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*Material for Steering Committee
for the Study*

(4) Scope of This Progress Report (1)

- To compile all the **Basic Study** results in 1st Work in Lao P.D.R. conducted from December 2001 to March 2002

Main Contents of P/R(1) for Today's Discussion

- 1) Introduction
- 2) Present Condition in the Study Area
- 3) Preparatory Study for Pilot Works
 - Facility Design
 - Construction Plan
- 4) Field Survey and Investigation for Pilot Works Conducted by Local Contractors
- 5) Program of 1st Technical Transfer Seminar in October 2002 (tentative)

2. PRESENT CONDITION IN THE STUDY AREA

(1) Riverbank Condition in the Study Area (around Vientiane Municipality)

1) Characteristics of the Mekong River in the Study Area

- Average riverbed slope: 1/8,100
- Average maximum channel depth: 14.87 m
- Average river width: 773 m (excluding islands)
- Average annual maximum water level: 10.68 m
- Average annual minimum water level: 0.43 m
- Riverbed materials: 0.44 mm (average of d60), specific gravity: 2.61

2) Riverbank condition

- Severely eroded bank form **vertical cliffs** mostly.
- The riverbanks seem younger and sediment movements are active.
- Geological formation: generally sandy gravel layer covered with of 6-8 m deep clayey soil. These materials are not consolidated and easily be eroded.
- Bank protection works commonly used are **gabion works**. The existing works are effective to protect the riverbank from erosion, though some works are damaged due to poor foot protection.



3) Riverbank alignments and islands

- During past 30 years, changes in riverbanks are not much as a whole, and the islands remained almost at the same location.
- The bank erosions are mainly caused by the attacking river flows and the reaches of flow attacks are historically fixed.
- Average intervals of meandering cycle: about 8.5 km (about 10 times of river width)

4) Sediment flow conditions (preliminary estimation)

- The dune bed under the frequent flood flow conditions may shift to the flat bed condition under the bankful flow condition.
- Sediment transport: Suspension not fully developed

5) Causes of bank erosion

- Due to **scouring at foot of riverbed** (Most of the eroded vertical riverbank cliffs are of this type)
- Due to lowering river water level
- Due to slope failure

(2) Riverbank Condition of Whole Mekong River in Lao P.D.R.

1) Southern part (Vientiane - Khong fall)

- Vertical cliffs of riverbanks commonly seen in the Study Area are seldom found.

1) Southern part (Vientiane-Khong fall)

- Wat Phu remain (Champasak province)
 - A part of the remnants of exterior wall of Wat Phu located at the eroded riverbank is now under constant threat of collapse.
 - Revetment works covering whole bank is not recommendable in view of the conservation and archaeological prospecting of remains.
 - Groin works might be effective to stabilize the bank by accelerating the sedimentation and vegetation at the foot of eroded bank.

Mekong Riverbank near Wat Phu Remain



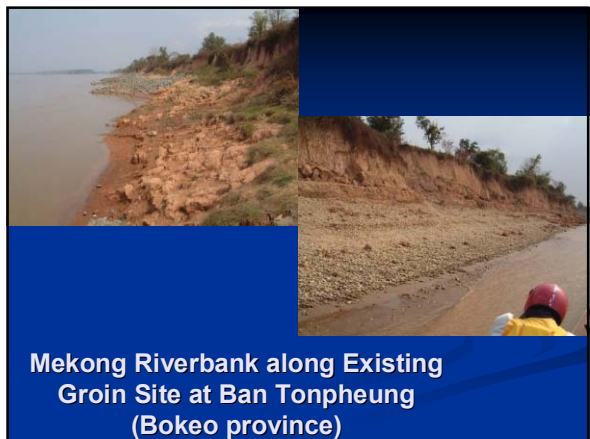
2) Northern part of whole Mekong River (Vientiane – Bokeo)

- In Luang Phabang city
 - Riverbanks are rather stable and keep some gentle slope.
 - The extent and damage of erosion is relatively small.



2) Northern part of whole Mekong River (Vientiane – Bokeo)

- In Bokeo province, the riverbanks, most notably existing groin site at Ban Tonpheung, form vertical cliffs at many places as can be seen in the Study Area.



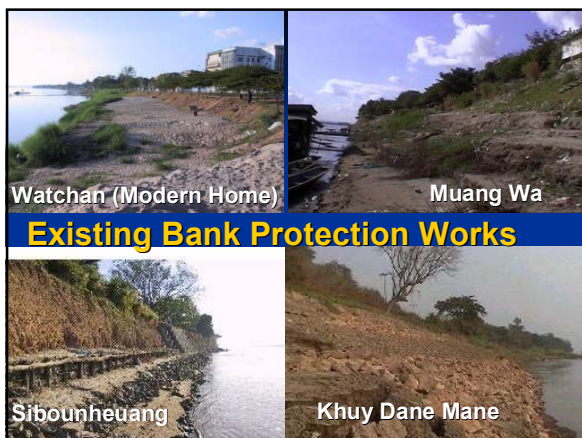
(3) Existing Bank Protection Works

1) Around Vientiane Municipality

- Bank protection works have been implemented since **early 1990s**.
- Most of protection works done by **gabion and Reno mattresses**.
 - at many locations, silt deposits with partly covered by vegetation are found.
 - some of wire nets have been corroded to become thin and partly damaged in a long period after construction.

1) Around Vientiane Municipality

- Wat Sibounheuang
 - Soda mattress has been tested.
- Hatdokkeo
 - Reno mattresses at the toe of the slope are damaged and stones in the net-cage are lost.
 - Existing sand excavation works near the site might have influenced the riverbed degradation in front of the work.



2) Whole Mekong River in Lao PDR (Southern part: Vientiane- Khong fall)

- At **Pakkadan** in Bolikhamxai province
 - 4 riprap groins was constructed and 2 new groins are under construction along NR 13.
 - Extension (27groins) of groins is planned.
 - With low elevation of the groin crown, the sedimentation is realized under the groin level.
 - Riverbank: partly collapse due to high velocity in the flood season.
 - Slightly higher groins and/or the combination of slope protection works as riprap between groins are supposed to be effective.

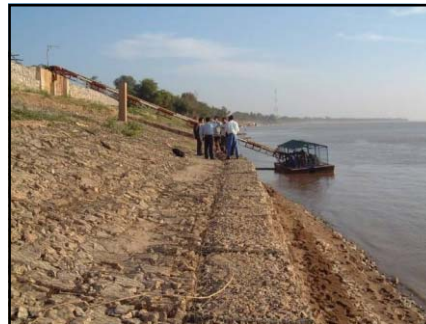


**2) Whole Mekong River in Lao PDR
(Southern part: Vientiane- Khong fall)**

- At the confluence with Nam Xan river in Bolikhamxai province
 - Riverbank was severely damaged.
 - Repair of embankment founded by groins are under construction.
 - Slopes between groins are considered still vulnerable against erosion.
 - Riprap protection works are recommended for the slope protection in addition to the groins.

**2) Whole Mekong River in Lao PDR
(Southern part: Vientiane- Khong fall)**

- Thakhek in Khammouan Province
 - gabion and Reno mattress works protect a water intake facility with concrete piles supported by “Soda mattress” and wooden pile works.



**Soda Mattress installed
site at Thakhek**

**3) Whole Mekong River in Lao PDR
(Northern part: Vientiane- Bokeo)**

- Luang Phabang city
 - Riverbank slope is rather stable except the drainage treatment on the slopes.
- Ban Tonephueng in Bokeo province
 - Riprap groin works has been done.
 - Amount of sedimentation is found between groins, resulting to protect the riverbank slopes.
 - Further extension of groin arrangement is planned.

**(4) Proposed Plans and
Projects in the Study Area**

1) Plans and projects by national budget

- GOL has plans to execute the riverbank protection works in 2002 by using around 1,000 mil Kip at:
 - 1) Tha Khek/Ban Hom (L=60 m)
 - 2) Hatdokkeo (L=50 m), and
 - 3) Bo-O (L=60 m)
- The protection works after 2003 is now under consideration.

2) Plans and projects by donors

- No specific future plans and projects by donors exist so far.

3) Modern Home's Project

- Modern Home Co. Ltd, has been implementing "the Mekong River Bank Erosion Protection and Development Project" by BOT method.
- Main objectives are to create land for business and recreation and to develop Chan Island for tourism.

3) Modern Home's Project

- Reclamation work (L=840 m) is now in progress by dredging up of sand from the Mekong riverbed.
- Original plan (L=6,400 m) is now under reconsideration.

4) Other related plans and projects

- a) Vientiane Urban Infrastructure and Services Project (VUISP):
 - This VUDAA project was formulated by ADB in 2001.
 - The main objectives are 1) urban drainage, 2) road construction, 3) solid waste disposal and 4) sanitation.
 - The proposed **bank protection** component in VUISP was discarded.

4) Other related plans and projects

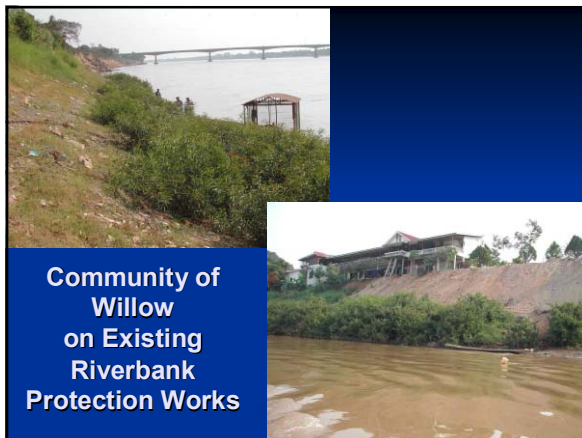
- b) The revision work of Vientiane Urban Development Master Plan formulated in 1991 starting from 1998 has been in progress in 2002.

(5) Riverine Vegetation in the Study Area

- 1) On natural riverbank
 - Little vegetation grows on vertical cliff bank.
 - Vegetation grows on the stable bank with gentle slope.
- 2) On existing bank protection works
 - Plants change with the situation of sedimentation.
 - The kinds of distributed plant differ in the upper, middle and lower layers of bank.
 - Growth of plant is not active for one year after the completion of work.

(5) Riverine Vegetation in the Study Area 3) Willow in the Mekong River

- Distribution of willow:
 - Existing bank protection works: Many communities of willow are found after 5 years or more from the completion.
 - Natural riverbanks: Few willows are found.
- Characteristics of willow:
 - The kind of soil has little influence on the growth of willow.
 - Moisture has strong influence on the growth of willow.
 - Community of willow can hold the soil of riverbank.



(6) Availability of Local Materials for Bank Protection in the Study Area

1) Quarry Site

- Ban Sakai (under operation)
 - **The only site** now under operation around the Study Area
 - The site is located about 50 km from city center
 - 3 sites is now under operation
 - Massive, very hard but rather cracky granitic rocks suitable for concrete aggregate

1) Quarry Site

- Ban Houayhom (for future development)
 - The site is located about 25 km form city center.
 - Many large scale exposures of massive sandstone are observed.
 - The sandstone is suitable enough as the material for riverbank protection works.

2) Fascine and wooden materials

- 13 kinds of local trees can be utilized for Soda.
- Fascine materials for pilot works could be supplied enough from investigated villages.
- Wooden piles for groin work: further investigation is required.

Fascine Materials



Soda (Fascine)



Taisya (Cross Twigs)



Kogui (Short Piles)

(7) Basic Environmental Condition in the Study Area

1) Natural environment

- Protected Area:
 - Phou Phanang National Biodiversity Conservation Areas (NBCA)
 - Phou Khao Khoay NBCA
- Fauna and flora:
 - Natural vegetation areas remain well in and around above NBCAs.
 - There is no natural vegetation along the Mekong riverbank.

NBCAs around the Study Area



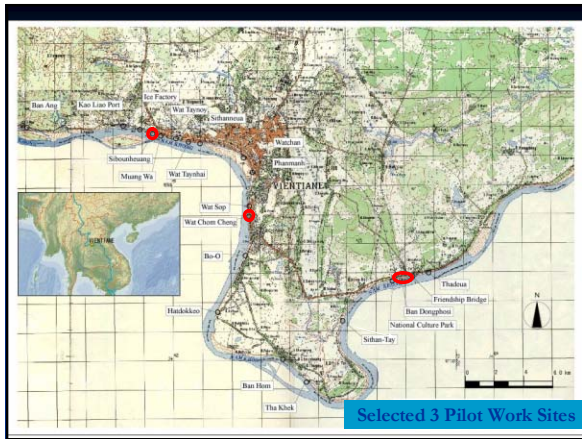
2) Social environment

- Forestry law in Lao P.D.R.
 - Forest are categorized 1) protected forests, 2) forest reserves, 3) production forests, 4) rehabilitation forests and 5) degraded forests.
 - Wood and other forest products can be exploited only from production forests.
- Riverine land use: 1) field, 2) field with trees, 3) residential area, 4) residential area with trees and 5) commercial area

3. PREPARATORY STUDY FOR PILOT WORKS

(1) Selection of Sites for Pilot Works

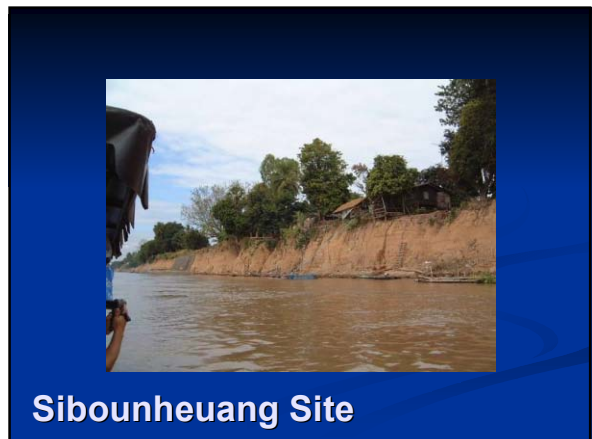
- Ban Dongphosi site (L=650 m)
- Wat Chom Cheng site (L=200 m)
- Sibounheuang Site (L=150 m)



Ban Dongphosi Site



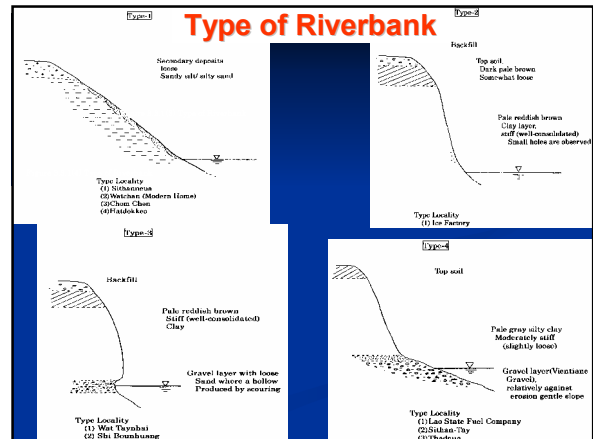
Wat Chom Cheng Site



Sibounheuang Site

(2) Site Condition for Pilot Works

Type of riverbank	Characteristics	Corresponding pilot work site
1	- bank slope: 45 degree or less - secondary deposits : loose sandy silt/silty sand	Wat Chom Cheng
2	- bank slope: 65-90 degree - upper layer: dark pale brown, somewhat loose - lower layer: pale reddish brown clay layer, stiff - small holes are observed	
3	- bank slope: 65-90 degree - upper layer: pale reddish brown, stiff clay - lower layer: gravel layer with loose sand where hollows are produced by scouring	Sibounheuang
4	- upper steep portion: pale gray silty clay, moderate stiff - lower gentle portion: gravel layer (Vientiane gravel), rather strong resistance against erosion	Ban Dongphosi



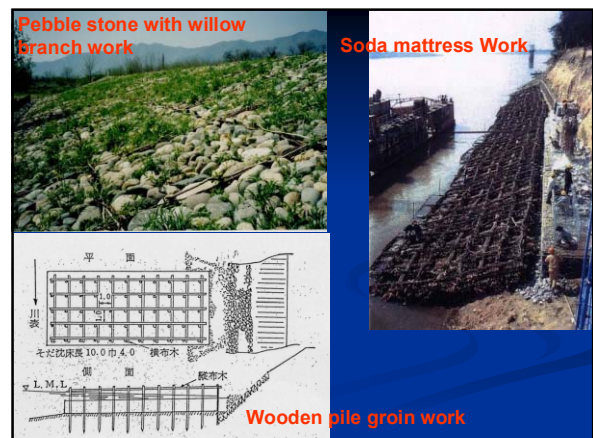
(3) Facility Design

1) Design criteria

Site Name	Design flow velocity (m/sec)	Low water level with 5-year return period (El. m)	Stone size
1. Ban Dongphosi	3.4	155.0	a) Rip-rap Stone: according to the formula of US Army Corps of Engineering b) Filling Stone: according to a experimental formula (Actual size should be 1.3 to 1.5 times of the critical size of stone)
2. Wat Chom Cheng	2.6	158.1	
3. Sibounheuang	2.6	158.9	

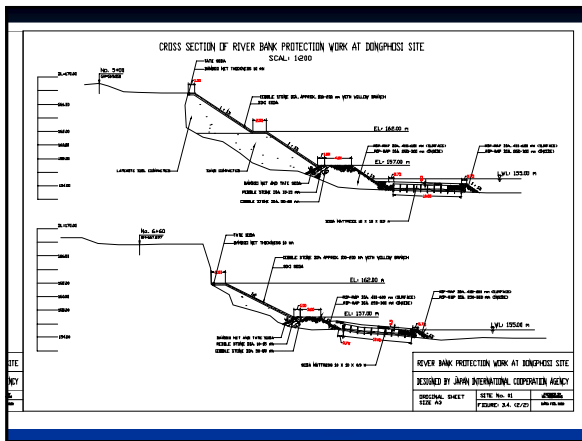
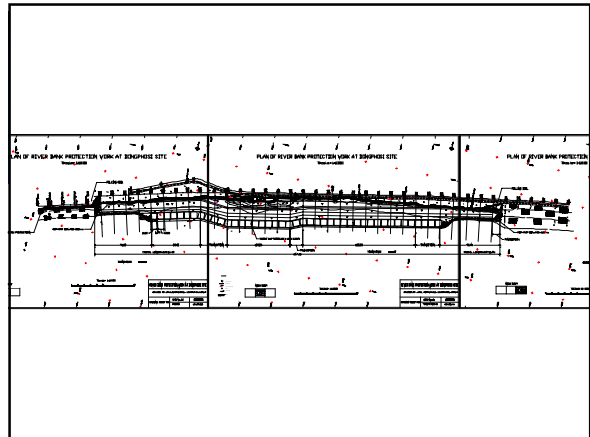
2) Selection of construction type

Site Name	Construction type
1. Ban Dongphosi	Pebble stone with willow branch work + Soda mattress work
2. Wat Chom Cheng	Wooden pile groin work + Soda mattress work
3. Sibounheuang	Soda mattress work + Pebble stone with willow branch work



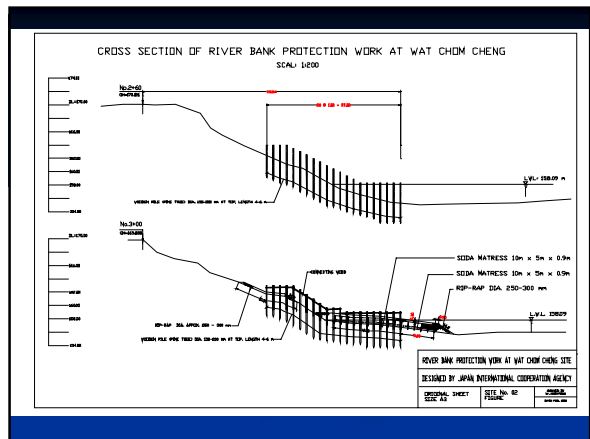
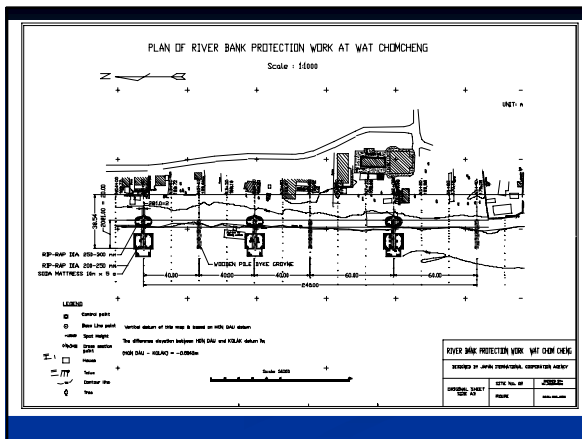
3) Design of pilot works

- Ban Dongphosi (L=650 m):
 - Much amount of embankment is introduced to protect important properties, especially around **Lao State Fuel Company**.
 - The slope protection work for peripheral part of the Company is designed to protect the foot of cliff to avoid further setback due to undermining and to establish naturally stable slope with vegetation.



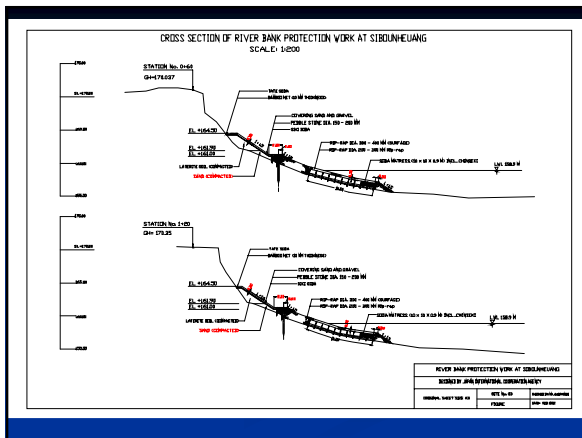
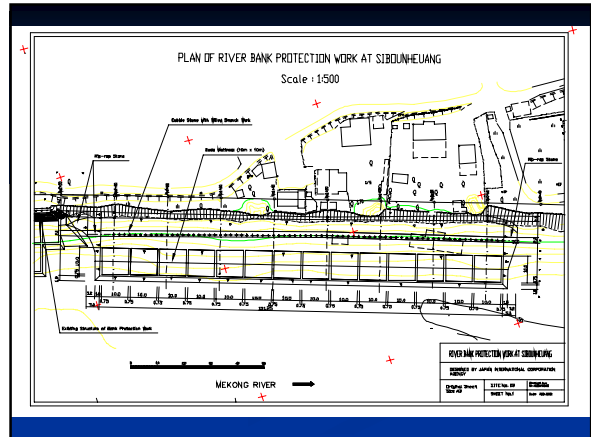
3) Design of pilot works

- Wat Chom Cheng (L=240 m):
 - Spacing of groins: 40 m (upper stretch), 60 m (downstream stretch)
 - Length of the groin: 20m
 - 3 rows of wooden piles is arranged in a hound's tooth spacing of 1m



3) Design of pilot works

- Sibounheuang (L=150 m):
 - The principle design concept is the same as IDI Japan's test project, i.e., to protect the foot of slope by foot protection work
 - The slope protection work is designed to cover the possible notch formation part to avoid undermining.



(4) Monitoring Program

1) Topographic and hydraulic condition

(D: Dry season, R: Rainy season)

Monitoring Items	Site	Nos	Inter-val	2001		2002		2003		2004	
				D	R	D	R	D	R	D	R
Cross-sectional surveying	All Sites	3				○		○			○
River water stage	All Sites		Every-day	○	○	○	○	○	○	○	○
Flow velocity and direction	All Sites	6			○	○	○	○	○	○	○
Scoring depth	Wat Chom Cheng	3			○		○		○		○

2) Vegetation condition

Monitoring Place	Monitoring Items	Unit	Quantities during 2002 - 2004
Pilot work sites (3 sites)	Distribution of vegetation and flora	Time	2
	Planting of willow	Time	3
	Growth situation of willow	Time	12
Existing bank protection work sites (4 sites)	Distribution of vegetation and flora	Time	2
	Growth situation of willow	Time	7
Natural slope (1 site)	Distribution of vegetation and flora	Time	2
	Growth situation of willow	Time	3
Place where soda material was gathered	Growth situation of trees	Time	3

(5) Construction Plan

1) Construction method

- Soda Mattress System
- Log Hurdle Work
- Riprap with Willow Fascine
- Log Piling

2) Material procurement

Type of materials	Procurement place
Soda fascine	Ban Dongphosi, Ban Naxone, Ban Thanghong, etc.
Woods for the log hurdle work, log piling	Market
Crushed stone for rip rap, deposition work	Ban Sakai
Laterite soil for backfilling	Ban Dongphosi
River sand and gravel	Mekong River at Xiangkhouan
Metal material (zinc-coated whip, bolt, nail)	Market

3) Equipment procurement

- Rough terrain crane, bulldozer, crawler crane, floating dock, barge motor, grader, backhoe, loader, motor excavator, roller compacter, truck and crane, damp track
- For Soda Mattress system, floating dock, barge, and crane shall be utilized.
- At Ban Dongphosi site, concrete breaker for the clearing work shall be required.

4) Preliminary cost estimate (Unit Cost)

	Description	Unit	Unit price (US\$)
1	Common excavation	M3	1.0~1.47
2	Supply and fill laterite	M3	4.02~4.50
3	Supply and fill gravel	M3	4.02~4.92
4	Supply and fill gravel below water	M3	10~15
5	Assemble, place Reno mattress	Unit	2~8
6	Supply and place rock	M3	27~31
7	Supply and place geotextile	M2	1~3
8	Gabion rock-fill	M3	30~38
9	Supply and riprap (φ=12-20 cm)	M3	18~26
10	Log piling (l=3-5m, φ=5-10 cm)	Unit	3~7

4) Preliminary cost estimate (Total quantities of main work items)

Description	Unit	Quantity
Soda Fascine	bundle	55,400
Log Pile (φ=4-20 cm, l=1.2 – 6 m)	Unit	99,700
Embankment Laterite and Gravel	M3	39,100
Crushed Stone	M3	20,900

5) Implementation schedule (6 months: Oct. 2002-Mar. 2003)

- The Study Team shall start the pilot works in the beginning of **October 2002**.
- About 1 month will be required for the preparation and approval of tender and bid.
- Construction work by **local contractor** will be started in the beginning of **November 2002**.
- 3 pilot works will be completed by the end of **March 2003**.

4 FIELD SURVEY AND INVESTIGATION FOR PILOT WORKS

Items at 3 Pilot Work Sites

- (1) Topographic Survey
 - Cross sections (80 lines, V=1:100, H=1:100)
 - Topographic maps (81,000 m², Scale= 1:500)
- (2) Velocity Measurement (300 points)
- (3) Geotechnical Investigation
 - 1) Soil investigation (boring of 115 m in total)
 - 2) Rock piece test (20 samples)
- (4) Supporting Investigation for Initial Environmental Examination

FIRST TECHNOLOGY TRANSFER SEMINAR (Tentative Program)

- Date: October ?, 2002 (*in the beginning of October*)
- Duration: One Day (9:00~16:00)
- Venue: Grand Ballroom of Lao Plaza Hotel
- Participants: 50 ~ 100 persons
- Equipments: Multimedia Projector, Overhead Projector, TV & Video Set, etc.
- An English/Laotian interpreter is available

Program of the Seminar (tentative)

Time	Theme	Speaker
<Session I>		
9:00 ~ 9:15	Key Notes Opening Speech	Mr. Sommad Pholsena, Director General of Department of Roads, MCTPC
9:15 ~ 9:45	Introduction of the Study on Mekong Riverbank Protection around Vientiane Municipality	Mr. Yasuhiko Kato, Team Leader of the Study Team
9:45 ~ 10:15	Introduction of Existing Riverbank Protection Works in Lao P.D.R.	Mr. Somchith Sithiphong, Bank Protection Project Manager, DCTPC
10:15 ~ 10:30	Break	
10:30 ~ 11:00	Outline of Pilot Riverbank Protection Works as a Major Component of the Study	Dr. Rokuro Kobayashi, Co-Team Leader of the Study Team
11:00 ~ 11:30	"Soda Mattress Work in Japan Now"	Showing of TV Program in Japan (Video)
11:30 ~ 12:00	Introduction of the Result of Counterpart Training in Japan	Mr. Viengsavanh Phasavath, Leader of the Counterpart for the JICA Study Team, MCTPC
< Buffet Lunch > 12:00 ~ 13:30		

Program of the Seminar (tentative)

<Session II>		
13:30 ~ 14:30	Special Lecture (River Morphology and Natural Disaster around Vientiane Municipality)	Dr. Masahiko Oya, Honorary Professor of Waseda University, Japan
14:30 ~ 15:00	Test of Riverbank Protection by the Planting of Mekong Willows	Dr. Sengdeunne Wayakone, National University of Laos
15:00 ~ 15:15	Break	
15:15 ~ 15:55	Free Discussion	Chaired by Mr. Yasuhiko Kato, Team Leader of the Study Team
15:55 ~ 16:00	Closing Address	Mr. Sommad Pholsena, Director General of Department of Roads, MCTPC

Future Schedule

- Jul 2002: First part of Supporting Investigation for EIA (by Mr. Watanabe)
- Aug? - Sep? 2002 (*to be determined later*) : Counterpart training in Japan (Mr. Viengsavanh Phasavath, MCTPC)
- Oct 2002: 1st technology transfer seminar
- Oct 2002 – Mar 2003: Execution of pilot works

END

JICA STUDY ON MEKONG RIVERBANK PROTECTION AROUND VIENTIANE MUNICIPALITY **PROGRESS REPORT (2)**

March 2003
NIKKEN Consultants, Inc.
and
NEWJEC Inc.

Main Contents of P/R(2) for Today's Discussion

- 1) Introduction
- 2) Execution of Pilot Works
 - Ban Dongphosi Site
 - Wat Chom Cheng Site
 - Sibounheuang Site
- 3) Test Execution of Vegetative Riverbank Protection
- 4) Monitoring of Pilot Works
- 5) Pre-EIA

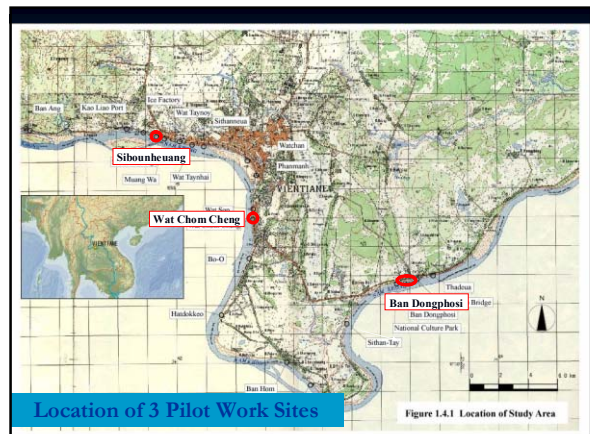
1. Introduction

(1) Objectives of the Study

- To study bank protection works adaptable to the Mekong River and sustainable in Lao P.D.R., introducing **river works in Japan**.
- To transfer technology to the counterpart personnel through **Pilot Works**.
- To formulate a bank protection **Master Plan** for the Mekong River around Vientiane Municipality.

(2) Overall Work Schedule

- 1st year (Dec. 2001-Mar. 2002)
Basic study in the Study area
- 2nd year (Oct. 2002- Mar. 2003)
Execution of pilot works
- 3rd year (Apr. 2003- Mar.2004)
 - Execution of pilot works (Apr.- May, 2003)
 - Monitoring of pilot works
 - Formulation of master plan (Dec.2003- Mar. 2004)
- 4th year (Nov. 2004- Mar. 2005)
Monitoring of pilot works



(3) First Technology Transfer Seminar

- **Date and venue:** October 4, 2002 at Lao Plaza Hotel, Vientiane
- **Objective:** to exchange technical ideas and to transfer technology on riverbank protection
- **Contents:** various bank protection-related themes by presenters and free discussion sessions

Time	Theme	Speaker
<Session I>		
9:00 ~ 9:15	Key Notes Opening Speech	Mr. Sommad Pholsena, Vice Minister of MCTPC
9:15 ~ 9:45	Introduction of the Study on Mekong Riverbank Protection around Vientiane Municipality	Mr. Yasuhiko Kato, Team Leader of the Study Team
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10:30 ~ 11:00	Outline of Pilot Riverbank Protection Works as a Major Component of the Study	Dr. Rokuro Kobayashi, Co-Team Leader of the Study Team
11:00 ~ 11:30	"Soda Mattress Work in Japan Now" (Introduction of the Latest Traditional River Work Method in Japan)	Showing of TV Program in Japan (Video)
< Buffer Lunch > 11:30 ~ 13:00		

<Session II>

13:00 ~ 13:45	Introduction of the Result of Counterpart Training in Japan	Mr. Viengsavanh Phasavath, Leader of the Counterpart for the JICA Study Team, MCTPC
13:45 ~ 14:30	River Bank Protection Work with Low Cost Materials	Mr. Bounthieng Venvongsoth, Co-leader of the Counterpart for the JICA Study Team, MCTPC
14:30 ~ 14:50	Break	
14:50 ~ 15:20	Free Discussion	Chaired by Mr. Yasuhiko Kato, Team Leader of the Study Team
15:20 ~ 15:30	Closing Address	Mr. Sommad Pholsena, Vice Minister of MCTPC

(4) Riverbank Erosion at Pilot Work Sites by August 2002 Flood (1/3)

1) General

- The flood caused severe riverbank erosion in many Mekong stretches around Vientiane Municipality
- The flood is the historical second biggest (H max = **170.64 m**, MSL) <cf. in 1966 (H max = 170.75 m, MSL)>

(4) Riverbank Erosion at Pilot Work Sites by August 2002 Flood (2/3)

2) Progress of Erosion at Pilot Work Sites

- **Ban Dongphosi:** Average setback width is **2.3 m**
<cf. average setback in ordinary year: 0.5 m>
 - Upstream reaches (220 m): **1.2 m**
 - Along oil stockpiling base (100 m): **2.2 m**
 - Downstream reaches (330 m) : **2.9 m**

Ban Dongphosi Site



(4) Riverbank Erosion at Pilot Work Sites by August 2002 Flood (3/3)

2) Progress of Erosion at Pilot Work Sites

- Wat Chom Cheng: The riverbank was not eroded so much
- Sibounheuang:
 - Several limited points were eroded 3-5 m locally
 - However, the bank was not eroded so much generally (harder than Ban Dongphosi)

Wat Chom Cheng Site



Sibounheuang Site



(5) Upgrading of Specification of Pilot Work at Ban Dongphosi Site (1/2)

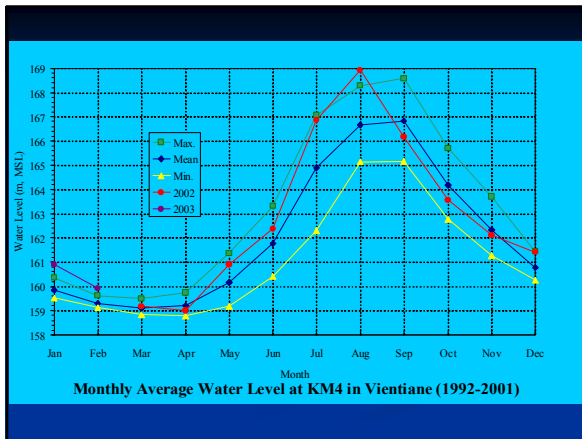
- JICA decided to **upgrade the facility design** after August 2002 flood taking into account the importance of oil stockpiling base located extremely close to the eroded bank:
 - **Additional backfill** corresponding to the riverbank setback (2.3 m in average)
 - Partial reinforcement by **stone covering** (L=100 m along oil stockpiling base)

(5) Upgrading of Specification of Pilot Work at Ban Dongphosi Site (2/2)

- Wat Chom Cheng and Sibounheuang sites: original design is applied
- The execution was rescheduled as a result of careful discussion in JICA on August 2002 flood and the design revision:
 - Original schedule: Nov. 2002 – Mar. 2003 (5 months)
 - **Present schedule:** Jan. 2003 – May 2003 (5 months)

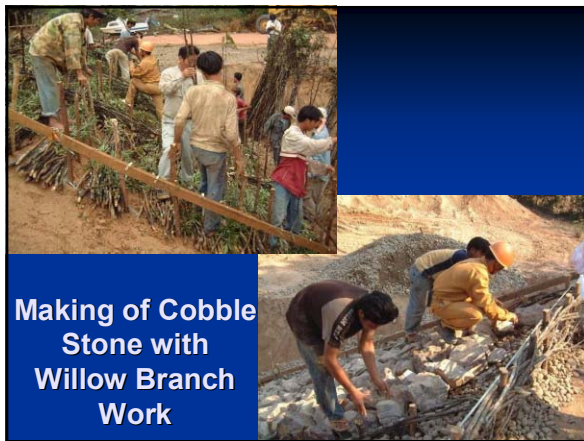
(6) Execution of Pilot Works

- Under construction at 3 work sites
- Scheme of execution: Sublet contract with the Study Team for **JICA Development Study (Not JICA Grant Aid Project scheme)**
- Contractor: Obayashi Corporation (selected by competitive bidding)
- Supervision: by the Study Team (in full cooperation with MCTPC/ DCTPC)
- Water level in Jan-Feb 2003: slightly higher than that of ordinary year



(7) Technical Guidance for Soda Technique

- Conducted by Soda (fascine) technique experts of the Study Team
- Period: Feb and Mar 2003
- Location: pilot work sites
- Items:
 - Soda Mattress work
 - Cobble stone with willow branch work

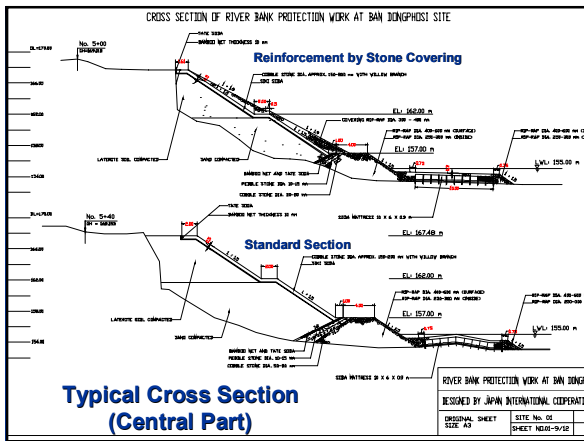
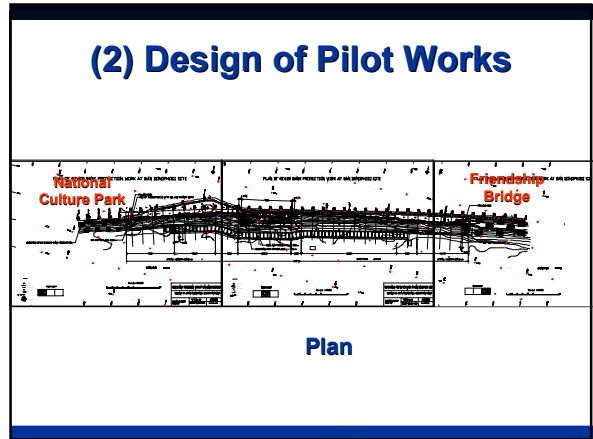


2. EXECUTION OF PILOT WORK AT BAN DONGPHOSI

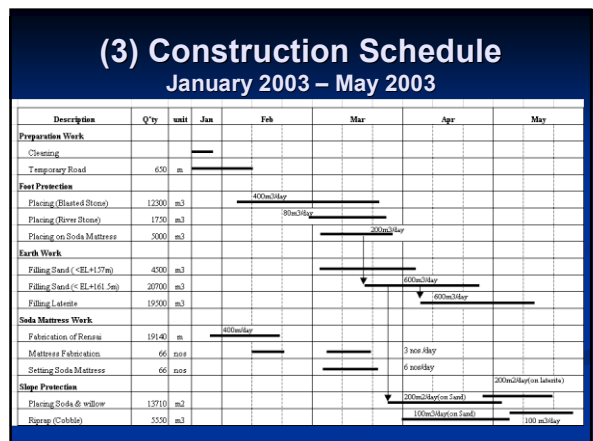
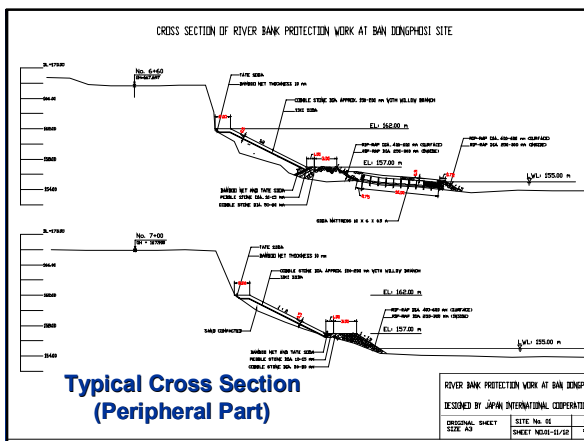


(1) Outline

- Under construction based on the revised facility design upgraded
- Construction type:
 - Foundation work (Riprap work)
 - Foot protection work (Soda Mattress work)
 - Slope protection work (Cobble stone with willow branch work)
- Total length: 643 m
- After completion, willows will grow and will **cover and grasp** the surface of the slope.



- ### Partial Reinforcement by Stone Covering
- covers completed slope protection works by **expendable** riprap.
 - The function:
 - to prevent Soda material to drying by accelerating the sedimentation on the slope
 - to strengthen the slope protection works by accelerating the growth of willow
 - to work as buffer zone against erosion.



(4) Construction Equipment and Materials
1) Construction equipment

Item	Capacity	Working Description
Rensai Stand	2 lines	Rensai assembling
Backhoe	0.7 m3	Riprap, Earthwork, Piling
Truck	6-10 t	Transportation (Soda Material)
Dump Truck	10 t	Transportation (stone, soil)
Clam shell	1.0 m3	Riprap, Depositing
Bulldozer	D5-D20	Earthwork
Rough Terrain Crane	30 t	Fabrication (Soda Mattress)
Crawler Crane	50 t	Setting Soda Mattress
Vibration Roller	8 t	Earthwork
Air Compressor	18 m3/min	Blasting
Drilling Machine	100 PS	Blasting (Quarry Site)
Flat Barge	150-250 t	Transportation, Work Space
Generator	10-60 KVA	Electricity Supply

(4) Construction Equipment and Materials
2) Materials (1/4)

Item	Specification	Site Name
Soda Mattress (Foot protection work)		3 Sites
Soda	Length: 2.7m, 45cm rise peripheral 60cm 200cm rise peripheral...55cm	○
Taisya	Length:2.7m, ϕ 2~3cm at butt end ϕ 1.0cm at 2.7m rise, 25 twigs per bundle	○
Kogui	Length: 1.2m, ϕ 3~5cm at butt end	○
Rubble stones	ϕ 600~250 mm, ϕ 100~50 mm (inside)	○
Straw rope	ϕ 10 mm	○
Zinc-coated whip	#10	○
Zinc-coated whip	#12	○
Note for Site: ○: Applicable		

Fascine Materials



Soda (Fascine)



Taisya (Cross Twigs)



Kogui (Short Piles)

(4) Construction Equipment and Materials
2) Materials (2/4)

Item	Specification	Site Name
Embankment (Slope protection work)		BD and SH
River sand & Gravel	< ϕ 80 mm, collected in the Mekong River	○
Laterite	Collected on Ban Dongphosi borrow pit	○
Pebble	ϕ 80~10 mm	BD
Cobble	ϕ 200~150 mm	○
Rubble	ϕ 600~400 mm (deposition)	BD
Rubble	ϕ 400~300 mm	○
Bamboo net	B=2.5 m L=2.5 m	○
Tate Soda	L=3.0 m, S=0.7 m	○
Note for Site: ○: Applicable, BD (Ban Dongphosi), SH (Sibounheuang)		

(4) Construction Equipment and Materials
2) Materials (3/4)

Item	Specification	Site Name
Cobble Stone with Willow Branch (Slope protection work)		BD and SH
Siki Soda	L=3.0 m, S=0.7 m	○
Taisya	L=3.0 m, 1 bundle =25 unit	○
Kogui (Short Pile)	L=1.2 m ϕ =4 cm	○
Willow	L=1.2 m, S=0.9 m	○
Cobble	ϕ =150 – 200 mm	○
Wooden Pile Grain Work (foot protection work)		WC
Wooden Pile	Length:4 – 6.0 m, tip end> ϕ 15 cm	○
Tie-beam	L=3.2 m, tip end> ϕ 9cm	○
Bolt	L=30 cm, d=13 mm	○
Zinc-coated whip	#12	○
Note for Site: ○: Applicable, BD (Ban Dongphosi), WC (Wat Chom Cheng), SH (Sibounheuang)		

(4) Construction Equipment and Materials
2) Materials (4/4)

Item	Specification	Site Name
Rip-Rap Work (Slope protection work)		WC
Rubble	ϕ 300~250 mm	○
Log Hurdle Work (slope protection work)		SH
Pile (Kogui)	Length:3.0m, tip end: ϕ 20 cm	○
Wailing log	Length:4.2m, tip end: ϕ 10 cm	○
Short pile	Length:1.5m, tip end: ϕ 10 cm	○
Bolt	L=30 cm, d=13 mm	○
Zinc-coated whip	#12	○
Nail	L=15 cm	○
Pebble	ϕ 150~50 mm	○
Tate Soda	T=20~30 cm	○
Bamboo Net	T=10 mm	○
Note for Site: ○: Applicable, WC (Wat Chom Cheng), SH (Sibounheuang)		

(5) Preparatory Works (1/3)

- Temporary works and facilities:
 - 2 access road of 8m wide (national road - the site)
 - Soda Mattress stockyard (fabrication and stock)
 - A temporary office and workers houses



(5) Preparatory Works (2/3)

- Collection and transportation of materials:
 - Stones:
 - Ban Sakai quarry site
 - Nong Teng temporary quarry site
 - Gravel and sand: Xiangkhouan borrow site
 - Laterite: borrow pit near Ban Dongphosi.

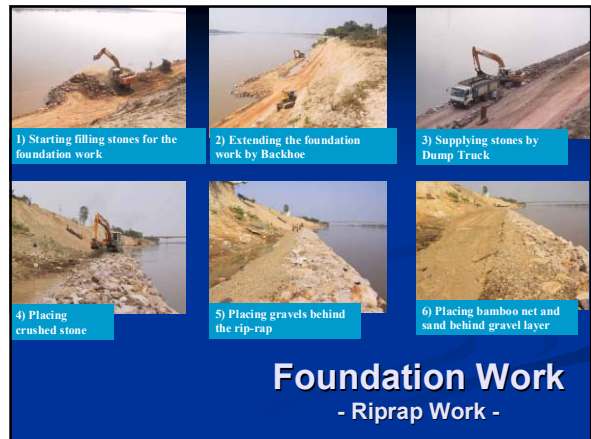


(5) Preparatory Works (3/3)

- Fascine material (Soda, Taisha and Kogui etc.)
 - collected in Nongpen Village located close to the site
 - transported by trucks (6-10 t) to the stockyard
 - In addition, soda mattresses will also be transported from Kao Liao stockyard.

(6) Foundation Works (1/2)

- Riprap work: foundation works to support upper slope protection work.
- Graded stones brought by dump truck from quarry sites are put on by using backhoe.



(6) Foundation Works (2/2)

- Quantity
 - Stone dike (Crushed stone of dia. 250mm-600mm): 13,500m³
 - Stone dike (gravel of dia. 50mm under): 2,400m³
- The riprap foundation is temporary used as the construction road for setting Soda mattress.

(7) Foot Protection Works (1/4)

a) Assembling of Soda Mattress

- Outline: Soda Mattress consists of:
 - Soda (fascine)
 - Rensai (brunch of fascine)
 - Siki-Soda (fascine flooring)
 - Sigara (hurdle work)
 - Chinseki (rubble stone).

(7) Foot Protection Works (2/4)

a) Assembling of Soda Mattress

- Construction Method:
 - On the lower lattice of Rensai, 3 layers of Siki-Soda are put on.
 - Upper lattice is put on the lower lattice and bound with rope and wooden pile driven at each node of the lattice to fix the structure.
 - Tie-twig hurdle work is made on it.





(7) Foot Protection Works (3/4)

a) Assembling of Soda Mattress

- Quantity: 66 sheets (10m x 6m x 0.9m)
- Almost all materials are produced locally.
- Soda mattress assembling work technique has been **well transferred**.

(7) Foot Protection Works (4/4)

b) Installation of Soda Mattress

- Assembled Soda mattresses are transported and submerged by putting rubble stones on them.
 - Transported by Crawler Crane to the riverbank
 - Using Crawler Crane, the mattress is placed on the river and fixed by anchors.



(8) Earth Works

- Outline:
 - Filling of river sand and compaction (up to El.161.5)
 - Filling of laterite and compaction (above El.161.5)
- Construction Method:
 - Transportation by dump truck (150 – 500 m³/day)
 - Filling by backhoe and bulldozer (500 m³/day), layer depth-25 cm max.
- Quantity:
 - Mekong river sand (V=25,000 m³)
 - Laterite from Ban Dongphosi pit (V=20,000 m³)



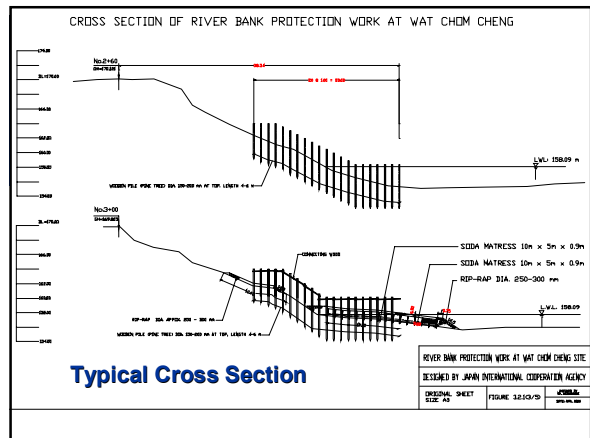
(7) Ongoing and Remaining Works

- Earth works (ongoing)
- Foot protection works
 - Installation of Soda Mattress (ongoing)
- Slope protection works
 - Cobble stone with willow branch works
 - Partial reinforcement by stone covering (L= 100 m)
- Finishing works and inspection by the Study Team

3. EXECUTION OF PILOT WORK AT WAT CHOM CHENG

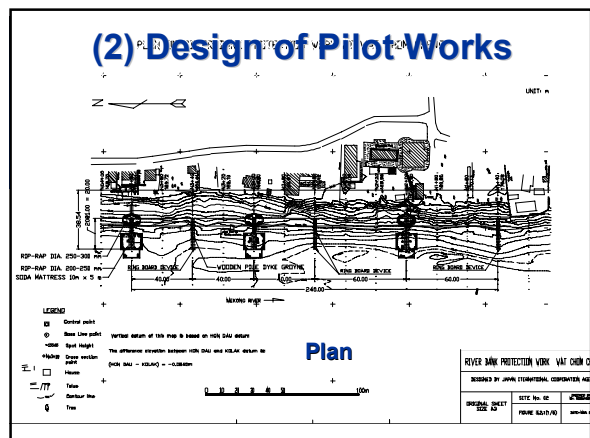
(1) Outline (1/2)

- Under construction based on the original design established
- Construction type:
 - Foot protection work (wooden pile groin work, Soda Mattress)
 - Slope protection work (wooden pile groin work)
- Wooden pile groin work: permeable dyke to reduce flow velocity and sifting current direction offshore-wards to protect riverbank.



(1) Outline (2/2)

- Total length: 240 m
- Test pattern:
 - 6 groins (3 of them: reinforced by Soda Mattress)
 - Spacing:
 - 40 m (upstream stretch)
 - 60 m (downstream stretch)
 - Length of the groin: 20m



(3) Construction Schedule January 2003 – Apr 2003

Description	Q'ty	unit	Jan	Feb	Mar	Apr
Wooden Piling Work						
Wooden piling	378	nos			30nos/day	
Connecting Wooden Pile	360	m				
Stone Work						
Riprap for slope protection	100	m ³				
Riprap on Soda Mattress	560	m ³				120 m ³ /day
Soda Mattress Work						
Fabrication of Rensai	2,253	m		200 m/day		
Mattress Fabrication	9	nos		1no./day		
Setting Soda Mattress	9	nos				2 nos/day

(4) Construction Equipment and Materials

- omission
 - Already mentioned in the description for Ban Dongphosi Site

(5) Preparatory Works (1/2)

- Workstation is set up at Kao Liao site
- All the work will be performed by barge from the Mekong River.
- Fascine (Soda) materials are:
 - collected in Donloun and Laksamsip Villages
 - transported by trucks (6-10 t) to the stockyard

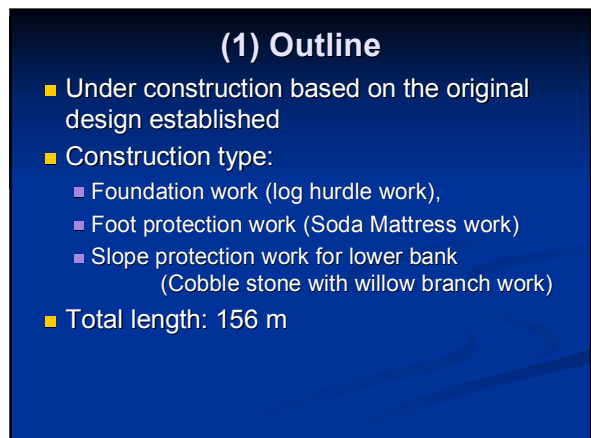
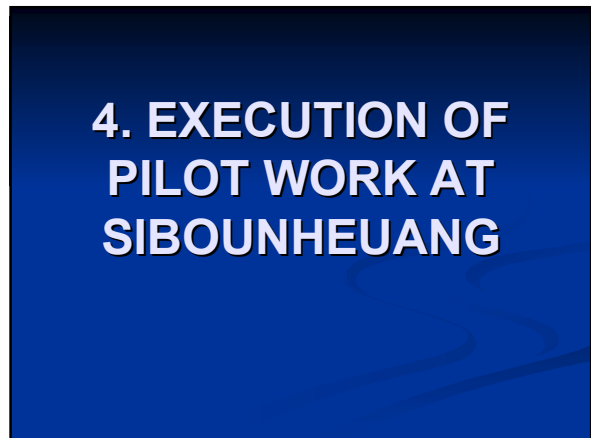
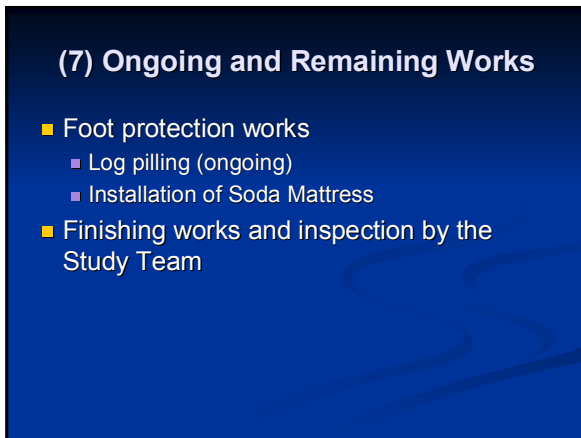
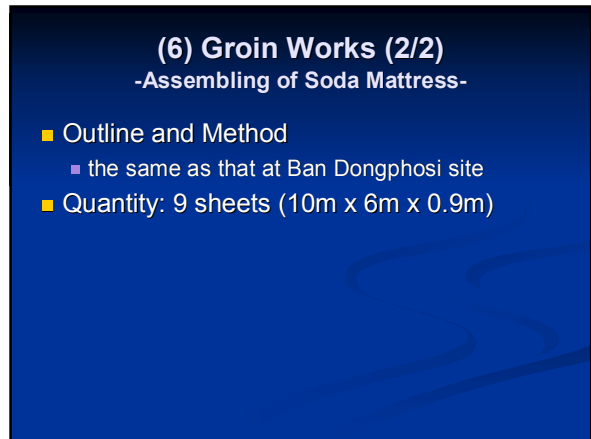


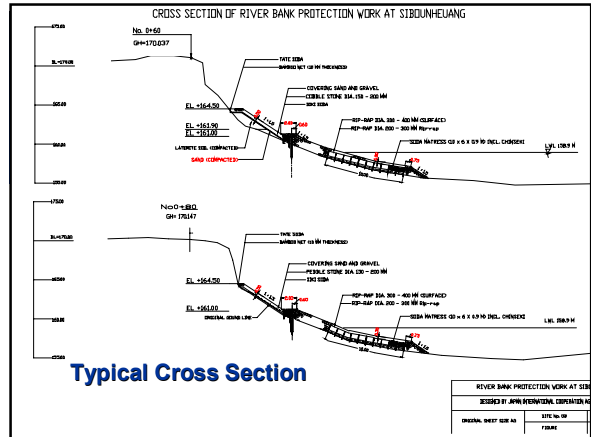
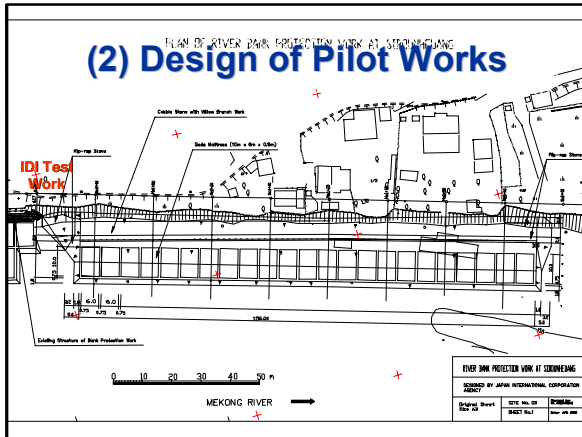
(5) Preparatory Works (2/2)

- Wooden logs:
 - are purchased in market.
 - is cut and sharpened as pile.
- A flat barge transports wooden piles and soda mattresses to the site.

(6) Groin Works (1/2) - Groin Works -

- Construction Method
 - 378 wooden piles (L=6 m) are driven by backhoe on barge
 - Wooden piles is connected with tie-beam (L=3.2 m).
 - The joint is fixed by bolt.





(3) Construction Schedule January 2003 – Apr 2003

Description	Q'ty	unit	Jan	Feb	Mar	Apr
Wooden Piling Work						
Log Hurdle (L=3m)	78	nos		20nos/4day		
Log Hurdle (L=1.5m)	770	nos		100nos/4day		
Earth Work						
Filling Sand	270	m ³			200m ³ /4day	
Filling Latente	520	m ³			200m ³ /4day	
Slope Protection						
Protection with soda material	1100	m ²			200m ² /4day	
Placing Pilecap	1100	m ³			200m ³ /4day	
Soda Mattress Work						
Fabrication of Rensu	6750	m		200m/day		
Mattress Fabrication	23	nos	1 set/day			2 set/day
Setting Soda Mattress	23	nos			4 set/day	
Pilecap on Soda Mattress	2400	m ³			170m ³ /4day	

- ### (4) Construction Equipment and Materials
- omission
 - Already mentioned in the description for Ban Dongphosi Site
- ### (5) Preparatory Works
- omission
 - the same as that for Wat Chom Cheng site

- ### (6) Foundation Works (1/2)
- Outline
 - **Log hurdle work:** foundation work to support slope protection work.
 - The work is composed of:
 - primary log piling (2m interval)
 - secondary (short) piling (0.2 m interval)
 - connecting beam
 - cobbles placed behind log hurdle as back-fill.

- ### (6) Foundation Works (2/2)
- Construction Method
 - Primary pile (L=3 m) is driven by backhoe set on barge.
 - Secondary piling (L=1.5 m) and connecting beam (L=4.2 m) setting is done by manpower.
 - Back-filling of cobble stones are done by Backhoe.
 - Quantity: 77 primarily logs, 760 secondary logs



(7) Foot Protection Works

- Outline and Method:
 - the same as that at Ban Dongphosi site
- Quantity: 23 sheets (10m x 6m x 0.9m)

(8) Ongoing and Remaining Works

- Earth works (ongoing)
- Foot protection works
 - Installation of Soda Mattress
 - Toe rubble deposition
- Slope protection works
 - Pebble stone with willow branch works for lower bank
- Finishing works and inspection by the Study Team

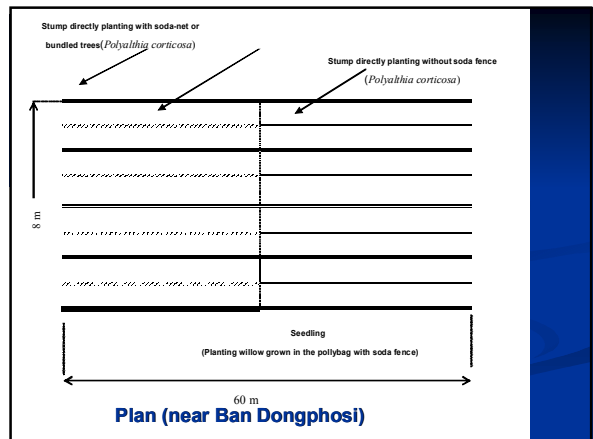
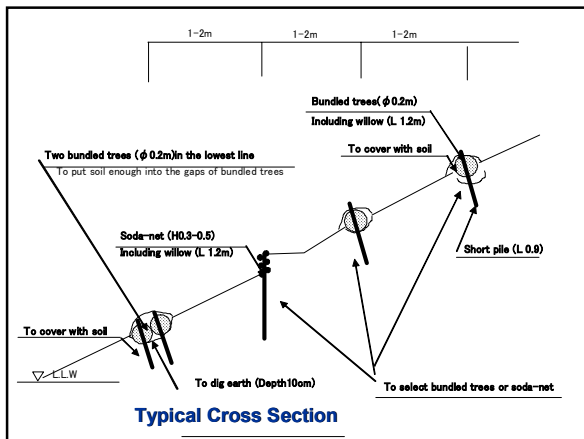
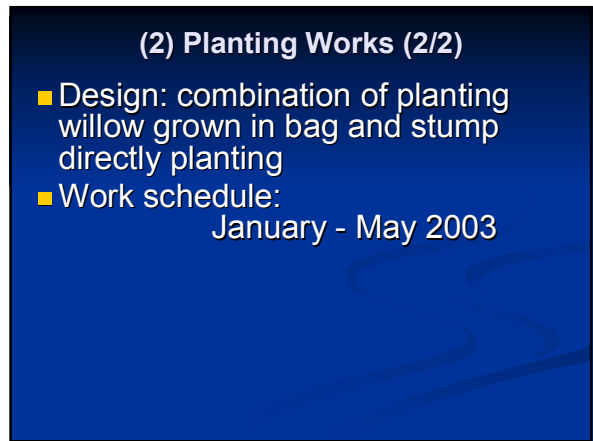
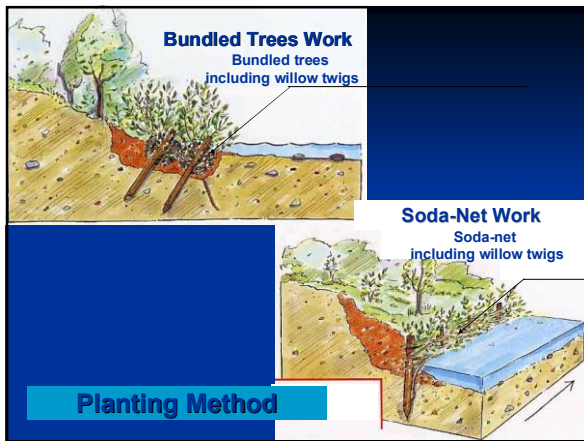
5 TEST EXECUTION OF VEGETATIVE RIVERBANK PROTECTION

(1) Outline

- High-cost bank protection works is unrealistic measures for the banks forming continuous vertical cliffs with low important riverine area.
- Small-scale vegetative bank protection works: possible measures to fix such bank soil.
- The implementation cost: extremely low (US\$ 10~50/m), though it requires several months-years before the work effects.
- Test works was executed in assistance with National University of Laos.

(2) Planting Works (1/2)

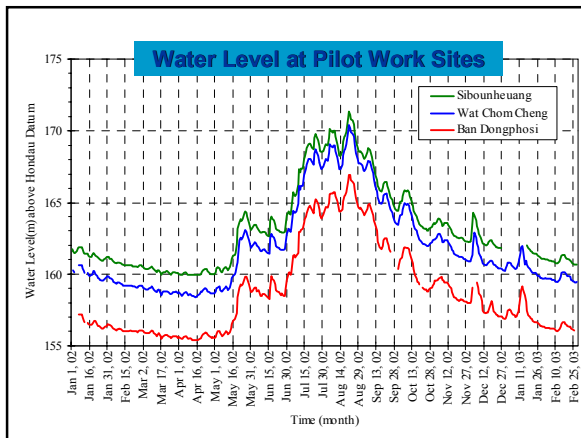
- Location:
 - near Ban Dongphosi (60 x 8 m)
 - near Wat Chom Cheng (24 x 5 m)
- Willow species: Khai Khao, Khai Nun and Khai Ngiu
- Planting method (including willow twigs):
 - Bundled trees work
 - Soda-net work



6 MONITORING OF PILOT WORKS

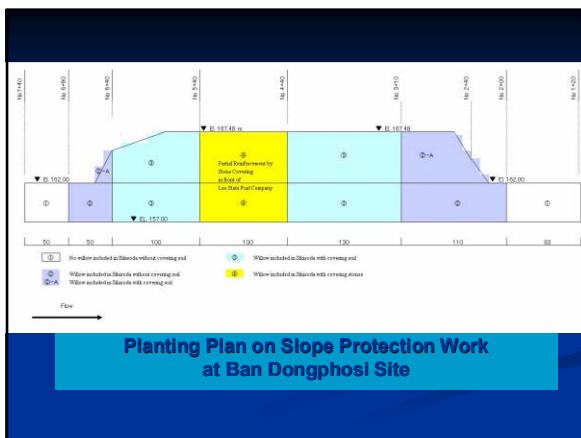
(1) Hydraulic Condition

- Daily water levels at 3 sites have been monitored since January 2002 in assistance with the counterpart of MCTPC.
- Velocity measurements conducted on October 2002:
 - Current velocity at all sites :
January 2002 < October 2002.
 - Highest velocity above 3m/sec: offshore of Sibounheuang Site on October 2002.



(2) Vegetation Condition

- At Ban Dongphosi site:
 - several **willow planting methods** on the **lower slope** protection work is to be examined.
 - executed after the completion of the work in cooperation with National University of Laos.
- The objective is to find out the suitable method of growing willow, since dryness of the dry season is intense.
- The growth situation of willow is compared with several vegetation conditions.



(3) Vegetation Condition at Related Sites

- Monitoring places
 - Test execution sites of vegetative riverbank protection
 - Several existing riverbank protection sites
- Monitoring items:
 - vegetation survey
 - growth situation of willow
- Vegetation lists were prepared.
- Monitoring work is now in progress. Final result will be compiled in next Interim Report.



7 PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT

- ### (1) Pre-EIA for Pilot Works (1/2)
- EIA is not required officially, since the pilot works are not the major projects defined in Environmental Protection Law of Lao P.D.R.
 - However, prior to the construction, Pre-EIA for the pilot works including questionnaire survey by local consultant was conducted by the Study Team.

- ### (1) Pre-EIA for Pilot Works (2/2)
- Pre-EIA proves that the pilot works have **no serious environmental impact** potentially as follows, since the works are conducted to create favorable river environment:
 - During construction stage: Most of check items are D (no impact).
 - Operation/maintenance stage: All check items are D (no impact)

Pre-EIA for Pilot Works

Check Item	During Construction			Operation/ Maintenance Stage		
	Ban Dongphosi	Wat Chom Cheng	Sibounheuang	Ban Dongphosi	Wat Chom Cheng	Sibounheuang
Environment						
Resettlement	D	D	D	D	D	D
Economic Activity	C	C	C	D	D	D
Traffic and public facilities	B	B	B	D	D	D
Split of communities	D	D	D	D	D	D
Cultural property	D	C	C	D	D	D
Water rights, Right of common	D	D	D	D	D	D
Public health condition	D	D	D	D	D	D
Waste	B	B	B	D	D	D
Hazard	B	D	D	D	D	C
Physical Environment						
Topography and geology	D	D	D	D	D	D
Soil erosion	B	B	B	C	C	C
Groundwater	D	D	D	D	D	D
Hydrological situation	D	D	D	D	D	D
Coastal zone	D	D	D	D	D	D
Flora and fauna	B	B	B	D	D	D
Landscape	D	D	D	B	D	D
Quality of Life						
Air pollution	B	B	B	D	D	D
Water pollution	D	D	D	D	D	D
Soil contamination	D	D	D	D	D	D
Noise and vibration	C	B	B	D	D	D
Ground subsidence	D	D	D	D	D	D

Assessment: A: High Negative Impact, B: Low Negative Impact, C: Unknown Impact, D: No Impact

- ### (2) IEE for Bank Protection Master Plan (1/4)
- IEE for the Master Plan to be formulated next stage study was conducted by the Study Team in assistance with local consultant.
 - Around 120 villagers were interviewed using questionnaire at five (5) typical villages within 50 m from the Mekong riverbank in Vientiane municipality.
 - Local people inhabited close to the pilot work site fully agreed the works and have no complaints to the construction works.**

(2) IEE for Bank Protection Master Plan (2/4)

- Impact on local people
 - Some riverbank slopes are utilized and possessed by local people. However, bank protection works will not require resettlement of the people.
 - Some protection works might disturb the access to the river of the local people. However, these can be avoided by proper design and the dissections with the affected peoples.

(2) IEE for Bank Protection Master Plan (3/4)

- Impact on forest resources
 - A large quantity of fascine material has been collected from the several forests by permission for the pilot works.
 - According to the monitoring, the impact of the collection is **negligible** and damage is recoverable.
 - Because the collection has been conducted widely and shallowly without tree-felling and cutting big trees.

(2) IEE for Bank Protection Master Plan (4/4)

- Impact of construction works
 - Construction equipment will generate harmful dust, noise and vibration, these are unavoidable to some degree, though.
 - However, these impacts can be mitigated by proper construction plan, advance explains to the local people, since the impact are temporary and limited.

Future Schedule (1/3)

- Apr 2003 – May 2003:
Execution of pilot works
 - Restart of the supervision of the works by the Study Team from the end of April (to be fixed later).
 - Counterpart of MCTPC/DCTPC shall assist the supervision by the Team during the Team is in Tokyo (Mar. 19 – the end of Apr).
 - The Study Team will compile the result of the remaining works in brief additional report in May 2003 and describe the detail in Interim Report in Dec 2003.

Future Schedule (2/3)

- May 2003: Monitoring for the pilot works (upon the completion of the works)
 - Cross-sectional survey
 - Velocity measurement
 - Test willow planting on the pilot work at Ban Dongphosi
 - Vegetation condition (under investigation)

Future Schedule (3/3)

- Dec 2003 – Mar 2004: Formulation of riverbank protection Master plan
 - practical future implementation plan taking financial condition in consideration
 - “Technical guidance for Soda Technique” will be held **again**, if the Government of Laos executes the bank protection works using Soda-system during this period.

