カンボジア国
公共事業運輸省

カンボジア国
建設の品質管理強化プロジェクト
事業完了報告書

（別冊）
第２部 業務完了総合報告書（短期専門家）
Final Report-Appendix

平成24年10月
（2012年）

独立行政法人国際協力機構
カンボジア事務所

KINGDOM OF CAMBODIA
MINISTRY OF PUBLIC WORKS AND TRANSPORT

KINGDOM OF CAMBODIA

THE PROJECT FOR STRENGTHENING OF CONSTRUCTION QUALITY CONTROL

FINAL REPORT (APPENDIX VOLUME)

OCTOBER 2012

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

KATAHIRA & ENGINEERS INTERNATIONAL

Appendix Volume

TABLE OF CONTENTS

Appendix 1 Plan of Operation

Appendix 2 (Task 1-1) Second Edition of Standard Guideline and Regulation

Appendix 3 (Task 1-2) Study of Application of Dispersive Soil to Road Works

- 3-1 Laboratory Test Result of Natural Soil
- 3-2 Laboratory Test Result of Additive Mixed Soil
- 3-3 Photograph of Work Progress
- 3-4 Photograph of Site Observation
- 3-5 Technical Specification of Pilot Work

Appendix 4 (Task 2) List of Supplied Equipment to Laboratory

Appendix 5 (Task 3) Database System for Completion Documents

- 5-1 Documents Scanning Manual
- 5-2 User Manual for Document Management Database

Appendix 6 (Task 4) Technical Training Course

- 6-1 Text Book of Training of Trainers (TOT)
- 6-2 Syllabi of Training Program in Regular Training Course

Appendix 7 (Task 5) Standard Drawings

- 7-1 Sample of Standard Drawings
- 7-2 User's Manual for Data Searching System for Road and Road Structure Standard Drawings

Appendix 8 Meeting Minutes

Appendix 1 Plan of Operation

Appendix 1

Plan of Operations (JFY2009 - JFY2012)

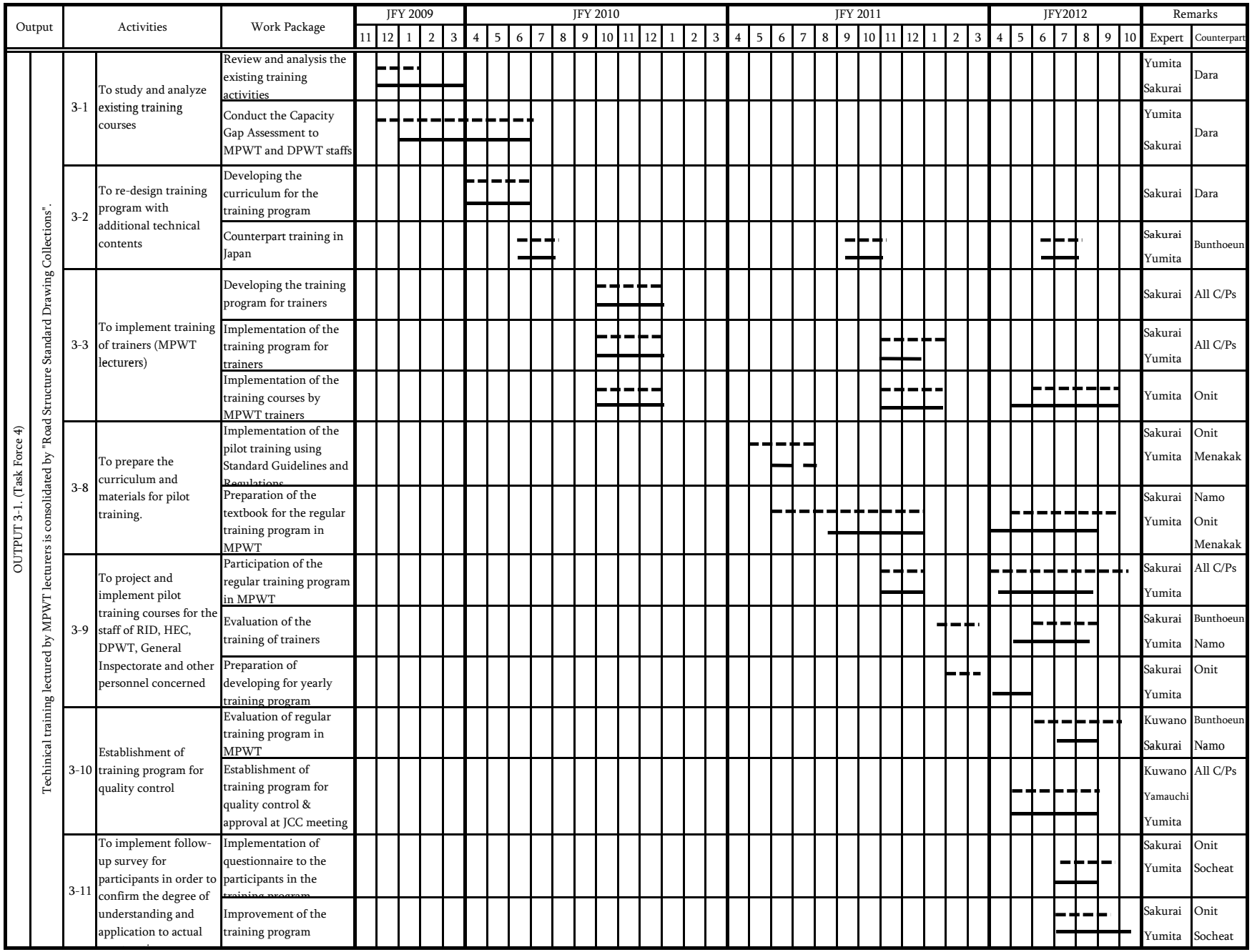
Output		Activities		Work Package	JFY 2009					JFY 2010											JFY 2011											JFY2012							Remarks	
					11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	Expert	Counterpart
OUTPUT 1 (Task Force 1)	Standards, Regulations, Guidelines for Quality Control of Road and Bridge Construction and Maintenance are Established.	1.1	To conduct the baseline survey on the current duties and capacity of each Department in MPWT relating quality control of construction	Meeting with Secretary, Director General and Directors																																			Yumita	Bunthoeun
		1-2	To set up Task Force for formulating draft SG, RG	Secure the capable person from related Department																																			Yumita	Bunthoeun
				Counterpart meeting will be conducted																																			Yamauchi Yumita	Bunthoeun
				Conduct regular Task Force meeting twice a month																																			Yamauchi Noda	Namo Phibal
		1-3 & 1-5	(1-3.) To study and analyze the currently applied specifications and Standards (1-5.) To formulate SG for actual application of Standards	Collecting and analysis the related specification and Standards																																			Noda Nakamura	Sinaveth Menakak
				Review of the implementation process (New and Maintenance)																																			Noda Nakamura	Phibal
				Confirmation of the Design process (New and Maintenance)																																			Noda Nakamura	Phibal
				Confirmation of the Quality Control process currently being adopted (Routine and Periodic)																																			Noda Nakamura	Phibal
				To identify all the problems and the problems to be improved																																			Noda Nakamura	Phibal
				Preparation of the draft Standards Guidelines																																			Noda Nakamura	Namo Phibal
				Confirmation of Standards Guidelines to be formulated and modified																																			Noda Nakamura	Namo Phibal
				Formulation of the draft Standards Guidelines																																			Noda Nakamura	Namo Phibal
				Conduct regular Task Force meeting																																			Noda	Phibal
				Counterpart meeting will be conducted																																			Yamauchi Yumita	Bunthoeun Namo

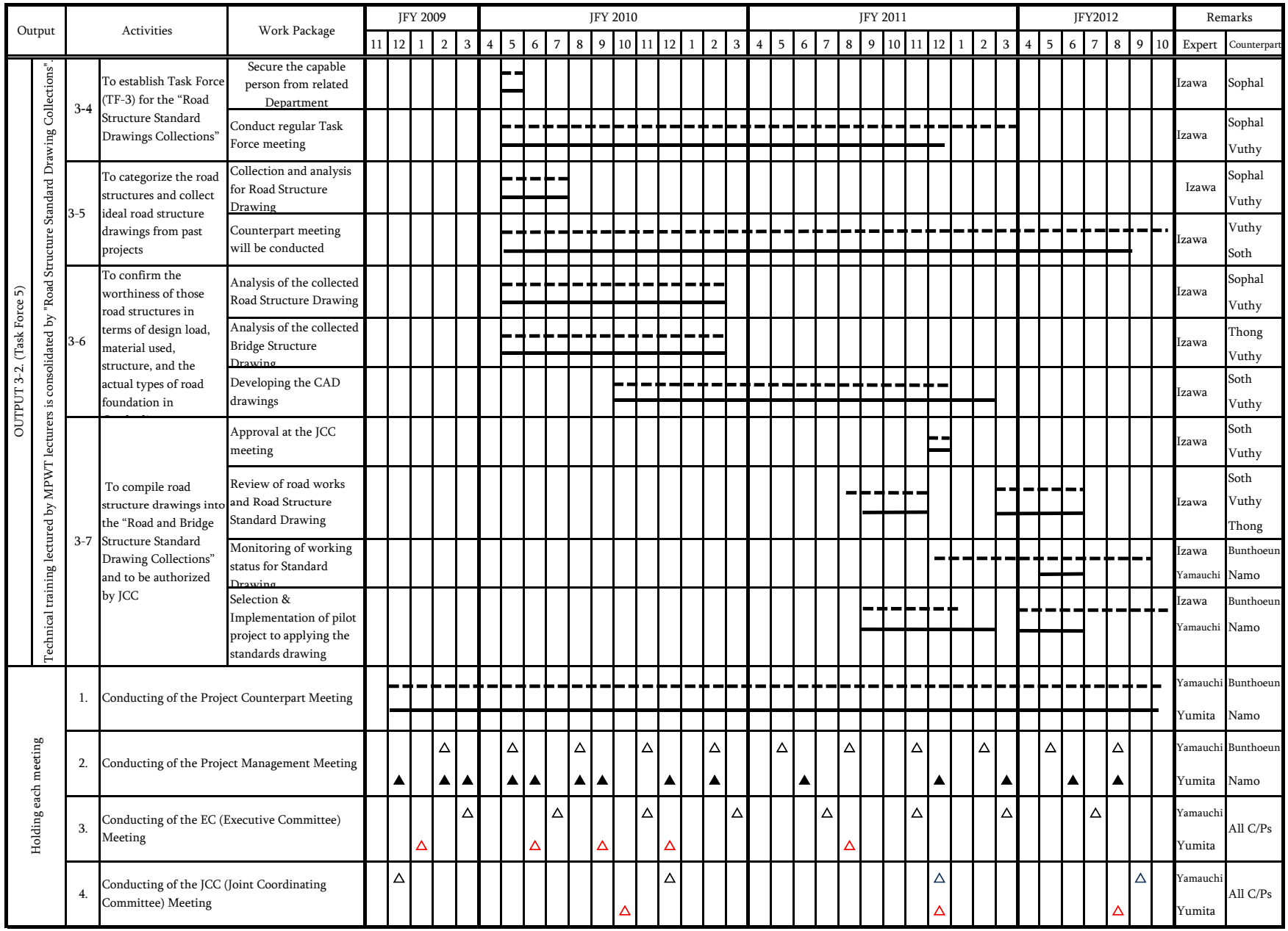
Output		Activities		Work Package	JFY 2009					JFY 2010											JFY 2011												JFY2012							Remarks	
					11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	Expert	Counterpart
OUTPUT 1 (Task Force 1)	Standards, Regulations, Guidelines for Quality Control of Road and Bridge Construction and Maintenance are Established.	1-4	To formulate the draft Regulations determining each Department duties for assuring construction quality	Meeting with Secretary, Director General and Directors																																				Yamauchi Yumita	Bunthoeun
				Analysis of relating Regulations documents such as sub-degree and result of the baseline survey																																					Yumita Noda Nakamura	Menakak Sinaveth
				Preparation of the work schedule for Regulations																																					Nakamura Noda	Phibal
				Meeting with MEF and related Department																																					Yumita Yamauchi	Bunthoeun
				Confirmation of Party A/B/C/D system for QC																																					Yamauchi Noda	Bunthoeun Namo
				Preparation of the draft Regulations																																					Noda Yamauchi	Namo Phibal
		1-6 & 1-9	(1-6.) To be authorized the draft SG and RG by JCC (1-9.) To be officially authorized Standards Guidelines and Regulations by the Minister of MPWT, and evaluate the application of Standards Guidelines and Regulations	Conducting the seminar at 24 provinces																																					Yumita Sakurai	Onit Menakak
				Conduct on EC/JCC meeting and to be approved Standards Guidelines and Regulations																																					Yamauchi Yumita	Bunthoeun Namo
				Review of Khmer version of Standards Guidelines and Regulations																																					-	Namo Phibal
				Formulation of the 2nd edition of Standards Guidelines and Regulations																																					Yamauchi Nakmura Noda	Namo Phibal
				Monitoring and evaluation for Standards Guidelines and Regulations																																					Yamauchi Ymauchi Noda	Namo Phibal
				Approved the 2nd edition of Standards Guidelines and Regulations by MPWT																																					Yamauchi Noda	Bunthoeun Namo

Output		Activities		Work Package	JFY 2009					JFY 2010										JFY 2011										JFY2012							Remarks	
					11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	Expert	Counterpart
OUTPUT 1 (Task Force 1)	Standards, Regulations, Guidelines for Quality Control of Road and Bridge Construction and Maintenance are Established.	1-8	Implementation of the pilot projects	Selection of the pilot project																																			Yamauchi Maeda	Bunthoeun Namo
				Development and application of Quality Control format (Daily Control/ Progress)																																					Yamauchi Nakamura Maeda	All C/Ps
				Detailed Cost estimation for Party B and C																																					Yamauchi Nakamura	All C/Ps
				Preparation of Contract Document																																					Yamauchi Nakamura	All C/Ps
				Conduct regular Task Force meeting																																					Noda Maeda	All C/Ps
				Implementation of the pilot projects (Observation of current practice)																																					Maeda	All C/Ps
				Evaluation of the pilot projects																																					Yamauchi Maeda	All C/Ps
				Selection of the pilot projects for Year 2012																																					Yamauchi Noda	All C/Ps
				Preparation of the pilot projects in Year 2012 (Construction Plan, etc.)																																					Yamauchi Yumita Maeda	All C/Ps
				Development and application of Quality Control format (Daily Control/ Progress) in Year 2012																																					Maeda	All C/Ps
		1-9A	Trial construction for dragon hall treatment	Confirmation of dispersive soil at site																																					Nakamura Okamoto	Menakak Socheat
				Trial construction																																					Okamoto	Leang Menakak
				Evaluation of pilot construction																																					Nakamura	All C/Ps

Output		Activities		Work Package	JFY 2009					JFY 2010											JFY 2011											JFY2012							Remarks	
					11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	Expert	Counterpart
OUTPUT 1 (Task Force 1) Standards, Regulations, Guidelines for Quality Control of Road and Bridge Construction and Maintenance are Established.		1-10	Monitor and evaluate the application of the Standards Guidelines and Regulations	Meeting with Secretary, Director General and Directors																																				Yumita Yamauchi	Bunthoeun Namo
				Monitoring and evaluation for Standards Guidelines and Regulations																																				Yamauchi Nakamura Kuwano	All C/Ps
				Conduct on EC/JCC meeting and to be approved Standards Guidelines and Regulations																																				Kuwano Yumita Yamauchi	Bunthoeun Namo
				Comparison of SG and applied daily control sheet																																				Maeda Yamauchi	All C/Ps
				Preparation of Khmer version of SG & RG																																					Namo Phibal
				Formulation of 2nd edition of SG & RG																																				Yamauchi Nakamura Noda	All C/Ps
		1-11	To study of current paractice of road inventory and to propose road data information system	Follow up & improvement of road inventory data																																				Yumita	Phibal Dara
				Propose to road data information system																																				Yumita	Dara

Output		Activities		Work Package	JFY 2009					JFY 2010										JFY 2011										JFY2012							Remarks	
					11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	Expert	Counterpart
OUTPUT 1-2 (Task Force 2)	Improvement of Laboratory equipment and staffs	1-7	Formulate the procurement plan of Laboratory equipment to meet the Standards Regulations	Analysis of existing laboratory equipment or device																																			Maeda	Leang
				Analysis of laboratory staffs ability																																					Maeda	Leang
				Formulation of the procurement plan																																					Maeda	Leang
				Inspection and Installation on delivered equipment at laboratory																																					Maeda Yumita	Leang
				Implementation of lecture for how to use and maintenance of new equipment																																					Maeda	Lab Staffs
				Monitoring of working status for new equipment																																					Maeda Yumita	Leang
OUTPUT 2 (Task Force 3)	Centralized and integrated management system of completion documents such as drawing and report of construction is established.	2-1	To list up the past implemented construction projects of roads and bridges	Developing the past projects records sheet with reference to road number																																			Yashiro	Sinaveth Menakak
		2-2	To collect the completion documents of construction at the MPWT Library	Tidy up at the library and repair if necessary																																			Yashiro	Sinaveth Menakak
				Developing the documents list with reference to road route																																			Yashiro	Namo Ratha
		2-3	To categorize all completion documents by road route, structure, regulation and guidelines	Selection and contract with the out-recourse																																			Yashiro	Namo Ratha
				Developing the draft documents index																																			Yashiro	Namo Ratha
		2-4	To formulate the database with index for reference	Encoding the data to computer and developing the primary system																																			Yashiro	Namo Ratha Sokly
				Conduct of training for the administrator and operator																																			Yashiro	Namo Ratha
				Developing the regulation (rule) of the system																																			Yashiro	Namo Ratha
		2-4A	To formulate the submission procedure of completion documents	Developing the regulation (rule) of the system																																			Yashiro Ishida	Namo Ratha Sokly
		2-5	To formulate database and apply the management	Training to Users (MPWT staffs)																																			Yashiro Yumita	Ratha Sokly


Output
Activities
Work Package
JFY 2009
JFY 2010
JFY 2011
JFY2012
Remarks
11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10
Expert
Counterpart
OUTPUT 3-1. (Task Force 4)
Techinical training lectured by MPWT lecturers is consolidated by "Road Structure Standard Drawing Collections".
3-1
To study and analyze existing training courses
Review and analysis the existing training activities
Yumita
Sakurai
Dara
Conduct the Capacity Gap Assessment to MPWT and DPWT staffs
Yumita
Sakurai
Dara
3-2
To re-design training program with additional technical contents
Developing the curriculum for the training program
Sakurai
Dara
Counterpart training in Japan
Sakurai
Yumita
Bunthoeun
3-3
To implement training of trainers (MPWT lecturers)
Developing the training program for trainers
Sakurai
All C/Ps
Implementation of the training program for trainers
Sakurai
Yumita
All C/Ps
Implementation of the training courses by MPWT trainers
Yumita
Onit
3-8
To prepare the curriculum and materials for pilot training.
Implementation of the pilot training using Standard Guidelines and Regulations
Sakurai
Yumita
Onit
Menakak
Preparation of the textbook for the regular training program in MPWT
Sakurai
Yumita
Namo
Onit
Menakak
3-9
To project and implement pilot training courses for the staff of RID, HEC, DPWT, General Inspectorate and other personnel concerned
Participation of the regular training program in MPWT
Sakurai
Yumita
All C/Ps
Evaluation of the training of trainers
Sakurai
Yumita
Bunthoeun
Namo
Preparation of developing for yearly training program
Sakurai
Yumita
Onit
3-10
Establishment of training program for quality control
Evaluation of regular training program in MPWT
Kuwano
Sakurai
Bunthoeun
Namo
Establishment of training program for quality control & approval at JCC meeting
Kuwano
Yamauchi
Yumita
All C/Ps
3-11
To implement follow-up survey for participants in order to confirm the degree of understanding and application to actual
Implementation of questionnaire to the participants in the training program
Sakurai
Yumita
Onit
Socheat
Improvement of the training program
Sakurai
Yumita
Onit
Socheat


Output
Activities
Work Package
JFY 2009
JFY 2010
JFY 2011
JFY2012
Remarks
11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10
Expert
Counterpart
OUTPUT 3-2. (Task Force 5)
Technical training lectured by MPWT lecturers is consolidated by "Road Structure Standard Drawing Collections".
3-4 To establish Task Force (TF-3) for the "Road Structure Standard Drawings Collections"
Secure the capable person from related Department
Izawa Sophal
Conduct regular Task Force meeting
Izawa Sophal Vuthy
3-5 To categorize the road structures and collect ideal road structure drawings from past projects
Collection and analysis for Road Structure Drawing
Izawa Sophal Vuthy
Counterpart meeting will be conducted
Izawa Vuthy Soth
3-6 To confirm the worthiness of those road structures in terms of design load, material used, structure, and the actual types of road foundation in
Analysis of the collected Road Structure Drawing
Izawa Sophal Vuthy
Analysis of the collected Bridge Structure Drawing
Izawa Thong Vuthy
Developing the CAD drawings
Izawa Soth Vuthy
3-7 To compile road structure drawings into the "Road and Bridge Structure Standard Drawing Collections" and to be authorized by JCC
Approval at the JCC meeting
Izawa Soth Vuthy
Review of road works and Road Structure Standard Drawing
Izawa Soth Vuthy Thong
Monitoring of working status for Standard Drawing
Izawa Bunthoeun
Yamauchi Namo
Selection & Implementation of pilot project to applying the standards drawing
Izawa Bunthoeun
Yamauchi Namo
Holding each meeting
1. Conducting of the Project Counterpart Meeting
Yamauchi Bunthoeun
Yumita Namo
2. Conducting of the Project Management Meeting
Yamauchi Bunthoeun
Yumita Namo
3. Conducting of the EC (Executive Committee) Meeting
Yamauchi
Yumita
All C/Ps
4. Conducting of the JCC (Joint Coordinating Committee) Meeting
Yamauchi
Yumita
All C/Ps

Appendix 2 (Task 1-1)

Second Edition of Standard Guideline and Regulation

KINGDOM OF CAMBODIA

NATION RELIGION KING

MINISTRY OF PUBLIC WORKS AND TRANSPORT

THE STRENGTHENING OF CONSTRUCTION QUALITY CONTROL

STANDARD GUIDELINE
FORCE ACCOUNT PROJECT

SECOND EDITION

August 2012

PREPARED BY: MPWT'S COUNTERPARTS AND JICA EXPERTS

The Strengthening of Construction Quality Control Project
Ministry of Public Works and Transport
Standard Guideline for MPWT Force Account Project
(Second Edition)

CONTENTS
LIST OF FIGURES AND TABLES

CONTENTS

Page

1 General 1
2 Roles of the Departments concerned in Maintenance 2
3 Basic Surveys and Investigations 3
3.1 New Construction, Reconstruction and Periodic Maintenance 3
3.2 Routine Maintenance 3
4 Basic Design 3
4.1 New Construction, Reconstruction and Periodic Maintenance 3
4.2 Routine Maintenance 4
5 Preliminary Cost Estimate 4
5.1 New Construction, Reconstruction and Periodic Maintenance 4
5.2 Routine Maintenance 4
6 Determination of Ceiling Amount 5
6.1 New Construction, Reconstruction and Periodic Maintenance 5
6.2 Routine Maintenance 5
7 Special Advance Payment 5
8 Detailed Investigation and Survey 5
8.1 New Construction, Reconstruction and Periodic Maintenance 5
8.1.1 Description 5
8.1.2 Testing and Sampling 5
8.1.3 Laboratory Test 6
8.1.4 Traffic Survey 7
8.2 Routine Maintenance 7
9 Detailed Design 7
9.1 New Construction, Reconstruction and Periodic Maintenance 7
9.2 Routine Maintenance 11
10 Detailed Cost Estimate 11
10.1 New Construction, Reconstruction and Periodic Maintenance 11
10.2 Routine Maintenance 11

11 Quality Control Documents 12
11.1 Earth Works 12
11.1.1 Flow of the Works 12
11.1.2 Quality Control Chart and Forms 15
11.1.3 As-built Measuring Control Chart and Forms 15
11.1.4 Documentation for Improvement: Check List 16
11.2 Pavement Works 19
11.2.1 Flow of the Works 19
11.2.2 Quality Control Chart and Forms 21
11.2.3 As-built Measuring Control Chart and Forms 21
11.2.4 Documentation for Improvement: Check List 21
11.3 Piling Works 23
11.3.1 Flow of the Works 23
11.3.2 Quality Control Chart and Forms 30
11.3.3 As-built Measuring Control Chart and Forms 30
11.3.4 Documentation for Improvement: Check List 31
11.4 Concrete Works 33
11.4.1 Flow of the Works 33
11.4.2 Quality Control Chart and Forms 34
11.4.3 As-built Measuring Control Chart and Forms 34
11.4.4 Documentation for Improvement: Check List 34
12 Inspection 37
13 IB Performance Evaluation 39

Appendices

A As-built Measurement Record Form
B Sand Cone Test Method and Test Sheet
C Check Sheet for Proof Rolling
D Check Sheet for Application of Bitumen Material
E Quality Control Sheet for Earth Work
F Quality Control Sheet for Piling Work
G Quality Control Sheet for Concrete Work
H Documentation for Improvement
Check List for Earthwork at Reconstruction Section, Earthwork at Embankment Section, Asphalt Concrete / DBST / SBST Works, Piling Works and Concrete Works
I Request for Inspection

LIST OF FIGURES AND TABLES

Page

Figure 11-1 Quality Control Documents 12
Figure 11-2 Flowchart of Earthwork at Reconstruction Section 13
Figure 11-3 Flow of Earthwork at Embankment Section 14
Figure 11-4 Flow of Asphalt Concrete Works 19
Figure 11-5 Flow of DBST Works 20
Figure 11-6 Flow of SBST Works 20
Figure 11-7 Flow of Piling Works 23
Figure 11-8 Typical Execution Flowchart of Driving Piles 25
Figure 11-9 Selection of Size of Ram 25
Figure 11-10 Arrangement of Piles and Instrument 26
Figure 11-11 Method of Driving Record 27
Figure 11-12 Sample of Driving Record Form 28
Figure 11-13 Flow of Concrete Works 33

Table 2-1 Roles of Department concerned 2
Table 4-1 New Proposed Scheme for Road Pavement Design 3
Table 4-2 Work Code of Routine Maintenance 4
Table 7-1 Rate of Special Advance Payment 5
Table 9-1 Detailed Pavement Formation 8
Table 9-2 Key to the Design Chart in TRL Overseas Road Note 31 9
Table 9-3 List of Layer Coefficient 10
Table 9-4 Sample of Conversion of Pavement Design Formation 11
Table 11-1 (Q-1) Quality Control Chart for Earth Work 17
Table 11-2 (A-1) As-built Measuring Control Chart for Earth / Road Work 18
Table 11-3 (Q-2) Quality Control Chart for Pavement Works 22
Table 11-4 Limit of Number of Blows 25
Table 11-5 Sample of Criteria of Stop Driving 26
Table 11-6 (Q-4) Quality Control Chart for Piling Works 32
Table 11-7 (Q-4) Quality Control Chart for Concrete Works 35
Table 11-8 (A-2) As-Built Control Chart for Concrete Works 36
Table 12-1 Points of Inspection 37
Table 12-2 Check List for Inspection 38

1 General

Background:

MPWT has constructed many road and bridge infrastructures in response to the needs of social and economic development and poverty reduction. But the quality of these infrastructures has been inadequate or insufficient because the MPWT focuses its effort only on construction.

Based on the above-mentioned backgrounds, the Royal Government of Cambodia (RGC) requested the implementation of the Technical Cooperation Project (TCP) to the Government of Japan in order to establish an adequate Quality Control and Quality Assurance (QC/QA) system for roads and bridges construction. In response to the request from the RGC, the Government of Japan dispatched the experts organized by JICA.

Objectives:

To establish Standard, Regulations and Guidelines is one of the Project objectives, which will help MPWT staff controls and assures qualities of construction appropriately with new institutional regulations, engineering standard and guidelines.

Standard, Regulations and Guidelines are established with objectives:

To improve procedures and methods of making annual plan including basic design, rough cost estimate,

To improve procedures and methods of detailed design, cost estimation,

To improve procedures and methods of supervising construction works including daily quality control, and

To improve procedures and methods of inspections.

Referred documents:

Cambodian references:

Construction Specification 2003 / Ministry of Public Works and Transport

Compact Construction Materials Specification for Maintenance & Construction of Roads and Structures 2011 / Ministry of Public Works and Transport

Standard Construction Specification (Cost Estimation Guideline) / Ministry of Public Works and Transport

Guideline for Supervision of Routine Maintenance 2008 / Ministry of Public Works and Transport

Guideline for Repairing Defects of Roads 2008 / Ministry of Public Works and Transport

Guideline for Regular Inspection Report 2008 / Ministry of Public Works and Transport

Guideline for Supervision of Periodic Maintenance 2008 / Ministry of Public Works and Transport

Guideline for Road Design Standard Part 2. Pavement / Ministry of Public Works and

Transport

IB Performance Evaluation Form 2008 / Ministry of Public Works and Transport

Other country's references:

Standard Specifications for Transportation Materials and Methods of Sampling and Testing / AASHTO

Civil Works Handbook / Japan

Manual for Asphalt Pavement 1989 / Japan Road Association

2 Roles of the Departments concerned in Maintenance

Road infrastructure maintenance and reconstruction have been implemented supervised, and inspected according to the chapter budget allocated as shown in the following Table 2-1.

Table 2-1 Roles of Department concerned

		Executor: Party B	**Checking party / Supervisor: Party C**	**Inspector: Party D**
Chapter 21 *(New Construction, Reconstruction)*		HEC RID (Unit) DPWT/RCAF/PO	PWRC RID(Plan) SPIED (Sub-National Public Infrastructure and Engineering Department	PEAC /GDI
Chapter 61 *(Maintenance)*	Routine	DPWT/RID(Unit)	RID(Plan)	
	Periodic	DPWT/RID(Unit)/ HEC	RID(Plan)/PWRC	
	Emergency	RID(Unit)	RID(Plan)	
Roles in design stage		-Preparation of Basic Design -Preparation of Preliminary Cost Estimate for Construction -Preparation of Detailed Design -Preparation of Cost Estimate for Construction	-Checking Basic Design -Preparation of Preliminary Cost Estimate for Supervision -Check and Sum of Preliminary Project Cost -Checking Detailed Design -Preparation of Cost Estimate for Supervision -Check and Sum of Project Cost	
Roles in execution stage		Execution	Supervising	Inspection

Note : (Unit) Road/Bridge Unit
(Plan) Planning and Technical Bureau
HEC : Heavy Equipment Center
RID : Road Infrastructure Department
DPWT : Provincial Department of Public Works and Transport
RCAF : Royal Cambodian Army Force
PO : Police Office
PWRC : Public Works Research Center
PEAC : Procurement Evaluation Award Committee
GDI : General Department of Inspection

3 Basic Surveys and Investigations

3.1 New Construction, Reconstruction and Periodic Maintenance

Basic survey and investigation for basic design mentioned below shall be conducted in June or July. The items of the basic surveys and investigations are as follows.

- Desk study and site reconnaissance
    - To confirm the beginning point and ending point of the project, if necessary by geodetic and control survey.
    - To confirm the length and location map of the project
    - To confirm the geological formation with the stations such as mountainous, flat, swamp.
    - To confirm the hydraulic and hydrological survey (catchment area calculation) if it is available or to consult with local people on the hydraulic and hydrological status of the project area.

3.2 Routine Maintenance

Based on the visual inspections, the measures for the defects appearing on the pavement shall be categorized into the work code. The effective work code shall be selected in the manner of the high productivities and low cost.

4 Basic Design

4.1 New Construction, Reconstruction and Periodic Maintenance

(1) Pavement Design

The road pavement design shall be done based on the basic survey. And the following Table 4-1 can be used for basic design of road pavement without consideration into traffic volume.

Table 4-1 New Proposed Scheme for Road Pavement Design

New Proposed Scheme (Draft)			
	Swamp	200 DBST 200 Base Course 200 Subbase Course 300 Capping	100 Asphalt Concrete 200 Base Course 225 Subbase Course 350 Capping
	Flat	200 DBST 175 Base Course 200 Subbase Course Capping	100 Asphalt Concrete 200 Base Course 225 Subbase Course 200 Capping
	Mountainous	200 DBST 225 Base Course Subbase Course	100 Asphalt Concrete 200 Base Course 250 Subbase Course

(2) Structure Design

Prior to do structure design (culverts and bridges), basic survey shall be carried out. Based on the survey, appropriate design shall be taken from the Standard Drawings for Road, and Bridge and Structure.

4.2 Routine Maintenance

Work codes of routine maintenance as specifications are shown in the Table 4-2. Basic design of routine maintenance is not needed.

Table 4-2 Work Code of Routine Maintenance

No.	Work Code	Description	Unite
1	1100	Patching on bituminous surface by AC	m²
2	1130	Sealing on crack surface	m²
3	1150	Shape corretion by Macadam	m²
4	1160	Patching on bituminous surface by DBST	m²
5	1170	Patching on bituminous surface by MCD	m²
6	1200	Grade shoulder	Km
7	1201-1	Material for shoulder	m³
8	1210-1	Refill dragon hole	m³
9	1250	Grade earth and laterite	Km
10	1260	Heavy grading	Km
11	2100	Clean Culvert by hand	m
12	2150	Drainage cleaning, both sides	m
13	3100	Culvert cleaning	Place
14	3200	Bridge minor repair	man/h
15	4150	Control vegetation and clean road side	Km

5 Preliminary Cost Estimate

5.1 New Construction, Reconstruction and Periodic Maintenance

Preliminary cost estimate shall be prepared based on the basic survey, basic design and Standard Construction Specifications (Cost Estimate Guideline) issued in 2005. In addition, provision for traffic safety and removal / relocation / shifting of utilities (cable, telephone, water etc.) shall be allowed, as the case may be.

5.2 Routine Maintenance

The supervising team shall prepare the preliminary cost estimate based on the basic surveys and investigations and its unit rate.

6 Determination of Ceiling Amount

6.1 New Construction, Reconstruction and Periodic Maintenance

The ceiling amount shall be determined through the inter-ministerial committee meetings. This meeting shall be conducted every two months and when the meeting is needed.

6.2 Routine Maintenance

The ceiling amount of routine maintenance will be determined as same procedure as new construction and periodic maintenance.

7 Special Advance Payment

Special advance payment shall be paid before award of the contract to enable the commencement of the works in January. The amounts to be paid are mentioned in the following Table 7-1 Rate of Special Advance Payment.

Table 7-1 Rate of Special Advance Payment

		Executor	%
Chapter 21 *(New Construction, Reconstruction)*		HEC	20~30
		RCAF/PO	30-40
		DPWT/RID(Unit)	20~30
Chapter 61 *(Maintenance)*	Routine	DPWT/RID(Unit)	30-40
	Periodic	DPWT/RID(Unit)/HEC	30-40
	Emergency	RID(Unit)	30-40

Note: (Unit) Road/Bridge Unit
(Plan) Planning and Technical Bureau

8 Detailed Investigation and Survey

8.1 New Construction, Reconstruction and Periodic Maintenance

8.1.1 Description

This clause consists of three items which are Sub-grade Investigation, Material Sources Investigation and Sub-soil Investigation.

8.1.2 Testing and Sampling

Sub-grade Investigation

The locations of the sampling shall be every 200m along the proposed road alignment. The location of the sampling shall be confirmed by checking party. The sampling shall be also done with witness of checking party. The samples shall be extracted from 0.5m below the sub-grade surface.

In case the length of the section is shorter than 200m, at least one location of the sampling shall be selected.

Checking party shall deliver the extracted materials tightly sealed in the plastic bags to

the laboratory.

Material Sources Investigation

Two or three material sources for base course, sub-base course, capping material and embankment material shall be identified near the project site. The sampling shall be done with witness of checking party. The samples shall be extracted from 0.5m below the ground surface. Checking party shall deliver the extracted materials tightly sealed in the plastic bags to the laboratory.

Sub-soil Investigation

Sub-soil investigation shall be carried out at least at one boring in each bridge location. During the boring, standard penetration test at each 1.0 m or 1.5 m and samplings shall be carried out for laboratory tests and the boring shall be continued until reaching to hard layer or until assuring the necessary length for an friction pile. Other site tests may be carried out as required.

8.1.3 Laboratory Test

The following soil tests shall be carried out in accordance with the following standard by laboratory with witness of checking party. Checking party shall determine the acceptability of the proposed materials.

Sub-grade Investigation

Natural Moisture Content	AASHTO T-265
Compaction Test	AASHTO T-180
CBR Test	AASHTO T-193
Sieve Analysis	AASHTO T-27
LL, PL, PI	AASHTO T-89,90

Material Sources Investigation

Natural Moisture Content	AASHTO T-265
Compaction Test	AASHTO T-180
Modified CBR Test	AASHTO T-193
Sieve Analysis	AASHTO T-27
LL, PL, PI	AASHTO T-89,90
Abrasion	AASHTO T-96 (for base course material, if necessary)

Sub-soil Investigation

Unit Weight	
Natural Moisture Content	AASHTO T-265
Sieve Analysis	AASHTO T-27
LL, PL, PI	AASHTO T-89,90
Unconfined Compression Test for cohesive soil	
Tri-axial Compression Test for sandy soil	

8.1.4 Traffic Survey

Collecting the result of traffic volume and axle load survey shall be conducted. Traffic survey will be conducted if the collected data is not enough. Traffic class of the road shall be determined by analyzing above those data with a consideration of prediction of traffic growth.

8.2 Routine Maintenance

Detailed investigation and survey has not been needed for routine maintenance.

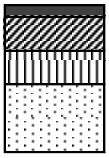
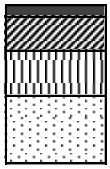
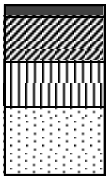
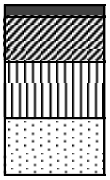
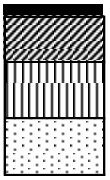
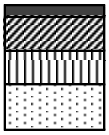
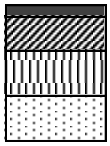
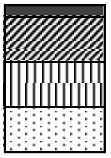
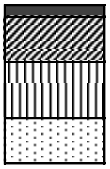
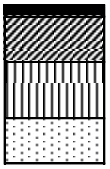
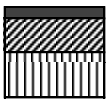
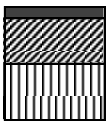
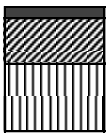
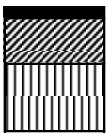
9 Detailed Design

9.1 New Construction, Reconstruction and Periodic Maintenance

(1) Design of pavement formation

The basic design which had been done based on the geographical formation shall be revised according to the results of sub-soil investigation and traffic survey results mentioned above. The pavement design formation shall be determined based on the following Table 9-1 Detailed Pavement Formation.

Table 9-1Table 9-1 Detailed Pavement Formation

subgrade class	DBST-T1 (CN_{esa} < 0.3×10^{6})	DBST-T2 (CN_{esa} < 0.3–0.7×10^{6})	DBST-T3 (CN_{esa} < 0.7–1.5×10^{6})	DBST-T4 (CN_{esa} < 1.5–3.0×10^{6})	AC-T6 (CN_{esa} < 1.5–3.0×10^{6})
S1 (CBR≧2%)	 150 175 300	 150 225 300	 200 200 300	 200 250 300	 200 225 350
S2 (CBR 3%, 4%)	 150 150 200	 150 200 200	 200 175 200	 200 225 200	 200 225 200
S3 (CBR ≧5%)	 150 200	 150 250	 200 225	 200 275	 200 250

Note: DBST, Base-course, Sub-base, Capping Layor, Asphalt Concrete

Definition of Traffic Class and Sub-grade class is specified in the following Table 9-2 Key to the Design Chart in TRL (the Transport Research Laboratory) Overseas Road Note 31.

Table 9-2 Key to the Design Chart in TRL Overseas Road Note 31

Traffic	10^6 CN_{esa}	Sub-grade class	CBR %
T1	＜0.3	S1	2
T2	0.3-0.7	S2	3-4
T3	0.7-1.5	S3	5-7
T4	1.5-3.0	S4	8-14
T5	3.0-6.0	S5	15-29
T6	6.0-10	S6	30+
T7	10-17		
T8	17-30		

N_{esa} is defined by the following equation.

$$N_{esa} = (\frac{P}{80})^{4.5} \times N_p$$

Where

N_{esa} = number of equivalent standard axles;

Np = number of axles with load P kN

The total number of heavy vehicles that will use the road during in design life is converted to a cumulative number of equipment standard axles (CN_{esa}).

The pavement design should be based on the cumulative number of standard axles in the busiest lane of the road. For two-lane roads with two-way traffic and no significant difference between the two traffic streams, the design number of standard axles is assumed to be 50% of the total number of standard axles in the two directions. Detailed guideline on carrying out axle load surveys and analyzing the results is given in TRRL Road Note 40.

(2) Conversion of pavement formation

In case the soil test results of the proposed materials cannot satisfy the requirement in the specifications, the pavement design formation shall be revised according to the availability of the materials.

The required bearing capacity of the pavement is expressed as a ‘structural number’

(SN). For CNesa higher than 0.5×10^6, the required SN is calculated from the empirical equation.

$$\log CN_{esa} = 9.36\log\left(\frac{SN}{25.4} + 1\right) - 0.83 + \log\frac{1}{R} + 1.395\log CBR$$

where

SN=structural number in mm

CBR=Design CBR for the subgrade

R=regional adjustment factor.

R is assumed to be 1.0 for areas with rainfall throughout most of year. A factor of 0.1 is assumed where the pavement structure and sub-base never reach a saturated condition.

After the materials for the different pavement layers have been selected the thickness are determined by trial and error so that the following equation is satisfied.

$$a_1h_1 + a_2h_2 + a_3h_3 = SN$$

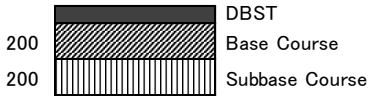
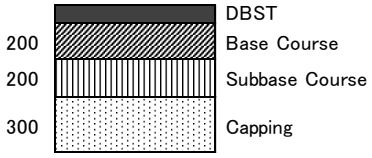
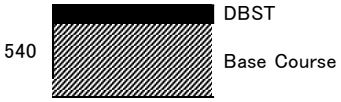
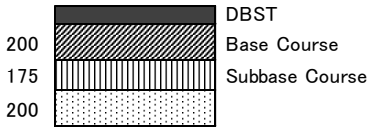
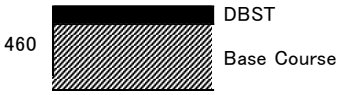
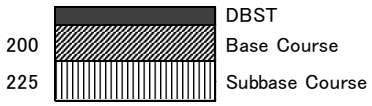
where a_1,a_2 and a_3 are the layer coefficient of the wearing course, base and sub base material, respectively, and h_1, $h_2$and h_3 are the thickness in mm of the wearing course, base and sub base respectively. In the case of a fourth pavement layer the equation is extended by adding a_4 and h_4. The values of the layer coefficient are shown in the following Table 9-3 List of Layer Coefficient.

Table 9-3 List of Layer Coefficient

Layer/material	Layer coefficient
Asphalt Concrete	0.35
DBST, SBST	0.2
Base Course (CBR>80%)	0.12
Sub-base (CBR>30%)	0.11
Capping Layer (CBR>15%)	0.06

The sample of pavement design formation is shown in the following Table 9-4.

Table 9-4 Sample of Conversion of Pavement Design Formation

	subgrade class	Section	
		Subbase Course(30%), Capping Layer(15%) are available	Subbase Course(30%), Capping Layer(15%) are not available
Current Scheme	All		
New Proposed Scheme (Draft)	CBR≧2%		
	CBR 3%, 4%		
	CBR ≧5%		

(3) Structure design

Based on the site survey, most suitable bridge design (span and structure type) shall be selected from the Standard Drawings of Road and Structure. Foundation of bridge shall be designed, including selection of pile type from the standard drawings and length of pile after careful review of sub-soil investigation result.

9.2 Routine Maintenance

Detailed design is not needed for routine maintenance project.

10 Detailed Cost Estimate

10.1 New Construction, Reconstruction and Periodic Maintenance

Cost estimate shall be prepared based on the detailed investigation and survey, detailed design and Standard Construction Specifications (Cost Estimate Guideline) issued in 2005. In addition, expenses for traffic safety and removal / relocation / shifting of utilities (cable, telephone, water etc.) shall be calculated and included in the cost estimation, as the case may be.

10.2 Routine Maintenance

Detailed Cost Estimate is not needed for routine maintenance project.

11 Quality Control Documents

The quality control documents consist of the following documents as shown in the Figure 11-1.

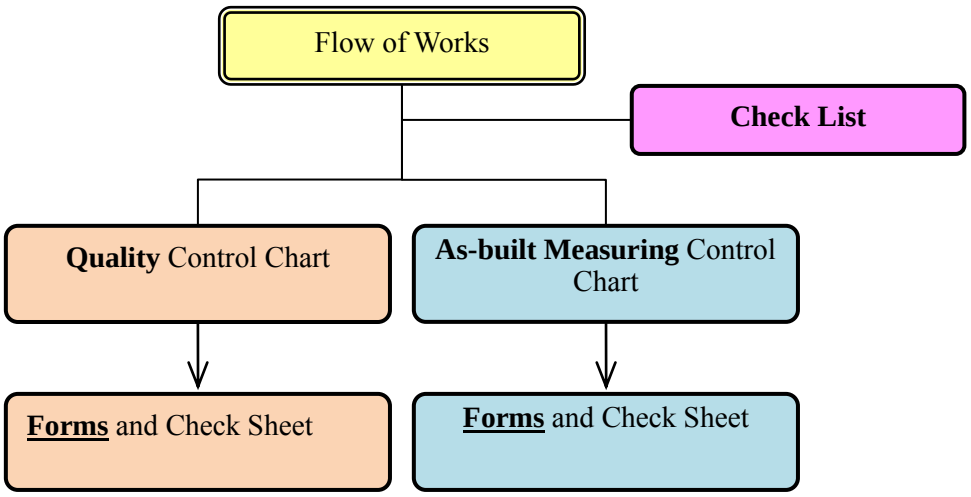


Figure 11-1 Quality Control Documents

11.1 Earth Works

11.1.1 Flow of the Works

The flows for reconstruction section and new construction section (embankment section) have been prepared and shown in the Figure 11-2 Flowchart of Earthwork at Reconstruction Section and the Figure 11-3 Flow of Earthwork at Embankment Section. The yellow and blue squares are quality control activities with target value and as-built measuring control activities with target value respectively. The squares on the right side are the identification code of quality control and as-built measuring control items. Supplemental instructions are as follows.

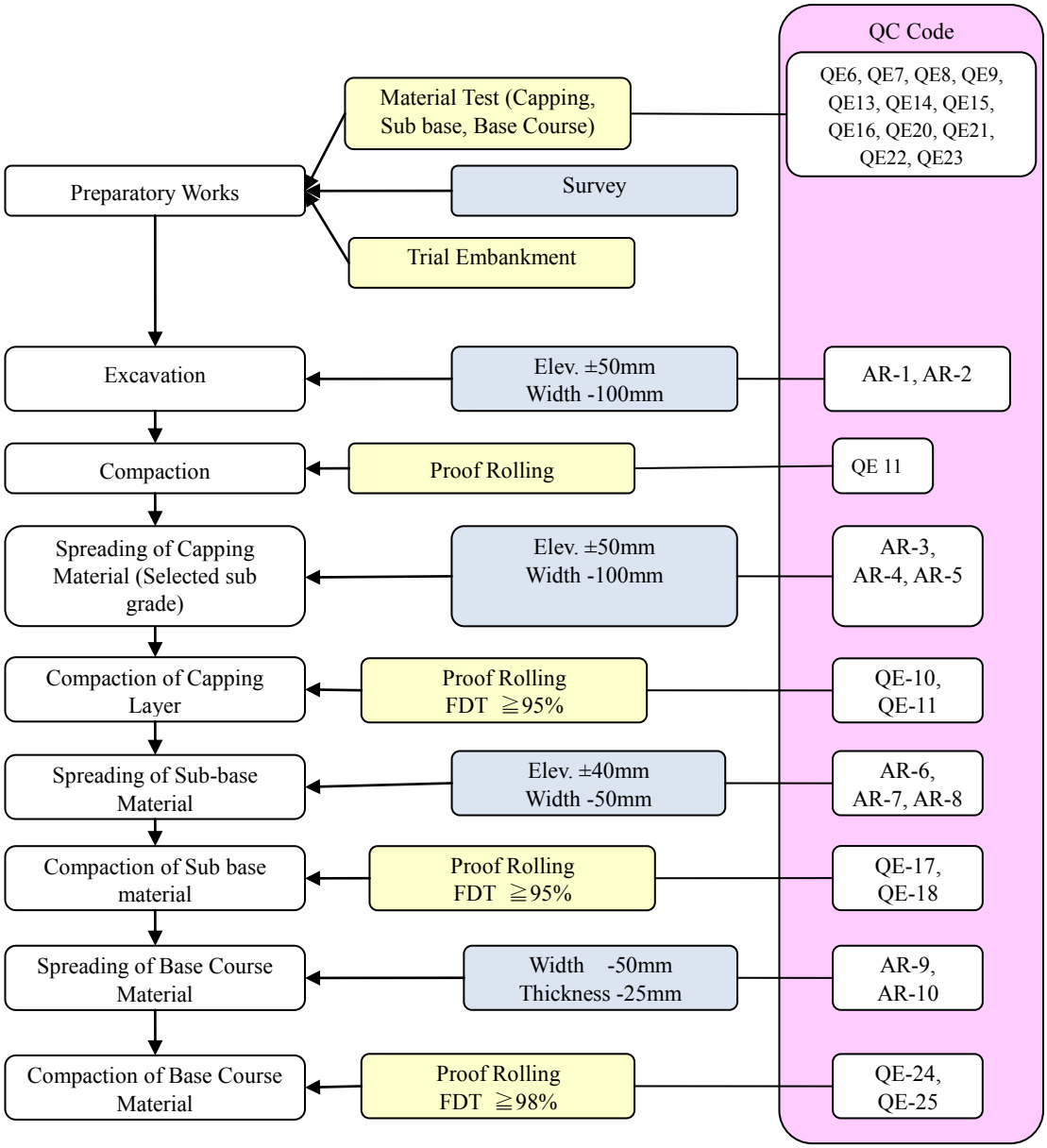


Figure 11-2 Flowchart of Earthwork at Reconstruction Section

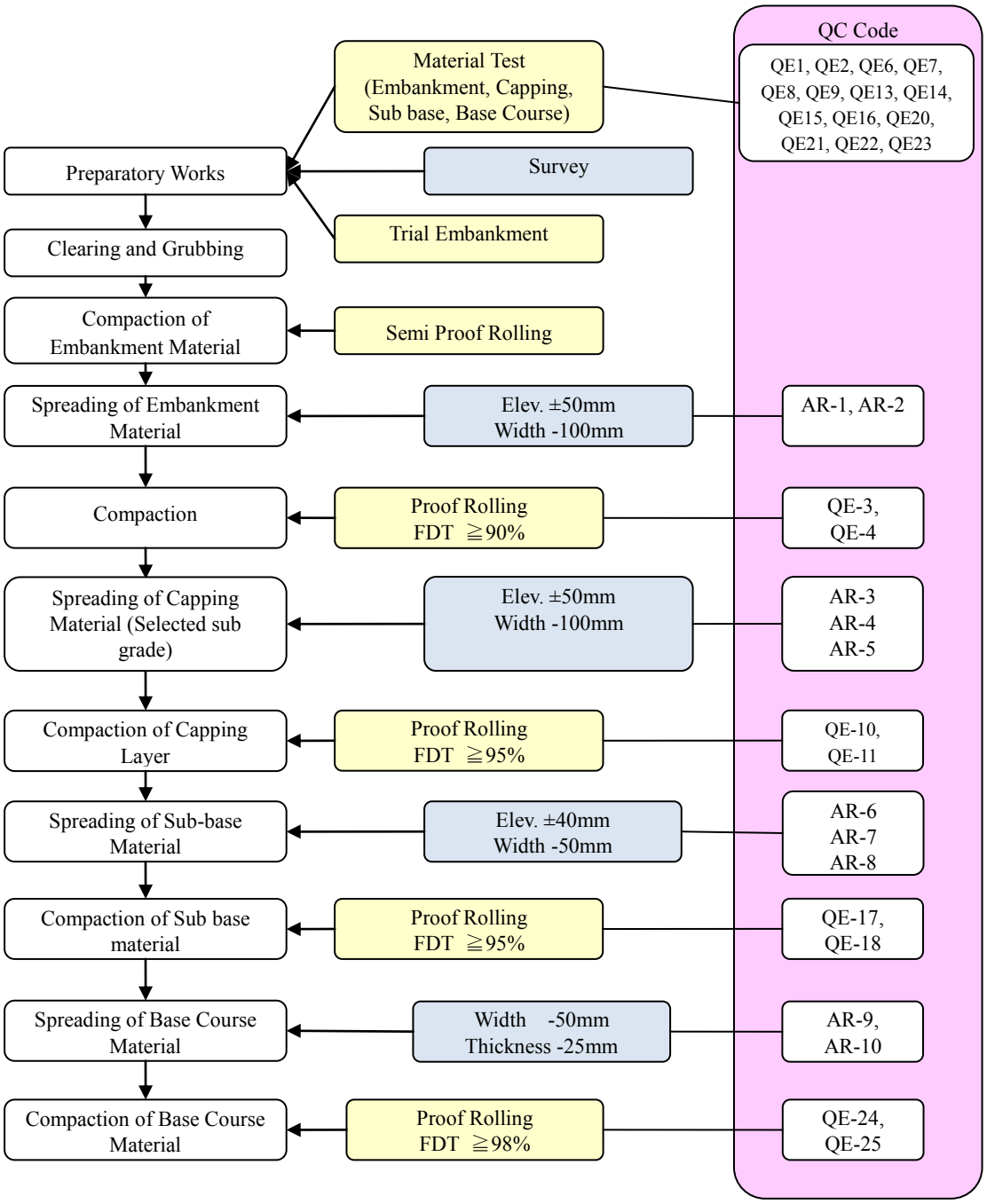


Figure 11-3 Flow of Earthwork at Embankment Section

(1) Survey (Preparatory Works)

Prior to the commencement of the work, Party B shall confirm the sections to be executed, the alignment and the elevation with Party C by the proper survey instruments. Party B shall execute the work according to the confirmed sections, alignment and elevation.

(2) Trial Embankment (Preparatory Works)

Before commencing the formation of embankments, Party B shall submit in writing to Party C for approval on his proposals for the compaction of each type of fill material to be used in the works. The proposals shall include the relationship between the types of compaction equipment, the number of passes required and the method of adjusting moisture content. Party B shall carry out full scale compaction trials on areas of not less than 10 m wide and 50 m long as required by Party C and using his proposed procedures or such amendments thereto as may be found necessary to satisfy Party C so that all the specified requirements regarding compaction can be consistently achieved. Compaction trials with the main types of fill material to be used in the works shall be completed before work with the corresponding materials will be allowed to commence.

Throughout the periods when compaction of earthwork is in progress, Party B shall adhere to the compaction procedures found from compaction trials for each type of material being compacted, each type of compaction equipment employed and each degree of compaction specified.

(3) Observation of the Cut Section

After the removal of existing paving material, Party B shall confirm the condition of the sub-grade after being graded as designated in the guideline and compacted. If the defect portions are found, Party B shall take the necessary actions to satisfy the following inspections by Party C.

(4) Proof Rolling

The procedure of all proof rolling tests indicated in the flow shown above shall follow the clause 2.6.3.7 in the Construction Specification. However, semi proof rolling in the flow shown above does not have to follow the specifications. Dump track without loads is enough to find the unsuitable portions for semi proof rolling. The unsuitable portions shall be replaced by suitable material. A sample of check sheet for proof rolling is attached in Appendix C.

11.1.2 Quality Control Chart and Forms

The quality control work shall be done according to Table 11-1 (Q-1) Quality Control Chart for Earth Work and be recorded. Especially a test method and test sheet of sand cone test as field density test which shall be conducted in the site is attached in Appendix B. Quality Control Sheet for Earth Works is attached in Appendix E.

11.1.3 As-built Measuring Control Chart and Forms

The as-built measuring control shall be done according to Table 11-2 (A-1) As-built Measuring Control Chart for Earth / Road Work and be recorded in the forms attached. Necessary forms shall be prepared based on the sample forms as attached in Appendix

A.

The thickness control item AR-4, AR-7, AR-9, AR-11 in Table 11-2 shall be checked by actual excavation or coring.

As-built record form shall be used day by day.

The final measured records of as-built record form in Appendix A shall be inside tolerance. In case the measured records deviated the tolerance, the structure whose records deviated the tolerance shall be rectified in compliance with the tolerance.

11.1.4 Documentation for Improvement: Check List

Check lists for Earthwork at Reconstruction Section and Earthwork at Embankment Section are enclosed in Appendix H.

Table 11-1 (Q-1) Quality Control Chart for Earth Work

Q-1 Quality Control Chart for Earth Works

Description		Specs	No.	Test Method	Standard	Tolerance	Frequency	Record method	Custody of Records	Witness
Embankment	Mat'l	CCMS Appendix 1	QE-1	Compaction Test	AASHTO T180	MDD, OWC	Per sourse, whenever any irregularity is observed	St'd Form	Party B & C	Party C
			QE-2	Modified CBR	AASHTO T193	≧ 2.0%		St'd Form	Party B & C	Party C
	Execution	CS 2.6.3.3	QE-3	Field Density Test	AASHTO T180	Dry Density ≧ 90% of MDD	5times / 2,000m2,	St'd Form	Party B & C	Party C
		CS 2.6.3.7	QE-4	Proof Rolling		By observation	Entire area on the embankment surface	Check Sheet	Party B & C	Party C
		CS 2.6.3.2	QE-5	Compaction thickness		≦ 20cm	All embankment works	Check Sheet	Party B & C	Party C
Capping Layor (Selected sub-grade)	Material	CCMS Appendix 1	QE-6	Compaction Test	AASHTO T180	MDD, OWC	Per sourse, whenever any irregularity is observed	St'd Form	Party B & C	Party C
			QE-7	Modified CBR	AASHTO T193	≧ 15%以上		St'd Form	Party B & C	Party C
			QE-8	Seive Analysis	AASHTO T27	74μMass Percent Passing : 10%-30%		St'd Form	Party B & C	Party C
			QE-9	LL･PL･PI	AASHTO T89, 90	LL ≦ 40%, PI ≦ 20%		St'd Form	Party B & C	Party C
	Execution	CCMS Appendix 1	QE-10	Field Density Test	AASHTO T180	Dry Density ≧ 95% of MDD	5times / 2,000m2	St'd Form	Party B & C	Party C
		CS 3.1.3.5	QE-11	Proof Rolling		Observation	Entire area on the embankment surface	Check Sheet	Party B & C	Party C
		CCMS Appendix 1	QE-12	Compaction thickness		≦ 20cm	All embankment works	Check Sheet	Party B & C	Party C
Sub Base	Material	CCMS Appendix 1	QE-13	Compaction Test			Per sourse, whenever any irregularity is observed	St'd Form	Party B & C	Party C
			QE-14	Modified CBR	AASHTO T193	≧ 30%以上		St'd Form	Party B & C	Party C
			QE-15	Sieve Analysis	AASHTO T27	Within the ranges spesified in the table		St'd Form	Party B & C	Party C
			QE-16	LL･PL･PI	AASHTO T89, 90	LL ≦ 35%, PI ≦ 20%		St'd Form	Party B & C	Party C
	Execution	CCMS Appendix 1	QE-17	Field Density Test	AASHTO T180	Dry Density ≧ 95% of MDD	5 times / 2,000m2	St'd Form	Party B & C	Party C
		CS 3.1.3.5	QE-18	Proof Rolling		Observation	Entire area on the embankment surface	Check Sheet	Party B & C	Party C
		CCMS Appendix 1	QE-19	Compaction thickness		≦ 20cm	All embankment works	Check Sheet	Party B & C	Party C
Base Course	Material	CCMS Appendix 1	QE-20	Compaction Test			Per sourse, whenever any irregularity is observed	St'd Form	Party B & C	Party C
			QE-21	Modified CBR	AASHTO T193	≧ 80%以上		St'd Form	Party B & C	Party C
			QE-22	Sieve Analysis	AASHTO T27	Within the ranges spesified in the table		St'd Form	Party B & C	Party C
			QE-23	LL･PL･PI	AASHTO T89, 90	LL ≦ 25%, PI ≦ 6%		St'd Form	Party B & C	Party C
	Execution	CCMS Appendix 1	QE-24	Field Density Test	AASHTO T180	Dry Density ≧ 98% of MDD	5 times / 2,000m2	St'd Form	Party B & C	Party C
		CS 3.3.3.7	QE-25	Proof Rolling		Observation	Entire area on the embankment surface	Check Sheet	Party B & C	Party C
		CCMS Appendix 1	QE-26	Compaction thickness		≦ 20cm	All embankment works	Check Sheet	Party B & C	Party C

Note : CCMS (Compact Contruction Materials Specification)

Table 11-2 (A-1) As-built Measuring Control Chart for Earth / Road Work

Description	Specs	No.	Measured Items	Method	Tolerance	Frequency	Record method	Custody of Records	Witness
Embankment/ Sub-grade	Civil Works Handbook/Japan	AR-1	Elevation	Level Instrument	± 5.0cm	every 40 m	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AR-2	Width	Measuring Tape	-10.0 cm	every 40 m	St'd Form	Party B & C	Party C
Capping Layor (Selected sub-grade)	Civil Works Handbook/Japan	AR-3	Elevation	Level Instrument	± 5.0cm	every 40 m	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AR-4	Thickness	Measuring Tape	-4.5 cm	every 200 m	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AR-5	Width	Measuring Tape	-5.0 cm	every 80 m	St'd Form	Party B & C	Party C
Sub Base	Civil Works Handbook/Japan	AR-6	Elevation	Level Instrument	± 4.0cm	every 40 m	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AR-7	Thickness	Measuring Tape	-4.5 cm	every 200 m	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AR-8	Width	Measuring Tape	-5.0 cm	every 80 m	St'd Form	Party B & C	Party C
Base Course	Civil Works Handbook/Japan	AR-9	Thickness	Measuring Tape	-2.5 cm	every 200 m	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AR-10	Width	Measuring Tape	-5.0 cm	every 80 m	St'd Form	Party B & C	Party C
Asphalt Concrete	Civil Works Handbook/Japan	AR-11	Thickness	Measuring Tape	-0.7 cm	every 1000 m2	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AR-12	Width	Measuring Tape	-2.5 cm	every 80 m	St'd Form	Party B & C	Party C

11.2 Pavement Works

11.2.1 Flow of the Works

The flows for asphalt concrete / DBST / SBST works have been prepared shown in Figure 11-4 Flow of Asphalt Concrete Works, Figure 11-5 Flow of DBST Works, Figure 11-6 Flow of SBST Works respectively. The yellow and blue square are quality control activities and as-built measuring control activities respectively. The squares on the right side are the identification code of quality control and as-built measuring control items.

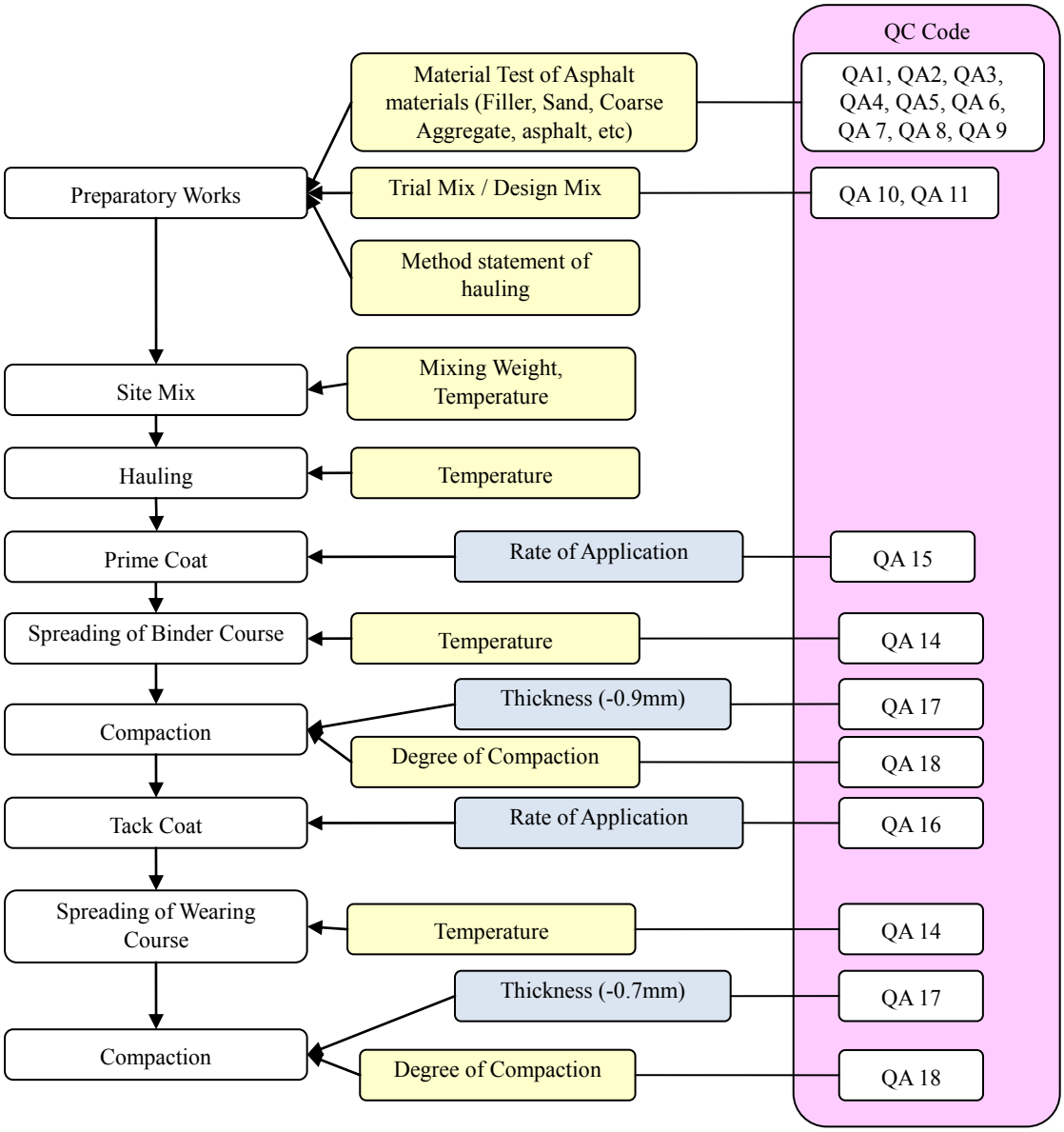


Figure 11-4 Flow of Asphalt Concrete Works

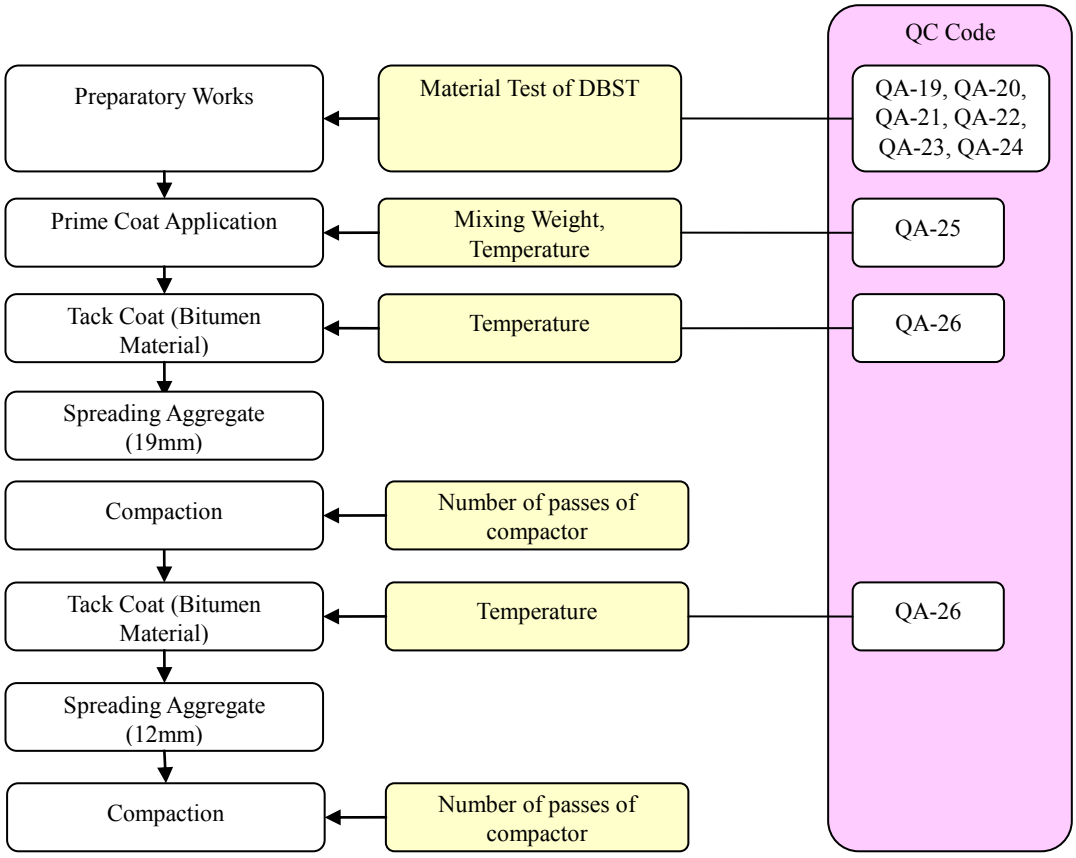


Figure 11-5 Flow of DBST Works

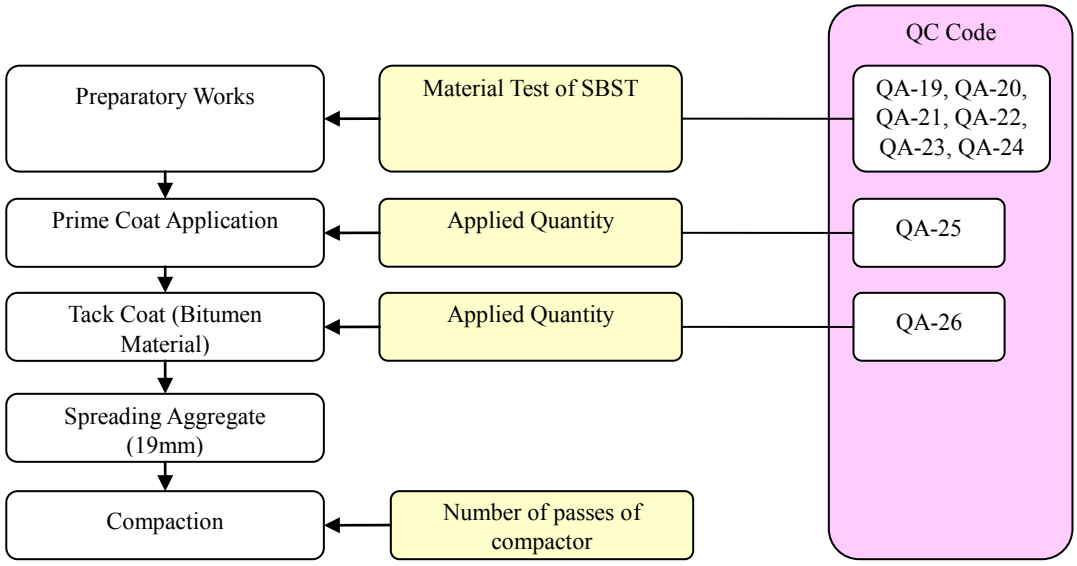


Figure 11-6 Flow of SBST Works

11.2.2 Quality Control Chart and Forms

The quality control work shall be done according to the Table 11-3 (Q-2) Quality Control Chart for Pavement Works

. In case the asphalt concrete is procured from a asphalt batching plant, Party B have to secure the results of quality control records for the materials and trial mix for design proportion from manufacturers.

A sample of check sheet for application of bitumen material is attached in Appendix D.

11.2.3 As-built Measuring Control Chart and Forms

The as-built measuring control shall be done according to Table 11-2 (A-1) As-built Measuring Control Chart for Earth / Road Work. Necessary forms shall be prepared based on the sample forms as attached in Appendix A.

11.2.4 Documentation for Improvement: Check List

Check lists for Asphalt Concrete / DBST / SBST Works are enclosed in Appendix H.

Table 11-3 (Q-2) Quality Control Chart for Pavement Works

Description				Specs	No.	Test Method	Standard	Tolerance	Frequency	Record method	Custody of Records	Witness
Asphalt Concrete	Responsibility of Asphalt Plant	Material	Filler	CS 4.4.3.3	QA-1	Ontario Vacuum Immersion Marshal Test	AASHTO M17	≦ 75%	Per source, irregularity is observed	St'd Form	Party B & C	Party C
			Fine Aggregate	CS 4.4.3.2	QA-2	Sieve Analysis / Grading	AASHTO M-29	≦ 4.75mm	Per source, irregularity is observed	St'd Form	Party B & C	Party C
				CS 4.4.3.2	QA-3	Sand Equivalent Test	ASSHTO T-176	≧ 50	Per source, irregularity is observed	St'd Form	Party B & C	Party C
			Coarse Aggregate	CS 4.4.3.1	QA-4	Fractured Faces	AASHTO M147-6S	≧75% (2 fractured faces) ≧90% (1 fractured faces)	Per source, irregularity is observed	Check List	Party B & C	Party C
				CS 4.4.3.2	QA-5	Abrasion	AASHTO T96	≦ 40%	Per source, irregularity is observed	St'd Form	Party B & C	Party C
				CS 4.5.2.1	QA-6	Grading	AASHTO T27	CS Table 4.5.1	Per source, irregularity is observed	St'd Form	Party B & C	Party C
			Asphalt	CCMP Appendix 1 5.2	QA-7	Manufacture's Certificate Shown in Clause 5.2	Shown in Clause 5.2	Shown in Clause 5.2	Per source, irregularity is observed	St'd Form	Party B & C	Party C
			Prime Coat	CCMP Appendix 1 5.2	QA-8	Shown in Clause 5.2	Shown in Clause 5.2	Shown in Clause 5.2	Per source, irregularity is observed	St'd Form	Party B & C	Party C
			Tack Coat	CCMP Appendix 1 5.2	QA-9	Shown in Clause 5.2	Shown in Clause 5.2	Shown in Clause 5.2	Per source, irregularity is observed	St'd Form	Party B & C	Party C
		Plant	Trial Mix	CCMP Appendix 1 5.2	QA-10	Marshal / Stability	AASHTO T-245		Per source, irregularity is observed	St'd Form	Party B & C	Party C
					QA-11	Marshal / Flow	AASHTO T-245		Per source, irregularity is observed	St'd Form	Party B & C	Party C
					QA-12	Marshal / Air Void	AASHTO T-245		Per source, irregularity is observed	St'd Form	Party B & C	Party C
			Hot Bin		QA-13	Grading			Per source, irregularity is observed	St'd Form	Party B & C	Party C
	Party C	Execution	Hot Mix	Manual for Asphalt Pavement / Japan	QA-14	Spreading Temperature	Japan Road Association	≧ 110℃ On arrival	1 time / 1000m2	Stud Form	Party B & C	Party C
			Prime Coat	Manual for Asphalt Pavement / Japan	QA-15	Application volume	Japan Road Association	≧ 1.0 lit/m2	1 time / 1000m2	Check List	Party B & C	Party C
			Tack	Manual for Asphalt Pavement / Japan	QA-16	Application volume	Japan Road Association	≧ 0.4 lit./m2	1 time / 1000m2	Check List	Party B & C	Party C
			Coring	Manual for Asphalt Pavement / Japan	QA-17	Thickness	Japan Road Association	-0.7 mm : Surface Course -0.9 mm : Binder Course	1 time / 1000m2	St'd Form	Party B & C	Party C
			Coring	Manual for Asphalt Pavement / Japan	QA-18	Degree of compaction	Japan Road Association	≧ 98%	1 time / 1000m2	St'd Form	Party B & C	Party C
SBST or DBST	Party C	Material	Aggregate	CCMP Appendix 1 5.1	QA-19	Sieve Analysis / Grading	AASHTO T-27	Table shown in Appendix 1 5.1	Per source, irregularity is observed	St'd Form	Party B & C	Party C
				CCMP Appendix 1 5.1	QA-20	Abrasion	AASHTO T-96	≦ 40%	Per source, irregularity is observed	St'd Form	Party B & C	Party C
				CS 4.4.3.1	QA-21	Fractured Faces	AASHTO M147-6S	≧75% (2 fractured faces) ≧90% (1 fractured faces)	Per source, irregularity is observed	Check List	Party B & C	Party C
				CCMP Appendix 1 5.1	QA-22	Flakiness Index Test	BS-82	≦ 33%	Per sourse, irregularity is observed	Check List	Party B & C	Party C
			Prime Coat	CCMP Appendix 1 5.2	QA-23	Shown in Clause 5.2	Shown in Clause 5.2	Shown in Clause 5.2	Per source, irregularity is observed	St'd Form	Party B & C	Party C
			Tack Coat / Binding material	CCMP Appendix 1 5.2	QA-24	Shown in Clause 5.2	Shown in Clause 5.2	Shown in Clause 5.2	Per source, irregularity is observed	St'd Form	Party B & C	Party C
		Execution	Prime Coat	Manual for Asphalt Pavement / Japan	QA-25	Application volume	Japan Road Association	≧ 1.0 lit/m2	1 time / 1000m2	Check List	Party B & C	Party C
			Tack	None	QA-26	Application volume	None	≧ 1.8 lit./m2 DBST 1st layer ≧ 1.2 lit./m2 DBST 2nd layer	1 time / 1000m2	Check List	Party B & C	Party C
			Tack	None	QA-27	Application volume	None	≧ 1.8 lit./m2 SBST	1 time / 1000m2	Check List	Party B & C	Party C

11.3 Piling Works

11.3.1 Flow of the Works

Bridge works consist of piling works, structural excavation and backfilling, sub-structure works and superstructure works. Since quality control for excavation and backfilling can be carried out in accordance with the requirements stipulated in clause 11.1 Earth Works and that for structure works with those in clause 11.4 Concrete Works, this clause describes for piling works.

The yellow and blue square are quality control activities and as-built measuring control activities respectively. The squares on the right side are the identification code of quality control and as-built measuring control items.

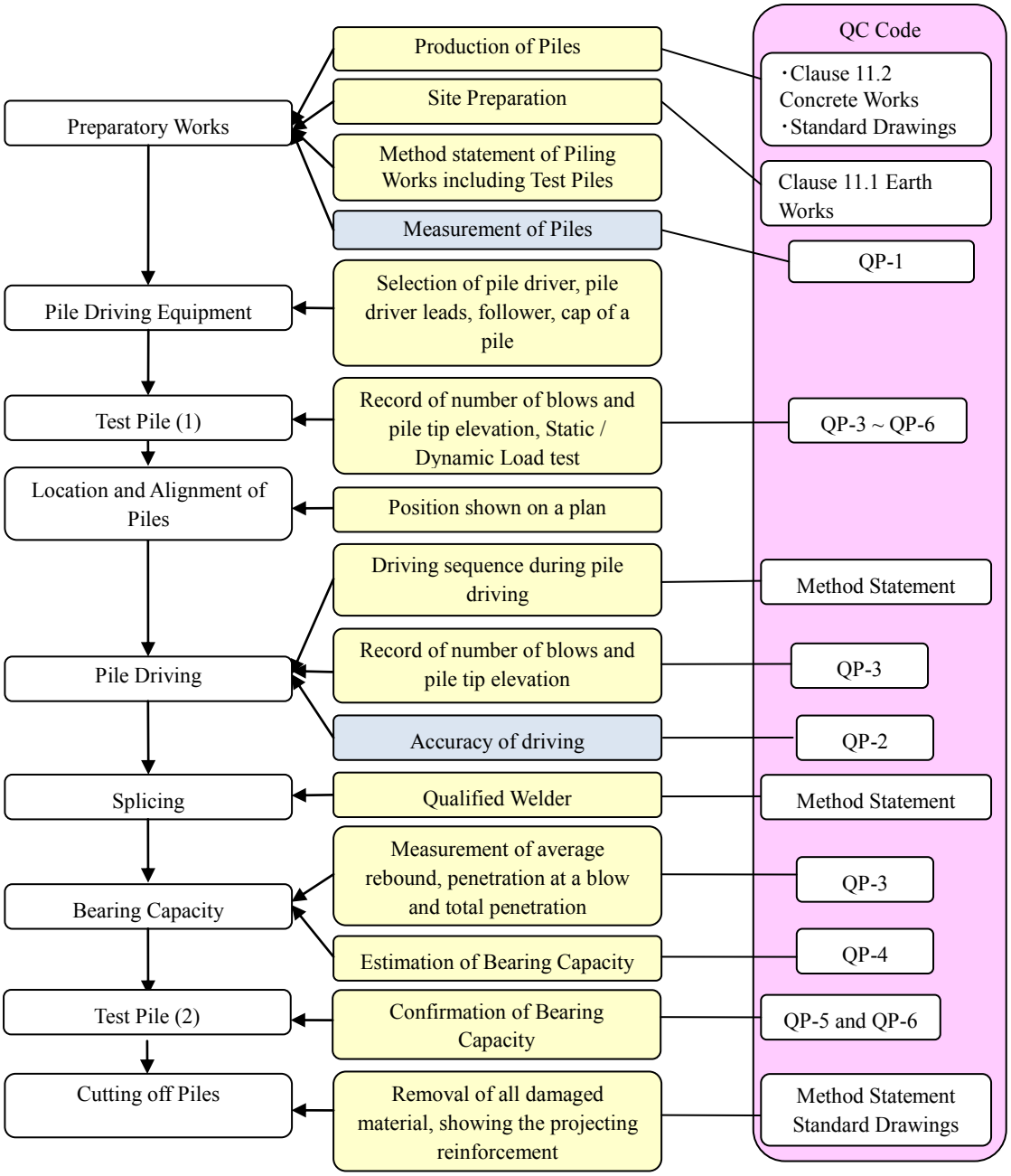


Figure 11-7 Flow of Piling Works

(1) Piling Works

Piling works shall be witnessed by Party C, when piling is about complete. A record of piling works shall be kept by Party B and submitted to Party C within 24 hours. The record shall contain the following information.

- Date of Driving
- Date of Casting and Identification Number
- Location of Pile
- Length of Pile and Cross Section
- Ground Level before Driving
- Estimated Tip Elevation (as shown on the drawings)
- Actual Tip Elevation after Driving
- Verticality of Piles
- Number of Blows for Each 500 mm Penetration from Start of Driving
- Number of Blows for each 100 mm Penetration in last 1.0 m
- Hammer Type, Weight and Rated Energy
- Calculation of Bearing Capacity using the Formula agreed with Party C
- Details of Condition of Pile Head
- Others

(2) Test Piles

Test piles shall be carried out as specified in the drawings and/or directed by Party C. Test shall be either static load test or dynamic load test, which shall be witnessed by Party C. The record shall be kept and submitted to Party C for approval as agreed.

Test Piles shall be conducted for the following reasons.

- To check the bearing capacity of driven test piles by Formula mentioned in clause 11.3.1 (7), Static Load Test or Dynamic Load Test mentioned in Clause 5.3.3.3 of the Construction Specification.
- To determine the pile length or to check the designed pile length.
- To make driving criteria based on driving records of Test Pile driving and bearing capacity.
- To confirm the Size of Driving Hammer.
- To confirm the capacity of driven working piles.

(3) Typical Execution Flow of Driving Piles

Typical execution flow of driving piles is shown in the Figure 11-8 Typical Execution Flowchart of Driving Piles.

.

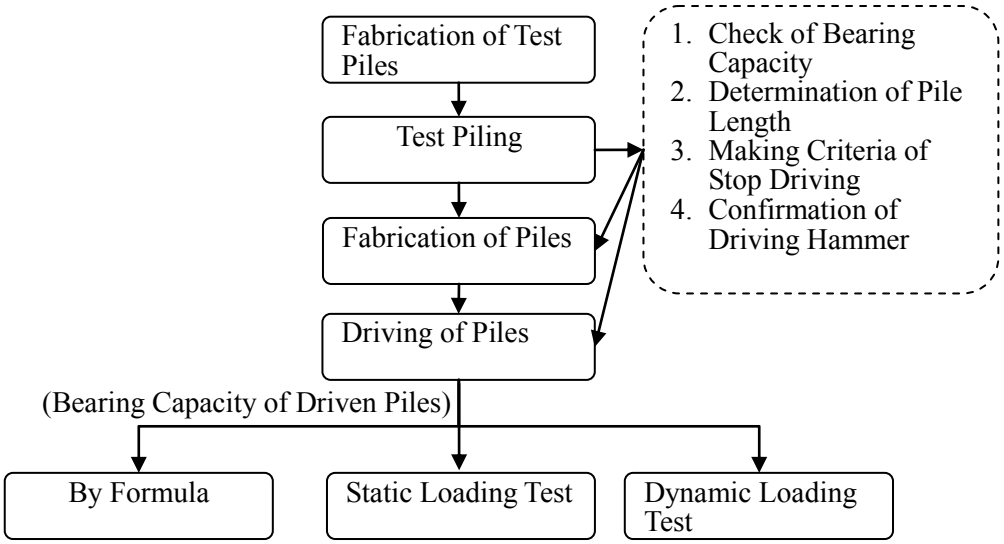


Figure 11-8 Typical Execution Flowchart of Driving Piles

(4) Selection of Hammer

The total number of the blows is limited to limit the vibration of piles and to minimize the deterioration of the quality of piles. The limit number is shown in the Table 11-4.

Table 11-4 Limit of Number of Blows

Type of pile	Total number	Driving last 10m
RC Pile	1000	500
SPP (Steel Tube Pile)	3000	1500

The selection for the hammer can be referred to the following Figure 11-9 Selection of Size of Ram.

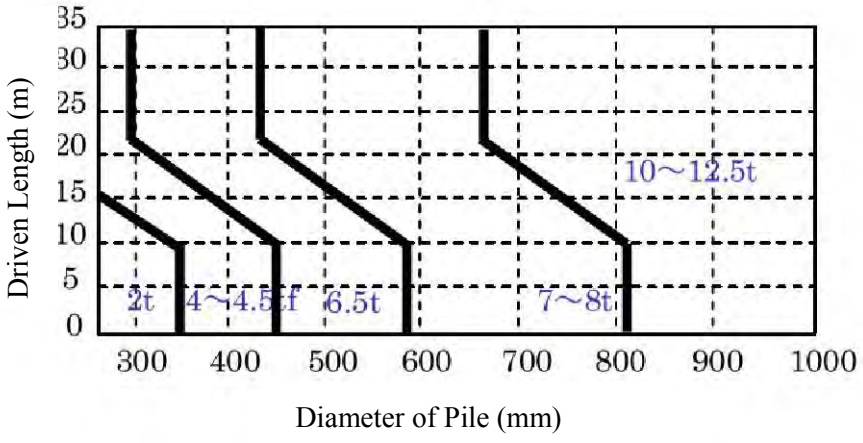


Figure 11-9 Selection of Size of Ram

(5) Criteria of Stop driving

Criteria of stop driving shall be determined based on the results of bearing capacity and driving records of test piles. Sample of criteria is shown in the following Table 11-5 Sample of Criteria of Stop Driving.

Table 11-5 Sample of Criteria of Stop Driving

Type of Bearing Strata	Criteria
Normal Strata	・Penetration per blow last 1m shall be is 3～5mm ・Penetration per blow shall be less than 2mm
Hard Strata	・Penetration into hard strata shall be more than 1～2 times of side or diameter of piles.
Rock	・Penetration of weathered rock. ・Penetration per blow shall be less than 1mm

(6) Driving Record

The preparation and recording of driving piles shall be done properly. The procedures are shown below.

<Setup of the Driving>

- To mark the measuring scale on the piles as shown in the Figure 11-10 Arrangement of Piles and Instrument.
- To set the level instruments to monitor the penetration as shown in the same Figure 11-10.

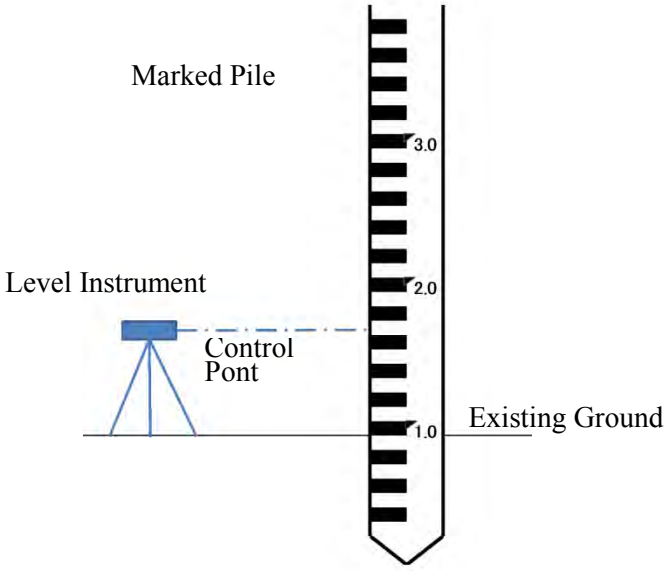


Figure 11-10 Arrangement of Piles and Instrument

<Record of Driving>

- The penetration and rebound records shall be obtained before stop driving as

shown in the Figure 11-11 Method of Driving Record.

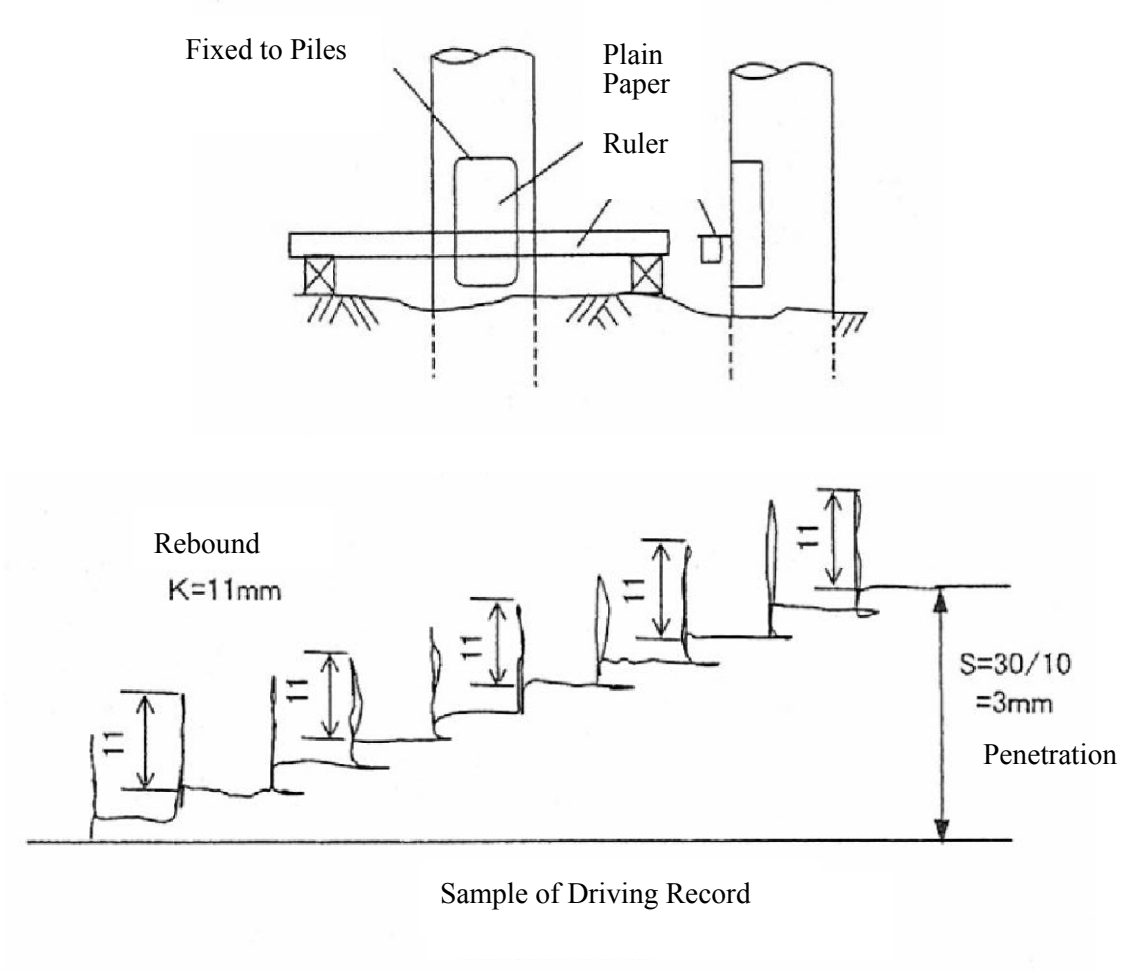


Figure 11-11 Method of Driving Record

- The driving record shall be kept properly. The Sample of driving record form is shown in the Figure 11-12.

No. Date:

Budget Year	Province
Chapter	Bridge Number
Name of Party B	Name of Party C

Pile Type	SPP	Driving Started		Pile Elev.	Top	Toe	Hammer Data	Diesel Hammer
Total Pile Length	40 m	Driving finished		Design Elev.	6.892m	-28.108m	Model	Kobelco
Design Bearing Cap. 100tf.		Control Elevation (Level)	6.792m	Actual Elev.	8.942m	-31.058m	Type/Length	Diesel Cylinder
Design Bearing Cap. 981KN				NGL.	6.506m	6.506m	Capacity/weight	3.5t (Ram Wt)
				Verticality	1/75			

Reading of Piles	No. of Blows	Total No. of Blows	Pile Toe Elevation	Penetration per Blow(mm)	Bearing Capacity KN
21.50					
22.00	45	45	-15.208	11.111	789
22.50	37	82	-15.708	13.514	709
23.00	35	117	-16.208	14.286	686
23.50	36	153	-16.708	13.889	697
24.00	34	187	-17.208	14.706	674
24.50	34	221	-17.708	14.706	674
25.00	34	255	-18.208	14.706	674
25.50	34	289	-18.708	14.706	674
26.00	33	322	-19.208	15.152	662
26.50	31	353	-19.708	16.129	638
27.00	33	386	-20.208	15.152	662
27.50	43	429	-20.708	11.628	770
28.00	54	483	-21.208	9.259	865
28.50	50	533	-21.708	10.000	833
29.00	47	580	-22.208	10.638	807
29.50	38	618	-22.708	13.158	719
30.00	34	652	-23.208	14.706	674
30.50	33	685	-23.708	15.152	662
31.00	34	719	-24.208	14.706	674
31.50	33	752	-24.708	15.152	662
32.00	30	782	-25.208	16.667	625
32.50	32	814	-25.708	15.625	650
33.00	42	856	-26.208	11.905	761
33.50	46	902	-26.708	10.870	798
34.00	213	1,115	-27.208	2.347	1,349
34.50	195	1,310	-27.708	2.564	1,326
35.00	160	1,470	-28.208	3.125	1,269
35.50	123	1,593	-28.708	4.065	1,184
36.00	101	1,694	-29.208	4.950	1,114
36.50	95	1,789	-29.708	5.263	1,092
37.00	164	1,953	-30.208	3.049	1,277
37.50	148	2,101	-30.708	3.378	1,245
37.85	166	2,267	-31.058	2.108	1,829

Allowable Bearing Caoacity
Modified Hiley's Fomula

$$Ra = 1/3\ Ru$$

$$= 1/3 \left[\frac{2WH(W)}{(S+K)x(W+Wp)} \right]$$

$$= 1/3 \left[\frac{49490}{88.40344} \right]$$

$$= 186.61\ tf$$

Rs = 1,829 KN > 981 KN OK

Where

Ra	=	Allowable Bearing Capacity		
Ru	=	Ultimate Bearing Capacity		
Wp	=	Weight of Pile, tf	=	6.204
W	=	Weight of Hammer, tf	=	3.50
H	=	Drop Height, mm	=	2,020
S	=	Penetration per Blow, mm	=	2.11
K	=	Rebound, mm	=	7

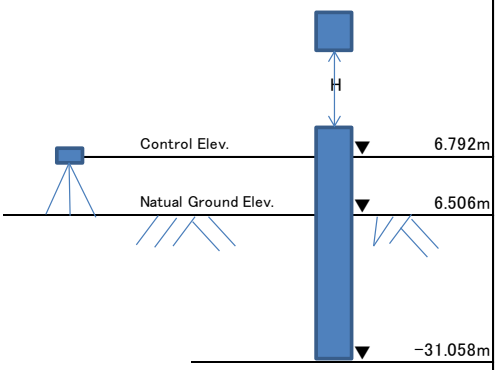


Figure 11-12 Sample of Driving Record Form

(7) Calculation of Bearing Capacity with Driving Records

There are several formulas to calculate the bearing capacity. In this clause, two typical formulas are introduced. One is Modified Hiley's Formula which has been used for civil work foundation in many countries. The other is Simple Estimate Formula has

been used for the building works in Japan and piling works in Cambodia. Among these two formulas, Modified Hiley's Formula is recommended for force account project since this formula is very reliable as the rebound value has been considered.

<Modified Hiley's Formula>

The bearing values for concrete and steel pile will be determined by the following formulas:

$$R_u = \frac{2WH \times (W)}{(S+K) \times (W+Wp)} \qquad \text{Diesel Hammer}$$

$$Ru = \frac{WH \times (W)}{(S+K) \times (W+Wp)} \qquad \text{Drop Hammer}$$

$$Ra = \frac{Ru}{Fs}$$

Where:

Ru	=	ultimate capacity of piles (KN)
Ra	=	capacity of pile (KN)
W	=	Weight of ram or hammer (KN)
H	=	height of fall of ram (mm)
Wp	=	weight of pile (KN)
S	=	average penetration for the last ten blows (mm)
K	=	Rebound (mm)
FS	=	factor of safety (3)

e.g.

W	=	35 (KN)
H	=	2000 (mm)
Wp	=	60 (KN)
S	=	2.0 (mm)
K	=	7.0 (mm)
FS	=	3

$$R_u = \frac{2WH \times (W)}{(S+K) \times (W+Wp)}$$

$$= 4{,}900{,}000/855$$

$$= 5{,}731 \text{ KN}$$

$$Ra = Ru/3 = 1{,}910 \text{ KN}$$

<Simple Estimate Formula>

The bearing values for concrete and steel pile will be determined by the following formula:

$$Ru = \frac{2WH}{(5S+0.1)} \quad \cdots\cdots \text{Diesel Hammer(Single Action)}$$

$$Ru = \frac{WH}{(5S+0.1)} \quad \cdots\cdots \text{Drop Hammer}$$

Where:

Ra	=	capacity of pile (KN)
W	=	Weight of ram or hammer (KN)
H	=	height of fall of ram (m)
S	=	average penetration for the last ten blows (m)

e.g.

W	=	35 (KN)
H	=	2 (m)
S	=	0.003 (m)

$$Ra = \frac{2WH}{(5S+0.1)}$$

$$=140/0.115=1{,}217 \text{ KN}$$

11.3.2 Quality Control Chart and Forms

The quality control work for concrete works shall be done according to the Table 11-7 (Q-4) Quality Control Chart for Concrete Works. In case the piles are produced at a factory, Party B has to secure the results of quality control records for the materials and trial mix for design proportion from a factory. A sample of quality control sheet for concrete work is attached in Appendix G.

The quality control for piling works shall be done according to Table 11-6 (Q-4) Quality Control Chart for Piling Works. Quality control sheets for pilling works are attached in Appendix F.

11.3.3 As-built Measuring Control Chart and Forms

Eccentricity of piles in whole footing shall be measured and confirmed as per allowable range. The result of the eccentricity shall be submitted to Party C. Quality

control sheets for eccentricity of piles are attached in Appendix F.

11.3.4 Documentation for Improvement: Check List

Check lists for Piling Work are enclosed in Appendix H.

Table 11-6 (Q-4) Quality Control Chart for Piling Works

Description			Specs	No.	Test Method	Standard	Tolerance	Frequency	Record method	Custody of Records	Witness
Piling Work	Execution	Precast RC Pile	CS 5.3.2.1	QP-1	Measurement of the distance from the line stretched from tip to butt to any surface		≦1/1000 of the length	Every pile	St'd Form	Party B & C	Party C
		Driving Piles	CS 5.3.3.2	QP-2	Measurement of positions of pile heads comparing the		≦80mm	Every pile	St'd Form	Party B & C	Party C
					Measurement of the center of gravity of row comparing		≦50mm	Every row of piles	St'd Form	Party B & C	Party C
			CS 5.3.3.3	QP-3	Recording driving			Every pile	St'd Form	Party B & C	Party C
		Bearing Capacity	CS 5.3.3.3	QP-4	Driving formula	JRA 17.10	≦Pile Load caluculated in the design, Safety factor of 3	Every pile		Party B & C	
				QP-5	Static Load Test		≦Pile Load caluculated in the design, Safety factor of 3	Test Pile		Party B & C	Party C
				QP-6	Dynamic Load Test	ASTM D4945	≦Pile Load caluculated in the design, Safety factor of 3	Test Pile		Party B & C	Party C

Note : CS (Construction Specification)

11.4 Concrete Works

11.4.1 Flow of the Works

The flows of Concrete Works has been prepared and shown in the Figure 11-13 Flow of Concrete Works. The yellow and blue square are quality control activities and as-built measuring control activities respectively. The squares on the right side are the identification code of as-built measuring quality control and as-built measuring control items.

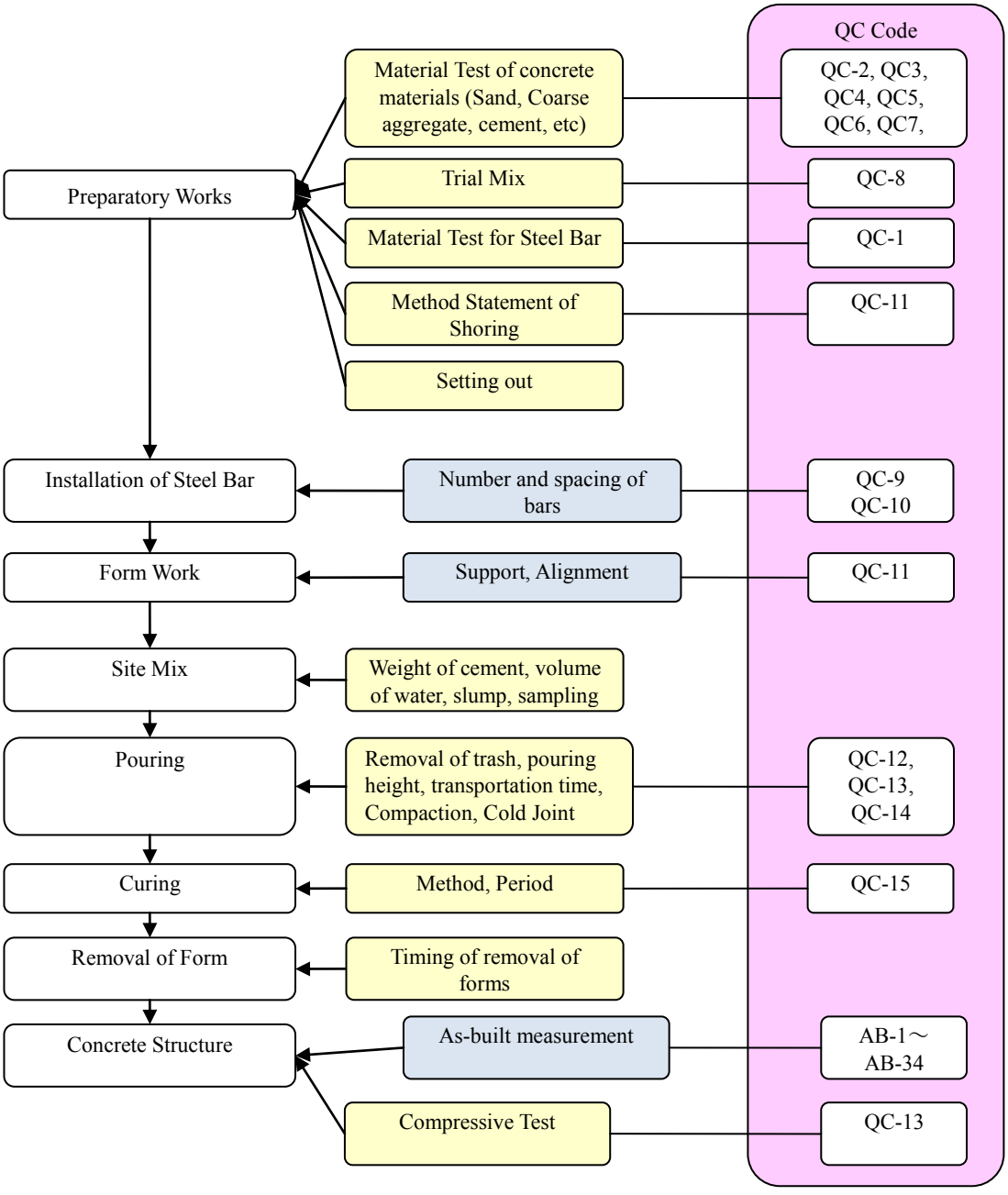


Figure 11-13 Flow of Concrete Works

11.4.2 Quality Control Chart and Forms

The quality control work shall be done according to Table 11-7 (Q-4) Quality Control Chart for Concrete Works. In case the concrete is procured from a concrete batching plant, Party B has to secure the results of quality control records for the materials and trial mix for design proportion from manufacturers. A sample of daily quality control sheet for concrete work is attached in Appendix G.

11.4.3 As-built Measuring Control Chart and Forms

Please refer to its forms. The as-built measuring control shall be done according to Table 11-8 (A-2) As-Built Control Chart for Concrete Works. Necessary forms shall be prepared based on the sample forms as attached in Appendix A.

11.4.4 Documentation for Improvement: Check List

Check list for Concrete Work is enclosed in Appendix H.

Table 11-7 (Q-4) Quality Control Chart for Concrete Works

Description			Specs	No.	Test Method	Standard	Tolerance	Frequency	Record method	Custody of Records	Witness
Concrete	Material	Deformed Bar	CCMS Appendix 2	QC-1	Mill Certificate	AASHTO T-68	Grade 400 (≧420Mpa)	Per sourse, whenever any irregularity is observed	Photocopy	Party B & C	Party C
		Fine Aggregate	CCMS Appendix 3	QC-2	Grading	AASHTO 1A	Within the ranges		St'd Form	Party B & C	Party C
		Course Aggregate	CCMS Appendix 3	QC-3	Grading	AASHTO 1A	Within the ranges		St'd Form	Party B & C	Party C
			CCMS Appendix 3	QC-4	Abrasion	AASHTO T-96	≦35% at 500 revolutions		St'd Form	Party B & C	Party C
			CCMS Appendix 3	QC-5	Flakiness Index	BS-82	≦33%		St'd Form	Party B & C	Party C
		Water	CCMS Appendix 3	QC-6	Taste of Water		Potable		Check List	Party B & C	Party C
		Cement	CCMS Appendx 3	QC-7	Manufacture's Certificate	AASHTO T-131	Portland Cement Type 1		Photocopy	Party B & C	Party C
	Execution	Mix Proportion	CS 5.1.2.5	QC-8	Trial Mix		shown in the CS 5.1.2.5		St'd Form	Party B & C	Party C
		Re-bar Arrangement	CS 5.2.3.3	QC-9	Placing, Supporting and Fastening			All staructures	Check List	Party B & C	Party C
			CS 5.2.3.4	QC-10	Splicing		40D	All staructures	Check List	Party B & C	Party C
		Forms	CS 4.1.4.5	QC-11	Shape, Strength, rigidity etc	Specified in CS	N/A	Before pourings	Check List	Party B & C	Party C
		Slump	CS 5.1.2.2	QC-12	Slump cone	AASHTO T-119	50-100	Every Truck	Check List	Party B & C	Party C
		Conrete Strength	CS 5.1.2.4	QC-13	Compressive Test	AASHTO T-22,23	≧Requirement	First batch & Every 25 m3	Check List	Party B & C	Party C
		Compaction	CS 5.1.4.7	QC-14	Observation	Specified in CS	N/A	All pourings	Check List	Party B & C	Party C
		Curing	CS 5.1.4.8	QC-15	Observation	Specified in CS	N/A	All pourings	Check List	Party B & C	Party C

Table 11-8 (A-2) As-Built Control Chart for Concrete Works

Description	Specs	No.	Measured Items	Method	Tolerance	Frequency	Record method	Custody of Records	Witness
Abutment	Civil Works Handbook/Japan	AB-1	Elevation of bearing seat	Level Instrument	± 20 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-2	Thickness of footing	Measuring Tape	- 20 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-3	Width of parapet wall	Measuring Tape	- 10 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-4	Width of bearing seat	Measuring Tape	- 10 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-5	Width of footing	Measuring Tape	-50 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-6	Height of abutment	Measuring Tape	-50 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-7	Height of parapet wall	Measuring Tape	- 30 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-8	Length of Parapet Wall	Measuring Tape	-50 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-9	Length of bearing seat	Measuring Tape	-50 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-10	Distance of parapet wall	Measuring Tape	± 30 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-11	Distance of bearing seat (Span Length)	Measuring Tape	± 50 mm	every structure	St'd Form	Party B & C	Party C
Pier Footing	Civil Works Handbook/Japan	AB-12	Elevation of bottom	Level Instrument	± 20 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-13	Width	Measuring Tape	-20 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-14	Height	Measuring Tape	-20 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-15	Length	Measuring Tape	-20 mm	every structure	St'd Form	Party B & C	Party C
Pier Superstructure	Civil Works Handbook/Japan	AB-16	Elevation of bearing seat	Level Instrument	± 20 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-17	Width of structure	Measuring Tape	-20 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-18	Height of structure	Measuring Tape	-50 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-19	Length of structure	Measuring Tape	-50 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-20	Distance of piers	Measuring Tape	± 30 mm	every structure	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-21	Span length	Measuring Tape	± 50 mm	every structure	St'd Form	Party B & C	Party C
PC/RC Girder	Civil Works Handbook/Japan	AB-22	Width (Upper)	Measuring Tape	＋10, -5 mm	every pier	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-23	Width (Lower)	Measuring Tape	± 0.5 mm	every pier	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-24	Height	Measuring Tape	＋10, -5 mm	every pier	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-25	Length	Measuring Tape	-30 mm	every pier	St'd Form	Party B & C	Party C
Box Culvert	Civil Works Handbook/Japan	AB-26	Formation level	Level Instrument	± 30 mm	inlet & outlet	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-27	Width (inside)	Measuring Tape	-30 mm	inlet & outlet	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-28	Height (inside)	Measuring Tape	± 30 mm	inlet & outlet	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-29	Thickness (slab & wall)	Measuring Tape	-20 mm	inlet & outlet	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-30	Length	Measuring Tape	-50 mm (L<20m) -100 mm (20m≤L)	every culvert	St'd Form	Party B & C	Party C
Pipe Culvert	Civil Works Handbook/Japan	AB-31	Formation level	Level Instrument	± 30 mm	inlet & outlet	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-32	Width (foundation)	Measuring Tape	-50 mm	inlet & outlet	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-33	Height (foundation)	Measuring Tape	- 30 mm	inlet & outlet	St'd Form	Party B & C	Party C
	Civil Works Handbook/Japan	AB-34	Length	Measuring Tape	-200 mm	every culvert	St'd Form	Party B & C	Party C

12 Inspection

Party C and D shall, at all times, have access to the work during its construction, and shall be furnished with every reasonable facility for ascertaining that the materials and the workmanship are in accordance with the requirements and intentions of construction specifications, special provisions, and construction plans. All work done and all materials furnished shall be subject to Party C and D inspection.

Party B shall make requests for inspection when necessary. A sample form of "Request for Inspection" is attached in Appendix I.

Inspections of Party D which are composed of Interim Inspection, Final Inspection and Warranty Inspection should be carried out by checking documents and site inspection as shown in the Table 12-1 and Table 12-2.

Checking document:

Documents of original and revised construction plans and records of Daily Quality Control shall be checked.

Site inspection:

Works which shall conform to the lines, grades, cross sections, dimensions and material requirements indicated in the specifications shall be inspected by eye and measurement.

Table 12-1 Points of Inspection

Checking Documents	・ All tests and as-built measurements specified in the technical specifications shall be carried out in conformity to their frequencies, record methods and those results shall satisfy their tolerances. ・ Construction work shall be carried out subject to approved construction plan.
Site Inspection	・ Measurements shall be carried out at points in a work site chosen by Party D according to the work types. ・ Workmanship such as material condition, level of flatness, crack appearance and so on shall be inspected by eye. ・ Construction methods shall be subject to approved construction plan.

Table 12-2　Check List for Inspection

Check List for Inspection

Checking Documents:

☐ Construction Plan
- ・Is the construction plan approved by Party C?　(　Yes　/　No　)
- ・Is the construction plan in conformity to the specification?　(　Yes　/　No　)

☐ Quality Control Chart (Material and Execution Test Result)

For each test,
- ・Is the test frequency enough?　(　Yes　/　No　)
- ・Is the record method appropriate?　(　Yes　/　No　)
- ・Is the test result within its tolerance?　(　Yes　/　No　)

☐ As-built Measurement Chart

For each measurement,
- ・Is the measurement frequency enough?　(　Yes　/　No　)
- ・Is the record method appropriate?　(　Yes　/　No　)
- ・Is the measurement error within its tolerance?　(　Yes　/　No　)

Site Inspection:

☐ Actual as-built measurement of works

For each measurement,
- ・Is the measurement error within its tolerance?　(　Yes　/　No　)

☐ Workmanship (Material, flatness, crack and etc. to be checked)

For asphalt concrete or DBST road surface,
- ・Did you check that flush did not occur?　(　Yes　/　No　)
- ・Did you check that hair crack did not occur?　(　Yes　/　No　)
- ・Did you check that stripping did not occur?　(　Yes　/　No　)
- ・Did you check that flatness was good?　(　Yes　/　No　)

For shoulder,
- ・Is the shoulder proper material and certainly compacted?　(　Yes　/　No　)
- ・Is the shoulder grade appropriate?　(　Yes　/　No　)

For embankment slope,
- ・Is the slope grade appropriate?　(　Yes　/　No　)
- ・Is the slope certainly compacted ?　(　Yes　/　No　)

For concrete work,
- ・Did you check that honeycomb did not appear on the surface?　(　Yes　/　No　)
- ・Did you check that re-bar did not appear on the surface?　(　Yes　/　No　)
- ・Is the condition of the joint good?　(　Yes　/　No　)

☐ Construction Method

For each construction work,
- ・Is the work procedure according to the construction plan?　(　Yes　/　No　)
- ・Is the equipment used for the work appropriate?　(　Yes　/　No　)
- ・Is the material used for the work appropriate?　(　Yes　/　No　)
- ・Are the quality control tests done appropriately?　(　Yes　/　No　)

Comments:

13 IB Performance Evaluation

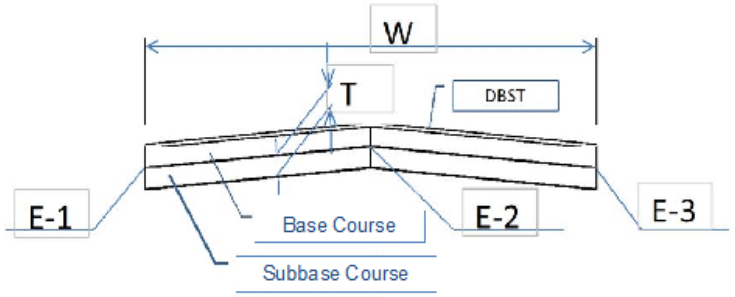
Performances of IB, in other words Party B shall be evaluated by Supervision & Evaluation Team under the RID and Evaluation & Hand-Over Team from MEF and PEAC according to the guideline named as “IB Performance Evaluation Form” promulgated by MPWT on May 02, 2008.

Appendices

A As-built Measurement Record Form

As-Built Record Form

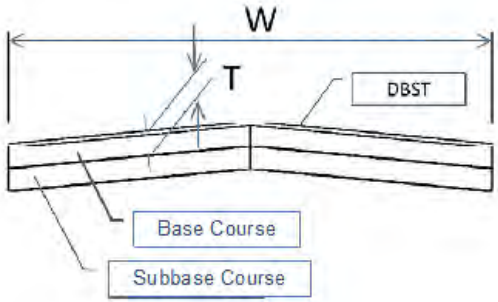
Date	
Budget Year	
Chapter	
Province	
Road Number	
Name of Structure	
Measuring Person	Name / Signature
Witness	Name / Signature



Sta	W(±50mm)			T(-45mm)			E-1(±50mm)			E-2(±50mm)			E-3(±50mm)		
	Design	Actual	Error	Design	Actual	Error	Design	Actual	Error	Design	Actual	Error	Design	Actual	Error
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	EL	EL	(mm)	EL	EL	(mm)	EL	EL	(mm)
Sta 0+000	6000	6010	10	200	210	10	15.121	15.131	10	15.721	15.710	-11	15.121	15.141	20
Sta 0+040	6000	-	-	200	-	-	15.621	15.609	-12	16.221	16.209	-12	15.621	15.601	-20
Sta 0+080	6000	6020	20	200	-	-	16.121	16.133	12	16.721	16.733	12	16.121	16.176	**55**
Sta 0+120	6000	-	-	200	-	-	16.621	16.631	10	17.221	17.244	23	16.621	16.567	**-54**
Sta 0+160	6000	6020	20	200	-	-	17.121	17.112	-9	17.721	17.755	34	17.121	17.091	-30
Sta 0+200	6000	-	-	200	150	**-50**	17.621	17.651	30	18.221	18.255	34	17.621	17.581	-40
Sta 0+240	6000	6060	**60**	200	-	-	18.121	18.151	30	18.721	18.764	43	18.121	18.081	-40
Sta 0+280	6000	-	-	200	-	-	18.621	18.631	10	19.221	19.264	43	18.621	18.655	34
Sta 0+320	6000	6010	10	200	-	-	19.121	19.061	**-60**	19.721	19.764	43	19.121	19.165	44
Sta 0+360	6000	-	-	200	-	-	19.621	19.576	-45	20.221	20.264	43	19.621	19.664	43
Sta 0+400	6000	5990	-10	200	230	30	20.121	20.071	-50	20.721	20.744	23	20.121	20.165	44
Sta 0+440	6000	-	-	200	-	-	20.621	20.644	23	21.221	21.187	-34	20.621	20.571	**-50**
Sta 0+480	6000	5980	-20	200	-	-	21.121	21.077	-44	21.721	21.688	-33	21.121	21.154	33
Sta 0+520	6000	-	-	200	-	-	21.621	21.671	50	22.221	22.187	-34	21.621	21.581	-40
Sta 0+560	6000	5950	-50	200	-	-	22.121	22.087	-34	22.721	22.755	34	22.121	22.181	60
Sta 0+600	6000	-	-	200	190	-10	22.621	22.655	34	23.221	23.255	34	22.621	22.581	-40
Sta 0+640	6000	5960	-40	200	-	-	23.121	23.076	-45	23.721	23.764	43	23.121	23.071	**-50**
Sta 0+680	6000	-	-	200	-	-	23.621	23.655	34	24.221	24.255	34	23.621	23.591	-30
Sta 0+720	6000	5990	-10	200	-	-	24.121	24.166	45	24.721	24.765	44	24.121	24.161	40
Sta 0+760	6000	-	-	200	-	-	24.621	24.664	43	25.221	25.264	43	24.621	24.589	-32
Sta 0+800	6000	6010	10	200	220	20	25.121	25.166	45	25.721	25.755	34	25.121	25.165	44

As-Built Record Form

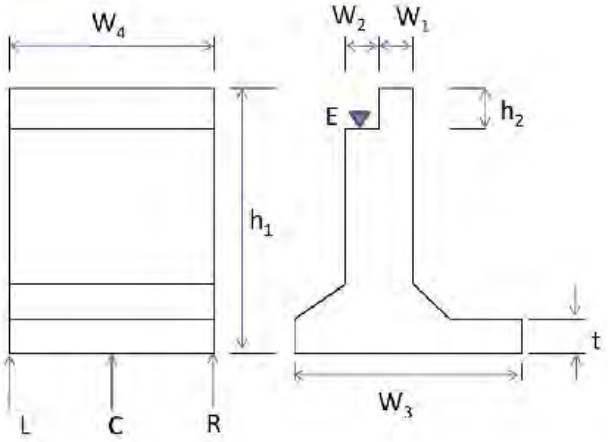
Date	
Budget Year	
Chapter	
Province	
Road Number	
Name of Structure	
Measuring Person	Name / Signature
Witness	Name / Signature



Sta	W(±50mm)			T(-45mm)		
	Design	Actual	Error	Design	Actual	Error
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
Sta 0+000	6000	6010	10	200	210	10
Sta 0+040	6000	–	–	200	–	–
Sta 0+080	6000	6020	20	200	–	–
Sta 0+120	6000	–	–	200	–	–
Sta 0+160	6000	6020	20	200	–	–
Sta 0+200	6000	–	–	200	150	**-50**
Sta 0+240	6000	6060	**60**	200	–	–
Sta 0+280	6000	–	–	200	–	–
Sta 0+320	6000	6010	10	200	–	–
Sta 0+360	6000	–	–	200	–	–
Sta 0+400	6000	5990	-10	200	230	30
Sta 0+440	6000	–	–	200	–	–
Sta 0+480	6000	5980	-20	200	–	–
Sta 0+520	6000	–	–	200	–	–
Sta 0+560	6000	5950	-50	200	–	–
Sta 0+600	6000	–	–	200	190	-10
Sta 0+640	6000	5960	-40	200	–	–
Sta 0+680	6000	–	–	200	–	–
Sta 0+720	6000	5990	-10	200	–	–
Sta 0+760	6000	–	–	200	–	–
Sta 0+800	6000	6010	10	200	220	20

As-Built Record Form

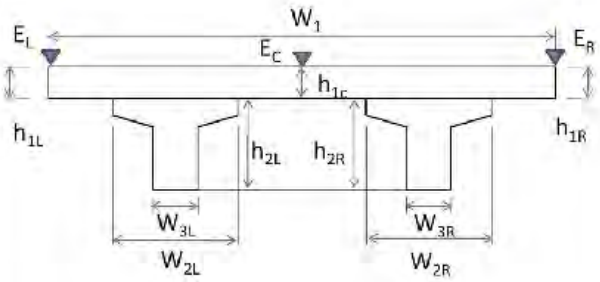
Date	
Budget Year	
Chapter	
Province	
Road Number	
Name of Structure	
Measuring Person	Name / Signature
Witness	Name / Signature

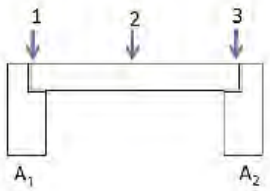


Location		E			W1			W2			W3			W4	h1			h2			t		
		±20mm			-10mm			-10mm			-50mm			-50 mm	-50mm			-30mm			-20mm		
		L	C	R	L	C	R	L	C	R	L	C	R		L	C	R	L	C	R	L	C	R
A1	Design																						
	Actual																						
	Error																						
A2	Design																						
	Actual																						
	Error																						

As-Built Record Form

Date	
Budget Year	
Chapter	
Province	
Road Number	
Name of Structure	
Measuring Person	Name / Signature
Witness	Name / Signature



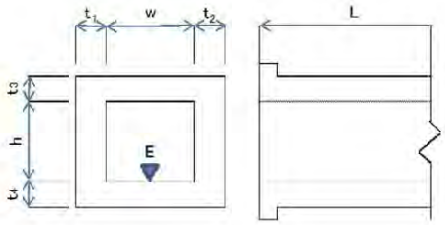


Location		E_1	E_2	E_3	W_1	W_{2L}	W_{3L}	W_{2R}	W_{3R}	h_{1L}	h_{1C}	h_{1R}	h_{2L}	h_{2R}
		±20mm			+30mm −5mm	+10mm −5mm	±5mm	+10mm −5mm	±5mm	+10mm −5mm	+10mm −5mm	+10mm −5mm	+10mm −5mm	+10mm −5mm
1	Design													
	Actual													
	Error													
2	Design													
	Actual													
	Error													
3	Design													
	Actual													
	Error													

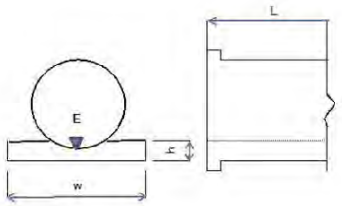
As-Built Record Form

Date	
Budget Year	
Chapter	
Province	
Road Number	
Name of Structure	
Measuring Person	Name / Signature
Witness	Name / Signature

Box Culvert



Pipe Culvert



Location		Box Culvert								Pipe Culvert			
		E	w	h	t_1	t_2	t_3	t_4	L	E	w	h	L
		±30mm	−30mm	±30mm	−20mm	−20mm	−20mm	−20mm	−50 mm (L<20m) −100 mm (20m≤L)	±30mm	−50mm	−30mm	−200mm
1−Inlet	Design												
	Actual												
	Error												
1−Outlet	Design												
	Actual												
	Error												
2−Inlet	Design												
	Actual												
	Error												
2−Outlet	Design												
	Actual												
	Error												

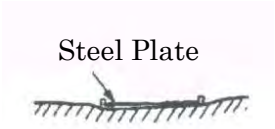
B Sand Cone Test Method and Test Sheet

Test method for soil density by the sand replacement method (Measurement)

①

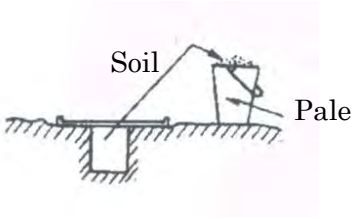
Remove loose material and dirt, then level the area approximately 35cm diameter

②



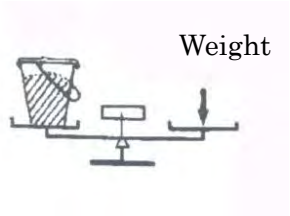
Place the steel plate closely on the ground

③



Dig a hole and extract soil and keep in a pale.
Hole size is determined in advance.

④



Weigh soil extracted and pale

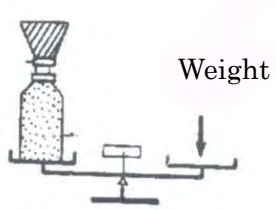
⑤

Fill sand into a jag

⑥

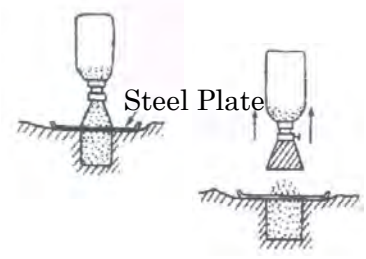
Remove extra sand from a jag

⑦



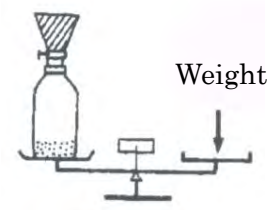
Weigh sand and jag + attachment

⑧



Fill sand into the hole.
Close the valve after sand flow stops

⑨



Weigh remaining sand and jag + attachment

Calibration Sheet for the Sand Cone Apparatus

Project Name: _____

Reference No.: _____

Date of Calibration: _____

(a) Sand type: _____

(b) Density of sand

Trial number	1	2	3
Volume of mold (V_1)			
Mass of baseplate and empty mold (M_1)			
Mass of baseplate, mold, and sand (M_2)			
Mass of sand $M_3 = M_2 - M_1$			
Density of sand $\rho_1 = M_3 / V_1$			

Density of sand (average value): _____

(c) Volume of funnel and baseplate

Trial number	1	2	3
Initial mass of funnel, container, and sand (M_4)			
Final mass of funnel, container, and sand (M_5)			
Mass of sand in funnel and baseplate (M_6)			
Volume of funnel and baseplate $V_2 = M_6 / \rho_1$			

Volume of funnel and baseplate (average value): _____

Submitted by : _____ on the date of : _____

Checked by : _____ on the date of : _____

Approved by : _____ on the date of : _____

Calculation Sheet for the Sand Cone Apparatus

Project Name: _____

Reference No.: _____

Sand density (ρ1): _____

Test Number	1	2	3	4	5
Date					
Location					
Elevation					
Sand cone test --- Volume of hole					
Initial mass of apparatus (M_7) Final mass of apparatus (M_8)					
Sand used $M_9 = M_7 - M_8$					
Volume of sand $V_3 = M_9 / \rho_1$					
Volume of funnel and baseplate (V_2)					
Volume of hole $V_4 = V_3 - V_2$					
Sand cone test --- Mass of wet soil					
Empty container (M_{10})					
Container plus wet soil (M_{11})					
Wet soil $M_{12} = M_{11} - M_{10}$					
Water content test					
Mass of empty cooking pan (M_c)					
Mass of cooking pan + wet soil (M_{wc})					
Mass of cooking pan + dry soil (M_{dc})					
Mass of water $M_w = M_{wc} - M_{dc}$					
Mass of solids $M_s = M_{dc} - M_c$					
Water content $w = M_w / M_s$					
Calculated values					
Wet density $\rho_t = M_{12} / V_4$					
Dry density $\rho_d = \rho_t / (1 + w)$					
Laboratory maximum dry density (ρ_{dmax})					
Relative compaction = $100\ \rho_d / \rho_{dmax}$					
Passed / Failed					

Submitted by : _____ on the date of : _____

Checked by : _____ on the date of : _____

Approved by : _____ on the date of : _____

C Check Sheet for Proof Rolling

Check Sheet for Proof Rolling

Budget Year	Province	Nameof Part B
Chapter	Road Number	Nameof Part C

P : Pass
F: Fail

Date	Work Items[1)]	Section	Length(m)	L/R/ L&R	Load[2)] (P/F)	Tire[3)] (P/F)	Result of Test (P/F)	In charge(Party B)		In charge(Party C)	
								Name	Sign	Name	Sign
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									
		Sta. ～Sta.									

1) : Base course, Sub base, Capping Layor, Sub-grade
2) : Load on the dump truck or in the water tank of tire roller shall be confimed by visual check.
3) : Air pressure of tires shall be confirmed by visual check.

D Check Sheet for Application of Bitumen Material

Check Sheet for Application of Bitumen Material

Budget Year	Province	Nameof Part B
Chapter	Road Number	Nameof Part C

Date	Work Items[1)]	Section	Length(m)	L/R/ L&R	Target Appli-cation (lit./m^2)	Actual Appli-cation (lit./m^2)	In charge(Party B)		In charge(Party C)	
							Name	Sign	Name	Sign
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								
		Sta. ～Sta.								

1) : SBST, DBST, Asphalt Concrete / Prime Coat, Tack Coat

E Quality Control Sheet for Earth Work

MINISTRY OF PUBLIC WORKS AND TRANSPORTS
BUILDING AND PUBLIC WORKS LABORATORY
L B T P OF CAMBODIA
STREET598,PHUM KHOR2,SANGKAT CHRANG CHOMRASS-2
KHAN RUSSEY KEO PHNOM PENH , Tel 023982240

KINGDOM OF CAMBODIA
Nation Religion King

SUMMARY OF TESTS RESULTS

Project Name : External Access Road at 2 x 50MW Coal fired Power Plant at Stung Hav
Customer Name : MEC
Received Date : June 14, 2012
Date of Testing : June 15, 2012
Source Material : O-Tres Stung Hav
Material : Soil
Purpose : Embankment (①Capping Layor, ②Sub-base, ③Base-course), ④Existing Sub-grade
Select and mark ①-④

LAB N°	SOURCE OF MATERIAL	Sieve Analysis (%)			Atterberg Limits (%)			Soil Classfication	Maximum Dry Density	Optimum Moisture Content	In case of ①②③	In case of ④
											CBR at Point__% of MDD	**CBR** at Degree of Compaction (%) of existing ground
		2.00mm	0.425mm	0.075mm	W_L	W_P	I_P		(g/cc)	(%)	Soaked	Soaked
0671	O-Tres Stung Hav	82.90	78.40	31.00	44.40	23.47	20.93	A_{2-7}	1.935	10.6	3.8	

Calculated by:

Mr. Men Bunny

Checked by:

Mr. Pich Vuthy

Approved by:
Director General of Laboratory .,

MINISTRY OF PUBLIC WORKS AND TRANSPORTS
BUILDING AND PUBLIC WORKS LABORATORY
LBTP OF CAMBODIA
STREET598,PHUM KHOR2,SANGKAT CHRANG CHOMRASS-2
KHAN RUSSEY KEO PHNOM PENH Tel 023982240

KINGDOM OF CAMBODIA
Nation Religion King

Purpose: Embankment ((①Capping Layor, ②Sub-base, ③Base-course), ④Existing Sub-grade

SIEVE ANALYSIS

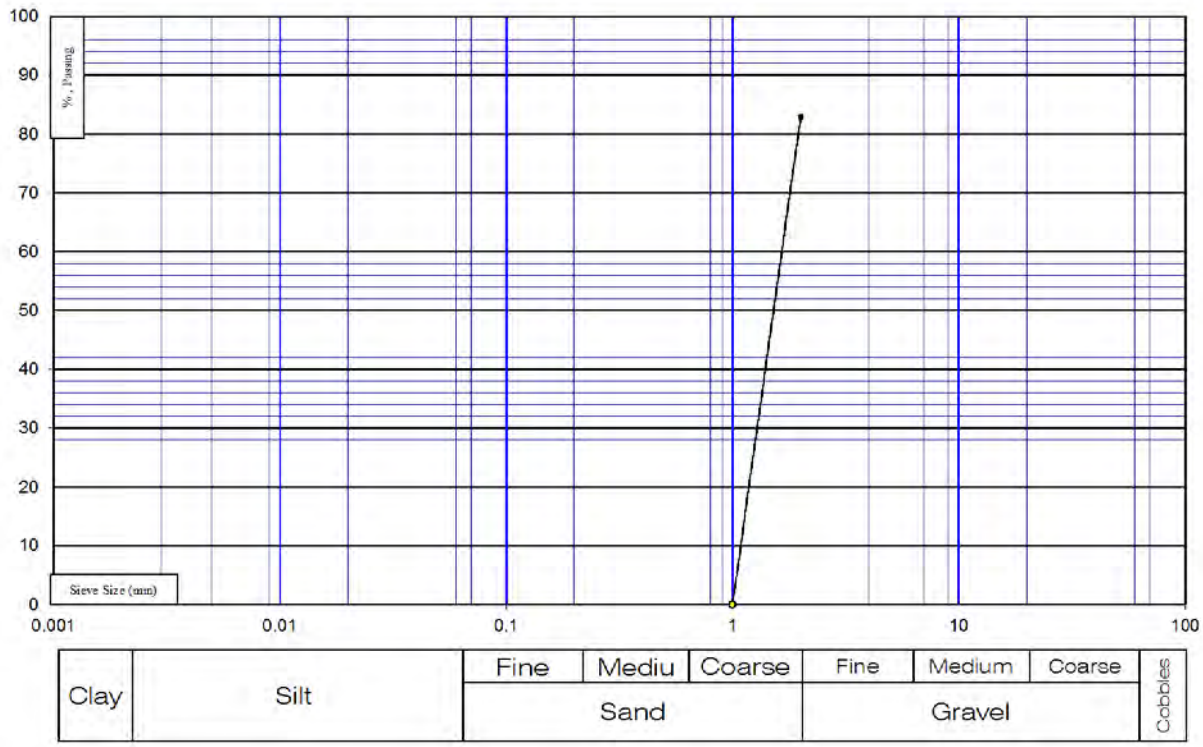
Client : MEC	Material : Soil	Received Date : June 14, 2012
Site : O-Tres Stung Hav	LAB : 0671	Date of testing : June 15, 2012

AASHTO - M57

sieve Size mm	weight retained g	retained %	passing %
75.00	0.0	0.00	100.0
50.80	0.0	0.00	100.0
25.40	0.0	0.00	100.0
9.50	34.2	9.79	90.2
4.750	49.1	14.1	85.9
2.000	59.7	17.1	82.9
0.425	75.4	21.6	78.4
0.075	241.0	69.0	31.0

weight of Dry soil = 349.4 g

Water Content % =	
Gravel % =	14.1
Sand % =	54.9
Silt+Clay % =	31.0



MINISTRY OF PUBLIC WORKS AND TRANSPORTS
BUILDING AND PUBLIC WORKS LABORATORY

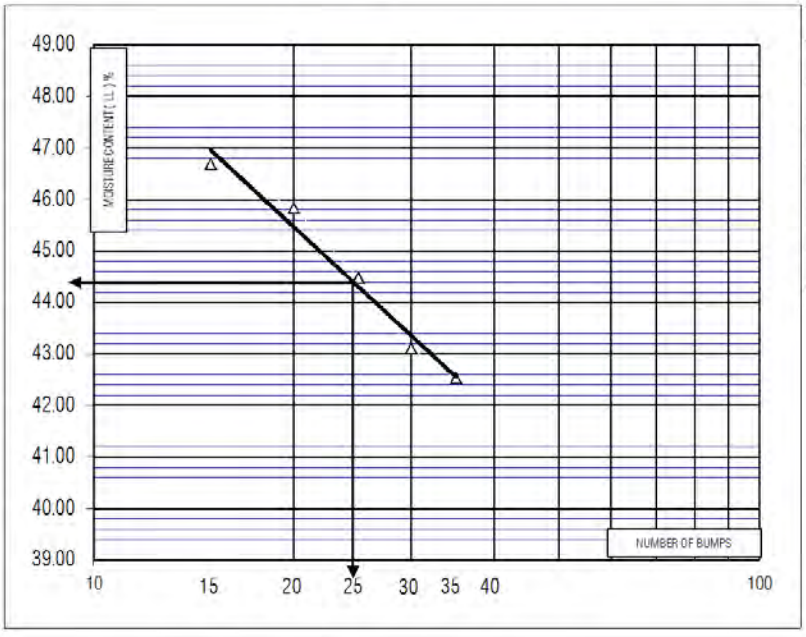
KINGDOM OF CAMBODIA
Nation Religion King

DETERMINING THE PLASTIC LIMIT AND PLASTICITY INDEX OF SOIL (AASHO T90-86)

Project Name	:	External Access Road at 2 x 50MW Coal fired Power Plant at Stung Hav
Customer Name	:	MEC
Received Date	:	June 14, 2012
Date of Testing	:	June 15, 2012
Source Material	:	O-Tres Stung Hav
Material	:	Soil
Purpose	:	Embankment (①Capping Layor, ②Sub-base, ③Base-course), ④Existing Sub-grade

LAB : 0761

Nº		LIQUID LIMIT					PLASTIC LIMIT	
NUMBER OF BUMPS		15	20	25	30	35		
COTAINER Nº		E26	B22	B8	D6	D7	T16	T20
MASS OF WET SOIL + CONTAINER	g	55.1	52.5	54.6	61	58.6	18.7	18.5
MASS OF DRY SOIL + CONTAINER	g	43.1	40.4	42.1	48.8	45.5	16.4	16.2
MASS OF CONTAINER	g	17.4	14	14	20.5	14.7	6.5	6.5
MASS OF MOISTRURE	g	12	12.1	12.5	12.2	13.1	2.3	2.3
MASS OF DRY SOIL	g	25.7	26.4	28.1	28.3	30.8	9.9	9.7
MOISTRURE CONTEN	%	46.69	45.83	44.48	43.11	42.53	23.23	23.71
							23.47	



RESULTS TEST	
Liquid Limit , %	44.40
Plastic Limit , %	23.47
Plastic Index , %	20.93
Soil Classification	A_{2-7}
Water Content ,%	

MINISTRY OF PUBLIC WORKS AND TRANSPORT
BUILDING AND PUPLIC WORKS LABORATORY

KINGDOM OF CAMBODIA
Nation Religion King

MODIFIED PROCTOR

(MOISTURE - DENSITY RELATOINS OF SOILS)

*AASTHO T180-97	Project Name	: External Access Road at 2 x 50MW Coal fired Power Plant at Stung Hav
* Weight of Rammer=4.54 kg	Customer Name	: MEC
*Free fall Height=457mm	Received Date	: June 14, 2012
*Drop=152.40mm	Date of Testing	: June 15, 2012
*Face of Diameter=50.8mm	Source Material	: O-Tres Stung Hav
*Compacted=56 blows/5layer	Material	: Soil
	Purpose	: Embankment (①Capping Layor, ②Sub-base, ③Base-course), ④Existing Sub-grade

DENSITY						TEST RESULTS
Wt.of Soil + Mold	g	6908.0	7184.0	7544.0	7305.0	7220.0	Maximum Dry Density
Wt.of Mold	g	2792.0	2792.0	3015.0	2792.0	2792.0	MDD = 1.935 g/cc
Wt.of Soil	g	4116.0	4392.0	4529.0	4513.0	4428.0	Optimum Moisture Content
Vol. Mold	cc	2138.0	2138.0	2117.6	2138.0	2138.0	OMC = 10.6%
Wet Density	g/cc	1.925	2.054	2.139	2.111	2.071	
Dry Density	g/cc	**1.808**	**1.889**	**1.933**	**1.870**	**1.807**	
WATER CONTENT							LAB Nº 0761
Wt.of Wet Soil + Container	g	243.3	242.2	285.4	262.9	274.4	
Wt.of Dry Soil + Container	g	230.3	225.2	260.9	236.4	243.3	
Wt.of Water	g	13.0	17.0	24.5	26.5	31.1	
Wt.of Container	g	29.1	30.7	30.1	30.6	30.5	
Wt.of Dry Soil	g	201.2	194.5	230.8	205.8	212.8	
Water Content	%	**6.5**	**8.7**	**10.6**	**12.9**	**14.6**	

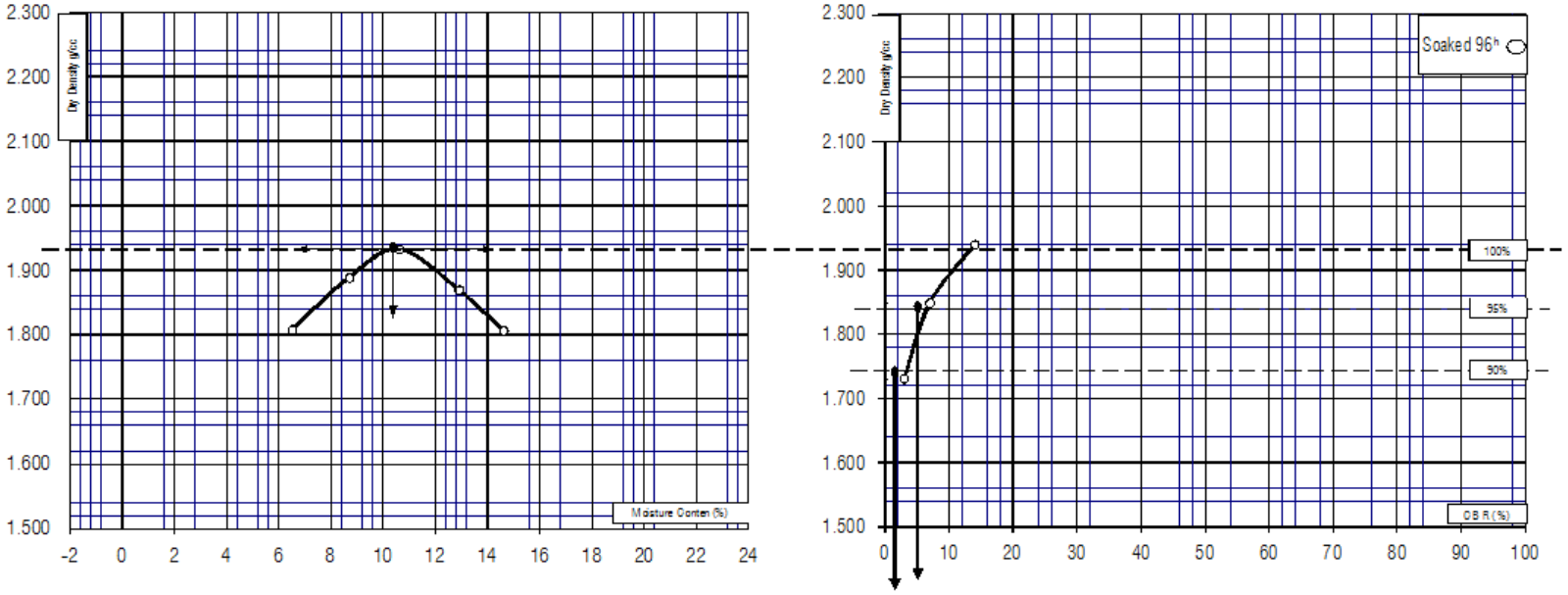
MINISTRY OF PUBLIC WORKS AND TRANSPORT
BUILDING AND PUPLIC WORKS LABORATORY
LBTP OF CAMBODIA
STREET598 , PHUM KHOR-1 , SANGKAT CHRANGCHOMRASS-2
KHAN RUSSEY KEO , PHNOM PENH , CAMBODIA , TEL 023982240

KINGDOM OF CAMBODIA
Nation Religion King

Purpose Embankment (①Capping Layor, ②Sub-base, ③Base-course), ④Existing Sub-grade

PROCTOR		CALIFORNIA BEARING RATIO						Date Sampling	Date Testing	LAB N°
Standards AASHTO T 180		Blows	Dry Density (g/cc)	Moisture Content at Compaction (%)	Moisture Content After Soaking 96h (%)	Swelling (%)	STANDARD			
MDD g/cc	OMC (%)	65	1.940	10.6	22.4	1.550	AASHTO T193	14-Jun-12	15-Jun-12	0761
		30	1.849	10.6	24.3	2.331				
1.935	10.6	10	1.731	10.8	25.2	2.950				
		CBR For Soil Soaked 96h at Point 95% of MDD = 7.0								

MEC Soil from 0-Tres Stung Hav



F Quality Control Sheet for Piling Work

Check sheet for Pilling Works (As Built Measurement)

No. Date: _____

Budget Year	Province
Chapter	Bridge Number
Nameof Party B	Name of Party C

Abutment / Pier No. : _____

Pile No. : _____

Profile of Pile

①	ID	
②	Date of Casting	_____
③	Length of Pile	_____m
④	Cross Section of Pile	☐Square ____mm × ____mm ☐Circle Diameter:____mm

Measurement of Pile

①	Cross Section of Pile	☐Square ____mm × ____mm ☐Circle Diameter:____mm
②	Length of Pile	_____m
③	Maximum Distance from the line stretched from tip to butt to any surface	_____m
④	②／③	<= 1/1000

Check by Party C

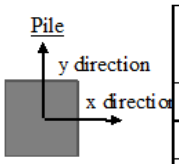
Name of Person in charge:	
Signature:	

Check sheet for Pilling Works (Measurement of Pile's eccentricity)

No. Date:

Budget Year	Province	
Chapter	Bridge Number	
Name of Party B	Name of Party C	

Abutment / Pier No. :



Number of Pile	difference (mm)			Tolerance	Check
	x direction	y direction	total		
1	15	60	62	<= 80mm	Pass/Fail
2	-20	40	45	<= 80mm	Pass/Fail
3	30	-50	58	<= 80mm	Pass/Fail
4	50	40	64	<= 80mm	Pass/Fail
5	-60	20	63	<= 80mm	Pass/Fail
6	70	10	71	<= 80mm	Pass/Fail
7				<= 80mm	Pass/Fail
8				<= 80mm	Pass/Fail
9				<= 80mm	Pass/Fail
10				<= 80mm	Pass/Fail
11				<= 80mm	Pass/Fail
12				<= 80mm	Pass/Fail
13				<= 80mm	Pass/Fail
14				<= 80mm	Pass/Fail
15				<= 80mm	Pass/Fail
16				<= 80mm	Pass/Fail
17				<= 80mm	Pass/Fail
18				<= 80mm	Pass/Fail
19				<= 80mm	Pass/Fail
20				<= 80mm	Pass/Fail
21				<= 80mm	Pass/Fail
22				<= 80mm	Pass/Fail
23				<= 80mm	Pass/Fail
24				<= 80mm	Pass/Fail
x					
Center of Gravity	14	20	25	<= 50mm	Pass/Fail

Check by Party C

Name of Person in charge:	
Signature:	

Check sheet for Pilling Works (Driving Record)

No. Date:

Budget Year	Province
Chapter	Bridge Number
Name of Party B	Name of Party C

Pile Type	SPP	Driving Started		Pile Elev.	Top	Toe	Hammer Data	Diesel Hammer
Total Pile Length	40 m	Driving finished		Design Elev.	6.892m	-28.108m	Model	Kobelco
Design Bearing Cap. 100tf.		Control Elevation (Level)	6.792m	Actual Elev.	8.942m	-31.058m	Type/Length	Diesel Cylinder
Design Bearing Cap. 981KN				NGL.	6.506m	6.506m	Capacity/weight	3.5t (Ram Wt)
				Verticality	1/75			

Reading of Piles	No. of Blows	Total No. of Blows	Pile Toe Elevation	Penetration per Blow(mm)	Bearing Capacity KN
21.50					
22.00	45	45	-15.208	11.111	789
22.50	37	82	-15.708	13.514	709
23.00	35	117	-16.208	14.286	686
23.50	36	153	-16.708	13.889	697
24.00	34	187	-17.208	14.706	674
24.50	34	221	-17.708	14.706	674
25.00	34	255	-18.208	14.706	674
25.50	34	289	-18.708	14.706	674
26.00	33	322	-19.208	15.152	662
26.50	31	353	-19.708	16.129	638
27.00	33	386	-20.208	15.152	662
27.50	43	429	-20.708	11.628	770
28.00	54	483	-21.208	9.259	865
28.50	50	533	-21.708	10.000	833
29.00	47	580	-22.208	10.638	807
29.50	38	618	-22.708	13.158	719
30.00	34	652	-23.208	14.706	674
30.50	33	685	-23.708	15.152	662
31.00	34	719	-24.208	14.706	674
31.50	33	752	-24.708	15.152	662
32.00	30	782	-25.208	16.667	625
32.50	32	814	-25.708	15.625	650
33.00	42	856	-26.208	11.905	761
33.50	46	902	-26.708	10.870	798
34.00	213	1,115	-27.208	2.347	1,349
34.50	195	1,310	-27.708	2.564	1,326
35.00	160	1,470	-28.208	3.125	1,269
35.50	123	1,593	-28.708	4.065	1,184
36.00	101	1,694	-29.208	4.950	1,114
36.50	95	1,789	-29.708	5.263	1,092
37.00	164	1,953	-30.208	3.049	1,277
37.50	148	2,101	-30.708	3.378	1,245
37.85	166	2,267	-31.058	2.108	1,829

Allowable Bearing Caoacity
Modified Hiley's Formula

$$Ra = 1/3\ Ru$$

$$= 1/3 \left[\frac{2WH(W)}{(S+K)x(W+Wp)} \right]$$

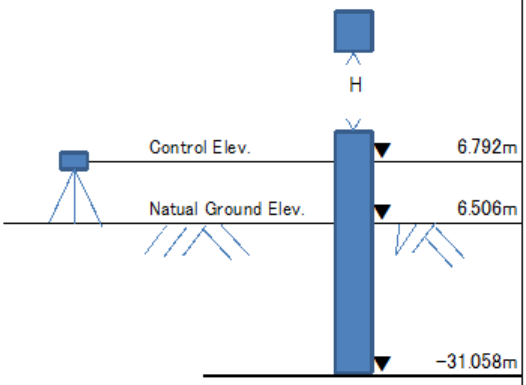
$$= 1/3 \left[\frac{49490}{88.40344} \right]$$

$$= 186.61 \text{ tf}$$

Rs = 1,829 KN > 981 KN OK

Where

Ra	=	Allowable Bearing Capacity		
Ru	=	Ultimate Bearing Capacity		
Wp	=	Weight of Pile, tf	=	6.204
W	=	Weight of Hammer, tf	=	3.50
H	=	Drop Height, mm	=	2,020
S	=	Penetration per Blow, mm	=	2.11
K	=	Rebound, mm	=	7



G Quality Control Sheet for Concrete Work

Daily Quality Control Sheet for Concrete Work

Budget Year	Province	Nameof Part B
Chapter	Road Number	Nameof Part C

Date	Struc -ture	Lot	Class	Design Strength (kg/cm²)	Q'ty (m³)	Name of Supplier or Site Mix 1)	Fre-quency	Slump			Test Piece Sampling		Result of Compressive Test σ^{28}				
								Result	PIC of Party C	Sign	PIC of Party C	Sign	Result			PIC 2) of Party C	Sign
													1st	2nd	Ave.		
6/10	Abut	2nd	A	210			1st										
							25m3										
							50m3										
							1st										
							25m3										
							50m3										
							1st										
							25m3										
							50m3										
							1st										
							25m3										
							50m3										
							1st										
							25m3										
							50m3										
							1st										
							25m3										
							50m3										
							1st										
							25m3										
							50m3										

1) : Please fill out Name of supplier or Site Mix
2) : Person in-cahrge

H Documentation for Improvement

Check List for Earthwork at Reconstruction Section

Earthwork at Embankment Section

Asphalt Concrete Work

DBST Work

SBST Work

Piling Work

Concrete Work

DOCUMENTATION FOR IMPROVEMENT IN EXECUTION, QUALITY AND MANAGEMENT

1. There are check lists for seven kinds of the works, such as 1) earthworks at reconstruction section, 2) earthwork at embankment section, 3) asphalt concrete work, 4) DBST work, 5) SBST work. 6) piling work and 7) concrete work.

2. The list shows test method, standard to follow and frequency for quality tests to be carried out in every activity with work procedure.

3. The project shall be divided with certain work volume as one unit to make checking in one sheet, such as earthwork and paving work in each 500 to 1000 m, each concrete structure (each bridge and each box culvert and so on).

4. Every cell in columns of "checked by Executor", "inspected by Inspector" and "confirmed by Engineer" in the check list shall be filled with date & signature, unless there are reasonable reasons to skip under the contract.

5. All quality test records shall be kept with order of activities and the corresponding check list shall be on top of those records.

6. The kind of check lists shall be added, as required.

Check List of Earthwork at Reconstruction Section

Budget Year:	Province:	
Project Name:		Location:

Party A:	Party B:	Party C:

QE: quality control for earthwork, AR: as-built control

	activity			code of QE / AR	test method	standard	frequency	checked by Executor (Party B)		inspected by Inspector (Party C)		confirmed by Engineer (Party C)		remarks
								date	sign	date	sign	date	sign	
1	Preparatory Works	Material Test	Capping layer	QE 6	Compaction test	AASHTO T 180	per source any irregularity							
2				QE 7	Modified CBR	AASHTO T 193								
3				QE 8	Sieve analysis	AASHTO T 27								
4				QE 9	LL PL PI	AASHTO T 89 & T 90								
5			Sub base	QE13	Compaction test	AASHTO T 180	per source any irregularity							
6				QE 14	Modified CBR	AASHTO T 193								
7				QE 15	Sieve analysis	AASHTO T 27								
8				QE 16	LL PL PI	AASHTO T 89 & T 90								
9			Base Course	QE 20	Compaction test	AASHTO T 180	per source any irregularity							
10				QE 21	Modified CBR	AASHTO T 193								
11				QE 22	Sieve analysis	AASHTO T 27								
12				QE 23	LL PL PI	AASHTO T 89 & T 90								
13		Trial Embankment												
14	Excavation			AR 1/2	Elevation & Width		every 40 m							
15	Compaction			QE 11	Proof Rolling		entire area							
16	Spreading of Capping Material (1st layer)				Thickness		as required							
17	Compaction of Capping Layer (1st layer)			QE 10	Field density test	AASHTO T 180	5 locations / 2000 m2							
18				QE 11	Proof Rolling		entire area							
19	Spreading of Capping Material (final layer)			AR 3	Elevation		every 40 m							
20				AR 4	Thickness		every 200 m							
21				AR 5	Width		every 80 m							
22	Compaction of Capping Layer (final layer)			QE 10	Field density test	AASHTO T 180	5 locations / 2000 m2							
23				QE 11	Proof Rolling		entire area							
24	Spreading of Sub Base Material (1st layer)				Thickness		as required							
25	Compaction of Sub Base Material (1st layer)			QE 17	Field density test	AASHTO T 180	5 locations / 2000 m2							
26				QE 18	Proof Rolling		entire area							
27	Spreading of Sub Base Material (final layer)			AR 6	Elevation		every 40 m							
28				AR 7	Thickness		every 200 m							
29				AR 8	Width		every 80 m							
30	Compaction of Sub Base Material (final layer)			QE 17	Field density test	AASHTO T 180	5 locations / 2000 m2							
31				QE 18	Proof Rolling		entire area							
32	Spreading of Base Course Material (1st layer)				Thickness		as required							
33	Compaction of Base Course Material (1st layer)			QE 24	Field density test	AASHTO T 180	5 locations / 2000 m2							
34				QE 25	Proof Rolling		entire area							
32	Spreading of Base Course Material (final layer)			AR 9	Thickness		every 200 m							
33				AR 10	Width		every 80 m							
34	Compaction of Base Course Material (final layer)			QE 24	Field density test	AASHTO T 180	5 locations / 2000 m2							
35				QE 25	Proof Rolling		entire area							

If capping layer is not more than 200 mm, disregard (1st layer)

If Sub Base is not more than 200 mm, disregard (1st layer) lines.

If Base Course is not more than 200 mm, disregard (1st layer) lines.

Check List of Earthwork at Embankment Section

Budget Year:	Province:		Party A:	Party B:	Party C:
Project Name:		Location:			

QE: quality control for earthwork, AR: as-built control

	activity			code of QE / AR	test method	standard	frequency	checked by Executor (Party B)		inspected by Inspector (Party C)		confirmed by Engineer (Party C)		remarks
								date	sign	date	sign	date	sign	
1	Preparatory Works	Material Test	Embankment	QE 1	Compaction test	AASHTO T 180	per source any irregularity							
2				QE 2	Modified CBR	AASHTO T 193								
3			Capping layer	QE 6	Compaction test	AASHTO T 180	per source any irregularity							
4				QE 7	Modified CBR	AASHTO T 193								
5				QE 8	Sieve analysis	AASHTO T 27								
6				QE 9	LL PL PI	AASHTO T 89 & T 90								
7			Sub base	QE13	Compaction test	AASHTO T 180	per source any irregularity							
8				QE 14	Modified CBR	AASHTO T 193								
9				QE 15	Sieve analysis	AASHTO T 27								
#				QE 16	LL PL PI	AASHTO T 89 & T 90								
#			Base Course	QE 20	Compaction test	AASHTO T 180	per source any irregularity							
#				QE 21	Modified CBR	AASHTO T 193								
#				QE 22	Sieve analysis	AASHTO T 27								
#				QE 23	LL PL PI	AASHTO T 89 & T 90								
#		Trial Embankment												
#	Clearing and Grubbing													
#	Compaction				Semi Proof Rolling		entire area							
#	Spreading of Embankment Material (1st layer)				Thickness		as required							
#	Compaction of Embankment Material (1st layer)			QE 3	Field density test	AASHTO T 180	5 locations / 2000 m2							
#				QE 4	Proof Rolling		entire area in each layer							
#	Spreading of Embankment Material (2nd layer)				Thickness		as required							
#	Compaction of Embankment Material (2nd layer)			QE 3	Field density test	AASHTO T 180	5 locations / 2000 m2							
#				QE 4	Proof Rolling		entire area in each layer							
#	*repeat until final layer*													
#	Spreading of Embankment Material (final layer)			AR 1/2	Elevation & Width		every 40 m in each layer							
#	Compaction of Embankment Material (final layer)			QE 3	Field density test	AASHTO T 180	5 locations / 2000 m2							
#				QE 4	Proof Rolling		entire area in each layer							
#	Spreading of Capping Material (1st layer)				Thickness		as required							
#	Compaction of Capping Layer (1st layer)			QE 10	Field density test	AASHTO T 180	5 locations / 2000 m2		*If capping layer is not more than 200 mm, disregard (1st layer)*					
#				QE 11	Proof Rolling		entire area							
#	Spreading of Capping Material (final layer)			AR 3	Elevation		every 40 m							
#				AR 4	Thickness		every 200 m							
#				AR 5	Width		every 80 m							
#	Compaction of Capping Layer (final layer)			QE 10	Field density test	AASHTO T 180	5 locations / 2000 m2							
#				QE 11	Proof Rolling		entire area							
#	Spreading of Sub Base Material (1st layer)				Thickness		as required							
#	Compaction of Sub Base Material (1st layer)			QE 17	Field density test	AASHTO T 180	5 locations / 2000 m2		*If Sub Base is not more than 200 mm, disregard (1st layer) lines.*					
#				QE 18	Proof Rolling		entire area							
#	Spreading of Sub Base Material (final layer)			AR 6	Elevation		every 40 m							
#				AR 7	Thickness		every 200 m							
#				AR 8	Width		every 80 m							
#	Compaction of Sub Base Material (final layer)			QE 17	Field density test	AASHTO T 180	5 locations / 2000 m2							
#				QE 18	Proof Rolling		entire area							
#	Spreading of Base Course Material (1st layer)				Thickness		as required							
#	Compaction of Base Course Material (1st layer)			QE 24	Field density test	AASHTO T 180	5 locations / 2000 m2		*If Base Course is not more than 200 mm, disregard (1st layer) lines.*					
#				QE 25	Proof Rolling		entire area							
#	Spreading of Base Course Material (final layer)			AR 9	Thickness		every 200 m							
#				AR 10	Width		every 80 m							
#	Compaction of Base Course Material (final layer)			QE 24	Field density test	AASHTO T 180	5 locations / 2000 m2							
#				QE 25	Proof Rolling		entire area							

Check List of Asphalt Concrete Work

Budget Year:	Province:		Party A:	Party B:	Party C:
Project Name:		Location:			

QA: quality control for pavement, AR: as-built control

	activity			code of QA / AR	test method	standard	frequency	checked by Executor (Party B)		inspected by Inspector (Party C)		confirmed by Engineer (Party C)		remarks
								date	sign	date	sign	date	sign	
1	Preparatory Works	Material Test	Filler	QA 1	Ontario Vacuum Immersion Marshal Test	AASHTO M 17	per source any irregularity							
2			Fine aggregate	QA 2	Sieve analysis/Grading	AASHTO M 29	per source any irregularity							
3				QA 3	Sand equivalent test	AASHTO T 176								
4			Coarse aggregate	QA 4	Fractured faces	AASHTO M 147-6S	per source any irregularity							
5				QA 5	Abrasion	AASHTO T 96								
6				QA 6	Grading	AASHTO T 27								
7			Asphalt	QA 7	Manufacture's Certificate, as shown in CCMP appendix I 5.2	as shown in CCMP appendix I 5.2	per source any irregularity							
8			Prime coat	QA 8	ditto		ditto							
9			Tack coat	QA 9	ditto		ditto							
10		Trial Mix / Design Mix		QA 10	Marshal / Stability	AASHTO T 245	per source any irregularity							
11				QA 11	Marshal / Flow	AASHTO T 245								
12		Method of Hauling												
13	(Site Mix)				Mixing weight, Temperature									
14	Hauling				Temperature									
15	Prime Coat			QA 15	Application volume	Japan Road Association	1 time / 1000 m2							
16	Spreading of Binder Course			QA 14	Spreading temperature	ditto	1 time / 1000 m2							
17	Compaction of Binder Course			QA 17	Thickness	ditto	1 time / 1000 m2							
18				QA 18	Decree of compaction	ditto	1 time / 1000 m2							
19	Tack coat			QA 16	Application volume	Japan Road Association	1 time / 1000 m2							
20	Spreading of Wearing Course			QA 14	Spreading temperature	ditto	1 time / 1000 m2							
21	Compaction of Wearing Course			QA 17	Thickness	ditto	1 time / 1000 m2							
22				QA 18	Decree of compaction	ditto	1 time / 1000 m2							

Check List of DBST Work

Budget Year:	Province:		Party A:	Party B:	Party C:
Project Name:		Location:			

QA: quality control for pavement, AR: as-built control

	activity			code of QE / AR	test method	standard	frequency	checked by Executor (Party B)		inspected by Inspector (Party C)		confirmed by Engineer (Party C)		remarks
								date	sign	date	sign	date	sign	
1	Preparatory Works	Material Test	Aggregate	QA 19	Sieve analysis / Grading	AASHTO T 27	per source any irregularity							
2				QA 20	Abrasion	AASHTO T 96								
3				QA 21	Fractured faces	AASHTO M 147-6S								
4				QA 22	Flakiness Index	BS 82								
5			Prime coat	QA 23	as shown in CCMP appendix I 5.2		per source any irregularity							
6			Tack coat / Binding	QA 24	as shown in CCMP appendix I 5.2		per source any irregularity							
7	Prime Coat			QA 25	Application volume	Japan Road Association	1 time / 1000 m2							
8	Tack coat			QA 26	Application volume	Japan Road Association	1 time / 1000 m2							
9	Spreading aggregate (19 mm)													
10	Compaction				Number of passes of compactor									
11	Tack coat			QA 26	Application volume	Japan Road Association	1 time / 1000 m2							
12	Spreading aggregate (12 mm)													
13	Compaction				Number of passes of compactor									

Check List of SBST Work

Budget Year:	Province:	Party A:	Party B:	Party C:
Project Name:	Location:			

QA: quality control for pavement, AR: as-built control

	activity			code of QE / AR	test method	standard	frequency	checked by Executor (Party B)		inspected by Inspector (Party C)		confirmed by Engineer (Party C)		remarks
								date	sign	date	sign	date	sign	
1	Preparatory Works	Material Test	Aggregate	QA 19	Sieve analysis / Grading	AASHTO T 27	per source any irregularity							
2				QA 20	Abrasion	AASHTO T 96								
3				QA 21	Fractured faces	AASHTO M 147-6S								
4				QA 22	Flakiness Index	BS 82								
5			Prime coat	QA 23	as shown in CCMP appendix I 5.2		per source any irregularity							
6			Tack coat / Binding	QA 24	as shown in CCMP appendix I 5.2		per source any irregularity							
7	Prime Coat			QA 25	Application volume	Japan Road Association	1 time / 1000 m2							
8	Tack coat			QA 26	Application volume	Japan Road Association	1 time / 1000 m2							
9	Spreading aggregate (19 mm)													
10	Compaction				Number of passes of compactor									

Check List of Piling Works

Budget Year:	Province:	
Project Name:		Location:

Party A:	Party B:	Party C:

QP: quality control for piling, AR: as-built control

	activity		code of QC / AR	test method	standard	frequency	checked by Executor (Party B)		inspected by Inspector (Party C)		confirmed by Engineer (Party C)		remarks
							date	sign	date	sign	date	sign	
1	Preparatory Works	Measurement of Precast Pile	QP 1	Measurement	CS 5.3.2.1	Every Pile							
1	Test Pile (1)	Recording	QP 3	Recording	CS 5.3.3.3	Every Pile							
2		Bearing Capacity	QP 4	Driving Formula	JRA 17.10	Every Pile							
3			QP 5	Static Load Test	CS 5.3.3.3	Test Pile							
4			QP 6	Dynamic Load Test	ASTM D4945	Test Pile							
5	Driving Piles	Eccentricity	QP 2	Measurement	CS 5.3.3.2	Every Pile							
6		Recording	QP 3	Recording	CS 5.3.3.3	Every Pile							
7		Bearing Capacity	QP 4	Driving Formula	JRA 17.10	Every Pile							
8	Test pPile (2)	Bearing Capacity	QP 5	Static Load Test	CS 5.3.3.3	Test Pile							
9			QP 6	Dynamic Load Test	ASTM D4945	Test Pile							

Check List of Concrete Works

Budget Year:	Province:		Party A:	Party B:	Party C:
Project Name:		Location:			

QC: quality control for concrete, AR: as-built control

	activity			code of QC / AR	test method	standard	frequency	checked by Executor (Party B)		inspected by Inspector (Party C)		confirmed by Engineer (Party C)		remarks
								date	sign	date	sign	date	sign	
1	Preparatory Works	Material Test	Fine aggregate	QC 2	Grading	AASHTO 1A	per source any irregularity							
2			Coarse aggregate	QC 3	Grading	AASHTO 1A	per source any irregularity							
3				QC 4	Abrasion	AASHTO T 96								
4				QC 5	Flakiness Index	BS 82								
5			Water	QC 6	Taste of water		per source any irregularity							
6			Cement	QC 7	Manufacture's Certificate	AASHTO T 131	per source any irregularity							
7		Trial Mix		QC 8	Mix proportion		per mix any irregularity							
8		Material Test	Steel bar	QC 1	Mill certificate	AASHTO T 68	per source any irregularity							
9		Shoring method	Form	QC 11	Shape, Strength, Rigidity	CS								
10		Setting out												
11	Installation of Steel Bar		Bar arrangement	QC 9	Placing, Supporting,		all							
12				QC 10	Slicing		all							
13	Form Work			QC 11	Shape, Strength, Rigidity	CS	all							
14	(Site Mix)				Concrete weight, Water volume, Slump, Sampling									
15	Pouring			QC 12	Slump cone	AASHTO T 119	every truck							
16				QC 13	Sampling	AASHTO T 22, T 23	first batch & every 25 m3							
17				QC 14	compaction	CS	all							
18	Curing		Method & period	QC 15	Observation		all							
19	Removal of Form		Removal timing				all							
20	Concrete Structure			QC 13	Compressive test	AASHTO T 22, T 23	all							
21				AR 1-16	Dimension & Elevation		all							

I Request for Inspection

KINGDOM OF CAMBODIA

NATION RELIGION KING

MINISTRY OF PUBLIC WORKS AND TRANSPORT

THE STRENGTHENING OF CONSTRUCTION QUALITY CONTROL

REGULATION
FORCE ACCOUNT PROJECT

SECOND EDITION

AUGUST 2012

PREPARED BY: MPWT'S COUNTERPARTS AND JICA EXPERTS

No. Date:

Budget Year	Province
Chapter	Road Number
Name of Party B	Name of Party C

Request for Inspection

To (Name of Inspector)
(Party C or D)

We request you to inspect the items mentioned below for your approval

Location :

Contents of Inspection

Requested BY

Name of in-charge
(Party B)

Approved By

Name of inspector
(Party C)

Preface

The Project for Strengthening of Construction Quality Control (SCQCP) was commenced at the end of 2009 and the team for task 1 (output 1-1), establishing new standard guideline and regulation for force account project was set up in January 2010. The team consists of counterparts from the various departments of the Ministry of Public Works and Transport (MPWT) in Cambodia and experts from Japan International Cooperation Agency (JICA).

Since setting up the team, related documents were collected and reviewed, such as sub decrees for relevant organizations in MPWT, construction specifications currently used for construction projects and contract agreements etc. Interviews to management, technical and support staff in MPWT were also conducted. Following those actions, numbers of discussions were taken place among the team and key concept and table of contents for the regulation were established in March 2010. At the same time, each clause in the regulation was assigned to counterparts in task 1.

All counterparts then started to write up clauses and reviewed those written papers with other counterparts, incorporating advices from the JICA experts. The first draft was completed in June 2010, as scheduled.

Following the completion of the first draft, the counterparts and experts commenced to explain concept and contents of the first draft to relevant parties concerned to the force account projects for their comments and advices. With these comments and advices, the team member discussed, reviewed and finalized the regulation (final draft) in August 2010.

The final draft of regulation together with the standard guideline was presented at the third Executive Committee (EC) meeting for discussion and comments from the member. After obtaining consents from the EC member, these documents (post final draft of regulation and standard guideline incorporating comments of the EC member) were delivered and accepted at the Joint Coordinating Committee (JCC) meeting for applying them to pilot projects in 2011.

The regulation in 2010 was first edition and it was being applied to pilot projects in 2011 and 2012. In February 2012, the team for task 1 (output 1-1) was set up again in order to review, add and modify the first edition of regulation as required toward compilation of second edition. Since then, there were quite a number of discussions among the team and at the counterpart meetings. At the end of April 2012, draft of second edition was up and comments on the second edition were requested to and collected from stakeholders. After reviewed those comments in the team for task 1, the second edition of regulation was complete in July 2012 together with Khmer version.

The second edition of regulation was explained and agreed in the sixth EC meeting in August 2012 and was finally accepted in the third JCC meeting in August 2012. Accordingly, the second edition of regulation and standard guideline shall be applied to all force account projects in Cambodia from 2013 onward.

It is to note that the regulation has been prepared purely for force account projects, however it will be applicable for contract-out projects with some modifications, as party B is private company. This is to say, authorities and responsibilities in each party shall be defined more clearly and precisely to fit to that purpose (contract-out projects).

contents

Preface

I GENERAL PROVISION 1

1. Scope 1
2. Objectives 1
3. Application 1
4. Roles and Responsibilities of Parties Concerned in Force Account Project 1

II RULES FOR PARTIES IN FORCE ACCOUNT PROJECT 2

1. Basic Survey and Design 2
   1.1 Preparation of Basic Design 2
   1.2 Check of Basic Design 2
2. Preliminary Cost Estimate 2
   2.1 Preparation of Preliminary Cost Estimate for Construction 2
   2.2 Preparation of Preliminary Cost Estimate for Supervision 2
   2.3 Check and Sum of Preliminary Project Cost 2
3. Negotiation for Project 2
   3.1 Submission of Basic Designs and Preliminary Project Costs to MPWT 2
   3.2 Discussion for Basic Designs and Project Costs between MEF and MPWT 2
4. Budget Confirmation 2
   4.1 List of Projects 2
5. Detailed Survey and Design 3
   5.1 Preparation of Detailed Design Documents 3
   5.2 Check of Detailed Design Documents 3
6. Detailed Cost Estimate 3
   6.1 Preparation of Detailed Cost Estimate for Construction 3
   6.2 Preparation of Detailed Cost Estimate for Supervision 3
   6.3 Check and Sum of Project Cost 3
7. Final Negotiation for Project 3
   7.1 Submission of Detailed Designs and Project Costs to MPWT 3
   7.2 Discussion for Detailed Designs and Project Costs between MEF and MPWT 3
8. Contract 3
   8.1 Party A, Party B, Party C and Party D 3
   8.2 Documents Forming Contract 5
   8.3 Construction Period and Warranty Period 5
   8.4 Contract Price 5
   8.5 Payment Term 5
   8.6 Approval of Contract 5
   8.7 Form of Contract Agreement 5
9. Implementation 5
   9.1 Definition 5
   9.2 Roles of Parties 5
   9.3 Subcontract 5
   9.4 Contract Documents and As-Build Documents 6
   9.5 Unforeseen Physical Conditions 6
   9.6 Programme, Progress and Meetings / Reports 6
   9.7 Quality Control 6
   9.8 Stop Order and Suspension 6
   9.9 Extension of Time 7
   9.10 Inspection (Interim, Completion and Warranty) 7
   9.11 Variations 7
   9.12 Payments 7
   9.13 Force Majeure 8
   9.14 Defects during Warranty Period 8
   9.15 Others 8
10. Appraisal of Projects 8

Annex A Form of Contract between Party A and Party B
B Project Information

Postscript

I GENERAL PROVISION

1. Scope

Scope of the regulation is to specify roles and responsibilities for related parties to the force account projects implemented in Ministry of Public Works and Transport (MPWT). The regulation shall also be applied to the force account projects carried out by Royal Cambodian Army Force (RCAF) and/or Police Office (PO).

2. Objectives

The objectives of the regulation are to make clear precisely which party does what matters in which timing in each activity along the flow of the force account project in order to achieve the required quality in construction.

Roles and responsibilities of related parties to the force account project in the project flow are indicated in clause 4 of Section I.

3. Application

1) The regulation is to apply only to the force account projects implemented by the organization, such as Department of Public Works and Transport (DPWT), General Department of Public Works (GDPW), General Department of Inspection (GDI), Heavy Equipment Center (HEC), Public Works Research Center (PWRC), Road Infrastructure Department (RID), Sub-National Public Infrastructure and Engineering Department (SPIED), Royal Cambodian Army Force (RCAF) and Police Office (PO).
2) As Procurement Evaluation Award Committee (PEAC), which is formed in member from Ministry of Economy and Finance (MEF) and MPWT is being involved in certain timings for check and inspection to the force account projects, roles and responsibilities for PEAC are also stipulated in relevant clauses of the regulation.

4. Roles and Responsibilities of Parties Concerned in Force Account Project

Project Flow and Roles & Responsibilities of Concerned Parties in Force Account Project of MPWT

activity of project flow		timing	prepared by		checked / supervised by		approved by		remarks
			chapter 21	chapter 61	chapter 21	chapter 61	chapter 21	chapter 61	
A	basic survey and design	may - jun in previous yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	-	-	*standard guideline to be applied*
B	preliminary cost estimate	jun in previous yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	-	-	*ditto*
C	negotiation	jul - dec in previous yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	DG of PW / RID / PWRC / SPIED		MPWT / MEF		
D	budget confirmation	end in previous yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	DG of PW / RID / PWRC / SPIED		MPWT / MEF		
E	detailed survey and design	jan - feb in execution yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	-	-	*standard guideline to be applied*
F	detailed cost estimate	feb in execution yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	-	-	*ditto*
G	final negotiation	feb in execution yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	DG of PW / RID / PWRC / SPIED		MPWT / MEF		
H	contract	feb - mar in execution yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	DG of PW / PEAC		
I-1	initial payment	mar in execution yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	PEAC		
J-1	implementation	jan - mid in execution yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	-	-	*standard guideline to be applied*
I-2	interim inspection	middle in execution yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	PEAC / GDI		*ditto*
J-2	implementation	mid - dec in execution yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	-	-	*ditto*
I-3	inspection at completion	end in execution yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	PEAC / GDI		*ditto*
K	maintenance during warranty period	jan - dec in next yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC / SPIED	RID / PWRC / SPIED	-	-	*ditto*
L	warranty inspection	end in next yr	RID / HEC / DPWT /RCAF/PO	RID/HEC /DPWT	RID / PWRC /SPIED	RID / PWRC / SPIED	PEAC / GDI		*ditto*

II RULES FOR PARTIES IN FORCE ACCOUNT PROJECT

1. Basic Survey and Design

Basic survey and design shall be carried out and complete in May to June of the previous year of project implementation.

1.1 Preparation of Basic Design

Execution party (DPWT, HEC, Road/Bridge Unit in RID, RCAF or PO) shall carry out basic survey and design for proposed projects, prepare the report and submit it to checking party.

1.2 Check of Basic Design

Checking party (Planning and Technical Bureau in RID, PWRC and/or SPIED) shall review the report submitted by the execution party stipulated in clause 1.1 and the checking party shall furnish either comments or agreement to the execution party within two weeks after submission.
This process shall be repeated until agreement is reached.

2. Preliminary Cost Estimate

Estimation of preliminary cost for proposed projects shall be carried out and complete in June of the previous year of project implementation.

2.1 Preparation of Preliminary Cost Estimate for Construction

Execution party (DPWT, HEC, Road/Bridge Unit in RID, RCAF or PO) shall make preliminary cost estimate for construction, based on the report agreed in clause 1.2 and submit it to checking party.

2.2 Preparation of Preliminary Cost Estimate for Supervision

Supervision party (Planning and Technical Bureau in RID, PWRC and/or SPIED) shall make preliminary cost estimate for supervision, based on the report agreed in clause 1.2 and submit it to checking party.

2.3 Check and Sum of Preliminary Project Cost

1) Checking party (Planning and Technical Bureau in RID, PWRC and/or SPIED) shall reviewed the preliminary cost estimate submitted by the executed party and the supervision party stipulated in clause 2.1 and clause 2.2 respectively and the checking party shall furnish either comments or agreement to the execution party and the supervision party within two weeks after submission.
This process shall be repeated until agreement is reached.
2) Checking party shall then sum up preliminary cost of construction and supervision as preliminary project cost.

3. Negotiation for Project

Negotiation shall take place in July to December of previous year of the project implementation, after preparing the preliminary project costs stipulated in clause 2.3.

3.1 Submission of Basic Designs and Preliminary Project Costs to MPWT

Execution party (DPWT, HEC, Road/Bridge Unit in RID, RCAF or PO) and checking party (Planning and Technical Bureau in RID, PWRC and/or SPIED) shall submit reports for basic design and preliminary project costs to GDPW and Undersecretary and Secretary of State in charge for review and approval.
This shall be considered approval process in MPWT.

3.2 Discussion for Basic Designs and Project Costs between MEF and MPWT

1) After approval process in MPWT, summary with reports for basic design and preliminary project costs for all force account projects planned shall be submitted to the Ministry of Economy and Finance (MEF) for discussion between MEF and MPWT.
2) Discussion shall be made and agreement be reached between them.

4. Budget Confirmation

Budget confirmation shall be made around end of the previous year of project implementation, after negotiation stipulated in clause 3.2.

4.1 List of Projects

1) As soon as after the agreement made between MEF and MPWT for basic design reports and preliminary project costs stipulated in clause 3.2, list of projects with preliminary amount for each project shall be compiled and published.

2) Amount for projects in the list shall be considered to be ceiling amount and shall not be exceeded during final negotiation.

5. Detailed Survey and Design

Detailed survey and design shall be carried out and complete in January and February of the year of project implementation.

5.1 Preparation of Detailed Design Documents

Execution party (DPWT, HEC, Road/Bridge Unit in RID, RCAF or PO) shall carry out detailed survey and design for proposed projects, prepare the report and submit it to checking party.

5.2 Check of Detailed Design Documents

Checking party (Planning and Technical Bureau in RID, PWRC and/or SPIED) shall review the report submitted by the execution party stipulated in clause 5.1 and the checking party shall furnish either comments or agreement to the execution party within two weeks after submission.

This process shall be repeated until agreement is reached.

6. Detailed Cost Estimate

Estimation of detailed cost shall be carried out and complete in February of the year of project implementation.

6.1 Preparation of Detailed Cost Estimate for Construction

Execution party (DPWT, HEC, Road/Bridge Unit in RID, RCAF or PO) shall make cost estimate for construction, based on the report agreed in clause 5.2 and submit it to checking party.

6.2 Preparation of Detailed Cost Estimate for Supervision

Supervision party (Planning and Technical Bureau in RID, PWRC and/or SPIED) shall make cost estimate for supervision, based on the report agreed in clause 5.2 and submit it to checking party.

6.3 Check and Sum of Project Cost

1) Checking party (Planning and Technical Bureau in RID, PWRC and/or SPIED) shall review the cost estimate submitted by the execution party and the supervision party stipulated in clause 6.1 and clause 6.2 respectively and the checking party shall furnish either comments or agreement to the execution party and the supervision party within two weeks after submission.
   This process shall be repeated until agreement is reached.
2) Checking party shall then sum up costs of construction and supervision as project cost.

7. Final Negotiation for Project

Final price negotiation shall take place in February of the year of project implementation, after preparing the project cost stipulated in clause 6.3.

7.1 Submission of Detailed Designs and Project Costs to MPWT

Execution party (DPWT, HEC, Road/Bridge Unit in RID, RCAF or PO) and checking party (Planning and Technical Bureau in RID, PWRC and/or SPIED) shall submit reports for detailed design and project cost to GDPW and Undersecretary and Secretary of State in charge for review and approval.

This shall be considered approval process in MPWT.

7.2 Discussion for Detailed Designs and Project Costs between MEF and MPWT

1) After approval process in MPWT, summary with reports for detailed design and project costs shall be submitted to the Ministry of Economy and Finance (MEF) for discussion between MEF and MPWT.
2) Discussion shall be made and agreement be reached between them.

8. Contract

Contract shall be made between concerned parties in February to March of the year of project implementation.

8.1 Party A, Party B, Party C and Party D

Following parties shall be the party for force account project;

Party A: the Employer, Director General of Public Works represents Party A. Main roles and responsibilities are;

1) to give Party B permission to work on site

2) to appoint supervisor as Party C and inform the appointment to Party B
3) to request MEF pay amount to Party B and Party C time to time

Party B: the Executor, (*Director / Chief of Heavy Equipment Center / Road or Bridge Unit of Road Infrastructure Department / Department of Public Works and Transport of xxxx Province /* Royal Cambodian Army Force / Police Office *)* represents Party B. Main roles and responsibilities are;

1) to carry out the Works in accordance with the Contract Documents.
2) to commence and complete the Works within construction period.
3) to carry out quality tests and keep records in accordance with the standard guideline.
4) to submit monthly report to Party C.
5) not to subcontract any part of the Works, without prior consent from Party C for such subcontract.
6) to inform unforeseen conditions to Party C, when encountered.
7) to request extension of time with reasons to Party C, if the Works delay.
8) to request inspections in accordance with the standard guideline and the regulation for interim payment, payment at completion and remaining payment after warranty period.
9) to submit all contract documents with as-build drawings and important papers (one hard copy and soft copy with PDF) to Party A through Party C upon completion

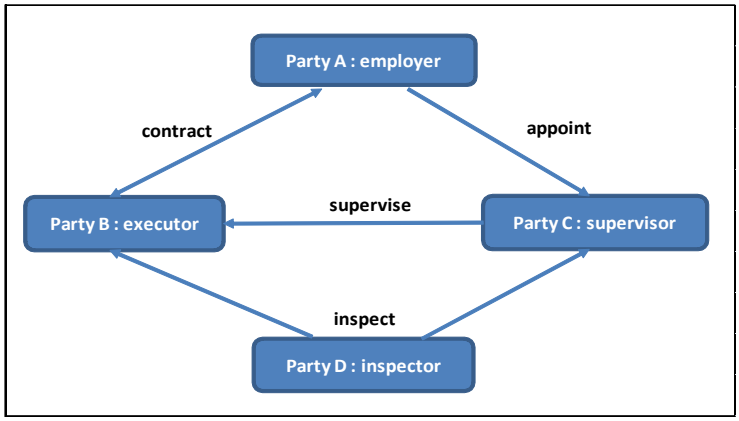
Party C: the Supervisor, *(Name of Staff from Planning and Technical Bureau in Road Infrastructure Department / Public Works Research Center / Sub-National Public Infrastructure and Engineering Department)* represents Party C. Main roles and responsibilities are;

1) to supervise the Works carried out by Party B.
2) to witness quality tests and check records in accordance with the standard guideline.
3) to review monthly report submitted by Party B and compile monthly report of Party C, adding observation of Party C.
4) to review unforeseen conditions reported by Party B and to make concept design change, if necessary.
5) to review request of extension of time from Party B and to make decision within reasonable time.
6) to stop and/or suspend the Works, if the Works are not in accordance with the Contract and/or any reason to do so.
7) to instruct Party B in order to achieve requirements in the Contract and to make design change, if necessary.
8) to check the Works and review the records upon requests of inspection from Party B for interim payment, payment at completion and remaining payment after warranty period and to inform Party D for their inspection, if satisfying himself of the works.

Party D: the Inspector, *(Procurement Evaluation Award Committee (PEAC) and/or General Department of Inspection)* represents Party D. Main roles and responsibilities are;

1) to check the Contract prior to signing by Party A and Party B.
2) to inspect upon request from Party B through Party C in accordance with the regulation and the standard guideline for interim payment, payment at completion and remaining payment after warranty period.

The formation of Party A, Party B, Party C and Party D during project implementation is shown below.



8.2 Documents Forming Contract

The contract consists of the following documents;

1) the Contract Agreement: form is enclosed in Annex A.
2) the Standard Guideline
3) the Regulation
4) the Technical Specification
5) the Detailed Design Documents, Project Costs and Works Schedule

8.3 Construction Period and Warranty Period

The construction period, including commencement and completion dates and warranty period (if any) shall be written in the Contract Agreement.

8.4 Contract Price

The contract price shall be written in the Contract Agreement, together with brief of the project.

8.5 Payment Term

The procedure of payment and pre-requisites to payment (inspection by Party C & Party D) shall be stipulated in clauses 9.10 and 9.12 in details and percentage of each payment (advance payment, initial payment, interim payment, payment at completion and payment after warranty period etc.) shall be written in the Contract Agreement.

8.6 Approval of Contract

The contract shall be checked and approved by Party D prior to signing by relevant parties.

8.7 Form of Contract Agreement

1) With the requirements in the above clauses, Forms of Contract Agreement are prepared between Party A and Party B attached in Annex A in the regulation for all force account projects.
2) The Form of Contract Agreement is set for purpose of contract standardization.

9. Implementation

The following clauses specify important aspects during project implementation, including warranty period.

9.1 Definition

1) “Party” means Party A, Party B, Party C and Party D, describing main roles and responsibilities in clause 8.1 above and as the context requires.
2) “Commencement Date” and “Completion Date” mean the date for commencing the Works and completing the Works respectively, stated in the Contract Agreement.
3) “Time for Completion” means the time for completing the Works or a Section (as the case may be) stated in the Contract Agreement (with any extension under clause 9.9 [Extension of Time]), calculated from the Commencement Date.
4) “Tests” mean the tests which are specified in the Contract Documents or agreed by Parties, shall be carried out under clause 9.7 [Quality Control] and 9.10 [Inspection].
5) “Contract Price” means the price stated in the Contract Agreement and includes adjustments in accordance with the Contract Documents.
6) “Works” mean the Permanent Works and the Temporary Works, or either of them as appropriate.

9.2 Roles of Parties

1) Party A shall permit Party B to implement the Works by providing site possession, shall appoint a supervisor as Party C and shall inform MEF to make payment to Party B and Party C, after each inspection and application for payments, as detailed in clause 9.10 and 9.12.
2) Party B shall carry out the Works in accordance with the Contract and inform to Party C when unforeseen conditions are encountered, variations require adjustment and delays appear. Party B shall receive any instruction from Party C.
3) Party C shall administer project in impartial and bona fade manner. Party C shall instruct to Party B, vary design in professional and proper way in order to maintain construction quality and Judge & determine on requests of extension of time and modification of design from Party B.
4) Party D shall check the Contract prior to signing by the parties and inspect the Works time to time as defined in clause 9.10.

9.3 Subcontract

Party B shall not subcontract any part of the Works, unless approval of subcontract is given by Party C.

9.4 Contract Documents and As-Build Documents

1) Contract Documents are defined in clause 8.2, which shall be mutually explanatory of one another.
2) Party B shall always keep the Contract Documents on site during implementation.
3) Party B shall at completion submit project information (using a format in Annex B) and all Contract Documents, including as-build documents and other important papers as agreed to Party C in form of one hard copy and soft copy with PDF. Upon the submission, Party C shall check and review them and shall furnish either comments or acceptance to Party B within two weeks. This process shall be repeated until acceptance.
4) Soon after the acceptance, Party C shall deliver them to Party A to store at library for database.

9.5 Unforeseen Physical Conditions

1) Physical conditions means natural physical conditions and man-made and other physical obstructions, which Party B encounters at the site when executing the Works, including sub-surface and hydrological conditions and extremely adverse climatic conditions.
2) If Party B encounters adverse physical conditions which he considers to have been unforeseeable, Party B shall give notice to Party C as soon as practicable.
3) Party B shall continue executing the Works, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with any instructions which Party C shall give. If an instruction constitutes a variation, clause 9.11 [Variations] shall apply.

9.6 Programme, Progress and Meetings / Reports

1) Party B shall submit to Party C construction schedule, work execution plan for the Works and other documents for approval, as soon as the Works commence. On receipt, Party C shall check and review them and shall furnish either comments or agreement to Party B within two weeks after submission.
   This process shall be repeated until acceptance.
2) When Party C finds the Works are behind the schedule, Party C shall notify such delay to Party B and request Party B submit revised schedule, taking such delay into consideration.
3) Party B shall prepare and submit monthly report, including status of progress every month to Party C at the end of first week of the following month. Upon receipt of the report, Party C shall compile his monthly report with observation of Party C and submit it to Party A within one week after receipt.
4) Party C shall call for monthly meeting and Party B shall attend the meeting and report the progress. Party B and Party C shall discuss any matters arising on site for maintaining progress and completing the Works on time. Party A may attend the meeting.

9.7 Quality Control

1) Party B shall carry out all execution of the Works, (a) in the manner (if any) specified in the Contract and (b) in a proper workmanlike and careful manner, in accordance with good practice.
2) Party B shall give Party A, Party C and/or Party D full opportunity to carry out checking quality of the Works at any time in accordance with the standard guideline.
3) Party B shall give notice to Party C whenever any work is ready and before it is covered up, put out of sight. Party C shall then carry out the examination, inspection, measurement or testing in accordance with the stipulation in the standard guideline.

9.8 Stop Order and Suspension

1) When Party A and/or Party C find that the Works are carried out with inappropriate manner by Party B and seem to affect final product in quality, Party C shall stop Party B to proceed to the Works and request rectification to the works already done improperly.
   After rectifying the works suspended or stopped to the satisfaction of Party C, Party C shall issue notice to Party B to resume the works.
2) Party C may at any time instruct Party B to suspend progress of part or all of the Works. During such suspension, Party B shall protect, store and secure such part or the Works against any deterioration, loss or damage. In such case, Party C shall notify the cause for the suspension to Party A and Party B. If and to the extent that the cause is not the responsibility of Party B, Party C shall evaluate such suspension in reasonable manner in accordance with clauses 9.9 and 9.11.

9.9 Extension of Time

1) Party B shall be entitled to an extension of time for completion if and to the extent that completion is or will be delayed by any causes, other than those through default of Party B.
2) If Party B considers himself to be entitled to an extension of time for completion, Party B shall give notice and request an extension of time with the details and reasons to Party C.
3) Upon receipt of such request, Party C shall judge and determine an extension of time within reasonable time and shall submit it to Party A for approval. As soon as after obtaining the consent from Party A, Party C shall inform the extension of time to Party B and send the copy to Party D accordingly.
4) When determining each extension of time, Party C shall review previous determinations and may increase the total extension of time.

9.10 Inspection (Interim, Completion and Warranty)

1) When time comes for interim payment, payment at completion or remaining payment after warranty period, Party B shall request such inspection to Party C through submission of the documents substantiating the Works have been complete to the relevant stage at interim, completion or after warranty period.
2) Upon request, Party C shall check status of the Works and the documents (as stated in 1) above) and inform Party D for inspection, otherwise Party C shall notify Party B to rejection of request, giving reasons and specifying the Works to be done prior to request such inspection again.
   In addition, Party C shall make a certificate stating that the Works have been confirmed to be complete and deliver the copy of certificate to Party D, when informing Party D for inspection at completion.
3) Upon information from Party C, Party D shall inspect the Works within two weeks in accordance with the details stipulated in the standard guideline. After such inspection, Party D shall inform Party B and Party C either that the Works are in order or re-inspection shall be carried out after defects (to be specified) are rectified.

9.11 Variations

1) Variations may be initiated by Party A and Party C for any reason to achieve requirements in the Contract at any time prior to completion of the Works, either by an instruction or by a request from Party B with proposal.
2) Party B shall execute and be bound by each variation. Simultaneously, Party B shall submit monetary proposal, if necessary and Party C shall evaluate variation with consultation with Party B and submit it to Party A for approval. As soon as after obtaining the consent from Party A, Party C shall adjust Contract Price if necessary and send the information to Party B and Party D.

9.12 Payments

A) Payments for construction shall be made at various stages and percentages to total sum for each payment shall be stated in the Contract Agreement.
   In all cases, payment shall be made within 28 days after Party A proceeds for payment.
   1) Advance payment: After budget confirmation stipulated in clause 4.1, Party B may request for advance payment. Upon such request, Party C shall examine and recommend Party A to proceed for payment, if such deems reasonable.
   2) Initial payment: After contract agreement is signed, Party B may request for payment of initial payment. Upon such request, Party C shall examine and recommend Party A to proceed for payment. Initial payment shall be amount specified in the Contract Agreement less advance payment, as the case may be.
   3) Interim payment: When inspection for interim payment stipulated in clause 9.10 is passed, Party B may request for payment of interim payment. Upon such request, Party C shall examine and recommend Party A to proceed for payment.
   4) Payment at completion: When inspection for payment at completion stipulated in clause 9.10 is passed, Party B may request for payment at completion. Upon such request, Party C shall examine and recommend Party A to proceed for payment.
   5) Payment after Warranty Period (if there is warranty period): When inspection for payment after warranty period stipulated in clause 9.10 is passed, Party B may request for payment after warranty period. Upon such request, Party C shall examine and recommend Party A to proceed for payment.

B) Payments for supervision shall be made at same time for those for construction and percentages

to total sum for each payment shall be as follows.

1) Advance payment: 20 % shall be paid or 25 % be paid if there is no warranty period.
2) Initial payment: 25 % shall be paid.
3) Interim payment: 25 % shall be paid.
4) Payment at completion: 25 % shall be paid.
5) Payment after warranty period: 5 % shall be paid or nil if there is no warranty period.

9.13 Force Majeure

1) "Force Majeure" means an exceptional event or circumstance, including (i) war, hostilities, invasion, (ii) rebellion, terrorism, revolution, insurrection, (iii) riot, commotion, disorder, strike or lockout, (iv) ionizing radiation or contamination by radio-activity, (v) natural catastrophes such as earthquake, typhoon or volcanic activity.
2) If a Party is or will be prevented from performing any of its obligations under the Contract by Force Majeure, it shall give notice to the other Parties of the event or circumstances constituting the Force Majeure. The notice shall be given within 14 days after the Party became aware.
3) If Party B is prevented from performing any of his obligations under the Contract by Force Majeure and suffers delay and/or incurs cost by reason of such Force Majeure, the Party B shall be entitled an extension of time for such delay and payment of any such cost. Upon such request, Party C shall proceed in accordance with clauses 9.9 and 9.11 to agree or determine these matters.
4) If the execution of Works is prevented for long time by reason of Force Majeure, either Party may give to the other Parties a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given. Upon such termination, Party B shall determine the value of the work done, as if the works are complete.

9.14 Defects during Warranty Period

During the warranty period, Party B shall be responsible for maintenance of the Works and replace any kind of Works and/or materials which do not meet with the requirements in the Standard Guideline and the Detailed Specification as soon as possible. All the expenses incurred for such reconstruction, maintenance and/or replacement shall be solely born by Party B, unless the damages are caused by natural disasters or force majeure as stipulated in clause 9.13 of the Regulation

9.15 Others

1) Every Party shall perform the duties, stipulated in the Contract, in bona fade manner and in accordance with the professional integrity.
2) When any event occurs during implementation other than those stipulated in the previous clauses, Party B and C shall discuss the matter in bona fade manner with professional discipline and shall seek solution together in amicable way.
3) All the Parties shall resolve the disputes arising in connection with the Contract amicably. In the case that the dispute is not amicably resolved between the Parties, then it may be referred to Cambodian court in Cambodia and in accordance with the laws of the Kingdom of Cambodia.

10. Appraisal of Projects

In order to have evaluation on force account projects, Party C and Party D shall appraise performance of Party B at completion in accordance with the standard guideline and the guideline recommended in Implementation Body (IB) Performance Evaluation.

Annex A (Party A and Party B)

(Form of Contract)

(xxxx xxx): *appropriate words shall be inserted to complete the contract agreement.*

Italic with underline: appropriate words shall be selected.

Contract Agreement
between
General Department of Public Works
and
(Heavy Equipment Center / Road or Bridge Unit of Road Infrastructure Department / Department of Public Works and Transport of xxxx Province) / Royal Cambodian Army Force / Police Office
for *(Name of Project)*

Project Name _____

Reference
Agreement No. *xxxxxx* dated on *(day) (month) 20xx* for *(Name of Project)* from the Ministry of Economy and Finance has been accepted by Ministry of Public Works and Transport.

Concerned Party
Party A: the Employer, Director General of Public Works represents Party A.
Party B: the Executer, *(Director / Chief of Heavy Equipment Center (HEC) / Road or Bridge Unit of Road Infrastructure Department (RID) / Department of Public Works and Transport (DPWT) of xxxx Province / Royal Cambodian Army Force (RCAF) / Police Office (PO))* represents Party B.
Party C: the Supervisor, *(Name of Staff from Planning and Technical Bureau in Road Infrastructure Department (RID), Public Works Research Center (PWRC) and/or Sub-National Public Infrastructure and Engineering Department (SPIED))* represents Party C.
Party D: the Inspector, *(Procurement Evaluation Award Committee (PEAC) and/or General Department of Inspection (GDI))* represents Party D.

Detailed role and responsibility of Party A, Party B and Party C shall be referred to the Regulation.

1. Contract Documents
The Contract consists of;
- the Contract Agreement,
- the Standard Guideline,
- the Regulation,
- the Detail of Technical Specification, and
- the Detailed Design Documents, the Project Costs and the Work Schedule.

2. The Contract Documents must be included in the agreement between both parties.

3. Works
Party A has agreed with Party B that Party B shall construct, complete and maintain the Works briefed below in accordance with the requirements of quality and schedule etc. specified in the Contract.

(project brief, like length & width, earthworks, pavement works, structure works etc.)

4. Work Schedule
1) The Works shall commence and complete as below.
   - Commencement date: *(date month 20xx)*
   - Completion date: *(date month 20xx)*.
2) Individual scope of work items shall be carried out in accordance with the Work Schedule referred to Clause 1 by Party B and confirmed by Party C.

5. Delay of the Works
The Contract shall be extended, only if there is reasonable cause for delay agreed by Party A.
If delay occurs, Party B shall inform reasons of delay to Party C and Party C shall decide duration of delay, after consultation with Party A, as stipulated in Clause 9.9 of the Regulation.

Annex A (Party A and Party B)

Party B shall not make any sub-contract over any part or whole of the Works to other contractors, as stipulated in Clause 9.3 of the Regulation.

7. Quality

Party B shall be responsible to all forms and structures and shall assure position and dimension of the Works.

During maintenance period, Party B shall amend, reconstruct and remedy defects and faults Party A and C may request before hand-over the Works.

8. Construction Quality Assurance

Party B shall assure that the works and materials are good enough and meet with the requirements in the Technical Specification (Compact Construction Materials Specification for Maintenance and Construction of Roads and Structures 2011 by Ministry of Public Works and Transport).

Warranty period is 12 months after completion of the Works, approved by PEAC.

During the warranty period, Party B shall maintain the Works and replace any kind of Works and materials not meeting with the requirements in the Specification as soon as possible.

Construction and maintenance of the Works shall be responsibility of Party B, unless damages are caused by natural disasters.

9. Failure or Incompletion

In case Party B is not able to complete the Works or any part of the Works, Party A may have right to terminate the Contract and file the matter to the court.

10. Contract Price

1) The Contract price is;

a) (section 1 xxx,xxx,xxx riel)
b) (section 2 yyy,yyy,yyy riel)
c) (section x …… riel)
d) (…… riel)
(total zzz,zzz,zzz riel)

2) Payment Term for Construction is as follows.

(in case of 4 steps payment)

Step 1: *(40 % of Contract Price)* shall be paid as an advance payment 7days after the Contract is signed and upon request by Party B.

Step 2: *(30 % of Contract Price)* shall be paid at the 50 % of progress as interim payment upon request by Party B after inspected and accepted by Party D.

Step 3: *(20 % of Contract Price)* shall be paid at completion as payment at completion upon request by Party B after inspected and accepted by Party D.

Step 4: 10 % of Contract Price shall be paid as payment for retention upon request by Party B after inspected and accepted by Party D.

(in case of 3 steps payment)

Step 1: *(40 % of Contract Price)* shall be paid as an advance payment 7days after the Contract is signed and upon request by Party B.

Step 2: *(50 % of Contract Price)* shall be paid at completion as payment at completion upon request by Party B after inspected and accepted by Party D.

Step 3: 10 % of Contract Price shall be paid as payment for retention upon request by Party B after inspected and accepted by Party D.

11. Document Usage

1) Every Party shall perform the duties, stipulated in the Contract, in bona fade manner.

2) Matters unexpectedly occurred shall be resolved by Parties concerned in amicable manner.

3) The Contract shall be made in Khmer language in *(x numbers)* signed and authorized according to the law of Cambodia and shall be kept by;

- *Party A : x no.*
- *Party B : x no.*
- *Party C : 1 no.*
- *Ministry of Economy and Finance : 2 no.*
- *Ministry of Public Works and Transport : 2 no.*

Annex A (Party A and Party B)

Phnom Penh, *xx month, 20xx*	*xxx xxx, xx month, 20xx*
Director General of Public Works	(*Director / Chief of Heavy Equipment Center / Road or Bridge Unit of Road Infrastructure Department / Department of Public Works and Transport of xxxx Province / Royal Cambodian Army Force / Police Office)*
Party A representative	Party B representative
_____	_____
Certified Phnom Penh, xx month 20xx Minister of Ministry of Economy and Finance	Certified Phnom Penh Minister of Ministry of Public Works and Transport
_____	_____

Italics show example only.

Annex B (Project Information)

Project Information

date: *May xx, 2012*

Prepared by Party B	
Checked by Party C	

(1) Basic Data		
1-1	Project name	*Rehabilitation of National Road 71*
1-2	Project fund	*National Budget Chapter 61*
1-3	Location & Road number	*Kampong Cham Province* *National Road 71 (PK2+160 ~ PK 10+940)*
1-4	Employer / Party A	*General Director of Public Works*
1-5	Executor / Party B	*DPWT Kampong Cham*
1-6	Supervisor / Party C	*Road Infrastructure Department (RID)*
1-7	Inspector / Party D	*Procurement Evaluation Award Committee (PEAC)*
1-8	Designer	*DPWT Kampong Cham checked by RID*
1-9	Others	

(2) Technical Data		
2-1	Road Length & Beginning and End Points	*2.5 km,* *Section I : 680 m (PK 2+160 - PK 2+840)* *Section II: 1,380 m (PK 4+210 – PK 5+590)* *Section III: 440 m (PK 10+500 – PK 10+940)*
2-2	Road Section	*(1 lane + shoulder) x 2 ways* *as 0.5 m (shoulder) – 3.5 m (1 lane) – 3.5 m (1 lane) – 0.5 m (shoulder)*
2-3	Earthwork	*Reconstruction of existing SBST road*
2-4	Pavement	*Capping layer (30 cm) – Sub-base (20 cm) – Base Course (20 cm) – DBST*
2-5	Culverts	*Pipe diameter 1.0 m 3 nos.* *Ditto 1.2 m 1 no.* *Box size 3.0 m x 3.0 n 2 nos.*
2-6	Bridges	*No. 1: 10 m wide x 30 m long (2 span x 15 m), Super: RC Girder* *No. 2: .....* *No. 3:*
2-7	Others	

(3) Contract Data		
3-1	Contract Amount: Original Final	*Riel xxx,xxx,xxx,xxx* *Riel yyy,yyy,yyy,yyy*
3-2	Schedule	*October xx, 2011 – May yy, 2012*
3-3	Completion Date	*May zz, 2012*
3-4	Inspection after Warranty Period	*(Plan) May zzz, 2013*
3-5	Others	

Postscript

It is the team's pleasure (task 1, consisting Cambodian counterparts and JICA experts) to present the regulation (second edition) for force account project in Cambodia. It took more than eight months in 2010 and six months in 2012 to discuss concept and contents of regulation, write up the draft and eventually complete the second edition of regulation. Following the eight months and six months struggle in the team, the regulation is really thought to be team's product.

During these months, there are lots of discussions with and opinions and comments from various departments and stakeholders. Taking those into consideration, it is recommended by the team to set up department in MPWT to look after project in view of supervision alone in order to avoid any conflict of interest. For future, force account projects would be lesser and contract-out projects be more. In this sense, the department for construction supervision would be certainly required and become more important.