Kingdom of Cambodia
Ministry of Public Works and Transport

Kingdom of Cambodia

The Project for Strengthening Capacity for Maintenance of Roads and Bridges

Project Completion Report

February 2018

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

CTI ENGINEERING INTERNATIONAL CO., LTD.

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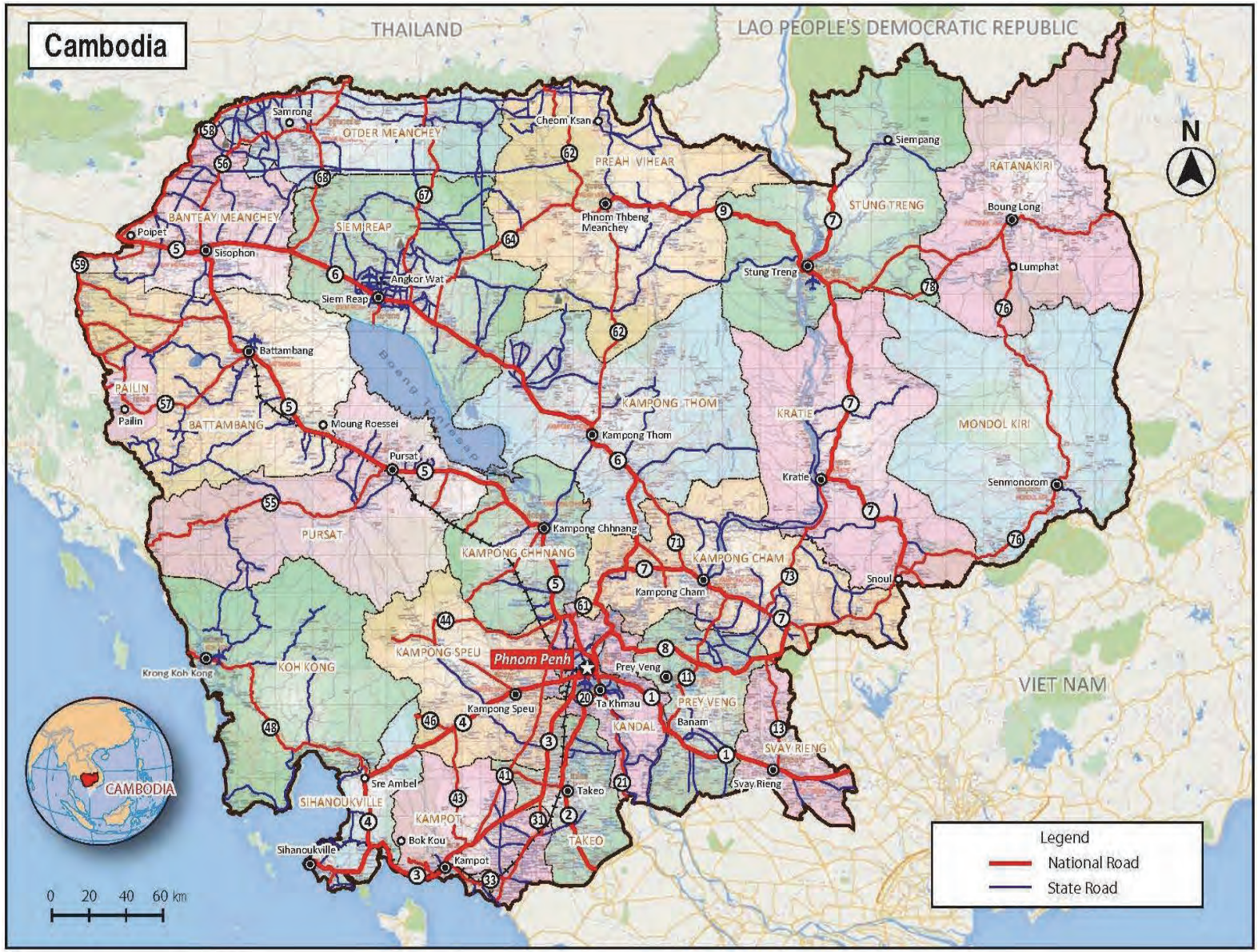

Location Map

The Project for Strengthening Capacity for Maintenance of Roads and Bridges
Project Completion Report

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Manuals and Guidelines prepared in the Project

I Road Maintenance

1. Road Maintenance Manual

Guideline for Routine Road Maintenance Using IRI

2. Road Repair Manual
   (1) Guideline for Repairing Defects of Road
   (2) Handbook Version

II Bridge Maintenance

1. Bridge Inspection Manual
   (1) Bridge Inspection Manual
   (2) Handbook Version
2. Bridge Repair Manual
   (1) Bridge Repair Manual
   (2) Handbook Version

III Annual Action Plan

1. Bridge Maintenance Annual Action Plan
2. 3-Year Bridge Maintenance Strategic Plan

Other deliverables prepared in the Project

1. Activity Report
2. Maintenance Expert Training Material

Chapter 1 Basic Information of the Project

1.1 Country

Kingdom of Cambodia

1.2 Title of the Project

The Project for Strengthening Capacity for Maintenance of Roads and Bridges

1.3 Duration of the Project

7th April 2015 – 16th March 2018

1.4 Background

In Cambodia, roads are the primary mode of transport. Cambodia has a road network of 58,400km, of which 7,248km is national road. Almost all roads in Cambodia were constructed from the 1920s to 1930s. However due to civil conflict in the 1970s the main roads were damaged. In addition, overloading of vehicles and periodic flood has also contributed to poor road conditions After the end of the civil war, roads and bridges were rehabilitated and constructed by the government of Cambodia and multilateral donors.

The pavement ratio grew to 99.1% for single digit national roads as a result of past projects implemented by multilateral donors including Japan International Cooperation Agency (hereinafter JICA). The road maintenance advisors and experts in Technical Cooperation Projects who were dispatched by JICA strengthened the road maintenance capacity of Ministry of Public Works and Transport (hereinafter MPWT). However, the maintenance of roads and bridges in Cambodia in comparison to other Asian countries is still far behind.

The main challenges hindering the maintenance of roads and bridges are; 1) lack of finance, 2) lack of skilled manpower with technical know-how and 3) lack of equipment for road development/maintenance works.

In order to meet some of the challenges above, the government of Cambodia requested the Japanese government to conduct a technical cooperation project to strengthen capacity for maintenance of roads and bridges

1.5 Implementing Agency

Road Infrastructure Department (hereinafter RID), Ministry of Public Works and Transport

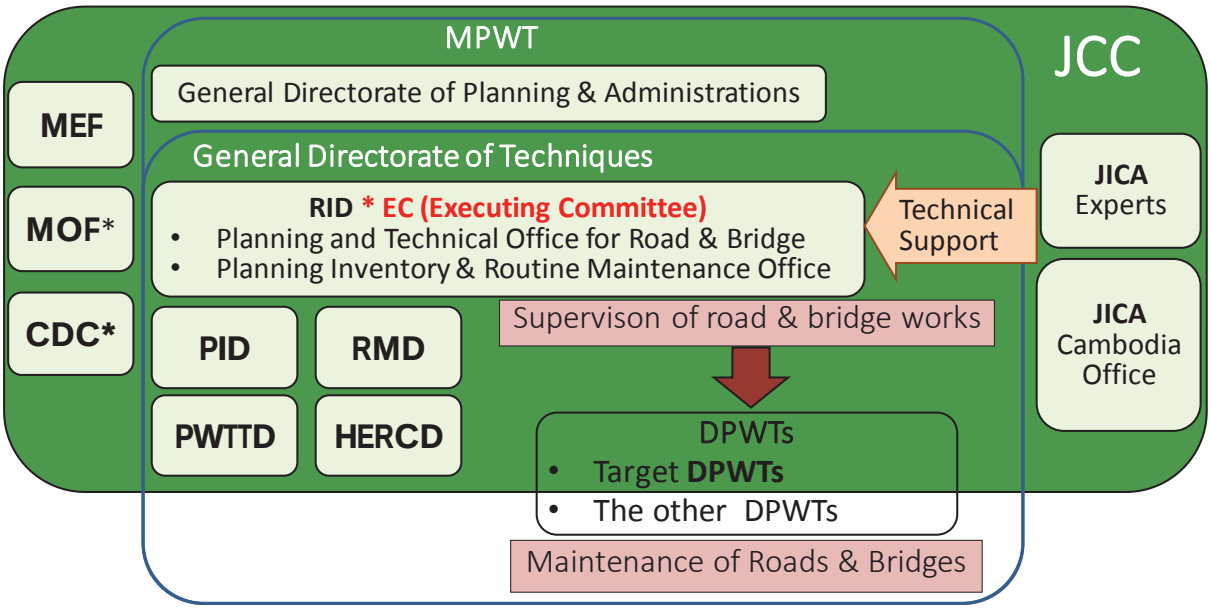
Outline of the Project

1. Project Title: The Project for Strengthening Capacity for Maintenance of Roads and Bridges
2. Project Period: April 2015 – March 2018
3. Overall Goal: Appropriate Maintenance of roads and bridges is managed by MPWT
4. Project Purpose: Capacity of RID to supervise implementing bodies maintaining roads and bridges are enhanced.
5.Outputs:
(1) The bridge maintenance cycle is established.
(2) Road and bridge inspection capacity of RID is enhanced.
(3) Road and bridge repair capacity of RID is enhanced.
(4) Road and bridge maintenance cycle is introduced to other Department of Public Works and Transport (hereinafter DPWT) and concerning agencies.
6. Activities
【related to Output (1)】
1-1. To review the present bridge maintenance cycle and the works of RID in comparison to the existing Japanese system
1-2. To propose 3 year bridge maintenance strategic plan with the annual action plan to establish a proper bridge maintenance cycle
1-3. To practice the action plan
1-4. To hold workshop of the bridge maintenance cycle
1-5. To prepare draft annual bridge maintenance budget
【 related to Output (2)】
2-1. To review and develop road maintenance manual
2-2. To review and develop bridge maintenance manual, including a database frame
2-3. To hold training workshops on road and bridge inspections
2-4. For bridges, to inspect roads and bridges and prepare rough cost estimation of the repair works at the target DPWTs
2-5. For roads, to inspect roads using International Roughness Index (IRI) and prepare rough cost estimation of the repair work at the target DPWTs
2-6. To register the inspection results in the database by RID
2-7. To revise the road and bridge maintenance manuals incorporating lessons learned from the above activities by organizing review workshops
2-8. To conduct preliminary study on overloading control (at Tsubasa Bridge)
【 related to Output (3)】
3-1. To review and establish road repair manual
3-2. To review and establish bridge repair manual
3-3. To hold training workshops on road and bridge repairs
3-4. To identify roads and bridges for the pilot repair works based on the inspection results at the target DPWTs
3-5. To establish repair plan for the identified roads and bridges at the target DPWTs
3-6. To repair the identified roads and bridges at the target DPWTs
3-7. To evaluate the above repair works
3-8.To revise the road and bridge repair manual incorporating lessons learned from the above activities by organizing review workshop by organizing review workshop
【 related to Output (4)】
4-1. To organize seminars for other DPWTs – trainings on road and bridge inspection
4-2. To organize seminars for other DPWTs – trainings on road and bridge repair
4-3. To organize the project wrap-up seminar
7. Counter Part: Road Infrastructure Department of Ministry of Public Works and Transport (RID MPWT)

1.6 Project Organization Chart

Figure 1-1 shows the Project Organization Chart confirmed in the 1st Joint Coordination Committee (hereinafter JCC) meeting dated on 10 July 2015. The Project is directed by JCC as supervisor of the Project. EC (Executing Committee) is formed under JCC for implementation of the Project.

The member lists for both committees are shown in 2.1.3.



Source: 1st JCC Meeting, 10 July 2015

Figure 1-1 Project Organization Chart

MEF: Ministry of Economy and Finance
MOF: Ministry of Foreign Affairs
CDC: Council for the Development of Cambodia
PID: Department of Public Infrastructure (former SPIED (Department of Sub-National Public Infrastructure and Engineering))
RMD: Department of Roads Repair and Maintenance (former RMC (Road Maintenance Center))
PWTTD: Department of Technical Public Works and Transport (former PWRC(Public Works Research Center)
HERCD: Department of Equipment and Roads Rehabilitation (former HEC (Heavy Equipment Center))

1.7 Project Flow Chart

The Project Flow Chart is shown in Figure 1-1.

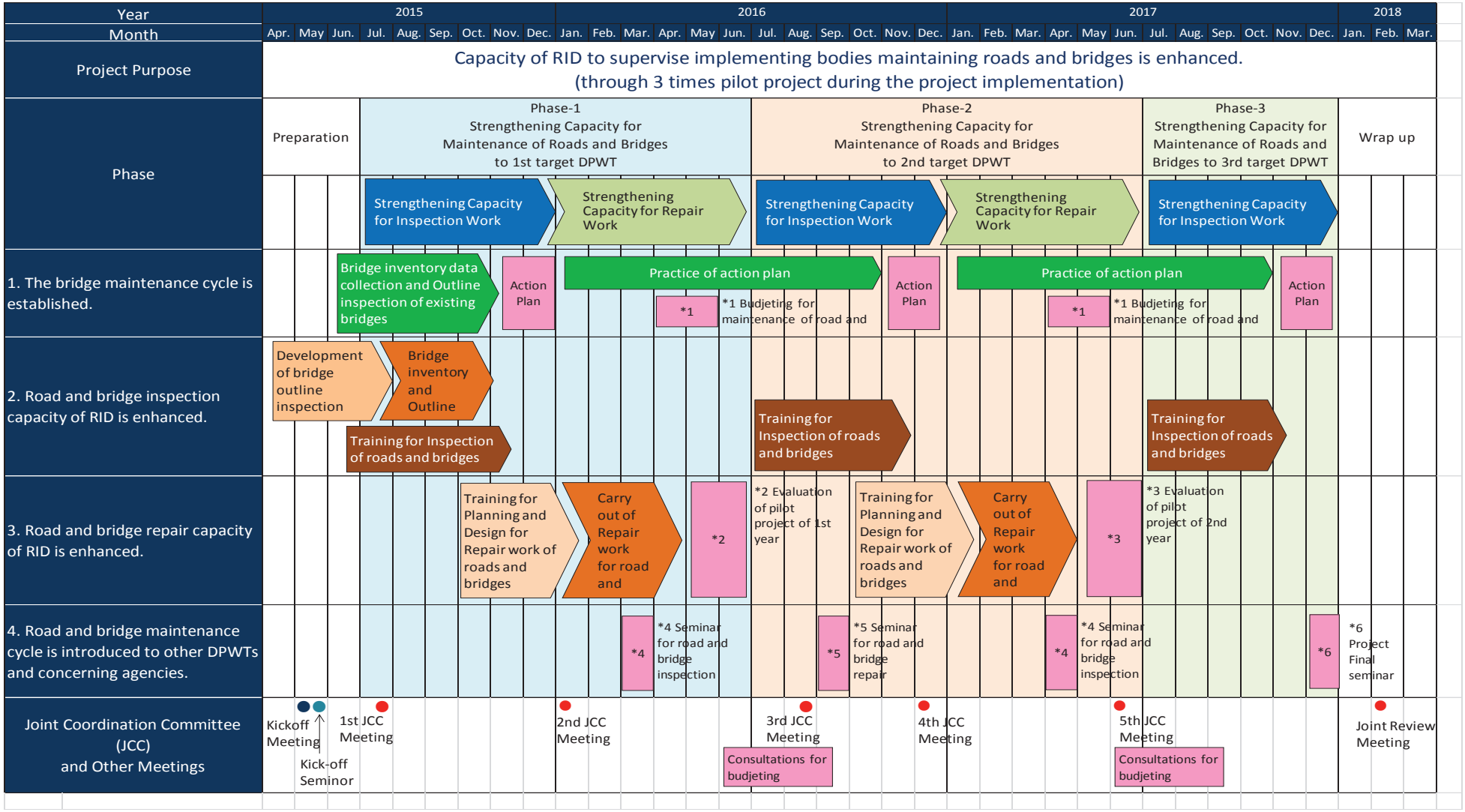


Figure 1-2 Project Flow Chart

Chapter 2 Result of the Project

2.1 Result of the Project

2.1.1 Input by the Japanese side (Planned and Actual)

Table 2-1 Summary of inputs from Japanese side

Planned (Ver.0)	Actual	Remark
1. A chief advisor/ Along term expert	1. A chief advisor / A long term expert	
36.0MM	36.0MM	Subtotal, Man-Month
2. Short term experts 1) Team Leader/Bridge maintenance engineer 2) Deputy-project manager/ Bridge repair engineer 3) Bridge Inspection Engineer 4) Road Engineer 5) Coordinator	2. Short term experts 1) Team Leader / Bridge Maintenance Engineer 2) Deputy-team leader / Road Maintenance Planner 3) Bridge Inspection Engineer (1) 4) Bridge Inspection Engineer (2) 5) Bridge Repair Engineer (1) (Planning and Design) 6) Bridge Repair Engineer (2) (Repairing work Expert) 7) Bridge Repair Engineer (3) 8) Bridge Maintenance Planner 9) Road Maintenance Engineer (1) / 10) Equipment procurement engineer 11) Road Maintenance Engineer (2) 12) Coordinator / Assistant for Road and Bridge Inspection 13) Coordinator for other relevant project / C/P training Supervision 14) Road Maintenance Engineer (3) (Overloading Control) 15) Database Expert	See detail of short term expert in put in Table 2-2. Support of pilot project Support for ME training Support for ME training Procurement of equipment Replacement of Road Maintenance Engineer (1) See Table 2-3
3. Equipment for road and bridge maintenance 4. C/P training 5. Cost for Seminars and Trainings as the project activities	3. Equipment for road and bridge maintenance 4. C/P training 5. Cost for seminars and Trainings as the project activities	Addition of the activity for overloading control at Tsubasa bridge
85.17 MM	92.64 MM	Subtotal, Man-Month
121.17MM	128.64MM(106.1%)	Total, Man-Month

Note: Red letter shows the contents modified during the project from the original plan or planned in version 0 (ver. 0) of Project Design Matrix (PDM).

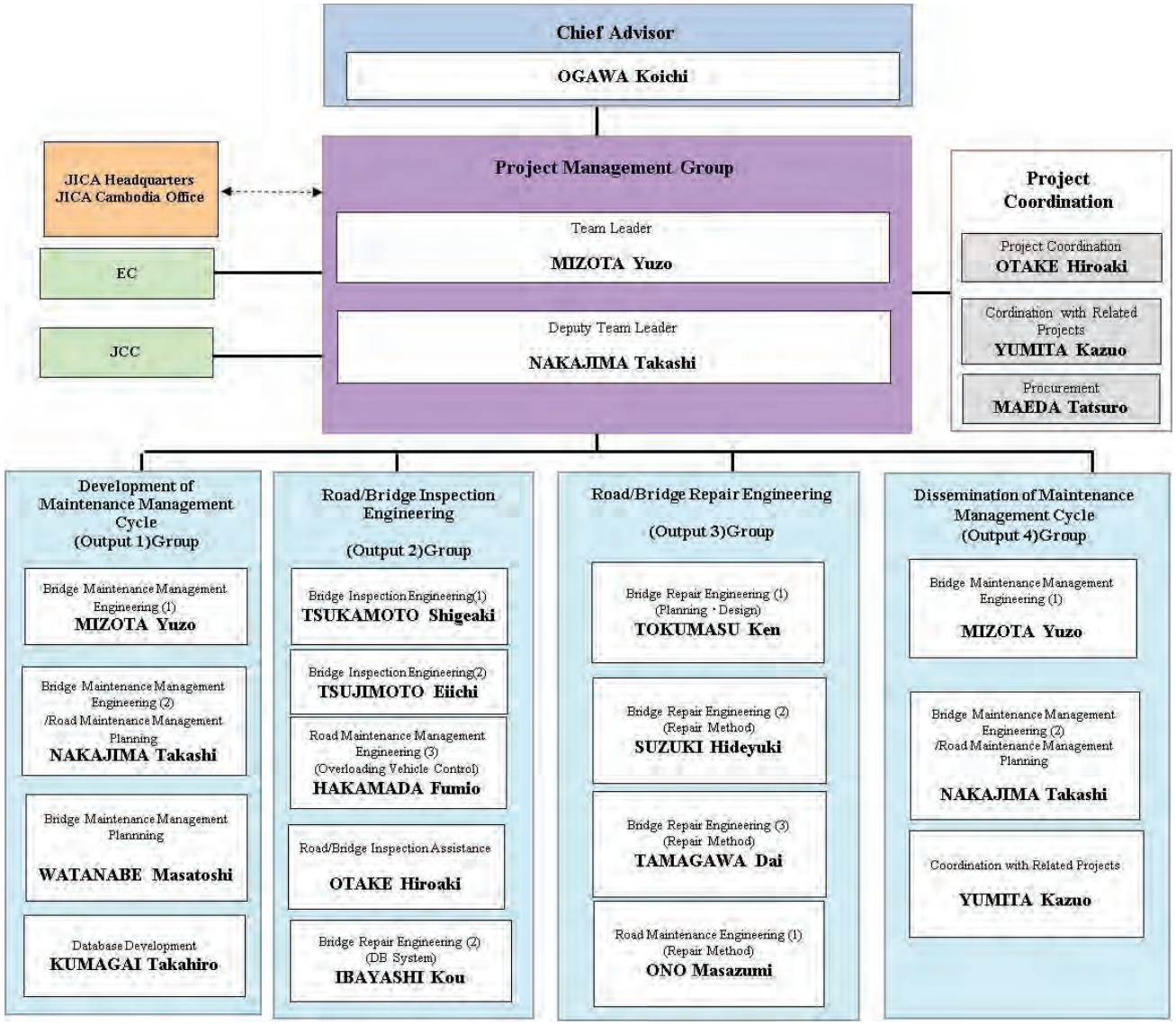


Figure 2-1 Organization of JICA Expert Team

Table 2-2 Name List of the Short Term Expert Team

Position	Name	Company	Major Tasks in Charge		Work in Cambodia	Work in Japan	Total
Team Leader / Bridge Maintenance Engineer	Yuzo MIZOTA	CTII	Project Management JCC, Reporting, Bridge Maintenance	Plan	267	5	272
				Actual	279	5	284
Deputy-team leader / Road Maintenance Planner	Takashi NAKAJIMA	CTII	Project Management JCC, Reporting, Road Maintenance	Plan	291	5	296
				Actual	292	5	297
Bridge Repair Engineer (1) (Planning and Design)	Ken TOKUMASU	HEX	Bridge Maintenance Manual Pilot projects, ME training	Plan	339		339
				Actual	339		339
Bridge Repair Engineer (2) (Repairing work Expert)	Hideyuki SUZUKI	HEX	On site training of bridge maintenance	Plan	66		66
				Actual	66		66
Bridge Repair Engineer (3)	Dai TAMAGAWA	HEX	Pilot project of bridge repair	Plan	30		30
				Actual	30		30
Bridge Inspection Engineer(1)	Shigeaki TSUKAMOTO	HEX	Bridge inspection manual ME training	Plan	270		270
				Actual	272		272
Bridge Inspection Engineer(2)	Eiichi TSUJIMOTO	HEX	On site training of bridge inspection	Plan	30		30
				Actual	30		30
Road Maintenance Engineer(1)	Hiroyuki HEIMA	CTII	Road repair manual On site training of road repair	Plan	92		92
				Actual	92		92
Equipment procurement engineer	Tatsuro MAEDA	CTII	Road repair manual On site training of road repair procurement of pilot project material	Plan	90		90
				Actual	90		90
Road Maintenance Engineer(1)	Masazumi ONO	CTII	Road administration improvement	Plan	103		103
				Actual	103		103
Road Maintenance Engineer(2)	Kou IBAYASHI	CTII (Nagaoka National Collecge of Technology)	Bridge database system development Training in Japan	Plan	40	7	47
				Actual	30	7	37
Road Maintenance Engineer(2)	Kohei NAGAI	CTII (Tokyo University)	Keynote lecture at the final seminar Training in Japan	Plan	0	0	0
				Actual	3	3	6
Road Maintenance Engineer (3) (Overloading Control)	Fumio HAKAMADA	HEX	Overloading control study Pilot Project Management Development of standard reporting	Plan	165		165
				Actual	163		163
Bridge Maintenance Planner	Masatoshi WATANABE	CTII	Briddge database development and training, 3 year bridge maintenance plan	Plan	270		270
				Actual	283		283
Database Expert	Takahiro KUMAGAI	CTII	Development of data management system (elecrornic library)	Plan	91		91
				Actual	91		91
Coordinator / Assistant for Road and Bridge Inspection	Hirokai OHTAKE	CTII	IRI and training Road Inspection Manual	Plan	355		355
				Actual	333		333
Coordinator for other relevant project / C/P training Supervision	Kazuo YUMITA	CTII	Project coordination and data collection, arrangement of meetings with management class	Plan	165		165
				Actual	165		165
Coordinator of Training in Japan(1)	Mamiko SUZUKI	CTII	Training in Japan (1st year)	Plan		20	20
				Actual		20	20
Coordinator of Training in Japan(2)	Hitomi IWAMASA	CTII	Training in Japan (2nd year)	Plan		20	20
				Actual		20	20
Coordinator of Training in Japan(3)	Kanayo SEKI	CTII	Training in Japan (3rd year)	Plan		20	20
				Actual		20	20
						Plan	2741
CTII: CTI Engineerig International Co.Ltd						Actual	2741
HEX:Hanshin Expressway Company							

Table 2-3 is the list of the equipment and Table 2-4 is the list of construction materials for pilot project procured by December 2016.

Table 2-3 Equipment List

Item	No. of Items	Year/Month	Storage Site	Status
(1) Road Inspection				
DRIMS (Dynamic Response Intelligent Monitoring System)	2	2015 April, 2016 October	JICA team office, MPWT	use for road condition evaluation
DRIMS-relevant accessary	2	2016 September	RID office*1	use for road condition evaluation
Movie recorder (road monitor)	2	2016 September	RID office	use for road condition evaluation
(2)Bridge Inspection				
Binocular	5	2015 August	RID office	use for bridge inspection
Inspection hammer	10	2015 October	RID office	use for bridge inspection
Waist pouch for inspection equipment	10	2015 October	RID office	use for bridge inspection
Flashlight	10	2015 October	RID office	use for bridge inspection
Inspection camera	1	2016 September	JICA team office	use for bridge inspection
Oxygen meter	1	2016 September	JICA team office	use for bridge inspection
Safety belt	5	2016 September	RID office	use for bridge inspection
Ladder	1	2016 September	RID office	use for bridge inspection
Head beam light	2	2016 September	RID office	use for bridge inspection
Head light	5	2016 September	RID office	use for bridge inspection
Transceiver	1	2016 September	RID office	use for bridge inspection
Shovel	2	2016 September	RID office	use for bridge inspection
Grass Cutter	1	2016 September	RID office	use for bridge inspection
Color cone	5	2016 September	RID office	use for bridge inspection
Vehicle stopper	1	2016 September	RID office	use for bridge inspection
(3) Bridge Database				
iPad	10	2016 September	RID office	use for bridge inspection
Laptop computer	2	2016 September	RID office	use for bridge database management
MacBook Pro（laptop PC）	1	2015 October	RID office	use for bridge database management
DELL Inspiron 15 5000series（laptop PC）	1	2015 October	RID office	use for bridge database management
FileMaker Sever (software)	1	2015 October	RID office	use for bridge database management
FileMaker Pro (software)	1	2015 October	RID office	use for bridge database management
(4) Overloading Control				
Portable type weighing scale	2	2016 September	Tsubasa Bridge	Use for measurement
Container house	1	2016 September	Tsubasa Bridge	Use for measurement
Load cell (spare parts)	1	2016 December	Secretariat of Permanent Coordination Committee for Inspection of Overloaded Trucks (SPCC)	Use for measurement

Table 2-4 List of Construction Materials for Pilot Projects

Item	No. of Items	Year/Month	Storage Site	Status
(1) Bridge Pilot Project				
BOND E206 (BASE)	15	2016 January	RID lab*2	Used for pilot projects
BOND E 206 (HARDENER)	15	2016 January	RID lab	Used for pilot projects
BOND E390 (BASE)	15	2016 January	RID lab	Used for pilot projects
BOND E 390 (HARDENER)	15	2016 January	RID lab	Used for pilot projects
CYLINDER FOR BOND	12 (box)	2016 January	RID lab	Used for pilot projects
WEIGHTING MACHINE	1	2016 January	RID lab	Used for pilot projects
WIRE BRUSH	6	2016 January	RID lab	Used for pilot projects
SPATURA FOR MIXING	3	2016 January	RID lab	Used for pilot projects
CHALK	1 (box)	2016 January	RID lab	Used for pilot projects
BUCKET	6	2016 January	RID lab	Used for pilot projects
STOP WATCH	3	2016 January	RID lab	Used for pilot projects
SPATURA FOR PAINT	3	2016 January	RID lab	Used for pilot projects
MEASURE CUP	6	2016 January	RID lab	Used for pilot projects
SANDPAPER	6	2016 January	RID lab	Used for pilot projects
BLOWER	3	2016 January	RID lab	Used for pilot projects
LEATHER SKIVING CUTTER	6	2016 January	RID lab	Used for pilot projects
Bridge repair materials for the pilot project	1 set	2016 November	Sihanouk DPWT	Used for pilot projects
Carbon fiber sheets	1 set	2016 November	Sihanouk DPWT	Used for pilot projects
Bridge repair materials for the pilot project	1 set	2016 November	JICA team office	Used for pilot projects
Carbon fiber sheets	1 set	2016 November	JICA team office	Used for pilot projects
(2) Road Pilot Project				
Permanent Cold Patch Asphalt (1)	100	2016 January	RID lab	Used for pilot projects
Permanent Cold Patch Asphalt (2)	200	2017	RID lab	Used for pilot projects

*1: MPWT main office building, 3rd floor

*2: Bridge unit warehouse in RID laboratory

Table 2-5 Trainings in Japan Conducted by the Project

Year	Schedule	Number of participants	Organization accepted the training
1st	14 October 2015 to 23 October 2015	7(1)	JICA Kansai Hanshin Expressway Company Akashi Bridge World Gifu University JICATokyo CTI Engineering Co.Ltd., Sumida River Tokyo Metropolitan Expressway Company Machida City
2nd	30 October 2016 to 12 November 2016	7(2)	JICA Kansai CTI Engineering Co.Ltd., TORAY Industries IKEE Group Hanshin Expressway Hanshin Expressway Engineering Niigata city Tanaka Scale National Institute of Technology, Nagaoka College Tokyo University CTII JICA Tokyo
3rd	5 November 2017 to 18 November 2017	7(2)	JICA Kyushu Kitakyushu City Fuji PS Tsutawaru Doboku (Kyushu Association for Bridge and Structural Engineering) Hanshin Expressway Company Hanshin Expressway Engineering Tokyo University Chiba City

Note :( ) indicates number of trainees from MEF.

Table 2-6 Name of the Trainees for 1st Training in Japan

Organization	Name	Position
MPWT (Ministry of Public Works and Transport)	Mr. NAY Chamnang	Director of Road Infrastructure Department
	Mr. LIM Sambo	Director of Kampot Provincial Department
	Mr. KIM Ponna	Director of Siem Reap Provincial Department
	Mr. MAM Touch	Director of Kep Provincial Department
	Mr. CHOU Kolla	Director of Kompong Thom Provincial Department
	Mr. CHAO Sopheak Phibal	Deputy Director of Road Infrastructure Department
Ministry of Economy and Finance	Mr. MEN Vivoit Vithiea	Chief of Investment Bureau

Table 2-7 Name of the Trainees for 2nd Training in Japan

Organization	Name	Position
MPWT (Ministry of Public Works and Transport)	Mr. SRENG Sros	Director, Department of Public Works and Transport of Kratie Province
	Mr. HAY Chandara	Deputy Chief Office, Road Infrastructure
	Mr. SITTHY Panhavuth	Deputy Chief Office, Road Infrastructure
	Mr. NIN Menakak	Deputy Chief of Planning and Technical Office, Road Infrastructure
	Mr. LONG Davuth	Officer, Road Infrastructure
MEF (Ministry of Economy and Finance)	Mr. VONGSEY Vicheth	Deputy Director, Department of Investment
	Mr. PHAT Kong	Deputy Chief Office, Department of Investment

Table 2-8 Name of the Trainees for 3rd Training in Japan

Organization	Name	Position
MPWT (Ministry of Public Works and Transport)	Mr. SIM San Vapiseth	Vice Chief Office, Road Infrastructure
	Mr. NGIM Nouba	Deputy Chief Office, Road Infrastructure
	Ms. CHAY Chakriya	Office, Road Infrastructure
	Mr. MOM Ratha	Vice Chief Office, Road Infrastructure
	Mr. CHHOUK Sochea	Office, Road Infrastructure
MEF (Ministry of Economy and Finance)	Mr. CHAN Pulrith	Deputy Chief Office, Department of Investment
	Ms. NONG Chandany	Deputy Chief Office, Department of Investment

2.1.2 Input by the Cambodia side (Planned and Actual)

Planned (Ver.0)	Actual	Remark
1. Arrangement of counterpart personnel 1) Project Director 2) Project Manager 3) Other Necessary Personnel 2. Implementation cost for the pilot repair works 3. Travel expenses and allowances for the participants of the seminars and trainings organized as the project activities 4. Maintenance cost of the JICA project equipment 5. Office space including its utility cost (electricity, water, internet and other necessary office facilities) 6. Etc.	1. Arrangement of counterpart personnel 1) Project Director 2) Project Manager 3) Other Necessary Personnel 2. Implementation cost for the pilot repair works 3. Travel expenses and allowances for the participants of the seminars and trainings organized as the project activities 4. Maintenance cost of the JICA project equipment 5. Office space including its utility cost (electricity, water, internet and other necessary office facilities) 6. Etc.	No change

2.1.3 Joint Coordination Committee

The Joint Coordination Committee for the Project was held as follows:

Table 2-9 List of Joint Coordination Committee

No	Date
1st	23 July 2015
2nd	18 January 2016
3rd	10 August 2016
4th	15 December 2016
5th	23 June 2017

Joint Coordination Committee Member List

1.	H.E. TAUCH Chankosal	Secretary of State,	President
2.	H.E. RHY Sophort,	Director General of Public Works,	Permanent Vice-president
3.	H.E VASIM Soriya	Director General of Administration	Vice-president
4.	Mr. NOU Vaddhanak	Deputy General of Public Works	Member
5.	Representative from Ministry of Foreign Affairs and International Cooperation,		Member
6.	Representative from Ministry of Economy and Finance		Member
7.	Representative Council for Development of Cambodia		Member
8.	Director of Road Infrastructure Department		Member
9.	Director of Public Works Research Center		Member
10.	Director of Heavy Equipment Center		Member
11.	Director of Road Maintenance Center		Member
12.	Director of Sub-national Public Infrastructure Engineering Department		Member
13.	Director of Accounting and Finance Department		Member
14.	Director of International and Cooperation Department		Member
15.	Representative of JICA Cambodia Office		Member
16.	Second Secretary, Embassy of Japan		Member
17.	JICA Experts for the Project		Member

Executing Committee Member List

1.	Mr. Heng Rathpiseth, Director of Road Infrastructure Department			Project Director
	(Mr. Heng Rathpiseth, Director of Road Infrastructure Department)			
	(Mr. Nay Chamnang Director of Road Infrastructure Department)			
2.	Mr.Chao Sopheak Phibal Deputy Director of Road Infrastructure Department			Deputy Project Director
3.	Mr. YOU Dara	Deputy Director of Road Infrastructure Department		Permanent Member
4.	Representative from Ministry of Economy and Finance			Member
5.	JICA Experts			Member
6.	Mr. KEM Socheat	Chief Office	(RID)	Member
7.	Mr. KHOUN Kompheak	Chief Office	(RID)	Member
8.	Mr. SA Sivutha	Chief Office	(RID)	Member
9.	Mr. POU Manith	Chief Office	(RID)	Member
10.	Mr. EM Sovisoth	Deputy Chief Office	(RID)	Member
11.	Mr. NIN Menakak	Deputy Chief Office	(RID)	Member
12.	Ms. THOU Saovry	Deputy Chief Office	(RID)	Member
13.	Mr. NGIM Nouba	Deputy Chief Office	(RID)	Member
14.	Mr. HAI Chandara	Deputy Chief Office	(RID)	Member
15.	Mr. NOP Kilarith	Deputy Chief Office	(RID)	Member
16.	Mr. SETHY Phanavuth	Deputy Chief Office	(RID)	Member
17.	Mr. VETH Piseth	Deputy Chief Office	(RID)	Member
18.	Mr. EM Bunnara	Deputy Chief Office	(SPIED)	Member
19.	Mr. LEAS Thlork	Deputy Chief Office	(SPIED)	Member
20.	Mr. LUN Virakvicheatra	Deputy Chief Office	(RMC)	Member
21.	Mr. HIN Son Odom	Deputy Chief Office	(RMC)	Member
22.	Mr. BOU Lindo	Officer	(RMC)	Member
23.	Mr. LONG Marly	Officer	(RID)	Member
24.	Mr. HOUT Sara	Officer	(RID)	Member
25.	Ms. CHHAY Chakriya	Officer	(RID)	Member
26.	Mr. PROMCHAN Moni Odom	Officer	(PWRC)	Member
27.	Mr. CHAN Rith	Officer	(PWRC)	Member
28.	Mr. VORK Sovan	Officer	(HEC)	Member
29.	Mr. HOUNG Sopheaktra	Officer	(HEC)	Member
30.	Representative from Department of Public Works Kandal Province			Member
31.	Representative from Department of Public Works K.Cham Province			Member
32.	Representative from Department of Public Works Battambang Province			Member
33.	Representative from Department of Public Works Seim Reab Province			Member
34.	Representative from Department of Public Works K.Thom Province			Member
35.	Representative from Department of Public Works Phnom Penh			Member

2.1.4 Activities (Planned and Actual)

Table 2-10 Comparison of Activities (Plan and Actual)

Planned (PDM ver.0)	Planned (PDM ver.4)	Actual	Compl eted	Will be comple ted	Will not be comple ted	Remark
1-1. To review the present bridge maintenance cycle and the works of RID in comparison to the existing Japanese system	1-1. To review the present bridge maintenance cycle and the works of RID in comparison to the existing Japanese system	The present bridge maintenance cycle was reviewed and major issues were identified; 1) No bridge database 2) Periodical inspection was not conducted 3) Needs of short term maintenance plan for the base of annual budget plan	☑			The PDM ver.0 was to develop "annual bridge maintenance plan". However, during discussion with CPs, it is more efficient to make the annual plan based of short-term plan (3 years). Therefore, PDM was amended to include development of 3 year bridge maintenance plan. This approach is more rational to explain budget program to MEF.
	1-2. To propose 3 year bridge maintenance strategic plan with the annual action plan to establish a proper bridge maintenance cycle	3 year bridge maintenance plan was prepared based on the bridge inspection result	☑			
1-2. To propose annual action plan for bridge maintenance cycle to establish a proper bridge maintenance cycle based on the review results	1-3. To propose annual action plan for bridge maintenance cycle to establish a proper bridge maintenance cycle based on the review results	Action plan for bridge maintenance cycle was prepared and issued by RID Director in October 2017.	☑			
1-3. To test the action plan	1-4. To test the action plan	The draft action plan was tested for the FY 2016 and 2017.	☑			
1-4. To hold workshop of the bridge maintenance cycle	1-5. To hold workshop of the bridge maintenance cycle	13 workshops 287 participants	☑			
1-5. To prepare draft annual bridge maintenance budget	1-6. To prepare draft annual bridge maintenance budget	Bridge maintenance budget for FY2017/18 were prepared using outputs from the project.	☑			
2-1. To review and develop road maintenance manual, including a database framework	2-1. To review and develop road maintenance manual, including a database framework	Following manuals were developed for road inspection; ***Guideline for Routine Road Maintenance Using IRI***	☑			In PDM ver.0, the scope of bridge inspection was 3 DPWTs, but the scope was extended to all (25) DPWTs without change of Input. This is because of following reasons; 1) The urgency or priority for action
2-2. To review and develop bridge maintenance	2-2. To review and develop bridge maintenance	Following manuals were developed for bridge inspection;	☑			

Planned (PDM ver.0)	Planned (PDM ver.4)	Actual	Completed	Will be completed	Will not be completed	Remark
manual, including a database framework	manual, including a database framework	***Bridge Inspection Manual*** Bridge database was created in RID.				is not clear among all other DPWTs if the inspection is only done in the target 3 DPWTs. 2) Without bridge condition status of nation level, it is difficult to judge appropriateness of allocation of budget to such selected bridges. 3) The selected bridge from the target DPWTs are not representing the typical bridge damages in Cambodia. In order to eliminate the external cause to bridge damage, such as overloading, one activity targeting to Tsubasa bridge was added to improve.
2-3. To hold training workshops on road and bridge inspections	2-3. To hold training workshops on road and bridge inspections	26 workshop 507 participants	☑			
2-4. To inspect roads and bridges and prepare rough cost estimation of the repair works at the target DPWTs	2-4. For bridge, to inspect bridges and prepare rough cost estimation of the repair works for all DPWTs	2,389 bridges were inspected Nationwide budget for Chapter 21(reconstruction) and Chapter 61(inspection and repair) were prepared	☑			
	2-5. For roads, to inspect roads using IRI and prepare rough cost estimation of the repair works at the target DPWTs	Total length of the inspection using IRI 2439.8km Number of roads 23* *Note:this figure is not including the measurement done independently by RID	☑			
2-5. To register the inspection results in the database at the target DPWTs	2-6. To register the inspection results in the database at the target DPWTs	The inspection results were registered in the database of RID	☑			
2-6. To revise the road and bridge maintenance manuals incorporating lessons learned from the above activities by organizing review workshops	2-7. To revise the road and bridge maintenance manuals incorporating lessons learned from the above activities by organizing review workshops	The draft manuals were revised based on the pilot projects, workshops	☑			
	2-8. To conduct preliminary study on overloading control (at Tsubasa Bridge)	Following activities were done; 1. Construction of temporary weigh bridge at site (2 locations) 2. Provision of portable weigh scale including spare parts 3. Inspection using above equipment 4. Standard data reporting form and analysis	☑			

Planned (PDM ver.0)	Planned (PDM ver.4)	Actual	Completed	Will be completed	Will not be completed	Remark
3-1. To review and establish road repair manual	3-1. To review and establish road repair manual	The existing road maintenance manuals were reviewed and identified issues.	☑			No change
3-2. To review and establish bridge repair manual	3-2. To review and establish bridge repair manual	There was no bridge maintenance manual	☑			
3-3. To hold training workshops on road and bridge repairs	3-3. To hold training workshops on road and bridge repairs	13 workshops 221 participants	☑			
3-4. To identify roads and bridges for the pilot repair works based on the inspection results at the target DPWTs	3-4. To identify roads and bridges for the pilot repair works based on the inspection results at the target DPWTs	For roads 3 selected roads For bridges 6 bridges for crack sealing 2 bridges for CFC	☑			
3-5. To establish repair plan for the identified roads and bridges at the target DPWTs	3-5. To establish repair plan for the identified roads and bridges at the target DPWTs	Repair plan was prepared	☑			
3-6. To repair the identified roads and bridges at the target DPWTs	3-6. To repair the identified roads and bridges at the target DPWTs	For roads, implementation of cold mix asphalt For bridges, implementation of crack sealing and CFC.	☑			
3-7. To evaluate the above repair works	3-7. To evaluate the above repair works	Monitoring of the pilot project has been done and established local supplier of the material	☑			
3-8. To revise the road and bridge repair manual incorporating lessons learned from the above activities by organizing review workshop by organizing review workshop	3-8. To revise the road and bridge repair manual incorporating lessons learned from the above activities by organizing review workshop by organizing review workshop	The work items used in the pilot project has been included in the new manuals	☑			

Planned (PDM ver.0)	Planned (PDM ver.4)	Actual	Completed	Will be completed	Will not be completed	Remark
4-1. To organize seminars for other DPWTs – trainings on road and bridge inspection	4-1. To organize seminars for other DPWTs – trainings on road and bridge inspection	9 seminars and workshops 653 participants	☑			No change
4-2. To organize seminars for other DPWTs – trainings on road and bridge repair	4-2. To organize seminars for other DPWTs – trainings on road and bridge repair	Included in the information above	☑			
4-3. To organize the project wrap-up seminar	4-3. To organize the project wrap-up seminar	Held on 20 December 2017 RID All DPWTs ITC Total 96 participants	☑			

2.2 Achievement of the Project

2.2.1 Outputs and indicators

（1）Achievement of Output-1

The bridge maintenance cycle is the cyclic connection of the work of inspection, planning and repair. Before the project, there was no standardized way of such cyclic work procedure while good practice for road maintenance was in place. It was mainly because the bridge maintenance was conducted as a part of road maintenance, the standardized manual and guideline was not prepared and RID officials were not trained on bridge maintenance.

The schematic image of the bridge maintenance cycle established in the project is shown in Figure 2-2. It is composed of 5 stages namely, 1) Inspection, 2) Condition Assessment, 3) Planning and budgeting, 4) Management and supervision and 5) Information and data management. The Maintenance Operation Meeting (MOM) links the stages as a verification process. Maintenance expert training and database management including document collections are supporting the cycle to move.

Major deliveries under this output were listed in Table 2-11;

Table 2-11 Major Deliveries under Output 1

Stage	Major output
Inspection	● Database of 2,389 bridges (all bridges under MPWT) ● Standardized Method for Bridge Inventory Survey ● Standardized Method for Bridge Preliminary Inspection ● Database system (application of FileMaker) ● Detailed inspection methodology ● Training of inspection and provision of inspection tools
Condition assessment	● Evaluation system
Planning and budgeting	● 3 year maintenance plan ● Priority list
Management and supervision	● Creation of Maintenance Operation Meeting (MOM)
Information and database management	● Bridge Database ● Document Database (Design drawing etc.,)

Table 2-12 Manuals and guidelines prepared in the project

Required Manuals under PDM	Actual Title of Manuals (Guidelines)	Revision/New	Khmer Version
I Road Maintenance			
3. Road Maintenance Manual	Guideline for Routine Road Maintenance Using IRI	New	
4. Road Repair Manual	Guideline for Repairing Defects of Road	Revision	Yes
	Handbook version	New	Yes
II Bridge Maintenance			
3. Bridge Inspection Manual	Bridge Inspection Manual	New	Yes
	Handbook version	New	Yes
4. Bridge Repair Manual	Bridge Repair Manual	New	Yes
III Annual Action Plan			
3. Bridge Maintenance Annual Action Plan	Bridge Maintenance Annual Action Plan	New	Yes
4. 3-Year Bridge Maintenance Strategic Plan	3-Year Bridge Maintenance Strategic Plan	New	

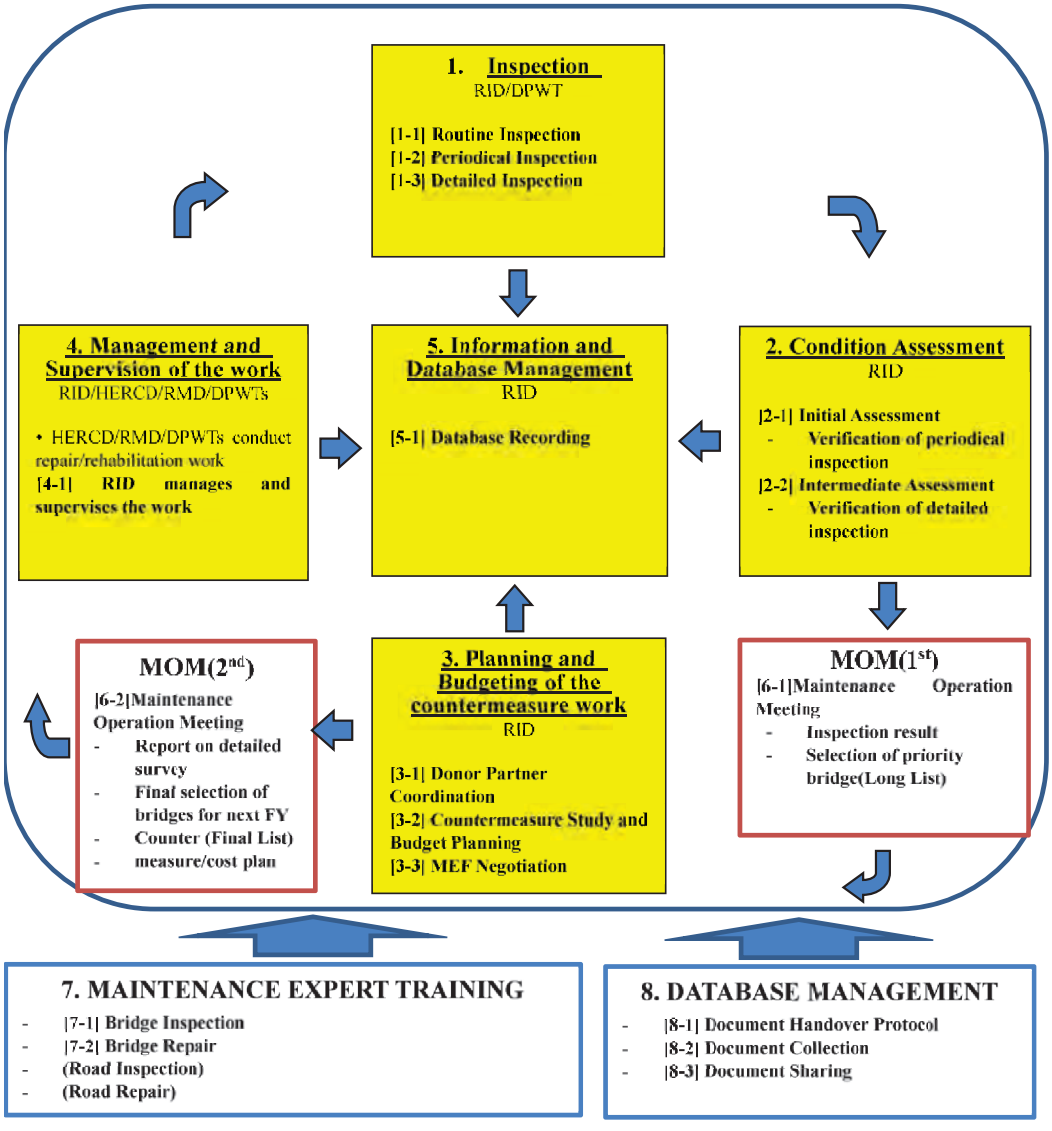


Figure 2-2 Schematic Image of Bridge Maintenance Cycle

Output-1: The bridge maintenance cycle is established.		
Indicators	Before Project April 2015	Achievement in January 2018
1) The annual action plan for bridge maintenance cycle is developed and approved by August every year for each targeted DPWT.	· The bridge maintenance was conducted as a part of road maintenance. · No standardized procedure and data on bridge maintenance (ex. bridge inventory, periodical inspection, standard repair method, manual) · The bridge condition was not evaluated periodically.	· As the approval process of the annual action plan (a base plan of budget for next year), MOM (Maintenance Operation Meeting) is proposed to hold twice a year (in April and in December and monitoring meeting in August) · The annual action plan has been approved by Director of RID after the monitoring activities of MOM. · Followings 4 items are the achievements to make this procedure to role out; · 1) The bridge inspection system and tools were developed. · 2) All bridges under all DPWTs were inspected and developed the database.(**initially inspection was supposed to conduct for target 3 DPWTs but the target was expanded to all DPWTs(25) without input change.**) · 3)The seriousness of bridge damage were evaluated by four ranks (SD, D, O and N[1]). · 4) RID is able to develop a 3 year maintenance plan and annual plan for bridge maintenance based on all bridge inventory and inspection result. · **For RID:** Key function: Nationwide budget preparation, supervision, technical standardization, evaluation 1) Bridge inventory database system 2) Bridge inspection system

[1] SD: Serious Damaged for reconstruction recommended, D: Damaged for repair recommended, O: Observation for periodic observation recommended, N: No damage for no treatment required till next periodic inspection.

Output-1: The bridge maintenance cycle is established.		
Indicators	Before Project April 2015	Achievement in January 2018
		3) Bridge maintenance action plan 4) 3 year bridge maintenance plan 5) Maintenance Expert training program 6) Maintenance Operation Meeting · **For DPWTs** Key function: implementation of the work, routine inspection 1) Bridge inspection manual 2) Bridge repair manual
2) At least 5[2] officials of RID engineers pass exam of bridge maintenance cycle.	No certified engineers on bridge maintenance cycle	· The Project established Maintenance Expert (ME) program to train on bridge maintenance. · The **Master MEs** are the engineers trained as trainers to DPWTs (and other organizations) on bridge maintenance. · **17** [3]**RID engineers** are certified by the project together with General Director of General Department of Techniques as Master ME · **112** engineers are certified as ME. · Document Management Database (web-library of road and bridge construction and administrative documents, standards) has been created. · 3 RID engineers are trained for operation of Document Management Database
3) The annual bridge maintenance budget is drafted at the target DPWTs of 2nd year and	There was no specific budget category for bridge maintenance.	· MEF request to RID to prepare a multi year program then develop an annual maintenance budget plan. · Based on the bridge inspection result of all DPWTs, the 1st 3 year bridge

[2] The target was set 5 officials each for road and bridges.
[3] Note, the bridge maintenance cycle is the basic concept of this project which was included in both bridge inspection ME training and bridge repair ME training. This number is the total of ME certified.

Output-1: The bridge maintenance cycle is established.		
Indicators	Before Project April 2015	Achievement in January 2018
3rd year by May every year.		maintenance plan was developed. This enables to monitor the bridge condition every year and evaluate effectiveness of budget allocation. · **Approved budget FY17 designated to bridge maintenance** 40,000 USD (Chap 61) for bridge inspection (this was the 1st approved budget for bridge periodic inspection) 2.0M USD (Chap 21) for re-construction of bridge · **Budget (draft) FY18** 181,000USD (Chap 61) 3.0M USD (Chap 21)
4) 3 Year Bridge Maintenance Strategic Plan of short term is prepared by RID/MPWT every August	There was no multi year plan of bridge maintenance. Development of multi year (3year) program for budget plan was a requirement from MEF to RID.	· The 1st draft of the nationwide 3-year maintenance plan was developed using bridge inspection result. · The plan is used for the budget planning for the next FY.

（2） Achievement of Output-2

For the road, a visual inspection has been the mainstream. Guidelines were prepared through other technical capacity development project on inspection of the roads. As such, visual inspection of the road and its practice to evaluate the condition were well adopted in RID. Major challenge to improve the inspection work were 1) application of objective indicator (IRI), 2) prepare template to evaluate road condition by both visual and IRI. Through the discussion with RID, importance of visual inspection were stressed to reflect actual road condition to the inventory which IRI can not translate well. For IRI measurement, DRIMS (Dynamic Response Intelligent Monitoring System) was employed for its technical accuracy and affordability. Through ME training, 5 RID officials were certified as Master Trainers who is able to evaluate road condition using DRIMS from calibration, measurement, analysis and evaluation. Phnom Penh and Kandal provinces were firstly selected as target DPWTs. Takeo is the second target province to expand for trial. Following two guidelines were prepared for road inspection;

1) Guideline for Routine Road Maintenance Using IRI
2) Guideline for Operation of Dynamic Response Intelligent Monitoring System (DRIMS)

For the bridge, inspection including evaluation of all of the bridges (2,389 bridges) under DPWT nationwide were completed. All the bridges are evaluated and classified in the Maintenance Operation Meeting (MOM) and classified into four (4) ranks (SD, D, O, N). 62 bridges were SD, 167 bridges were D bridges with structural damage found. SD are subjected to be replaced in principal. D bridges were re-inspected to check their detailed condition. Following manuals were prepared; for the easy use of the inspectors, handbook was prepared. Through ME training, 6 RID officials were certified as Master Trainers who has learnt bridge inspection through OJT with JICA Expert team and fully involved development of the manuals.

1) Bridge Inspection Manual (English and Khmer)
2) Handbook of Bridge Inspection Manual (English and Khmer)
3) Bridge database management manual

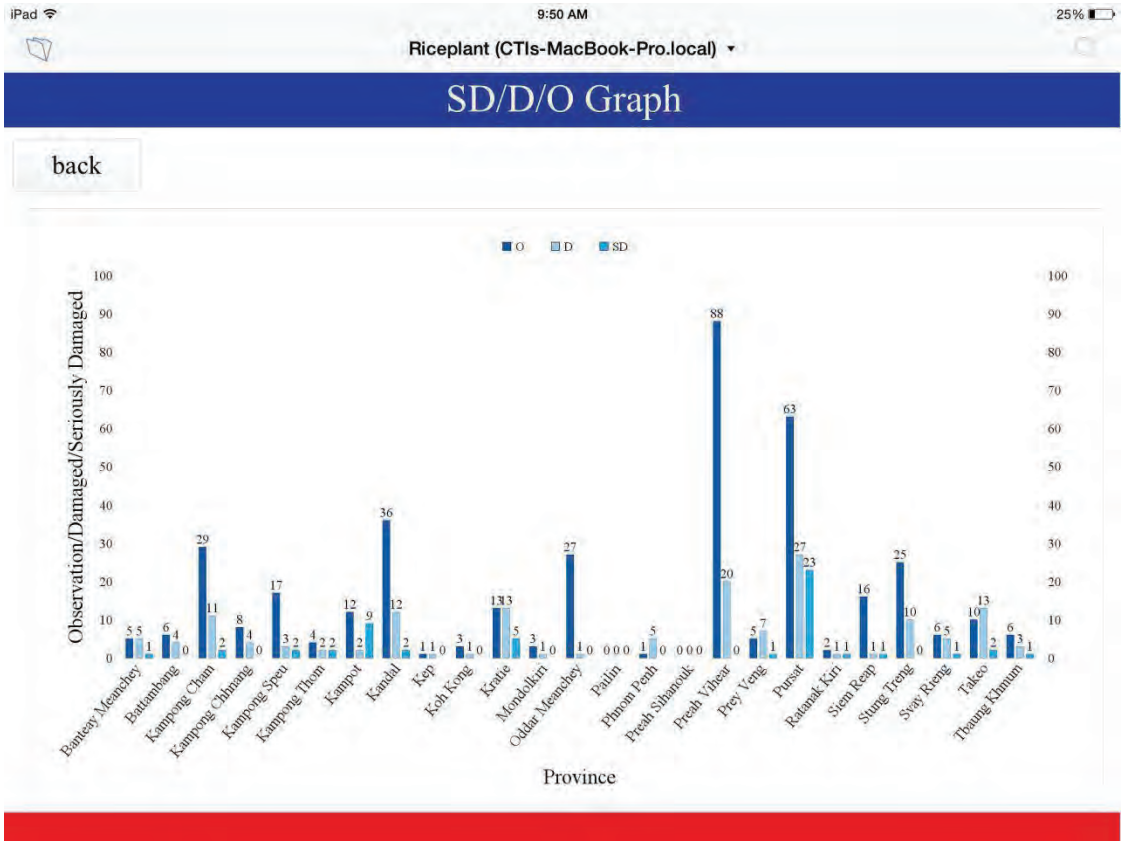


Figure 2-3 Bridge Inspection Result

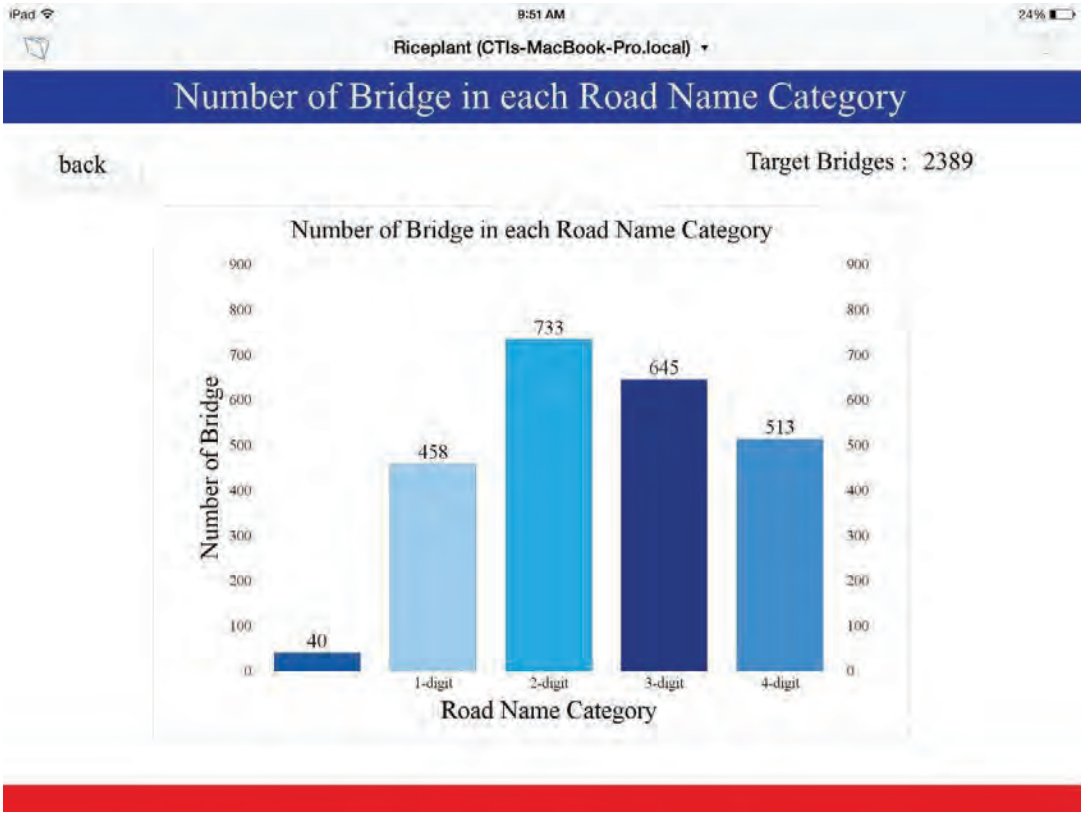


Figure 2-4 Bridge Inspection Result

External condition may affect to have an output of the project. For this project, because there is almost no bridge maintenance experienced officials are in the counterpart, a sustainable training was a critical issues. As the second issue, the overloading control was critical.

Capability of RID's engineers have been enhanced through Maintenance Expert (ME) program. The Master Trainers have been firstly educated then they provided training to other RID officials and DPWT officials. The Pilot Project of overloading control at Tsubasa Bridge was added to enhance the ban of the overloading vehicle crossing the bridge by data collection. Portable scales and temporary container offices were provided to facilitate. Though the pilot project, standard monthly report form, monthly data analysis, analysis on identified problem were prepared and used for enhancement of the activity.

Output-2: Road and bridge inspection capacity of RID is enhanced.		
Indicators	Before Project April 2015	Achievement in January 2018
1) The road and bridge maintenance manuals are drafted by August 2015 and finalized by December 2017.	[Road] Existing guidelines 1) Guideline for supervision of routine maintenance (6 work codes)	[Road] Following document were prepared; · The Guideline for Routine Road Maintenance Using IRI [English] · Guideline for Operation of Dynamic Response Intelligent Monitoring System [English]

Output-2: Road and bridge inspection capacity of RID is enhanced.		
Indicators	Before Project April 2015	Achievement in January 2018
	2) Guideline for regular inspection 3) Guideline for Repairing Defects of Roads (6 work codes) Identified Problem 1) The guideline does not cover sufficient work items implemented. 2) Requirement of guideline for application of IRI for road repair plan [Bridge] No manual on bridge inspection	· Application of RONDAS and DRIMS was proposed and agreed in MPWT. [Bridge] Following document were prepared; · Bridge Inspection Manual [English and Khmer] · Handbook of Bridge Inspection Manual [English and Khmer] · Bridge List book [English]
2) The selected bridges of all DPWTs are inspected according to the maintenance manual.	No periodic and standardized inspection	· All the bridges (2,389 bridges) nationwide under DPWTs were inspected. · Inspection result was classified into SD, D, O and N according to the bridge maintenance manual. · The bridge inspection system support to judge the condition by providing automatic judgement. · The Ipad system can provide the bridge database with minimum workload by synchronization of the databse. · Bridge inspection program was formed. Routine inspection : same time as road inspection (visual inspection) Periodical inspection: 500 bridges every year (1 round by 5 years) (Ipad system inspection)
3) The selected roads in the targeted DPWTs are inspected according	Visual inspection was conducted for the road routine maintenance.	· The project introduced inspection and evaluation of the road condition by IRI using DRIMS.

Output-2: Road and bridge inspection capacity of RID is enhanced.		
Indicators	Before Project April 2015	Achievement in January 2018
to the maintenance manual.		· 4 sets of DRIMS are equipped in RID (2 from JICA, 2 purchased by RID) · The actual achievement of the road inspection by the manual (application of IRI) · The road condition is evaluated considering both visual inspection and IRI in the standardized template. · Evaluation using IRI was conducted to the following selected target DPWTs as planned. · **Year 2015(target DPWT :Kandal)** NR1,RN2,RN3,RN4,RN5,Rn6,RN7,RN8,RN9 RN14,RN41,RN62,RN71 **Year 2016 (target DPWT: Takeo)** RN4,RN21,RN110,RN120,RN150A,RN261,RN383 **Year 2017** RN46,RN41
4) The inspection results are registered to the road and bridge database by RID until November every year.	[Road] The routine inspection by visual inspection was conducted according to the guideline and the result was recorded in the standardized template. [Bridge] No database for the bridge	[Road] · A hard disk to save the data was prepared and used to keep following related data. 1) IRI measurement original data 2) IRI map 3) Inventory data (integrated visual inspection and IRI) · The inspection result is used for the budget request plan. [Bridge] · Database was created and installed in RID. The DB is managed by Business Road Management Office. · The periodic inspection data is to be registered by November every year. · The bridge inventory data is to be updated reflecting re-construction bridges by November

Output-2: Road and bridge inspection capacity of RID is enhanced.		
Indicators	Before Project April 2015	Achievement in January 2018
5) At least 5[4] officials of RID's engineers pass road and bridge inspection test.	[Road] No RID officials trained to inspect road by IRI [Bridge] No RID officials trained to inspect bridges in a standardized method	Maintenance Expert Program has been established for training of experts. [Road] · Through training, following RID officials are certified as road inspection master trainers including use of DRIMS (5 staff); **Road Inspection Master Trainers** 1. Mr You Dara 2. Mr Sa Sivutha 3. Mr Hay Chandara 4. Mr Sitthy Panhavuth 5. Mr Veth Piseth [Bridges] · Maintenance Expert Program has been established for bridge inspection. · **6 RID** officials are certified as Bridge Inspection Master Trainers and **14 RID** officials and **77 DPWT** officials passed ME training. **Bridge Inspection ME Master Trainers** 1. Nin Menakak 2. Eam Sovisoth 3. Long Davuth 4. Chhouk Sochea 5. Nut Sovanneth 6. You Dara **Bridge Inspection ME (RID)** 1. Chea Dara 2. Hou Sovannarith 3. Chheng Gyvorn 4. Mak Sopheap 5. Thou Saovry 6. Chhay Chakriya

Output-2: Road and bridge inspection capacity of RID is enhanced.		
Indicators	Before Project April 2015	Achievement in January 2018
		7. Mam Sovarn 8. Ros Sreng 9. Va Panha 10. Nop Kilarith 11. Veth Piseth 12. Penh Otdom 13. Ut Vinakim 14. Doung Vnnak **Bridge Inspection ME (DPWTs)** 1st seminar and 2nd seminar **29 people** (Koh Kong,Kompong Spoeu, Phnom Penh, Kandal, PreyVeng, Takeo ,Kampot, HEC,RMC, Spied) (Stung Treng, Rattakiri, Kratie, Mondulkiri) 3rd seminar and 4th seminar **35 people** (Kompong Chhnang, Pursat, Pailin, Battambang) (Oder Meanchey,Bantey Meanchey, Prehivier, Siem Reap) 5th seminar **13 people** (Kompong Tom, Kompong Cham, Takeo,Parlin,Sianouk Ville,Kep) Total **77 people** (and coverage of DPWT 25 =100%)

（3） Achievement of Output-3

This output aimed to improve capacity of repair skill of roads and bridges.

For repair of roads and bridges, DPWT is to implement the work while RID is to provide technical guidance and inspect the work. Under this output, road and bridge repair manuals were prepared by RID with support of JICA Expert Team which were improved through pilot projects and review by workshop with DPWTs. For road repair, the guideline was revised to include 46 work items which were implemented by DPWT under contract with MPWT while previous manual covers only 6 items. For bridge, a bridge repair manual was newly developed. Handbook version was also prepared for convenience of reference at site. Followings are the manuals prepared under the Project;

1) Guideline for repairing defects of road (English and Khmer)
2) Handbook version of the Guideline for Repairing Defects of Road
3) Bridge Repair Manual (English and Khmer)
4) Handbook version of the Bridge Repair Manual

For roads, the Project supported to shift from reactive maintenance to preventive maintenance. Cold mix asphalt was introduced to fill the potholes before they grow bigger. Pilot projects were conducted in Kandal and Phnom Penh. 4 RID officials were certified as Master Trainers who fully involved revision of road repair manuals.

For bridges, the Project also supported to introduce preventive maintenance methods. Considering that the major target bridge is concrete and easiness of the construction, 1) crack sealing and 2) carbon fiber cloth methods were selected to introduce. 4 bridges in Kandal and 2 bridges in Phnom Penh were repaired by crack sealing method by DPWT. 2 bridges in Sihanoukville were repaired by a carbon fiber cloth method.

All the material used for the pilot project are available to procure from a vender in Cambodia.

11 RID officials were certified as Mater Trainer who involved in the preparation of bridge repair manual and took initiative of implementation of pilot project together with JICA Expert Team.

Output-3. Road and bridge repair capacity of RID is enhanced.		
Indicators	Before Project April 2015	Achievement in January 2018
1) The road and bridge repair manuals are drafted by January 2016 and finalized by June 2017.	[Road] Existing manual 1) Guideline for Supervision of Routine Maintenance 2) Guideline for Regular Inspection 3) Guideline for Repairing Defects of Road	[Road] - New version of Guideline for repairing defects of road (English and Khmer) which covers 46 work items instead of 6 in the previous manual. - Handbook of guideline for repairing defects of road (English and Khmer)

Output-3. Road and bridge repair capacity of RID is enhanced.		
Indicators	Before Project April 2015	Achievement in January 2018
	[Bridge] No specific manual for bridge repair	[Bridge] - Bridge Repair Manual (English and Khmer) - Hand book of bridge repair manual
2) The identified roads and bridges in the targeted DPWTs are repaired according to the repair manuals and the inspection results.	[Road] Routine maintenance was conducted according to the visual inspection. [Bridges] No periodic bridge inspection was conducted. Bridge repair was normally reactive to the problem.	[Road] · The project supported to introduce ready mixed cold asphalt for small scale pothole patching to facilitate a preventive repair. · Excel Patch was introduced and conducted in the pilot projects in Kandal and Takeo. · [Bridge] · Two methods were introduced; 1) Crack sealing for minor crack repair 2) Carbon Fiber Cloth for reinforcement of bridge deck · 4 bridges from Kandal DPWT and 2 bridges from Phnom Penh DPWT were repaired by crack sealing method through the 1st pilot project. **(Total 6 bridges)** · Kizuna bridge in Kompong Cham was repaired using crack sealing method. · The 2nd pilot project was completed for O Trav Bridge in Preah Sihanouk applying Carbon Fiber Cloth. **(Total 2 bridges)**
3) The repair results are registered to the road and bridge database by RID within 1 month after the completion of repair works.	· Repair result is recorded in the monthly inspection by RID.	[Road] The inspection result is confirmed and registered in the monthly inspection report. [Bridge] · The inspection result is confirmed and registered in the monthly inspection report. · The bridge inventory database is updated (ex.for re-constructed bridges and repaired bridges) · The monthly report is saved in the Database Management System.
4) At least 5 officials of RID's engineers pass road and bridge repair test.	-	[Road][5] · Maintenance Expert Program has been established for road repair works. · 4 RID officials are certified as Maintenance Expert Master Trainer. 1. You Dara 2. Hay Chandara 3. Sitthly Panhavuth

[5] The certified Master Trainer was 4 for road and 6 for bridges, total 10 with agreement of RID.

Output-3. Road and bridge repair capacity of RID is enhanced.		
Indicators	Before Project April 2015	Achievement in January 2018
		4. Veth Piseth [Bridge] · 11RID officials are certified as Bridge Repair Maintenance Expert Master Trainers. 35 officials of DPWT were certified as ME. 1. Mr.Nin Menakak 2. Mr.Eam Sovisoth 3. Mr.Long Davuth 4. Mr.Dvong Dhhomratanak 5. Mr,Chhouk Sochea 6. Mr.Nuth Sovanneth 7. Mr.You Dara 8. Mr.Keat Sarun 9. Mr.Rous Sreng 10. Mr.Koy Somrith Visoth 11. Mr.Nut Sovannith

（4） Achievement of Output-4

This output is aiming to disseminate project output to DPWT and related agencies.

Based on the project activity, the Action Plan for the Bridge Maintenance Cycle was prepared. This action plan includes following actions to implement bridge maintenance cycle.

1) Bridge Inspection
2) Condition Assessment
3) Planning and budgeting
4) Maintenance and supervision
5) Information and database system
6) Maintenance operation meeting
7) Maintenance expert training
8) Document management

The Action Plan was approved by Director’s order of RID to implement.

During the project, the Maintenance Expert training were conducted to all DPWTs. The Master Trainer was trained by JICA Expert Team (6 for bridge inspection, 11 for bridge repair (total 17 for bridge maintenance cycle), 5 for road inspection and 4 for road repair, total 26). 77 of DPWT officials were trained for Bridge Inspection and 35 of DPWT (total 112) officials were trained for Bridge Repair, and 14 RID officials for bridge inspection. Professors of ITC (Institute of Technology of Cambodia) were involved in the training which facilitate future collaboration between MPWT and ITC.

Table 2-13 List of Other Organization attended to the Project

Category	no	Organization	Remark
Other Ministry	1	MEF	Ministry of Economy and Finance
	2	MFA	Ministry of Foreign Affairs
Other MPWT organization	3	PWRC	Public Works Research Center
	4	RMD	Road Maintenance Department
	5	HERCD	Heavy Equipment and Road Center Department
	6	SPIED	Sub-National Public Infrastructure and Engineering Department
Academic Institute	7	ITC	Instinute de Technologie du Cambodge
	8	DTC	Department of Technical and Transport
	9	EXMID	Expressway and Mega Bridge and Investment Department
	10	HERCD	Heavy Equipment and Road Construction Department
	11	Muhibbah Engineering	
	12	Norton University	
	13	PUC University	
Private company	14	Chipmong	
Other development entity	15	Asia Development Bank	

Output-4. Road and bridge maintenance cycle is introduced to other DPWTs and concerning agencies		
Indicators	Before Project April 2015	Achievement January 2018
1) Bridge inspection is carried out at more than 80% DPWTs (20/25 DPWTs).	No periodic bridge inspection was conducted	Bridge inspection was conducted in all the DPWTs**.(25/25 =100%)** and all bridges. ME training program to all DPWTs were conducted. Certified ME in the project by DG of General Directorate of Techniques; -Bridge Inspection -Bridge Repair
2) More than 80% DPWTs attends the seminar held in the Project.	-	Attendance of DPWTs: 100% (25 out of 25 DPWTs) (**1,668 participants in total 61 events** organized)

Output-4. Road and bridge maintenance cycle is introduced to other DPWTs and concerning agencies		
Indicators	Before Project April 2015	Achievement January 2018
3) The project activities are disseminated to other agencies concerning road/bridge maintenance. (number is not specified but with increments through the project)	-	1) Kickoff Seminar on 22 May (MPWT, 5 DPWTs, MEF, WB, ADB, JICA, EOJ) 2) SIP seminar on road and bridge maintenance jointly held with ITC in March 2016 3) Coordination of bridge database utilization with university (ITC) 4) Participation of database training from HEC, RMC and SPEAD 5) Bridge inspection joint with ITC 6) Final Project Seminar was held in 20 December (MPWT, 25 DPWT, MEF, JICA, EOJ, ADB, WB)

2.2.2 Project Purpose and indicators

（1） Project Purpose

The project purpose is expected to be realized by outputs achievements (Figure 2-5). RID has duties to provide technical standards, road network master plan, construction layout, quality of material and to evaluate quality of the road construction. The RID play roles as engineering consultant in the force account works.

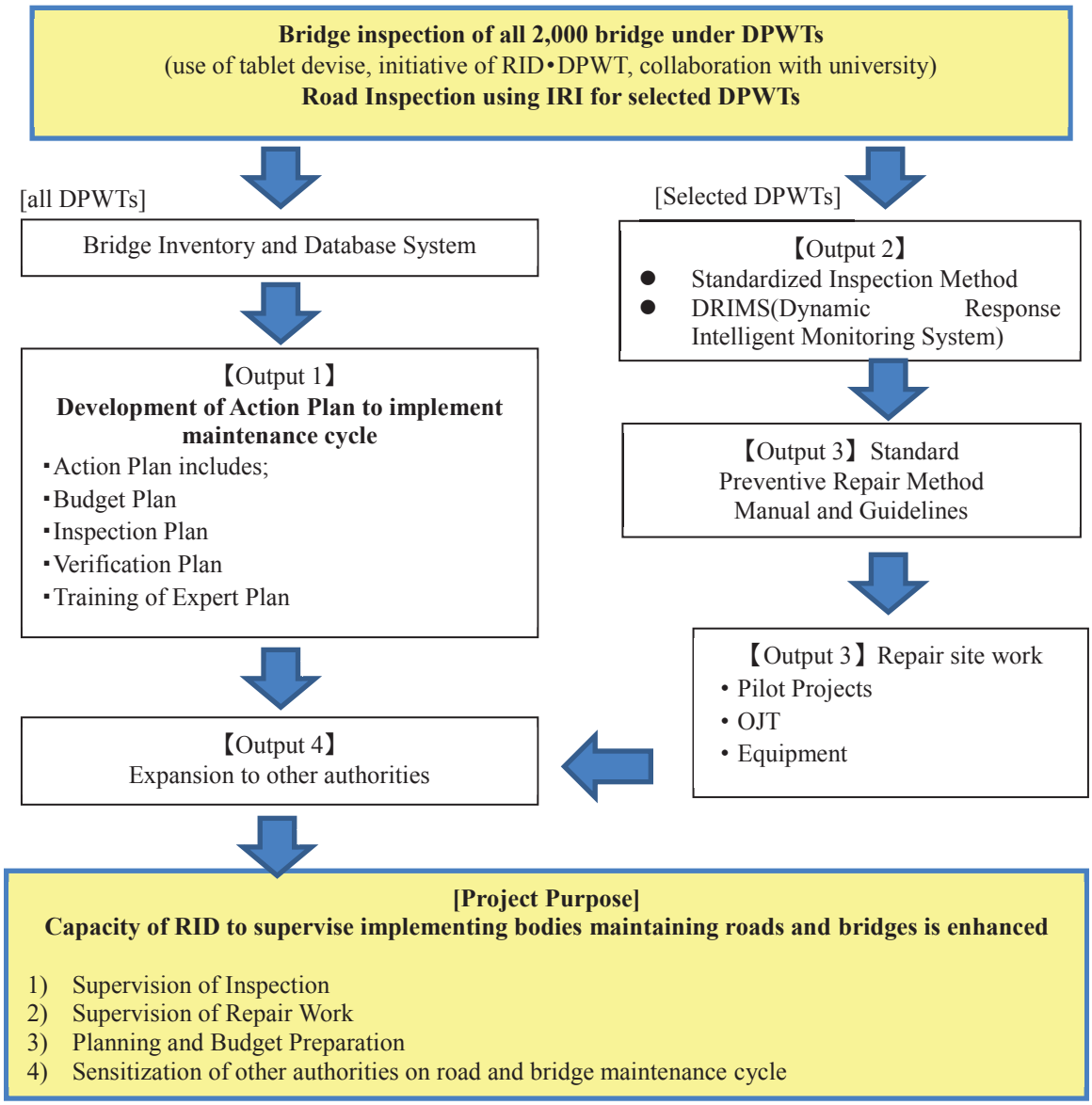


Figure 2-5 Schematic Structure of the Project Outputs

Project Purpose: Capacity of RID to supervise implementing bodies maintaining roads and bridges is enhanced.		
Indicators	Achievement in January 2018	Related outputs and other intervene
1. Inspection results done by the three target DPWTs are approved by RID based on the manuals by the end of the Project.	[Road] all 1-digit roads and selected roads (not limited to the target DPWTs) were inspected using DRIMS based on the manual. All roads under Kandal and Takeo Provinces were measured and analyzed the condition based on the manual. By such, RID is able to verify road condition by standardized criteria (IRI and visual inspection) and provide a guidance to DPWTs. [Bridge] Completion of inspection of all the bridges under DPWTs (not limited to the target DPWTs) and encoded in the bridge inventory database.(2,389 bridges) The bridge inspection is to be conducted by DPWT and supervised by RID. In order to calibrate the inspection method, inspection system gives standardized question list to the inspector to check. The inspection result is confirmed in the Maintenance Operation Meeting (MOM) in May 2017. By such, RID is able to verify bridge inspection result by DPWT and to develop a maintenance plan accordingly.	[Related output] OUTPUT 2 ME training [Other intervene] Not Applicable (N/A)
2. Repair results done by the two target DPWTs are approved by RID based on the manuals by the end of the Project.	[Road][Bridge] ・Manuals and guidelines for road and bridge repair was prepared to provide technical standard and distributed to DPWTs. ・RID is able to check the work by using the guideline and manual.	[Related output] OUTPUT 3 Pilot project Phnom Penh DPWT Kandal DPWT Preh Sianouk DPWT ME training [Other intervene] N/A

Project Purpose: Capacity of RID to supervise implementing bodies maintaining roads and bridges is enhanced.		
Indicators	Achievement in January 2018	Related outputs and other intervene
3. The above two target DPWTs prepare a draft budget for road and bridge maintenance for FY 2018 respectively within pre-agreed schedule.	RID developed a short term (3 years) program budgeting for road and bridge maintenance in national level supported by JICA Project. Bridge inventory, inspection result, action plan were used for budget request.	[Related output] OUTPUT 1 [Other intervene] N/A
4. Road and bridge maintenance cycle is explained and shared to concerned offices and units at the project wrap-up seminar.	Sensitized to the following agencies 1) Within MPWT HERCD,SPIED,PWRC,RMD 2) DPWT All DPWT (25) 3) MEF 4) Institute de Technologie du Cambodia (ITC) It is to note that very close corporative framework was developed between RID and ITC through the project. Professors from ITC deeply involved in the activity of bridge inspection, verification. Seminars were conducted jointly.	[Related output] OUTPUT 4 ME training (all DPWT) Kickoff Seminar Rap up Seminar [Other intervene] SIP Seminar

Project Purpose: Capacity of RID to supervise implementing bodies maintaining roads and bridges is enhanced.		
Indicators	Achievement in January 2018	Related outputs and other intervene
5. Maintenance budget of road and bridge is prepared by RID according to the road and bridge maintenance cycle	[Road] The road condition is evaluated objectively(by IRI) and verified by visual inspection. This supported to quantify and visualize the road condition to prepare budget. RID improved the road maintenance budget by having road condition survey result with support of the project. [Bridge] In order to prepare RID budget plan (which is nationwide), the project targeted all bridges under MPWT. Budget for bridge maintenance was approved. (There was no specific budget for bridge maintenance before the project) RID prepared the bridge maintenance budget with support of the project. **Year 2017** Chapter 21 (reconstruction) 2.0M USD Chapter 61 (minor repair and inspection) 0.04MUSD **Year 2018** Chapter 21 2.8M USD Chapter 61 0.18M USD	[Related output] OUTPUT 1 MOM [Other intervene] MEF requirement for multi year programming budget

2.2.3 Other Achievement not stated in the PDM

（1） Long- term training on asset management of road and bridges

Since commencement of the project, the JICA Project Team have been well coordinated with Bridge Maintenance Project supported by SIP (Strategic Innovative Program) which is financed by Japanese government for promoting innovative technology research and development. A part from capacity development project, importance of human resource development is mutually understood and the long -term training program was created to educate young engineers in specific field. 2 RID officials who were involved in the project are nominated to study road and bridge maintenance engineering in Japan.

These officials are expected to bring back Japan's good practice to Cambodia in the future.

（2） Document and data management (electronic library)

In related to establish a bridge maintenance cycle, importance of document library such as tender document, tender drawings, As-built drawings, technical standards and inspection reports is understood. However, such documents are not well managed systematically but more relied on person. This makes loss of work efficiency in maintenance stage.

On the other hand, electrical document library which was developed in the past JICA project was in use in PWTTD. The JICA project updates the system and linked to RID network to share document database library in PWTTD for the use of road and bridge maintenance.

（3） IRI measurement and allocation of objectives (ROMDAS and DRIMS)

ROMDAS is the equipment to analyze road condition with laser profiler (IRI) and FWD. 1 set of ROMDAS was employed in Cambodia almost 10 years for the road condition survey. However, due to limit number of the equipment and cost of operation, it was difficult to apply for routine maintenance. In such condition, the project introduced as pilot DRIMS to estimate IRI economically and fast. The practice was successful so a apart from the 2 sets of DRIMS which donated from the project, additional 2 sets were procured by RID budget for implementation.

In order to make clear application of both equipment to facilitate collection of IRI from site, a simple guidance was prepared proposing that ROMDAS shall be applied to 1st Digit roads and DRIMS shall be applied to other roads. This guidance was agreed among the top management of MPWT.

（4） Creation of appropriate environmental condition surrounding of bridges for maintenance

During the pilot project for bridge repair, importance of cleaning (ban of garbage disposal around bridge) was explained. Garbage around bridge were collected and site was cleaned before commencement of pilot projects.

This practice is simple but essentially important. Through actual practice during the pilot project, importance of proper environment of bridge surrounding must have been understood by participants.

2.3 History of PDM Modification

Version	Date	Amendment of PDM
Version 0	Oct 17 2014	Original
Version 1	July 2015	1. Project Purpose [Amendment] "Maintenance budget of road and bridge is prepared by RID according to the road and bridge maintenance cycle" was added. [Reason] RID is responsible to prepare nationwide road and bridge maintenance budget. PDM ver.0 did not include RID's role. 2. Outputs [Amendment] Amendment was made for following clarifications; 1) Clarification of time 2) Clarification of number of RID staff to be passed exam Clarification of coverage of DPWTs to attends seminars.
Version 2	January 2016	1. Outputs 1) Output 1 [Amendment] "1-4. 3 Year Bridge Maintenance Strategic Plan of short term is prepared by RID/MPWT every August" was added. [Reason] In order to prepare annual maintenance budget, short term plan (3 years) should be prepared in order to clarify the priority of maintenance and to foresee the achievement and future required budget. 2) Output 2 [Amendment] 2-2. The selected bridges of **all DPWTs** are inspected according to the maintenance manual. 2-3. The selected roads in the **targeted DPWTs** are inspected according to the maintenance manual [Reason] The PDM ver.0 stated to inspect bridges in the 3 target bridges and expand the practice to other DPWTs at the end of the project by seminar. However, considering to the RID's responsible to prepare nationwide budget plan, inventory and condition assessment of bridges under all DPWTs were required because there was no

Version	Date	Amendment of PDM
		database built in the past. The amendment of PDM to expand the target from 3 DPWTs to 25 DPWTs for bridge inspection was proposed and agreed. Tablet bridge inspection system contributed to make it possible to collect all the data in the first year, and use that data to prepare a maintenance plan and budget preparation. In result, budget plan in 2017 and 2018 for bridge inspection and repair were approved by MEF. For road the PDM remain the same target DPWT, because inspection and database on roads were sufficiently well practiced. The project concentrated on introduction of using IRI in the prescribed target DPWTs for road. 2. Activities 1) Following activities were added related to amendment of output [Amendment] 1-2. To propose 3 year bridge maintenance strategic plan with the annual action plan to establish a proper bridge maintenance cycle 2-4. For bridge, to inspect bridges and prepare rough cost estimation of the repair works for all DPWTs 2-5. For roads, to inspect roads using IRI and prepare rough cost estimation of the repair works at the target DPWTs 2-6.To register the inspection results in the database by RID 2-1. To conduct preliminary study on overloading control (at Tsubasa Bridge) 2) Addition of Overloading Control at Tsubasa bridge [Amendment] "2-8. To conduct preliminary study on overloading control (at Tsubasa Bridge)" was added. [Reason] Overloading is one of the most important causes of damage on roads and bridges. Tsubasa bridge has been damaged by overloaded trucks and there was no efficient countermeasure taken. In order to build efficient data collection and to set system, it was agreed to conduct pilot project at Tusbasa bridge.
Version 3	December 2016	[Amendment] Addition of Equipment Procurement engineer [Reason]

Version	Date	Amendment of PDM
		For a smooth procurement of equipment for pilot projects, procurement engineer was added.
Version 4	June 2017	[Amendment] Addition of 1) Bridge Inspection Engineer (2) 2) Bridge Repair Engineer (3) 3) Database Expert [Reason] In order to sensitize the project activity and conduct Maintenance Expert training to all DPWT, bridge inspection engineer and bridge repair engineer were added. Document Management System which collects technical standards and drawings (such as AS-built drawing) was added.

Chapter 3 Result of Joint Review

3.1 Result of Review based on DAC Evaluation Criteria

In accordance with the Project Monitoring and Evaluation System of JICA, the project was evaluated in light of five evaluation criteria of Relevance, Effectiveness, Efficiency, Impact, Sustainability by the joint review used the following categories;

High, Fair, Low

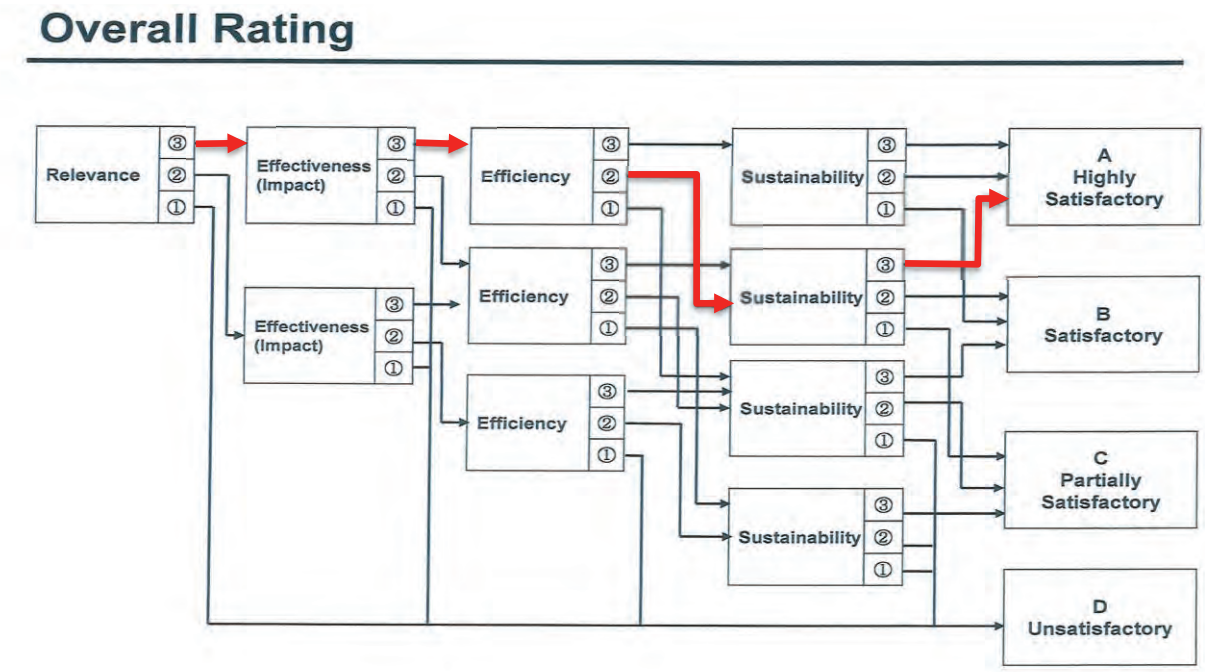
Then the total project evaluation rate is given using;

Highly satisfactory／Satisfactory／Partially satisfactory／Unsatisfactory

The project was rated as;

Highly Satisfactory

*(Evaluation result of sub-criteria, **Relevance: High, Effectiveness: High, Efficiency: Fair, Impact: Fair, Sustainability: High**)*



①：Low, ②：Fair, ③：High

Figure 3-1 Overall Rating of the Project

3.1.1 Relevance

Relevance – High

（1）Relevance with the policy of the Cambodia

The Project was well aligned with Cambodia's development policy and strategy. National long-term development plan, "National Strategic Development Plan (2014-2018) (NSDP)" prioritizes the economic development and poverty alleviation through infrastructure development. MPWT is responsible for implementing the policy with regards to the public works. For road sector, MPWT has following mandates;

1) Improve more 3,500km of road infrastructure in the next 5 years
2) Improve 1-digit national roads – expand from DBST to AC pavement
3) Widen 1-digit national roads from 2 lanes to 4 lanes in and around major cities
4) Increase a pavement ratio in 2 digit national roads from 50% to 90%
5) Install drainage facilities in 1 digit national roads for flood control

The NSDP also states improvement of management and database as below;

1) Strengthen and improve planning, statistics, data management, and information dissemination in the transport sector
2) Strengthen human and institutional capacity in the transport sector

At the end of the project, there is no change in the policy of Cambodia. Besides, the Cambodia government laid out the policy to maintain roads and bridges. Thus, the project relevance is still high.

（2）Relevance with the assistance policy of Japan

The Project is also in line with the Japanese policy and strategies. Infrastructure development is one of the priority areas in the Country Assistance Policy to Cambodia (July 2017). The policy emphasizes to support regional link (southern economic corridor), quality infrastructure (hard and soft measures) and coordination with public and private sectors. Assistance in road development and maintenance will contribute to the achievement of revitalization of regional economy through corridor development with enhanced mobility of people and goods. Thus, the project is recognized as one of strategies to attain the priority areas of the Japan's Country Assistance Policy to Cambodia.

（3）Appropriateness of the project

The intervention of the project was timely when the road and bridge has been rapidly constructed and the responsibility of the Cambodia government for maintenance would be more important. While number of bridges were reconstructed to the concrete bridges, no periodic inspection had been conducted.

The damage of bridge was found when it is already in a critical condition which resulted in high cost to repair. Also there was no specific allocated budget for bridge maintenance including inspection. Therefore, there was a strong demand from implementing agencies to set a framework of the bridge maintenance by a standardized inspection and maintenance methods. The Ministry of Finance and Economy demand to MPWT to develop a program budget of multiple years for budget request. In order to meet this demand, standardized and databased approach for road and bridge maintenance were required.

Therefore, it is recognized that the project met the needs of the Cambodia's demand and timing of intervention was very appropriate.

3.1.2 Effectiveness

Effectiveness – High

（1）Achievement of the Project Purpose

The Project Purpose predetermined in the PDM is "Capacity of RID to supervise implementing bodies maintaining roads and bridges is enhanced". As seen in the Chapter 2 Result of the Project, the achievements of project purpose are observed as below.

1) Inspection stage (related to Output 2)
   For roads, objective verification of the road condition is possible to implement by introduction of IRI to the inspection. DRIMS is easy and affordable equipment. RID has capacity to assess the road condition in an effective way and to verify inspection results from DPWT. Road Maintenance Manual using IRI was prepared.
   For bridge, while there was no standardized bridge inventory or periodic inspection, all the bridge were surveyed and inspection result was encoded in a database. This enables RID to assess bridge condition by province and assess the priority in nation level. The bridge inspection system (by iPad) support the inspector from DPWT who may not have special knowledge and training on bridge inspection, to obtain required data from survey as well as to evaluate bridge condition. The system also enabled to reduce the work load to collect and bind the data by synchronizing data in the tablet to server automatically. Statistical analysis and search of the inventory and inspection record is easily done through the system. The foundation of the bridge maintenance is prepared by this system. Bridge Inspection Manual (including pocketbook) was prepared. With this approach, it enabled to develop the bridge inventory database and bridge condition assessment which is used for the basic information to build the bridge maintenance cycle. The inspection training was targeted not only RID but also all DPWTs. This supports to collect standardized condition assessment result from

provincial level to RID. MEF approved cost for such training and routine inspection during the project with understanding of importance of periodic inspection.

With following aspects effectiveness of this stage is **high;**

- Employment of affordable tool with appropriate accuracy
- Enabled to develop the basic information (database) to develop nationwide road and bridge maintenance cycle since RID is in charge of maintenance for national level.

2) Repair and Supervision stage (related to Output 3)

For roads, a guideline for repair defects of roads was revised to cover all work codes (46) implemented on the ground to provide a technical guidance to DPWTs while it was only 6 codes before the Project commencement. This also supports RID to supervise the work of DPWTs and to evaluate budget request from DPWTs. Good practices were collected through the process from DPWTs to integrate into the standard. In order to support the shift to preventive maintenance from reactive maintenance, the Project introduced all weather type "cold mix" which is now locally produced.

For bridges, while no periodical maintenance was conducted, preventive maintenance methods were recommended to introduce to save cost of future maintenance. Crack sealing and CFC (Carbon Fiber Cloth) methods implemented in the pilot project are practical and affordable in Cambodia. Bridge Maintenance Manual was prepared to provide a technical guidance to DPWTs.

With following aspects effectiveness of this stage is **high**;

- Collect the best practices from DPWT level (implementer of works) and develop the guideline to cover all work items. The guideline is "job-sheet" style which is easy to add new items when necessary. Development of standard manual and provision of trainings to DPWTs.
- Support of preventive maintenance.

3) Planning and budget preparation stage (related to Output 1)

One of the most significant outputs from the project is that the budget for bridge maintenance and bridge periodic inspection was approved by MEF. Using bridge database, the project supported to prepare a program budget for 3 years bridge maintenance. In FY 2017, 2.0MUSD for re-construction (Chapter 21) and 0.04MUSD for minor repair and inspection (Chapter 61) was approved. Through the project, the bridge maintenance is mainstreamed.

In order to institutionalize the bridge maintenance cycle within RID, the Action Plan which summarizes whole procedure composing was developed and approved by RID Director.

With following aspects effectiveness of this stage is **high;**

- Importance of routine inspection and assess the condition periodically has been well understood.
- Budget is approved in accordance with the action plan developed jointly with RID and the Project.

4) Sensitization of related authorities

Sensitization of bridge maintenance cycle to related authorities is one of the major challenge to mainstream the concept. In the early stage of the project (1st year), series of workshops were held inviting RID and other department in MPWT. In the middle stage of the project (2nd year), the Project Team held series of workshops to collect experiences and opinions. Communication were closely taken with target DPWT of pilot projects (3 DPWTs). In the last stage of the project (3rd year), the Maintenance Expert Training was conducted targeting to all DPWTs for bridge maintenance cycle and the coverage achieved 100% (all 25 DPWTs). The total number of participation was 1,668 peoples (with 61 events), all DPWT was covered and had participants as related authorities from following entities.

With following aspects effectiveness of this stage is **high;**

- Deep involvement of DPWTs and ITC
- Understanding on bridge maintenance cycle has been well created through dissemination of the concept to provincial level and other related organization (ex MEF).

Table 3-1 List of Other Organization attended to the Project

Category	no	Organization	Remark
Other Ministry	1	MEF	Ministry of Economy and Finance
	2	MFA	Ministry of Foreign Affairs
Other MPWT organization	3	PWRC	Public Works Research Center
	4	RMD	Road Maintenance Department
	5	HERCD	Heavy Equipment and Road Center Department
	6	SPIED	Sub-National Public Infrastructure and Engineering Department
Academic Institute	7	ITC	Instinute de Technologie du Cambodge
	8	DTC	Department of Technical and Transport
	9	EXMID	Expressway and Mega Bridge and Investment Department
	10	HERCD	Heavy Equipment and Road Construction Department
	11	Muhibbah Engineering	Private contractor
	12	Norton University	Private university
	13	PUC University	
Private company	14	Chipmong	
Other development entity	15	Asia Development Bank	

（2） Contributing factors to achieve the Project Purpose

The Project revised PDM to adjust the direction of the project for the following reasons. 1) Add overloading control at Tsubasa bridge, 2) Inclusion of 3 year plan, 3) targeting all DPWT for bridge inspection and 4) Clarifying use of IRI for road. These modification of PDM were done timely to enhance the achievement of the Project Purpose.

Training in Japan exposed Cambodian C/P to the experience of Japanese methodologies and tools for road and bridge maintenance and enhanced their understanding and awareness. Three (3) training were held during the project. One of C/P personnel who participated in the training in Japan recognized the importance of planning for the maintenance activities, importance of coordination among industry, academy and authority, importance of preventive approach of the maintenance to save total cost of investment. This finding was shared with other trainees in the evaluation meeting and reflected to the action plan. Many C/Ps requested the similar training in Japan be conducted again for other staff.

Strong ownership of the project and initiative from the Cambodia side such as procuring DRIMS from their own budget promoted smooth technical transfer in good cooperative atmosphere.

（3）Hindering factors to achieve the Project Purpose

No hindering factor was observed.

3.1.3 Efficiency

Efficiency – Fair

The input of expert (including chief advisor and project experts) was increased 6.1% from PDM ver.0 and project duration was not changed.

As described in Chapter 2, the project decided to develop the bridge database covering all 25 DPWTs while initial plan was to cover 3 target DPWTs **without change of inputs**. With support of RID and DPWTs, sufficient number of data for prepare bridge maintenance cycle was collected in 6 month after commencement of the project. This data enabled to develop 3 year maintenance plan for program budget for FY 2017.

While amendment of the above project approach (to change the target DPWTs from 3 to 25) was required to achieve the project goal and to disseminate the concept to all DPWTs by the end of the project, the given project period was tight especially for site survey for bridge inventories and condition rating. However, the project used IT technology to support work of inspector and time for data harmonization. This effort enabled to prepare all required data to prepare bridge condition for nationwide plan. In order to cover the additional area (by increasing 3 DPWTs to 25 DPWTs), additional travel expenses were required. This problem was managed without requesting additional budget by using above mentioned tool and save total time.

For bridge repair, pilot project were conducted 2 times timely with target DPWTs. For the CFC method, 2 bridges were selected. One bridge is led by Japanese experts and 2nd bridge was led by Cambodian C/P. This enabled to grow ownership and initiative of RID and target DPWTs.

For Maintenance Expert Training, the project invited professors from Institute de Technologie du Cambodia and cultivated link between MPWT. The professor provides appropriate technical advises in the training. This corporation is expected to continue after the project.

C/P personnel were assigned as scheduled. Although some C/P personnel (RID directors) had to leave the Project for the personnel transfer, the new C/Ps were assigned without delay. Those transfers did not create serious obstacles to implement the Project.

Most of the inputs from Japanese side including dispatching the experts, provision of training in Japan and local cost have been made as planned. Contents, numbers and timing of the trainings in Japan were identified as appropriate and effective.

Good communication between Japanese experts and C/P personnel in all C/P organizations promoted smooth implementation of the project.

With following aspects efficiency is **fair;**

- Employment of efficient methodology to collect data.
- The input was 6% increased than predetermined in PDM ver.0.
- The training in Japan gave very positive effect to project implementation.

3.1.4 Impact

Impact - Fair

（1）Achievement of Overall Goal

It is expected that the Overall Goal “Appropriate maintenance of roads and bridges is managed by MPWT” will be achieved if the continuous initiative from Cambodian side is taken after the project complete.

One of the good impact of the project to the overall goal is admission of the bridge maintenance budget including periodical inspection by MEF. Also it is to note for the case of FY 2017, DPWT completed re-construction of 4 bridges in NR.43 on time using the approved budget.

· Sta. 2+650 L=30m, W=8m

· Sta.43+00 L=60m, W=8m

Sta.51+220 L=45m,W=8m

Sta.66+890 L=15M,W=8m

Figure 3-2 Re-construction of Bridges along NR.43

Another good sign is that the Action Plan was approved by RID director to show the clear direction to institutionalize bridge maintenance cycle. As such, the road map for the bridge maintenance cycle to mainstream is observed.

For roads, objective and quantitative evaluation will be the principal method for maintenance plan. In this connection, introduction of IRI and creation of DRIMS team gives positive impact to the future improvement of planning. In an actual case, MEF is requesting the same objective assessment of the road condition to MPWT. Principal demarcation of the IRI measurement tools, ROMDAS which is more accurate and comprehensive function and DRIMS which is simple only for IRI measurement, is set which facilitate to apply the equipment without conflict.

With following aspects impact for overall goal is Satisfactory;

- Understanding of budget plan for road and bridge maintenance.
- Setting of human training program for further training
- Involvement of academic sectors which support to include importance of maintenance in educational stage.

（2） Other Impact Observed

1) Enhancement of academic link between Japan and Cambodia

During the project, joint seminar for SIP (Strategic Innovation Program) led by Tokyo University and ITC was held. This was the opportunity to build close corporation in the academic field on road and bridge maintenance. Two (2) RID officials are selected to study in Japan for a long term scholarship training.

2) Data sharing

The project also supported to share the existing document database for the purpose of road and bridge maintenance. The document database developed in the previous technical capacity building project and managed in PWTTD contains important document for maintenance such as as-built drawings. While the document database was not aware by RID, the project supported to provide link to the database from RID.

3.1.5 Sustainability

Sustainability - High

（1） Policy Aspects

As seen in the “Relevance”, the current policy and strategy of Cambodia continues to prioritize the development of road infrastructure including road maintenance. The policy also states enhancement of capacity of planning and database management. Along with the policy on road infrastructure development, enforcement of over loading control is substantially important to develop an appropriate external condition for road and bridge maintenance. In this regards, the Committee for Inspection of Overloading Trucks was established in 2009 and the provision of the Committee is regulated as Sub-Degree No.141 to enhance their activity. In addition to this, inspection activity in all the weigh bridge station is monitored by surveillance camera system supported by ADB for eliminate corruption.

With following aspects sustainability is **high;**

- Considering outside factor and gave warning to the relevant authority

（2） Institutional and Technical Aspects

During the project, MPWT has reformed the organization under new appointed senior minster on May 2016 and sub-degree of new organization and function was prepared on 13 October 2016. RID is set under newly established General Department of Technique. The duties of RID remains the same on road and bridge maintenance to provide plan, monitoring and supervision of quality. So the CPs trained in the project will continue to serve the same services under the new organization.

The skills and knowledge will be expanding and continuously used for the training through Maintenance Expert Program. The Master MEs were trained through the project and conducted series of seminars to DPWTs as principal trainer. The ME training is expected to organize periodically (at least once a year). The manuals were prepared in Khmer and pocket book style for easy use on site by the inspectors in DPWTs.

The product from the project is well considered to be used in the different levels which facilitate technical sustainability of the project.

With following aspects sustainability is **high;**

- Meet the requirement of long term plan, (the database and tools introduced in the project support to react to the request from MEF.)
- Creation of understanding of importance on road and bridge maintenance in MEF through project activity.
- Setting the Maintenance Expert Program with training plan, training material and required cost, made easier to continue the training.
- Institutionalization of the training program is ideal but implementation of the periodical training may need top-down order.

（3） Financial Aspects

The national budget for road and bridge maintenance is steadily increasing since 2013. According to the MEF officials in charge of road infrastructure maintenance, MEF support the road and bridge maintenance policy proposed by RID with support of JICA Team (ex. allocation of budget for bridge inventory, bridge inspection, measurement of IRI, allocation of reconstruction of bridge for priority SD bridge etc.,).

With following aspects efficiency is **high**;

- Creation of a new budget framework for routine inspection of bridge (new)

3.2 Key Factors Affecting Implementation and Outcomes

Followings are the particular affecting factors observed;

（1） Basic knowledge and practice on quality control

The initial quality of the structure is the most important factor for maintenance. Due to some poor construction projects, importance of quality control has been recognized in the ministry and quality of works are improved day by day. However, there are number of bridges with damage caused by poor quality control at the initial stage such as no sufficient covering of rebar, honey comb surface on concrete slab etc., This was a negative heritage from internal war which to be solved near future but some bridge needs to take attention.

（2） Lack of bridge structure engineer in the ministry

In RID, majority of officials were road engineer and only limited (one officials actually) has an education back ground of bridge structure. The project needed to cover very basic aspects on bridge engineering such as name of bridge members, typical damage of bridge etc., The number of bridge structures in RID should be increased in future.
The project had a good corporation with Institute of Technology of Cambodia (ITC) to fill this gap. The professors from ITC participated to the seminars and trainings organized by the project. This also facilitated more close communication between ITC and MPWT on technical auditory activity on other projects.

（3） Overloading

Overloading is the important factor to make bridge maintenance cycle to work effectively. While lots of efforts have been done by donor partners and MPWT, the number of violent vehicles are still observed. Knowing the importance of overloading control, and having emergence case at Tsubasa bridge accident caused by overloaded vehicle, the project amended PDM to include a pilot project to enhance enforcement of overloading control by data collection approach. By using portable scales and temporary weigh station on both sides of Tsubasa bridge, using the data collected on the site, standardized template to monitor overloading and analysis was tested together with counterpart. It was identified that abnormal overloading offenders were mainly repeaters and t enforcement of such repeating offenders are effective action to take.

（4） Allocation of sufficient counterpart personnel to the project

RID was the counterpart of the project. RID works as an internal consultant to inspect and supervise of works done by DPWTs. The staff was given provinces in charge and need to conduct monthly inspection to report to MPWT and MEF. As project, it is ideal that fix staff to be a part of project member in order to provide a concentrated and continuous training to them. For RID, this was a challenge to allocate such member for the project.
In such condition, RID formed a bridge team and a road team to make it possible to conduct activity by team.

（5） Budget required for 1st year project activity

In order to collect data from field and develop the preliminary database for the activity, the first year of the project was important stage. However, due to uncertainty of the starting time of the project, budget for activity was not reserved for the 1st year. The Project Team was required to bear the cost for such important activity to facilitate progress of the project. However, budgetary consideration and arrangement should be confirmed for commencement of the project to eliminate such hindering factor.

3.3 Evaluation on the result of the Project Risk Management

（1） Prime Minister Election

During the election period of the local government in 2016, restriction of the project activity was observed. However, the Project arrange the project activities to avoid the concerned period so that the negative effect to the project was almost zero.

（2） Reform of MPWT

The project formed the execution committee led by the director of the RID. During the project, reform of the MPWT was taken in place and some of the counter parts were transferred to different organization including the director. Also, key personnel were moved to the different department. This may have had a risk to give negative impact to the project activities. However, other key counterparts remained in the same department and grew as master trainers which enables to have minimum affects.

3.4 Lessons Learnt

（1） Change of target DPWTs to establish bridge maintenance cycle (related to Output 1)

- In order to establish bridge maintenance cycle, 1) bridge inventory and 2) bridge condition data were required to be collected in early stage of the project.
- The initial PDM was targeted only 3 selected DPWTs and practice the bridge maintenance cycle within them. However, considering to the function of counterpart (RID) who is in charge of road and bridge maintenance nation level, this original approach was not effective.
- The project proposed and changed the target DPWTs in the earlier stage of the project to meet the mandate of RID.

（2） Importance of local availability of product (related to Output 3)

- The project employed crack bond sealing method for bridge and cold mix asphalt for road maintenance as preventive method.
- It is very important to find local supplier to sustain the introduced methods.
- A company has been established locally to produce the introduced cold mix asphalt (this establishment was supported by other JICA project).
- The material required for crack bond sealing was also available from above company.

（3） Overloading Control at Tsubasa Bridge (Others)

- In the traditional way, the overloaded vehicle control was only by giving warning or penalty to the offended drivers. It is a passive way. On the other hand, having statistical data, more active method is possible (ex. capture repeated offended vehicles). The importance of data collection should be well understood. The counterpart noted continuous data collection after the pilot project.

- MPWT plans to increase from 25 to 31 weigh bridge stations. The data collection and analysis method employed in the pilot project at Tsubasa bridge would be considered to apply along with this expansion plan.
- Identification of repeated offence vehicles and operation company of such vehicle would be most efficient way in overloading control.

3.5 Recommendations

（1）Data maintenance on bridge inspection (related to Output 2)

- The inspection should be periodically conducted to update bridge inspection database.
- In order to facilitate, IT technology could be a good supporting tool to collect same information and make standardized judgement.
- The project employed a system with FileMaker and iPad.
- IT division / expert should take a part of the activity for data maintenance.

（2）Coordination with academic entities (related to Output 4)

- The project had a good coordination with the Institute of Technology of Cambodia (ITC). There were following benefits for both ITC and MPWT for coordinating. For ITC, it was good opportunity to offer to the students to expose to the practical issues on road and bridge maintenance in Cambodia. Also, to expose to the technology such as inspection tools and database. For MPWT, it was good to have an external audit on quality control and specific technical advise from the academic entity to ensure the inspection result (such as technical audit of the project). Especially for RID, there is limited number of staff who has education on bridge structure. This coordination fills such gaps.
- During the seminar on bridge inspection and bridge repair, professor gave to MPWT/DPWT lectures and observation.
- This coordination is expected to remain after the project and contribute to the achievement of the overall goals.
- The professors who graduated from Japanese universities were very helpful for coordination.

Chapter 4 For the Achievement of Overall Goals after the Project Completion

4.1 Prospects to achieve Overall Goals

This chapter is prepared by having joint review meetings between JICA Expert Team and counter parts.

1st Joint Review Meeting：September 2017 , discussion and brain storming how to achieve the overall goals, confirming important approach and to do list for the remaining project period

2nd Joint Review Meeting：November 2017, Completion of Post Project Strategy

3rd Joint Review Meeting: February 2018, Confirmation of the Project Completion Report

Overall goals are predetermined in PDM as below.

Appropriate maintenance of roads and bridges is managed by MPWT.
1) The road and bridge database is updated once / a year.
2) Road and bridge maintenance plans are updated once / a year based on the result of the road and bridge database updated.
3) Road and bridge maintenance is carried out based on the road and bridge maintenance plan and the maintenance and repair manuals, under supervision of RID.
4) The road maintenance and repair manuals, and the bridge maintenance and repair manuals are regularly reviewed.

The overall goal of the Project will be evaluated after approximately 3 years of the Project completion. The project has been conducted with RID as a project counterpart and with selected 5 target DPWTs (3 for bridge inspection and 2 for bridge repair). The overall goals aim to sustain appropriate road and bridge maintenance of MPWT level. To achieve overall goal, it is important to continuously practice the road and bridge maintenance cycle.

With regards to overall goals, achievement in the project and challenges for overall goal were jointly discussed with RID as concluded in Table 4-1.

Table 4-1 Achievement and Challenges for Overall Goal

Overall Goal: Appropriate maintenance of roads and bridges is managed by MPWT.		
Indicators	Achievement in December 2017	Challenges for overall goal achievement (in 3 years)
1) The road and bridge database is updated once / a year.	[Road] General framework of road inspection and data collection by DRIMS was proposed. The road inspection was improved by evaluating both IRI and visual inspection. 4 sets of DRIMS were equipped in RID. A road inspection database has been established and all the inspection data has been stored in it. The roads covered by the new inspection method during the project are listed below · **Year 2015(target DPWT :Kandal)** · RN1,RN2,RN3,RN4,RN5,Rn6,RN7,RN8,RN9 · RN14,RN41,RN62,RN71 · **Year 2016 (target DPWT: Takeo)** · RN4,RN21,RN110,RN120,RN150A,RN261,RN383 · **Year 2017** · RN46,RN41 [Bridge] Bridge database which covers all bridges on national roads was developed and installed in RID office. Total number of bridges in DB: 2,389 bridges Bridge inspection plan (according to the Action Plan 2017) 1) Routine Inspection (visual inspection) : 2,389 bridges (along with road inspection) 2) Periodic Inspection (system inspection):500 bridges /year 3) Detailed Inspection (system inspection) : 6 to 10 bridges/ year 4) Follow up inspection (visual inspection): as required 5) Emergency inspection (visual inspection): as required	[Road] In order to achieve the predetermined indicator, major challenges are; 1. Data collection to cover all major road inspected (target 5,000 km/ year) 2. Increase of the DRIMS team (target 4 teams in RID, 4 teams in DPWTs) 2 experts/team =16 experts 3. Maintenance of DRIMS equipment [Bridge] 1. Implementation of bridge inspection plan Target: Periodic Inspection:1,500 Detailed Inspection:20 2. Database system Continue to use the provided server and program 3. System improvement License update of File Maker 4. Data sharing and communication Share bridge database with in MPWT
2) Road and bridge maintenance plans are updated once / a year based on the result of the road and bridge database updated.	[Road/Bridge] 1) The Action Plan for road and bridge maintenance was developed and approved by the RID director. 2) Master plan for 3-year bridge maintenance was drafted based on bridge database.	[Road/Bridge] 1. Maintenance plan Revision of bridge maintenance list for 3 times 2. Implementation of MOM periodically

Overall Goal: Appropriate maintenance of roads and bridges is managed by MPWT.		
Indicators	Achievement in December 2017	Challenges for overall goal achievement (in 3 years)
	3) MOM (Maintenance Operation Meeting) headed by RID is adopted. 4) Action plan was prepared to practice the bridge maintenance cycle developed in the project.	FY 2018 :2 times FY 2019 :2 times FY 2020: 2 times Total 6 times
3) Road and bridge maintenance is carried out based on the road and bridge maintenance plan and the maintenance and repair manuals, under supervision of RID.	[Road] IRI measurement and visual inspection have been conducted for 1-digit roads and target roads in Kandal province according to the new manual. Road repair by cold mix asphalt "Excel Patch" have been introduced through the1st pilot project. [Bridge] SD (Seriously damaged: 63) and D (Damaged:173) bridges were identified. Crack sealing using injection bond 4 bridges along NR.43 were reconstructed by approved budget in FY2017.	1. Status of the bridge should be improved; In 2020 SD 63 → 48 (5 bridges reconstruction /year x3=15) D 167 →143 (8 bridges repair/ year x 3=24)* assuming crack sealing and CFC
4) The road maintenance and repair manuals, and the bridge maintenance and repair manuals are regularly reviewed.	Manuals were officially launched but copies for distribution are under preparation; **[Road]** Following document were prepared; · Updated Guideline for Repairing Defects of Roads (covering 46 work items) [English and Khmer] · Pocket book of Guideline for Repairing of Defects of Roads [English and Khmer] · The Guideline for Routine Road Maintenance Using IRI [English] · Guideline for Operation of Dynamic Response Intelligent Monitoring System [English] · Application of ROMDAS and DRIMS was proposed and agreed in MPWT. **[Bridge]** Following document were prepared; · Bridge Inspection Manual [English and Khmer] · Pocketbook of Bridge Inspection Manual [English and Khmer] · Bridge List book [English]	1. Distribution of road and bridge repair manual to DPWTs 10 manuals to be distributed to each to DPWT 2. Review of manual and guideline including addition and revision of job code 1time in 3 years 3. Implementation of Maintenance Expert Training 1 time /yearx3=3 times

4.2 Plan of Operation and Implementation Structure of the Cambodia side to achieve Overall Goals

4.2.1 Assessment of Important Actions to Take

Following to the challenges for overall goal, actions to be taken were discussed with RID as concluded in Table 4-2.

Table 4-2 Target Setting and Actions to Take for Overall Goal

Overall Goal: Appropriate maintenance of roads and bridges is managed by MPWT.		
Indicators	Target in 3 years	Actions to take
1) The road and bridge database is updated once / a year.	[Road] 1) Data collection to cover all major road inspected (target 5,000km/ year→5,000km x 3 =15,000km) 2) Increase of the DRIMS team (target 4 teams in RID and 4 teams in DPWTs (2 experts / team)) 3) Maintenance of DRIMS equipment	1) To make clear division of area/ province of responsibility for inspection. RID 4 team Expand to selected 4 DPWTs for operation of DRIMS 2) Set the "Annual Road Condition Survey" using DRIMS in 5,000km every year 3) Allocation of budget for DRIMS survey
	[Bridge] 1) Implementation of bridge inspection plan Target: ● Periodic Inspection:1,500 ● Detailed Inspection:20 2) Database system ● Continue to use the provided server and program 3) System improvement ● License update of File Maker 4) Data sharing and communication ● Share bridge database with in MPWT	1) To make clear division of area/ province of responsibility for inspection. 2) Set one official responsible person in charge of database maintenance , the Road Inventory and Ferry Department will be in charge 3) Set some support staff for operation of the database 4) Allocation of budget for routine bridge inspection
2) Road and bridge maintenance plans are updated once / a year based on the result of the road and bridge database updated.	[Road/Bridge] 1. Maintenance plan Revision of bridge maintenance list for 3 times 2. Implementation of MOM periodically FY 2018 :2 times FY 2019 :2 times FY 2020: 2 times Total 6 times	1) To survey road and bridge condition for base of planning (related to Item 1) 2) Based on 1) update the3 year Plan 3) Expand and share the 3 year plan with provincial level (RID → DPWT)

Overall Goal: Appropriate maintenance of roads and bridges is managed by MPWT.		
Indicators	Target in 3 years	Actions to take
3) Road and bridge maintenance is carried out based on the road and bridge maintenance plan and the maintenance and repair manuals, under supervision of RID.	1. Status of the bridge should be improved; In 2020 SD 63 → 48 (5 bridges reconstruction /year x 3 =15, so the number of SD bridges will be reduced from 63 to 48) D 167 →143 (8 bridges repair/ year x 3=24, so the number of D bridges will be reduced from 167 to 143)* assuming crack sealing and CFC	1) Budget request to MEF Chapter 21 (2.0M/ year) Chapter 61 (0.2 M/year) 2) To set periodical skill training (Maintenance Expert Program) in repair 3) Use of repair method introduced in the project Crack sealing (Bridge) CFC (Bridge) Cold Mix Asphalt (Road)
4) The road maintenance and repair manuals, and the bridge maintenance and repair manuals are regularly reviewed.	1) Dissemination of road and bridge repair manual to DPWTs 10 manuals each to DPWT 2) Review of manual and guideline including addition and revision of job code 1 time in 3 years 3) Implementation of Maintenance Expert Training 1 time /year x 3 =3 times	1) To set periodical technical training of RID and DPWT 2) To set standard/ guideline review group (3 RID officials in charge) 3) Budget request for ME training

4.3 Recommendations for the Cambodia side

（1）Enhancement of Research Function

For RID, work as the engineering consultant of the road and bridge maintenance, it is important to enhance its institutional research function such as on project management, on quality control and on technical investigation. Following actions in different levels are recommended;

Level of capacity enhancement	Actions
a. Ministerial Level	**Recommendation 1: Intersectoral Committee on infrastructure maintenance** · Setting of inter sectoral committee with regards to infrastructure maintenance. Academic sector (ex. ITC), private sector (contractor and consultant), public sector (MPWT, MEF, MOR) · The committee has mandate to set a long term vision of the infrastructure maintenance and marketing.
b. RID Level	**Recommendation 2: Enhancement of research institute** · Integrate the data and survey, knowledge into the one focal portal point (server) which is expansion of document management database developed in the project. · Procure and provide training on technical equipment for inspection and investigation of the road and bridge condition. · Procurement of additional DRIMS and training.
c. Provincial Level	**Recommendation 3: ME Program (2nd generation)** · By using the material and program developed in the project, expand the ME training to DPWTs · In this connection, provide training of 2nd generation of MT from the 1st generation MT.

（2）Expansion to Provincial Level

The central government should have more function of policy development, budget programming and technical standards/ quality control. The technical works such as survey, supervision and inspection works should be gradually transferred to the provincial level.

Recommendation 4: Select model DPWTs to lead DRIMS, bridge inspection in the provincial level

（3）Communication of neighboring countries

Good practices (and bad practices) from neighboring countries would be good lessons in practice. MPWT has already exchange trainings between neighboring counties such as Thailand, this communication should be expand to share and solve the problem fast. With regards to the procurement equipment and material, this communication network would be very efficient. JICA may support this initiative for the activity.

International association such as Road Association, PIARC, FIDIC, APEC might support to forming such communication network.

Recommendation 5: Enhancement of communication with neighboring countries on road and bridge maintenance

4.4 Monitoring Plan from the end of the Project to Ex-post Evaluation

After the end of the project, monitoring to ex-post evaluation will be planned and implemented by JICA Cambodia Office in consultation with JICA Headquarter. The monitoring plan is proposed as Table 4-3. Considering to budget cycle, the most appropriate timing of the monitoring is in January (beginning of the fiscal year) to see the progress of the previous year and plan of the year.

Monitoring schedule: January (1 time / year)
Monitoring method: Table 4-3

Table 4-3 Monitoring Plan (Proposal)

Overall Goal: Appropriate maintenance of roads and bridges is managed by MPWT.			
Monitoring Schedule	1st	January 2019 (in 1 year (10 months from project completion))	
	2nd	January 2020 (in 2 years)	
	3rd	January 2021 (in 3 years)	
Indicators	Target in 3 years		Monitoring Method
1) The road and bridge database is updated once / a year.	[Road] In order to achieve the predetermined indicator, major challenges are; 1) Data collection to cover all major road inspected (target 5000km/year) 2) Increase of the DRIMS team (target 4 teams in RID and 4 teams in DPWTs) 3) Maintenance of equipment DRIMS		1) Cumulative length of the road measured 2) Nos of DRIMS MT 3) Equipment condition
	[Bridge] 1) Implementation of bridge inspection plan Target: ● Periodic Inspection:1,500 ● Detailed Inspection:20 2) Database system ● Continue to use the provided server and program 3) System improvement ● License update of File Maker 4) Data sharing and communication ● Share bridge database with in MPWT		1) Number of bridges inspected 2) Bridge database
2) Road and bridge maintenance plans are updated once / a year based on the result of the road and bridge database updated.	[Road/Bridge] 1. Reflect of the maintenance plan to the program budget Revision of bridge maintenance list for 3 times 2. Implementation of MOM periodically FY 2018 :2 times FY 2019 :2 times FY 2020: 2 times Total 6 times		1) Bridge maintenance short list 2) Number of MOM and meeting minutes
3) Road and bridge maintenance is carried out based on the road and bridge maintenance plan and the maintenance and repair manuals, under supervision of RID.	1. Status of the bridge should be improved; In 2020 SD 63 → 48 (5 bridges reconstruction /year x3=15) D 167 →143 (8 bridges repair/ year x 3=24)* assuming crack sealing and CFC		1) Result of periodic bridge inspection result
4) The road maintenance and repair manuals, and the bridge maintenance and repair manuals are regularly reviewed.	1) Dissemination of road and bridge repair manual to DPWTs 10 manuals each to DPWT 2) Review of manual and guideline including addition and revision of job code 1 time in 3 years 3) Implementation of Maintenance Expert Training 4) 1 time /yearx3=3 times		1) Nos of copies made 2) Update of road maintenance manual 3) ME training record

Annexes

Table of Contents (Annex)

Annex 1 Results of the Project

List of Dispatched Experts

Chief Advisor	OGAWA Koichi
Team Leader / Bridge Maintenance Engineer	MIZOTA Yuzo
Deputy Team Leader / Road Maintenance Planner	NAKAJIMA Takashi
Bridge Repair Engineer (1) (Plannning and Design)	TOKUMASU Ken
Bridge Repair Engineer (2) (Repairing Work Expert)	SUZUKI Hideyuki
Bridge Repair Engineer (3)	Tamagawa Dai
Bridge Inspection Engineer (1)	TSUKAMOTO Shigeaki
Bridge Inspection Engineer (2)	TSUJIMOTO Eichi
Road Maintenance Engineer (1)	HEIMA Hiroyuki
Equipment Procurement / Road Maintenance Engineer (1)	MAEDA Tatsuro
Road Maintenance Engineer (1)	ONO Masazumi
Road Maintenance Engineer (2)	IBAYASHI Kou
Road Maintenance Engineer (3)	HAKAMADA Fumio
Bridge Maintenance Planner	WATANABE Masatoshi
Database System Engineer	KUMAGAI Takahiro
Coordinator / Assistant for Road and Bridge Inspection	OHTAKE Hiroaki
Coordinator for other Relevant Project	YUMITA Kazuo

List of Counterpart

Joint Coordination Committee Member List

1.	H.E. TAUCH Chankosal	Secretary of State,	President
2.	H.E. RHY Sophort,	Director General of Public Works,	Permanent Vice-president
3.	H.E VASIM Soriya	Director General of Administration	Vice-president
4.	Mr. NOU Vaddhanak	Deputy General of Public Works	Member
5.	Representative from Ministry of Foreign Affairs and International Cooperation,		Member
6.	Representative from Ministry of Economy and Finance		Member
7.	Representative Council for Development of Cambodia		Member
8.	Director of Road Infrastructure Department		Member
9.	Director of Public Works Research Center		Member
10.	Director of Heavy Equipment Center		Member
11.	Director of Road Maintenance Center		Member
12.	Director of Sub-national Public Infrastructure Engineering Department		Member
13.	Director of Accounting and Finance Department		Member
14.	Director of International and Cooperation Department		Member
15.	Mr.Itsu ADACHI,	Representative of JICA Cambodia Office	Member
16.	Mr.Taizo CHIBA,	Second Secretary, Embassy of Japan	Member
17.	JICA Experts for the Project		Member

Executing Committee Member List

1.	Mr.Chhim Phalla (replaced from Mr. Heng Rathpiseth, Mr. Nay Chamnang) Director of Road Infrastructure Department			Project Director
2.	Mr.Chao Sopheak Phibal Deputy Director of Road Infrastructure Department			Deputy Project Director
3.	Mr. YOU Dara Deputy Director of Road Infrastructure Department			Permanent Member
4.	Representative from Ministry of Economy and Finance			Member
5.	JICA Experts for the Project for Strengthening Capacity for Maintenance of Road and Bridge			Member
6.	Mr. KEM Socheat	Chief Office	(RID)	Member
7.	Mr. KHOUN Kompheak	Chief Office	(RID)	Member
8.	Mr. SA Sivutha	Chief Office	(RID)	Member
9.	Mr. POU Manith	Chief Office	(RID)	Member
10.	Mr. EM Sovisoth	Deputy Chief Office	(RID)	Member
11.	Mr. NIN Menakak	Deputy Chief Office	(RID)	Member
12.	Ms. THOU Saovry	Deputy Chief Office	(RID)	Member
13.	Mr. NGIM Nouba	Deputy Chief Office	(RID)	Member
14.	Mr. HAI Chandara	Deputy Chief Office	(RID)	Member
15.	Mr. NOP Kilarith	Deputy Chief Office	(RID)	Member
16.	Mr. SETHY Phanavuth	Deputy Chief Office	(RID)	Member
17.	Mr. VETH Piseth	Deputy Chief Office	(RID)	Member
18.	Mr. EM Bunnara	Deputy Chief Office	(SPIED)	Member
19.	Mr. LEAS Thlork	Deputy Chief Office	(SPIED)	Member
20.	Mr. LUN Virakvicheatra	Deputy Chief Office	(RMC)	Member
21.	Mr. HIN Son Odom	Deputy Chief Office	(RMC)	Member
22.	Mr. BOU Lindo	Officer	(RMC)	Member
23.	Mr. LONG Marly	Officer	(RID)	Member
24.	Mr. HOUT Sara	Officer	(RID)	Member
25.	Ms. CHHAY Chakriya	Officer	(RID)	Member
26.	Mr. PROMCHAN Moni Odom	Officer	(PWRC)	Member
27.	Mr. CHAN Rith	Officer	(PWRC)	Member
28.	Mr. VORK Sovan	Officer	(HEC)	Member
29.	Mr. HOUNG Sopheaktra	Officer	(HEC)	Member
30.	Representative from Department of Public Works Kandal Province			Member
31.	Representative from Department of Public Works K.Cham Province			Member
32.	Representative from Department of Public Works Battambang Province			Member
33.	Representative from Department of Public Works Seim Reab Province			Member
34.	Representative from Department of Public Works K.Thom Province			Member
35.	Representative from Department of Public Works Phnom Penh			Member

List of Training

Date	Title	Organization	Participants
22 May 2015	Kickoff Seminar	MPWT, MEF, JICA, EOJ, DPWT, WB, ADB	49
6 July 2015	DRIMS Training	MPWT	3
6 July 2015	Bridge inspection manual and inspection method	RID	
11 July 2015	DRIMS training (calibration)	MPWT	2
25 July 2015	IRI measurement	MPWT	2
31 July 2015	IRI measurement	MPWT	2
7 August 2015	1st workshop ①Road Maintenance Cycle using IRI ②Points on bridge inspection and progress of 2000 bridge inspection	MPWT Mr. You Dara Mr. NIN Menakak Mr. SA Sivutha	31 (RID 18, DPWT 0, Other13)
11 August 2015	Instruction on 2000 Bridge inspection （Field Training）	MPWT	2
17 September 2015	2nd Workshop ①Bridge Maintenance Cycle ②Progress of 2000 Bridge Inspection ③Overloading Control in Cambodia	MPWT JICA Expert Team	23 (RID14, DPWT0,Other9)
5 to 6 October	Site visit on NR5 and NR6	MPWT	5
22 October 2015	3rd Workshop （ Introduction of database system and discussion） 1. History of road network development in Japan 2. Database structure and function 3. Discussion on iPad system bridge inspection	MPWT (Inspector Class)	22 (RID11,DPWT0, Other11)
27 October 2015	4th Workshop (Introduction of database and practices, overloading control） 1. Database 2. Progress of 2000Bridge Inspection 3. Overloading Control	MPWT (Manager Class)	6 (RID6)
11 December 2015	5th Workshop 1. Overloading Control at Tsubasa Bridge 2. Report of Training in Japan	MPWT	61 (RID9,DPWT43, Other9)
25,27 January 2016 29 January 2016	Pilot project for bridge repair (in Phnom Penh)	MPWT, DPWT	6 20 (on 27 January)
1,3,5,6,8,10,11,12 February 2016	Pilot project for bridge repair (Kandal)	MPWT, DPWT	9 Cambodia Institute of Technology on 3 Feb. 5 On 12 Feb
18 February ,2016	6th Workshop	MPWT, DPWT	31 (RID12,DPWT8,

Date	Title	Organization	Participants
	① Bridge and Road Database System ② Database using DRIMS ③ 1st Bridge Maintenance Pilot Project		Other11)
1 March 2016	SIP Seminar	Tokyo University, Hokkaido University, Tokyo Metropolitan Expressway Company, MPWT, DPWT, CIT	1st March 474 (RID17,DPWT61, ITC327,Other69) 2nd March 57 (RID2,DPWT20, Other35)
14 and 16 March, 2016	Bridge maintenance OJT (Kompong Cham, Kizuna Bridge)	MPWT, DPWT	14 March site visit （4 provinces: Svey Rien, Kompong Cham, Preyven, Tompongkum） 16 attendants 16 March site visit （4 provinces） 12 attendants
31 March 2016	7th Workshop ① Road Repair Guideline Outline and next step to sensitization of the guideline, handbook sample etc.,) ② Monitoring result of excel patch and introduction of local production of excel	MPWT, DPWT	15 (RID6,DPWT2, Other 7)
4,5,10,16 and 18 May 2016	Training on bridge database operation	RID	3
25 May 2016	IRI measurement training（RN129, RN21A, RN110, RN151A）	RID	2
From 6 to 8 June 10 June, 2016	Road Maintenance Expert Training (Inspection)	RID	2
From 13 to 15 June 2016	Bridge Maintenance Expert Training （2days lecture ：1day site training）	RID	4
16 June 2016	Road Maintenance Expert Training（Repair） （1.5hours lecture and 0.5 hours exam）	RID	3
16 September 2016	Bridge Maintenance Expert Training（Repair） （2 hours lecture）	RID	5
From 17 to 19 Oct. 2016	2nd Bridge Maintenance Expert Training （2days lecture ：1day site training）	RID, Takeo DPWT	13
23 November 2016	Bridge Data base Training	RID	28 (RID16,Other12)
14 December 2016	1st Workshop	MPWT,DPWT	24 (RID7,DPWT12 Other5)
15 December 2016	4th JCC	MPWT	34 (RID16,Other18)
16 December 2016	2nd workshop	MPWT,DPWT	14 (RID2,DPWT19, Other3)
19 December 2016	3rd workshop	MPWT,DPWT	13 (RID2,DPWT8 Other3)
20 December 2016	4th workshop	MPWT,DPWT	17 (RID2,DPWT11 Other4)
21 December 2016	5th workshop	MPWT,DPWT	13 (RID2,DPWT10 Other1)
10 February 2017	Bridge Maintenance Cycle Meeting	RID	6
22 February 2017	Bridge Management Plan	MPWT	9

Date	Title	Organization	Participants
			(RID6,Other3)
13 March 2017	Bridge Management Plan	MPWT	9 (RID5,Other4)
21 April 2017	Bridge Management Plan	MPWT	7 (RID4,Otherr3)
19 May 2017	Bridge Inspection Workshop at Siem Reap	MPWT,DPWT	4 (RID3,Other1)
22 May 2017	Bridge Inspection Workshop at Pursat	MPWT,DPWT	4 (RID3,Other1)
23 May 2017	Bridge Inspection Workshop at Sihanouk Vile	DPWT	5 (DPWT4,Other1)
26 May 2017	1st Maintenance Operation Meeting	RID	10 (RID4,Other6)
9 June 2017	Workshop on Bridge Repair	MPWT,DPWT	25 (RID8,DPWT11 Other6)
12 June 2017	Workshop on Bridge Repair	MPWT,DPWT	9 (DPWT6,Other3)
13 June 2017	Workshop on Bridge Repair	DPWT	23 (DPWT23)
14 June 2017	Workshop on Bridge Repair	DPWT	11 (DPWT11)
15 June 2017	Workshop on Bridge Repair	DPWT	15 (DPWT15)
23 June 2017	5th JCC	MPWT,Other	36 (RID18,Other18)
26 June 2017	Maintenance Road Expert	RID	11 (RID11)
02 August 2017	Workshop Bridge Inspection	RID,DPWT,Other	36 (RID7,DPWT15 Other14)
03 August 2017	Workshop Bridge Inspection	RID,DPWT,Other	25 (RID2,DPWT13, Other10)
04 August 2017	Workshop Bridge Inspection	RID,DPWT,Other	24 (RID2,DPWT10, Other12)
08 August 2017	Workshop Bridge Inspection	RID,DPWT,Other	23 (RID4,DPWT13 Other6)
09 August 2017	Workshop Bridge Inspection	RID,DPWT,Other	20 (RID3,DPWT10 Other7)
10 August 2017	Workshop Bridge Inspection	RID,DPWT,Other	19 (RID3,DPWT11 Other5)
13 September 2017	1st Project Review Meeting	RID,Other	10 (RID8,Other2)
05 October 2017	Report Meeting Overload Enforcement	Other	5 (Other5)
10 October 2017	Final Presentation of Overloading Enforcement at Tsubasa Bridge	Other	10 (Other10)
11 October 2017	3rd Bridge Inspection Workshop (Day 1)	RID,DPWT,Other	17 (RID4,DPWT10,Other3)
12 October 2017	3rd Bridge Inspection Workshop (Day 2)	RID,DPWT,Other	18 (RID4,DPWT9,Other5)

Date	Title	Organization	Participants
13 October 2017	3rd Bridge Inspection Workshop (Day 3)	RID,DPWT,Other	26 (RID4,DPWT9,Other3)
18 October 2017	4th Bridge Inspection Workshop (Day 1)	RID,DPWT,Other	25 (RID4,DPWT17,Other4)
19 October 2017	4th Bridge Inspection Workshop (Day 2)	RID,DPWT	19 (RID4,DPWT15)
11 December 2017	2nd Maintenance Operation	RID,DPWT	11 (RID5,Other6)
13 December 2017	5th Bridge Inspection Workshop (Day 1)	RID,DPWT	32 (RID3,DPWT29)
14 December 2017	5th Bridge Inspection Workshop (Day 2)	RID,DPWT	25 (RID4,DPWT21)
15 December 2017	5th Bridge Inspection Workshop (Day 3)	RID,DPWT	16 (RID5,DPWT11)
20 December 2017	Final Bridge Inspection Seminar	RID,DPWT	96 (RID13,DPWT83)

Annex 2 List of Products

List of the guidelines and manuals

I Road Maintenance

1. Guideline for Routine Road Maintenance Using IRI (English)
2. Guideline for Repairing Defects of Road (English)
3. Guideline for Repairing Defects of Road(Khmer)
4. Pocket Book of Guideline for Repairing Defects of Road (English)
5. Pocket book of Guideline for Repairing Defects of Road (Khmer)

II Bridge Maintenance

1. Bridge Inspection Manual (English)
2. Bridge Inspection Manual (Khmer)
3. Hand book of Bridge Inspection Manual (English)
4. Hand book of Bridge Inspection Manual (Khmer)
5. Bridge Repair Manual (English)
6. Bridge Repair Manual (Khmer)
7. Pocket Book of Bridge Repair Manual (English) * included in Pocket Book of Guideline for Repairing Defects of Road
8. Pocket book of Bridge Repair Manual (Khmer) * included in Pocket Book of Guideline for Repairing Defects of Road
9. Bridge List Book

III Action Plan

1. Action Plan for Bridge Maintenance Cycle (English)
2. Action Plan for Bridge Maintenance Cycle (Khmer)

List of Reports and Database

1. Project Completion Report
2. Final Report for Implementation Program of Pilot Project for Overload Control at Tsubasa Bridge
3. Bridge Inventory and Inspection System
4. Document Management Database
5. 10 sets of Ipad with bridge inspection system

List of the equipment

Table 0-1 Equipment List

Item	No. of Items	Year/Month	Storage Site	Status
DRIMS	2	2015 April, 2016 October	JICA team office, MPWT	Donated
Binocular	5	2015 August	RID office*1	Donated
MacBook Pro（laptop PC）	1	2015 October	RID office	Donated
DELL Inspiron 15 5000series（laptop PC）	1	2015 October	RID office	Donated
FileMaker Sever (software)	1	2015 October	RID office	Donated
FileMaker Pro (software)	1	2015 October	RID office	Donated
Inspection hammer	10	2015 October	RID office	Donated
Waist pouch for inspection equipment	10	2015 October	RID office	Donated
Flashlight	10	2015 October	RID office	Donated
Portable type weighing scale	2	2016 September	Tsubasa Bridge	Donated
Load cell (spare parts)	1	2016 December	In process	Donated
Container house	1	2016 September	Tsubasa Bridge	Donated
Inspection camera	1	2016 September	JICA team office	Donated
Oxygen meter	1	2016 September	JICA team office	Donated
iPad	10	2016 September	RID office	Donated
Laptop computer	2	2016 September	RID office	Donated
Safety belt	5	2016 September	RID office	Donated
Ladder	1	2016 September	RID office	Donated
Head beam light	2	2016 September	RID office	Donated
Head light	5	2016 September	RID office	Donated
Transceiver	1	2016 September	RID office	Donated
Shovel	2	2016 September	RID office	Donated
Grass Cutter	1	2016 September	RID office	Donated
Color cone	5	2016 September	RID office	Donated
Vehicle stopper	1	2016 September	RID office	Donated
Movie recorder (road monitor)	2	2016 September	RID office	Donated
DRIMS-relevant accessary	2	2016 September	RID office	Donated

Table 0-2 List of construction materials for pilot projects

Item	No. of Items	Year/Month	Storage Site	Remains
BOND E206 (BASE)	15	2016 January	RID lab*2	12.3
BOND E 206 (HARDENER)	15	2016 January	RID lab	12.3
BOND E390 (BASE)	15	2016 January	RID lab	13.3
BOND E 390 (HARDENER)	15	2016 January	RID lab	13.3
CYLINDER FOR BOND	12 (box)	2016 January	RID lab	10.6 (box)
WEIGHTING MACHINE	1	2016 January	RID lab	1
WIRE BRUSH	6	2016 January	RID lab	6
SPATURA FOR MIXING	3	2016 January	RID lab	3
CHALK	1 (box)	2016 January	RID lab	0.5 (box)
BUCKET	6	2016 January	RID lab	6
STOP WATCH	3	2016 January	RID lab	3
SPATURA FOR PAINT	3	2016 January	RID lab	3
MEASURE CUP	6	2016 January	RID lab	6
SANDPAPER	6	2016 January	RID lab	6
BLOWER	3	2016 January	RID lab	3
LEATHER SKIVING CUTTER	6	2016 January	RID lab	6
Permanent Cold Patch Asphalt (1)	100	2016 January	RID lab	5
Permanent Cold Patch Asphalt (2)	200	2017	To be procured	200
Bridge repair materials for the pilot project	1 set	2016 November	Sihanouk DPWT	1 set
Carbon fiber sheets	1 set	2016 November	Sihanouk DPWT	1 set
Bridge repair materials for the pilot project	1 set	2016 November	JICA team office	Donated
Carbon fiber sheets	1 set	2016 November	JICA team office	Donated

*1: MPWT main office building, 3rd floor

*2: Bridge unit warehouse in RID laboratory

Annex 3 PDM

ANNEX I

Project Title : The Project for Strengthening of Inspection and Maintenance of Roads and Bridge in the Kingdom of Cambodia
Project Period : March 2015 to March 2018 (Three Years) **Target Group : Engineers of RID**
Target Area : Roads and Bridges under MPWT **Dated : Oct. 17 2014**
Target Organization : Road Infrastructure Department (RID), Ministry of Public Works and Transport (MPWT) **Ver. 0**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Appropriate maintenance of roads and bridges is managed by MPWT.	1. The road and bridge database is updated regularly and accurately. 2. Road and bridge maintenance plans are developed based on the result of the road and bridge database updated. 3. Road and bridge maintenance is carried out based on the road and bridge maintenance plan and the maintenance and repair manuals. 4. The road maintenance and repair manuals, and the bridge maintenance and repair manuals anreregularly reviewed.	1. Log record of the database, random sample check of individual data 2. The maintenance plans, corresponding data from the database 3. The maintenance record, the maintenance plans and manuals 4. Minutes of the review meeting	- Country's Socio-political situation does not change rapidly.
Project Purpose Capacity of RID to maintain roads and bridges is enhanced.	1. Inspection results done by the three target DPWTs are approved by RID based on the manuals by the end of the project. 2. Repair results done by the two target DPWTs are approved by RID based on the manuals by the end of the project. 3. The above two target DPWTs prepare a draft budget for roads and bridges maintenance for FY 2018 respectively within pre-agreed 4. road and bridge maintenance cycle is explained and shared to concerning offices and units at the project wrap-up seminar. 5. More than XX % of the above seminar participants show interests to practice road and bridge maintenance cycle.	1. DPWT inspection reports and on-site confirmation by RID 2. DPWT repair reports and on-site confirmation by RID 3. The said draft budget and its submission date 4. Number and name of the participated offices and unit 5. Interest level of the participants through the questionnaire	- Organizational arrangement of MPWT is not changed drastically.
Outputs 1. The bridge maintenance cycle is established.	1-1. The annual action plan for bridge maintenance cycle is developed by MM/YYY. 1-2. The above action plan is approved by MM every year. 1-3. More than XX % of RID engineers pass exam of bridge maintenance 1-4. The annual bridge maintenance budget is drafted at the target DPWTs by MM every year.	1-1. The annual action plan and it's date developed 1-2. The approved date 1-3. The exam results and participants list 1-4. The drafted budget and its date	- The trained staff/officers remain at the job. - Roles of DPWTs and other concerning offices and units are not changed including budget preparation system.
2. Road and bridge inspection capacity of RID is enhanced.	2-1. The road and bridge maintenance manuals are prepared by MM/YYYY. 2-2. The selected X roads and Y bridges in the targeted DPWTs are inspected according to the maintenance manual. 2-3. The inspection results are registered to the road and bridge database by RID within XX weeks after the inspection. 2-4. More than XX % of RID's engineers pass road and bridge inspection test.	2-1. The manuals and its' date prepared 2-2. Inspection record and sample on-site confirmation 2-3. Inspection record and corresponding data for sample check 2-4. The test results and participants list	
3. Road and bridge repair capacity of RID is enhanced.	3-1. The road and bridge repair namuals are prepared by MM/YYYY. 3-2. The identified X' roads and Y' bridges in the targeted DPWTs are repaired according to the repair manuals and the inspection results. 3-3. The repair results are registered to the road and bridge database by RID within XX weeks after the repair. 3-4. More than XX % of RID's engineers pass road and bridge repair test.	3-1. The manuals and its' data prepared 3-2. Repair record and sample on-site confirmation 3-3. Repair record and corresponding data for sample check 3-4. The test results and participants list	

Project Monitoring Sheet I (Revision of Project Design Matrix)

Version 1
Dated July 2015

Project Title: The Project for Strengthening Capacity for Maintenance of Roads and Bridges
Implementation Agency: Road Infrastructure Department of Ministry of Public Work and Transport (RID MPWT)
Target Groups: Engineers of RID
Period of Project: April 2015 – March 2018
Project Site: Cambodia
Target Area: Roads and Bridges under MPWT

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Appropriate maintenance of roads and bridges is managed by MPWT.	1. The road and bridge database is updated once / a year. 2. Road and bridge maintenance plans are updated once / a year base on the result of the road and bridge database updated. 3. Road and bridge maintenance is carried out based on the road and bridge maintenance plan and the maintenance and repair manuals, under supervision of RID. 4. The road maintenance and repair manuals, and the bridge maintenance and repair manuals are regularly reviewed.	1. Log record of the database, random sample check of individual data 2. The maintenance plans, corresponding data from the database 3. The maintenance record, the maintenance plans and manuals 4. Minutes of the review meeting	- Country's socio-political situation does not change rapidly.
Project Purpose Capacity of RID to supervise implementing bodies maintaining roads and bridges is enhanced.	1. Inspection results done by the three target DPWTs are approved by RID based on the manuals by the end of the Project. 2. Repair results done by the two target DPWTs are approved by RID base on the manuals by the end of the Project. 3. The above two target DPWTs prepare a draft budget for roads and bridge maintenance for FY 2018 respectively	1. DPWT inspection reports and on-site confirmation by RID 2. DPWT repair reports and on-site confirmation by RID. 3. The said draft budget and its submission date 4. Number and name of the participated offices and unit 5. Interest level of the participants	- Organizational arrangement of MPWT is not changed drastically.

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	within pre-agreed schedule. 4. Road and bridge maintenance cycle is explained and shared to concerning offices and units at the project wrap-up seminar. 5. Maintenance budget of road and bridge is prepared by RID according to the road and bridge maintenance cycle	through the questionnaire.	
Outputs 1. The bridge maintenance cycle is established.	1-1. The annual action plan for bridge maintenance cycle is developed by June every year for each targeted DPWT. 1-2. The above action plan is approved by August every year. 1-3. At least 5 officials of RID engineers pass exam of bridge maintenance cycle. 1-4. The annual bridge maintenance budget is drafted at the target DPWTs of 2nd year and 3rd year by May every year.	1-1. The annual action plan and it's date developed 1-2. The approved date 1-3. The exam results and participants list 1-4. The drafted budget and its date	- The trained staff/officers remain at the job. - Roles of DPWTs and other concerning offices and units are not changed including budget preparation system.
2. Road and bridge inspection capacity of RID is enhanced.	2-1. The road and bridge maintenance manuals are drafted by August 2015 and finalized by June 2017. 2-2. The selected roads and bridges in the targeted DPWTs are inspected according to the maintenance manual. 2-3. The inspection results are registered to the road and bridge database by RID until November every year. 2-4. At least 5 officials of RID's engineers pass road and bridge inspection test.	2-1. The manuals and its' date prepared 2-2. Inspection record and sample on-site confirmation 2-3. Inspection record and corresponding data for sample check 2-4. The test results and participants list	
3. Road and bridge repair capacity of RID is enhanced.	3-1. The road and bridge repair manuals are drafted by January 2016 and finalized by June 2017. 3-2. The identified roads and bridges in the targeted DPWTs are repaired according to	3-1. The manuals and its' date prepared 3-2. Repair record and sample on-site confirmation 3-3. Repair record and corresponding data for sample check	

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	the repair manuals and the inspection results. 3-3. The repair results are registered to the road and bridge database by RID within 1 month after the completion of repair works. 3-4. At least 5 officials of RID's engineers pass road and bridge repair test.	3-4. The test results and participants list	
4. Road and bridge maintenance cycle is introduced to other DPWTs and concerning agencies.	4-1. Bridge inspection is carried out at the more than 80% DPWTs (20/25 DPWTs). 4-2. More than 80% DPWTs attends the seminar held in the Project. 4-3. The project activities are disseminated to other agencies concerning road/bridge maintenance. (number is not specified but with increments through the project)	4-1. Bridge inventory data 4-2. The participants list 4-3. Publicity matter	

Activities	**Inputs**		
1-1. To review the present bridge maintenance cycle and the works of RID in comparison to the existing Japanese system 1-2. To propose annual action plan for bridge maintenance cycle to establish a proper bridge maintenance cycle based on the review results 1-3. To practice the action plan 1-4. To hold workshop of the bridge maintenance cycle 1-5. To prepare draft annual bridge maintenance budget 2-1. To review and develop road maintenance manual 2-2. To review and develop bridge maintenance manual, including a database frame 2-3. To hold training workshops on road and bridge inspections 2-4. To inspect roads and bridges and prepare rough cost estimation of the repair works at the target DPWTs 2-5. To register the inspection results in the database at the target DPWTs 2-6. To revise the road and bridge maintenance manuals incorporating lessons learned from the above activities by organizing review workshops 3-1. To review and establish road repair manual 3-2. To review and establish bridge repair manual 3-3. To hold training workshops on road and bridge repairs 3-4. To identify roads and bridges for the pilot repair works based on the inspection results at the target DPWTs 3-5. To establish repair plan for the identified roads and bridges at the target DPWTs 3-6. To repair the identified roads and bridges at the target DPWTs 3-7. To evaluate the above repair works 3-8. To revise the road and bridge repair manual incorporating lessons learned from the above activities by organizing review workshop by organizing review	(Japan side) 1 A chief advisor / A long term expert 2 Short term experts 1) Team Leader / Bridge Maintenance Engineer 2) Deputy-team leader / Road Maintenance Planner 3) Bridge Inspection Engineer 4) Bridge Repair Engineer (1) (Planning and Design) 5) Bridge Repair Engineer (2) (Repairing work Expert) 6) Bridge Maintenance Planner 7) Road Maintenance Engineer(1) 8) Road Maintenance Engineer(2) 9) Coordinator / Assistant for Road and Bridge Inspection 10) Coordinator for other relevant project / C/P training Supervision 3 Equipment for road and bridge maintenance 4 C/P training 5 Cost for seminars and Trainings as the project activities	(Cambodia side) 1 Arrangement of counterpart personnel 1) Project Director 2) Project Manager 3) Other Necessary Personnel 2 Implementation cost for the pilot repair works 3 Travel expenses and allowances for the participants of the seminars and trainings organized as the project activities 4 Maintenance cost of the JICA project equipment 5 Office space including its utility cost (electricity, water, internet and other necessary office facilities) 6 Etc.	- Conditions of roads and bridges under MPWT are not rapidly deteriorated. - Flood with large scale is not occurred annually.

workshop 4-1. To organize seminars for other DPWTs – trainings on road and bridge inspection 4-2. To organize seminars for other DPWTs – trainings on road and bridge repair 4-3. To organize the project wrap-up seminar			

Project Monitoring Sheet I (Revision of Project Design Matrix)

Version 2
Dated January 2016

Project Title: The Project for Strengthening Capacity for Maintenance of Roads and Bridges
Implementation Agency: Road Infrastructure Department of Ministry of Public Work and Transport (RID MPWT)
Target Groups: Engineers of RID
Period of Project: April 2015 – March 2018
Project Site: Cambodia
Target Area: Roads and Bridges under MPWT

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Appropriate maintenance of roads and bridges is managed by MPWT.	1. The road and bridge database is updated once / a year. 2. Road and bridge maintenance plans are updated once / a year base on the result of the road and bridge database updated. 3. Road and bridge maintenance is carried out based on the road and bridge maintenance plan and the maintenance and repair manuals, under supervision of RID. 4. The road maintenance and repair manuals, and the bridge maintenance and repair manuals are regularly reviewed.	1. Log record of the database, random sample check of individual data 2. The maintenance plans, corresponding data from the database 3. The maintenance record, the maintenance plans and manuals 4. Minutes of the review meeting	- Country's socio-political situation does not change rapidly.
Project Purpose Capacity of RID to supervise implementing bodies maintaining roads and bridges is enhanced.	1. Inspection results done by the three target DPWTs are approved by RID based on the manuals by the end of the Project. 2. Repair results done by the two target DPWTs are approved by RID base on the manuals by the end of the Project. 3. The above two target DPWTs prepare a draft budget for roads and bridge maintenance for FY 2018	1. DPWT inspection reports and on-site confirmation by RID 2. DPWT repair reports and on-site confirmation by RID. 3. The said draft budget and its submission date 4. Number and name of the participated offices and unit	- Organizational arrangement of MPWT is not changed drastically.

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	respectively within pre-agreed schedule. 4. Road and bridge maintenance cycle is explained and shared to concerning offices and units at the project wrap-up seminar. 5. Maintenance budget of road and bridge is prepared by RID according to the road and bridge maintenance cycle	5. Interest level of the participants through the questionnaire.	
Outputs			
1. The bridge maintenance cycle is established.	1-1. The annual action plan for bridge maintenance cycle is developed and approved by August every year for each targeted DPWT. 1-2. At least 5 officials of RID engineers pass exam of bridge maintenance cycle. 1-3. The annual bridge maintenance budget is drafted at the target DPWTs of 2nd year and 3rd year by May every year. 1-4. 3 Year Bridge Maintenance Strategic Plan of short term is prepared by RID/MPWT every August	1-1. The annual action plan and it's date developed and approved 1-2. The exam results and participants list 1-3. The drafted budget and its date 1-4. 3 Year Bridge Maintenance Strategic Plan	- The trained staff/officers remain at the job. - Roles of DPWTs and other concerning offices and units are not changed including budget preparation system.
2. Road and bridge inspection capacity of RID is enhanced.	2-1. The road and bridge maintenance manuals are drafted by August 2015 and finalized by June 2017. 2-2. The selected bridges of all DPWTs are inspected according to the maintenance manual. 2-3. The selected roads in the targeted DPWTs are inspected according to the maintenance manual 2-4. The inspection results are registered to the road and bridge database by RID until November every year. 2-5. At least 5 officials of RID's engineers pass road and bridge inspection test.	2-1. The manuals and its' date prepared 2-2. Inspection record and sample on-site confirmation 2-3. Inspection record and corresponding data for sample check 2-4. The test results and participants list	
3. Road and bridge repair capacity of RID is enhanced.	3-1. The road and bridge repair manuals are drafted by January 2016 and finalized by June 2017. 3-2. The identified roads and bridges in the targeted DPWTs are repaired according to the repair	3-1. The manuals and its' date prepared 3-2. Repair record and sample on-site confirmation 3-3. Repair record and corresponding	

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	manuals and the inspection results. 3-3. The repair results are registered to the road and bridge database by RID within 1 month after the completion of repair works. 3-4. At least 5 officials of RID's engineers pass road and bridge repair test.	data for sample check 3-4. The test results and participants list	
4. Road and bridge maintenance cycle is introduced to other DPWTs and concerning agencies.	4-1. Bridge inspection is carried out at the more than 80% DPWTs (20/25 DPWTs). 4-2. More than 80% DPWTs attends the seminar held in the Project. 4-3. The project activities are disseminated to other agencies concerning road/bridge maintenance. (number is not specified but with increments through the project)	4-1. Bridge inventory data 4-2. The participants list 4-3. Publicity matter	

Activities	**Inputs**		
1-1. To review the present bridge maintenance cycle and the works of RID in comparison to the existing Japanese system 1-2. To propose 3 year bridge maintenance strategic plan with the annual action plan to establish a proper bridge maintenance cycle 1-3. To propose annual action plan for bridge maintenance cycle to establish a proper bridge maintenance cycle based on the review results 1-4. To practice the action plan 1-5. To hold workshop of the bridge maintenance cycle 1-6. To prepare draft annual bridge maintenance budget 2-1. To review and develop road maintenance manual 2-2. To review and develop bridge maintenance manual, including a database frame 2-3. To hold training workshops on road and bridge inspections 2-4. For bridge, to inspect bridges and prepare rough cost estimation of the repair works for all DPWTs 2-5. For roads, to inspect roads using IRI and prepare rough cost estimation of the repair works at the target DPWTs 2-6.To register the inspection results in the database by RID 2-7. To revise the road and bridge maintenance manuals incorporating lessons learned from the above activities by organizing review workshops 2-8. To conduct preliminary study on overloading control (at Tsubasa Bridge) 3-1. To review and establish road repair manual 3-2. To review and establish bridge repair manual 3-3. To hold training workshops on road and bridge repairs 3-4. To identify roads and bridges for the pilot repair works based on the inspection results at the target DPWTs 3-5. To establish repair plan for the identified roads and bridges at the target DPWTs	(Japan side) 1. A chief advisor / A long term expert 2. Short term experts 1) Team Leader / Bridge Maintenance Engineer 2) Deputy-team leader / Road Maintenance Planner 3) Bridge Inspection Engineer 4) Bridge Repair Engineer (1) (Planning and Design) 5) Bridge Repair Engineer (2) (Repairing work Expert) 6) Bridge Maintenance Planner 7) Road Maintenance Engineer(1) 8) Road Maintenance Engineer(2) 9) Coordinator / Assistant for Road and Bridge Inspection 10) Coordinator for other relevant project / C/P training Supervision 11) Road Maintenance Engineer (3) (Overloading Control) 3. Equipment for road and bridge maintenance 4. C/P training 5. Cost for seminars and Trainings as the project activities	(Cambodia side) 1. Arrangement of counterpart personnel 1) Project Director 2) Project Manager 3) Other Necessary Personnel 2. Implementation cost for the pilot repair works 3. Travel expenses and allowances for the participants of the seminars and trainings organized as the project activities 4. Maintenance cost of the JICA project equipment 5. Office space including its utility cost (electricity, water, internet and other necessary office facilities) 6. Etc.	- Conditions of roads and bridges under MPWT are not rapidly deteriorated. - Flood with large scale is not occurred annually. Pre-condition N/A

3-6. To repair the identified roads and bridges at the target DPWTs 3-7. To evaluate the above repair works 3-8. To revise the road and bridge repair manual incorporating lessons learned from the above activities by organizing review workshop by organizing review workshop 4-1. To organize seminars for other DPWTs – trainings on road and bridge inspection 4-2. To organize seminars for other DPWTs – trainings on road and bridge repair 4-3. To organize the project wrap-up seminar			

Project Monitoring Sheet I (Revision of Project Design Matrix)

Version 3

Dated December 2016

Project Title: The Project for Strengthening Capacity for Maintenance of Roads and Bridges
Implementation Agency: Road Infrastructure Department of Ministry of Public Work and Transport (RID MPWT)
Target Groups: Engineers of RID
Period of Project: April 2015 – March 2018
Project Site: Cambodia
Target Area: Roads and Bridges under MPWT

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Appropriate maintenance of roads and bridges is managed by MPWT.	1. The road and bridge database is updated once / a year. 2. Road and bridge maintenance plans are updated once / a year base on the result of the road and bridge database updated. 3. Road and bridge maintenance is carried out based on the road and bridge maintenance plan and the maintenance and repair manuals, under supervision of RID. 4. The road maintenance and repair manuals, and the bridge maintenance and repair manuals are regularly reviewed.	1. Log record of the database, random sample check of individual data 2. The maintenance plans, corresponding data from the database 3. The maintenance record, the maintenance plans and manuals 4. Minutes of the review meeting	- Country's socio-political situation does not change rapidly.
Project Purpose Capacity of RID to supervise implementing bodies maintaining roads and bridges is enhanced.	1. Inspection results done by the three target DPWTs are approved by RID based on the manuals by the end of the Project. 2. Repair results done by the two target DPWTs are approved by RID base on the manuals by the end of the Project. 3. The above two target DPWTs prepare a	1. DPWT inspection reports and on-site confirmation by RID 2. DPWT repair reports and on-site confirmation by RID. 3. The said draft budget and its submission date 4. Number and name of the participated offices and unit 5. Interest level of the participants through the	- Organizational arrangement of MPWT is not changed drastically.

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	draft budget for roads and bridge maintenance for FY 2018 respectively within pre-agreed schedule. 4. Road and bridge maintenance cycle is explained and shared to concerning offices and units at the project wrap-up seminar. 5. Maintenance budget of road and bridge is prepared by RID according to the road and bridge maintenance cycle	questionnaire.	
Outputs 1. The bridge maintenance cycle is established.	1-1. The annual action plan for bridge maintenance cycle is developed and approved by August every year for each targeted DPWT. 1-2. At least 5 officials of RID engineers pass exam of bridge maintenance cycle. 1-3. The annual bridge maintenance budget is drafted at the target DPWTs of 2nd year and 3rd year by May every year. 1-4. 3 Year Bridge Maintenance Strategic Plan of short term is prepared by RID/MPWT every August	1-1. The annual action plan and it's date developed and approved 1-2. The exam results and participants list 1-3. The drafted budget and its date 1-4. 3 Year Bridge Maintenance Strategic Plan	- The trained staff/officers remain at the job. - Roles of DPWTs and other concerning offices and units are not changed including budget preparation system.
2. Road and bridge inspection capacity of RID is enhanced.	2-1. The road and bridge maintenance manuals are drafted by August 2015 and finalized by June 2017. 2-2. The selected bridges of all DPWTs are inspected according to the maintenance manual. 2-3. The selected roads in the targeted DPWTs are inspected according to the maintenance manual	2-1. The manuals and its' date prepared 2-2. Inspection record and sample on-site confirmation 2-3. Inspection record and corresponding data for sample check 2-4. The test results and participants list	

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	2-4. The inspection results are registered to the road and bridge database by RID until November every year. 2-5. At least 5 officials of RID's engineers pass road and bridge inspection test.		
3. Road and bridge repair capacity of RID is enhanced.	3-1. The road and bridge repair manuals are drafted by January 2016 and finalized by June 2017. 3-2. The identified roads and bridges in the targeted DPWTs are repaired according to the repair manuals and the inspection results. 3-3. The repair results are registered to the road and bridge database by RID within 1 month after the completion of repair works. 3-4. At least 5 officials of RID's engineers pass road and bridge repair test.	3-1. The manuals and its' date prepared 3-2. Repair record and sample on-site confirmation 3-3. Repair record and corresponding data for sample check 3-4. The test results and participants list	
4. Road and bridge maintenance cycle is introduced to other DPWTs and concerning agencies.	4-1. Bridge inspection is carried out at the more than 80% DPWTs (20/25 DPWTs). 4-2. More than 80% DPWTs attends the seminar held in the Project. 4-3. The project activities are disseminated to other agencies concerning road/bridge maintenance. (number is not specified but with increments through the project)	4-1. Bridge inventory data 4-2. The participants list 4-3. Publicity matter	

Activities	**Inputs**		
1-1. To review the present bridge maintenance cycle and the works of RID in comparison to the existing Japanese system 1-2. To propose 3 year bridge maintenance strategic plan with the annual action plan to establish a proper bridge maintenance cycle 1-3. To propose annual action plan for bridge maintenance cycle to establish a proper bridge maintenance cycle based on the review results 1-4. To practice the action plan 1-5. To hold workshop of the bridge maintenance cycle 1-6. To prepare draft annual bridge maintenance budget 2-1. To review and develop road maintenance manual 2-2. To review and develop bridge maintenance manual, including a database frame 2-3. To hold training workshops on road and bridge inspections 2-4. For bridge, to inspect bridges and prepare rough cost estimation of the repair works for all DPWTs 2-5. For roads, to inspect roads using IRI and prepare rough cost estimation of the repair works at the target DPWTs 2-6.To register the inspection results in the database by RID 2-7. To revise the road and bridge maintenance manuals incorporating lessons learned from the above activities by organizing review workshops 2-8. To conduct preliminary study on overloading control (at Tsubasa Bridge) 3-1. To review and establish road repair manual 3-2. To review and establish bridge repair manual 3-3. To hold training workshops on road and bridge repairs 3-4. To identify roads and bridges for the pilot repair works based on the inspection results at the target DPWTs 3-5. To establish repair plan for the identified roads and bridges at the target DPWTs	(Japan side) 1. A chief advisor / A long term expert 2. Short term experts 1) Team Leader / Bridge Maintenance Engineer 2) Deputy-team leader / Road Maintenance Planner 3) Bridge Inspection Engineer 4) Bridge Repair Engineer (1) (Planning and Design) 5) Bridge Repair Engineer (2) (Repairing work Expert) 6) Bridge Maintenance Planner 7) Road Maintenance Engineer(1) / Equipment procurement engineer 8) Road Maintenance Engineer(2) 9) Coordinator / Assistant for Road and Bridge Inspection 10) Coordinator for other relevant project / C/P training Supervision 11) Road Maintenance Engineer (3) (Overloading Control) 3. Equipment for road and bridge maintenance 4. C/P training 5. Cost for seminars and Trainings as the project activities	(Cambodia side) 1. Arrangement of counterpart personnel 1) Project Director 2) Project Manager 3) Other Necessary Personnel 2. Implementation cost for the pilot repair works 3. Travel expenses and allowances for the participants of the seminars and trainings organized as the project activities 4. Maintenance cost of the JICA project equipment 5. Office space including its utility cost (electricity, water, internet and other necessary office facilities) 6. Etc.	- Conditions of roads and bridges under MPWT are not rapidly deteriorated. - Flood with large scale is not occurred annually. Pre-condition N/A

3-6. To repair the identified roads and bridges at the target DPWTs 3-7. To evaluate the above repair works 3-8. To revise the road and bridge repair manual incorporating lessons learned from the above activities by organizing review workshop by organizing review workshop 4-1. To organize seminars for other DPWTs – trainings on road and bridge inspection 4-2. To organize seminars for other DPWTs – trainings on road and bridge repair 4-3. To organize the project wrap-up seminar			

Project Monitoring Sheet I (Revision of Project Design Matrix)

Version 4
Dated June 2017

Project Title: The Project for Strengthening Capacity for Maintenance of Roads and Bridges
Implementation Agency: Road Infrastructure Department of Ministry of Public Work and Transport (RID MPWT)
Target Groups: Engineers of RID
Period of Project: April 2015 – March 2018
Project Site: Cambodia
Target Area: Roads and Bridges under MPWT

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Appropriate maintenance of roads and bridges is managed by MPWT.	1. The road and bridge database is updated once / a year. 2. Road and bridge maintenance plans are updated once / a year base on the result of the road and bridge database updated. 3. Road and bridge maintenance is carried out based on the road and bridge maintenance plan and the maintenance and repair manuals, under supervision of RID. 4. The road maintenance and repair manuals, and the bridge maintenance and repair manuals are regularly reviewed.	1. Log record of the database, random sample check of individual data 2. The maintenance plans, corresponding data from the database 3. The maintenance record, the maintenance plans and manuals 4. Minutes of the review meeting	- Country's socio-political situation does not change rapidly.
Project Purpose Capacity of RID to supervise implementing bodies maintaining roads and bridges is enhanced.	1. Inspection results done by the three target DPWTs are approved by RID based on the manuals by the end of the Project.	1. DPWT inspection reports and on-site confirmation by RID 2. DPWT repair reports and on-site confirmation by RID. 3. The said draft budget and its submission date 4. Number and name of the participated offices and	- Organizational arrangement of MPWT is not changed drastically.

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	2. Repair results done by the two target DPWTs are approved by RID base on the manuals by the end of the Project. 3. The above two target DPWTs prepare a draft budget for roads and bridge maintenance for FY 2018 respectively within pre-agreed schedule. 4. Road and bridge maintenance cycle is explained and shared to concerning offices and units at the project wrap-up seminar. 5. Maintenance budget of road and bridge is prepared by RID according to the road and bridge maintenance cycle	unit 5. Interest level of the participants through the questionnaire.	
<u>Outputs</u> 1. The bridge maintenance cycle is established.	1-1. The annual action plan for bridge maintenance cycle is developed and approved by August every year for each targeted DPWT. 1-2. At least 5 officials of RID engineers pass exam of bridge maintenance cycle. 1-3. The annual bridge maintenance budget is drafted at the target DPWTs of 2nd year and 3rd year by May every year. 1-4. 3 Year Bridge Maintenance Strategic Plan of short term is	1-1. The annual action plan and it's date developed and approved 1-2. The exam results and participants list 1-3. The drafted budget and its date 1-4. 3 Year Bridge Maintenance Strategic Plan	- The trained staff/officers remain at the job. - Roles of DPWTs and other concerning offices and units are not changed including budget preparation system.

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	prepared by RID/MPWT every August		
2. Road and bridge inspection capacity of RID is enhanced.	2-1. The road and bridge maintenance manuals are drafted by August 2015 and finalized by June 2017. 2-2. The selected bridges of all DPWTs are inspected according to the maintenance manual. 2-3. The selected roads in the targeted DPWTs are inspected according to the maintenance manual 2-4. The inspection results are registered to the road and bridge database by RID until November every year. 2-5. At least 5 officials of RID's engineers pass road and bridge inspection test.	2-5. The manuals and its' date prepared 2-6. Inspection record and sample on-site confirmation 2-7. Inspection record and corresponding data for sample check 2-8. The test results and participants list	
3. Road and bridge repair capacity of RID is enhanced.	3-1. The road and bridge repair manuals are drafted by January 2016 and finalized by June 2017. 3-2. The identified roads and bridges in the targeted DPWTs are repaired according to the repair manuals and the inspection results. 3-3. The repair results are registered to the road and bridge database by	3-1. The manuals and its' date prepared 3-2. Repair record and sample on-site confirmation 3-3. Repair record and corresponding data for sample check 3-4. The test results and participants list	

Project Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	RID within 1 month after the completion of repair works. 3-4. At least 5 officials of RID's engineers pass road and bridge repair test.		
4. Road and bridge maintenance cycle is introduced to other DPWTs and concerning agencies.	4-1. Bridge inspection is carried out at the more than 80% DPWTs (20/25 DPWTs). 4-2. More than 80% DPWTs attends the seminar held in the Project. 4-3. The project activities are disseminated to other agencies concerning road/bridge maintenance. (number is not specified but with increments through the project)	4-1. Bridge inventory data 4-2. The participants list 4-3. Publicity matter	

Activities	**Inputs**		
1-1. To review the present bridge maintenance cycle and the works of RID in comparison to the existing Japanese system 1-2. To propose 3 year bridge maintenance strategic plan with the annual action plan to establish a proper bridge maintenance cycle 1-3. To propose annual action plan for bridge maintenance cycle to establish a proper bridge maintenance cycle based on the review results 1-4. To practice the action plan 1-5. To hold workshop of the bridge maintenance cycle 1-6. To prepare draft annual bridge maintenance budget 2-1. To review and develop road maintenance manual 2-2. To review and develop bridge maintenance manual, including a database frame 2-3. To hold training workshops on road and bridge inspections 2-4. For bridge, to inspect bridges and prepare rough cost estimation of the repair works for all DPWTs 2-5. For roads, to inspect roads using IRI and prepare rough cost estimation of the repair works at the target DPWTs 2-6.To register the inspection results in the database by RID 2-7. To revise the road and bridge maintenance manuals incorporating lessons learned from the above activities by organizing review workshops 2-8. To conduct preliminary study on overloading control (at Tsubasa Bridge) 3-1. To review and establish road repair manual 3-2. To review and establish bridge repair manual 3-3. To hold training workshops on road and bridge repairs 3-4. To identify roads and bridges for the pilot repair works based on the inspection results at the target DPWTs 3-5. To establish repair plan for the identified roads and bridges at the target DPWTs 3-6. To repair the identified roads and bridges at the target	(Japan side) 1. A chief advisor / A long term expert 2. Short term experts 1) Team Leader / Bridge Maintenance Engineer 2) Deputy-team leader / Road Maintenance Planner 3) Bridge Inspection Engineer(1) 4) Bridge Inspection Engineer (2) 5) Bridge Repair Engineer (1) (Planning and Design) 6) Bridge Repair Engineer (2) (Repairing work Expert) 7) Bridge Repair Engineer (3) 8) Bridge Maintenance Planner 9) Road Maintenance Engineer(1) / Equipment procurement engineer 10) Road Maintenance Engineer(2) 11) Coordinator / Assistant for Road and Bridge Inspection 12) Coordinator for other relevant project / C/P training Supervision 13) Road Maintenance Engineer (3) (Overloading Control) 14) Database Expert 3. Equipment for road and bridge maintenance 4. C/P training 5. Cost for seminars and Trainings as the project activities	(Cambodia side) 1. Arrangement of counterpart personnel 1) Project Director 2) Project Manager 3) Other Necessary Personnel 2. Implementation cost for the pilot repair works 3. Travel expenses and allowances for the participants of the seminars and trainings organized as the project activities 4. Maintenance cost of the JICA project equipment 5. Office space including its utility cost (electricity, water, internet and other necessary office facilities) 6. Etc.	- Conditions of roads and bridges under MPWT are not rapidly deteriorated. - Flood with large scale is not occurred annually. Pre-condition N/A

DPWTs 3-7. To evaluate the above repair works 3-8. To revise the road and bridge repair manual incorporating lessons learned from the above activities by organizing review workshop by organizing review workshop 4-1. To organize seminars for other DPWTs – trainings on road and bridge inspection 4-2. To organize seminars for other DPWTs – trainings on road and bridge repair 4-3. To organize the project wrap-up seminar			