impaired by the deposition of dust/soil, and damage.	
Soundness	There is no problem with the drainage function.	

II. Distress of Pavement

Typical distress of pavement and degree of distress are described below. These are indications of pavement condition of each instance, and it is necessary that the pavement evaluation is conducted while considering multiple distress condition and range.

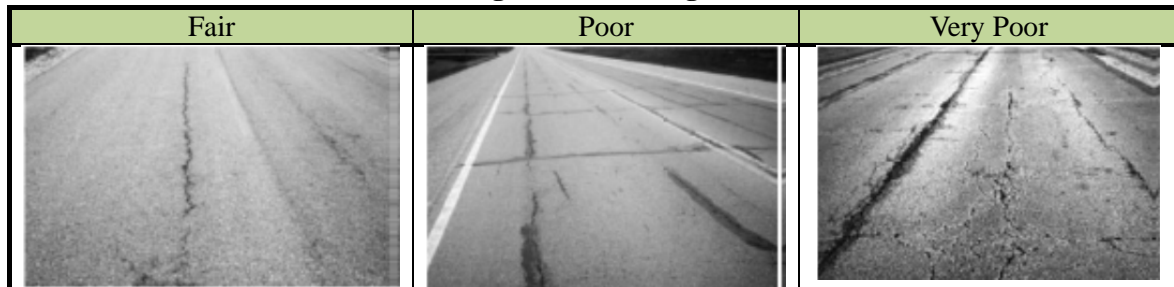
(a) Cracks

■ Longitudinal Crack

Cracks running in the direction of traffic are longitudinal cracks. Centerline or lane cracks are caused

by inadequate bonding during construction or reflect cracks in underlying pavement. Longitudinal cracks in the wheel path indicate fatigue failure from heavy vehicle loads. Cracks are caused by insufficient shoulder support, poor drainage, or frost action. Cracks usually start as hairline or very narrow and widen and erode with age. Without crack filling, they can ravel, develop multiple cracks, and become wide enough to require patching.

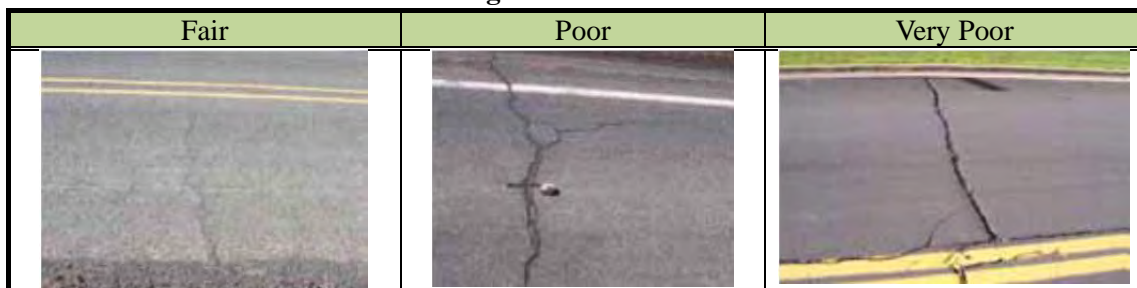
Table 5-8 Damage Level of Longitudinal Cracks



■ Transverse Crack

A crack at an approximate right angle to the centerline is a transverse crack. Transverse cracks are often regularly spaced. The cause is movement due to temperature changes and hardening of the asphalt with aging. Transverse cracks will initially be widely spaced. Additional cracking will occur with aging until they are closely spaced (within several feet). These usually begin as hairline or very narrow cracks; they widen with aging. If not properly sealed and maintained, secondary or multiple cracks develop parallel to the initial crack. The crack edges can further deteriorate by raveling and eroding the adjacent pavement.

Table 5-9 Damage Level of Transverse Cracks



■ Block Crack

Block cracks are interconnected cracks forming large blocks. Cracks usually intersect at nearly right angles. Blocks may range from 30cm to approximately 3m or more across. The closer spacing indicates more advanced aging caused by shrinking and hardening of the asphalt over time.

Table 5-10 Damage Level of Block Cracks



■ Alligator Crack

Interconnected cracks forming small pieces ranging in size from about 2.5cm to 15cm are alligator cracks. They are caused by failure of the surface due to traffic load (fatigue) and very often also due to inadequate base or subgrade support.

Table 5-11 Damage Level of Alligator Cracks



(b) Rutting

Rutting is displacement of material, creating channels in wheel paths. It is caused by traffic compaction or displacement of unstable material. Severe rutting may be caused by base or subgrade consolidation.

Table 5-12 Damage Level of Rutting



(c) Pothole

Holes and loss of pavement material caused by traffic loading, fatigue and inadequate strength are potholes. They are often combined with poor drainage.

Table 5-13 Pothole Damage Levels

Fair	Poor	Very Poor
		

(d) Patching

Patching occurs at original surfaces repaired with new asphalt patch material. This indicates a pavement defect or utility excavation which has been repaired. Patches with cracking or distortions indicate underlying causes still remain.

Table 5-14 Damage Level of Patching

Fair	Poor	Very Poor
		


2) Slope



Evaluation criteria and category of slope are filled out in Tables 5-15 and 5-16. If slope corresponding to “Disturbance” is confirmed in the routine inspection, the check sheet is filled out.

Table 5-15 Evaluation Criteria for Slopes

Category	Slope Condition
Disturbance	Corresponds to criteria for "Disturbance" (In case of extending the disturbance to a third party)
Soundness	Slope condition is sound or minor damage which does not correspond with "Disturbance".

Table 5-16 Evaluation Category of Slopes

Type	Slope Condition (In case of extending the disturbance to a third party)	
Natural Slope	Locations where there is possibility of rock slope collapse and slope failure, or avalanche; Locations where the avalanche and rock slides have occurred.	

Type	Slope Condition (In case of extending the disturbance to a third party)	
Fill/Cut Slope	Large cracks or erosion is confirmed by visual inspection, and there is possibility of slope failure.	
Retaining Wall	The retaining wall is damaged, and there is a danger of retaining wall collapse.	



3) Road Facilities



Evaluation criteria and category of road facilities are filled out in Tables 5-17 and 5-18. If the road facilities corresponding to "Defect" are confirmed in the routine inspection, the check sheet is filled out.

Table 5-17 Evaluation Criteria of Road Facilities

Category	Road Facility Conditions
Defect	Deterioration or damage to the road facility has occurred, and the original function of road facility is significantly impaired.
Soundness	The road facility condition is sound or minor damage is present that does not correspond with "Defect".

Table 5-18 Evaluation Category of Road Facilities

Type	Condition Corresponding to "Defect"	
Guardrail	Guardrail is damaged, and facility function is significantly impaired.	
Road Lighting	Road lighting (bulbs) is not functioning. The road lighting is damaged, and there is a possibility that members will fall or the columns collapse.	
Road Signal	Road signal is not functioning. The road signal is damaged, and there is a possibility that members will fall or the columns collapse.	

Type	Condition Corresponding to “Defect”	
Road Surface Marker	The paint of road surface markers is faded, and drivers cannot recognize them.	
Road Sign	The road sign marker is damaged, and drivers cannot recognize them.	



4) Bridge/Culvert



Evaluation criteria and category of bridge sections are shown in Tables 5-19 and 5-20. If the bridge section which corresponds to "Defect" is confirmed in the routine inspection, the check sheet is filled out.

Table 5-19 Evaluation Criteria of Bridge/Culvert

Category	Bridge/Culvert Contains
Defect	Damaged guardrail, functional failure of drainage ditch, stepped portion of abutment has occurred, and drivability or safety is significantly impaired.
Soundness	There is no problem with the safety and drivability.

Table 5-20 Evaluation Category of Bridge/Calvert

Type	Condition of Corresponding to “Defect”	
Bridge Railing	Guardrail is damaged, and facility function is significantly impaired.	
Lighting	Road lighting not functioning. Light facilities are damaged and there is a possibility that members will fall or columns collapse.	

Type	Condition of Corresponding to “Defect”	
Drainage Ditch	Drainage function is significantly impaired by the deposition of dust/soil and damaged.	
Stepped Portion of Abutment Section	Drivability is impaired significantly by the stepped portion of abutment. (It is necessary to reduce driving speed.)	

(4) Inspection Tools

Inspection tools are shown in the table below.

Table 5-21 Inspection Tools

Inspection	Binoculars, Tape measure
Equipment	Cellphone, Safety vest
Recording	Inspection form
Others	Traffic control equipment

5.2.5 Activities Required for Routine Maintenance Work

Routine road maintenance (cleaning, etc.) and functional maintenance (repair, disaster recovery, snow and ice measures, etc.) are conducted to ensure safety and smooth traffic.

Table 5-22 Outline of Road Routine Maintenance Works

Maintenance Activity	Period	Frequency
(1) Summer Maintenance 1) Cleaning (Surface/Drainage/Whitewashing) <ul style="list-style-type: none"> ➤ Clean-out the sand/salt poured on the road in winter season and remove garbage. ➤ Remove garbage and sand deposited on drainage ditches. ➤ Paint border stones, curbstones and protective walls with the prescribed white paint. 2) Painting <ul style="list-style-type: none"> ➤ Paint lane lines and road surface markers with the prescribed paint. 3) Road Facility Maintenance <ul style="list-style-type: none"> ➤ Perform maintenance and repair of road signs or signage. ➤ Perform maintenance and repair of guardrails and road lighting. 	March to August	As required and generally once per period (season)

Maintenance Activity	Period		Frequency
(2) Winter Maintenance	1) Winter Season Preparation Prepare snow removal tools and have a sufficient stock of sand and salt. 2) Snow Cleaning (Snow Removal and Pouring of Salt/Sand) <ul style="list-style-type: none"> ➤ Pour salt/sand on snow to avoid skidding of vehicles and freezing of road surface. ➤ Remove snow from roads, intersections and sidewalks within the ROW. 	September to March	As required and generally once per period (season)
(3) Routine Repair	1) Patch Work Perform patching work as required. 2) Crack Sealing Perform crack sealing as required.	March to August	As required

(1) Cleaning Work (Spring Clean-up)

Sweeping and cleaning of paved surfaces is undertaken to:

- Remove sand and debris from the pavement surface to avoid damage to vehicles.
- Remove sand and debris from areas scheduled for line and message painting.
- Prevent debris from entering drainage inlets.
- Reduce potential for skidding by increasing traction.
- Remove sand and debris from the pavement surface prior to crack filling or tacking.
- Clean up spills and vehicle accident debris.
- Remove loose chips from pavement surface.

Sweeping is usually done with a “pick-up broom”. This will remove residual sand remaining from winter sanding operations.

(2) Painting

Road markings are painted/installed for the safety of pedestrians and car drivers. Paintings to be performed are as follows:

- Center lines
- Shoulder lines
- Stop lines
- Pedestrian crossings
- Road surface messages, etc.

(3) Road Surface Maintenance

Road facilities which include traffic signals, pedestrian signals, guardrails and road lighting are maintained in proper condition for the safety of motorists and pedestrians. Road facility maintenance should cover the following:

- Road signals
- Pedestrian signals
- Guardrails
- Road lighting
- Road signs

(4) Winter Season Preparation

The department in charge shall estimate the next winter's requirement of calcium chloride, sodium chloride (salt) and sand in the spring of each year, including amounts necessary for freeze-proofing winter sand stockpiles.

Freeze proofed winter sand must be stockpiled at appropriate locations before winter. Inventories of salt, calcium chloride and sand must be monitored throughout the winter season to ensure adequate supplies are available.

All equipment must be in place before the onset of winter with sufficient number of trained staff. All sanding units must be calibrated to ensure that sand and deicing chemicals can be applied at the proper rates.

(5) Snow Cleaning (Snow Removal and Pouring Salt/Sand)

Snowplowing of paved highways should commence before snow becomes packed by traffic, or when snow accumulations exceed 3cm.

To assist in providing timely response during changing winter conditions, maintenance staff must keep themselves informed of weather forecasts. News of advancing storms should be communicated to neighboring maintenance areas.

The basic strategy for snow removal and ice control is: first, remove as much snow or ice as possible with suitable plowing equipment and, second, treat all remaining snow or ice with sand, salt, or a salt/sand combination to achieve good winter driving conditions within the required time frames. Plowing and deicing activities shall continue, as weather and operational conditions permit, with the aim of eventually achieving bare pavement.

Snowplows should pull over at reasonable intervals, usually about 5 to 8km when it is safe to do so, to allow traffic the opportunity to pass. When traffic is heavy, or rearward visibility is obscured, this interval should be shortened. Pulling over helps reduce any frustration experienced by motorists following the snowplow. Safety is the prime concern, and pulling over is a balance between minimizing inconvenience to the public and bringing the highway to "good winter driving conditions" in the shortest period possible.

When plowing snow in overpass structures, the equipment operator must ensure the snow is not plowed off the overpass while there are vehicles on the roadway below. Excessive accumulation of snow in overpass structures shall be avoided by loading the plowed snow onto trucks and hauled away. Steep hills, curves, important intersections and other areas known to create difficulties for traffic should first be attended to. Priority should be given to higher volume roadways, to provide the best service to the greatest number of motorists.

When roadway surface temperatures are too low for the use of salt, calcium chloride, other deicing chemicals and sand should be applied to maintain the best possible winter driving conditions. After the surface temperature of the roadway rises, applications of deicing chemicals will remove snow and ice accumulations more rapidly. Road surface temperature is often different from air temperatures, and application rates should be chosen based on road temperature, not air temperature.

(6) Patch Work

For permanent pothole patching, proceed as follows:

- Remove the defective material down to a stable base.
- Square off the edge of the hole vertically.
- Dry the hole as much as possible (fiber reinforced mix often does well in wet holes).

- Tack the hole if possible.
- Place and compact the mix.

Compaction is very important in making the repair permanent (heat applied to the mix is very beneficial to good compaction). If traffic is picking the fresh mix out of the hole, try dusting the finished patch with some roadside dirt. Spend a little more time patching the pothole the first time. This will often prevent returning to patch the same hole repeatedly. Permanent repairs are normally made with hot mix if available.

(7) Crack Sealing

Generally, alligator cracks or more general cracking can be repaired most inexpensively with chip seals. Serious cracking and settlement of the pavement may indicate the need for excavation to repair the subgrade before patching can be successful.

The main purpose of crack pouring is to prevent water from entering the subgrade and causing damage. There are two widely used types of crack pouring material, hot pour and cold pour. The two types use different techniques and equipment. The purpose of the two is the same, to minimize water entry and resulting damage.

Hot Pour Method utilizes blocks of crack pour material heated in specialized crack pouring machines. The most common type in maintenance are trailer mounted, oil jacketed units. This method is often used by contractors and maintenance crack sealing distressed areas that are not going to be removed and repaired prior to an overlay. It is a common method of sealing the joint between the edge of a PCC road surface and the asphalt shoulder. It works well for large volume work involving large cracks. Often the cracks are routed out first. If not, they should be cleaned and dried with compressed air prior to pouring. Filling cracks with this method requires a large crew and specialized equipment. Safety is a major concern in a hot crack pour operation. This material is extremely hot and can cause severe burns when loading the machine or applying the material.

Cold Pour Method utilizes cold applied liquid material and does not require specialized equipment. This type of material is available in 5- to 50-gallon containers. It can be sanded lightly after application and opened to traffic. One person can apply it using the spout on the 5-gallon bucket it comes in. Experience has shown that for maintenance purposes cold pour seems to prevent water entry into the subgrade as well as hot pour material. It also resists build up on bumps better than the hot material does. Cold pour is excellent as tack for small asphalt patches and pothole repairs. It greatly reduces the problems of tack storage, transporting, and application. A sealed 5-gallon bucket can be carried easily by a pothole patching crew. This material works well for hand pouring the cracks around an isolated bridge drain or catch basin if a piece of foam 'backer rod' is poked down into the crack before pouring to serve as a bottom for the material. It can also be poured against rubber expansion joints without melting the rubber joint.

5.2.6 Proposed Organizational Structure for Routine Maintenance

Figures 5-7 to 5-9 show the Framework of road maintenance management by DEP, PLUAD/UAD and RMD.

(1) DEP

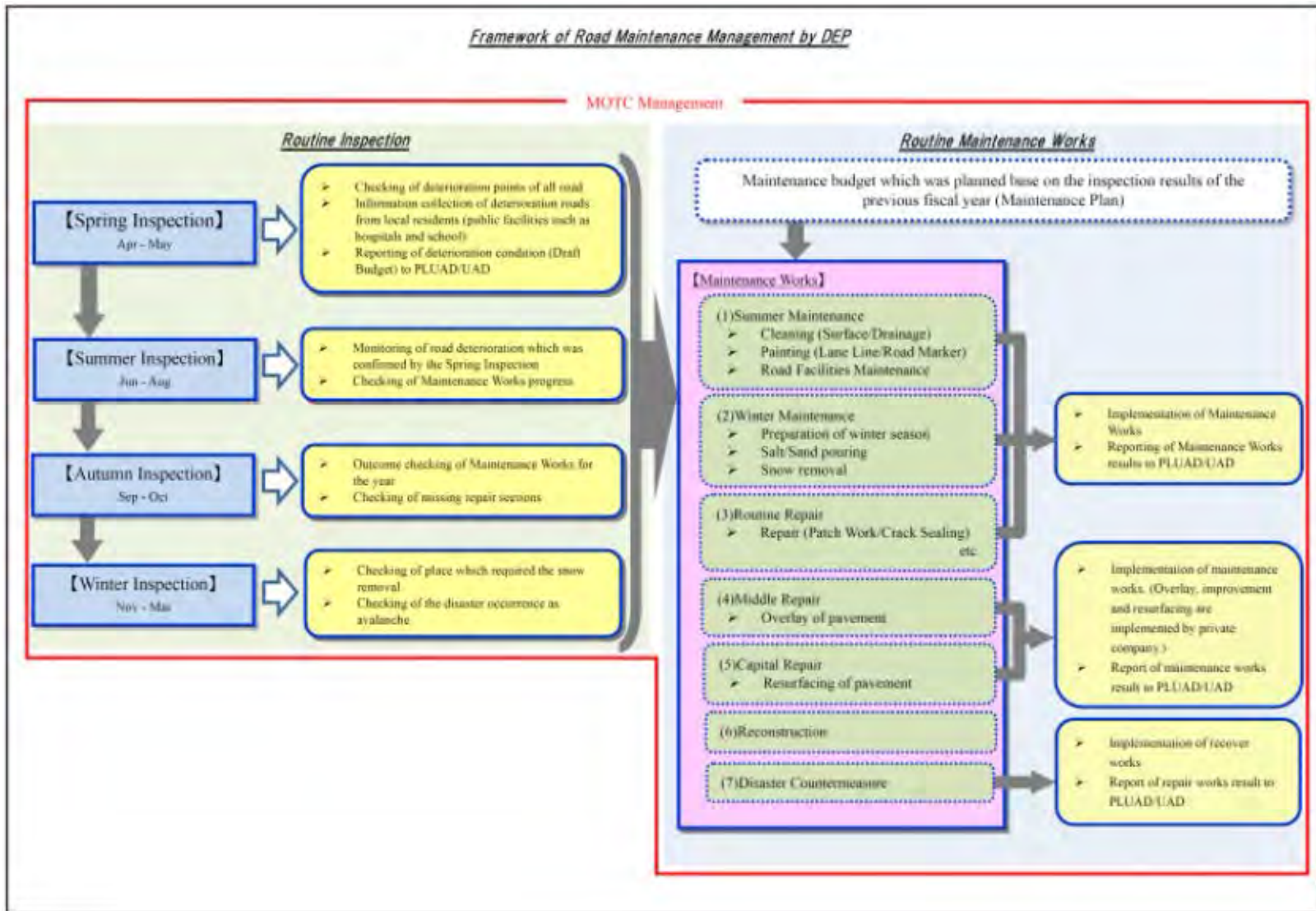


Figure 5-7 Framework of Road Maintenance Management by DEP

(2) PLUAD/UAD

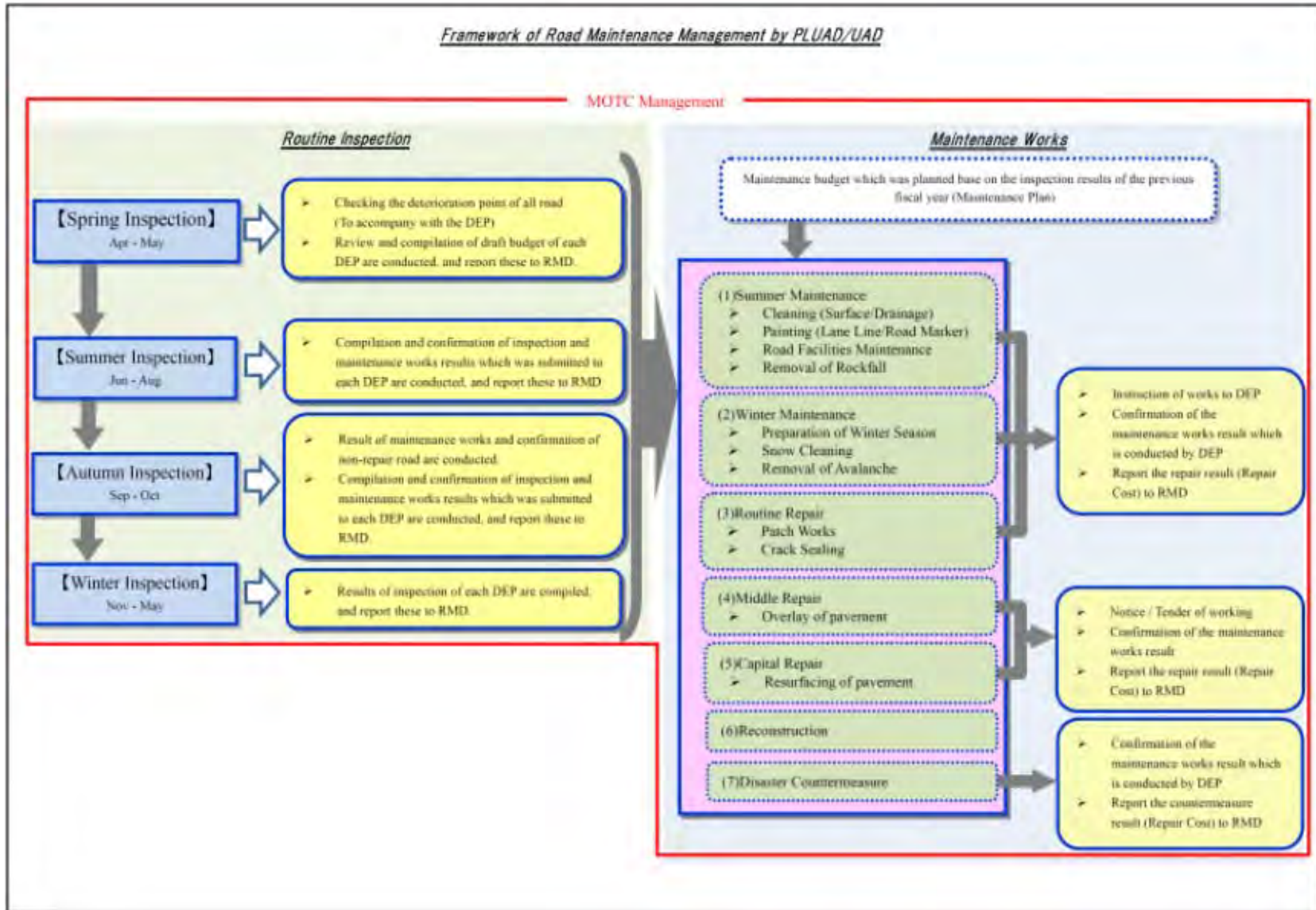


Figure 5-8 Framework of Road Maintenance Management by PLUAD/UAD

(3) RMD Inspection

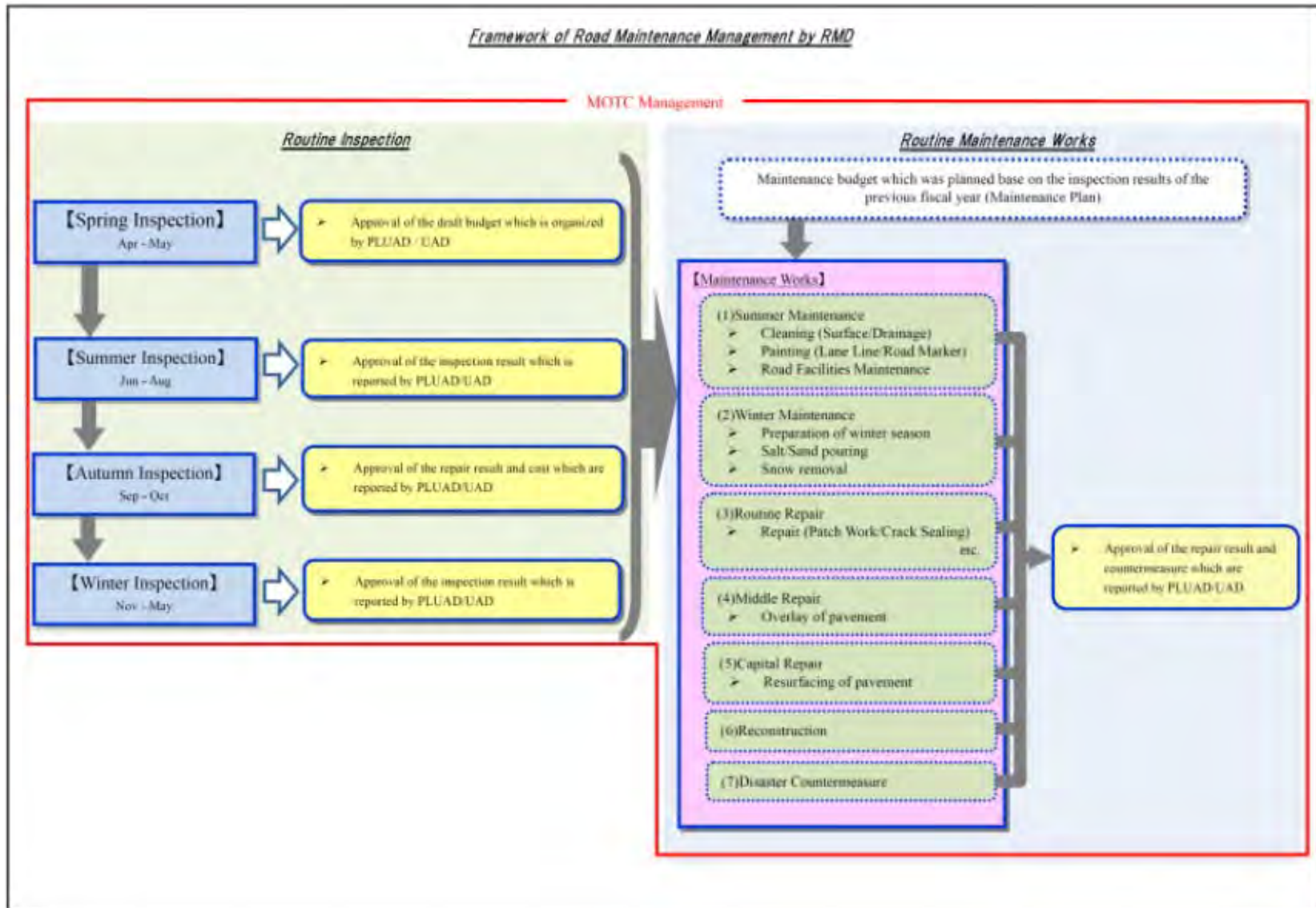


Figure 5-9 Framework of Road Maintenance Management by RMD

5.2.7 Practical Maintenance Activities

The routine maintenance manual for bridges had been improved though trial implementation of the maintenance by each DEP. Results of the 1st Routine maintenance implemented in Spring of 2015 are summarized in Table 5-23. Table 5-24 contains the Form for road Routine Maintenance Results with the indication of a number of photos depicting the defects.

Table 5-23 Summary of Bridge Routine Maintenance Work

PLUAD/UAD	№	DEP	Road name, station number	Road Surface				Super Structure		Sub structure			Fatal Situation
				Defect in Railing	Drainage Clogging	Defect in Pavement/ Road Side	Damage in Joint	Defect in Deck Slab	Defect in Main Girder	Damage in Sub structure	Debris Accumulation	Scouring	
PLUAD #1	1	DEP-1	2+500 km Romanovka-Kamyshanovka		✓					✓			
	2	DEP-25	35+300км Bishkek-Koi-Tash-Ysyk-Ata	✓									
	3	DEP-28	2+200 km Belovodskoe-Tolok										
	4	DEP-40	39+00 km Poltavka-Besh-Terek	✓									
	5	DEP-42	8+800 km Panfilovka- Chaldovar	✓									
	6	DEP-43	11+500 km Kant-Asphalt-Concrete plant	✓									
	7	DEP-954	14+00 Kegety-Vostochnyi Karakol	✓									
	8	DEP-958	4+00 km Manas-Kamyshanovka	✓									
PLUAD#3	9	DEP-8	1) Naryn-Oruk-Tam, 38+000					✓					
	10	DEP-8	2)Naryn-Oruk-Tam, 49+400					✓	✓				
	11	DEP-8	3) Naryn-Oruk-Tam, 60+000										
	12	DEP-8	4)On-Archa-Jany-Talap-Ashyrma, 00+100						✓				
	13	DEP-14	1) Sary-Bulak-Archaaly-Oruk-Tam, 52+000									✓	
	14	DEP-14	2) Sary-Bulak-Archaaly-Oruk-Tam, 70+000									✓	
	15	DEP-14	3) Sary-Bulak-Archaaly-Oruk-Tam, 76+050			✓				✓			
	16	DEP-14	4) Sary-Bulak-Archaaly-Oruk-Tam, 76+190									✓	
	17	DEP-14	5) Sary-Bulak-Archaaly-Oruk-Tam, 86+500			✓				✓			
	18	DEP-15	Naryn-Baetovo, 114 km				✓						
	19	DEP-18	1) Aktalchat-Kazarman, 62+700						✓			✓	
	20	DEP-20	1) At-bashy-Kynda-Torugart, 35+000	✓					✓				
	21	DEP-20	2) At-bashy-Kynda-Torugart, 64+000	✓						✓		✓	
	22	DEP-20	3) At-bashy-Kynda-Tirugart, 103+500						✓			✓	
PLUAD#4	23	DEP-24	Kochkor-Aral-Too-Ashuu, 87 km			✓							
	24	DEP-3	Balykchy-Bokonbaeva-Karakol, 135+300			✓							
	25	DEP-4	1) Tyup-Kegen, 17 km	✓									
	26	DEP-4	2) Tyup-Kegen, 19 km	✓									
	27	DEP-7	1) Balykchy-Ananyevo-Karakol, 112	✓									
	28	DEP-7	2) Balykchy-Ananyevo-Karakol, 116	✓									
	29	DEP-7	3) Balykchy-Ananyevo-Karakol, 120	✓									
	30	DEP-10	1) Balykchy-Ananyevo-Karakol, 29+420	✓		✓							
	31	DEP-10	2) 40+100			✓							
	32	DEP-10	3)47+50	✓									
	33	DEP-10	4)49+600	✓									
	34	DEP-10	5)58+670	✓									
	35	DEP-11	Karakol-Enilchek, 19 km										✓
	36	DEP-33	1) Balykchy-Bokonbaeva-Karakol, 104+72 km								✓		
37	DEP-33	2) Balykchy-Bokonbaeva-Karakol, 113	✓										
38	DEP-35	Djety-Oguz-Koisary, 9+070 km	✓										
39	DEP-35	Pokrovka-Pristan, 8+020 km	✓										
PLUAD#5	40	DEP-6	Maimak station road 8km	✓		✓							
	41	DEP-19	Kyzyl-Tuu - Kumboz Manas 0+550	✓									
	42	DEP-36	Taraz-Talas-Suusamyr 126+300	✓				✓					
	43	DEP-47	Taraz-Talas-Suusamyr 82+000	✓									
	44	DEP-48	Taraz-Pokrovka-Kayindy 19+900	✓									
PLUAD#6	45	DEP-12	Myrzake-Karakulja-Alaiku 1,5km					✓					

THE PROJECT FOR CAPACITY DEVELOPMENT
FOR MAINTENANCE MANAGEMENT OF BRIDGES AND TUNNELS IN THE KYRGYZ REPUBLIC
PROJECT COMPLETION REPORT

PLUAD/UAD	№	DEP	Road name, station number	Road Surface				Super Structure		Sub structure			Fatal Situation
				Defect in Railing	Drainage Clogging	Defect in Pavement/ Road Side	Damage in Joint	Defect in Deck Slab	Defect in Main Girder	Damage in Sub structure	Debris Accumulation	Scouring	
	46	DEP-17	All the bridges in good condition										
	47	DEP-27	Ala-Buka-Janybazar-Kirovka 217km	✓				✓					
	48	DEP-31	Jalal-Abad-Kazarman 63+000	✓									
	49	DEP-50	Bazarkorgon-Arstanbap-KyzylUnkur 12+800	✓									
	50	DEP-51											
	51	DEP-52											
UAD BO	52	DEP-5	Myrzake-Karakulja-Alaiku 7										
	53	DEP-9	Bishkek-Osh road "Jantai bridge"27+000	✓	✓								
	54	DEP-22	Suzak bypass road 8-100	✓	✓								
	55	DEP-22	Bishkek-Osh road 532-300	✓	✓								
	56	DEP-23	Bishkek-Osh 264+30	✓									
	57	DEP-30	All the bridges in good condition										
	58	DEP-956	Bishkek-Osh 647+558			✓							
	59	DEP-38	Tash Kumyr-Kyzyl Jar-12 138	✓	✓								
	60	DEP-26	Myrzake-Karakulja-Alaiku 74+815			✓							
UAD OBI	61	DEP-2	Buzum-Batken-Isfara, 8,5 km	✓									
	61	DEP-13	Osh-Isfana road 336+600km	✓									
	62		Osh-Isfana road 339+200								✓		
	63		Osh-Isfana road 360+000	✓									
	64	DEP-46	Osh-Isfana road 178km										✓
	65		Osh-Isfana road 157km+800			✓					✓		
	66		Osh-Isfana road 175km+100							✓			
UAD BNT	67	DEP-34	Tokmok-Shamshy-Tuyuk road,24+300 km	✓						✓		✓	
	68		Tokmok-Koshoy road, 8+700 km						✓				
	69	DEP-41	Bishkek-Naryn-Torugart 350km+10M	✓									
	70		Bishkek-Naryn-Torugart 292km+900M			✓							
	71		Bishkek-Naryn-Torugart 351km+950M	✓		✓				✓			
	72		Bishkek-Naryn-Torugart 216km+50M			✓				✓			
	73		Bishkek-Naryn-Torugart 303km+60M			✓				✓			
	74		Bishkek-Naryn-Torugart 0km+50M							✓			
	75		Bishkek-Naryn-Torugart 351km+500M	✓									
	76	DEP-955	Kochkor-Kommunizm, 1km	✓				✓					
	77		Kochkor-Aral-Too-Ashuu, 5 km					✓					
	78	DEP-957	Bishkek-Torugart road, 461 км, Burgan Suu river			✓				✓			
	79		Bishkek-Torugart road, 400 км, At-Bashy river										
	80		At-Bashy road, 3km, river Sarygoo										
	81	DEP-32	Kemin-Ilich-Ak-tuz, 15km	✓				✓					
	82	DEP-39	Almaty-Bishkek-Tashkent road, 238 km	✓				✓					
AD OSI	83	DEP-16	Sary-Tash-Karamyk, 57km, river Daraa						✓	✓			
	84		Sary-Tash-Karamyk, 53km, river Kashka-Suu						✓	✓			
	85	DEP-45	Kara-Suu-Otuz-Adyr road, 14km	✓									
	86	DEP-959	Korul-Suuk-Dobo road, 21 km			✓							
	87		Korul-Suuk-Dobo road, 23 km										✓
	88	DEP-960	11-км. Sary-Tash-Komsomolabad road			✓							
	89		38-км.Sary-Tash road-Kyzyl-Art pass	✓		✓							
	90		5-км. Sary-Tash-Komsomolabad road			✓							
	91	DEP-21	Osh city by-pass route 8+200 km				✓						
	92		Ak-Terek-Bapan-Kojo-Kelen 24+600 km					✓					
	93	DEP-44	Nookat-Aravan-Topo-Korgon road, 44+60km	✓								✓	
	94	DEP-37	Nookat-Papan road, 19 km			✓							
	95		Nookat-Papan road, 4km			✓							
	96		Osh-Isfana road, 63 km, Apshyr-Say bridge						✓				

【Road Routine Maintenance Form】

Organization: DEP-16

Brief explanation
 This form is an attachment to the Road Routine Maintenance Manual which is currently being developed. This form is used during the inspection of roads. The main purpose of completion of this form is to provide a road safety through planning and implementation of such activities as repair works, cleaning works, etc. The following items should be completed in the form and each defect should be photographed.

#1 At which km of the road there are potholes, deep ruts;
 #2 At which km of the road there are trees or other objects which hinder vision;
 #3 At which km road signs are lacking;
 #4 If the bridge, located on the inspected road, has guardrails or not; Or the bridge has other defects which might threaten road safety;
 #5 At which km there is scouring, etc.

Date	Name	Road Name	Contents of Inspection/Measures to be Taken	Number of Photo
Oct. 24, 2014	Kadyrov M.	Sarytash-Karamyk	There are some holes in a slab of the bridge located at Km 1. These holes need to be repaired urgently.	0271 0272 0273
			At Km 8, 2 rings of water pipe are fallen apart due to scouring. They need to be restored to their places. Shoulders of the road also need to be repaired.	0268 0269 0270

Table 5-24 Routine Maintenance Results (DEP-16)



Photographs supporting the Road Routine Maintenance Form provided in the above Table 5-24.

5.2.8 Interview Survey to DEP concerning Routine Road Patrol and Inspection Forms

In order to utilize the manual continuously after the Project, it is necessary to improve the manual to match actual status in Kyrgyz through using the draft of the "Manual for Routine Road Maintenance" prepared by the Project. Each DEP is in charge of the actual maintenance work. Therefore, the JICA Expert Team conducted interview surveys to some DEPs.

5.2.8.1 Comment of DEP 1

The Brief Explanation in the Routine Road Maintenance Form contains all the necessary points on patrolling. We would like to use this Form, but it should be simplified. Taking photos of the potholes and other frequently occurring road damage is very time-consuming, because many roads in the KR are in bad condition. Therefore, the Form should be completed narratively. We have not used photos of widespread road damages in budget request, except emergency situations, occurring on roads, and bridges.

5.2.8.2 Comment of DEP 39

The roads of KR have a lot of damage and it is too hard to take photos of all of them. In cases of small scale damage of roadside facilities, usually, we take measures immediately and we do not need to take photos; in cases of large scale damage, that threatens safety of motorists or pedestrians (damage to guardrails, road or bridge scouring, etc.) we take photos and use it for budget requests. There is a shortage of staff for note taking and photos. Once a year we patrol our DEP roads, make a list of damaged sections and submit to MOTC for the next year's budget plan

5.2.8.3 Comment of DEP 958

We need such forms for Road Maintenance. All the 5 points of "Brief Explanation" are necessary. If damage photos are attached to "Damage List" submitted once a year to the MOTC, it would help us get necessary funding. No need for photos and notes of small damage to the Road facilities.

5.2.8.4 Comment of DEP 43

Photos of large scale and rare damage are useful and make it easier to understand the situation, when requesting the budget. Points #1, 4, 5 of "Brief Explanation" are necessary, others are not. We do not need to take photos of every pothole in the roads, because there are too many in Kyrgyz roads

5.3 Inspection and Condition Rating

5.3.1 Master Trainer's Training on Inspection and Condition Rating

At the beginning of the Project, MTs were categorized into four (4) groups, namely; MT-A, MT-B, MT-B-1, and MT-X, depending on the location of each PLUAD/UAD where they were belonging. However, a difference of personal skill has observed among the MTs due to their attendance rate to workshops. Although the MTs who reside in the vicinity of Bishkek were able to attend training easily, it was difficult for the MTs who reside outside the locality to attend. As a result, the MTs were significantly divided into two groups, MT-S and MT-B, at the end of 2014.

The classification of MTs in 2013 is shown in Table 5-25 and the classification of MTs in 2014 is

shown in Table 5-26. MT-S was mainly selected from the MT-A and MT-X who were categorized in 2013. Six (6) master trainers were categorized into MT-S. They acquired the same level of skill as the Japanese Expert for bridge inspection and condition rating through the trainings in the Project. In particular, their abilities have achieved the level that could conduct lectures to MT-B at the same level as the Japanese Expert in terms of Inspection and Condition Rating.

Table 5-25 Classification of Master Trainers (July 2013 to December 2013)

MT	Criteria	Major Activities
A	Staff and/or engineers of RMD, PLUAD #1, BNT UAD and BO UAD	1) Preparation of Work Plan 2) Preparation of Manuals 3) Inspection and Condition Rating of Bridges 4) Repair Methods for Bridges
B	Staff and/or engineers of PLUAD #3, PLUAD#4 and PLUAD #5	1) Inspection and Condition Rating of Bridges 2) Repair Methods for Bridges
B-1	Staff and/or engineers of OSI UAD, OBI UAD and PLUAD #6	1) Inspection and Condition Rating of Bridges 2) Repair Methods for Bridges
X	Engineers and/or staff members able to attain data collection for nationwide bridge inventory.	Nationwide bridge inventory data collection with pictures thereof (1,100 bridges)

Table 5-26 Classification of Master Trainers (April 2014 to December 2014)

MT	Criteria	Major Activities
S	<ul style="list-style-type: none"> • Selected MT who lecture to other MTs on Planned Inspection and condition rating • Staff and/or engineers of RMD, PLUAD #1, BNT UAD and BO UAD 	1) Lecture of Planned Inspection and Condition Rating of Bridges 2) Lecture of Repair Methods for Bridges 3) Preparation of Short-term plan 4) Preparation of Long-term plan
B	<ul style="list-style-type: none"> • Able to carry out both Planned Inspection A and Planned Inspection B • Selected MT as a representative MT from 9 PULAD/UADs, Staff and/or engineers of PLUAD #1, #3, #4, #5, #6, UAD BO, UAD OBI, UAD BNT, and UAD OSI 	1) Inspection and Condition Rating of Bridges 2) Repair Methods for Bridges

The difference in the ability of MT-S and MT-B are shown in Table 5-27.

Table 5-27 Difference in the ability of MT-S and MT-B

MT	Ability
MT-S	<p>1) In terms of Planned Inspection A, Planned Inspection B and Condition Rating, able to lecture other MTs</p> <p>2) Planned Inspection A</p> <ul style="list-style-type: none"> • Able to complete the Bridge Passport information accurately • Able to take damage photos, not only Imminent and Critical but also Poor and Fair photos • Able to draw an illustration of the damaged bridges accurately • Able to create Inspection Result Sheet in Excel <p>3) Planned Inspection B (Detailed Inspection)</p> <ul style="list-style-type: none"> • Able to distinguish between defect and non-defect by infrared camera • Able to set the Maximum and Minimum temperature of infrared camera accurately • Able to accurately calculate compressive strength in Schmidt hammer in Excel • Able to create 3 types of Inspection Result Sheets (Infrared camera, Schmidt hammer and Depth of carbonation) in Excel <p>4) Condition Rating</p> <ul style="list-style-type: none"> • Able to classify 5 level Condition Ratings accurately • Able to distinguish between Imminent and Critical bridges
MT-B	<p>1) Planned Inspection A</p> <ul style="list-style-type: none"> • Able to take 3 photo views (Overview, Surface and Underside pictures) necessary for Bridge Passport Sheet • Able to take Imminent and Critical damage pictures • Able to describe inspection results narratively <p>2) Planned Inspection B</p> <ul style="list-style-type: none"> • Able to distinguish between defect and non-defect by infrared camera • Able to set the Maximum and Minimum temperature of infrared camera accurately • Able to accurately calculate compressive strength in Schmidt hammer narratively • Able to create 3 types of Inspection Result Sheets (Infrared camera, Schmidt hammer and Depth of carbonation) in handwriting <p>3) Condition Rating</p> <ul style="list-style-type: none"> • At the minimum, able to distinguish Imminent and Critical bridges without omission

The functions and roles of MT-S and MT-B are as shown in Table 5-28.

Table 5-28 Functions and Roles of MT-S and MT-B

MT	Functions	Roles
MT-S	Key person who continuously demonstrates ability within MOTC in terms of not only Inspection and Condition Rating but also maintenance cost estimation on the basis of inspection results.	<ul style="list-style-type: none"> - To lecture MT-Bs, representatives of PLUAD/UAD to formulate a budget plan for each PLUAD/UAD, and to finalize the establishment of a management system within DEPs in order to enhance efficient financial planning. - To lecture other MTs on each different item.
MT-B	Conduct lectures to PLUAD/UAD/ DEP staff outlining what they were taught by MT-S in terms of Inspection and Condition Rating	To conduct the lectures within PLUAD/UAD and DEP

Figure 5.10 shows how the classification of MTs has changed from 2013 to 2014.

Arrows in Figure 5.10 indicate the following:

- Arrow (1) : 6 MTs were selected as MT-S who can conduct lectures to other MTs among MT-X and MT-A
- Arrow (2) : The remaining MTs, not selected as MT-S that became MT-B
- Arrow (3) : All MT-Bs and MT-B1s chosen as MT-B
- Arrow (4) : MT-S conducting lectures to MT-Bs selected as a representative MTs from 9 PLUAD/UADs

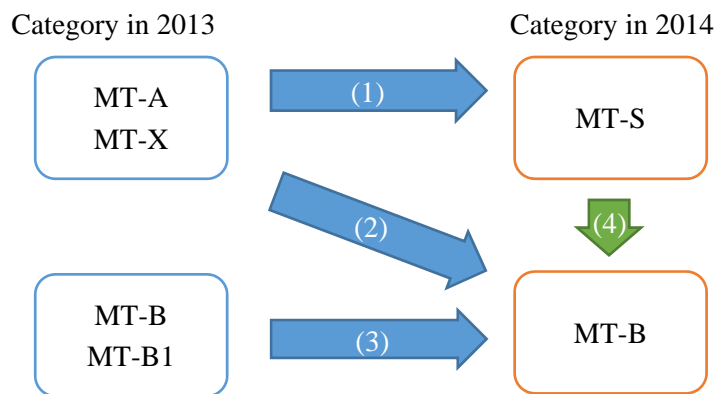


Figure 5-10 Categories of MT

The Phase 1 (year 2013) and Phase 2 (year 2014) training on inspection and condition rating of bridges has been carried out in accordance with the schedule provided in Table 5-29 for the year 2013, Table 5-30 for the year 2014 and Table 5-31 for the year 2015.

Table 5-29 Training Schedule of Master Trainers (MTs) in 2013

MT		Month	2013				
			Jul.	Aug.	Sep.	Oct.	Nov.
MT-S	RMD PLUAD #1 BNT UAD	Planned A Inspection	Planned A (for PLUAD/UAD by MT)				
		Condition Rating					
		Repair Method					
MT-B	PLUAD #1, #3, #4 PLUAD #5, #6 BNT UAD, BO-UAD OSI UAD, OBI UAD	Planned A Inspection	Planned A (for PLUAD/UAD by MT)				
		Condition Rating					
		Repair Method					

Table 5-30 Training Schedule of Master Trainers (MTs) in 2014

MT		Month	2014						
			Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
MT-S	RMD PLUAD #1 BNT UAD	Routine Inspection	Cost Estimation		Planned B Inspection		Planned B (for PLUAD/UAD by MT)		
		Condition Rating	Criteria		Long-Term Plan				
		Criteria	Short-term Plan			Short-Term Plan			
MT-B	PLUAD #1, #3, #4 PLUAD #5, #6 BNT UAD, BO UAD OSI UAD, OBI UAD	Condition Rating	Short-term Plan			Planned B Inspection		Planned B (for PLUAD/UAD by MT)	

Table 5-31 Training Schedule of Master Trainers (MTs) in 2015

MT		Month	2014						
			Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
MT-S	RMD PLUAD #1 BNT UAD	Planned A							
		Planned B		Planned B	LCC			Long-term Plan	
MT-B	PLUAD #1, #3, #4 PLUAD #5, #6 BNT UAD, BO UAD OSI UAD, OBI UAD	Planned A	Planned B						

The Training for MT on Planned Inspection-A and Condition Rating was carried out by the Japanese Expert and MT-S especially focusing on the following items to start bridge inspection nationwide.

5.3.1.1 Project Guideline

Purpose, goal and schedule of the Project were introduced.

5.3.1.2 Basic Knowledge on Bridges

Type of bridge, structural mechanics and common forms of bridge damage were explained to facilitate the understanding of critical items during bridge inspection.

5.3.1.3 Importance of Bridge Maintenance

Necessity and purpose of bridge maintenance in terms of traffic safety and economic efficiency were introduced by using examples from other countries.

5.3.1.4 Introduction of Preventive Maintenance

Preventive maintenance as approached in developed countries to optimize the maintenance budget and minimize the life cycle cost (LCC) was introduced for further understanding of the project purpose. The training was divided into two (2) sessions for each MT.

5.3.1.5 Bridge Inspection Outline

Basic bridge inspection methodology was developed by the JICA Expert Team to start the nationwide inspection of bridges in Kyrgyz. Seven (7) pilot bridges around Bishkek were selected to carry out the inspection training for MTs. The training was divided into two (2) sessions for each MT.

5.3.1.6 Data Collection and Recording Methodology

Training on the methodology of data collection, such as measurement of dimensions and engineering sketches of damage and/or defect, was carried out for MTs by the JICA expert at the site of pilot bridges. The training was held twice for further understanding of the methodology.

5.3.1.7 Introduction of Photo Records

To record overview, particular member and bridge defects, photo shooting was explained by the JICA Expert Team and put into practice by the MTs. To record the general view under the bridge, photo-shooting with “fish-eye lens” was introduced as an advanced and effective data recording technique.

5.3.1.8 Inspection Manual Contents and Preparation

The basic concept of the Bridge Inspection Manual has been drafted by the JICA Expert Team and discussion was held to create and develop the manual to accommodate former practices and capacity in Kyrgyz in collaboration with the MTs. Contents and substance to be stipulated in the manual were discussed and accomplished during the training.

Table 5-32 shows the list of MTs who participated in the trainings on Planned Inspection A and Condition Rating.



Photo 5-1 Training to Introduce Preventive Maintenance



Photo 5-2 Training on Data Collection and Recording



Photo 5-3 Training on Preventive Maintenance

**Table 5-32 Accomplishment of Training for Master Trainers on Planned Inspection A
 (Data collection and Input) and Condition Rating**

No.	Office/Position	Master Trainer	Name	Project Guideline	Basic Knowledge on Bridge	Importance of Bridge Maintenance	Introduction of Preventive maintenance	Outline of Bridge Inspection	Methodology of Data Collection and Recording (Data Input)	Introduction of Photo Recording	Inspection Manual Contents
1	PLUAD #1, Chief Mechanic	MT-S	Amanov Kushtarbek	✓	✓	✓	✓	✓	✓	✓	✓
2	PLUAD#1, DEP-43, Chief Engineer	MT-S	Ashirbaev Bakai	✓	✓	✓	✓	✓	✓	✓	✓
3	UAD BO, Engineer	MT-S	Dubashev Nur	✓	✓	✓	✓	✓	✓	✓	✓
4	RMD , Leading Specialist	MT-S	Eraliev Nurlan	✓	✓	✓	✓	✓	✓	✓	✓
5	PLUAD #1, Chief Specialist	MT-S	Abyshev Tursunbek	✓	✓	✓	✓	✓	✓	✓	✓
6	RMD, Leading Specialist	MT-S	Jeldenov Akim	✓	✓	✓	✓	✓	✓	✓	✓
7	UAD BNT, Chief Specialist	MT-B	Chengelov Baktybek	✓	✓	✓	✓	✓	✓	✓	✓
8	PLUAD #1, DEP-42, Chief Engineer	MT-B	Toktonaliev Chyngyz	✓	✓	✓		✓	✓	✓	
9	PLUAD #1, DEP-954, Lead Specialist	MT-B	Seitkaziev Baktybek	✓	✓	✓		✓	✓	✓	
10	PLUAD #3, DEP-20, Chief Specialist	MT-B	Kulanbaev Askat	✓	✓	✓	✓	✓	✓	✓	
11	PLUAD #3, DEP-8, Leading Engineer	MT-B	Nurbaev Farhat	✓	✓	✓	✓	✓	✓	✓	
12	PLUAD #3, DEP-18, Chief Specialist	MT-B	Suranbaev Munarbek	✓	✓	✓	✓	✓	✓	✓	
13	BNT UAD, DEP-957, Chief Engineer	MT-B	Aralbaev Zamir	✓	✓	✓	✓	✓	✓	✓	✓
14	BNT UAD, DEP-955, Chief Engineer	MT-B	Askarbek uulu Kurmanbek	✓	✓	✓	✓	✓	✓	✓	✓
15	BNT UAD, DEP-32, Foreman	MT-B	Bektemirov Nurlan	✓	✓	✓	✓	✓	✓	✓	
16	BNT UAD, DEP-34, Head	MT-B	Imanalieva Anara	✓	✓	✓	✓	✓	✓	✓	✓
17	PLUAD #4, DEP-35, Chief Engineer	MT-B	Samakov Taalaibek	✓	✓	✓		✓	✓	✓	
18	PLUAD #4, DEP-35, Chief Specialist	MT-B	Omurov Altynbek	✓	✓	✓	✓	✓	✓	✓	

No.	Office/Position	Master Trainer	Name	Project Guideline	Basic Knowledge on Bridge	Importance of Bridge Maintenance	Introduction of Preventive maintenance	Outline of Bridge Inspection	Methodology of Data Collection and Recording (Data Input)	Introduction of Photo Recording	Inspection Manual Contents
19	PLUAD #4, DEP-4, Chief Engineer	MT-B	Omukeev A	✓	✓	✓	✓	✓	✓	✓	
20	PLUAD #5, Chief Specialist	MT-B	Sadyraliev Nurkan	✓	✓	✓	✓	✓	✓	✓	✓
21	PLUAD #6, DEP-50, Chief Engineer	MT-B	Joldoshev Shadybek	✓	✓	✓	✓	✓	✓	✓	
22	PLUAD #6, DEP-52, Chief Engineer	MT-B	Janseitov Almaz	✓	✓	✓	✓	✓	✓	✓	
23	UAD OSI, Chief Engineer	MT-B	Junusov Toktogul	✓	✓	✓	✓	✓	✓	✓	
24	UAD OSI, Chief Engineer	MT-B	Joroev Janybek	✓	✓	✓	✓	✓	✓	✓	
25	UAD OSI, DEP-21, Chief Engineer	MT-B	Turdubaev Alimbek	✓	✓	✓	✓	✓	✓	✓	
26	UAD OSI, DEP-45, Chief Engineer	MT-B	Usenov Rajap	✓	✓	✓	✓	✓	✓	✓	
27	UAD OSI, DEP-959, Chief Engineer	MT-B	Maksutov Sulaiman	✓	✓	✓	✓	✓	✓	✓	
28	UAD OBI, Chief Engineer	MT-B	Akmatov Ikmarali	✓	✓	✓		✓	✓	✓	
29	UAD OBI, DEP-13, Chief Engineer	MT-B	Shaibekov M	✓	✓	✓		✓	✓	✓	
30	UAD OBI, DEP-46, Chief Engineer	MT-B	Anarbaev Erkin	✓	✓	✓		✓	✓	✓	
			Total	30	30	30	24	30	30(*1)	30(*2)	11

Source: JICA Expert Team

*1 Achievement indicator of 3rd indicator in Output-2 and 3rd indicator in Output-3

*2 Achievement indicator of 3rd indicator in Output-3

5.3.1.9 Planned Inspection B (Detailed Inspection)

The concept of Planned B Inspection (Detailed Inspection) was introduced to MTs by the Japanese Expert and discussion was held on Infrared Thermography Testing, Schmidt hammer and Depth of carbonation using a portable drill. The JICA Expert Team suggested three kinds of detailed inspection methods that are supposed to be commonly used to obtain more detailed information.



Photo 5-4 Training on Detailed Inspection



Photo 5-5 Training on Infrared Thermography

After the training on Planned Inspection A, Planned Inspection B and Condition Rating, more than 30 MTs achieved the required level to carry out Inspection and Condition Rating that was certified by the Japanese Expert Team. Some workshops were carried out in 2013 and 2014 as shown in Table 5-33.

Table 5-33 Implementation of Trainings/Workshops for Bridge

Date	Venue	Contents
03 July - 16 August 2013	CHUY	1) Inspection and Condition Rating (Planned Inspection A) 2) Repair Method
25 September - 18 October 2013	9 PLUAD/UAD	Ditto
11 November 2013	RMD Office	Inspection and Condition Rating (Planned Inspection A)
30 November 2013	RMD Office	Ditto
28 April - 07 May 2014	CHUY	Routine Maintenance(VIMS)
08 May 2014	RMD Office	1) Inspection and Condition Rating (Planned Inspection A) 2) Repair Method 3) Calculation of Repair and Replacement Cost 4) Maintenance Management Plan 5) 360 degree panoramic image view
21 May 2014	Osh OBI Office	Ditto
29 May 2014	RMD Office	1) Inspection and Condition Rating (Planned Inspection A) 2) Repair Method 3) Prioritization in repair work
10 June 2014	PLUAD#4 Office (Karakol)	1) Inspection and Condition Rating (Planned Inspection A) 2) Repair Method
03 July 2014	RMD Office	Calculation of Repair and Replacement Cost
09 July 2014	RMD Office	1) Maintenance Prioritizing 2) Short-Term Budget Request 3) Short-Term Maintenance Management Plan
16 July 2014	RMD Office	1) Bridge Maintenance Prioritizing 2) Short-Term Budget Request
29 August 2014	RMD Office	1) Planned Inspection B (Detailed Inspection) 2) Condition Rating
02 September 2014	RMD Office	Ditto

Date	Venue	Contents
03 September 2014	RMD Office	Ditto
06 September 2014	Osh OBI Office	Ditto
12 September 2014	Naryn Office	Ditto
17 October 2014	RMD Office	Long-term bridge maintenance management plan
01 October - 13 November 2014	9 PLUAD/UAD	Planned Inspection B (Detailed Inspection)
14 November 2014	RMD Office	Long-term bridge maintenance management plan
18 November 2014	RMD Office	Examination for Planned Inspection (A and B) and Condition Rating
19 November 2014	RMD Office	Ditto
15-16 April 2015	Osh	Detailed inspection and Final Examination
24 April 2015	RAMS	Detailed Inspection
27 April 2015	RAMS	Site Training for Detailed Inspection
30 April 2015	RAMS	Lecture for VIMS
6-8 May 2015	RAMS	Site Training for VIMS Operation
10 July 2015	RMD Office	Planned Inspection B (Detailed Inspection) Long-term Bridge Maintenance Plan (LCC)

5.3.2 Training of MOTC Staff by Master Trainers (MT-S)

Table 5-34 shows the training contents required for MT-B and progress. The training of PLUAD and DEP staff by the master trainers has been implemented as shown in Table 5-34. The training was focused on: (i) Techniques to conduct primary inspection; (ii) Techniques to make inspection sketches; (iii) Input of inspection data into Excel format, and (iv) Techniques about 3 types of Detailed Inspection.

Trainings (i) to (iii) are about Planned Inspection A, and training (iv) is about Planned Inspection B. Table 5-35 shows the contents and schedule of Planned Inspection A, and Table 5-36 shows those of Planned Inspection B.

Table 5-34 Training Contents required for MT-B and Progress

Training contents	Completed	Not completed (shall be carried out by April 2015)
Planned Inspection A	<ul style="list-style-type: none"> • Take 3 photo views(Overview, Surface and Underside pictures) that are necessary for Bridge passport Sheet • To take Imminent and Critical damaged pictures • To create Inspection results in handwriting 	<ul style="list-style-type: none"> • To create Inspection results in Excel
Planned Inspection B (Detailed Inspection)	<ul style="list-style-type: none"> • To distinguish between defect and non-defect by Infrared camera • To set the Maximum and Minimum temperature of Infrared camera accurately • To calculate accurately compressive strength in Schmidt hammer in handwriting • To create 3 kinds of Inspection result Sheets (Infrared camera, Schmidt hammer and Depth of carbonation) in handwriting 	<ul style="list-style-type: none"> • To create 3 kinds of Inspection result Sheets in Excel

Training contents	Completed	Not completed (shall be carried out by April 2015)
Condition Rating	<ul style="list-style-type: none"> To distinguish at least Imminent and Critical bridges without omission. 	<ul style="list-style-type: none"> To classify 5level Condition Rating accurately To distinguish between Imminent and Critical bridges

Table 5-35 Training of PLUAD and DEP Staff by MT-S on Planned Inspection A (Data collection and Input)

No.	DATE	PLUAD /UAD	MT	TRAINEES	TRAINING CONTENTS
1	Sep 13, 2013	PLUAD #1	Eraliev Nurlan, RMD, PPAW Abyshev Tursunbek, PLUAD #1 Omurzakov Stalbek, BNT UAD, DEP-39	Esenbekov Tilek, RMD, PPAW Chengelov Baktybek, BNT UAD Ashyrbaev Bakai, PLUAD #1, DEP-43 Amanov Kushtarbek, PLUAD #1 Kojomberdiev Turdubek, BNT UAD, DEP-34	Primary inspection of bridges including sketch drawing, photographing and data input into Excel format
2	Sep 20, 2013	PLUAD #1	Eraliev Nurlan, RMD Abyshev Tursunbek, PLUAD #1	Onke uulu Urmat, DEP-958 Jumabaev Adilet, DEP-42 Smanov Eldiyar, DEP-25 Beishebaev Taalai, DEP-1	Ditto
3	Sep 25, 2013	PLUAD #1	Eraliev Nurlan, RMD Abyshev Tursunbek, PLUAD #1	Onke uulu Urmat, DEP-958 Jumabaev Adilet, DEP-42 Smanov Eldiyar, DEP-25 Beishebaev Taalai, DEP-1 Moldoshev Tilek, DEP-1 Abdraymov Rinat, DEP-28 Koichubek uulu Baktybek, DEP-40 Seitkaziev Baktybek, DEP-954	Ditto
4	Oct 03, 2013	BNT UAD	Chengelov Baktybek, BNT UAD Abyshev Tursunbek, PLUAD #1	Sultanaliyev Jaguza, DEP-32 Imanaliyeva Anara, DEP-34 Samidinov Anarbek, DEP-39 Toktaliev Saparbek, DEP-41 Askarbek uulu Kurmanbek, DEP-955 Aralbaev Zamir, DEP-957	Ditto
5	Oct 08, 2013	PLUAD #4	Eraliev Nurlan, RMD Esenbekov Tilek, RMD	Kadyrbaev Kanatbek, PLUAD #4 Musalimov Bakyt, DEP-3 Omukeev Azamat, DEP-4 Moldosanov Avaz, DEP-7 Jumaliyev Sarygul, DEP-10 Kuchukov Joomart, DEP-11 Omurov Nurlan, DEP-33 Samakov Taalai, DEP-35	Ditto
6	Oct 09, 2013	PLUAD #3	Eraliev Nurlan, RMD Esenbekov Tilek, RMD	Kulanbaev Ashat, PLUAD #3 Nurbaev Farhat, DEP-8 Kubanychbek uulu Adilet, DEP-14 Razakulov Maksatbek, DEP-15 Suranbaev Munarbek, DEP-18 Kamchybekov Nurlan, DEP-20 Duishonaliyev Dayrbek, DEP-24	Ditto

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7	Oct 11, 2013	PLUAD #5	Abyshov Tursunbek, PLUAD #1	Sadyraliev Nurkan, PLUAD #5 Kudakeev Islam, DEP-19 Turdumbekov Altynbek, DEP-48 Imanaliev Mirlan, DEP-6 Musuraliev Sabyr, DEP-36 Batyrbashiev Zamirbek, DEP-47	Ditto
8	Oct 12, 2013	PLUAD #6	Abyshov Tursunbek, PLUAD #1	Atabaev Ilham, DEP-17 Subanaliev Talantbek, DEP-27 Chargynov Mamatkazy, DEP-31 Urazov Kubanych, DEP-51 Joldoshev Shadybek, DEP-50 Azimbaev Adyl, DEP-12 Janseitov Almaz, DEP-52	Ditto
9	Oct 16, 2013	BO UAD	Jeldenov Akim, RMD	Orozbaev Aman, DEP-5 Ismailov Shailoobek, DEP-9 Shaidildaev Sadyrbek, DEP-22 Chotubaev Anarbek, DEP-23 Jalilov Arstan, DEP-26 Seitaliev Edil, DEP-30 Kojobekov Nasyr, DEP-38 Pirmatov Daniyar, DEP-956	Ditto
10	Oct 17, 2013	OSI UAD	Jeldenov Akim, RMD	Kadyrov Mansur, DEP-16 Turdubaev Alimbek, DEP-21 Mamataipov Oljobai, DEP-37 Ismanov Kahraman, DEP-44 Usynov Rajab, DEP-45 Maksutov Sulaiman, DEP-959 Dyikanbaev Maamat, DEP-960 Junusov Toktogul, OSI UAD	Ditto
11	Oct 18, 2013	OBI UAD	Jeldenov Akim, RMD	Akmatov Ikmarali, OBI UAD Jalilov Yrysbai, DEP-2 Shaibekov Mustafa, DEP-13 Anarbaev Erkin, DEP-46	Ditto

Implementation of 11 times workshops in above table is satisfied 4th indicator of Output-2.
 The situation on Planned Inspection A by MT-S is shown in Photo 5-6 and Photo 5-7.



Photo 5-6 Training on Planned Inspection A at Site



Photo 5-7 Training on Input of Inspection Data into Format

Table 5-36 Training of PLUAD and DEP Staff by MT-S
on Planned Inspection B (Detailed Inspection)

No.	DATE	PLUAD /UAD	MT	TRAINEES	TRAINING CONTENTS
1	Sep 26, 2014	PLUAD #1	Amanov Kushtarbek (PLUAD #1)	Omuke uulu Urmat, DEP-958 Seitkaziev Baktybek, DEP-954 Toktonaliev Chyngyz, DEP-42	Detailed Inspection of bridges including Infrared Camera, Schmidt Hammer, Carbonization depth
2	Oct 01, 2014	BNT UAD	Amanov Kushtarbek (PLUAD #1)	Aralbaev Zamir, DEP-957 Askarbek Uulu Kurmanbek, DEP-955 Imanalieva Anara, DEP-34	Ditto
3	Oct 2, 2014	PLUAD #5	Jeldenov Akim (RMD) Abyshov Tursunbek (PLUAD #1) Dubashev Nur (BO UAD)	Sadyraliev Nurkan, PLUAD #5 Kudakeev Islam, DEP-19 Abdraimov Mudaris, DEP-19 Imanaliev Mirlan, DEP-6 Musuraliev Sabyr, DEP-36 Batyrbashiev Zamirbek, DEP-47	Ditto
4	Nov 5, 2014	BO UAD	Jeldenov Akim (RMD) Dubashev Nur (BO UAD)	Ismailov Shailoobek, DEP-9 Chotubaev Anarbek, DEP-23 Seitaliev Edil, DEP-30 Kojobekov Nasyr, DEP-38	Ditto
5	Nov 6, 2014	PLUAD #6	Jeldenov Akim (RMD) Dubashev Nur (BO UAD)	Atabaev Ilham, DEP-17 Subanaliev Talantbek, DEP-27 Chargynov Mamatkazy, DEP-31 Urazov Kubanych, DEP-51 Joldoshev Shadybek, DEP-50 Jansaitov Almaz, DEP-52	Ditto
6	Nov 10, 2014	PLUAD #3	Jeldenov Akim (RMD) Abyshov Tursunbek (PLUAD #1)	Kulanbaev Askat, PLUAD #3 Nurbaev Farhat, DEP-8 Razakulov Maksatbek, DEP-15 Suranbaev Munarbek, DEP-18	Ditto
7	Nov 11, 2014	PLUAD #4	Jeldenov Akim (RMD) Abyshov Tursunbek (PLUAD #1)	Musalimov Bakyt, DEP-3 Omukeev Azamat, DEP-4 Nurdin uulu Baktiyar, PLUAD #4 Kuchukov Joomart, DEP-11 Omurov Nurlan, DEP-33 Samakov Taalai, DEP-35	Detailed Inspection of bridges including Infrared Camera, Schmidt Hammer, Carbonization depth

8	Nov 13, 2014	OBI UAD	Amanov Kushtarbek (PLUAD #1) Dubashev Nur (BO UAD)	Akmatov Ikmarali , OBI UAD Jalilov Yrysbai , DEP-2 Shaibekov Mustafa , DEP-13 Anarbaev Erkin , DEP-46	Ditto
9	Nov 14, 2014	OSI UAD	Amanov Kushtarbek (PLUAD #1) Dubashev Nur (BO UAD)	Turdubaev Alimbek , DEP-21 Turdubaev Alimbek , DEP-21 Abdyrahmanov Tuigunbek , DEP-21 Nurmanov Askat , DEP-21 Ismanov Kahraman , DEP-44 Usenov Rajab , DEP-45 Maksutov Sulaiman , DEP-959 Dyikanbaev Maamat , DEP-960 Junusov Toktogul , OSI UAD Temirov Turdubek	Ditto
10	15-16 April 2015	Osh	Amanov Kushtarbek (PLUAD #1) Abyshev Tursunbek (PLUAD #1)		Ditto

Implementation of the 10 workshops provided in the above table satisfied the 4th indicator of Output-3.

The situation on Planned Inspection B by MT-S is shown in Photo 5-8 and Photo 5-9.



Photo 5-8 Training on Planned Inspection B at Site



Photo 5-9 Training on Input of Inspection Data into Format

5.3.3 Inspection and Condition Rating by MOTC Staff

The JICA Expert Team has provisionally made the Condition Rating based on data of initial inspection for 871 bridges carried out by MOTC staff members since 2013 to 2014. Based on these data, it was scheduled to implement the Planned Inspection-A for 194 bridges in 2015 by MOTC to complete periodic inspection for all 871 bridged in five (5) years. Planned Inspection-A and condition rating for 194 bridges by MOTC completed in September 2015.

Table 5-37 Provisional Condition Rating based on Initial Inspection

	Kyrgyz	PLUAD 1	PLUAD 3	PLUAD 4	PLUAD 5	PLUAD 6	UAD BO	UAD OBI	UAD BNT	UAD OSI
Good	500	43	46	99	16	30	125	27	46	68
Fair	205	23	23	38	8	20	43	4	23	23
Poor	85	8	11	21	4	7	17	2	11	4
Critical	56	11	4	7	3	4	4	3	9	11
Imminent	25	4	5	2	3	3	3	1	1	3
Total	871	89	89	167	34	64	192	37	90	109
No. of inspected bridges in 2015	197	21	22	34	9	15	43	8	21	24

Technology level of soundness evaluation of MOTC at the moment is as follows:

- At least able to distinguish Imminent and Critical bridges without omission
- Able to distinguish between Imminent and Critical bridges

The future tasks in MT-B about Condition Rating are as follows:

- To clarify the definition of Poor and Fair and Good
- To distinguish between Poor and Fair and Good and determine countermeasures for Fair and Good condition

5.4 Certification of Master Trainers on Inspection and Condition Rating

Regarding Planned Inspection A, Planned Inspection B and Condition Rating, MTs were examined on November 18-19, 2014. The exam was carried out on the bridge (PLUAD No. 1 DEP-43 Krasnaya Rechka-Ysyk Ata 25+000 km).

Examination carried out on Planned Inspection A (Visual inspection), Planned Inspection B (3 kinds of Detailed inspection using infrared camera, Schmidt hammer and portable drill), was also conducted on Condition Rating, based on their inspection results. Inspection results are shown in Figures 5-11 and 5-12.

A-1: Bridge passport

ПУУАД УАД	ПУУАД №1	ДЭП	ДЭП №43	Область	ЧФ
№ моста	11	Название реки водотока	Мост Ата	Категория дороги	государственного значения
Название дороги	Красная река-Мост-Ата	Местоположение, км	25-000	п.д.	19.03.09
Расчетная нагрузка	Н-13	Объективность		с.ш.	42° 41' 35"
Примечание					
[Габариты] [Ед. изм.: м]					
Длина моста	34.00	Ширина проезжей части	7.00	Ширина тротуара	0.75
				Кат. пролетов	3.00
[Материал / Тип конструкции]					
Составная часть	Материал	Конструкция 1	Конструкция 2	Количество балок	Количество плит
Пролетное строение 1	Бетон	Балка	Простая	6.00	
Пролетное строение 2	Бетон	Балка	Простая	6.00	
Пролетное строение 3	Бетон	Балка	Простая	6.00	
Опорное строение	Бетон	Одна опора	Высота опорного строения (м)	3.00	Количество опор
					2.00
[Другие элементы]					
Название	Наличие	Материал	Название	Наличие	Материал
Освещения	Есть	Металл	Температурный зазор	Есть	Закрытый зазор
					Перекла
					Есть
					Металл
					Длина(м)
					34.00
[Рисунки]					
Общий вид		Поверхность		Нижняя часть	

A-2: Damage photograph

№ 101-1415	Дата проведения инспекции 19.10.2013г.
Элемент конструкции ж/б	Расположение повреждения балка
Степень повреждения	Имя инспектора Ашырбаев Б.
№ 101-1418	Дата проведения инспекции 19.10.2013г.
Элемент конструкции ж/б	Расположение повреждения балка
Степень повреждения	Имя инспектора Ашырбаев Б.
№ 101-1414	Дата проведения инспекции 19.10.2013г.
Элемент конструкции ж/б	Расположение повреждения балка
Степень повреждения	Имя инспектора Ашырбаев Б.

A-3: Drawing

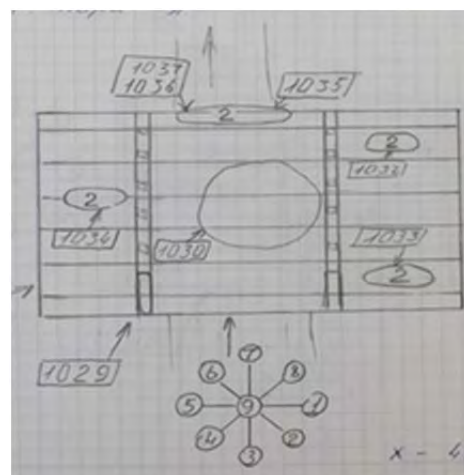

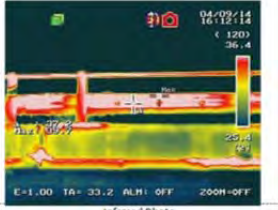


Figure 5-11 Result of Planned Inspection A

B-1: Infrared camera

PLUAD / UAD	UAD_BO	Date	04.09.2014	
DEP	DEP_No.23	Inspector	Kushnarbek	
Road name	Bishkek-Osh			
Bridge No.	299+700			
Member for attention	Girder			
Observation	The bottom and top of main girder may be a defect.			
				

B-2: Portable drill

PLUAD / UAD	UAD_BO	Date	04.09.2014	
DEP	DEP_No.23	Inspector	Kushnarbek	
Road name	Bishkek-Osh			
Bridge No.	264+400			
Point	Depth (cm)	Signature		
1	3.2			
2	4.2			
3	3.7			
Ave.	3.7			

B-3: Schmidt Hammer


PLUAD / UAD	UAD_BO	Date			
DEP	DEP_No.23	Inspector			
Road name					
Bridge No.	299+700				
Member Estimated Strength (N/mm ²)	285				
Rebound Value	Point Value	Point Value	Point Value	Point Value	Point Value
1	35	1	1	1	1
2	35	2	2	2	2
3	35	3	3	3	3
4	33	4	4	4	4
5	42	5	5	5	5
6	33	6	6	6	6
7	33	7	7	7	7
8	32	8	8	8	8
9	32	9	9	9	9
10	31	10	10	10	10
11	30	11	11	11	11
12	40	12	12	12	12
13	36	13	13	13	13
14	30	14	14	14	14
15	32	15	15	15	15
16	20	16	16	16	16
17	34	17	17	17	17
18	36	18	18	18	18
19	35	19	19	19	19
20	37	20	20	20	20
Ave.	36.55	Ave.	Ave.	Ave.	Ave.
R1	R1	R1	R1	R1	R1
Direction (Coefficient)	Horizontal				
Surface (Coefficient)	Wet				
Strength estimation equation	$F=0.098 \times (-184+13R)$ [N/mm ²]				
Record Sheet Attachment Field					

Figure 5-12 Result of Planned Inspection B

5.4.1 Planned Inspection A

Assessment points, maximum score is 100 points, are shown in Figure 5-13. “Passing mark” of 70 points must be gained.

<Points>

- To fill out the necessary information in the Bridge Passport
- To take pictures of Critical and Imminent bridges
- To draw damaged location

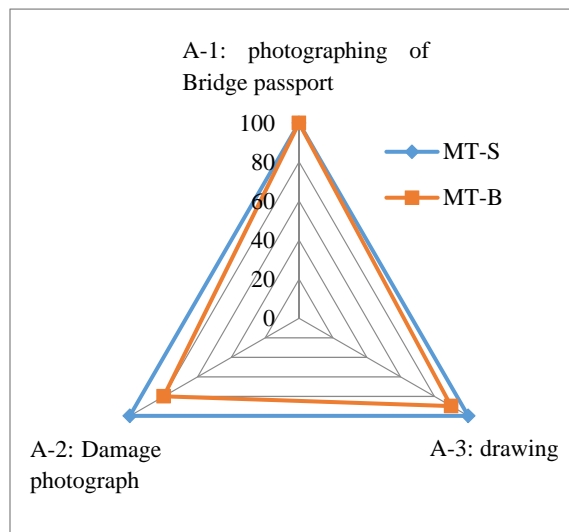


Figure 5-13 Assessment Points on Planned Inspection A

5.4.2 Planned Inspection B

If the trainer is able to identify the most significant damage when checking the ability to work with Infrared Camera on the site (setting the maximum and minimum temperatures), the trainer earns a point. When Schmidt Hammer is used, the ability to perform calculation in Excel adjustments in the corners, as well as compressive strength shall be checked. For a correct answer, the trainer gets point.

< Points >

- Ability to distinguish damaged from not damaged, as well as adjustment of suitable temperature (Infrared Camera)
- Output calculation of compressive strength (Schmidt Hammer)
- Output depth of carbonation

Assessment points are shown in Figure 5-14.

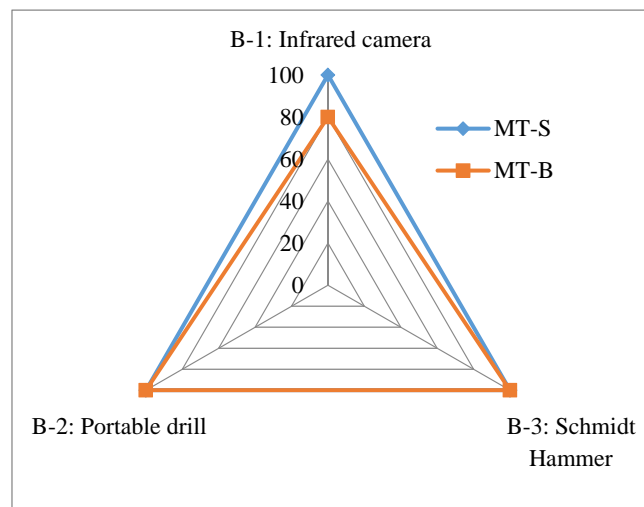


Figure 5-14 Assessment Points on Planned Inspection B

5.4.3 Condition Rating

There are four (4) levels of assessment of conducted Condition Rating, as follows:

- Level 4: Able to accurately determine bridges in Imminent and Critical conditions
Trainer gets “passing level” for the ability to determine bridges in Critical and Imminent condition. Further, he gets “passing level” for the ability to make a list of bridges in the short-term budget plan that require urgent repair.
- Level 3: Able to distinguish Critical and Imminent Bridges
Depending on the bridge condition: Imminent (\Rightarrow rehabilitation) or Critical (\Rightarrow repair) countermeasures would be different; therefore, current level oriented for the trainers who are able to differ one from another.
- Level 2: Able to distinguish bridges in poor condition (close to critical condition)
For bridges that did not reach the Critical condition, after conducting measures according to the short-term plan of Critical and Imminent bridges, it is necessary to make a long-term plan of preventive measures for bridges in unsatisfactory condition. In this connection, current level was introduced.
- Level 1: Able to give assessment up to “Fair” and “Good” conditions

All bridges are categorized into 5 maintenance levels. Thus, bridge maintenance in “Fair” and “Good” conditions, are not so significant. However, the ability to assess all five (5) levels is essential condition for the final Level 1. Assessment points are shown in Figure 5-15.

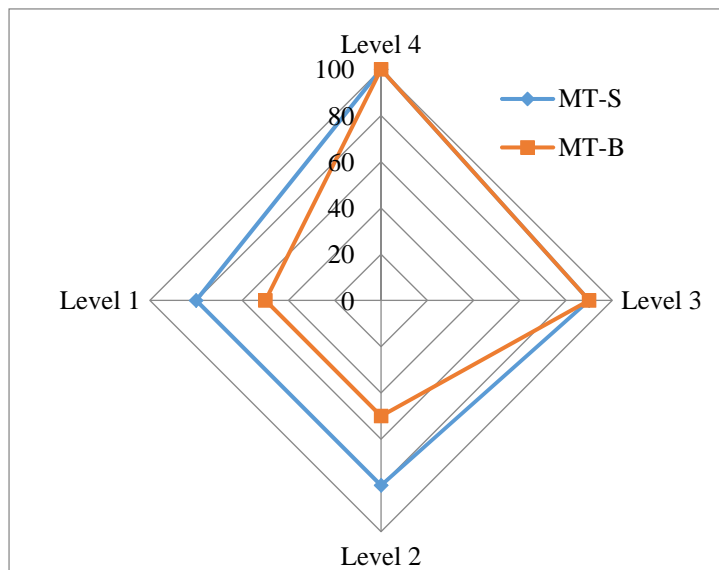


Figure 5-15 Assessment Points on Condition Rating

Assessment for the results of visual inspection of the MTs, as well as the condition rating of four (4) bridges was implemented. Moreover, as the minimum passing level in the following tests, the unerring ability to determine the bridges in Imminent and Critical conditions were checked.

- 1) PLUAD No. 1 DEP-43 Krasnaya Rechka-Ysyk Ata 25+000 km. (Poor)
- 2) PLUAD No. 1 DEP-43 Krasnaya Rechka-Ysyk Ata 27+000 km. (Critical)
- 3) PLUAD No. 1 DEP-954 Tokmok-Donaryk-Rot Front-Ivanovka 14+000 km. (Imminent)
- 4) PLUAD No. 1 DEP-954 Tokmok-Donaryk-Rot Front-Ivanovka 20+000 km. (Critical)

5.4.4 Final Examination in 2014

Final examination for bridge inspection and condition rating was carried out by paper test and interview test in 18th and 19th November 2014 in order to check personal skill achievement. Paper test consist 25 questions of four-alternative question. Since the level of understanding as 56% in average at the time of November 2014, the second examination was carried out in April 2015 after supplemental workshop for inspection and condition rating. Understanding level of the second final exam was increased by 83% after all, which could be certified as sufficient level of understanding. The paper test score of final exam is indicated in Figures 5-16 and 5-17.

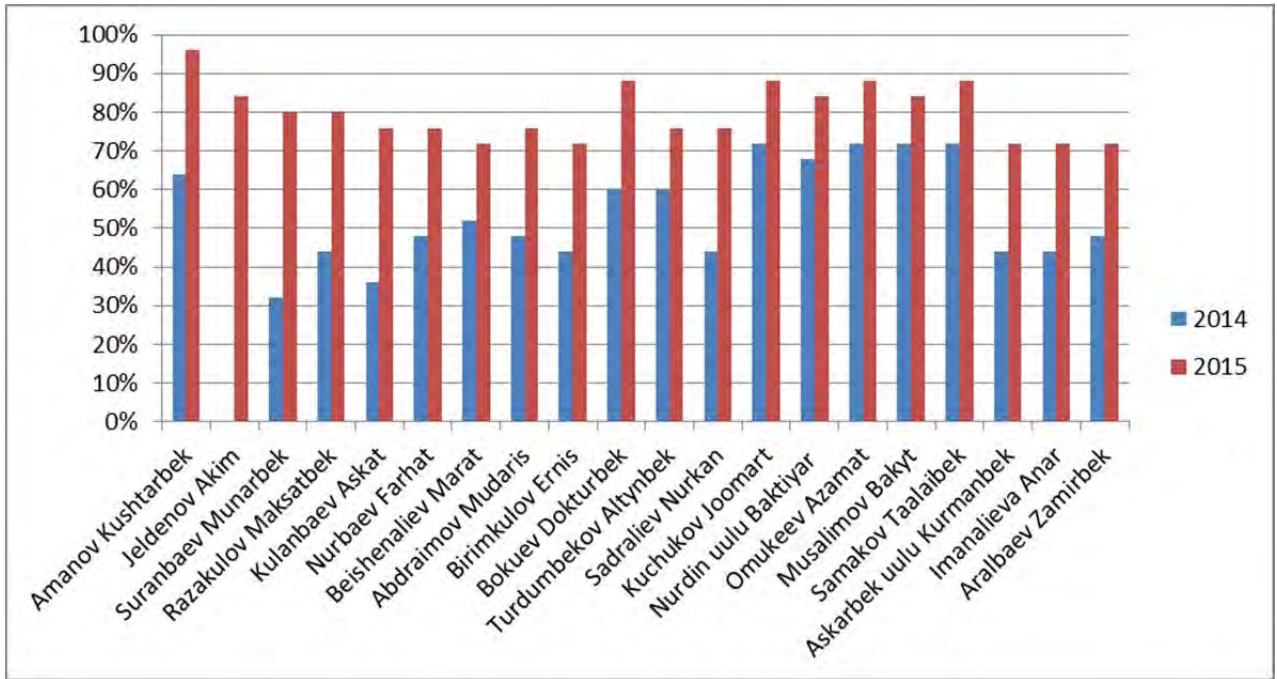


Figure 5-16 Assessment Points in Bridge Maintenance Test

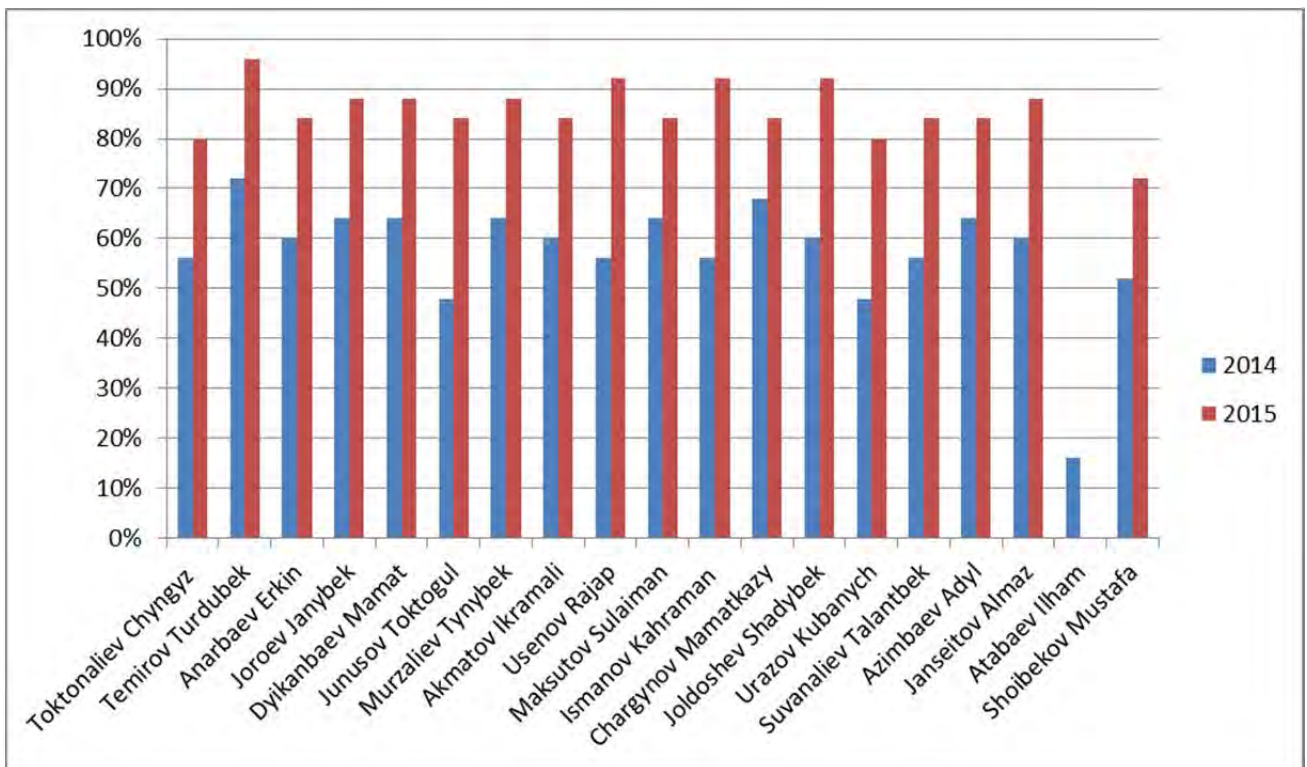


Figure 5-17 Assessment points on Bridge Maintenance Test

5.5 Preparation of Manuals

5.5.1 Routine Maintenance Manual

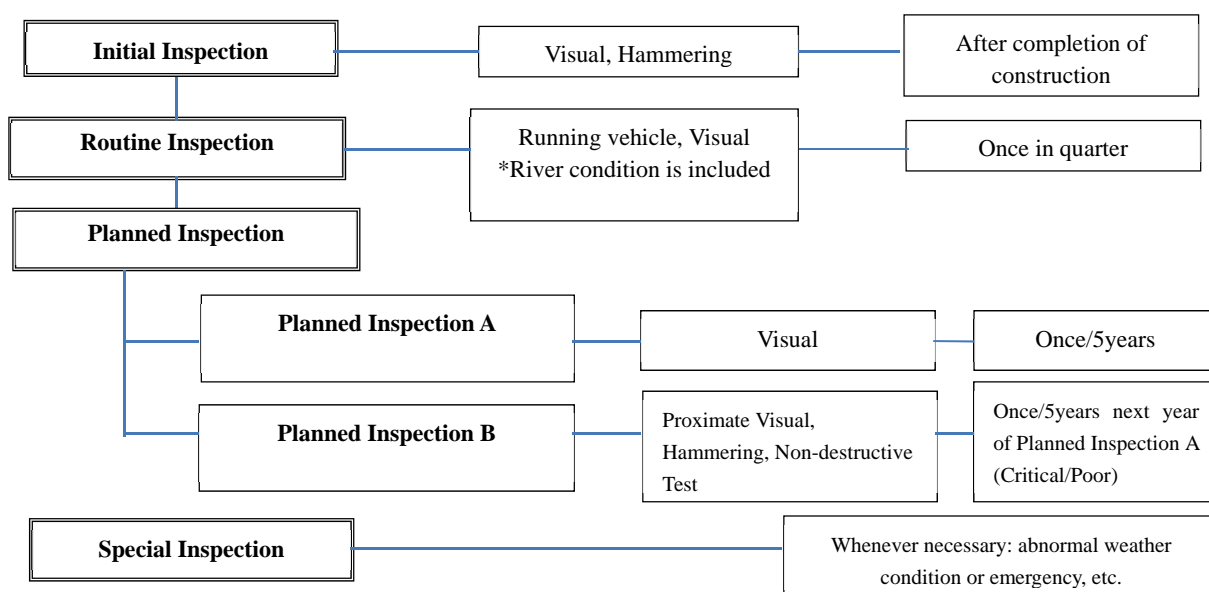
Routine maintenance manual was developed under the Project. The content of the manual is described

in Sub-clause 5.2.

5.5.2 Inspection Manual

A “Bridge Inspection Manual” was prepared in the Project by the master trainers. As shown in Figure 5-18, inspection system is classified into four (4) categories, namely; (i) Initial Inspection; (ii) Routine Inspection; (iii) Planned Inspection; and (iv) Special Inspection, in consideration of practical implementation frequency and the responsible organization given in Table 5-38.

The manual was finalized in July 2015, and authorized by MOTC in October 2015. All DEPs are going to utilize not only for the Planned Inspection A, but also for the Planned Inspection B (Detailed Inspection). The results of Planned Inspection A and B will be utilized for Condition Rating. Condition Rating will be utilized for Short-Term Budgeting and Long-Term Budgeting.



Source: JICA Expert Team

Figure 5-18 Inspection System Proposed in the Bridge Inspection Manual

Table 5-38 Organizations Responsible for Each Inspection

Inspection Category	Responsible Organization
Initial inspection	RMD/DEP
Routine Inspection	DEP
Planned Inspection A (Visual Inspection)	DEP
Planned Inspection B (Detailed Inspection)	RMD
Special Inspection	DEP

Source: JICA Expert Team

5.5.2.1 Initial Inspection

Proximity visual inspection and hammering inspection for determining the initial condition of

completed structures shall be undertaken by RMD. In the case of a newly constructed bridge, the initial condition of the bridge is usually certified at the time of take-over from the contractor. However, a considerable number of bridges with defects have been taken over due to minimal quality control through insufficient inspection during the construction period. Thus, a quality control system for the construction period shall be developed to reduce maintenance cost and hence the initial inspection results are indispensable for bridge maintenance management.

5.5.2.2 Routine Inspection

The routine inspection implemented on the quarterly basis for bridges shall be executed by visual check to monitor the presence of damage and/or defect to be improved, as shown in the following table.

Table 5-39 Information to be recorded in Routine Inspection Check Sheet

Check Items	Damage/Defect to be Recorded
Road Surface	Damage on Pavement, Defect in Expansion Joint, Clogging of Drainage
Girder	Crack, Cross-Section Loss, Corrosion
Deck Slab	Crack, Water Leakage
Substructure	Scouring, Settlement, Crack, Cross-Section Loss
Riverbank/Abutment Protection	Crack, Scouring

Source: JICA Expert Team

5.5.2.3 Periodical Inspection

(1) Planned Inspection A (Visual Inspection)

Visual inspection for bridges shall be implemented once in every five (5) years to visually determine and record the defects of structure and progress compared to the findings of prior inspection. Rough location of cracks, exposed re-bars, free lime and water leakage and photographs shall be recorded.

(2) Planned Inspection B (Detailed Inspection)

The detailed inspection for bridges shall be implemented subject to the poor/critical bridges judged by Planned Inspection A in the next year of Planned Inspection A. This inspection is to objectively investigate the damage and/or defect through detailed survey in an expert manner. Strength of major materials, precise location and scale of defects shall be surveyed and recorded. They are to be used for the evaluation of condition based on the Condition Rating Manual.

5.5.2.4 Emergency Inspection

Emergency Inspection shall be carried out to supplement routine inspections: (i) immediately after abnormal weather conditions like heavy rainfall and earthquake; and (ii) when a major accident or damage has occurred to the structure. The inspection shall be implemented to confirm whether or not the same type of accident or damage has been observed on the structure under the same conditions.

5.5.3 Condition Rating Manual

The JICA Expert Team and MTs held series of discussions to develop the Condition Rating Manual. Condition Rating shall be given to each evaluation item as specified in Table 5-40 to estimate the damage and extent of damage and/or defect. The Condition Rating is currently proposed to be classified into five (5) categories depending on the structural soundness of the item to be individually evaluated (see Table and 5-41). Practical examples for the soundness evaluation of each evaluation item are to be described in the Manual to facilitate the understanding of users.

Final approval is carried out by RMD. If it is necessary, the manual shall be modified and centrally managed by RMD.

Table 5-40 Evaluation Items for Structural Soundness

Type of Structure	Members	Evaluation Items
Concrete Superstructure	<ul style="list-style-type: none"> • Girder • Deck slab 	<ul style="list-style-type: none"> • Entire span • End of girder and deck slab
Steel Superstructure	<ul style="list-style-type: none"> • Girder (Plate girder, truss members, etc.) • Deck slab (RC, Steel) 	<ul style="list-style-type: none"> • Entire span • End of girder and deck slab

Source: JICA Expert Team



Table 5-41 Categories of Evaluation for Structural Soundness

Evaluation Category	Structural Condition
Good	No damage or slight damage
Fair	(Satisfactory Condition) The element of main structure is sound; however, small damage is found (cross-section loss, crack, peeling, scouring, etc.)
Poor	(Poor/Serious Condition) <ul style="list-style-type: none"> • Damage is in progress (cross-section loss, crack, peeling, scouring, etc.) • Fatigue crack on steel structure • Shear crack on concrete structure
Critical	(Critical Condition) <ul style="list-style-type: none"> • Structural defects (Design or construction works issues) • Severe damage or fracture on critical members is in progress • Fatigue crack of critical members on steel structure • Shear crack, moment crack of critical members on concrete • There is a possibility of loss of foundation ground of substructure by scouring.
Imminent Failure	(Imminent Failure Condition) <ul style="list-style-type: none"> • Vertical or horizontal displacement affecting stability of structure • Lack of bearing load capacity

Source: JICA Expert Team

Most of the Imminent and Critical bridges have been selected by visual judgment. However, quantitative judgment is necessary to distinguish between Critical and Poor bridges.

Examples of crack and rebar exposure are shown below.

<p>【Crack Example】 «Critical Condition» If visually possible to determine: (i) that cracks width is more than 0.3 mm, and (ii) interval between them is less than 0.5 mm (if cracks width is less than 0.5 mm, such condition is evaluated as "Poor").</p>	 <p>There are bending cracks and horizontal crack (width 0.3mm) on girder web.</p>
<p>【Rebar Exposure Example】 «Critical Condition» Condition is considered "critical" if there are many places with concrete spalling, with rebar exposure (more than 0.3m x 0.3m). If these defects are in small quantities and over a smaller scale, such condition is evaluated as "Poor".</p>	 <p>There is spalling and rebar exposure on bottom surface of girder web.</p> <p>There is rebar exposure on bottom surface of girder because of poor construction.</p>

5.5.4 Bridge Inspection Pocket Book

The judgment of deterioration mechanism and condition rating from inspection result can be considered that the individual differences of inspectors are significantly affected. Therefore, “Bridge Inspection Pocket Book” was prepared in order to reduce the individual difference of judgment, and to improve the technical capability of inspectors, in July 2015. In this pocket book, it shows some examples of the standard judgment for the deterioration mechanism and that of condition rating from actual inspection photo of the structures. During inspection, it is desirable to carry on the site and use for your help. At the moment, recorded numbers of case are still small in this pocket book. Therefore, enrichment of the contents by the RMD engineers and the utilization of this pocket book for efficient Bridge Inspection in the near future is required.

Chapter 6 Tunnel Maintenance Inspection and Condition Rating

6.1 General

Chapter 6 gives a description of the tunnels routine maintenance, planned inspection and development of manuals for tunnel routine maintenance as well as inspection and condition rating as shown in the diagram in Figure 6-1. Based on the results of maintenance works described in this chapter, formulation of the Tunnel Maintenance Management Plan is introduced in Chapter 8.

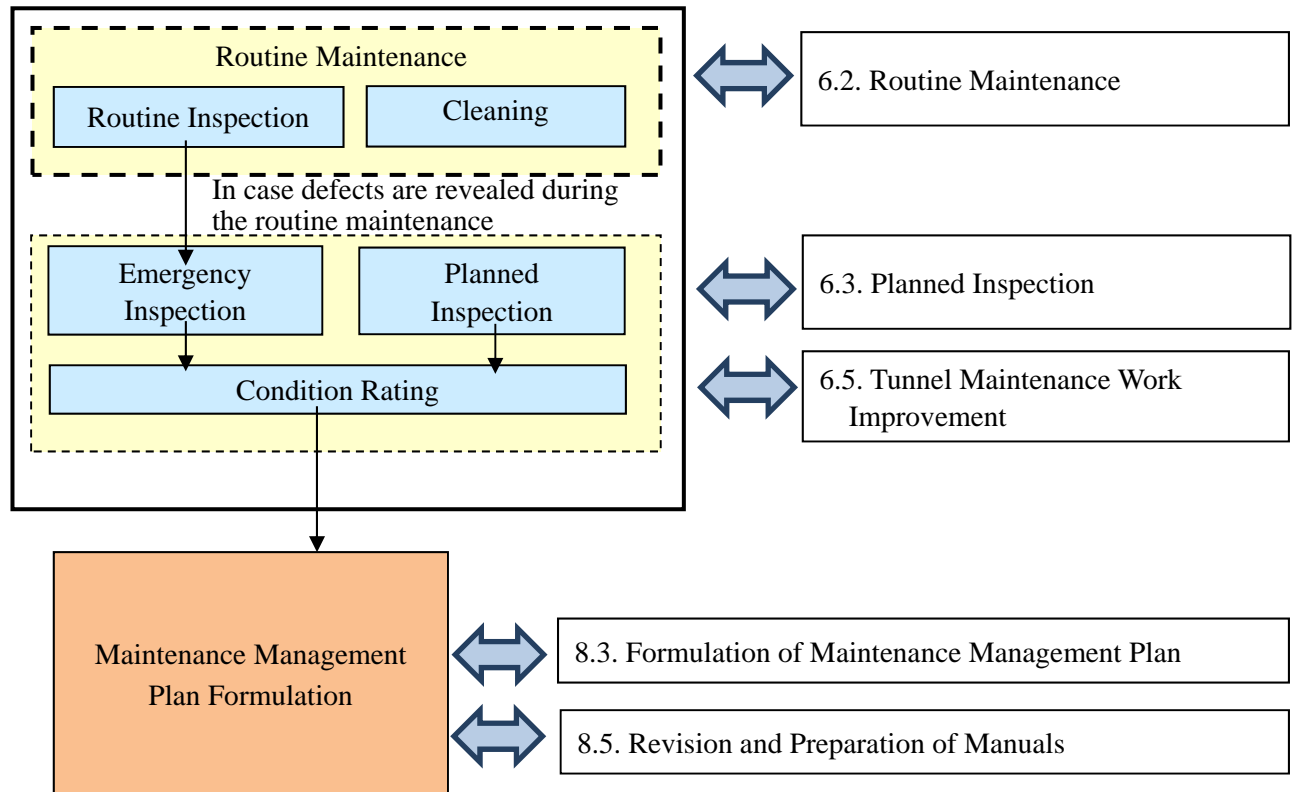


Figure 6-1 Outline of Tunnel Maintenance Management

6.2 Preparation of Routine Maintenance Manual

(1) Purpose of Routine Maintenance

Routine maintenance work consists of two (2) categories; Routine Inspection and Cleaning. The purpose of the Routine Inspection is to keep the structures/facilities in good condition and function for the early detection of changes in defects. Cleaning aims at enhancing traffic safety by removing foreign objects such as dust, soil/stone, garbage, snow, ice, etc.

(2) Works of Routine Maintenance

Types of the works of Routine Inspection are shown in Table 6-1.

Table 6-1 Types of Routine Inspection Work

Tunnel	Types of the Works	Frequency		DEP
		Summer Period (Apr-Nov)	Winter Period (Dec- Mar)	
Kolbaev	<ul style="list-style-type: none"> Tunnel inner surface (concrete spalling; water leakage, icicles); 	Every day		9
Tunnel No. 1, 2, 3	<ul style="list-style-type: none"> Portals (concrete spalling; water leakage, icicles); 	Once a week	Once a week	30
Tash-Komur	<ul style="list-style-type: none"> Road surface (fallen foreign objects; water stagnation, ice slick; pavement damage) 	Once a week	Once a week	38

Types of Cleaning Works are shown in Table 6-2.

Table 6-2 Types of Cleaning Work

Tunnel	Types of the Works	Frequency	DEP
Kolbaev tunnel; №1, 2, 3; Tash-Komur tunnel	Pavement dust removal and cleaning inside the tunnel	Once in 2 weeks	9; 30; 38
Kolbaev tunnel	Tunnel wall cleaning	More than once a year	9
Kolbaev tunnel	Central drainage system cleaning	More than 2 times a year	9

(3) Current Situation Check of Routine Maintenance

For the formulation of the Routine Maintenance Manual, Tunnel Chiefs of each DEP were given hearing on condition of tunnel construction, facility, maintenance and other issues. The list of persons interviewed during the preparation of the Routine Maintenance Manual is shown in Table 6-3.

Table 6-3 Interviewed Persons in Charge

Tunnel name	Managing DEP	Name	Position
Kolbaev Tunnel	DEP9	Altymyshev E.M.	Head of Tunnel Service
		Shopokov Erjan	Tunnel master
Tunnel No.1 Tunnel No.2 Tunnel No.3	DEP30	Seitaliev Edil	Chief engineer
		Chynaliev Erlanbek	Head of tunnel Service
		Kalygulov Belek	Head of Production & technical department
Tash-Komur Tunnel	DEP38	Momukulov B.E.	Chief engineer
		Kojobekov Nasyr	Head of Road repair section



2013.8.20 (DEP 9)



2013.8.19 (DEP 30)



2013.8.19 (DEP 38)



2013.9.20 (DEP 38)

Photo 6-1 Situation Pictures of the Hearing with DEP on Maintenance Management

(4) Preparation and Revision of Routine Maintenance Manual for Tunnel Structure

1) Preparation of Routine Maintenance Manual for Tunnel Structure.

Routine Maintenance Manual (on tunnel construction) was prepared by the Tunnel Expert based on the results of hearing with tunnel managers of each DEP. Final version of the manual was completed in consultation with BO UAD staff (2 people) based on the abridged content of the initial draft version. Dates and contents of and participation status in the seminars organized for the formulation of the Routine Maintenance Manual (on tunnel construction) are shown in Tables 6-4 and 6-5.

Table 6-4 Content of the Seminars Held to Formulate the Manual

Date	Venue	Content	Remarks
2013/8/30	BO UAD	• Formulation of Routine Maintenance Manual (tunnel construction)	
2013/9/5	BO UAD	• Formulation of Routine Maintenance Manual (tunnel construction) • Formulation of inspection, condition rating manual	
2013/9/11	BO UAD	• Confirmation of Routine Maintenance Manual (tunnel construction) • Formulation of Inspection and Condition Rating Manual	

Table 6-5 Participation Status in the Seminars

Name	Organization	Position	Date and venue		
			2013/8/30	2013/9/5	2013/9/11
			BO UAD	BO UAD	BO UAD
Shalpykov Kaldar	BO UAD	Head of Production and Quality Control department	○	○	○
Bazaraliev Beknazar	BO UAD	Head of Tunnel Service department	○	○	○

Note: ○ participated; × did not participate.



2013.8.30



2013.9.5



2013.9.11

Photo 6-2 Seminars for Formulation of the Manuals (BO UAD)

Consensus within the MOTC was achieved (Phase 1 of the Project) through the confirmation of the contents of Routine Maintenance Manual by the members of the RMD, BO UAD and DEP. The list of the participants of the meeting on confirming the contents of the Manual is provided in Table 6-6.

Table 6-6 Participants List for Manual Content Confirmation Meeting

Name	Organization	Position	Remarks
Nurmanbetov K.R.	RMD	Deputy Director	
Kaldybaev R.J.	RMD	Legal Specialist	
Duishembiev J.D.	BO UAD	First Deputy Director	
Altyмышov E.M.	BO UAD	Main Specialist	
Bazaraliev Beknazar	BO UAD	Head of Tunnel Service department	
Chynaliev Erlanbek	BO UAD DEP 30	Head of Tunnel Service	



Photo 6-3 Situation Picture of the Meeting for Content Confirmation (2013.10.23)

2) Revision of Routine Maintenance Manual for Tunnel Structure

Based on the inspection for tunnel condition check in June 2014, it was decided to amend the “Routine Maintenance Manual” prepared in October, 2013 (in Phase 1).

- The frequency of cleaning of the central drainage system in Kolbaev Tunnel was amended from “as needed” to “more than 2 times per year”.
- Date : 2014.6.18
- Participant : Beknazar Bazaraliev (Head of Tunnel Service Department, BO UAD)

The workshop on the revision of the Routine Maintenance Manual was conducted as shown in Photo 6-4. The amendment of the manual was completed with the participation of Mr. Bazaraliev, Head of Tunnel Service Department, BO UAD, because Mr. Shalpykov, Head of Production and Quality Control Department, BO UAD, who also took part in the initial formulation of the Manual in 2013, was transferred to another section not related to tunnel.

- Date of Workshop: June 18, 2014
- Participants: Beknazar Bazaraliev (Head of Tunnel Service and information support staff of BO UAD)



Photo 6-4 Workshop on Revision of Manual at BO UAD (2014.6.18)

(5) Preparation and Revision of Routine Maintenance Manual for Tunnel Facilities

1) Preparation of Routine Maintenance Manual for Tunnel Facilities

In order to formulate the Routine Maintenance Manual (for tunnel equipment), the implementation status of routine maintenance of tunnel equipment (lighting system, power distributor, backup generator, jet-fans, CCTV, emergency telephone, fire extinguisher), its functionality and quantity, etc. were directly checked at site. Moreover, each DEP tunnel managers were interviewed. Based on the collected data, the tunnel specialist developed “Inspection and Condition Rating Manual (for tunnel equipment)” and “Routine Maintenance Manual (for tunnel equipment)” with reference to various manuals used in tunnel equipment maintenance of Japan’s highways (Phase 1 of the Project)

2) Revision of Routine Maintenance Manual for Tunnel Facilities (Phase-2)

As a result of verifying operational effects of the “Inspection and Condition Rating Manual (for tunnel equipment)” and “Routine Maintenance Manual (for tunnel equipment)” developed in August 2013 (Phase-1 of the Project), it was revealed that the manuals were not being used.

After this, the location and condition of tunnel equipment (lighting system, power distributor, backup generator, jet-fans, CCTV, emergency telephone, fire extinguisher), mostly installed in Kolbaev Tunnel, were confirmed, and tunnel managers of BO UAD and DEP-9 were interviewed (2014.6.19).

As a result, BO UAD personnel has shown high motivation (the hearing showed the existence of knowledge of equipment and understanding of the system) and improved technical understanding of equipment compared to the previous years. On the other hand, DEP tunnel staff, who had been working with the equipment, demonstrated poor knowledge of equipment and routine maintenance. Based on the hearing result, components of “Inspection and Condition Rating Manual (for tunnel equipment)” and “Routine Maintenance Manual (for tunnel equipment)” were revised and consolidated into “Routine Maintenance Manual (for tunnel equipment)”. This manual was meant for the staff with less experience in tunnel equipment operation by reducing inspection contents (items). This judgment was made based on the idea that in order to achieve the level of tunnel facilities maintenance on Japan’s Highways, the local system would require a reasonable period of time, and it was considered more realistic to aim at “Minimum standards for facility maintenance” in a short term. For the explanation of the manual in a seminar, personnel of the Kolbaev Tunnel were invited to BO UAD on June 24, 2014. In this seminar not only manual revisions but also importance of equipment maintenance was discussed presenting of accident cases.



Photo 6-5 Explanation of the Manual at BO UAD in Seminar (2014.6.24)

3) Revision of Routine Maintenance Manual for Tunnel Facilities (Phase-3)

In 2014, in order to confirm the manuals operation effect, the implementation status of routine maintenance of Kolbaev tunnel equipment (lighting system, power distributor, backup generator, jet-fans, CCTV, emergency telephone, fire extinguisher), its functionality and quantity, etc. were checked at site. Moreover, each DEP tunnel managers have been interviewed (2015.6.10).

The results have shown that the “Routine Maintenance Manual (for tunnel equipment)” created in 2014 was not used properly despite the staff understood the necessity of routine inspection and cleaning works. Equipment functionality was made in a possible range (the notes about it do not exist, but the actual cleaning process was confirmed on site). In addition, from the explanations on regularity and methods of the works, high credibility of above statement can be confirmed.



Photo 6-6 The Hearing at Kolbaev Tunnel (2015.6.10)

Further approaches for the formulation of the manual are described below.

BO UAD Tunnel Chief is fully understanding the ability of the DEP tunnel management personnel and considering failure frequency of equipment, of which maintenance is partly outsourced (in 2014, one-year outsource contract for ventilation equipment and CCTV equipment is concluded). Results of the hearing on determining the reasons for why the Routine Maintenance Manual cannot be used demonstrated that “Although it is clear that 2014 version of the manual shows the minimum standards of facility maintenance, the level of knowledge of the DEP technicians is not sufficient. Therefore it cannot be used”. However, they understand the necessity of keeping records of routine inspections, so BO UAD Tunnel Chief asked to simplify the style of inspection form.

Although the Routine Maintenance Manual (tunnel equipment) formulated in June 2014 sets the minimum standards for tunnel equipment maintenance, the level of local (DEP) system is insufficient for implementing the routine maintenance in accordance with this manual. On the other hand, depending on DEP personnel organization and equipment breakdown, BO UAD made efforts to keep the equipment in a working order by outsourcing to specialists. From this fact, it is clear that BO UAD has a high awareness for tunnel equipment preservation, while not all of the DEPs are being able to catch up with it. Further approaches of the manual include the following:

(Immediate measures)

Similar to the tunnel structure, the main goal is to submit a written report by DEPs to BO UAD once a month. Specifically, it is necessary to make a record of "date and weather", "object", "work description (cleaning, repair, etc.)," "operation check" and "other comments" on the prescribed form. Then, DEP's responsible person signs upon receiving BO UAD personnel's confirmation. This shall be done monthly on any day stipulated.

(Future initiatives)

The tunnel equipment routine maintenance based on the "Routine Maintenance Manual (tunnel equipment)" assumes detection of abnormalities and prevents the breakdown of facility by light maintenance like cleaning and keeping the good working order day by day.

In addition, regarding the revised manual, the seminar was held in Kolbaev Tunnel on June 17, 2015. During the seminar, the manual's content was explained, as well as obtained the agreement from the DEP staff on implementation possibilities according to this content. Also, the guidance on maintenance management methods was carried out.



Explanation of the Manual content




The guidance on maintenance methods

Photo 6-7 Seminars on the Revised Manual (2015.6.17)

(6) Routine Maintenance

The tunnel routine maintenance (for tunnel structure) has been implemented based on the manual developed in this Project from January 2014. The report has been submitted almost every month. Although there are months without reports. Therefore, in order to implement the routine maintenance thoroughly, BO UAD which manages all of the tunnels issued the Director-General Instruction (2015.02.27) which assumes the obligation of routine maintenance. The order issued by BO UAD is shown in Figures 6-2 and 6-3.

Кыргыз Республикасынын транспорт жана коммуникациялар министрлиги
БИШКЕК-ОШ
АВТОМОБИЛЬ ЖОЛУНУН
МАМЛЕКЕТТИК ДИРЕКЦИЯСЫ



Министерство транспорта и коммуникаций Кыргызской Республики
ГОСУДАРСТВЕННАЯ ДИРЕКЦИЯ
АВТОМОБИЛЬНОЙ ДОРОГИ
БИШКЕК-ОШ

№ 26/01 «27» 02 2015 ж.

**Б У Ю Р Т М А
РАСПОРЯЖЕНИЕ**

**«О выполнении требований
Руководства по текущему
техническому обслуживанию тоннелей»**

В целях выполнения требований Руководства по текущему техническому обслуживанию тоннелей находящихся на автодороге Бишкек-Ош, а также в целях своевременного заполнения разработанных форм выполненных работ,

О Б Я З Ы В А Ю :

1. Начальникам ДЭП-9, 30 Токтомамбетову Н., Сейталиеву Э. ежемесячно потребовать выполнения требований Руководства по текущему техническому обслуживанию тоннелей и заполнения разработанных форм по еженедельному содержанию тоннелей с фотографией выполненных работ.
2. Назначить ответственных лиц по ведению делопроизводства из числа работников тоннеля им.Кольбаева и других тоннелей, обеспечить передачу требуемых документов (ежедневные отчеты и контрольные листы) в ГДАД Бишкек-Ош своевременно.
3. В случае игнорирования выполнения настоящего распоряжения и срыва совместной работы со специалистами ИСА будут приняты соответствующие меры по отношению начальников и ответственных работников тоннеля им.Кольбаева и других тоннелей.
4. Настоящим распоряжением ознакомить ответственных лиц и начальников и других работников по техническому обслуживанию тоннелей под роспись.
5. Контроль исполнения настоящего приказа возложить на начальника службы информатизации по обеспечению за деятельностью тоннелей Базаралиева Б.Т.


Генеральный директор  **Ж. Алиязов**

Figure 6-2 The Director-General Instruction on Obligation of Routine Maintenance (1)

Instruction

"On the implementation of the requirements of Routine Maintenance Manual of Tunnels"

Routine maintenance on the Bishkek-Osh road must be conducted as per the Tunnel Routine Maintenance Manual, and the timely completion of developed forms on performed maintenance work. In this order I hereby

Oblige:

1. The heads of DEP-9, DEP-30 Toktomambetov N., E. Seitaliev are to require tunnel staff to implement Routine Tunnel Maintenance as specifically defined and described in The Routine Tunnel Maintenance Manual. In addition, the tunnel staff is to be required to provide completed monthly maintenance forms and attached photographs of executed work.
2. Appoint persons responsible for record keeping in the Kolbaev tunnel and other tunnels, to ensure the submission of the required documents (routine maintenance reports and control lists) in BO UAD on time.
3. In the event of this Instruction being ignored and breaking the work collaboration agreement with the JICA experts, action will be taken against the chiefs and management personnel of the Kolbaeva and all other tunnels.
4. I hereby order this Instruction to be properly disseminated to the management, supervisors and other tunnel maintenance staff by way of a signed memorandum.
5. Control of execution of this Order shall lay on the Information provision and tunnel service division chief Bazaraliev BT

The Director-General J. Aliyazov

Figure 6-3 The Director-General Instruction on Obligation of Routine Maintenance (2)

The following effects can be expected by the Instruction:

- Tunnel routine maintenance is conducted on time.
- The routine maintenance sheet and control sheet are submitted on time (every month).
- Tunnel Equipment inspection is carried out frequently.
- The quality of implementing works is improved.

6.3 Planned Inspection

(1) Purpose of Inspection and Condition Rating

Planned inspection is conducted regularly and emergency inspection is conducted in case of concentrated downpour, traffic accidents, earthquakes and tunnel accidents and when defects are detected during the routine inspection. The contents of both inspections are the same.

Tunnel Inspection is conducted for the purpose of collecting and accumulating data necessary for reasonable maintenance management and early detection of defects. Defects are classified into “A”, “B” and “S” for the prioritization of measures and for judging the necessity of measures and survey.

(2) Works of Inspection and Condition Rating

The schedule and frequency of conducting planned and emergency inspections are as specified in Table 6-7.

Table 6-7 Schedule and Frequency of Planned and Emergency Inspections

Type of Inspection	Frequency of Inspection
Planned Inspection	Once a year
Emergency Inspection	Conducted in case of concentrated downpour, earthquake and accident inside the tunnel; Conducted when defects are detected during the routine inspection.

The items are to be inspected during planned and emergency inspections and the types of defect are as shown in Table 6-8.

Table 6-8 Types of Defect and Sections Inspected during Periodical Inspection

Section	Type of defect
Lining concrete Shotcrete	<ul style="list-style-type: none"> • Cracks • Spalling • Water Leakage, Icicles • Electric Cable Hanging Down
Portal	<ul style="list-style-type: none"> • Cracks • Spalling • Water Leakage, Icicles
Road pavement	<ul style="list-style-type: none"> • Cracks, Roughness, Pothole • Puddle, Ice Floe, Dust and Dirt Accumulation

Tunnel condition is rated at every 10m inside the tunnel during periodical inspection and emergency inspection. Rating is based on the standards given in Table 6-9.

Table 6-9 Routine Inspection Results Categorization.

Category	Condition rating
A	There is a defect which does not allow providing safety passage of transport. Critical condition demanding immediate measures.
B	There is a defect, which will cause a danger to a passing transport. It is needed to pay attention now and periodically provide counter-measures. Or the defect which demands more careful (detail) inspection.
S	There is no defect or it is negligible. No need for counter-measures.

Sections with “A” grade are to be repaired before the next routine inspection. (If it is impossible to complete before the next routine inspections, these sections are to be repaired within one (1) year). Inspection checklist is given in Table 6-10.

Table 6-10 Inspection checklist

	Category	
	A	B
Water leakage	<ul style="list-style-type: none"> • if puddle occurs on the road surface due to the water leakage; • in case of high risk of fallen icicles; • in case of wall flaking occurs obstructing traffic flow; 	<ul style="list-style-type: none"> • if there is water drip from a tunnel crown, as a result – road surface gets wet
Cracks	<ul style="list-style-type: none"> • if there is a possibility of concrete pieces blocked in a cracks to fall down; • in case of multiple cracks occurrence which cause concrete spalling; 	<ul style="list-style-type: none"> • when dense cracks occurs; • if there is a crack (3mm wide and more than 5m long) on the tunnel crown;
Spalling, Rockfall	<ul style="list-style-type: none"> • if there is a lining concrete spalling on the tunnel crown; • in case of shotcrete spalling which cause rock-fall; 	<ul style="list-style-type: none"> • if shotcrete spalling on the tunnel crown is detected;
Equipment which was not removed	<ul style="list-style-type: none"> • if electric cable hangs down and obstructs the traffic flow; • if there is unused equipment or its' fastening elements. 	—

※if water drip occurs on the walls then the condition rating is “S”

(3) Preparation and Revision of Planned Inspection Manual

1) Preparation of Planned Inspection Manual

The formulation procedure of “Inspection and Condition Rating Manual” is as in the “Routine Maintenance Manual” was drafted by the tunnel experts on the present tunnel maintenance situation and damages/abnormalities condition. Based on the draft manual, the content was improved and completed after consultation with BO UAD and DEP staff (see “6.2(4)1 Preparation of Routine Maintenance Manual for Tunnel Structure” for information on seminars held for the Manual development).

Inspection and Condition Rating Manual is as a routine maintenance manual was confirmed by RMD and BO UAD members. Thus, the consensus regarding the content within the MOTC has been achieved. (The Project’s Phase-1)

2) Revision of Planned Inspection Manual

For the purpose of ensuring sustainable continuation of conducting planned inspection and concerning the planned inspection results and its methodology from May 2014, the following items have been revised in “Planned Inspection and Condition Rating Manual” developed in October 2013 (the Project’s Phase-1) (June 2014)

- The frequency of the planned inspection: twice a year → once a year
- Marking methods on the tunnel wall for planned inspection implementation
- Drawing methods on tunnel damage sketch: CAD → handwriting, scanning

6.4 Training for staff members of the MOTC

(1) Staff Responsible for Tunnels

Initially, as persons in charge of tunnel of this Project the members shown in Table 6-11 has been selected from the MOTC side.

Table 6-11 Initial Member List

Name	Organization	Position	Remarks
Shalpykov Kaldar	BO UAD	Head of Production Quality Control department	
Bazaraliev Beknazar	BO UAD	Head of Tunnel Service department	
Dubashev Nur	BO UAD	Leading Specialist	The section not related to tunnel maintenance
Muratov A.	BO UAD DEP30	Head	
Ismailov Shailoobek	BO UAD DEP9	Chief Engineer	

However, the selected persons were from the sections not related to the tunnel maintenance or DEP members actually related to the tunnel maintenance were not included in the member list. After the consultation with CP, member list was revised adding the necessary members. Table 6-12 indicates the complete member list.

Table 6-12 Revised Member List (2013 (Phase-1))

Name	Organization	Position	Remarks
Shalpykov Kaldar	BO UAD	Head of Production Quality Control department	
Bazaraliev Beknazar	BO UAD	Head of Tunnel Service department	
Altymyshev E.M.	BO UAD DEP9	Head of Tunnel Service	Added member
Ismailov Shailoobek	BO UAD DEP9	Chief Engineer	
Chynaliev Erlanbek	BO UAD DEP30	Head of Tunnel Service	Added member
Kojobekov Nasyr	BO UAD DEP38	Head of Road Repair section	Added member

※Regarding the member from DEP38 of BO UAD, initially the CP selected Chief Engineer Momukulov B.E., but actually the tunnel maintenance has been implemented by Kojobekov Nasyr, so he was selected as a seminar participant.

From 2014 (the Project Phase-2), BO UAD staff Mr. Shalpykov was excluded from the member list because of transfer to another department. In addition, regarding the DEP 9 staff, Mr. Altymyshev was replaced with Mr. Erjan, the Kolbaev Tunnel Head, who actually manages the Tunnel. The member list for 2014 (Phase-2) ~ 2015 (Phase-3) is shown in Table 6-13 below. However, not only the following members but many other employees participated in the seminars held at each DEP.

Table 6-13 Revised Member List (2014 (Phase-2)~2015 (Phase-3))

Name	Organization	Position	Remarks
Bazaraliev Beknazar	BO UAD	Head of Tunnel Service department	
Shopokov Erjan	BO UAD DEP9	Head of Kolbaev Tunnel	revised
Chynaliev Erlanbek	BO UAD DEP30	Head of Tunnel Service	
Kojobekov Nasyr	BO UAD DEP38	Head of Road Repair section	

(2) Contents of Training and Participants

The trainings were conducted in accordance with the content provided in Table 6-14. The seminar for the explanation of “Routine Maintenance Manual” carried out on September 18 at DEP30 office for DEP staff by Mr. Bazaraliev, the Chief of the BO UAD Tunnel Section.

Table 6-14 Content of Trainings

Date	Venue	Contents	Remarks
2013/9/17	DEP30	<ul style="list-style-type: none"> • Explanations regarding tunnel present condition and damages. • Planned inspection implementation and condition rating methods • Recording methods on planned inspection forms 	
2013/9/18	Tunnel No.2	<ul style="list-style-type: none"> • Explanations and practice on planned inspection and condition rating implementation 	
2013/9/18	DEP30	<ul style="list-style-type: none"> • Development of Inspection and condition rating manual • Explanation of Routine Maintenance manual(BO UAD~DEP) 	
2013/10/9	BO UAD	<ul style="list-style-type: none"> • Explanations regarding tunnel present condition and damages. • Planned inspection implementation and condition rating methods • Recording methods on planned inspection forms 	The seminar was held for 2 person who could not take part on seminar on Sep.17

Participants in the trainings are shown in Table 6-15.

Table 6-15 Participants in Trainings

Name	Organization	Date and venue	
		2013 9/17,18	2013 10/9
		DEP30 Tunnel No.2	BO UAD
Shalpykov Kaldar	BO UAD	○	-
Bazaraliev Beknazar	BO UAD	○	-
Altymyshev E.M.	BO UAD DEP9	×	○
Sh.Ismailov	BO UAD DEP9	×	○
Chynaliev E.O.	BO UAD DEP30	○	-
Kojobekov Nasyr	BO UAD DEP38	○	-

Note ○ : participated; × : did not participate; — : no need for participation

Although the seminar held at DEP 30 on September 17-18, 2013 was planned in advance, 2 of the DEP 9’s staff could not take part because of circumstances. Therefore, training on inspection methodology, etc. was organized for these 2 persons later (on October 9).



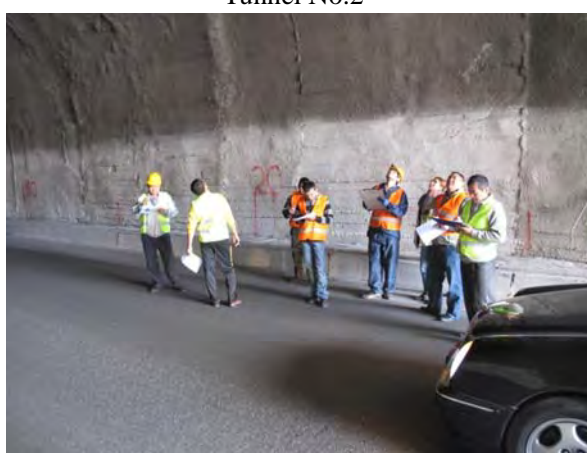
2013.9.17 DEP30
 Training on inspection methodology
 (lecture in office)



2013.9.18 Tunnel No.2
 Training on inspection methodology
 Tunnel No.2



2013.9.19 Tunnel No.2
 Training on inspection methodology
 Tunnel No.2



2013.9.19 Tunnel No.2
 Training on inspection methodology
 Tunnel No.2



2013.9.19 DEP 30
 Explanation of the Routine maintenance
 management methodology for DEP responsible
 persons from BO UAD staff



2013.10.9 BO UAD
 Training on inspection methodology

Photo 6-8 Training on Inspection Methodology

(3) Site Training

1) Target Tunnel for Site Training

The tunnel No.2 managed by DEP 30 and located in south-west of Kara-Kol town was selected for site training due to the following reasons.

- Existence of damages as spalling, cracks, water leakage etc.
- The tunnel was the object of JICA, SAPS Projects in 2011-2012 and its damage condition has been checked (recorded) already. Therefore, it is assumed that the practice in this tunnel would be effective.

2) Necessary Tools

Materials used during the practice shown in Table 6-16. During the training, it was necessary to put the car inside the tunnel, because the power for lighting equipment supplied from car battery. In this respect, to inform other vehicles about stopping car inside the tunnel as well as purpose of safety improvement, the patrol lamp was installed on the top of the car.

Table 6-16 Used tools

Items	Tools/instruments
Inspection tools	Inspection hammer, convex, ESLON tape, lacquer spray (red)
Inspection equipment	Floodlight
Safety tools	Safety vest, helmet, patrol lamp



ESLON tape, lacquer spray



Floodlight
 Safety vest, helmet



Patrol lamp

Photo 6-9 Hearing implementation

3) Evaluation during the Implementation of Site Training

Two persons belonging to the BO UAD have very high awareness of tunnel maintenance. It is expected that they have fully understood the manuals contents from the fact that they mainly completed the manuals. Also they have made all explanations related to manuals contents during confirmations with DEP personnel and MOTC. Regarding the inspection condition rating, BO UAD personnel has reached the level when they can enter the inspection results into the tunnel damage

sketch and make condition rating looking at the manual. However, it is necessary to confirm the implementation of planned inspection and check its capacity again.

Regarding the responsibility for tunnel maintenance of each DEP staff, DEP 9 staff who manages Kolbaev Tunnel and DEP 30 staff who manages Tunnel No.1, 2, 3 have high awareness on tunnel maintenance. On the other hand, the responsibility level of DEP 38 for Tash-Komur tunnel maintenance is extremely low. It is assumed that this difference comes from the damage level of each tunnel (Tash-Komur Tunnel managed by DEP 38 has almost no damage). Regarding the knowledge on tunnel damage, both two (2) staffs of DEP 9 are more than 50 years old and have vast experience so they have been fully understand the damage types. Knowledge of the two (2) responsible staffs of DEP 30 and DEP 38 on damage situation was initially insufficient, and despite participation in the training, the level of understanding remained low. However, this factor will not be an issue, because the planned inspection and condition rating conducted by BO UAD staff per the member list provided in Table 6-17.

Table 6-17 Tunnel Trainings member list

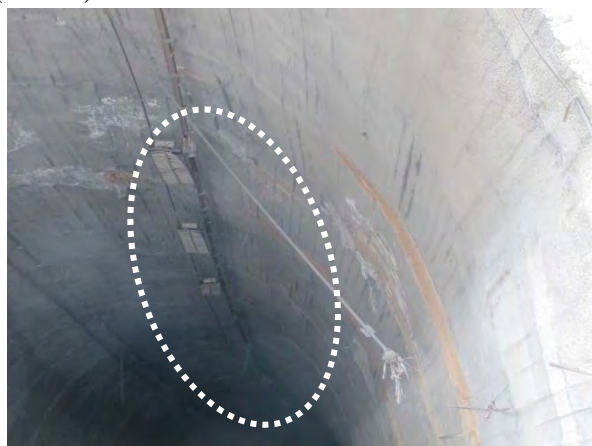
Name	Organization	Position	Remarks
Shalpykov Kaldar	BO UAD	Head of Production Quality Control department	
Bazaraliev Beknazar	BO UAD	Head of Tunnel Service department	
Alтымyshev E.M.	BO UAD DEP9	Head of Tunnel Service	
Ismailov Shailoobek	BO UAD DEP9	Chief Engineer	
Chynaliev Erlanbek	BO UAD DEP30	Head of Tunnel Service	
Kojobekov Nasyr	BO UAD DEP38	Head of Road Repair section	

6.5 Tunnel Maintenance Work Improvement

(1) Tunnel Structure

1) Non-Functioning Equipment on Tunnel Crown

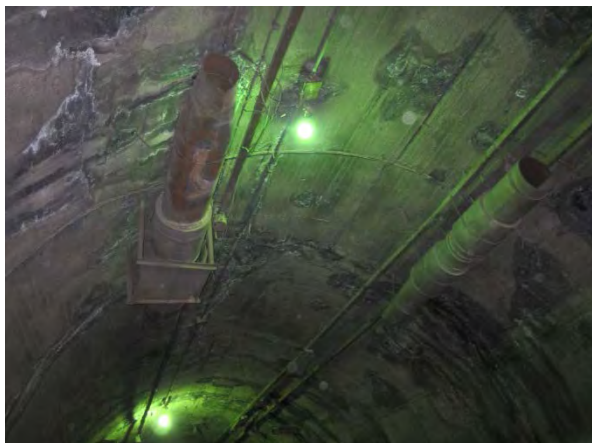
Not functioning lighting equipment and jet fans on the crown of Tunnel No.1, No.2, No.3 and Tashkomur Tunnel were left intact. This unnecessary equipment could be an obstacle during detailed inspections or repair works and also it was dangerous and could fall down because of deterioration (2013.8).



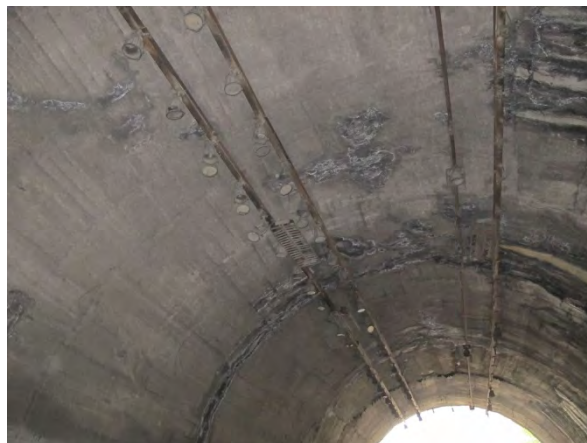
Tunnel No.1



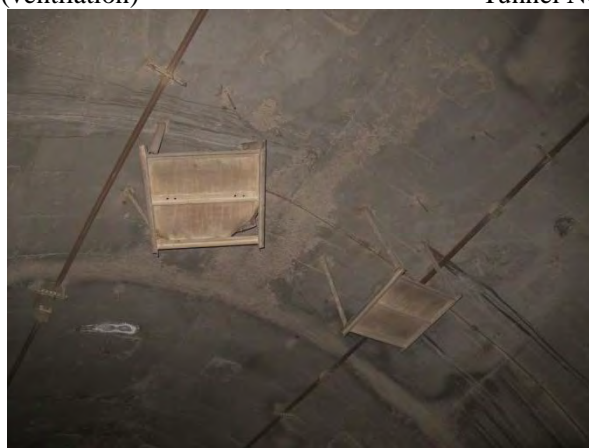
Tunnel No.2



Tunnel No.3 (ventilation)



Tunnel No.3 (lighting)



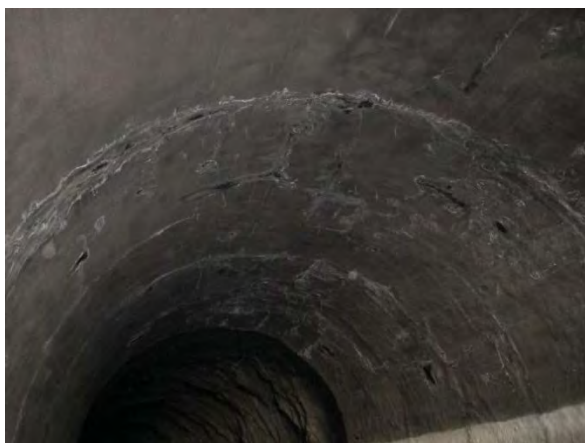
Tashkomur Tunnel

Photo 6-10 Unnecessary Equipment on the Tunnel Crown (2013.8)

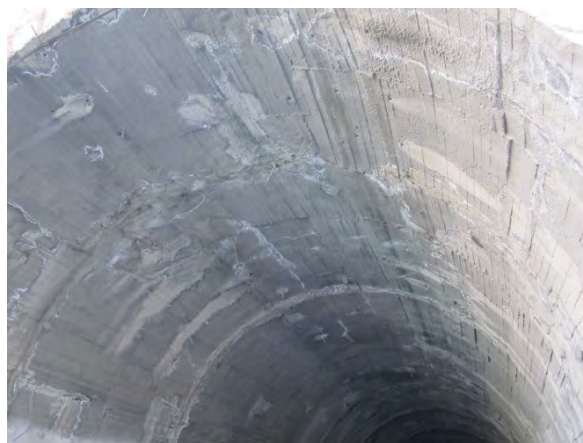
As a result of introduction, explanation and pointing out of the disadvantage of nonfunctioning equipment in the Routine Maintenance Manual developed in this Project's Phase-1, in autumn 2013 lead works to remove them by turn.

- Tunnel No.1, No.2 : Removal finished in October 2013
- Tunnel No.3 : Removal finished in July 2014
- Tashkomur Tunnel : Removal finished in July 2014

The each tunnel condition from June 2014 to June 2015 is shown in Photo 6-11.



Tunnel No.1 (2014.6)



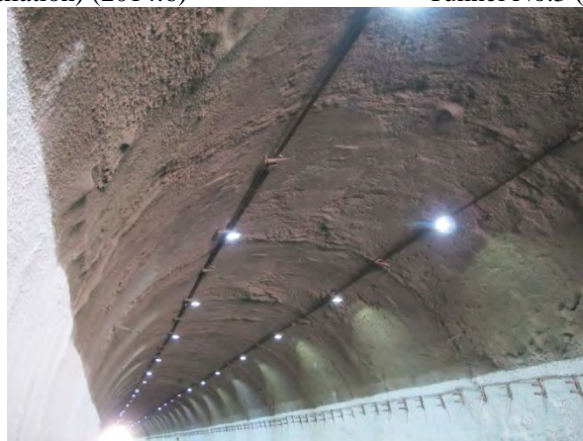
Tunnel No.2 (2014.6)



Tunnel No.3 (ventilation) (2014.6)



Tunnel No.3 (lighting) (2014.6)



Tashkomur Tunnel (2015.6)

Photo 6-11 The Condition of Unnecessary Equipment Removal on Tunnel Crowns

2) The Cable Ditch Concrete Cover on Roadsides in Tunnel

There are ditches where put the equipment cable in Tunnels No.1 and No.2. The covers (concrete) of the ditches partly opened and were left disorderly. (2013.8).

By putting the covers in appropriate position it would be possible to walk on ditch covers and ensure the safety during the routine maintenance.



Tunnel No.1



Tunnel No.2

Photo 6-12 Condition of Ditch Covers on Tunnel Roadsides (2013.8)

As a result of introducing in the Routine Maintenance Manual developed in this Project's Phase-1, pointing out and explanation of the disadvantage of nonfunctioning equipment in workshops etc., in January 2014 lead works to put the concrete covers on appropriate position. At present, except the broken covers, all the covers are put back on its position.

The present condition inside the tunnels is shown in photos 6-13 and 6-14.



Photo 6-13 Putting Back the Covers on Appropriate Position (Provided from BO UAD)



Tunnel No.1



Tunnel No.2

Photo 6-14 Improvement of Ditch Covers on Roadsides of Tunnel (2014.6)

3) The Wall Damage in Kolbaev Tunnel

Near the Osh side portal (south portal) of Kolbaev Tunnel the ground water freezing at the back of the lining causes its breakage (2014.6).



Photo 6-15 The Condition of Kolbaev Tunnel Wall Damage (2014.6)

The existence of this damage was confirmed by the responsible person of BO UAD, so by June 2014 the repair work for it has been already included into budget plan. After this, from June to September 2014 the lining walls repair was carried out. Furthermore, the waterways situated on the ground surface were renovated in order to suppress as much as possible ground water inflow into the tunnel.

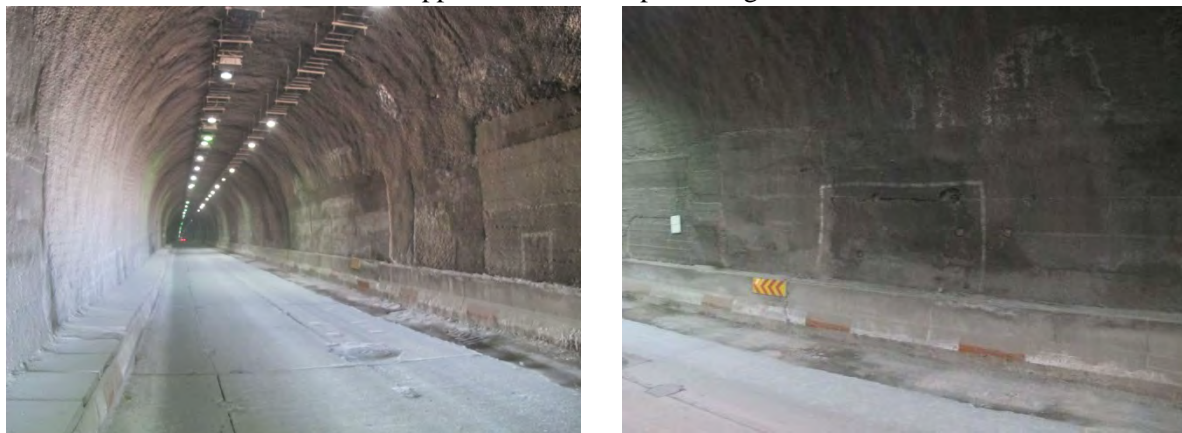


Photo 6-16 The Condition of Wall Renovation in Kolbaev Tunnel (2015.6)

4) Reconstruction of Tashkomur Tunnel Retaining Wall Joint to Tunnel

Since the cut slope ground surrounding Tashkomur Tunnel portals unconsolidated and exposed, at the time of rainfall the surface scoured and flew out, so the ground and sand flew into the tunnel (2013.8)



Photo 6-17 The Situation on Osh Side Portal of Tashkomur Tunnel Osh (2013.8)

At the Bishkek side portal the heightening of existing retaining wall has been completed. At the Osh side portal by the June of 2015 the works have been still implementing.



Bishkek side portal



Osh side portal

Photo 6-18 The Improvement Condition of Tashkomur Tunnel Osh Side Portal Surroundings (2015.6)

(2) Tunnel Facilities and Equipment

1) Lighting Equipment

The insufficient lighting may not only decrease the safety of maintenance staff and vehicle passage but also make the detection of damage at early stage difficult. In Kolbaev Tunnel high-pressure sodium lamps were installed. However, the distance between them was too long or the lamps often burnt-out, causing insufficient lighting power in tunnel and the existence of continuous unlighted spaces.

Replacement of lighting system in Kolbaev Tunnel was included into 2013 budget year. Although the cost for maintenance in the Kyrgyz Republic is included into the budget plan, it may be reallocated on to other expenses. Because of continued appeal of light necessity and its importance through the Project's seminars and workshops, the budget plan appropriately implemented and the LED lighting system was installed in 2013.

By setting the LED light the tunnel inside have become lighter and the passage safety and work environment for tunnel staff significantly improved.



2013.8



2014.6

Photo 6-19 The Condition Of Lighting System in Kolbaev Tunnel

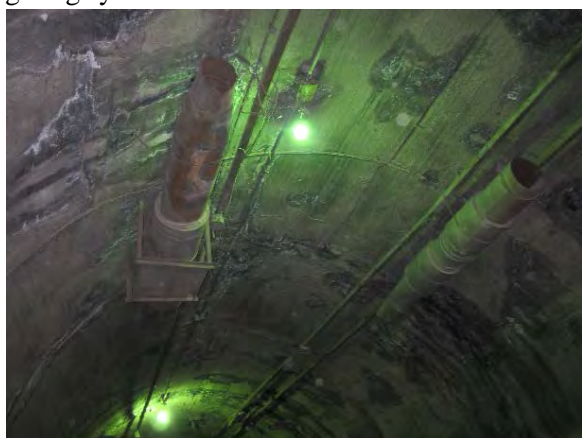
Furthermore, to illuminate the edges of the portal for passing vehicles, lighting at the front of Kolbaev Tunnel was installed in November 2014.



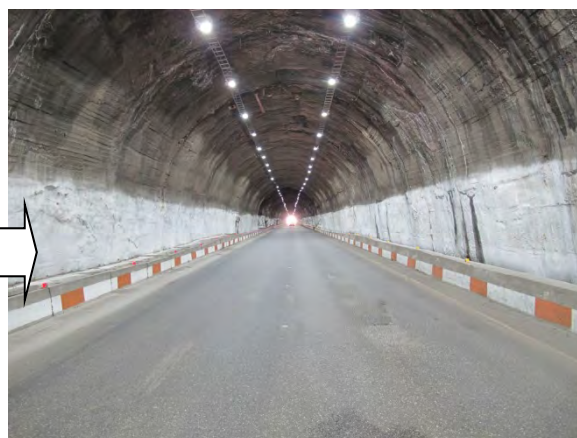
Photo 6-20 Illumination of Kolbaev Tunnel Portal (2014.6)

In Tunnel No.3 32 mercury lamps (500W with space of 10~20m) were installed. However, 16 lamps were not lighted because of leakage from the tunnel crown or cables disconnection (2013.8)

The length of the Tunnel No.3 (L=694m) is the second longest in the Kyrgyz Republic after Kolbaev Tunnel. Therefore, with the non-lighting lamps within the half of the length, inside of the tunnel was very dark. The priority of this issue's countermeasure was set as high. As a result of explanation of the importance of lighting equipment during the seminars and workshops, in September-October 2014, the lighting system was renewed.



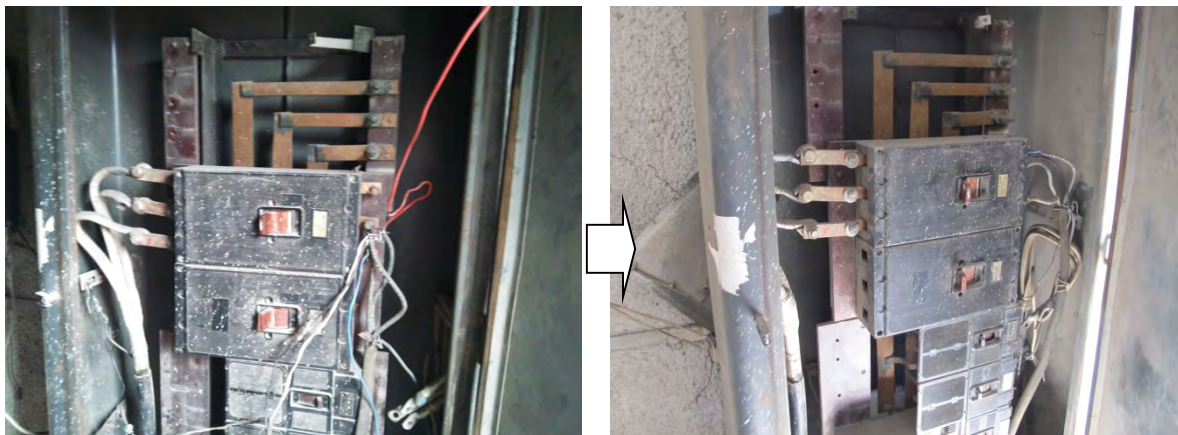
2013.8



2015.6

Photo 6-21 Lighting Condition in the Tunnel No.3

Further, the cables in power-distributing panel of the Tunnel No.3 were set disorderly preventing the cover door from closing (2013.8). This condition was also improved during the renewal of lighting system. Now the cover door closes properly.



2013.8

2015.6

Photo 6-22 The Condition of Distributing Panel at the Tunnel No.3

At the Tashkomur Tunnel up to 2013 the lighting equipment was not installed, but the evidence of lighting equipment that had been installed in the past was confirmed (2013.8).

The Tashkomur Tunnel short as 260m in length has a straight horizontal alignment. Accordingly, in comparison with other tunnels, the lighting equipment is not very necessary. Nevertheless, because of seminars and workshops explaining the necessity of lighting equipment for safety and proper maintenance works in tunnel, in October-November 2014 a new lighting system was installed.



2013.8

2015.6

Photo 6-23 Inside view of the Tashkomur Tunnel

In the past, the lighting equipment was installed in Tunnels No.1 and No.2, but up to June 2015, there had been no lighting. Now, after the explanations through workshops and seminars of the necessity of lighting of tunnels, the responsible person of BO UAD also recognizes the importance of lighting. However, because the electricity cables were not laid at the tunnels zone, installation of the lighting was not easy. For the 2015 fiscal year, the lighting system using solar and/or wind power was designed.

2) CCTV

In Kolbaev Tunnel 10 CCTV cameras for monitoring (at portals 2, inside the tunnel 8) were installed. The monitors were from Braun tube, 3 monitors out of 10 were burnt and was out of service. Regarding the video cameras, the issue was the failure to properly clean cameras, which led to blurred images (2013.8).



Monitors (Braun tube)



Video camera

Photo 6-24 The CCTV System (2013.8)

Kolbaev Tunnel's CCTV system renewal was included into the 2013-year budget. In the Kyrgyz Republic, the budget for maintenance is included into the budget plan and it is often reallocated to other items. Because of continued appeal of CCTV importance and the need of its urgent upgrade, the budget plan was appropriately implemented and the CCTV system reinstalled in autumn 2013.

The quantity of CCTV cameras increased from 10 to 28. Now it is possible to monitor every 100 m inside the tunnel. On June 6th, 2014 vehicle fire occurred inside the tunnel, but because the possibility to quickly grasp the situation by CCTV, it was possible to take urgent measures.



Monitors (Liquid crystal)

Kolbaev Tunnel operation room inside



Camera

Photo 6-25 Condition of CCTV (2014.6)

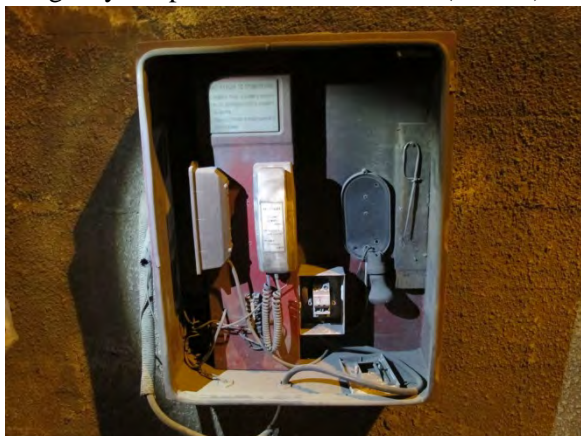
Starting from February 2015, it has been made possible to monitor the Kolbaev Tunnel in the BO UAD office in real time by video images from CCTV cameras through internet access.



Photo 6-26 BO UAD Monitors for Tunnel Surveillance in Mr. Beknazar's Office (2015.6)

3) Emergency telephone

In Kolbaev Tunnel 35 boxes of emergency telephone were installed, so by this system the base station was put in operation room connected by call with tunnel inside. The base station was broken and emergency telephone did not function (2014.6).



Emergency phone (Tunnel inside)



Base station

Photo 6-27 Condition of emergency phones (2014.6)

Since the emergency phone is very important equipment, the necessity of urgent repair of broken equipment and payment of high-level priority was explained and instructed through the seminars and workshops. As a result, in August 2014 new emergency phones were installed.



Photo 6-28 Condition of Improved Emergency Phone (2015.6)

4) Leading marks

In Kolbaev Tunnel leading marks were not installed (it is installed in Japan's long tunnels) for the case of accidents. BO UAD responsible person was introduced to the materials of the Japanese emergency equipment shown by the expert and in June 2014 consulted with experts on installation of leading marks together with emergency phones. From this fact, it is clear that the awareness regarding the equipment importance, ensuring the users' safety being up since the Project beginning.

The leading marks were designed by BO UAD responsible person and were installed in November 2014 with 200m space.



Photo 6-29 The Leading Marks in Kolbaev Tunnel (2015.6)

5) Delineators and Leading Marks

Delineators partially were installed in the past in the Kolbaev tunnel side bottom. But delineators were not functioning due to sediment accumulating on the road sides. However, by tunnel cleaning the functionality could have been reliably performed. In addition to the delineators on lateral bottom, in May 2015 delineators were tentatively installed near the tunnel center on the staff pass way. This was experimental installation of delineators. In the future, it is planned to install such delineators along the entire line of the tunnel.

Moreover, visual leading marks were installed on the tunnel walls on November 2014. The underground environment for vehicle passage was significantly improved given that the width of this tunnel is narrow.

The BO UAD personnel proposed the idea of installation of these delineators and visual leading marks not proposed from the Project. From this fact, it may be concluded that motivation of the BO UAD to improve tunnel condition was greatly improved.



Delineators (bottom side)

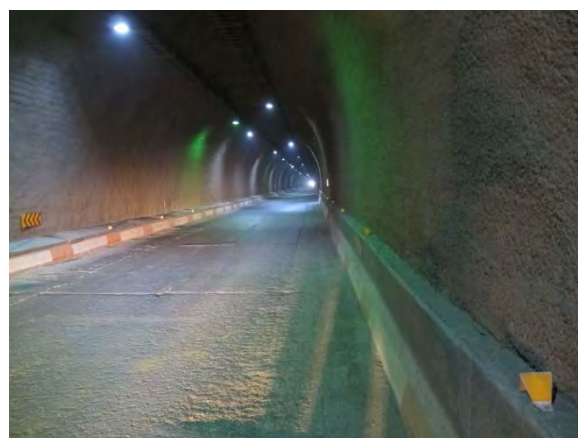
Did not function, because of sediment



Delineators (experimentally installed)



Leading marks



The tunnel inside condition

Photo 6-30 Condition of Visual Leading Marks Facility in Kolbaev Tunnel (2015.6)

In all of the tunnels other than Kolbaev Tunnel, Tunnel No.1, No.2, No.3 and Tashkomur Tunnel, delineators were installed along the entire tunnel line on the staff pass way. As a result, the environment for vehicle passage in the tunnel was significantly improved.

Particularly, Tunnel No.1 and No.2 where the installation of lighting equipment had been delayed due to shortages in power supply, the curve contour had become clearly seen thanks to these delineators. According to the hearing of DEP-30 person in charge, they had been receiving favorable reviews from the tunnel users.



Tunnel No.1



Tunnel No.2



Tunnel No.3



Tashkomur Tunnel

Photo 6-31 Condition of Visual Leading Marks Facility (2015.6)

In the Tunnel No.3, delineators were installed in the center of the lane, but they were partially damaged because vehicles were passing through the surface of delineators. In general, it may be concluded that the efforts to improve driving environment in the tunnel deserves appreciation.

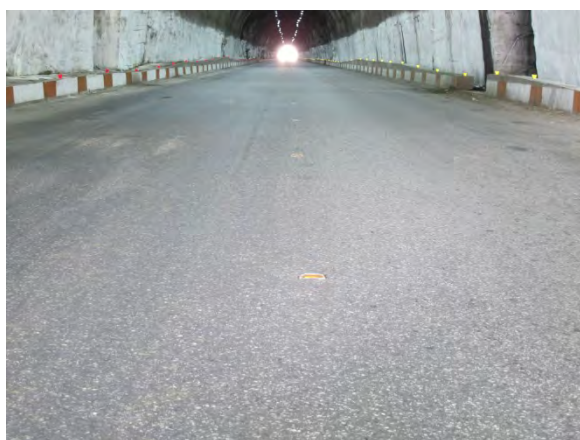


Photo 6-32 Tunnel No.3 Delineators Established in the Center of the Lane (2015.6)

(3) Other Improvement Condition

1) The Road Signs in Tunnel

Until now road sign such as speed limitation has not been installed near the portal of the Kolbaev Tunnel. Speed limit sign was installed in October 2014 which demonstrates motivation of the BO UAD to ensure traffic safety in the tunnel.



2013.8



2015.6

Photo 6-33 Condition of Leading Marks near the Portal of Kolbaev Tunnel

2) Vehicle under Tunnel Management

Wheel-mounted hoist has been used for carrying out cleaning and replacement of the tunnel lighting, etc. Purchase of lift cars for the tunnel work was considered in the 2014 fiscal year budget and they were ordered in 2014 autumn and delivered to the site in April 2015. Usage of the lift car for the tunnel maintenance work greatly improved the efficiency of the tunnel maintenance work. Purchased cars were stationed in the Kolbaev Tunnel and DEP 30 respectively.



Tunnel underground working truck (2014.6)



Tunnel work lift car(2015.6)

Photo 6-34 Improved Situation of Tunnel Working Truck

In addition, fire engine was placed at the Kolbaev Tunnel for emergency accidents. Fire engine was purchased previously, but it was out of service due to breakage. Now, after purchase of spare parts and repair in 2014 the vehicle is functioning. Also the ambulance car was bought in June 2015. After the painting the external part, it is a planned to be deployed to Kolbaev Tunnel.



Fire engine (2015.6)



Ambulance (2015.6)

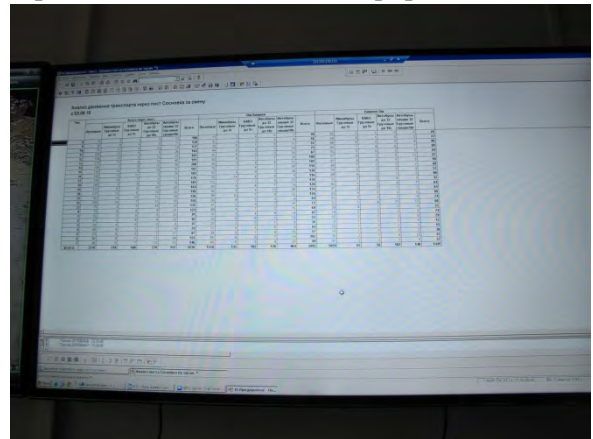
Photo 6-35 Condition of Tunnel Emergency Vehicle

3) Renovation of toll gate

Maintenance cost of the tunnel is financed by fee revenue from the toll gates installed in Sosnovka village and Kara-Kyol town. Installation of monitoring cameras in Sosnovka toll gate in February 2015, made it possible to trace the situation from the BO UAD office, and to observe the situation at the Kolbaev Tunnel. In addition, the traffic counter was installed in Sosnovka and Kara-Kyol toll gates which allowed the collection of accurate data on the exact number of traffic volume and eventually on the appropriate toll revenue to allow consideration of the purchase of the ventilation equipment.

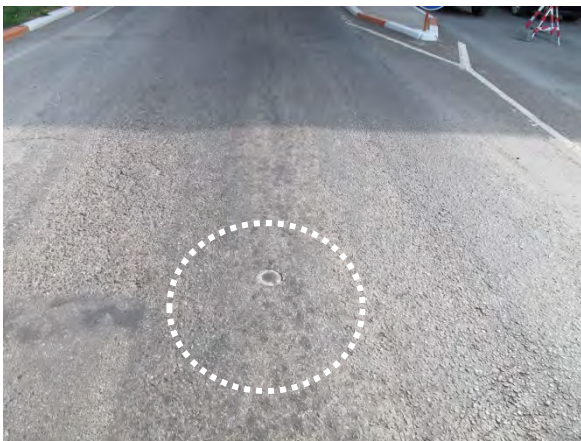


Observed status



Traffic counter

Photo 6-36 Confirmation Situation in BO UAD Beknazar's Room (2015.6)



Sosnovka toll gate (Magnetic sensor type)



Kara-Kyol toll gate (Camera type)







Photo 6-37 Installation situation of traffic counter (2015.6)









Table 6-18 and 6-19 indicate the repair and replacement condition up to present according to the necessary measures (repair, replacement) selected in the Project for each tunnel and the outline of repair and replacement works as recommended by the Project.


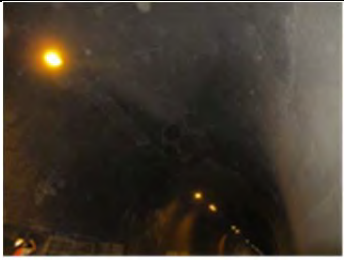



Table 6-18 Implementation and Planning of Repair and Replacement Works



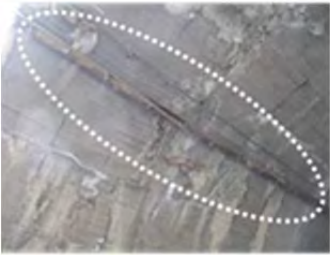



Tunnel	Issue	Repair & Replacement		Planning in the Budget of 2015	No Planning	No. of Project Report
		2013	2014			
Kolbaev Tunnel, 2,650m. Sta. #130km	1. Emergency telephone (base station and telephone boxes) is not functioning		○ July-Aug., 2014			1
	2. Several non-luminous bulbs and Installation of delineators and visual guidance sign	○	○ July 2014			2
	3. CCTV camera and monitors need replacement	○				3
	4. Repair of drainage system (damaged wall)		○ July-Sep., 2014			5
	5. Deployment of vehicles for tunnels		○ Sep., 2014	○		
	6. Insufficient fan power, noticeable by poor visibility in the tunnel				○	4
Tunnel #1, 313m Sta.#409km	7. Unremoved parts (binders and cables) from previously dismantled equipment		○ July, 2014			6
	8. Dislocated concrete ditch covers		○ July, 2014			8
	9. Lack of lighting and installation of delineators		○ Dec, 2014	○		7
Tunnel #2, 355m. Sta.#410km	10. Unremoved old non-functional equipment (of lighting and ventilation system)		○ July, 2014			6
	11. Dislocated concrete ditch cover		○ July, 2014			8
	12. Lack of lighting and installation of delineators		○ Dec, 2014			7
	13. Countermeasures for collapses			○		
Tunnel #3, 694m. Sta.#427km	14. Unremoved old non-functional equipment (of lighting and ventilation system)		○ July, 2014			6
	15. Lack of lighting and installation of delineator		○ Sep-Oct., 2014			7
	16. Incorrect cabling, bad waterproofing and weak cable connections	○	○ Sep-Oct., 2014			9
	17. Unrepaired drainage system (Leakage from joints)			○		5
Tashkomur Tunnel, 260m. Sta.#455km	18. Unremoved old non-functional equipment (of lighting and ventilation system)		○ July, 2014			6
	19. Lack of lighting and installation of delineator		○ Oct-Nov., 2014			
	20. Retaining wall near south portal			○		




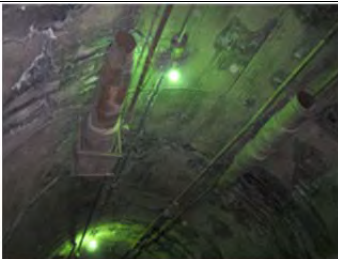



Table 6-19 Outline of Repair and Replacement Work as Recommended under the Project

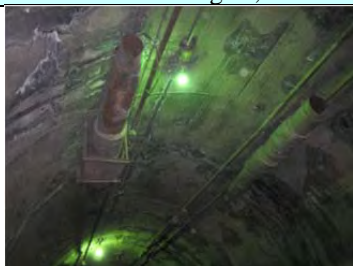






Tunnel	Issues	Repair & Replacement	
		Condition in August, 2013	Condition in June, 2015
Kolbaev Tunnel, 2,650m Sta. #130km	Emergency telephone (base station and telephone boxes)	 <p>Emergency telephones are not functioning due to breakdown of base station (35 units)</p>	 <p>Old emergency phones (inside the tunnel and base station in the office) were replaced with new high-light ones (35 units)</p>
	Lighting System	 <p>1-line yellow light with poor lighting power installed</p>	 <p>Lighting system upgraded into 2-line floodlights, autumn, 2013 Yellow lamps changed to white floodlights</p>
	CCTV camera and monitor	 <p>- CCTV Monitors are old type, based on the cathode ray tube, and often cause problems. - CCTV cameras not properly cleaned, affecting image quality.</p>	 <p>-CCTV monitors and cameras replaced with new equipment: LCD Monitors - 2 units Cameras – 28 units</p>






Tunnel	Issues	Repair & Replacement	
		Condition in August, 2013	Condition in June, 2015
			 <p>-It became possible to confirm the tunnel condition at BO UAD office through the internet.</p>
	Repair of Drainage System (Damaged Wall)	   <p>- Spring groundwater freezes in winter beyond the tunnel wall - Beyond that, collapsing wall of shotcrete exists causing thick ice flow. - Central drain hatch clogged with soil, causing water from it to spurt.</p>	  <p>- Upper drainage (for spring water removal under the tunnel) repaired - Collapsed wall repaired - Central drain cleaned</p>
	Vehicles for the tunnel	 <p>-It was inconvenient to use this equipment, because it was too old and bad mobility.</p>	 <p>-Vehicle for work at high has been deployed.</p>

Tunnel	Issues	Repair & Replacement	
		Condition in August, 2013	Condition in June, 2015
			 <p>-Fire engine and ambulance have been deployed, too.</p>
	Ventilation system	 <p>-Insufficient fan power, noticeable from poor visibility in the tunnel</p>	 <p>-The issue of insufficient fan power remains unresolved. -Traffic counter has been installed at the toll gate. So it became possible to grasp the traffic volume. -Designing cost of additional ventilation installation is included in the 2015 budget.</p>
Tunnel #1, 313m Sta. #409km	Unremoved parts (binders and cables) of previously used equipment	 <p>-In Tunnels No.1, there are fragments of broken lighting equipment. Remnants of the old equipment will not only be a hindrance to the conduct of detailed inspection or maintenance, but may also cause accidents by collapsing due to age and condition.</p>	 <p>-The fragments of broken equipment were completely removed by July 2014.</p>

Tunnel	Issues	Repair & Replacement	
		Condition in August, 2013	Condition in June, 2015
	Dislocated concrete ditch cover	 <p>-There are roadside ditch concrete covers for cable equipment in Tunnel No. 1, where covers were partially damaged, opened and disturbed.</p>	 <p>-The concrete covers were rehabilitated.</p>
	Lack of lighting/reflective road marker	 <p>-The tunnel has an arcuate shape that substantially impairs visibility in the absence of light.</p>	 <p>-Reflective road markers rather than light equipment were installed. -Lighting system is under designing.</p>
Tunnel #2, 355m Sta. #410km	Unremoved parts (binders and cables) of previously used equipment	 <p>-In Tunnels No.2, there are fragments of broken lighting equipment.</p>	 <p>-The fragments of non-functional lighting equipment were completely removed by July 2014.</p>
	Dislocated concrete ditch cover	 <p>-Concrete covers of roadside ditch and cable equipment in Tunnel No. 2 are partially damaged, open and dislocated.</p>	 <p>-Dislocated and damaged concrete covers were rehabilitated by July 2014.</p>

Tunnel	Issues	Repair & Replacement	
		Condition in August, 2013	Condition in June, 2015
	Lack of lighting/ reflective road marker	 <p>-The tunnel has an arcuate shape that substantially impairs visibility in the absence of light.</p>	 <p>-Reflective road markers rather than light equipment were installed. -Lighting system is under designing.</p>
	There are Collapses	 <p>-Collapses caused by fault line are confirmed inside the tunnel.</p>	<p>-Its countermeasure cost is included in the budget of 2015.</p>
Tunnel #3, 694m Sta. #427km	Unremoved old non-functional equipment of lighting and ventilation system	  <p>-In Tunnel No.3, there are fragments of non-functional equipment of lighting and ventilation system.</p>	  <p>-The fragments of non-functional lighting equipment were completely removed by July 2014.</p>

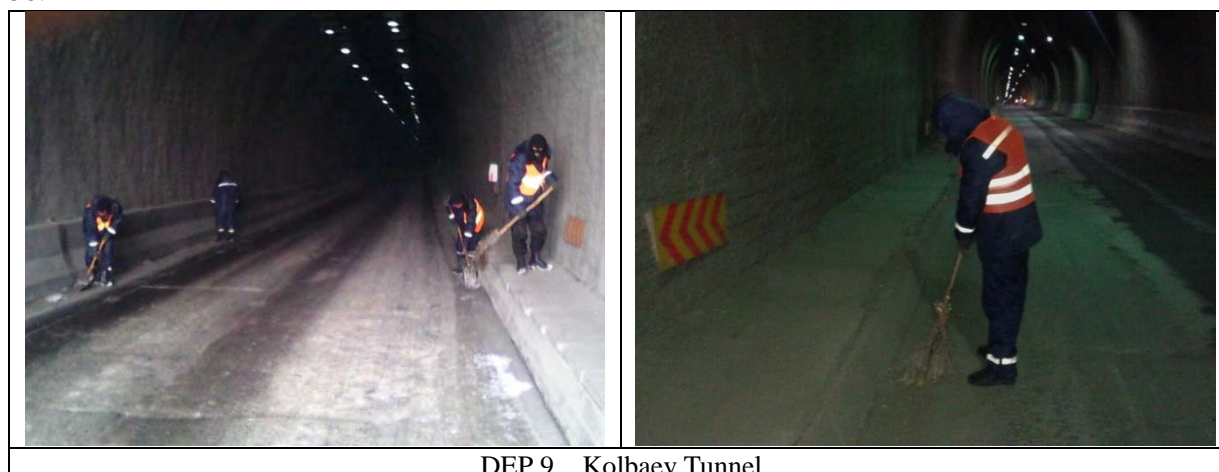
Tunnel	Issues	Repair & Replacement	
		Condition in August, 2013	Condition in June, 2015
	Lack of Lighting	 <p>-Considering the relatively high traffic volume and the length of the tunnel, the installation of lighting is necessary.</p>	 <p>-The lighting system in the tunnel was replaced in October 2014.</p>
	Incorrect cabling, bad waterproofing and weak cable connections	 <p>-Electrical wiring in the electrical panel is in a chaotic situation -The door could not be closed due to improper connection route. -The inside of the shield is covered with dust.</p>	 <p>-Electrical wiring in the electrical panel was arranged when the lighting was replaced. -The door can be closed properly. Therefore, it has become possible to prevent of dust invasion.</p>
	Drainage system repair (Leakage from joints)	 <p>-At the surface of the centermost part of Tunnel No.3, intensive water leakage occurs from the shotcrete, it is likely that the groundwater level above the shotcrete is increased. Therefore, it is necessary to prevent water leakage from the cracks.</p>	<p>-Its countermeasure cost is included in the budget of 2015.</p>
Tashkomur Tunnel, 260m Sta. #455km	Unremoved old non-functional equipment (of lighting and ventilation system)	 <p>-In Tashkomur Tunnel, there are fragments of non-functional equipment of lighting and ventilation system.</p>	 <p>-The fragments of non-functional equipment were completely removed.</p>

Tunnel	Issues	Repair & Replacement	
		Condition in August, 2013	Condition in June, 2015
	Lighting system installation	 <p>-The length of the tunnel is 260m, the tunnel is straight. -But the lighting system is necessary for the maintenance.</p>	 <p>-The lighting system in the tunnel was installed in November 2014.</p>
	Retaining wall near south portal	 <p>-During heavy rains, mudslides flow into and fill the tunnel, hampering traffic flow and tunnel maintenance.</p>	 <p>-The wall on Bishkek side is improved.</p>  <p>-The wall on Osh side is under construction.</p>

6.6 Implementation of Routine maintenance and Planned Inspection

(1) The Routine Maintenance

The Routine Maintenance Manual (for tunnels) developed by the Project, has been operated since January 2014. The condition of routine maintenance implementation at each DEP is shown in Photo 6-38.



THE PROJECT FOR CAPACITY DEVELOPMENT
FOR MAINTENANCE MANAGEMENT OF BRIDGES AND TUNNELS IN THE KYRGYZ REPUBLIC
PROJECT COMPLETION REPORT



DEP9 Kolbaev Tunnel



DEP30(Tunnel No.1)

Tashkomur Tunnel

Photo 6-38 Maintenance Condition at Each DEP (Provided by BO UAD)

A part of routine maintenance forms submitted from each DEP to BO UAD is shown below in Figure 6-4.

Контрольный Лист по Ежедневному Содержанию

Полное наименование: г.д. Бишкек-Он	Год: 2015	Месяц: апрель					
Полное наименование им. К.Колбаева	Отчет по форме (полное имя отдела ГС ГАД В О)						
Месторасположение: 129 км							
Длина: 2510м							
Частота проведения отчетных работ							
Пункты	Частота						
Очистка дорожной поверхности от гололеда и снежных наездов	1 раз в 2 недели						
Очистка стенок тоннеля	Больше 1 раза в год						
Очистка центральной дренажной системы	По мере необходимости						
Частота проведения Ежедневному содержанию							
Управляющий ДПП	Летний период (апрель-ноябрь)	Зимний период (декабрь-март)					
ДЭП №9 (Тоннель им.Колбаева)	Каждый день	Каждый день					
ДЭП №30 (Тоннель №1,2,3)	1 раз в неделю	Каждый день					
ДЭП №38 (Ташкомурской тоннель)	1 раз в неделю	2 раза в неделю					
Месяц: апрель 2015г							
День недели	1	2	3	4	5	6	7
Очистка от льда и грязи							
Ежедневное содержание	8	9	10	11	12	13	14
Очистка от льда и грязи							
Ежедневное содержание	15	16	17	18	19	20	21
Очистка от льда и грязи							
Ежедневное содержание	22	23	24	25	26	27	28
Очистка от льда и грязи							
Ежедневное содержание	29	30					
Очистка от льда и грязи							
Ежедневное содержание							
Очистка стенок	Дата выполнения: 31.04.2015г		Подпись (исполняющего)				
Очистка центральной дренажной системы							

※Структура, выполняющие отчеты, осмотра пополняются в поле "дата выполнения".
※При очистке стенок и центральной дренажной системы, вносить дату проведения и подписывать.
※Данный лист каждый месяц должен сдаваться в ГАД В О для проверки.

Подпись: заведующего отдел ежедневного отдела ДДХ

"Check Sheet"

Журнал по ежедневному содержанию

Дата	Объект	Выполненные работы/заявки на работы (с указанием участка/метра)	Мероприятие
01.04.15	Асгаров Н	Выявлено скопление снега на тротуаре №6	Зачистка тротуара
02.04.15	Кыдыралыев У	Выявлено скопление льда на дачном участке №9	Очистка дачного участка
03.04.15	Богачев А	Выявлено скопление льда на дачном участке №10	Очистка участка
04.04.15	Кашарчи Б	Выявлено повреждение бытовых отходов в парке №11	Очистка парка
05.04.15	Алиев Б	Выявлено скопление воды на дренажной стенке тоннеля на 230м метре	Слить воду
06.04.15	Богачев А	Выявлено повреждение осветительных ламп на 170м	Зачистка тротуара
07.04.15	Колбаев В	Скопление льда и грязи по краям дороги в восточной тоннели	Очистка тротуара
08.04.15	Кыдыралыев У	Выявлено скопление мусора в парке №12	Очистка парка
09.04.15	Ордобеков К	Зачистка тротуара длиной 40м на восточной стороне тоннеля	Устранить скопление
10.04.15	Абдылдаев А	Выявлено скопление льда на тротуаре №7	Зачистка тротуара
11.04.15	Алиев Ш	Выявлено скопление грязи и льда на тротуаре №3	Очистка тротуара
12.04.15	Асгаров Н	Выявлено скопление мусора в парке №13	Очистка парка
13.04.15	Алиев Б	Выявлено скопление мусора в парке №14	Очистка парка
14.04.15	Султаналиев М	Зачистка тротуара по краям проезжей части в восточной тоннели на 2470м	Подписать акты
15.04.15	Шарипов Э	Скопление льда и грязи по краям дороги в восточной тоннели	Очистка тротуара
16.04.15	Жапаров Т	Выявлено скопление грязи от люка на 5 м от входа	Зачистка тротуара от люка
17.04.15	Жапаров Т	Выявлено скопление грязи на дачном участке №5	Устранить скопление
18.04.15	Ордобеков К	Выявлено скопление воды на дренажной стенке на 3405 метре	Слить воду
19.04.15	Алиев Б	Скопление твердых бытовых отходов на парке №15	Очистка парка
20.04.15	Султаналиев М	Выявлено скопление льда на дачном участке №16	Очистка участка
21.04.15	Богачев А	Выявлено повреждение бытовых отходов в парке №17	Зачистка участка
22.04.15	Ордобеков К	Выявлено скопление льда на дачном участке №18	Очистка участка
23.04.15	Алиев Ш	Выявлено скопление мусора в парке №19	Очистка парка
24.04.15	Абдылдаев А	Выявлено скопление льда на тротуаре №11	Очистка тротуара
25.04.15	Шарипов Э	Скопление льда и грязи по краям дороги в восточной тоннели	Очистка тротуара

"Routine Maintenance Register"

Figure 6-4 Routine Maintenance Recordings Made by Each DEP

Table 6-20 indicates the frequency of routine maintenance works created based on the DEP reports submitted to BO UAD. According to this Table 6-20, all of the 4 tunnels except the Tashkomur tunnel managed by DEP 30 carry out the cleaning works in frequency set by the Manual. Particularly in the longest Kolbaev Tunnel the implementation of pavement and drainage cleaning greatly exceeds the frequency set in the Manual.

Table 6-20 Condition of Cleaning Works Implementation

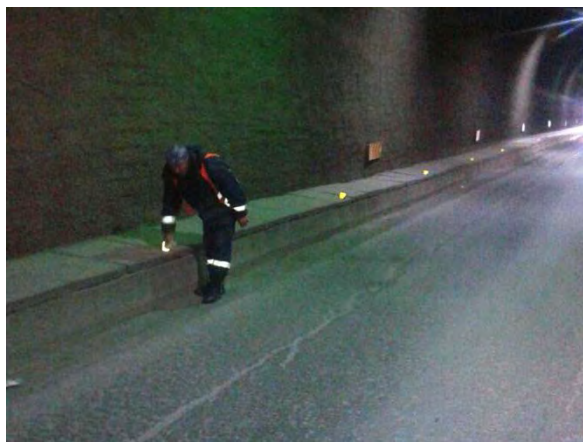
	Set frequency	The implementation status※1				
		Kolbaev	No.1	No.2	No.3	Tashkomur
Pavement cleaning	Twice/month	11.1 times /month	2.0 times /month	2.0 times /month	2.9 times /month	1.1 times /month
Wall cleaning	Once/year	Once/year	-	-	-	-
Drainage cleaning	Twice/year	8.3 times/ year	-	-	-	-

※1 : The implementation status is average value of implementation period

Further, implementation of cleaning works of leading marks and delineators which is not included in the Manual was also confirmed by the pictures taken by each DEP. These items for cleaning were not included because by the moment of Manual formulation these things were not installed. From this fact, the awareness for keeping of tunnel inside clean is being up since the Project start.



Kolbaev Tunnel



Kolbaev Tunnel

Tunnel No.1

Photo 6-39 Cleaning of Leading Marks and Delineators (Provided from BO UAD)

Routine maintenance is divided into routine inspection and cleaning works. Cleaning works have been recorded properly. Though being implemented, the recordings of the routine inspection were not made appropriately in accordance with Manual regulation (2015.6). Therefore, trainings on routine maintenance were carried out once again for DEP 9 on 2015.6.17, for DEP 38 on 6/22 and for DEP30 on 6/23.

From the photographs provided by DEP 30 it was found the issues in safety management, so at the same time the JICA Experts instructed to ensure the safety management. As for the DEP 38, because the DEP does not satisfy the requirement of the Manual in terms of pavement cleaning frequency as minimum twice a month, they were instructed once again by JICA Expert.



With DEP9 at Kolbaev Tunnel (2015.06.17)



DEP30 (2015.06.22)



DEP38(2015.06.22)

Photo 6-40 Instruction on Routine Maintenance

As mentioned above, the formats from Routine Maintenance Manual formulated in 2013 (Phase-1) and in 2014 (Phase-2) for tunnel facility inspection were not used (2015.6). Nevertheless, the cleaning of emergency phones and lighting equipment was implemented properly thanks to its renewal and purchase of a new lifting car in April 2015 located now at the tunnel site. Generally, lighting and emergency phone equipment in Kolbaev Tunnel are cleaned once in 2 weeks. In fact, during Kolbaev Tunnel inspection the lighting equipment was not very dirty and was functioning properly.



Lighting equipment cleaning



Emergency telephones cleaning

Photo 6-41 Cleaning of Lighting Equipment and Emergency Telephones (provided by BO UAD)

(2) Planned Inspection

The planned inspection based on “Inspection and Condition Rating Manual” developed within the Project was implemented on 28-29th of October 2014 mainly by BO UAD tunnel responsible person Mr. Bazaraliev. Situation pictures of the planned inspection are shown in Photos 6-42 and 6-43.



Kolbaev Tunnel Planned inspection(2014.10.28)



Tunnel No.1 Planned inspection(2014.10.29)



Tunnel No.2 Planned inspection (2014.10.29)

Photo 6-42 Tunnels Planned Inspection (Provided by BO UAD)



Tunnel No.3 Planned inspection(2014.10.29)



Tashkomur Tunnel Planned inspection (2014.10.29)

Photo 6-43 Tunnels Planned Inspection (Provided by BO UAD)

Following are overall evaluation for the Planned inspection by the BO UAD.

- Distance mark by color spray at 10m interval was properly installed prior to the inspection in accordance with the manual.

- Inspection items specified in the manual were properly inspected at 10m interval and the inspection data was organized in Excel file as shown in Figure 6-5. Minor error like incompleteness of inspection form such as miss recording of inspection date and name of inspector, were instructed by JICA Expert to improve on June 23, 2015.
- Inspection result was generally appropriate. Regarding Tunnel No.2 some damage was overlooked due to no lighting. This point was instructed at the site by JICA Expert. Since the lighting system has been newly installed in Tunnel No.1 and No.2 in 2015, it is expected this kind of situation will be improved.
- Sufficient level of understanding for tunnel inspection and evaluation was confirmed with the questionnaire survey carried out in May 2015.

Результаты Плановой инспекции тоннеля				
Название автодороги	А/д Бишкек-Ош	Порядковый номер	3	
Название тоннеля	Тоннель №2	Инспектор		
Месторасположения	410км	Дата проведения инспекции		
Длина	355м	Управление ДЭП№	ДЭП 30	

Категория оценки	A	Трещина	Откальвание	Протечка воды	Неиспользуемое и оборудование
		20m (5.6%)	20m (5.6%)	0m (0.0%)	0m (0.0%)
B	10m (2.8%)	40m (11.3%)	15m (4.2%)	0m (0.0%)	0m (0.0%)
	325m (91.5%)	295m (83.1%)	340m (95.8%)	0m (0.0%)	0m (0.0%)

Участок	Категория оценки			
	Трещина	Откальвание	Протечка воды	Неиспользуемое и оборудование
0 ~ 10 м	S	S	S	
10 ~ 20 м	S	B	S	
20 ~ 30 м	B	B	S	
30 ~ 40 м	S	S	S	
40 ~ 50 м	A	A	S	
50 ~ 60 м	S	S	S	
60 ~ 70 м	A	S	S	
70 ~ 80 м	S	S	S	
80 ~ 90 м	S	S	S	
90 ~ 100 м	S	S	S	
100 ~ 110 м	S	S	S	
110 ~ 120 м	S	S	S	
120 ~ 130 м	S	S	S	
130 ~ 140 м	S	S	S	
140 ~ 150 м	S	S	S	
150 ~ 160 м	S	S	S	
160 ~ 170 м	S	S	S	
170 ~ 180 м	S	S	S	
180 ~ 190 м	S	S	S	
190 ~ 200 м	S	S	S	
200 ~ 210 м	S	A	S	
210 ~ 220 м	S	S	S	
220 ~ 230 м	S	S	S	
230 ~ 240 м	S	S	S	
240 ~ 250 м	S	S	S	
250 ~ 260 м	S	S	S	
260 ~ 270 м	S	S	S	
270 ~ 280 м	S	S	S	
280 ~ 290 м	S	S	S	
290 ~ 300 м	S	S	S	
300 ~ 310 м	S	S	S	
310 ~ 320 м	S	S	S	
320 ~ 330 м	S	S	S	
330 ~ 340 м	S	B	B	
340 ~ 350 м	S	B	S	
350 ~ 355 м	S	S	B	

□ : Места для ввода

□ : Длина участка, требующая проведения Детального исследования
75m

※Под "требующим проведения детального исследования" подразумевается участок с трещинами, откалами или протечкой воды соответствующий на оценочную категорию A или B.

Результаты Плановой инспекции тоннеля			
Название автодороги	А/д Бишкек-Ош	Порядковый номер	2
Название тоннеля	Тоннель №1	Инспектор	
Месторасположения	409км	Дата проведения инспекции	
Длина	313м	Управление ДЭП№	ДЭП 30

Категория оценки	A	Трещина	Откальвание	Протечка воды	Неиспользуемое и оборудование
		0m (0.0%)	0m (0.0%)	10m (3.2%)	0m (0.0%)
B	0m (0.0%)	10m (3.2%)	0m (0.0%)	0m (0.0%)	0m (0.0%)
	313m (100.0%)	303m (96.8%)	303m (96.8%)	0m (0.0%)	0m (0.0%)

Участок	Категория оценки			
	Трещина	Откальвание	Протечка воды	Неиспользуемое и оборудование
0 ~ 10 м	S	S	S	
10 ~ 20 м	S	S	S	
20 ~ 30 м	S	S	S	
30 ~ 40 м	S	S	S	
40 ~ 50 м	S	S	S	
50 ~ 60 м	S	S	S	
60 ~ 70 м	S	B	S	
70 ~ 80 м	S	S	A	
80 ~ 90 м	S	S	S	
90 ~ 100 м	S	S	S	
100 ~ 110 м	S	S	S	
110 ~ 120 м	S	S	S	
120 ~ 130 м	S	S	S	
130 ~ 140 м	S	S	S	
140 ~ 150 м	S	S	S	
150 ~ 160 м	S	S	S	
160 ~ 170 м	S	S	S	
170 ~ 180 м	S	S	S	
180 ~ 190 м	S	S	S	
190 ~ 200 м	S	S	S	
200 ~ 210 м	S	S	S	
210 ~ 220 м	S	S	S	
220 ~ 230 м	S	S	S	
230 ~ 240 м	S	S	S	
240 ~ 250 м	S	S	S	
250 ~ 260 м	S	S	S	
260 ~ 270 м	S	S	S	
270 ~ 280 м	S	S	S	
280 ~ 290 м	S	S	S	
290 ~ 300 м	S	S	S	
300 ~ 310 м	S	S	S	
310 ~ 313 м	S	S	S	

□ : Места для ввода

□ : Длина участка, требующая проведения Детального исследования
20m

※Под "требующим проведения детального исследования" подразумевается участок с трещинами, откалами или протечкой воды соответствующий на оценочную категорию A или B.

Tunnel No.1 Tunnel No.2
Figure 6-5 The Part of Results of Tunnel Inspection

Photographs in 6-44 are from the trainings conducted on the base of BO UAD's planned inspection results (2015.6.23). Portable floodlight and other materials were prepared by BO UAD.



Photo 6-44 Training (2015.6.23)

Chapter 7 Bridge Maintenance Management Plan Formulation

7.1 General

The Maintenance Management Plan shall incorporate long-term and/or short-term maintenance management plans based on the results of inspection and evaluation. Since a considerable number of bridges in the Kyrgyz Republic are expected to sustain damage, systematic maintenance shall be performed in accordance with the maintenance management plan, based on engineering evaluation and appropriate management criteria, to accommodate budgetary constraints on future maintenance work. Existing bridges are currently being maintained with no objective management criteria. Only five or six seriously damaged bridges have been repaired or replaced in a year due to the limited bridge maintenance budget. To improve the situation and to facilitate bridge maintenance, the management criteria shall be regulated to include the preparation of long-term and/or short-term bridge maintenance plans for effective bridge maintenance management under the budgetary constraints. The Maintenance Management Criteria shall be defined, taking into account the safety of traffic and significance of objective roads in terms of road network.

7.2 Concept of Bridge Maintenance Management Plan

In order to plan bridge maintenance management including budgetary funds allocation, it is necessary to know nationwide condition data of bridges in need of maintenance. This process involves staff of DEP, PLUAD / UAD and RMD. Moreover, it is important to emphasize the vitality of the web translation of information. This data is sent from DEP directly to RMD in order to expedite urgent and important damage. It also ensures the accuracy of data. Each office is responsible for specific parts of the overall process of bridge data collection, assessment of these bridges and definition of countermeasures, and ultimately preparing maintenance management plan showing budgeting plan. This process is clearly described in Figures 7-1 and 7-2.

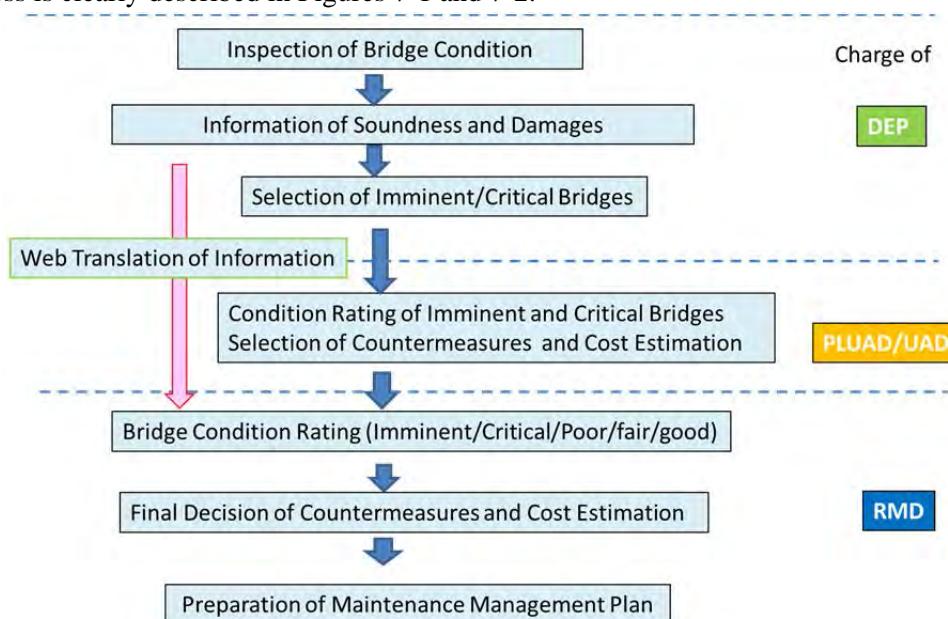


Figure 7-1 Flowchart of Bridge Data Collection

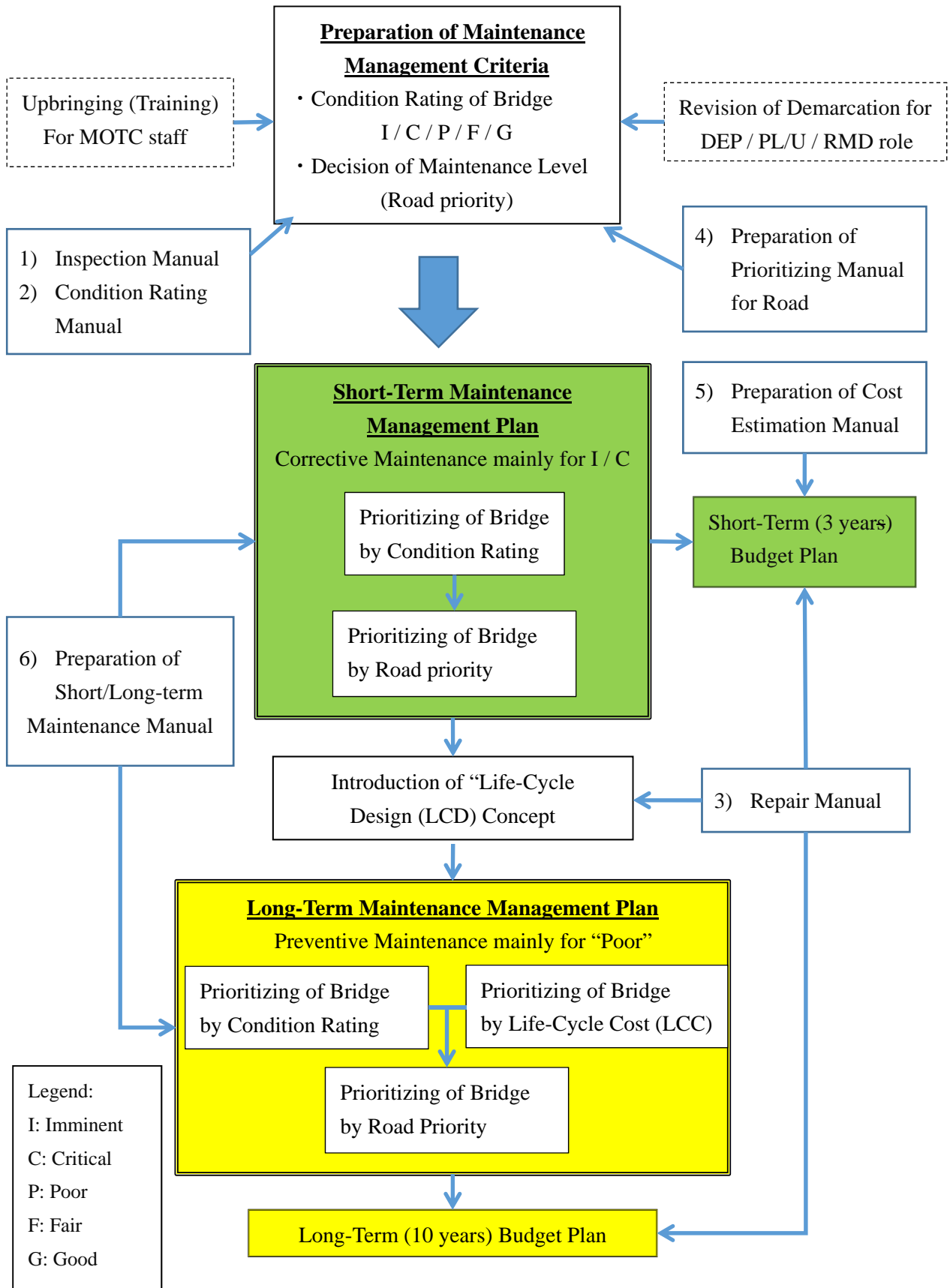


Figure 7-2 Bridge Maintenance Management Flow Chart

7.3 Preparation of Maintenance Management Criteria

7.3.1 Maintenance Management Criteria

The priority grade for bridge maintenance management is determined by two factors, bridge condition rating (structural soundness) and required road maintenance service level (Levels 1 to 3), as shown in Table 7-1. The criteria for deciding the priority grade of countermeasures for bridge maintenance is shown in Table 7-2, and the service level for road maintenance is explained in Table 7-3.

In cases of the condition rating of some bridges would be evaluated in imminent condition on the high road service level (Level 1) and low road service level (Level 2), the imminent bridges on the road service Level 1 could be prioritized at Grade I (urgent countermeasure requirement) and the imminent bridges on the road service Level 2 could be evaluated at Grade II (planned repair requirement). Countermeasures for bridge maintenance would be different with the road service level even if they are the same bridge condition rating.

Table 7-1 Countermeasure Priority by Soundness and Maintenance Level

Road Maintenance Level Structural Soundness	Level-1	Level-2	Level-3
Good	IV	IV	IV
Fair	III	IV	IV
Poor	II	III	IV
Critical	II	II	III
Imminent	I	II	II

Source: JICA Expert Team

Table 7-2 Criteria for Countermeasure Priority

Criteria	Definition of Countermeasure Priority
I	Urgent countermeasure is required
II	Detailed investigation or planned repair is required
III	Monitoring is required
IV	Nothing is required until next inspection

Source: JICA Expert Team

Table 7-3 Criteria for Maintenance Level

Level	Road Priority	Contents of Maintenance
Level-1	High (Preventive Maintenance)	To provide systematic inspection, detection and correction of incipient defect/damages either before they occur or prior to becoming major defects.
Level-2	Middle (Corrective Maintenance)	To aim at restoring a bridge and/or bridge component to a condition in which it can perform its intended function after failure detection.
Level-3	Low (Observation Only)	To observe damages until seriously deteriorated or defected until the damaged bridge becomes obsolete. In cases of serious deterioration, traffic restrictions will be introduced or the bridge will be reconstructed.

Source: JICA Expert Team

Details of the 5-level classification assessment of bridge condition are explained in Table 7-4 below:

Table 7-4 Definition of Condition Rating

Classification of Condition	Description of Structure Condition	Remarks
Good	No damage or slight damage is presented.	Monitoring for Long-Term maintenance
Fair	(Satisfactory condition) The elements of main structure is sound, however, small damage (Cross-section loss, Cracks, Peeling, Scour etc.) is presented.	
Poor	(Poor / Serious condition) <ul style="list-style-type: none"> • Damage (Cross-section loss , Cracks, Peeling, Scour etc.) is in progress • Fatigue crack in steel structure is presented. • Shear crack in concrete structure is presented. 	Long-Term maintenance
Critical	(Critical condition) <ul style="list-style-type: none"> • Structural defects (Design or construction works issues) • Severe damage or fractured critical members is in progress • Fatigue crack of critical members in steel structure is presented. • Shear crack, Bending crack of critical members on concrete is presented. • There is a possibility of lost substructure support ground by scouring 	Short-Term maintenance
Imminent	(Imminent failure condition) <ul style="list-style-type: none"> • Vertical or horizontal displacement affecting stability of Structure appears • Lack of bearing load capacity 	

Source: JICA Expert Team

7.3.2 Indicators of Prioritization for Bridge Maintenance Management Planning

Bridges estimated higher priority grade and/or required countermeasures should be prioritized in the view of three (3) aspects for bridge maintenance planning, and the road importance is to be considered the inter-regional relation and international relation, as shown in the following:

- (1) Traffic volume
- (2) The economic impact
- (3) The importance of roads
 - 1) The importance of inter-regional relations in the country

2) The importance of relations with neighboring countries

(1) Traffic Volume

Traffic volume is one of major indicators in evaluating the priority of bridge maintenance. MOTC's future traffic demand in 2025 of the nationwide road network evaluated with the technical assistance of ADB is as described in Figure 7-3.



Source: ADB, 2012

Figure 7-3 Vehicle Transportation Demand of Road Network in 2025

(2) Economic Impact

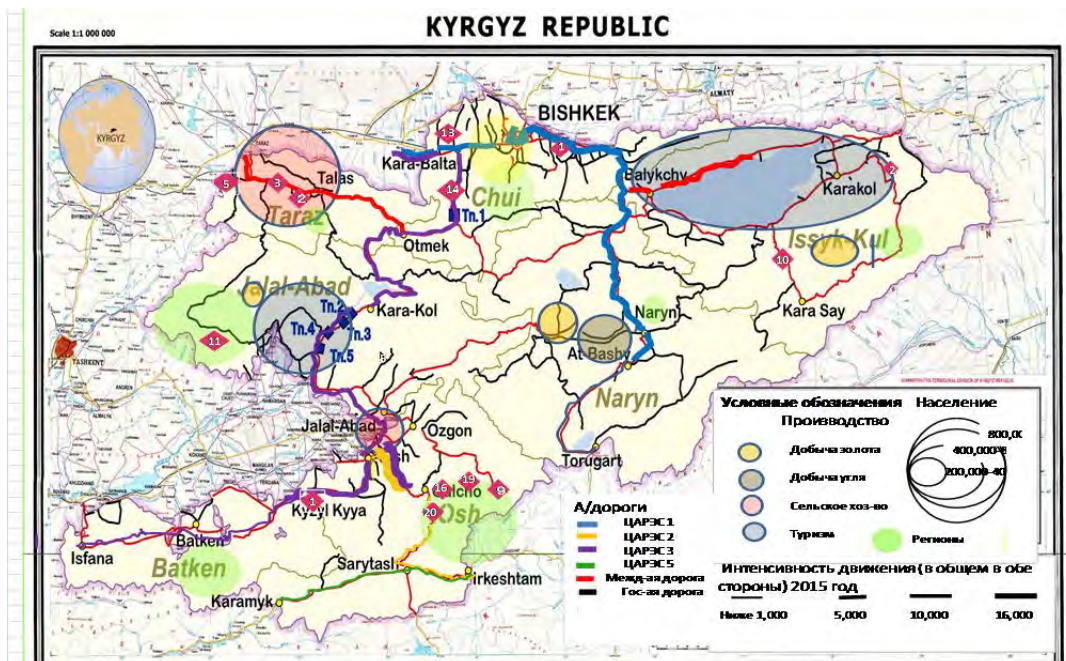


Figure 7-4 Economic Information for Determining Maintenance Priority

Information identifying the priority shown in Figure 7-4. These include traffic, location of industry and production, the route of the CAREC corridors, and the population of each of the areas.

Economic impact is one of the key factors, which determine the priority in the maintenance of bridges. The main types of industries that may have an economic impact indicators were identified as mining (gold mining and coal mining), agriculture and tourism sectors.

Based on the National Sustainable Development Strategy for the Kyrgyz Republic (for the period of 2013-2017) there have been unfavorable trends in Kyrgyzstan's exports in recent years. Weakening export capacity is manifested through reduction in supplies to traditional markets in the CIS countries, causing increased shares of raw products in exports, resulting in increasing reliance on few commodity items and export markets. Kyrgyzstan chief exports include nine commodity groups (fruits and vegetables, tobacco, cotton, textiles, inorganic chemicals, electrical energy, cement, slate, incandescent light bulbs), which amounted to 52% of all country's exports in 2011, and if to include gold, the share increases to 96% of total exports.¹

One of the main industry components is gold and coal mining. Registered gold reserves as of November 1, 2012 for 60 gold deposits amount to 448 tons, including 443 tons for 36 primary deposits, and 5 tons for 24 alluvial gold deposits. Out of all the primary gold deposits, 5 are being developed - "Kumtor," "Makmal," "Solton-Sary," "Terek," and "Terekkan." Six primary gold deposits have been prepared for commercial development ("Jeruy," "Taldybulak Levobrejnyi," "Andash," "Bozymchak," "Ishtamberdy," and "Kuru-Tegerek"), for which plans for development have already been prepared or being finalized. On other sites, companies are conducting exploration and prospecting.

The current situation in the coal mining industry is as follows:

In the northern regions of the country, substantial coal deposits are located in the Naryn and Issyk-Kul States. However, these States' markets are dominated by Kazakh coal. License agreements with 13 companies to develop deposits "Turuk," "Karakeche," "Min-Kush," and "Jyrgalga" for a long time have not been fully implemented, because neither licensee has the equipment for effective development of these deposits. In the south of the country, "Tash Kumyr," "Sulyukta," "Kyzyl-Kiya," "Kok-Yangak" deposits and other fields have been squandered among more than 30 private entities, none of which has offered an effective investment program of deposit development.²

Agriculture sector: in terms of the contribution to the economy, providing the industry with raw materials, and the population with food, and in terms of the employed population, this sector has been one of the most important priorities of the economic development of the Kyrgyz Republic. A comprehensive approach to solving existing problems in the development of this sector will help reduce social tension in the country and comprehensively approach the solution of future problems of rural development in general. The share of agriculture in GDP and the share of the employed in the industry over the last 5 years have been steadily decreasing, in 2011, the figures were, respectively, 18% and 30.7%.³

The current situation in the tourism sector is as follows.

Indicators of success in tourism include the income received thanks to cash spent by foreign citizens. According to 2011 data, revenue from tourism amounted to more than USD 630 million, with more

¹ National sustainable development strategy for the Kyrgyz Republic for the period of 2013-2017 years, p. 62

² National sustainable development strategy for the Kyrgyz Republic for the period of 2013-2017 years, p. 95-96

³ National sustainable development strategy for the Kyrgyz Republic for the period of 2013-2017 years, p. 86

than 800 thousand tourists visiting the country in 2011. The share of tourism in the GDP has hovered around 4% in the past 5 years. However, the tourism potential of the country is far from being fully exploited. According to forecasts by the World Tourism Organization, Kyrgyzstan, at an appropriate level of development of tourism infrastructure, can host up to 2.5 million foreign tourists annually, which exceeds the 2011 value 3 times as much. The country has a high tourism and recreation potential, its territory has a wide range of unique natural and recreational resources, objects of national, cultural and historical heritage. However, there are some problems that hinder further development of tourism. One of the main problems is the low level of development of tourism infrastructure, and the lack of quality road infrastructure (on almost all highways of the country).⁴

(3) Importance of Roads

The currently identified number of bridges on international and national roads is as shown Table 7-5.

**Table 7-5 Classification of Roads and Identified Number of Bridges
 on International and National Roads**

Classification	Road Length	Number of Bridges	Maintenance Category
International Road	4,163 km	418	A1, A2
National Road	5,678 km	433	B
Local Road	8,969 km	Unknown	C

Source: Prepared by JICA Expert Team

International roads can be divided into two categories A1 and A2 based on the Road Sector Development Strategy for 2007-2010 which envisages the following 8 prioritized transport corridors categorized A1 in the table of the figure below. According to the existing priorities, Priorities "A1" and "A2" are designated as international roads while "B" is for national roads.

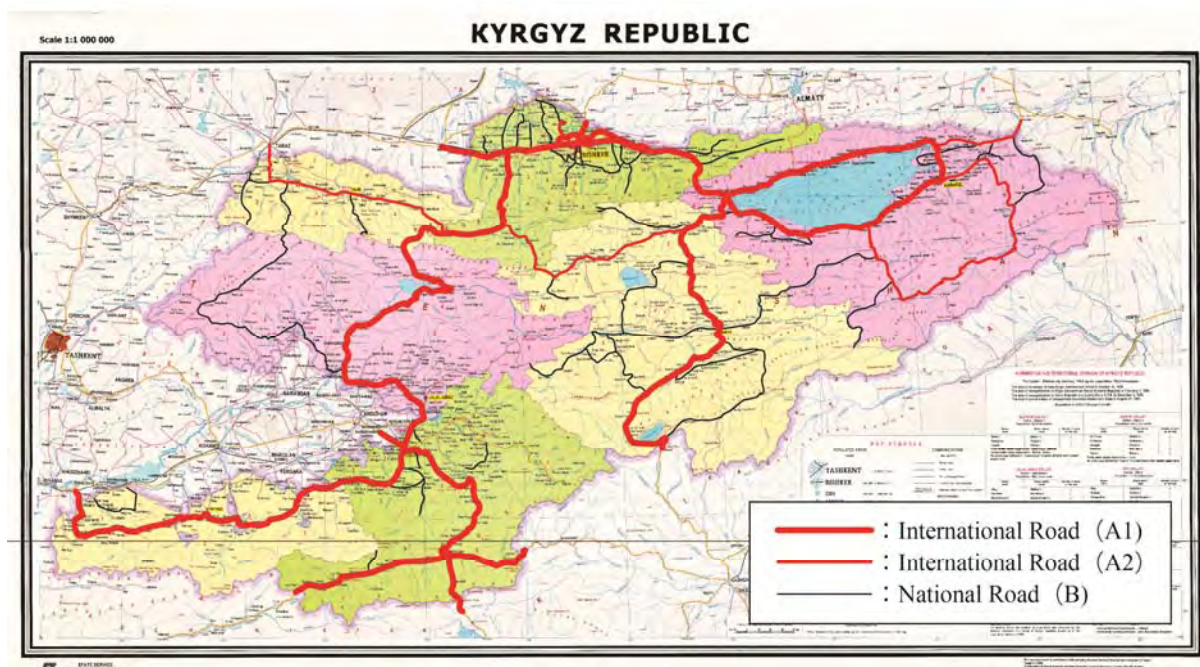


Figure 7-5 Sample of Road Priority Map

⁴ National sustainable development strategy for the Kyrgyz Republic for the period of 2013-2017 years, p. 100

Scheme CAREC corridors inside of Kyrgyz Republic is given in Figure 7-6.

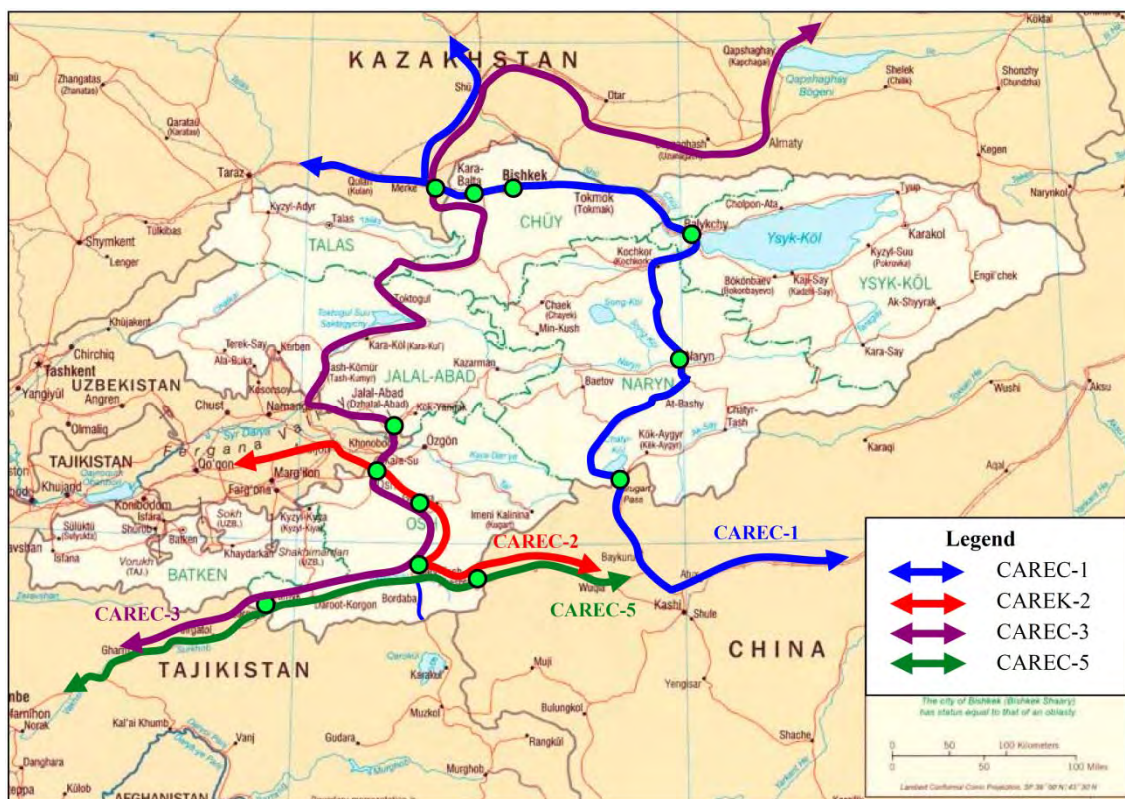


Figure 7-6 Map of CAREC Corridors

7.3.3 Sample of Prioritization for Bridge Maintenance Management Planning.

Criteria for opinion evaluate the bridge on a 5-point system and calculate the total score of the bridge is determined by the priority in its maintenance.

Table 7-6 Case Study on Road Priority Using Some Indicators

Maintenance category	Priority order NO.	Road name	Road characteristics		Judgment criteria					Total Points	Comments	Im. Bridges	Cr. Bridges
			Road category	CAREC*	Traffic volume 2015	Economic importance	Connections among the states	Relations with neighbor countries					
A1	1	Bishkek-KaraBalta-Osh-Gulcho	Int'l	1,2,3	4	5	5	5	5	19	Traffic volume is 10,000veh/day		
	2	Bishkek-Naryn-At Bashy	Int'l	1	5	5	5	5	3	18			
	3	Blykchy-Cholpon Ata	Int'l	1	4	5	4	4	4	17		⑧63+500 ⑨59+350	
	4	Osh-Kyzyl Kyya	Int'l	3	4	3	3	3	2	12		①63+500	
	5	Gulcho-Sarytash-Irkeshtam	Int'l	2,5	2	3	2	2	5	12		⑩97+500	
	6	Sarytash-Karamyk	Int'l	5	2	3	2	4	4	11			
	7	Kyzyl Kyya-Batoken-Isfana	Int'l	3	2	2	2	3	3	10			
A2	1	Otmek-Talas-Taraz	Int'l		4	2	2	2	2	10		③82+000 ④54+900	①126+300 ④54+900
	2	Karakol-Kara Say	Int'l		2	4	2	2	2	10		②19+950 ⑩55+000	①9+500
		*CAREC1:Chaldovar-Karabalta-Bishkek-Torugart Road.											
		*CAREC2:Irkeshtam-Sarytash-Osh Road.											
		*CAREC3:Isfana-Batken-Osh-Chaldovar Road											
		*CAREC5:Irkeshtam-Sarytash-Karamyk Road.											

7.4 Short-term Maintenance Management Plan

The short-term plan to be proposed shall be three (3) years. The Maintenance Management Plan has to be formulated on the basis of the condition rating of the respective bridge and road maintenance level and the budget parameters. In addition, in formulating the plan, safety of motorists must be the top priority. Therefore, the short-term (3 year) plan is drawn up for bridges in serious condition such as critical condition and imminent condition bridges in order to execute “Corrective Maintenance”. It is possible to create a Budget Plan based on these maintenance planning methods. It creates the possibility for the efficient execution of the maintenance budget and leveling budgets every year. A sample budget plan for three years is shown in Table 7-7, which is in consideration of priorities and leveling of the budget for each fiscal year.

Table 7-7 Example of Short-Term Budget Distribution Plan

No.	State	DEP	Road		Location(km)	Deck Area m ²	Priority	Cost (MillionKGS)	Year			
			Classification	Route (Section)					2015	2016	2017	
1												
2			37	International	Osh-Batken-Isfana	63+500	387	I	82.4130	82.4		
3			37	National	Nookat-Papan	4+000	96	II	6.3000			6.3
4			37	National	Nookat-Papan	19+000	84	II	5.5125			5.5
5			21	National	Detour road Osh city	8+250	786	II	51.5970			51.6
6			21	National	Ak Terek-Papan-Kojskelen	24+300	160	II	10.4895			10.5
7			21	National	Ak Terek-Papan-Kojskelen	24+600	132	II	2.5988			2.6
8			44	National	Nookat-Aravan-Tobo Korzon	27+020	245	II	16.2750			16.3
9			956	International	Bishkek-Osh	647+708	225	II	14.7680			14.8
10			26	International	Myrzake-Kara Kulia-Alaiku	74+815	127	I	27.0960	27.1		
11			960	International	Sarytash-Kyzylart pass	34+000	65	II	1.7120			1.7
12			959	National	Glucha-Korul-Suukdobo	23+000	200	I	42.5600	42.6		
13			959	National	Glucha-Korul-Suukdobo	20+000	60	II	1.1810			1.2
14			959	National	Glucha-Korul-Suukdobo	18+000	60	II	1.1810			1.2
15			959	National	Glucha-Korul-Suukdobo	11+000	78	I	16.5980	16.6		
16			959	International	Osh-Sarytash-Irkeshtam	97+500	459	I	97.6110	97.6		
17			50	National	Bazar Korzon-Arslanbob(Kyzyl Unkyur)	9+920	288	II	18.8790			18.9
18			50	National	Bazar Korzon-Arslanbob(Kyzyl Unkyur)	12+800	152	I	32.3250			32.3
19			17	National	Kerben-Ala Buka-Chatkal	23+000	150	I	31.9200			31.9
20			1	National	Tokmok-Donaryk-Rotfront-Ivanovka	14+000	179	I	38.0590			38.1
21			954	National	Tokmok-Donaryk-Rotfront-Ivanovka	20+000	333	II	6.5625			6.6
22			954	National	Kegety-Vostochniy Karakol	14+000	59	II	1.1498			1.1
23			954	National	Kegety-Vostochniy Karakol	21+700	24	II	0.4725			0.5
24			954	National	Kegety-Vostochniy Karakol	22+500	36	II	0.7088			0.7
25			25	National	Alamedin-Arashan-Koi-Tash	0+300	121	II	2.3783			2.4
26			958	International	Bishkek-Torugart	27+000	567	II	1.8795			1.9
27			43	National	Krashnaya Rechka-Ysyk-Ata	11+000	136	II	2.6775			2.7
28			43	National	Krashnaya Rechka-Ysyk-Ata	27+000	95	II	1.8795			1.9
29			1	National	Sokuluk-Kamyshanovka	1+700	383	II	25.1475			25.1
30			40	National	Kalinskoe-Stepnoe	6+000	128	II	2.5200			2.5
31			42	National	Panfilivka-Chaldovar	8+800	153	II	3.0135			3.0
32			40	National	Petrovka-Beshterek	3+500	144	I	30.6430			30.6
33			28	National	Petrovka-Narzan spring	43+600	84	I	17.8750			17.9
34			11	International	Karakol-Enyichek	9+500	251	II	4.9455			4.9
35			11	International	Karakol-Enyichek	19+950	36	I	7.6610	7.7		
36			7	International	Barykchy-Ananievo-Karakol	63+500	207	II	5.4233			5.4
37			7	International	Barykchy-Ananievo-Karakol	59+350	159	II	4.1843			4.2
38			3	International	Barskoon-Ak Shyrak	55+000	20	I	4.2130	4.2		
39			33	International	Balykchy-Bokonbaevo-Karakol	110+950	310	II	8.1323			8.1
40			33	International	Balykchy-Bokonbaevo-Karakol	104+200	205	II	5.7593			5.8
41			36	International	Taraz-Talas-Suusamvr	126+300	176	II	3.4650			3.5
42			47	National	Taraz-Kalinin	2+000	50	I	10.6400			10.6
43			47	International	Taraz-Talas-Suusamvr	82+000	304	I	64.7090	64.7		
44			6	International	Taraz-Talas-Suusamvr	54+900	449	II	29.4525			29.5
45			6	National	Kirovka-Amanbaevo-Maimak station	21+100	39	I	8.3420			8.3
46			6	National	Kirovka-Amanbaevo-Maimak station	9+800	455	II	8.9565			9.0
Total Cost									256.6	303.5	201.7	762
Replace Bridges									5/1,206	10/1,203	0/0	513
Repair Bridges									0/0	5/1,242	25/5,209	249
<p>I For rated “imminent” bridges, detailed investigation and replacement(rebuild) need to be conducted within one year.</p> <p>II For rated “critical” bridges, detailed investigation and repair works need to be conducted within three years.</p>												

7.5 Long-Term Maintenance Management Plan

The long-term plan to be proposed shall be ten (10) years

The Maintenance Management Plan has to be formulated on the basis of the condition rating of bridge and required road maintenance level and the budget condition. In the long-term plan, minimization of maintenance budget and prolonging the service life of the bridges are important. Inherently the targets of preventive maintenance are Good, Fair and Poor condition, however, “Poor” is the only condition required preventive repair work as shown in Figure 7-2. And bridges of “Fair” condition require monitoring. Other cost such as monitoring work is very small, because this long-term plan was made

by targeting the poor condition bridges. It is possible to prepare a Budget Plan based on this maintenance planning method. It makes possible the efficient execution of the maintenance budget and leveling budgets every year. In preparing the long-term plan, estimation of the maintenance cost and comparison of the effect of introducing LCC concept are calculated in the following conditions as a practical and simple way.

- 1) Number of target bridges in this case study is 54, which is evaluated “Poor condition” by the inspection of the Project.
- 2) All of the maintenance levels (levels 1 to 3) of poor bridges are targeted, because the segmentation of road maintenance levels is under consideration.
- 3) The “Poor condition” bridges are implemented with preventive maintenance every ten (10) years. 10% of the bridge deck area is assumed in the repair scale.
- 4) The “Imminent condition” bridges are implemented with corrective maintenance, and its maintenance method is supposed reconstruction every seventy (70) years.
- 5) The “Critical condition” bridges possess the supposed repair work already completed.

7.5.1 Case Study for Cost Reduction Effect

Maintenance based on this plan, in so much as the main component is Preventive Maintenance (Scenario 1), allows to reduce Life Cycle Cost (hereinafter LCC).

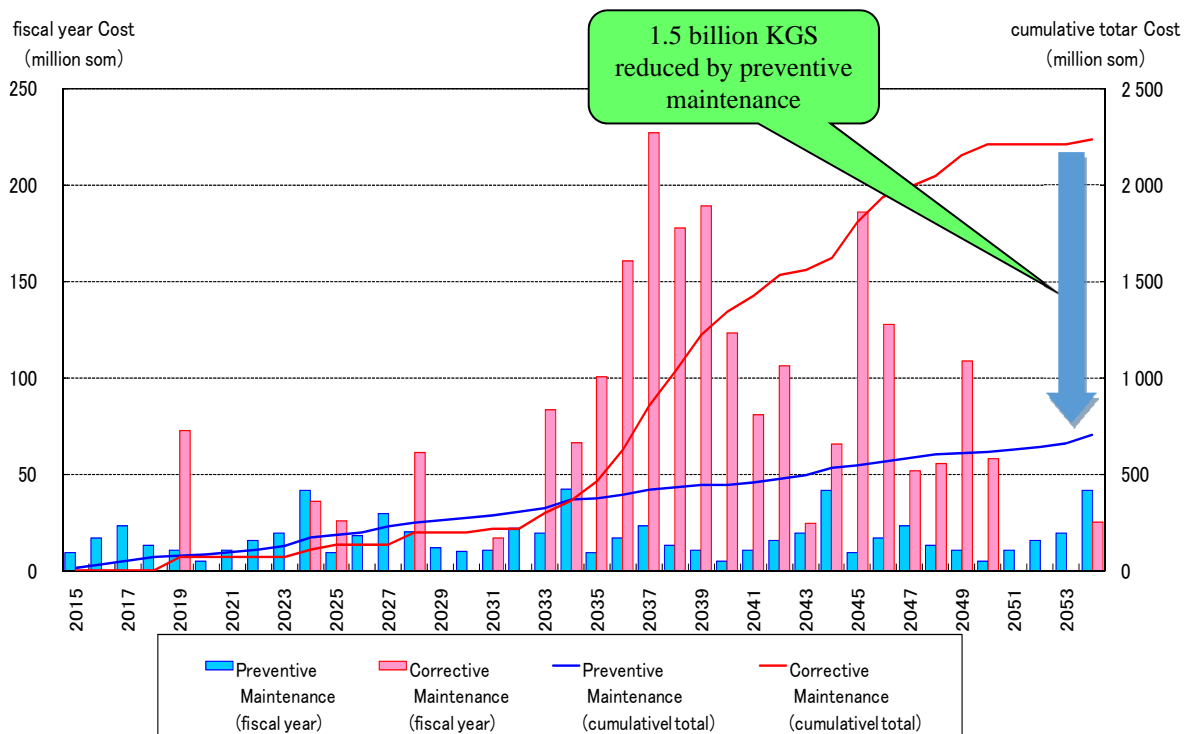


Figure 7-7 Cost Reduction Effect (from 2015 during 40 years)

7.5.2 Long-Term Budget Distribution Plan Case Study

Distribution Plan for Long-Term Budget for ten (10) years is shown in Table 7-8. The bridge maintenance budget of each year is total of “Short-Term Plan” shown in Table 7-7 and “Long-Term Plan” in Table 7-8. MTs have studied this method during the Project.

Table 7-8 Example of Long-Term Budget Plan

State	PLUAD/UAJ	DEP	Road		Location (km)	Deck Area (m ²)	Cost (MillionKGS)	Year										
			Classification	Route (Section)				2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
CHUY	UAD_BNT	DEP 41	International	Bishkek-Naryn-Torugart	292+900	96	1.3	1.3										
	UAD_BNT	DEP 41	International	Bishkek-Naryn-Torugart	351+950	40	0.5		0.5									
	UAD_BNT	DEP 957	International	Bishkek-Naryn-Torugart	505+000	50	0.7				0.7							
	UAD_BO	DEP 9	International	Bishkek-Osh	110+600	177	2.3					2.3						
	PLUAD 1	DEP 958	International	Lugevoï-At-Bashy	16+500	2202	28.9											28.9
	UAD_BNT	DEP 39	National	Voenno-Antzovka-Uchkhoz	2+600	198	2.6	2.6										
	PLUAD 1	DEP 25	National	Alamedin-Arashiin-Koi-Tash	13+700	310	4.1		4.1									
	PLUAD 1	DEP 43	National	Krasnaya rechka-Ysyk-Ata	2+000	122	1.6			1.6								
	PLUAD 1	DEP 43	National	Krasnaya rechka-Ysyk-Ata	3+000	170	2.2				2.2							
	PLUAD 1	DEP 43	National	Krasnaya rechka-Ysyk-Ata	25+000	289	3.8					3.8						
NARYN	PLUAD 1	DEP 43	National	Krasnaya rechka-Ysyk-Ata	39+000	120	1.6					1.6						
	UAD_BNT	DEP 955	International	Kokmoinok-Kuyakly	0+000	243	3.2			3.2								
	UAD_BNT	DEP 955	International	Kokmoinok-Kuyakly	4+000	232	3.3											
	PLUAD 3	DEP 8	National	Naryn-Oruk-Tam	35+800	216	2.8								2.8			
	PLUAD 3	DEP 8	National	Naryn-Oruk-Tam	60+000	406	5.3									5.3		
	PLUAD 3	DEP 8	National	On-Archa-Jany-Talap-Ashyma	0+200	404	5.3										5.3	
	PLUAD 3	DEP 8	National	On-Archa-Jany-Talap-Ashyma	8+900	348	4.6											4.6
	PLUAD 3	DEP 8	National	On-Archa-Jany-Talap-Ashyma	30+000	54	0.7	0.7										
	PLUAD 3	DEP 8	National	On-Archa-Jany-Talap-Ashyma	33+000	120	1.6		1.6									
	PLUAD 3	DEP 15	National	Ugut-Alabuga-Kazarmen	0+300	428	5.6			5.6								
TALAS	PLUAD 3	DEP 20	National	At-Bashy-Kynde-Torugart	61+000	34	0.4					0.4						
	PLUAD 5	DEP 47	National	Talas-Kalinin	13+000	394	5.2					5.2						
	PLUAD 5	DEP 47	National	Talas-Kalinin	14+000	24	0.3							0.3				
	PLUAD 5	DEP 48	National	Taraz-Pokrovka-Kaindy	19+900	82	1.1									1.1		
	PLUAD 4	DEP 3	International	Balykchy-Bokonbaevo-Karakol	135+300	511	6.7					6.7						
	PLUAD 4	DEP 3	International	Barskoon-Ak-Shyryak	446+000	25	0.3						0.3					
	PLUAD 4	DEP 4	International	Tyup-Kegen	52+000	60	0.8							0.8				
	PLUAD 4	DEP 4	International	Balykchy-Ananevo-Karakol	160+100	296	3.9									3.9		
	PLUAD 4	DEP 7	International	Balykchy-Ananevo-Karakol	50+500	119	1.6										1.6	
	PLUAD 4	DEP 7	International	Balykchy-Ananevo-Karakol	95+600	263	3.4											3.4
YSYK-KOL	PLUAD 4	DEP 7	International	Balykchy-Ananevo-Karakol	145+400	549	7.2											7.2
	PLUAD 4	DEP 11	International	Karakol-Barskoon-thr.Enlichek-Akshyryak	20+300	110	1.4	1.4										
	PLUAD 4	DEP 11	International	Karakol-Barskoon-thr.Enlichek-Akshyryak	30+060	305	4.0		4.0									
	PLUAD 4	DEP 11	International	Karakol-Barskoon-thr.Enlichek-Akshyryak	38+400	427	5.6			5.6								
	PLUAD 4	DEP 11	International	Karakol-Barskoon-thr.Enlichek-Akshyryak	125+270	68	0.9				0.9							
	PLUAD 4	DEP 11	International	Karakol-Barskoon-thr.Enlichek-Akshyryak	130+240	48	0.6					0.6						
	PLUAD 4	DEP 33	International	Balykchy-Bokonbaevo-Karakol	60+550	26	0.3						0.3					
	PLUAD 4	DEP 33	International	Balykchy-Bokonbaevo-Karakol	108+500	93	1.2							1.2				
	PLUAD 4	DEP 35	International	Balykchy-Bokonbaevo-Karakol	182+970	384	5.0									5.0		
	PLUAD 4	DEP 35	International	Balykchy-Bokonbaevo-Karakol	185+700	722	9.5										9.5	
BATKEN	UAD_OBI	DEP 46	International	Osh-Batken-Isfana	126+500	41	0.5	0.5										
	UAD_OBI	DEP 46	International	Osh-Batken-Isfana	175+000	50	0.7		0.7									
JALAL-ABAD	UAD_BO	DEP 22	International	Bishkek-Osh	532+300	153	2.0								2.0			
	UAD_BO	DEP 30	International	Bishkek-Osh	372+600	221	2.9	2.9										
	UAD_BO	DEP 23	National	Torkent-Tooluk-Sarykamysh	75+000	72	0.9									0.9		
	UAD_BO	DEP 23	National	Torkent-Tooluk-Sarykamysh	78+000	48	0.6										0.6	
	UAD_BO	DEP 23	National	Toktogul-Beshtash	48+000	27	0.4											0.4
	UAD_BO	DEP 23	National	Toktogul-Beshtash	50+500	16	0.2	0.2										
OSH	UAD_BO	DEP 38	National	Tashkomur-Kerben-Alabuka	44+500	473	6.2		6.2									
	UAD_BO	DEP 26	International	Myszak-Karakulja-Alabku	100+326	238	3.1									3.1		
	UAD_BO	DEP 956	International	Bishkek-Karasuu-Ozgon	26+000	76	1.0										1.0	
	UAD_BO	DEP 956	International	Bishkek-Karasuu-Ozgon	26+050	43	0.6											0.6
	UAD_OSI	DEP 37	International	Osh-Batken-Isfana	30+000	582	7.6					7.6						
Total Cost								9.7	17.0	23.6	13.6	10.6	5.3	11.0	16.0	19.9	41.6	
Repair Bridges								7/798	6/1,298	5/1,802	6/1,035	5/808	5/407	5/839	5/1,219	5/1,513	5/3,168	

7.6 Revision and Preparation of Manuals

7.6.1 Revision of Repair Method Manual

The Repair Method Manual prepared in the first year of the Project is based on the method prescribed in the Soviet Era, because the repair methods are considered to still be feasible today. However, revision of the manual is required if more efficient methods are found by further investigation of the latest procurable repair materials in Kyrgyz.

In order to make a Long-term maintenance management plan (Preventive Maintenance Plan) in consideration of the Life Cycle Cost, adoption of an effective repair method is the most important issue. The repair method must be able to apply in Kyrgyz. Therefore, market research was carried out in the second year of 2014. As a result, the adhesive or polymer cement needed for a sectional repair method was found to be capable of supply. And the item of the sectional repair method is added to the Repair Method Manual prepared in the previous year.

By actually using this manual, the implementation of efficient bridge maintenance becomes possible in Kyrgyz.

7.6.2 Preparation of Cost Estimation Manual

(1) Purpose of Cost Estimation Manual

It is very important to take advantage of the manual prepared in this JICA project in choosing the best repair method and in the improvement of technical skill on construction cost estimation. For the

purpose of requesting the repair budget, the manual is needed to objectively substantiate the estimates of replacement and repair costs.

(2) Procedure of Manual Preparation

DEPs want utilization of the manual as a rule, and the budget calculation is possible if there is a simple calculation EXCEL sheet. Unit costs of repair works in the proposed manual were derived from its performance in Japan. Alternatively, unit costs for the replacement of concrete structures were derived from actual construction costs in Kyrgyz.

(3) Revision in the Future

Preparation of a database by accumulating work experience in Kyrgyz is required in the near future. The maintenance budget for bridges can be calculated by using the estimation manual prepared by the Project.

7.6.3 Preparation of Maintenance Management Manual

A short-term and/or long-term maintenance plan manual is expected to be prepared in this Project. This manual shall consist of the priority maintenance procedures, a suggestion of the roles of RMD/PLUAD/DEP, and the budgetary request. The concepts of LCC are also included in this manual.

7.7 Training of MOTC Staff Members

Trainings or workshops held for MOTC staff members are shown in Table 7-9. The involved MTs have the responsibility to transfer their technical knowledge to all of the respective MOTC staff through training or workshop.

Table 7-9 Implementation of Training/Workshop for Bridges

Date	Venue	Content
08 May 2014	RMD Office	1) Inspection and Condition Rating 2) Repair Method 3) Calculation of Repair and Replacement Cost 4) Maintenance Management Plan 5) View panoramic image covering 360 degrees
21 May 2014	Osh OBI Office	Ditto
03 July 2014	RMD Office	1) Calculation of Repair and Replacement Cost
09 July 2014	RMD Office	1) Prioritizing of Maintenance 2) Short-Term Budget Request 3) Short-Term Maintenance Management Plan
16 July 2014	RMD Office	1) Prioritizing of Bridge Maintenance 2) Short-Term Budget Request
17 October 2014	RMD Office	1) Long-Term Maintenance Management Plan
14 November 2014	RMD Office	1) Traffic regulatory actions 2) Long-Term Maintenance Management Plan 3) Short and Long-Term Budget Request
20 November 2014	RMD Office	1) Prioritizing of Roads 2) Long-Term Maintenance Management Plan 3) Short and Long-Term Budget Request
10 July 2015	RMD Office	1) Planed Inspection B (trial) 2) How to use the result of Planed Inspection B for Long-term Plan

Chapter 8 Formulation of Tunnel Maintenance Management Plan

8.1 General

The Maintenance Management Plan for tunnels in the Kyrgyz Republic shall incorporate the results of inspection and evaluation. Since considerable damage to these tunnels is expected, systematic maintenance shall be performed in accordance with the maintenance management plan, prepared based on engineering evaluation and appropriate management criteria, to accommodate budgetary constraints on the maintenance work. Formulation of the Tunnel Maintenance Management Plan is described below.

8.2 Concept of Tunnel Maintenance Management Plan

(1) Procedure of Annual Budgeting

The procedure of annual budgeting for tunnel maintenance is as outlined below:

- December to January : BO-UAD assumes the income from toll stations
- January to February : BO-UAD prepares budget planning with RMD's approval
- February to March : Approval of budget for tunnel maintenance by the Ministry of Finance

Annual income from toll stations generates revenue for the maintenance work in the same year. The planned budget was therefore analyzed based on the past 2-year record of toll income, and it was found that there was a small margin of error between the planned budget and the actual toll income.

(2) Existing Budget for Tunnel Maintenance

All funds for the maintenance management of tunnels have originated from funds collected from toll stations at Bishkek-Osh Road since no fund is allocated from the national budget. Approximately 50 million Som are collected from toll stations every year, and 20 to 25% of these funds were spent for taxes until tax payments were abolished in 2013. Thirty-five percent (35%) of the funds were allocated for the salaries of staff of BO-UAD (for maintenance), Ministry of Emergency (for disaster prevention), and Ministry of Internal Affairs (for security).

Budget for repair work and equipment replacement was 9.8 million Som in 2011 and 13.5 million Som in 2012, and the budget in 2013 of 25.6 million Som were significantly increased due to the abolishment of tax.

As for the maintenance work budget in 2015, the amount has been drastically increased compare to 2013 or 2014. The breakdown of annual budget from 2011 to 2015 is as given in Table 8-1.

Table 8-1 Breakdown of Annual Budget from 2011 to 2015 (in thousand Soms)

Items	2011 Budget Year	2012 Budget Year	2013 Budget Year	2014 Budget Year	2015 Budget Year
Account balance of the previous year	24	72	212	2,554	10,727
Income from passage payment	49,678	50,698	55,752	56,827	58,974
Income tax	11,862	12,205	2,471	631	649
Income	37,816	38,493	53,281	56,157	58,326
Expense	37,769	38,353	50,939	47,983	69,053
Salary	16,552	15,387	17,048	16,790	16,828
Social Fund	1,977	2,560	2,889	2,843	2,901
Buildings and facilities	19,240	20,406	31,001	28,350	49,334
[Breakdown of articles on buildings and facilities]					
Unpaid salary and contribution to social fund in the previous year	3,126	1,003	509	0	0
Taxes of special account for previous year	0	290	118	0	0
Security department	2,031	2,547	2,150	1,984	2,787
Traffic Police under MIA	3,454	1,767	1,371	0	0
Medical services	357	708	747	755	746
MES	525	548	508	572	542
Tunnel repair, equipment replacement, building repair	9,747	13,543	25,598	25,039	45,259
Account balance at the end of budget year	72	212	2,553	10,727	0

*Income tax of 2 471 thousand SOM for 2013 is the debt for the previous year.

The budgeting plan for tunnel maintenance management has been prepared by BO UAD with the approval of RMD, based on the requests from each DEP.

(3) Condition Rating and Maintenance Management Level

It is difficult to predict the deterioration of tunnels in a long-term period because the deterioration itself typically depends on surrounding mountains unlike bridges or pavement, which depend more on traffic load. This is why periodical inspection should be the basis of the maintenance management plan, the conduct of which will make it possible to take measures before the safety of tunnel is threatened.

As mentioned above, since it is difficult to predict the deterioration for a long-term period and the maintenance plan is developed on the basis of inspection results, the short-term maintenance management plan (3-year plan) will be developed.

In the Inspection and Condition Rating Manual, the periodical inspection of tunnel structures is decided to be conducted at least twice a year (in spring and autumn). This inspection is supposed to check water leakage, cracks, spalling, landslide and existing facilities in every 10m inside the tunnel along its whole length. Criteria for condition rating are decided as shown in Table 8-2.

Table 8-2 Classification of Results of Periodic Inspection

Category	Condition Rating
A	Defect does not provide for the safe passage of transport; Critical condition demanding immediate measures.
B	Defect will cause danger to passing transport and need immediate attention and periodical countermeasures, or the defect demands more careful (detailed) inspection.
S	No defect or defect is negligible. No need for countermeasures.

Sections categorized as Grade “A” shall be repaired before the next routine inspection. If it is impossible to complete repair before the next routine inspection, these sections are to be repaired within one (1) year of damage occurrence. In cases where “there are no defects, or they are minor and do not require any measures”, the category of tunnel maintenance management shall be determined as “S”.

(4) Prioritization of Maintenance Work

Within the framework of the Maintenance Management Plan for tunnel construction, the priority of repair work will be determined based on the results of planned inspection (condition rating). Figure 8-1 below shows the ratio of planned inspection results and priority.

Category	Priority	
A	I	Detailed inspection; countermeasures are taken within a year.
B	II	Conducted through detailed inspection to determine the necessity of countermeasures. If required, conduct within 3 years.
S		No countermeasure is needed

Figure 8-1 Results of Planned Inspection and Priority of Conducting Countermeasures

As for the construction of tunnel, it is necessary to carry out renewal and replacement of tunnel equipment, as described in Table 8-3.

Table 8-3 Prioritization of Tunnel Equipment

Priority	
I	Carry out replacement or rearrangement of equipment within a half year - one year
II	Replacement or renewal of equipment to be carried out within three (3) years

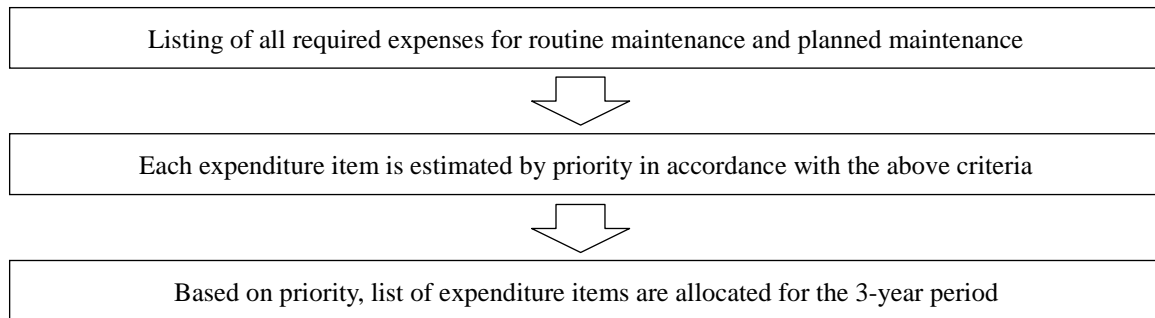
When priority implementation of countermeasures is divided, replacement or improvement of the working condition of the existing equipment due to its faults is defined as “Priority I”, and installation of new equipment for safety improvement is defined as “Priority II”. Table 8-4 shows the priority of facilitating tunnel equipment as of June 2014.

Table 8-4 Priority of Facilitating Tunnel Equipment

No.	Priority	Tunnel Name	Equipment
1	I	Kolbaev Tunnel	Emergency communications
2	I	Kolbaev Tunnel	Ventilation system
3	I	Tunnel No.3	Lighting
4	II	Tunnel No.2	Lighting
5	II	Tunnel No.1	Lighting
6	II	Tashkomur Tunnel	Lighting

8.3 Formulation of Maintenance Management Plan

The maintenance plan for the forthcoming 3 years will be prepared based on the prioritization mentioned above. The procedure of maintenance management planning is shown below.



On the above procedures, the following aspects are required to be considered:

- To take into account a full list of required activities in determining the budget for required tunnel maintenance works;
- To take into account the costs of detailed survey, design and repair work after detecting condition rating on “A” by planned inspection;
- To take into account the costs of detailed survey for the following year after detecting condition rating on “B” by planned inspection;
- To determine priority due to possible number of human casualties after detecting numerous selection of condition rating on “A” by planned inspection;
- To estimate by the same ratio as previous year or by the same amount as previous year in determining the budget for expenditures, etc.

8.4 Practice of Maintenance Management Plan

The three (3) year maintenance management plan from 2014 to 2016 proposed in June 2014 under the Project is shown in Table 8-4. The proposed maintenance management plan of tunnels consists of two components namely “Tunnel Structure” and “Tunnel Facilities”. Priority (I or II) of each activity was determined based on the terms and definitions stipulated in the Inspection and Condition Rating Manual for Tunnel. Actual maintenance works referring to the proposed maintenance management plan have been conducted since July 2014. Most of the expenditures listed in 2014 excluding urgent repair work have been executed in accordance with the proposed maintenance management plan, while the expenditure amount and priority have been changed.

Table 8-5 Maintenance Management Plan for Tunnels proposed by the Project

Items	Repair & Maintenance works	Priority	Proposed Budget Plan by the Project		Expenditure		Remarks
			2014	2015	2014	2015	
Structure							
Kolbaev Tunnel	Countermeasures of Leakage	I	500,000		150,000		Sept. 2014: Urgent work
	Repair of side wall and drainage	I	1,200,000		1,037,000	700,000	July-Aug. 2014: 150 m ² . Implemented by necessity
	Detailed Investigation	I	200,000			500,000	Implemented by necessity
	Repair of Pavement	I				3,071,359	
Tunnel No.1	Painting of the wall	II	500,000	500,000			Implemented by necessity
	Countermeasures of Leakage	I	400,000				Dec. 2013
	Removal of Existing Facilities	I	200,000				Implemented by necessity
	Detailed Investigation	I				1,500,000	Implemented by necessity
Tunnel No.2	Countermeasures of Leakage	I	500,000				
	Countermeasures of Cracks	I	160,000	160,000			
	Countermeasures of Collapse	I	6,000,000	6,000,000			
	Removal of Existing Facilities	I	400,000				
Tunnel No.3	Removal of Existing Facilities	I	200,000				Dec. 2013
	Detailed Investigation	I	250,000	250,000			Implemented by necessity
	Countermeasures of Leakage	I	250,000			1,500,000	Implemented by necessity
	Removal of Existing Facilities	I	400,000	400,000			July 2014
Tashkomur Tunnel	Various work for Portals	I	200,000				Implemented by necessity
	Countermeasures of Leakage	II	500,000	500,000			Implemented by necessity
	Countermeasures of soil inflow	I	1,000,000				Under Construction (June, 2015)
	Removal of Existing Facilities	II	50,000				Dec.2014
Facilities	Detailed Investigation	I	200,000				Implemented by necessity
	Lighting	I	4,000,000				July 2014 (removal of remained old 177 lamps and renewal) designing cost of additional ventilation installation
	Ventilation	I	1,800,000				July-Aug.2014
	Emergency Phone	I	1,700,000				Autumn 2013
Tunnel No.1	CCTV	I	1,600,000				
	Power receiving and distributing facility	I					
	Generator	I					
	Maintenance cost of CCTV and Emergency Phone	I				240,000	
Tunnel No.2	Lighting	II	1,000,000				Dec. 2014: Installation of reflective road markers
	Facility of power supply	II	3,000,000	3,000,000			
	Lighting	II	1,000,000				Dec.2014: Installation of reflective road markers
	Lighting	I	2,500,000				Sept.-Oct. 2014
Others	Lighting	II	1,800,000				Dec.2014
	Purchase of vehicle for work at high	I	3,000,000				Autumn 2014
	Repair of emergency vehicle (firefighting vehicle)	I					Spring 2015
	Purchase of fire extinguishers and medicine, etc	I					Sept. 2014
Tunnel No.1,2,3	Building of garage	I					
	Purchase of vehicle for work at high	I	3,000,000				Autumn 2014
	Building of public toilets	I					
	Total Cost			10,410,000	10,050,000	13,517,749	18,004,994
Priority							
I	Detailed investigation, countermeasures and facilities replacement need to be conducted within one year.						
II	The necessity of countermeasures will be determined based on the result of the detailed investigation. If countermeasures are needed, these need to be conducted within 3 years.						
Facilities replacement needed to be conducted within 3 years.							
※1 including " lighting cost "							

8.5 Preparation of Maintenance Management Plan Manual

The Maintenance Management Manual for Tunnels was prepared in consideration of the procedure of plan formulation, level of management, method of prioritization, diagrams, etc. On June 30th, 2014 a seminar was held on the manual contents to the TS BO-UAD employee involved in the planning of the tunnel budget.

- Date of Seminar: June 30, 2014
- Participants: Bazaraliev Beknazar (Head of BO-UAD Tunnel Service)



Photo 8-1 Maintenance Management Plan Seminar (June 30, 2014)

8.6 Preparation and Revision of Repair Method Manual for Tunnel

(1) Purpose of Repair Method Manual for Tunnel

The “Repair Method Manual” describes an efficient and appropriate repair method for various defects of road tunnels, and it is intended to ensure the safety of passing vehicles.

If external forces cause the damages, it is necessary to investigate in detail the mechanisms, and depending on the situation formulate an appropriate plan of repair works. Therefore, this Manual does not include the external forces causing the damages, and is targeted on repair works that could be standardized as for the leakage, spall, delamination, and honeycomb.

(2) Works of Repair Method

The Repair Methods Manual was prepared in order to maintain continuous and independent maintenance of bridges in the Kyrgyz Republic using available construction materials in the country. The Manual describes an efficient and appropriate repair method for various defects of road tunnels, and is intended to ensure the safety of passing vehicles. Overview of repair methods for defects is shown in Table 8-6.

Table 8-6 Overview of Repair Method for Tunnel Defects

Defects	Methods of Repair	Materials
Water Leakage	Provide water works	Water conveyance mat, Waterproof sheet, insulating material (Polyurethane) Wire net, Anchor bolt
De-lamination, Spalling	Beating work	-
Honeycomb	Use of wire net	Wire net, Flat bar, Anchor bolt

Source: JICA Expert Team

(3) Procedure of Manual Preparation

Prior to preparation of the Repair Methods Manual, JICA experts ascertained the condition of all tunnels through visual inspection of the interior side of tunnels, interview with staff of BO UAD and DEPs. After, they developed the draft version of the Manual taking into account the results of interview conducted with companies who are engaged in repair works of tunnels. The content of this draft was completed through the discussions with appropriate BO UAD staff. List of the trainings held for the Manual preparation is provided in Table 8-7, and the list of the participants of these trainings is given in Table 8-8.

Table 8-7 Implementation of trainings

Date	Venue	Content	Note
2013/8/19 - 8/20	Each tunnel	Confirmation of condition of each tunnel (At the same time information for the development of database were collected)	
2013/9/18	DEP 30	Discussion of countermeasures (hearing of opinions) (at the same time the inspection and condition rating were explained)	
2013/9/25	BO UAD	Discussion of countermeasures (hearing of opinions)	Construction companies had participated
2013/10/3	BO UAD	Preparation of Repair Methods Manual	

Table 8-8 Training Participants

Name	Organization	Date and venue			
		2013 8/19-20	2013 9/18	2013 9/25	2013 10/3
		Each tunnel	DEP30	BO UAD	BO UAD
ShalpykovKaldar	BO UAD	-	○	○	○
BazaralievBeknazar	BO UAD	○	○	○	○

Note ○ : participated, × : did not participate, — : no need to participate



2013.8/19-20

Confirmation of each tunnel condition



2013.9.18 DEP30

Discussion of Countermeasures (Hearing of Opinions)



2013.9.25 BO UAD

Discussion of Countermeasures
(Hearing of Opinions)



2013.10.3

Manual Preparation

Photo 8-2 Seminars

The contents of the prepared Repair Methods Manual were confirmed with the staff of RMD, BO UAD and DEPs on October 23, 2013. Thus, the consensus within the MOTC was achieved.

Table 8-9 Member List of Meeting for Discussion and Confirmation of Manuals

Name	Organization	Position
Nurmanbetov K.R.	RMD	Deputy Director
Kaldybaev R.J.	RMD	Legal Specialist
Duishembiev J.D.	BO UAD	First Deputy Director
Altymyshov E.M.	BO UAD	Main Specialist
BazaralievBeknazar	BO UAD	Head of Tunnel Service department
ChynalievErlanbek	BO UAD DEP30	Head of Tunnel Service



Photo 8-3 Meeting for Confirmation of Contents of Manuals (2013.10.23)

(4) Revision of Repair Method Manual

In the Manual prepared in Phase 1 of the Project in 2013, the following changes were made in June 2014, including the condition of icing formation during the winter period:

- Causes of damage and repair methods are additionally described on the tunnel wall damages.
- Repair method on ice formations during the winter period is additionally explained.

Brief description of the workshop on amendments to the Manual is given below:

- Date of Workshop: June 18, 2014
- Participants: Bazaraliev Beknazar (Head of BO UAD Tunnel Service)

Chapter 9 Lessons Learned and Recommendations

9.1 Approach to Identified Issues

9.1.1 Nationwide Scattered Counterpart (C/P)

Since 59 DEPs and 9 PLUADs are located all over the country, technical transfer and data collection were the initial issues to be taken measures. The following approaches were made by the JICA Project Team:

- Concentrated training was carried out in Bishkek City with the participation of the Nominated Master Trainers (MTs). These MTs visited remote areas to transfer the technology to each staff of PLUADs and DEPs instead of JICA Experts. JICA Experts visited the remote area to verify their capacity at each juncture and to conduct supplemental training for the staff in remote area.
- Step wise data collection was implemented. Since the capacity in bridge engineering was very small at the beginning of the Project, fast data collection was concentrated in “Initial Inspection” consists of simple site works such as measurement of main dimension and shooting general photo. Visual Inspection-A which requires some engineering knowledge to evaluate its soundness, was carried out after the training and workshop with materials based on the Initial Inspection. Thus, data collection for 871 bridges, and trainings were successfully completed without any delay.

9.1.2 Less experience in bridge maintenance technology

Maintenance in bridge structure requires some special engineering technology and experience. However, most of the staff in RMD, PLUADs and DEPs had very less experience in Bridge Engineering at the beginning. The following approach was applied to negotiate this situation:

- Not only maintenance but also basics of bridge structure such as major function of each member and deterioration mechanism of the members were lectured during the workshops to supplement their understanding.
- Bridge maintenance manual was prepared through discussion with C/Ps. The Manuals had been gradually developed in accordance with capacity development of C/Ps.
- Items and methodologies for Bridge Inspection were simplified as much as possible to increase the motivation and ownership of C/Ps to accomplish these activities, and in order not to interfere much into their daily routine works.

9.1.3 Insufficient Equipment and Office Supply to carry out Data Collection

DEPs located at remote areas have insufficient equipment and office supply such as digital camera, computer, and internet connection, while bridge inspection data collected by DEPs has to be sent to RMD office to develop the bridge maintenance database. The following approach proved efficient to overcome this situation:

- Data record is not fully computerized to accommodate handwriting inspection data sheet to accomplish the data collection from remote area.

- Fax mail was used as one of the communication tools in case of poor internet connection.
- Data to be recorded at site was minimized to reduce the office work after the inspection.

9.1.4 Continuous Monitoring by the JICA Project Team

Since assignment period of the JICA Experts was limited, the most of the efforts was made to train the MTs, and to encourage their ownership during the assignment. On the other hand, continuous monitoring and assistance of the MTs's activities was essential to sustain their ownership. The JICA Project Team employed capable supporting staff continuously during the Project to support the C/Ps although JICA Experts are not available in Kyrgyz:

- to monitor and facilitate data collection work
- to give advice and interpretation related to manuals and work procedure, and
- to intermediate question and information toward JICA Experts who were absent in Kyrgyz

9.1.5 Final Seminar for Sustainable Bridge Maintenance

By the time of completing the Project, seminars on bridge maintenance were held in Bishkek and Osh, with the purpose to ensure sustainable implementation of bridge maintenance. RAMS convened leading engineers from all PLUAD/UADs and DEPs. The contents of the seminars are as follows:

- 1) Institutional Demarcation
- 2) Database system (Forms for inspection)
- 3) Problematic Design of Bridges in the Kyrgyz Republic
- 4) Long-term and Short-term Planning for Bridges
- 5) Monitoring after the Project's completion
- 6) Information on the Project at the website of MOTC

After completion of the Project, the bridge maintenance system developed under the Project shall be operated effectively. Its continuous improvement by the RMD is important, therefore, monitoring of the outcome of bridge maintenance was strongly recommended.



Photo 9-1 Seminar for Confirmation of Bridge Maintenance Technology (25 and 27 November 2015)

9.2 Recommendation for Project Overall Goal

In order to ensure the achievement of the Overall Goal in that the "Maintenance status of bridges and tunnels is improved in Kyrgyz", the following recommendations are given to encourage the activities to be taken by the MOTC after the completion of the Project.

9.2.1 Requirement of Quality Control

Initial defects will have a large impact on the durability of a bridge, causing an increase of maintenance cost. Therefore, it is essential for MOTC to formulate a quality control standard for bridge construction in Kyrgyz.

Compaction of concrete in particular is deficient and initial defects such as lack of concrete cover of re-bars is remarkable. For example, honeycomb, a condition in which strength of concrete is insufficient, occurs at the main girder. In addition, concreting of spaces between the girders is also roughly carried out. Loss of concrete is also remarkable due to the increase of traffic load. The following policies shall be enforced:

- Review and change the design criteria for bridge to improve and decrease initial defects. Standard design drawing is recommended to be prepared through technical assistance by the Development Partners.
- Development of quality control system during the construction. Development of quality control manual and establishment of systematic inspection framework shall be implemented.

9.2.2 Strong Commitment to the Bridge Maintenance Management

Methodology and knowledge on maintenance management for bridge and tunnels was transferred through the Project. Regarding the tunnel maintenance, sufficient budget for the maintenance management is to be ensured in accordance with the Short-term plan. However, required cost for the maintenance management of bridge needs to be increased more than before according to the Short-term and Long-term Plans developed under the Project. Strong commitment to the implementation of the Short-term and Long-term Bridge Maintenance Plan by the MOTC is essential to ensure the budgetary allocation for bridge maintenance management. Particularly, the Short-term Plan, which focuses on the replacement of very dangerous bridges, shall be the first priority to be executed by MOTC to ensure traffic safety on arterial roads in Kyrgyz.

9.2.3 Tunnel Maintenance

(1) Routine Maintenance for Tunnels

The "Routine Maintenance Manual" had not been fully utilized because of the frequent change of DEP staff members, which caused the difficulty of understanding the manual in detail. A summary sheet (1-2 pages) showing work items and their frequency is recommended to understand the required maintenance work easily. Furthermore, the summary sheet should be placed in a conspicuous location for easy access by the DEP staff members.

(2) Ventilation Equipment Monitoring and Operation System Upgrade

Actual time monitoring data of exhaust gas (VI, CO and AV) and jet fan operational data should be accumulated and analysed for the effective operation of the ventilation system. Furthermore, the monitoring and operation system of ventilation should be upgraded integrately from the collected data.

(3) Purchase of Portable Lighting Equipment

Portable lighting equipment used in planned inspection is to be procured by BO UAD as advised in Phase 1 of the Project. Rented equipment has been used during the recent site trainings, but it would prove to be more beneficial for BO-UAD to have its own equipment for the periodical inspection of tunnels.

(4) Sustainable Willingness for Maintenance Work

Consciousness and willingness for the maintenance work should be sustainable as conducted below by BO-UAD staff members during the Project:

- BO UAD staff members requested the Japanese Expert Team to show and introduce the traffic guide signs facilitated in Japanese long tunnels for emergency and accidents in Kolbaev Tunnel.
- BO UAD staff members suggested posting a summary sheet of the Routine Maintenance Manual in a conspicuous place.
- DEP staff members submitted photos to BO UAD depicting maintenance work issues in the routine maintenance work report.
- BO UAD staff members have prepared the cost estimation of a new lighting system for Tunnels No. 1 and No. 2, as well as Tashkomur Tunnel.

The consciousness and willingness for the maintenance works which had not been conducted before starting the Project should be sustainable as conducted below by BO UAD staff.

- In the Kolbaev Tunnel, up to the year 2013, damages were repaired without ascertaining the causes. However, from the year 2014, the BO UAD staff began to plan the repair work after ascertaining the causes of damage.
- Study and designing were practiced on the repair method of leakage that cause large icicles and ice formations in/on walls in Tunnel No. 3.

(5) Utilization of Manuals

The items necessary for the effective utilization of the manuals are as listed below:

- Early approval of manuals is required for their effective utilization.
- The manuals have been developed mainly by staff members of BO UAD through confirmation of their contents with the staff member of the appropriate DEP. At the same time, revision of the contents is required during utilization.

(6) Requirement of Prioritization of Repair and Replacement

As stated earlier, funds for tunnel repair or equipment replacement were taken from toll income, which increased to 25.6 million Som in 2013. Before increasing the budget, necessary measures have been

postponed due to lack of funding. It is required to prioritize the repair and replacement of equipment, and implement them in order, because of the increasing budget constraints.

9.2.4 Authorization of Manuals

Since the Kyrgyz has become a member of the Eurasian Customs Union (UACU) in 2015, all of the technical standards are required to be harmonized with GOST and SNiP applied in the Customs Union. ADB Project has been launched in September 2015 to study all relevant technical specifications and manuals to check for conformity with GOST and SNiP. Bridge Maintenance Manual and Tunnel Maintenance Manual will be the subject for study by the ADB Project. It shall be remarked that authorization of the manuals under such multilateral framework enhances the sustainability of the Project.

9.2.5 Database Operation

(1) Continuous Data Updating

The Database shall be updated every year by the RAMS staff based on inspection data collected by PLUADs and DEPS. RAMS shall always be responsible for facilitating the data collection and updating the database. RAMS has to be in charge of the following activities to maintain the database:

- Inspection results for Bridge Inspection-A, which are expected for approximately 200 bridges per year and some results for Inspection B shall be updated every year.
- Newly constructed or replaced bridges, which are expected 3 to 5 bridges per year, shall be registered in the Database every time after its construction.
- Information on rehabilitation work such as year constructed and its content shall be recorded in the Database. It is expected that there are 10 to 20 bridges to be rehabilitated.

(2) Development of Network System to share the Information

In consideration with current capacity in computer operation and condition of office supply, the database system has been developed as central control system which could be operated and browsed in RMD office only. At this moment, RAMS staff is required to deliver the data of bridges to be inspected to respective DEPs in hard copy for next inspection. On the other hand, it is expected that rapid change in internet condition and computerization in Kyrgyz will change this situation to the better soon. To accommodate such situation, PLUADs and/or DEPS with the capacity to develop computer system with an operator, shall gradually connect a network to the central database to browse each bridge data required.

9.2.6 Collaboration with Maintenance Management Proposed by Other Development Partners

Several projects related to road maintenance have been implemented under the WB, ADB and EBRD aiming at several aspects such as road asset management, performance based maintenance and restructuring of organization of MOTC. Since the Project was focused on capacity development of administrative and engineering aspects, output of the Project can be accommodated to each proposals by other Development Partners based on the following consideration:

- Ongoing reform of MOTC shall be carefully examined to accommodate the institutional demarcation proposed by the Project. RMD shall take the initiative to prepare and implement the Long/Short-term Maintenance Management Plans.
- Database on Road Asset Management developed by WB and Database System developed by the Project shall be well maintained by the staff of RAMS in RMD. Currently, only road inventory and location information of both databases are compatible, while integrated management system shall be developed in the future to mitigate workload of RAMS staff.
- In case PBM (Performance Based Maintenance) is executed, the maintenance management criteria proposed by the Project shall be taken into account to define its performance level to be maintained so that bridges could be maintained in the same condition with any funding resources.

Appendices

<i>Appendix-1</i>	<i>Project Design Matrix</i>	<i>A1-1</i>
<i>Appendix-2</i>	<i>Work Breakdown Structure</i>	<i>A2-1</i>
<i>Appendix-3</i>	<i>Plan of Operation</i>	<i>A3-1</i>
<i>Appendix-4</i>	<i>Assignment Record/Schedule of Experts</i>	<i>A4-1</i>
<i>Appendix-5</i>	<i>Record of Training in Japan</i>	<i>A5-1</i>
<i>Appendix-6</i>	<i>List of Equipment (w/ Handing Over Certificate)</i>	<i>A6-1</i>
<i>Appendix-7</i>	<i>Record of Seminars and Workshops</i>	<i>A7-1</i>
<i>Appendix-8</i>	<i>Minutes of Discussion</i>	<i>A8-1</i>
	➤ <i>1st JCC Meeting</i>	
	➤ <i>2nd JCC Meeting</i>	
	➤ <i>3rd JCC Meeting</i>	
	➤ <i>4th JCC Meeting</i>	
	➤ <i>5th JCC Meeting</i>	
	➤ <i>6th JCC Meeting</i>	
	➤ <i>7th JCC Meeting</i>	
<i>Appendix-9</i>	<i>Flow chart of the Project</i>	<i>A9-1</i>
<i>Appendix-10</i>	<i>MOTC Orders under the Project</i>	<i>A10-1</i>

Appendix 1 Project Design Matrix

Project Title: The Project for Capacity Development for Maintenance Management of Bridges and Tunnels

Period (Tentative): July 2013 – Dec. 2015

Implementation Organizations: Ministry of Transport and Communications (MOTC)

Project Sites: MOTC's HQ, Bridges on International and National Roads and 5 Tunnels in the Kyrgyz

Target Groups: Staff members of MOTC's HQ, RMD, PLUADs/UADs and DEPs

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p>Overall Goal Maintenance status of bridges and tunnels is improved in Kyrgyz.</p>	<ol style="list-style-type: none"> 1. Regularly reported and updated data on routine maintenance of bridges and tunnels 2. Formulation of maintenance management plan for bridges and tunnels 3. Preparation of budgetary allocation from the maintenance management plan for bridges and tunnels 4. A bridge and a tunnel chosen by maintenance management plan based on the nation-wide management criteria which is prepared in the project are repaired / replaced. 		/
<p>Project Purpose MOTC's capacity is improved for maintenance cost estimation of bridges and tunnels on the basis of inspection results.</p>	<ol style="list-style-type: none"> 1. Maintenance budget document with breakdowns for bridges and tunnels is prepared by [June, 2015]. 2. Data from the newly developed database system is utilized for formulating maintenance budget for bridges and tunnels. 	<ol style="list-style-type: none"> 1. Maintenance budget document for bridges and tunnels 2. Analysis of the quality of data for bridges and tunnels, project report 	<p>Level of road maintenance budget does not decrease dramatically. The Government of Kyrgyz secure necessary budget and personnel to continue activities. A drastic natural disaster such as earthquake, flood, etc.</p>

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
			with the high risk of damages on bridges and tunnels do not occur in Kyrgyz.
<p>Outputs</p> <p>1. Demarcation of MOTC HQ, RMD, PLUADs/UADs and DEPs is clearly identified with necessary staffing for the maintenance management of bridges and tunnels.</p> <p>2. A database system to record information on bridges and tunnels is developed and ready for maintenance planning.</p> <p>3. Capacity of DEPs for routine maintenance and capacity of PLUADs/UADs for inspection and condition rating of bridges and tunnels are enhanced.</p>	<p>1-1. Demarcation of MOTC HQ, RMD, PLUADs/UADs and DEPs for maintenance management of bridges and tunnels becomes clear and approved by MOTC.</p> <p>1-2. Roles of MOTC HQ, RMD, PLUADs/UADs and DEPs in the maintenance management of bridges and tunnels are implemented.</p> <p>2-1. A database system with necessary information for maintenance planning of bridges and tunnels is developed by [July, 2015].</p> <p>2-2. A manual for data input is developed by [July, 2015].</p> <p>2-3. [B] 30 master trainers for data collection and input are trained and certified by [July, 2015].</p> <p>2-4. [B] All the master trainers hold at least three (3) workshops on data collection and input for their responsible sections.</p> <p>2-5. [T] All the staff members trained for data collection and input pass the final exam.</p> <p>2-6. [B] RMD operates and develops the DB system. [T] BO UAD operates and develops the DB system under the supervision of RMD.</p> <p>3-1. A routine maintenance manual is</p>	<p>1-1. MOTC documents for organization, project report</p> <p>1-2. Project report.</p> <p>2-1. Database system</p> <p>2-2. Project report, training reports</p> <p>2-3. Project report, master trainers' reports</p> <p>2-4. Analysis of the quality of data on the database , project report</p> <p>2-5. Track record of periodical update of the database, analysis of data, project report</p> <p>2-6 DB system operated and developed by RMD staff.</p> <p>3-1. DEPs routine maintenance reports</p> <p>3-2. Project report, training reports</p>	<p>Technical and financial assistance from major development partners in the sector does not decrease dramatically.</p>

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p>4. Capacity of MOTC's HQ, RMD, PLUADs/UADs and DEPs for preparing maintenance management plans on bridges and tunnels is enhanced.</p>	<p>developed by [B] [November, 2014] and [T] [November, 2014].</p> <p>3-2. Through the review by all the PLUADs/UADs, more than 90% of DEPs are determined to implement routine maintenance of bridges/tunnels in accordance with a newly created routine maintenance manual.</p> <p>3-3. [B] 30 master trainers for inspection and condition rating are trained and certified by [June, 2015].</p> <p>3-4. [B] All the master trainers hold at least three (3) workshops on inspection and condition rating for their responsible sections.</p> <p>3-5. [B] 100% of the results of inspection and condition rating implemented by Master Trainers are evaluated to be accurate by RMD by [June, 2015].</p> <p>3-6. [T] All the staff members trained for inspection and condition rating pass the final exam.</p> <p>3-7. [T] 100% of the results of inspection and condition rating implemented by BO UAD/DEPs are evaluated to be accurate by RMD by [June, 2015]</p> <p>4-1. A nation-wide management criteria is developed by [B] [November, 2013] and [T] [November, 2013].</p> <p>4-2. A repair methods manual is developed by [B] [November, 2013] and [T] [November, 2014].</p> <p>4-3. [B] A long-term plan for maintenance management of bridges in consideration of LCC is prepared by RMD in accordance with the nation-wide management criteria by [June, 2015].</p>	<p>3-3. Project reports, master trainers' reports</p> <p>3-4. PLUADs/UADs' input for database system, analysis of the quality of the data</p> <p>3-5. BO UADs/DEPs' input for database system, analysis of the quality of the data</p> <p>4-1. A long-term plan for maintenance management for bridges</p> <p>4-2. A short-term plan for maintenance management for bridges</p> <p>4-3. A short-term plan for maintenance management for tunnels</p>	

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	4-4. [B] A short-term plan with cost estimation for maintenance management of bridges is prepared by RMD by [June, 2015]. 4-5. [T] A short-term plan with cost estimation for maintenance management of tunnels is prepared by RMD/BO UAD by [June 2015].		
<p>Activities</p> <p>1-1. To collect information regarding other partners and each section's staffing, etc.</p> <p>1-2. To identify the most suitable section to take charge of each of collection, input and analysis of data on bridges and tunnels for a database system.</p> <p>1-3. To identify the most suitable section to take charge of each of inspection, evaluation, maintenance plan preparation, and implementation of maintenance and repair of bridges and tunnels.</p> <p>2-1. To collect information regarding other partners and current conditions of bridges and tunnels, etc.</p> <p>2-2. To create a database system including dimension of bridges and tunnels.</p> <p>2-3. [B] To establish the procedure for data input and reporting.</p> <p>2-4. [B] To draft, review and finalize a manual for data input.</p> <p>2-5. [B] To implement master trainers' trainings on data collection and input.</p> <p>2-6. [B] To implement trainings by master trainers for staff members of PLUADs/UADs and DEPs for data collection and input.</p> <p>2-7. [B] To collect and input data of inspection, condition rating and costing of each bridge</p>	<p>Inputs</p> <p><u>Kyrgyz side</u></p> <ol style="list-style-type: none"> 1. Counterparts for the project <ol style="list-style-type: none"> 1) Project Director: 2) Project Manager: 3) Counterparts: 2. Office for the Project with office furniture and utilities such as internet connectivity, telephone line, electricity, etc. 3. Running expenses necessary for the implementation of the Project including travel expenses and allowances for the participants of the trainings with the exception for some participants. <p><u>Japanese side</u></p> <ol style="list-style-type: none"> 1. Experts <ol style="list-style-type: none"> 1) Team Leader / Bridge Maintenance Expert (1) 2) Deputy Team Leader / Bridge Maintenance Expert (2) 3) Bridge Maintenance Expert (3) 4) Tunnel Expert-1 (Structure) 5) Tunnel Expert-2 (Facilities) 6) Database Expert 7) Cost Estimator / Detailed Bridge Inspection 8) Coordinator / Bridge Inspection Assistant 9) Bridge Maintenance Expert (4) / Assistant for Detailed Bridge Inspection / Assistant for International Roughness Index (IRI) Survey 10) IRI Survey Expert 11) Local Coordinator 2. Equipment <ol style="list-style-type: none"> 1) Lighting Facilities 2) Schmidt Hammers 		<p>MOTC coordinates the project activities of other donors and JICA properly.</p> <p>The management of MOTC is committed to the Project.</p> <p>Trained counterparts do not resign, or are transferred, too frequently.</p> <p>Kyrgyz side provides appropriate financial and personnel allocation for the Project.</p> <p>Kyrgyz and other neighboring countries do not fall into conflict or turmoil due to social, economic, political reasons or famine.</p>

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p>by staff members of RMD.</p> <p>2-8. [T] To establish the procedure for data input and reporting.</p> <p>2-9. [T] To create a manual for data input.</p> <p>2-10. [T] To implement trainings for staff members of BO UAD/DEPs for data collection and input.</p> <p>2-11. [T] To collect and input data of inspection, condition rating and costing of each tunnel by staff members of BO UAD/DEPs.</p> <p>3-1. [B] To draft, review and finalize a routine maintenance manual.</p> <p>3-2. [B] To draft, review and finalize an inspection and condition rating manual.</p> <p>3-3. [B] To implement master trainers' trainings on inspection and condition rating.</p> <p>3-4. [B] To implement trainings by master trainers for staff members of PLUADs/UADs and DEPs for inspection.</p> <p>3-5. [B] To carry out inspection by staff members of RMD/PLUADs/UADs/DEPs. To carry out condition rating by staff members of RMD.</p> <p>3-6. [T] To create a routine maintenance manual.</p> <p>3-7. [T] To create an inspection and condition rating manual.</p> <p>3-8. [T] To implement trainings for staff of BO UAD/DEPs for inspection and condition rating.</p> <p>3-9. [T] To carry out inspection and condition rating by staff members of BO UAD/DEPs.</p> <p>4-1. [B] To establish a nation-wide management criteria for bridges.</p> <p>4-2. [B] To draft, review and finalize a</p>	<p>3) Test Hammers</p> <p>4) Infrared camera</p> <p>5) Electric drill</p> <p>6) VIMS</p> <p>3. Trainings in Japan Training in Japan will be implemented twice during the implementation of the Project. The schedule and participants of the training in Japan are as follows:</p> <p>1) Schedule 1st training: September 2014 2nd training: September 2015</p> <p>2) Participants 5 persons for each training Participants will be chosen from the member of counterparts and master trainers of the Project.</p> <p>Inputs other than indicated here will be determined through mutual consultation between JICA and MOTC during the implementation of the Project, as necessary.</p>		

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p>repair methods manual including cost estimation.</p> <p>4-3. [B] To implement trainings for staff of RMD on detailed survey and cost estimation for preparing a long-term plan for maintenance management of bridges.</p> <p>4-4. [B] To prepare a long-term plan for maintenance management of bridges by staff members of RMD.</p> <p>4-5. [B] To implement trainings for staff members of RMD on preparing a short-term plan for maintenance management of bridges.</p> <p>4-6. [B] To prepare a short-term plan for maintenance management of bridges by staff members of RMD.</p> <p>4-7. [T] To establish a management criteria for tunnels.</p> <p>4-8. [T] To create a repair method manual including cost estimation.</p> <p>4-9. [T] To prepare a short-term plan for maintenance management for tunnels through trainings for staff of RMD/BO UAD/DEPs.</p>			

Process of Changing the Project Design Matrix (PDM): From Version 1.0 to Version 5.0

During the course of the Project’s implementation, changes in the table below were introduced to the PDM.

All of the revisions were made upon mutual agreement of the JCC members during the meetings accordingly.

Project Title: The Project for Capacity Development for Maintenance Management of Bridges and Tunnels in the Kyrgyz Republic

Period: July 2013 – Dec. 2015

Implementation Organizations: Ministry of Transport and Communications of the Kyrgyz Republic (MOTC)

Project Sites: MOTC’s HQ, Bridges on International and National Roads and 5 Tunnels in the Kyrgyz

Target Groups: Staff members of MOTC’s HQ, RMD, PLUADs/UADs and DEPs

This Table contains information on the revision of objectively verifiable indicators for overall goal, outputs, activities, input by Japanese side, and input in equipment.

Objectively Verifiable Indicators		Process of Changing the PDM
Original (Version 1)	Final (Version 5)	
Overall Goal		
Maintenance status of bridges and tunnels is improved in Kyrgyz.		
The number of repairs implemented on the damaged bridges and tunnels is increased by 100% in [December, 2015] from the start of the Project.	<ol style="list-style-type: none"> 1. Routine maintenance of bridges and tunnels is reported and updated at least twice a year by the RMD. 2. Maintenance management plan for bridges and tunnels is formulated annually by the RMD. 3. Budgetary allocation from the maintenance management plan for bridges and tunnels is prepared annually by the RMD. 4. A bridge and a tunnel chosen by maintenance management plan based on the nation-wide management criteria which is prepared in the project are repaired / replaced. 	<p>[Item 4 was revised in the 5th JCC] To achieve an actual repair and replacement after the Project under the constraint budget condition in MOTC.</p> <p>[Items 1 to 3 were added in the 7th JCC] To monitor the necessary activities for the maintenance management after the Project.</p>
Project Purpose		
MOTC’s capacity is improved for maintenance cost estimation of bridges and tunnels on the basis of inspection results.		
<ol style="list-style-type: none"> 1. Maintenance budget document with breakdowns for bridges and tunnels is prepared by [June, 2015]. 2. Data from the newly developed database system is utilized for formulating maintenance budget for bridges and tunnels 	<ol style="list-style-type: none"> 1. Maintenance budget document with breakdowns for bridges and tunnels is prepared by [June, 2015]. 2. Data from the newly developed database system is utilized for formulating maintenance budget for bridges and tunnels. 	No Change
Output 1: Demarcation of MOTC HQ, RMD, PLUADs/UADs and DEPs is clearly identified with necessary staffing for the maintenance management of bridges and tunnels.		

Objectively Verifiable Indicators		Process of Changing the PDM
Original (Version 1)	Final (Version 5)	
1-1. Demarcation of MOTC's HQ, RMD, PLUADs/UADs and DEPs for maintenance management of bridges and tunnels becomes clear and approved by MOTC. 1-2. Roles of MOTC's HQ, RMD, PLUADs/UADs and DEPs in maintenance management of bridges and tunnels are implemented.	1-1. Demarcation of MOTC HQ, RMD, PLUADs/UADs and DEPs for maintenance management of bridges and tunnels becomes clear and approved by MOTC. 1-2. Roles of MOTC HQ, RMD, PLUADs/UADs and DEPs in the maintenance management of bridges and tunnels are implemented.	No Change
Output 2: A database system to record information on bridges and tunnels is developed and ready for maintenance planning.		
2-1. A database system with necessary information for maintenance planning of bridges and tunnels by [July, 2015]. 2-2. A manual for data input is developed by [July, 2015]. 2-3. [B] 30 master trainers for data collection and input are trained and certified by [July, 2015]. 2-4. [B] All the master trainers hold at least three (3) workshops on data collection and input for their responsible sections. 2-5. [T] All the staff members trained for data collection and input pass the final exam. 2-6. [B] [T] All of PLUAD/UAD operate and develop the DB system.	2-1. A database system with necessary information for maintenance planning of bridges and tunnels is developed by [July, 2015]. 2-2. A manual for data input is developed by [July, 2015]. 2-3. [B] 30 master trainers for data collection and input are trained and certified by [July, 2015]. 2-4. [B] All the master trainers hold at least three (3) workshops on data collection and input for their responsible sections. 2-5. [T] All the staff members trained for data collection and input pass the final exam. 2-6. [B] RMD operates and develops the DB system. [T] BO UAD operates and develops the DB system under the supervision of RMD.	[Item 2-6 was revised in the 2 nd JCC] To make clear the responsibility of BO UAD, which is in charge of the maintenance management of Tunnels under the supervision of RMD.
Output 3: Capacity of DEPs for routine maintenance and capacity of PLUADs/UADs for inspection and condition rating of bridges and tunnels are enhanced.		
3-1. A routine maintenance manual is developed by [B] [November, 2014] and [T] [November, 2014]. 3-2. Through the review by all the PLUADs/UADs, more than 90% of DEPs are determined to implement routine maintenance of bridges/tunnels in accordance with a newly created routine maintenance manual. 3-3. [B] 30 master trainers for inspection and condition rating are trained and certified by [June, 2015]. 3-4. [B] All the master trainers hold at least three (3) workshops on inspection and condition rating for their responsible sections. 3-5. [B] 100% of the results of inspection and condition rating implemented by PLUADs/UADs are evaluated to be accurate by RMD by [June, 2015]. 3-6. [T] All the staff members trained for inspection and	3-1. A routine maintenance manual is developed by [B] [November, 2014] and [T] [November, 2014]. 3-2. Through the review by all the PLUADs/UADs, more than 90% of DEPs are determined to implement routine maintenance of bridges/tunnels in accordance with a newly created routine maintenance manual. 3-3. [B] 30 master trainers for inspection and condition rating are trained and certified by [June, 2015]. 3-4. [B] All the master trainers hold at least three (3) workshops on inspection and condition rating for their responsible sections. 3-5. [B] 100% of the results of inspection and condition rating implemented by Master Trainers are evaluated to be accurate by RMD by [June, 2015]. 3-6. [T] All the staff members trained for inspection and	[Item 3-5 was revised in the 2 nd JCC] To implement the inspection and condition rating by Master Trainers under RMD.

Objectively Verifiable Indicators		Process of Changing the PDM
Original (Version 1)	Final (Version 5)	
condition rating pass the final exam. 3-7. [T] 100% of the results of inspection and condition rating implemented by BO UAD/DEPs are evaluated to be accurate by RMD by [June, 2015]	condition rating pass the final exam. 3-7. [T] 100% of the results of inspection and condition rating implemented by BO UAD/DEPs are evaluated to be accurate by RMD by [June, 2015]	
Output 4: Capacity of MOTC's HQ, RMD, PLUADs/UADs and DEPs for preparing maintenance management plans on bridges and tunnels is enhanced.		
4-1. A nation-wide management criteria is developed by [B] [November, 2013] and [T] [November, 2013]. 4-2. A repair methods manual is developed by [B] [November, 2013] and [T] [November, 2014]. 4-3. [B] A long-term plan for maintenance management of bridges in consideration of LCC is prepared by RMD/PLUADs/UADs in accordance with the nation-wide management criteria by [June, 2015]. 4-4. [B] A short-term plan with cost estimation for maintenance management of bridges is prepared by RMD/PLUADs/UADs by [June, 2015]. 4-5. [T] A short-term plan with cost estimation for maintenance management of tunnels is prepared by RMD/PLUADs/UADs by [June 2015].	4-1. A nation-wide management criteria is developed by [B] [November, 2013] and [T] [November, 2013]. 4-2. A repair methods manual is developed by [B] [November, 2013] and [T] [November, 2014]. 4-3. [B] A long-term plan for maintenance management of bridges in consideration of LCC is prepared by RMD in accordance with the nation-wide management criteria by [June, 2015]. 4-4. [B] A short-term plan with cost estimation for maintenance management of bridges is prepared by RMD by [June, 2015]. 4-5. [T] A short-term plan with cost estimation for maintenance management of tunnels is prepared by RMD/BO UAD by [June 2015].	[Items 4-3 and 4-2 were revised in the 2 nd JCC] To prepare the maintenance management of bridges by RMD, not by PLUADs/UADs because of limited human resources. [Item 4-5 was revised in the 3 rd JCC] To prepare the maintenance management of tunnels by BO UAD under RMD, because all of the tunnels are managed by BO UAD.
Activities		
1-1. To collect information regarding other partners and each section's staffing, etc. 1-2. To identify the most suitable section to take charge of each of collection, input and analysis of data on bridges and tunnels for a database system. 1-3. To identify the most suitable section to take charge of each of inspection, evaluation, maintenance plan preparation, and implementation of maintenance and repair of bridges and tunnels.	1-1. To collect information regarding other partners and each section's staffing, etc. 1-2. To identify the most suitable section to take charge of each of collection, input and analysis of data on bridges and tunnels for a database system. 1-3. To identify the most suitable section to take charge of each of inspection, evaluation, maintenance plan preparation, and implementation of maintenance and repair of bridges and tunnels.	No Change
2-1. To collect information regarding other partners and current conditions of bridges and tunnels, etc. 2-2. To create a database system including dimension of bridges and tunnels. 2-3. [B] To establish the procedure for data input and reporting. 2-4. [B] To draft, review and finalize a manual for data input.	2-1. To collect information regarding other partners and current conditions of bridges and tunnels, etc. 2-2. To create a database system including dimension of bridges and tunnels. 2-3. [B] To establish the procedure for data input and reporting. 2-4. [B] To draft, review and finalize a manual for data input.	[Item 2-7 was revised in the 2 nd JCC] To collect and input data of inspection, condition rating and costing of each bridge by Road Asset Management Section (RAMS) under RMD which was newly established to manage bridge database comprehensively.

Objectively Verifiable Indicators		Process of Changing the PDM
Original (Version 1)	Final (Version 5)	
<p>2-5. [B] To implement master trainers' trainings on data collection and input.</p> <p>2-6. [B] To implement trainings by master trainers for staff members of PLUADs/UADs and DEPs for data collection and input.</p> <p>2-7. [B] To collect and input data of inspection, condition rating and costing of each bridge by staff members of PLUADs/UADs/DEPs.</p> <p>2-8. [T] To establish the procedure for data input and reporting.</p> <p>2-9. [T] To create a manual for data input.</p> <p>2-10. [T] To implement trainings for staff members of BO UAD/DEPs for data collection and input. [T] To collect and input data of inspection, condition rating and costing of each tunnel by staff members of BO UAD/DEPs.</p>	<p>2-5. [B] To implement master trainers' trainings on data collection and input.</p> <p>2-6. [B] To implement trainings by master trainers for staff members of PLUADs/UADs and DEPs for data collection and input.</p> <p>2-7. [B] To collect and input data of inspection, condition rating and costing of each bridge by staff members of RMD.</p> <p>2-8. [T] To establish the procedure for data input and reporting.</p> <p>2-9. [T] To create a manual for data input.</p> <p>2-10. [T] To implement trainings for staff members of BO UAD/DEPs for data collection and input.</p> <p>2-11. [T] To collect and input data of inspection, condition rating and costing of each tunnel by staff members of BO UAD/DEPs.</p>	
<p>3-1. [B] To draft, review and finalize a routine maintenance manual.</p> <p>3-2. [B] To draft, review and finalize an inspection and condition rating manual.</p> <p>3-3. [B] To implement master trainers' trainings on inspection and condition rating.</p> <p>3-4. [B] To implement trainings by master trainers for staff members of PLUADs/UADs and DEPs for inspection and condition rating.</p> <p>3-5. [B] To carry out inspection and condition rating by staff members of PLUADs/UADs/DEPs.</p> <p>3-6. [T] To create a routine maintenance manual.</p> <p>3-7. [T] To create an inspection and condition rating manual.</p> <p>3-8. [T] To implement trainings for staff of BO UAD/DEPs for inspection and condition rating.</p> <p>3-9. [T] To carry out inspection and condition rating by staff members of BO UAD/DEPs.</p>	<p>3-1. [B] To draft, review and finalize a routine maintenance manual.</p> <p>3-2. [B] To draft, review and finalize an inspection and condition rating manual.</p> <p>3-3. [B] To implement master trainers' trainings on inspection and condition rating.</p> <p>3-4. [B] To implement trainings by master trainers for staff members of PLUADs/UADs and DEPs for inspection.</p> <p>3-5. [B] To carry out inspection by staff members of RMD/PLUADs/UADs/DEPs. To carry out condition rating by staff members of RMD.</p> <p>3-6. [T] To create a routine maintenance manual.</p> <p>3-7. [T] To create an inspection and condition rating manual.</p> <p>3-8. [T] To implement trainings for staff of BO UAD/DEPs for inspection and condition rating.</p> <p>3-9. [T] To carry out inspection and condition rating by staff members of BO UAD/DEPs.</p>	<p>[Items 3-4 and 3-5 were revised in the 2nd JCC]</p> <p>To carry out condition rating by Road Asset Management Section (RAMS) under RMD which was newly established to manage bridge condition rating comprehensively.</p>
<p>4-1. [B] To establish a nation-wide management criteria for bridges.</p> <p>4-2. [B] To draft, review and finalize a repair methods manual including cost estimation.</p> <p>4-3. [B] To implement trainings for staff of</p>	<p>4-1. [B] To establish a nation-wide management criteria for bridges.</p> <p>4-2. [B] To draft, review and finalize a repair methods manual including cost estimation.</p> <p>4-3. [B] To implement trainings for staff of RMD on detailed</p>	<p>[Items 4-3 to 4-6 were revised in the 2nd JCC]</p> <p>To prepare the short/long-term plans for bridge maintenance management including the training for RMD staff by Road Asset Management Section (RAMA) under RMD</p>

Objectively Verifiable Indicators		Process of Changing the PDM
Original (Version 1)	Final (Version 5)	
<p>RMD/PLUADs/UADs on detailed survey and cost estimation for preparing a long-term plan for maintenance management of bridges.</p> <p>4-4. [B] To prepare a long-term plan for maintenance management of bridges by staff members of RMD/PLUADs/UADs.</p> <p>4-5. [B] To implement trainings for staff members of RMD/PLUADs/UADs on preparing a short-term plan for maintenance management of bridges.</p> <p>4-6. [B] To prepare a short-term plan for maintenance management of bridges by staff members of RMD/PLUADs/UADs.</p> <p>4-7. [T] To establish a management criteria for tunnels.</p> <p>4-8. [T] To create a repair methods manual including cost estimation.</p> <p>4-9. [T] To prepare a short-term plan for maintenance management for tunnels through trainings for staff of RMD/BO UAD/DEPs.</p>	<p>survey and cost estimation for preparing a long-term plan for maintenance management of bridges.</p> <p>4-4. [B] To prepare a long-term plan for maintenance management of bridges by staff members of RMD.</p> <p>4-5. [B] To implement trainings for staff members of RMD on preparing a short-term plan for maintenance management of bridges.</p> <p>4-6. [B] To prepare a short-term plan for maintenance management of bridges by staff members of RMD.</p> <p>4-7. [T] To establish a management criteria for tunnels.</p> <p>4-8. [T] To create a repair method manual including cost estimation.</p> <p>4-9. [T] To prepare a short-term plan for maintenance management for tunnels through trainings for staff of RMD/BO UAD/DEPs.</p>	<p>which was newly established to manage short/long-term plans for bridges comprehensibly.</p>
Inputs		
<p><u>Kyrgyz side</u></p> <ol style="list-style-type: none"> 1. Counterparts for the project <ol style="list-style-type: none"> 1) Project Director: 2) Project Manager: 3) Counterparts: 2. Office for the Project with office furniture and utilities such as internet connectivity, telephone line, electricity, etc. 3. Running expenses necessary for the implementation of the Project including travel expenses and allowances for the participants of the trainings with the exception for some participants. 	<p><u>Kyrgyz side</u></p> <ol style="list-style-type: none"> 1. Counterparts for the project <ol style="list-style-type: none"> 1) Project Director: 2) Project Manager: 3) Counterparts: 2. Office for the Project with office furniture and utilities such as internet connectivity, telephone line, electricity, etc. 3. Running expenses necessary for the implementation of the Project including travel expenses and allowances for the participants of the trainings with the exception for some participants. 	<p>No Change</p>
<p><u>Japanese side</u></p> <ol style="list-style-type: none"> 1. Experts <ol style="list-style-type: none"> 1) Team Leader / Bridge Maintenance Expert (1) 2) Deputy Team Leader / Bridge Maintenance Expert (2) 3) Bridge Maintenance Expert (3) 4) Tunnel Expert-1 (Structure) 5) Tunnel Expert-2 (Facilities) 	<p><u>Japanese side</u></p> <ol style="list-style-type: none"> 1. Experts <ol style="list-style-type: none"> 1) Team Leader / Bridge Maintenance Expert (1) 2) Deputy Team Leader / Bridge Maintenance Expert (2) 3) Bridge Maintenance Expert (3) 4) Tunnel Expert-1 (Structure) 5) Tunnel Expert-2 (Facilities) 	<p>[Items 9 and 10 were added in the 3rd JCC] To transfer the knowledge for the special equipment of detailed bridge inspection and IRI survey.</p>

Objectively Verifiable Indicators		Process of Changing the PDM
Original (Version 1)	Final (Version 5)	
6) Database Expert 7) Cost Estimator / Detailed Bridge Inspection 8) Coordinator / Bridge Inspection Assistant 9) Local Coordinator	6) Database Expert 7) Cost Estimator / Detailed Bridge Inspection 8) Coordinator / Bridge Inspection Assistant 9) Bridge Maintenance Expert (4) / Assistant for Detailed Bridge Inspection / Assistant for International Roughness Index (IRI) Survey 10) IRI Survey Expert 11) Local Coordinator	
2. Equipment 1) Scaffolding / Platform Truck 2) Lighting Facilities 3) Schmidt Hammers 4) Crack Scales 5) Test Hammers 3. (Trainings in Japan / third country) Inputs other than indicated here will be determined through mutual consultation between JICA and MOTC during the implementation of the Project, as necessary.	2. Equipment 1) Lighting Facilities 2) Schmidt Hammers 3) Test Hammers 4) Infrared camera 5) Electric drill 6) VIMS 3. Trainings in Japan Training in Japan will be implemented twice during the implementation of the Project. The schedule and participants of the training in Japan are as follows: 1) Schedule 1 st training: September 2014 2 nd training: September 2015 2) Participants 5 persons for each training Participants will be chosen from the member of counterparts and master trainers of the Project. Inputs other than indicated here will be determined through mutual consultation between JICA and MOTC during the implementation of the Project, as necessary.	[Items 4 and 5 were added in the 2 nd JCC] To transfer the knowledge for the special equipment of detailed bridge inspection. [Item 6 was added in the 3 rd JCC] To transfer the knowledge for the IRI survey.