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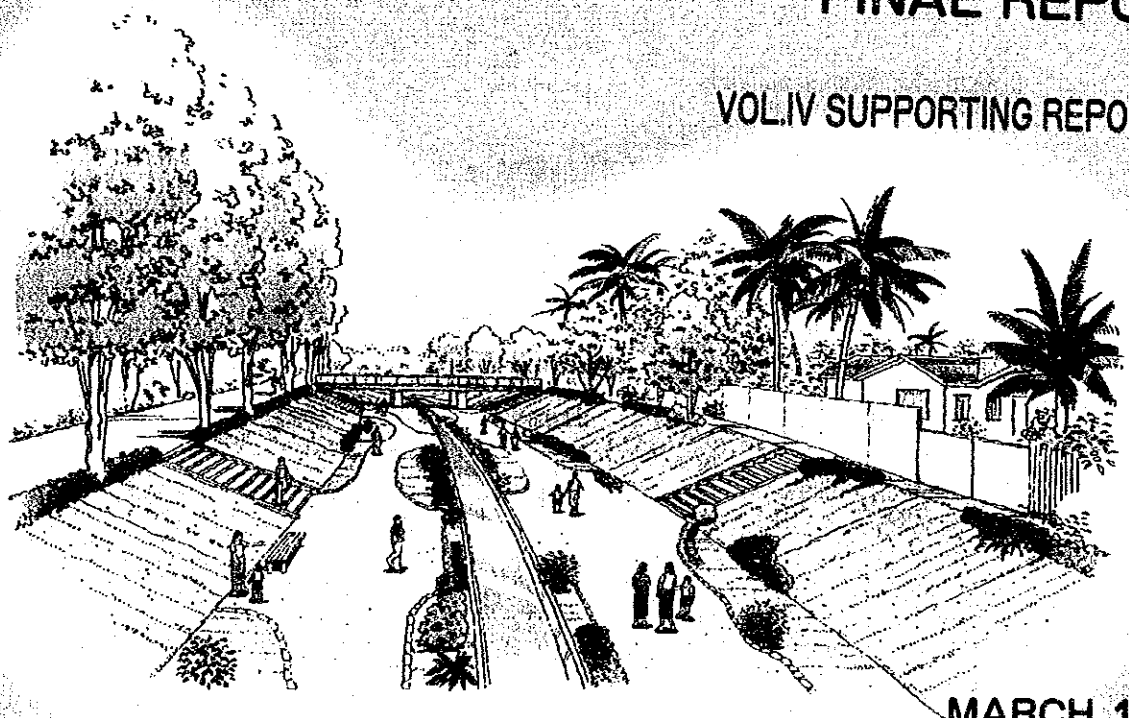
LAO PEOPLE'S DEMOCRATIC REPUBLIC

FEASIBILITY STUDY ON IMPROVEMENT OF DRAINAGE SYSTEM IN VIENTIANE

FINAL REPORT

VOL.IV SUPPORTING REPORT (3)



MARCH 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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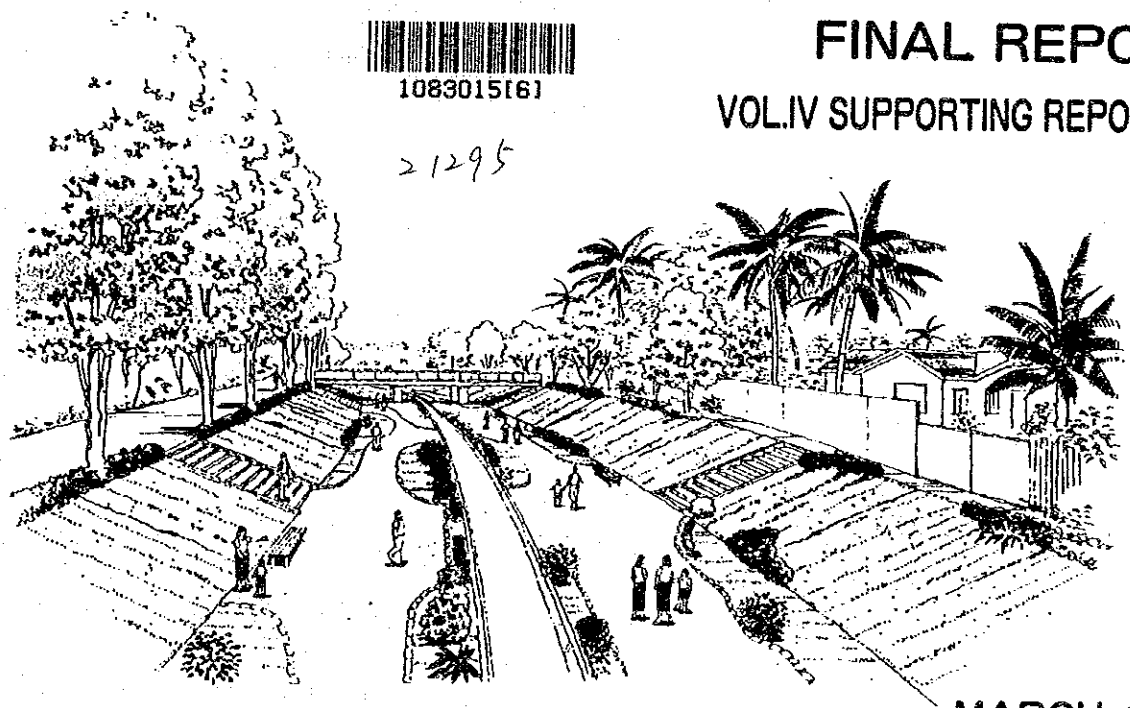

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FEASIBILITY STUDY ON IMPROVEMENT OF DRAINAGE SYSTEM IN VIENTIANE

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CONSTRUCTION PLAN

APPENDIX G. CONSTRUCTION PLAN

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APPENDIX G. CONSTRUCTION PLAN

G.1 Construction Plan and Method of the Hong Ke System

G.1.1 General

This part presents construction plan on the proposed works for whole Hong Ke system.

The construction plan is worked out to provide a guide for the construction and a basis for the cost estimate as well as adopting conventional and prevailing construction methods in Lao People's Democratic Republic (Lao P.D.R.).

The construction plan are based on the following conditions for the implementation

(1) Executive body

The Government of Lao People's Democratic Republic (Lao P.D.R.) assigned the Municipality of Vientiane (MOV), will be the executing agency for the implementation of the Improvement of Drainage System in Vientiane under the MOV. The Municipality of Vientiane will perform the supervision and administration works with assistance of consulting engineers.

(2) Execution System of Works

The construction will be conducted on the contract basis through the international competitive bidding (ICB) in compliance with Government's regulation.

The work quantities of major works are given in Table G.1.

G.1.2 Construction Plan

(1) Working conditions

The working conditions for the construction planning are as follows:

(a) Workable Day and Hour

The estimation of workable days and hours has a close relation to labor regulation, weather, and handling of materials, etc. As a result of survey and study on such conditions, one (1) shift work for eight (8) hours per day.

The working shift and hour are determined on condition that the earth works and concrete works will be carried out by one (1) shift work for eight (8) hours.

(b) Labor Regulation

There is governmental labor regulation under the Lao Labor Association. According to the regulation, basic daily working hour is eight (8) hours and the work will be stopped on Sunday and national holiday.

(c) Weather Condition

The working days are estimated by deducting the Sundays, national holidays and suspension days caused by rainfall from the yearly calendar days. The suspension day means the time when the work is stopped due to the rainfall, and it varies with the basis of the following criteria.

Suspension days for works

Amount of rainfall (mm)	Work-suspended day	
	Earth works	Concrete works
0 - 5	0	0
6 - 10	0.5	0
11 - 20	1	0
21 - 30	1	0.5
Over 31	2	1

(d) Swell Factor

The volume of soil will be changed when it is moved, hulled and compacted. It is classified into three conditions i.e., natural, loose and compacted.

The soil in the natural condition is the soil in its original position. The soil in the compacted condition is the soil after being compacted on backfilled. The swell factor of volumetric change of earth materials is assumed as listed follows.

Swell Factor

Material	Natural	Loose	Compacted
Common	1.0	1.18	0.85
Sand and gravel	1.0	1.15	1.05
Rock	1.0	1.65	1.30

(e) Hourly Production Rate of Construction Equipment

The hourly production rates of major equipment were estimated on the basis of a conventional construction methods and formula considering the site conditions. Details of hourly production rates for each type of equipment are given in Table G.2.

(f) Land Acquisition and Compensation

Compensation cost for land and houses in the project area and right-of-way of the land to be required for the execution of the project, which are to be furnished by the Government of Lao People's Democratic Republic (P.D.R.).

(g) Construction Material

Earth materials for embankment, fine and coarse aggregates for concrete, sand and gravel and laterite for road surfacing, boulder for stone masonry, sod for sod facing, and timber products can be obtained locally by the contractors.

The earth materials for embankment and backfill shall be obtained from several kinds of excavation to be carried out under the contract as far as practicable. The earth materials for embankment and backfill will be available from borrow pits shown on the drawings or designated by the Engineer.

The materials of the cement, reinforcement bars and steel materials are imported by the contractors.

G.1.3 Construction Time Schedule

(1) Pre-construction Program

The pre-construction program broadly consists of loan arrangement, selection of consultant, will be started and concluded within a period of twelve (12) months.

In accordance with the procurement guideline of the financial agency for implementing a large scale construction, the prequalification of interested tenderers will be conducted. Tendering and subsequent procedures will follow the prequalifications. Successful tenderers will be selected by the 5th and 6th month for the contract as shown in Fig. G.1.

The land acquisition along the Drainage canal and Nong Chanh Retarding Basin will have to be started as early as possible prior to start of the construction.

(2) Mobilization and Construction Facilities

Mobilization and temporary works consisting of transportation, installation of plants, access road, water and electric supply system and temporary buildings, etc. will be completed or prepared within the 3 months after mobilization of contractor.

(3) Construction Time Schedule

The target data for completion of the project is assumed to be the end 3rd year. Approximately, 3 years would be required for the project work from commencement of Engineering Design to completion of Construction Works as shown in Fig. G.2 and construction work scheduled in each year are described below.

First Year

(i) Signing of Exchange Notes
(ii) Selection and Contract of Consultant
(iii) Detailed design and preparation of tender documents
(iv) Advertising
(v) Prequalification
(vi) Tendering and evaluation of civil works

Second Year

(i) Award of civil work contract
(ii) Mobilization
(iii) Construction of access road and haul road
(iv) Construction of temporary facilities for contractor use
(v) Care of water and dewatering
(vi) Fascine hurdle with sand bags (coffering)
(vii) Excavation, embankment and slope protection works of the Hong Ke drainage canal

(viii) Excavation and concrete works of the Morning Market box culvert
(ix) Excavation and concrete works of lateral canal

Third Year

(i) Care of water and dewatering
(ii) Fascine hurdle with sand bags (coffering)
(iii) Excavation, embankment and slope protection works of the Khoua Khao, Hong Thong drainage canal and Nong Chanh retarding basin
(iv) Excavation and concrete work of structure for Khoua Khoa, Hong Thong drainage canal and Nong Chanh retarding basin
(v) Removal of temporary facilities for contractor use
(vi) Finishing works

G.1.4 Preparatory Works and Construction Facilities

(1) Access Road

Access from Bangkok to Vientiane is available by the combined route of railway and public road to Nong Khai, by Mekong ferry from Nong Khai to the New Vientiane river pot, and by road from river port to project area.

An improvement by widening and laterite or gravel metalling of the access to the rock quarry site at Danecy from the National No. 13. Contractors under Improvement of Drainage system area will be allowed to use this access road subject to providing necessary repair and maintenance under cooperation among the contractors. For the borrow areas of sand and gravel and earth deposits for the construction of drainage canal, approach roads to work site will be constructed from the provincial asphalted road by contractors under the contract as the temporary access road.

During the construction, contractors will be required to maintain the national, provincial and village roads to be used for access by using motor grader and macadam roller. Contractors will also have to provide

temporary diversion roads at the construction sites at their own expense where necessary.

(2) Temporary Building and Land Space

It is assumed that the contractors' office, quarter, stores and workshops will be established at the construction sites.

The required areas to be used for these building and yards are estimated as follows:

Description	Building (m^2)	Land (m^2)
Office	300	730
Quarter	150	370
Warehouse	500	1,000
Labor camp	1,500	3,750
Motor pool and repair shop	600	1,200
Miscellaneous	200	400
Total	3,250	7,470

(3) Concrete Production and Aggregate

To produce concrete conforming to the requirements of the Technical Specifications and construction program, suitable concrete materials should be selected and concrete mixing plant having an adequate capacity should also be provided at each site.

The concrete aggregate to be furnished will be available at the borrow area of Mekong river located about 15 km downstream from Vientiane. The material will be hauled by 8 ton dump truck to the stock yard.

Since sources of aggregate are submerged in the river water in the wet season, a sufficient stock of aggregate will have to be stored for enabling the concrete work to be carried out throughout year.

G.1.5 Construction Method

(1) Main Drainage Facilities

The construction of the main drainage facilities will be mainly executed during the dry season when water level of the existing drainage canal is low. Care of water and dewatering will be carried out firstly and this will be immediately followed by a temporary fascine hurdle with sand bags (coffering) construction. Then excavation, embankment, slope trimming and slope protection works will follow thereafter.

Earth works for main drainage canals will be carried out mainly by a back hoe and bulldozers. Excavation of high water canal will be conducted by combination of swamp type bulldozers and amphibious excavators. For the canal reaches, the excavation will be carried out using bulldozer and back hoe for a short hauling distance of material. For a long distance of more than 50 m, backhoe and dump truck will be used for loading and hauling the excavated material. Some of the excavated materials will be used for embankment. The trimming of canal side slopes will be made by back hoes or manual labors. The compaction for canal embankment will be carried out by vibration rollers after conditioning the fill materials to have a moisture content in the required range. The embankment materials will be obtained from suitable excavated materials in drainage canals, and/or the extracted from borrow pits.

Stone or concrete block masonry works will be conducted by manual power mainly.

Revetment and sod facing works are also carried out by manual power mainly.

Bank protection work and structures with wet masonry will be carried out using a portable type concrete mixer as the supporting equipment to the manual construction.

(2) Box Culvert

A combination works by manual power and a back hoe will be applied for this works. A portable type concrete mixer will be used for the concrete. The box culvert construction should be carried out by the stepwise construction taking account of the site conditions.

The demolishing work for the existing structures will be carried out in stepwise providing the partial coffering dike made of wooden piles with bamboo sheets and sand bags.

Removal of concrete and excavation of structures will be carried out by a concrete breaker, pick hammer and 0.6 m^3 class back hoe. Those excavated materials will be loaded into 8 ton dump truck for hauling to the spoil bank.

(3) Lateral Canal

The construction of lateral canal improvement will be carried out divided into several stages of the construction section in order to secure the drainage system during construction.

Based on the run-off discharge to the drainage canal and economical point of view, it is planned that the lateral canal improvement works should be carried out by the stepwise construction taking account of the site conditions. The works will be executed by two to three crews in a parallel way.

Excavation will be carried out by a back hoe and dump trucks for hauling works.

Removal of concrete for the existing structures will be carried out by a concrete breaker, pick hammer and 0.6 m^3 class back hoe. Those removed materials will be loaded into 8 ton dump truck for hauling to the spoil bank.

A portable type of concrete mixer will be provided for the small quantity of concrete of the lateral canal improvement works.

(4) Nong Chanh Retarding Basin

The retarding basin construction works will be carried out by the stepwise construction in accordance with the site condition providing the partial coffering method using fascine hurdle with sand bags. The works will be executed by two to three crew in a parallel way.

The coffering material will be shifted to the next step construction.

The construction works will be concentrated to the retarding basin in the dry season.

Excavation of high water portion will be conducted by the combination of a swamp type bulldozer, an amphibious excavators and dump trucks under the dry condition to be secured by partial coffering.

Fascine hurdle with sand bags for coffering will be provided mainly by manual power.

Excavated soil will be disposed to the spoil bank by dump trucks.

The trimming of side slopes will be made by back hoe or manual labor. The compaction for embankment will be carried out by a vibration roller after conditioning the fill materials to have a moisture content in the required range. The embankment materials will be obtained from the suitable excavated materials in canals, and/or the extracted from borrow-pits.

Stone or concrete block masonry works will be conducted by manual power mainly.

Revetment and sod facing works are also carried out by manual power mainly.

(5) Metal Works

The installation of gate, screen and its accessories will be conducted in later stage of construction works.

Installation will be conducted mainly by manual power. Truck crane will be utilized as the supporting equipment to manual work for installation of gates, screen and accessories.

(6) Crossing Facilities

There are crossing utilities in the Vientiane City Intercepter such as power lines, water supply pipes and telephone lines.

Those facilities are planned to be replaced following to drainage canal works.

Required works for renewal will be conducted by the nominated contractors of each agencies.

G.1.6 Construction Equipment

The construction equipment are selected based on the time schedule, work quantities, site conditions, design features and suitable combination of equipment.

The hourly production rates and major construction equipment is listed in Table G.2 and Table G.3.

G.2 Construction Plan and Method of the Nam Pasak System and Sub Area I, K

The civil works to be constructed under the Project are broadly divided into two categories; the drainage facilities and the retarding basin. The drainage facilities are further divided into two categories; the main drainages canal and the lateral canals. Main works for each category are listed as follows;

(1)	Nam Pasak Main Drainage Canal	3,300 m
(2)	Sub Area "I"	
	a) Hong Kai Keo Main Drainage Canal	1,270 m
	b) Nong Bon Retarding Basin	5 ha
(3)	Sub Area "K"	
	a) Lateral Canal	1,800 m

G.2.1 Construction Schedule of the Nam Pasak System and Sub Area I & K

(1) Project Schedule

The target data for completion of the Nam Pasak System and sub area I, K is assumed to be the 36th month. Approximately, 3 years respectively would be required for the Nam Pasak System and sub area I, K work from the commencement of Engineering detailed design to the completion of construction work as shown in Fig. G.1. The necessary periods are summarized as follows;

a)	Engineering design including preparation of tender documents, and prequalification	: 6 months
b)	Tendering	: 6 months
c)	Main construction works	: 24 months

(2) Construction Work Schedule

Fig. G.1 shows the construction time schedule of the Nam Pasak System and sub area I, K. Major works scheduled in each year are described below.

Sixth Year (Nam Pasak System)

a) Signing of Exchange Notes
b) Selection and contract of consultant
c) Detailed design and preparation of tender document
d) Advertising
e) Prequalification
f) Tendering and evaluation of civil works

Seventh Year

a) Award of main construction work contract and mobilization
b) Construction of temporary facilities for contractor use
c) Construction of access road and haul road
d) Care of water and dewatering
e) Fascine hurdle with sand bags (coffering)
f) Excavation, embankment and slope protection work of the Nam Pasak main drainage canal

Eighth Year

a) Care of water and dewatering
b) Fascine hurdle with sand bags (coffering)
c) Excavation, embankment and slope protection work of the Nam Pasak main drainage canal
d) Removal of temporary facilities for contractor use
e) Finishing works

Eleventh Year (sub area I & K)

a) Signing of Exchange Notes
b) Selection and contract of consultant
c) Detailed design and preparation of tender documents
d) Advertising
e) Prequalification
f) Tendering and evaluation of civil works

Twelfth Year

a) Award of main construction work contract and mobilization
b) Construction of temporary facilities for contractor use
c) Construction of access road and haul road
d) Care of water and dewatering
e) Fascine hurdle with sand bags (coffering)
f) Excavation, embankment and slope protection work of the Hong Kai Kaoi main drainage canal
g) Excavation and concrete work of lateral canal for area I
h) Excavation, embankment and slope protection works of the Nong Bon retarding basin.

Thirteenth Year

a) Care of water and dewatering
b) Excavation and concrete work of lateral canal for area K
c) Removal of temporary facilities for contractor use
d) Finishing works

G.2.2 Construction Method

(1) Main Drainage Facilities

The construction of the Nam Pasak main drainage canal will be started at after completion of access road. Excavated soil will be conveyed by dump trucks and partly by utilized for embankment. The rest of them will be deposited into the old channel (short cut portion), which has an enough capacity to receive the soil from excavation.

The construction of the main drainage facilities will be mainly executed during the dry season when water level of the existing drainage canal is low. Care of water and dewatering will be carried out firstly and this will be immediately followed by a temporary fascine hurdle with sand bags (coffering) construction, then excavation, embankment, slope trimming and slope protection works will follow thereafter.

Earth works for main drainage canals will be carried out mainly by a back hoe and bulldozers. Excavation of high water canal will be conducted by combination of swamp type bulldozers and/or Amphibious excavators. The trimming of canal side slopes will be made by back hoes or manual labors. The compaction for canal embankment will be carried out by vibration rollers after conditioning the fill materials to have a moisture content in the required range. The embankment materials will be obtained from suitable excavated materials in drainage canals, and/or the extracted from borrow-pits.

Stone or concrete block masonry works will be conducted by manual power mainly.

Revetment and sod facing works are also carried out by manual power mainly.

Bank protection work and structures with wet masonry will be carried out using a portable type concrete mixer as the supporting equipment to the manual construction.

(2) Lateral Canal

The construction of lateral canal improvement will be carried out divided into several stages of the construction section in order to secure the drainage system during construction.

Based on the run-off discharge to the drainage canal and economical point of view, it is planned that the lateral canal improvement works should be carried out by the stepwise construction taking account of the site conditions. The works will be executed by two to three crews in a parallel way.

Excavation will be carried out by a back hoe and dump trucks for hauling works.

The existing structure will be demolished by concrete breaker, pick hammer and back hoe. The fragment will be removed to the spoil bank.

A portable type of concrete mixer will be provided for the small quantity of concrete of the lateral canal improvement works.

(3) Nong Bon Retarding Basin

The regarding basin construction works will be carried out by the stepwise construction in accordance with the site condition providing the partial coffering method using fascine hurdle with sand bags. The works will be executed by two to three crew in a parallel way.

The coffering material will be shifted to the next step construction.

The construction woks will be concentrated to the retarding basin in the dry season.

Excavation of high water portion will be conducted by the combination of a swamp type bulldozer, an amphibious excavators and dump trucks under the dry condition to be secured by partial coffering.

Fascine hurdle with sand bags for coffering will be provided mainly by manual power.

Excavated material will be disposed to the spoil bank by dump trucks.

The trimming of side slopes will be made by back hoe or manual labor. The compaction for embankment will be carried out by a vibration roller after conditioning the fill materials to have a moisture content in the required range. The embankment materials will be obtained from the suitable excavated materials in canals, and/or the extracted from borrow-pits.

Stone or concrete block masonry works will be conducted by manual power mainly.

Revetment and sod facing works are also carried out by manual power mainly.

(4) Metal Works

The installation of gate, screen and its accessories will be conducted in later stage of civil construction works.

Installation will be conducted mainly by manual power. Truck crane will be utilized as the supporting equipment to manual work for installation of gates, screens and accessories.

(5) Crossing Facilities

There are crossing utilities in the Vientiane city Intercepter such as power lines, water supply pipes and telephone lines.

Those facilities are planned to be replaced following to drainage canal works.

Required works for renewal will be conducted by the nominated contractors of each agencies.

TABLES

Table G.1 Major Work Items and Quantities (1/2)

	Work Items	Unit	Quantity
1.	Preparatory Works		
	1.1 Access road	m	2,800
	1.2 Haul road	m	2,500
2.	Main Drainage Canal		
	2.1 Khoua Khao	m	1,100
	1) Excavation	m^3	79,500
	2) Embankment	m^3	1,500
	3) Concrete	m^3	1,600
	4) Reinforcement bar	kg	69,200
	5) Slope protection	m^2	39,600
	2.2 Hong Thong	m	1,130
	1) Excavation	m^3	31,550
	2) Embankment	m^3	4,000
	3) Concrete	m^3	1,200
	4) Reinforcement bar	kg	65,700
	5) Slope protection	m^2	19,200
	2.3 Box Culvert (Morning market)	m	270
	1) Excavation	m^3	6,400
	2) Backfill	m^3	3,000
	3) Concrete	m^3	2,330
	4) Reinforcement bar	kg	215,000
	2.4 Hong Ke	m	2,570
	1) Excavation	m^3	152,330
	2) Embankment	m^3	1,600
	3) Concrete	m^3	1,380
	4) Reinforcement bar	kg	116,200
	5) Slope protection	m^2	5,700

Table G.1 Major Work Items and Quantities (2/2)

	Work Items	Unit	Quantity
2.5	Nong Chanh Retarding Basin	ha	12
	1) Excavation	m^3	136,040
	2) Embankment	m^3	21,040
	3) Concrete	m^3	875
	4) Reinforcement bar	kg	43,270
	5) Slope protection	m^2	18,190
2.6	Lateral Canal	m	3,000
	1) Excavation	m^3	23,640
	2) Backfill	m^3	10,210
	3) Concrete	m^3	3,690
	4) Reinforcement bar	kg	211,880

Table G.2 Hourly Production Rates of Equipment (1/3)

Equipment	Description	Hourly Production (m^3/hr)
Excavation		
Bulldozer, 21 ton	Common	82
	Soft rock	75
	Sand & gravel	88
Swamp bulldozer, 13 ton	Common	57
	Sand & gravel	61
Bulldozer, 11 ton	Common	38
	Soft rock	38
	Sand & gravel	41
Crawler loader, 1.4 m^3	Common	56
	Soft rock	31
	Hard rock	26
	Sand & gravel	37
Wheel loader, 2.1 m^3	Common	76
	Soft rock	43
	Hard rock	35
	Sand & gravel	50
Wheel loader, 1.2 m^3	Common	44
	Soft rock	24
	Hard rock	20
	Sand & gravel	29
Back hoe, 0.6 m^3	Common	52
	Soft rock	34
	Sand & gravel	28
Amphibious excavator, 0.4 m^3	Sandy silt	32
	Common	26
	Hard silt	18
Hauling		
		Hauling Distance (m)
Dump truck, 11 t	Common	100 44
		200 40
		300 38
		400 35
		500 33
		1,000 25
		1,500 20
		2,000 17

Table G.2 Hourly Production Rates of Equipment (2/3)

Equipment	Description		Hourly Production (m^3/hr)
Hauling			
		Hauling Distance (m)	
Dump truck, 11 t	Sand & gravel	1,000	25
		2,000	17
		3,000	13
		5,000	8.5
		10,000	4.7
Dump truck, 6 t	Common	100	27
		200	27
		300	23
		400	23
		500	20
		1,000	15
		1,500	12
		2,000	10
Dump truck, 6 t	Sand & gravel	1,000	15
		2,000	9.8
		3,000	7.3
		5,000	4.9
		10,000	2.7
Compaction			
Vibration roller, 3 ton	Common		18
	Soft rock		15
	Hard rock		9
	Sand & gravel		18
Vibration roller, 0.6 ton	Common		11
	Soft rock		8
	Hard rock		4
	Sand & gravel		11
Road roller, 8 ton	Common		14
	Soft rock		10
	Hard rock		5
	Sand & gravel		14
Tire roller, 6 - 8 ton	Common		77
	Sand & gravel		78

Table G.2 Hourly Production Rates of Equipment (3/3)

Equipment	Description	Hourly Production (m^3/hr)
Vibratory plate compactor	Common	3
	Soft rock	2
	Hard rock	2
	Sand & gravel	3
21-t Bulldozer	Common	54
	Sand & gravel	56
	Hard rock	39
Spreading		
Bulldozer, 21 ton	Common	70
	Soft rock	52
	Hard rock	43
	Sand & gravel	61
Bulldozer, 11 ton	Common	46
	Soft rock	35
	Hard rock	29
	Sand & gravel	41
Concrete Bucket		
Bucket, 0.5 m^3		4
Motor grader	Common	469
	Sand & gravel	331
Cram shell, 0.6 m^3	Sandy silt	28
	Common	29
	Hard silt	30

Table G.3 Major Construction Equipment

Item No.	Description	Capacity	HP or kW	Quantities
1.	Bulldozer	21 ton	211	2
2.	Bulldozer	11 ton	108	2
3.	Swamp dozer	13 ton	112	4
4.	Crawler loader	1.4 m^3	110	2
5.	Wheel loader	2.1 m^3	127	1
6.	Wheel loader	1.2 m^3	75	2
7.	Amphibious excavator	0.4 m^3	63	2
8.	Back hoe	0.6 m^3	119	3
9.	Dump truck	11 ton	310	7
10.	Dump truck	6 ton	170	5
11.	Ordinary truck	4 ton	164	2
12.	Truck crane	20 ton	230	2
13.	Motor grader	3.1 m	113	2
14.	Macadam roller	8 ton	90	2
15.	Pneumatic roller	8 ton	89	2
16.	Vibratory roller	3 ton	27	2
17.	Vibratory roller	0.6 ton	5.5	2
18.	Tamper	80 kg	4	8
19.	Portable concrete mixer	0.2 m^3	4.5 kW	10
20.	Agitator truck	3.2 m^3	220	2
21.	Concrete bucket	0.5 m^3	-	4
22.	Concrete vibrator	Dia. 40 mm	0.7 kW	10
23.	Concrete cart	0.1 m^3	-	20
24.	Diesel engine generator	35 kVA	48	2
25.	Vibro driver	2.4 ton	30 kW	2
26.	Water tanker	6 kl	180	2
27.	Submersible pump	Dia. 150 mm	11 kW	5
28.	Submersible pump	Dia. 100 mm	5.5 kW	10
29.	Submersible pump	Dia. 50 mm	1.5 kW	10
30.	Welder w/engine	250 A	19 kW	2
31.	Asphalt sprayer	30 l/min	3.5	2
32.	Air compressor	10.6 m^3/min	106	2
33.	Concrete breaker	30 kg	-	4
34.	Pick hammer	7 kg	-	5
35.	Chain saw	500 mm	55 cc	2

FIGURES

Fig.G.1 Implementation Program

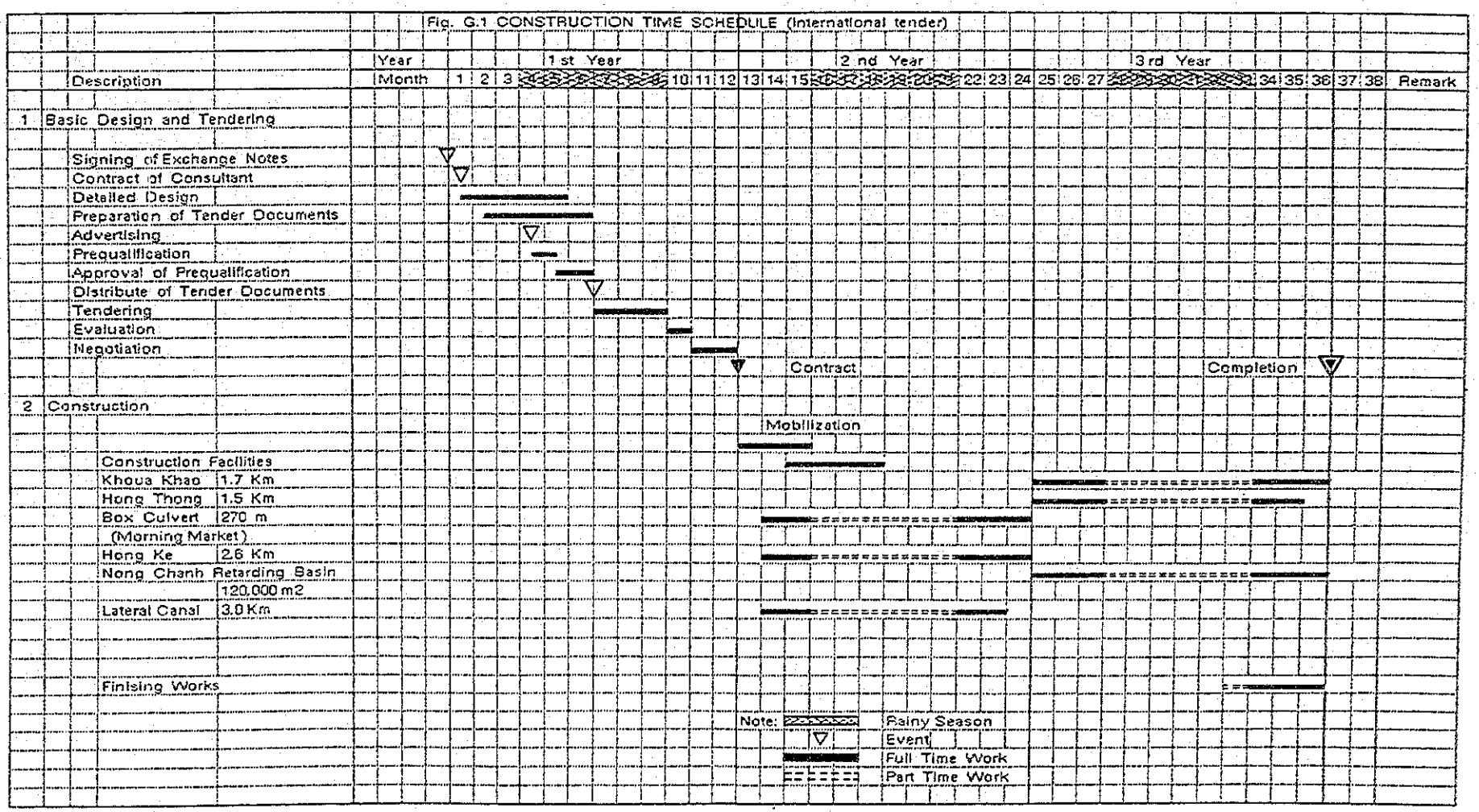

Fig.G.2 Construction Work Schedule

LAO PEOPLE'S DEMOCRATIC REPUBLIC FEASIBILITY STUDY ON IMPROVEMENT OF DRAINAGE SYSTEM IN VIENTIANE
JAPAN INTERNATIONAL COOPERATION AGENCY

APPENDIX H

COST ESTIMATE

APPENDIX H. COST ESTIMATE

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APPENDIX H. COST ESTIMATE

H.1 General

This part presents the project cost for the implementation of the improvement work of the project. The contractors of this project will be selected by international competitive tenderers. The project cost is estimated at the price level of 1989 on the basis of the Feasibility Study completed in February 1990 and the construction plan and schedule as follows:

Foreign Currency	:	J.Yen	1,123,677,000.-
Local Currency	:	US$	5,268,000.-
Total (equivalent to J. Yen)			1,866,465,000.-
Total (equivalent to US$)			13,237,000.-

In order to make cost estimate, a unit price method is mainly applied for each work. Each unit price is estimated and analyzed on the basis of local conditions, the proposed construction method, unit rates of labor wages, material and equipment costs, and reference cost data of the similar projects in Lao P.D.R. and Bangkok. Furthermore, the breakdown is worked out taking into account the financial source, recent international tendering system and cost estimating procedures prevailing in Lao P.D.R. The summary of construction cost is shown in Table H.1.

(1) Basic conditions of Cost Estimates

Prior to estimate of construction cost, the following data collection and pre-study were made:

(a) Collection of local material and local labor costs published by Ministry of Public Works.

(b) Collection of CIF costs of imported materials and construction equipment from local dealers and foreign suppliers.

(2) Price Level and Exchange Rate

The construction cost for the project is estimated on the price level of last quarter of 1989.

The following exchange rates are applied considering the prevailing exchange rates at the time of collection of cost data: US$1.0 = 590 kip = 141 J. Yen.

(3) Currency for Cost Estimate

The construction cost is estimated for the foreign currency component and local currency component in accordance with the source and origin of material and equipment.

The currency for cost estimate is expressed in Japanese Yen (J. Yen) for foreign currency component and in US Dollar (US$) for local currency component respectively. Total construction cost is expressed in US Dollars (US$).

The foreign currency component and the local currency component include the following items:

(a) Foreign currency component

- Cost of all imported equipment and spare parts
- Cost of imported materials
- Cost of engineering service for consultant

(b) Local currency component

- Labor cost
- Cost of local materials
- Cost of land acquisition
- Project administration expenses

H.2 Estimate of Project Cost

(1) Cost Component

The costs for the project administration, engineering service and land acquisition are also estimated. The project cost includes physical contingencies.

The project cost consists of the following components:

I. Direct Construction Cost (Contract Cost)
   - a) Preparatory works
   - b) Main drainage canal
     - i) Khoua Khao drainage canal
     - ii) Hong Thong drainage canal
     - iii) Box culvert (Morning market)
     - iv) Hong Ke drainage canal
   - c) Nong Chanh retarding basin
   - d) Lateral canal

II. Land Acquisition & Compensation
III. Government Administration
IV. Engineering Service
V. O&M Equipment
VI. Physical Contingency

(2) Direct Cost

The direct cost consists of three items, that is, material, labor and equipment costs. The costs include allowance and work loss on the net costs. The priced bill of quantity is listed in Table H.2.

(a) Material Cost

The construction materials are divided into local and imported materials.

The unit prices of local materials are estimated based on the price "Price of Construction Materials" assessed by Lao P.D.R.

The local materials are assumed to be procured fro the market in the city where the Project site is located and these materials are to be transported to the job site.

The unit prices of imported materials are estimated based on the market prices in Bangkok or Japan together with the inland transportation charge. Basic prices of materials are assumed as listed in Table H.3.

(b) Labor Cost

The laborers required for the construction work are assumed to be local labor. The unit prices of labors are estimated to be local labor.

The labor wages estimated at the rate of 8-hour working per day according to the labor regulation.

The labor wages are shown in Table H.4.

(c) Equipment Cost

The equipment expenses consist of the hourly or daily depreciation cost, repairing cost and management cost which comprise local and foreign currency portions.

The life time ratio of depreciation represented by a straight line method, ratio of repairing represented by an average method and ratio of management for the construction equipment are assumed based on the Japanese Standard criteria. The hourly or daily equipment cost are shown in Table H.5.

(3) Indirect Cost

Contractor's indirect cost which consists of overhead and profit of the contractor is included in this cost estimate. The overhead expenses comprise general administrative expenses and field expenses.

The general administrative expenses include salaries and allowances for contractor's personnel, legal welfare expenses, international traveling and communication expenses, depreciation, insurance, profit and so on. The field expenses consist of cost for contractor's personnel, camp operation, labor control expenses, security insurance and bond, stationary and communication expenses and so on.

The overhead expenses and profit are distributed to the unit price or lump sum of each work item. These expenses are estimated 20 per cost of direct unit cost comprising material costs, labor wages and equipment costs.

(4) Land Acquisition Cost

The costs of right of way and compensation are estimated for the lands, house and other private properties by using the prevailing unit costs obtained at Vientiane.

(5) Administration Cost

The project administration expenses are on man-month basis to cover the costs of supervisions and management of the project.

(6) Engineering Services Costs

The cost of engineering services to be required for the implementation of the project is estimated on man-month basis.

(7) Procurement Cost of O&M Equipment

O&M equipment as the minimum requirement for the project are selected. The cost of equipment is estimated at CIF at the site.

(8) Contingency

The contingency is provided to cope with the unforeseen change of physical conditions. The physical contingency is assumed to be 10% of total construction cost for both currencies.

(9) Taxes and Duties

The taxes and duties to be levied by the Government of Lao P.D.R., consisting of contract tax and income tax, were included in the indirect cost of the unit prices. Other taxes and duties such as personal income tax on the employees of the contractor, and the custom duties on the equipment and materials imported by the contractor were also taken into account in the respective unit prices.

H.3 Disbursement Schedule

Construction funds will be disbursed a period of 36 months to complete the project works. The quarterly fund requirement is estimated as shown in below based on the construction schedule as described in Part G. The detailed disbursement schedule is shown in Table H.6.

Description	Foreign Currency (1,000 J. Yen)	Local Currency (1,000 US$)	Total Equivalent (1,000 US$)
First Year			
1st Quarter	37,341	60	325
2nd Quarter	22,404	106	265
3rd Quarter	22,404	118	277
4th Quarter	8,962	66	130
Sub total	91,111	350	997
Second Year			
1st Quarter	296,725	1,472	3,576
2nd Quarter	53,789	274	655
3rd Quarter	41,275	254	547
4th Quarter	119,047	644	1,488
Sub total	510,836	2,644	6,266
Third Year			
1st Quarter	158,286	859	1,982
2nd Quarter	45,871	297	622
3rd Quarter	125,154	297	1,185
4th Quarter	192,420	822	2,185
Sub total	521,731	2,275	5,974
TOTAL	1,123,677	5,268	13,237

TABLES

Table H.1 Summary of Construction Cost

	Foreign Currency (1,000 J. Yen)	Local Currency (1,000 US$)	Total Equivalent (1,000 US$)	Equivalent J. Yen (Million)
1. Preparatory Works				
1.1 Access road, office & quarter	56,885	133	536	76
1.2 Transportation of equipment	45,752		324	46
Sub total of Item 1	102,637	133	860	122
2. Civil Works				
2.1 Khoua Khao drainage canal	148,795	944	1,999	282
2.2 Hong Thong drainage canal	112,116	671	1,466	207
2.3 Box culvert (Morning Market)	53,201	393	770	109
2.4 Hong Ke drainage canal	166,863	891	2,074	292
2.5 Nong Chanh retarding basin	130,905	879	1,807	255
2.6 Lateral canal	67,607	423	902	127
Sub total of Item 2	679,487	4,201	9,018	1,272
Total of Direct Cost	782,124	4,334	9,878	1,394
3. Land Acquisition & Compensation		122	122	17
4. Government Administration		227	227	32
5. Engineering Service	149,777	152	1,214	171
6. O & M Equipment	113,564		805	114
7. Contingency (physical, 10% of D/C)	78,212	433	988	139
Grand Total	1,123,677	5,268	13,237	1,866

Table H.2. PRICED BILL OF QUANTITY (1/10)

Item No. (Cl.No. in T.S)	Description of Works	Unit	Quantity	Foreign Currency (J.Y		Local Currency ($)		Total Equivalent (US $)
				Unit Price	Amount	Unit Price	Amount	
1	PREPARATORY WORKS							
1.1	Access road							
	1) Access road	m	2,800	4,506	12,616,800	8.96	25,088	114,563
	2) Haul road	m	2,500	3,864	9,660,000	7.82	19,550	87,560
	3) Office quarters and work shop	L.S.	1		34,808,000		88,380	333,828
1.2	Transportation of Equipment	L.S.	1		45,752,000		0	324,482
	Sub total Item 1				102,836,800		132,518	860,436
2	CIVIL WORKS							
2.1	Khoua Khao Main Drainage Canal							
	1) Care of water and dewaterring	L.S.	1		3,495,000		8,300.00	33,087.00
	2) Stripping of top soil	m3			0		0.00	0.00
	3) Excavation of drainage canal	m3	80,000	419	33,520,000	0.86	68,800.00	306,530.00
	4) Embankment, Type A	m3			0		0.00	0.00
	5) Embankment, Type B	m3			0		0.00	0.00
	6) Embankment, Type C	m3			0		0.00	0.00
	7) Excavation for structure	m3	2,500	228	570,000	0.34	850.00	4,892.00
	8) Backfill for structure	m3	3,000	210	630,000	0.39	1,170.00	5,638.00
	9) Concrete pile	m	3,200	6,716	21,491,200	60.88	194,816.00	347,235.00
	10) Removal of existing structures	m3	260	7,168	1,863,680	26.48	6,884.80	20,101.80
	11) Concrete, Type A	m3			0		0.00	0.00
	12) Concrete, Type B	m3	2,100	5,588	11,734,800	30.73	64,533.00	147,758.00
	13) Concrete, Type C	m3	145	3,538	513,010	28.42	4,120.90	7,758.90
	14) Form for concrete	m2	6,000	507	3,042,000	12.82	76,920.00	98,494.00
	15) Reinforcement bar	Kg	95,880	93	8,914,960	0.05	4,793.00	88,019.00
	16) Precast concrete pipe Dia.1,200	m			0		0.00	0.00
	17) Precast concrete pipe Dia.1,000	m			0		0.00	0.00
	18) Precast concrete pipe Dia. 800	m			0		0.00	0.00
	19) Precast concrete pipe Dia. 700	m			0		0.00	0.00
	20) Stone masonry	m2			0		0.00	0.00
	21) Concrete block masonry	m2	4,800	4,557	20,962,200	85.02	391,092.00	539,760.00
	22) Concrete plate block pitching	m2			0		0.00	0.00

Table H.2. PRICED BILL OF QUANTITY (2/10)

Item No. (Cl.No. in T.S)	Description of Works	Unit	Quantity	Foreign Currency (J.Y)		Local Currency ($)		Total Equivalent (US $)
				Unit Price	Amount	Unit Price	Amount	
	23) Gravel foundation	m3	200	4,353	870,600	27.29	5,458.00	11,632.00
	24) Step bar and ladder	kg			0		0.00	0.00
	25) G.I Pipe for handrail	m	1,610	3,784	6,092,240	7.44	11,978.40	55,185.40
	26) Bearing shoe for bridge	no.	132	93,537	12,346,884	27.48	3,627.36	91,183.36
	27) Expansion joint for bridge	m	208	49,951	10,389,808	12.72	2,645.76	76,331.76
	28) P.V.C Water stop (W=200 mm)	m			0		0.00	0.00
	29) Staff gauge	m	3	1,282	3,846	8.03	24.09	51.09
	30) Joint filler (t=20 mm)	m2	46	1,900	87,400	1.09	50.14	669.14
	31) Asphalt pavement	m2	6,700	958	6,418,600	1.03	6,901.00	52,422.00
	32) Laterite pavement	m2	2,600	109	283,400	0.18	468.00	2,477.00
	33) Curbston	m			0		0.00	0.00
	34) P.V.C Drain pipe Dia. 50 mm	m	270	473	127,710	1.40	378.00	1,283.00
	35) P.V.C Drain pipe Dia. 100 mm	m	500	1,368	684,000	4.05	2,025.00	6,876.00
	36) Miscellaneous steel works	Kg			0		0.00	0.00
	37) Guard post for culvert	no.			0		0.00	0.00
	38) Landscape gardening	m2			0		0.00	0.00
	39) Plant trees	no.	240	922	221,280	29.81	7,108.40	9,675.40
	40) Sod Facing	m2	35,000	93	3,255,000	1.51	52,850.00	75,935.00
	41) Base coase	m3	830	405	336,150	8.15	6,764.50	9,148.50
	42) Sub base coase	m3	2,600	232	603,200	7.86	20,436.00	24,714.00
	43) Precast concrete stoplog	m3	1	17,052	17,052	20.46	20.46	140.46
	44) Steel fram for gate	kg	550	347	190,850	1.30	715.00	2,068.00
	45) Manual Type Winch	no.	2	65,000	130,000	46.00	92.00	1,013.00
	Sub total 2.1				148,794,890		943,820	1,999,089

Table H.2. PRICED BILL OF QUANTITY (3/10)

Item No. (Cl.No. in T.S)	Description of Works	Unit	Quantity	Foreign Currency (J.Y)		Local Currency ($)		Total Equivalent (J.Y)
				Unit Price	Amount	Unit Price	Amount	
2.2	Hong Thong Main Drainage canal							
	1) Care of water and dewatering	L.S.	1		3,590,000		8,500.00	33,960.00
	2) Stripping of top soil	m3			0		0.00	0.00
	3) Excavation of drainage canal	m3	37,150	419	15,565,850	0.86	31,949.00	142,345.00
	4) Embankment, Type A	m3	3,000	476	1,428,000	0.93	2,790.00	12,917.00
	5) Embankment, Type B	m3			0		0.00	0.00
	6) Embankment, Type C	m3			0		0.00	0.00
	7) Excavation for structure	m3	1,650	229	376,200	0.34	561.00	3,229.00
	8) Backfill for structure	m3	1,300	210	273,000	0.39	507.00	2,443.00
	9) Concrete Pile	m	1,500	6,716	10,074,000	60.88	91,320.00	162,766.00
	10) Removal of existing structures	m3	150	7,168	1,075,200	26.48	3,972.00	11,597.00
	11) Concrete, Type A	m3			0		0.00	0.00
	12) Concrete, Type B	m3	1,440	5,588	8,046,720	30.73	44,251.20	101,319.20
	13) Concrete, Type C	m3	1,700	3,538	6,014,600	28.42	48,314.00	90,970.00
	14) Form for concrete	m2	3,820	507	1,936,740	12.82	48,972.40	62,707.40
	15) Reinforcement bar	Kg	90,350	93	8,402,550	0.05	4,517.50	64,109.50
	16) Precast concrete pipe Dia.1,200	m			0		0.00	0.00
	17) Precast concrete pipe Dia.1,000	m			0		0.00	0.00
	18) Precast concrete pipe Dia. 800	m			0		0.00	0.00
	19) Precast concrete pipe Dia. 700	m			0		0.00	0.00
	20) Stone masonry	m2			0		0.00	0.00
	21) Concrete block masonry	m2	3,400	4,557	15,493,800	85.02	289,068.00	398,953
	22) Concrete plate block pitching	m2			0			0.00
	23) Gravel foundation	m3	300	4,353	1,305,900	27.29	8,187.00	17,448.00
	24) Step bar and ladder	no.			0		0.00	0.00
	25) G.I Pipe for handrail	m	3,500	3,784	13,244,000	7.44	26,040.00	119,969.00
	26) Bearing shoe for bridge	no.	102	93,537	9,540,774	27.48	2,802.96	70,467.96
	27) Expansion joint for bridge	m	137	48,951	6,843,287	12.72	1,742.64	50,275.64
	28) P.V.C Water stop (W=200 mm)	m			0		0.00	0.00
	29) Staff gauge	m	6	1,282	7,692	6.03	48.18	102.18
	30) Joint filler (t=20 mm)	m2	36	1,900	68,400	1.09	39.24	524.24
	31) Asphalt pavement	m2	5,700	958	5,460,600	1.03	5,871.00	44,596.00
	32) Laterite pavement	m2	2,300	109	250,700	0.18	414.00	2,192.00

Table H.2 PRICED BILL OF QUANTITY (4/10)

Item No. (Cl.No. in T.S)	Description of Works	Unit	Quantity	Foreign Currency (J.Y		Local Currency ($)		Total Equivalent (US $)
				Unit Price	Amount	Unit Price	Amount	
	33) Curbston	m			0		0.00	0.00
	34) P.V.C Drain pipe Dia. 50 mm	m	160	473	75,680	1.40	224.00	760.00
	35) P.V.C Drain pipe Dia. 100 mm	m	220	1,368	300,960	4.05	891.00	3,025.00
	36) CIP (Dia. 250 mm)	m	24	5,288	126,912	3.35	80.40	980.40
	37) Porous Pipe Dia. 400 mm	m	9	4,692	42,228	36.74	330.66	629.66
	38) Waterproof Sheet	m2	263	1,275	335,325	2.11	554.93	2,932.93
	39) Plant trees	no.	110	922	101,420	29.61	3,257.10	3,976.10
	40) Sodfacing	m2	14,000	93	1,302,000	1.51	21,140.00	30,374.00
	41) Base coase	m3	800	405	324,000	8.15	6,520.00	8,817.00
	42) Sub base coase	m3	2,300	232	533,600	7.86	18,078.00	21,862.00
	Sub total 2.2				112,116,398		670,548	1,466,250

Table H.2. PRICED BILL OF QUANTITY (5/10)

Item No. (Cl.No. in T.S)	Description of Works	Unit	Quantity	Foreign Currency (J.Y		Local Currency ($)		Total Equivalent (US $)
				Unit Price	Amount	Unit Price	Amount	
2.3	Box Culvert (Morning Market)							
	1) Care of water and dewatering	L.S.	1		860,000		2,000	8,099
	2) Excavation for structure	m3	6,400	228	1,459,200	0.34	2,176.00	12,524.00
	3) Backfill for structure	m3	3,000	210	630,000	0.39	1,170.00	5,638.00
	4) Removal of existing structures	m3	1,450	7,168	10,393,600	26.48	38,396.00	112,109.00
	5) Concrete , Type A	m3			0		0.00	0.00
	6) Concrete , Type B	m3	1,950	5,588	10,896,600	30.73	59,923.50	137,203.50
	7) Concrete , Type C	m3	380	3,538	1,344,440	28.42	10,799.60	20,334.60
	8) Form for concrete	m2	5,300	507	2,687,100	12.82	67,946.00	87,003.00
	9) Reinforcement bar	Kg	215,000	93	19,995,000	0.95	204,250.00	346,058.00
	10) Stone masonry	m2			0		0.00	0.00
	11) Concrete block masonry	m2			0		0.00	0.00
	12) Riprap protection	m3			0		0.00	0.00
	13) Gravel foundation	m3			0		0.00	0.00
	14) Step bar and ladder	no.			0		0.00	0.00
	15) G.I Pipe for handrail	m	90	3,784	340,560	7.44	669.60	3,084.60
	16) P.V.C Water stop (W=200 mm)	m	510	1,530	780,300	2.53	1,290.30	6,824.30
	17) Staff gauge	m			0		0.00	0.00
	18) Joint filler (t=20 mm)	m2			0		0.00	0.00
	19) Asphalt pavement	m2	3,900	958	3,736,200	1.03	4,017.00	30,514.00
	20) P.V.C Drain pipe Dia. 50 mm	m	165	473	78,045	1.40	231.00	784.00
	21) Guard post for culvert	no.			0		0.00	0.00
	Sub total 2.3				53,201,045		392,869.00	770,178.00

Table H.2. PRICED BILL OF QUANTITY (6/10)

Item No. (Cl.No. in T.S)	Description of Works	Unit	Quantity	Foreign Currency (J.Y)		Local Currency ($)		Total Equivalent (US $)
				Unit Price	Amount	Unit Price	Amount	
2.4	Hong Ke Main Drainage Canal							
	1) Care of water and dewaterring	L.S.	1		8,100,000		19,000	76,446
	2) Stripping of top soil	m3			0		0.00	0.00
	3) Excavation of drainage canal	m3	167,500	419	70,182,500	0.86	144,050.00	641,798.00
	4) Embankment, Type A	m3	7,300	476	3,474,800	0.93	6,789.00	31,432.00
	5) Embankment, Type B	m3			0		0.00	0.00
	6) Embankment, Type C	m3			0		0.00	0.00
	7) Excavation for structure	m3	3,000	228	684,000	0.34	1,020.00	5,871.00
	8) Concrete Pile	m	1,200	6,716	8,059,200	60.88	73,056.00	130,213.00
	9) Backfill for structure	m3	2,100	210	441,000	0.39	819.00	3,946.00
	10) Removal of existing structures	m3	450	7,168	3,225,600	26.48	11,916.00	34,792.00
	11) Concrete, Type A	m3			0		0.00	0.00
	12) Concrete, Type B	m3	1,460	5,588	8,158,480	30.73	44,865.80	102,726.80
	13) Concrete, Type C	m3	130	3,538	459,940	28.42	3,694.60	6,955.60
	14) Form for concrete	m2	3,320	507	1,683,240	12.82	42,562.40	54,499.40
	15) Reinforcement bar	Kg	118,330	93	11,004,690	0.05	5,916.50	83,983.50
	16) Precast concrete pipe Dia.1,200	m			0		0.00	0.00
	17) Precast concrete pipe Dia.1,000	m			0		0.00	0.00
	18) Precast concrete pipe Dia. 800	m			0		0.00	0.00
	19) Precast concrete pipe Dia. 700	m			0		0.00	0.00
	20) Stone masonry	m2			0		0.00	0.00
	21) Concrete block masonry	m2	5,300	4,557	24,152,100	85.02	450,606.00	621,897
	22) Concrete plate block pitching	m2	400	2,151	860,400	30.09	12,036	18,138
	23) Gravel foundation	m3	100	4,353	435,300	27.29	2,729.00	5,816.00
	24) Step bar and ladder	no.			0		0.00	0.00
	25) G.I Pipe for handrail	m	950	3,794	3,594,800	7.44	7,068.00	32,563.00
	26) Bearing shoe for bridge	no.	54	93,537	5,050,998	27.48	1,483.92	37,305.92
	27) Expansion joint for bridge	m	88	49,951	4,395,688	12.72	1,119.36	32,294.36
	28) P.V.C Water stop (W=200 mm)	m	60	1,530	91,800	2.53	151.80	802.80
	29) Staff gauge	m	12.5	1,282	16,025	8.03	100.38	213.38
	30) Joint filler (t=20 mm)	m2	22	1,900	41,800	1.09	23.98	319.98
	31) Asphalt pavement	m2	1,450	958	1,389,100	1.03	1,493.50	11,344.50

Table H.2. PRICED BILL OF QUANTITY (7/10)

Item No. (Cl.No. in T.S)	Description of Works	Unit	Quantity	Foreign Currency (J.Y)		Local Currency ($)		Total Equivalent (US $)
				Unit Price	Amount	Unit Price	Amount	
	32) Laterite pavement	m2	5,200	109	566,800	0.18	936.00	4,955.00
	33) Curbston	m			0		0.00	0.00
	34) P.V.C Drain pipe Dia. 50 mm	m	130	473	61,490	1.40	182.00	618.00
	35) P.C.C Drain pipe Dia. 100 mm	m	160	1,368	218,880	4.05	648.00	2,200.00
	36) Miscellaneous steel works	Kg			0		0.00	0.00
	37) Guard post for culvert	no.			0		0.00	0.00
	38) Landscape gardening	m2			0		0.00	0.00
	39) Plant trees	no.	0	822	0	29.61	0.00	0.00
	40) Sod facing	m2	0	93	0	1.51	0.00	0.00
	41) Base coase	m3	1,600	405	648,000	8.15	13,040.00	17,635.00
	42) Sub base coase	m3	5,000	232	1,160,000	7.86	39,300.00	47,526.00
	43) PVC Pipe D 500 mm	m	27	10,067	271,809	3.44	92.88	2,018.88
	44) I Shape Steel	kg	81,900	97	7,944,300	0.06	4,914.00	61,256.00
	45) Bolt and anchor	kg	800	351	280,800	1.15	920.00	2,911.00
	46) Steel pipe D 300 mm	m	33	8,345	209,385	4.02	132.66	1,617.66
	Sub total 2.4				166,882,925		890,667	2,074,077

Table H.2. PRICED BILL OF QUANTITY (8/10)

Item No. (Cl.No. in T.S)	Description of Works	Unit	Quantity	Foreign Currency (J.Y)		Local Currency ($)		Total Equivalent (US $)
				Unit Price	Amount	Unit Price	Amount	
2.5	Nong Chanh Retarding Basin							
	1) Care of water and dewatering	L.S.	1		5,080,000		12,000	48,028
	2) Stripping of top soil	m3			0		0.00	0.00
	3) Excavation of retarding basin	m3	135,000	407	54,945,000	0.84	113,400.00	503,080.00
	4) Embankment, Type A	m3	20,000	476	9,520,000	0.93	18,600.00	86,117.00
	5) Embankment, Type B	m3			0		0.00	0.00
	6) Embankment, Type C	m3			0		0.00	0.00
	7) Excavation for structure	m3	1,040	228	237,120	0.34	353.60	2,034.60
	8) Concrete Pile	m	420	6,716	2,820,720	60.88	25,569.60	45,574.60
	9) Concrete Sheet Pile	m	1,400	1,570	2,198,000	15.10	21,140.00	36,728.00
	10) Backfill for structure	m3	500	210	105,000	0.39	195.00	939.00
	11) Removal of existing structures	m3			0		0.00	0.00
	12) Concrete, Type A	m3	400	5,063	2,025,200	29.08	11,632.00	25,995.00
	13) Concrete, Type B	m3	400	5,598	2,235,200	30.73	12,292.00	28,144.00
	14) Concrete, Type C	m3	75	3,538	265,350	28.42	2,131.50	4,012.50
	15) Form for concrete	m2	1,440	507	730,080	12.82	18,460.80	23,637.80
	16) Reinforcement bar	Kg	43,270	93	4,024,110	0.05	2,163.50	30,702.50
	17) Precast concrete pipe Dia.1,200	m			0		0.00	0.00
	18) Precast concrete pipe Dia.1,000	m			0		0.00	0.00
	19) Precast concrete pipe Dia. 800	m			0		0.00	0.00
	20) Precast concrete pipe Dia. 700	m			0		0.00	0.00
	21) Stone masonry	m2	1,700	1,409	2,395,300	34.54	58,718.00	75,705.00
	22) Concrete block masonry	m2	5,310	4,557	24,197,670	85.02	451,456.20	623,070
	23) Concrete plate block pitching	m2	1,400	2,151	3,011,400	30.09	42,126.00	63,483.00
	24) Gravel foundation	m3	35	4,353	152,355	27.29	955.15	2,035.15
	25) Step bar and ladder	kg	450	409	184,050	1.15	517.50	1,822.50
	26) G.I Pipe for handrail	m	180	3,784	681,120	7.44	1,339.20	6,169.20
	27) Bearing shoe for bridge	no.	18	93,537	1,683,666	27.48	494.64	12,434.64
	28) Expansion joint for bridge	m	31	49,951	1,548,481	12.72	394.32	11,378.32
	29) P.V.C Water stop (W=200 mm)	m	50	1,184	59,200	2.53	126.50	545.50
	30) Staff gauge	m	5	1,282	6,410	8.03	40.15	85.15
	31) Joint filler (t=20 mm)	m2	10	1,900	19,000	1.09	10.90	144.90
	32) Asphalt pavement	m2	8,200	958	7,855,600	1.03	8,446.00	64,159.00

Table H.2. PRICED BILL OF QUANTITY (9/10)

Item No. (Cl.No. in T.S)	Description of Works	Unit	Quantity	Foreign Currency (J.Y)		Local Currency ($)		Total Equivalent (J.Y)
				Unit Price	Amount	Unit Price	Amount	
	33) Laterite pavement	m2			0		0.00	0.00
	34) Curbston (Brick)	m			0		0.00	0.00
	35) P.V.C Drain pipe Dia. 50 mm	m	41	473	19,393	1.40	57.40	194.40
	36) Flapvalve,weep hole	m			0		0.00	0.00
	37) Miscellaneous steel works	Kg			0		0.00	0.00
	38) Guard post for culvert	no.			0		0.00	0.00
	39) Slide gate							
	a) 1.10 (W) X 1.10 (H)	Set	1	700,000	700,000	1,300.00	1,300.00	6,264.00
	40) Landscape gardening	m2	2,500	672	1,680,000	5.17	12,925.00	24,839.00
	41) Plant trees	no.	200	922	184,400	29.61	5,922.00	7,229.00
	42) Sod facing	m2	9,780	93	909,540	1.51	14,767.80	21,217.80
	43) Base coase	m3	1,300	405	526,500	8.15	10,595.00	14,329.00
	44) Sub base coase	m3	3,900	232	904,800	7.86	30,654.00	37,071.00
	Sub total 2.5				130,904,665		878,784	1,807,168

Table H.2. PRICED BILL OF QUANTITY (10/10)

Item No. (Cl.No. in T.S)	Description of Works	Unit	Quantity	Foreign Currency (J.Y)		Local Currency ($)		Total Equivalent (US $)
				Unit Price	Amount	Unit Price	Amount	
2.6	Lateral Canal							
	1) Care of water and dewaterring	L.S.	1		1,900,000		4,500	17,975
	2) Excavation for structure	m3	24,120	228	5,499,360	0.34	8,200.80	47,202.80
	3) Backfill for structure	m3	10,480	210	2,200,800	0.39	4,087.20	19,695.20
	4) Removal of existing structures	m3	500	7,168	3,584,000	26.48	13,240.00	38,658.00
	5) Concrete , Type A	m3			0		0.00	0.00
	6) Concrete , Type B	m3	3,160	5,588	17,658,080	30.73	97,106.80	222,340.80
	7) Concrete , Type C	m3	650	3,538	2,299,700	28.42	18,473.00	34,762.00
	8) Form for concrete	m2	16,270	507	8,248,890	12.82	208,581.40	267,083.40
	9) Reinforcement bar	Kg	211,860	93	19,704,840	0.05	10,594.00	150,344.00
	10) Riprap protection	m3	940	613	576,220	50.63	47,592.20	51,678.20
	11) Manhole caver	no.	300	9,070	2,721,000	14.99	4,497.00	23,784.00
	12) Crashed stone	m3	30	4,353	130,590	27.29	818.70	1,744.70
	13) Step bar and ladder	no.	280	730	204,400	2.06	576.80	2,025.80
	14) P.V.C Water stop (W=150 mm)	m	1,320	1,184	1,562,880	2.53	3,339.60	14,423.60
	15) Joint filler (t=20 mm)	m2	290	1,900	551,000	1.09	316.10	4,223.10
	16) Asphalt pavement	m2			0		0.00	0.00
	17) Mesh screen	no.	300	2,550	765,000	4.22	1,266.00	6,681.00
	Sub Total of Item 2.6				67,606,760		423,188.60	902,661.60

Table H.3 Material Cost (1/3)

Item No.	Description	Unit	Unit Cost F.C. (J. Yen)	Unit Cost L.C. (US$)
1.	Fuel & Lubricant			
	(1) Gasoline	Lit.	45	
	(2) Diesel	Lit.	40	
	(3) Engine oil	Lit.	135	
	(4) Grease	kg	215	
2.	Cement & Admixture			
	(1) Cement (bag)	ton	13,400	
	(2) Air entraining agent	kg	215	
3.	Reinforcement steel bar			
	(1) Round bar	ton	70,500	
	(2) Deformed bar	ton	70,500	
4.	Timber			
	(1) Plank			
	Class I	m 3		250
	Class II	m 3		220
	Class III	m 3		180
	(2) Square			
	Class I	m 3		220
	Class II	m 3		180
	Class III	m 3		150
	(3) Log Dia. 10 to 150 mm	m 3		35
5.	Plywood			
	(1) t = 9 mm, 900 x 1,800 mm	Sheet		6.00
	(2) t = 12 mm, 900 x 1,800 mm	Sheet		8.00
6.	Bamboo			
	(1) Big size (l = 4 m)	PC		0.30
	(2) Small size (l = 4 m)	PC		0.20
7.	Asphalt	kg	35	
8.	Sand & Gravel, Stone			
	(1) Fine aggregate	m 3		4.50
	(2) Coarse aggregate	m 3		6.50
	(3) Natural gravel	m 3		6.00
	(4) Crushed aggregate	m 3		12.00
	(5) Crusher run	m 3		12.00
	(6) Blasted rock	m 3		40.00

Table H.3 Material Cost (2/3)

Item No.	Description	Unit	Unit Cost F.C. (J. Yen)	Unit Cost L.C. (US$)
9.	Brick	PC		0.025
10.	Concrete Pipe			
	(1) Dia. 200 mm	m		15.00
	(2) Dia. 300 mm	m		18.00
	(3) Dia. 400 mm	m		20.00
	(4) Dia. 500 mm	m		21.00
	(5) Dia. 600 mm	m		23.00
	(6) Dia. 800 mm	m		27.00
	(7) Dia. 1,000 mm	m		30.00
11.	P.V.C. Waterstop			
	(1) W = 150 mm	m	920	
	(2) W = 250 mm	m	1,200	
12.	P.V.C. Pipe			
	(1) Dia. 50 mm (l = 4 m)	m	370	
	(2) Dia. 75 mm (l = 4 m)	m	990	
	(3) Dia. 100 mm (l = 4 m)	m	1,310	
13.	Steel Material			
	(1) Angle & channel	kg	60	
	(2) I-shape steel	kg	60	
	(3) H-shape steel	kg	60	
	(4) Steel plate	kg	60	
	(5) Steel pipe Dia. 65 mm	m	1,050	
	Steel pipe Dia. 65 mm	kg	110	
	(6) Steel sheet pile			
	Type-II (48 kg/m)	kg	110	
	Type-III (60 kg/m)	kg	110	
	(7) Galvanized pipe			
	Dia. 25 mm	m	380	
	Dia. 50 mm	m	590	
	Dia. 80 mm	m	1,330	
	Dia. 100 mm	m	1,550	
	Dia. 150 mm	m	2,230	
	(8) Galvanized iron wire	kg	280	
	(9) Barbed wire	kg	210	
	(10) Welded wire net	m2	560	
	(11) Wire mesh	m2	990	
	(12) Bolt and nut	kg	210	
	(13) Nail	kg		1.00

Table H.3 Material Cost (3/3)

Item No.	Description	Unit	Unit Cost F.C. (J. Yen)	Unit Cost L.C. (US$)
14.	Others			
(1)	Welding rod	kg	170	
(2)	Electricity	kWh		0.01
(3)	Concrete block (for wall)	No.		0.20
(4)	Fence H = 1.8 m	m	3,390	
(5)	Gabion matters			
	1.2 m x 2.0 m x 0.5 m	PC	44,000	
	1.2 m x 3.0 m x 0.5 m	PC	58,800	
(6)	Gabion cylinder			
	Dia. 600 mm	m	650	
	Dia. 450 mm	m	450	
(7)	Metal form			
	300 x 1,500 mm	PC	2,700	
	200 x 1,500 mm	PC	2,700	
	150 x 1,500 mm	PC	2,150	
	100 x 1,500 mm	PC	1,820	
(8)	Separator Dia. 8 to 10 mm	m	90	
(9)	Form tie Dia. 8 to 10 mm	m	100	
(10)	Cone	No.	30	
(11)	Form oil	Lit.	450	
(12)	Pipe support Dia. 48.6 mm	m	1,300	

Table H.4 Price List of Labor Wages

Item No.	Description	Unit	Price F.C. (J. Yen)	Price L.C. (US$)
1.	Foreman			
	(a) Foreign	Man-day	35,300	
	(b) Local	Man-day		10
2.	Operator	Man-day		7
3.	Assistant operator	Man-day		5
4.	Driver			
	(a) Dump truck	Man-day		7
	(b) Ordinary truck	Man-day		5
5.	Mechanic	Man-day		7
6.	Electrician	Man-day		8
7.	Rigger	Man-day		7
8.	Welder	Man-day		7
9.	Carpenter	Man-day		7
10.	Steel worker	Man-day		5
11.	Mason	Man-day		5
12.	Plasterer	Man-day		5
13.	Plumber	Man-day		7
14.	Concrete worker	Man-day		4.5
15.	Painter	Man-day		4.5
16.	Skilled labor	Man-day		6
17.	Common labor	Man-day		4

Table H.5 Hourly or Daily Cost of Equipment

Item No.	Description	Capacity	HP or kW	F.C. (J.Y/Hr) (J.Y/day)	L.C. ($/Hr) ($/day)
1.	Bulldozer	21 ton	211	7,258	6.07
2.	Bulldozer	11 ton	108	3,723	3.12
3.	Swamp dozer	13 ton	112	4,286	3.67
4.	Crawler loader	1.4 m3	110	3,320	2.84
5.	Wheel loader	2.1 m3	127	4,264	3.65
6.	Wheel loader	1.2 m3	75	2,289	1.87
7.	Amphibious excavator	0.4 m3	63	12,046	10.42
8.	Back hoe	0.6 m3	119	4,019	3.06
9.	Dump truck	11 ton	310	1,983	1.49
10.	Dump truck	6 ton	170	1,248	0.94
11.	Ordinary truck	4 ton	164	889	0.59
12.	Truck crane	20 ton	230	5,140	3.80
13.	Motor grader	3.1 m	113	3,379	2.61
14.	Macadam roller	8 ton	90	1,881	1.52
15.	Pneumatic roller	8 ton	89	2,329	1.88
16.	Vibratory roller	3 ton	27	2,036	1.53
17.	Vibratory roller	0.6 ton	5.5	632	0.46
18.	Tamper	80 kg	4 day	928	0.58
19.	Portable concrete mixer	0.2 m3	4.5 kW day	4,210	3.47
20.	Agitator truck	3.2 m3	220	1,986	1.42
21.	Concrete bucket	0.5 m3	- day	1,499	1.14
22.	Concrete vibtrator	Dia. 40 mm	0.7 kW day	452	0.26
23.	Concrete cart	0.1 m3	- day	51	0.02
24.	Diesel engine generator	35 kVA	48 day	3,778	2.64
25.	Vibro driver	2.4 T	30 kW	2,344	1.76
26.	Water tanker	6 kl	180	2,558	2.84
27.	Submersible pump	Dia. 150 mm	11 kW day	1,149	1.13
28.	Submersible pump	Dia. 100 mm	5.5 kW day	786	0.78
29.	Submersible pump	Dia. 50 mm	1.5 kW day	318	0.31
30.	Welder w/engine	250 A	19 kW day	2,328	1.80
31.	Asphalt spray	30 l/min.	3.5 day	812	0.40
32.	Air compressor	10.6 m3/min	106 day	9,576	7.40
33.	Concrete breaker	30 kg	- day	300	1.00
34.	Pick hammer	7 kg	- day	154	0.07
35.	Chain saw	500 mm	55 cc day	815	0.70

Table H.6 Disbursement Schedule (Hong Ke System)

(Unit: J.Yen 1,000, US$ 1,000)

	Total		First Year								Second Year								Third Year							
			1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)	F.C. (J.Y)	L.C. (US$)
1. Direct Cost																										
a) Preparatory Works																										
Access road, office & quarters	56,885	133									34,131	80	11,377	27											11,377	26
Transportation of equipment	45,752										27,451	0													18,301	0
b) Civil Works																										
Khoua Khao drainage canal	148,795	944									29,759	189							44,639	283	14,880	94	14,880	94	44,637	284
Hong Thong drainage canal	112,116	671									22,028	154							46,031	208	11,014	77	11,014	77	22,029	155
Box culvert (Morning Market)	53,201	393									21,280	157	7,980	59	7,980	59	15,961	118								
Hong Ke drainage canal	166,863	891									75,088	401	16,686	89	16,686	89	58,403	312								
Nong Chanh retarding basin	130,905	879									26,181	176							39,272	264	13,091	88	13,091	88	39,270	263
Lateral canal	67,607	423									27,043	169	10,141	63	10,141	63	20,282	128								
Total of direct cost	782,124	4,334	0	0	0	0	0	0	0	0	262,961	1,326	46,184	238	34,807	211	94,646	558	129,942	755	38,985	259	38,985	259	135,614	728
2. Land Acquisition & Compensation		122				37		49		36																
3. Administration cost		227		21		46		46		21		5		9		19		14		16		9		9		12
4. Engineering Services	149,777	152	37,341	39	22,404	23	22,404	23	8,962	9	7,468	8	2,987	3	2,987	3	14,936	16	15,350	13	2,987	3	2,987	3	8,964	9
5. O & M Equipment Cost	113,564																						79,283		34,281	
6. Physical Contingency	78,212	433	0	0	0	0	0	0	0	0	26,296	133	4,618	23	3,481	21	9,465	56	12,994	75	3,899	26	3,899	26	13,561	73
Grand Total	1,123,677	5,268	37,341	60	22,404	106	22,404	118	8,962	66	296,725	1,472	53,789	274	41,275	254	119,047	644	158,286	859	45,871	297	125,154	297	192,420	822

Table H.7 Freight Charge of Construction Equipment

Item No.	Description	Capacity	HP or kW	Quantities	Total Freight Charge (J.Yen 1,000)
1.	Bulldozer	21 ton	211	2	3,200
2.	Bulldozer	11 ton	108	2	2,053
3.	Swamp dozer	13 ton	112	4	4,939
4.	Crawler loader	1.4 m3	110	2	1,576
5.	Wheel loader	2.1 m3	127	1	1,410
6.	Wheel loader	1.2 m3	75	2	1,326
7.	Amphibious excavator	0.4 m3	63	2	5,451
8.	Back hoe	0.6 m3	119	3	6,713
9.	Dump truck	11 ton	310	7	3,241
10.	Dump truck	6 ton	170	5	1,815
11.	Ordinary truck	4 ton	164	2	706
12.	Truck crane	20 ton	230	2	1,560
13.	Motor grader	3.1 m	113	2	2,389
14.	Macadam roller	8 ton	90	2	1,066
15.	Pneumatic roller	8 ton	89	2	927
16.	Vibratory roller	3 ton	27	2	352
17.	Vibratory roller	0.6 ton	5.5	2	145
18.	Tamper	80 kg	4	8	76
19.	Portable concrete mixer	0.2 m3	4.5 kW	10	3,241
20.	Agitator truck	3.2 m3	220	2	776
21.	Concrete bucket	0.5 m3	-	4	87
22.	Concrete vibtrator Dia.	40 mm	0.7 kW	10	56
23.	Concrete cart	0.1 m3	-	20	192
24.	Diesel engine generator	35 kVA	48	2	193
25.	Vibro driver	2.4 T	30 kW	2	249
26.	Water tanker	6 kl	180	2	778
27.	Submersible pump Dia.	150 mm	11 kW	5	71
28.	Submersible pump Dia.	100 mm	5.5 kW	10	51
29.	Submersible pump Dia.	50 mm	1.5 kW	10	31
30.	Welder w/engine	250 A	19 kW	2	40
31.	Asphalt spray	30 l/min.	3.5	2	153
32.	Air compressor	10.6 m3/min.	106	2	838
33.	Concrete breaker	30 kg	-	4	17
34.	Pick hammer	7 kg	-	5	7
35.	Chain saw	500 mm	55 cc	2	27
	TOTAL				45,752

Table H.8 Comparison of Labor Cost

(Unit: US$)

	Unit	Vientiane Municipality	Ministry of Communication *1	Foreign Contractor (Japanese A)	Foreign Contractor (Japanese B)	State *2 Enterprise Irri. No. 1	State *3 Enterprise Irri. No. 2	Mittapap Construction Co.	Vientiane Drainage Project
Foreman									
a) Foreign	M.d.	-	-	-	-	-	-	160.0	250.0
b) Local	M.d.	10.0	6.0	10.0	12.0	8.0	-	8.0	10.0
Operator	M.d.	-	4.5	7.0	7.0	6.0	8.1	3.6	7.0
Assistant operator	M.d.	-	4.0	4.0	6.0	5.0	5.4	3.2	5.0
Driver									
a) Dump truck	M.d.	8.0	4.0	4.0	7.0	4.0	8.1	3.2	7.0
b) Ordinary truck	M.d.	8.0	3.0	4.0	6.0	3.0	5.4	2.8	5.0
Mechanic	M.d.	8.0	5.0	7.0	10.0	-	-	4.0	7.0
Electrician	M.d.	8.0	4.5	7.0	8.0	5.0	-	3.6	8.0
Rigger	M.d.	8.0	5.5	4.0	7.0	-	-	3.2	7.0
Welder	M.d.	8.0	4.5	4.0	10.0	5.0	-	3.6	7.0
Carpenter	M.d.	8.0	3.5	7.0	8.0	5.0	-	3.2	7.0
Steel worker	M.d.	8.0	2.5	4.0	5.0	-	-	3.2	5.0
Mason	M.d.	8.0	3.5	4.0	5.0	5.0	4.9	4.8	5.0
Plasterer	M.d.	8.0	3.5	4.0	5.0	5.0	3.7	4.8	5.0
Plumber	M.d.	8.0	4.0	7.0	7.0	4.5	-	3.6	7.0
Concrete worker	M.d.	8.0	2.5	4.0	5.0	4.5	-	2.4	4.5
Painter	M.d.	8.0	3.7	4.0	5.0	4.5	-	3.2	4.5
Skilled labor	M.d.	6.0	3.5	7.0	6.0	7.0	-	2.8	6.0
Common labor	M.d.	5.0	1.7	4.0	5.0	3.5	1.7	2.4	4.0

Note; *1 Ministry of communication, material laboratory and surveying
*2 State irrigation construction enterprise No. 1
*3 Ministry of agriculture & forestry, state enterprise of irrigation No. 2

Table H.9 Comparison of Material Cost (1/4)

(Unit: US$)

Description	Unit	Vientiane Municipality	Ministry of Communication *1	Foreign Contractor (Japanese A)	Foreign Contractor (Japanese B)	State *2 Enterprise Irri. No. 1	State *3 Enterprise Irri. No. 2	Mittapap Construction Co.	Vientiane Drainage Project
1. Fuel & Lubricant									
(1) Gasoline	Lit.	0.28	0.25	0.30	0.40	0.25	0.29	-	0.30
(2) Diesel	Lit.	0.28	0.24	0.25	0.43	0.23	0.23	-	0.28
(3) Engine oil	Lit.	2.50	1.00	0.95	0.94	1.20	1.14	-	0.95
(4) Grease	kg	-	1.50	1.20	1.65	-	139.00	-	1.50
2. Cement & Admisture									
(1) Cement (bag)	ton	95.00	90.00	95.00	95.00	89.00	64.29	-	95.00
(2) Air entraining agent	Lit.	-	-	1.50	-	-	-	-	1.50
3. Reinforcement Steel Bar									
(1) Round bar	ton	480	340	600	550	290	171	-	500
(2) Deformed bar	kg	-	400	600	550	-	315.3	-	500
4. Timber									
(1) Plank									
Class I	m3	250	260	200	-	155	121.43	-	250
Class II	m3	220	240	200	-	155	107.15	-	220
Class III	m3	180	130	200	-	155	92.86	-	180
(2) Square									
Class I	m3	215	260	200	280	140	92.86	300	220
Class II	m3	180	240	200	185	140	92.86	200	180
Class III	m3	150	130	200	150	140	92.86	170	150
(3) Log Dia. 10 - 150 mm	m3	-	-	-	40.00	-	36.38	-	35.00
5. Plywood									
(1) 9 mm 900 x 1,800	Sheet	-	-	6.50	6.00	-	2.25	-	6.00
(2) 12 mm 900 x 1,800	Sheet	-	-	8.10	8.00	-	2.80	6.19	8.00
6. Bamboo									
(1) Big size l = 4 m	PC	-	0.29	-	-	-	0.06	0.80	0.30
(2) Small size l = 4 m	PC	-	0.19	-	-	-	0.05	0.60	0.20

(to be continued)

Table H.9 Comparison of Material Cost (2/4)

(Unit: US$)

Description	Unit	Vientiane Municipality	Ministry of Communication *1	Foreign Contractor (Japanese A)	Foreign Contractor (Japanese B)	State *2 Enterprise Irri. No. 1	State *3 Enterprise Irri. No. 2	Mittapap Construction Co.	Vientiane Drainage Project
7. Asphalt	kg	-	0.28	0.25	0.25	-	-	-	0.25
8. Sand & Gravel, Stone					5.00	-			5.00
(1) Fine aggregate	m3	4.20	3.50	8.00	7.00	-	6.00	3.00	7.00
(2) Coarse aggregate	m3	6.50	7.00	10.00	8.00	-	19.50	5.00	8.00
(3) Natural gravel	m3	-	-	10.00	7.00	-	-	6.00	10.00
(4) Crushed aggregate	m3	25.00	-	12.00	8.00	-	-	7.00	10.00
(5) Crusher run	m3	25.00	-	12.00	40.00	-	-	-	35.00
(6) Blasted rock	m3	40.00	-	35.00	25.00	-	-	-	
9. Brick (1,000 pc)	PC	20.00	22.00	30.00	15.00	-	20.00	26.00	25.00
10. Concrete Pipe									
(1) Dia. 200 mm	m	-	-	-	15.00	-	-	-	15.00
(2) Dia. 300 mm	m	-	-	-	20.00	18.00	-	-	18.00
(3) Dia. 400 mm	m	-	-	-	25.00	20.00	-	-	20.00
(4) Dia. 500 mm	m	-	-	-	30.00	21.00	-	-	21.00
(5) Dia. 600 mm	m	-	-	-	35.00	23.00	-	-	23.00
(6) Dia. 800 mm	m	-	-	-	40.00	-	-	-	27.00
(7) Dia. 1,000 mm	m	-	-	-	43.00	-	-	-	30.00
11. P.V.C. Waterstop									
(1) W = 150 mm	m	-	-	-	-	-	-	-	6.50
(2) W = 250 mm	m	-	-	-	-	-	-	-	8.50
12. P.V.C. Pipe									
(1) Dia. 50 mm (l = 4 m)	m	-	5.25	2.60	1.63	-	-	-	2.60
(2) Dia. 75 mm (l = 4 m)	m	-	8.50	3.50	7.00	-	-	-	7.00
(3) Dia. 100 mm (l = 4 m)	m	-	10.25	6.50	9.25	-	-	-	9.30
13. Steel material									
(1) Angle & channel	kg	0.45	0.40	0.50	-	-	-	-	0.45
(2) I-shape steel	kg	0.45	0.40	0.50	-	-	-	-	0.45
(3) H-shape steel	kg	0.45	0.40	0.70	-	-	-	-	0.45
(4) Steel plate	kg	0.45	0.40	0.50	-	-	-	-	0.45
(5) Steel pipe Dia. 65 mm	m	-	-	-	-	-	-	-	7.47
Steel pipe Dia. 65 mm	kg	-	-	0.90	-	-	-	-	0.80

(to be continued)

Table H.9 Comparison of Material Cost (3/4)

(Unit: US$)

Description	Unit	Vientiane Municipality	Ministry of Communication *1	Foreign Contractor (Japanese A)	Foreign Contractor (Japanese B)	State *2 Enterprise Irri. No. 1	State *3 Enterprise Irri. No. 2	Mittapap Construction Co.	Vientiane Drainage Project
(6) Steel sheet pile									
Type-II (48 kg/m)	kg	-	-	0.90	-	-	-	-	0.80
Type-III (60 kg/m)	kg	-	-	0.90	-	-	-	-	0.80
(7) Galvanized pipe		-	-						
Dia. 25 mm	m	-	-	3.00	2.67	-	-	2.50	2.70
Dia. 50 mm	m	-	-	5.60	4.17	-	-	4.00	4.20
Dia. 80 mm	m	-	-	-	9.67	-	-	9.33	9.40
Dia. 100 mm	m	-	-	-	11.33	-	-	11.00	11.00
Dia. 150 mm	m	-	-	-	15.83	-	-	-	15.80
(8) Galvanized iron wire	kg	-	-	2.00	2.00	-	-	2.00	2.00
(9) Barbed wire	kg	-	-	1.40	2.80	-	-	1.50	1.50
(10) Welded wire net	m2	-	-	5.00	5.00	-	-	4.00	4.00
(11) Wire mesh	m2	-	-	-	7.00	-	-	-	7.00
(12) Bolt and nut	kg	-	-	1.50	2.00	-	-	1.00	1.50
(13) Nail	kg	1.00		1.50	1.50	-	-	1.00	1.00
14. Others									
(1) Welding rod	kg	0.79	-	1.50	-	-	-	1.20	1.20
(2) Electricity	kWh	0.01	-	-	-	0.02	-	-	0.01
(3) Concrete block (for wall)	No.	-	0.30	0.20	-	-	-	0.30	0.20
(4) Fence, H = 1.8 m	m	-	-	-	-	-	-	-	28.30
(5) Gabion matters									
1.2 m x 2.0 m x 0.5 m	PC	-	-	-	-	-	-	-	312.00
1.2 m x 3.0 m x 0.5 m	PC	-	-	-	-	-	-	-	417.40
(6) Gabion cylinder									
Dia. 600 mm	m	-	-	-	-	-	-	-	4.60
Dia. 450 mm	m	-	-	-	-	-	-	-	3.20
(7) Metal form									
300 x 1,500 mm	PC	-	-	15.00	-	-	-	-	19.10
200 x 1,500 mm	PC	-	-	-	-	-	-	-	19.10
150 x 1,500 mm	PC	-	-	-	-	-	-	-	15.20
100 x 1,500 mm	PC	-	-	-	-	-	-	-	12.90

(to be continued)

Table H.9 Comparison of Material Cost (4/4)

(Unit: US$)

Description	Unit	Vientiane Municipality	Ministry of Communication *1	Foreign Contractor (Japanese A)	Foreign Contractor (Japanese B)	State *2 Enterprise Irri. No. 1	State *3 Enterprise Irri. No. 2	Mittapap Construction Co.	Vientiane Drainage Project
(8) Separator Dia. 8 to 10 mm	m	-	-	0.70	-	-	-	-	0.60
(9) Form tie Dia. 8 to 10 mm	No.	-	-	1.20	-	-	-	-	0.70
(10) Cone	No.	-	-	0.40	-	-	-	-	0.20
(11) Form oil	Lit.	-	-	-	-	-	-	-	3.20
(12) Pipe support Dia. 48.6 mm	m	-	-	-	-	-	-	-	9.20

APPENDIX I

SOCIO-ECONOMY

APPENDIX I. SOCIO-ECONOMY

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I.1 Introduction

The socio-economic study mainly aims at projecting population, gross domestic product (GDP) and gross regional domestic product (GRDP) in the year of 1990, 2000 and 2020, as the basic framework for the preparation of the drainage improvement plan. Present socio-economic framework and other principal indicators are simultaneously mentioned in this sectoral study.

The composition of the socio-economic study is as follows:

Chapter I.2	Present socio-economic condition
Chapter I.3	National economic development plan
Chapter I.4	Socio-economic projection

Chapter I.2 describes to the present socio-economic framework of Lao PDR as well as the Study area and following items are included in the description:

1. Administrative unit
2. Population
3. GDP and GRDP
4. Employment
5. Health condition
6. Price
7. Exchange rate
8. External trade

National economic development plans and Regional development plan of the Vientiane Municipality are presented in Chapter I.3. Population, GDP and GRDP were projected for the year of 1990, 2000 and 2020 in Chapter I.4.

I.2 Present Condition of Socio-economy

I.2.1 Administrative Unit

The Lao PDR is composed of 16 provinces and Vientiane Municipality. The Vientiane Municipality is the capital of the nation and divided into 7 districts, that is, Sisatanak, Chanthabury, Saisettha, Sikhot Tabong, Hat Sai Fong, Hasaithong, Phialad and Saithany district. The Sisatanak, Chanthabury, Saisettha and Sikhot Tabong district are classified as the urban district while the Hat Sai Fong, Hasaithong, Phialad and Saithany district are classified as the rural district.

In each district, there is the district office under the control of the Vientiane Municipality. The district is divided into tassengs that are lower level administrative units composed of villages.

The Study area covers 56.19 km^2 which is 1.7% of total area of the Vientiane Municipality. Administratively the Study area belongs to four urban districts of Vientiane Municipality, Sykottabong, Chanthaboury, Saysetta and Sysatthanak, and the Study area includes about 100 villages.

I.2.2 Population

The national population census in 1985 is available data source of national population. According to this census there were 3.58 million Laotians, comprising 11.75 million males and 1.82 million female. The average population density was estimated to be 15.1 persons per km^2 on the basis of the territory of 236,800 km^2. As for the regional distribution of population in 1985, more than 10% of population concentrated in Vientiane as shown in Table I.1. According to the World Bank estimation in 1986, 85% of population were in rural area

The growth rate of the population during last decade was about 2.6% per annum on an average, however the growth rate at present becomes higher due to baby boom in the post-war periods. Thus the present growth rate was estimated to be 2.9% per annum and 45% of total population were less than 15 years of age.

In 1985 the mortality rate for infants up to one year of age was estimated by the World Bank at 115 per 1,000 live births. The estimated mortality rate for children of one to four years of age 23 per 1,000 due to the poor health condition in rural area. Thus both the birth rate and the death rate were also high and the average expectancy was low as follows:

Birth rate in 1985	42 per 1,000 persons
Death rate in 1985	19 per 1,000 persons
Life expectancy in 1985	44 years of age for male
	46 years of age for female

On the basis of the World Bank estimation in 1989, the population in 1988 was estimated to be about 3.84 million and the population density was about 16 persons per km^2.

The total population of Vientiane Municipality was estimated to be 337,000 in 1985 based on the national population census. The population in 1988 was estimated to be 474,000 by the Department of Economic Planning and Finance of Vientiane Municipality and the average annual growth rate from 1985 to 1988 was calculated at 4.7%.

The total population of the Study area in 1985 and 1988 were estimated to be 148,985 and 157,653 respectively based on the population survey by Department of Economic Planning and Finance of Vientiane Municipality.

In 1988 the population in the Study area accounted for 35.5% of the total population of Vientiane Municipality. The population density was 2,806 persons/km^2 and annual growth rate of population was estimated to be 1.9% from 1985 to 1988. The Study area is characterized as a densely populated area.

The Study area is divided into 17 sub-areas on account of the existing drainage system and topographic conditions. The population and population density in each sub-areas is shown in Table I.2.

At present, the population of the Study area is increasing due to inflows from the rural villages.

I 2.3 GDP and GRDP

(1) Estimation of GDP

The national accounts of the Lao P.D.R. were established according to the system of material production methodology which differs from the U.N. system of national accounts. In the material product system only the output of materials sectors (agriculture, industry, construction, transport and commerce) is included in the calculation of Net Material Product (NMP). NMP is defined as output (Gross Material Product) minus the value of material inputs and depreciation. This concepts thus differs from Gross Domestic Product (GDP) by excluding value added in the service sectors and depreciation.

In order to convert NMP into GDP, the World Bank add back to the value of NMP depreciation expenditures and the value added of the government sector and nonmaterial services (private sector commerce). To carry out these adjustments, it was assumed that depreciation expenditures amounted to 6% of NMP on the basis of the World Bank estimation.

The revised national accounts are shown in Table I.3.

(2) GDP and GRDP

The gross domestic product (GDP) and per capita GDP in 1986 are estimated to be Kip. 62,891 million and Kip. 17,132 (US$180 equivalent). The economy has been growing rapidly during 1982 to 1986, recording an increase of 6.4% per annum. However, in 1987 the GDP fell by 3.8% due to the impact of the 1987 drought which drastically reduced agricultural production and electricity generation. Net Material Product and GDP during 1982 to 1987 are shown in Table I.4.

The shares of GDP and employment by industrial origins in 1986 are shown as follows;

Sector	Share of GDP	Share of Employment
Agriculture	65.2%	80.0%
Industry	14.0%	2.2%
Service	20.8%	17.8%

Source: World Bank, 1988

Gross Regional Domestic Product (GRDP) of Vientiane Municipality was estimated by the Department of Economic Planning and Finance of Vientiane Municipality since 1987, as shown in Table I.5. GRDP were estimated based on Net Regional Material Products (NRMP) by adopting above mentioned procedures of the World Bank. The shares of GRDPs of Vientiane Municipality to GDP are estimated to be about 26% and 27% in 1987 and 1988 respectively.

The share of GRDP by industrial sector were estimated to be 76.9% for agriculture, 14.5% for Industry, 4% for Commerce, 1.9% for Construction and 1.8% for Transportation in 1988.

The Study area has been the most important economic center of national and regional economy. The agricultural sector has been the major sector in the Study area. The major products thereof were paddy, vegetables, mungbeans, tobacco and sugarcane. The major industrial products have been those from agro-industry and consumer goods industry. Tobacco, fertilizer, soap, beer, soft drink and fabric are the principal products. Commerce is the other sector which characterize the Study area. There were most important commercial zones in Chanthabury district and 15 major markets in the Study area where both agricultural products and industrial products were collected from whole Vientiane Municipality.

The importance of agricultural sector in the Study area is lower than that in whole Vientiane Municipality. In turn it has produced most of industrial and commercial output in Vientiane Municipality.

(3) World Bank GDP Projection

The World Bank projected the future GDP growth by sector up to 1995 as follows:

Projections of GDP by Sector, 1987 - 95
(Annual Percentage Growth Rates in 1987 Prices)

	1987 - 91	1991 - 95
Gross domestic project	5.3	5.4
of which:		
Agriculture	4.7	4.0
Industry	8.0	9.0
Construction	6.9	8.3
Transport	6.5	8.0
Commerce, Government and private sector services	5.6	7.0

The projected condition of future economic development in each sector is summarized by the World Bank as belows:

(a) Agricultural production is projected to recover from the impact of the 1987 drought and to rise by 4.7% p.a. in 1987 - 91. Since Laos' per capita consumption of rice is already one of the highest in the world, it is assumed that rice consumption would increase at about the same rate as population growth so that rice output would grow much slower than in the early eighties. It is for this reason that rapid growth of nonrice commodities is essential if agricultural growth is to be high in the future.

(b) The industrial sector would grow by about 8.0% in 1987 - 91 and 9.0% in later years. Mining output would initially rise rapidly as a consequence of ongoing investments in tin and gypsum, and later on as a result of the exploitation of new mineral deposits. As the effect of the 1987 drought would wear off, electricity production would recover its 1986 level in 1989, and would increase by 24% in 1991 - 95 due to the completion of the Xeset hydropower station. The construction sector would increase by 6.9% in 1987 - 91 and 8.3% in 1991 - 95 as a result of the projected increase in the demand for housing, planned investment in roads, and increased availability of construction materials.

(c) In 1982 - 86 the transport sector grew at a slower rate than net material product. With the removal of restrictions on shipment of goods across provinces, the relationship between GDP and transport would follow the usual pattern characterized by trasnport services increasing at a faster rate than GDP. At the same time, the 1987 - 88 removal of restrictions on private sector activities in services and commerce would lead to a rise in commerce and private services. This trend is reflected in the projected rapid growth of the commerce and service sectors.

I 2.4. Employment

The population in working age of Lao PDR in 1986 was estimated to be 1.55 million and 42% of total population according to the World Bank. The figure appears to exclude economically inactive Buddhist monks, secondary school students and military personnels. The World Bank also estimated the sectoral shares of employment in 1986, that is, 80% for agriculture, 2% for industry and 18% for service.

The World Bank projected the future structure of employment up to year of 2000 and the results are shown in following table.

	1986		1995		2000	
	Total (in '000)	%	Total (in '000)	%	Total (in '000)	%
Agriculture	1,364	80.0	1,762	78.0	2,009	77.0
Industry	27	1.6	52	2.3	73	2.7
Construction	10	0.6	23	1.0	31	1.2
Transport, commerce and services	304	17.8	422	18.7	499	19.1
Total	1,706	100.0	2,251	100.0	2,612	100.0

I 2.5 Health Condition

In 1975, a primary health care strategy was adopted to provide health care to the vast majority of the population and a community participation campaign was launched. However much progress has been made in the past 12 years, the health situation and the development of the health system remains unsatisfactory. The absence of well qualified personnel, the lack of drugs, equipment, recurrent cost funding and the poor physical state of health facilities are major cause of this poor health condition.

Life expectancy at birth is 45 years. The crude birth rate of 46 and the crude death rate of 19. Infant mortality is presently estimated at 115 per 1,000 live births and ranges from 50 in Vientiane to 290 in remote rural areas.

The serious problem diseases are malaria, and more recently epidemics of dengue fever at the beginning of the rainy season. These epidemics reclaiming an increasingly high death toll. In addition, typical children diseases, diarrheal diseases and respiratory infections, have high incidence rates. Many of these diseases are preventable through immunization and proper sanitation. However, only 4% of children 12 - 23 months are fully immunized, only 11% are immunized against tuberculosis, 8% have been immunized for DPT and poliomyelitis and 4% for measles. In addition, only 22% of the population has access to safe water.

The health condition in the Vientiane Municipality is same as that of nation described above. The number of patients by kind of disease were obtained from Department of Health, Vientiane Municipality as shown in Table I.6. The typical diseases due to poor sanitary and drainage condition were malaria and dengue and people in the Study area were suffered by these diseases.

According to Department of Health, Vientiane Municipality, there are serious problems in the health sector of Vientiane. The lack of hospitals, equipments, drugs, medicines and personnels are serious constraints to improve health conditions while the low level of sanitary condition of both urban and rural area is major cause of diseases.

The list of hospital in the Vientiane Municipality is summarized in Table I.7.

I 2.6. Price

During 1980's, the economy of Lao PDR has been suffered from the high inflation rate. In 1986 the consumer price index of Vientiane was 65% due to the high price escalation in free market. The major reason of the high price escalation in free market was imbalance between excess money supply and luck of supply of goods and commodities. So the government decreased the money supply and reformed the price system.

There were two kinds of price, official price and free market price before 1985 and the official market price was controlled by the government. Thus the free market price was much higher than the official price. In 1985, the government decided to decrease the price differential between the official price and the free market price which was considered to be the major cause of confusion of price system and thus price differentials were almost eliminated in 1988. As a result the price reflect to the balance of supply and demand of goods and commodities. Besides various policies were carried by the government in order to improve economical structure of Lao economy according to the New Economic Policy for the stabilizing of the inflation. Thus the annual inflation rate in 1987 was decreased to 6.7% and despite the

substantial increase of the official prices in early 1988, the free market prices remained 4.4% by mid-1988.

The price increases during 1982 to 1988 are shown in Table I.8.

I 2.7. Exchange Rate

The multiple price system corresponded a multiple exchange rate system consisting of seven exchange rates which were infrequently adjusted during the 1982 - 86 period. However, starting in 1986 and in parallel with the implementation of a new system of economic management, the Government initiated a unification process of the various exchange rates. The commercial exchange rate was devalued by 171% in 1986 and 320% during the first half of 1988. By mid-July 1988, there were only two official exchange rates, an official (or representative) exchange rate (10 kips per U.S. dollar), which applies to disbursements and repayments of loans and a market rate which is set at the level of the parallel market exchange rate. The exchange rates during 1982 to 1987 are summarized in Table I.9 and the exchange rates in the parallel market in 1989 are shown as follows:

	U.S.$	J.¥	Kip
Apr, 1989	1.0	133.8	555.0
May, 1989	1.0	144.1	555.0
Jun, 1989	1.0	141.4	565.0
July, 1989	1.0	139.7	589.0
Aug, 1989	1.0	145.7	601.0
Sep, 1989	1.0	140.7	656.0
Average		141.0	590

I 2.8. External Trade

Foreign trade in Lao PDR is characterized by a persistent disequilibrium and a large share of a few commodities for export, namely electricity, logs and wood products and coffee. Most of industrial commodities, such as machinery, vehicles, petroleum, medicine and medical equipment depend on import. The

foreign trade from 1976 to 1988 and the composition of official export and import in 1986 and 1987 are shown in Table I.10 to I.14.

From 1987 the import and export between Lao P.D.R. and foreign countries, mainly Thailand, have expanded rapidly. The major export good were electricity, logs, wood products, mining products and coffee. Meanwhile major import goods were machinery, petroleum products and other industrial goods. The Study area has been a main transit point of trade with Thailand.

I.3 Socio-economic Development Plan

I.3.1 National Socio-economic Development Plan

I.3.1.1 The Interim Three Year Development Plan

After the foundation of Lao P.D.R., the Government launched the Interim Three Year Development Plan (1978 - 1980) in order to restore deteriorated economy and increase production. The objectives of the plan were to develop the agricultural sector and reach self-sufficient of food by 1980, to expand exports of forestry products, to construct the national road of route 9 as an alternative route to sea through Vietnam and to expand education and training.

Laotian economy achieved a substantial recovery and improvement of food self-sufficiency during this period. The paddy production increased by 15% per annum from 1977 to 1980. GDP was estimated to have grown at a rate of 7% per annum in real terms during the same period. However, the recovery was made only in limited areas and the economic infrastructure was far from satisfactory.

I.3.1.2 The First Five Year Development Plan

In view of the unsatisfactory achievement of the previous Three Year Plan the Government planned to continue the economic development along the same lines laid down by the said Plan, and formulated the First Five Year Plan (1981 - 85). The major objectives of this Plan were:

(1) To increase agricultural and forestry production so as to provide enough food for consumption and to increase exports of timber, coffee and tobacco,

(2) To increase industrial production,

(3) To improve basic infrastructure by expanding internal transport, constructing the national road of route 9 and by developing the distribution network for electricity,

(4) To improve the internal distribution of goods,

(5) To increase the number of state enterprise and state controlled cooperatives so as to consolidate the leading role of the socialist sector in the economy,

(6) To increase the mobilization of resources for investment through taxation, exports and foreign aid,

(7) To expand the education and training system and improve the health system,

(8) To improve economic management and organization

So far as agricultural sector is concerned, the Plan focussed on increasing production of rice by expansion of cultivation areas and introduction of irrigation.

During the period from 1981 to 1985, GDP was estimated to have increased at a rate of 5.4% per annum in real term. Agriculture was the major growth sector mainly because of the increase of paddy production, largely as a result of favorable climate condition. On the other hand, despite relatively large investment in the industrial sector, investment returns were much less than initially expected in the period. This is mainly due to inefficient state industrial sector and discouragement of private sector.

I.3.1.3 The Second Five Year Development Plan

In 1986, the Government commenced the Second Five Year Development Plan (1986 - 1990). This plan contains government commitment to a New Economic Policy which involves a comprehensive series of economic reforms covering agricultural price policy, adjustments of wage levels and introduction of profit-oriented principle to public enterprises.

The main development objectives were as follows:

(1) Stimulation of economic growth through increasing of agricultural production and diversification,

(2) Maintenance of monetary and fiscal stability through the promotion of the export,

(3) Control of inflation,

(4) Strengthening of planning and economic management through reformation of organization of development administration and state enterprises

The target of annual growth rate of GDP by sector were set as following.

Agricultural	9.85%
Industry	13.65%
Transport	11.30%
Construction	12.55%
Internal trade	7.70%
Overall growth	10.35%

The average annual planned growth rate by sector is shown in Table I.15.

I.3.2 New economic policy

The Government have carried out the reformation of economic system in 1987 and 1988 including improvement of price, tax and wage system, reformation of state enterprise management, introduction of competition among the enterprises and liberalization of foreign trade.

I.3.3 Socio-economic Development Plan of Vientiane

The general directions of Five Years Socio-economic Development Plan from 1986 to 2000 of Vientiane Municipality were as the following:

(1) To improve living standard of the people by supplying foods for daily consumption, consumer goods and houses,

(2) To increase the agricultural production by introducing the intensive production,

(3) To improve industrial sector based on new economic policy,

(4) To improve transportation and communication system,

(5) To train professionals and technical specialists,

(6) To guarantee income, budget and fiscal situation

The overall target annual growth rate of output was set to be as high as 10% and major target growth rate by sectors were as follows:

Agriculture	12.2%
Industry	10.0%
Commerce	11.7%

I.4 Socio-Economic Projection

I.4.1 Projection of Population

The 1985 Census provides the most reliable population data in March 1985. In September 1988 the World Bank estimated the population in 1986. Meanwhile Laos Politics, Economics and Society produced a projection for the year of 2000 on the basis of the United Nations Assessment Data. The population growth rates applied in this projections were examined and the projections were availed for the basis of the Study. The figures were simply extrapolated up to the year 2020. The obtained annual growth rates in 1,000 persons are estimated to be as follows;

Year:	1985	1986	1990	2000	2010	2020
Rate (%):	2.90	2.40	2.20	1.92	1.60	1.30
Population:	3,585	3,671	4,016	4,825	5,645	6,426

where the growth rate in 1985 of 2.9% p.a. is the average rate from 1980 through 1984.

The population in the year of 1990 in Vientiane Municipality of 474,000 is estimated through extrapolation of the populations in 1985 and 1988. The shares of the municipality against the national population are assumed by means of the smoothing.

The obtained shares in percent and the consequent populations in 1,000 persons are as follows;

Year:	1985	1988	1990	2000	2010	2020
Share (%):	10.5	11.3	11.8	14.1	16.5	19.0
Population:	377	433	474	680	931	1,221

The population share of the Study area (56.19 km^2) against Vientiane Municipality (3,267 km^2) was arbitrarily assumed to be 25% in the year 2000. The shares in percent for other years and the consequent populations in 1,000 persons are estimated through extrapolation to be as follows;

Year:	1985	1988	1990	2000	2010	2020
Share:	39.5	35.5	34.5	29.5	27.0	25.0
Population:	149	158	164	201	251	305
Person/km^2:	2,651	2,811	2,918	3,577	4,467	5,427

The future population in each sub-area is estimated on the basis of the present population plus the future population increase in each area. The future population increase in the Study area is supposed to be affected by expansion of urbanized area and a rise in the population density.

The future land use plan in the Study area is proposed by UNDP up to 2000 and after 2000 the land use in the Study area is assumed not to be changed. The landuse projection is shown in Table I.16. Based on this assumption of the future landuse, the future population in each sub-area is estimated as follows;

(1) The period from 1988 to 2000 the population in each sub-area is assumed to increase by expansion of urbanized area. The share of population increase in each sub-area against the total population increase in the Study area is calculated in proportion to the expansion of assumed urbanized area in each sub-area. The urbanized area is assumed to be composed of central area, public and commercial area, industrial area and residential area according to the projection of land use by the UNDP.

(2) The population increase in each sub-area after 2000 is assumed to increase by intensification of population density. The share of population increase in each sub-area against total population increase in the Study area is calculated in proportion to the share of assumed urbanized area in each sub-area.

The future population thus projected for each sub-area in 2000, 2010 and 2020 are shown in Table I.17.

I.4.2 Projection of GRDP

(1) Projection of GDP

The government of Lao PDR formulated socio-economic plan under the Second Five Year Development Plan (1986 - 1990).

The plan assumed the annual growth rates of socio-economic figures as follows;

Period	:	1986 - 1990
Population	:	2.9%
GDP (Overall)	:	10.35%
Agriculture	:	9.85%
Industry	:	13.65%
Service	:	7.7%
Transportation	:	11.3%
Construction	:	12.55%

The per capita GDP in the year 2000 is estimated to be Kip. 42,400 applying the same growth rates assumed. The figures were obtained through the accumulation of the future demands and requirements of the detailed items. The plan will be achieved if the global economy, domestic economy and other circumstances such as local climate could maintain the economic environment envisaged. The GDPs projected applying the growth rates presented as above are adopted as the high growth scenario. In this projection, the GDP's after 2000 are estimated through the tangential curve of GDP at the year 2000.

Meanwhile the GDP of Lao PDR were projected by the World Bank from 1987 to 1995 by industrial origin. The figures are available for the study. The World Bank projected GDP up to 1995 in 1988 that the overall annual growth rate of GDP was estimated to be 5.3% from 1987 to 1991 and 5.4% from 1991 to 1995, respectively. The annual growth rate of GDP by industrial origin were estimated as follows:

	1987 - 1991	1991 - 1995
Agriculture	4.7%	4.0%
Industry	8.0%	9.0%
Construction	6.9%	8.3%
Transportation	6.5%	8.0%
Commerce	5.6%	7.0%
GDP	5.3%	5.4%

The GDP in 1990 and 1995 are estimated in 1986 constant price as below:

	1985	1990	1995
GDP (million kip)	58,774	77,300	100,500
Growth rate of GDP (%)	-	5.3%	5.4%
Per capita GDP (kip)	16,394	119,254	22,827
Per capita GDP (US$) (US$1 = Kip 95)	173	202	240
Growth rate of per capita GDP (%)	-	3.1%	3.5%

The growth rate of per capita GDP in the period from 1985 to 1990 is estimated to be 3.1% per annum. Meanwhile that in 1990 to 1995 is estimated to be 3.5%. The annual growth rate of per capita GDP after 1995 is assumed applying the tangential curve of the average annual growth rate in 1990 - 1995 as below:

Period	Average annual growth rate
1985-1990	3.1%
1990-1995	3.5%
1995-2000	4.0%
2000-2005	4.5%
2005-2010	5.0%
2010-2015	5.5%
2015-2020	6.0%

The GDPs in 2020 at 1986 constant price is estimated to be 497,000 x 10^6 Kip.

The per capita GDP in 2020 is projected to be 820US$ based on above projection. The GDPs projected as above are adopted as the low growth scenario.

In this study figures of the low growth scenario are adopted for the planning to avoid over investment. GDPs projected on the basis of both scenarios are presented in Table 3.3.2.

(2) Projection of GRDP in Municipality

The GRDP of Municipality is estimated in proportion to the share of GRDP against GDP. The future share of GRDP against GDP will increase because the economic importance of Municipality will grow for the year to come. The share of future population in Municipality against national population will increase as well. The shares of GRDP against GDP in 1987 and 1988 were estimated to be 26% and 27% respectively on the basis of the actual data as shown in Tables I.4 and I.5. The future shares are estimated by means of the curve fitting through smoothing and the shares are assumed to increase by constant proportion of 1% per annum. The GRDPs projected up to 2020 at 1986 constant price are shown as follow:

	1990	1995	2000	2010	2020
GDP (million kip)	77,300	100,500	133,900	249,400	497,000
GRDP (million kip)	22,500	34,200	52,200	122,200	293,200
Share (%)	29%	34%	39%	49%	59%
Per capita GRDP (US$)	500	640	810	1,380	2,530

(3) Projection of GRDP in the Study area

The GRDP in the Study area is estimated applying the following assumptions.

1) At present most of commercial and industrial productions are born in the Study area. The economic structure and the productivity of the remaining area in Municipality is assumed to be similar to that of whole nation, characterized as a rural area. Accordingly the per capita GRDP in the remaining area is assumed to be equal to the per capita GDP.

2) The estimated per capita GDP are applied to the population in the Municipality less the population in the Study area to obtain the GRDP in the area excluding the Study area. The substantial part of differences in two GRDPs are basically assumed to be born in the Study area.

3) Further, in the future the production of commercial and industrial products in the remaining area is assumed to be increasing due to the expansion of urban area in the Municipality. outside of the Study area The productivity of the remaining area is assumed to increase due to the urbanization. The share of population in the remaining area against the population in the Municipality is assumed to be an index of the increase in the productivity.

The following formula is adopted to estimate the GRDP in the Study area.

$$GRDP_{SA} = p.c.GDP \times P_{SA} + (p.c.GRDP_{VM} - p.c\ GDP) \times P_{VM} \times I$$

where:

	$GRDP_{SA}$	:	GRDP in the Study area
	p.c.GDP	:	Per capita GDP
	P_{SA}	:	Population in Study area
	$p.c.GRDP_{VM}$	:	Per capita GRDP in the Municipality
	P_{VM}	:	Population in the Municipality
	I	:	Index of share of population

The GRDPs in the Study area up to 2020 at 1986 constant price are thus estimated as below:

	1990	1995	2000	2010	2020
GRDP (million kip)	15,800	22,800	32,700	71,100	160,000
Share in GRDP (%) of Municipality	35%	32%	30%	27%	25%
Per capita GRDP (US$)	1,020	1,320	1,710	2,990	5,520

The contributions of industrial sectors for the projected GRDP in the Study area were estimated through applying the rates of land productivity and land use in the Study area.

The land productivity are estimated on the basis of labour productivity by industrial origin in Lao calculated by the World Bank and the density of labour by industrial origin in the Study area. The proportion of land productivity by industrial sector are assumed as below;

Agriculture	1
Commerce	10
Industry	50

The GRDPs by industrial origin in the Study area at 1986 constant price are estimated as below;

(Unit Million Kip)

	1988		1990		2000		2010		2020	
	GRDP	Share	GRDP	Share	GRDP	Share	GRDP	Share	GRDP	Share
Agriculture	9,183	68%	10,300	66%	16,300	50%	24,300	34%	34,100	21%
Industry	2,800	21%	3,600	23%	11,400	35%	34,000	48%	95,100	60%
Commerce	1,480	11%	1,900	12%	5,000	15%	12,800	18%	30,800	19%
Total	13,463	100%	15,800	100%	32,700	100%	71,100	100%	160,000	100%

(4) Projection of GRDP in sub-area

The shares of GRDP of sub-areas against the Study area is assumed in proportion to the landuses projected. The land productivity in agricultural area, industrial area and commercial area is adopted weighted value.

The GRDPs in each sub-area are shown in Table I.9.

TABLES

Table I.1 Population in 1985

Unit : 1,000 persons

Province/Municipality	Total	Males	Females
1 Vientiane Municipality	377	193	184
2 Phong Saly	123	60	63
3 Luang Namtha	97	46	51
4 Oudomai	187	90	97
5 Bokeo	55	26	29
6 Luang Prabang	295	146	149
7 Houa Phan	210	105	105
8 Sayaboury	224	110	114
9 Xieng Khouang	162	81	81
10 Vientiane	264	133	131
11 Bolikhamsai	122	60	62
12 Khammouane	213	102	111
13 Savannakhet	544	264	280
14 Saravane	188	88	100
15 Sekong	51	25	26
16 Champassak	403	195	208
17 Attopeu	70	33	37
Total	3,585	1,757	1,828

Source: LPDR Central Population Cencus Guidance Committee, March 1985

Table I.2 Population in the Study Area

Sub-area	Popuation (person)				Population Density (person/km²)					Share in Study Area	
	1985	1988	85-88	% p.a.	Area(km²)	1985	1988	85-88	% p.a.	1985	1988
A	3,004	3,208	204	2.21%	4.5	668	713	45	2.21%	2.02%	2.03%
B	12,584	13,074	490	1.28%	7.51	1,676	1,741	65	1.28%	8.45%	8.29%
C	11,537	11,625	88	0.25%	1.96	5,886	5,931	45	0.25%	7.74%	7.37%
D	11,191	10,313	-878	-2.69%	2.44	4,587	4,227	-360	-2.69%	7.51%	6.54%
E	6,363	9,247	2,884	13.27%	1.45	4,388	6,377	1,989	13.27%	4.27%	5.87%
F	5,084	6,889	1,805	10.66%	1.25	4,067	5,511	1,444	10.66%	3.41%	4.37%
G	3,944	3,044	-900	-8.27%	0.55	7,171	5,535	-1,636	-8.27%	2.65%	1.93%
H	19,522	18,780	-742	-1.28%	1.88	10,384	9,989	-395	-1.28%	13.10%	11.91%
I	13,487	14,938	1,451	3.46%	2.76	4,887	5,412	526	3.46%	9.05%	9.48%
J	4,369	5,873	1,504	10.36%	3.12	1,400	1,882	482	10.36%	2.93%	3.73%
K	679	679	0	0.00%	2.34	290	290	0	0.00%	0.46%	0.43%
L	5,213	7,369	2,156	12.23%	2.14	2,436	3,444	1,008	12.23%	3.50%	4.67%
M	30,898	28,737	-2,161	-2.39%	7.79	3,966	3,689	-277	-2.39%	20.74%	18.23%
N	7,309	8,812	1,503	6.43%	13.89	760	891	131	5.46%	4.91%	5.59%
O	3,547	3,920	373	3.39%	0.4					2.38%	2.49%
P	8,538	8,979	441	1.69%	1.54	5,544	5,831	286	1.69%	5.73%	5.70%
Q	1,716	2,166	450	8.07%	0.67	2,561	3,233	672	8.07%	1.15%	1.37%
Total	148,985	157,653	8,668	1.90%	56.19	2,652	2,806	154	1.90%	100.00%	100.00%

Table I.3 Estimated Structure of GDP, 1986

Unit: Million kip in 1986 price

	Net Value Added	Materials and Depreciation	Depreciation	Gross Domestic Product	Share (%)
Agriculture	40,026	6,446	967	40,993	65.2%
Industry	5,298	6,948	1,042	6,340	10.1%
Construction	2,050	2,049	307	2,357	3.7%
Transport and Communication	741	802	120	861	1.4%
Commerce	4,834	1,612	242	5,076	8.1%
Administration and services	6,734	795	531	7,265	11.6%
Total	59,683	18,652	3,209	62,892	100.0%

Source : World Bank, 1988

Table I.4 Net Material Product and Gross Domestic Product
(In millions of kip; 1986 constant prices)

	1982	1983	1984	1985	1986	1987 /b
Agriculture and forestry	31,324	32,292	34,638	37,292	40,026	39,965
Industry	3,440	3,569	3,785	4,469	5,298	5,329
Construction	1,023	1,378	1,613	2,261	2,050	2,466
Transport and communication	575	642	687	725	741	920
Commerce	3,923	4,293	4,478	4,631	4,834	4,926
Other	344	357	378	447	530	533
Net Material Product	40,629	42,531	45,579	48,825	53,479	54,139
Depreciation	2,438	2,552	2,735	2,990	3,209	3,248
Government and other services	6,062	5,520	5,547	5,959	6,204	6,876
GDP	49,129	50,603	53,861	58,774	62,891	64,263
GDP deflator /a	20.2	35.8	48.2	71.4	100.0	103.8
GDP at current prices	9,910	18,130	25,959	41,969	62,891	66,699

/a IMF estimates.

/b Estimated on the basis of official growth rates (in 1987 prices).

Source: World Bank, 1988

Table I.5 Gross Regional Domestic Product

Gross Regional Material Product of Government Sector

	GRMP (million kip)			Share	Growth Rate	
	1987	1988	1989	% (88)	87/88	88/89
Agriculture	13,494	17,889	19,690	83.7%	32.6%	10.1%
Industry	1,866	2,132	2,564	10.0%	14.3%	20.3%
Commerce	235	280	398	1.3%	19.1%	42.1%
Transportation & Communication	219	415	619	1.9%	89.5%	49.2%
Construction	407	440	488	2.1%	8.1%	10.9%
Others	186	213	256	1.0%	14.5%	20.2%
Total	16,407	21,369	24,015	100.0%	30.2%	12.4%

Estimated Gross Regional Domestic Product

	GRDP (million kip)			Share	Growth Rate	
	1987	1988	1989	% (88)	87/88	88/89
Agriculture	13,494	17,889	19,690	79.9%	32.6%	10.1%
Industry	2,195	2,508	3,016	11.2%	14.3%	20.3%
Commerce	783	933	1,327	4.2%	19.2%	42.2%
Transportation & Communication	219	415	619	1.9%	89.5%	49.2%
Construction	407	440	488	2.0%	8.1%	10.9%
Others	186	213	256	1.0%	14.5%	20.2%
Total	17,284	22,398	25,396	100.0%	29.6%	13.4%

* Share of private sector in whole GDP was estimated as below agriculture & industry 15%, commerce 70%, Other 0%.
** GMP of agriculture included product of private sector.
*** 1987 & 1988 actual, 1989 planned.

Source: Department Economic Planning and Finance of Vientiane Municipality

Table I.6 Number of Patients by Kind of Disease

Unit : person

	1985	1986	1987	1988
Malaria	8,678	8,255	8,846	7,184
Influenza	15,339	25,765	18,566	22,359
Dyseenterie	2,746	5,827	8,262	10,295
Diarrhee	8,161	15,708	14,140	13,555
Conjonctivite	3,941	1,568	714	2,343
Dengue	712	155	6,728	136

Source : Department of Health, Vientiane Municipality, 1989

Table I.7 List of Hospital in Vientiane Municipality

Class of hospital	No. of hospital in Vientiane	No. of beds* (bed)	No. of doctors* (person)	No. of hospital in Study area
Municipality Hospital	1	200	36	1
District level hospital	8	30	4	4
Sub-district level hospital	37	5	0	19
Village level hospital	77	0	0	39
Mahosot Hospital	1	400	n.a.	1
Militaly 103 Hospital	1	200	n.a.	1
Police Hospital	1	100	n.a.	1
Lao-Soviet Hospital	1	150	n.a.	1
Total	127			66

Source : Department of Health, Vientiane Municipality, 1989

Note : * Average number per one hospital

Table I.8 Price Increases, 1982 - 1988
(Percentage change over previous period)

Year	CPI	Parallel market prices	Official prices
1982	70.4	39.7	117.9
1983	62.5	94.0	31.0
1984	27.2	43.4	3.1
1985	114.7	29.2	290.8
1986	35.0	34.0	35.7
1987	6.1	7.7	5.0
1988 *	19.0	4.4	29.1

Source: LPDR Central Population Cencus Guidance Committee, March 1985

Note: * First two quarters

Table I.9 Exchange Rates, 1982 - 1987

Unit Kip per US$ 1

	1982	1983	1984	1985	1986	1987
Official exchange rate	10	10	10	10	10	10
Exchange rate for the local expenses of embassies	35	35	35	35	35	350
Commercial exchange rate	35	35	35	95	95	95
Exchange rate for tourist receipt and inward remittances to non-Lao nations	N/A	108	108	108	350	350
Rate for private remittances to Lao nationals	N/A	108	108	270	350	350
Exchange rate for the Vientiane Export-Import Partnership Corp.	N/A	N/A	N/A	300	380	350
Selling rate of the Prefecture of Vientiane	N/A	N/A	N/A	N/A	390	390
Exchange rate in the parallel market	105	140	253	424	400	390

Source : World Bank, 1988

Table I.10 Official Export and Import

(Unit: US$ million)

Year	1976	1980	1985	1987 (estimated)	1988 (planned)
Export	10.1	17.0	58.1	66.3	80.7
to Socialist Countries	-	1.2	13.2	30.5	31.0
to Capitalist Countries	10.1	14.8	31.9	18.8	30.7
Border trade	-	1.0	13.0	17.0	19.0
Import	31.3	65.3	98.7	140.7	160.1
from Socialist Countries	13.9	21.7	64.7	96.9	117.7
from Capitalist Countries	17.4	42.2	21.0	26.8	23.4
Border trade	-	1.4	13.0	17.0	19.0
Balance of Trade	-21.2	-48.3	-40.6	-74.4	-79.4
between Socialist Countries	-13.6	-20.5	-51.5	-66.4	-86.7
between Capitalist Countries	-17.4	-27.4	10.9	-8.0	7.3
Border trade	-	-0.4	0	0	0

Source : Ministry of Economic Planning and Finance

Table I.11 Composition of Official Export, 1986

(Unit: US$1,000)

Items	to Socialist Countries	to Capitalist Countries	Total	%
Electricity	0	27,759	27,759	56.3%
Logs	1,036	5,600	6,636	13.5%
Other wood products	2,024	0	2,024	4.1%
Coffee	5,914	0	5,914	12.0%
Tobacco	1,510	0	1,510	3.1%
Other agricultural products	363	1,054	1,417	2.9%
Tin ore	1,682	0	1,682	3.4%
Gypsum	2,244	0	2,244	4.6%
Others	2	89	91	0.2%
Total	14,775	34,502	49,277	100.0%

Source: Ministry of Economic Planning and Finance

Table I.12 Composition of Official Export, 1987 (estimated)

(Unit: US$1,000)

Items	to Socialist Countries	to Capitalist Countries	Total	%
Electricity	0	14,817	14,817	30.0%
Logs	1,461	3,471	4,932	10.0%
Other wood products	10,584	89	10,673	21.6%
Coffee	10,423	80	10,503	21.3%
Tobacco	1,793	0	1,793	3.6%
Other agricultural products	845	373	1,218	2.5%
Tin ore	2,331	0	2,331	4.7%
Gypsum	2,477	0	2,477	5.0%
Others	637	23	660	1.3%
Total	30,551	18,853	49,404	100.0%

Source: Ministry of Economic Planning and Finance

Table I.13 Composition of Official Import,1986

(Unit: US$1,000)

Items	from Socialist Countries	from Capitalist Countries	Total	%
Machinary and Vehicles	26,757	2,740	29,497	30.7%
Petroleum products	26,105	7,873	33,978	35.4%
Raw materials	552	8,431	8,983	9.4%
Foodstuff	2,160	3,285	5,445	5.7%
Medicine and Medical equipment	6,272	800	7,072	7.4%
Electricity	404	925	1,329	1.4%
Construction materials	754	313	1,067	1.1%
Others	2,481	6,085	8,566	8.9%
Total	65,485	30,452	95,937	100.0%

Source: Ministry of Economic Planning and Finance

Table I.14 Composition of Official Import,1987 (estimated)

(Unit: US$1,000)

Items	from Socialist Countries	from Capitalist Countries	Total	%
Machinary and Vehicles	37,640	5,074	42,714	32.8%
Petroleum products	36,684	5,075	41,759	32.0%
Raw materials	2,271	8,751	11,022	8.5%
Foodstuff	3,475	8,690	12,165	9.3%
Medicine and Medical equipment	9,139	850	9,989	7.7%
Electricity	1,286	1,159	2,445	1.9%
Construction materials	1,910	452	2,362	1.8%
Others	4,522	3,316	7,838	6.0%
Total	96,927	33,367	130,294	100.0%

Source: Ministry of Economic Planning and Finance

Table I.15 Average Annual Planned Growth Rates by Sector
(In constant price)

Unit: %

	First Five-Year Plan, 1981 - 1985	Second Five-Year Plan, 1986 - 1990
Agriculture	7.35	9.85
Of which: Livestock	11.85	7.05
Crops	5.30	11.30
Industry	7.20	13.65
Transportation	7.80	11.30
Construction	7.10	12.55
International trade	10.20	7.70
Overall growth	7.00	10.35

Source : World Bank, 1988

Table I.16 Land Use Plan by Sub-area

Year: 1989 Unit: ha

Sub-area	Residential	Public & Commercial	Industrial	Water	Green	Other	Total
A	60.3		10.8	83.7	295.2		450.0
B	403.3	50.3	3.8		293.6		751.0
C	123.9	36.3		8.2	27.6		196.0
D	111.3	14.1	0.4		118.2		244.0
E	78.0	28.2		5.0	33.8		145.0
F	101.4	4.7		2.0	16.9		125.0
G	27.5	1.1		7.0	19.5		55.1
H	72.8	88.8	0.4	2.8	23.2		188.0
I	88.4	50.4			137.2		276.0
J	160.9	3.9		10.2	137.0		312.0
K	63.2	23.3	2.7	7.4	137.4		234.0
L	161.7	23.2	1.8	7.0	20.0		213.7
M	367.5	44.6	5.0	24.0	233.0	104.8	778.9
N	214.9		9.7	9.0	910.8	244.6	1,389.0
O	18.4				21.6		40.0
P	79.5	30.3		0.4	43.8		154.0
Q	31.4	1.4	3.6		30.5		66.9
Total	2,164.4	400.6	38.2	166.7	2,499.3	349.4	5,618.6

Year: 2020 Unit: ha

Sub-area	Residential	Public & Commercial	Industrial	Water	Green	Other	Total
A	273.2		14.8	35.1	126.9		450.0
B	411.6	50.3	41.3		247.8		751.0
C	113.9	61.1	0.7	12.5	7.8		196.0
D	202.0	19.0	9.0		14.0		244.0
E	88.0	33.3		3.4	20.3		145.0
F	118.3	4.7		2.0			125.0
G	7.1	22.0		11.3	14.7		55.1
H	37.0	130.2	2.0		18.8		188.0
I	141.8	82.2			52.0		276.0
J	188.8	26.1		1.8	95.3		312.0
K	128.1	23.3	7.1	7.6	67.9		234.0
L	130.3	47.1	9.3	7.0	20.0		213.7
M	364.2	47.4	5.5	24.0	233.0	104.8	778.9
N	251.8		9.7	11.4	831.8	284.3	1,389.0
O	35.6				4.4		40.0
P	125.0	26.1	2.5	0.4			154.0
Q	41.6	2.3	5.5		17.5		66.9
Total	2,658.3	575.1	107.4	116.5	1,772.2	389.1	5,618.6

Table I.17 Projection of Future Population in the Study Area

Sub-area	Population in sub-area				Population density in sub-area (person/km²)				Growth Rate
	1988	2000	2010	2020	1988	2000	2010	2020	1988-2020
A	3,208	14,863	19,086	23,647	713	3,303	4,241	5,255	6.44%
B	13,074	15,535	22,912	30,880	1,741	2,069	3,051	4,112	2.72%
C	11,625	13,083	15,830	18,797	5,931	6,675	8,077	9,590	1.51%
D	10,313	15,912	19,285	22,927	4,227	6,521	7,904	9,396	2.53%
E	9,247	10,058	11,837	13,758	6,377	6,937	8,163	9,488	1.25%
F	6,889	7,797	9,601	11,549	5,511	6,238	7,681	9,239	1.63%
G	3,044	3,408	3,927	4,487	5,535	6,196	7,140	8,158	1.22%
H	18,780	21,067	24,066	27,304	9,989	11,206	12,801	14,523	1.18%
I	14,938	19,516	22,801	26,348	5,412	7,071	8,261	9,546	1.79%
J	5,873	8,565	11,716	15,119	1,882	2,745	3,755	4,846	3.00%
K	679	4,403	6,727	9,237	290	1,882	2,875	3,947	8.50%
L	7,369	7,964	10,864	13,996	3,444	3,722	5,077	6,540	2.02%
M	28,737	28,992	35,178	41,861	3,689	3,722	4,516	5,374	1.18%
N	8,812	10,795	14,630	18,771	891	2,586	3,222	3,909	2.39%
O	3,920	4,844	5,366	5,930					1.30%
P	8,979	11,333	13,585	16,018	2,546	7,359	8,821	10,401	1.83%
Q	2,166	2,865	3,589	4,371	3,233	4,276	5,357	6,524	2.22%
Total	157,653	201,000	251,000	305,000	2,806	3,577	4,467	5,428	2.08%

Table I.18 GDP Projection from 1987 to 2020 (1986 Constant Price)

	1987	1990	1995	2000	2010	2020
HIGH GROWTH CASE						
GDP (Million kip)	64,263	86,400	141,299	231,207	619,049	1,657,479
GDP GROWTH RATE (%)		10.35%	10.35%	10.35%	10.35%	10.35%
POPULATION (1,000 persons)	3,757	4,093	4,722	5,448	7,251	9,650
PER CAPITA GDP (kip / person)	17,105	21,100	29,900	42,400	85,400	171,800
LOW GROWTH CASE						
GDP (Million kip)	64,263	77,300	100,500	133,900	249,400	497,000
GDP GROWTH RATE (%)		5.30%	5.40%	5.40%	6.00%	7.20%
POPULATION (1,000 persons)	3,757	4,016	4,402	4,825	5,645	6,426
PER CAPITA GDP (kip / person)	17,105	19,300	22,900	27,800	44,200	77,300

Table I.19 Projection of GRDP in the Study Area

Unit : Million kip

Sub-area	GRDP in sub-area					Growth rate p.a.
	1988	1990	2000	2010	2020	1988 -2020
A	1,513	1,766	2,011	4,374	9,842	6.0%
B	1,776	2,075	2,180	4,741	10,669	5.8%
C	490	575	2,214	4,815	10,835	10.2%
D	368	431	751	1,632	3,674	7.5%
E	456	531	895	1,945	4,378	7.3%
F	89	100	121	263	592	6.1%
G	51	60	929	2,019	4,544	15.1%
H	358	421	5,207	11,321	25,476	14.3%
I	1,899	2,213	2,433	5,291	11,906	5.9%
J	1,212	1,412	1,423	3,093	6,961	5.6%
K	814	951	1,059	2,302	5,180	6.0%
L	455	531	1,935	4,208	9,470	10.0%
M	599	699	6,164	13,403	30,162	13.0%
N	2,697	3,145	4,256	9,253	20,824	6.6%
O	70	81	115	250	563	6.7%
P	543	631	738	1,604	3,610	6.1%
Q	153	180	269	585	1,316	7.0%
Total	13,543	15,800	32,700	71,100	160,000	8.0%