TO CR of JICA Timor-Leste OFFICE

Project Title: The Project for the Capacity Development of Road Services in the Democratic Republic of Timor-Leste

Version of the Sheet: Ver.3（Term: March, 2016 - March, 2019）

Name: Hisashi MUTO
Title: Team Leader/ Road Maintenance1
Submission Date: 28th March 2017

< I. Summary (all achievements are as of 31st March, 2017) >

1. Progress

1-1 Progress of Inputs

1-1-1 Japanese side

< Short-term experts dispatched to Timor-Leste>

NO	Name	Title	Dispatched Period to Timor-Leste	Changes or delay
1	Hisashi MUTO	Team Leader/ Road Maintenance 1	(1st) 8th Mar - 10th Apr, 2016 (2nd)14th Jun - 25th Jun, 2016 (3rd)1st Sep - 18th Sep, 2016 (4th) 23th Jan - 19th Feb,2017 (5th) 24th Mar – 31st Mar, 2017	None
2	Makoto MATSUURA	Deputy Team Leader/ Road Maintenance 2	(1st) 8th Mar – 15th Apr, 2016 (2nd)14th Jun - 13th Jul, 2016 (3rd) 20th Sep - 14th Oct,2016 (4th) 1st Dec - 16th Dec,2016 (5th) 23th Jan - 19th Feb,2017	None
3	Mitsuhide SAITO	Deputy Team Leader/ Road Maintenance 2	(1st) 24th Mar – 31st Mar, 2017	None
3	Johji KOIZUMI	Road Construction Supervision	(1st) 19th Jul -17th Aug, 2016 (2nd)24th Sep - 14th Oct,2016	None
4	Sueo HIROSE	Quality Control/ Road Repair	(1st) 28th Mar - 17th Apr, 2016 (2nd)13th May - 11th Jun, 2016 (3rd) 14th Aug -12th Sep, 2016 (4th) 7th Oct - 14th Oct, 2016 (5th) 23th Jan - 22th Feb,2017	None

5	Shutaro SAKANAKA	Disaster Restoration	(1st) 11th May - 31st May, 2016 (2nd)28th Jun - 21st Jul, 2016 (3rd)12th Sep – 6th Oct, 2016 (4th) 13th Feb - 8th Mar, 2017	None
6	Yoshiyuki AKAGAWA	Road Design/ Project Coordinator	(1st) 17th Mar - 15th Sep, 2016 (2nd)21st Jun - 13th Jul, 2016 (3rd)12th Sep - 6th Oct, 2016 (4th) 13th Feb - 5th Mar, 2017	None
7	Kenji MINEGISHI	Structure Design	(1st) 5th Apr - 24th Apr, 2016 (2nd) 5th Jul - 4th Aug, 2016 (3rd) 14th Nov- 13th Dec,2016	None
8	Takashi SAITO	Database	(1st) 19th Jul - 24th Aug, 2016 (2nd) 3rd Oct - 14th Oct, 2016 (3rd) 13th Mar- 31st Mar,2017	None
9	Nao TSUJIMURA	Evaluation/Monitoring	Resident in Timor-Leste	None

< Equipment and materials >

NO	Items	Qty	Unit price	Unit	Total amount
1	Copy machine	1	515 US$	1	515 US$
2	Copy machine	1	470 US$	1	470 US$

(Remark: Equipment and materials which have a durable years for 2 years and are more than JPY50,000 are listed.)

1-1-2 Timor-Leste side

- **Counterpart (C/P) personnel (from MPWTC and DRBFC)**

NO	Name	Title of the Project	Engaged Period
1	Jose Gaspar R.C. Piedade	Project Director	8th Mar 2016 – at present
2	Rui Hernani F. Guterres	Project Manager	8th Mar 2016 – at present
3	Joao Gama	C/P staff	8th Mar 2016 – at present
4	Joao Pedro Amaral	C/P staff	8th Mar 2016 – at present
5	Joao Gregorio	C/P staff	8th Mar 2016 – at present
6	Cristovao da Costa Monteiro	C/P staff	22nd Feb 2017- 3rd March 2017
7	Pedro Corte Real oronha	C/P staff	22nd Feb 2017- 3rd March 2017
8	Francisco B. Gama	C/P staff	22nd Feb 2017- 3rd March 2017
9	Antonio de Araujo	C/P staff	22nd Feb 2017- 3rd March 2017

- **Equipment and materials for the project office**

NO	Items	Qty	Unit
1	Office space (including desks and chairs)	1	room

1-2 Progress of Activities

NO	Activity	Achievement level
1.3	To update the database based on the inspection result and repair/rehabilitation works of road and bridges.	● JICA Expert Team identified that existing database entry format has to be improved so as to match the present road maintenance activities. Therefore, Inspection form and database are being improved.
1.4	To formulate maintenance and repair/rehabilitation plans for next cycle.	● Maintenance Department of DRBFC has prepared the preliminary estimate of road maintenance budget in the next year. 3.4 million USD has been secured for road/bridge maintenance budget in 2017. ● Maintenance Department of DRBFC has prepared drawings and BOQ of 9 maintenance package program.
1.5	To implement emergency inspections and repair/rehabilitation works when necessity arises.	● Emergency inspections were conducted by DRBFC at damaged sites on A03 caused after heavy rain. Failures of slope, drainage, pavement and shoulder were confirmed. ● After inspection, feedback workshop was held JICA to discuss cause and countermeasures on them.
1.6	To undertake appropriate road maintenance/ rehabilitation works by following annual work and budget plans which reflect priorities within the limited budget	● One of 9 maintenance package is started and implemented in Dili. However, other 8 packages are delay due to the design and cost review by ADN and tender procedure

2.2	To conduct the case studies for the planning, design check, and construction supervision of the project	● 1 case study on construction and 3 case studies on design are selected and started. Working group members organized by DRBFC and JICA Expert Team conducted the site observation on design case study sites. ● Classroom lectures related to case studies were held as mentioned in 3.3.
3.3	To acquire necessary knowledges of civil engineering for design through classroom lectures and case studies.	● JICA Expert Team held seminar of introduction of safety activities on construction site as one of case study; DRBFC engineers attended this seminar to acquire following knowledges; • Examples of construction accidents and causes of them; • Proposed safety activities done in Japan and other overseas projects ● JICA Expert Team held seminar of introduction of slope protection; DRBFC engineers and professors of engineering department of National University of Timor-Leste attended this seminar to acquire following knowledges; • General information of slope protection and applicable countermeasures on the slope collapses; • Basic principle of calculation of slope stabilities. ● JICA Expert Team held a lecture of the protection method against scouring on Sahen Bridge as one of case study site. During lecture, 4 DRBFC staffs have learned following knowledges; • Phenomenon and mechanism of scouring could be occurred on the riverbed around bridge substructures; • How to calculate the scouring depth to examine scouring risks on the bridge substructures; • How to calculate appropriate weight of protection blocks; • Standard repair work of damaged abutment. ● JICA Expert Team provided classroom lecture of design check for road drainage through study on catchment basin. 4 DRBFC engineers attended this lecture and learn following contents; • Theory of catchment basin as well as practice on making river profile; • How to grasp basin boundary using topographic map; • Method of confirmation of river networks.

1-3 Achievement of Output

Indicators of Outputs		Achievement level
1.1	More than 30% of requested budget for road maintenance are distributed.	This concrete indicator has been set up and approved in the 2nd JCC on 16th February, 2017. Achievement level of output is to be measured accordingly.

		Baseline in 2016 is 20%.
1.2	Improved road database is utilized for preparation of the annual work plan of road maintenance.	This concrete indicator has been set up and approved in the 2nd JCC on 16th February, 2017. Achievement level of output is to be measured accordingly.
2.1	At least 3 case studies for construction and 3 case studies for design are conducted (Totally 6 case studies).	This concrete indicator has been set up and approved in the 2nd JCC on 16th February, 2017. Achievement level of output is to be measured accordingly. 1 site for construction and 3 sites for design are selected.
2.2	More than 60% of trainees pass the achievement test for construction supervision and design.	This concrete indicator has been set up and approved in the 2nd JCC on 16th February, 2017. Achievement level of output is to be measured accordingly. Baseline in 2016 is that 28% of examinees passed design baseline test. 8 % passed quality control baseline test.
3	Technical guideline of investigation and design for slope protection, drainage and measures against scouring are prepared.	This concrete indicator has been set up and approved in the 2nd JCC on 16th February, 2017. Achievement level of output is to be measured accordingly.

1-4 Achievement of the Project Purpose

Indicators of Project Purpose	Achievement level
Total length of maintained national roads became 400km.	This concrete indicator has been set up and approved in the 2nd JCC on 16th February, 2017. Achievement level of output is to be measured accordingly.

1-5 Changes of Risks and Actions for Mitigation

- Risks are not confirmed so far, thus actions for mitigation are not taken.

1-6 Progress of Actions undertaken by JICA

- JICA Timor-Leste shared important information and documents with JICA Expert Team.
- JICA Timor-Leste assisted visa acquisition process for JICA Expert Team.
- JICA Timor-Leste promoted internship program and two internship students were dispatched on this project for one month.

1-7 Progress of Actions undertaken by Gov. of Timor-Leste

- General Director of Public Works held the 2nd JCC as the acting chairperson.
- DRBFC shared necessary information and documents with JICA Expert Team.
- DRBFC has prepared the drawings of road and bridge maintenance based on the road inspection.

1-8 Progress of Environmental and Social Considerations (if applicable)

- No activities for the progress of Environmental and Social Considerations are undertaken.

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

- Not Applicable so far.

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

- No other issues are confirmed so far.

2. Delay of Work Schedule and/or Problems (if any)

- Based on the PDM, the project activities have been implemented as planned.

3. Modification of the Project Implementation Plan

3-1 PO

- PO is modified according to the change of PDM.

3-2 Other modifications on detailed implementation plan

- No other modification of the detailed implementation plan is confirmed.

4. Preparation of Gov. of Timor-Leste toward after completion of the Project

- The Gov. of Timor-Leste tries to secure the budget for road maintenance so that the capacity enhancement of DRBFC for road maintenance which is the Project Purpose will be sustainable and contribute to the achievement of Overall Goal.

< II. Project Monitoring Sheet I & II >

- Project Monitoring Sheet I & II are attached as PM Form I and II.

Attachment 1: Material of Safety Lecture (October 2016)
Attachment 2: Training Material on Slope Protection (December 2016)
Attachment 3: Material of Workshop on A03 Inspection (February 2017)
Attachment 4: Training Material on Analysis of Catchment Basin (March 2017)
Attachment 5: Training Material on Measures against Souring (March 2017)
Attachment 6: Minutes of 2nd JCC

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: The Project for Capacity Development of Road Services in Timor-Leste (CDRS)

Implementing Agency: Ministry of Public Works, Transport and Communications

Target Group: Officials of Direstorate of Road, Bridge and Flood Control (DRBFC)

Period of Project: (Three (3) years)

Project Site: Whole Timor-Leste **Model Site:**

Version 3

Dated 31st March, 2017

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	**Achievement**	**Remarks**
Overall Goal					
The maintenance conditions of major roads are improved in TL.	OG1 More than 60% of major national roads is in good condition.	Periodic Road Inspection	Budget and staff will be secured at satisfactory levels. Traffic volume is not increased more than expected.	Indicator has been set up and approved in 2nd JCC on February 2017.	
Project Purpose					
Capacity of DRBFC for maintenance of major roads in the whole country is enhanced.	Total length of maintained national roads become 400km.	Periodic Road Inspection	Enough number of DRBFC staff in the HQs and regional offices is ensured as planned. Budget for road maintenance and management is ensured.	Indicator has been set up and approved in 2nd JCC on February 2017.	
Outputs					
Output 1: Appropriate road maintenance and rehabilitation for major roads is realized in accordance with annual work plan and annual budget plan.	1-1 More than 30% of requested budget for road maintenance are distributed. 1-2 Improved road database is utilized for preparing the annual work plan of road maintenance.	Budget Report Monitoring Sheet	Budget for road maintenance and management is ensured. The trained DRBFC personnel continue to work for the Project (They do not quit the Project)	Indicator has been set up and approved in 2nd JCC on February 2017.	
Output 2: Capacity of DRBFC construction management for maintenance and rehabilitation including slope protection is improved through case studies in the whole country.	2-1. At least 3 case studies for construction and 3 case studies for design are conducted (Totally 6 case studies). 2-2. More than 60 % of trainees pass the achievement test for construction supervision and design.	Monitoring Sheet Achievement test	Unforeseen natural disasters will not occur which may destroy construction works under case studies.	2-1. 1 site for construction and 3 sites for design are selected.	
Output 3: Technical guideline of investigation and design for maintenance and rehabilitation are provided as a tool for more appropriate design including slope protection.	3. Technical guideline of investigation and design for slope protection, drainage and measures against scouring are prepared.	Technical guideline prepared			

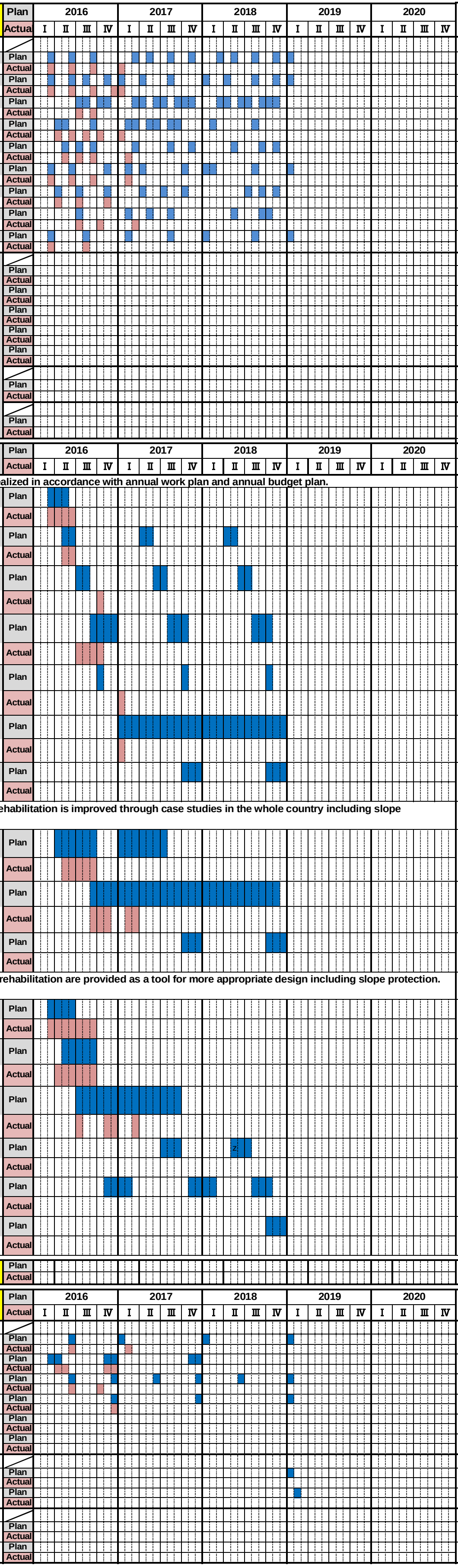
Activities	Inputs		Pre-Conditions
	The Japanese Side	The Timor-Leste Side	
1.1 To review existing management structure condition of maintenance and rehabilitation for major roads. 1.2 To conduct periodic/routine inspection. 1.3 To update the database based on the inspection result and repair/rehabilitation works of roads and bridges. 1.4 To formulate maintenance and repair/rehabilitation plans for next cycle. 1.5 To implement emergency inspections and repair/rehabilitation works when necessity arises. 1.6 To undertake appropriate road maintenance/rehabilitation works by following annual work and budget plans which reflect priorities within the limited budget. 1.7 To propose appropriate framework of road maintenance and rehabilitation for major roads. 2.1 To identify typical rehabilitation and repair works of major roads in the whole country as case studies. 2.2 To conduct the case studies for the planning, design and construction supervision of the project. 2.3 To propose preferable structures for construction management for repair/rehabilitation and maintenance works through case studies. 3.1 To review existing technical documents for road maintenance and rehabilitation. 3.2 To review and identify factors of failure from past examples of damaged rehabilitation and construction works. 3.3 To acquire necessary knowledges of civil engineering for design through classroom lectures and case studies. 3.4 To prepare the technical guideline of investigation and design. 3.5 To reflect the lessons learned from case studies to the technical guideline. 3.6 To disseminate the technical guideline for concerned parties.	1. Dispatch of the Japanese experts Short-term experts: - Team leader / Road maintenance 1 - Deputy team leader / Road maintenance 2 - Road construction supervision - Quality control / Road repair - Disaster restoration - Road design / Project coordinator - Structure design - Database - Evaluation / Monitoring - Other areas if needed 2. Facillities and equipment In accordance with necessity of activities 3. Training in Japan In accordance with necessity of activities	1. Assignment of C/Ps - Project Director - Project Manager - DRBFC Staff 2. Assignment of Trainees In accordance of necessity 3. Facillities and Equipment - Project office Equipment and tools 4. Recurrent costs - Expenses for equipment maintenance - Spare parts - Transportation fees of C/Ps and trainees - Expenses for contract-out of works - Necessary expenditures for case studies - C/Ps' wages and allowances	DRBFC's budget necessary for the Project is allocated by TL government. ⬇ <Issues and countermesures>

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 3

Dated 31st March 2017

Project Title: The Project for the Capacity Development of Road Services in the Democratic Republic of Timor-Leste(CDRS)



Inputs	Plan / Actual	Remarks	Monitoring: Issue	Monitoring: Solution
Expert				
Team Leader/Road Maintenance 1 /Mr. Hisashi MUTO	Plan Actual		-	-
Deputy Team Leader/Road Maintenance 2 /Mr. Makoto MATSUURA	Plan Actual		-	-
Road Construction Supervision /Mr. Johji KOIZUMI	Plan Actual		-	-
Quality Control/Road Repair /Mr. Sueo HIROSE	Plan Actual		-	-
Disaster Restoration /Mr. Shutaro SAKANAKA	Plan Actual		-	-
Road Design/Project Coordinator /Mr. Yoshiyuki AKAGAWA	Plan Actual		-	-
Structure Design /Mr. Kenji MINEGISHI	Plan Actual		-	-
Database /Mr. Takashi SAITO	Plan Actual		-	-
Evaluation/Monitoring Ms. Nao TSUJIMURA	Plan Actual		-	-
Equipment				
	Plan Actual			
	Plan Actual			
	Plan Actual			
	Plan Actual			
	Plan Actual			
Training in Japan				
necessities are under discussion	Plan Actual			
In-country/Third country Training				
	Plan Actual			

Activities / Sub-Activities	Plan / Actual	Responsible Organization: Japan	Responsible Organization: GOTL	Achievements	Issue & Countermeasures
Output 1: Appropriate road maintenance and rehabilitation for major roads is realized in accordance with annual work plan and annual budget plan.					
1.1 To review existing management structure and condition of maintenance and rehabilitation for major roads	Plan Actual				
1.2 To conduct the periodic/routine inspection	Plan Actual			Inspection form is being improved	
1.3 To update the database based on the inspection result and repair/rehabilitation works of roads and bridges	Plan Actual			Database is being improved	The database has to be updated so as to match the revised inspection form
1.4 To formulate maintenance and repair/rehabilitation plans for next cycle	Plan Actual			Maintenace budget has been proposed based on the road inspection and drawing	3.4 million USD has been secured for road/bridge maintenance budget in 2017
1.5 To implement emergency inspections and repair/rehabilitation works when necessity arises	Plan Actual			Emargency inspection on A03 has been conducted	Budget for emargency rehabilitation shall be secured
1.6 To undertake appropriate road maintenance/ rehabilitation works by following annual work and budget plans which reflect priorities within the limited budget	Plan Actual			One of 9 maintenance package is started and being implemented.	Other 8 maintenance packages are delay due to the tender procedure
1.7 To propose appropriate framework of road maintenance/rehabilitation for major roads	Plan Actual				
Output 2: Capacity of DRBFC construction management for maintenance and rehabilitation is improved through case studies in the whole country including slope protections					
2.1 To identify typical rehabilitation and repair works of major roads in the whole country as case studies	Plan Actual				
2.2 To conduct the case studies for the planning, design check, and construction supervision of the project	Plan Actual			1 case study on construction and 3 case studies on design are selected and started.	Allocation of additional budget for case stusies is under negotiation with JICA.
2.3 To propose preferable structures for construction management for repair/rehabilitation works through case studies	Plan Actual				
Output 3: Technical guideline of investigation and design for maintenance and rehabilitation are provided as a tool for more appropriate design including slope protection.					
3.1 To review existing technical documents for road maintenance and rehabilitation	Plan Actual				
3.2 To review and identify factors of failure from past examples of damaged rehabilitation and construction works	Plan Actual				
3.3 To acquire necessary knowledges of civil engineering for design through classroom lectures and case studies	Plan Actual			Classroom lectures on construction safety, slope protection and hydlorogy are conducted	
3.4 To prepare the technical guideline of investigation and design	Plan Actual				
3.5 To reflect the lessons learned from case studies to the technical guideline	Plan Actual				
3.6 To disseminate the technical guideline for concerned parties	Plan Actual				

Duration / Phasing	Plan Actual

Monitoring Plan	Plan / Actual	Remarks	Issue	Solution
Monitoring				
Joint Coordination Committee	Plan Actual		-	-
Set-up the Detailed Plan of Operation	Plan Actual		-	-
Submission of Monitoring Sheet	Plan Actual		-	-
Joint Monitoring	Plan Actual		-	-
Post Monitoring	Plan Actual			
	Plan Actual			
Reports/Documents				
Technical Guideline	Plan Actual			
Project Completion Report	Plan Actual			
Public Relations				
	Plan Actual			
	Plan Actual			

Attachment 1　Material of Safety Lecture (October 2016)

The Project for Capacity Development of Road Services
in the Democratic Republic of Timor-Leste (CDRS)

Case Study

Example of accidents and Introduction of Safety activities in construction site

13th October, 2016

Direstorate of Road, Bridge and Flood Control (DRBFC) of
Ministry of Public Works, Transport and Communications (MPWTC)
and JICA Expert Team (JET)

Example of accidents and Introduction of Safety activities in construction site

Case Study: EX Japan Road
Reconstruction of the Road EX Japan (STA.8+000~19+750)

Contents: Safety Control (1)

1. Example of accidents
Typical examples of accidents on construction site

2. Introduction of Safety activities
1) Morning Meeting (tool box meeting)
2) Safety Patrol
3) Safety Assembly

1. Example of accidents

Typical examples of accidents on construction site are shown on following cartoons;

Hiyari (Feeling "Shudder" or "Startled")
Hakfodak !!!

Accident !!

Road is partially blocked by the fallen rocks, if the truck detours, it will take a long time

Going through by force, then the truck fell down the cliff

In the construction site, it is said there are three (3) biggest Serious Accidents;

a) Accidents by construction machinery
b) Accidents caused by landslides or collapse during excavation
c) Accidents caused by falls from high places or falling objects
And it is likely to occur the third party accident in traffic accident

a) Accidents by construction machinery

Hakfodak !!!

Accident !!

Dump truck is going back without checking back side…

The truck hit the worker

Hakfodak !!!

Accident !!

Both men are out of sight with each other…

Going back rubber-tired roller hit the worker

b) Accidents caused by landslides or collapse during excavation

a rainy day, ground is soft, slope is partially collapsing…

Bulldozer fell down the slope

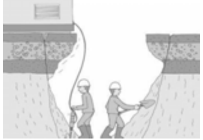
Hakfodak !!!

Accident !!

Earth retaining is not enough and partially collapsing…

Workers were buried alive by the mudslide.

c) Accidents caused by falls from high places or falling objects



Overhead asphalt pavement is on the brink of collapse…

Asphalt block fell onto worker's head

The third party accident often occurs in the traffic accident

Traffic accident involve s the third party

Hakfodak !!!

Accident !!

Dump truck is trying right turn, a motorcycle is coming closer

Dump truck collided with the motorcycle (Third Party)

2. Introduction of Safety activities

In order to prevent labour accidents, following activities (events) are carried out on site;

Exercise before morning meeting

1) Morning Meeting (tool box meeting)

Before start, all the person have a morning meeting for;
- a) today's work schedule and remarks safety measures
- b) tool box meeting among the work group

As a each working group, supervisors explain today's work procedures and safety remarks to workers

2) Safety Patrol

All parties concerns, Client, Consultant, Contractor and sub-contractor conduct Safety Patrol regularly for;
- a) checking site conditions and hazard of safety
- b) discussion for safety measures

Jointly site inspection and find out dangerous points and if necessary instructions are to be made

3) Safety Assembly

Safety Assembly is held with attending all staff & workers on the site for;
- a) encouraging the importance of the Safety and
- b) knowing safety minds and points

Project Manager or senior staff give speech regarding the importance of Safety and reminding safety manners to all the workers.

site on reconstruction of the road of Ex Japan

Almost all works are found, without helmets protecting themselves

When slope cutting and close the road, there is found no watchmen and warning sign board

Proposed schedule of activity for Safety Control in C/S;

- * Observation of Safety Activities on other project
- * General theory of accident's occurrence and prevention measures
- * Tying carry out Safety Activity on Ex Japan Road
- * Final purpose and general responsibility for Safety

☆ Obrigado Barak !!

You come to the site fine(Diak)
in the morning and you leave the site
fine(Diak) in the evening

Attachment 2 Training Material on Slope Protection (December 2016)

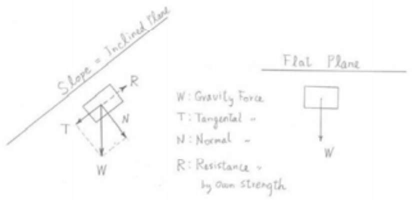
Introduction of Slope Protection

Out Line

1. General Information of Slope Protection
2. Countermeasure, Existing Methods and Methods shall be Introduced
3. Basic Points of Slope Stability Calculation
4. Necessary Information for Countermeasure Design

GENERAL INFORMATION OF SLOPE PROTECTION

Slope



Slope Classification

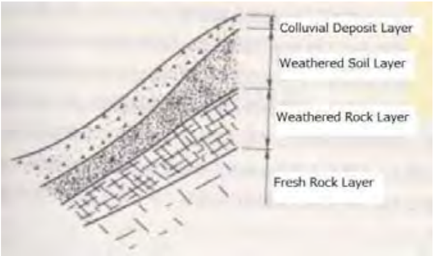
Natural Slope, Cut Slope
Collapsed Slope

Embankment Slope

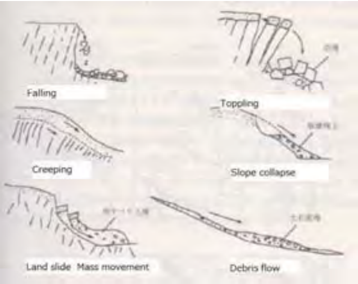
Slope Classification

Classification	Shape	Geology	
Natural Slope	Natural Terrain	Natural Ground	Complexity Inhomogeneous
Collapsed Slope	Collapsed Gradient		
Cut Slope	Cut Gradient		
Embankment Slope	Embankment Gradient	Banking Material	Depending on Q.C. Random－Selected Homogeneous

Natural Slope Surface Structure

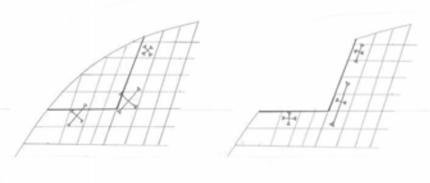


Slope Failure Classification by Movement Mechanism



Cut Slope

- Stress release
- Cut slope is steeper than natural slope



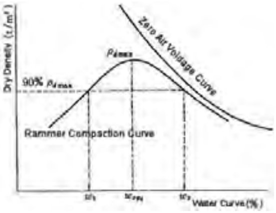
Cut Slope

- Scouring

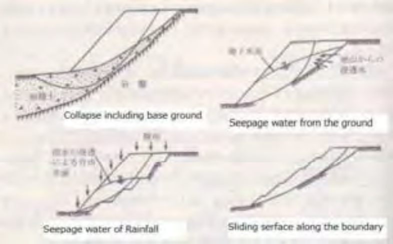
- Weathering and Slaking

Compaction of Embankment

Curve of Soil Compaction



Collapse on Embankment Slope



Slope shall stand up by own strength

Standard Gradients for Cut Slope

Soil classification		Cut Slope Height	Gradient
Hard rock			1:0.3 to 1:0.8
Soft rock			1:0.5 to 1:1.2
Sand	Not dense, and poorly graded		1:1.5 to
Sandy soil	Dense	Less than 5m	1:0.8 to 1:1.0
		5 to 10m	1:1.0 to 1:1.2
	Not dense	Less than 5m	1:1.0 to 1:1.2
		5 to 10m	1:1.2 to 1:1.5
Sandy soil mixed with gravel or rock masses	Dense, or well graded	Less than 10m	1:0.8 to 1:1.0
		10 to 15m	1:1.0 to 1:1.2
	Not dense, or poorly grade	Less than 10m	1:1.0 to 1:1.2
		10 to 15m	1:1.2 to 1:1.5
Clayey soil		0 to 15m	1:0.8 to 1:1.2
Clayey soil mixed with rock masses or cobble-stone		Less than 5m	1:1.0 to 1:1.2
		5 to 10m	1:1.2 to 1:1.5

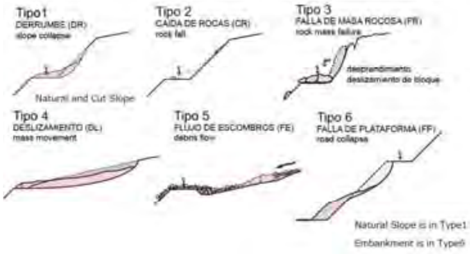
Slope shall stand up by own strength 2

Standard Gradients for Embankment

Banking materials	Height of embankment (m)	Standard gradient	Remarks
Well-graded Sand (S), gravel, and sand mixed with gravel (G)	Less than 5m	1:1.5 to 1: .8	To be applied to embankments with sufficient bearing capacity at foundation ground, which is not affected by inundation. Typical unified soil classification are shown in ( ) for reference.
	5m to 15m	1:1.8 to 1:2.0	
Poorly-graded Sand (SG)	Less than 10m	1:1.8 to 1:2.0	
Rock masses (including muck)	Less than 10m	1:1.5 to 1:1.8	
	10m to 20m	1:1.8 to 1:2.0	
Sandy soil (SF), hard clayey soils and hard clay (hard clayey soils and clay of alluvium, loam, etc.)	Less than 5m	1:1.5 to 1:1.8	In case of exception of standard slope is needed the stability calculation.
	5m to 10m	1:1.8 to 1:2.0	
Volcanic cohesive soils (V)	Less than 5m	1:1.8 to 1:2.0	

COUNTERMEASURE
EXISTING METHODS AND METHOD
SHALL BE INTRODUCED

Classification of Road Disaster



Natural Slope is in Type1

Embankment is in Type6

Characteristics of Disaster Type

Disaster Type		Movement	Topography	Moving Material	Moisture	Scale	Speed
T 1	Slope collapse	Fall, Slide	Steep, High slope	Weathered Rock, Soil	Moist	Small-Medium （<5,000m³）	Rapid
T 2	Rock fall	Fall	Steep, High slope	Rock	Dry	Very Small （<5m³）	Extremely rapid
T 3	Rock mass failure	Topple, Slide, Fall	Steep, High slope	Rock	Dry	Medium-Large （>100m³）	Rapid
T 4	Mass movement	Slide	Gentle slope with characteristic landform	Soil, Debris, Rock	Moist	Large （>5,000m³）	Slow
T 5	Debris flow	Flow	Stream	Debris, Mud	Liquid form	Medium-Large （>1,000m³）	Rapid
T 6	Road collapse	Slide、Fall	Embankment slope, Road shoulder	Fill material, Soil	Moist-Wet	Small （<1,000m³）	Rapid

T3 Rock Mass Failure

T5 Debris Flow

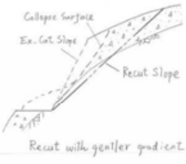
Principle Classification of Slope Disaster Countermeasure

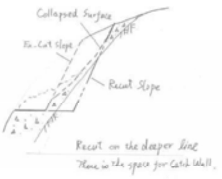
Classification	Principle
Control work	Control work makes the ground itself be stable. This is basic means of countermeasure. Represented by adoption of adequate slope gradient, subsurface drainage and so on.
Prevention work	Structure prevents soil mass movement by equilibrium of force. This work is broadly classified two. One counteracts moving force by structure's own weight as retaining wall. Another counteracts by structure's tension or stiffness as anchor or pile.
Traffic Protection work	Instead of treating disaster phenomenon directly, protection work protects road / traffic solely. Represented by catch wall, rock fall protection fence, rock shed and so on.
Avoidance plan	When size of disaster phenomenon is too large to treat from technical point or cost, road avoids disaster point by route change, bridge, tunnel etc. Avoidance plan must be reasonable than countermeasure works.

Slope Failure Countermeasure

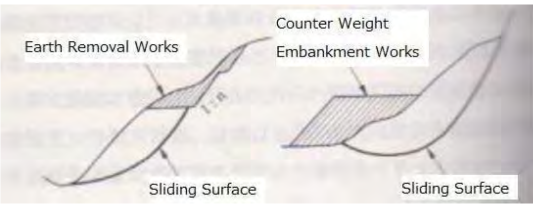
Classification	T1 Slope collapse	T2 Rock fall	T3 Rock mass failure	T4 Mass movement	T5 Debris flow	T6 Road collapse
Control work	Cutting with adequate slope gradient Subsurface drainage	Removing of source rock	Removing of source rock mass	Surface water drainage Shallow groundwater drainage Deep groundwater drainage Earth removal works Counter weight embankment works	Mountainside works Valley works	Embankment with adequate slope gradient Groundwater drainage
Prevention work	Shotcrete crib Rock bolt works（Insertion of reinforced bar） Anchor works	Mortar spraying Concrete pitching Cover type rock fall prevention net Shotcrete cirb Rock bolt works	Wire rope works Adhesive bonding works Rock bolt works	Pile works Anchor works	None	Retaining wall Reinforced soil retaining wall Anchor works
Protection work	Catch wall	Rock fall protection fence Pocket type rock fall protection net Rock shed	None	None	Keeping of enough flow section Debris flow shed Opened check dam	None

Existing Methods against Slope Collapse



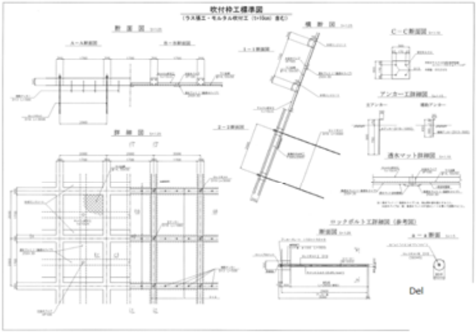


Existing Methods against Mass Movement



Methods shall be introduced against Slope Collapse

Example of Rock Bolt Detail

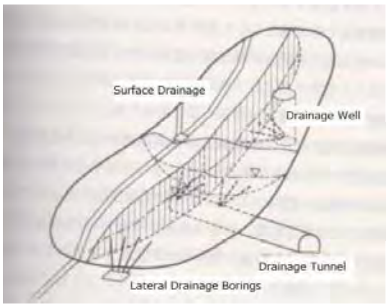


Concrete Placing of Shotcrete Crib

Shotcrete Crib
Lateral Form and Spraying Machine

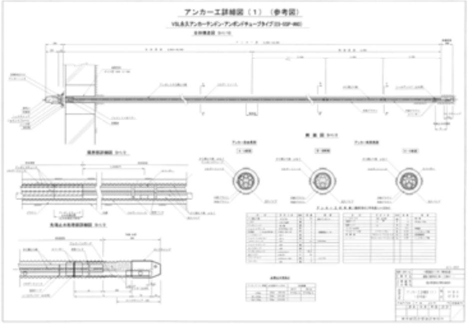
Methods shall be introduced against Mass Movement

Drainage Works against Mass Movement



Example of Drainage Well and Drainage Tunnel

Example of Ground Anchor Detail



Example of Ground Anchor Head Structure

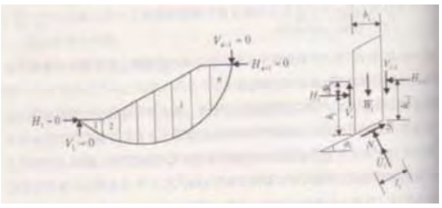
Pile Works

BASIC POINTS OF SLOPE STABILITY CALCULATION

Calculating Formula of Slope Stability

Simplified formula

$$F_s = \frac{\sum(c_i l_i + (W_i - u_i b_i)\cos\alpha_i \tan\phi_i)}{\sum W_i \sin\alpha_i}$$



Assumed Conditions for Statically Determinate

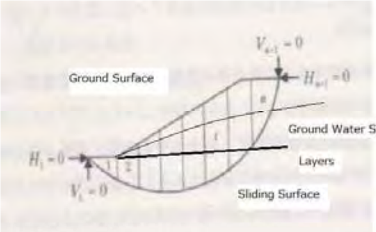
- Acting forces on both side of the slices are even.

$$\Delta V_i = V_{i+1} - V_i = 0$$
$$\Delta H_i = H_{i+1} - H_i = 0$$

- Collection on "N"

$$N_i = (W_i - u_i b_i)\cos\alpha_i$$

Necessary Conditions for the Calculation (1)

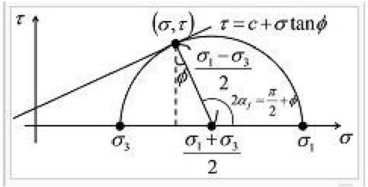


Necessary Conditions for the Calculation (2)

Soil characteristics

- Shear strength of sliding surface
  c: cohesion, ϕ: Internal friction angle
- Unit weight of sliding body
  γ_t : wet unit weight
  γ_{sat} : Saturated unit weight

Mohr-Coulomb Yield Criterion



Unit Weight of Soil

$$\gamma_t = \frac{G_s + eS_r}{1+e}\gamma_w$$
$$\gamma_d = \frac{G_s}{1+e}\gamma_w$$
$$\gamma_{sat} = \frac{G_s + e}{1+e}\gamma_w$$
$$\gamma_{sub} = \frac{G_s - e}{1+e}\gamma_w$$

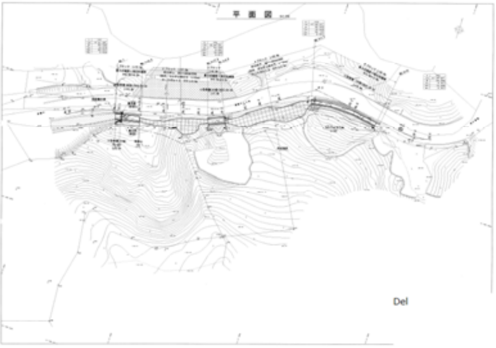
γt: wet unit weight
γd: dry unit weight
γsat: Saturated unit weight
γsub: Submerged unit weight
γw: water unit weight
Gs: specific weight of soil particle
Sr: degree of saturation
e: void ratio

NECESSARY INFORMATION FOR COUNTERMEASURE DESIGN

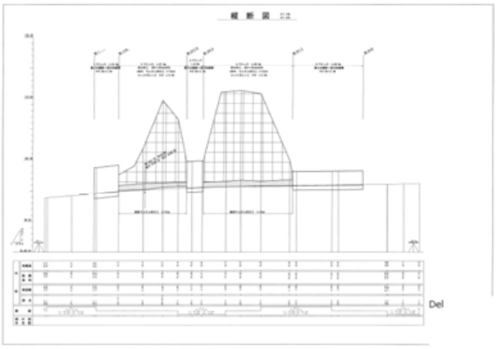
Topography Information

- Plan (Contour map)
- Longitudinal Section
- Cross Sections

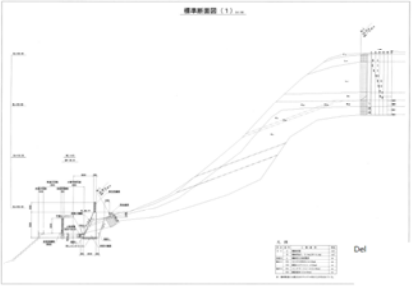
Plan



Longitudinal Section



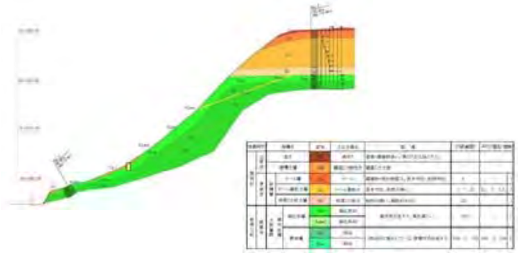
Cross Section



Cross Section

Geology Information

- Geological Cross Section



Thank you very much
For
Your long patience.

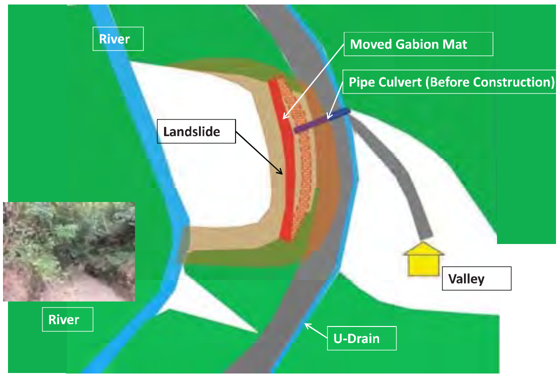
minegishi@ess-jpn.co.jp

Attachment 3　Material of Workshop on A03 Inspection
(February 2017)

Locations

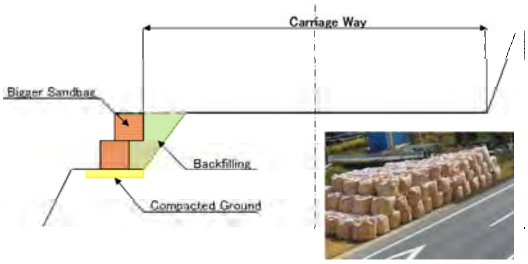
No.1 Site, (A03-05) JCT Batugade to Balibo - Maliana

No.1 Site, Sketct



No.2 Site, Close to Kaikasa

No.2 Site, Emergency Countermeasure



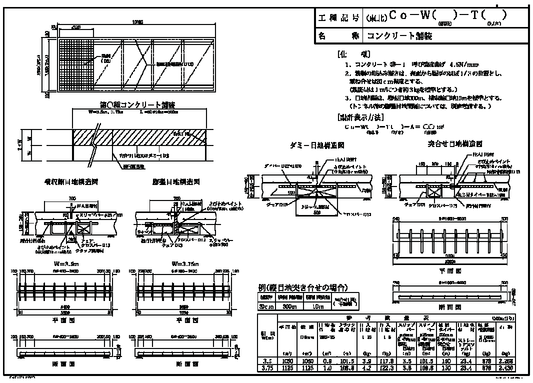
Bigger Sandbag

No.3 Site, Close to Kaikasa

No.4 Site, Close to Kaikasa

No.5 Site, Close to Gulumanu

No.6 Site, Carimbala Road



Unsuitable Material


Ununiformly-sized Materials


high PI Materials

MPWTT Standare Specifictions

Subbase

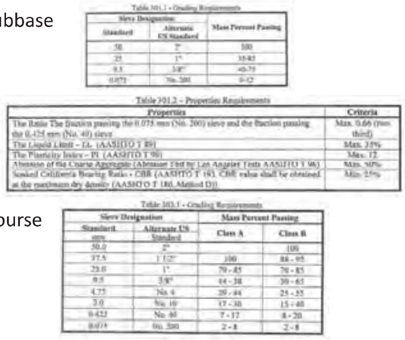


Table 301.1 - Grading Requirements

Sieve Designation		Mass Percent Passing
Standard	Alternate US Standard	
50	2"	100
25	1"	55-85
9.5	3/8"	40-75
0.075	No. 200	0-12

Table 301.2 – Properties Requirements

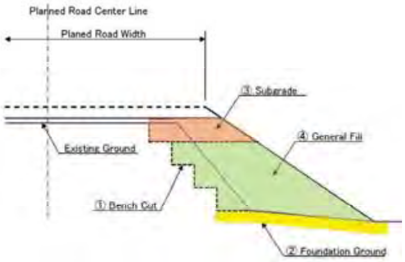
Properties	Criteria
The Ratio The fraction passing the 0.075 mm (No. 200) sieve and the fraction passing the 0.425 mm (No. 40) sieve	Max. 0.66 (two third)
The Liquid Limit – LL (AASHTO T 89)	Max. 25%
The Plasticity Index – PI (AASHTO T 90)	Max. 12
Abrasion of the Coarse Aggregate (Abrasion Test by Los Angeles Tests AASHTO T 96)	Max. 50%
Soaked California Bearing Ratio - CBR (AASHTO T 193. CBR value shall be obtained at the maximum dry density (AASHTO T 180, Method D))	Min. 25%

Base course

Table 303.1 - Grading Requirements

Sieve Designation		Mass Percent Passing	
Standard mm	Alternate US Standard	Class A	Class B
50.0	2"		100
37.5	1 1/2"	100	88 - 95
25.0	1"	70 - 85	70 - 85
9.5	3/8"	44 - 58	30 - 65
4.75	No. 4	29 - 44	25 - 55
2.0	No. 10	17 - 30	15 - 40
0.425	No. 40	7 - 17	8 - 20
0.075	No. 200	2 - 8	2 - 8

Under construction for Widening of Embankments



Attachment 4　Training Material on Analysis of Catchment Basin
(March 2017)

The Project for
the Capacity Development of Road Services
in the Democratic Republic of Timor-Leste

Case Study for Design Check

Road Drainage (1)

March 2017

JICA Expert Teams

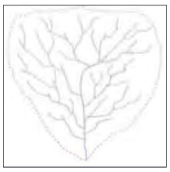
Today's Training

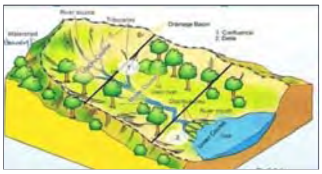
How to Make a Catchment Basin

Contents

What is a Catchment Basin?

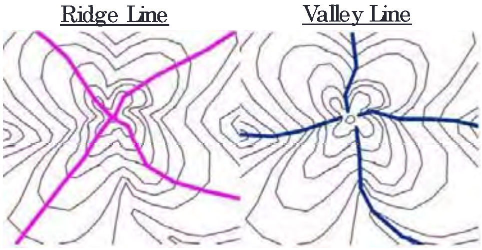
A catchment basin is an extent or an area of land where all surface water from rain converges to a single point at a lower elevation, usually the exit of the basin, where the waters join another body of water, such as a river, lake, reservoir, estuary, wetland, sea, or ocean. Source: Wikipedia





What is a Catchment Basin?

- ✓A right-angle line to convex (Purple line) : Ridge
- ✓A right-angle line to concave (Blue line) : Valley (River)



Ridge Line

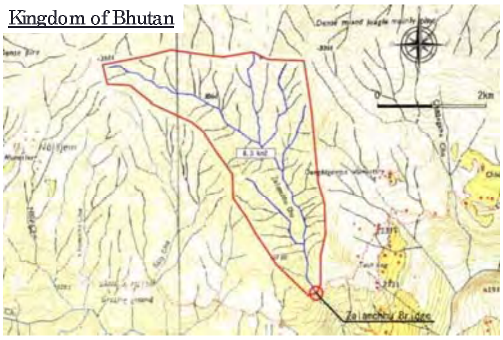
Valley Line

Basin Map of Other Country (1)

Kingdom of Bhutan

Basin Map of Other Country (2)

Kingdom of Bhutan

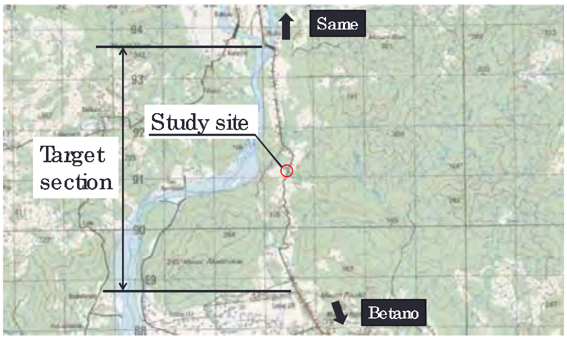


Basin Map of Other Country (3)

Papua New Guinea

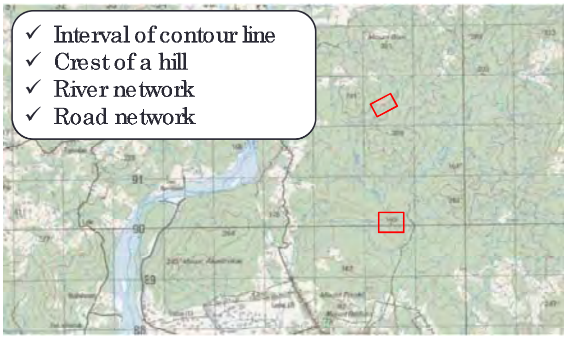
Location of the Study Site

Practice-1 : Making a Basin Boundary

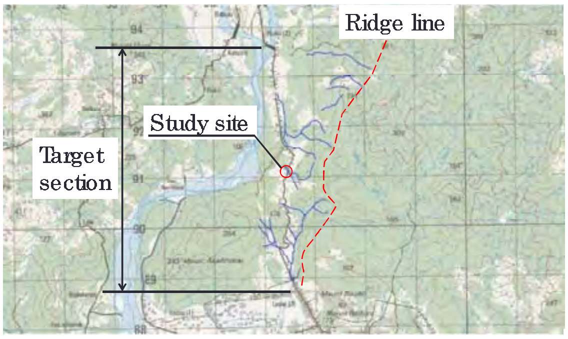


STEP1 : Check Item of Topographic Map

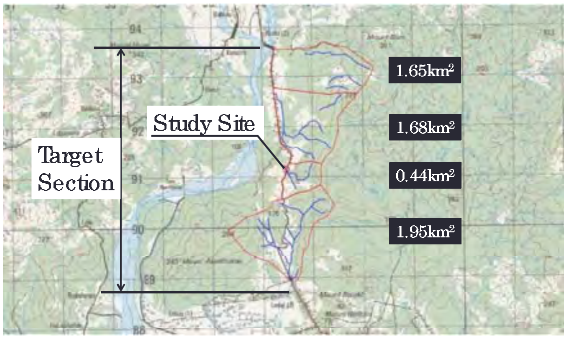
- ✓ Interval of contour line
- ✓ Crest of a hill
- ✓ River network
- ✓ Road network



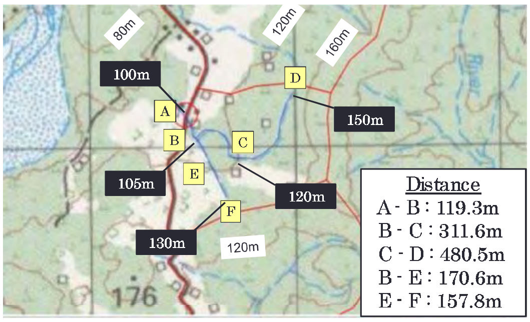
STEP2 : Confirmation of River Network



STEP3 : Separete a Boundary Line



Practice-2 : Making a River Profile



Distance

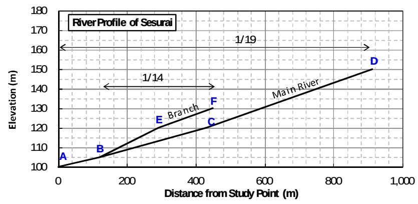
A - B : 119.3m
B - C : 311.6m
C - D : 480.5m
B - E : 170.6m
E - F : 157.8m

Practice-2 : Making a River Profile

Main River	Distance (m)	Total Dis (m)	EL. (m)	Riverbed Slope	Branch River	Distance (m)	Total Dis (m)	EL. (m)	Riverbed Slope
D									
C					F				
B					E				
A		0.00			B				

Practice-2 : Making a River Profile

Main River	Distance (m)	Total Dis (m)	EL. (m)	Riverbed Slope	Branch River	Distance (m)	Total Dis (m)	EL. (m)	Riverbed Slope
Upstream					Upstream				
D	480.50	911.40	150	1/19					
C	311.60	430.90	120		F	157.80	447.70	130	1/14
B	119.30	119.30	105		E	170.60	289.90	120	
A		0.00	100		B		119.30	105	



Next Step

Hydrological Study

- ✓ Collection of Rainfall Data at Dili and Same
- ✓ Rainfall Analysis
- ✓ Estimation of Discharge Volume

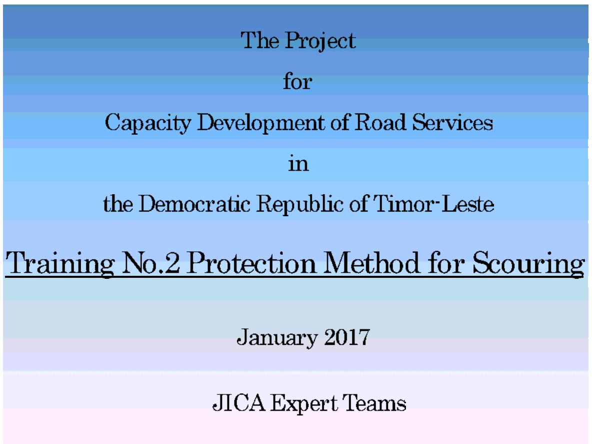
Technical Assistance to Basic Design

- ✓ Topographic Survey
- ✓ Confirmation of Flow Capacity of Box Culvert
- ✓ Judgment of Bearing Capacity of Ground

Thank you all for coming

Today's Classroom Lecture !

Attachment 5　Training Material on Measures against Souring
(March 2017)

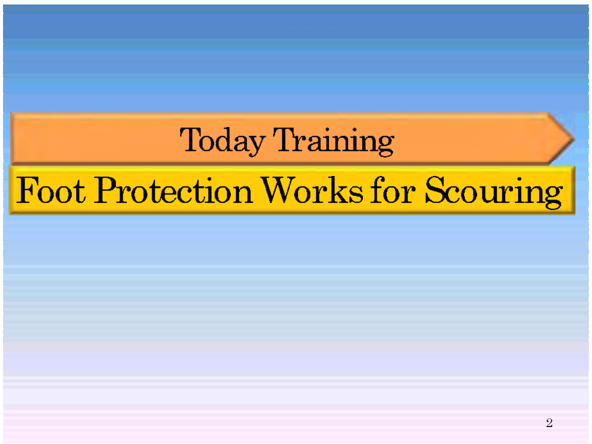


The Project
for
Capacity Development of Road Services
in
the Democratic Republic of Timor-Leste

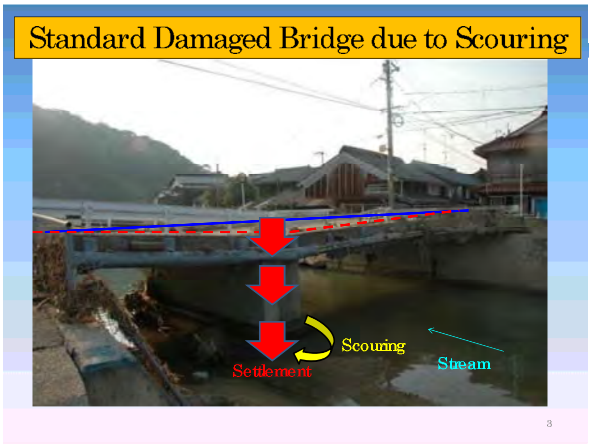
Training No.2 Protection Method for Scouring

January 2017

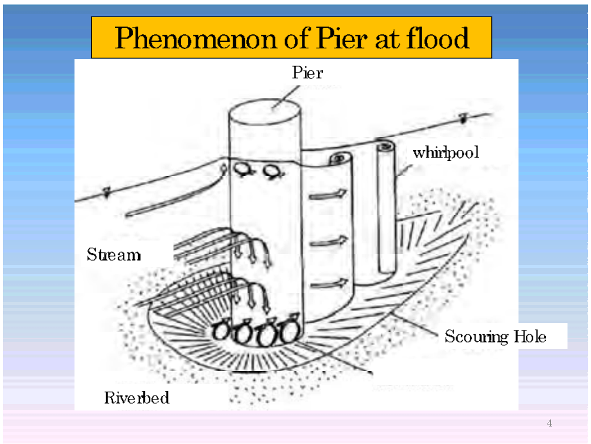
JICA Expert Teams



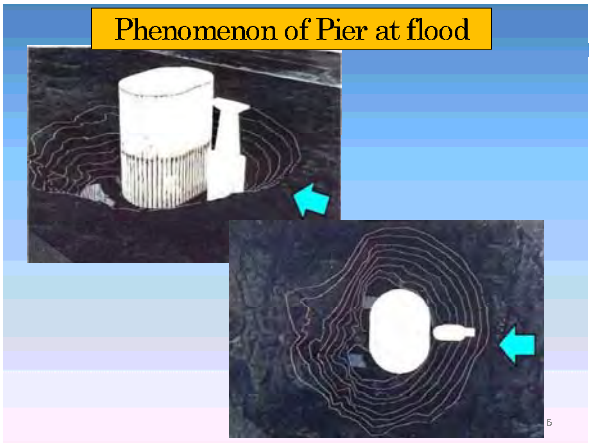
Today Training
Foot Protection Works for Scouring



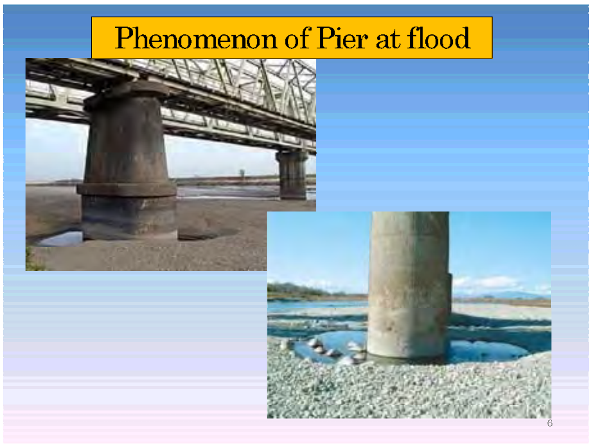
Standard Damaged Bridge due to Scouring



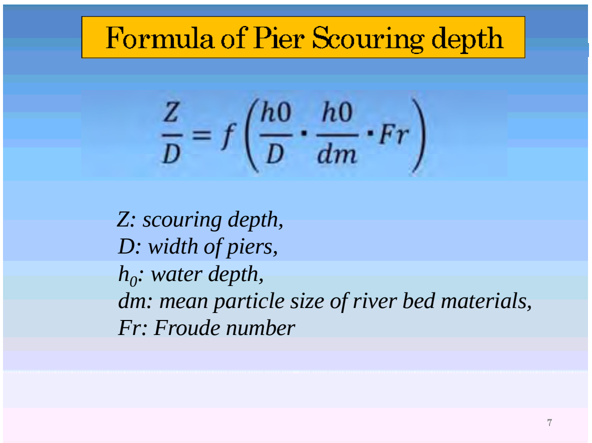
Phenomenon of Pier at flood



Phenomenon of Pier at flood



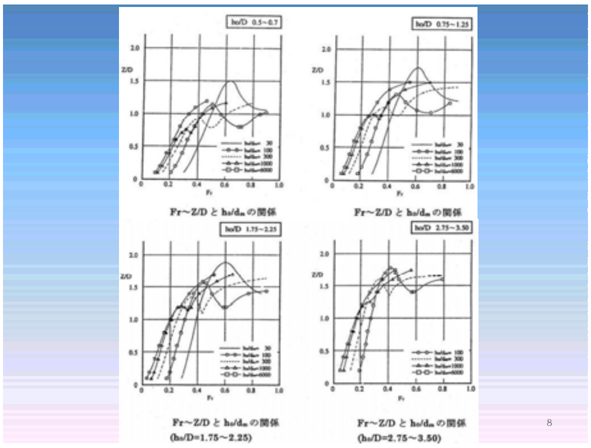
Phenomenon of Pier at flood



Formula of Pier Scouring depth

$$\frac{Z}{D} = f\left(\frac{h0}{D} \cdot \frac{h0}{dm} \cdot Fr\right)$$

Z: scouring depth,
D: width of piers,
h_0: water depth,
dm: mean particle size of river bed materials,
Fr: Froude number



Fr～Z/D と h_0/d_m の関係

Fr～Z/D と h_0/d_m の関係

Fr～Z/D と h_0/d_m の関係
(h_0/D=1.75～2.25)

Fr～Z/D と h_0/d_m の関係
(h_0/D=2.75～3.50)

Example of Calculation

Question

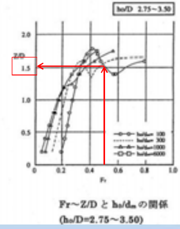
In the case below condition.
Which depths is pier scouring Z?

Condition
H.W.L.=24.80m
Design river bed height=18.97m
h0=24.80-18.97=5.83m
Fr=0.54
D=2.0m
dm=24.9mm

Answer

$h_0/D=5.83/2.0=2.915$
$h_0/dm=5.83/0.0249=234.1$
$Z/D=1.5$

$Z=\frac{Z}{D}\cdot D=1.5\cdot 2.0=3.0m$



Fr～Z/D と ho/dm の関係
(ho/D=2.75～3.50)

Standard Foot Protection Work for Scoring

Type of Foot Protection Block

Formula for Weight of Foot Protection Block

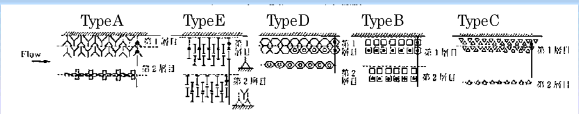
$$W>a\left(\frac{\rho w}{\rho b-\rho w}\right)^3\cdot\frac{\rho b}{g^2}\cdot\left(\frac{V0}{\beta}\right)^6$$

W: Weight of Foot Protection Block
a: Factor of Foot Protection Block Shape
β: Factor of Setting type

V_0: Average Velocity
ρw: Density of water 980 (kg/m3)
ρb: Density of blocks 2030(kg/m3)
g: Acceleration of gravity (9.8m/s2)

Table Coefficient of Deformed Foot Protection Block

Shape of block	specific gravity ρb/ρw	a× 10³	β
TypeA: Projection	2.22	1.2	1.0
TypeB: Plane	2.03	0.54	1.0
TypeC: Triangular conic	2.35	0.83	1.0
TypeD: Triangular bearing	2.25	0.45	1.0
TypeE: Rectangle	2.09	0.79	1.0



Example of Calculation

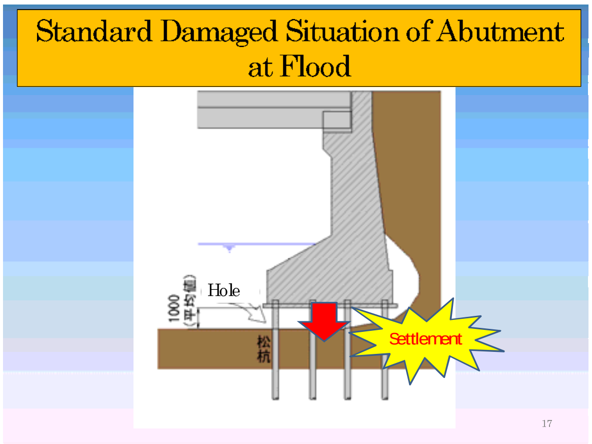
Question

In the case below condition.
Which size is foot protection block?

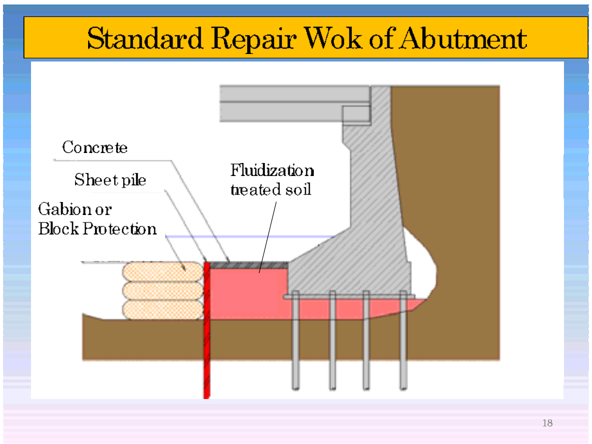
Condition
V_0=3.0m/s
Type Protection Block=TypeB: Plane
α=0.54 β=1.0 Refer to Table of Coefficient of Deformed Foot Protection Block

Answer

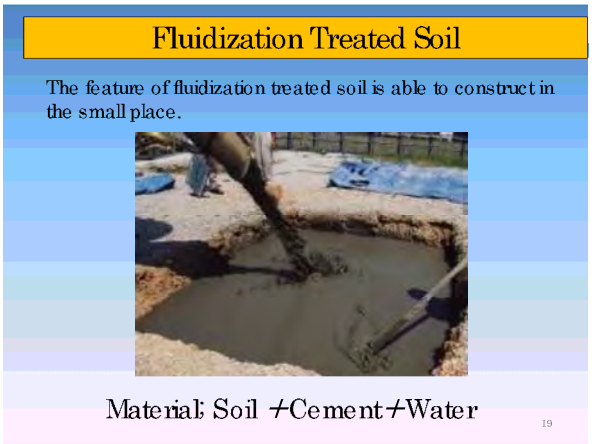
$$W>a\left(\frac{\rho w}{\rho b-\rho w}\right)^3 * \frac{\rho b}{g^2} * \left(\frac{Vd}{\beta}\right)^6$$
$$=0.54\times\left(\frac{1000}{2030-1000}\right)^3\times\frac{2030}{9.8^2}\times\left(\frac{3.0}{1.0}\right)^6$$
$$=7615N$$
$$=777.04kg$$



Standard Damaged Situation of Abutment at Flood



Standard Repair Wok of Abutment



Fluidization Treated Soil

The feature of fluidization treated soil is able to construct in the small place.

Material: Soil +Cement+Water

Vibratory Hammer Method

Thank you very much for your kind attention!

Attachment 6　Minutes of 2nd JCC

Minutes of the Joint Coordinating Committee (JCC)
For
The Project for the Capacity Development of Road Services in the Democratic Republic of Timor-Leste

The 2nd Joint Coordinating Committee for the Project for the Capacity Development of Road Services in the Democratic Republic of Timor-Leste (hereinafter referred to as the Project") was held on 16th February 2017, under the acting chairmanship of Mr. Jose Gaspar R.C. Piedade, Director General, Ministry of Public Works, Transport and Communications (hereinafter referred to as "MPWTC").

Matters mentioned in this Minutes of JCC were reported to the chairperson, Mr. Gastao Francisco de Sousa, Minister, MPWTC.
Chairperson and members attended JCC have agreed this Minutes of JCC with the mutual understandings reached through the discussion.

Dili, XXth March, 2017

Mr. Hisashi MUTO	Mr. Gastao Francisco de Sousa
Team Leader	Minister
The Project for the Capacity Development of Road Services in the Democratic Republic of Timor-Leste	Ministry of Public Works, Transport and Communications in the Democratic Republic of Timor-Leste

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THE ATTACHED DOCUMENT

The JCC was held on 16th February, 2017 at the conference room of DRBFC. The JCC consists of 6 agendas shown in (I) and discussions were made as shown in (II).

(I) The JCC consists of 6 agendas:
1. Opening of JCC
2. Presentation of Project Activities in 2016 and 2017 by JICA Expert Team
3. Presentation of Road Maintenance Activity in 2017 by Maintenance Department, DRBFC
4. Open Discussion for the Project
5. Comment by JICA
6. Conclusion and Closing Remarks

(II) Discussions Made
(a) Members of JCC agreed the revised Project Design Matrix (PDM) and indicators.
(b) Maintenance Department of DRBFC stated the issues on road maintenance activities such as the lack of budget, operational costs, facilities, staffs as well as long process of payment.
(c) Members of JCC discussed the urgency of treatments on the case study sites where have serious damages. JICA Expert Team is trying to secure additional project budget for the topographic and geotechnical survey in order to study the proper countermeasures on them. Members of JCC agreed the importance of continuous coordination between DRBFC and CDRS to implement the projects smoothly.
(d) Maintenance Department of DRBFC proposed to establish the standard unit prices of road maintenance though the discussion among stakeholders in order to smoothen the project implementation. However, the difficulties of establishing standard unit prices were pointed out due to the differences of sites.
(e) Joint inspections by construction stakeholders such as ADN, DRBFC and Contractor are proposed to smoothen the procedure of projects. ADN replied that it is difficult because of the decree of law, and ADN should conduct the final inspection as the project owner.

Appendices:
1. Presentation Material of 2nd JCC by JICA Expert Team
2. Presentation Material of Road Maintenance Activity by Maintenance Department, DRBFC
3. Revised PDM

Appendix 1　Presentation Material of 2nd JCC by JICA Expert Team

The Project for the Capacity Development of Road Services in the Democratic Republic of Timor-Leste

Presentation of 2nd JCC
February 2017

Ingerosec Corporation
Earth System Science Co., Ltd.

Contents

1. Project activities done in 2016
2. Project activity plan in 2017
3. Change of Project Design Matrix(PDM)
4. Issues and challenges

1. Project activities done in 2016

1-1. Baseline Survey

1) Share of road and bridge failures

- ✓ Pavement damages have highest share, but proper pavement repair is progressing in TL, especially in Dili.
- ✓ Slope is 2nd and Drainage is 3rd , but appropriate measures are not taken for the repair of them.

- ✓ 42% of total bridges is damaged in TL, 60% of damaged bridges is caused by scouring. However, appropriate measures are not taken.

2) Cause of road and bridge damages

Pavement failure on A05 due to the lack of roadside ditch

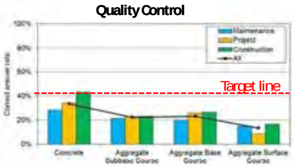
Cut slope failure on A02 due to the heavy rain and lack of slope protection

Embankment slope failure on A07 due to the unsuitable foundation material and lack of compaction

Scouring of bridge substructure on A14 due to severe river flow and lack of protection

3) Baseline examination to DRBFC

- ✓ Training of slope protection to every department will be required and effective.
- ✓ Training of drainage to Maintenance Dpt. will be required and effective



- ✓ Training of quality control, especially in pavement, to every department will be required and effective.

4) Condition of road maintenance and rehabilitation

Approx. 700km (50%) of national roads are under full rehabilitation by TL Government and Donors.

Approx. 350km (26%) of national roads are on-going or under preparation of road maintenance package(9 package project).

5) Road maintenance budget in 2016 and 2017

Budget Implementation

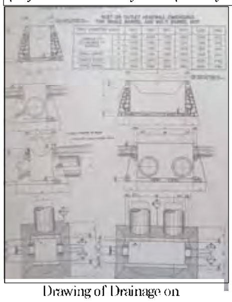
4 million US$ was secured by Infra Fund as the road maintenance budget in 2016. However, none of the budget has been used due to the delay of procedure and project implementation.

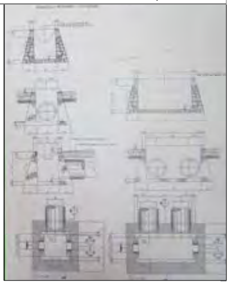
Budget Request

16 million US$ was requested for road/bridge maintenance budget in 2017. However, 3.4 million US$ (20% of request) has been secured (by LMs Fund).

6) Existing Drawing

This Project originally include the preparation of standard drawings. However, the Team studied 100 existing drawings and found out that drawings on ADB and WB projects are commonly and repeatedly utilized on the TL Government Project.


Drawing of Drainage on ADB project


Drawing of Drainage on Government project

1-2. Selection of Case Studies Sites

At least 6 Case Studies are conducted to have OJT and enhance the capacity of DRBFC technical staff on the important points of design and construction supervision by utilizing the on-going projects and difficult sites to be solved.

1-3. Lectures in 2016

1) Hydrology

2) Observation of quality control test in Comoro Bridge

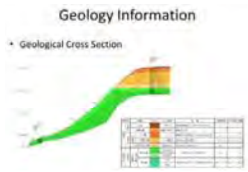
3) Safety activity


3) Safety Assembly

Safety Assembly is held with attending all staff & workers on the site for:
a) encouraging the importance of the Safety and
b) knowing safety minds and points

Project Manager or senior staff give speech regarding the importance of Safety and reminding safety manners to all the workers.

4) Slope protection


Geology Information

- Geological Cross Section

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2. Project activities plan in 2017

2-1. Improvement of road inspection and database

[Issues of Existing database]

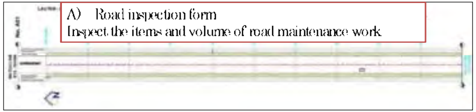
- ✓ So delicate (many items to be input) ⇒ Take long times to input
- ✓ Each defect is inspected and rehabilitation cost is calculated
  - ⇒ It does not match the present road maintenance activity.

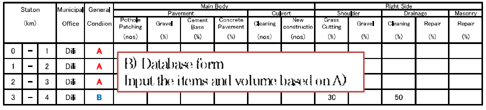

Evaluation sheet

Defect information and cost calculation sheet

2-1. Improvement of road inspection and database

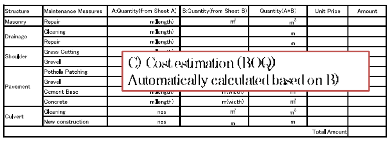
[Proposed improvement] ⇒Simple and quick road maintenance planning


A) Road inspection form
Inspect the items and volume of road maintenance work



Staton (km)			Municipal Office	General Condion	Main Body						Right Side				
					Pavement				Culvert		Shoulder		Drainage		Masonry
					Pothole Patching (nos)	Gravel (%)	Cement Base (%)	Concrete Pavement (%)	Cleaning (nos)	New constructio (nos)	Grass Cutting (%)	Gravel (%)	Cleaning (%)	Repair (%)	Repair (%)
0	–	1	Dili	A											
1	–	2	Dili	A											
2	–	3	Dili	A											
3	–	4	Dili	B							30		50		

B) Database form
Input the items and volume based on A)



Structure	Maintenance Measures	A:Quantity(from Sheet A)	B:Quantity(from Sheet B)	Quantity(A*B)	Unit Price	Amount
Masonry	Repair	m(length)	m²	m³		
Drainage	Cleaning	m(length)		m		
	Repair	m(length)		m		
Shoulder	Grass Cutting					
	Gravel					
Pavement	Pothole Patching					
	Gravel					
	Cement Base					
	Concrete	m(length)	m(width)	m²		
Culvert	Cleaning	nos	m²	m³		
	New construction	nos	m	m		
					Total Amount	

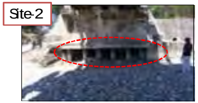
C) Cost estimation (BOQ)
Automatically calculated based on B)

2-2. Case study

1) Design


Site-1

Site-1: Landslide in Aituto
- ➢ Geotechnical boring and topographic survey
- ➢ Monitoring of slope mass movement
- ➢ Analysis of field survey data
- ➢ Propose the proper or applicable measures


Site-2

Site-2: Scouring of bridge abutment in Sahen River
- ➢ Topographic survey
- ➢ River flow analysis
- ➢ Propose the proper or applicable measures
- ➢ Technical advise to the basic design


Site-3

Site-3: Damaged Culvert in Sesurai
- ➢ Topographic survey
- ➢ Catchment area analysis
- ➢ Discharge volume analysis
- ➢ Technical advise to the basic design

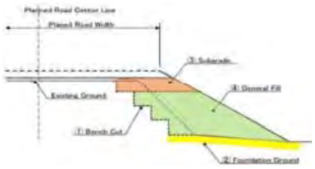
2) Construction-Quality Control

Proposed check items on construction site

Existing Road

Damaged Shoulder

Check item of under construction for Widening of Embankments



Checklist(Draft)

No.	Check Items	Judgements		[illegible]	Remarks
1	Was Bench Cut carried out appropriately?	Yes	No		
2	Was Foundation Ground satisfied?	Yes	No		Replacement, Thickness=[illegible]
3	Subgrade				
	Subgrade Material	–	–	–	Selected Material From Borrow Pit No.1
	Compaction Degree	95%		95%	
	Compacted Thickness	20cm		30cm	
4	General Fill				
	Subgrade Material				From Site
	Compaction Degree	91%		90%	
	Compacted Thickness	30cm		30cm	

3) Construction-Safety Control

Lecture of Safety activities

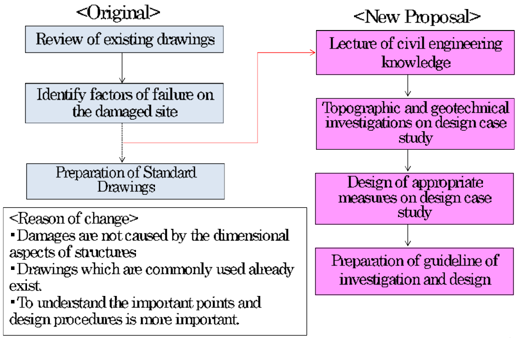
Observation of Safety activities on other projects

Introducing Safety activities to case study sites

Monthly Safety Patrol

Feedback meeting after Safety Patrol

2-3. Preparation of technical guideline



<Original>

Review of existing drawings

Identify factors of failure on the damaged site

Preparation of Standard Drawings

<New Proposal>

Lecture of civil engineering knowledge

Topographic and geotechnical investigations on design case study

Design of appropriate measures on design case study

Preparation of guideline of investigation and design

<Reason of change>
・Damages are not caused by the dimensional aspects of structures
・Drawings which are commonly used already exist.
・To understand the important points and design procedures is more important.

3. Change of Project Design Matrix(PDM)

➢ Review of PDM and indicators(target)

<OUTPUT 1>⇒No change
Appropriate road maintenance and rehabilitation for major roads is realized in accordance with annual work plan and annual budget plan.

<Indicator in 2019>
1-1.More than 30% of requested budget for road maintenance are distributed.
1-2.Improved road database is utilized for preparing the annual work plan of road maintenance.

Preparing the breakdown of requested budget by improved inspection and database

<Baseline in 2016>
1-1.Approx. 20% of requested budget from DRBFC for road maintenance were distributed.

➢ Review of PDM and indicators(target)

<OUTPUT 2>⇒No change
Capacity of DRBFC construction management for maintenance and rehabilitation including slope protection is improved through case studies in the whole country.

<Indicator in 2019>
2-1.At least 3 case studies for construction and 3 case studies for design are conducted.
2-2. More than 60 % of trainees pass the achievement test for construction supervision and design.

<Baseline in 2016>
2-1. 1 case study for construction and 3 case studies for design is selected.
2-2. 28% of examinees passed design baseline test. 8 % passed quality control baseline test.

➢ Review of PDM and indicators(target)

<Original OUTPUT 3>
Standard drawing of maintenance and rehabilitation are provided as a tool for more appropriate design including slope protection.

Changed based on the analysis in 2016

<Changed OUTPUT 3>
Technical guideline of investigation and design for maintenance and rehabilitation are provided as a tool for more appropriate design including slope protection.

<Indicator in 2019>
Technical guideline of investigation and design for slope protection, drainage and measures against scouring are prepared.

➢ Review of PDM and indicators(target)

<Project Purpose>⇒No change
Capacity of DRBFC for maintenance of major roads in the whole country is enhanced.

<Indicator in 2019>
Total length of maintained national roads become 400km.

Challenges of smoothening the project implementation by technical supports to DRBFC in the review of design, cost estimation and site inspection by ADN.

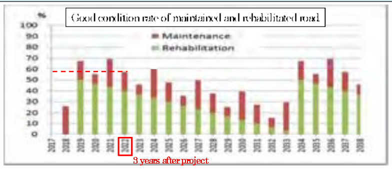
<Baseline in 2016>
350km is being prepared or on-going in the 9 maintenance package in 2016.

➢ Review of PDM and indicators(target)

<Overall Goal>⇒No change
The maintenance conditions of major roads are improved in TL.

<Indicator in 2022(3 years after project completion>
More than 60% of major national roads will be in good condition.

<Baseline in 2016>
Currently 2~3% is in good condition. 26 % is taget of road maintenance package. 50 % is taget of whole rehabilitation project by TL and Donors.



4. Issues and challenges

4. Issues and challenges

1) Limited number and time of C/P staff
How the C/P staffs are involved is so important in this Project activity because of their limited time and number

2) Travel allowance to C/P staff
Schedule of road inspection and activities tends to be delay due to the delay of distribution of travel allowance to C/P staff

3) Review of design and cost by ADN
Budget disbusement and project implementation tend to be delay because of review by ADN. Improving the accuracy of design and cost as well as relation with ADN is required to smoothen the project implementation.

Thank you for your attention
Obrigado Barak !!

Appendix 2　Presentation Material of Road Maintenance Activity by Maintenance Department, DRBFC

Presentation on Roads Maintenance Activities in 2016 and 2017

BY:

João Pedro Amaral

MAINTENANCE DAPARTMENT

Contents

- Roads Maintenance Activities in 2016
- Roads Maintenance Activities for 2017
- Issues and challenges of roads maintenance activities
- Recommandations

Roads Maintenance Activities in 2016

- There were 9 maintenance packages planned in 2016.
- 8 packages implemented through out sourcing process, and the implementation status are now under contract signing process for implementation in early 2017
- Another 1package for Dili Urban Maintenance is implemented through direct appointment system and it's now under implementation process.

Roads Maintenance Activities for 2017

- Supervising the implementation of 9 maintenance packages from 2016
- Some candidate roads have been identified to be packaged for 2017 maintenance program, but there is no real action taken in term of documents preparation for no budget allocate for 2017
- Finalizing of National and District Roads Map Trip line to support Data Base updating process
- To finalize the development of existing Data Base
- To finalize Roads Maintenance Unit Rates analysis for the consolidation and uniformity
- Recruiting consultant to prepare SOP Standard Manual, conducting traffic count survey and IRI survey in collaboration with ADB

Issues and challenges of Roads Maintenance implementation process

- Lack and no continue budget allocation for roads maintenance
- No operational cost to secure the quality of roads maintenance and rehabilitation supervision work
- Lack facilities (vehicles) to support roads maintenance work
- lack of technical staffs
- Payment process takes to much time
- No unit rates uniformity in place for roads maintenance

Recommendations

- Needs enough and continuous budget allocation for roads maintenance every year
- Increase the no of Engineer or technical staffs
- Need enough facilities(vehicles) and operational cost in place to secure the quality of roads maintenance work
- Beaurocracy simplification to accelerate payment process
- Uniform maintenance unit rates to be used nationally
- To improve communication and coordination amongst related parties who involve in roads sector development

Appendix 3　Revised PDM

Project Monitoring Sheet I （Revision of Project Design Matrix）

Version 3
Dated 16,February,2017

Project Title: The Project for Capacity Development of Road Services in Timor-Leste (CDRS)
Implementing Agency: Ministry of Public Works, Transport and Communications
Target Group: Officials of Direstorate of Road, Bridge and Flood Control (DRBFC)
Period of Project: (Three (3) years)
Project Site: Whole Timor-Leste **Model Site:**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	**Achievement**	**Remarks**
Overall Goal The maintenance conditions of major roads are improved in TL.	OG1 More than 60% of major national roads is in good condition.	Periodic Road Inspection	Budget and staff will be secured at satisfactory levels. Traffic volume is not increased more than expected.		
Project Purpose Capacity of DRBFC for maintenance of major roads in the whole country is enhanced.	Total length of maintained national roads become 400km.	Periodic Road Inspection	Enough number of DRBFC staff in the HQs and regional offices is ensured as planned. Budget for road maintenance and management is ensured.		
Outputs Output 1: Appropriate road maintenance and rehabilitation for major roads is realized in accordance with annual work plan and annual budget plan.	More than 30% of requested budget for road maintenance are distributed. Improved road database is utilized for preparing the annual work plan of road maintenance.	Budget Report Monitoring Sheet	The trained DRBFC personnel continue to work for the Project (They do not quit the Project) Unforeseen natural disasters will not occur which may destroy construction works under case studies.		
Output 2: Capacity of DRBFC construction management for maintenance and rehabilitation including slope protection is improved through case studies in the whole country.	At least 3 case studies for construction and 3 case studies for design are conducted. More than 60 % of trainees pass the achievement test for construction supervision and design.	Monitoring Sheet Achievement test			
Output 3: Technical guideline of investigation and design for maintenance and rehabilitation are provided as a tool for more appropriate design including slope protection.	Technical guideline of investigation and design for slope protection, drainage and measures against scouring are prepared.	Technical guideline prepared			

Activities	Inputs		Pre-Conditions
	The Japanese Side	The Timor-Leste Side	
1.1 To review existing management structure condition of maintenance and rehabilitation for major roads. 1.2 To conduct periodic/routine inspection. 1.3 To update the database based on the inspection result and repair/rehabilitation works of roads and bridges. 1.4 To formulate maintenance and repair/rehabilitation plans for next cycle. 1.5 To implement emergency inspections and repair/rehabilitation works when necessity arises. 1.6 To undertake appropriate road maintenance/rehabilitation works by following annual work and budget plans which reflect priorities within the limited budget. 1.7 To propose appropriate framework of road maintenance and rehabilitation for major roads. 2.1 To identify typical rehabilitation and repair works of major roads in the whole country as case studies. 2.2 To conduct the case studies for the planning, design and construction supervision of the project. 2.3 To propose preferable structures for construction management for repair/rehabilitation and maintenance works through case studies. 3.1 To review existing technical ducuments for road maintenance and rehabilitation. 3.2 To review and identify factors of failure from past examples of damaged rehabilitation and construction works. 3.3 To acquire necessary knowledges of civil engineering for design through classroom lectures and case studies. 3.4 To prepare the technical guideline of investigation and design. 3.5 To reflect the lessons learned from case studies to the technical guideline. 3.6 To disseminate the technical guideline for concerned parties.	1. Dispatch of the Japanese experts Short-term experts: - Team leader / Road maintenance 1 - Deputy team leader / Road maintenance 2 - Road construction supervision - Quality control / Road repair - Disaster restoration - Road design / Project coordinator - Structure design - Database - Evaluation / Monitoring - Other areas if needed 2. Facilities and equipment In accordance with necessity of activities 3. Training in Japan In accordance with necessity of activities	1. Assignment of C/Ps - Project Director - Project Manager - DRBFC Staff 2. Assignment of Trainees In accordance of necessity 3. Facilities and Equipment - Project office Equipment and tools 4. Recurrent costs - Expenses for equipment maintenance - Spare parts - Transportation fees of C/Ps and trainees - Expenses for contract-out of works - Necessary expenditures for case studies - C/Ps' wages and allowances	DRBFC's budget necessary for the Project is allocated by TL government. <Issues and countermesures>

TO CR of JICA Timor-Leste OFFICE

Project Title: The Project for the Capacity Development of Road Services in the Democratic Republic of Timor-Leste
Version of the Sheet: Ver.4（Term: March, 2016 - March, 2019）
Name: Hisashi MUTO
Title: Team Leader/ Road Maintenance1
Submission Date: 30th September 2017

< I. Summary (all achievements are as of 30th September, 2017) >

1. Progress

1-1 Progress of Inputs

1-1-1 Japanese side

< Short-term experts dispatched to Timor-Leste>

NO	Name	Title	Dispatched Period to Timor-Leste	Changes or delay
1	Hisashi MUTO	Team Leader / Road Maintenance 1	(1st) 8th Mar – 10th Apr, 2016 (2nd) 14th Jun – 25th Jun, 2016 (3rd) 1st Sep – 18th Sep, 2016 (4th) 23th Jan – 19th Feb,2017 (5th) 24th Mar – 2nd Apr, 2017 (6th) 18th Aug – 10th Sep, 2017	None
2	Makoto MATSUURA	Deputy Team Leader / Road Maintenance 2	(1st) 8th Mar – 15th Apr, 2016 (2nd) 14th Jun – 13th Jul, 2016 (3rd) 20th Sep – 14th Oct,2016 (4th) 1st Dec – 16th Dec,2016 (5th) 23th Jan – 19th Feb,2017	None
3	Mitsuhide SAITO	Deputy Team Leader / Road Maintenance 2	(1st) 24th Mar – 9th Apr, 2017 (2nd) 9th Jun – 25th Jun, 2017	Note: Mr. Mitsuhide Saito replaced Mr. Matsuura as Deputy Team Leader.
4	Johji KOIZUMI	Road Construction Supervision	(1st) 19th Jul – 17th Aug, 2016 (2nd) 24th Sep – 14th Oct,2016	None

			(3rd)19th Jun – 5th Jul, 2017 (4th) 21st Aug – 30th Sep,2017	
5	Sueo HIROSE	Quality Control / Road Repair	(1st) 28th Mar – 17th Apr, 2016 (2nd)13th May – 11th Jun, 2016 (3rd) 14th Aug – 12th Sep, 2016 (4th) 7th Oct – 14th Oct, 2016 (5th) 23th Jan – 22th Feb,2017 (6th) 4th Aug – 3rd Sep, 2017	None
6	Shutaro SAKANAKA	Disaster Restoration	(1st) 11th May – 31st May, 2016 (2nd) 28th Jun – 21st Jul, 2016 (3rd) 12th Sep – 6th Oct, 2016 (4th) 13th Feb – 8th Mar, 2017 (5th) 17th Apr – 7th May, 2017	None
7	Yoshiyuki AKAGAWA	Road Design / Project Coordinator	(1st) 17th Mar – 15th Sep, 2016 (2nd) 21st Jun – 13th Jul, 2016 (3rd) 12th Sep – 6th Oct, 2016 (4th) 13th Feb – 5th Mar, 2017	None
8	Nicholas BROOKER-JONES	Road Design / Project Coordinator	(1st) 31st Jul – 30th Aug, 2017	Note: Mr. Brooker-Jones replaced Mr. Akagawa as Project Coordinator.
9	Kenji MINEGISHI	Structure Design	(1st) 5th Apr – 24th Apr, 2016 (2nd) 5th Jul – 4th Aug, 2016 (3rd) 14th Nov – 13th Dec,2016 (4th) 12th May – 11th Jun, 2017 (5th) 1st Sep – 30th Sep,2017	None
10	Takashi SAITO	Database	(1st) 19th Jul – 24th Aug, 2016 (2nd) 3rd Oct – 14th Oct, 2016 (3rd) 13th Mar – 12th Apr, 2017 (4th) 16th Jun – 2nd Jul, 2017 (5th) 18th Aug – 30th Sep, 2017	None
11	Masahiko HAYASHI	Landslide	(1st) 16th Jun – 28th Jun, 2017	Note: Activity on Landslide

				analysis was approved by 2nd JCC; Mr. Hayashi was assigned in June 2017.
12	Sohshi MIKAMI	Topographical Analysis	(1st) 19th Jun – 16th Jul, 2017	Note: Activity on Landslide analysis was approved by 2nd JCC; Mr. Mikami was assigned in June 2017.
13	Nao TSUJIMURA	Evaluation/Monitoring	Resident in Timor-Leste	None

< Equipment and materials >

NO	Items	Qty	Unit price	Unit	Total amount
	Not Applicable				

(Remark: Equipment and materials which have a service life of 2 years and are more than JPY 50,000 are listed.)

1-1-2 Timor-Leste side

- **Counterpart (C/P) personnel (from MPWTC and DRBFC)**

NO	Name	Title of the Project	Engaged Period
1	Jose Gaspar R.C. Piedade	Project Director	8th Mar 2016-31st Aug, 2017
2	Rui Hernani F. Guterres	Project Manager	8th Mar 2016 – present
3	Joao Gama	C/P staff	8th Mar 2016 – present
4	Joao Pedro Amaral	C/P staff	8th Mar 2016 – present
5	Joao Gregorio	C/P staff	8th Mar 2016 – present

- **Equipment and materials for the project office**

NO	Items	Qty	Unit
1	Office space (including desks and chairs)	1	room

1-2 Progress of Activities

NO	Activity	Achievement level
1.2	To conduct periodic/routine inspections.	● JICA Expert Team conducted periodic/routine inspections to assist data collection in a new format. Those inspections have been carried out with Dept. Maintenance team of Region 1 and 4; moreover, the target sections of national roads A08, A11, A12 and A16 have been inspected.
1.3	To update the database based on the inspection results and repair/rehabilitation works of roads and bridges.	● JICA Expert Team conducted data input of collected information from handwritten raw data to Excel data; the GIS database file has been updated using inspection results of 2016 for A01, A03, A06, A07, A08 and A11. ● JICA Expert Team assisted staff of Dept. Maintenance in compiling inspection results of 2017 for Reg.1 and 4 into GIS software.
1.5	To implement emergency inspections and repair/rehabilitation works when necessity arises.	● In accordance with the request of Dept. Maintenance, JICA Expert Team conducted site inspections and quality control of emergency maintenance packages on C23a and A16. Details: Road collapses and embankment collapses have occurred in both C23a Ainaro – Hatoudo and A16 Fohoren – Fatululik – Fatumean areas. Those roads have plans to be maintained by budget of 2017 Line of Ministry (totally, there are 7 maintenance packages in TL). However, traffic on C23a and A16 was paralyzed by the above; therefore, those 2 packages were changed to emergency maintenance with the Minister of PWTC's approval. Note: the other 5 packages follow the normal tender process of NDCS. ● JICA Expert Team assisted with inspection of Loes River

		● JICA Expert Team delivered classroom lectures about weather resistant big sandbags; DRBFC staff learned relevant knowledge about 1) theory and applicable conditions to use these materials; 2) application range of stacking height and inclination of slope; 3) standard drawings of installation of big sandbag; 4) orientation for demonstration to install big sandbag.
2.2.	To conduct the case studies for the planning, design check and construction supervision of the project.	● JICA Expert Team/JET conducted supervision of 2017 maintenance construction in A05 Betano – Dotik. (1 of 9 maintenance packages based on CAFI budget) JICA Expert Team supported DRBFC staff to doing quality control of the following operations: 1. <u>Installation of new pipe culverts</u> Proper compaction method of backfill; selection of appropriate materials according the ground strength; JET recommended that when the strength of original ground is not enough, there is a need for replacement of original ground or improvement of soft ground conditions with small stones. 2. <u>Construction of stone masonry walls</u> Proper compaction method of backfill. ● JICA Expert Team/JET conducted topographic survey using UAV on A05 in Aituto landslide area. After survey, JET held a seminar in order to explain UAV itself and utilization of UAV aerial photos for topographic analysis of landslide areas. ● JICA Expert Team delivered classroom lectures about design check of road drainage (part 2). Those classroom lectures were provided to DRBFC in order to do design check of Sesurai box culvert construction as part of a case study. During 3 lectures, DRBFC engineers learned following: • Design discharge volume by the calculation of runoff coefficient and rainfall intensity; • Analysis of rainfall data to ascertain rainfall intensity; • Calculation of daily rainfall intensity by Mononobe's formula.
3.3	To acquire necessary knowledges of civil engineering for design through classroom lectures and case studies.	● JICA Expert Team held workshops about retaining walls; DRBFC engineers and an international consultant working in DRBFC attended this workshop to acquire the following knowledge: • Calculation of stability of retaining walls to compare physical characteristics of 2 different types of typical retaining wall using in TL; • Calculation of Coulomb activity earth pressure coefficient; • Calculation of ultimate bearing capacity using Excel format.

1-3 Achievement of Output

Indicators of Outputs		Achievement level
1.1	More than 30% of requested budget for road maintenance are distributed.	This concrete indicator has been approved in February 2017 in the 2nd JCC. Achievement level of this output is not ready to be measured.
1.2	Improved road database is utilized for preparation of the annual work plan of road maintenance.	49% of target national roads' condition data have been updated into GIS database.
2.1	At least 3 case studies for both construction and design are conducted. (Totally 6 case studies)	Four (4) sites proposed for case studies were approved in February 2017 in the 2nd JCC.
2.2	More than 60% of trainees pass the achievement test for construction supervision and design.	A baseline survey found that the percentage of examinees exceeding the expected level by subject was a) design: 28% and b) quality control: 8%.
3	Technical guideline of investigation and design for slope protection, drainage and measures against scouring are prepared.	This indicator was approved in February 2017 in the 2nd JCC. Achievement level of this output is not ready to be measured.

1-4 Achievement of the Project Purpose

Indicators of Project Purpose	Achievement level
Total length of maintained national roads were became 400km.	This concrete indicator was approved on 16th February, 2017, in the 2nd JCC. Achievement level of this output is not ready to be measured.

1-5 Changes of Risks and Actions for Mitigation

- Risks have not been confirmed so far; thus actions for mitigation have not been taken.
- As a result of the Parliament election, reshuffle of cabinet officers will occur. General Director of Public Works was the project director of this project; however his term of office has expired. His successor will be designated by the new Government.

1-6 Progress of Actions undertaken by JICA

- JICA Timor-Leste shared important information and documents with JICA Expert Team.
- JICA Timor-Leste assisted with visa acquisition process for JICA Expert Team.

1-7 Progress of Actions undertaken by Gov. of Timor-Leste

- DRBFC shared necessary information and documents with JICA Expert Team.
- DRBFC has prepared the drawings of road and bridge maintenance based on the road inspection.

1-8 Progress of Environmental and Social Considerations (if applicable)

- No activities for the progress of Environmental and Social Considerations have been undertaken.

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

- Not Applicable so far.

1-10 other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

- No other issues have been confirmed so far.

2. Delay of Work Schedule and/or Problems (if any)

- Based on the PDM, the project activities have been implemented as planned.

3. Modification of the Project Implementation Plan

3-1 PO

- PO has not been modified from Monitoring Sheet ver.1.

3-2 Other modifications on detailed implementation plan

- No other modification of the detailed implementation plan have been made.

4. Preparation of Gov. of Timor-Leste toward after completion of the Project

- The Gov. of Timor-Leste tries to secure the budget for road maintenance so that the capacity development of DRBFC for road maintenance, which is the Project Purpose, will be sustainable and contribute to the achievement of the Overall Goal.

< II. Project Monitoring Sheet I & II >

- Project Monitoring Sheet I & II are attached as PM Form I and II.

Project Monitoring Sheet I (Revision of Project Design Matrix)

Version 3

Date: 30th September, 2017

Project Title: The Project for Capacity Development of Road Services in Timor-Leste (CDRS)

Implementing Agency: Ministry of Public Works, Transport and Communications

Target Group: Officials of Directorate of Road, Bridge and Flood Control (DRBFC)

Period of Project: (Three (3) years)

Project Site: Whole Timor-Leste **Model Site:**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal The maintenance conditions of major roads are improved in TL.	OG1 More than 60% of major national roads is in good condition.	Periodic Road Inspection	Budget and staff will be secured at satisfactory levels. Traffic volume is not increased more than expected.	Indicator has been set up and approved in 2nd JCC in February 2017.	
Project Purpose Capacity of DRBFC for maintenance of major roads in the whole country is enhanced.	Total length of maintained national roads become 400km.	Periodic Road Inspection	Enough number of DRBFC staff in the HQs and regional offices is ensured as planned. Budget for road maintenance and management is ensured.	Indicator has been set up and approved in 2nd JCC in February 2017.	
Outputs Output 1: Appropriate road maintenance and rehabilitation for major roads is realized in accordance with annual work plan and annual budget plan.	1-1. More than 30% of requested budget for road maintenance are distributed. 1-2. Improved road database is utilized for preparing the annual work plan of road maintenance.	Budget Report Monitoring Sheet	Budget for road maintenance and management is ensured. The trained DRBFC personnel continue to work for the Project (They do not quit the Project)	1-2. 49% of 2016's raw handwritten inspection data have been inputted into GIS database.	
Output 2: Capacity of DRBFC construction management for maintenance and rehabilitation including slope protection is improved through case studies in the whole country.	2-1. At least 3 case studies for construction and 3 case studies for design are conducted (Totally 6 case studies). 2-2. More than 60 % of trainees pass the achievement test for construction supervision and design.	Monitoring Sheet Achievement test	Unforeseen natural disasters will not occur which may destroy construction works under case studies.	2-1. 1 site for construction and 3 sites for design have been selected.	
Output 3: Technical guideline of investigation and design for maintenance and rehabilitation are provided as a tool for more appropriate design including slope protection.	3. Technical guideline of investigation and design for slope protection, drainage and measures against scouring are prepared.	Technical guideline prepared			

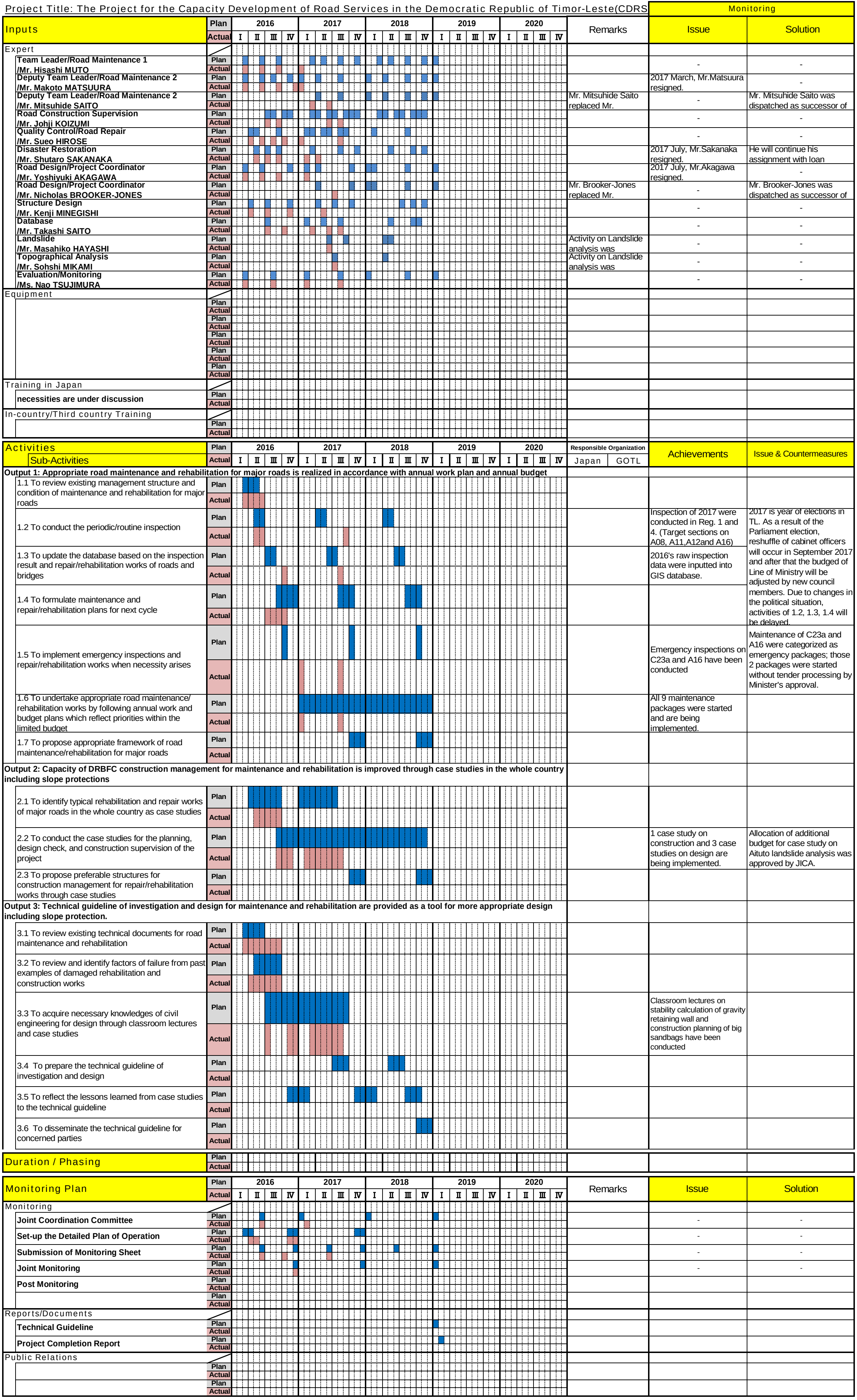
Activities	Inputs		Pre-Conditions
	The Japanese Side	The Timor-Leste Side	
1.1 To review existing management structure condition of maintenance and rehabilitation for major roads. 1.2 To conduct periodic/routine inspection. 1.3 To update the database based on the inspection result and repair/rehabilitation works of roads and bridges. 1.4 To formulate maintenance and repair/rehabilitation plans for next cycle. 1.5 To implement emergency inspections and repair/rehabilitation works when necessity arises. 1.6 To undertake appropriate road maintenance/rehabilitation works by following annual work and budget plans which reflect priorities within the limited budget. 1.7 To propose appropriate framework of road maintenance and rehabilitation for major roads. 2.1 To identify typical rehabilitation and repair works of major roads in the whole country as case studies. 2.2 To conduct the case studies for the planning, design and construction supervision of the project. 2.3 To propose preferable structures for construction management for repair/rehabilitation and maintenance works through case studies. 3.1 To review existing technical documents for road maintenance and rehabilitation. 3.2 To review and identify factors of failure from past examples of damaged rehabilitation and construction works. 3.3 To acquire necessary knowledges of civil engineering for design through classroom lectures and case studies. 3.4 To prepare the technical guideline of investigation and design. 3.5 To reflect the lessons learned from case studies to the technical guideline. 3.6 To disseminate the technical guideline for concerned parties.	1. Dispatch of the Japanese experts Short-term experts: - Team leader / Road maintenance 1 - Deputy team leader / Road maintenance 2 - Road construction supervision - Quality control / Road repair - Disaster restoration - Road design / Project coordinator - Structure design - Database - Evaluation / Monitoring - Other areas if needed 2. Facilities and equipment In accordance with necessity of activities 3. Training in Japan In accordance with necessity of activities	1. Assignment of C/Ps - Project Director - Project Manager - DRBFC Staff 2. Assignment of Trainees In accordance of necessity 3. Facilities and Equipment - Project office Equipment and tools 4. Recurrent costs - Expenses for equipment maintenance - Spare parts - Transportation fees of C/Ps and trainees - Expenses for contract-out of works - Necessary expenditures for case studies - C/Ps' wages and allowances	DRBFC's budget necessary for the Project is allocated by TL government. ▼ <Issues and countermeasures>

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 3

Date: 30th September, 2017

Project Title: The Project for the Capacity Development of Road Services in the Democratic Republic of Timor-Leste(CDRS



Inputs	Plan / Actual	2016 I II III IV · 2017 I II III IV · 2018 I II III IV · 2019 I II III IV · 2020 I II III IV	Remarks	Monitoring: Issue	Monitoring: Solution
Expert					
Team Leader/Road Maintenance 1 /Mr. Hisashi MUTO	Plan Actual			-	-
Deputy Team Leader/Road Maintenance 2 /Mr. Makoto MATSUURA	Plan Actual			2017 March, Mr.Matsuura resigned.	-
Deputy Team Leader/Road Maintenance 2 /Mr. Mitsuhide SAITO	Plan Actual		Mr. Mitsuhide Saito replaced Mr.	-	Mr. Mitsuhide Saito was dispatched as successor of
Road Construction Supervision /Mr. Johji KOIZUMI	Plan Actual			-	-
Quality Control/Road Repair /Mr. Sueo HIROSE	Plan Actual			-	-
Disaster Restoration /Mr. Shutaro SAKANAKA	Plan Actual			2017 July, Mr.Sakanaka resigned.	He will continue his assignment with loan
Road Design/Project Coordinator /Mr. Yoshiyuki AKAGAWA	Plan Actual			2017 July, Mr.Akagawa resigned.	-
Road Design/Project Coordinator /Mr. Nicholas BROOKER-JONES	Plan Actual		Mr. Brooker-Jones replaced Mr.	-	Mr. Brooker-Jones was dispatched as successor of
Structure Design /Mr. Kenji MINEGISHI	Plan Actual			-	-
Database /Mr. Takashi SAITO	Plan Actual			-	-
Landslide /Mr. Masahiko HAYASHI	Plan Actual		Activity on Landslide analysis was	-	-
Topographical Analysis /Mr. Sohshi MIKAMI	Plan Actual		Activity on Landslide analysis was	-	-
Evaluation/Monitoring /Ms. Nao TSUJIMURA	Plan Actual			-	-
Equipment					
	Plan Actual				
	Plan Actual				
	Plan Actual				
	Plan Actual				
	Plan Actual				
Training in Japan					
necessities are under discussion	Plan Actual				
In-country/Third country Training					
	Plan Actual				

Activities / Sub-Activities	Plan / Actual	2016 I II III IV · 2017 I II III IV · 2018 I II III IV · 2019 I II III IV · 2020 I II III IV	Responsible Organization: Japan	Responsible Organization: GOTL	Achievements	Issue & Countermeasures
Output 1: Appropriate road maintenance and rehabilitation for major roads is realized in accordance with annual work plan and annual budget						
1.1 To review existing management structure and condition of maintenance and rehabilitation for major roads	Plan Actual					
1.2 To conduct the periodic/routine inspection	Plan Actual				Inspection of 2017 were conducted in Reg. 1 and 4. (Target sections on A08, A11,A12and A16)	2017 is year of elections in TL. As a result of the Parliament election, reshuffle of cabinet officers will occur in September 2017 and after that the budged of Line of Ministry will be adjusted by new council members. Due to changes in the political situation, activities of 1.2, 1.3, 1.4 will be delayed.
1.3 To update the database based on the inspection result and repair/rehabilitation works of roads and bridges	Plan Actual				2016's raw inspection data were inputted into GIS database.	
1.4 To formulate maintenance and repair/rehabilitation plans for next cycle	Plan Actual					
1.5 To implement emergency inspections and repair/rehabilitation works when necessity arises	Plan Actual				Emergency inspections on C23a and A16 have been conducted	Maintenance of C23a and A16 were categorized as emergency packages; those 2 packages were started without tender processing by Minister's approval.
1.6 To undertake appropriate road maintenance/ rehabilitation works by following annual work and budget plans which reflect priorities within the limited budget	Plan Actual				All 9 maintenance packages were started and are being implemented.	
1.7 To propose appropriate framework of road maintenance/rehabilitation for major roads	Plan Actual					
Output 2: Capacity of DRBFC construction management for maintenance and rehabilitation is improved through case studies in the whole country including slope protections						
2.1 To identify typical rehabilitation and repair works of major roads in the whole country as case studies	Plan Actual					
2.2 To conduct the case studies for the planning, design check, and construction supervision of the project	Plan Actual				1 case study on construction and 3 case studies on design are being implemented.	Allocation of additional budget for case study on Aituto landslide analysis was approved by JICA.
2.3 To propose preferable structures for construction management for repair/rehabilitation works through case studies	Plan Actual					
Output 3: Technical guideline of investigation and design for maintenance and rehabilitation are provided as a tool for more appropriate design including slope protection.						
3.1 To review existing technical documents for road maintenance and rehabilitation	Plan Actual					
3.2 To review and identify factors of failure from past examples of damaged rehabilitation and construction works	Plan Actual					
3.3 To acquire necessary knowledges of civil engineering for design through classroom lectures and case studies	Plan Actual				Classroom lectures on stability calculation of gravity retaining wall and construction planning of big sandbags have been conducted	
3.4 To prepare the technical guideline of investigation and design	Plan Actual					
3.5 To reflect the lessons learned from case studies to the technical guideline	Plan Actual					
3.6 To disseminate the technical guideline for concerned parties	Plan Actual					
Duration / Phasing	Plan Actual					

Monitoring Plan	Plan / Actual	2016 I II III IV · 2017 I II III IV · 2018 I II III IV · 2019 I II III IV · 2020 I II III IV	Remarks	Issue	Solution
Monitoring					
Joint Coordination Committee	Plan Actual			-	-
Set-up the Detailed Plan of Operation	Plan Actual			-	-
Submission of Monitoring Sheet	Plan Actual			-	-
Joint Monitoring	Plan Actual			-	-
Post Monitoring	Plan Actual				
	Plan Actual				
Reports/Documents					
Technical Guideline	Plan Actual				
Project Completion Report	Plan Actual				
Public Relations					
	Plan Actual				
	Plan Actual				

Attachment 1 Training Material

Case Study for Design Check Road Drainage (1) on March 2017

Case Study for Design Check Road Drainage (2) on August 2017

The Project for
the Capacity Development of Road Services
in the Democratic Republic of Timor-Leste

Case Study for Design Check

Road Drainage (1)

March 2017

JICA Expert Teams

Today's Training

How to Make a Catchment Basin

Contents

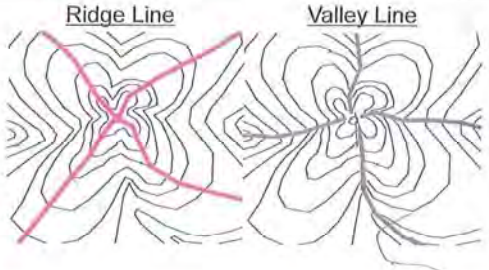
1. What is a Catchment Basin?
2. Basin Map of Other Country
3. Location of the Study Site
4. Practice-1 Making a Basin Boundary
5. Practice-2 Making a River Profile
6. Next Step

What is a Catchment Basin?

A catchment basin is an extent or an area of land where all surface water from rain converges to a single point at a lower elevation, usually the exit of the basin, where the waters join another body of water, such as a river, lake, reservoir, estuary, wetland, sea, or ocean. Source: Wikipedia

What is a Catchment Basin?

- ✓A right-angle line to convex (Purple line) : Ridge
- ✓A right-angle line to concave (Blue line) : Valley (River)

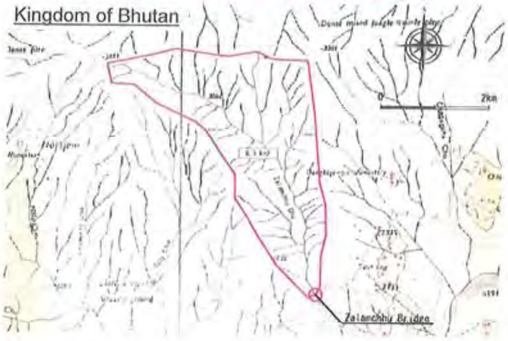


Basin Map of Other Country (1)

Kingdom of Bhutan

Basin Map of Other Country (2)

Kingdom of Bhutan

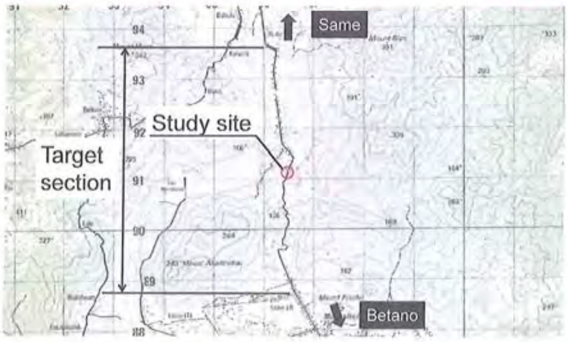


Basin Map of Other Country (3)

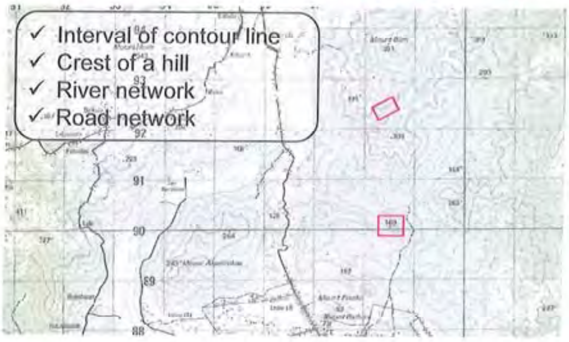
Papua New Guinea

Location of the Study Site

Practice-1 : Making a Basin Boundary

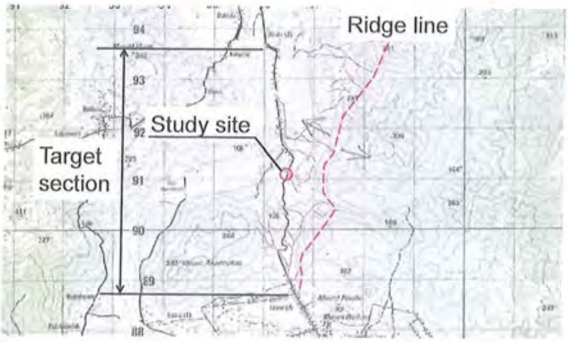


STEP1 : Check Item of Topographic Map

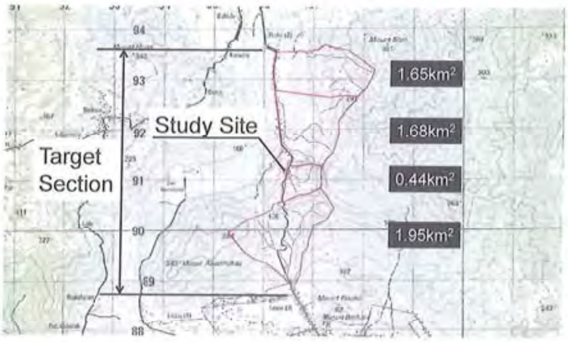


- ✓ Interval of contour line
- ✓ Crest of a hill
- ✓ River network
- ✓ Road network

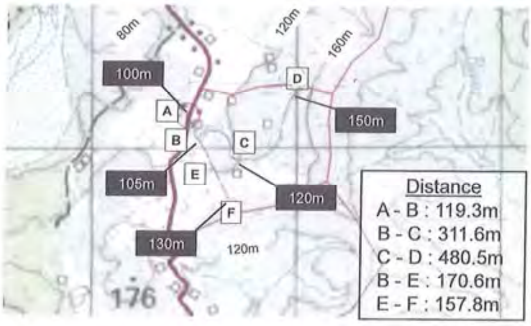
STEP2 : Confirmation of River Network



STEP3 : Separete a Boundary Line



Practice-2 : Making a River Profile



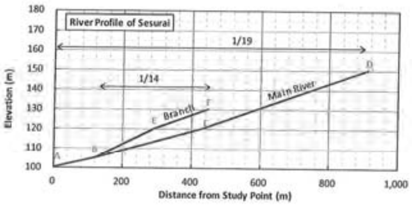
Distance
A - B : 119.3m
B - C : 311.6m
C - D : 480.5m
B - E : 170.6m
E - F : 157.8m

Practice-2 : Making a River Profile

Main River	Distance (m)	Total Dis (m)	EL. (m)	Riverbed Slope	Branch River	Distance (m)	Total Dis (m)	EL. (m)	Riverbed Slope
D									
C					F				
B					E				
A		0.00			B				

Practice-2 : Making a River Profile

Main River	Distance (m)	Total Dis (m)	EL. (m)	Riverbed Slope	Branch River	Distance (m)	Total Dis (m)	EL. (m)	Riverbed Slope
Upstream					Upstream				
D	480.50	911.40	150	1/19					
C	311.60	430.90	120		F	157.80	447.70	130	1/14
B	119.30	119.30	105		E	170.60	289.90	120	
A		0.00	100		B		119.30	105	



Next Step

Hydrological Study

- ✓ Collection of Rainfall Data at Dili and Same
- ✓ Rainfall Analysis
- ✓ Estimation of Discharge Volume

Technical Assistance to Basic Design

- ✓ Topographic Survey
- ✓ Confirmation of Flow Capacity of Box Culvert
- ✓ Judgment of Bearing Capacity of Ground

Thank you all for coming

Today's Classroom Lecture !

The Project for
the Capacity Development of Road Services
in the Democratic Republic of Timor-Leste

Case Study for Design Check
Road Drainage (2)

August 2017

JICA Expert Team

Overview of Hydraulic Analysis

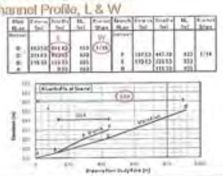
Contents of Road Drainage (1)

Road Drainage (1) review: Catchment Area, A

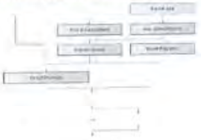
Road Drainage (1) review: Channel Profile

Distance
A - B : 119.3m
B - C : 311.6m
C - D : 480.5m
B - E : 170.6m
E - F : 157.8m

Road Drainage (1) review: Channel Profile, L & W



Contents of Road Drainage (2)

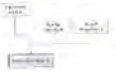


Overall Lecture Goal: Design Discharge

Modelling:

- Relationship between rainfall and stream flow through empirical rainfall-runoff prediction
- Rational Method will be applied:
  - Peak discharge only
  - Ease of use
  - Relatively simple representation of infiltration/evaporation/storage using a coefficient
  - Applicable < 4.0 km²
  - Best suited ≤ 0.4 km²

(Note: other methods exist, such as Talbot, Raffelt, and SCS Method)



Overall Lecture Goal: Rational Method

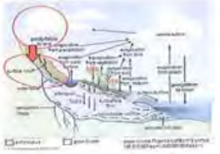
- $Q = \frac{1}{3.6} f R A$

Where:

- Q = design discharge (m³/s)
- f = runoff coefficient
- R = rainfall intensity (mm/hr)
- A = catchment area (km²)

Runoff Proportion

Runoff Proportion: Hydrologic Cycle



Runoff Proportion : Runoff Coefficient (f)

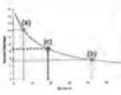
- Represents proportion of rainfall that becomes runoff
- Infiltration / evaporation / storage accounted for using the coefficient
- Must be weighted if you have different area types within the drainage area
- Adopt. f = 0.9, considering study site is only steep mountainous terrain

(Note: Limited to catchments < 4.0 km² because water storage becomes complex and coefficient cannot accurately represent catchment)

Rainfall Intensity

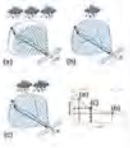
Rainfall Intensity: Intensity-Duration Relationship

- General climate trends: storm intensity ∝ storm duration (inverse relationship)
- (a) high intensity-short duration
- (b) low intensity-long duration
- (c) critical intensity when duration = time of concentration
- Time of concentration is when all parts of the watershed begin contributing to the runoff from the basin



Rainfall Intensity: Critical Intensity

- (a) high intensity, but duration < time of concentration so not all catchment contributes
- (b) duration > time of concentration, so all catchment contributes, but low intensity
- (c) duration = time of concentration, so intensity is highest possible with all catchment contributing



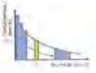
Rainfall Intensity: Mononobe's Formula

- $R = \frac{R_{24}}{24}\left(\frac{24}{t_c}\right)^{2/3}$

Where:

- R = rainfall intensity (mm / hr)
- R_{24} = maximum rainfall in 24 hours (mm)
- t_c = time of concentration (hr)

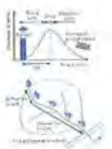
- If rainfall data has 5-min, 10-min … 1-hour records, then intensity-duration-frequency(IDF) charts could be developed and other methods could be used

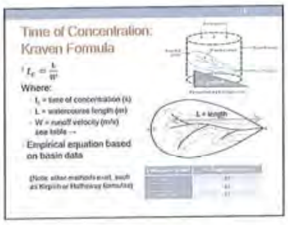


Time of Concentration

Time of Concentration

- Different areas of a watershed contribute to runoff at different times after rainfall begins
- Time of concentration
  - Time of flow from the farthest point in the watershed
  - Time at which all parts of the watershed begin contributing to the runoff from the basin
- Lag time
  - Time from the centre of mass of rainfall to hydrograph peak





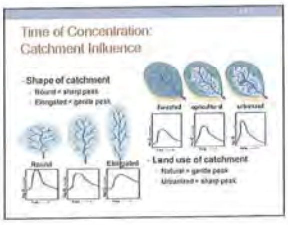
Time of Concentration: Kraven Formula

- $t_c = \frac{L}{W}$

Where:

- t_c = time of concentration (s)
- L = watercourse length (m)
- W = runoff velocity (m/s) see table →
- Empirical equation based on basin data

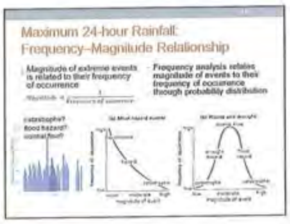
(Note: other methods exist, such as Kirpich or Rathsway formulas)



Time of Concentration: Catchment Influence

- Shape of catchment
  - Round = sharp peak
  - Elongated = gentle peak
- Land use of catchment
  - Natural = gentle peak
  - Urbanised = sharp peak

Maximum 24-hour Rainfall

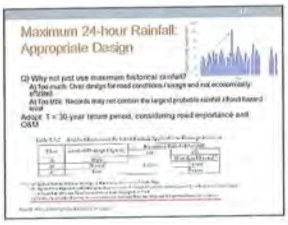


Maximum 24-hour Rainfall: Frequency–Magnitude Relationship

- Magnitude of extreme events is related to their frequency of occurrence

$Magnitude \propto \frac{1}{Frequency\ of\ occurrence}$

- Frequency analysis relates magnitude of events to their frequency of occurrence through probability distribution



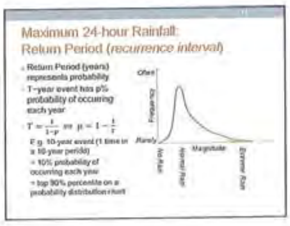
Maximum 24-hour Rainfall: Appropriate Design

Q) Why not just use maximum historical rainfall?

A) Too much: Over design for road conditions / usage and not economically efficient

A) Too little: Records may not contain the largest probable rainfall / flood hazard level

Adopt: T = 30-year return period, considering road importance and O&M



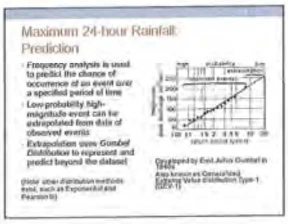
Maximum 24-hour Rainfall: Return Period (*recurrence interval*)

- Return Period (years) represents probability
- T-year event has p% probability of occuring each year
- $T = \frac{1}{1-p}$ or $p = 1 - \frac{1}{T}$

E.g. 10-year event (1 time in a 10-year period)

= 10% probability of occurring each year

= top 90% percentile on a probability distribution chart



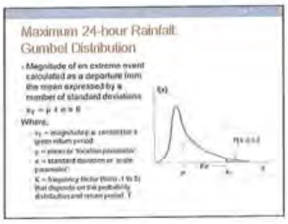
Maximum 24-hour Rainfall: Prediction

- Frequency analysis is used to predict the chance of occurrence of an event over a specified period of time
- Low-probability high-magnitude event can be extrapolated from data of observed events
- Extrapolation uses *Gumbel Distribution* to represent and predict beyond the dataset

(Note: other distribution methods exist, such as Exponential and Pearson III)

Developed by Emil Julius Gumbel in 1940s

Also known as Generalized Extreme Value distribution Type-1 (GEV-1)

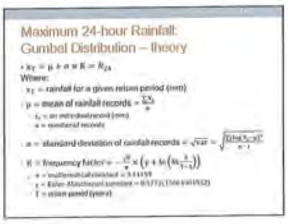


Maximum 24-hour Rainfall: Gumbel Distribution

- Magnitude of an extreme event calculated as a departure from the mean expressed by a number of standard deviations
- $x_T = \mu + \sigma \times K$

Where:

- x_T = magnitude of a variable for a given return period
- μ = mean or 'location parameter'
- σ = standard deviation or 'scale parameter'
- K = frequency factor (from -1 to 5) that depends on the probability distribution and return period T

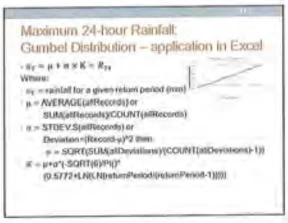


Maximum 24-hour Rainfall: Gumbel Distribution – theory

- $x_T = \mu + \sigma \times K = R_{24}$

Where:

- x_T = rainfall for a given return period (mm)
- μ = mean of rainfall records = $\frac{\sum x_i}{n}$
  - x_i = an individual record (mm)
  - n = number of records
- σ = standard deviation of rainfall records = $\sqrt{var} = \sqrt{\frac{\sum (x_i - \mu)^2}{n-1}}$
- K = frequency factor = $-\frac{\sqrt{6}}{\pi} \times \left(\gamma + \ln\left(\ln\frac{T}{T-1}\right)\right)$
  - π = mathematical constant = 3.14159
  - γ = Euler-Mascheroni constant = 0.5772(15664901532)
  - T = return period (years)



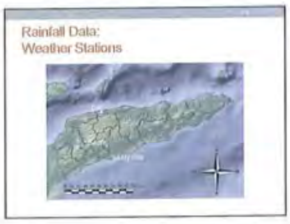
Maximum 24-hour Rainfall: Gumbel Distribution – application in Excel

- $x_T = \mu + \sigma \times K = R_{24}$

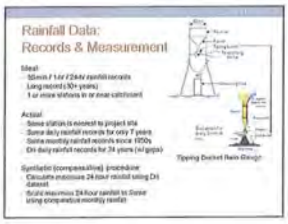
Where:

- x_T = rainfall for a given return period (mm)
- μ = AVERAGE(allRecords) or SUM(allRecords)/COUNT(allRecords)
- σ = STDEV.S(allRecords) or Deviation=(Record-μ)^2 then σ = SQRT(SUM(allDeviations)/(COUNT(allDevisions)-1))
- K = μ+σ*(-SQRT(6)/PI()*(0.5772+LN(LN(returnPeriod/(returnPeriod-1))))

Rainfall Data



Rainfall Data: Weather Stations



Rainfall Data: Records & Measurement

Ideal:

- 10min / 1hr / 24hr rainfall records
- Long record (30+ years)
- 1 or more stations in or near catchment

Actual:

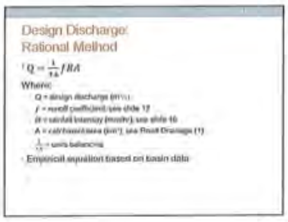
- Same station is nearest to project site
- Same daily rainfall records for only 7 years
- Same monthly rainfall records since 1950s
- Dili daily rainfall records for 24 years (w/ gaps)

Synthetic (comparative) procedure:

- Calculate maximum 24-hour rainfall using Dili dataset
- Scale maximum 24-hour rainfall to Same using comparative monthly rainfall

Tipping Bucket Rain Gauge

Design Discharge

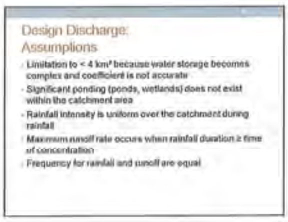


Design Discharge: Rational Method

- $Q = \frac{1}{3.6} f R A$

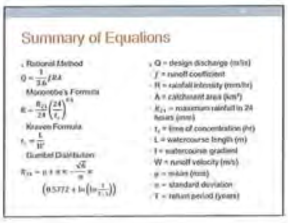
Where:

- Q = design discharge (m³/s)
- f = runoff coefficient; see slide 17
- R = rainfall intensity (mm/hr); see slide 16
- A = catchment area (km²); see Road Drainage (1)
- $\frac{1}{3.6}$ = units balancing
- Empirical equation based on basin data



Design Discharge: Assumptions

- Limitation to < 4 km² because water storage becomes complex and coefficient is not accurate
- Significant ponding (ponds, wetlands) does not exist within the catchment area
- Rainfall intensity is uniform over the catchment during rainfall
- Maximum runoff rate occurs when rainfall duration ≥ time of concentration
- Frequency for rainfall and runoff are equal



Summary of Equations

- Rational Method

$Q = \frac{1}{3.6} f R A$

Mononobe's Formula

$R = \frac{R_{24}}{24}\left(\frac{24}{t_c}\right)^{0.6}$

Kraven Formula

$t_c = \frac{L}{W}$

Gumbel Distribution

$R_{24} = \mu + \sigma \times -\frac{\sqrt{6}}{\pi} \times \left(0.5772 + \ln\left(\ln\frac{T}{T-1}\right)\right)$

- Q = design discharge (m³/s)
- f = runoff coefficient
- R = rainfall intensity (mm/hr)
- A = catchment area (km²)
- R_{24} = maximum rainfall in 24 hours (mm)
- t_c = time of concentration (hr)
- L = watercourse length (m)
- I = watercourse gradient
- W = runoff velocity (m/s)
- μ = mean (mm)
- σ = standard deviation
- T = return period (years)

Summary of Process

The Project
for
Capacity Development of Road Services
in
the Democratic Republic of Timor-Leste

Training No.3 Introduction of Weather Resistance Big Sandbag

April 2017
JICA Expert Teams

Self-introduction

Name ; Shutaro SAKANAKA

Specialized field : River Plan and River Design
Harbor Design
Disaster Management
Disaster Restoration

E-mail ; shutaro.sakanaka@ingerosec.com

Today Training

Weather Resistance Big Sand Bag Method for Damage Site

Application Works of Weather Resistance Big Sandbag

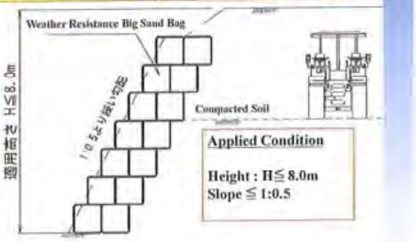
- ✓ Emergency works
- ✓ Temporary works

Notice:
Do not use weather resistance big sandbag for main civil works

Example of Weather Resistance Big Sand Bag

Example of Weather Resistance Big Sand Bag

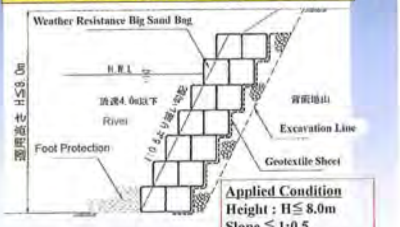
Applied Condition of Weather Resistance Big Sand Bag for Slope



Applied Condition

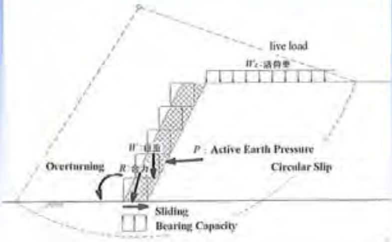
Height : H≦8.0m
Slope ≦ 1:0.5

Applied Condition of Weather Resistance Big Sand Bag for River

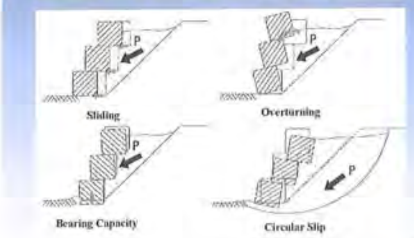


Applied Condition
Height : H≦8.0m
Slope ≦ 1:0.5
River velocity≦4m/s

Analysis Parameter for Weather Resistance Sand Big Bag



Analysis Parameter for Weather Resistance Sand Big Bag

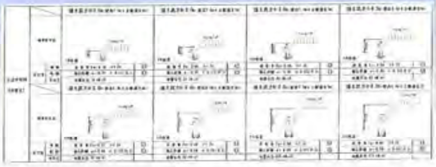


Safety Factor for Weather Resistance Big Sand Bag Analysis

Item	Safety Factor
Compression Stress of Big Sand Bag	F≧1.5
Sliding	F≧1.2
Overturning	Eccentricity distance E≧B/3
Bearing Capacity	F≧2.0
Circular Slip	F≧1.05

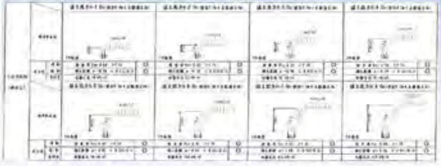
Standard Drawing of Weather Resistance Big Sand Bag Analysis

Applied Condition H<8m
Internal Material ; Sand Soil



Standard Drawing of Weather Resistance Big Sand Bag Analysis

Applied Condition H<8m
Internal Material ; Gravel Soil



Standard Drawing of Weather Resistance Big Sand Bag Analysis

Applied Condition H<8m
Internal Material ; Sand Soil

Standard Drawing of Weather Resistance Big Sand Bag Analysis

Applied Condition H<8m
Internal Material ; Gravel Soil

Comparison of Normal and Weather Resistance Type

	Normal Type	Weather Resistance Type
Image		
Ultraviolet Rays	Weak	Strong
Cost	Cheap	Normal
Endurance	Weak	Strong
Strength	Weak	Strong

Normal Big Sand Bag

The Normal type geo-bag is vulnerable to ultraviolet rays

Recommended Plan of Weather Resistance Big Sand Bag

Thank you very much for your kind attention!

Attachment 2 Training Material
Introduction of Weather Resistance Big Sandbag on April 2017

30June, 2017

Recordof Lecture of construction planning for demonstration of Jumbo Pack (Big sand bag)

Johji Koizumi, a member of JICA Expert Team
For CDRS Project

This is the record of the Lecture of construction planning for demonstration ofJumbo Pack (Big sand bag) for Applicable new Technology Introduction.

1. Date & place of the Lecture

Time and Date : 10:00 – 10:50, Thursday 29June, 2017
Venue : Conference room of DRBFC, Dili

2. Contents of Lecture

(1) Presentation of construction for Jumbo Pack 10:00 - 10:30, presented by CDRS expert

1) Introduction of Jumbo Pack
2) Outline of demonstration for JumboPack
3) Consideration for using machinery
4) Procedure of Jumbo Pack construction
5) Remark points for construction
6) Training / learning for DRBFC staff

(2) Question/Answer and Discussion 10:30 – 10:50 among the participants

Q1: Engineer, Construction Department of DRBFC

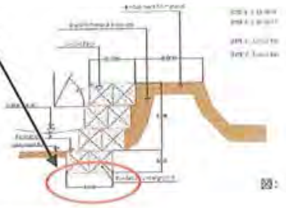
Q1-1: What kind of material will be used for stuffing/filling into Jumbo Pack

A1-1: As designing principal, weight of material (Jumbo Pack) is desired as heavy as possible in case of river revetment works in order to protect water floor.

In the demonstration, material of lower layer is preferable to use gravel/stone and at upper layer to use sandy material.

Q1-2: It wouldbe better to provide **gravel foundation** offirst (bottom) layer as same as gabion construction. Don't you think so?

A1-2: It is agreed that with stiff foundation of Jumbo Pack layers is more strong. But Jumbo Pack usually is to be used for emergency repair works and quite temporary purse, so it is not required



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special foundation measures for this demonstration.

In case of using weather resistance big sandbag (Jumbo Pack), as sated in last designing Lecture, it is to be considered to provide such foundation in order to be more durable layer of Pack structures.

Q2: Road Engineering Specialist, Road for Development Programme (R4D)

Q2: It is suggested that the works can be made without big machinery, such an excavator, by only man power as same as gabion mat construction. If fabrication of Jumbo Pack is casted in-site, it is no need machine to stuffing/filling material into bags.

A2: Thank you for valuable advice. It is possible practical procedure to carry out the works and it would be considered for calculate numbers of labour and compare with in the aspect of cost and construction time.

3. Futher activities

1) Introduction and observation events for Jumbo Pack construction will be made for staff of DRBFC during the demonstration for Jumbo Pack construction.
2) In line with rehabilitation of the damaged revetment works, UAV survey demonstration is made by CDRS expert under the cooperation of DRBFC staff at the same site

Attachment

1. Attendance List of Lecture of construction planning for Jumbo Pack
2. Photos for lecture at the conference room of DRBFC
4. Delivery material for lecture (add the pictures indication Access road road from Lois Bridge and machinery access point to the river-side site)

Attachment #1: Attendance List of Lecture for Jumbo Pack construction on29June, 2017

The Project for The Capacity Development of Road Service in The Democratic Republic of Timor-Leste

ATTENDANCE LIST

Date : 29 June 2017
Subject : Lecture "Construction for Jumbo Pack (Big Sand Bag)"
Venue : DRBFC Conference Room

No	Mr/Ms	Name	Affiliation/Duty	Department	E-mail	Mobile	Signature
1	Mr/Ms	Mr. Celestino E. Ximenes		Vai Rapaza	[redacted]	[redacted]	
2	Mr/Ms	Mr. Alcino F. Da Costa		Mainteta Dep.	[redacted]	[redacted]	
3	Mr/Ms	Ms. Filomena C.C. da Almeida		Maintenance dep	[redacted]	[redacted]	
4	Mr/Ms	Felisberto [illegible] Guterres		R4D	[redacted]	[redacted]	
5	Mr/Ms	Abril dos Santos		ILO / R4D	[redacted]	[redacted]	
6	Mr/Ms	[illegible]		[illegible]	[redacted]	[redacted]	
7	Mr/Ms	Simon Done		R4D	[redacted]	[redacted]	
8	Mr/Ms	Sinaro Laranjinha		Dep Projeto	[redacted]	[redacted]	
9	Mr/Ms	Natanaela S. de Carvalho		Silo	[redacted]	[redacted]	
10	Mr/Ms	Cleto Ximenes		MOPTC-EPC	[redacted]	[redacted]	
11	Mr/Ms	Antonio De Araujo		MOPTC-NATTC	[redacted]	[redacted]	
12	Mr/Ms	Luis S. da Cruz		MOPTC. EPCC	[redacted]	[redacted]	
13	Mr/Ms	Takashi Saito		CDRS expert	[redacted]	[redacted]	
14	Mr [✓ Ms]	Lenchio S A. Barreto		CDRS	[redacted]	[redacted]	
15	[✓ Mr] Ms	Johji KOIZUMI	Engineer	CDRS	[redacted]	[redacted]	
16	Mr/Ms				[redacted]	[redacted]	
17	Mr/Ms				[redacted]	[redacted]	

Attachment #2. Photos for lecture at the conference room of DRBFC

Photo-1 Lecture of Jumbo Pack construction are held at the conference room of DRBFC, Dili

Photo-2Agenda: Construction Planning and Management for Jumbo Pack construction

Photo-3 Presentation are made by using slide pictures

Photo-4 After presentation, discussion are made among the participants

Photo-5Optional other construction method are advised by attendance

Photo-6. Room for improvement of foundation of Pack layer and other opinions are delivered

Attachment 3

Record of Construction planning for demonstrarion of Jumbo pack

Attendance list of Lecture of Construction planning for Demonstration of Jumbo Pack

Lecture of Construction Planning for Demonstration of Jumbo Pack (Big Sandbag) On June 2017

The Project
for
Capacity Development of Road Services
in
the Democratic Republic of Timor-Leste

Lecture of construction planning for demonstration of Jumbo Pack (Big sand bag)

June 2017

JICA Expert Teams

Self-introduction

Name ; Johji KOIZUMI

Specialized field : Construction Supervising,
In charge of Case Study_
Ex Japan Road in Timor-Leste,
Professional Engineer for Civil Engineering

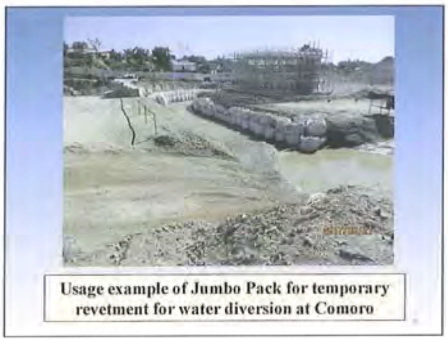
E-mail ; johji.koizumi@ingerosec.com

Today Training

Construction Planning and Management for demonstration of Jumbo Pack construction

Content of Today's Lecture

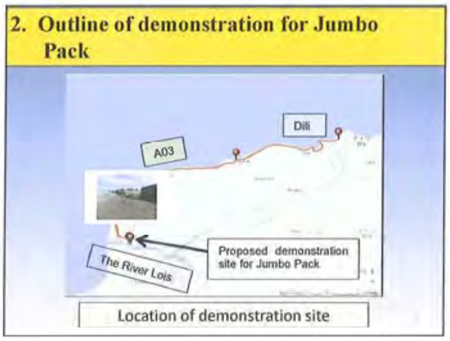
1. Introduction of Jumbo Pack
2. Outline of demonstration for Jumbo Pack
3. Consideration for using machinery
4. Procedure of Jumbo Pack construction
5. Remark points for construction
6. Training / learning for DRBFC staff



Usage example of Jumbo Pack for temporary revetment for water diversion at Comoro

1. Introduction of Jumbo Pack (Big sand bag)

- ✓ Jumbo Pack is used widely for Emergency works and Temporary works on Civil Engineering.
- ✓ Demonstration of fabrication and Lecture of designing for Jumbo Pack have already conducted at March/May 2017.

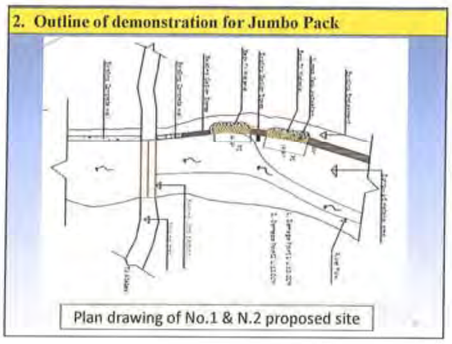


2. Outline of demonstration for Jumbo Pack

Location of demonstration site

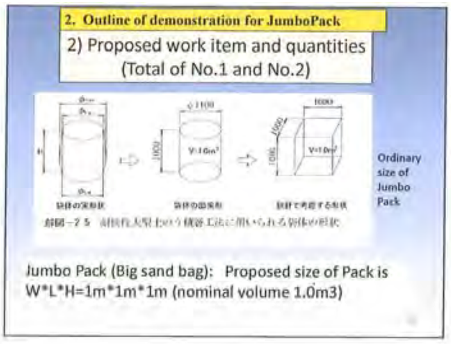
2. Outline of demonstration for Jumbo Pack

Photo of existing condition of proposed demonstration site No.1



2. Outline of demonstration for Jumbo Pack

Plan drawing of No.1 & N.2 proposed site

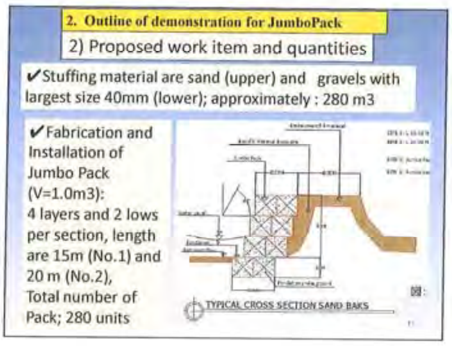


2. Outline of demonstration for JumboPack

2) Proposed work item and quantities (Total of No.1 and No.2)

Ordinary size of Jumbo Pack

Jumbo Pack (Big sand bag): Proposed size of Pack is W*L*H=1m*1m*1m (nominal volume 1.0m3)



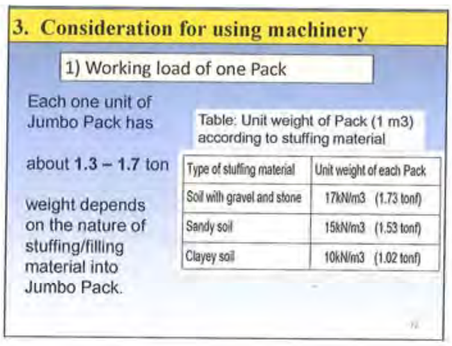
2. Outline of demonstration for JumboPack

2) Proposed work item and quantities

✔Stuffing material are sand (upper) and gravels with largest size 40mm (lower); approximately : 280 m3

✔Fabrication and Installation of Jumbo Pack (V=1.0m3):
4 layers and 2 lows per section, length are 15m (No.1) and 20 m (No.2),
Total number of Pack; 280 units

TYPICAL CROSS SECTION SAND BAKS



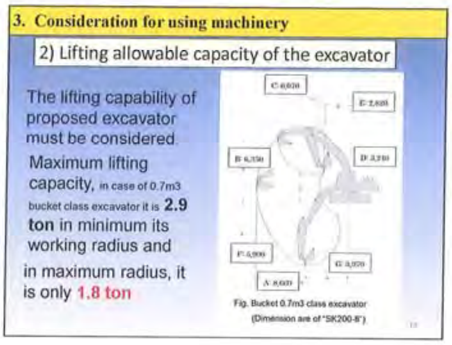
3. Consideration for using machinery

1) Working load of one Pack

Each one unit of Jumbo Pack has about **1.3 – 1.7** ton weight depends on the nature of stuffing/filling material into Jumbo Pack.

Table: Unit weight of Pack (1 m3) according to stuffing material

Type of stuffing material	Unit weight of each Pack
Soil with gravel and stone	17kN/m3 (1.73 tonf)
Sandy soil	15kN/m3 (1.53 tonf)
Clayey soil	10kN/m3 (1.02 tonf)



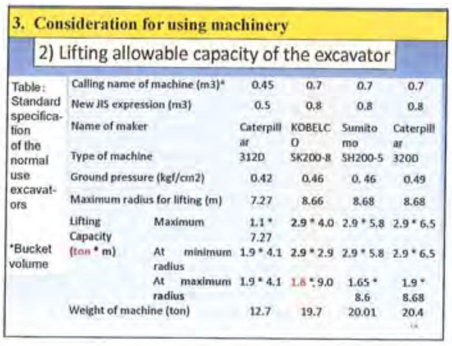
3. Consideration for using machinery

2) Lifting allowable capacity of the excavator

The lifting capability of proposed excavator must be considered.

Maximum lifting capacity, in case of 0.7m3 bucket class excavator it is **2.9 ton** in minimum its working radius and in maximum radius, it is only **1.8 ton**

Fig. Bucket 0.7m3 class excavator (Dimension are of "SK200-8")



3. Consideration for using machinery

2) Lifting allowable capacity of the excavator

Table: Standard specification of the normal use excavators	Calling name of machine (m3)*		0.45	0.7	0.7	0.7
	New JIS expression (m3)		0.5	0.8	0.8	0.8
	Name of maker		Caterpillar	KOBELCO	Sumitomo	Caterpillar
	Type of machine		312D	SK200-8	SH200-5	320D
	Ground pressure (kgf/cm2)		0.42	0.46	0. 46	0.49
	Maximum radius for lifting (m)		7.27	8.66	8.68	8.68
	Lifting Capacity (ton * m)	Maximum	1.1 * 7.27	2.9 * 4.0	2.9 * 5.8	2.9 * 6.5
*Bucket volume		At minimum radius	1.9 * 4.1	2.9 * 2.9	2.9 * 5.8	2.9 * 6.5
		At maximum radius	1.9 * 4.1	1.8 * 9.0	1.65 * 8.6	1.9 * 8.68
	Weight of machine (ton)		12.7	19.7	20.01	20.4

Attachment 4 Training Material

Workshop #1 Retaining wall (Stability Calculation of Gravity Retaining wall) on May 2017

Workshop #2 Retaining wall (Bearing Capacity of plane and slope Ground) on May 2017

Workshop #3 Retaining wall (Stepped cut Foundation for Retaining wall) on June 2017

Workshop #1
Retaining Wall

Stability Calculation
Of
Gravity Retaining Wall

Modelization for Design Calculation

Design Calculation

Realness Phenomena

To be calculate-able
Modelization
Simplified
Abbriviated

Assumed Condition

	Model	Realness
Wall body Foundation ground	Rigid body No deformation	Elasto-plastic body Elastic / plastic deformation
Sliding resistance	R=μN	Shearing stress distributing along base plane not equally
Reaction force	Linear distribution	Compressive stress distributing along base plane not equally

Design Conditions

1. Situation
2. Shape of the wall
3. Backfill
4. Loads
5. Guardrail
6. Foundation ground
7. Front resistance ground
8. Concrete
9. Reinforcement Bar in the wall

Situation

- Normal
- Abnormal

Large loads or extra loads in rare cases

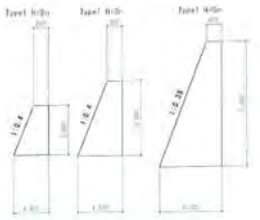
Earthquake

Collision on the guardrail

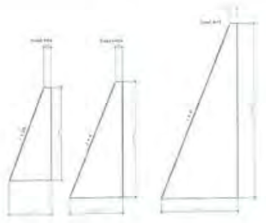
Shape of the Wall

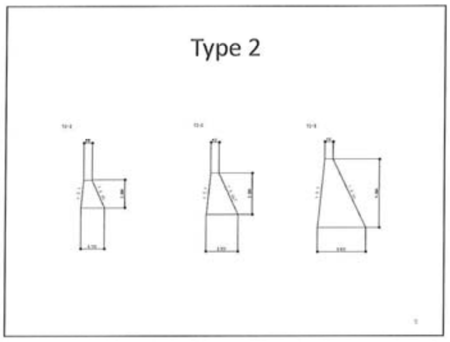
- Common Drawing; Type1, Type2
- Engineer's Original Trapezoidal Shape
- Wall stands by itself, not leans to backfill

Type 1

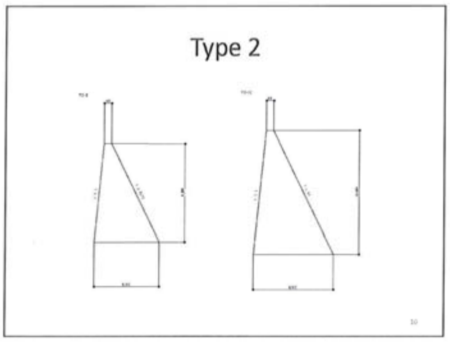


Type 1

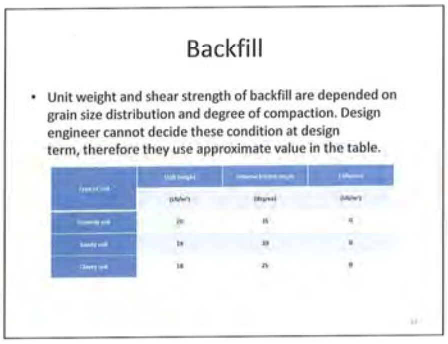




Type 2



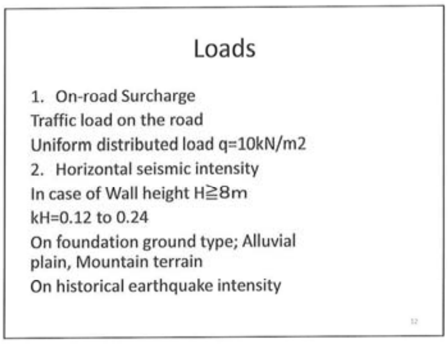
Type 2



Backfill

- Unit weight and shear strength of backfill are depended on grain size distribution and degree of compaction. Design engineer cannot decide these condition at design term, therefore they use approximate value in the table.

Type of soil	Unit weight	Internal friction angle	Cohesion
	(kN/m³)	(degree)	(kN/m²)
Gravelly soil	20	35	0
Sandy soil	19	30	0
Clayey soil	18	25	0



Loads

1. On-road Surcharge

Traffic load on the road

Uniform distributed load q=10kN/m2

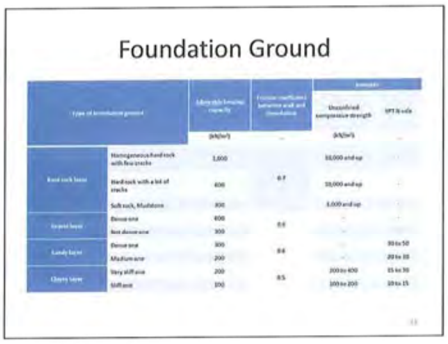
2. Horizontal seismic intensity

In case of Wall height H≧8m

kH=0.12 to 0.24

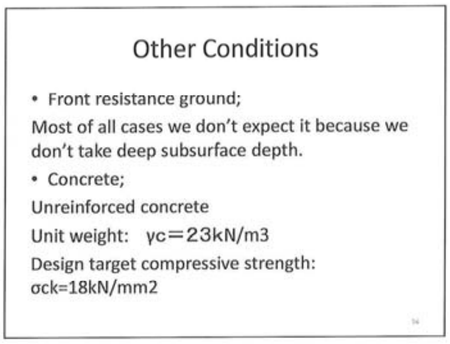
On foundation ground type; Alluvial plain, Mountain terrain

On historical earthquake intensity



Foundation Ground

Type of foundation ground		Allowable bearing capacity	Friction coefficient between wall and foundation	Remarks	
				Unconfined compressive strength	SPT N value
		(kN/m²)	–	(kN/m²)	–
Hard rock layer	Homogeneous hard rock with few cracks	1,000	0.7	10,000 and up	–
	Hard rock with a lot of cracks	600		10,000 and up	–
	Soft rock, Mudstone	300		1,000 and up	–
Gravel layer	Dense one	600	0.6	–	–
	Not dense one	300		–	–
Sandy layer	Dense one	300	0.6	–	30 to 50
	Medium one	200		–	20 to 30
Clayey layer	Very stiff one	200	0.5	200 to 400	15 to 30
	Stiff one	100		100 to 200	10 to 15



Other Conditions

- Front resistance ground;

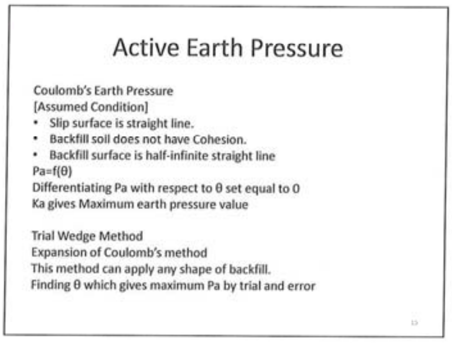
Most of all cases we don't expect it because we don't take deep subsurface depth.

- Concrete;

Unreinforced concrete

Unit weight: γc=23kN/m3

Design target compressive strength: σck=18kN/mm2



Active Earth Pressure

Coulomb's Earth Pressure

[Assumed Condition]

- Slip surface is straight line.
- Backfill soil does not have Cohesion.
- Backfill surface is half-infinite straight line

Pa=f(θ)

Differentiating Pa with respect to θ set equal to 0

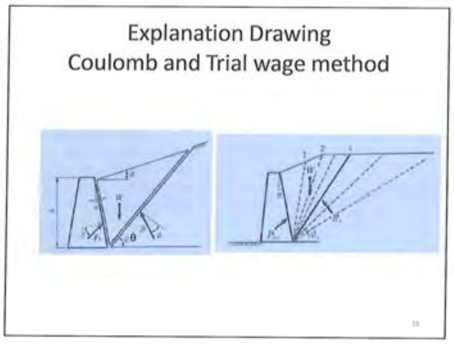
Ka gives Maximum earth pressure value

Trial Wedge Method

Expansion of Coulomb's method

This method can apply any shape of backfill.

Finding θ which gives maximum Pa by trial and error



Explanation Drawing Coulomb and Trial wage method

Coulomb's active earth pressure coefficient

$$K_A = \frac{\cos^2(\varphi-\alpha)}{\cos^2\alpha\cos(\alpha+\delta)\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\cos(\alpha+\delta)\cos(\alpha-\beta)}}\right]^2}$$

$$P_A = \frac{1}{2}\gamma h^2 K_A$$

P_A: Active earth pressure acting on the wall

K_A: Active earth pressure coefficient

γ: Unit weight of the backfill

h: Height of the wall

α: Angle between back surface of the wall and vertical line

β: Angle between ground surface and horizontal line

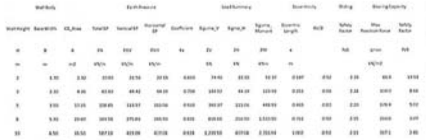
φ: Internal friction angle

δ: Friction angle between back surface of the wall and the soil

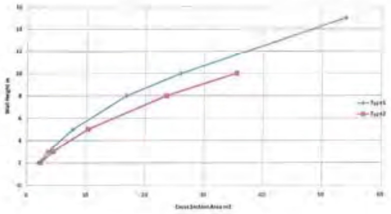
Earth pressure value by Coulomb Equation

Result Table Type 1

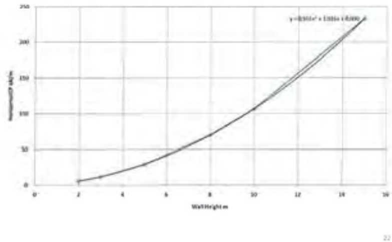
Result Table Type 2



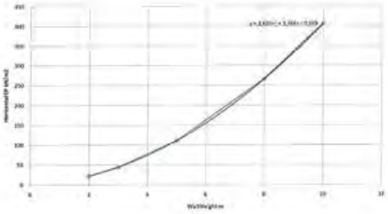
Compare Cross Section Area T1 and T2



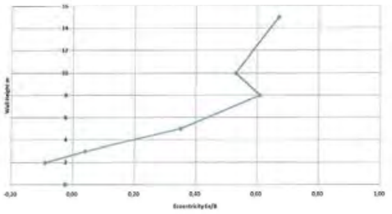
Horizontal Earth Pressure T1



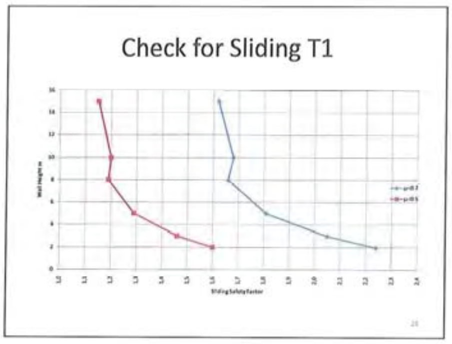
Horizontal Earth Pressure T2



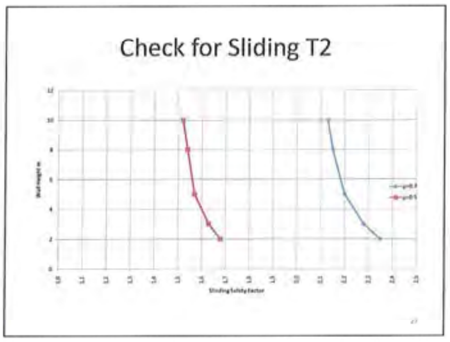
Check for Over-turning T1



Check for Over-turning T2

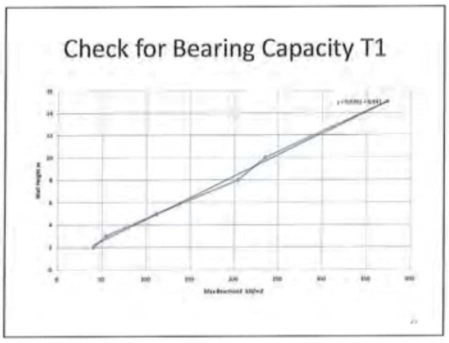


Check for Sliding T1

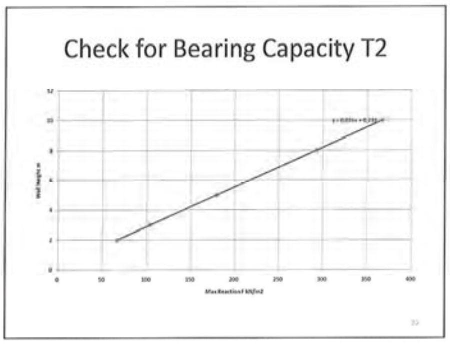


Check for Sliding T2

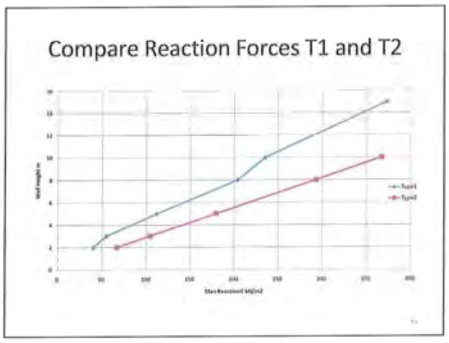
Requested Friction Coefficient of Sliding Stability



Check for Bearing Capacity T1



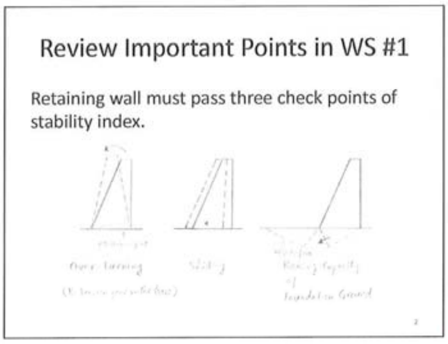
Check for Bearing Capacity T2



Compare Reaction Forces T1 and T2

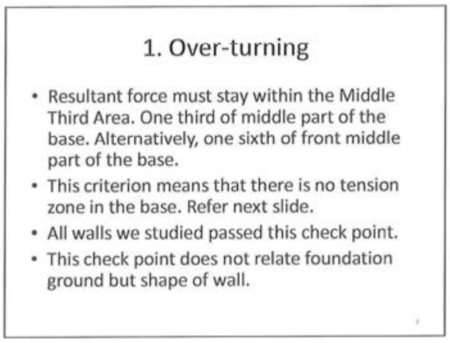
Workshop about Retaining Wall #2

Bearing Capacity of
Plane and Slope Ground



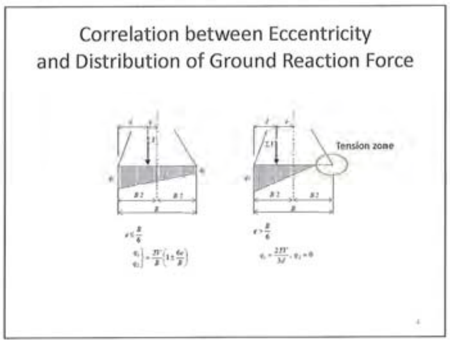
Review Important Points in WS #1

Retaining wall must pass three check points of stability index.



1. Over-turning

- Resultant force must stay within the Middle Third Area. One third of middle part of the base. Alternatively, one sixth of front middle part of the base.
- This criterion means that there is no tension zone in the base. Refer next slide.
- All walls we studied passed this check point.
- This check point does not relate foundation ground but shape of wall.



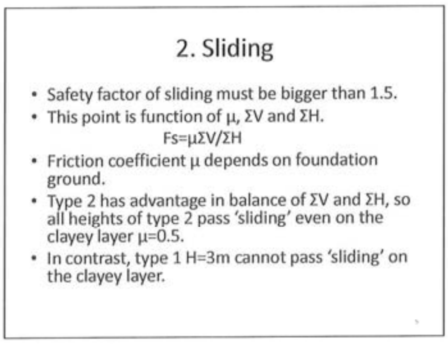
Correlation between Eccentricity and Distribution of Ground Reaction Force

$e \le \frac{B}{6}$

$\left.\begin{matrix}q_1\\q_2\end{matrix}\right\} = \frac{\Sigma V}{B}\left(1 \pm \frac{6e}{B}\right)$

$e > \frac{B}{6}$

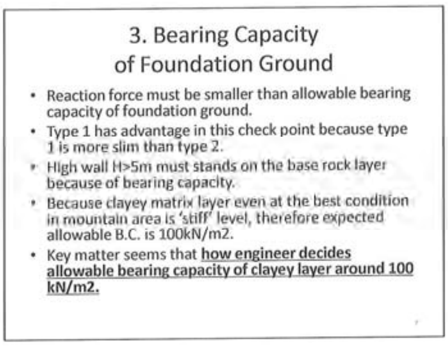
$q_1 = \frac{2\Sigma V}{3d},\ q_2 = 0$



2. Sliding

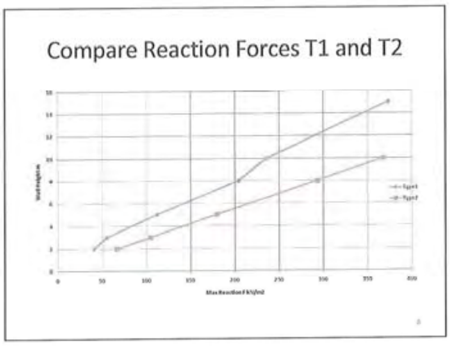
- Safety factor of sliding must be bigger than 1.5.
- This point is function of μ, ΣV and ΣH.
  Fs=μΣV/ΣH
- Friction coefficient μ depends on foundation ground.
- Type 2 has advantage in balance of ΣV and ΣH, so all heights of type 2 pass 'sliding' even on the clayey layer μ=0.5.
- In contrast, type 1 H=3m cannot pass 'sliding' on the clayey layer.

Requested Friction Coefficient of Sliding Stability

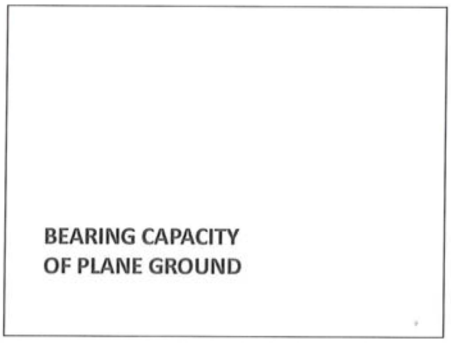


3. Bearing Capacity of Foundation Ground

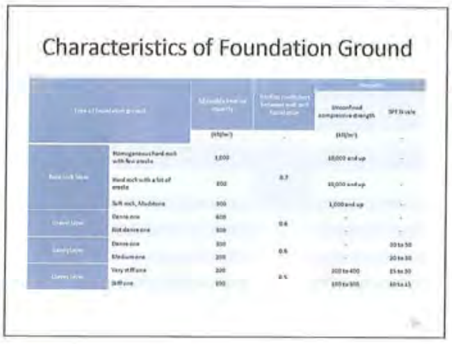
- Reaction force must be smaller than allowable bearing capacity of foundation ground.
- Type 1 has advantage in this check point because type 1 is more slim than type 2.
- High wall H>5m must stands on the base rock layer because of bearing capacity.
- Because clayey matrix layer even at the best condition in mountain area is 'stiff' level, therefore expected allowable B.C. is 100kN/m2.
- Key matter seems that **how engineer decides allowable bearing capacity of clayey layer around 100 kN/m2.**



Compare Reaction Forces T1 and T2

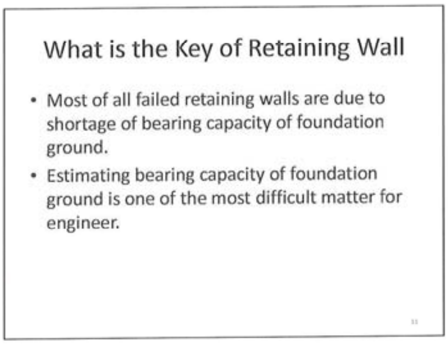


BEARING CAPACITY OF PLANE GROUND



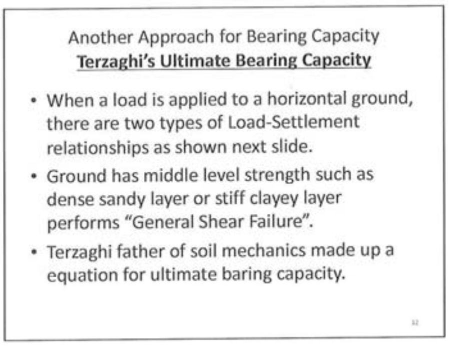
Characteristics of Foundation Ground

Type of foundation ground		Allowable bearing capacity	Friction coefficient between wall and foundation	Remarks	
				Unconfined compressive strength	SPT N-value
		(kN/m²)	-	(kN/m²)	-
Rock bed layer	Homogeneous hard rock with few cracks	1,000	0.7	10,000 and up	-
	Hard rock with a lot of cracks	600		10,000 and up	-
	Soft rock, Mudstone	300		1,000 and up	-
Gravel layer	Dense one	600	0.6	-	-
	Not dense one	300		-	-
Sandy layer	Dense one	300	0.6	-	30 to 50
	Medium one	200		-	20 to 30
Clayey layer	Very stiff one	200	0.5	200 to 400	15 to 30
	Stiff one	100		100 to 200	10 to 15



What is the Key of Retaining Wall

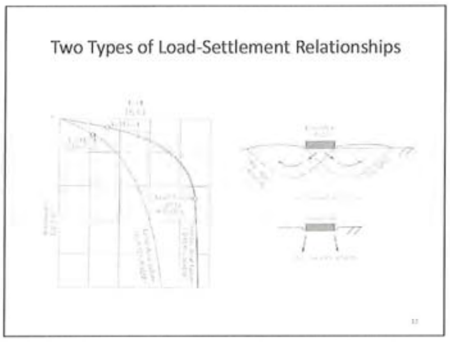
- Most of all failed retaining walls are due to shortage of bearing capacity of foundation ground.
- Estimating bearing capacity of foundation ground is one of the most difficult matter for engineer.



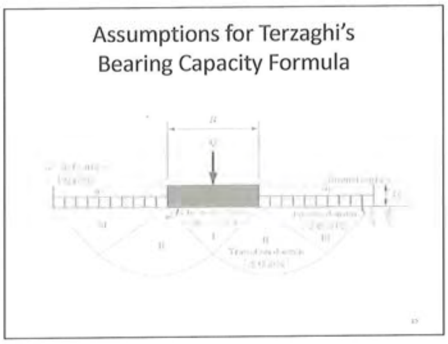
Another Approach for Bearing Capacity

Terzaghi's Ultimate Bearing Capacity

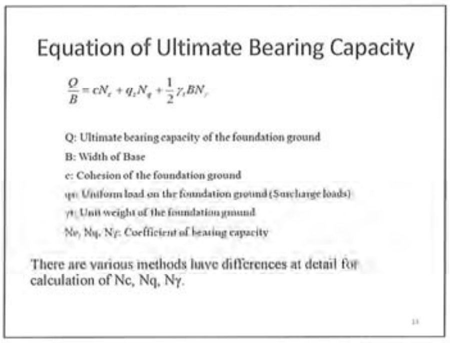
- When a load is applied to a horizontal ground, there are two types of Load-Settlement relationships as shown next slide.
- Ground has middle level strength such as dense sandy layer or stiff clayey layer performs "General Shear Failure".
- Terzaghi father of soil mechanics made up a equation for ultimate baring capacity.



Two Types of Load-Settlement Relationships



Assumptions for Terzaghi's Bearing Capacity Formula



Equation of Ultimate Bearing Capacity

$$\frac{Q}{B} = cN_c + q_t N_q + \frac{1}{2}\gamma_t BN_\gamma$$

Q: Ultimate bearing capacity of the foundation ground

B: Width of Base

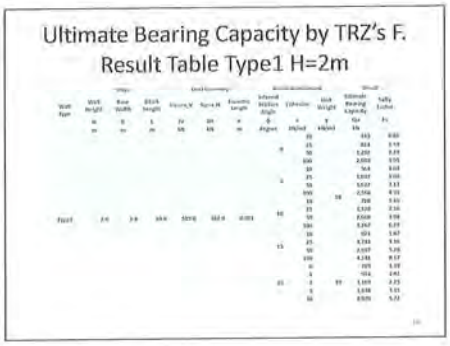
c: Cohesion of the foundation ground

qt: Uniform load on the foundation ground (Surcharge loads)

γt: Unit weight of the foundation ground

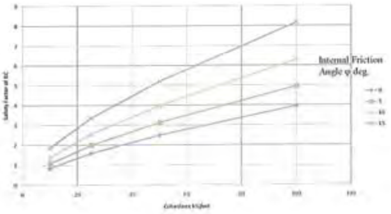
Nc, Nq, Nγ: Coefficient of bearing capacity

There are various methods have differences at detail for calculation of Nc, Nq, Nγ.



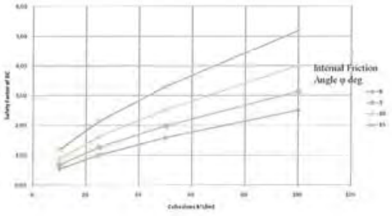
Ultimate Bearing Capacity by TRZ's F. Result Table Type1 H=2m

Ultimate Bearing Capacity by TRZ's F. Result Graph Type1 H=2m



Ultimate Bearing Capacity by TRZ's F. Result Table Type1 H=3m

Ultimate Bearing Capacity by TRZ's F. Result Graph Type1 H=3m



Index on Site to Estimate Bearing Capacity for Sandy Layer

Type	Condition	Index on Site	Allowable Bearing Capacity kN/m²	SPT N-value
Sandy Layer	Very loose	Reinforcement bar ϕ13mm easily penetrates by the hand.	0	Less than 4
	Loose	Scoop-able by the hand with shovel	50	4 to 10
	Medium	Reinforcement bar ϕ13mm easily penetrates by the hand with 2.2kgf hammer.	100	10 to 15
		Same as above Some effort is required.	200	15 to 30
	Dense	Same as above Depth reaches approx. 30cm.	300	30 to 50
	Very dense	Same as above Emitting metallic sound. Depth reaches approx. 5cm.	300	Greater than 50

Index on Site to Estimate Bearing Capacity for Clayey Layer

Type	Condition	Index on Site	Allowable Bearing Capacity kN/m²	SPT N-value
Clayey Layer	Very soft	Fist easily penetrates about 10cm depth.	0	Less than 2
	Soft	Thumb easily penetrates about 10cm depth	20	2 to 4
	Medium	Thumb penetrates about 10cm with medium effort.	50	4 to 8
	Stiff	Thumb dents the surface with normal effort and penetrates with much effort	100	8 to 15
	Very stiff	Remove-able with spade	200	15 to 30
	Hard	Removing requires pickax	200	Greater than 30

BEARING CAPACITY OF SLOPE GROUND

Bearing Capacity of Slope Ground

- How does bearing capacity decrease when retaining wall stands near a slope ground?
- Example will shows flowing slides.

[Conditions]

Resultant forces and eccentric-length from Type 1 H=3m;

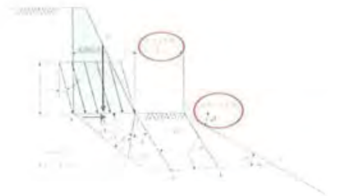
B=1.8m, L=10m, ΣV=945.4kN, ΣH=322.7kN, e=0.011m

Strength of foundation grounds;

Clayey layer φ=15deg. c=50kN/m2 γ=18kN/m3

Sandy layer φ=30deg. c=10kN/m2 γ=19kN/m3

Explanation Drawing Front Space and Angle from Horizon



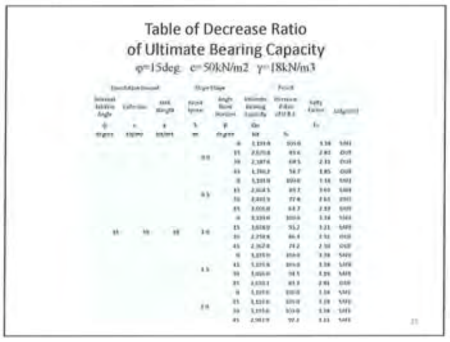


Table of Decrease Ratio of Ultimate Bearing Capacity

φ=15deg. c=50kN/m2 γ=18kN/m3

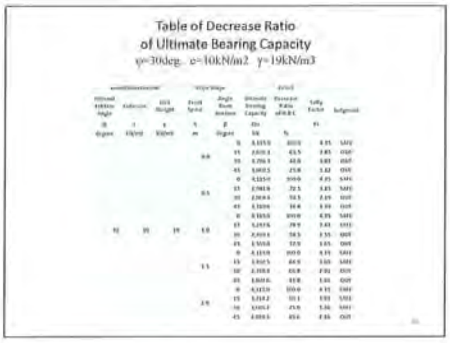
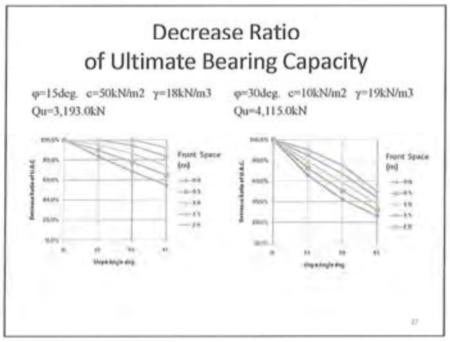


Table of Decrease Ratio of Ultimate Bearing Capacity

φ=30deg. c=10kN/m2 γ=19kN/m3



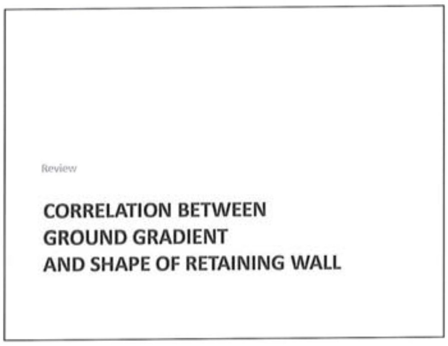
Decrease Ratio of Ultimate Bearing Capacity

φ=15deg. c=50kN/m2 γ=18kN/m3
Qu=3,193.0kN

φ=30deg. c=10kN/m2 γ=19kN/m3
Qu=4,115.0kN

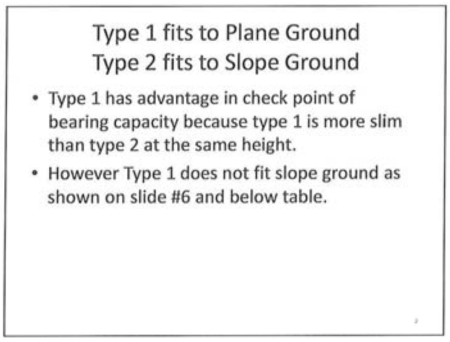
Workshop about Retaining Wall #3

Stepped Cut Foundation
For
Retaining Wall



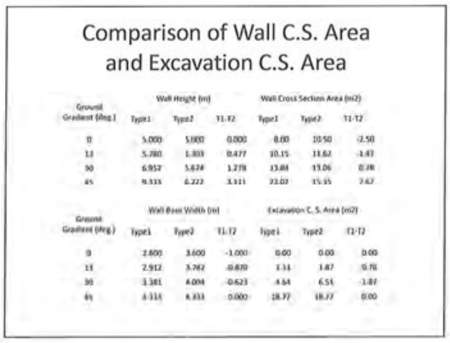
Review

CORRELATION BETWEEN GROUND GRADIENT AND SHAPE OF RETAINING WALL



Type 1 fits to Plane Ground
Type 2 fits to Slope Ground

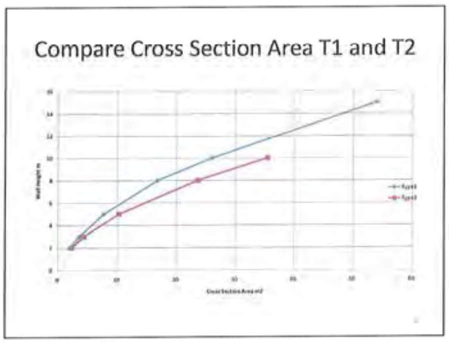
- Type 1 has advantage in check point of bearing capacity because type 1 is more slim than type 2 at the same height.
- However Type 1 does not fit slope ground as shown on slide #6 and below table.



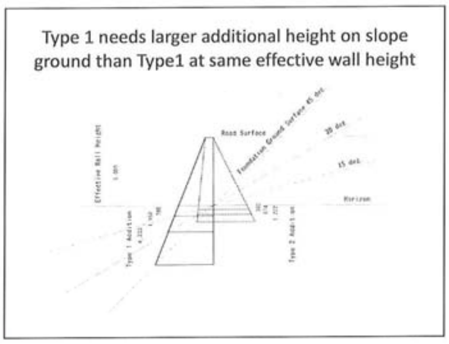
Comparison of Wall C.S. Area and Excavation C.S. Area

Ground Gradient (deg.)	Wall Height (m)			Wall Cross Section Area (m2)		
	Type1	Type2	T1-T2	Type1	Type2	T1-T2
0	5.000	5.000	0.000	8.00	10.50	-2.50
15	5.780	5.303	0.477	10.15	11.62	-1.47
30	6.952	5.674	1.278	13.84	13.06	0.78
45	9.333	6.222	3.111	23.02	15.35	7.67

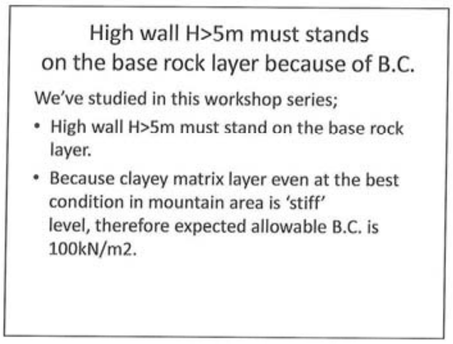
Ground Gradient (deg.)	Wall Base Width (m)			Excavation C. S. Area (m2)		
	Type1	Type2	T1-T2	Type1	Type2	T1-T2
0	2.600	3.600	-1.000	0.00	0.00	0.00
15	2.912	3.782	-0.870	1.11	1.87	-0.76
30	3.381	4.004	-0.623	4.64	6.51	-1.87
45	4.333	4.333	0.000	18.77	18.77	0.00



Compare Cross Section Area T1 and T2



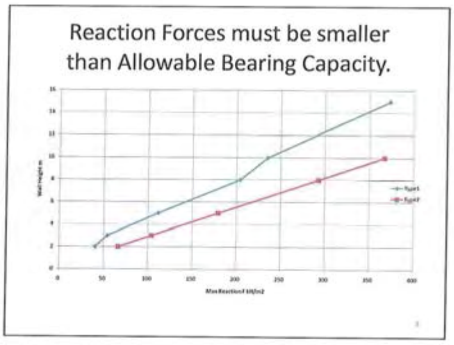
Type 1 needs larger additional height on slope ground than Type1 at same effective wall height



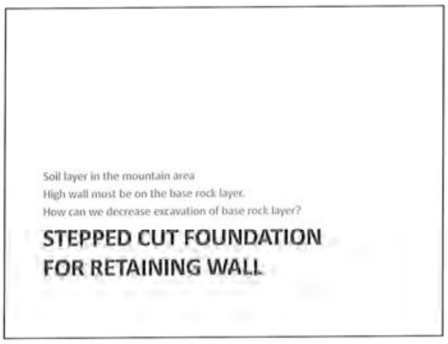
High wall H>5m must stands on the base rock layer because of B.C.

We've studied in this workshop series;

- High wall H>5m must stand on the base rock layer.
- Because clayey matrix layer even at the best condition in mountain area is 'stiff' level, therefore expected allowable B.C. is 100kN/m2.

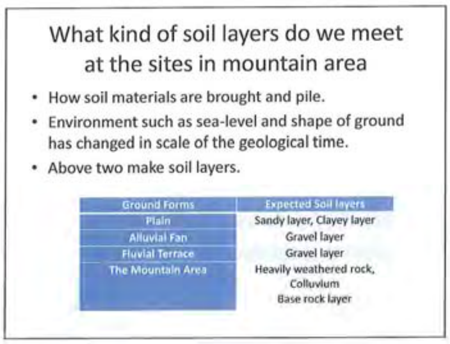


Reaction Forces must be smaller than Allowable Bearing Capacity.



Soil layer in the mountain area
High wall must be on the base rock layer.
How can we decrease excavation of base rock layer?

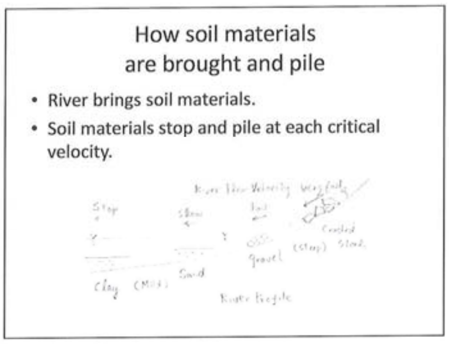
STEPPED CUT FOUNDATION FOR RETAINING WALL



What kind of soil layers do we meet at the sites in mountain area

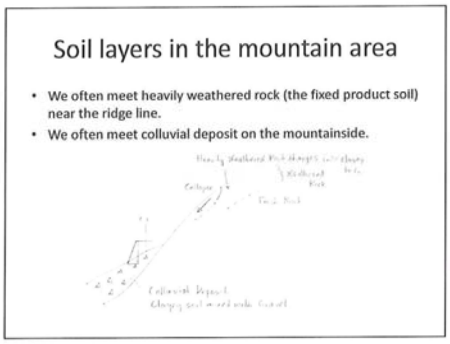
- How soil materials are brought and pile.
- Environment such as sea-level and shape of ground has changed in scale of the geological time.
- Above two make soil layers.

Ground Forms	Expected Soil layers
Plain	Sandy layer, Clayey layer
Alluvial Fan	Gravel layer
Fluvial Terrace	Gravel layer
The Mountain Area	Heavily weathered rock, Colluvium Base rock layer



How soil materials are brought and pile

- River brings soil materials.
- Soil materials stop and pile at each critical velocity.



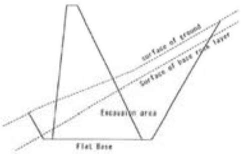
Soil layers in the mountain area

- We often meet heavily weathered rock (the fixed product soil) near the ridge line.
- We often meet colluvial deposit on the mountainside.

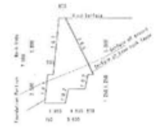
Huge Excavation can be solved by Stepped Cut Foundation

- Flat base requires huge excavation to realize base rock foundation in slope ground.
- This problem can be solved by stepped cut foundation.

Huge Excavation in case of flat base



Stepped cut foundation
Type 2 H=5m Base rock gradient 30deg.



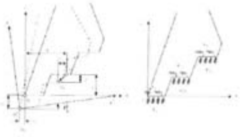
Stepped cut foundation
Type 2 H=5m Base rock gradient 45deg.

Stepped cut foundation
Type 2 H=8m Base rock gradient 30deg.

Stepped cut foundation
Type 2 H=5m Base rock gradient 45deg.

Calculation Methodology

- This problem is a statically-indeterminate problem
- Solved by displacement method
- Reaction forces are represented by discrete elastic springs.

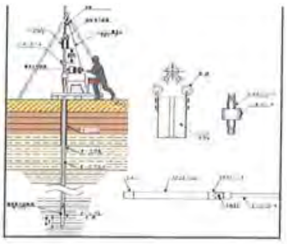


INVESTIGATION OF SOIL LAYER

Characteristics of Penetration Tests

	Standard Penetration Test (SPT)	Simplified Dynamic Cone Penetration Test	Swedish Sounding Test	Portable Cone Penetration Test	Prospect Rod for Soil Layer Strength Cone Penetration Test
Driving Method	Dynamic Hammering by Weight	Dynamic Hammering by Weight	Static Pushing by Weight and Turning by Hand	Static Pushing by Hand	Static Pushing by Hand
Power	Mechanical Power	Man power	Man power	Man power	Man power
Portability	Un-portable	30kgf / Set	More than 100kgf		4.5kgf / Set
Penetrator	Sampler φ51mm	Cone φ25mm	Screw-point φ33.3mm	Cone φ28.6mm	Cone φ25mm
Rod Diameter	φ40.5mm	φ16mm	φ19mm	φ16mm	φ10mm
Weight and Stroke	63.5kgf, 760mm	5kgf, 500mm	5,15,25,50,75,100kgf		
Unit Sensing Length	30cm, Pre Blow 15cm	10cm	25cm	Every 10cm	At the Point
Allowable Layer	All Soil Layer Except Gravel Layer	All Soil Layer Except Gravel Layer	All Soil Layer Except Gravel Layer	Clayey Layer	Soil Layer except Dense Sandy Layer
Maximum Depth	Limitless	15m	15m	5m	5m
Outcome	SPT-N: Number of hammering per 30cm penetration	N_d: Number of hammering per 10cm penetration	N_{sw}: Number of half revolution per 1m penetration	D: Pushing load q_c: Penetration resistance	W: Pushing load q_w: Penetration strength
Characteristics	King of penetration test So many past results Established outcome usage With boring	Downsized SPT	Common test for house foundation in Japan	Test only for soft soil layer	Good for slope investigation Multi use for Soil depth prospection Penetration test Shear strength test

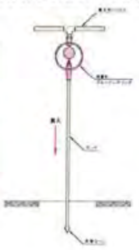
Standard Penetration Test



Simplified Dynamic Cone Penetration Test

Swedish Sounding Test

Portable Cone Penetration Test



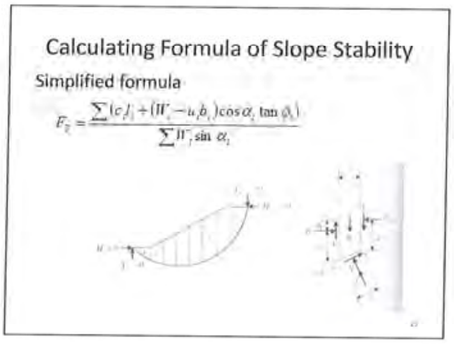
Prospect Rod for Soil Layer Strength

Multi Use of Prospect Rod for Soil Layer Strength

1. ① Soil layer depth prospection
2. ② Penetration test by spring load meter
3. ③ Shear strength test by dial torque wrench with vane cone

Slope stability calculation
Slope protection in Japan

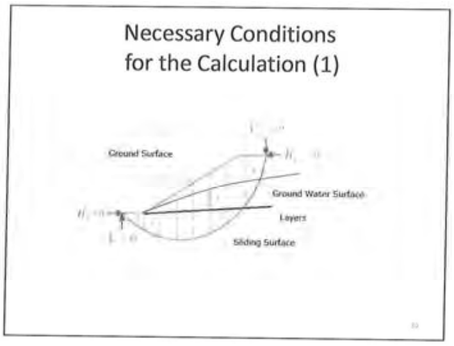
SLOPE PROTECTION



Calculating Formula of Slope Stability

Simplified formula

$$F_s = \frac{\sum\{c_i l_i + (W_i - u_i b_i)\cos\alpha_i \tan\phi_i\}}{\sum W_i \sin\alpha_i}$$



Necessary Conditions for the Calculation (1)

Necessary Conditions for the Calculation (2)

Soil characteristics

- Shear strength of sliding surface
  c: cohesion, ϕ: Internal friction angle
- Unit weight of sliding body
  γ_t : wet unit weight
  γ_{sat} : Saturated unit weight

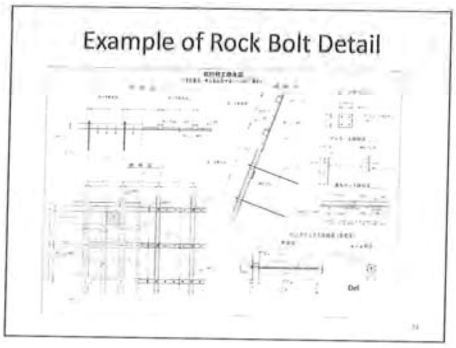
Required Investigation and Design Skill

- Surveying of the ground shape
- Prospecting of the soil layer depth

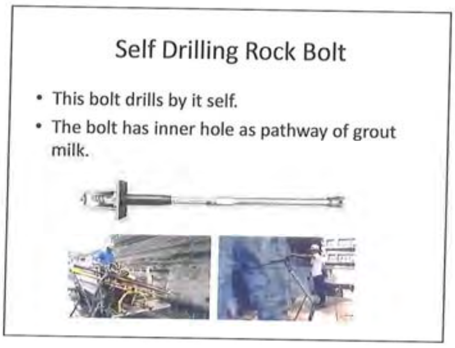
Slope collapse often occurs along bottom of the soil layer shallower than 2 meters

- Searching for shear strength of sliding surface
- Estimating for ground water influence
- Executing of slope stability calculation
- Designing of countermeasure

Methods shall be introduced against Slope Collapse



Example of Rock Bolt Detail



Self Drilling Rock Bolt

- This bolt drills by it self.
- The bolt has inner hole as pathway of grout milk.

Concrete Placing of Shotcrete Crib

Shotcrete Crib
Lateral Form and Spraying Machine

Required Construction Skill

- Drilling or boring 3 to 5m hole on the slope
- Keeping the drilled hole to insert the bolt
- Grouting to fix the bolt
- Treatment of bolt head
- Formwork on the slope
- Reinforcement bar arrangement on the slope
- Concrete placing on the slope

Attachment 5 Training Material
Workshop about the soil prospect Rod Dokenbo#1 on September 2017
Workshop about the soil prospect Rod Dokenbo#2 on September 2017

Workshop about the Soil Prospect Rod Dokenbo #1

How to use Dokenbo

How to record the result

CDRS 14th Sep. 2017

1 General Information of Dokenbo

- What is Dokenbo?

Equipment for Soil layer prospection consists of

1)Cone 2)Rod 450mm*1 3)Rod 500mm*9

4)Handle 5)Vane cone 6)Load meter

7)Dial torque wrench 8)Open-end wrench*2

9)Connection sleeve 10)Carry bag

Component of Dokenbo

Who developed?

Public Works Research Institute PWRI in Japan developed Dokenbo and got patent in Japan. Anyone can use Dokenbo but only permitted one can make Dokenbo.

2 Usage of Dokenbo

① Soil layer depth prospection

② Penetration test by spring load meter

③ Shear strength test by dial torque wrench with vane cone

3 Coverage of Dokenbo

3.1 Hardness of Soil

- Dokenbo covers soil layer.

SPT N<10～(15)

Plain	Alluvial layer
Mountain area	Colluvium
	Heavily weathered rock

What kind of soil layers can we use Dokenbo for in Plain

- Alluvial sandy layer Ordinary dence N=10 to 15.
- Alluvial clayey layer Ordinary N=4 to 8
- Diluvial clayey layer Stiff N=8 to 15

Ground Forms	Expected Soil layers
Plain	Sandy layer, Clayey layer
Alluvial Fan	Gravel layer
Fluvial Terrace	Gravel layer
The Mountain Area	Heavily weathered rock, Colluvium Base rock layer

How about Colluvium in Mountain Area

Colluvium ordinarily consists of gravel and matrix clayey soil.

Gravel is obstruction against penetration.

Stiffness of soil depends on water content.

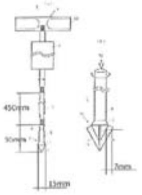
Heavily Weathered Rock in Mountain Area

The photo is example of heavily weathered rock in mountain area.
Rock mass is changing into gravel by weathering.
Gravel has kept its shape not changed into soil.

3.2 Coverage Depth

- Coverage depth is 5m from the surface.
- Main target of this equipment is prospection of shallow slope collapse less than 2m depth. 5m is very enough for the target.
- If movable layer is deeper than 5m, investigator shall adopt mechanical boring.

4 Detail Information of members
4.1 Cone and Special Rod



① Cone
② Vane cone
③ Special Rod
Apex angle of cone is 60deg.
Length of special rod is 450mm
Total of cone and SR is 500mm
Mass: Cone is 000kg
Vane cone is 000kg
Special rod is 000kg

Cone and Vane cone

4.2 Rods

Length is 500mm.
Diameter is 10mm.
Mass of one rod is 000kg.
Number of rods are 9.

4.3 Load Meter and Dial Torque Wrench

① Load Meter
② Dial Torque Wrench
Maximum load of LM is 300N (30.5kgf)
Maximum torque of DTW Is 7Nm (0.71kgfm)

⚠ 5 Most Important Caution

The rods connects each other by right-screw.
Therefore,

Never turn anticlockwise

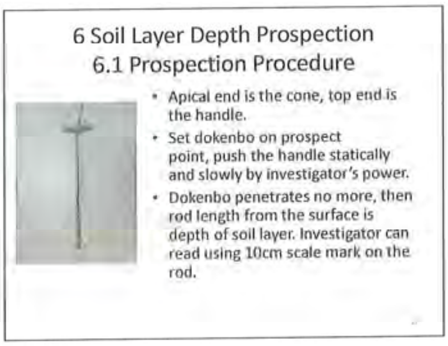
when the Dokenbo is in the soil layer.
If you do connection screw is released and apical end is lost in the soil layer.

⚠ Most Important Coution

Dokenbo is designed for static use.
Therefore,

Never hit top by hammer

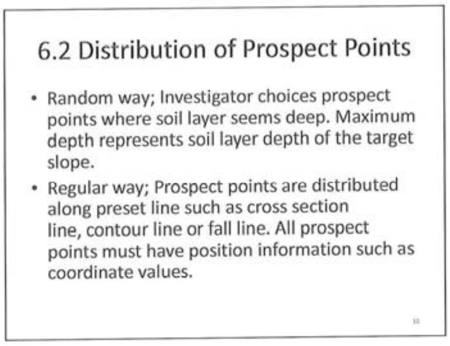
to penetration.
If you do Dokenbo would buckle up or get broken.



6 Soil Layer Depth Prospection

6.1 Prospection Procedure

- Apical end is the cone, top end is the handle.
- Set dokenbo on prospect point, push the handle statically and slowly by investigator's power.
- Dokenbo penetrates no more, then rod length from the surface is depth of soil layer. Investigator can read using 10cm scale mark on the rod.



6.2 Distribution of Prospect Points

- Random way; Investigator choices prospect points where soil layer seems deep. Maximum depth represents soil layer depth of the target slope.
- Regular way; Prospect points are distributed along preset line such as cross section line, contour line or fall line. All prospect points must have position information such as coordinate values.

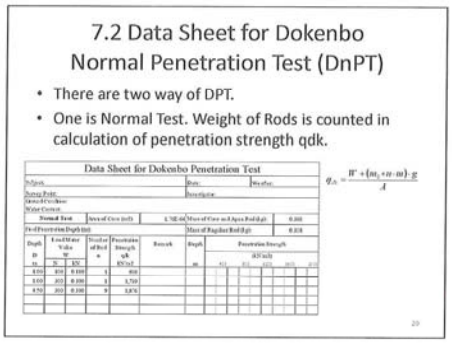
7 Soil Layer Penetration Test

7.1 Procedure of the Test

① Investigator penetrates Dokenbo till measurement depth.

② Investigator push Dokenbo through load meter slowly, when Dokenbo goes into action then investigator reads load meter.

③ Investigator fills data on 'Data Sheet for Dokenbo Penetration Test'.

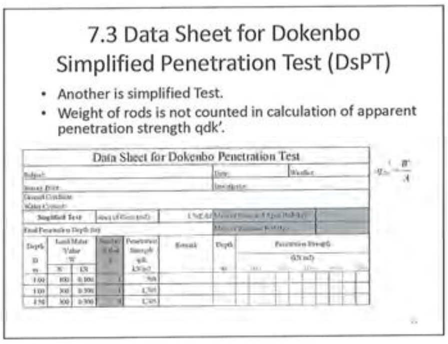


7.2 Data Sheet for Dokenbo Normal Penetration Test (DnPT)

- There are two way of DPT.
- One is Normal Test. Weight of Rods is counted in calculation of penetration strength qdk.

Data Sheet for Dokenbo Penetration Test

$$q_{dk} = \frac{W + (m_1 + n \cdot m) \cdot g}{A}$$

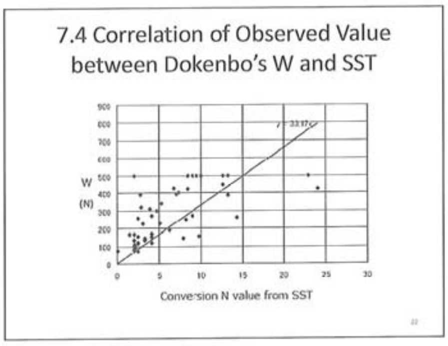


7.3 Data Sheet for Dokenbo Simplified Penetration Test (DsPT)

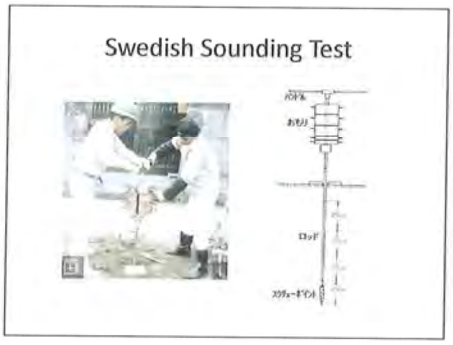
- Another is simplified Test.
- Weight of rods is not counted in calculation of apparent penetration strength qdk'.

Data Sheet for Dokenbo Penetration Test

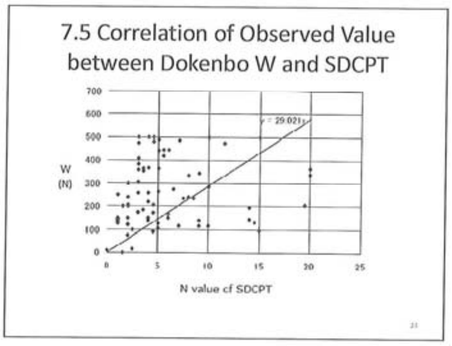
$$q_{dk}' = \frac{W'}{A}$$



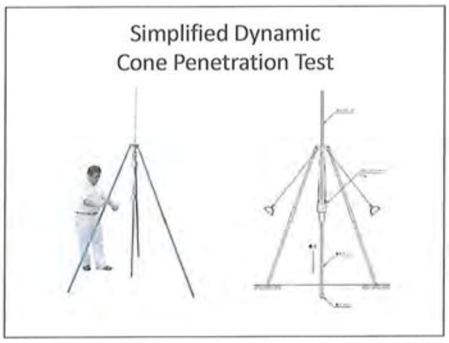
7.4 Correlation of Observed Value between Dokenbo's W and SST



Swedish Sounding Test



7.5 Correlation of Observed Value between Dokenbo W and SDCPT



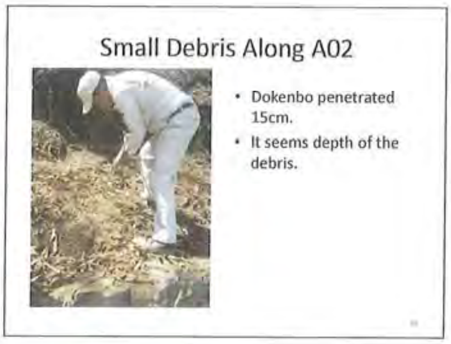
Simplified Dynamic Cone Penetration Test

8 Soil Layer Shear Strength Test

This Topic will be presented **next workshop** on 28th September.

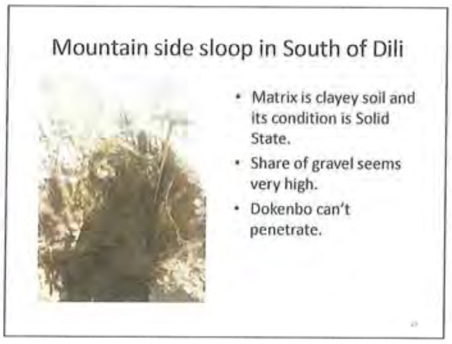
8 Finding Field for Practical Works Ex-Japan No.7

- Matrix is clayey soil and its condition is **Solid State**. Therefore Dokenbo can't penetrate.



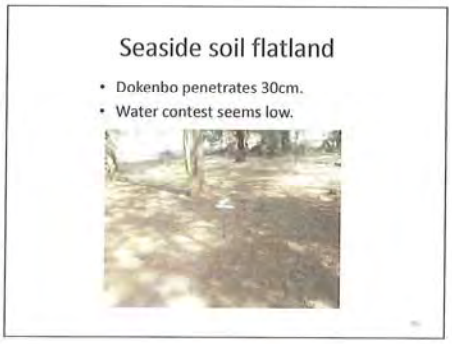
Small Debris Along A02

- Dokenbo penetrated 15cm.
- It seems depth of the debris.



Mountain side sloop in South of Dili

- Matrix is clayey soil and its condition is Solid State.
- Share of gravel seems very high.
- Dokenbo can't penetrate.



Seaside soil flatland

- Dokenbo penetrates 30cm.
- Water contest seems low.

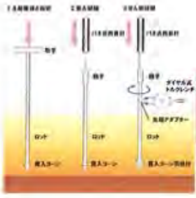
9 Postponement of Dokebo Practical works till Rain Season

- There is no adequate field for Dokenbo practical works near Dili in dry season.
- It can be said from opposite side, there is no sloop which can collapse in dry season near Dili.
- Practical works will be held on adequate field in coming November or December.
- Please make sure **the practical works on 19th and 21st September are cancelled.**

Workshop about
the Soil Prospect Rod
Dokenbo #2

Dokenbo Shear Strength Test
Slope Stability Calculation
CDRS 28th Sep. 2017

1. Usage of Dokenbo



① Soil layer depth prospection

② Penetration test by spring load meter

③ Shear strength test by dial torque wrench with vane cone

Today's Topic

---

2. Dokenbo Shear Strength Test DSST
2.1 Member Conpornent

① Vane cone and Apex rod

② Rods

③ Dial torque wrench

④ Load meter and connection sleeve

Vane cone

Load Meter
and Dial Torque Wrench

① Load Meter

② Dial Torque Wrench

Maximum load of LM is 300N (30.5kgf)

Maximum torque of DTW Is 7Nm (0.71kgfm)

3. Procedure of DSST (1)

① Investigator penetrates Dokenbo to target depth with vaneless cone.

② He turns Dokenbo slowly with dial torque wrench to clockwise under load mater indicates 0. Maximum value shall be recorded as Torque by skin friction (**T0**).

③ He replaces of cone for vane cone.

④ He sets same depth and adds some load to penetrate vane only into the soil.

---

3. Procedure of DSST (2)

⑤ He loads vertical planned load **Wi** through load mater.

⑥ He turns Dokenbo slowly with dial torque wrench to clockwise under load mater indicates **Wi**. Maximum value shall be recorded as Torque **Ti**.

⑦ He pulls Dokenbo out and checks condition of vane cone.

⑧ He writes remark such as attached soil and smooth rotation or stepped one and so on.

3. Procedure of DSST (3)

⑨ He repeats procedure from ④ to ⑧ under difference vertical load 3 times. Then he gets 4 sets of **Wi** and **Ti**. While this procedure he must change testing depth a little deeper because to get fresh testing soil.

4. Data Sheet for DSST Empiric Formula Way

- There are two ways of organizing of test result.
- One is Empiric Formula way.

$$\sigma = 2.4\times10^{2}\cdot W_{TC}$$
$$\tau = 1.5\times10^{4}\cdot T_{TC}$$
$$W_{TC} = W + (m_0 + n\cdot m)\cdot g$$
$$T_{TC} = T - T_0$$

c_{di}': Cohesion by Empiric Formula

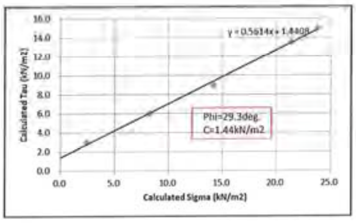
ϕ_{di}': Internal Friction Angle by Empiric Formula

4. Data Sheet for DSST Empiric Formula Way

Data Sheet for Dokenbo Shear Strength Test

Subject	CDRS				Date	13-Sep-17		Weather	Fine
Survey Point		STA15+055			Investigator		Kenji Minegishi		
Ground Condition Water Content		Colluvium, Gravel rich Matrix is clayey soil, Plastic state							
Empiric Formula		Height of Vane (m)	7.00E-03		Mass of Vane Cone and Apex Rod (kg)				0.310
Final Test Depth (m)		1.2			Mass of Regular Rod (kg)				0.308
Depth D	Load Meter Value W	Number of Rod n	Vertical Load on Vane Wvc	Torque by Skin T0	Dial Torque Wrench T	Torque on Vane Tvc	Calculated Normal Stress Sigma	Calculated Shear Stress Tau	Remark
m	N		kN	Nm	Nm	kNm	kN/m2	kN/m2	
1.00	1	2	0.010	0.0	0.2	0.0002	2.4	3.0	Clayey Soil
1.05	25	2	0.034	0.0	0.4	0.0004	8.2	6.0	Clayey Soil
1.10	50	2	0.059	0.0	0.6	0.0006	14.2	9.0	Clayey Soil
1.15	80	2	0.089	0.0	0.9	0.0009	21.4	13.5	Clayey Soil
1.20	90	2	0.099	0.0	1.0	0.0010	23.8	15.0	Clayey Soil

5. Shear Strength by Empiric Formula (1)



5. Shear Strength by Empiric Formula (2)

① Investigator makes chart of Sigma and Tau.
② He makes linear regression formula.
③ Y-intercept is **Cohesion**.
④ Gradient is tangent Phi.
⑤ Phi is **Internal friction angle**.

6. Data Sheet for DSST Correlation Formula Way (1)

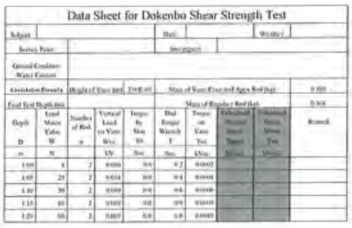
- Another is Correlation Formula way.

$$W_{TC} = W + (m_0 + n\cdot m)\cdot g$$
$$T_{TC} = T - T_0$$

c_{di} : Cohesion by Correlation Formula

ϕ_{di} : Internal Friction Angle by Correlation Formula

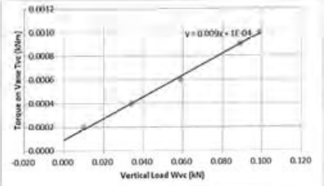
6. Data Sheet for DSST Correlation Formula Way (2)



Data Sheet for Dokenbo Shear Strength Test

Subject					Date			Weather	
Survey Point					Investigator				
Ground Condition Water Content									
Correlation Formula		Height of Vane (m)	[illegible]		Mass of Vane Cone and Apex Rod (kg)				[illegible]
Final Test Depth (m)					Mass of Regular Rod (kg)				[illegible]
Depth D	Load Meter Value W	Number of Rod n	Vertical Load on Vane Wvc	Torque by Skin T0	Dial Torque Wrench T	Torque on Vane Tvc	[illegible]	[illegible]	Remark
m	N		kN	Nm	Nm	kNm	[illegible]	[illegible]	
1.00	1	2	[illegible]	[illegible]	0.2	0.0002			
1.05	25	2	0.034	[illegible]	0.4	[illegible]			
1.10	50	2	[illegible]	[illegible]	0.6	[illegible]			
1.15	80	2	[illegible]	0.0	0.9	[illegible]			
1.20	90	2	[illegible]	0.0	1.0	[illegible]			

7. Shear Strength by Correlation Formula (1)



7. Shear Strength by Correlation Formula (2)

① Investigator makes chart of Wvc and Tvc.
② He makes linear regression formula, and gets y-intercept and gradient of the line.
③ On the other hand, this way needs Cohesion c and Internal Friction Angle Fai from **triaxial compressive CU test** using **undisturbed sample** of same point by mechanical boring.
④ One couple of y-intercept and cohesion c, and one couple of gradient and friction angle Fai are got through this procedure.

7. Shear Strength by Correlation Formula (3)

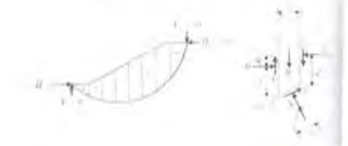
⑤ He needs **3 couples of data at least** to advance next step.
⑥ He makes chart of y-intercept and c.
⑦ He makes linear regression formula.
⑧ He can change y-intercept to c through the formula.
⑨ He makes chart of gradient and tangent Fai.
⑩ He can change gradient to Fai same way.

SLOPE STABILITY CALCULATION

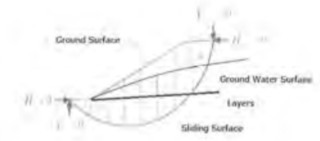
Calculating Formula of Slope Stability

Simplified formula

$$F_s = \frac{\sum \left(c_i l_i + (W_i - u_i b_i)\cos\alpha_i \tan\phi_i\right)}{\sum W_i \sin\alpha_i}$$



Necessary Conditions for the Calculation (1)



Necessary Conditions for the Calculation (1 rest)

- Caster can survey Ground Surface.
- Shallow slope collapse often occurs within one layer. Therefore he doesn't need deeper layers information in many cases. He needs to know collapse depth.
- Rain triggers slope collapse. However we cannot know groundwater condition just on time. He needs to estimate the groundwater surface.
- All saturated condition (Groundwater surface is as same as ground surface) is useful estimation.

Necessary Conditions for the Calculation (2)

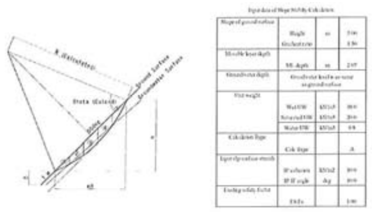
Soil characteristics

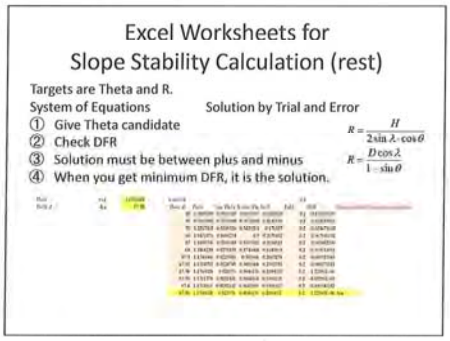
- Shear strength of sliding surface
  c: cohesion, ϕ: Internal friction angle
- Unit weight of sliping body
  γ_t : wet unit weight
  γ_{sat} : Saturated unit weight

Necessary Conditions for the Calculation (2 rest)

- Values of wet unit weight are not widely distributed. Caster can set it 17 to 19 kN/m3.
- Saturated unit weight can be set 19 to 21 kN/m3 same as above.
- In contrast it is very difficult and fine issue to set shear strength of slip surface. It seems a kind of mission impossible. Caster must pay maximum attention to this issue. DSST gives him not the answer but a hint for this issue.

Excel Worksheets for Slope Stability Calculation





Excel Worksheets for Slope Stability Calculation (rest)

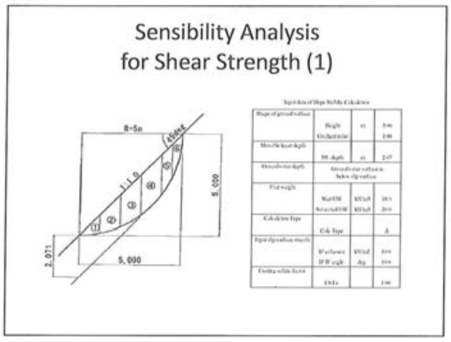
Targets are Theta and R.

System of Equations   Solution by Trial and Error

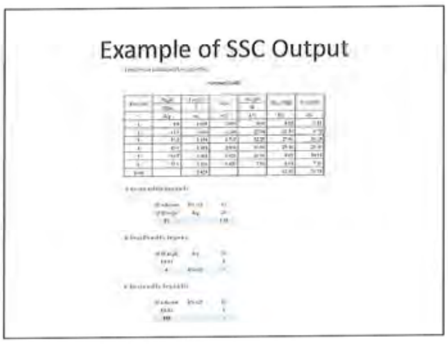
① Give Theta candidate
② Check DFR
③ Solution must be between plus and minus
④ When you get minimum DFR, it is the solution.

$$R = \frac{H}{2\sin\lambda \cdot \cos\theta}$$

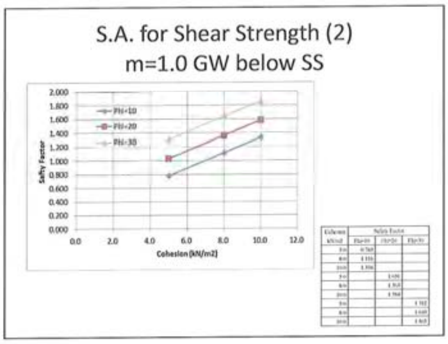
$$R = \frac{D\cos\lambda}{1-\sin\theta}$$



Sensibility Analysis for Shear Strength (1)

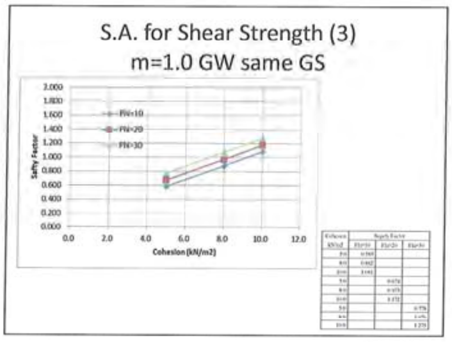


Example of SSC Output



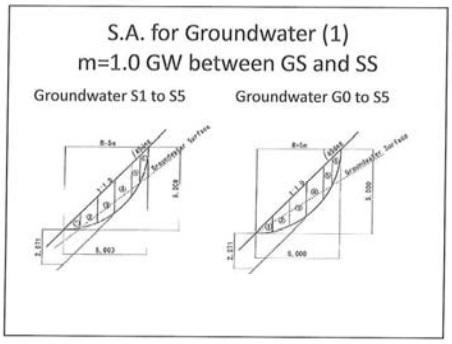
S.A. for Shear Strength (2)

m=1.0 GW below SS



S.A. for Shear Strength (3)

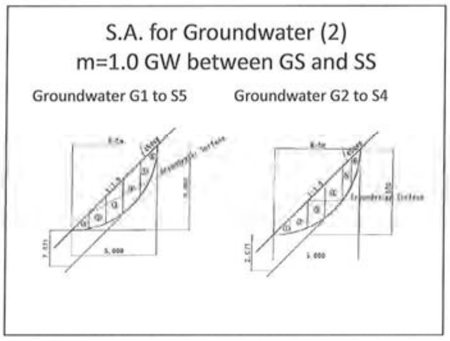
m=1.0 GW same GS



S.A. for Groundwater (1)

m=1.0 GW between GS and SS

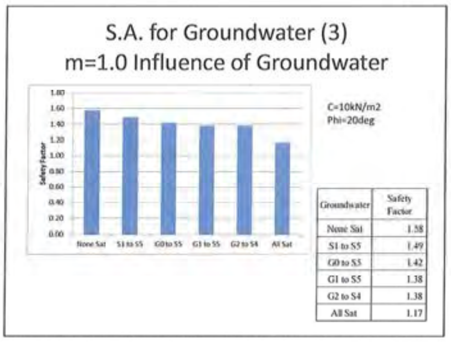
Groundwater S1 to S5   Groundwater G0 to S5



S.A. for Groundwater (2)

m=1.0 GW between GS and SS

Groundwater G1 to S5   Groundwater G2 to S4

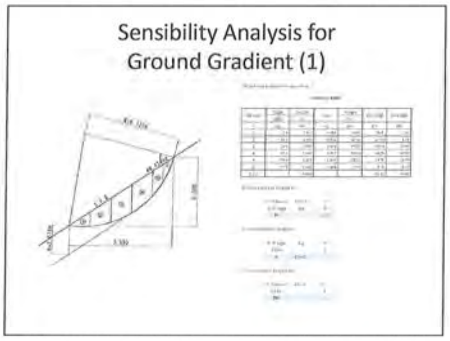


S.A. for Groundwater (3)

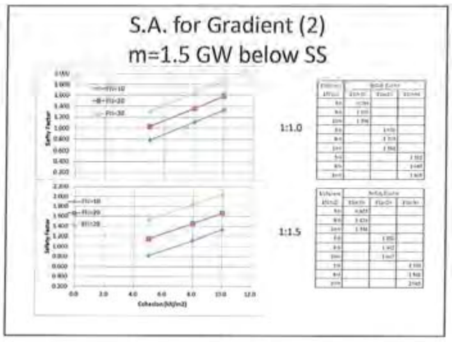
m=1.0 Influence of Groundwater

C=10kN/m2
Phi=20deg

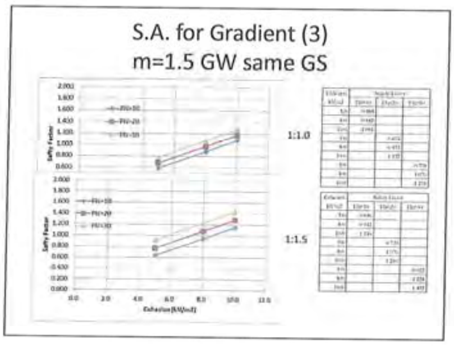
Groundwater	Safety Factor
None Sat	1.58
S1 to S5	1.49
G0 to S5	1.42
G1 to S5	1.38
G2 to S4	1.38
All Sat	1.17



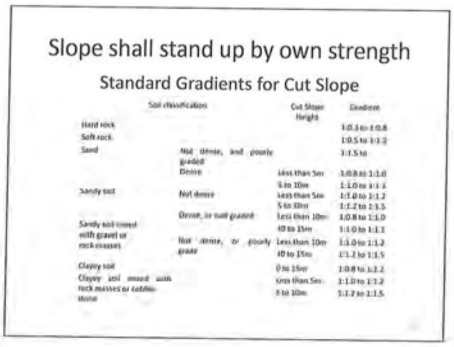
Sensibility Analysis for Ground Gradient (1)



S.A. for Gradient (2) m=1.5 GW below SS



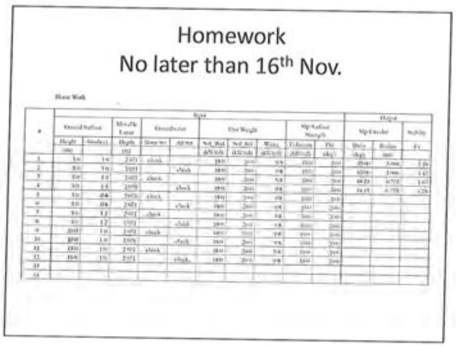
S.A. for Gradient (3) m=1.5 GW same GS



Slope shall stand up by own strength

Standard Gradients for Cut Slope

Soil classification		Cut Slope Height	Gradient
Hard rock			1:0.3 to 1:0.8
Soft rock			1:0.5 to 1:1.2
Sand	Not dense, and poorly graded		1:1.5 to
	Dense	Less than 5m	1:0.8 to 1:1.0
Sandy soil		5 to 10m	1:1.0 to 1:1.2
	Not dense	Less than 5m	1:1.0 to 1:1.2
		5 to 10m	1:1.2 to 1:1.5
Sandy soil mixed with gravel or rock masses	Dense, or well graded	Less than 10m	1:0.8 to 1:1.0
		10 to 15m	1:1.0 to 1:1.2
	Not dense, or poorly grade	Less than 10m	1:1.0 to 1:1.2
		10 to 15m	1:1.2 to 1:1.5
Clayey soil		0 to 10m	1:0.8 to 1:1.2
Clayey soil mixed with rock masses or cobble stone		Less than 5m	1:1.0 to 1:1.2
		5 to 10m	1:1.2 to 1:1.5



Homework No later than 16th Nov.

Attachment 6

Record Observation for Safety Patrol (2) at Upriver Comoro Bridge on September 2017

20 September, 2017

Record of Observation for Safety Patrol (2) at upriver Comoro Bridge

For Case Study on Reconstruction Road of Ex Japan (Ex Japan Road) and other sites

DRBFC working group and JICA Expert Team
Johji Koizumi, Road Construction Supervision

This is record of the Lecture of Safety Patrol (2) at upriver Comoro Bridge held on 19 September, 2017 for our reference and further our activities.

1. Agenda of the Patrol

1) Time and Date : 9:30 – 10:45, Tuesday 19 September, 2017

2) Outline of the project: Bridge: 6 Span Continuous PC Box Girder Bridge.
Length= 250m, Span=33.7m + 4@45m + 33.7, Width=11.55m
Access Road: Total length 3.2 km, 2 lanes, Asphalt Concrete

3) Joint Site Inspection: Under construction Drainage works, Road works and PC Girder work site

4) Discussion for safety: Discussing and pointing out the room for improvement for Safety, including safety instructions to the Contractor

2. Objective points for Observation and Learnings

2-1 Objective points for Observation

1) Who organize the Safety Patrol → the Contractor and the Supervising (SV) Consultant (Resident Engineer)

2) How to Jont Inspection/instruction → finding/pointing out at the site inspection and summarize the instructions at the meeting room → write down on White Board and make minutes

3) How to Feed back to the site →reviewing record and check the previous Patrol result

2-2 Laerning

To carry out "Safety Patrol" at DRBFC direct supervising site, DRBFC have intiative to organize and conduct such "Safety Patrol" in order to minimize the construction accidents and worker's injury at the DRBFC contruction sites, with the training/instructions to their contractors..

Attachment

1. Attendance List of Observation for Safety Patrol (2) at upriver Comoro Bridge
2. Photos of Safety Patrol for Inspection and discussion on 19 September, 2017
3. Briefly Introduction Trial Pavement

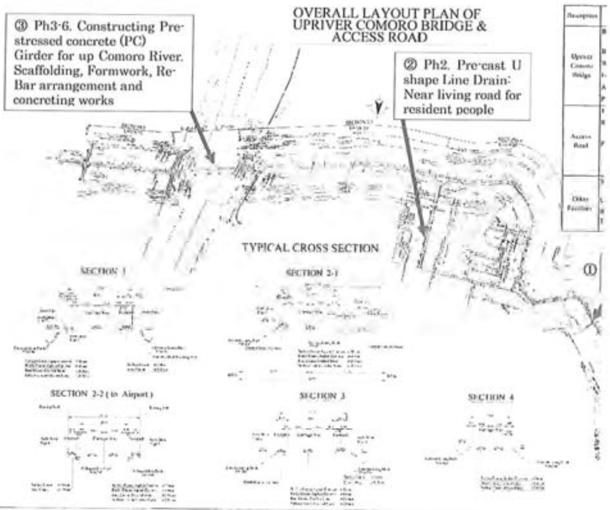
Attendance List

ATTENDANCE LIST

Date : 19 September 2017
Subject : Observation for safety Patrol
Venue : Meeting Place at the junction Nicolau Lobato/ Acces Road (near Mary Statue) and upriver Comor

No.	Mr/Ms	Name	Affiliation/Duty	Department	E-mail
1	[✓ Mr]/Ms	Matsuyama Hideaki		JICA	
2	[✓ Mr]/Ms	Profirio F. Xavier		JICA	
3	[✓ Mr]/Ms	Yuji Wakamatsu		TOBISHIMA	
4	[✓ Mr]/Ms	Hirono		CTL	
5	Mr/Ms	Zelia Costa		Consultant	
6	Mr/Ms	Altino F da Costa		MoPTC/EPCC	
7	Mr/Ms	Rogerio da costa F.		EPCC	
8	Mr/Ms	MANUEL SOARES		EPCC	
9	Mr/Ms	Francisco B. Gama		EPCC	
10	Mr/Ms	Lourenco Luis		—u—	
11	[✓ Mr]/Ms	Mitsuo. FUJIO		In-service	
12	Mr/Ms	Angelo Ribeiro		EPCC	
13	[✓ Mr]/Ms	Johji KOIZUMI	Road Construction Supervision	JICA CDRS Project	
14	[✓ Mr]/Ms	Celestino E - Ximenes		Highway Dept	
15	Mr/Ms	Fernando F. P.C. Freitas		—u—	
16	Mr/Ms	Pedro Corte Real Noronha		Manutencão EPCC	
17	Mr/Ms	LETICHIA S. A. BARRETO		CDRS Project	

Location of inspection on the Patorol



Photos of Safety Patrol (2) Attachment #2.


Photo-1 Inspect the line Drainage in-situ concrete at the access road


Photo-2 Check the third party safety beside the line Drain with precast U-Drain. Need more precaution post, especial children


Photo-3 Many heavy machine are moving at the In-situ PC concrete Girder construction site


Photo-4 At Re-bar arrangement, formwork and concreting are going on in the Girder. More safety fence at the end point is instructed.


Photo-5 Safety measure for scaffolding and fence on the formwork can be seen on the Girder construction site

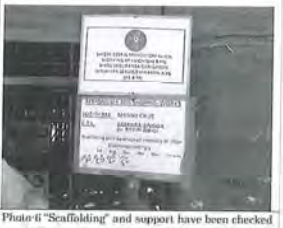
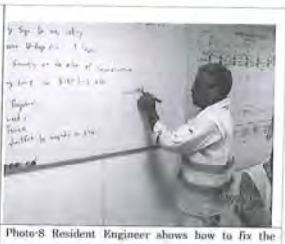


Photo-6 "Scaffolding" and support have been checked regularly by the Contractor and its records are described on the Board

	
Photo-7 Dangerous points and safety measures are discussed among the participants of the Patrol: 1) Safety Pole, Barricade should be installed without any lack 2)Fix barricade strongly at the end of superstructure and other matters	Photo-8 Resident Engineer shows how to fix the counter-measures for falling down from superstructure.

3. Briefly Introduction Trial Pavement

Attachment #3.

3-1 Photo of preparation for Trial Pavement on 19 September 2017

	
Photo-9 Survey formation level and setting guide gage and spreading prime coat and other preparation works were made at existing road near by Project site.	Photo-8 Resident Engineer shows how to fix the counter-measures for falling down from superstructure.

See Attachment 3-2: "Method of Statement for Trial Pavement" prepared by TPBISHIMA Corporation (separate PDF)

Attachment 7
UAV Aerial Photo Survey on July 2017

UAV Aerial Photo Survey

13 July 2017

Table of Contents

1. What is UAV Aerial Photo Survey
2. Procedures of Survey
3. Equipment
4. UAV Survey Result

- 1. What is a UAV Aerial Photo Survey

1. What is UAV Aerial Photo Survey

Taking aerial photos on target structures / terrains

→ Making

3D models, Ortho(projected)-photos, Digital elevation models

And use Slope maps, Stereo-pair photo, Anaglyph, Cross-section

- 2. Procedures UAV Survey

2.Procedures of UAV Survey

2.1 Preparation and Planning (at office)

1Day～1Month

2.2 Field Survey (at the site)

1Day～3Days

2.2 Analyzing (at office)

1Week～1Month

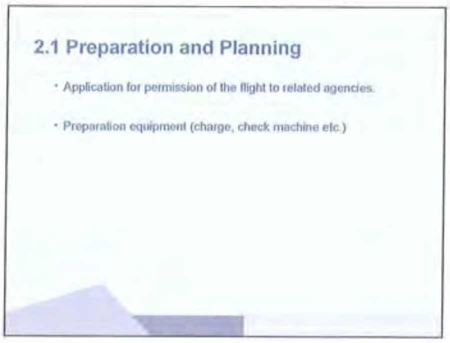
2.1 Preparation and Planning

- Planning flight route

Set area to take aerial photo at satellite map

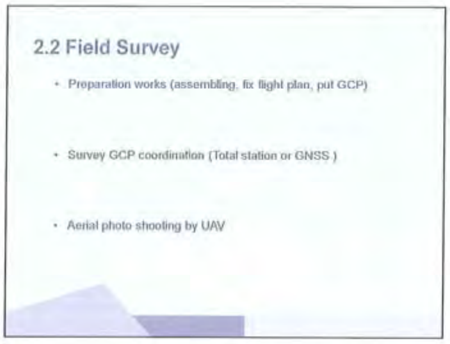
Set flight data (flight speed, flight altitude, etc.) and generate flight route

2.1 Preparation and Planning



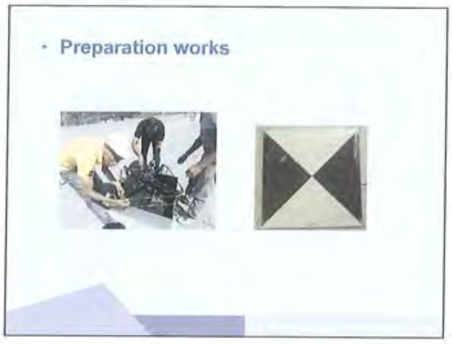
2.1 Preparation and Planning

- Application for permission of the flight to related agencies.
- Preparation equipment (charge, check machine etc.)

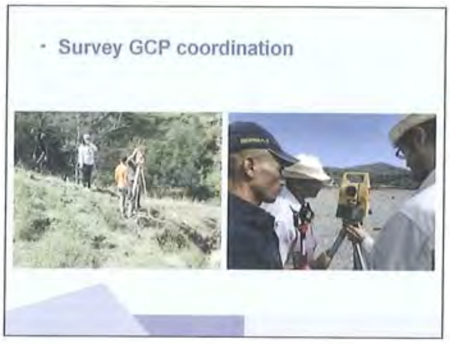


2.2 Field Survey

- Preparation works (assembling, fix flight plan, put GCP)
- Survey GCP coordination (Total station or GNSS)
- Aerial photo shooting by UAV

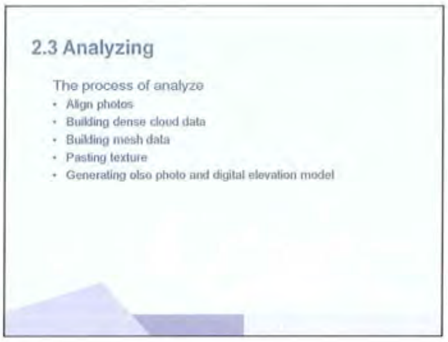


- Preparation works



- Survey GCP coordination

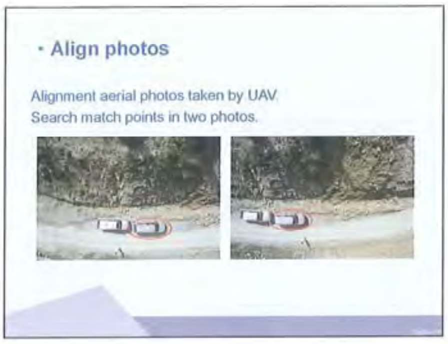
- Aerial photo shooting by UAV



2.3 Analyzing

The process of analyze

- Align photos
- Building dense cloud data
- Building mesh data
- Pasting texture
- Generating olso photo and digital elevation model

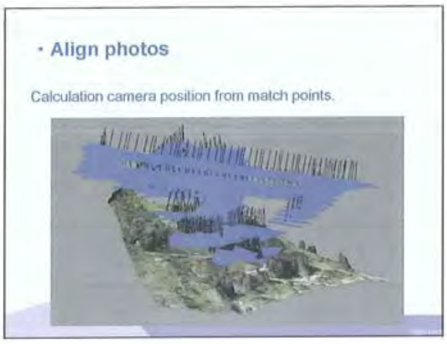


- Align photos

Alignment aerial photos taken by UAV.
Search match points in two photos.

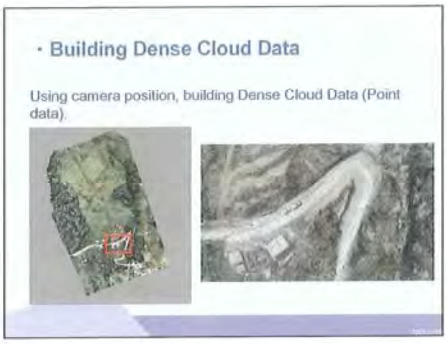
- Align photos

Calculation camera position from match points.



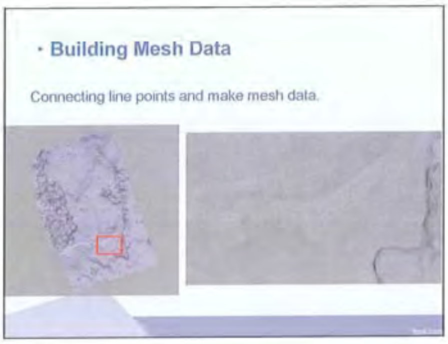
• Align photos

Calculation camera position from match points.



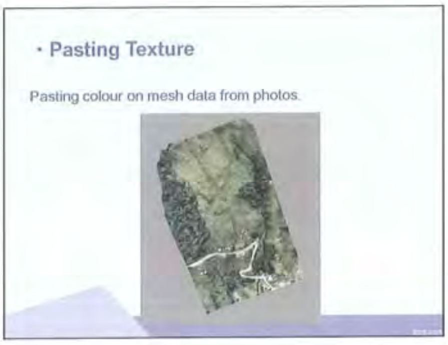
• Building Dense Cloud Data

Using camera position, building Dense Cloud Data (Point data).



• Building Mesh Data

Connecting line points and make mesh data.



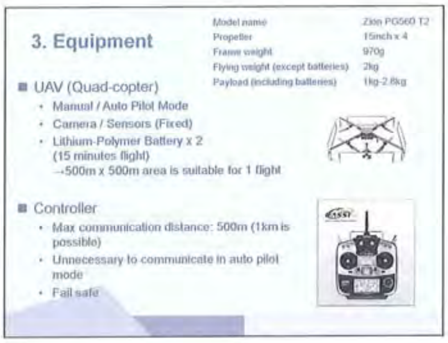
• Pasting Texture

Pasting colour on mesh data from photos.

• Generating olso photo and DEM

Generating olso photo from mesh.

• 3. Equipment



3. Equipment

Model name	Zion PG560 T2
Propeller	15inch x 4
Frame weight	970g
Flying weight (except batteries)	2kg
Payload (including batteries)	1kg-2.8kg

- UAV (Quad-copter)
  - Manual / Auto Pilot Mode
  - Camera / Sensors (Fixed)
  - Lithium-Polymer Battery x 2 (15 minutes flight) →500m x 500m area is suitable for 1 flight
- Controller
  - Max communication distance: 500m (1km is possible)
  - Unnecessary to communicate in auto pilot mode
  - Fail safe

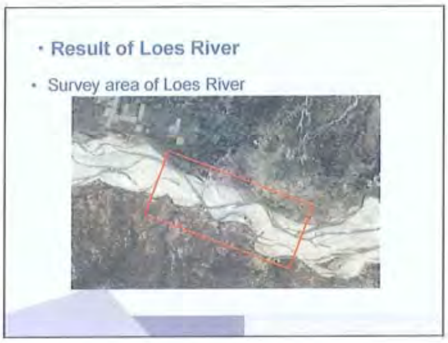
3. Equipment

- Flight planner and telemetry (Mission Planner)
  - Fight track will be planned on Google Satellite Map, then exported to UAV
  - Real-time flight information monitoring via USB antenna (height, velocity, voltage etc.)
  - When detecting trouble, UAV can return to the landing point automatically
  - Density of the flight tracks depends on the camera angle and flight height
  - Flight commands of each waypoint can be modified (velocity, height, etc.)

- 4. UAV Aerial Survey Result

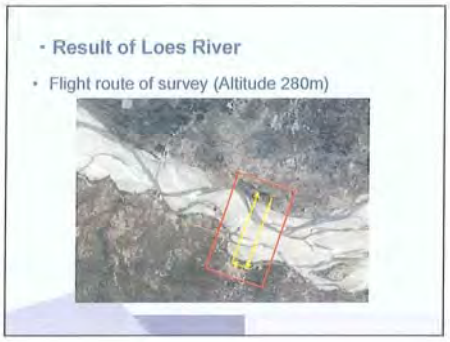
4. UAV Aerial Survey Result

- Loes River
- Aituto Landslide



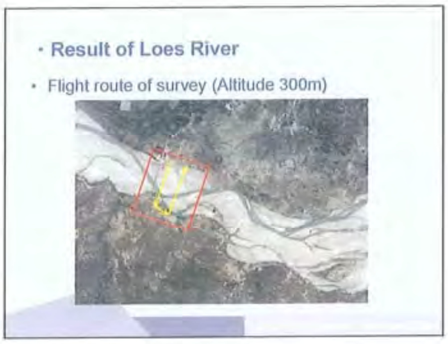
- Result of Loes River
- Survey area of Loes River

- Result of Loes River
- Flight route of survey (Altitude 300m)

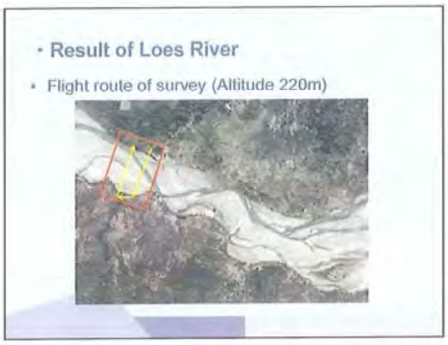


- Result of Loes River
- Flight route of survey (Altitude 280m)

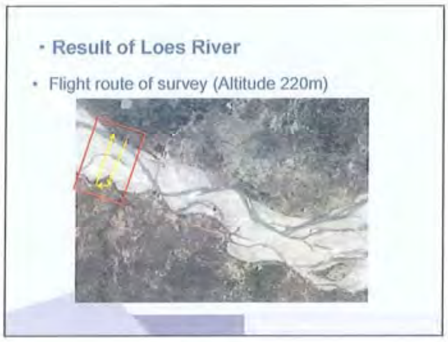
- Result of Loes River
- Flight route of survey (Altitude 300m)



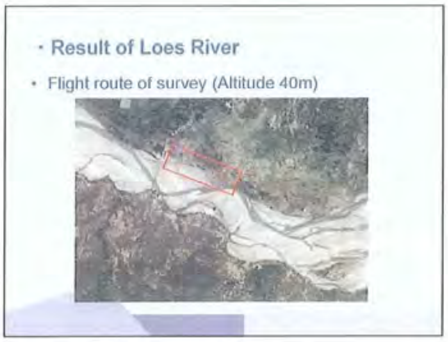
- Result of Loes River
- Flight route of survey (Altitude 300m)



- Result of Loes River
- Flight route of survey (Altitude 220m)

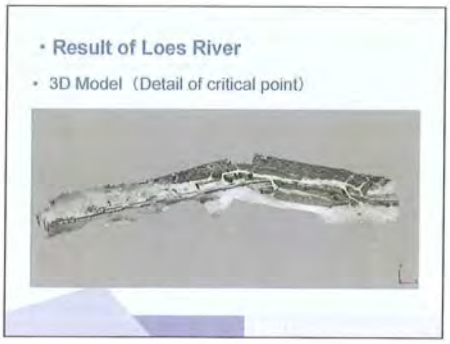


- Result of Loes River
- Flight route of survey (Altitude 220m)

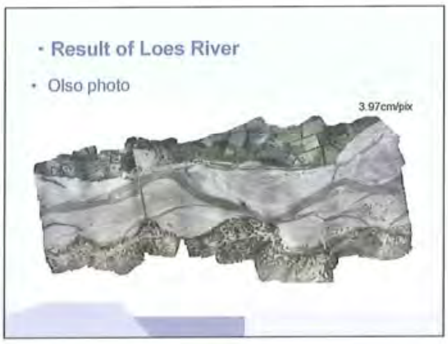


- Result of Loes River
- Flight route of survey (Altitude 40m)

- Result of Loes River
- 3D Model

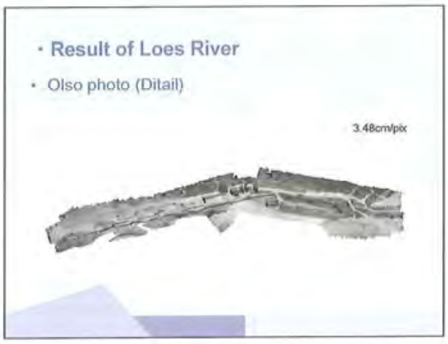


- Result of Loes River
- 3D Model（Detail of critical point）



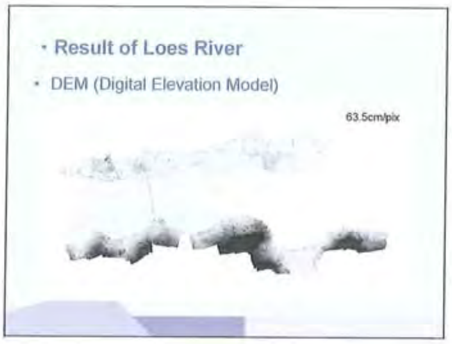
- Result of Loes River
- Olso photo

3.97cm/pix



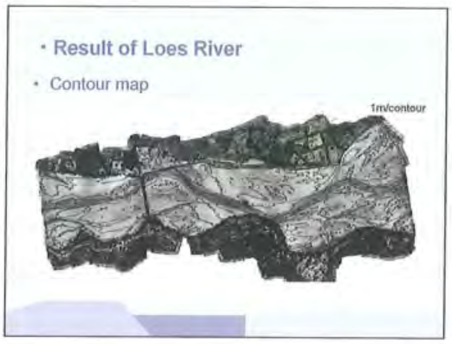
- Result of Loes River
- Olso photo (Ditail)

3.48cm/pix



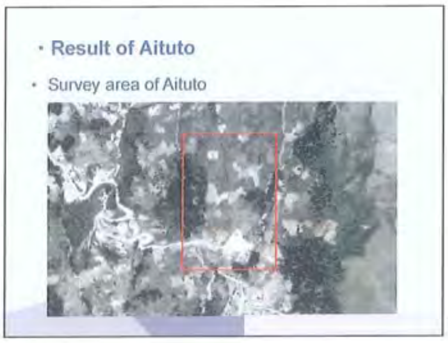
- Result of Loes River
- DEM (Digital Elevation Model)

63.5cm/pix



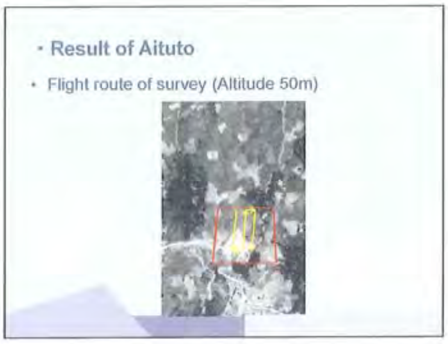
- Result of Loes River
- Contour map

1m/contour



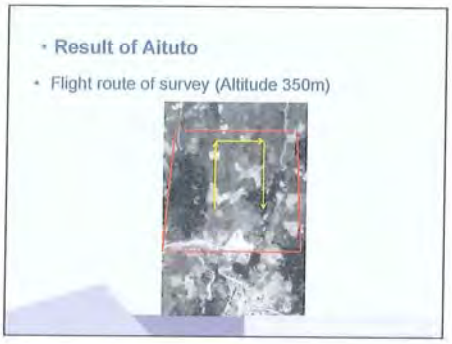
Result of Aituto

- Survey area of Aituto



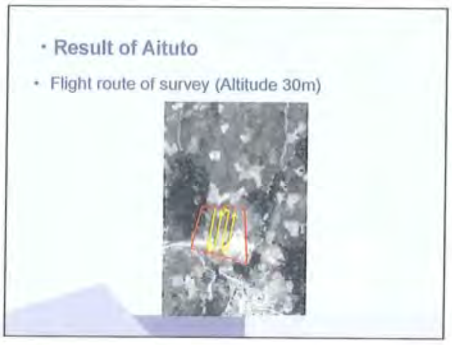
Result of Aituto

- Flight route of survey (Altitude 50m)



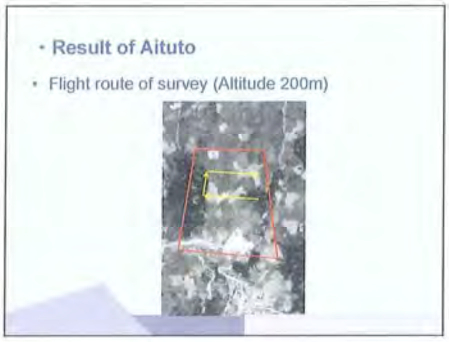
Result of Aituto

- Flight route of survey (Altitude 350m)



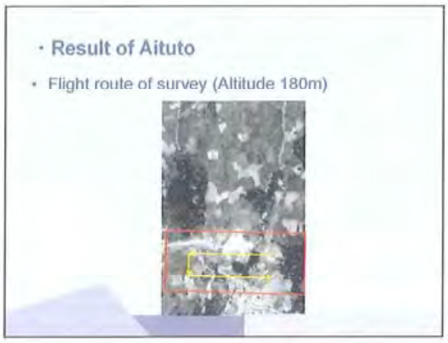
Result of Aituto

- Flight route of survey (Altitude 30m)



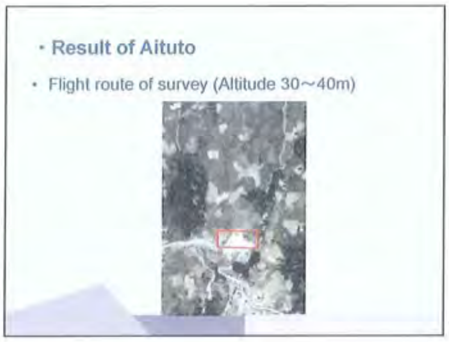
Result of Aituto

- Flight route of survey (Altitude 200m)



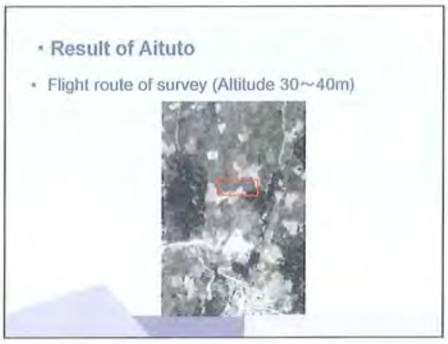
Result of Aituto

- Flight route of survey (Altitude 180m)



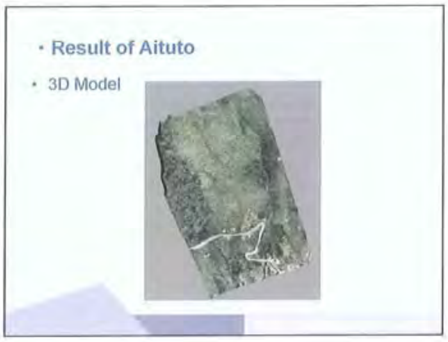
Result of Aituto

- Flight route of survey (Altitude 30～40m)



Result of Aituto

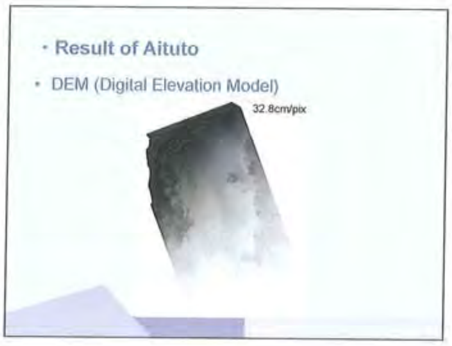
- Flight route of survey (Altitude 30～40m)



- Result of Aituto
  - 3D Model

- Result of Aituto
  - Olso photo

2.06cm/pix



- Result of Aituto
  - DEM (Digital Elevation Model)

32.8cm/pix

- Result of Aituto
  - Contour map

1m contour

Thank you for listening