

Appendix 6 (Task 4) Technical Training

6-1 Text Book of Training of Trainers (TOT)

6-2 Syllabi of Training Program in Regular Training Course

6-1 Text Book of Training of Trainers (TOT)

Training of Trainers Program

PLANNING OF TRAINING EVENT
AND
PRESENTATION SKILL

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The Strengthening of Construction Quality Control Project

Training of Trainers Program

PLANNING OF TRAINING EVENT AND PRESENTATION SKILL

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PART 1: PLANNING OF TRAINING EVENT

1.1 Introduction

1.1.1 Institutional Capacity and Capacity of Individual Staff

Ability of an organization, such as MPWT, for accomplishing its business is usually called 'institutional capacity'. Institutional capacity is influenced by many factors as shown in Figure 1.

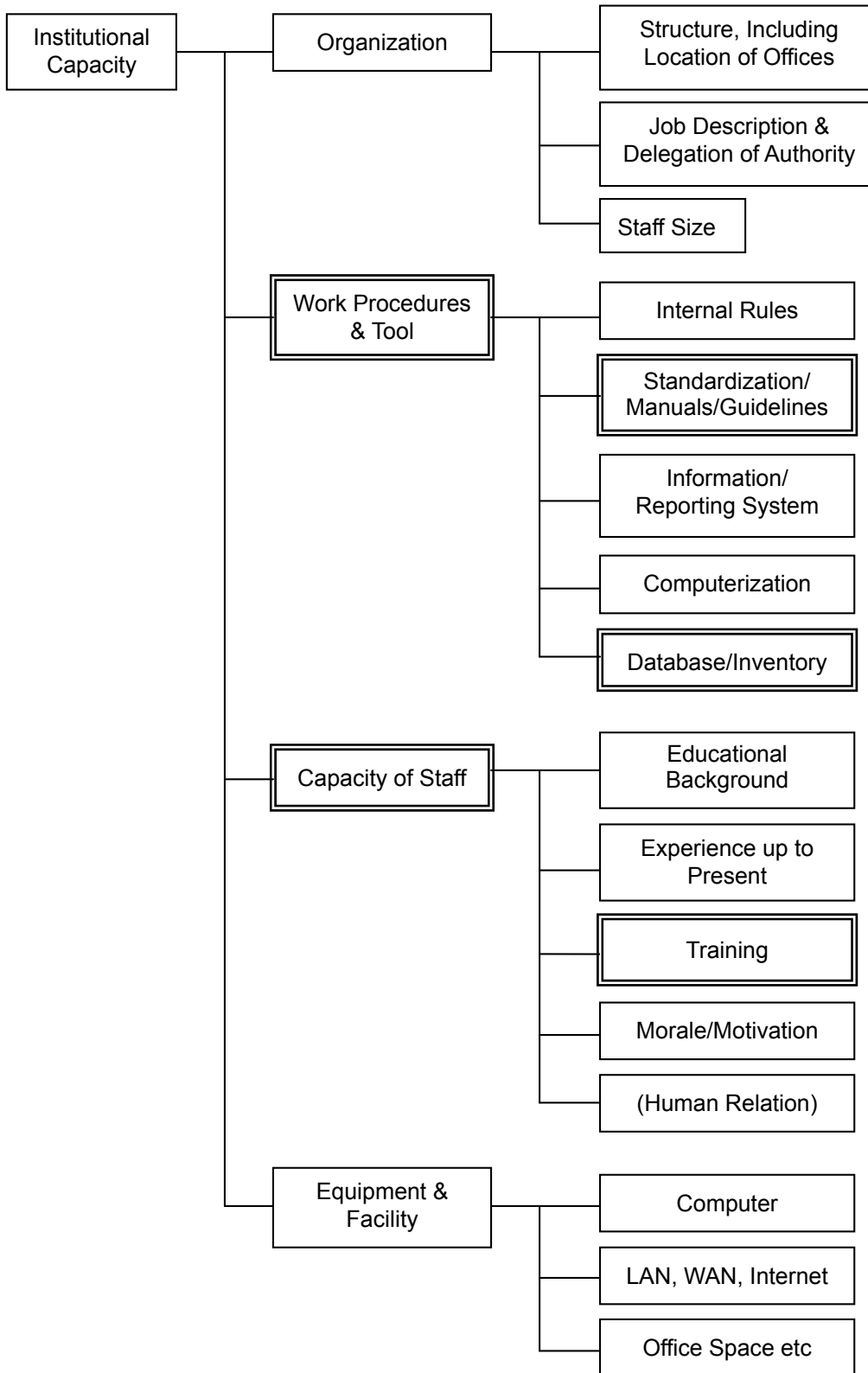
One of the important factors is work procedures and work tools. Work procedures include standardization, and guidelines/manuals which lead the staff to actually do the tasks in accordance with prescribed standard procedure. The 'Guideline' recently published by MPWT, for which this TOT is held, is an example of the guideline which directs staff of DPWT and other relevant organization to carry out the job in accordance with the standard procedures of road works.

Work tools include database/inventory. An example of database is the 'Standard Drawings of Bridge' which are now being planned in this Project.

Another important factor of institutional capacity is capacity of the staff of the institution. Capacity of staff as a group consists of the capacities of the individual staff and combination of them (team work). Capacity of an individual staff is influenced by several factors such as educational background, experience and morale/motivation. Training is also one of the factors influencing the capacity of staff.

The words 'capacity development' (or capacity building) and 'human resources development' (HRD) are often used almost as same meaning with the word 'training'. Particularly, the word HRD is often used covering wider range of concept than 'training'. The word HRD is used in Japan to refer all kinds of actions taken by an organization to upgrade the holistic capacity of staff, both as an individual and as a group, including scheme of career path.

In this text, the word 'training' or 'training event' will be used to mean actions or measures to improve capacity of an individual staff or particular group of staff. More detailed explanation of training is given in the following section.



(Note: Items in are those discussed in the Project)

Figure 1-1: Factors Influencing Institutional Capacity

1.1.2 Types of Training

When someone hears the word ‘training’, he/she may think of a training event delivered to a group of a people who are allowed to leave their daily work place (called ‘group training’). However, there are various ways to improve one’s capacity. Methods of improving one’s capacity are usually categorized into those as shown in Figure 1-2. These methods are explained below:

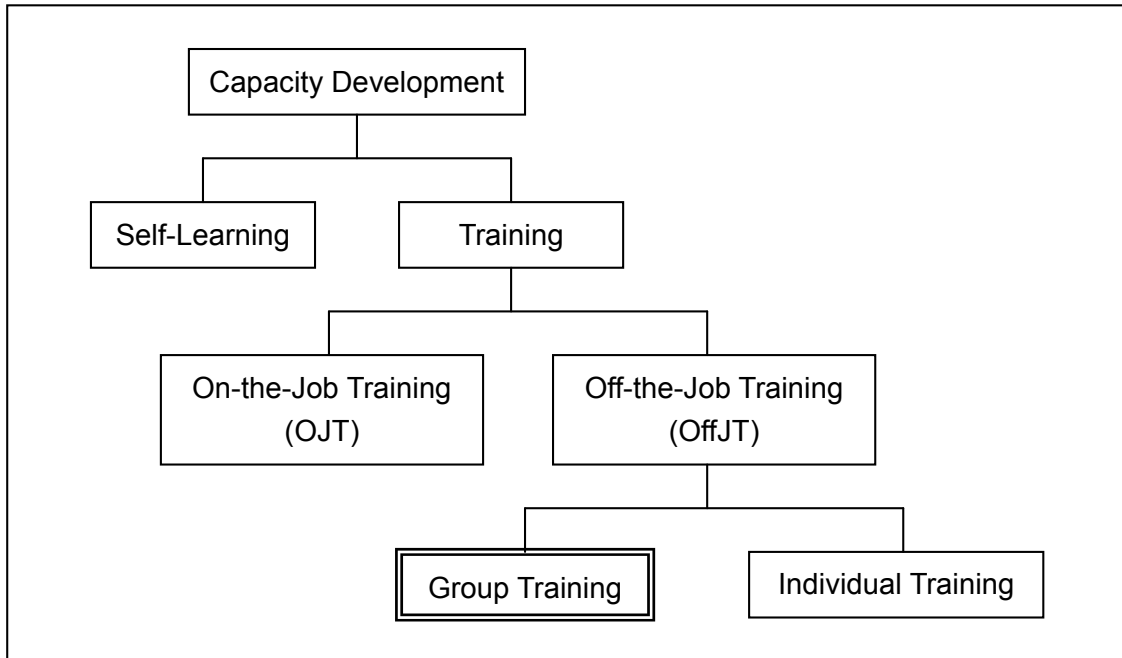


Figure 1-2 : Types of Training

(1) Self-Learning (Self-Development)

Before training is discussed, most basic way of improving one’s capacity is learning by himself/herself. This fact is often overseen. Suppose that someone is assigned to a new position, he or she has to acquire knowledge/skill needed in performing daily tasks. This is usually done through learning by him/herself with assistance of available reference such as manuals/guidelines. Actually, self-learning is often very effective way of improving his/her capacity.

Encouraging self-development is also desirable to make training effective, because desire to improve his/her capacity is indispensable for trainees.

(2) Types of Training

So-called ‘training’ is usually classified into the following types:

(i) By the place of training:

- On-the-job training (OJT): Training given in one’s working place.
- Off-the-job training (OffJT): Training given outside of one’s work place.

- (ii) By the number of participants (usually applied to OffJT)
- Group training: Training where large number of trainees are trained together.
 - Individual training: Training given on individual basis.

These types of training are compared in the following tables.

Table 1-1: Comparison of OJT and OffJT

	OJT	OffJT
Description	<ul style="list-style-type: none"> • Training given through day-to-day work in one's work place. • Trainer can be trainee's manager or senior worker 	<ul style="list-style-type: none"> • Trainee is discharged from daily duties and allowed to participate in training. • Usually implemented at location other than trainees work place (but can be in the same building).
Advantage	<ul style="list-style-type: none"> • Usually efficient and effective because training is done through actual works. • The outcome can be used immediately after completion of training. • Cost is minimal and usually does not need special budget. • Daily duties need not to be interrupted. 	<ul style="list-style-type: none"> • Trainee can concentrate in the training. • Trainers can be selected from qualified persons. • Due to above, training can be efficient and effective, and can be implemented in shorter period than OJT.
Disadvantage	<ul style="list-style-type: none"> • Unless systematically planned, often interrupted/ignored when urgent works come in, or for any other reasons. • Can be biased or have some problem if the knowledge of trainer (manager or senior worker) is biased. 	<ul style="list-style-type: none"> • Daily duties need to be interrupted. • Need certain amount of budget.

Table 1-2: Comparison of Group Training and Individual Training

	Group Training	Individual Training
Description	<ul style="list-style-type: none"> • Large number of trainees are trained at the same time. • Contents of training are decided before trainees are selected. 	<ul style="list-style-type: none"> • One trainee or small number of trainees are trained at one time. • Trainee is selected first and outline of training is decided. • Typical example is studying abroad for high-level education.
Advantage	<ul style="list-style-type: none"> • Many trainees can be trained at one time. • Cost per trainee is usually lower than individual training. • Thus, effective when large number of people need to be trained on particular subject in a short period. • Network of trainees is often created which later can help further improvement of trainees' capacity. 	<ul style="list-style-type: none"> • Level of training can be freely set based on the objective and level of trainee. • Thus, high-level training, such as study of state-of-the-art engineering, is possible.
Disadvantage	<ul style="list-style-type: none"> • Effectiveness and efficiency may not be uniform over all trainees. 	<ul style="list-style-type: none"> • Number of trainee is limited. • Therefore, not suitable when a large number of people need to be trained in a short period. • Cost per person is high.

Although types of training are usually classified as above, there is no clear boundary between them. For example, OJT often needs to be supported by self-learning and actually self-learning is a part of OJT process.

Several different words, such as 'training', 'training event', 'seminar' and 'workshop' are used to mean 'group training'. Although there are no established definitions of these words, they are usually used as the following:

- The word 'training' is generally used covering both 'workshop' and 'seminar'.
- The word 'workshop' is used to mean a type of training where active participation of the audience (trainee) is encouraged.
- On the other hand, 'seminar' is often used to mean a 'conference-type' of meeting and participation of the audience is less than workshop.

In this text, these three words are used interchangeably.

1.2 Planning and Implementation of Training Event

Like many other event, training event is planned, implemented and evaluated following 'Plan-Do-See' (PDS) cycle.

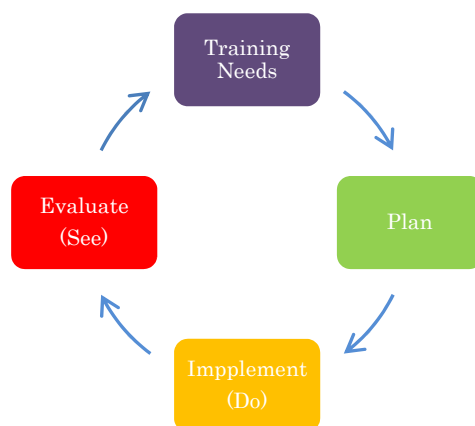


Figure 1-3: PDS Cycle of Training

Those steps of training are explained in the following sections.

1.2.1 Training Needs

Whenever a training event is planned, there should be 'needs' for the training. Such needs may be identified through 'capacity gap assessment' such as done in the early stage of this Project. Another case of training needs is when a new rule, such as technical standard, manual or guideline, is issued. To let the all concerned people know that the new rule is now effective and let them effectively use it, it is necessary to deliver a training event.

1.2.2 Planning

Planning of a training event can be divided into two steps; general plan and detailed plan or design as described below:

(1) General Plan (Outline)

First, the general plan, or the outline, of the training event needs to be defined. The general plan needs to be approved by an appropriate authority. General plan usually covers the following items:

- Objective
- Target group or participants
- Target level of achievement
- Teaching material or textbook
- Rough timing

- Duration
- Candidates of trainers
- Place: Such as Phnom Penh or Kandal? Etc

It is advisable to summarize the general plan in a tabular format as shown in Table 1-3.

Table 1-3: Example of Summary Sheet of General Plan

Outline of Workshop on Guideline and Regulation	
Objective	To familiarize DPWT staff with the Guideline and Regulation
Target Group	Working level staff of DPWT (Jr. engineers & technicians); Sr. engineers and managers may participate
Target Level of Achievement	<ol style="list-style-type: none"> 1. Working level become familiar with the contents of the Guideline and Regulation and can refer when necessary in their daily works. 2. In the future, they are expected to understand the process and procedures of site management and quality control.
Teaching Material	
Timing	4 th week of November 2010
Duration	2 days
Candidate Trainers	Mr. AA, Mr. BB,
Place	Kandal DPWT

This summary sheet can be used to explain and obtain necessary approval of the higher authority.

(2) Detailed Plan (Design)

After the general plan is approved, a detailed plan, or design of the training event, is prepared. A detailed plan usually covers the following items:

- Title and objective
- Date
- Participants
- Program & schedule, including planning of lunch break & tea break
- Teaching material
- Venue & layout of table/chair
- Trainers & other key persons
- Consideration on accommodation for the participants, if necessary
- Cost estimate & method of payment

A few key points of the above items are explained below:

Program

An example of a program is shown in Table 1-4.

Table 1-4: Example of Program

Time	Program	Speaker	Remarks
8:00 – 8:30	Registration		
8:30 – 8:45	Opening Address	Mr. XX	
8:45 – 9:15	Pre-Test		
9:15 – 10:15	Chapter 1 – 3	Mr. YY	
10:15 – 10:35	Tea Break		
10:35 – 12:00	Chapter 4 – 7	Mr. ZZ	
12:00 – 13:00	Lunch Break		Move to Room AA
13:00 – 14:10	Chapter 8-10		

Layout of Table and Chair

Figure 1-3 shows typical layout of tables and chairs. One suitable for the planned training should be selected.

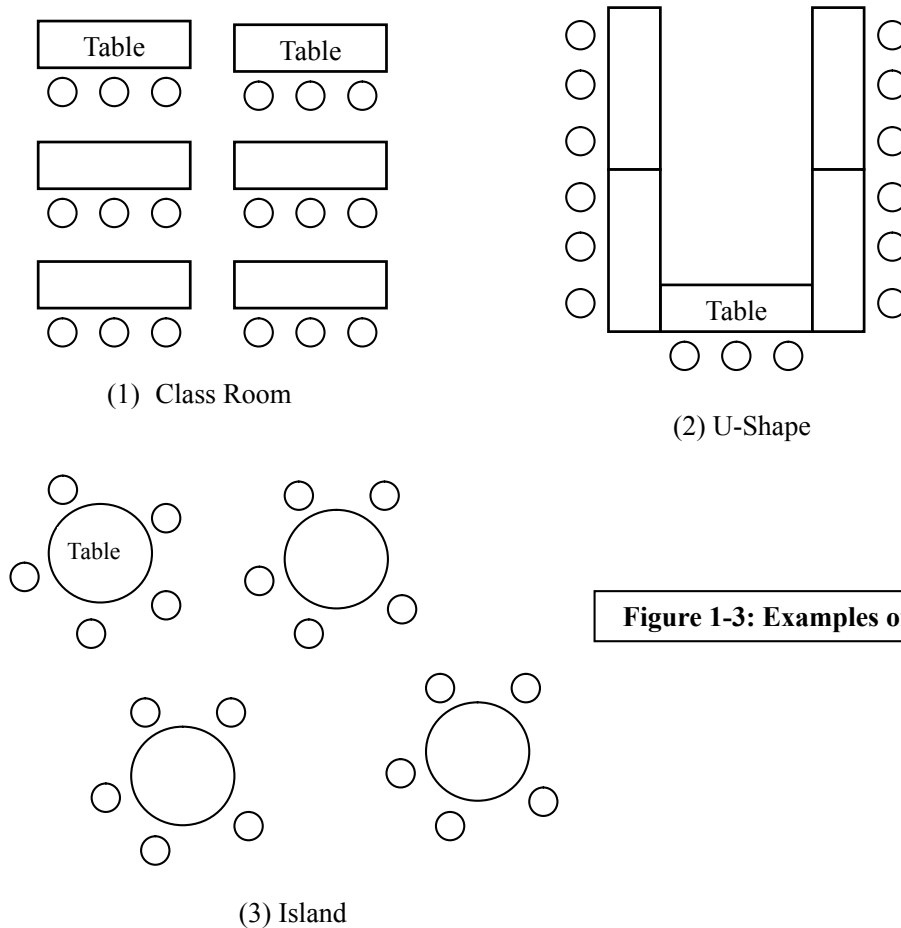


Figure 1-3: Examples of Layout

‘Island’ type is suitable when group discussion will be held, while ‘class room’ type is suitable for lecture.

Trainer

It is recommended to prepare more than one trainer for one subject for safety. The planned trainer may be unable to come due to unexpected reason such as traffic jam or sudden illness.

1.2.3 Implementation

Implementation consists of three steps; preparation, implementation and evaluation.

(1) Preparation

After implementation of the training event is approved by the concerned authority, the preparation starts. In reality, there is no clear boundary between detailed planning/designing and preparation. In preparation, the following jobs needs to be done.

- Booking the room and decide layout of tables and chairs
- Sending invitation to the participants, including preparation of attendant list
- Confirm availability of the trainers, including agreeing on the contents that each trainer teaches
- Preparation (copying & binding) of teaching material
- Preparation of tools and equipments (see the check list below)
- Arrangement of tea & food for breaks, and accommodation of participants as necessary
- Assignment of the staff for training, such as reception, time monitoring, provision of equipment/tool and ‘microphone porter’
- Preparation of evaluation sheet etc

It is recommended to prepare a ‘checking list’ as shown in Table 1-5 and make it sure that all the necessary equipment, tool and materials are there. This is done on the day before the day of implementation of the training event.

Table 1-5: Example of Check List of Equipment and Tool

	Item	No.	Remarks
Equipment & Tool	<input type="checkbox"/> PC		
	<input type="checkbox"/> Projector		Connection cable for PC
	<input type="checkbox"/> Screen		Wall of the room can be substitute
	<input type="checkbox"/> Extension cable		
	<input type="checkbox"/> White board		Necessary for drawing simple picture etc
	<input type="checkbox"/> Microphone & amp		May be equipped in the meeting room
	<input type="checkbox"/> Laser pointer		
Stationary	<input type="checkbox"/> Large-size paper		Can be used for various purposes
	<input type="checkbox"/> Flip chart		
	<input type="checkbox"/> A3 – A4 paper		
	<input type="checkbox"/> Pen		
	<input type="checkbox"/> Marker		
	<input type="checkbox"/> Adhesive tape		
	<input type="checkbox"/> Magnet		
Documents	<input type="checkbox"/> Teaching material		
	<input type="checkbox"/> Participants list		
	<input type="checkbox"/> Evaluation sheet		
Others	<input type="checkbox"/>		
	<input type="checkbox"/>		

It is recommended that ‘Plan B’ be prepared considering unexpected incident may happen. An example of such unexpected incidents is a trouble in the PC or projector. As much as possible, spare PC and projector should be prepared.

(2) Implementation

Once the training event actually begins, everything should be done in accordance with the plan. Time to time, however, unexpected incidents may happen. The person(s) responsible for the training event needs to make judgment to minimize the negative influence of the unexpected incident(s) on the training event.

(3) Evaluation

At the end of the training event, evaluation sheets are handed out to, and filled by, all the participants. The items to be typically evaluated are as follows:

- Increase of the participant’s knowledge on the subject and/or degree of understanding
- Teaching material
- Trainer’s lecture
- Duration of the training event
- Usefulness

An end-of-training report should be prepared after the data of evaluation sheets are compiled and analyzed. End-of-training report should include the following information/data

- General information (Title of the training and objective/target, date, venue, trainers etc)
- Program
- Participants list (actual)
- Teaching material
- Cost (budget and actual expenditure)
- Result of analysis of evaluation sheets
- Other relevant documents/information

These data/information are very useful when similar training will be planned in the future.

PART 2: PRESENTATION SKILL

2.1 Basic Concept : Difference between Education in School and Training for Grown-Ups

In the classes of school, students often do not fully understand the importance of the lessons. On the other hand, in training for grown-ups who are actually working in an organization, participants (trainees) are aware of the importance of the subject of training. Therefore, one of the important tasks of the trainer of grown-ups is to stimulate the mind of 'participation' of the participants. This calls for creation of two-way communication between the trainer and the trainees, and even three-way communication between the trainer and the trainees and between trainees themselves. Two-way communication can be introduced by the trainer through asking simple questions to the paraticipants.

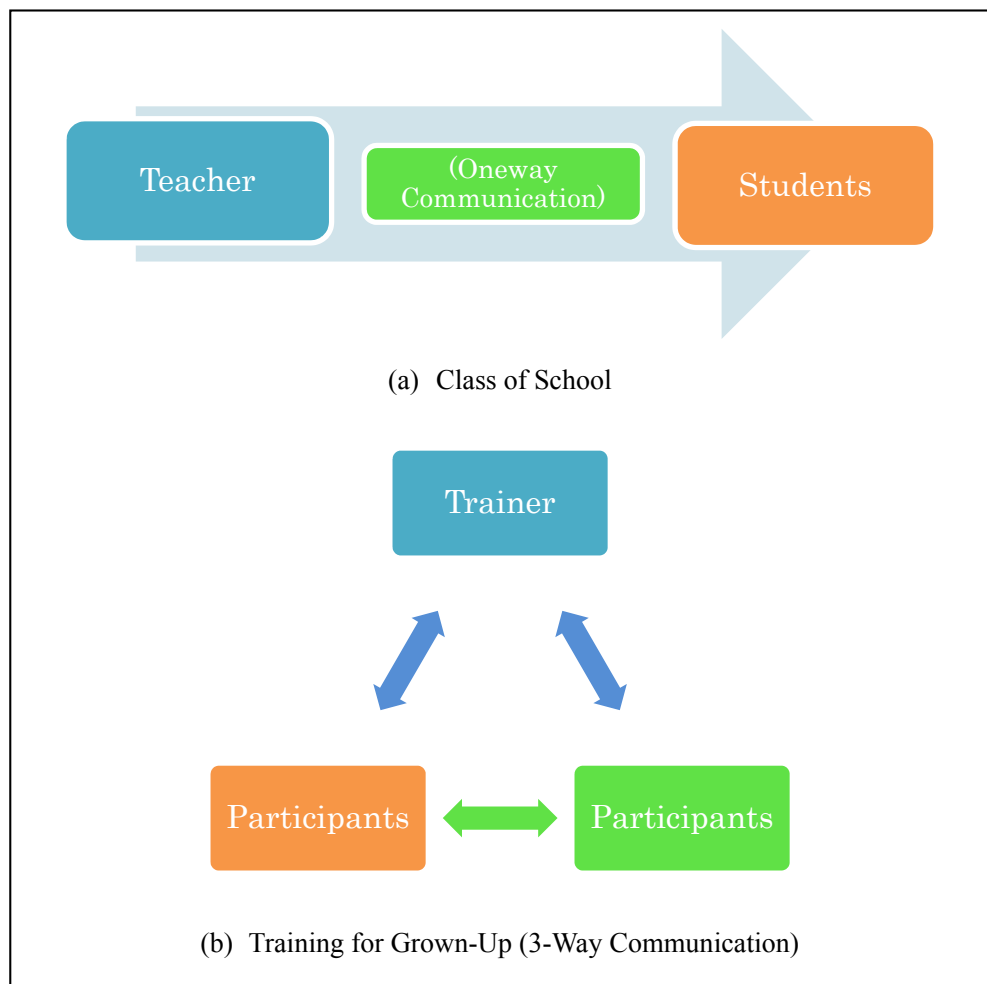


Figure 2-1: Difference Between Class in School and Training for Grown-Up

2.2 Presentation Skill

(Note: In this section, the word 'audience' is used almost as the same meaning with 'participant' or 'trainee'.)

2.2.1 How to Speak

(1) SECSHALGTR

There are several key points for speaking which can attract the attention of the audience:

- Slow (Not fast)
- Eye Contact
- Stand & move
- Humor
- Audible (Loud)
- Gesture
- Tone
- Repeat

By combining the initials of these key words [Slow, Eye Contac, Stand & move, Humor, Audible (Loud), Gesture, Tone and Repeat], we get **SECSHALGT** (not **SEXUALGTR**). These initials should be always remembered whenever you are speaking in front of the audience. Short explanations on these key points are given below:

Slow

If a speaker talks too fast, it becomes difficult for the audience to understand. Therefore, speak slowly enough so that the audience can catch up and understand.

Eye contact

Do not look at screen or textbook. Look at the audience and let each audience feel that you are talking to him/her personally. You can know the response of the audience by looking at them and adjust your lecture. Eye-contact is essential for 'two-way communication'.

Stand and move

Do not sit on the chair and read the prepared material. By standing, gesture comes out naturally. Walk around the class room if the floor of the room is flat (without platform). By moving around the classroom, the lecturer can go near each one of the audience. This can promote two-way communication.

Humor

Talk without humor is like 'coffee without milk'. Humor can attract attention of the audience as well as 'wake up' the audience. Good joke spoken in the beginning of the lecture can make the entire lecture interesting. Followings are some hints for creating jokes:

- Talk your personal experience, especially mistake, which is related to the subject of the

lecture.

- Talk a story that you found funny in recent TV news, newspaper, magazine etc which is related to the subject of the lecture.

Audible (loud)

Nobody can understand what you talk unless he/she can hear. Often volume of voice becomes soft towards the end of word or end of phrase. Speak loud enough up to the end of each phrase/word.

Gesture

Use gesture to emphasize important points. Gesture is not special thing. Speaker often use gesture without noticing. Effective use of gesture can make the lecture attractive and easy to understand.

Tone

Monotonous voice makes human being sleepy. Time to time change the loudness and pitch (tone) of the voice. Change tone to attract the attention of the audience.

Repeat

Important point should be repeated. Repeating is effective to let the audience memorize.

(2) Encourage Participation of Audience

To encourage active participation of the audience, it is recommended that ask simple questions on the topics, time to time. When one participant (trainee) is asked a question, other participants also think about the same question. Thus, the asking a question can attract the attention of many participants.

[Example]

- What is problem if the compaction of base course is insufficient?
- What are the possible factors which disturb good compaction of soil?

Another way of encouraging audience participation is to let a few of the audience speak their experience. Once someone speaks his/her experience, other audience feel relaxed and start speaking. This is more effective if done in the early stage of the whole program.

[Example]

- Please tell an example that you have experienced about poor quality of pavement works. Please explain what was observed and the cause of the problem
- Please explain your experience of a problem regarding disagreement between you and the contractor on the condition of contract.

(3) Answering Question

Question is the sign of participation of the participants. It also shows that the questioner at least understands something of the lecture. Unless understand something, participants cannot ask question. Therefore, questions should be welcomed. The followings are some keys for encouraging and answering questions.

Say “thank you for the question’ and/or ‘it is a good question’ to show that you (the lecturer) appreciate the question and encourage other participants ask question.

If the question is too difficult one to answer, you do not need to answer. You can simply say “I cannot answer here. I will check the rule (or reason, theory etc) (or ask my colleague who knows this matter better than me) when I will be back in my office and answer you through e-mail or telephone”.

2.2.2 Planning and Preparation of Lecture

Even a very experienced trainer, such as a college professor needs preparation before delivering a lecture. It is quite natural that a non-professional lecturer needs good planning and preparation. It is recommended to prepare a memo summarizing what are to be spoken in the lecture. Sometimes it is necessary and/or effective to write notes in the text.

(1) Planning of the Structure of the Lecture

Basic structure of the lecture needs to be diligently planned. Followings are the key points for planning the lecture.

- Review the text
- Plan the structure of lecture
- Concise
- Supplement to text
- Example
- Time allocation

Review the text

A lecturer needs to review and refresh the understanding of the teaching material. Reviewing the text is also necessary to plan the entire structure of the lecture, including time allocation and planning of supplementary explanations as explained below.

Plan the structure of lecture

Show the objective and contents of the lecture in the beginning

Concise

The lecture should be concise. The audience cannot memorize too many things in a limited time. Also, the audience do not know what is important. Quite often s lecturer who knows the subject very well tends to speak too much and often makes the audience confused. By speaking too much, the lecturer often runs out of time and cannot cover the some of the planned subjects. **Select ‘speak what’ and ‘not speak what’.**

Supplement text

This may sound somewhat contrary to what is explained above. No textbook can be perfect and some part of the text need supplementary explanation. A good example of this is a flow chart. A flow chart is used to show the general flow of work procedures. Good explanation is necessary to let the audience understand the chart.

Example

Examples greatly help the participants’ understanding. Try to insert practical examples after explaining a theoretical subject. When LCD projector is available, photo or illustration (drawing) of the example greatly helps understanding of the audience.

Time allocation

Based on the time given to you, plan the time length given to each item that you speak. The lecturer should prepare a simple memo on time allocation and refer it during the lecture. It is recommended to take off the watch and place it on the desk so that the time is always in the eyes.

(2) Preventing the Audience from Falling Asleep

Participants tend to become sleepy after lunch. (Some training specialists call this time zone ‘grave time’.) To prevent the participants fall asleep in the early afternoon session, the followings should be planned as much as possible:

- Use early afternoon for exercise or group discussion
- Arrange site visit in the afternoon

If the above cannot be adopted, and a lecture is given in the early afternoon, the lecturer should try to encourage participation of the trainees by asking questions or by other means.

Another thing that a lecturer should keep in mind is that concentration of attention can be maintained only up to 40 - 50 minutes. If the lecture continues beyond 1 hour, the audience tend to be exhausted and fall asleep. This is why the time duration of classes of elementary school in Japan are usually 50 minutes and 10 minutes of break is given. If the lecture needs to continue beyond 50 minutes, the lecturer should try to let the audience refresh their state of mind when 45 - 50 minute has passed since the beginning of the lecture. Some hints for this are listed below:

- Speak some episode.

- Show slides (photos) related to the subject of lecture.
- Move to next topic of the lecture.

(3) Summarize (conclude) at the end of each session and repeat the important points.

It is often effective to summarize the lecture at the end by listing several (less than 10; preferably less than 5) important points. Such points should be selected so that the participant can later remember other subjects related to these important points. Summarizing also means ‘repeating’ and is effective to let the audience memorize the matter.

[Example]

- Maintain the water content of soil near the OMC during compaction. (Participants later remember not only OMC but also laboratory tests to determine OMC and compaction, these subjects are taught in the lecture.)
- Maintain the temperature of bitumen during pavement work.

(4) Rehearsal

It is always recommended to practice in front of somebody else and ask his/her opinion before the actual lecture. Rehearsal is also effective to check planned time allocation is adequate.

2.2.3 Use of Audio-Visual Equipment

(1) Using Microphone

Prevent ‘howling’

Often ‘peeen’ sound occurs especially the volume of sound from the speaker (machine; not lecturer) is too loud. This phenomenon is called ‘howling. Howling occurs as the voice from the speaker is picked-up by the microphone and comes out of the speaker and this process is repeated in a short time. The best way to prevent/stop howling is to place the microphone to the backward of the speaker, or set speaker not facing the microphone, and minimize the sound being picked-up by the speaker. If Karaoke set is used, minimize ‘echo’.

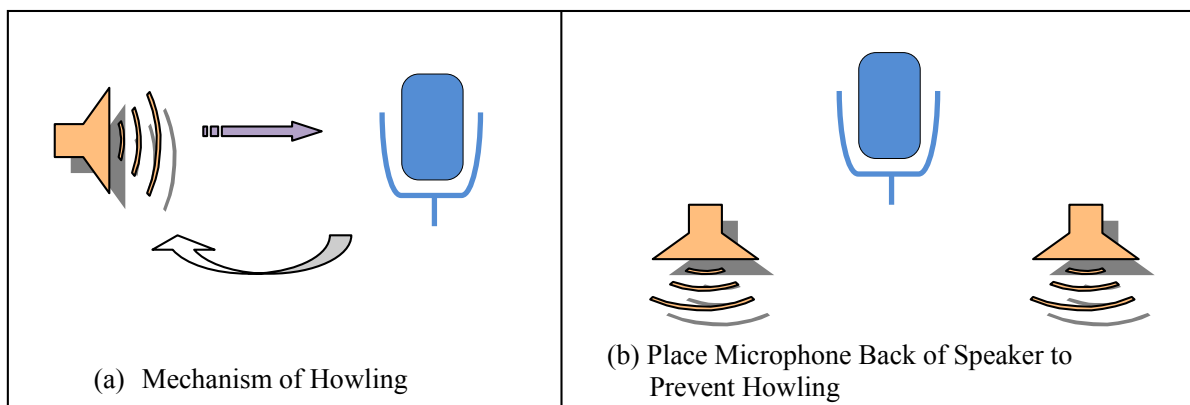
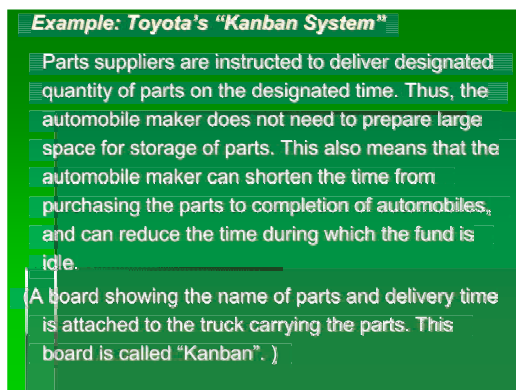


Figure 2-2: Mechanism and Prevention of Howling

(2) Using Powerpoint

Nowadays, Powepoint is widely used in presentation. Powerpoint is a very strong tool in presentation, but it also has some disadvantage. Therefore, it is important to use it wisely.

- When writing sentences, do not write too many sentences in one frame: Maximum 10 lines in one frame (see examples below). If necessary, divide into two frames.
- Do not use 'animation' too much: Take too long time between frames
- Do not rely on Powerpoint too much: Time to time, come back to the text and **let the participants write note important points on the text**. These points noted on the text help the participants remember the contents of the lecture when they will use the text. Also use of Powerpoint reduces 'eye contact' and tend to lead to 'one-way communication'.
- Use dark background color: White or other too light color make eyes of audience exhausted.



Bad Example



Good Example

Figure 2-3: Bad & Good Example of Powepoint Presentation

6-2 Syllabi of Training Program in Regular Training Course

Syllabus of Quality Control Training Program

Course No. 1	Subject: Standard Guideline (SG)	
Objective: To let the working level staff of MPWT and provincial DPWTs understand the fundamentals of standard guideline		
Target Level of Knowledge: Upon successful completion of this course, trainees are expected to be able supervise ordinary road works at the site.		
Target Group & No. of Participants: Engineer & Technician of provincial DPWT; 50 persons		Frequency: First Year: 1 time/yr Following Yrs: 1 time/yr
Hand-out		
Teaching Material: 1. Standard Guideline 2.		Trainer: Project Counterpart
Contents and Time Allocation Day 1 (5 hrs) <ul style="list-style-type: none"> ◇ Pre-test 1. General 2. Roles of the department concerned in maintenance 3. Basic Survey and Investigation 4. Basic Design 5. Preliminary Cost Estimate 6. Determination of Ceiling Amount 7. Special Advance Payment 8. Detailed Investigation and Survey 9. Detail Design 10. Detail Cost Estimate 11. Earth Works, Concrete Works, Asphalt Works 12. Inspection 13. IB performance Evaluation 14. Question & Answer and Discussion ◇ Post test 		

Syllabus of Quality Control Training Program

Course No. 2	Subject: Regulation (RG)	
Objective: To let the working level staff of MPWT and provincial DPWTs understand the fundamentals of regulation		
Target Level of Knowledge: Upon successful completion of this course, trainees are expected to be able follow the procedure for force account project.		
Target Group & No. of Participants: Engineer & Technician of provincial DPWT; 50 persons		Frequency: First Year: 1 time/yr Following Yrs: 1 time/yr
Hand-out		
Teaching Material: 1. Regulation 2.		Trainer: Project Counterpart
Contents and Time Allocation Day 1 (3 hrs.) ✧ Pre-test 1. General Provision 2. Basic Survey and Design 3. Preliminary Cost Estimate 4. Negotiation 5. Budget Confirmation 6. Detail Survey and Design 7. Detail Cost Estimate 8. Final Negotiation for Project 9. Contract 10. Implementation 11. Question & Answer and Discussion ✧ Post test		

Syllabus of Quality Control Training Program

Course No. 3	Subject: Standard Drawing	
Objective: To let the staff of MPWT and provincial DPWTs understand the fundamentals of standard drawing		
Target Level of Knowledge: Upon successful completion of this course, trainees are expected to be able apply to force account project.		
Target Group & No. of Participants: Engineer & Technician of provincial DPWT; 50 persons		Frequency: First Year: 1 time/yr Following Yrs: 1 time/yr
Hand-out		
Teaching Material: 1. Standard Drawing 2.		Trainer: Project Counterpart
Contents and Time Allocation Day 1 (1 hr.) 1. Objective/Concept and Outline of Standard Drawing 2. Technical term of structural design detail 3. Selection of structure 4. Part 1 Road 5. Part 2 (1) Pipe Culvert and Box Culvert 6. Part 2 (2) RC Flat Slab Bridge and RCDG 7. Part 2 (3) Pre tension Hollow Slab Bridge, Post tension Hollow Slab Bridge, Post tension T and I Girder Bridge 8. Group discussion for particular issue 9. Question & Answer		

Syllabus of Quality Control Training Program

Course No. 4	Subject: Database System Management	
Objective: To let the staff of MPWT & provincial DPWTs understand the fundamentals of database system		
Target Level of Knowledge: Upon successful completion of this course, trainees are expected to be able to put to practical use in future works.		
Target Group & No. of Participants: Engineer & Technician of provincial DPWT; 50 persons		Frequency: First Year: 1 time/yr Following Yrs: 1 time/yr
Hand-out		
Teaching Material: 1. Document Management Database USER Manual 2. Computer		Trainer: Project Counterpart
Contents and Time Allocation Day 1 (1 hr.) 1. Concept of database system 2. Content of database 3. How to search the necessity documents 4. Touch and try the database system 5. Question & Answer and Discussion		

Syllabus of Quality Control Training Program

Course No. 5	Subject: Test Method and Soil Mechanic	
Objective: To let the staff of MPWT & provincial DPWTs have basic knowledge on laboratory test and field test.		
Target Level of Knowledge: Upon successful completion of this course, trainees are expected to be able to make the right decision for work quality.		
Target Group & No. of Participants: Engineer & Technician of provincial DPWT; 50 persons		Frequency: First Year: 1 time/yr Following Yrs: 1 time/yr
Hand-out		
Teaching Material: 1. Standard Guideline 2. Construction Specification 3. Design Standard (Pavement & Road)		Trainer: Laboratory/MPWT
Contents and Time Allocation Day 1 (5 hrs) 1. Objective the laboratory test and role of MPWT laboratory 2. Test for related to earthwork 3. Test for related to pavement 4. Test for related to concrete 5. Question & Answer and Discussion		

Syllabus of Quality Control Training Program

Course No. 6	Subject: Safety Management & Road Safety	
Objective: To let the staff of MPWT & provincial DPWTs have basic knowledge on safety management.		
Target Level of Knowledge: Upon successful completion of this course, trainees are expected to be able to take care of safety concerns.		
Target Group & No. of Participants: Engineer & Technician of provincial DPWT; 50 persons		Frequency: First Year: 1 time/yr Following Yrs: 1 time/yr
Hand-out		
Teaching Material: 1. Annual Report from Handicap International Belgium (HIB) 2. Traffic Law 3. Manual of Road Safety		Trainer: In charge of Safety Management
Contents and Time Allocation Day 1 (5 hrs) 1. Introduction of safety management and introduce accident data 2. Traffic safety 3. Safety at construction site 4. Introduction of law systems 5. How to apply the Manual 6. Question & Answer and Discussion		

Syllabus of Quality Control Training Program

Course No. 7	Subject: Contract Management	
Objective: To let the staff of MPWT & provincial DPWTs have basic knowledge on contract management for civil works.		
Target Level of Knowledge: Upon successful completion of this course, trainees are expected to be able to consider the contractual issues during construction.		
Target Group & No. of Participants: Engineer & Technician of provincial DPWT; 50 persons		Frequency: First Year: 1 time/yr Following Yrs: 1 time/yr
Hand-out		
Teaching Material: 1. Fédération Internationale Des Ingénieurs-Conseils (FIDIC) 2. Current Procurement Document3.		Trainer: In charge of Contract Management
Contents and Time Allocation Day 1 (2 hrs) 1. Objective the contract management 2. Current practice in MPWT 3. Content and how to apply the FIDIC 4. Question & Answer and Discussion		

Syllabus of Quality Control Training Program

Course No. 8	Subject: Road Management System	
Objective: To let the staff of MPWT & provincial DPWTs understand the fundamentals of road and bridge inventory		
Target Level of Knowledge: Upon successful completion of this course, trainees are expected to be able to put to practical use in future works and to monitor road condition for road network..		
Target Group & No. of Participants: Engineer & Technician of provincial DPWT; 50 persons		Frequency: First Year: 1 time/yr Following Yrs: 1 time/yr
Hand-out		
Teaching Material: 1. Road Management and Decision Support System (RMDS) 2. Guideline for Regular Inspection 3. Project Information Sheet		Trainer: RID, RAMP in charge
Contents and Time Allocation Day 1 (2 hrs) 1. Objective and application of inventory 2. Introduction and usage of RMDS system 3. How to judge the Roughness (IRI), Surface Integrity (SII) 4. Method of Regular Inspection 5. Integration of inventory data 6. Question & Answer and Discussion		

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

7-1 Sample of Standard Drawings

STANDARD DRAWING

Part 1 - Road

- | | |
|--------|-------------------------------|
| Sec. 1 | FORMAT OF DRAWING |
| Sec. 2 | ROAD GEOMETRY DESIGN |
| Sec. 3 | ROAD SLOPE PROTECTION |
| Sec. 4 | ROAD DRAINAGE |
| Sec. 5 | ROAD TRAFFIC DEVICES |
| Sec. 6 | ATTACHMENT: SAMPLE OF DRAWING |

Part 2 - Road Structure

- | | |
|--------|--------------|
| Vol. 1 | PIPE CULVERT |
| Vol. 2 | BOX CULVERT |
| Vol. 3 | BRIDGE (1) |
| Vol. 4 | BRIDGE (2) |
| Vol. 5 | BRIDGE (3) |

Part-1 Road

HIGHWAY/ROAD CLASSIFICATION		ROAD CLASSIFICATION AND GEOMETRIC DESIGN STANDARD											ASIAN HIGHWAY				
NUMBER OF LANES		R6	R5	R4	R3	R2	R1	U6	U5	U4	U3	U2	U1	PRIMARY 4 OR MORE	CLASS I 4 OR MORE	CLASS II 2	CLASS III 2
DESIGNED SPEED (km/hr)	R FLAT TERRAIN (F1) U AREA TYPE I	120	100	90	70	60	40	100	80	70	60	50	40	100-120	80-100	60-100	40-80
	R ROLLING TERRAIN (R1) U AREA TYPE B	100	80	70	60	50	30	80	60	50	40	30	20	80-100	60-80	40-60	30-50
RIGHT OF WAY (ROW) (m)	R RURAL	30-25		20-15				NOT SPECIFIED		NOT SPECIFIED		NOT SPECIFIED		40-60	30-40	20-40	30-40
	URBAN	30-25		20-15				NOT SPECIFIED		NOT SPECIFIED		NOT SPECIFIED		40-60	30-40	20-40	30-40
WIDTH (m)	LANE (L)	3.5(2.75)	3.5	3.5	3.5	3.0		3.5	3.5	3.5	3.5	3.0		3.75	3.50	3.50	3.00
	SIDEWALK (S)	3.0	3.0	3.0	2.5	2.0	1.5	3.0	3.0	3.0	2.5	2.0	1.5	3.0	2.5	2.5	2.0
	SHOULDER/ SIDEWALK (SH)	3.0	3.0	2.0	2.5	2.0	1.5	3.0	3.0	2.5	2.0	1.5	1.5	3.0	2.5	2.5	2.0
	MIX WIDTH (M)	3.0	3.5	2.5	-	-	-	3.5	3.5	3.0	2.5	2.0	1.5	1.5	2.5	2.5	2.0
MAX HORIZONTAL CURVE RADIUS (m)	FLAT TERRAIN (F1)	665	415	320	175	130	55	495	300	230	160	100	64	300	220	200	110
	ROLLING TERRAIN (R1)	415	255	195	125	90	27	300	160	100	60	30	20	220	170	150	75
MAX SUPERELEVATION (%)	RURAL	4	4	3	2	1	0	3	3	3	3	3	3	3	3	3	3
	URBAN	4	4	3	2	1	0	3	3	3	3	3	3	3	3	3	3
MAX VERTICAL GRADE (%)	FLAT TERRAIN (F1)	5	5	4	3	2	1	4	4	4	4	4	4	4	4	4	4
	ROLLING TERRAIN (R1)	4	4	3	2	1	0	4	4	4	4	4	4	4	4	4	4
MINIMUM VERTICAL CLEARANCE (m)	PUMPUP	5.2	5.2	5.2	5.2	4.5	4.5	5.2	5.2	5.2	5.2	5.0	4.5	4.5	4.5	4.5	4.5
	DESARAME	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5	5	4.5	4.5
DESIGN TRAFFIC VOLUME (ADT/600)	ALL	+10	3-10	1-3	0.5-1	+0.5	ALL	+10	3-10	1-3	0.5-1	+0.5					
PAYMENT	SURFACE TYPE	TAA/LAL/PLP210											TAA/LAL/PLP210				
	CROSSFALL (%)	TAA/LAL/PLP210											TAA/LAL/PLP210				

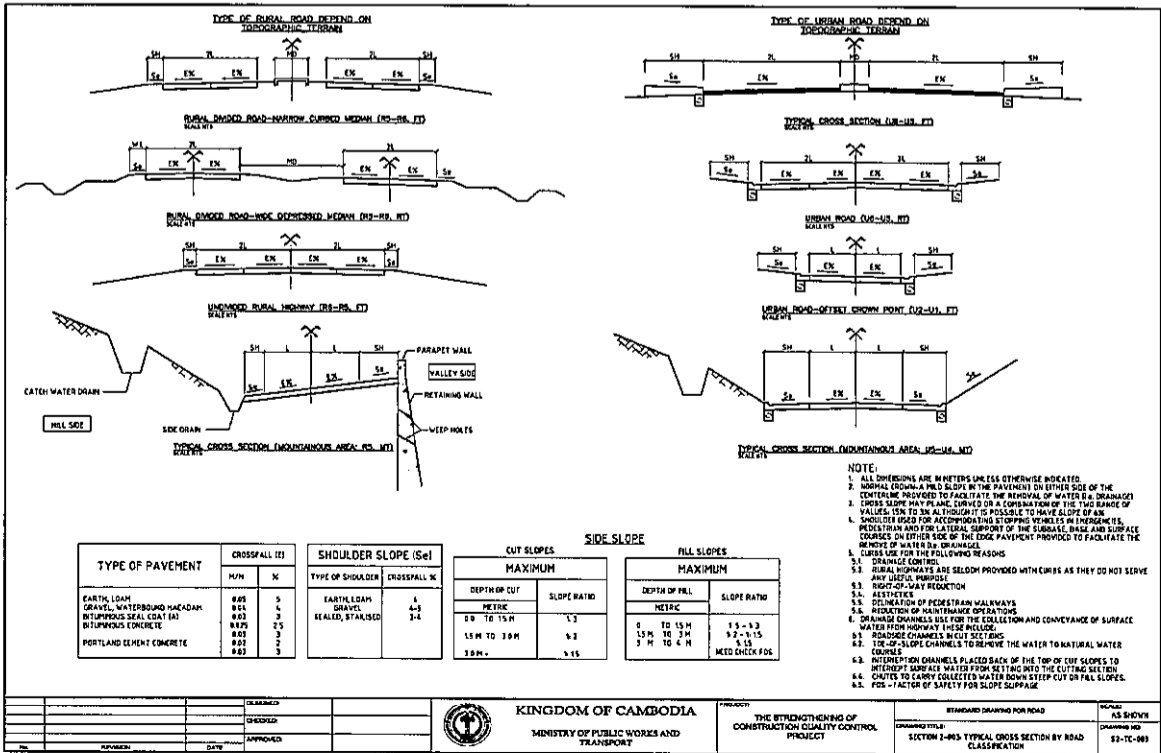


KINGDOM OF CAMBODIA
MINISTRY OF PUBLIC WORKS AND TRANSPORT

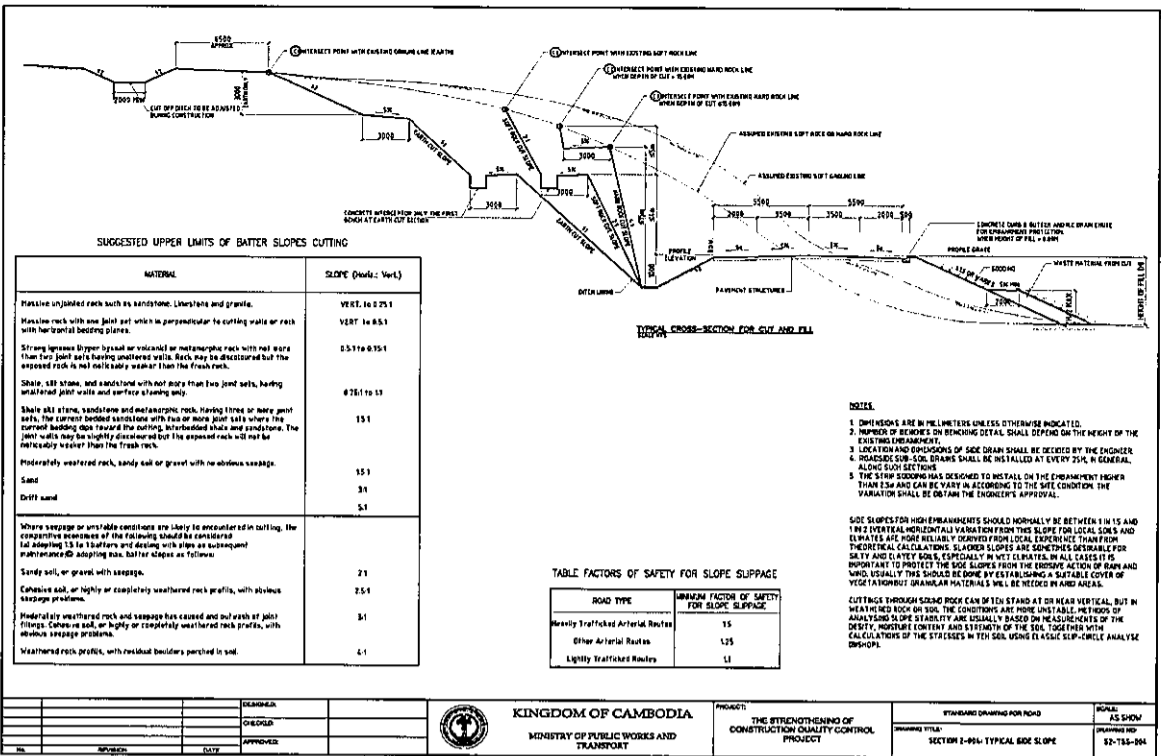
PROJECT: THE STRENGTHENING OF CONSTRUCTION QUALITY CONTROL PROJECT

STANDARD DRAWING FOR ROAD
DRAWING TITLE: SECTION 3-102 ROAD CLASSIFICATION

SCALE: 1/25
DRAWING NO: S2-RC-042



TYPE OF PAVEMENT	CROSSFALL (%)		SHOULDER SLOPE (S%)		CUT SLOPES		FILL SLOPES	
	M/M	N	TYPE OF SHOULDER	CROSSFALL %	DEPTH OF CUT	SLOPE RATIO	DEPTH OF FILL	SLOPE RATIO
EARTH, LOAM	0.65	5	EARTH/LOAM	4	METRIC	1:1	0 TO 15 M	1:1 - 1:3
GRAVEL, WATERBOUND SACADAR	0.65	4	GRAVEL	4-3				
BITUMINOUS SEAL COAT (BS)	0.75	2.5	SEALED, STABILISED	3-4				
BITUMINOUS CONCRETE	0.65	3			15 M TO 30 M	1:1	15 M TO 3 M	1:1.5 - 1:1.5
PORTLAND CEMENT CONCRETE	0.65	3			30 M +	1:1.5	3 M TO 4 M	1:1.5 - 1:1.5 NEED CHECK FOR



TYPICAL PAVEMENT DESIGN

SUBGRADE CLASS	DBST-11 (C _{BR} 4.0-6.3m ²)		DBST-12 (C _{BR} 6.4-8.7m ²)		DBST-13 (C _{BR} 8.8-11.1m ²)		DBST-14 (C _{BR} 11.2-13.5m ²)		DBST-15 (C _{BR} 13.6-16.0m ²)		DBST-16 (C _{BR} 16.1-18.4m ²)	
	CMR (%)	CMR (%)	CMR (%)	CMR (%)	CMR (%)	CMR (%)	CMR (%)	CMR (%)	CMR (%)	CMR (%)	CMR (%)	CMR (%)
S1 EMR 2-30	100	150	200	250	300	350	400	450	500	550	600	650
	175	225	275	325	375	425	475	525	575	625	675	725
	300	300	300	300	300	300	300	300	300	300	300	300
S2 EMR 3-30	100	150	200	250	300	350	400	450	500	550	600	650
	150	200	250	300	350	400	450	500	550	600	650	700
	200	200	200	200	200	200	200	200	200	200	200	200
S3 EMR 4-30	100	150	200	250	300	350	400	450	500	550	600	650
	150	200	250	300	350	400	450	500	550	600	650	700
	200	200	200	200	200	200	200	200	200	200	200	200

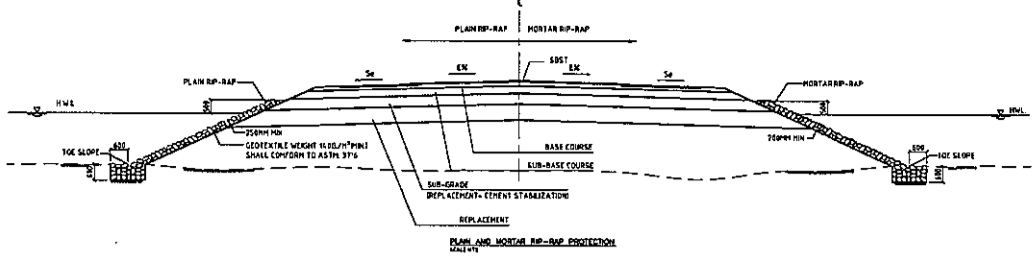
NOTE: DBST BASE-COURSE SUB-BASE CAPPOY LAYER ASPHALT CONCRETE

FORMULAR:
 C_{BR} = CUMULATIVE NUMBER OF EQUIVALENT STANDARD AXLES
 N_{ESD} = N_{ESD} (10⁶)
 WHERE:
 N_{ESD} = NUMBER OF EQUIVALENT STANDARD AXLES
 N = NUMBER OF AXLES WITH LOAD P/MS

SUBGRADE CLASS	AC-7E (C _{BR} 4.0-10.0m ²)		AC-7E (C _{BR} 10.1-15.0m ²)		AC-7E (C _{BR} 15.1-20.0m ²)	
	CMR (%)	CMR (%)	CMR (%)	CMR (%)	CMR (%)	CMR (%)
S1 EMR 2-30	100	125	175	225	275	325
	200	225	275	325	375	425
	250	250	250	250	250	250
S2 EMR 3-30	100	125	175	225	275	325
	200	225	275	325	375	425
	250	250	250	250	250	250
S3 EMR 4-30	100	125	175	225	275	325
	200	225	275	325	375	425
	250	250	250	250	250	250

NOTE:
 1. C_{BR} VALUE OF SUBGRADE IS REPRESENTATIVE C_{BR} VALUE OF SOIL OF ONE METER THICKNESS FROM THE BOTTOM OF SUBGRADE.
 2. IF C_{BR} VALUE OF SUBGRADE IS UNDER 2.0, SUBGRADE MUST BE REPLACED OR STABILIZED WITH ADDITIVE.
 3. IF ROAD IS LOCATED UNDER SUBGRADE IS SOFT, CONSTRUCTION MEASURES FOR STABLE FOUNDATION SUCH AS PUTTING SPLITTABLE SAND, CONTRACTOR FILL, COUNTER WEIGHT EMBANKMENT, ETC. SHD AND COUNTERMEASURE AGAINST CONSOLIDATION SETTLEMENT SUCH AS PRE-LOADING, REPLACEMENT AND ETC. SHALL BE DESIGNED AND APPLIED OTHER THAN ROAD STRUCTURE DESIGN.
 4. THE ABOVE DESIGN CHART IS FROM FIGURE 16.3 OF HIGHWAY AND TRAFFIC ENGINEERING HANDBOOK FOR CAMBODIA.
 5. IF REQUIRED, THE DETAIL DESIGN OF PAVING STRUCTURE SHALL BE MADE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR ROAD CONSTRUCTION (LAOS/STP 701) AND THE OTHER REFERENCED DOCUMENTS STATED IN THE HEAD OF CONTRACT FORM REFER TO SPECIFICATION OF MINISTRY OF PUBLIC WORKS 2003.

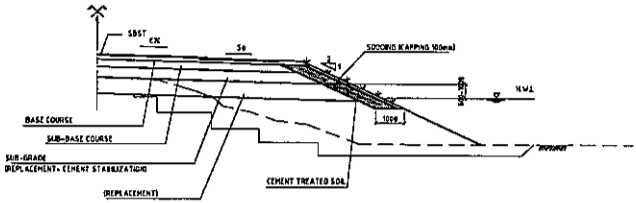
				KINGDOM OF CAMBODIA MINISTRY OF PUBLIC WORKS AND TRANSPORT	PROJECT: THE STRENGTHENING OF CONSTRUCTION QUALITY CONTROL PROJECT	STANDARD DRAWING FOR ROAD DRAWING TITLE: SECTION 2-405-TYPICAL PAVEMENT DESIGN	SCALE: N/A SHEET NO: 52-790-095
DESIGNED	CHECKED	APPROVED					
DATE	DATE	DATE					



PLAIN RIP-RAP CONSTRUCTION:
 1. EMBANKMENT SLOPES SHALL BE COMPACTED AND SHAPED TO TYPICAL CROSS-SECTION SPECIFIED.
 2. STONE USED FOR PLAN RIP-RAP SHALL WEIGHT BETWEEN 25-38KG EACH AND AT LEAST 70 PERCENT SHALL WEIGHT MORE THAN 40KG, WITH KEY STONE SIZE IS SUITABLE.
 3. THE LARGEST STONE SHALL BE PLACED FIRST. THE INTERSTICES SHALL BE FILLED WITH SMALL STONES.
 4. THE THICKNESS OF PLAN RIP-RAP SHALL NOT LESS THAN 20 CENTIMETERS.
 5. THE PLACING OF STONE SHALL BE AT LEAST 10 CM UNDER EXISTING GROUND LEVEL.
 6. STONE SHALL BE CONSIDERED TO FALL AT TOE SLOPE AS SUITABLE IN CASE OF EXISTING GROUND ARE SOFT.

MORTAR RIP-RAP CONSTRUCTION:
 1. EMBANKMENT SLOPES SHALL BE COMPACTED AND SHAPED TO TYPICAL CROSS-SECTION SPECIFIED.
 2. STONE USED FOR MORTAR RIP-RAP SHALL WEIGHT BETWEEN 10-15 KG EACH AND AT LEAST 50 PERCENT SHALL WEIGHT MORE THAN 10KG, WITH KEY STONE SIZE IS SUITABLE.
 3. THE LARGEST STONE SHALL BE PLACED FIRST. THE INTERSTICES SHALL BE FILLED WITH SMALL STONES.
 4. THE THICKNESS OF PLAN RIP-RAP SHALL NOT LESS THAN 20 CENTIMETERS.
 5. THE PLACING OF STONE SHALL BE AT LEAST 10 CM UNDER EXISTING GROUND LEVEL.
 6. STONE SHALL BE CONSIDERED TO FALL AT TOE SLOPE AS SUITABLE IN CASE OF EXISTING GROUND ARE SOFT.

REMARK:
 THIS METHOD OF SLOPE PROTECTION IS SUITABLE ONLY IN SPECIFIC LOCATION AND CERTAIN CONDITIONS. IT SHOULD BE APPLIED WITH THE FIRST INFORMATION CONCERNED AND RECOMMENDED BY THE ENGINEER.



NOTE:
 1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.
 2. CEMENT TREATED SOIL:
 RATE OF CEMENT CONTENT IN SOIL SHALL BE EXAMINED TO AVOID SOIL DISPERSION BEFORE CONSTRUCTION. CEMENT SHALL BE MIXED WITH SOIL, WELL NOT BEING UNIFORM.

				KINGDOM OF CAMBODIA MINISTRY OF PUBLIC WORKS AND TRANSPORT	PROJECT: THE STRENGTHENING OF CONSTRUCTION QUALITY CONTROL PROJECT	STANDARD DRAWING FOR ROAD DRAWING TITLE: SECTION 2-405-PLAIN/MORTAR RIP-RAP PROTECTION AND CEMENT TREATED SOIL PROTECTION	SCALE: AS SHOWN SHEET NO: 52-790-095
DESIGNED	CHECKED	APPROVED					
DATE	DATE	DATE					

Part-2 Road Structure

Vol.1 Pipe Culvert

(3 x 1.5mDia. Pipe Culvert)

GENERAL

IT IS TO NOTE THAT STANDARD DRAWINGS HAS BEEN PREPARED PURELY FOR FORCE ACCOUNT PROJECT. HOWEVER IT WILL BE APPLICABLE FOR CONTRACT-OUT PROJECTS WITH SOME MODIFICATIONS

1. CLASSIFICATION OF PIPE (CULVERT) ARE:

PIPE (DIAMETER)	1	2	3
10	●	●	●
12	●	●	●
15	●	●	●

IN THE INTERPRETATION OF DRAWINGS, INDICATED DIMENSION SHALL COVER ALL DIMENSIONS, DISTANCES AND SIZES SHALL NOT BE SCALED FOR CONSTRUCTION PURPOSES.

UNLESS OTHERWISE INDICATED, ALL DIMENSION AND MEMBER SIZE ARE IN MILLIMETERS.

DESIGN SPECIFICATION

1. DESIGN OPERATIONS

- AUSTROADS SINCE DESIGN CODES, AUSTRALIA 1993
- AMERICAN CONCRETE INSTITUTE, AND THE RELEVANT CODE REQUIREMENTS FOR REINFORCED CONCRETE, AND OTHER RELEVANT I.C.
- AMERICAN SOCIETY FOR TESTING AND MATERIALS, ASTM
- AMERICAN INSTITUTE OF STEEL CONSTRUCTION
- AMERICAN WELDING SOCIETY STANDARD, AWS/AWS D1.1-B
- ALL PIPES SHALL BE MANUFACTURED AND TESTED BY ASHTO TRB

2. LOADS

TYPE OF LOADS	WEIGHT
ROADWAY	75.00 kN/m ²
RAILWAY	110.00 kN/m ²
CASUALTY CONCRETE	22.50 kN/m ²

3. LINE LOADS

A. AUSTRALIAN 92 (TANK TRUCK) LOADING

GENERAL NOTES FOR PIPE CULVERT

12. BACKFILL SHALL BE NOT EXCEEDING 150mm THICKNESS IN EACH LAYER AND UNCOMPACTED DEPTH AND THEREAFTER COMPACTED TO OBTAIN A DENSITY OF NOT LESS THAN 90% OF THAT DETERMINED BY ASTM D 1557.

A. CONCRETE PILING AND PILING

A1. DESIGN OF CONCRETE PILING SHALL MEET THE DESIGN CONCRETE STRENGTH UNDER 100% OF WATERBARS.

A2. CONCRETE SHALL BE DEPOSITED, VIBRATED AND CURED IN ACCORDANCE WITH THE SPECIFICATIONS.

A3. FOR CONCRETE EXPOSED AGAINST THE GROUND, UNLESS OTHERWISE INDICATED, LEAD CONCRETE WITH A MINIMUM THICKNESS OF 75mm SHALL BE LAID FIRST BEFORE NOT FALLING THE REINFORCEMENT. THIS LEAD CONCRETE SHALL NOT BE CONSIDERED IN THE DESIGNING THE STRUCTURAL BOTTOM OF CONCRETE SECTION.

A4. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR APPROVAL PLACING SEQUENCES FOR ALL CONCRETING WORKS.

B. BAR BENDING, SPACING AND PILING

B1. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR APPROVAL DETAILED SHOP DRAWINGS INDICATING THE BENDING, CUTTING, SPACING AND INSTALLATION OF ALL REINFORCEMENT BARS.

B2. BARS SHALL BE BENT TO BE FULLY PARTIALLY ENBEDDED IN CONCRETE SHALL NOT BE FIELD BENT UNLESS PERMITTED BY THE ENGINEER.

B3. BAR SPACING NOT INDICATED ON DRAWINGS SHALL BE SUBJECT TO THE APPROVAL OF THE ENGINEER.

B4. NOT MORE THAN 50% OF THE BARS AT ANY ONE SECTION SHALL BE SPACED. BARS SHALL NOT BE SPACED AT POINTS OF MAXIMUM STRESS.

B5. UNLESS OTHERWISE SHOWN ON THE PLANS, THE CLEAR DISTANCE BETWEEN PARALLEL BARS IN LAYER SHALL NOT BE LESS THAN 1.5 TIMES THE NOMINAL DIAMETER OF THE BAR NOR LESS THAN 40mm OR 50mm OF COURSE AGGREGATE. THE CLEAR DISTANCE BETWEEN LAYERS SHALL NOT BE LESS THAN 40mm OR 50mm OF COURSE AGGREGATE. BARS IN THE LOWER LAYER SHALL BE PLACED DIRECTLY ABOVE THOSE IN THE BOTTOM LAYER.

B6. MINIMUM DEVELOPMENT LAP TO BE 40 BAR DIAMETERS.

B7. HOOKS AND BENDS

DIMENSIONS OF 90 DEGREE AND 135 DEGREE HOOKS

90° HOOK
PIN DIAMETER: 0.4x FOR GRADE 400 REINFORCEMENT BAR
0.4x FOR GRADE 400 REINFORCEMENT BAR
DIMENSIONS FOR STIRRUPS AND THE HOOKS

135° HOOK
PIN DIAMETER: 0.4x FOR GRADE 400 REINFORCEMENT BAR
0.4x FOR GRADE 400 REINFORCEMENT BAR

C. CONCRETE COVER

C1. MINIMUM CONCRETE COVER TO REINFORCEMENT SHALL BE 50mm UNLESS SHOWN OTHERWISE ON DRAWINGS.

C2. UNDER AND AFTER CAUSES OF REINFORCEMENT SHALL BE PLACED TO PROVIDE MINIMUM COVER OF 25mm.

D. CONSTRUCTION JOINT

D1. THE POSITION AND FORM OF ANY CONSTRUCTION JOINT SHALL BE AS SHOWN IN DRAWINGS OR AS AGREED WITH THE ENGINEER.

D2. THE MISMATCH BETWEEN THE FIRST AND SECOND POUR CONCRETES SHALL BE REDUCED WITH AN AMPLITUDE OF 5mm MINIMUM.

SYMBOLS

LINE OF SYMMETRY OR SIMILARITY

LIMITS OF DIMENSION

SECTION IN EARTH

SECTION IN LEAN CONCRETE

SECTION IN CONCRETE

PLAN VIEW AND ELEVATION OF CUT AND FILL SLOPES

IDENTIFICATION SYMBOL

TITLE TARGET

SECTION TARGET

○ ROUND

△ AT

□ AND

— CENTER LINE

— BAR SPACING IN mm. ETC (EQUAL SPACING)

— BAR MARK

ABBREVIATIONS

AVE	AVERAGE	MPA	MEGAPASCAL
C/C	CENTER TO CENTER <td>NO.</td> <td>NUMBER </td>	NO.	NUMBER
U	CENTER LINE <td>PCS</td> <td>PIECES </td>	PCS	PIECES
CM	CENTIMETER <td>QTY</td> <td>QUANTITY </td>	QTY	QUANTITY
CON	CONCRETE <td>R</td> <td>RADIUS </td>	R	RADIUS
CON	CONCRETE <td>RE</td> <td>REINFORCED CONCRETE </td>	RE	REINFORCED CONCRETE
DRW	DRAWING <td>RE</td> <td>REINFORCEMENT </td>	RE	REINFORCEMENT
H	HOLLOW <td>SYMT</td> <td>SYMMETRIC </td>	SYMT	SYMMETRIC
MPA	MEGAPASCAL <td>SYMT</td> <td>SYMMETRIC </td>	SYMT	SYMMETRIC
M	METER <td>THK</td> <td>THICKNESS </td>	THK	THICKNESS
MM	MILLIMETER <td></td> <td></td>		

MATERIALS

UNLESS INDICATED OTHERWISE ON PLANS, THE CONCRETE CLASS AND STRENGTH SHALL BE AS FOLLOWS:

CLASS	USE	MAX. STRENGTH (MPA)	MIN. COMPRESSIVE STRENGTH (MPA)
B1	WING WALL	25	22
B2	PIPE CULVERT	25	22
C	SEAL CONCRETE	25	22

2. REINFORCEMENT STEEL

A. REINFORCEMENT STEEL SHALL CONFORM TO ASSAHTO 304 GRADES 300 & 400 HARMONY FIELD STRUCTURES, TYP GRADE 300, TYP 300MPA, PLAIN ROUND BARS

GRADE 400, TYP 400MPA, PLAIN WELDED BARS

B. REINFORCEMENT STEEL BE FREE OF OIL, GREASE, OIL OR ANY OTHER SUBSTANCES WHICH WILL WEAKEN THE BOND WITH CONCRETE

CONSTRUCTION

CAMBODIAN CONSTRUCTION SPECIFICATION 2003, MPWT.

1. SETTING OUT

11. THE SETTING OUT AND THE ELEVATION OF THE DIFFERENT COMPONENTS OF THE STRUCTURE SHALL BE APPROVED BY THE ENGINEER PRIOR TO THE START OF ANY CONSTRUCTION WORK.

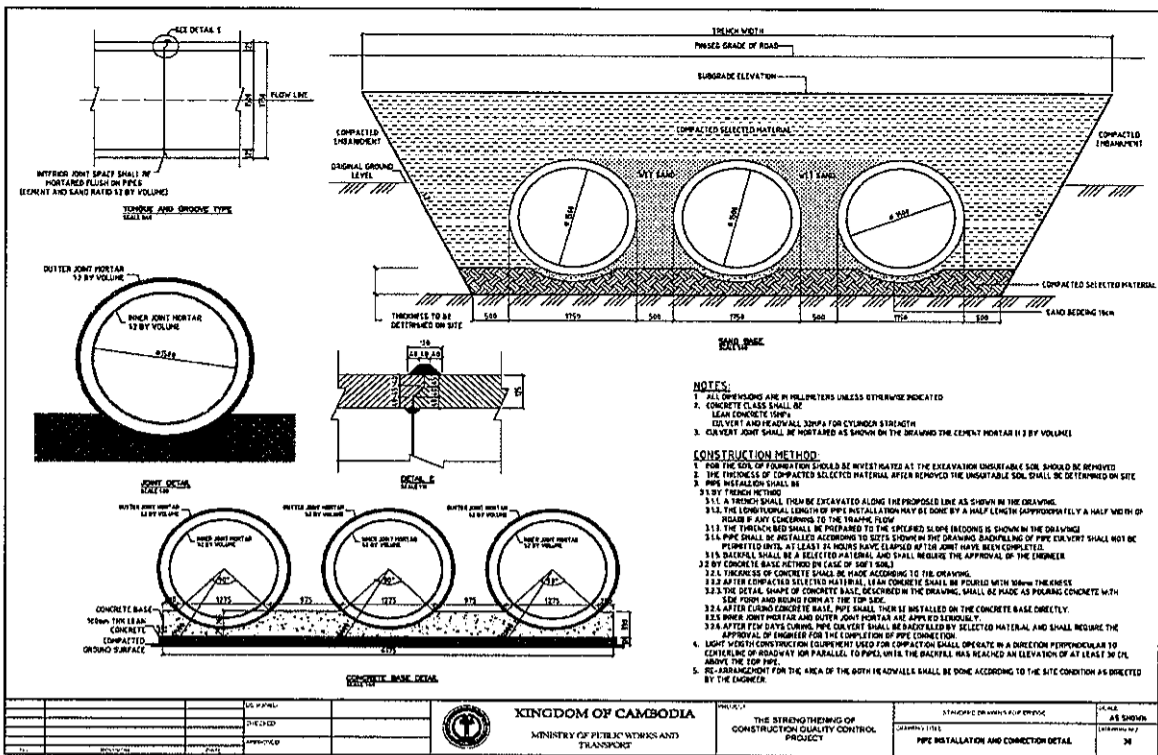
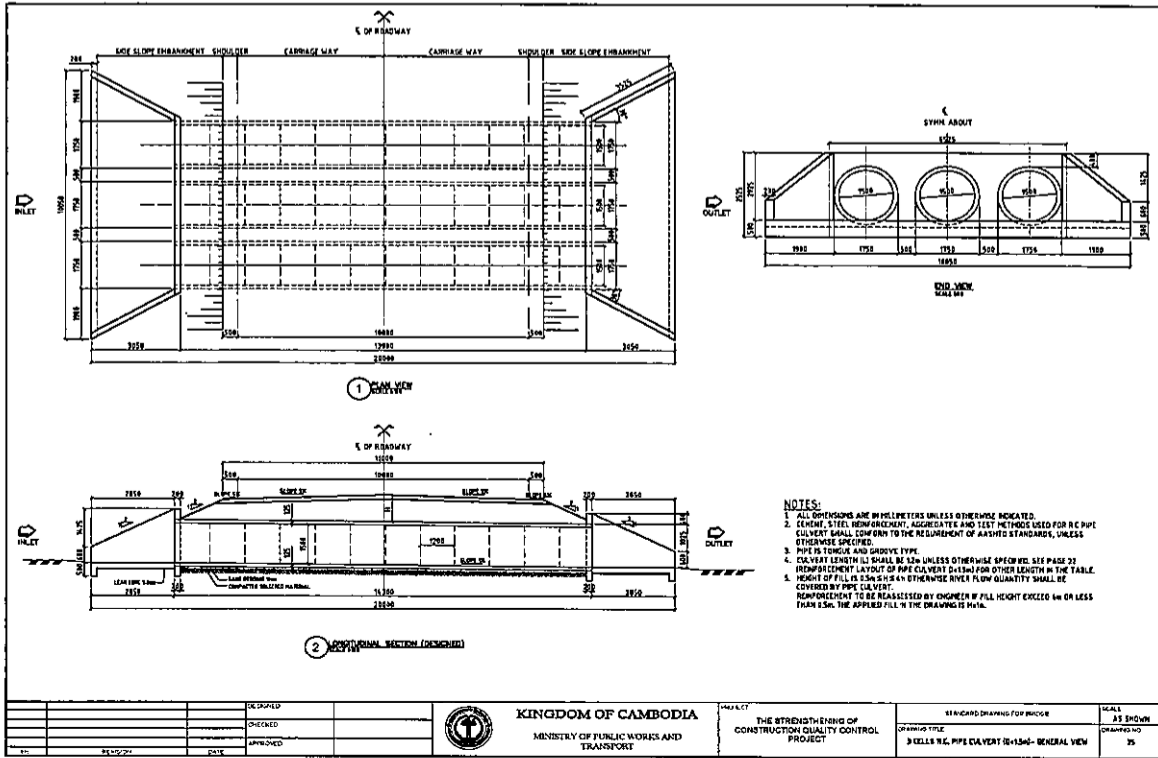
KINGDOM OF CAMBODIA

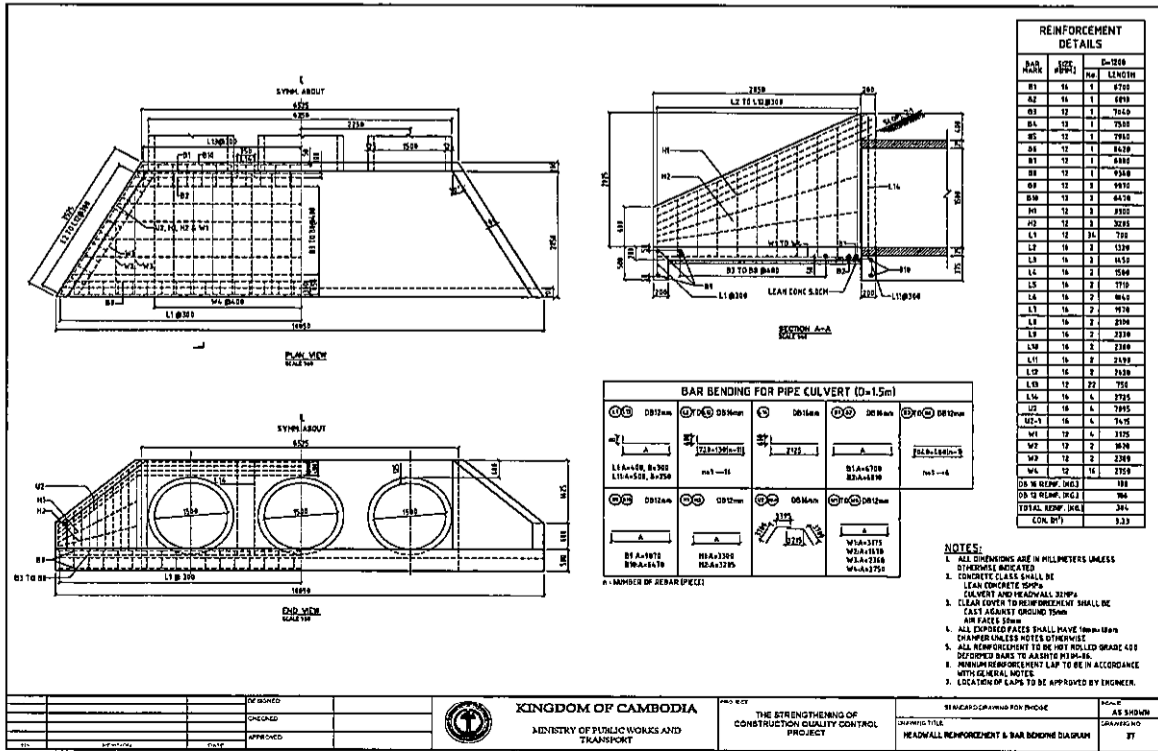
MINISTRY OF PUBLIC WORKS AND TRANSPORT

PROJECT: THE BETHOUGH-HEARING OF CONSTRUCTION QUALITY CONTROL PROJECT

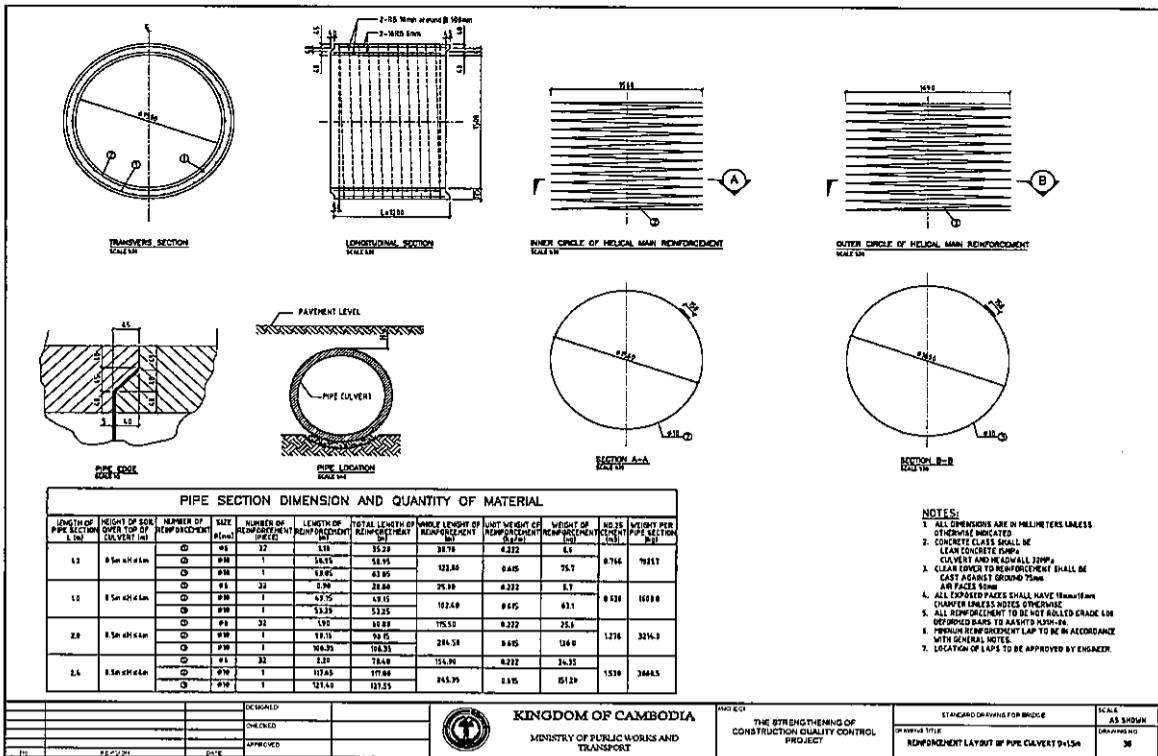
PRODUCT: GENERAL NOTES FOR PIPE CULVERT

DATE: 1





DESIGNED	CHECKED	APPROVED		KINGDOM OF CAMBODIA MINISTRY OF PUBLIC WORKS AND TRANSPORT	PROJECT THE STRENGTHENING OF CONSTRUCTION QUALITY CONTROL PROJECT	STANDARD DRAWING FOR BRIDGE	SCALE AS SHOWN
DATE	DATE	DATE				DRAWING TITLE HEADWALL REINFORCEMENT & BAR BENDING DIAGRAM	DRAWING NO. BT



DESIGNED	CHECKED	APPROVED		KINGDOM OF CAMBODIA MINISTRY OF PUBLIC WORKS AND TRANSPORT	PROJECT THE STRENGTHENING OF CONSTRUCTION QUALITY CONTROL PROJECT	STANDARD DRAWING FOR BRIDGE	SCALE AS SHOWN
DATE	DATE	DATE				DRAWING TITLE REINFORCEMENT LAYOUT BY PIPE CULVERT 04150	DRAWING NO. BT

Part-2 Road Structure

Vol.2 Box Culvert

(3Cell 3mx3m Box Culvert)

GENERAL NOTES FOR BOX CULVERT

GENERAL

IT IS TO NOTE THAT STANDARD DRAWINGS HAS BEEN PREPARED PURELY FOR REFERENCE ACCOUNT PROJECT. HOWEVER IT WILL BE APPLICABLE FOR CONTRACT-BID PROJECTS WITH SOME MODIFICATIONS.

1 APPLICATION RANGE OF BOX CULVERT ARE:

A. 1 BOX

H DIMEN HEIGHT (m)	B DIMEN WIDTH (m)
15	2.8 2.5 3.0
2.0	2.5 3.0
2.5	3.0

B. 2 BOXES

H DIMEN HEIGHT (m)	B DIMEN WIDTH (m)
15	2.5 3.0
2.0	3.0
2.5	3.0

C. 3 BOXES

H DIMEN HEIGHT (m)	B DIMEN WIDTH (m)
15	2.2 2.5 3.0
2.0	2.5 3.0
2.5	3.0

2. IN THE INTERPRETATION OF DRAWINGS, INDICATED DIMENSION SHALL COVER ALL DIMENSIONS DISTANCES AND SIZES SHALL NOT BE SCALED FOR CONSTRUCTION PURPOSES.

3. UNLESS OTHERWISE INDICATED, ALL DIMENSION AND HEIGHT SIZE ARE IN MILLIMETERS.

DESIGN SPECIFICATION

1. DESIGN SPECIFICATIONS

- AUSTRALASIAN BRIDGE DESIGN CODES, AUSTRALIA 1987
- AMERICAN CONCRETE INSTITUTE, ACI 318, BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE, AND OTHER RELEVANT ACI.
- AMERICAN SOCIETY FOR TESTING AND MATERIALS, ASTM
- AMERICAN INSTITUTE OF STEEL CONSTRUCTION.
- AMERICAN WELDING SOCIETY STANDARD, ANSI/AWS D1.1.

2. DEAD LOADS

CONCRETE	24.00 KN/M ³
ADJUSTED	19.80 KN/M ³
BLASTH	27.50 KN/M ³

3. LIVE LOADS

A. AUSTRAD 17 (T4.4 TRUCK LOAD)

MATERIALS

CLASS	USE	MAX. SIZE (mm)	MIN. STRENGTH (MPa)
B1	BOX CULVERT, WING WALL AND APPROACH SLABS	19	32
C	LEAN CONCRETE	5.0	15

2. REINFORCEMENT STEEL

A. REINFORCEMENT STEEL SHALL CONFORM TO ASSHASTM A631 GRADES 302 & 432. MINIMUM YIELD STRENGTH, F_y GRADE 302: F_y 420 MPa; GRADE 432: 550 MPa.

B. REINFORCEMENT STEEL BE FREE OF MILL SCALE, OIL OR ANY SUBSTANCE WHICH WILL WEAKEN THE BOND WITH CONCRETE.

CONSTRUCTION

1. EXAMINE CONSTRUCTION SPECIFICATION 3003, MPWT LETTING OUT.

1.1. THE SETTING OUT AND THE ELEVATION OF THE DIFFERENT COMPONENTS OF THE STRUCTURE SHALL BE APPROVED BY THE ENGINEER PRIOR TO THE START OF ANY CONSTRUCTION WORK. BARREL SHALL BE NOT EXCEEDING 15mm THICKNESS EACH LAYER IN UNCOMPACTED TOPTH AND THOROUGHLY COMPACTED TO OBTAIN A DENSITY OF NOT LESS THAN 98% OF THAT DETERMINED BY ASTM D 1557.

2. REINFORCED CONCRETE

A. CONCRETE MIX AND PLACING

A1. DESIGN OF CONCRETE MIX SHALL MEET THE DESIGN CONCRETE STRENGTH GIVEN UNDER ITEM C OF MATERIALS.

A2. CONCRETE SHALL BE DEPOSITED, VIBRATED AND CURED IN ACCORDANCE WITH THE SPECIFICATIONS.

A3. FOR CONCRETE DEPOSITED AGAINST THE GROUND UNLESS OTHERWISE INDICATED, LEAN CONCRETE WITH A MINIMUM THICKNESS OF 50mm SHALL BE LAID FIRST BEFORE INSTALLING THE REINFORCEMENT. THIS LEAN CONCRETE SHALL NOT BE CONSIDERED IN MEASURING THE STRUCTURAL DEPTH OF CONCRETE SECTION.

A4. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR APPROVAL PLACING SEQUENCES FOR ALL ENGINEERING WORKS.

B. BAR BENDING, SPACING AND INSTALLATION

B1. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR APPROVAL OF BARS LAYOUT INDICATING THE BENDING, CUTTING, SPLACING AND INSTALLATION OF ALL REINFORCEMENT BARS.

B2. BARS SHALL BE BENT COLD. BARS PARTIALLY EMBEDDED IN CONCRETE SHALL NOT BE WELD BENT UNLESS PERMITTED BY THE ENGINEER.

B3. BAR SPACING NOT INDICATED ON DRAWINGS SHALL BE SUBJECT TO THE APPROVAL OF THE ENGINEER.

B4. NOT MORE THAN 50% OF THE BARS AT ANY ONE SECTION SHALL BE SPLICED. BARS SHALL NOT BE SPLICED AT POINTS OF MAXIMUM STRESS.

B5. UNLESS OTHERWISE SHOWN ON THE PLANS, THE CLEAR DISTANCE BETWEEN PARALLEL BARS IN LAYER SHALL NOT BE LESS THAN 4 TIMES THE NOMINAL DIAMETER OF THE BAR NOR LESS THAN 4 TIMES THE NOMINAL SIZE OF COARSE AGGREGATE. THE CLEAR DISTANCE BETWEEN LAYERS SHALL NOT BE LESS THAN 4 TIMES THE NOMINAL SIZE OF THE AGGREGATE. BARS IN THE UPPER LAYER SHALL BE PLACED DIRECTLY ABOVE THOSE IN THE BOTTOM LAYER.

3. FORMWORK

FORMWORK SHALL BE CONSTRUCTED SUCH THAT IT WILL NOT YIELD UNDER THE LOAD AND SHALL BE SIZED AS TO AVOID THE FORMATION OF JOINTS. ALL CORNERS OF CONCRETE MEMBERS SHALL BE CHAMFERED TO 15mm UNLESS NOTED OTHERWISE ON DRAWINGS. STRIPPING OF FORMS AND HEIGHT SHALL BE AS DETERMINED BY THE ENGINEER. THE FOLLOWING MAY BE USED AS A GUIDE:

	MIN.	TIME
SLABS	1	24 HOURS
WING WALLS	1	7 DAYS
VERTICAL SURFACES	1	3 DAYS

4. PROTECTION AND CURING OF CONCRETE

CONCRETE SURFACES SHALL BE PROTECTED FROM HARMFUL EFFECTS OF SUN, WIND AND RUNNING WATERS AND SHALL BE KEPT DAMP FOR AT LEAST 7 DAYS.

5. BAR BENDING SHALL BE APPLIED IN ANY CASE BELOW:

1. ENHANCEMENT HEIGHTS EQUAL OR MORE THAN 25m.

2. 90° POINT LOCATED AT INLET AND OUTLET.

BAR BENDING SHOULD BE USED IN CASE BELOW:

GABION OPTION	
SLOPE (m)	OUTLET
1:2	1.0
1:1	1.5
1:1	2.0
1:1	2.5
1:1	3.0

SYMBOLS

ABBREVIATIONS

SYM	MEANING
AVE	AVERAGE
C/E	CENTER TO CENTER
C	CENTER LINE
CM	CENTIMETER
CON	CONCRETE
DWD	DRAINAGE
I	INCLINATION
HPA	HORIZONTAL
M	METER
MM	MILLIMETER
MAX	MAXIMUM
MIN	MINIMUM
HPA	HORIZONTAL
HPA	HORIZONTAL
NO.	NUMBER
NTS	NOT TO SCALE
PCS	PIECES
QTY	QUANTITY
R	RADIUS
R	REINFORCEMENT
SYMM	SYMMETRIC

GENERAL NOTES FOR BOX CULVERT

1. APPLICATION RANGE OF BOX CULVERT ARE: (See tables A, B, C)

2. IN THE INTERPRETATION OF DRAWINGS, INDICATED DIMENSION SHALL COVER ALL DIMENSIONS DISTANCES AND SIZES SHALL NOT BE SCALED FOR CONSTRUCTION PURPOSES.

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1:2	1.0
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1:1	2.0
1:1	2.5
1:1	3.0

SYMBOLS:

LINE OF SYMMETRY OR EQUALITY

LIMITS OF DIMENSION

SECTION IN EARTH

SECTION IN LEAN CONCRETE

SECTION IN CONCRETE

SECTION IN GARDEN

PLAN VIEW AND ELEVATION OF OUT AND FALL SLOPES

DEPTH CATION SYMBOL

TITLE TARGET

ROUND

AT

AND

CENTER LINE

BAR SPACING IN PLAN (E/C EQUAL SPACING)

DIAMETER OF BAR OR PIPE

OR (C/OFFERED BAR OR ROLLING BAR)

NO OF BARS IN SINGLE LEAVE OR BLANK IN NO SPOKE OR NO OF STRIPPINGS

BAR MARK

ABBREVIATIONS:

SYM	MEANING
AVE	AVERAGE
C/E	CENTER TO CENTER
C	CENTER LINE
CM	CENTIMETER
CON	CONCRETE
DWD	DRAINAGE
I	INCLINATION
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KINGDOM OF CAMBODIA

MINISTRY OF PUBLIC WORKS AND TRANSPORT

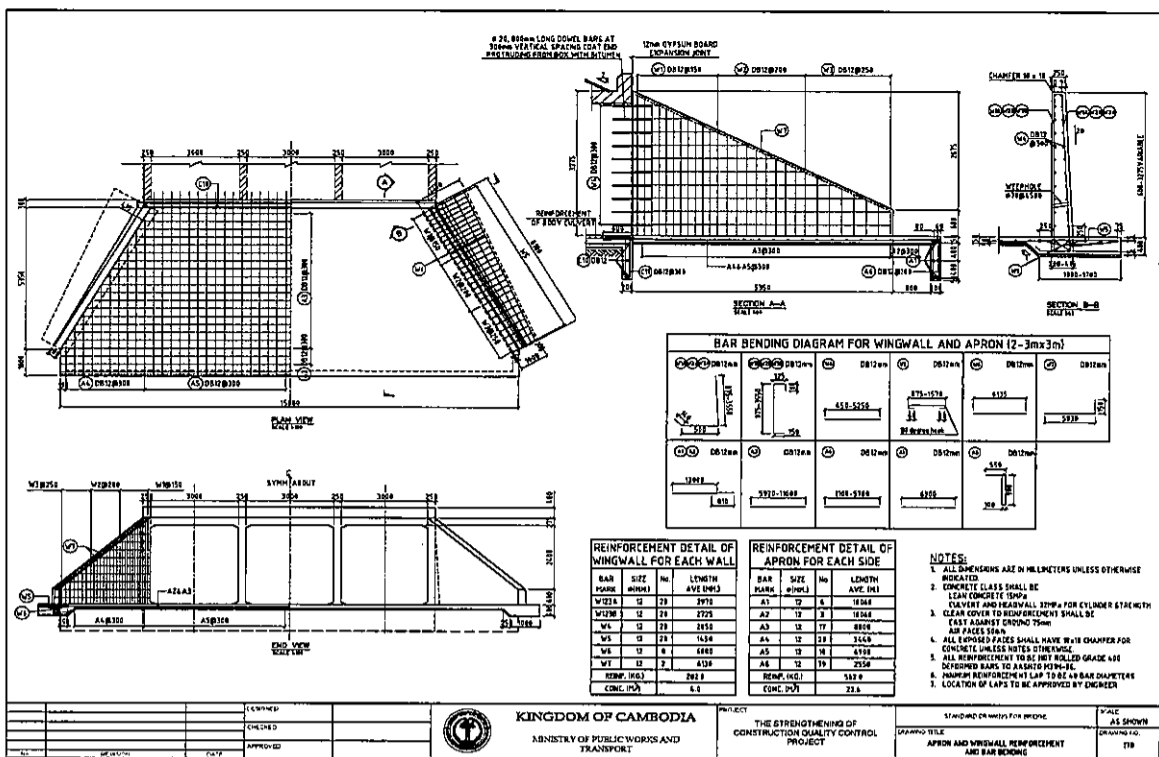
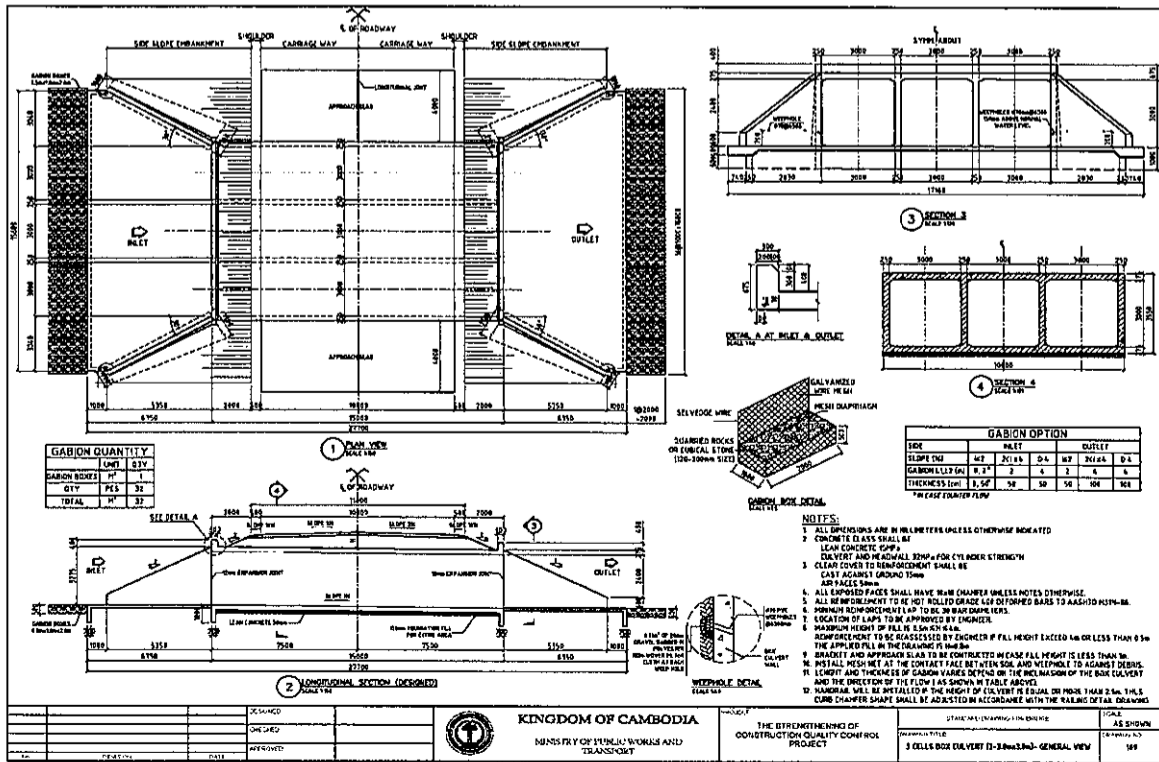
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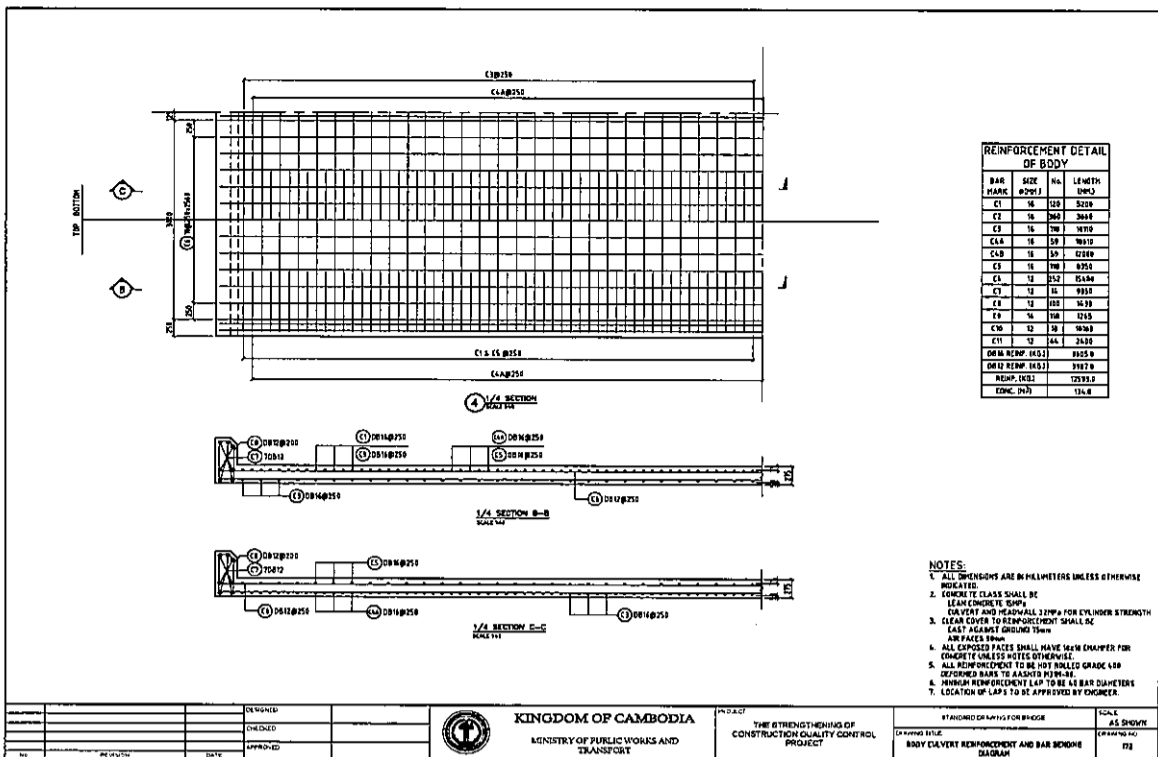
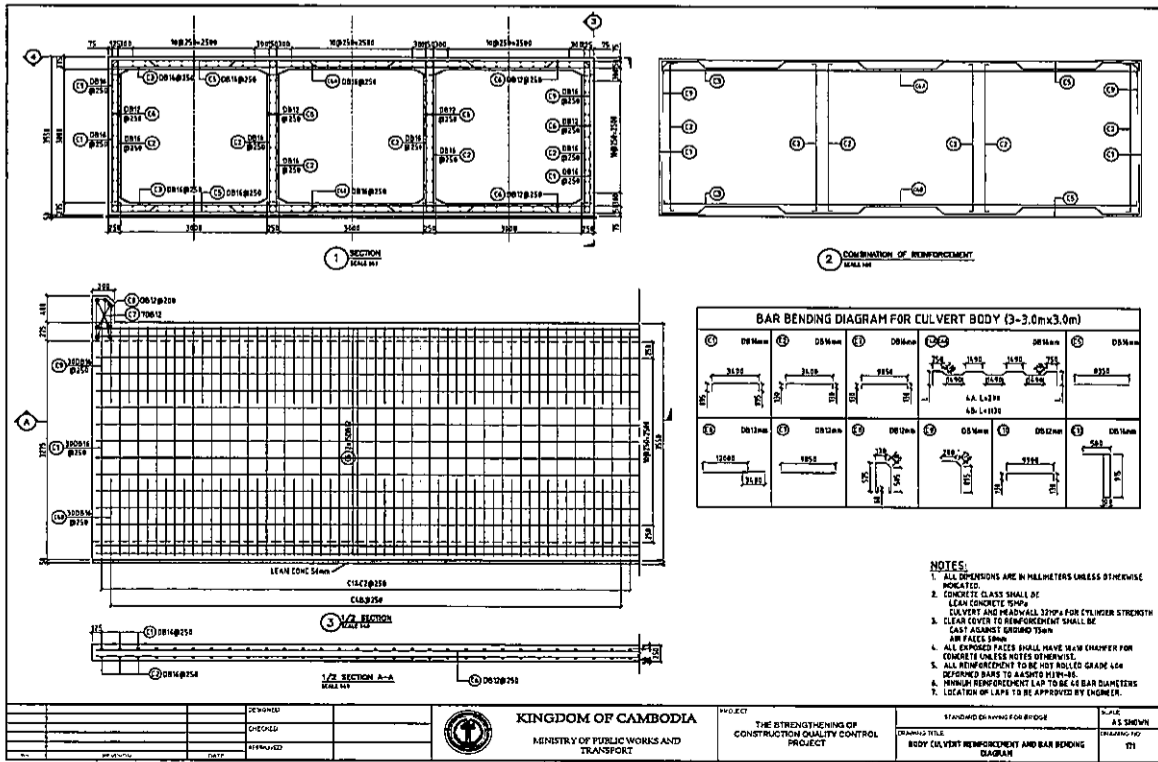
STANDARD DRAWING FOR BOX CULVERT

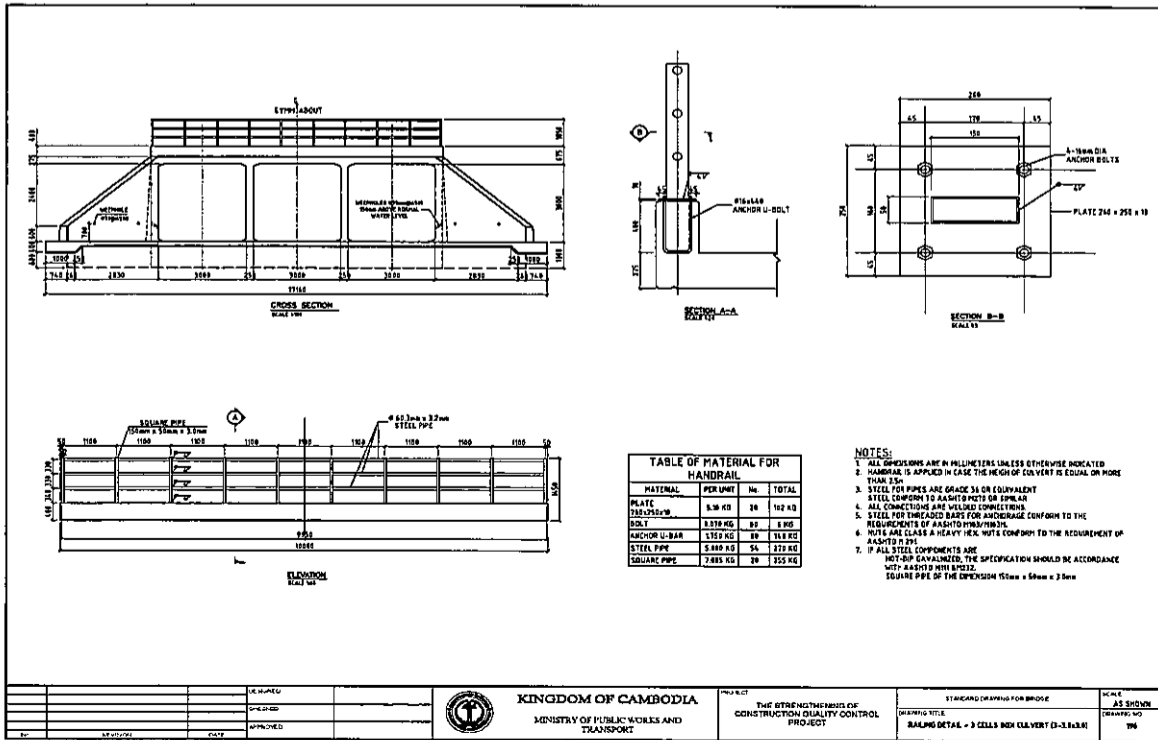
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SCALE: NTS

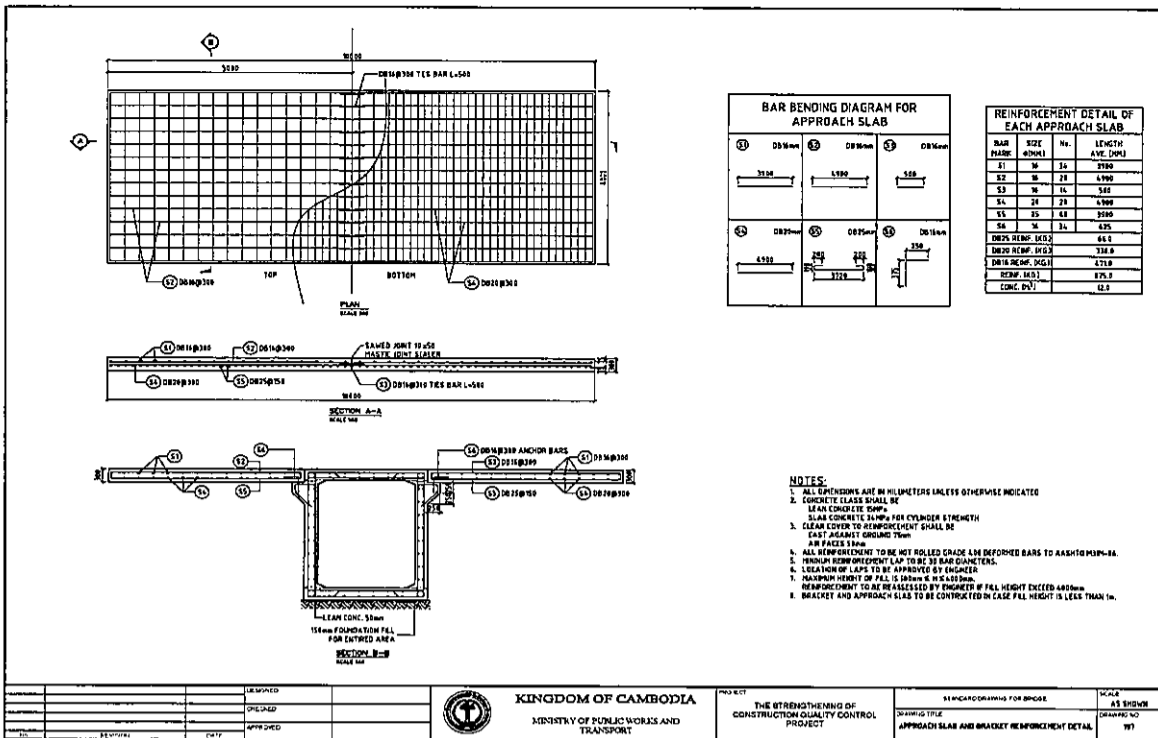
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DATE	DATE					



DESIGNED BY	APPROVED BY		KINGDOM OF CAMBODIA MINISTRY OF PUBLIC WORKS AND TRANSPORT	PROJECT: THE STRENGTHENING OF CONSTRUCTION QUALITY CONTROL PROJECT	STANDARD DRAWING FOR BRIDGE	DRAWING TITLE: APPROACH SLAB AND BRACKET REINFORCEMENT DETAIL SCALE: AS SHOWN DRAWING NO: 107
DATE	DATE					