

Ministry of Agriculture and Forestry  
Lao People's Democratic Republic

**OUTLINE DESIGN REPORT**  
**ON**  
**THE PROGRAMME FOR FOREST**  
**INFORMATION MANAGEMENT**  
**IN**  
**LAO PEOPLE'S DEMOCRATIC REPUBLIC**

June 2010

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)**

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**KOKUSAI KOGYO CO., LTD.**

**Ministry of Agriculture and Forestry  
Lao People's Democratic Republic**

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## **Preface**

Japan International Cooperation Agency (JICA) conducted the outline design survey on the Programme for forest information management in Lao People's Democratic Republic.

JICA sent to Laos a survey team from September 28 to October 27, 2009.

The team held discussions with the officials concerned of the Government of Laos, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Laos in order to discuss a draft outline design, and as a result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Lao People's Democratic Republic for their close cooperation extended to the teams.

June 2010

Kikuo NAKAGAWA

Director General, Global Environment Department

Japan International Cooperation Agency

June 2010

## **Letter of Transmittal**

We are pleased to submit to you the outline design report on the Programme for forest information management in Lao People's Democratic Republic.

This survey was conducted by Kokusai Kogyo Co., Ltd, under contract to JICA, during the period from September 2009 to June 2010. In conducting the survey, we have examined the feasibility and rationale of the Programme with due consideration to the present situation of Laos and formulated the most appropriate outline design for the Programme under Japan's Grant Aid scheme.

Finally, we hope that this report will contribute to further promotion of the Programme

Very truly yours,

Hideto YAMAZAKI  
Programme manager  
Outline Design Survey team on  
The Programme for Forest Information Management  
Kokusai Kogyo Co., Ltd.

## Summary

### 1. Background of the Programme

#### (1) Present Status and Issues

Lao People's Democratic Republic (hereinafter referred to as "Laos"), has a land area of 23.7 million hectares, is mostly mountainous, except for land around the Mekong River, and is mostly covered by forest. Most people in Laos, especially farmers, are highly dependant on the forest for fuel and food—including slash and burn agriculture—and so on to meet their needs. In addition, forestry—including timber processing—is one of the dominant industries in Laos, providing the government with a high proportion of its income and foreign exchange. The area of forest (more than 20% of tree crown density), however, had decreased from 47% in 1920 to 42% in 2002 due to an overdependence on forest resources by a rapidly growing population, and due to illegal harvesting and expanding production of commercial crops in Laos. Also, the existing forest is being degraded as larger trees and wild animals are decreasing.

#### (2) Superior Plans and Programme Goal

Laos has formulated a plan to restore its forestation rate to 70% by 2020. It has also been establishing and revising forest related laws and passing legislation regarding village forestry management. Furthermore, it has seized on the Reducing Emissions from Deforestation and Forest Degradation programme (hereinafter referred to as "REDD") to combat global warming as an extremely valuable means of protecting forests and raising the livelihood of farmers dependent on forests. The Lao government is moving forward with preparations to implement REDD such as actively participating in relevant workshops. Moreover, Laos pronounced its participation in the Forest Carbon Partnership Facility (hereinafter referred to as "FCPF"), and was selected as one of the initial 14 participant countries. The government intends to promote forest conservation through the formulation and implementation of a plan to prepare a REDD system, and through experimental emissions trading and so on.

This Programme's overall goal, in accordance with the abovementioned programme, is to prepare benchmark maps for REDD based on forest resources information so that the prevention of deforestation is dealt with globally; and the purpose of the Programme is to establish a fundamental structure to make basic forestry maps using several types of satellite imagery in Laos.

### 2. Result of the Study and Contents of the Programme

#### (1) Summary of Result of the Outline Design Study

Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the outline design study team (hereinafter referred to as "the Study team") to Laos over a period between September 28<sup>th</sup>, 2009 and October 27<sup>th</sup>, 2009. The Study team had discussions with Lao government officials and

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conducted a field survey. The Study team examined the appropriateness of the construction of new facilities, the procurement of equipment and technical assistance included in the official request from the government of Laos; it then concluded a plan and specifications. After a study period in Japan, the representatives from the Study team visited Laos to explain the Summary of Outline Design Report from January 22<sup>nd</sup> to 31<sup>st</sup>, 2010.

(2) Summary of the Outline Design Study

1) Construction

Summary of the planned facilities are shown in the tables below.

Summary of Planned Facility (1F)

Room name	Utilization	Floor size(m <sup>2</sup> )
Entrance Lobby	Vestibule and air conditioning systems not to be installed	19.8
Reception	Lending and making copies of documents for guests	21.0
Library / Documents Storage	To store documents and references produced by FIPD, To enable guests to use these documents	21.0
Multipurpose Meeting Room	For uses such as computer training and meetings	98.1
Storage for Meeting Room	To store tables and chairs for the meeting room	20.6
Management & Administration Office (1)	To be used as Deputy Director's office	20.6
Management & Administration Office (2)	To be used as Deputy Director's office	20.6
Management & Administration Office (3)	To be used as an office for administration section staff	51.5
Resting Room	To be used for staff, trainees and meeting participants to take a rest	41.2
Storage	To store equipment for administrative work	12.3
EPS		2.8
Toilet (M), Toilet (F)		23.3
Corridor, Staircase		89.2
Total		442.0

Summary of Planned Facility (2F)

Room name	Utilization	Floor size(m <sup>2</sup> )
Computer Room	To implement work concerned with forest resource information	243.9
Service Room	To install equipment such as plotters and scanners	20.6

Room name	Utilization	Floor size(m <sup>2</sup> )
Server Room	Data sever room Air conditioning for 24 hours	10.3
Director's Office	To be used as the Director's office	20.6
Guest Room	Adjacent to the Director's office for guests	20.6
Resting Room	To be used for staff to take a rest	30.9
Storage	To store equipment for administrative works	10.3
EPS		2.8
Toilet (M), Toilet (F)		27.3
Corridor, Staircase		54.7
Total		442.0

## 2) Equipment

List of planned equipment is shown in the table below.

List of the planned equipment

Category	Item No.	Name of equipment	Q'ty
A. Equipment for satellite imagery analyses and database construction	A-1	Desktop PC (A)	6 units
	A-2	Desktop PC (B)	6 units
	A-3	Data Server (A)	1 set
	A-4	Data Server (B)	2 sets
	A-5	Laptop	18 units
	A-6-1	ALOS AVNIR (2010)	106 scenes
	A-6-2	ALOS AVNIR (2011)	106 scenes
	A-7	ALOS PRISM (2010)	193 scenes
	A-8-1	ALOS PALSAR (2010)	111 scenes
	A-8-2	ALOS PALSAR (2011)	111 scenes
	A-9	SPOT4 (2005)	114 sets
	A-10-1	SPOT5 (2008)	2 scenes
	A-10-2	SPOT5 (2010)	14 scenes
	A-11-1	RapidEye (2008)	1 set
	A-11-2	Rapid Eye (2010)	1 set
	A-12	GIS Software	1 set
	A-13-1	Imagery Analysis Software1	1 set
	A-13-2	Imagery Analysis Software2	2 set
B. Equipment for sampling site surveys	A-14	Plotter	1 set
	A-15	Scanner	1 set
	A-16	Printer	1 set
	A-17	Projector set	1 set
	A-18	Microphone set	1 set
	B-1	Survey Compass	12 sets
	B-2	Planimeter	6 units
	B-3	Diameter Tape	12 units
	B-4	GPS device	18 units
B-5	Binocular	12 units	
B-6	Transceiver	12 sets	
B-7	Clinometer	12 units	
B-8	Digital Camera	12 units	
B-9	Vehicle	6 units	

### 3) Technical Assistance

List of technical assistance activities is shown in the table below.

List of the technical assistance activities

No.	Contents of Activity
1	Technical assistance of satellite imagery analyses using LANDSAT imagery taken in 1990 and 2000 / GIS (basic level: including conceptual lectures)
2	Technical assistance of satellite imagery analyses using SPOT 4 imagery taken in 2005 / GIS (intermediate level)
3	Technical assistance of imagery analyses from satellites such as ALOS, SPOT5 and RapidEye to be taken in 2010 / GIS
4	Technical assistance concerned with field surveys necessary for the analysis of satellite imagery to be taken in 2010 / GIS and database construction
5	Technical assistance concerned with the development/management of a basic database on forestry throughout all of the technical assistance activities
6	Technical assistance concerned with change extractions by means of forest base maps to be produced in 2010 and ALOS imagery to be taken in 2011

### 3. Implementation Schedule and Programme Cost Estimation

#### (1) Implementation Schedule

The implementation schedule of the Programme is shown in the table on the next page.





(2) Programme Cost Estimation

This cost estimate is provisional and will be further examined by the Government of Japan for the approval of the Grant.

■ Obligation of Lao side

The following cost shall be borne by the Lao side.

Obligation	Cost (KIP)
Site ground leveling, fence removal, etc.	20,160,000
Making fence (including gate)	67,200,000
Connecting electricity	12,600,000
Connecting telephone lines	1,260,000
Connecting LAN	2,100,000
Bank fees	4,200,000
Furniture (chairs, desks, booklets etc.) procurement	69,000,000
Total	176,520,000

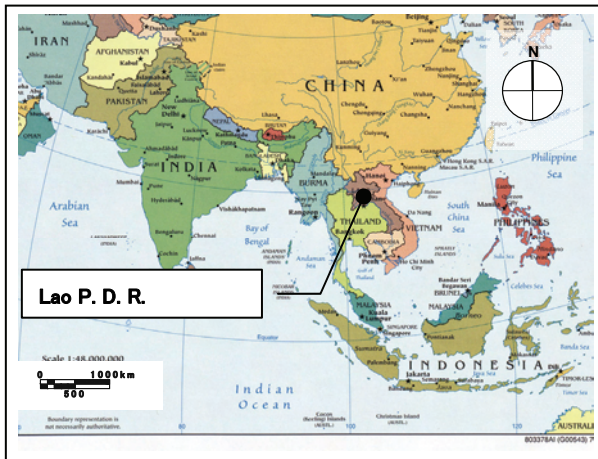
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Lao People's Democratic Republic



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The Programme for Forest Information Management in Lao P. D. R.  
Location Map



Perspective

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## Abbreviations

ADB	Asian Development Bank
AIT	Asian Institute of Technology
CBI	SFW's Community and Biodiversity Investment of EPF
C/P	Counterpart
DoF	Department of Forestry
EPF	Environment Protection Fund
FCPF	Forest Carbon Partnership Facility
FFPRI	Forestry and Forest Products Research Institute
FIPD	Forest Inventory and Planning Division
FRIC	Forest Resource Information Center
FRDF	Forestry and Forest Resource Development Fund
FSIP	Forestry Strategy Implementation Promotion Project
GIS	Geographic Information System
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
JICA	Japan International Cooperation Agency
Kfw	Kreditanstalt für Wiederaufbau
LEnS	Lao Environmental and Social Project
MAF	Ministry of Agriculture
MPI	Ministry of Planning and Investment
NAFES	National Agriculture and Forestry Extension Service
NAFRI	National Agriculture and Forestry Research Institute
NLMA	National Land Management Authority
NTFP	Non-Timber Forest Products
OJT	On the Job Training
PAFO	Provincial Agriculture and Forestry Office
PARED	Participatory Land and Forest Management Project for Reducing Deforestation
PDM	Project Design Matrix
PICE	SFW's Policy Implementation and Capacity Enhancement of EPF
PO	Plan of Operations
PC	SFW's Pollution Control of EPF
REDD	The United Nations collaborative programme on Reducing Emissions from Deforestation and Forest Degradation in developing countries
R-PIN	FCPF Readiness Preparation Proposal
SFW	EPF's Specialized Financing Window
SIDA	Swedish International Development Cooperation Agency
SUFORD	Sustainable Forestry and Rural Development Project
SLM	SFW's Sustainable Land Management of EPF
WB	World Bank
WMU	EPF's Window Management Unit
WREA	Water Resource and Environment Administration
WRM	SFW's Water Resource Management of EPF

# *Chapter1 Background of the Programme*

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## **Chapter 1 Background of the Programme**

### **1-1 Present Status and Issues in the Sector**

Laos has a land area of 23.7 million hectares, is mostly mountainous, except for land around the Mekong River, and is mostly covered by forest. Most people in Laos, especially farmers, are highly dependant on the forest for fuel and food—including slash and burn agriculture—and so on to meet their needs. In addition, forestry—including timber processing is one of the dominant industries in Laos, providing the government with a high proportion of its income and foreign exchange. The area of forest (more than 20% of tree crown density), however, had decreased from 47% in 1920 to 42% in 2002 due to an overdependence on forest resources by a rapidly growing population, and due to illegal harvesting and expanding production of commercial crops in Laos. Also, the existing forest is being degraded as larger trees and wild animals are decreasing.

### **1-2 Background of Request for Japan's Grant Aid**

At the annual meeting of the World Economic Forum held in Davos, Switzerland in January 2008, then Prime Minister Yasuo FUKUDA gave a speech to announce the Cool Earth Partnership initiative as a measure to assist developing countries that are aiming to achieve both emissions reductions and economic development. This means that Japan had decided to actively cooperate on energy conservation and other efforts for emissions reduction by developing countries and support developing countries that are seriously affected by climate change.

As part of this initiative, the Grant Aid for Environment and Climate Change Programme was introduced in fiscal 2008 to support developing countries that are short of capacity and funds for making reductions to greenhouse gas emissions compatible with economic development, despite having the desire to contribute to climate stability.

The Lao government has been formulating a plan to restore its forest percentage to 70% by 2020. It has also been establishing and revising forest related laws as well as setting legal acts concerned with community forest controls. In addition, as a result of defining Reducing Emissions from Deforestation and Forest Degradation (hereinafter referred to as “REDD”) as a measure against climate change and as an extremely useful means to raise the livelihoods of farmers who rely on forest conservation and forests, the Lao government is getting ready for REDD implementation while actively participating in related workshops. Besides, it announced its participation in the Forest Carbon Partnership Facility (hereinafter referred to as the “FCPF”) established by the World Bank, and was then selected as one of the first 14 participant countries. The Lao government intends to formulate and implement a plan to prepare a REDD system, and to promote forest conservation through experimental trading of carbon oxygen emission reduction, etc.

Under such circumstances, this survey shall carry out the necessary survey for outline design, aiming to grasp forest resources and to accelerate forest conservation as a series of measures against climate change, to implement the Japanese Grant Aid cooperation based on local specifications and designs on the assumption of applying to the Japanese Grant Aid Program for Environment and Climate Change.

At the United Nations Summit on Climate Change meeting in September 2009, the Hatoyama Initiative was set up as a framework to reduce carbon dioxide emissions as a necessary measure to combat with green house effect. The contents of the framework are:

- First, the developed countries, including Japan, must contribute through substantial, new and additional public and private financing.
- Second, rules must be developed that will facilitate international recognition of developing countries' emissions reductions, in particular those achieved through financial assistance, in a measurable, reportable and verifiable manner.
- Third, an international system should be established under the auspices of the UN climate change regime, this system should facilitate one-stop provision of information on and matching of available bilateral and multilateral financing, while securing transparency and effective utilization of assistance.
- And fourth, a framework is established to promote the transfer of low-carbon technologies which ensures the protection of intellectual property rights.

In this outline design study, it was requested that the survey is implemented based on the Hatoyama Initiative.

### **1-3 Environmental and Social Consideration**

Facilities planned in the Programme are constructed in the FIPD's property in Vientiane city. Therefore, there is no environmental and social effect envisaged to the surrounding area. Equipment to be procured in the Programme is to protect the forest and to be used for field surveys. Also, they are stored inside of the building, thus there is no environmental impact.

## *Chapter 2 Contents of the Programme*

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## **Chapter 2 Contents of the Programme**

### **2-1 Basic Concept of the Programme**

#### **2-1-1 Overall Goal and Programme Goal**

Laos has formulated a plan to restore its forestation rate to 70% by 2020. It has also been establishing and revising forest related laws and passing legislation regarding village forestry management. Furthermore, it has seized on REDD to combat global warming as an extremely valuable means of protecting forests and raising the livelihood of farmers dependent on forests. The Lao government is moving forward with preparations to implement REDD such as actively participating in relevant workshops. Moreover, Laos pronounced its participation in FCPF, and was selected as one of the initial 14 participant countries. The government intends to promote forest conservation through the formulation and implementation of a plan to prepare a REDD system, and through experimental emissions trading and so on.

This Programme's overall goal, in accordance with REDD, is “to prepare benchmark maps for REDD based on the forest resources information so that the prevention of deforestation is dealt with globally”; and the purpose of the Programme is “to establish a fundamental structure to make basic forestry maps using several types of satellite imagery in Laos”.

#### **2-1-2 Outline of the Programme**

To achieve the above purpose, the Programme will construct the Forest Resource Information Center (hereinafter referred to as “FRIC”), procure equipment and implement technical transfer. In the process it is expected that the Lao side's base forest mapping capacity will be strengthened and at the same time forest conservation will be promoted. The equipment procured will be that for analyzing satellite images and the database, and that for surveys of sample sites.

### **2-2 Outline Design of the Japanese Assistance**

#### **2-2-1 Design Policy**

##### **2-2-1-1 Basic Policy**

###### **(1) Basic Concept for Facility Design**

As a result of explanations and discussions in relation to a request from the Lao side to the Japanese side regarding the new facility design, it was confirmed that the purposes of the use of the new FIPD facility were to be for ordering forest resource information (including collection and analyses), controlling them and upgrading their technical skills by constructing the new facility including computer rooms, multipurpose meeting rooms and administrative offices.

The collecting, analyzing and controlling of forest resource information work is presently implemented by the three sections of FIPD: the Remote Sensing Division, Inventory Division and Database Division; but these divisions separately implement their work at each of their working rooms. So, they have operational problems such as insufficient information communications and difficulties to handle personnel changes. Besides, although the rooms have air-conditioning, they are not air-tight, causing concern that this negatively affects their precision instruments installed at the rooms because their fitting materials are made of wood and decrepit. From these reasons, it was confirmed by the field survey that the contents and capacities of the existing FIPD facility were inadequate for implementing the collecting, analyzing and controlling of forest resource information work.

In view of these circumstances, the Programme shall construct the new FIPD facility as FRIC based on the local standard specifications of Laos, aiming to formulate frameworks to enable to collect, analyze and manage information for forest resource control as part of measures against climate change.

Because the three sections, Remote Sensing Section, Inventory & Planning Section and Planning & Database Section need to exchange and to share collected and analyzed information collectively, it is efficient for them to implement their works not separately in individual rooms but collectively in the same room. Consequently, the Programme shall plan FRIC on condition that these three sections can efficiently work collectively in the same room.

The detailed design scale of the new facility shall have Remote Sensing Section, Inventory Section, Database Section and Administrative Section; for a total of 44 staff. Because there are no standard design specifications to construct office facilities in Laos, the Programme shall determine necessary components and room sizes, while referring to the way the existing FIPD facility is used and examples of other facilities related to the Ministry of Agriculture and Forestry (hereinafter referred to as “MAF”) and the Department of Forestry (hereinafter referred to as “DoF”). The working conditions of the Database Section at the existing facilities are good. Accordingly, the size of the working spaces at the new FIPD facility shall nearly be the same as the size (7.5 m<sup>2</sup> / person) of the existing FIPD facility.

FIPD implements initial training for the new staff of MAF and DoF. Staff adopted by MAF and DoF are assigned to their departments or sections respectively after the initial training. Other technical training is also implemented for staff concerned with forest resource information depending on their technical levels. On the other hand, because no training rooms are located at the existing FIPD facility at present, rooms for other purposes such as satellite analysis rooms are forced to be used. As a result, this situation brings obstacles to their routine works at present.

As for the technical training, their detailed training plans are formulated in fields of forestry inventory, GIS / RS / database and forest planning management by dividing into the classes of Manager, Advanced Operator / Researcher and Field Worker / Interpreter / Assistance. In terms of training by FIPD, training for 13 to 18 participants is mostly held, and maximally for 25 participants are also scheduled. This training is

mostly held using computers to reflect these effects in their practical works. Accordingly, the Programme shall schedule training so that each participant will be able to use their own computer in intensive training for 13 to 18 participants, and one computer will be shared by two participants for training of up to 25 participants. Besides, the room for these purposes shall also be designed for multipurpose uses such as technical lectures planned for up to 78 participants and also for FIPD staff meetings.

The components and area of the FRIC were planned with reference to the existing facilities and usage condition of MAF since standard design criteria is still not established in Laos. Heat insulation and good breeze against hotness is secured to keep the operation cost of air conditioning low. It is planned to procure materials which are generally in circulation in Laos.

Concerning their room specifications, they shall be determined on the premise that they are durable and they can easily be operated and maintained, while referring to specifications used for similar facilities concerned with MAF. In general, in terms of rooms where a number of computers are installed, it is adequate to wire electric and LAN cables using spaces between floors called the free-access floor system for enabling to handle advanced information, system/equipment changes, networking arrangement, and high-speed / high-capacity transmissions. As a result of discussions with FIPD, it was confirmed that FRIC would need to handle advanced information and networking arrangements, and thus, the Programme shall adopt the free-access floor system in the case of rooms for works concerned with forest resource information.

## (2) Basic Concept for Equipment Procurement

The Programme shall plan to procure equipment such as PCs to be necessary for developing nation-wide forest base map in 2010, imagery analyses/GIS software, satellite imagery covering the whole of Laos (plural satellite combinations) and instruments necessary for sampling site surveys.

[PC, etc.]

Upon the consideration of requests from FIPD, the Programme shall procure new equipment by analyzing the usability of the existing FIPD equipment as listed in the Table on the next page. In terms of the existing equipment machines introduced a long time ago, they are insufficient for data processes and analyses which the Programme is supposed to carry out even though their functions are extended.



Table 2-1 Analysis of the Existing FIPD Equipment such as PCs and Plan of New Equipment Procurement

Section	Procurement	Maker	Type	Capacity	No	Purchase year	Support by	Useable
RS, Mapping, Land Use Planning (24)	Existing	HP	Pentium (R) D desktop	250 GB, 1GB	4	2008	SUFORD	○
		No brand	Pentium 3 desktop	40 GB, 512 MB	2	2006	FIPD	x
		No brand	Pentium 4 desktop	80 GB, 512 MB	1	1999	SIDA	x
		NEC	Pentium 4 desktop	120 GB, 512 MB	1	1999	SIDA	x
		No brand	Pentium 4 desktop	80 GB, 1 GB	1	2003	SUFORD	○
		No brand	Pentium 4 desktop	150 GB, 1 GB	1	2003	SUFORD	○
		HP	Plotter Design Jet 1055 EM		1	2000	SIDA	x
		Epson 9800	Plotter, A0		1	2006	SUFORD	○
		HP	Printer, A3, Office Jet Pro K850		2	2007	SUFORD	○
		HP 1700	Printer, A3		1	2002	SUFORD	x
		Scanner, A0		1	2007	SUFORD	○	
		Can comp 9500		3	2000	SIDA	x	
	New	HP	Desktop PC(high-end)		6	2010	JICA	◎
		HP	Desktop PC(standard)		6	2010	JICA	◎
		HP	Laptop PC (for fields)		18	2010	JICA	◎
		HP	Plotter, A0		1	2010	JICA	◎
HP		Laser Printer, A3		1	2010	JICA	◎	
HP		Scanner, A3		1	2010	JICA	◎	
Planning & Database (6)	Existing	HP	Pentium (R) D desktop	160 GB, 1 GB	2	2007	SUFORD	○
		HP	Pentium (R) D desktop	160 GB, 512 MB	2	2006	SUFORD	○
		HP	Pentium (R) D desktop	250 GB, 1 GB	2	2007	SUFORD	○
		No brand	Pentium (R) D desktop	60 GB, 512 MB	1	2006	SUFORD	○
		Toshiba	Pentium (M) notebook	60 GB, 512 MB	1	2005	SIDA	○
New	HP	Storage/Workspace/Tower		1	2010	JICA	◎	
	HP	Storage/Server(NAS)/Rack		2	2011	JICA	◎	
Administration (10)	Existing	No brand	Pentium 4 desktop	150 GB, 960 MB	1	2008	FIPD	○
		ACER	Pentium 4 notebook	100 GB, 512 MB	1	2008	FIPD	○
		No brand	Pentium 4 desktop	? 896 MB	1	1999	SIDA	○
		HP	Pentium (R) D desktop	250 GB, 1 GB	2	2007	SUFORD	○
		Samsung	Intel core desktop	80 GB, 448 MB	1	2008	FIPD	○
		Toshiba	Intel (R) notebook	100 GB, 512 MB	1	2006	SUFORD	○
		Toshiba	Intel (R) notebook	250 GB, 1 GB	1	2008	SUFORD	○
New	-	-	-	-	-	-	-	

[Imagery Analysis and GIS software]

Upon the considerations of requests from FIPD, the Programme shall plan to procure new software by analyzing the usability of the existing FIPD software, as summarized in the table below. The basic concept of the software procurement shall be to introduce software programmes which other donors have already introduced in the past rather than to introduce the other kinds of imagery analysis and GIS software programmes. This is because it shall be better to further develop the usability of FIPD with software programmes which FIPD currently uses. In terms of the upgrading of software programmes which other donors introduced to FIPD before, it is premised that they shall be upgraded by the donors. The Programme shall basically replace software programmes, which have difficulties to be upgraded because they have been introduced a long time ago.

Table 2-2 Analysis of the Existing FIPD Software and Plan of New Software Procurement

Procurement	Software	Purchase year	Supported by	No.	Comments	Remarks
Existing	ArcGIS 9.1			12	Upgrade to 9.3 by SUFORD?	
	ArcInfo 3.4	1993	SIDA	6	Will not be used	
	ArcView 3.2	1993	SIDA	6	Will not be used	
	ERDAS 8.6	2006	SUFORD	4	Upgrade to 9.3 by SUFORD?	
New	ArcGIS 9.3	2010	JICA	2		Spatial Analyst x2, 3D Analyst x2
	ArcView 9.3	2010	JICA	6		Spatial Analyst x6, 3D Analyst x6
	ArcView 9.3	2010	JICA	18		No Extension (For Field Survey (Laptop))
	ERDAS 9.3	2010	JICA	4		IMAGINE x2, LPS x2

[Satellite imagery]

The following summarize FIPD's needs concerned with satellite imagery toward the REDD implementation found by the outline design study of the Programme.

- FIPD has strong needs for data development within the same year, though whether or not its standard years are yet to be set.
  - It is unrealistic to set multiyear data as benchmarks, due to developing countries' tendency to change rapidly.
- It is necessary to categorize forestry much more accurately in view of growth amounts for the estimates of carbon amounts.
  - It is necessary to develop data in the same season for categorizing them under universal standards.
- It is desirable to take satellite imagery regularly at affordably low prices in order to monitor changes.
  - It is desirable to develop data obtained in the same season as those obtained in the past for the efficiencies of the change extractions.

The table below summaries the advantages, disadvantages and uses of major satellites (except past satellites and satellites with a low-resolution of less than 30 m from the viewpoint of the REDD benchmark map developments).

Table 2-3 Summary of the Advantages, Disadvantages and Suitable Uses of Major Satellites

Kind	Satellite / sensor	Advantage	Disadvantage	Suitable Use
Medium resolution	LANDSAT	Free, a number of past data, wide-area imagery	Not high resolutions, limitations of categorizations and distinctions	Analyses of the past data
High resolution	ALOS/ PRISM&AVNIR2	Affordably low price, high resolutions of Pan* <sup>1</sup> , possible to be used by multiple users of value-added products	Pan* <sup>1</sup> and MS* <sup>2</sup> are different sensors, no coverage of simultaneous shootings	Nation-wide developments, regular updates
	SPOT5	Comparisons with past archives, coverage of accuracies and qualities, medium-infrared band	High price (compared with ALOS), no blue bands	Nation-wide developments, partly updates
	RapidEye	Imagery shootings available for a short period (5 satellites), high-resolution of MS* <sup>2</sup> , RedEdge band* <sup>4</sup>	No Pan* <sup>1</sup> available, a small number of archives, a small number of use experiences, inadequate authorized shop networks	Emergency and short period developments (new shootings)
Very high resolution	QuickBird GeoEye, etc.	Possible to interpret up to tree species and rural roads	High price, difficult to analyze in the same year and season	Field survey supplements and examinations, examinations of carbon estimated models for rural

Kind	Satellite / sensor	Advantage	Disadvantage	Suitable Use
				road development
Air survey	LiDAR	Possible to accurately interpret surface and ground elevations	Usable for sloping lands and high density areas	Contributions to produce volume tables
Radar SAR	ALOS/ PALSAR	Regular and certain observations, strong in change extractions* <sup>5</sup>	Because of SAR's characteristics, difficult to analyze mountainous areas (sloping lands)	Regular change monitoring

- \*1: Panchromatic, black and white sensor (usually higher resolution than color).
- \*2: Multispectral, color sensor (usually lower resolution than black and white).
- \*3: Band which can work for moorland vegetation discriminations, SPOT covers it but normal optical satellites do not cover it.
- \*4: Band which can work for vegetation stress analyses, RapidEye covers it but normal optical satellites do not cover it.
- \*5: Radar receives little influence from weather conditions and solar altitudes compared with optics, and radar can easily catch physical changes of terrestrial features.

The following table summarizes the information of existing major satellite imagery (kinds, operation terms, owning organizations, using conditions, etc.) in Laos (except for partial imagery shootings and websites such as Google). These satellites have the issues of uses for producing nation-wide benchmark maps toward REDD implementation.

Table 2-4 Information of the Main Existing Satellite Imagery in Laos

Kind of satellite/sensor	Operation term	Owning organization	Using condition, etc.
LANDSAT 5 & 7 /TM & ETM+	1990/2000 /2005	-	Officially not used yet (freely released in 2009, so anticipated to be used widely)
SPOT4	2001	FIPD/SIDA	FIPD owns and controls its hardcopies only, impossible to use for imagery analyses.
ALOS /PRISM & AVNIR-2	2007-2008	NLMA <sup>*1</sup> /ADB	PRISM and AVNIR have not shot simultaneously, and their imagery is simply and geometrically corrected. So, there are issues of high quality uses.

\*1 : National Land Management Authority (NLMA)

The Programme shall target at the development of the 2010 nation-wide forest base map. High resolution satellites (ALOS, SPOT, RapidEye) have possibilities to realize the target. However, because there are the failure risks of shooting satellite imagery with cloudy influences to cover the whole of Laos only in the dry season of 2010 (from November 2010, after the Programme commencement, until the end of February 2011), it is not feasible to realize the data only with a single satellite. Accordingly, it is necessary to combine the uses of plural satellites for the target achievement.

While considering the characteristics of the needs and the satellites as explained above, the following set the selection concepts of satellite imagery and other equipment to be used for the Programme and its technical assistances.

- Quantity of equipment shall be decided based on the number of existing staff
- Regarding the equipment for sampling site survey, the specification shall not be as high as electrical device mounted, in consideration of situation in Laos, but general and easy usage.
- Regarding satellite imageries, ALOS, SPOT and Rapid Eye shall be procured to cover the whole country in one dry season. Satellite data in the dry season of 2010 (in the same season as the field surveys) shall be based on ALOS/AVNIR-2+PRISM (OB2). SPOT5 and RapidEye shall complement their cloudy and orbit problems. (Planned to carry out pre-examination surveys for integrated satellite uses.)
- With SPOT 4 in 2005, a forest base map of the existing forest shall be made to compare with that to be developed in 2010. (Propriety of satellite sensor unifications rather than timing in 2010)
- LANDSAT (TM and ETM) in 1990 and 2000 shall be used as data for basic technical training
- Training of ALOS/PALSAR shall be carried out for part of leading technicians. (Desirable to observe FBD in 2010 and 2011)
- Very high-resolution satellites (QuickBird, etc.) and air surveys shall be committed to pilot projects.
- The specification of imagery analysis software shall be appropriate for several types of satellite image analysis.
- The equipment except for satellite imagery and imagery analysis software shall be easy specification which can be procured generally in Laos.
- Technical assistance contains the components of field survey, its analysis and making the results throughout the entire work.

### **2-2-1-2 Policy on Natural Conditions**

It is desired that equipment such as computers and data servers are installed in hermetically sealed rooms for the purpose of dust proofing. Vientiane has high temperature and humidity climates all through the year, and heat flushing from such as equipment increases indoor temperature. Accordingly, the Programme shall design to install air-conditioning systems at each room of FRIC except its corridors and stairways. The existing FIPD facility has installed central air-conditioning systems before. However, because the systems have been difficult for operate and maintenance works, the existing facility adopts individual air-conditioning systems at present. From this reason, the Programme shall introduce individual air-conditioning systems generally used in Laos in view of easy operation and maintenance. As measures against hot climate all through the year in Laos, the Programme shall design to minimize FRIC's operational costs generated from air-conditioning systems by ensuring thermal insulation and wind ventilation in the attic of FRIC.

In the rainy season, because there are intense rainfalls, the Programme shall design slope roofs generally used in Laos to avoid the ingress of rainwater into the room. Drainage culverts shall also be designed to prevent from water ingress into FRIC. Furthermore, the Programme shall install lightning protection for frequent thunderbolts in the rainy season. There are the possibilities of electric power failures by thunderbolts in the Programme site area. Therefore, the installation of electric generators shall also be

designed for data servers and air-conditioning system for the servers necessary to be always turned-on. For computer systems to be procured by the Programme, their emergency power shall be covered with uninterruptible power systems (hereinafter referred to as “UPS”) and electric generators shall not be installed for the computer systems

In the northern part of Laos, there are discernable earthquakes, but there are not these considerations in the Vientiane city area. In a neighboring country, Thailand, there are also no seismic considerations around the Mekong River. Consequently, the Programme shall also not consider seismic influences on the design of FRIC.

The ground of the candidate site for FRIC is not strong. Therefore, the Programme shall design FRIC on the premise that precast concrete bearing piles are adopted because they are easily procured and the piles are generally used in Vientiane city where the Programme site is located. By adopting the piles, it can be anticipated that the Programme shall be able to set the construction schedule of FRIC without great influences by the ground condition. As a result, the Programme shall be able to raise its implementation efficiency.

### **2-2-1-3 Policy on Socioeconomic Condition**

In the case of buildings in Laos, slope roof with hipped style is generally adopted. FRIC shall be an environmental-related facility to manage forest resource information, and therefore, its exterior look shall be fused with its surrounding environment by adopting the roofing style. Its roofing materials are generally made of corrugated slates and cement tiles. However, durable and weatherproofing cement tiles shall be adopted to reduce the operation and maintenance costs of FRIC.

It is difficult to communicate with FIPD’s ordinary staff in the English language. Carbon-dioxide typed fire extinguishers in the computer room and the data server room has possibilities to have a negative impact on the human health if they are used incorrectly. Accordingly, their operation manuals shall be translated into the Lao language and they shall be attached on systems and/or equipment which need to ensure full understanding of their usages.

### **2-2-1-4 Policy on Construction and Equipment Procurement**

In terms of construction standards in Laos, there is “Handbook of Construction Rules” issued by Ministry of Communication, Transport, Post and Construction (hereinafter referred to as “MCTPC”). However, the fact is that it is not established as construction standards in the country. As a result, construction works in Laos are generally designed based on a neighboring county, Thailand’s standards, American Concrete Institute (hereinafter referred to as “ACI”) standards, British Standard (hereinafter referred to as “BS”), etc. Because Vientiane city, the site of the Programme, is across the Mekong River from Thailand, the Programme shall design FRIC while referring to the Thai design standards.

Regarding applications for construction permits, building owners should submit a series of building application forms (including layout, floor plan and elevation drawings) to their district office of MCTPC. MCTPC examines the layout plans of the planned building mainly from viewpoints of urban plans and site conditions. After the examinations by MCTPS, Department of Public Works and Transport (hereinafter referred to as “DPWT”) of Vientiane city continues to examine the contents of the planned building, and DPWT awards construction permits to the owner. Criteria are not standardized on the examinations, but there are no refusals to award the permit if they are based on certain standards such as Thai standards and ACI standards. In general, the times estimated after application submissions until permit receipts are for approximately two months in terms of private buildings and for approximately four weeks in terms of public buildings, but it is also possible to commence the construction works before the permit receipts.

Table 2-5 Documents for Application for Construction Permits

Document	Explanations
Application for construction permits	
Certificate of domicile	Certified by local administrations
Land title, Land measurement certificate	<ul style="list-style-type: none"> <li>- Inheritance certificates</li> <li>- Certificate of transfer of property</li> <li>- Certificate of ownership</li> <li>- Receipt for land tax payment</li> </ul>
Site maps of building control offices the construction	Scale 1/5,000 – 1/20000, including surrounding facilities and roads
Detailed development plans of the land parcel	1/50 - 1/200 development plans, including surrounding facilities and roads
Architectural Drawings	1/50 – 1/200 development plans, cross sections, perspective, etc.
Blueprints of the recycling sanitary system	Indicate the reservoirs' location and flow direction

(Source: Handbook of Construction Rules, MCTPC, Lao P.D.R.)

Construction materials made in Laos and Thailand are generally distributed in Laos, and they can be procured for the Programme.

### **2-2-1-5 Basic Concept for Uses of Local Contractors (Construction and Consultant Companies)**

In Laos, construction companies are categorized depending on their capital and technical level, and there are restrictions on the capacities of authorized construction works. Local construction companies in Laos have basic technical skills for building, civil and building equipment works. Because the Programme shall not adopt special technical methods and works for the construction work of FRIC, and it shall implement the work based on the Lao specifications. Accordingly, the Programme shall be able to implement the work by local contractors in Laos.

In the Programme, it is premised on building designs based on general specifications and implementation by local contractor. Therefore, the Programme shall be able to use local consultants in Laos for basic works in terms of the building designing and implementation supervising works of FRIC.

Table 2-6 Documents for Application for Construction Permits

	Total capital	Bank deposit	Technicians' years of experience	Authorized construction area
Class 1	LAK 50,000,000 (=Approx. 71,400 USD)	LAK 1,500,000 (=Approx. 2,140 USD)	More than 5	No limit
Class 2	LAK 10,000,000~50,000,000 (=Approx. 14,300 – 71,400 USD)	LAK 600,000 (=Approx. 860 USD)	More than 4	Less than 1300 m <sup>2</sup>
Class 3	LAK 10,000,000 (=Approx. 14,300 USD)	LAK 300,000 (=Approx. 430 USD)	More than 3	Less than 260 m <sup>2</sup>

(Source: Handbook of Construction Rules)

## 2-2-1-6 Policy on Operation and Maintenance

### (1) Construction

The existing FIPD facility was constructed in the late 1980's. Although the facility is decrepit, FIPD maintains the dirty and broken parts of the facility and on a whole it is well operated and maintained at present. Besides, although FIPD does not implement regular maintenance works for the facility, FIPD contacts private companies to commit maintenance works for the facility as necessary. Until present, because FIPD has continuously experienced the operation and maintenance works for forest resource information, the Programme shall plan to design the specifications of FRIC without so different from the specifications of the existing facility. As a result, FIPD staff shall be able to carry out their same operation and maintenance works.

### (2) Equipment

The FIPD staff members, as users, shall need to carry out the operation and maintenance works of equipment for satellite imagery analyses and database constructions such as workstations, servers and notebook PCs adequately and sustainably. Accordingly, the Programme shall select these equipment items having locally authorized agents for the smooth supplies of these spare parts and these after-sale services promptly.

The equipment of plotters and printers shall include the proper volumes of consumables such as rolled papers and inks. However, the other equipment items to be procured by the Programme do not need special spare parts and consumables. Some of them can easily be prepared in Laos. Therefore, the Programme shall not procure spare parts and consumables for these other items.

### **2-2-1-7 Policy on Construction and Equipment Grade**

#### **(1) Construction**

In order to ensure the sustainability and independent development of the Lao side, the Programme shall make the easy operation and maintenance of FRIC a priority. Including the existing FIPD, facilities concerned with MAF are relatively well operated and maintained. Thus, the grade of FRIC shall be the same as them.

#### **(2) Equipment**

FIPD has sufficient technical skills to operate its existing equipment. It is supposed that the skills shall also be sufficient for the operation and maintenance of new equipment to be procured by the Programme. As for equipment items with further computerized controlling systems, however, it is impossible for the FIPD staff members to operate and maintain such equipment by themselves. In terms of equipment to be used for sample site surveys in particular, they shall be used in site, and they shall be used frequently. Consequently, the Programme shall design them with specifications as simple as possible, and it shall arrange to minimize their specifications with further computerized controlling systems.

#### **(3) Technical Assistance**

The Programme shall apply local consultants, third-country consultants and third-country educational research institutes to the technical assistance. As for the technical skills of satellite imagery analyses, GIS and database constructions, the Programme shall implement a series of works from basic training through OJT. The educational organization from the third country shall be in charge of basic training, and the Japanese, third-country and local consultants shall implement the OJT for the Programme. In terms of the OJT, the Programme shall plan to establish the capacities of the FIPD staff members for their practical works by gradually, repeating activities on a step-by-step basis.

### **2-2-1-8 Policy on Technical Methods / Procurement Methods and Implementation Term**

Japan's Programme Grant Aid for Environment and Climate Change (hereinafter referred to as "GAEC") has been introduced as a scheme for growing international concern regarding climate change, and it is desirable for it to move forward promptly. Under the GAEC, the national origin of construction contractors, procurement contractors and consultants are untied, and also it is possible to implement construction works by means of local technical methods, materials and equipment. Therefore, while taking cost reductions into consideration, the Programme shall actively adopt local specifications, materials and equipment. By using local specifications, it is possible to minimize the implementation schedule of the Programme by means of local contractors who does not need to implement with unfamiliar technical methods.

According to the example of another construction work similar to the facility construction capacity of the

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Programme, it has taken approximately 10 - 12 months from its foundation work until its finishing work. The Programme shall plan special considerations and treatments to implement the earth works, excavation works and foundation works of FRIC while ensuring their working qualities during the rainy season. Therefore, to ensure their working accuracies, this work shall not be implemented under unfavorable weather conditions during the rainy season.

In addition, satellite imagery has to be taken and the field surveys shall be implemented in the dry season in Laos. Technical assistance in the Programme is supposed to begin around July 2010 and only 4 months to the beginning of dry season. Therefore, preparation and planning of the field survey needs to be finished within this very short period. To achieve this, the leading staff are trained intensively by the Japanese consultant and the consultants from third countries after basic training by educational organization from third countries, to be able to survey and analyze the data in a short period. And then, the other staff are trained to develop their capacity with the leading staff for two and a half years until March 2013.

## **2-2-2 Basic Plan**

### **2-2-2-1 Construction Plan**

#### **(1) Contents of Facility**

The field survey of the Programme confirmed the activity contents, components of each room and room sizes of the existing FIPD facility. In addition, as a result of discussions with the Lao side on consideration of the standard room components of its similar facilities, the Programme shall design FRIC with the following necessary rooms.

##### **1) Facility Entrance**

In terms of the facility entrance of FRIC, FIPD requested to design not only spaces for a reception and a lobby but also spaces to exhibit topographical models to introduce FIPD's activities. However, it is alternatively possible to exhibit photographs / maps and drawings. Therefore, the Programme shall not design spaces to exhibit the models at FRIC.

At the existing FIPD facility, there is obligation to store documents produced by FIPD, but they are stored at offices and on book shelves because there are not special rooms at the existing facility to store documents and documents concerned with forest resources. From this reason, during the field survey, FIPD requested to design spaces to be used as a library and document/book stores, together with a cafeteria for the users to take a rest. In terms of documents stored at FIPD, there are cases that not only its staff but also its guests such as students wish to use them. However, because there are no such special purpose rooms, they cannot easily search for and read the documents comfortably. Therefore, it is also possible that FIPD cannot carry out its routine work smoothly. Under these circumstances, although it is necessary to design such special rooms to store the documents, the Programme shall not plan cafeteria spaces because humidity control is important to store documents certainly. Furthermore, since most of the users do not purchase the

documents but request to copy them, the Programme shall plan not a document/book store but a reception for document readings and their copies.

Table 2-7 Comparison between request and planning

Contents of Request	Contents of Planning
Exhibition / Lobby / Entrance (including Reception) Library / Book and Document Store / Cafeteria	Entrance lobby Library / Reception Document Storage

## 2) Training and Meeting

Not only the initial training and the technical training for FIPD staff but also meetings for provincial foresters are held in FIPD. For these events, during the Programme's field survey, FIPD requested to design meeting rooms with video and multimedia systems and training rooms where the staff can use computers. In terms of the training and the meetings, the Programme shall plan a multipurpose room for training and meetings because it is a small number of their schedules to be held at the same time, while considering the rate of their room utilization.

Table 2-8 Comparison between request and planning

Contents of Request	Contents of Planning
Meeting/ Video Meeting/ Multipurpose Room Computer Training Room	Multipurpose Meeting Room

## 3) Forest Resource Information

The existing FIPD facilities implement satellite imagery analysis, GIS processing and database compiling work concerned with forest resource information by the three sections individually. However, since their work is related to each other, it is efficient if they can contact each other closely. Therefore, the Programme shall plan a room for integrated computer systems as the workshop room of these three sections. Printers, plotters and scanners shall be installed at the same space so that the three sections are able to use them collectively. Moreover, in order to handle noise generated from printers and also to operate and maintain them easily, this equipment is installed intensively in a separate room. As for database, the Programme shall locate its data at separate rooms to ensure its security. These rooms shall be designed with the free-access floor system for sharing its data information.

FIPD also requested to plan a computer repair room. However, special shops can handle repairing works on high difficulty and specialty levels. A FRIC service room shall be able to do the works on easy levels. Therefore, the request of the computer repair room shall be exempt from the Programme plan.

Table 2-9 Comparison between request and planning

Contents of Request	Contents of Planning
Computer Room	Computer Room
Service Room	Service Room
Server Room	Server Room
Computer Repair Room	

4) Administration

The Administration Section of the existing FIPD facility uses each room individually by one or two persons. So, it cannot use spaces efficiently at the existing facility, and it cannot also execute sectional and organizational management smoothly. Accordingly, the Programme shall design rooms for the Section for efficient operation and management works together with concerned staff and sections collectively by ensuring sufficient room capacities for their works.

In Laos, executive levels such as directors and deputy directors generally work in individual rooms. Therefore, they are designed as individual rooms for their works at FRIC as well as those at the existing facility.

Table 2-10 Comparison between request and planning

Contents of Request	Contents of Planning
Administration Room 1	Director's office
Administration Room 2	Management and Administration Office (1) (for Deputy Director 1)
Administration Room 3	Management and Administration Office (2) (for Deputy Director 2)
Administration Room 4	Management and Administration Office (3)
Administration Room 5	

5) Other Necessary Rooms

A resting room is designed for FRIC staff to be refreshed and to distinguish zonings clearly between rooms with precision instruments and those where water is used. Besides, a guest room is also arranged. The Programme shall also plan a store room for general equipment, but such as satellite imagery and maps shall be kept for a long time at the existing FIPD facility.

Table 2-11 Comparison between request and planning

Contents of Request	Contents of Planning
Resting Room, Pantry	Resting Room, Pantry
Guest Room	Guest Room
Storage	Storage
Satellite Imagery and Map Store Room	

Contents of Request	Contents of Planning
Toilet	Toilet (including cleaning tool storage)
Cleaning Tool Storage	
Corridor	Corridor
Staircase	Staircase

#### 6) Use of the FIPD Existing Facility

Although there is a facility shortage for the ordinary staff of FIPD's Inventory Section, the Programme shall plan the Section to carry out work such as the recording and storing of survey results using the existing FIPD facility. Moreover, FIPD's Botany uses the existing facility continuously.

#### (2) Site and Facility Planning

At the Programme site, there is available access from a front road facing to the south side of the site, and a rotary is formulated around an electric transformer there. Because the existing FIPD facility needs to continue its works concerned with forest resource information, it is indispensable to prevent from interrupting the works during the implementation term of FRIC's construction. Therefore, the Programme shall take priority to the site layout plan of FRIC which can minimize its construction influence on the works during the implementation term. Also, there are a number of trees inside the Programme site. Because these trees are effective to avoid increasing the room temperatures due to direct sun rays, the Programme shall design FRIC at the east side of the site so that the trees are used to avoid increasing the temperature without cutting them down. The candidate site of FRIC is used as nurseries with shading nets at present, but these can be moved easily, therefore they are not an obstacle for the new facility construction.

To use the existing FIPD facilities continuously as a facility for the arrangement and control of forest resource information, there are many inadequate conditions. However, the existing facilities can continuously be used as such an ordinary office, and therefore, the Programme shall plan a new available access not on the existing east side road but on the layout axis of the existing facility for functional linkages with FRIC. Because it is prohibited to construct buildings within 17m from their front road center, the Programme shall ensure a sufficient setback from the east side road, and areas produced by the setback shall be used as vehicle access roads. Vehicles accessing from the east side road shall be only for guests to FRIC, and those for field survey works shall access from the south side road as usual. By expanding the rotary formulated around the transformer, the access shall be linked with FRIC.

Besides, as a result of comparisons and examinations of the necessary capacities and the site conditions of the Programme, a two storied building shall be adequate for FRIC.

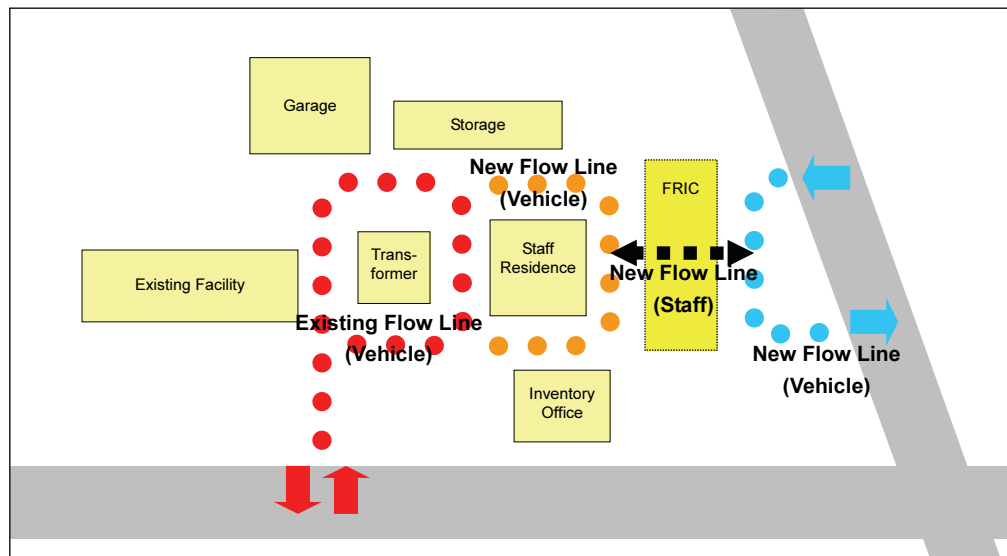


Figure 2-1 Image of Relationship between FRIC and Existing Facility

### (3) Facility Planning

#### 1) Floor Plan

The Programme shall not plan vestibules at FRIC as well as those at the existing FIPD facility and similar facilities concerned with MAF which do not operate air conditioning systems. Because FIPD is obliged to store documents and references for ten years at least, the Programme shall plan Document Store Room which has a capacity for storing them with a volume of ten years. In terms of documents and references, the Programme shall design Document Store Room near Entrance Lobby for the easy access of guests such as students. The Programme shall also plan a Reception which can watch over those coming into and out of FRIC. Another role of the reception is the lending out and making copies of documents.

Since it is assumed that the Multipurpose Meeting Room is used not only by FIPD staff, it shall be designed on the first floor of FRIC. It is assumed that tables shall be used at the Multipurpose Meeting Room in terms of training with computers. Consequently, the room shall have an adequate size for these table installations. It is also assumed that only chairs shall be used in the case of meetings for a number of participants.

The Programme shall plan a Computer Room which can handle the data collecting, analyzing and controlling works of forest resource information by the Remote Sensing Section, Inventory and Planning Section, and Planning and Database Section. The Database Room in the existing FIPD office seems to be operating satisfactorily. Therefore, the unit area per person of the Computer Room shall be nearly the same as that of the existing Database Room. The Programme shall plan a Computer Room with a free access floor system to enable changing the wiring and cables easily in case of organizational changes, increases in personnel numbers, layout changes occurred by introducing new equipment systems in the future and the necessity of sharing massive data. Forest resource information must continuously be handled, and the information should not be easily touched by others except FIPD staff. For these reasons, the Programme

shall locate the Computer Room and Database Room on the second floor of FRIC.

Regarding the room of FRIC's Director, its size shall nearly be the same as those of the existing facility. As for the sizes of rooms to be planned at FRIC for the Administration Section, their unit area shall nearly be the same as those of the existing FIPD Database Room.

Necessary components and room floor sizes are as summarized in the following tables. In terms of furniture and equipment, the Programme shall include tables and chairs to be used for the Multipurpose Meeting Room. It shall also include tables and chairs for the Computer Room to be necessary for activities concerned with forest resource information. However, it shall exclude items such as furniture, equipment and bookshelves to be used for ordinary administration work.

Table 2-12 Summary of Planned Facility (1F)

Room name	Utilization	Floor size(m <sup>2</sup> )
Entrance Lobby	Vestibule and air conditioning systems not to be installed	19.8
Reception	Lending and making copies of documents for guests	21.0
Library / Documents Storage	To store documents and references produced by FIPD, Possible for the guests to use references as well	21.0
Multipurpose Meeting Room	For uses such as computer training and meetings	98.1
Storage for Meeting Room	To store tables and chairs for Multipurpose Room	20.6
Management & Administration Office (1)	To be used as the Deputy Director's office	20.6
Management & Administration Office (2)	To be used as the Deputy Director's office	20.6
Management & Administration Office (3)	To be used as an office for administration section staff	51.5
Resting room	To be used for staff, trainees and meeting participants to take a rest	41.2
Storage	To store equipment for administrative work	12.3
EPS		2.8
Toilet (M), Toilet (F)		23.3
Corridor, Staircase		89.2
Total		442.0

Table 2-13 Summary of Planned Facility (2F)

Room name	Utilization	Floor size(m <sup>2</sup> )
Computer Room	To implement work concerned with forest resource information	243.9

Room name	Utilization	Floor size(m <sup>2</sup> )
Service Room	To install equipment such as plotters and scanners	20.6
Server Room	Data sever room Air conditioning for 24 hours	10.3
Director's Office	To be used as the Director's office	20.6
Guest Room	Adjacent to Director's office for guests	20.6
Resting room	To be used for staff to take a rest	30.9
Storage	To store equipment for administrative work	10.3
EPS		2.8
Toilet (M), Toilet (F)		27.3
Corridor, Staircase		54.7
Total		442.0

## 2) Sectional Planning

The Programme shall adopt slope roofs generally used in Laos which can easily avoid rainwater ingress. Although the climate at the site is hot all year round, ventilation under the roof can ensure natural airflows. Thus, the roofs can minimize operating costs generated by air conditioners. The Programme shall design a ceiling height of 3 m or over for FRIC by considering the example of the existing FIPD facility. In terms of Computer Room, the Programme shall adopt a free access floor system and a non-level floor.

## 3) Structural Planning

### a) Design criteria

In Laos, there is "Handbook of Construction Rules" issued by MCTPC. However, it is not established as a design standard, and most construction in Laos refers to Thai and other countries' standards. As for the designs of public buildings in Laos, most of them are implemented based on Thai standards. No notable trouble has arisen with the standards so far, and therefore, the Programme shall also carry out the structural planning of FRIC based on Thai standards.

### b) Structural design

A reinforced concrete structure is generally used for main structures in Laos. The Programme needs to plan column-free spaces to ensure the functionality of rooms in FRIC such as the Multipurpose Room and Computer Room. Accordingly, the Programme adopts not the wall structure but the Rahmen (rigid frame) structure with columns and beams for the construction of FRIC. In terms of the roof of FRIC, the Programme plans the roof truss and slope roof systems with steel and reinforced concrete. As for its foundation, the Programme uses footing pile foundation on condition of the labor and use of easily procurable precast concrete piles generally adopted in Vientiane city where the Programme site is located. As a result of using the piles, the Programme is easily able to design its implementation schedule without influences brought from geological conditions, and therefore, it can raise the efficiency of the

implementation.

- Main structure : Reinforced Concrete, Rahmen (rid frame) structure
- Roof truss : Steel structure, Reinforced Concrete
- Internal and external wall : Brick wall

c) Design Load

The Programme shall determine design load of FRIC's construction based on the Thai standard.

Fixed load, movable load and wind load for columns, beams and roof trusses, and fixed load and movable load for beams and floor are calculated respectively.

Earthquakes are not in consideration in Vientiane, it occurs sometimes in northern Laos, though. The opposite shore of Vientiane, which is in Thailand, is not an area susceptible to earthquakes. Therefore, earthquake load is not necessarily considered in the Programme.

4) Building Equipment Planning

a) Electric power

The existing FIPD facility receives electric power from a step-down transformer installed at the Programme site. The Programme includes the installation of equipment delicate to voltage changes such as computers and data servers. Also, the important databases of forest resource information shall be handled with care. For these reasons, it is highly necessary to avoid unanticipated situations by always supplying stable electric power to the site. Therefore, the Programme shall plan to install a new independent power transformer for the stable power supply.

b) Lightning protection system

There are frequent thunder storms in Laos, especially during the rainy season. The Programme shall install lightning protection systems because there are no high buildings around the site and it is necessary to avoid damage to equipment such as computers and data servers by thunderbolts.

c) Emergency power generation

Since electric power failures occur due to thunderbolts, the Programme shall install an electric generator for data servers and air conditioners for the servers which always need electric power. The emergency power supply for the computers and so on shall be covered with UPS.



d) Lighting

Concerning lighting systems for FRIC, the Programme shall principally plan to install fluorescent lights because they are generally used in Laos and they can be maintained with low cost. While referring to the examples of the existing FIPD facilities and similar facilities of MAF, the Programme shall install this lighting system and it shall ensure the nearly same illuminating levels as at these facilities.

e) Air conditioning and ventilating systems

The Programme shall plan air conditioning systems for FRIC, because it is desired to avoid increasing room temperatures by heat flush from a series of equipment to be installed by the Programme and it is also desired to close their room spaces tightly. For these reasons, the Programme shall install individual air conditioning systems to ease the operation and maintenance of FRIC and to minimize their costs. As for FRIC's rooms without stationed staff, such as the resting room, library and document storage room, the Programme shall adopt ceiling fans, and the fans are used during the times of their low frequent uses to reduce running cost.

f) Telephone

The Programme shall provide telephone systems by wiring telephone lines and terminals which can connect to other rooms and sections inside FRIC.

g) Local Area Network (LAN)

The Programme shall arrange LAN systems by wiring LAN cables and terminals which can connect to computers.

h) Electric and Piping Shaft (EPS)

The Programme needs spaces to store the main lines from power supply equipment to loading equipment and distribution boards at FRIC. It shall also arrange spaces to store the main lines for telephone information and terminal boards. To ensure their safeness on disaster prevention, therefore, the Programme shall plan EPSs as special spaces to increase the security of forest resource information.

i) Water supply

The Programme shall design the sanitary tools of toilets and water supply to the resting room. Since direct-pressured water can be used, water tanks and pumps shall not be installed. In terms of hot-water supply systems, the existing facility boils water with electric pots at present. Consequently, the Programme shall not arrange hot-water supply systems.

j) Toilet

The Programme shall plan Western-style flushing lavatory. The existing FIPD facility has four toilets. Three of them are Western-style lavatories, and the remaining one is squat type. All of MAF's similar facilities adopt Western-style lavatories.

k) Drainage treatment

The Programme shall plan to treat sewage water by installing a combined treatment septic tank in the Programme site. The treated sewage water shall be run out of the site through main drainage pipes after combining all wastewater and rainwater.

l) Fire fighting system

In Laos, there are no installing regulations of fire fighting system such as fire fighting laws, and there are no fire alarms at the existing FIPD facilities and MAF's similar facilities. The Programme shall install dry powder fire extinguishers generally used in Laos as well as other similar facilities. In terms of Computer Room and Data Server Room, the Programme shall plan to install carbon dioxide fire extinguishers which can work for extinction of computer and data server rooms.

5) Construction Material Planning

In terms of construction material selection for FRIC, the Programme shall introduce materials and methods generally adopted in Laos, while taking into account the ease of their operation and maintenance, weather conditions, the climate, local construction situation, implementation terms and construction costs. Products widely distributed in Laos are made in Laos or Thailand.

a) Roofing material

In Laos, corrugated slates and roof tiles are generally used. The Programme shall use cement roof tiles for FRIC, because they have advantages such as heat insulation, noise proofing during rainfall and weather proofing.

b) External wall material

In Laos, brick walls are generally adopted. The Programme shall design brick walls with weatherproofing paints onto mortar finishing for FRIC.

c) Fitting

In Laos, fittings are generally made of aluminum and wood. Steel made fittings are not distributed widely. In consideration for weatherproofing and air tightness, the Programme shall install Aluminum doors for

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exterior fittings and wooden doors for interior fittings. Doors on each room are made of wood, as well as those of the existing FIPD facilities.

d) Floor materials

Ceramic tiles are easily cleaned and they have durability. Besides, they are generally adopted in Laos. Accordingly, the Programme shall use ceramic tiles for FRIC’s general floors. On the other hand, the Programme shall design the free access floor systems for the Computer Room. Moreover, the Programme shall plan PVC tiles for the Store Room.

e) Internal walls and skirting materials

In terms of the area where water is used, the Programme shall adopt ceramic tiles for easily cleaning purposes. It shall also plan mortar and paint finishing for ordinary rooms such as Administration Rooms. As for skirting boards, the Programme shall use wooden materials to avoid breakages by the collisions of cleaning tools.

f) Ceiling material

The Programme shall adopt gypsum boards together with ceiling systems generally used in Laos. In terms of large rooms such as the Computer Room and Meeting Room which need sound absorbing effects, the Programme shall adopt acoustic boards.

From the situations above, methods and materials are compared as the table below.

Table 2-14 Comparison Table of Methods and Materials

Material	Examples of Similar Facilities	Design Planning	Reason for Adoption
Roof material	Corrugated slate	Cement tile roofing	Superiority to heat, soundproofing, weatherproofing
	Roof tile		
External wall material	Brick masonry, Mortar / paint finishing	Brick masonry, Mortar / paint finishing	Generally adopted in Laos
Fitting material	Aluminum fitting	Aluminum fitting	Generally adopted in Laos
	Wooden fitting	Wooden fitting	
Floor material	Ceramic tile	Ceramic tile	Generally adopted in Laos
Interior wall material (ordinary room)	Brick masonry, Mortar / paint finishing	Brick masonry, Mortar / paint finishing	Generally adopted in Laos
Interior wall material (where	Ceramic tile	Ceramic tile	Generally adopted in Laos

Material	Examples of Similar Facilities	Design Planning	Reason for Adoption
water is used)			
Skirting (ordinary room)	Ceramic tile	Hard wood	Possible to avoid breakage by the collisions of cleaning tools
	Mortar / paint finishing		
	Wooden skirting		
Ceiling material	Board / paint finishing	Gypsum board	Generally adopted in Laos
		Acoustic board	Gypsum board for sound absorption

Table 2-15 Table of External Finishing Works of Planned Facility

Roof	Cement tile roofing with slope
External wall	Brick masonry
Fitting	Aluminum door (interior), aluminum sash, wooden door (exterior)

Table 2-16 Table of Interior Finishing Works of Planned Facility

Room	Floor	Skirting	Wall	Ceiling
Entrance Lobby	Ceramic tile	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Reception	Ceramic tile	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Library / Document storage	Ceramic tile	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Multipurpose Meeting room	Ceramic tile	Hard wood	Mortar, Paint finishing	Acoustic board
Storage for Meeting room	PVC tile	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Management & Administration Office (1)	Ceramic tile	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Management & Administration Office (2)	Ceramic tile	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Management & Administration Office (3)	Ceramic tile	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Computer room	Carpet tile (free-access)	Hard wood	Mortar, Paint finishing	Acoustic board
Service room	PVC tile (free-access)	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Server room	PVC tile (free-access)	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Guest room	Ceramic tile	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Resting room	Ceramic tile	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing
Storage	PVC tile	Hard wood	Mortar, Paint	Gypsum board,

Room	Floor	Skirting	Wall	Ceiling
			finishing	Paint finishing
Toilet	Ceramic tile	Ceramic tile	Mortar, Paint finishing	Gypsum board, Paint finishing
Corridor, staircase	Ceramic tile	Hard wood	Mortar, Paint finishing	Gypsum board, Paint finishing

## 2-2-2-2 Equipment Plan

### (1) Overall Plan

The equipment planned to be procured in the Programme is not produced in Laos, therefore, it will be from Japan or third countries. In principle, as the procurement must be untied, there will be no rules set regarding the country of procurement or origin, however, procurement in Laos is desirable from the perspective of spare parts supply and manufacturer after service for future maintenance management.

Moreover, a field survey has confirmed that the abovementioned concerns will be of no issue even if the equipment planned in this Programme is procured in Laos.

Below is a list of equipment confirmed to be necessary to procure for this Programme.

Table 2-17 List of the planned equipment

Category	Item No.	Name of equipment	Q'ty
A. Equipment for satellite imagery analyses and database construction	A-1	Desktop PC (A)	6 units
	A-2	Desktop PC (B)	6 units
	A-3	Data Server (A)	1 set
	A-4	Data Server (B)	2 sets
	A-5	Laptop	18 units
	A-6-1*	ALOS AVNIR (2010)	106 scenes
	A-6-2*	ALOS AVNIR (2011)	106 scenes
	A-7*	ALOS PRISM (2010)	193 scenes
	A-8-1*	ALOS PALSAR (2010)	111 scenes
	A-8-2*	ALOS PALSAR (2011)	111 scenes
	A-9*	SPOT4 (2005)	114 sets
	A-10-1*	SPOT5 (2008)	2 scenes
	A-10-2*	SPOT5 (2010)	14 scenes
	A-11-1*	RapidEye (2008)	1 set
	A-11-2*	Rapid Eye (2010)	1 set
	A-12*	GIS Software	1 set
	A-13-1*	Imagery Analysis Software1	1 set
	A-13-2*	Imagery Analysis Software2	2 set
A-14	Plotter	1 set	
A-15	Scanner	1 set	
A-16	Printer	1 set	
A-17	Projector set	1 set	
A-18	Microphone set	1 set	
B. Equipment for sampling site surveys	B-1	Survey Compass	12 sets
	B-2	Planimeter	6 units
	B-3	Diameter Tape	12 units
	B-4	GPS device	18 units
	B-5	Binocular	12 units

Category	Item No.	Name of equipment	Q'ty
	B-6	Transceiver	12 sets
	B-7	Clinometer	12 units
	B-8	Digital Camera	12 units
	B-9	Vehicle	6 units

\* This equipment (software and satellite imagery) is to be of designated source or supplier (below are further details of each equipment).

## (2) Equipment Plan

### A-1 Desktop PC (A)

These PCs are to have software for image analysis and GIS installed; and are to be high performance workstation type PCs. This equipment will be installed in the FRIC, and is to be used to compile—and analyze with the abovementioned software—the field survey results. In particular, work using the image analysis software requires high spec computers, so they need to be of higher capacity than a regular desktop computer.

Furthermore, as the field surveys will be implemented by six teams, it is supposed that each team will use one of these computers for data analysis, so all six are planned to be installed in the Forest Resources Information Center. The following table shows the main specifications of the equipment.

Table 2-18 Main specifications of desktop PCs (A)

Item	Specification
Hard disk	Approx. 500 GB
Memory	Approx. 4 GB
MS Office	Installed
Anti-virus software	Installed
Accessories	UPS (surge protector/V regulator)

### A-2 Desktop PC (B)

These desktop computers will mainly be for the use of GIS software. As with the equipment for A-1, they will be installed in FRIC for the compilation of field survey results and the analysis of this with the GIS software.

As in A-1, the field surveys will be implemented by six teams, so it is envisaged that each team will use one of these computers for data analysis. Therefore, all six are planned to be installed in FRIC. The following table shows the main specifications of the equipment.

Table 2-19 Main specifications of desktop PCs (B)

Item	Specification
Hard disk	Approx. 250 GB
Memory	Approx. 2 GB
MS Office	Installed
Anti-virus software	Installed
Accessories	UPS (surge protector/V regulator)

### A-3 Server (A)

This server is to be used to temporarily store data in the first year of the technical assistance. The data to be stored is mainly satellite imagery and a database of survey results. After the construction of the new center is completed in the second year of technical assistance, a more advanced server (A-4) is planned to be procured for the center; therefore, it is then planned to be used as a high-spec workstation.

Only one of this type of server is planned, to be used temporarily in the first year of technical assistance, and is to be used as an advanced workstation from the second year. The following table shows the main specifications of the equipment.

Table 2-20 Main specifications of server (A)

Item	Specification
Type	Tower type
Hard disk	Approx. 1.5 TB
Memory	Approx. 8 GB
Accessories	UPS(surge protector/V regulator)

### A-4 Server (B)

These servers (B) are to be of higher capacity than the abovementioned server (A), and are planned to be installed in the new center upon its completion. These are mainly for the storage of satellite imagery and a database of survey results. Based on the satellite imagery—and its unit size—planned to be procured in this Programme, the total capacity required for the next five years, after taking into consideration the size of output data after processing and analysis, was found to be approximately ten terabytes (hereinafter referred to as “TB”). Refer to the table below for details of how this figure was arrived at. It is to be a rack type server so its capacity can easily be increased, and its configuration is to be RAID5 out of consideration of hardware trouble.

Table 2-21 Reasons for capacity of server (B)

SN	Satellite Imagery	Swath (km)	Resolution (m)	Pixel No	Size (MB)	Band No	Image Size (MB)	Scene	Unit Size (GB)	Multiple	Total Size (GB)
1	LANDSAT TM	180	30	36,000,000	36	7	252	18	5	1	5
2	LANDSAT ETM+ (MS)	180	30	36,000,000	36	7	252	18	5	1	5
3	LANDSAT ETM+ (Pan)	180	15	144,000,000	144	1	144	18	3	1	3
4	SPOT4 (MS)	60	20	9,000,000	9	4	36	120	4	1	4
5	SPOT4 (Pan)	60	10	36,000,000	36	1	36	120	4	1	4
6	SPOT5 (MS)	60	10	36,000,000	36	4	144	10	1	5	7
7	SPOT5 (Pan)	60	2.5	576,000,000	576	1	576	10	6	5	29
8	RapidEye	80	6.5	151,479,290	151	5	757	10	8	5	38
9	ALOS/AVNIR-2	70	10	49,000,000	49	4	196	100	20	5	98
10	ALOS/PRISM(OB2)	70	2.5	784,000,000	784	1	784	100	78	5	392
11	ALOS/PALSAR(FBD)	70	10	49,000,000	392	2	784	100	78	5	392
										SUM	976
										Multiply	10
										Total (TB)	10

As the assumed total size of satellite imagery and data to be stored is approximately ten terabytes, two general servers of approximately five terabytes each will fulfill this purpose. Based on the above, two servers are planned to be procured for the Forest Resources Information Center. The following table shows the main specifications of the equipment.

Table 2-22 Main specifications of server (B)

Item	Specification
Type	Rack type
Hard disk	Approx. 5.0 TB
Memory	Approx. 8 GB
Anti-virus software	Installed
Accessories	UPS(surge protector/V regulator)

### A-5 Laptop

The laptops to be used in this Programme are mainly for data input/output during the field surveys, and for the training of remote sensing and GIS data analysis. Relatively high performance laptops are desirable, because they will be equipped with GIS software for data analysis.

The field surveys will be implemented by six teams—three of the members in each team are for field survey—for a total of 18 members. It is assumed that each member will use one laptop, so that they can input data acquired by GPS, confirm the results and promptly carry out basic analysis. Therefore, 18 laptops are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-23 Main specifications of laptops

Item	Specification
Hard disk	Approx. 120 GB
Memory	Approx. 2 GB
MS Office	Installed
Anti-virus software	Installed
Accessories	UPS (surge protector/V regulator)



**A-6 ALOS AVNIR-2****A-6-1 ALOS AVNIR-2 (2010)**

This satellite imagery is to be multi-spectral (color) of 10 m resolution necessary to make the 2010 base forest maps of the whole of Laos. In principle, the imagery used is to be taken in the same period during the dry season of 2010-2011, when the field surveys are to be implemented; however, order of priority of observation period will be set taking into account the effect of cloud cover.

The total number of scenes required to cover the whole country, including sufficient coverage of border areas, is 106 scenes. Therefore, 106 scenes are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-24 Main specifications of ALOS AVNIR-2 (2010)

Process	Level 1B1
Swath	Approx. 70 km×70 km
Format	CEOS
Media	CD-R/DVD-R
Area	Whole of Laos
Observation period	Order of priority: (1) 01/Nov/2010-01/Mar/2011 (2) Oct/2010 & Mar/Apr 2011 (3) 01/Nov/2009-01/Mar/2010 (4) Oct/2009 & Mar/Apr 2010
Cloud cover	20% or less
License	Intended use B (possible to make products of added value)
Other	Request images taken in PRISM/OB2 mode simultaneously

**A-6-2 ALOS AVNIR-2 (2011)**

This satellite imagery is to be multi-spectral of 10 m resolution taken in 2011 to be used to grasp temporal change based on the planned 2010 base forest maps of the whole of Laos. The observation period, as was the case with the 2010 imagery, will principally be taken at a corresponding period in the dry season of 2011-2012, however, order of priority of observation period will be set taking into account the effect of cloud cover.

The total number of scenes required to cover the whole country, including sufficient coverage of border areas, will be 106 scenes. Therefore, 106 scenes are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-25 Main specifications of ALOS AVNIR-2(2011)

Process	Level 1B1
Swath	Approx. 70 km×70 km

Format	CEOS
Media	CD-R/DVD-R
Area	Whole of Laos
Observation period	Order of priority: (1)1/Nov/2011-01/Mar/2012 (2) Oct 2011 & Mar/Apr 2012
Cloud cover	20% or less
License	Intended use B (possible to make products of added value)
Other	-

#### A-7 ALOS PRISM (OB2)

These are to be panchromatic images of 2.5 m resolution (high definition black and white) necessary to make the 2010 base forest maps of Laos. In principle, the images are to be those taken at a period in the dry season of 2010-2011 corresponding to when the field surveys are implemented; however, order of priority of the observation period will be set taking into account the effect of cloud cover.

The total number of scenes required to cover the whole country, including sufficient coverage of border areas, will be 193 scenes. Therefore, 193 scenes are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-26 Main specifications of ALOS PRISM (2010)

Mode	OB2 (nadir + backward views)
Process	Level 1B1
Swath	Approx. 70 km×35 km
Format	CEOS
Media	CD-R/DVD-R
Area	Whole of Laos
Observation period	Order of priority: (1)01/Nov/2010-01/Mar/2011 (2) Oct/2010 & Mar/Apr 2011 (3) 01/Nov/2009-01/Mar/2010 (4) Oct/2009 & Mar/Apr 2010
Cloud cover	20% or less
License	Intended use B (possible to make products of added value)
Other	Request images to be taken simultaneously with AVNIR-2 Request product with RPC file attached

#### A-8 ALOS PALSAR (FBD)

##### A-8-1 ALOS PALSAR (FBD, 2010)

These are radar images mainly intended as supplementary data of areas where it was difficult to acquire optical images (AVNIR-2 and PRISM) to be used for the planned 2010 base forest maps. The observation period will be as close as possible to the period the optical satellite images were taken.

The total number of scenes required to cover the whole country, including sufficient coverage of border areas, will be 111 scenes. Therefore, 111 scenes are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-27 Main specifications of ALOS PALSAR (FBD, 2010)

Mode	FBD (high resolution mode 2 polarizations)
Process	Level 1.1
Swath	Approx. 70 km×70 km
Format	CEOS
Media	CD-R/DVD-R
Area	Whole of Laos
Observation period	Order of priority (however optical has priority): (1)1/Nov/2010-01/Mar/2011 (2) Oct 2010 & Mar/Apr 2011
License	Intended use B (possible to make products of added value)
Other	-

#### A-8-2 ALOS PALSAR (FBD, 2011)

These are to be 2011 radar satellite images used to analyze and grasp temporal change based on the radar images planned for 2010. The observation period will be as close as possible to the period the optical satellite images were taken.

The total number of scenes required to cover the whole country, including sufficient coverage of border areas, will be 111 scenes. Therefore, 111 scenes are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-28 Main specifications of ALOS PALSAR (FBD, 2011)

Process	Level 1.1
Swath	Approx. 70 km×70 km
Format	CEOS
Media	CD-R/DVD-R
Area	Whole of Laos
Observation period	Order of priority (however optical has priority): (1)1/Nov/2011-01/Mar/2012 (2) Oct 2011 & Mar/Apr 2012
License	Intended use B (possible to make products of added value)
Other	-

#### A-9 SPOT 4

These satellite images are to be multi-spectral (color) of 10 m resolution to make base forest maps for 2005, necessary to compare with the 2010 base forest maps of the whole of Laos and to grasp patterns of change.

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In principle, the images are to be those taken during the dry season of 2005-2006; however, cloud cover will be considered when deciding the priority of imagery time period.

The total number of scenes required to cover the whole country, including sufficient coverage of border areas, will be 114 scenes. Therefore, 114 scenes are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-29 Main specifications of SPOT 4 (2005)

Process	Level 1A
Swath	Approx. 60 km×60 km
Format	DTED
Media	CD-R/DVD-R
Area	Whole of Laos
Observation period	Order of priority: (1) 01/Nov/2005-01/Mar/2006 (2) Oct/2005 & Mar/Apr 2006 (3) 01/Nov/2004-01/Mar/2005 (4) Oct/2004 & Mar/Apr 2005
Cloud cover	10% or less
License	Multi-user license
Other	Includes some SPOT5 images

## A-10 SPOT 5

### A-10-1 SPOT 5 (2008)

This satellite imagery is to be a set of multispectral (color) 10 m resolution and 2.5 m resolution panchromatic (black and white) images used in the Preparatory Survey, towards establishing techniques regarding the integrated use of various satellite images necessary for the 2010 base forest mapping of the whole of Laos.

Single imagery is insufficient in order to establish new skills, so with the cementing/establishment of techniques in mind, it is necessary to deliberate and confirm issues to be solved when joining together various images. It is planned to procure two SPOT 5 scenes. The following table shows the main specifications of the equipment.

Table 2-30 Main specifications of SPOT5 (2008)

Process	Level 1A
Swath	Approx. 60 km×60 km
Format	DTED
Media	CD-R/DVD-R
Area	Where there is verifiable data
Observation period	Dry season of 2008
Cloud cover	10% or less
License	Single-user license
Other	-

### A-10-2 SPOT5 (2010)

This satellite imagery is to be a set of 10 m resolution multispectral (color) and 2.5 m resolution panchromatic (black and white) images necessary for the 2010 base forest mapping of the whole of Laos. To be used as supplementary data for areas where ALOS images were not taken, due mainly to cloud cover.

The level of cloud cover of ALOS in 2010 based on the provider's policy is set to 20% or less; in other words, it cannot guarantee 20% of images. That is approximately 22 of the total of 106 ALOS scenes. This is proportionate to the area of 14 scenes of SPOT, which along with RapidEye is for supplementary use. To allow for the cloud cover risk of ALOS, 14 SPOT5 scenes will be procured. The following table shows the main specifications of the equipment.

Table 2-31 Main specifications of SPOT5 (2010)

Process	Level 1A
Swath	Approx. 60 km×60 km
Format	DTED
Media	CD-R/DVD-R
Area	Areas ALOS could not cover
Observation period	Order of priority: (1) 01/Nov/2010-01/Mar/2011 (2) Oct/2010 & Mar/Apr 2011 (3) 01/Nov/2009-01/Mar/2010 (4) Oct/2009 & Mar/Apr 2010
Cloud cover	10% or less
License	Multi-user license
Other	-

### A-11 RapidEye

#### A-11-1 RapidEye (2008)

This is to be multispectral (color) 5 m resolution satellite imagery for use in the Preparatory Survey, towards establishing techniques regarding the integrated use of various satellite images necessary for the 2010 base forest mapping of the whole of Laos.

Single imagery is insufficient in order to establish new skills, so it is necessary to deliberate and confirm issues to be solved when joining together various images. However, as RapidEye are not sold by the scene, it is planned to procure imagery to cover an advantageous observation width (swath). The following table shows the main specifications of the equipment.

Table 2-32 Main specifications of RapidEye (2008)

Process	Level 3A
Swath	Approx. 80km×80km
Format	GeoTIFF

Media	CD-R/DVD-R
Area	Where there is verifiable data
Observation period	Dry season of 2008 or 2009
Cloud cover	10% or less
License	Single-user license
Other	-

### A-11-2 RapidEye (2010)

This is to be 5 m resolution multispectral (color) imagery necessary for the 2010 base forest mapping of the whole of Laos. It is mainly to be used to supplement the areas where ALOS images were not taken (five satellites mean a high probability of image taking).

The level of cloud cover of ALOS in 2010 based on the provider's policy was set to 20% or less; in other words, it cannot guarantee 20% of images. That is approximately 22 of the total of 106 ALOS scenes. However, as RapidEye are not sold by the scene, it is planned to procure imagery to cover an advantageous observation width. The following table shows the main specifications of the equipment.

Table 2-33 Main specifications of RapidEye (2010)

Process	Level 3A
Swath	Approx. 80km×80km
Format	GeoTIFF
Media	CD-R/DVD-R
Area	Areas ALOS could not cover
Observation period	Order of priority: (1) 01/Nov/2010-01/Mar/2011 (2) Oct/2010 & Mar/Apr 2011 (3) 01/Nov/2009-01/Mar/2010 (4) Oct/2009 & Mar/Apr 2010
Cloud cover	10% or less
License	Single-user license
Other	-

### A-12 GIS Software

This Geographic Information System (hereinafter referred to as “GIS”) software is to be ArcGIS, a product becoming the world standard and also being used more in Laos. It is planned to procure:

- ✧ ArcInfo – has functions targeted for professionals, to be used for making and editing basic forest map data,
- ✧ ArcView – has basic functions for inputting and confirming the results of field survey data, and for simple analysis and so on,
- ✧ Spatial Analyst – an extension for spatial analysis,
- ✧ 3D Analyst – an extension function for three dimensional visualization, and also
- ✧ ArcGIS Sever – a product for servers with functions to effectively manage large volumes of data.

For two of the desktop PCs (A) to be installed in FRIC: one set each of ArcInfo+ Spatial Analyst+3D Analyst. And for all of the six desktop PCs (B) to be installed in FRIC: one set each of ArcInfo+ Spatial Analyst+3D Analyst. While only ArcView will be installed in all 18 laptop computers. One ArcGIS Server will be installed. The license type for all sets will be floating, which is flexible to user increases and decreases.

### **A-13 Imagery Analysis Software**

#### **A-13-1 Imagery Analysis Software 1**

Imagery analysis software, which the Laotian counterparts have experience with, other projects also plan to use and which have an easy interface, are to be used. It is planned to procure:

- ✧ ERDAS IMAGINE Professional – has pro-level functions enabling analysis of high resolution satellite imagery,
- ✧ LPS Core – has function for correction of orthographic projection of high resolution satellite imagery,
- ✧ ATCOR for ERDAS IMAGINE – functional module for the correction of cloud/haze effects across several scenes,
- ✧ IMAGINE Auto Sync – functional module for adjusting position important for detecting changes between images,
- ✧ ERDAS Mosaic Pro – functional module for joining together several images, and
- ✧ IMAGINE Radar Mapping Suites – functional module for radar analysis.

Two sets of both ERDAS IMAGINE Professional and LPS Core are to be installed on four of the desktop PCs (A) planned for FRIC. It is also planned to install as optional modules, one set each of: ATCOR for ERDAS IMAGINE, IMAGINE Auto Sync, ERDAS Mosaic Pro, and Radar Mapping Suites. The license type for all software will be floating, which is flexible to user increases and decreases.

#### **A-13-2 Imagery Analysis Software 2**

In addition to the aforementioned imagery analysis software, eCognition, which is specialized in dividing images into sections, extremely important in forest cover classification, is also used. This function, known as object oriented segmentation, does not divide images by pixel as in the past, but makes it possible to segment objects similar to human interpretation. It would be difficult to substitute this function in any of the imagery analysis software 1, or any other software for that matter.

Two sets are planned to be installed, because it is specialized in one function, and will act as a supplementary module to the imagery analysis software 1.

**A-14 Plotter**

The plotter will be used to print the base forest maps and so forth produced in this Programme. As these maps will cover the whole of Laos, it will be able to plot A0 size paper in color. In addition, it will have at least 256MB of memory, because plotting of large files is envisaged. Also, suitable amounts of consumables such as A0 roll paper and ink are planned to be procured.

As plotting will only be undertaken in FRIC, one plotter is planned to be installed here. The following table shows the main specifications of the equipment.

Table 2-34 Main specifications of the plotter

Item	Specification
Max. print size	A0
Print color	Color
Memory	256MB
Consumables	Roll paper, ink
Accessories	UPS (surge protector/V regulator)

**A-15 Scanner**

This will be used to scan maps during field survey analysis and for inputting the results of this survey. These will mainly be of A3 size; therefore it will be capable of scanning this size.

As scanning will only be undertaken in FRIC, one scanner is planned to be installed here. The following table shows the main specifications of the equipment.

Table 2-35 Main specifications of the scanner

Item	Specification
Max. scan size	A3
Scan color	Color
Accessories	UPS (surge protector/V regulator)

**A-16 Laser Printer**

This printer will be used for routine work. In addition to the printer, a suitable amount of color ink is planned to be procured.

As printing will only be undertaken in FRIC, one printer is planned to be installed here. The following table shows the main specifications of the equipment.



Table 2-36 Main specifications of laser printers

Item	Specification
Type	Color laser
Max. print size	A3
Print color	Color
Accessories	UPS (surge protector/V regulator)

### A-17 Projector Set

This projector will be used in the lectures in the technical assistance, and presentations in meetings and of survey results and so on. A stand alone, LCD type—with a screen and tripod—is planned to be procured. As the above activities will only be held in FRIC, one projector is planned to be installed here. The following table shows the main specifications of the equipment.

Table 2-37 Main specifications of the projector

Item	Specification
Type	LCD, stand alone
Accessories	UPS (surge protector/V regulator)
	Screen
	Tripod

### A-18 Microphone Set

This will be used in the lectures in the technical assistance, and presentations in meetings and of survey results and so on. Two microphones are planned, one for the lecturer and a spare. The spare will be used by participants to ask questions, therefore they will be wireless.

As the above activities will only be held in FRIC, one set of this microphone set is planned to be installed here. The following table shows the main specifications of the equipment.

Table 2-38 Main specifications of microphone sets

Item	Specification
Microphone	2 wireless
Speaker	1
Accessories	UPS (surge protector/V regulator)

### B-1 Survey Compass

This is a simple compass to be used in the field surveys. It is to be a portable type able to measure 360°.

The field surveys will be undertaken by six teams. Each team will use two compasses, therefore 12 in total are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-39 Main specifications of survey compasses

Item	Specification
Type	Portable
Measurement	N-E -S -W, 360°

### B-2 Planimeter

This is an instrument to easily measure the area and the line length of a specific section on a map. It is used to calculate the area of a catchment for hydrological analysis and the area of a forest on a given map or technical drawing. Consequently, this will be digital and at the least be able to measure area and the length of a line.

Each field survey team will use one, so a total of six are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-40 Main specifications of planimeters

Item	Specification
Type	Portable
Measurement	At least area & line length

### B-3 Diameter Tape

This can simultaneously measure a tree's circumference and diameter. It will be used for measuring in the field surveys, and will be useful in developing the database and making the forest maps of the whole of Laos. The table below lists the main specifications.

Each field survey team will use two, so a total of 12 are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-41 Main specifications of diameter tape

Item	Specification
Type	Portable
Measurement	Tree circumference & diameter simultaneously
Length	10 m or more

### B-4 GPS device

The GPS devices will be used in the field surveys for positional control and to record movement trajectories. They will be useful in developing the database, making maps of the whole of Laos, field survey management and so on. General GPS devices able to measure trajectory and coordinates are acceptable, however, they must be of a certain precision, which will be set at approximately 15 RMS. Also, as they will be used in the field surveys, they must be portable and rainwater resistant.

Each field survey team will use three, because this device is used to collect the base information for the forest maps. Therefore, a total of 18 are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-42 Main specifications of GPS devices

Item	Specification
Type	Portable (rainwater resistant)
Precision	Approx. 15 RMS

### **B-5 Binoculars**

These will be used in the field surveys. They are indispensable for the field surveys such as confirming tree species, selecting survey areas and deciding on a travel route.

Each field survey team will use two, so a total of 12 are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-43 Main specifications of binoculars

Item	Specification
Type	Portable (rainwater resistant)
Magnification	Approx. 8 times

### **B-6 Transceiver**

The transceivers will be used for communication within teams during the field surveys. Because they will be used in mountainous areas, VHF type is planned as it can be used over long distances at relatively low-power. Also, as there will be a lot of movement between sites, it will be of handheld type.

Each field survey team will use two sets, so a total of 12 sets are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-44 Main specifications of transceivers

Item	Specification
Type	Handheld (rainwater resistant)
Frequency	VHF

### **B-7 Clinometer**

Clinometers are used to measure the angle and movement of slopes and geological layers, and are necessary for field measurements. They will be general clinometers that can be carried around.

Each field survey team will use two, so a total of 12 are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-45 Main specifications of clinometers

Item	Specification
Type	Portable

### B-8 Digital Camera

Digital cameras will be used in the field survey to record the situation in the field including the species and form of trees. As they will not be used to photograph distant objects, a general compact camera will be sufficient. Also, the resolution will be approximately 10 megapixels, which is currently standard.

Each field survey team will use two, so a total of 12 are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-46 Main specifications of digital cameras

Item	Specification
Type	Compact camera (rainwater resistant)
Resolution	Approx. 10 megapixels
Memory card	2GB

### B-9 Vehicle

These vehicles will be pickup trucks to transport the field survey team members and equipment. Four wheel drive vehicles are planned as it is assumed there will be many unpaved roads on the way to field survey sites. Further, each team will be made up of three to five members and survey equipment basically consists of the abovementioned B-1 to B-8, therefore, they will be double cab pickups.

Each field survey team will use one, so a total of six are planned to be procured. The following table shows the main specifications of the equipment.

Table 2-47 Main specifications of vehicles

Item	Specification
Type	Double cab pickup truck
Engine	Water cooled diesel
Drive system	4x4
Seats	At least 5

### 2-2-3 Outline Design Drawing

The following pages present the outline design drawings of the facilities and the layout plans of equipment by the Programme.

Table 2-48 Summary of Planned Facility

Drawing title	Scale
Site Plan	1:500
1 <sup>st</sup> Floor Plan	1:200
2 <sup>nd</sup> Floor Plan	1:200
Elevation (1)	1:200
Elevation (2)	1:200
Elevation (3)	1:200
Elevation (4)	1:200
Section (1)	1:200
Section (2)	1:200
1 <sup>st</sup> Floor equipment layout plan	1:200
2 <sup>nd</sup> Floor equipment layout plan	1:200

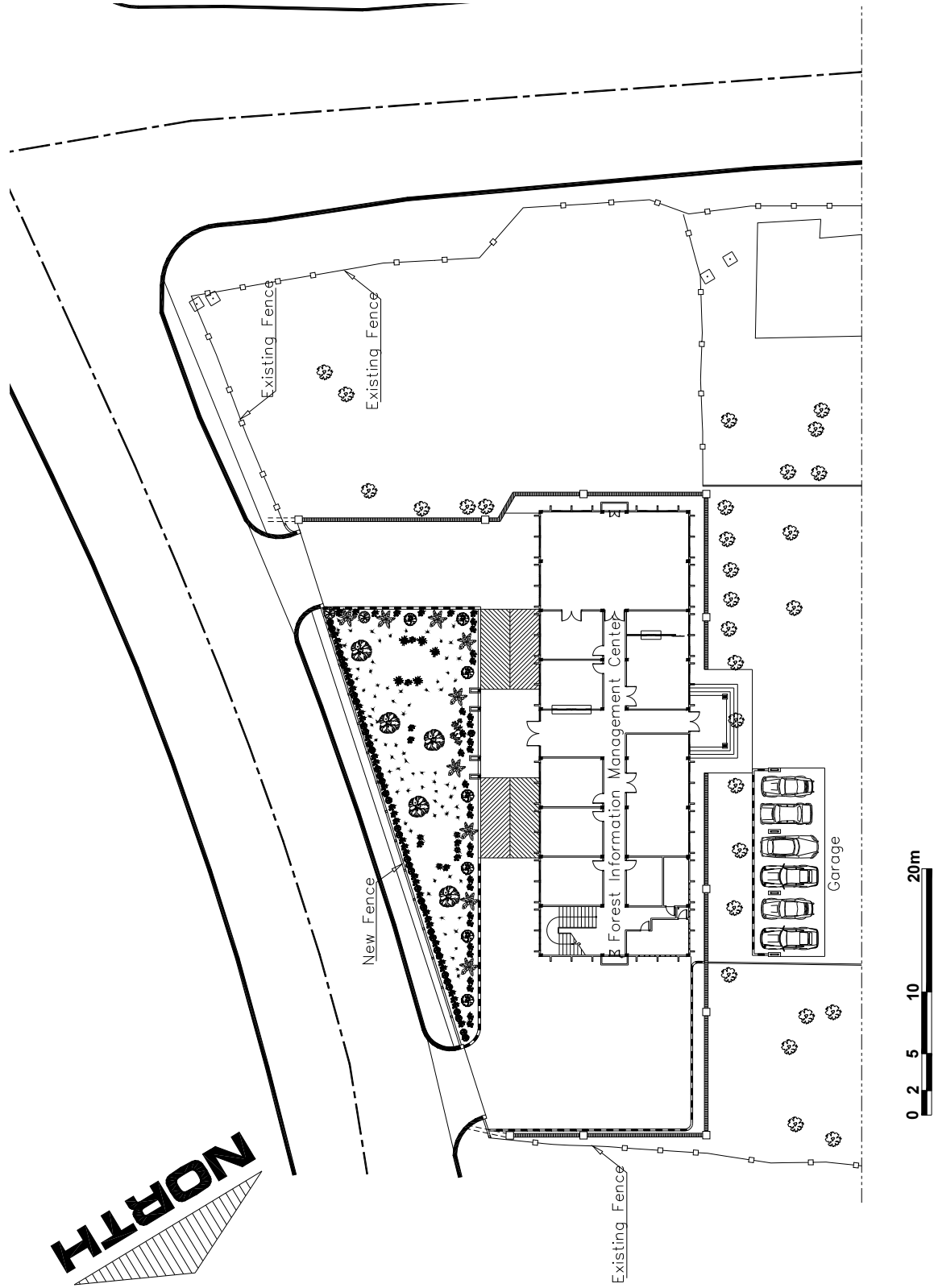


Figure 2-2 Site Plan

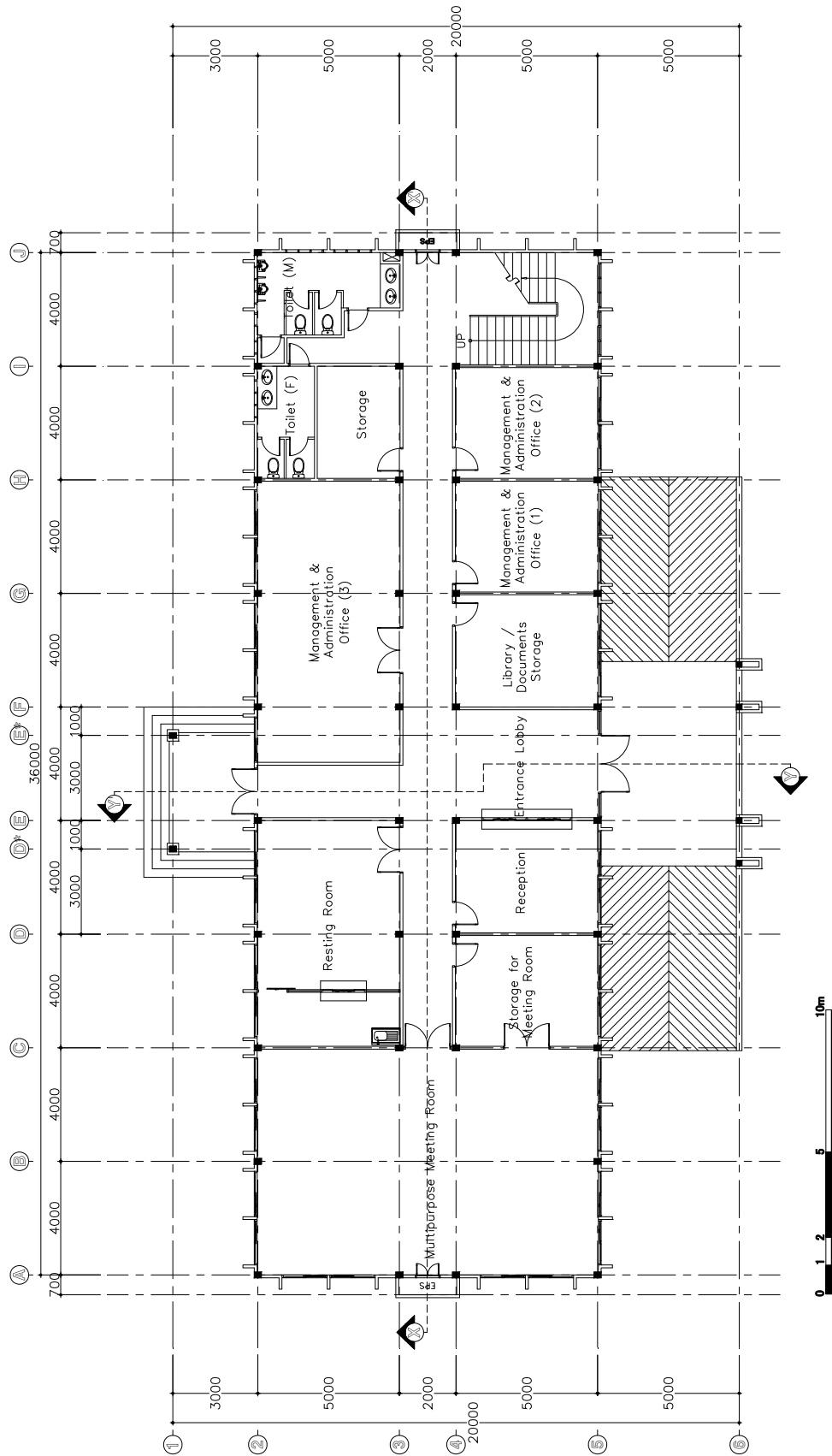


Figure 2-3 1<sup>st</sup> Floor Plan

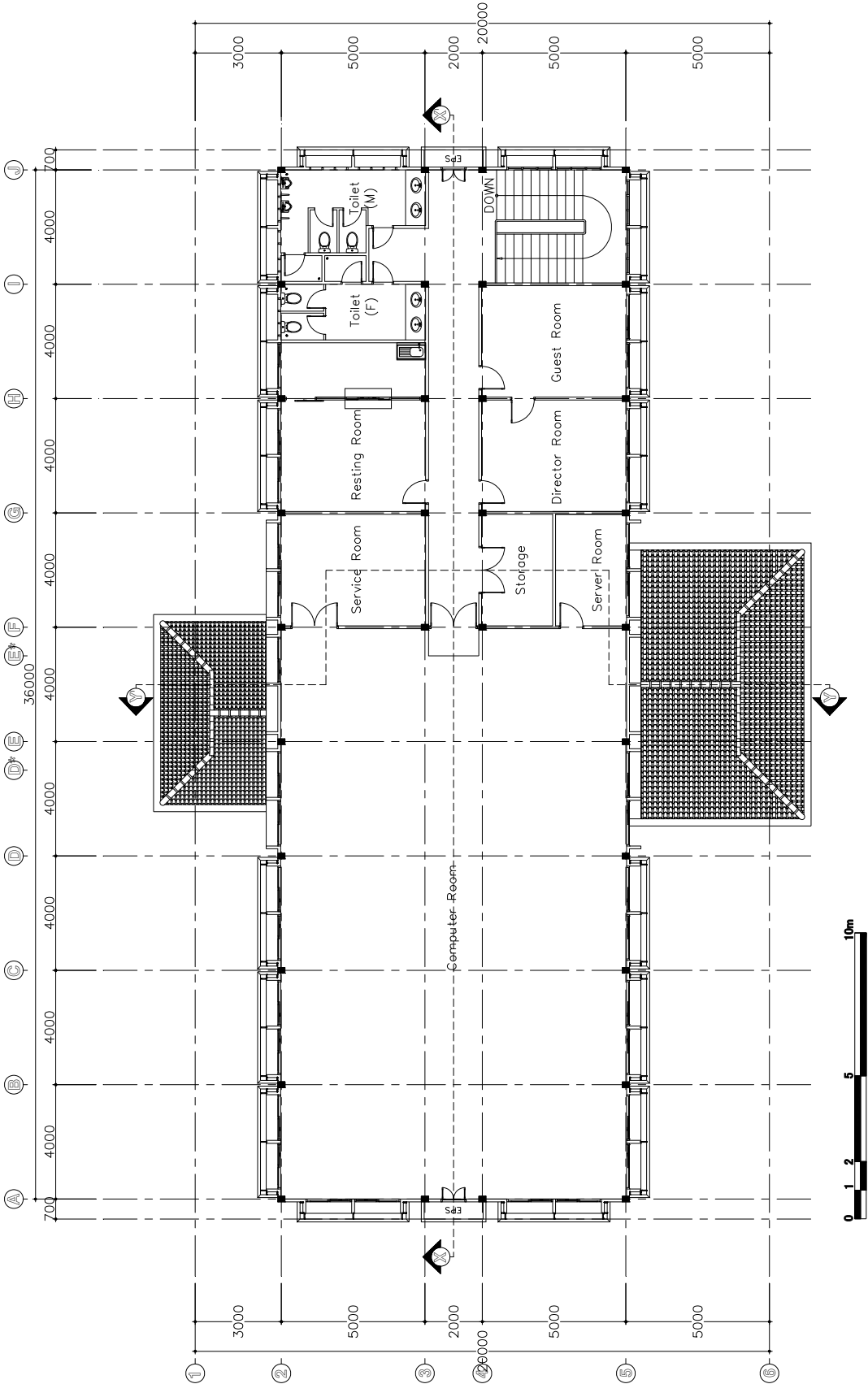


Figure 2-4 2<sup>nd</sup> Floor Plan



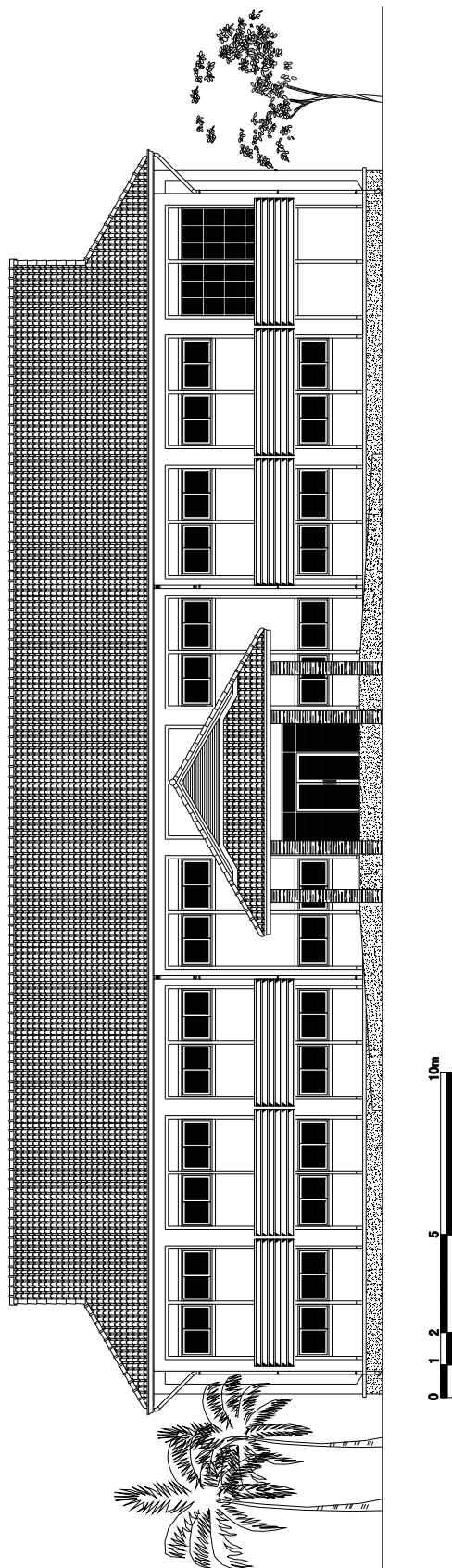


Figure 2-5 Elevation (1)

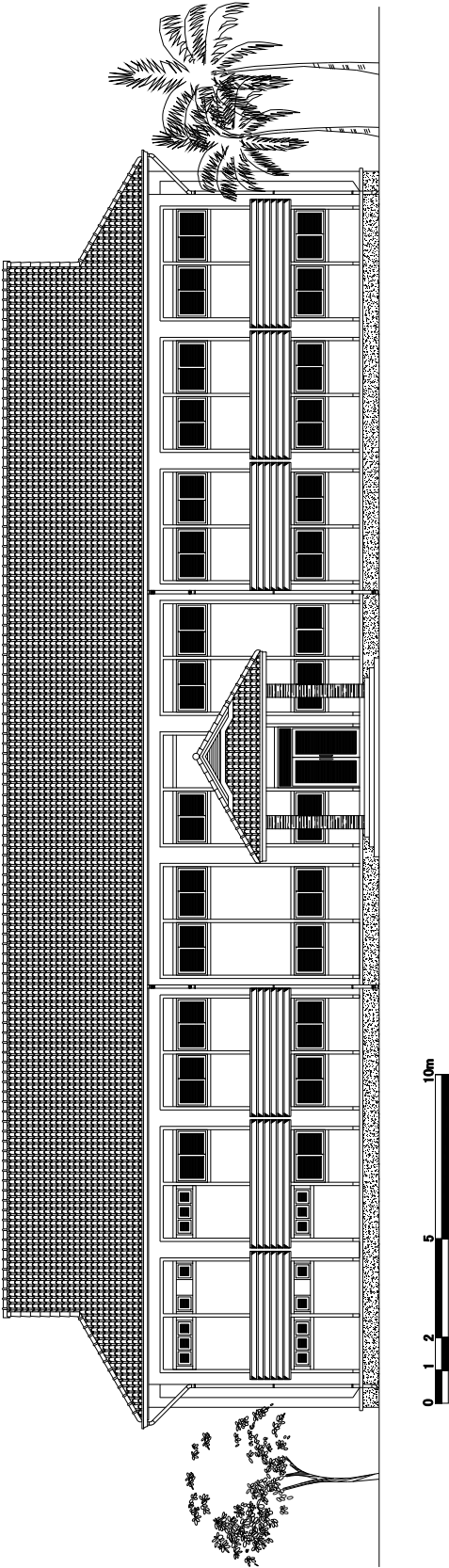


Figure 2-6 Elevation (2)

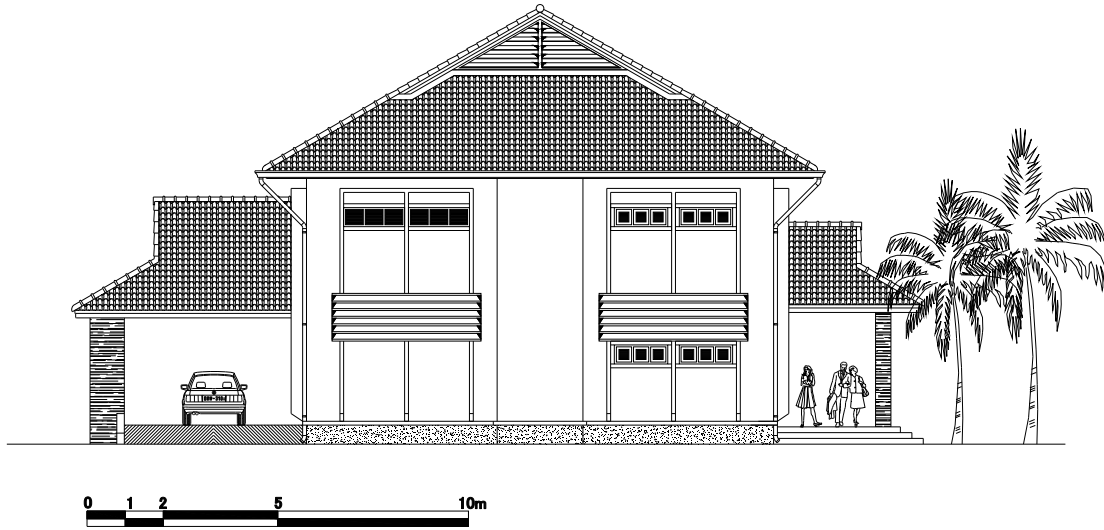


Figure 2-7 Elevation (3)

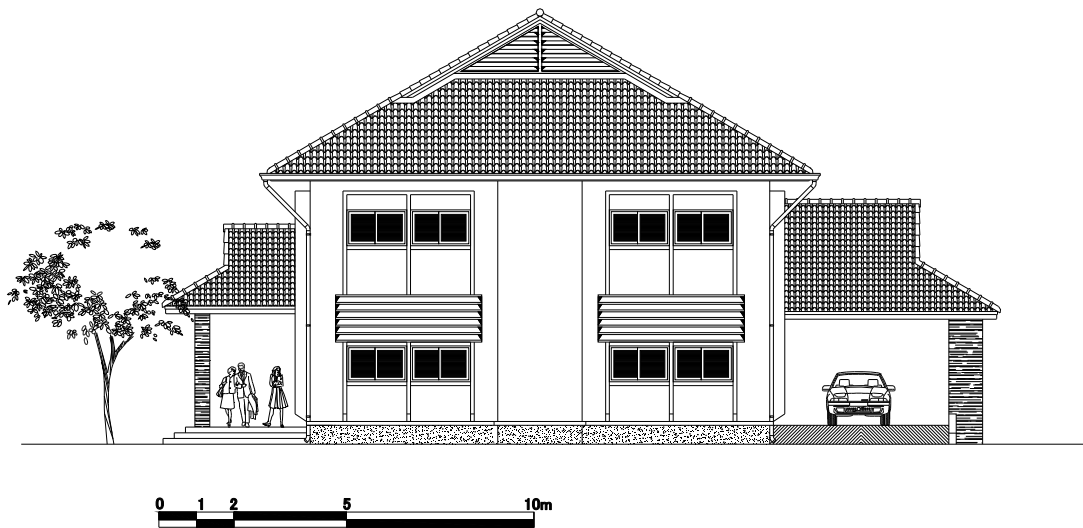


Figure 2-8 Elevation (4)