

### 8.2.3 Organization for Check and Approval of Standard Drawings

Combination of bridge types, carriageway width and span length for Standard Drawings was confirmed by collected as-built drawings. If there is no reference to as-built drawings, supplemental CAD drawings were applied in accordance with design standard.

During preparation of CAD drawings, checks and revises were done step by step for final version of standard drawings for road, pipe culverts, box culverts and several types of bridges.

Specially, detail hearings and discussions were conducted to the undersecretary and related directors in order to incorporate experiences in the past and improve standard drawings for road, pipe culverts, box culverts and bridges, as shown in Figure 8.2-1.

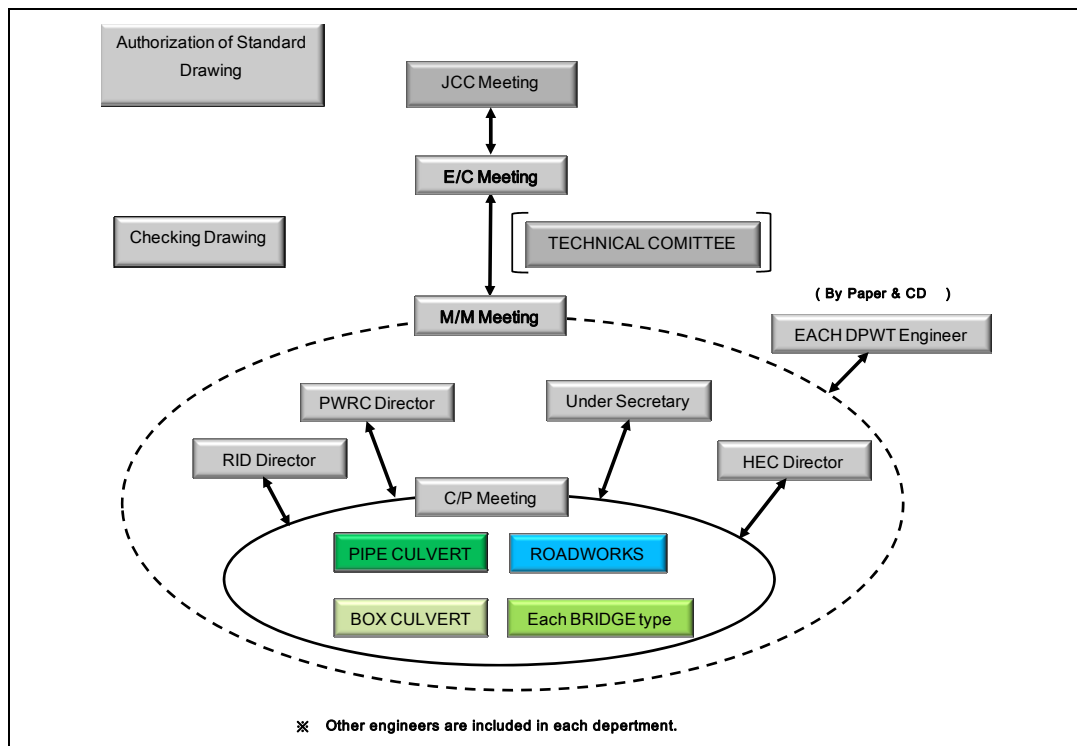


Figure 8.2-1 Organization Chart for Check and Approval of Standard Drawings

### 8.2.4 Complement of Combination for Span and Carriageway Width

As-built drawings of 96 bridges were collected. The results of classification about type of bridge, carriageway width and span length are shown in Table 8.2-8. Gray color cells without number mean no as-built drawings available, and therefore drawings for those cells were prepared with complement computation developed from related as-built drawings.

**Table 8.2-8 Result of Combination of Span and Carriageway Width of Bridge**

RC Flat Slab Bridge				
Span	Carriageway width			
	7	8	10	12
10			2	
12			4	
15				
18				

RC Hollow Slab Bridge				
Span	Carriageway width			
	7	8	10	12
10				
12			3(13m)	
15				

PC Flat Slab Bridge				
Span	Carriageway width			
	7	8	10	12
10			1	
12				
15				
18				

RCDG				
Span	Carriageway width			
	7	8	10	12
12	3			
15	4		7	
18	6			

Pretension Hollow Slab Bridge				
Span	Carriageway width			
	7	8	10	12
10			6	
12			15(13m)	
15			13	
18				
20				
25			6	

PCDG				
Span	Carriageway width			
	7	8	10	12
15				
18				
20			2	
25			6	1
30		1	1	

Post tension Hollow Slab Bridge				
Span	Carriageway width			
	7	8	10	12
15			1	
18				
20			8	
25				

Similarly, as-built drawings of 58 box culverts were collected. The results of classification about type of box culvert, height and width are shown in Table 8.2-9. Blank cells mean no as-built drawings available and number in the cells means as-built drawings were available. Drawings for blank cells were prepared with complement computation from related as-built drawings.

**Table 8.2-9 Result of Combination of Height and Width of Box Culvert**

1-Box				
H(inner height,m)	B(inner width,m)			
	1.5	2.0	2.5	3.0
1.0	11			
1.5	2	1		
2.0		1		
2.5				1
3.0				1

1 - Box (cm)			
Span	U.Slab	Wall	L.Slab
1	—	20	—
1.5	22.5	22.5	25
2	25	25	27.5
2.5	27.5	27.5	30
3	30	27.5	30

2-Box				
H(inner height,m)	B(inner width,m)			
	1.5	2.0	2.5	3.0
1.0	11			
1.5		2		
2.0		4	3	
2.5			1	
3.0				1

2 - Box (cm)			
Span	U.Slab	Wall	L.Slab
1	—	20	—
1.5	20	20	22.5
2	22.5	20	22.5
2.5	25	22.5	25
3	27.5	25	27.5

3-Box				
H(inner height,m)	B(inner width,m)			
	1.5	2.0	2.5	3.0
1.0	4	1		
1.5				
2.0				
2.5				1
3.0				

3 - Box (cm)			
Span	U.Slab	Wall	L.Slab
1	—	—	—
1.5	20	20	22.5
2	22.5	20	22.5
2.5	25	22.5	25
3	27.5	25	27.5

### 8.2.5 CAD Drawings

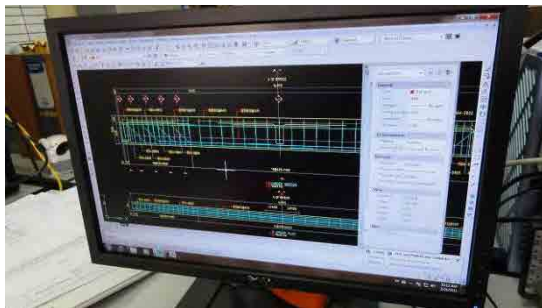
Process of CAD drawings started from November 2010 and approved by the JCC meeting on December 21, 2011. During process of CAD drawings for road, pipe culverts, box culverts and bridges, checks and revises were done with consultation with the undersecretary and related directors.

Progress of Standard Drawings became around 30% from November 2010 to the end of March 2011. It was 100% in November 2011, as shown in Table 8.2-10, and Photo 8.2-1 and 8.2-2.

**Table 8.2-10 Schedule of Making CAD Drawing**

Schedule of making Standard Drawing for Bridge and Road Structure 12-Dec-11

Item		2010						2011												
		7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Task 5 ( Output 3-2 )	Assignment	2nd				3rd		4th				5th		6th		7th		8th		
	Collection of Road & Road structure As-built drawing					[Red bar]														
	Comparison with AUSTROAD and AASHTO	[Red bar]																		
	Making CAD drawing					[Red bar]														
	Editing of Standard Drawing													[Red bar]						
	Approval of Standard Drawing																	[Red bar]		JCC
	Modification and additional drawing																[Red bar]			
Progress of Drawing (%)					100															
					80															
					60															
					40															
					20															
					0															



**Photo 8.2-1 Sample CAD Operation**



**Photo 8.2-2 Making CAD by Two Operators**

Progress of compiling standard drawings is shown in Table 8.2-11. Sample content of standard drawings and sample drawing are shown in Table 8.2-12 and Figure 8.2-2 (refer to Appendix 7-1) respectively.

After approval in the second JCC meeting, post tension hollow slab bridge drawings were added in the Standard Drawings requested by MPWT. All drawings were complete in February 2012.

**Table 8.2-11 Progress of Compiling Standard Drawing**

Progress of Compiling Standard Drawings					
	Type of Structure	Detail	Progress	Total	
Part1: Road	Format of Drawing	Section 1	6	6	
	Road Geometry Design	Section 2	13	13	
	Road Slope Protection	Section 3	5	5	
	Road Drainage	Section 4	7	7	
	Road Traffic Devices	Section 5	16	16	
	Attachment: Sample of Drawing	Section 6	6	6	
Part2: Bridges and Structure	Pipe Culvert	1-Pipe	12	12	
		2-Pipe	12	12	
		3-Pipe	12	12	
	Box Culvert	1-Box	52	52	
		2-Box	40	40	
		3-Box	40	40	
	RC Flat Slab Bridge			96	96
	RC Deck Girder Bridge			96	96
	Pretension Hollow Slab Bridge			96	96
	PCDG T-Girder Bridge			144	144
	PCDG I-Girder Bridge			144	144
	2-Span Bridge : RCDG			36	36
	2-Span Bridge : PC Hollow Slab Bridge			32	32
Miscellaneous			37	37	
Progress			902	902	
			100	%	

**Table 8.2-12 Sample Content of Standard Drawings**

STRUCTURE		TITLE OF DRAWING		DRAWING	BOQ	
				PDF	EXCEL	
SELECTION OF STRUCTURE				⇒	-	
CONTENT				⇒	-	
PIPE CULVERT	DIAMETER	GENERAL NOTES FOR PIPE CULVERT		⇒	-	
		REBAR CONNECTION		⇒	-	
	D = 1.0m	SINGLE PIPE	GENERAL VIEW		⇒	⇒
			PIPE INSTALLATION AND CONNECTION DETAIL			
			HEADWALL REINFORCEMENT AND CONNECTION DETAIL			
			REINFORCEMENT LAYOUT OF PIPE CULVERT			
		DOUBLE PIPES	GENERAL VIEW		⇒	⇒
			PIPE INSTALLATION AND CONNECTION DETAIL			
	D = 1.2m	SINGLE PIPE	GENERAL VIEW		⇒	⇒
			PIPE INSTALLATION AND CONNECTION DETAIL			
			HEADWALL REINFORCEMENT AND CONNECTION DETAIL			
			REINFORCEMENT LAYOUT OF PIPE CULVERT			
		DOUBLE PIPES	GENERAL VIEW		⇒	⇒
			PIPE INSTALLATION AND CONNECTION DETAIL			
	D = 1.5m	SINGLE PIPE	GENERAL VIEW		⇒	⇒
			PIPE INSTALLATION AND CONNECTION DETAIL			
			HEADWALL REINFORCEMENT AND CONNECTION DETAIL			
			REINFORCEMENT LAYOUT OF PIPE CULVERT			
DOUBLE PIPES		GENERAL VIEW		⇒	⇒	
		PIPE INSTALLATION AND CONNECTION DETAIL				
D = 1.5m	SINGLE PIPE	GENERAL VIEW		⇒	⇒	
		PIPE INSTALLATION AND CONNECTION DETAIL				
		HEADWALL REINFORCEMENT AND CONNECTION DETAIL				
		REINFORCEMENT LAYOUT OF PIPE CULVERT				
	TRIPLE PIPES	GENERAL VIEW		⇒	⇒	
		PIPE INSTALLATION AND CONNECTION DETAIL				

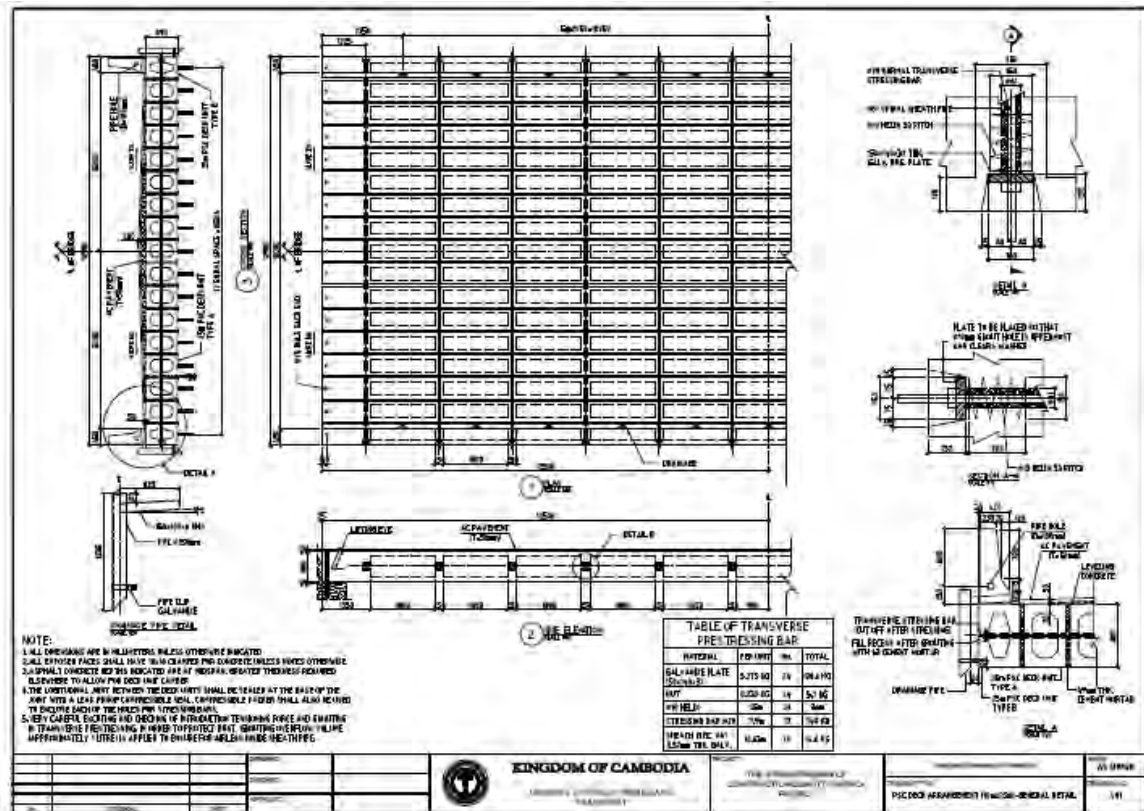


Figure 8.2-2 Sample of Standard Drawings

Standard Drawings were uploaded to database system by Task 3, which is illustrated in Figure 8.2-3 below.

Then, nationwide DPWT engineers will be able to access the database system in near future. Further, Standard Drawings will be used through internet by MPWT and DPWT engineers.

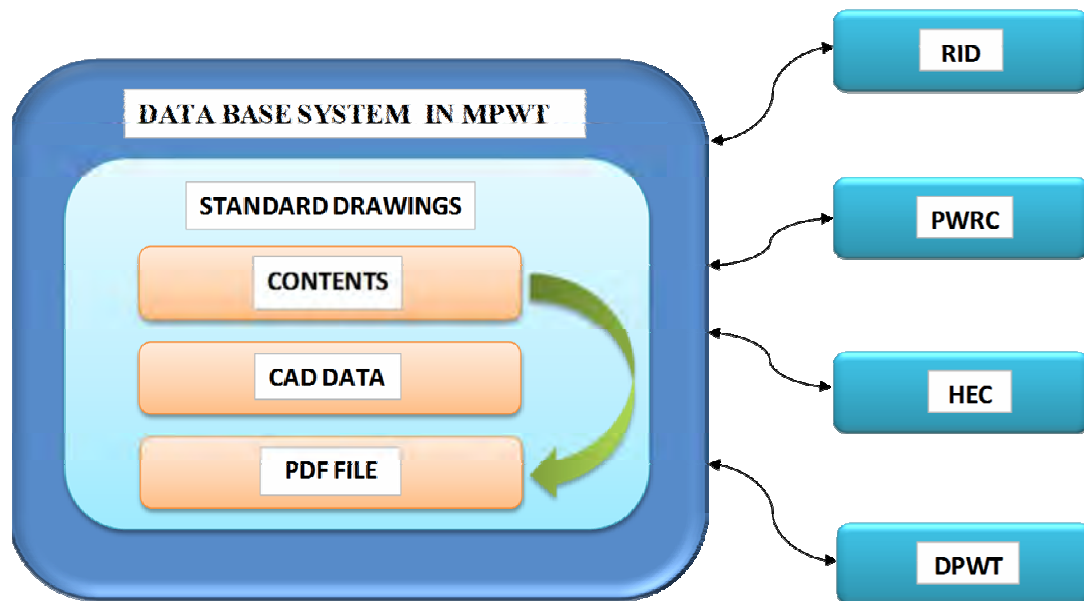


Figure 8.2-3 Standard Drawings Database System in MPWT

### **8.3 Dissemination of Standard Drawings in MPWT / DPWT**

#### **8.3.1 Seminar on Standard Drawings for Road and Road Structure**

After approval of Standard Drawings in JCC meeting in December 2011, seminar on Standard Drawings for road, pipe culverts, box culverts and bridges were held on February 17, 2012 as below. Purpose of seminar is dissemination of Standard Drawings for nationwide 24 DPWTs and MPWT.

Attendance was totally 51 persons.

Date: Friday, February 17, 2012

Time : 8:10am – 12:00noon

Venue: MPWT's conference room, Phnom Penh.

Participants: MPWT Director General Mr. Kem Borey

PWRC Director Mr. Bunthoem

24DPWT 27 persons

JICA experts

Presenter: C/Ps

Total 51persons

##### (1) Contents of Seminar

Standard Drawing was compiled by collecting as-built drawing from several donor projects. Typical detail drawing on road, pipe culverts, box culverts and several types of bridge were presented by C/P presenters. After each presentation, discussion was conducted. The Standard Drawings may be modified and added partially by several comments during discussion.



**Photo 8.3-1 Seminar**



**Photo 8.3-2 Presentation by C/P**

#### **8.3.2 Dispatch of Standard Drawings in MPWT / DPWT**

After the JCC approval of Standard Drawings on December 21, 2011, DVD and manual of Standard Drawings were delivered to all 24 DPWTs by PWRC Director, as shown in Photo 8.3-3. The purpose of delivery was to collect comments from DPWT engineers. On the other hand, post tension hollow slab bridge standard drawings were added to CAD drawings requested by MPWT until February 2012.

As stated before, Standard Drawings were uploaded to database system and drawing searching system was formulated in June 2012, as shown in Figure 8.3-1 (refer to Appendix 7-2).

Official notice by Ministry shall be issued after the third JCC meeting in August 2012. Then, Standard Drawings will be applied to nationwide force account project.



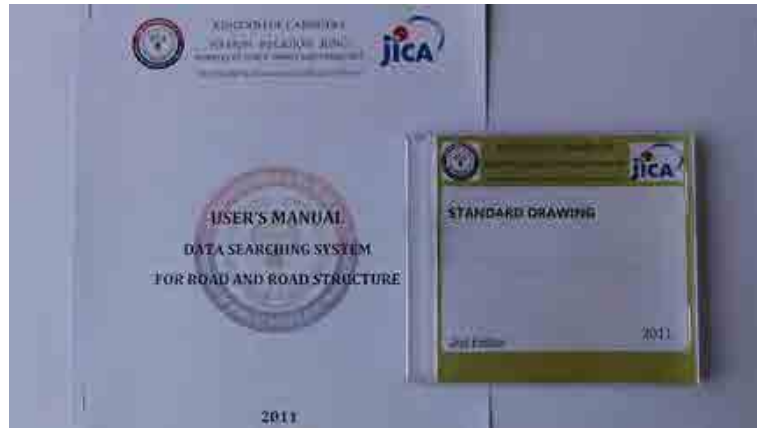


Photo 8.3-3 DVD and Manual of Standard Drawings to 24 DPWTs



Figure 8.3-1 Standard Drawings Searching System in MPWT Database

## 8.4 Issues and Actions to be Taken by MPWT

### 8.4.1 Maintenance and Upgrading of Standard Drawings

New as-built drawings shall be added to database system, if MPWT gets them. It is important that MPWT database maintenance group shall be established to conduct these activities as shown in Figure 8.4-1.

This maintenance group shall conduct to collect, keep and apply new as-built drawings. Upgrading the Standard Drawings shall be conducted by this group regularly. MPWT shall organize this group as soon as possible. Bridge standard drawings were many papers than pipe culverts and box culverts. Almost major types of bridge drawings were incorporated in the Standard Drawings, but rare types of bridge were not included in the Standard Drawings. If rare types of bridge drawings are needed, MPWT shall make the standard drawings by own staff.

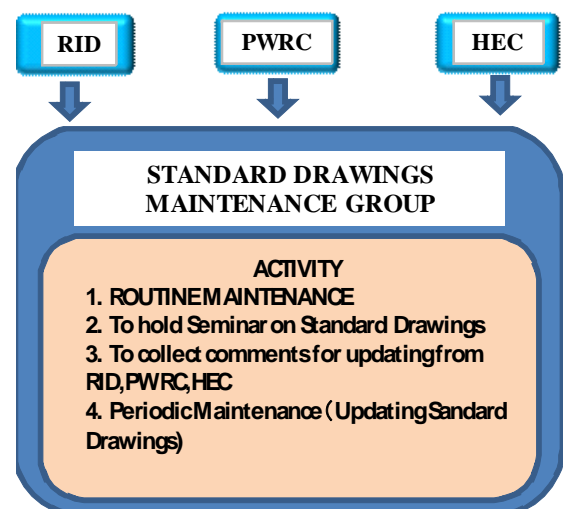


Figure 8.4-1 Standard Drawings Maintenance Group

## CHAPTER 9 RECORD OF MEETINGS (JCC, EC, MM AND C/P MEETINGS)

### 9.1 Outline of Main Meeting

The project team has conducted the necessary meetings time to time. Joint Coordinating Committee meeting (JCC), Executive Committee meeting (EC) and Project Management meeting (MM) were important to steer the Project and have been held regularly to secure the objective of the Project. The project team also have steered the direction of the Project and authorized SG, RG and Standard Drawing in the task force meeting. Main meeting and function are shown in Table 9.1-1.

**Table 9.1-1 Outline of Main Meeting**

Committee	JCC (Joint Coordinating Committee)	EC (Executive Committee)	MM (Management)
Frequency	Once a year	Several times a year	Regularly as required
Function/ Authorization	<ul style="list-style-type: none"> <li>• Authorization of Standard Guideline (SG), Regulation (RG)</li> <li>• Authorization of Road and Road Structure Standard Drawings</li> <li>• Authorization of Training Program</li> </ul>	<ul style="list-style-type: none"> <li>• Steering to Project Direction</li> <li>• Confirmation of Project Progress</li> <li>• Establishment of Task Forces</li> <li>• Tackle of Project Issues</li> </ul>	<ul style="list-style-type: none"> <li>• Report of each Task Activities</li> <li>• Allocation of Counterpart</li> <li>• Management of Task Force</li> <li>• Observation of Pilot Project</li> </ul>
Chair Person	Minister of MPWT	Secretary of State, MPWT	Director General of Public Works
Members	Cambodia Side	Secretary of State, MPWT/ Under Secretary of State, MPWT/ Director General of Public Works/ Deputy Director General of Public Works/ Director General of Public Works Laboratory/ Director, relevant Department, MPWT/ MEF, MLMCPC, MRD/ Institute of Technology/ Engineering Association	Director General of Public Works/ Deputy Director General of Public Works/ Director General of Public Works Laboratory/ Director, relevant Department, MPWT/ Director & Deputy Director of PWRC/ MEF
	Japan Side	JICA Cambodia Office JICA Expert	JICA Expert

Counterpart meeting has been also held in mostly once a week to report each task progress from C/Ps in charge. This meeting was chaired by project manager, Director of PWRC, and discussed the technical issues concerns to the Project among participants. It was good opportunity for C/Ps to learn quality control aspects from JICA experts.

In addition, meeting member went to site trip in Japan Grand Aid projects for several times to observe the management of large scale construction sites.



## 9.2 List of Each Meeting Conducted

Content of each meeting is described in Table 9.2-1 and the minutes of meeting for main meetings are attached in the Appendix 8.

**Table 9.2-1 List of Meeting**

(1) Joint Coordinating Committee Meeting (JCC)

No.	Title	Date	Agenda
1	The 1 <sup>st</sup> JCC Meeting	October 13, 2010	1) Opening Remarks (Minister H.E. Tram Iv Teuk)
			2) Project Brief (H.E. Tauch Chankosal)
			3) Authorization of the 1 <sup>st</sup> edition of SG & RG
			4) Discussion/Comments
2	The 2 <sup>nd</sup> JCC Meeting	December 21, 2011	1) Progress Report (each task)
			2) Project Brief (H.E. Tauch Chankosal)
			3) Authorization of Standard Drawing
			4) Report of Mid-term Review (mission team)
			5) Discussion/Comments
3	The 3 <sup>rd</sup> JCC Meeting	August 30, 2012	1) Activities Report in the whole project period (each task)
			2) Authorization of the 2 <sup>nd</sup> edition of SG & RG
			3) Authorization of Training Program
			4) Report of Final Review (mission team)
			5) Discussion/Comments

(2) Executive Committee Meeting (EC)

No.	Title	Date	Agenda
1	The 1 <sup>st</sup> EC Meeting	January 6, 2010	1) The Project Structure/Concept of the Project Activities
			2) The Project Work Plan
			3) Report of the Outline of Basic Survey in MPWT
			4) Allocation of the Project Counterparts
			5) Discussion/Comments
2	The 2 <sup>nd</sup> EC Meeting	June 4, 2010	1) Project Outcom in year 2010
			2) Progress Report & Activities Plan
			3) Exposition of the draft of SG & RG
			4) Discussion/Comments
3	The 3 <sup>rd</sup> EC Meeting	September 1, 2010	1) Progress Report (Jun - Aug)
			2) Explanation of the 1st edition of SG & RG
			3) Discussion/Comments
4	The 4 <sup>th</sup> EC Meeting	December 9, 2010	1) Progress of the Project
			- Plan of the Pilot Project
			- Training of Trainers (TOT) and the Pilot Training
			- Standard Drawing
2) Discussion/Comments			
5	The 5 <sup>th</sup> EC Meeting	August 4, 2011	1) Progress of the Project
			- General
			- Pilot Project
			- Database Management
			- Explanation of Standard Drawing
2) Discussion/Comments			

(3) Project Management Meeting (PMM)

No.	Title	Date	Agenda
1	The 1 <sup>st</sup> PM Meeting	August 10, 2009	1) Explanation of Concept of JICA Technical Cooperation Project 2) Confirmation of the Project Concept 3) Allocation of the Project Counterparts 4) Others
2	The 2 <sup>nd</sup> PM Meeting	December 22, 2009	1) Outline of Project Activities 2) The Project Work Plan 3) Report of the Outline of Basic Survey in MPWT 4) Allocation of the Project Counterparts 5) Others
3	The 3 <sup>rd</sup> PM Meeting	February 12, 2010	1) Report of the Progress Activities 2) Project Counterpart Training in Japan 3) Others
4	The 4 <sup>th</sup> PM Meeting	March 1, 2010	1) Report of the Progress Activities 2) Project Counterpart Training in Japan 3) Schedule on the 2 <sup>nd</sup> EC Meeting and the 1 <sup>st</sup> JCC Meeting 4) Others
5	The 5 <sup>th</sup> PM Meeting	May 21, 2010	1) Report of the Progress Activities 2) Schedule on the 2 <sup>nd</sup> EC Meeting 3) Each Activities Plan on JFY 2010 4) Others
6	The 6 <sup>th</sup> PM Meeting	June 28, 2010	1) Procedure for the Application of the 1 <sup>st</sup> Draft of SG & RG 2) Observation the Pilot Project Site 3) Allocation of the Additional counterpart 4) Others
7	The 7 <sup>th</sup> PM Meeting	August 9, 2010	1) Comments on the 1 <sup>st</sup> Draft of SG & RG 2) Schedule on the 3 <sup>rd</sup> EC Meeting and the 1 <sup>st</sup> JCC Meeting 3) Others
8	The 8 <sup>th</sup> PM Meeting	September 30, 2010	1) Schedule on the 1 <sup>st</sup> JCC Meeting 2) Selection of the Pilot Project Sites for Year 2011 3) Provision of the Donated Equipment 4) Person in Charge for the Database Management System 5) Condition of the MPWT Library
9	The 9 <sup>th</sup> PM Meeting	December 3, 2010	1) Report of the Progress Activities 2) Schedule on the 4 <sup>th</sup> EC Meeting 3) Concerning the Pilot Project Year 2011
10	The 10 <sup>th</sup> PM Meeting	February 10, 2011	1) Progress Report 2) Schedule on the 5 <sup>th</sup> EC Meeting 3) Concerning the Pilot Project in 2011 4) Others
11	The 11 <sup>th</sup> PM Meeting	June 7, 2011	1) Progress Report 2) Schedule on the EC meeting and JCC meeting in 2011 3) Others
12	The 12 <sup>th</sup> PM Meeting	December 19, 2011	1) Progress Report 2) Content of the 2 <sup>nd</sup> JCC Meeting 3) Pilot Project in 2012 4) Others
13	The 13 <sup>th</sup> PM Meeting	March 5, 2012	1) Overall Schedule in 2012 2) Progress Report 3) Action toward JICA Final Evaluation 4) Others
14	The 14 <sup>th</sup> PM Meeting	June 21, 2012	1) Progress Report 2) Library Management 3) Training Program 4) Standard Drawing 5) Actions toward JICA Final Evaluation 6) Others
15	The 15 <sup>th</sup> PM Meeting	August 16, 2012	1) Presentation from Each Task 2) MPWT Future Action 3) Content of the 3 <sup>rd</sup> JCC Meeting 4) Others

(4) Project Counterpart Meeting

No.	Title	Month	Date	Agenda
1	JFY 2009 <1 <sup>st</sup> - 9 <sup>th</sup> >	January	15, 22	1) Report of the Progress Activities - Output 1-1 - Output 1-2
		February	2, 12, 19, 26	
		March	5, 12, 26	
2	JFY 2010 <10 <sup>th</sup> - 44 <sup>th</sup> >	April	2, 9, 23	1) Report of the Progress Activities - Output 1-1 - Output 1-2 - Output 2 - Output 3-1 - Output 3-2 - Pilot Project - Others
		May	12, 21, 28	
		June	11, 17, 25	
		July	2, 6, 30	
		August	6, 13, 20, 27	
		September	10, 17	
		October	1, 15, 25	
		November	2, 12, 19, 26	
		December	3, 20, 27	
		January	10, 18, 28	
		February	11, 21	
		March	3, 14	
		3	JFY 2011 <45 <sup>th</sup> - 74 <sup>th</sup> >	
May	10, 20, 30			
June	10, 24			
July	5, 15, 26			
August	4, 16, 29			
September	16, 22			
October	7, 18, 25			
November	4, 18, 25			
December	2, 9, 23, 29			
January	10, 27			
February	6, 20			
March	2, 16			
4	JFY 2012 <75 <sup>th</sup> - 84 <sup>th</sup> >			April
		May	11, 24	
		June	8, 26	
		July	11	
		August	1, 9	



## CHAPTER 10 JICA MID-TERM REVIEW AND TERMINAL EVALUATION MISSION

### 10.1 Mid-Term Review Mission

The mid-term review mission was dispatched to the Project for evaluation from December 8 to December 22, 2011 and herewith briefed.

#### 10.1.1 Objective of Evaluation

- (1) To verify the accomplishment of the Project compared to those planned;
- (2) To identify obstacles and/or facilitating factors that have affected the implementation process;
- (3) To analyze the Project in terms of the five review criteria (i.e. Relevance, Effectiveness, Efficiency, Impact and Sustainability) with special focus on Relevance, Effectiveness and Efficiency;
- (4) To make recommendations on the Project regarding the measures to be taken for the remaining period; and
- (5) To extract lessons learnt so that similar projects could utilize the experience of the Project.

#### 10.1.2 Member of Joint Evaluation Team

- (1) Cambodian Side

	Name	Job Title
1	Mr. Samrangdy Namu	Deputy Director, PWRC, MPWT
2	Mr. Chao Sopheak Phibal	RID, MPWT

- (2) Japanese Side

	Name	Mission	Job Title	Duration of stay
1	Mr. Yukiharu KOBAYASHI	Leader	Senior Representative, JICA Cambodia Office	Resident
2	Mr. Hozumi KATSUTA	Construction Quality Control	Senior Advisor, JICA	December 11 to 21, 2011
3	Dr. Keiko WATANABE	Evaluation and Analysis	Assistant Director / Senior Researcher in FASID	December 08 to 22, 2011
4	Mr. Masahiko EGAMI	Evaluation Planning	Representative, JICA Cambodia Office	Resident
5	Ms. Keiko SUZUKI	Evaluation and Planning	Project Formulation Advisor, JICA Cambodia Office	Resident

### 10.1.3 Schedule of Evaluation

no	month	date	Schedule	
1	12	8	AM	Ms. Watanabe arrives at Phnom Penh
			PM	Meeting with JICA Interview with H.E. Kem Borey Project Briefing from Mr. Kuwano
2	12	9	AM	Interview with Mr. Koun Bunthoeun Interview with Mr. Samrang Dynamo
			PM	Courtesy with H.E. Tauch Chankosal, MPWT Interview with Dr. Khun Sokha
3	12	10		
4	12	11		Mr.Katsuta arrives at Phnom Penh
5	12	12	AM	Interview with JICA Long Term Experts
			PM	Interview with short-term experts Courtesy call to EoJ
6	12	13	AM	Interview with Counterparts
			PM	Group Meeting with Counterparts Interview with Mr. Pheng Sovicheano
7	12	14	AM	on of National Road No. 71 and Interview with DPWT Kampong Cham
			1500	Workshop with MPWT
8	12	15	AM	Interview with Counterpart
			PM	Internal Meeting
9	12	16	AM	Visit Public Works Laboratory of MPWT (Meeting with Mr. Srun, 012 976 909 and see the Equipment supported by the Project)
			PM	Interview with Mr. Bunthoon, Deputy Director, Department of Personnel and Human Resource)
10	12	17		
11	12	18		
12	12	19		Drafting Document
			PM	Report to EOJ
13	12	20	AM	Meeting with MPWT on JER/MM
				Document Confirmation
14	12	21	AM	JCC (H.E. Tram Iv Tek)
			PM	Report to JICA Mr. Katsuta leaves
15	12	22		Ms. Watanabe Leaves

### 10.1.4 Evaluation Results by Five Criteria

#### (1) Relevance

The Project was well aligned with Cambodian overall development strategy of “Rectangular Strategy for Growth, Employment, Equity and Efficiency Phase II (RSII) (2008)” and five-year

development plan of “National Strategic Development Plan (NSDP) (2006-2010)” at the time of Ex-ante Evaluation. The physical infrastructure development for transport is one of Cambodia’s priority areas stated in both RSII and NSDP. The government identifies infrastructural development as one of four growth rectangles, which states “Further Rehabilitation and Construction of the Physical Infrastructure” in RSII. NSDP also emphasizes that the appropriate and prioritized road maintenance is indispensable. With the maintenance cost pressed the increase in the national budget for MPWT, improvement of the capacity of MPWT on quality control was the urgent needs especially for force account project which the quality control practices have not been made in an appropriate manner.

The Project is also in line with the Japanese policy and strategies. The Japan’s Assistance Policy for Cambodia (2004) sets “Improvement of Social and Economic Infrastructure and Conditions for Economic Progress” as one of priority areas. It also stipulates that socio-economic infrastructure that forms the foundation of the country's development still needs to be significantly improved”.

## (2) Effectiveness

The progress includes the developments of the 1<sup>st</sup> editions of SG and RG, database system for the relevant drawings of completion projects, and standard drawings. The capacity of MPWT staff also improved through the process of formulation of SG, RG and standard drawings, conducting trainings to DPWT staff after TOT, and receiving technical knowledge from the JICA experts. At the interview, some of MPWT CPs expressed that they learned new skills and knowledge from the JICA experts not only on quality control but also other technical knowledge on roads and bridges.

The Project surely contributed to upgrade operational and practical capacity to implement quality control (QC) and quality assurance (QA) activities. One of the significant outputs from the Project is the production of SG and RG for force account projects, which clearly define the division of duties among Employer (Party A), Executor (Party B), Supervisor (Party C) and Inspector (Party D), since some responsibility had not been clearly divided before. In addition, the documentation of records throughout the process of quality control by each Party in accordance with the contract documents contributes to ensure the quality as well as makes the trace of the problem possible.

Both Party B and Party C of the pilot project in Kampong Cham also expressed the effectiveness of the SG and RG to ensure the quality at the interview by the evaluation team. In addition, the interview revealed their willingness to apply the SG procedure to ensure the quality despite of the additional tasks.

In light of the above, the remaining activities until the end of the Project are very important to achieve the Project Purpose, especially the modification of SG and RG by incorporation of lessons from the pilot projects. To that end, the utmost efforts and strong contribution is essential by both Cambodian and Japanese sides.

## (3) Efficiency

Some factors that affected efficiency were observed, although achievements of outputs are foreseeable. As stated above, the timing of both short-term experts and assignment of CPs were delayed. In addition, although mostly due to unforeseeable and unavoidable reasons, some CPs left the Project. Up to the Mid-Term Review, 19 CPs were assigned in total and 9 of them have left for different timing. Whenever the new CPs were assigned, the JICA experts had to make efforts to explain the project from scratch.

In regard to the input of the equipment provided by the Project was made in timely manner except



the Nuclear Moisture Density Gauge. It arrived one month later due to the complexity process and tighter regulation of importing those radioactive apparatus especially after Fukushima plant accident.

Although the above factors made some delays in some of the activities, the evaluation team confirmed the steady progress in producing expected outputs. However, the Project has to make intensive efforts in the remaining period.

#### (4) Impact

[Achievement of the Overall Goal]

As well as the Project Purpose, it is early to judge the level of achievement of the Overall Goal, “Quality and cycle of road and bridge construction and maintenance are improved”. The Project will establish a mechanism to disseminate the Project outputs nationwide. If that mechanism works well in a sustainable manner after the end of the Project, it is highly likely to achieve the Overall Goal.

[Other impact observed]

Some positive impact was observed through the interviews to CPs. Some CPs expressed that they have learned technical skills and knowledge not only on quality control of road and bridges but also on other issues such as safety control and Japanese experience of infrastructure development in general. Those improvements were obtained through the exchange of ideas and discussions with the JICA experts and the participation in the trainings in Japan. In addition, the Project stimulated CPs technical knowledge and motivation by publishing papers collected from CPs and relevant MPWT officers and giving the opportunity to present them. This kind of activities consolidated the CPs’ capacity.

It is also foreseeable that the revised SG and RG for force account projects in MPWT will be applied to other governmental executors who are not directly targeted in the Project such as Royal Cambodia Police.

No negative impact has been observed.

#### (5) Sustainability

[Policy Aspects]

Upgrading physical infrastructure is still one of the high priority areas of RGC. It is also highlighted in the revised NSDP (2009-2013) that “transport network is a Prime Mover of economic growth”.

The force account projects done by DPWT, RID, HEC and other implemented body are expected to be reduced year by year and gradually those works will be contracted out to the private companies, although such strategy and the numeric target year have not been officially stated in any of papers. Even so, it takes long time to be realized and some portion of force account done by the government offices will remain, especially for emergency works. In this regard, the political sustainability of the Project effects will be ensured for a long period.

[Organizational Aspects]

PWRC has the central role of the quality control but all departments under General Department of Public Works and the laboratory are related to force account, thus CPs were mainly assigned from these departments. The Project is producing many outputs to ensure QC/QA such as formulation of SG/RG, database, management of library, and designing a training program. These outputs have to be continuously upgrading and updating to fit the situation. In order to do that, a proper

mechanism including who is in charge, when it is updating, how is managed, should be developed and institutionalized.

[Technical Aspects]

It is confirmed that most of knowledge and skills transferred through the Project activities are appropriate and timely in the context of the Cambodia and it has already been adopted in many of CPs. If those trained engineers under the Project remained and served to expand the knowledge and skills for all provinces, the technical sustainability will be ensured.

The training program on QC/QA will be incorporated into the conventional annual MPWT training program. The conventional course will conduct continuously; however, it limits the scope of participants. Participants are only 3 DPWT officers from each province and officer in charge of Public Works is only one of them. In this regard, technical sustainability will be ensured but with limited scope. The Project, therefore, needs to develop a training plan to instruct SG/RG, database, and standard drawing to relevant provincial officers in effective and efficient way. Updating training curriculum and materials as well as a mechanism to produce trainers have to be sought to ensure the technical sustainability.

Furthermore, if the established database as well as the library were easily accessible to MPWT/DPWT staff members, it will contribute to individual and institutional technical capacity building.

Equipment provided to the laboratory has been utilized without any technical problem since they were not new to the laboratory staff.

[Financial Aspects]

The national budget for road maintenance and construction has been increasing as below Table 10.1-1. In the force account, there are mainly three categories; Routine Maintenance, Periodic Maintenance and New Construction other than emergency and flood works.

**Table 10.1-1 Budget Record for Road Maintenance and Construction (2007-2011)**

Unit: US\$ million

	2007	2008	2009	2010	2011
Routine Maintenance	5.7	8.8	17.1	17.9	16.1
Periodic Maintenance	12.2	14.3	13.3	15.0	26.6
New Construction	8.9	12.0	45.2	45.2	50.0
Flood	2.4	2.4	-	-	-
Emergency	1.6	1.9	2.4	2.9	3.7
<b>Total</b>	<b>30.9</b>	<b>39.3</b>	<b>78.0</b>	<b>81.0</b>	<b>96.3</b>

Source: Road and Infrastructure Department, MPWT (2011)

It is anticipated that more new construction and maintenance of roads will be conducted to meet the needs of the country. The Project will clarify the estimate cost necessary to ensure the quality of construction including the laboratory test, field inspection and management cost through the implementation of the pilot projects. It will promote the systematic negotiation and smooth allocation of the budget.

In addition, necessary budget for trainings on SG and RG should be estimated and needs to be allocated.

Maintenance cost for the equipment for the laboratory will be secured since the laboratory has been autonomous since 1996 and financially stable.

### 10.1.5 Recommendation from Review Mission

The mission made the following recommendations to the project team.

- 1) Revision and endorsement of the SG and RG within the project period
- 2) Proactive contribution to formulate and consolidate the SG and RG from both sides
- 3) Development of a sustainable database management and library management
- 4) Development of a sustainable training mechanism

The project team had to carry out the tasks stated in Chapter 2 to 8 with due consideration of the revised PDM and the mission recommendations and achieve the goal in the Project at the Project completion (October 2012).

## 10.2 Terminal Evaluation Mission

The terminal evaluation mission was dispatched to the Project for evaluation of project achievement from August 20 to August 30, 2012 and herewith briefed.

### 10.2.1 Objective of Evaluation

The review activities were performed with the following objectives:

- (1) To verify the accomplishment of the Project compared to those planned;
- (2) To identify obstacles and/or facilitating factors that has affected the implementation process;
- (3) To analyze the Project in terms of the five review criteria (i.e. Relevance, Effectiveness, Efficiency, Impact and Sustainability) with special focus on Relevance, Effectiveness and Efficiency;
- (4) To make recommendations on the Project regarding the measures to be taken for the remaining period and extract lessons learnt so that similar projects could utilize the experience of the Project.

### 10.2.2 Member of Joint Evaluation Team

#### (1) Cambodian Side

	Name	Job Title
1	Dr. Khun Sokha	Deputy Director, PWRC, MPWT

#### (2) Japanese side

	Name	Mission	Job Title	Duration of stay
1	Mr. Hitoshi HIRATA	Leader	Senior Representative, JICA Cambodia Office	Resident
2	Mr. Hozumi KATSUTA	Construction Quality Control	Senior Advisor, JICA	August 22 to 30, 2012
3	Dr. Keiko WATANABE	Evaluation and Analysis	Assistant Director/ Senior Researcher Foundation for Advanced Studies on International Development (FASID)	August 20 to 30, 2012
4	Mr. Masahiko EGAMI	Evaluation Planning	Representative, JICA Cambodia Office	Resident
5	Mr. Say Bora	Evaluation Planning	Staff JICA Cambodia Office	Resident

### 10.2.3 Schedule of Evaluation

no	month	date	Schedule	
1	8	19	AM	Ms. Watanabe arrives at Phnom Penh
2	8	20	AM	Meeting with JICA Meeting with Experts Meeting with Mr. Ishida
			PM	Meeting with Mr. Yamauchi Meeting with Mr. Yumita, Mr. Sakurai, Mr. Nakamura and Mr. Noda
3	8	21	AM	Interview with Dr. Khun Sokha Courtesy call on H.E. Tauch Chankosal
			PM	Interview with Mr. Samrang Dynamo Mr. Katsuta arrives at PP
4	8	22	AM	Meeting with Mr. Kuwano Internal meeting Meeting with Experts
			PM	Group Meeting with C/Ps(Mr. Manith, Mr. Ratha, Mr. Onit, Mr. Menakak, and others) Meeting with JICA Office
5	8	23	AM	Meeting with Japanese Experts Meeting with Experts and C/Ps (Mr. Bunthoeun, Mr. Namo and taskforce member)
			PM	Meeting with MEF-DIC Mr. Khun Juline, DD, Domestic Investment & cooperation. Interview with H.E. Kem Borey
6	8	24	AM	Site visit to Construction site on NR110 with party C and C/P, and Meeting with DPWT Kandal
			PM	Arrive at Phnom Penh Interview with Mr. Koun Bunthoeun
7	8	25		Drafting Document
8	8	26		Drafting Document
9	8	27	AM	
			PM	Internal Meeting
10	8	28	AM	Discussion of draft report with MPWT(H.E. Kem Borey, and C/Ps)
			PM	Drafting Document
11	8	29	AM	Report to EOJ
			PM	Drafting Document
12	8	30	AM	JCC (Signing of M/D later)
			PM	Report to JICA Office (@8 <sup>th</sup> floor) Katsuta and Watanabe leave from PP

### 10.2.4 Achievement of Outputs

The original PDM was revised slightly at the mid-term review and PDM2 was developed. The main revisions were indicators. According to the PDM2, the level of achievement of Output as of the terminal evaluation is shown in Table 10.2-1 below.

**Table 10.2-1 Achievement of Project**

<b>Output 1: Standard Guideline (SG) and Regulation (RG) for quality control of road and bridge construction and maintenance are established.</b>	
<b>Objectively Verifiable Indicators</b>	<b>Achievement</b>
By the end of the Project, the second edition of SG and RG are produced after incorporation of the lessons learned from the pilot projects.	<p>5 pilot projects which applied SG/RG have been conducted. One of them (NR71 in Kampong Cham) has experienced all the process of SG and the necessary documents have been compiled as a completion document. Other pilot projects will be completed by the end of December 2012.</p> <ul style="list-style-type: none"> <li>• First edition of SG/RG (both English and Khmer) was formulated in August 2010 and revised 2nd edition was formulated in August 2012 after incorporated lessons learned from the pilot projects. Khmer version of SG/RG was translated by the CPs.</li> <li>• Equipment for various kinds of test for construction has been procured and installed in the laboratory.</li> </ul>
<b>Output 2: Centralized and integrated management system of completion documents such as drawing and reports of construction is established.</b>	
Database system is completed and information of Database is utilized by MPWT staff by the end of the Project	<ul style="list-style-type: none"> <li>• A simple database management system was developed for as-build drawings, standard drawings and books at the library. The database was accessible to MPWT officials through MPWT intranet.</li> <li>• As-build drawings were collected as many as possible and converted into electronic format for database use.</li> <li>• Standard drawings which were developed and compiled in the Output 3 were also installed into the database.</li> <li>• Library was renovated twice and completed in April 2012. All necessary books and documents were sorted out with labeling.</li> <li>• Operation and User manuals were developed in July 2012.</li> </ul>
<b>Output 3: Technical trainings are implemented by MPWT lecturers.</b>	
Technical training developed by the Project is incorporated into the conventional training program by Department of Personnel & Human Resources.	<ul style="list-style-type: none"> <li>• The training plan was prepared in February 2010 after assessing MPWT capacity needs and current training program.</li> <li>• Two Trainings of Trainers (TOTs) were conducted in 2010 and 2012 for 13 MPWT officials.</li> <li>• QC/QA training subjects were incorporated into the MPWT conventional training course. Trainings have been conducted since November 2011 by MPWT trainers.</li> <li>• As of August 2012, 6 training workshops for provincial DPWT staff have been conducted by trained MPWT trainers.</li> </ul>

#### 10.2.5 Achievement of Project Purpose

Achievement of project purpose is also described in Table 10.2-2 below.

**Table 10.2-2 Achievement of Project Purpose**

Project Purpose	Capacity of MPWT engineers in the quality control for road and bridge construction and maintenance undertaken by force account is improved through application of the Quality Control and Quality Assurance (QC/QA) system (Standard Guideline, Regulation, Trainings, Standard Drawings)	
	Objectively Verifiable Indicator	Achievement
	(1) By the end of the project, the revised SG and RG are applied to at least three force account projects of roads and bridges starting in 2013 (new construction or major rehabilitation under periodical maintenance) in three provinces except in the two pilot provinces.	<ul style="list-style-type: none"> <li>At the time of the terminal evaluation, the projects which apply SG/RG has not been identified yet. However, the team noted MPWT’s plan to conduct at least one force account project per each DPWT applying SG/RG.</li> </ul>
	(2) Trainers received TOT are assessed and trainees who participate the annual technical training in year 2012 improve the knowledge level of quality control and score 70 at the post test.	<ul style="list-style-type: none"> <li>Through the preparation of teaching materials and actual teaching experiences, the MPWT trainers upgraded their knowledge and skills on SG/RG as well as teaching method, although continuous improvement needs to be made.</li> <li>The results from the comparison between pre- and post-test showed the positive improvement of the participants. However, the average score has not reached to the target point yet, ranged from 54 to 68 depending on the training sessions.</li> </ul>

### 10.2.6 Evaluation Results by Five Criteria

#### (1) Relevance

The relevance of the project is high based on the following points.

The Project was well aligned with Cambodian overall development strategy of “Rectangular Strategy for Growth, Employment, Equity and Efficiency Phase II (RSII) (2008)” and five-year development plan of “National Strategic Development Plan (NSDP) (2006-2010)”. The physical infrastructure development for transport is one of Cambodia’s priority areas stipulated in both RSII and NSDP. The government identifies rehabilitation and construction of physical infrastructural as one of four growth rectangles in RS II. NSDP also emphasizes that the appropriate and prioritized road maintenance is indispensable. With the maintenance cost pressed the increase in the national budget for MPWT, improvement of the capacity of MPWT on quality control was the urgent needs especially for force account project which the quality control activities have not been practiced in an appropriate manner.

The Project is also in line with the Japanese policy and strategies. The Japan’s Assistance Policy for Cambodia (2004) sets “Improvement of Social and Economic Infrastructure and Conditions for Economic Progress” as one of priority areas. It also stipulates that socio-economic infrastructure that forms the foundation of the country’s development still needs to be significantly improved. In addition, JICA stipulates that “(JICA) will assist the rehabilitation of road network as soon as possible by collaborating with other donors, and contribute to its economic growth through institutional development for maintaining and assuring effective use of the traffic network” in its Country-specific implementation Plan (2007). Besides, the Road Network Development Study by JICA (2006) recommended that the quality control system should be established in the mid-term target (2011 to 2015).



(2) Effectiveness

Effectiveness of the project is evaluated as high.

[Achievements of Project Purpose]

In regard to actual application of SG/RG into force account projects, the project made significant difference in QC/QA system. The changes were mainly seen in three areas, i.e., improvement of pavement design, formulation of the work execution plan, and preparation of record documents of quality control activities.

Improvement of pavement design such as adding capping was realized by the result of soil test (California Bearing Ratio: CBR) before construction work. This kind of test for ensuring the quality of construction was not always conducted before. It could provide a big effect on the quality improvement. Second, formulation of the work execution plan became in place, which plays an important role to manage construction work including quality control. Lastly, preparation of record documents for quality control information regularly (quality control test results, as-built measurement data) based on SG can be said a significant progress in quality control process. Most of these documents have not been prepared in ordinary construction works conducted by DPWT. In addition the clarification of division of duties among Employer (Party A), Executor (Party B), Supervisor (Party C) and Inspector (Party D) in SG/RG clarified the relationship among them and increased transparency.

The Team also confirmed by the interview with MPWT CPs that easy access to as-build drawings and standard drawings through database enhanced the effectiveness.

[Contribution of each Output]

As stated in the above, regarding to the application of SG/RG into the force account project, Output 1 and 3 made synergy effect to achieve the project purpose in terms of actual development of SG/RG document and upgrading technical skills for its application. Output 2 has enforced the quality control activities by establishing database system for necessary documents and materials.

[Inhibiting factors to achieve the Project Purpose]

It was revealed that the heavy workload of CPs from many other duties made difficult in some degree to concentrate the project activities. Other factor is that due to the fact that this was the first technical cooperation project (TCP) for MPWT, they had initially some confusion in working style in comparison to that of development studies which they used to be in charge.

(3) Efficiency

Efficiency of the project is fair.

Some factors that affected efficiency were observed, although they did not impair the realization of Outputs. It was regrettable that if the 1<sup>st</sup> phase of pilot projects could have started earlier, more effectiveness could have realized through OJT which could be continued until the end of pilot projects.

[Japanese side]

Most of the inputs from Japanese side including dispatching the experts, procurement of equipment, provision of training in Japan and local cost have been made as planned. However, the initial inputs of short-term experts could have made earlier to produce more fruitful outputs.

[Cambodian side]

As stated above, although mostly due to unforeseeable and unavoidable reasons, there were some turnovers of CPs especially at the initial stage of the project. Some of them worked for the project only few months. The Japanese experts had to make efforts to explain the project from scratch whenever the new CPs were assigned. However, the team noted that some main CPs who have stayed in the project committed themselves to implement project activities despite their other workload. In addition, it is noted that the cost for all five pilot projects has been allocated by the Cambodian side.

(4) Impact

Impact of the project is relatively high. No negative impact by the project has been observed.

[Achievement of Overall Goal]

It is expected that Overall Goal, “Quality and cycle of road and bridge construction and maintenance are improved” will be achieved if the strong initiative from MPWT were demonstrated in a sustainable manner even after the project terminates.

[Other impact observed]

Some positive impacts by the project were observed through the interviews with MPWT/DPWT staff at the terminal evaluation. Motivation of CPs was raised through the intellectual stimulus by giving opportunities to learn not only on quality control of road and bridges but also on other issues such as safety control and Japanese experience of infrastructure development in general. Those improvements were obtained through the exchange of ideas and discussions with the Japanese experts, writing and presenting technical papers, and the participation in the trainings in Japan. These kinds of activities consolidated the capacity of MPWT/DPWT staff.

In addition, they expressed that throughout the project process, they have learned the difference in working styles between TCP and development study. They noted that TCP put much on the capacity development aspect. It required more presence and involvement from the Cambodian side since the team work was necessary for learning by doing process. Other positive impact observed was the creation of network among different departments of MPWT by involving several MPWT offices in relation to force account projects. It would become the foundation of focused group on quality control.

(5) Sustainability

Sustainability of the project effect is relatively high, however, some concerns in financial aspects have been observed in terms of library and database management.

[Policy Aspects]

Upgrading physical infrastructure is still one of the high priority areas of the RGC. It is also highlighted in the revised NSDP (2009-2013) that “transport network is a Prime Mover of economic growth”.

Relative volume of force account projects implemented by DPWT, RID and HEC and other implementing bodies are expected to be reduced year by year and gradually those works will be contracted out to the private companies, although officially any strategy including the target year has not been issued. Even so, it takes long time to be realized and some portion of force account done by the government offices will remain, especially for emergency works.

In this regard, the political sustainability of the Project effects will be ensured for a long period.

[Organizational Aspects]

PWRC has the central role of quality control but all departments under General Department of Public Works and the laboratory are related to force account, thus CPs were mainly assigned from these departments. The network among staff in different departments of MPWT has been established, which became the foundation of quality control. If a few librarians were allocated even after the project terminates, organizationally sustainability will be secured.

[Technical Aspects]

It was confirmed that most of knowledge and skills transferred through project activities were appropriate and timely. They have already been adopted in many of CPs. If those trained engineers under the project remained and served to expand the knowledge and skills to all provinces, the technical sustainability will be ensured.

As of the terminal evaluation, around 200 DPWT public work engineers have received training on QC/QA by the project either through the MPWT conventional training or training workshops. The training program on QC/QA was approved to be incorporated into the conventional annual MPWT training program. Therefore, the certain level of technical sustainability is ensured. However, since the conventional training has limited number of participants from DPWT and some of them are not public works engineers, it is strongly recommended that practical methods to ensure QC/QA for force account project should be sought.

Equipment provided to the laboratory has been utilized without any technical problem.

[Financial Aspects]

The national budget for road maintenance and construction has been drastically increasing more than threefold for 4 years from 2007 to 2011 as shown in Table 10.2-3 below (same as Table 10.1-1).

**Table 10.2-3 Budget Record for Road Maintenance and Construction (2007-2011)**

	2007	2008	2009	2010	2011
Routine Maintenance	5.7	8.8	17.1	17.9	16.1
Periodic Maintenance	12.2	14.3	13.3	15.0	26.6
New Construction	8.9	12.0	45.2	45.2	50.0
Flood	2.4	2.4	-	-	-
Emergency	1.6	1.9	2.4	2.9	3.7
Total	30.9	39.3	78.0	81.0	96.3

Source: Road and Infrastructure Department, MPWT (2011)

It is anticipated that more new construction and maintenance of roads will be conducted to meet the needs of the country. The Project will clarify the estimate cost necessary to ensure the quality of construction including the laboratory test, field inspection and management cost through the implementation of the pilot projects. It will promote the systematic negotiation and smooth allocation of the budget of the construction as well as additional training cost as demonstrating tangible outputs from the project. However, there is a concern in the financial sustainability of library and database system management. Since the database system is usually managed and administered by outsourcing company, the necessary budget should be secured. Maintenance cost for the provided equipment for the laboratory will be secured since the laboratory has been autonomous since 1996 and financially stable.

### **10.2.7 Conclusion**

The achievement of the project purpose is promising with utmost efforts from both Cambodian side and Japanese experts in good manner. The project was highly relevant with RGC policies as well as the development needs of the country. The project achieved high effectiveness and impact through the introduction of significant changes in QC/QA system. The changes were mainly seen in three areas, i.e., improvement of pavement design, formulation of the work execution plan, and preparation of record documents of quality control activities. All three areas were not been conducted appropriately before. The efficiency was fair from the timing of the assignment of Cambodian CPs and Japanese short-term experts, as well as delay in commencement of the pilot projects. Sustainability of the project was relatively high with some concerns in financial aspects for library and database system management.

The team prepared following recommendations to be implemented.

### **10.2.8 Recommendation and Lessons Learned**

#### **(1) Recommendation**

The following recommendations are made by the terminal evaluation team.

➤ Issuing Prakas on SG/RG and setting up a support mechanism for scaling up the project effects

The 2<sup>nd</sup> edition of SG/RG incorporated the lessons learned from the experiences in pilot projects were formulated after developing the 1<sup>st</sup> edition. It is recommended that the 2<sup>nd</sup> edition of SG/RG be authorized through issuing Prakas (Ministerial ordinance) by MPWT within the project period in order to apply them to more construction works to be conducted by DPWTs. However, this action is not enough for scaling up the SG/RG oriented construction works. In addition to the conventional training to DPWTs, it is recommended to establish a support mechanism with a leadership of PWRC, which can assist DPWTs to easily apply the new quality control system. A helping group should be organized within the project period, composing MPWT CP members and some members of DPWTs where pilot projects were conducted. The group will follow up project outcomes and provide advice and instruction through visiting, e-mail and mobile phone. In order to do that, members and division of work in the group should be identified before the project ends. It would be very useful when DPWTs face problems/issues in the course of implementation of construction works based on RG/SG.

➤ Sustainable management of database system

The database of completion documents including as-build drawings, standard drawings and library books established by the project has to be updated and maintained properly adding the new information. Submission of completion documents of force account projects to the library was prescribed in RG, and an official letter was already issued by the MPWT Minister for those of the foreign assisted projects. Therefore, collecting mechanism of completion documents has been established. However, the management system of those collected documents still remains to be established especially after the project financed librarian leaves. Though MPWT has a plan to arrange necessary personnel for it through annual recruitment or reallocation of existing officials, realization of this plan cannot be easily guaranteed. Also outsourcing of database system management will require additional budget.

Now that MPWT recognizes the importance of database of completion documents, it is strongly recommended to allocate necessary staff in charge and to secure adequate budget for system maintenance.

➤ Enhancement of technical trainings for MPWT/DPWT public work engineers

A part of the conventional training course was already allocated to QC/QA technical trainings. Accordingly, dissemination of technical guideline of RG/SG will be attained to a certain level since the trainees of the conventional training are coming from all departments including administration and transportation other than public works. It is desirable to upgrade more technical skills for public work engineers on quality control by conducting additional trainings or workshops depending on the availability of budget. In this regard, MPWT is recommended to take proactive budget request activities such as frequent dialogue with MEF at all levels and negotiation on reallocation of budget within MPWT.

➤ Strengthening public relations

Though awareness of importance of quality control has been shared in MPWT, the practice of developed measure to ensure the quality remains unconvinced yet to other stakeholders. It is most important to show the tangible results of the project widely. It is recommended that the project should widely appeal the results of the project to relevant government ministries and agencies, donors, international agencies and private sectors within the project period. This appealing activity should be continued even after the project through various occasions.

(2) Lessons Learned

➤ Effort to secure sustainability especially from the viewpoint of finance

[Planning stage]

It has some concern for sustainability of the library and database system due to a small amount of budget requirement. Regarding project outputs whose sustainability may be restricted by even a small amount of budget, careful consideration should be sought from the designing stage of the project. Due consideration should be made such as securing necessary time and amount of budget for achieving satisfactory output level, assuring commitment from the financial authority and even cancelling inclusion in the project.

[Implementation stage]

Since sustainability of the project effect is in many cases subject to the financial sustainability, the necessary activities should be made during the project period by the project team. Appealing to the MEF with showing tangible results is one of the ways to do it not only at the JCC but also at the Inter-Ministerial Committee. JICA office also should have frequent dialogue directly with MEF on the project if necessary.

➤ Ensuring Adequate budgetary allocation from Cambodian side

The current working environment of MPWT with heavy workload made difficult for assigned CPs to make full commitment to this project. Since it is not anticipated that Cambodian economic and working condition would drastically improve in a few years, this problem will continue for the time being. Even though, high involvement of CPs is essential. In order to complement the situation it is advisable that necessary budget from the Cambodian side should be spelled out in the project agreement. In doing so, implementation agency should have consultation with MEF at the planning stage of the project. JICA should confirm the adequate budgetary allocation from Cambodian side. Adequate budgetary allocation will include communication, per diem for CPs and any other cost in accordance with the government regulation.

➤ Timing of the input of Japanese experts

Delay of the first phase of the pilot projects was caused directly by additional negotiation with MEF for cost increase, coordination on overlapping with other project, and flood. At the same time, the setting up of the project team had to wait until dispatch of short-term experts affected the delay of pilot projects. The revision work of SG/RG through conducting pilot projects within the project period was reached at satisfactory level, however, if the pilot projects were conducted as original schedule, the CPs could have gained more effect through OJT. In this regard, JICA should consider the timing of procurement of short-term experts and plan well in advance before the project starts.



## CHAPTER 11 CONCLUSION AND RECOMMENDATION

The Project consists of five original tasks and two additional tasks, shown in Table 11-1 below.

**Table 11-1 Summary of Tasks in the Project**

Task number / Description		Chapter No
Task 1-1	Formulation of Standard Guideline (SG) and Regulation (RG)	Chapter 2
Task 1-2	Study of Application of Dispersive Soil to Road Works	Chapter 3
Task 1-3	Study of Road Inventory	Chapter 4
Task 2	Improvement of MPWT Laboratory Equipment	Chapter 5
Task 3	Establishment of Centralized Management System for Completed Documents	Chapter 6
Task 4	Implementing Technical Training for Quality Control / Quality Assurance	Chapter 7
Task 5	Compilation of Road and Road Structure Standard Drawings	Chapter 8

At the final JCC meeting in August 2012, it has been concluded that outputs (SG/RG, new equipment at laboratory, database system, technical training, standard drawings) are the assets of MPWT and goal of the Project is confirmed to achieve road and bridge construction with good quality by utilizing those outputs.

Recommendations of each task are stipulated in the corresponding chapters indicated in Table 11-1 and overall conclusion and recommendation is summarized hereafter to achieve the goal of the Project.

- (a) **Net-Work System:** the Project started in 2009 and complete in 2012 (three years) and there are quite a few counterparts (shown in the Table 1.2-4 of Chapter 1) and Party B / C, working during these period with JICA experts as the team. Net-work with these counterparts and Party B / C (core member) is recommended to formulate. Then the net-work will be expanded, by training in regard to construction quality control and assurance by the core member, so that member in the net-work will be increased and construction quality control in MPWT will be further disseminated.
- (b) **Support System:** In order to support construction in force account projects, supporting structure is recommended to set up in MPWT (core in the net-work may be the member), so that any problem arising in the survey, design and construction stage of force account project will be informed to the supporting structure to have advices, ideas or solutions from them.
- (c) **Collection of Completion Documents:** Procedure to collect completion documents has been stipulated in the RG for force account project and the instruction for donor funded project has been issued to the responsible departments to follow similar process. Since the procedure for collection of completion documents is clear, action to collect those documents shall be monitored and encouraged by top management. With more data to input, database system formulated in Task 3 will be more usable and worth accessing.
- (d) **Regular Training and Workshop:** As regular training includes quality control course and this is highly important to level up staff of MPWT in knowledge of construction quality in sustainable manner. Workshop is equally important in different way for the same purpose (staff level up) to be continued.

- (e) **Update / Upgrade of SG / RG, Database, Standard Drawings and Training Course:** The written rules, systems and technical standard / manual are said in general to be reviewed regularly and updated / upgraded within certain period by incorporating new findings and technologies. Otherwise those will be out of date and deteriorated. It is therefore recommended that ad hoc task force in PWRC of MPWT shall be set up for review of the contents of SG / RG, database, standard drawings and training course in regular basis.
- (f) **Importance of Calibration on Laboratory Equipment:** It is recommended that rules for calibration on equipment shall be set at laboratory and calibration equipment shall be possibly procured.
- (g) **Application of Dispersive Soil to Road Works:** Dispersive soil exists in wide area in Cambodia and it is not possible to avoid dispersive soil for use in road works. Since the study confirmed (details to be referred to Chapter 3) that simple test judges whether dispersive soil or not and cement is effective additives to improve the soil, these results may be applied in actual construction in order to utilize dispersive soil for road works and to have more experiences in this regard for further development.
- (h) **Road Inventory with Construction History:** It is recommended that system shall be set to produce output sheet (road inventory with construction history as shown in Table 4.3-3 of Chapter 4) in order to plan and manage new construction and maintenance works effectively.