THE STUDY ON PHUKET INTERNATIONAL AIRPORT
DEVELOPMENT PLAN IN THE KINGDOM OF THAILAND

FINAL REPORT
VOLUME Ⅲ APPENDICES

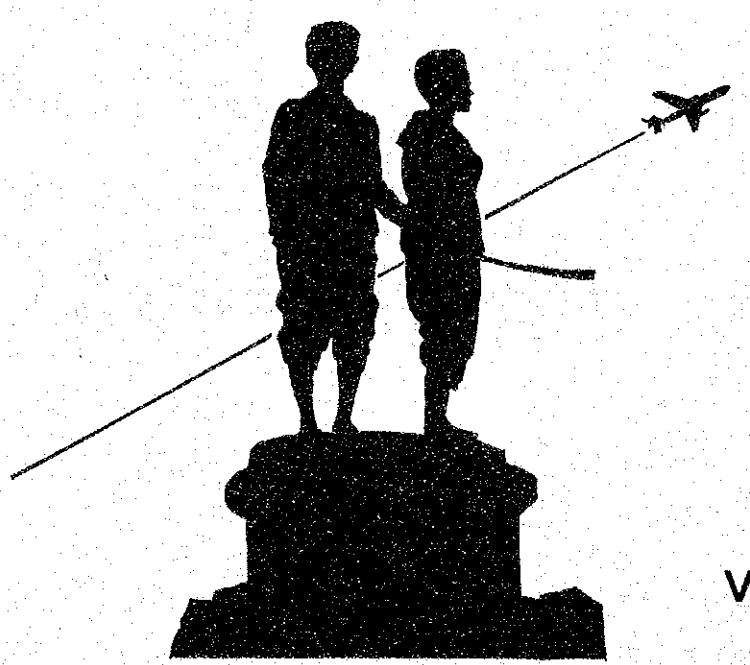
OCTOBER 1993

社会開発調査部報告書

No. 52

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
AIRPORTS AUTHORITY OF THAILAND
THE KINGDOM OF THAILAND

The Study on Phuket International Airport Development Plan in the Kingdom of Thailand



FINAL REPORT
VOLUME Ⅲ:APPENDICES

OCTOBER 1993

PACIFIC CONSULTANTS INTERNATIONAL
PASCO INTERNATIONAL INC.

NOTE

The following exchange rate was adopted throughout this report :

US$ 1.00 = Baht 25.0 = Yen 110 (February, 1993)

Baht 1.0 = Yen 4.4

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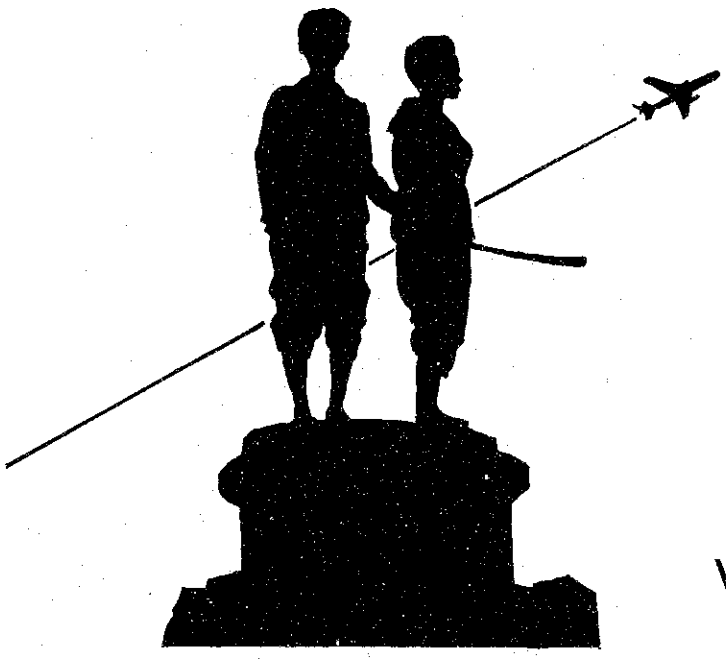

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LIST OF APPENDIX

APPENDIX TO CHAPTER 1

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APPENDIX TO CHAPTER 1

SCOPE OF WORK

FOR

THE STUDY

ON

PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN

IN

THE KINGDOM OF THAILAND

AGREED UPON BETWEEN

THE AIRPORTS AUTHORITY OF THAILAND

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

BANGKOK, JANUARY, 30TH, 1992

Air Marshal Taworn KERDSIN,
Managing Director,
Airports Authority of
Thailand

Mr. Makoto TAKAHASHI,
Leader,
Preparatory Study Team,
Japan International
Cooperation Agency

I. INTRODUCTION

In response to a request from the Government of the Kingdom of Thailand (hereinafter referred to as "the Government of Thailand"), the Government of Japan decided to conduct the Study on the Phuket International Airport Development Plan in the Kingdom of Thailand (hereinafter referred to as "the Study"), within the general framework of technical cooperation between Japan and Thailand, which is set forth in the Agreement on Technical Cooperation between the Government of Japan and the Government of the Thailand signed on November 5, 1981.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for implementing technical cooperation programmes of the Government of Japan, will undertake the Study in accordance with the relevant laws and regulations in force in Japan and in close cooperation with the authorities of the Kingdom of Thailand.

The Airports Authority of Thailand (hereinafter referred to as "AAT"), shall act as counterpart agency to the Japanese Study Team and also as coordinating body in relation with the other relevant organizations for the smooth implementation of the Study.

The present document sets forth the scope of work with regard to the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are as follows:

2.1 To formulate a Master Plan for development of the Phuket International Airport, and

2.2 To evaluate the technical, economic, and financial feasibilities of a Short-Term Development Plan for the existing airport to be formulated within the framework of the Master Plan.

III. SCOPE OF THE STUDY

In order to achieve the objectives mentioned above, the Study shall cover the following items:

3.1 Evaluation of Existing Situation

(1) Review of available data and information relevant to the Study,
(2) Analysis of present air transport network and air transport demand,
(3) Analysis of other relevant development plans such as tourism,
(4) Evaluation of existing facilities and of their utilization, and
(5) Observation of natural conditions.

3.2 Formulation of Master Plan

An appropriate Master Plan shall be prepared for the target year of 2010.

(1) Forecast of future air transport demand,
(2) Analysis of facilities requirements,
(3) Study on the Possibility of a New Airport,
(4) Formulation of alternative plans for airport development,
   1) Expansion of Existing Airport
   2) Upgrading of Existing Airport
   3) New Airport
(5) Preliminary cost estimates,
(6) Comparison of these alternatives and selection of an optimum plan,
(7) Environmental study based on existing data and information, and
(8) Formulation of a development plan.

3.3 Feasibility Study on Short-Term Development Plan

A Feasibility Study on a short-term development plan for the exixting airport shall be formulated within the framework of the Master Plan for the target year of 2000 or other appropriate target year.

(1) Preparation of a staged implementation plan,
(2) Identification of a short-term development plan,
(3) Preliminary design and construction schedule,
(4) Cost estimates,
(5) Economic and financial analysis,

T. Kd

(5) Economic and financial analysis,
(6) Evaluation of a short-term development plan, and
(7) Implementation programmes.

IV. SCHEDULE OF THE STUDY

The Study will be carried out in accordance with the attached tentative schedule as shown in the Appendix. This schedule, however, is subject to change according to circumstances.

V. REPORTS

JICA shall prepare and submit the following reports in English to the Government of the Kingdom of Thailand.

5.1 Inception Report (20 copies)
This report will be submitted at the beginning of the 1st work in Thailand.

5.2 Progress Report (20 copies)
This report will be submitted at the end of the 1st work in Thailand.

5.3 Interim Report (I) (20 copies)
This report will be submitted at the beginning of the 2nd work in Thailand.

5.4 Interim Report (II) (20 copies)
This report will be submitted at the beginning of the 3rd work in Thailand.

5.5 Draft Final Report (20 copies)
This report will be submitted at the beginning of the 4th work in Thailand.
AAT will provide comments on the Draft Final Report in English within 4 weeks after receipt of the report.

5.6 Final Report (50 copies)
This report will be submitted within 2 months after receipt of the above-mentioned comments on the Draft Final Report.

VI. UNDERTAKING OF THE GOVERNMENT OF THE KINGDOM OF THAILAND

6.1 In accordance with the Agreement on Technical Cooperation between the Government of Japan and the Government of the Kingdom of Thailand dated November 5, 1981, the Government of the Kingdom of Thailand shall accord benefits to the Japanese Study Team as follows:

1) permit the members of the Japanese Study Team to enter, leave and sojourn in Thailand for the duration of their assignment therein and exempt them from alien registration requirements and consular fees,

2) exempt the members of the Japanese Study Team from taxes, duties and any other charges on equipment, machinery and other materials brought into Thailand for the conduct of the Study,

3) exempt the members of the Japanese Study Team from income taxes and charges of any kind imposed on or in connection with any emolument or allowance paid to the members of the Japanese Study Team for their services in connection with implementation of the Study, and

4) bear claims, if any arise, against the members of the Japanese Study Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Japanese Study Team.

6.2 To facilitate smooth conduct of the Study, AAT shall take necessary measures in cooperation with other relevant organizations:

1) to secure permission as deemed appropriate for entry into private properties or restricted areas for the conduct of the Study,

2) to secure permission, as deemed necessary based on written requests from the Japanese Study Team, for the

T. Kd

Japanese Study Team to take to necessary data and documents, including photographs out of the country for the purpose of the Study,

3) to provide the medical services as needed (its expense will be chargeable to the members of the Japanese Study Team), and

4) to ensure the safety of the members of the Japanese Study Team when and as it is required in the course of the Study.

6.3 AAT shall, at its own expenses, provide the Japanese Study Team with the following;

1) available data and information related to the Study,

2) counterpart personnel,

3) suitable office space with necessary equipment in Phuket and Bangkok, and

4) credentials or identification cards.

VII. UNDERTAKING OF JICA

For implementation of the Study, JICA shall take measures;

1) to dispatch, at its own expenses, the Study Team to Thailand, and

2) to pursue technology transfer to the Thai counterpart personnel in the course of the Study.

VIII. CONSULTATION

JICA and AAT shall consult with each other in respect of any matters that may arise from or in connection with the Study.

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Appendix

TENTATIVE STUDY SCHEDULE

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Work in Thailand																	
Work in Japan																	
Submission of Report	△ IC/R			△ P/R			△ IT/R(I)			△ IT/R(II)			△ DF/R			△ F/R	

(Legend)

IC/R : Inception Report
P/R : Progress Report
IT/R(I) : Interim Report
IT/R(II): Interim Report
DF/R : Draft Final Report
F/R : Final Report

(a)

T. Kobi

MINUTES OF MEETING

ON

INCEPTION REPORT

ON

THE STUDY ON PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN

IN

THE KINGDOM OF THAILAND

AGREED UPON BETWEEN

THE

AIRPORTS AUTHORITY OF THAILAND

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

BANGKOK, AUGUST 21ST, 1992

SOPAR ROJNUCKRIN
Deputy Managing Director
Airports Authority of Thailand

YOSHIYA NIINOMI
Team Leader
Study Team
Japan International Cooperation Agency

MINUTES OF MEETING ON THE INCEPTION REPORT ON THE STUDY ON PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN

1. A team organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") arrived in Bangkok on August 17, 1992 for the Study on Phuket International Airport Development Plan (hereinafter referred to as "the Study"). The JICA team consists of the Study Team, headed by Mr. Yoshiya Niinomi, and the Advisory Committee, headed by Mr. Makoto Takahashi.

2. JICA Study Team submitted 20 copies of Inception Report on August 19, 1992 and they were received by the Counterpart Team of Thai Side.

3. A joint meeting between the JICA team and the Thai side was held on August 19 and 20, 1992 for the presentation of the Inception Report of the Study. The Thai side consists of the Counterpart Team headed by Mr. Kavee Nitithan, Director, Airports Development Office, Airports Authority of Thailand (hereinafter referred to as "AAT"). A list of attendants is shown in Attachment - A.

4. After the presentation and the discussion, the Inception Report submitted by the JICA Study Team was accepted by the Counterpart Team. Some additional discussion was done and noted by both sides as follows:

   1) The content of initial environmental study was explained by the JICA Study Team as shown in Attachment - B.
   2) The tentative work items of preliminary design of the Study in the course of third study work in Japan was explained as shown in Attachment - C.
   3) The preliminary evaluation on the new airport sites based on the map of scale 1:50,000 was explained as shown in Attachments - D1 and D2. The Counterpart Team understood the preliminary evaluation results and they will assist the data collection of wind direction and others to support the final selection of the sites.
   4) The schedule of the first site reconnaissance in Phuket was explained by the JICA Study Team. AAT accepted the request for assistance of the JICA Study Team.
      The schedule discussed was shown in Attachment - E.
   5) The undertaking matters by AAT were confirmed by both parties as shown in Attachment - F.

5. On behalf of the Government of Thailand, AAT expressed its sincere appreciation for the JICA assistance to the Study.

LIST OF ATTENDANTS

1. Thai Side

1.1 Counterpart Team

1.	Mr. KAVEE NITITHAM	Director, Airports Development Office, AAT
2.	Mr. DECHA USWARANGSRI	Specialist, Office of the Managing Director, AAT
3.	Ms. PIENGMAS SANGAPONG	Correspondence Staff, AAT
4.	Mr. VIRAT TANTIATIMONGKOL	Electrical Engineer, AAT
5.	Mr. CHAOWALIT PAKA ARIYA	Communication Engineer, AAT
6.	Mr. TORSAK NINGSANON	Civil Engineer, AAT

2. Japanese Side

2.1 JICA Advisory Committee

1.	Mr. MAKOTO TAKAHASHI	Leader of JICA Advisory Committee
2.	Mr. JUNICHI TAKEMURA	Member of JICA Advisory Committee

2.2 JICA Coordinator

1.	Mr. FUMIO ISHIKAWA	JICA, Headquaters

2.3 JICA Study Team

1.	Mr. YOSHIYA NIINOMI	Leader of JICA Study Team
2.	Mr. SHINICHI SAKABE	Member of JICA Study Team
3.	Mr. HAJIME HONJO	Member of JICA Study Team
4.	Mr. OSAMU ISODA	Member of JICA Study Team
5.	Miss CHIZUKO IHARA	Member of JICA Study Team
6.	Mr. MITSUHARU NISHIMURA	Member of JICA Study Team
7.	Mr. YUTAKA KYAKUNO.	Member of JICA Study Team

SCOPE OF ENVIRONMENTAL FIELD RECONNAISSANCE

I. OBJECTIVES

Objectives of this environmental field reconnaissance of Phuket Airport and its vicinity are to obtain ecological and socio-economic data of the area.

II. SITE

a) Location

The reconnaissance should be carried out in the following three sites.

A. Phuket International Airport
B. Proposed New Airport Site (_____)
C. Proposed New Airport Site (_____)

b) Area

The reconnaissance should cover the areas described below;

A. Surrounding area of the existing airport, including the coastal zone, approximately 300 ha
B. Project site and its surrounding area, approximately 300 ha
C. Project site and its surrounding area, approximately 300 ha

III. ITEMS

The work items are as follows;

1. Birds
   - -Times ..... 2 times at site A, 1 time at B and C
   - -Contents ..... Secondary data collection
     Detailed study at 3 fixed points (site A)
     General study of the whole area (site A,B and C)
   - -Results ..... List of birds
2. Vegetation
   - -Times ..... 2 times at A, 1 time at B and C
   - -Contents ..... Secondary data collection
     Detailed study at 3 particular points of vulnerable areas,e.g. mangrove forests, wet lands etc. (Site A)
     ..... General study of the whole area (Site A, B and C)
   - -Results ..... List of flora of the detailed study
     Vegetation map of the whole area
3. Marine ecology
   - -Times ..... 2 seasons at A , 1 time at B/C(if any)
   - -Contents ..... Secondary data collection
     Detailed study at 3 particular points (Site A)
     General study of the whole area (Site A, B/C(if any))
   - -Results ..... List of fish and benthos
4. Land use
   - -Times ..... 1 time at site A , B and C
   - -Contets ..... General study
     e.g.Land use, including distribution of common land (Site A, B and C)
     Number of houses and population (Site A)
   - -Results ..... Land use map

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Work Items of Preliminary Design

Preliminary design will be executed to clarify basic concept, design criteria, outline specifications and dimensions of the facilities for the cost estimates of the Project. Following work items will be included in the Preliminary Design.

(1) Civil Works

Airport layout planning
Runway profile and typical cross section planning
Storm water drainage planning
Pavement planning

(2) Architectural Works

Planning of Passenger terminal building
Planning of Cargo terminal building
Planning of Other buildings

(3) Air Navigation Systems

Layout planning of air navigation systems consisting of Radio navigation aids, Air traffic control system, Aeronautical telecommunications system, Aeronautical ground lights, Meteorological observation system, and associated power supply system.

(4) Public Utilities

Power supply system planning
Water supply
Sewerage
Sewerage disposal
Solid waste disposal
Telephone system

(5) Other Services (if necessary)

Planning for provision of Fire fighting vehicles and Maintenance vehicles

Evaluation
A : Excellent
B : Fair
C : Poor
X : Unacceptable

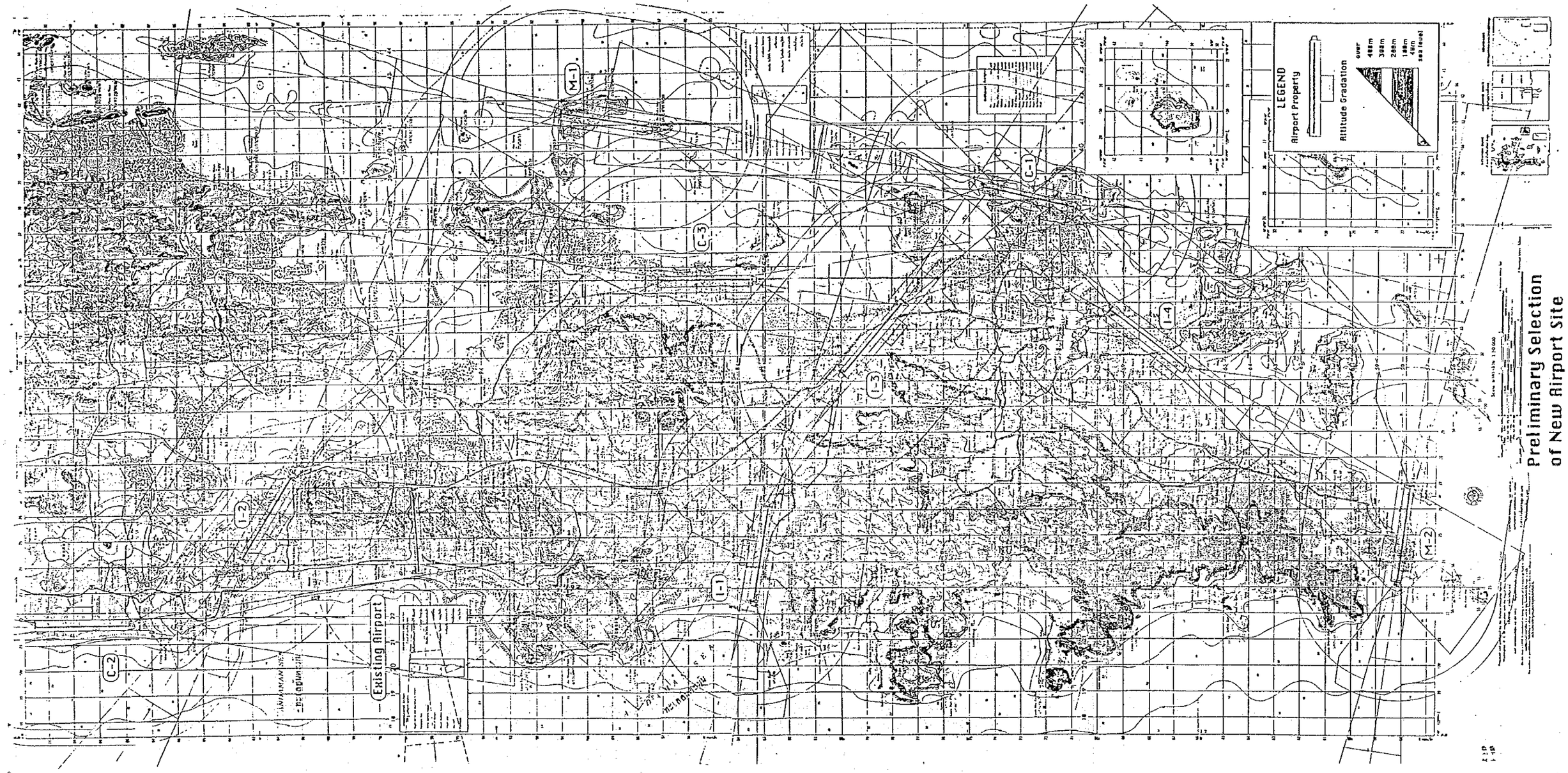
Preliminary Evaluation of New airport sites (on Desk Work)

Alt. No.	INLAND I-1		INLAND I-2		INLAND I-3		INLAND I-4		MARINE M-1		MARINE M-2		COAST C-1		COAST C-2		COAST C-3		REMARKS
1 Site Condition																			
~ Location		South part of central plain of the Island, near to Bang Thao beach		Northern end of the Island, near to Khlong Tha Nun strait		East end of the central plain of the Island, 7km north to Phuket Town		South-east of the Island, 4km south to Phuket Town		North-east offshore of the Island, Nakha Yai and Naka Noi Islands in Phang Nga bay		Southern end of the Island, Partly off shore of the coast, and Man and Bon Islands		South-east of the Island, 4km east to Phuket Town, Coast of a cope		Opposite shore of Phuket Island, West coast of Malay pen.		East of the central part of the Island, Along the coast of Phang Nga bay	
~ Sorounding condition		Rice field, plantation area, village and abandoned mine on flat terrain		Rubber plantation area and village on flat hill		Swampy area and relatively flat terrain		Plantation and mangrove area		Two small islands in relatively shallow sea				Plantation area between 200 and 130 meter high hills		Plantation area along undevelopped beach, and village		Plantation and mangrove area	
Compatibility with Pre-Study		O								O				O					
2 Airport Development Aspect	A		B		B		A		B		B		B		A		B		<Existing Airport>
~ Runway orientation		E - W		SEE - NWW		SE - NW		NE - SW		N - S		E - W		N - S		N - S		N - S	E - W
~ Extensibility of runway	A	Extensible, One side	C	Poor	C	Poor	B	Partial reclamation	C	Large reclamation	C	Large reclamation	C	Poor	A	Good	B	Partial reclamation	
~ Expansibility of terminal	A	Expansible	A	Expansible	A	Expansible	A	Expansible	B	Reat Is. can be used	B	Large scale earth work	B	Large scale earth work	A	Expansible	A	Expansible	
~ Accessibility	B		B		A		A		B		B		A		C		B		
Distance from Phuket Town		26.7km		43.4km		8.4km		5.9km		37.0km		14.2km		3.8km		54.6km		24.4km	40.2km
Main access route		Routes 402 & 4025		Route 402		Route 402		Routes 4021 & 4023		Route 402 & 4027		Routes 4021 & 4024		Existing road		Route 402		Routes 402 & 4027	Routes 402 & 4031
New access road		3.3km		0.8km		0.2km		0.3km		7.2km		1.5km		3.0km		0.5km		1.0km	
Special access way		None		None		None		None		Marine access		Marine access		Marine access		None		None	
3 Construction Aspect	A		A		B		C		C		B		C		A		B		
~ Special required civil work	A	Detour of Route 4030	B	Protection of river	C	Reroute of Route 403	C	Reroute of Route 4023	C	New access road includes 1,000m and 600m bridges	A	None	C	Large scale earth work for site preparation	A	None	A	None	
~ Need for land reclamation	A	None	A	None	A	None	C	Mangrove area	B	Sandy bottom	B	Unknown	A	None	A	None	C	Mangrove	
~Availability of utilities,(Elec . tel . etc)	A	No problem	A	No problem	A	No problem (*)	A	No problem	C	Problematic	B	Problematic	A	No problem	A	No problem	A	No problem	
4 Aircraft Operational Aspect	B		B		C		C		A		A		B		A		C		<Existing Airport>
~ Obstacle Limitation Surface																			
Approach	A	Clear	A	Clear	A	Clear	A	Clear	A	Clear on S	A	Clear	A	Clear	A	Clear	A	Clear on S	Clear
	A	Clear	A	Clear	A	Clear	A	Clear	C	Phanak Is. on N (60m)	A	Clear	A	Clear	A	Clear	B	Terrain on N (10m)	Irregular slope established
Horizontal *	B	Terrain on N (60m)	B	Terrain on NNE (30m)	B	Terrain on NE (150m)	B	Town on NW	A	Clear	?	Lighthouses on S	A	Clear on E	A	Clear on W	A	Clear on E	Terrain 160m infringes
	C	Terrain on S (500m)	C	Terrain on SSW (220m)	C	Terrain on SW (300m)	C	Terrain on SE (180m)	B	Terrain on W (30m)	C	Terrain on N (300m)	C	Maphrao Is. on W (160m	B	Terrain on E (10m)	C	Terrain on W (440m)	Terrain 200m infringes
Transitional	A	Clear	A	Clear	C	Terrain at SW	A	Clear	A	Clear	A	Clear	A	Clear	A	Clear	B	Terrain on E	Terrain estimated infringes
~ Establishment of GPS procedure	B	Possible	A	No problem	C	Problematic	C	Problematic	A	No problem	A	No problem	B	Possible	A	No problem	C	Problematic	
*Figure in ( ) shows obstacle height above surface																			
5 Social Aspect	C		B		A		C		B		X		A		X		A		
~ Land use	C	Existance of village	C	Existance of village	B	Existance of village	C	Town area	C	Pearl culture	A	Few houses	B	Existance of village	C	Existance of village	A	Few houses	Plantations exist in any sites
~ Compatibility with other development plan	C	Existance of beach resort	B	Potentiality of tourism resource	A	No problem	B	Existance of tounsm development area	A	No problem	X	Existance of famous tounsm attraction	A	No problem	X	Resort development plan	A	No problem	
6 Environmental Aspect	A		B		C		C		B		B		B		B		C		
~ Scenery destruction	A	None	B	View of river	A	None	C	View of mangrove	B	Oceanic view	C	Famous scenic spot	A	None	B	Coastal view	B	Coastal view	
~ Wild life destruction	A	None	A	None	C	Mangrove and forest life	C	Mangrove	B	Sea life	B	Sea life	C	Mangove near to the site	A	None	C	Mangrove	
~ Noise pollution	C	Village and beach resort near to the site	C	Village near to the site	C	Village under approach surface	C	Phuket Town near to the site	A	None	A	None	B	None	C	Village near to the site	C	Phuket Town under approach surface	
~ Water pollution	A	None	B	Discharge into river	A	None	C	Discharge into mangrove forest	C	Influence by marine reclamation	C	Influence of marine reclamation	C	Mangove near to the site	A	None	C	Discharge into mangrove forest	
7 Comprehensive Evaluation	B		B		C		C		(A)		C		(B)		C		C		

Summary

	Priority	I-1	I-2	I-3	I-4	M-1	M-2	C-1	C-2	C-3
Aspect 2		A	B	B	A	B	B	B	A	B
Aspect 3		A	A	B	C	C	B	C	A	B
~~Aspect 4~~	~~O~~	~~B~~	~~B~~	~~C~~	~~C~~	~~A~~	~~A~~	~~B~~	~~A~~	~~C~~
Aspect 5		C	B	A	C	B	X	A	X	A
~~Aspect 5~~	~~O~~	~~A~~	~~B~~	~~C~~	~~C~~	~~B~~	~~B~~	~~B~~	~~B~~	~~C~~
Total Evaluation		B	B	C	C	(A)	C	(B)	C	C

S.A.



Preliminary Selection of New Airport Site

S.A

Site Survey Schedule (Tentative)

Name	Assignment	August													September													
		19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T
Activity											Traffic Survey																		
					Reconnaissance of New airport sites								Reconnaissance of Existing airport sites																	
									Data Collection at Province Office						Re-check of New airport sites														
															Aerial Topographic Survey														
<Advisory committee>																													
Mr. M. Takahashi					(Leave for Japan)																								
Mr. J. Takemura					(Leave for Japan)																								
<JICA>																													
Mr. H. Ishikawa					(Leave for Japan)																								
<Study Team>																													
Mr. Y. Niinomi	Team Leader / Airport Planning										(Leave for Japan)																		
Mr. H. Honjo	Airport Architect																												
Mr. S. Sakabe	Airport Civil Engineer																												
Miss. C. Ihara	Economic Analyst																												
Mr. O. Isoda	Environmental Specialist																												
Mr. A. Kadoguchi	Air Navigation System Engineer																												
Mr. T. Itoh	Airways Planner																												
Mr. Y. Kyakuno	Senior Topographic Surveyor																												
Mr. M. Nishimura	Topographic Surveyor																												
<Supporting Staff>																													
Mr. H. Nagasawa	Assistant for Study Team																												
	Work in Phuket																												
	Work in Bangkok																												

UNDERTAKING MATTERS BY AAT

1. Suitable office space with necessary equipment in Bangkok on Item 6-3 3) of page B-6.

- Desk with chair for engineer	: 7 sets
- Desk for secretary	: 1 set
- Book shelf	: 3 sets
- Draftsman and drafting table	: 1 set
- Big table for conference and working	: Available
- Copy machine with the function of enlarging / reducing	: Available
- Computer with Printer	: Available
- Telephone / Facsimile	: Available for local call

2. Counterpart personnel in Item 6-3 2) of page B-6.

- Engineer required on Item 4-1 (5) of page 4-2.
- Assignment of one security officer from Royal Thai Survey Department and one officer from AAT to Japan for 45 days for aerial photographic mapping.
- Attendance for site reconnaissance in Phuket.

3. Providing of assistance for traffic survey

4. Requesting the assistance for coordination with Royal Thai Survey Department for obtaining the basic data of control points to implement the aerial photographic survey.

MINUTES OF MEETING

ON

PROGRESS REPORT

ON

THE STUDY
ON
PHUKET INTERNATIONAL AIRPORT
DEVELOPMENT PLAN

IN

THE KINGDOM OF THAILAND

AGREED UPON BETWEEN

THE

AIRPORTS AUTHORITY OF THAILAND

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

BANGKOK, OCTOBER 29TH, 1992

MANOJ PORNPIBUL	YOSHIYA NIINOMI
Deputy Managing Director	Team Leader
Airports Authority of Thailand	Study Team
	Japan International Cooperation Agency

MINUTES OF MEETING ON THE PROGRESS REPORT ON THE STUDY OF PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN

1. JICA Study Team submitted 20 copies of the Progress Report of the Study to Airports Authority of Thailand on October 28, 1992.

2. Joint meetings between the Thai side and the JICA Study Team were held on October 28 and 29, 1992 for a presentation and discussion on the Progress Report of the Study. The Thai side consisted of the Counterpart Team headed by Mr. Kavee Nititham, Director of Airports Development Office, AAT. A list of attendants is indicated in Attachment - A.

3. After the presentation and the discussions, the report was accepted by the Thai side.

4. Items discussed on the meetings are shown in Attachment - B.

5. The Thai side expressed their satisfaction with the progress of the study to-date and look forward to future discussions on the airport development alternatives to be recommended in the Interim Report (1) for Phuket International Airport.

Attachment - A

LIST OF ATTENDANTS

1. Thai Side

1.1 Counterpart Team

1.	Mr. Kavee NITITHAM	Director, Airports Development Office, AAT
2.	Mr. Uthai THAISANTAD	Maintenance Dept., AAT
3.	Mr. Decha USWARANGSRI	Specialist, Office of the Managing Director, AAT
4.	Mr. Padungpong PAKSUDHIPOL	Air Traffic Control Div., AAT
5.	Mr. Charoon JORNTES	Air Traffic Control Div., Flight Control Dept., AAT
6.	Mr. Chaowalit PAKA ARIYA	Communication Engineer, AAT
7.	Mr. Torsak NINGSANON	Civil Engineer, AAT
8.	Ms. Suwannee SAMRONGWATANA	Planning Dept., AAT
9.	Mr. Serirat PRASUTANOND	Planning Dept., AAT

2. Japanese Side

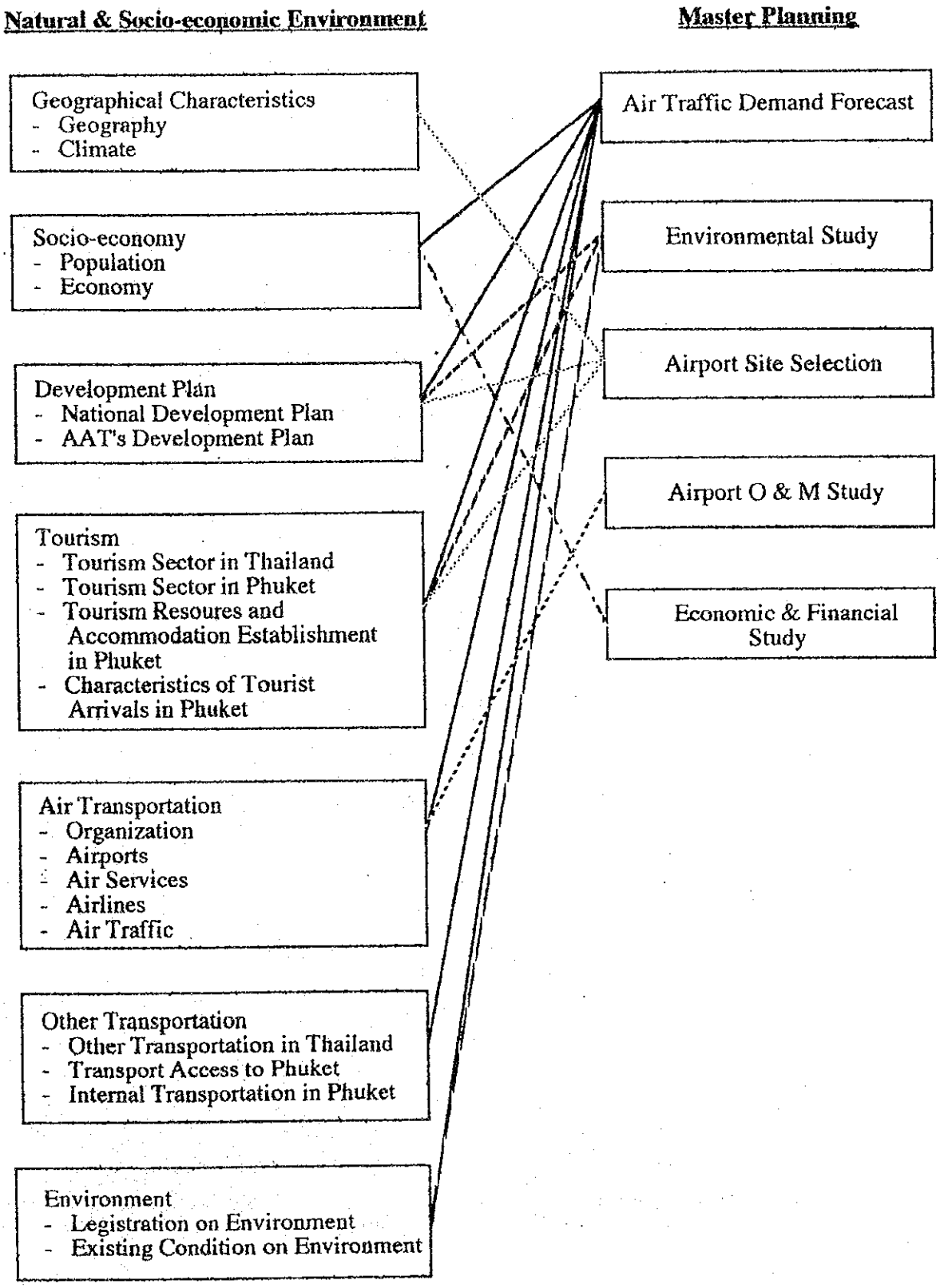
2.1 JICA Study Team

1.	Mr. Yoshiya NIINOMI	Leader of JICA Study Team
2.	Mr. Shinichi SAKABE	Member of JICA Study Team
3.	Mr. Osamu ISODA	Member of JICA Study Team
4.	Mr. Tadamitsu ITOH	Member of JICA Study Team

Attachment - B

1. The Study Team explained the following matter with the discussion paper attached herewith as Appendix - 1.

   Relationship between collected data on "Natural & Socio-economic Environment" in Chapter 2 and Master Planning


Natural & Socio-economic Environment
Master Planning
Geographical Characteristics
- Geography
- Climate
Socio-economy
- Population
- Economy
Development Plan
- National Development Plan
- AAT's Development Plan
Tourism
- Tourism Sector in Thailand
- Tourism Sector in Phuket
- Tourism Resoures and Accommodation Establishment in Phuket
- Characteristics of Tourist Arrivals in Phuket
Air Transportation
- Organization
- Airports
- Air Services
- Airlines
- Air Traffic
Other Transportation
- Other Transportation in Thailand
- Transport Access to Phuket
- Internal Transportation in Phuket
Environment
- Legistration on Environment
- Existing Condition on Environment
Air Traffic Demand Forecast
Environmental Study
Airport Site Selection
Airport O & M Study
Economic & Financial Study

MINUTES OF MEETING

ON

INTERIM REPORT (1)

ON

THE STUDY
ON
PHUKET INTERNATIONAL AIRPORT
DEVELOPMENT PLAN

IN

THE KINGDOM OF THAILAND

AGREED UPON BETWEEN

THE

AIRPORTS AUTHORITY OF THAILAND

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

BANGKOK, FEBRUARY 5 TH, 1993

KAVEE NITITHAM
Director
Airports Development Office
Airports Authority of Thailand

YOSHIYA NIINOMI
Team Leader
Study Team
Japan International Cooperation Agency

MINUTES OF MEETING ON THE INTERIM REPORT (1) ON THE STUDY ON PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN

1. JICA Study Team submitted 20 copies of the Interim Report (1) of the Study to Airports Authority of Thailand on February 2nd, 1993.

2. Joint meetings between the Thai side headed by Mr. Kavee Nititham, Director of Airports Development Office, AAT and Japanese side composed of the JICA Advisory Committee headed by Mr. Keiichi Mikami, Special Assistant to the Director, Civil Aviation Bureau, Ministry of Transport and the JICA Study Team headed by Mr. Yoshiya Niinomi were held during the period from February 2 up to 5, 1993.
   The attendance list is shown in Attachment-A

3. Items discussed on the meetings are shown in Attachment-B.

4. The Study Team asked the special consideration on the selection of alternative among three alternatives for Master Planning as Step [24] in Inception Report.
   The Counterpart Team agreed to provide the priority on alternatives with condition for the selection of the best alternative by the end of February 1993.

5. The result of discussion will be reflected on the next study on Interim Report (2), which is scheduled to submit on May 1993.

Attachment - A

LIST OF ATTENDANTS

1. Thai Side

1.1 Counterpart Team

1.	Mr. Kavee NITITHAM	Director, Airports Development Office, AAT
2.	Mr. Decha USWARANGSRI	Specialist, Office of the Managing Director, AAT
3.	Mr. Padungpong PAKSUDHIPOL	Director, Air Traffic Control Div., AAT
4.	Mr. Charoon JORNTES	Deputy Director, Air Traffic Control Div., Flight Control Dept., AAT
5.	Mr. Virat TANTIATIMONGKOL	Electrical Engineer, AAT
6.	Mr. Chaowalit PAKA ARIYA	Communication Engineer, AAT
7.	Mr. Torsak NINGSANON	Civil Engineer, AAT
8.	Ms. Suwannee SAMRONGWATANA	Planning Dept., AAT
9.	Mr. Thaweechai NATHISATHIDTAN	Planning Dept., AAT
10.	Ms. Suthasinee PORAPONGSA	Medical Dept. , AAT

2. Japanese Side

2.1 JICA Advisory Committee

1.	Mr. Keiichi MIKAMI	Member of JICA Advisory Committee
2.	Mr. Yukio HASEBE	Member of JICA Advisory Committee

2.2 JICA Coordinator

1.	Mr. Fumio ISHIKAWA	JICA, Headquaters

2.3 JICA Study Team

1.	Mr. Yoshiya NIINOMI	Leader of JICA Study Team
2.	Mr. Shinichi SAKABE	Member of JICA Study Team
3.	Ms. Chizuko IHARA	Member of JICA Study Team
4.	Mr. Osamu ISODA	Member of JICA Study Team
5.	Mr. Tadamitsu ITOH	Member of JICA Study Team

Attachment - B

ITEMS DISCUSSED

1. The study Team explained the following matters as the main points of Interim Report (1).
   (1) Demand forecast up to 2010 and breakdown of passenger traffic demand with the additional paper as shown in Appendix-1.
   (2) Airport facility requirements.
   (3) Selection of new airport sites.
   (4) Airport Master Planning on three alternatives with the additional papers as shown in Appendix-2.
   (5) Environmental consideration.
   (6) Airspace use plan.

2. The Counterpart Team accepted the study results in Interim Report (1).

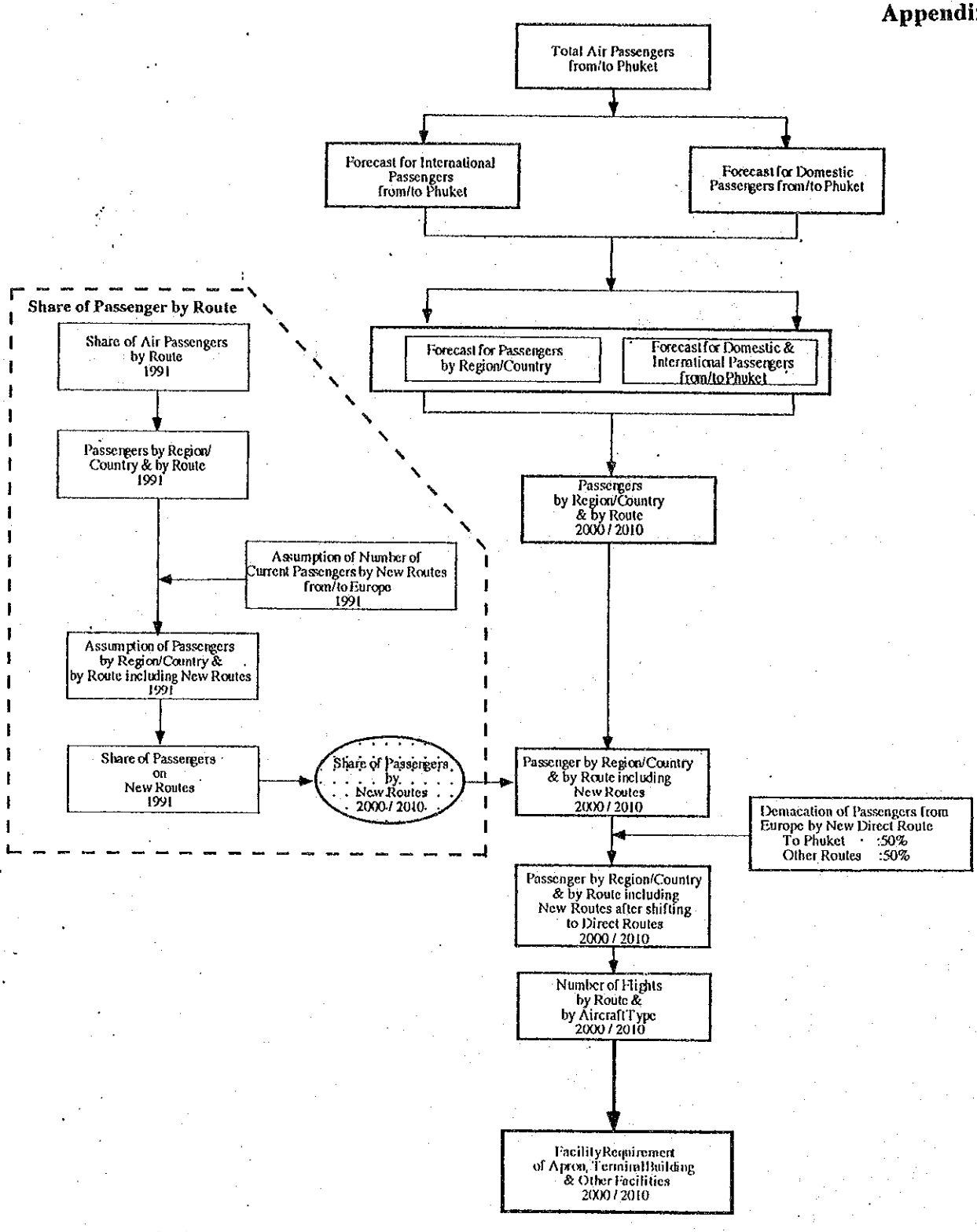


Figure 1 Flow Chart for Forecast of Passengers Traffic Demand

Table 1 Comparision Study of the Basic Function for Airport Operation

Main Purpose	Subject	Contents	Measures	Evaluation result on			Remark
				Alt-1	Alt-2	Alt-3	
Maintaining of Safety operation of Airport	Aircraft	· Development of airport infrastructure	· Provision of adequate capacity of facilities being cope with the demand	Fitted	Fitted	Fitted	
			· Compatibility or satisfaction with international standards / recommendations	Not met	Met	Met	RWY strip RWY/TWY clearance
		· Development of supporting system facility for landing and taking off at the airport	· Establishment of various procedure	Not met *	Not met *	Not met *	* Straight-in/out procedure only
			· Provision of ILS, VOR/DME . NDB	Provided	Provided	Provided	
			· Provision of air field lighting	Provided	Provided	Provided	
			· Provision of airport and meteorological information	Provided	Provided	Provided	
		· Development or completion of supporting system to aircraft at en-route so as to guide to the airport	· Elimination or limitation of obstacle or marking	Not enough	Met	Met	Existence of obstacle
			· Provision of Radar System including RDP.FDP	Provided	Provided	Provided	
			· Provision of VOR/DME . NDB	Provided	Provided	Provided	
			· Development of aeronautical communication system of air to ground	Provided	Provided	Provided	
			· Provision of the equipment of airport terminal information	Provided	Provided	Provided	
	Passenger	· Smooth handling of passenger	· Compliance with International standards or recommendations on building space. No of CIQ booth, check-in space etc.	Met	Met	Met	
		· Provision of good service level	· Development of supporting facility such as information system, boarding bridge, and baggage handling system etc.	Considered	Considered	Considered	
			· Maintaining of the stability of public utility such as power, telephone, water supply	Considered	Considered	Considered	
		· Maintaining of security	· Provision of security system	Considered	Considered	Considered	

THE STUDY
ON
PHUKET INTERNATIONAL AIRPORT
DEVELOPMENT PLAN
IN
THE KINGDOM OF THAILAND

DISCUSSION PAPER

FEBRUARY 1993

JICA STUDY TEAM

Table 2 Evaluation of Alternatives

Aspect	Items to be evaluated	Evaluation Result Alt-1	Alt-2	Alt-3	Points to be Evaluated
Compatibility with International Standard	1. Airfield infrastructure by Annex 14	Poor	Good	Good	Width of runway strip Clearance between RWY and TWY Obstacles
	2. Obstacles by airport service manual	Fair	Fair	Fair	Operational consideration in Article 5.5.3 - 5.5.7 of Airport Planning Manual
	3. Obstacles by PANS OPS	Poor	Fair	Fair	Checked by OAS
	Total Evaluation	Poor	Good	Good	
Operational Aspects	1. Establishment of APCH/DEP procedure	Fair	Fair	Fair	Only straight in and out procedure
	2. Existence of obstacle	Poor	Fair	Good	Obstacle restriction in Annex 14
	3. Approach surface	Poor	Fair	Good	Obstacle restriction in Annex 14
	4. Transitional surface	Poor	Fair	Good	Obstacle restriction in Annex 14
	5. Inner horizontal surface	Poor	Poor	Poor	Obstacle restriction in Annex 14
	6. Conical surface	Fair	Fair	Fair	Obstacle restriction in Annex 14
	7. Take off climb surface	Poor	Fair	Good	Obstacle restriction in Annex 14
	8. OCS	Poor	Fair	Good	PANS - OPS
	9. Location of ILS	Poor	Good	Good	Location on course
	10. Taxiing distance	Fair	Fair	Good	Consideration of landing on both runway
	11. Accessibility from Town	Fair	Fair	Good	
	12. Maneuverability of aircraft operation	Fair	Fair	Good	Simplicity of operation
	13. Apron control by controller at control tower	Poor	Good	Good	Existence of blind area
	Total Evaluation	Poor	Fair	Good	
Construction Aspects	1. Civil work				
	Land acquisition	Good	Fair	Poor	Volume
	Existing road diversion	Good	Fair	Poor	Distance
	Land reclamation	Good	Good	Poor	Volume of area
	Embankment	Good	Poor	Good	Requirement
	Improvement of land	Good	Poor	Poor	Requirement
	Pavement area	Good	Fair	Poor	Volume
	2. Building work				
	Floor area	Good	Good	Poor	Volume
	Designability	Fair	Fair	Good	No limitation on design
	Passenger handling procedure	Fair	Fair	Good	Simplification for mixed handling of Dom. and Int'l.
	Passenger accessibility at curbside	Fair	Fair	Good	Simplisity
	3. Effective utilization of existing facility	Good	Fair	Poor	
	4. Construction period	Good	Fair	Poor	From 2 years to 3 years
	5. Construction cost	Good	Fair	Poor	
	Total Evaluation	Good	Fair	Fair	
Environmental Aspects	1. Resettlement	Good	Fair	Poor	Number of houses
	2. Effection to surrounding	Poor	Poor	Fair	
	3. Topography	Good	Poor	Poor	Scale of civil work
	4. Flora and Fauna	Good	Fair	Poor	Impact to mangrove
	5. Water Pollution	Good	Good	Poor	
	6. Noise Problem	Fair	Fair	Fair	
	Total Evaluation	Good	Fair	Poor	

Table 3 Comparison of Airport Development Alternatives (1)

Comparison Item		Existing Airport	Alternative - 1 (Expansion)	Alternative - 2 (Upgrading)	Alternative - 3 (New Airport)
A. Traffic Demand		Present (1991)	2010	2010	2010
Annual Passengers	Int'l	555,000	3,110,000	3,110,000	3,110,000
	Dom.	1,211,000	3,700,000	3,700,000	3,700,000
Annual Cargo (ton)	Int'l	1,000	4,600	4,600	4,600
	Dom.	2,700	14,600	14,600	14,600
Peak Hour Aircraft Movement	Int'l	7	7	7	7
	Dom.		7	7	7
Peak Hour Passenger	Int'l	330	1,500	1,500	1,500
	Dom.	680	1,800	1,800	1,800
B. Facility / Capacity		4D	4E	4E	4E
Peak Hour Aircraft Movement		7	14	14	14
Maximum Aircraft and Destination		A300, Middle East	B747, London	B747, London	B747, London
Parallel Taxiway		Partial	Full	Full	Full
Terminal Building (sq. m)	Int'l	12,200	30,000	30,000	30,000
	Dom.	11,500	17,000	17,000	17,000
Terminal Building (Floor Area per peak hour pax)	Int'l	37 sq.m	20 sq.m	20 sq.m	20 sq.m
	Dom.	17 sq.m	10 sq.m	10 sq.m	10 sq.m
Apron (Number of Spots)	B747	–	4	4	4
	B777	–	3	3	3
	A300	4	2	2	2
	Small	6	2	2	2
Nav. Aid		ILS (Cat - I)	ILS (Cat - I)	ILS or MLS (Cat - I)	ILS or MLS (Cat - I)
C. Operation		OCA RWY 27	OCA RWY 27	OCA RWY 27	
OCA for Cat I		A: 520' B: 530' C: 540' D: 550'	A: 406' B: 418' C: 426' D: 437'	A: 308' B: 310' C: 318' D: 329'	No obstacles exist in both final approach and missed approach areas
		RWY 09	RWY 09	RWY 09	
		A: – B: – C: – D: –	A: – B: – C: – D: –	A: 342' B: 354' C: 362' D: 373'	
(OCA : Obstacle Clearance Altitude)		(Note 1)		(Note 2)	
D. Construction					
Area to be acquired (ha) :			20	60	210
Rough Construction Cost (Baht) :					
Earthwork (Baht) :			600 Mil	2,400 Mil	1,800 Mil
Pavement (Baht) :			700 Mil	1,100 Mil	2,200 Mil
Other Works (Baht) :			100 Mil	600 Mil	700 Mil
Architectural Work (Baht) :			1,300 Mil	1,300 Mil	2,700 Mil
Nav. Aids (Baht) :			200 Mil	300 Mil	700 Mil
Total (Baht) :			2,900 Mil	5,700 Mil	8,100 Mil
Immediate Improvement of Existing Airport			–	–	700 Mil
E. Environment					
Social Environment	: Resettlement		No impact	No impact	No impact
	: Land Use		Impact to condominium	Impact to condominium	No impact
Natural Environment	: Topography		Hill cutting	Hill cutting	Alternating of wetland
	: Flora & Fauna		No impact	No impact	Impact to mangroves
Quality of Life	: Water Pollution		No impact	No impact	Impact to mangroves
	: Noise Problem		Impact to condominium	Impact to condominium	Impact to the village

Note 1. Mountains and hills proximity to Runway are influenced to decide the OCA

Note 2. Mountain, 116.2 m AMSL located south of runway is still influenced to decide the OCA

Exchange Rate : Baht 1.00 = ¥ 5.00

Table 4 Cost Comparison of Airport Development Alternatives

Alternative	Alt-1	Alt-2	Alt-3
Outline of Concept	Expansion to cope with the traffic demand of target year	Upgrading for future demand in compliance with Int'l standard	New airport concept for the full development in compliance with future demand and Int'l standard
Quantity and Cost			
- Quantity			
• Works in the Airport			
Earth works (Cut)	1.1 mil cu.m	4.5 mil cu.m	2.7 mil cu.m
(Filling)	1.0 mil cu.m	4.1 mil cu.m	3.2 mil cu.m
Other Civil Works	(See Table 9.3.1)	(See Table 9.3.1)	(See Table 9.3.1)
Other Works	(See Table 9.3.1)	(See Table 9.3.1)	(See Table 9.3.1)
• Works out of Airport			
Earthwork			
.Cut of Obstructions(North)	0 cu.m	174 mil cu.m	1,000 mil cu.m
Cut of Obstructions(South)	0 cu.m	368 mil cu.m	1,100 mil cu.m
- Cost			
• Works in the Airport			
Earth works	600 mil Baht	2,400 mil Baht	1,800 mil Baht
Other Civil Works	800 mil Baht	1,700 mil Baht	2,900 mil Baht
Other Works	1,500 mil Baht	1,600 mil Baht	3,400 mil Baht
Total	2,900 mil Baht	5,700 mil Baht	8,100 mil Baht
• Works out of Airport			
Earthwork			
Cut of Obstructions	_____* Baht	_____* Baht	_____* Baht

* Note: Cost for cut of obstructions out of airport will be prepared.

Table 5 Comparison of Airport Development Alternatives (2)

Alternative	Alt-1	Alt-2	Alt-3
Outline of Concept	Expansion to cope with the traffic demand of target year	Upgrading for future demand in compliance with Int'l standard	New airport concept for the full development in compliance with future demand and Int'l standard
1. Construction aspect			
- Land acquisition	Required Small site 20 ha	Bigger than Alt-1 60 ha	Required all airport site 210 ha
- Detour of Main Road	0.9 km	1.6 km	2.5 km
- Civil Work			
• Cut work	1.1mil cu.m	4.5mil cu.m	2.7mil cu.m
• Filling work	1.0mil cu.m	4.1mil cu.m	3.2mil cu.m
• Land reclamation(Swamp area	Not required	Required	Required
• Pavement area	220,000 sq.m	360,000 sq.m	670,000 sq.m
• Drainage system			
• Special work	Small banking will be required	High banking and land improvement will be required	Land improvement will be required
- Building work			
• Designability	Required coordination with existing bldg.	Same as Alt-1	Required bldg. design freely
• Usability	L shape due to addition new bldg.	Same as Alt-1	Linear frontal apron
• Cooperatebility with existing building	Required the cooperation		
• Passenger's accessibility	Complicated than Alt-3	Same as Alt-1	Easy because Curbside is linear frontage
- Navigation aids (ILS, position, etc.)	Offset localizer	Localizer will be set on the extended runway center line	Localizer can be installed on course
- Effective utilization of existing facilities	Maximum utilization	Less than Alt-1	Newly construction
- Construction period	Less period(around 2 years)	More than Alt-1	Most long period (around 3 years)
- Easiness of connection with public utility	Depend on the back capacity of existing facility		No difficulty because of adjacent with main road
2. Operational aspect			
- Existence of obstacle in the obstacle limitation surface	Obstacles exist in the approach, transitional and inner horizontal surfaces	Obstacles projected above approach and transitional surfaces are to be cut by Alt-2 plan	No obstacle exist in the approach areas for both runways. High mountains located on the southern and northern parts of inner horizontal surfaces are projected.
- ILS procedure	ILS approach procedure will be established for Runway 27.	ILS approach Category I procedures for both runways will be established	ILS approach Category I procedures for both runways will be established successfully.
- OCS	OCS will not be improved due to existence of obstacles around the airport	OCS for ILS approach procedures for both runways will be improved provided that the completion of cut works around the airport	Lower OCS of ILS approach procedures for both runways will be gotten in comparison with those of Alt-1 and 2.
- Take off climb Surface	No obstacle exists on the Take off climb surface for Runway 27 provided that the portion of 142.2m hill which is projected above the 1/50 slope is to be cut	No obstacle exists on the Take off climb surface for Runway 27 provided that the portion of 142.2m hill which is projected above the 1/50 slope is to be cut	No obstacles exist in Take off climb area for both runways.
- Approach Surface	Same as the above	Clear (both R/W)	• Clear (both R/W)
- Taxing distance	• Long distance of taxing from RWY09 landing • Less distance landing from RWY 27 and take off from RWY09		
- Maneuverability of aircraft operation	• A little complicated control for arriving and departure aircraft around terminal area. • Apron control will be required complicated procedure at apron area		• Simple control because of linear parking apron around the center of RWY with Parallel TWY.
- Maneuverability of GSE	• Complicated procedure will be required due to L-shaped apron configuration.		• Simple due to linear apron configuration.
- Safety apron control	• Existence of blind area of apron from the existing control tower	• Inferior than Alt-3	• Very safety due to the fully observation from control tower.
- Expansibity for future demand	• Less expansibility than Alt-3	• Same as Alt-1	• High expansibility
- Comparability with ICAO recommendation	• Not complied fully	• Satisfied with ICAO fully	• Same as Alt- 2
3.Environmental Aspect			
- Social Environment			
• Resettlement	• No impact due to very few resettlement	• Same as Alt-1	• Same as Alt-1
• Land use	• Impact to the golf club and National Park	• Same as Alt-1	• Conversion of land use at the existing airport
- Natural Environment			
• Topography	• A few impact due to hill cutting	• Impact by hill cutting	• Impact by alteration of wetland
• Flora & Fauna	• A little impact due to felling	• Impact to mangrove that will be felled	• Significant impact to mangrove that is on good condition.
- Quality of Life			
• Water Pollution	• No impact due to very few earth work	• Same as Alt-1	• Impact to mangrove that will be polluted
• Noise Problem	• Impact to the condominium in the golf club	• Same as Alt-1	• Impact to the villages near the airport
4. Cost (Preliminary)	2.9 bil Baht	5.7 bil Baht	8.1 bil Baht

MINUTES OF MEETING
ON
INTERIM REPORT (2)
ON

THE STUDY
ON
PHUKET INTERNATIONAL AIRPORT
DEVELOPMENT PLAN
IN
THE KINGDOM OF THAILAND

AGREED UPON BETWEEN
THE
AIRPORTS AUTHORITY OF THAILAND
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

BANGKOK, MAY 20TH, 1993

SOPAR ROJNUCKRIN
Deputy Managing Director
Airports Authority of Thailand

YOSHIYA NIINOMI
Team Leader
Study Team
Japan International Cooperation Agency

MINUTES OF MEETING ON THE INTERIM REPORT (2) ON THE STUDY ON PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN

1. JICA Study Team submitted 20 copies of the Interim Report (2) of the Study to Airports Authority of Thailand on May 11th, 1993.

2. Joint meetings between the Thai side headed by Mr. Udorn Buranajaru, Assistant Managing Director of Airports Development Office, Airports Authority of Thailand (AAT) and Japanese side composed of the JICA Advisory Committee headed by Mr. Keiichi Mikami, Special Assistant to the Director, Civil Aviation Bureau, Ministry of Transport and the JICA Study Team headed by Mr. Yoshiya Niinomi were held during the period from May 11th up to 20th, 1993.
   The attendance list is shown in Attachment-A

3. The Thai side explained the development policy for the Phuket Airport as follows :

   - The Thai side considered that the development of the airport shall be limited within the Province of Phuket.

   - The Thai side considered that the development of the airport is looked forward to beyond 2010.

   - The government of Thailand has established the policy to develop the southern sea board project for the encouragement of socio-economic activity in Southern Thailand, and Phuket International Airport is expected to take the important role on the policy.

4. The Thai side informed the JICA Study Team of the final selection of Alt-3 for the airport master plan alternative.

   The main reasons for selection are explained as follows :

   - The Constrains of terrain condition, land acquisition and environmental condition of Alt-2 is same as the condition of Alt-3. Therefore, the maintaining of the possibility of "better layout" for effective operation of the airport and future expansibility on the airport development is considered as the advantage.

   - The Thai side expected the construction of the ideal airport at the new site, which is satisfied with the international standards as much as possible and less constrain on the airport operation in comparison with the existing airport because of the difficulty for the resolution of the current constrain at the existing airport even though in future.

- The land acquisition and cutting of mountainous area along the existing airport site is very difficult due to the complicated laws and regulation concerned. And Terrain constrain at the new airport site is considered to be smaller than the existing airport site and constrain for airspace is considered to be smaller than the existing one.

5. The Thai side said that the development plan based of the Study will be submitted for the government approval at next step. The financial arrangement will be considered by the Government after the decision of the Project.

6. The Study Team explained the Thai side the following programme for the implementation of new airport development as follows :

- Execution of actual data collection of weather condition such as wind direction and wind velocity at the proposed site.

- Execution of detailed soil and topographic survey on the new airport construction site.

- Implementation of Environmental Impact Assessment (EIA) on the site based on the Thai regulation.

7. Regarding the work programme for next step, as of feasibility study the following was discussed.

- Thai side said the feasibility study on the short term plan targeted 2000 will be considered to cope with the increased demand only and not considered the upgrading in consideration of cost minimization for the future new airport.

8. Workshop

The Study Team proposed the workshop on airport master planning during the period on mid of August which is scheduled to submit the draft final report. The object of workshop is for the technology transfer for the airport master planning to AAT stuff concerned.

The outline tentative contents are shown in Attachment-B.

LIST OF ATTENDANTS

1. Thai Side

1.1 Counterpart Team

1.	Ms. Sopar ROJNUCKRIN	Deputy Managing Director, AAT
2.	Group Captain Udorn BURANAJARU	Assistant Managing Director, AAT
3.	Mr. Passakorn SUWANAKANIT	Chief of Development Dept., AAT
4.	Mr. Decha USWARANGSRI	Specialist, Airport Development Office, AAT
5.	Mr. Virat TANTIATIMONGKOL	Electrical Engineer, Airport Development Office, AAT
6.	Mr. Chaowalit PAKA-ARIYA	Communication Engineer, Airport Development Office, AAT
7.	Mr. Torsak NINGSANON	Civil Engineer, Airport Development Office, AAT
8.	Ms. Suwannee SAMRONGWATANA	Planning Dept., AAT
9.	Mr. Thaweechai NATHISATHIDTAN	Planning Dept., AAT
10.	Ms. Suthasinee PORAPONGSA	Airport Development Office, AAT
11.	Mr. Serirat PRASUTANOND	Planning Dept., AAT

2. Japanese Side

2.1 JICA Advisory Committee

1.	Mr. Keiichi MIKAMI	Member of JICA Advisory Committee
2.	Mr. Junichi TAKEMURA	Member of JICA Advisory Committee

2.2 JICA Coordinator

1.	Mr. Fumio ISHIKAWA	JICA, Headquaters

2.3 JICA Study Team

1.	Mr. Yoshiya NIINOMI	Leader of JICA Study Team
2.	Mr. Shinichi SAKABE	Member of JICA Study Team
3.	Mr. Hajime HONJO	Member of JICA Study Team
4.	Mr. Osamu ISODA	Member of JICA Study Team

Attachment-B

WORKSHOP ON AIRPORT MASTER PLANNING (Tentative)

I. ITEMS OF LECTURE

1. Objectives of Airport Master Planning
2. Methodology of Airport Master Planning
3. Air traffic demand forecast
   - Setting of target year
   - Socio-economic activity
   - Policy for the development of airlines (fleet plan, etc.)
4. Study of existing condition of the airport
   - Analysis of existing conditions
   - Relation with development plan established by the government
5. Facility requirement analysis
6. Evaluation of existing facilities

   Points to be evaluated
   - Capacity
   - Safe operation
   - Compatibility with international standards
7. New airport site selection
8. Airspace using plan
   - Obstacle limitation surface analysis
9. Environment consideration
   - Initial Environmental Examination (IEE)
   - Regulation concerned
10. Airport layout plans
    - Alternatives of layout plan
    - Comparison study
    - Airport layout plan
11. Case study : Airport development in Japan
    - Establishment of development policy by the government
    - Laws, standard and regulation
    - Budgetting
    - Technical study procedure

II. ATTENDANT

Staff in Planning Deparetment and Airports Development Office of AAT

III. PERIOD

Two or Three days in August 1993 during the stay of JICA Study Team

MINUTES OF MEETING

ON

DRAFT FINAL REPORT

ON

THE STUDY ON PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN IN THE KINGDOM OF THAILAND

AGREED UPON BETWEEN

THE

AIRPORTS AUTHORITY OF THAILAND

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

BANGKOK, AUGUST 20 TH, 1993

S. Roj

SOPAR ROJNUCKRIN

Deputy Managing Director

Airports Authority of Thailand

Yoshiya Niinomi

YOSHIYA NIINOMI

Team Leader

Study Team

Japan International Cooperation Agency

MINUTES OF MEETING ON THE DRAFT FINAL REPORT ON THE STUDY ON PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN

1. The JICA Study Team submitted 20 copies of the Draft Final Report of the Study to Airports Authority of Thailand (AAT) on August 17th, 1993.

2. Joint meetings between the Thai side headed by Mr. Passakorn Suwanakanit, Director of Airports Development Office, AAT and the Japanese side composed of the JICA Advisory Committee headed by Mr. Makoto Takahashi, Director, Construction Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport and the JICA Study Team headed by Mr. Yoshiya Niinomi were held during the period from August 17 up to 20, 1993.
   The report was generally accepted by the Thai side after presentation and a series of discussion.
   The attendance list is shown in Attachment-A.

3. Items discussed on the meetings are shown in Attachment-B.

4. The Study Team confirmed with Thai side to provide the comments on the Report within four weeks after submission of the Report through JICA Thailand office in compliance with Article 5.5 of agreed Scope of Work.

   The Study Team will submit the Final Report based on the comments provided by the Thai side within 2 months after receipt of comments.

Attachment - A

LIST OF ATTENDANTS

1. Thai Side

1.	Mr. Decha USWARANGSRI	Specialist, Office of the Managing Director, AAT
2.	Mr. Chaowalit PAKA ARIYA	Communication Engineer, AAT
3.	Mr. Virat TANTIATIMONGKOL	Electrical Engineer, AAT
4.	Ms. Suwannee SAMRONGWATANA	Planning Dept., AAT
5.	Mr. Serirat PRASUTANOND	Planning Dept., AAT
6.	Ms. Suthasinee PORAPONGSA	Airports Development Office, AAT

2. Japanese Side

2.1 JICA Advisory Committee

1.	Mr. Makoto TAKAHASHI	Chairman of JICA Advisory Committee
2.	Mr. Keiichi MIKAMI	Member of JICA Advisory Committee
3.	Mr. Hiroji NISHIDA	Member of JICA Advisory Committee

2.2 JICA Coordinator

1.	Mr. Hideyuki UO	JICA, Headquaters
2.	Mr. Yoshiharu YONEYAMA	JICA, Thailand Office

2.3 JICA Study Team

1.	Mr. Yoshiya NIINOMI	Leader of JICA Study Team
2.	Mr. Hajime HONJO	Member of JICA Study Team
3.	Mr. Shinichi SAKABE	Member of JICA Study Team
4.	Ms. Chizuko IHARA	Member of JICA Study Team

Attachment -B

Items discussed on the Meeting

Following items were discussed on the meeting.

1. Draft Final Report

1) Supplemental information concerning the items listed below for the expansion of passenger terminal building by Alternative-A scheme shall be added in section 15.3.

- Work flow chart for layout planning of the terminal building
- Limited conditions for the expansion
- Information sign for check-in counter and other facilities

2) Maximum annual increase rate in number of AAT's staff will be considered to be 2 % or less according to AAT's Corporate Plan (1994 - 1996) on the estimation of the future number of staff in section 16.3.

3) The last paragraph of Clause 18.3.2 on the evaluation of noise influence shall be deleted due to the relocation of the school.

4) Preparatory work as a supplemental work item by the Government of Thailand for Phase II development shall be added before the feasibility study in Figure 19.2.1 concerning the project implementation schedule.

2. General Discussion

1) The Thai side will make final decision for the development of the new airport construction based on the final report of the Study.

2) The Thai side accepted that the results of the Study on short-term development plan are possible to be applied for the improvement of the existing airport.

3) The Thai side requested the Japanese side the further cooperation, such as being described below, for the implementation of a new airport construction.

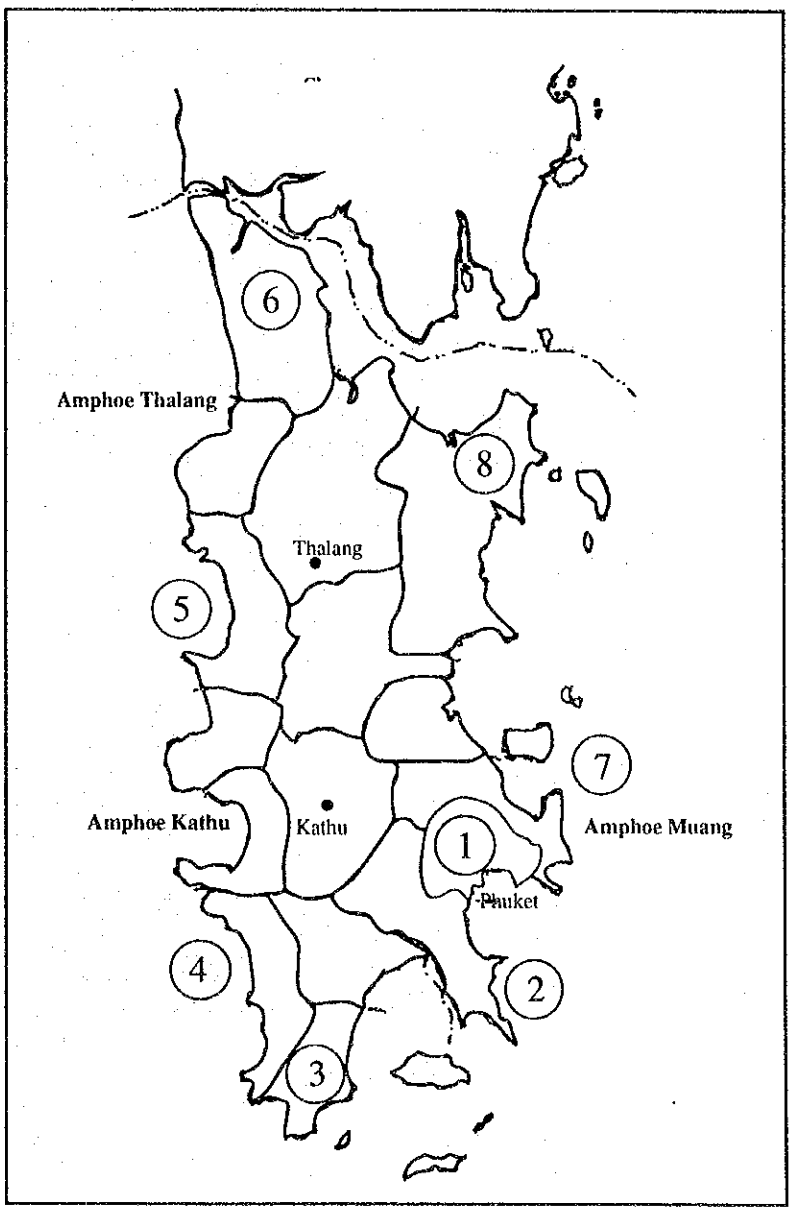
- Feasibility study on the new airport
- Technical advisory services such as despatching technical experts, etc.

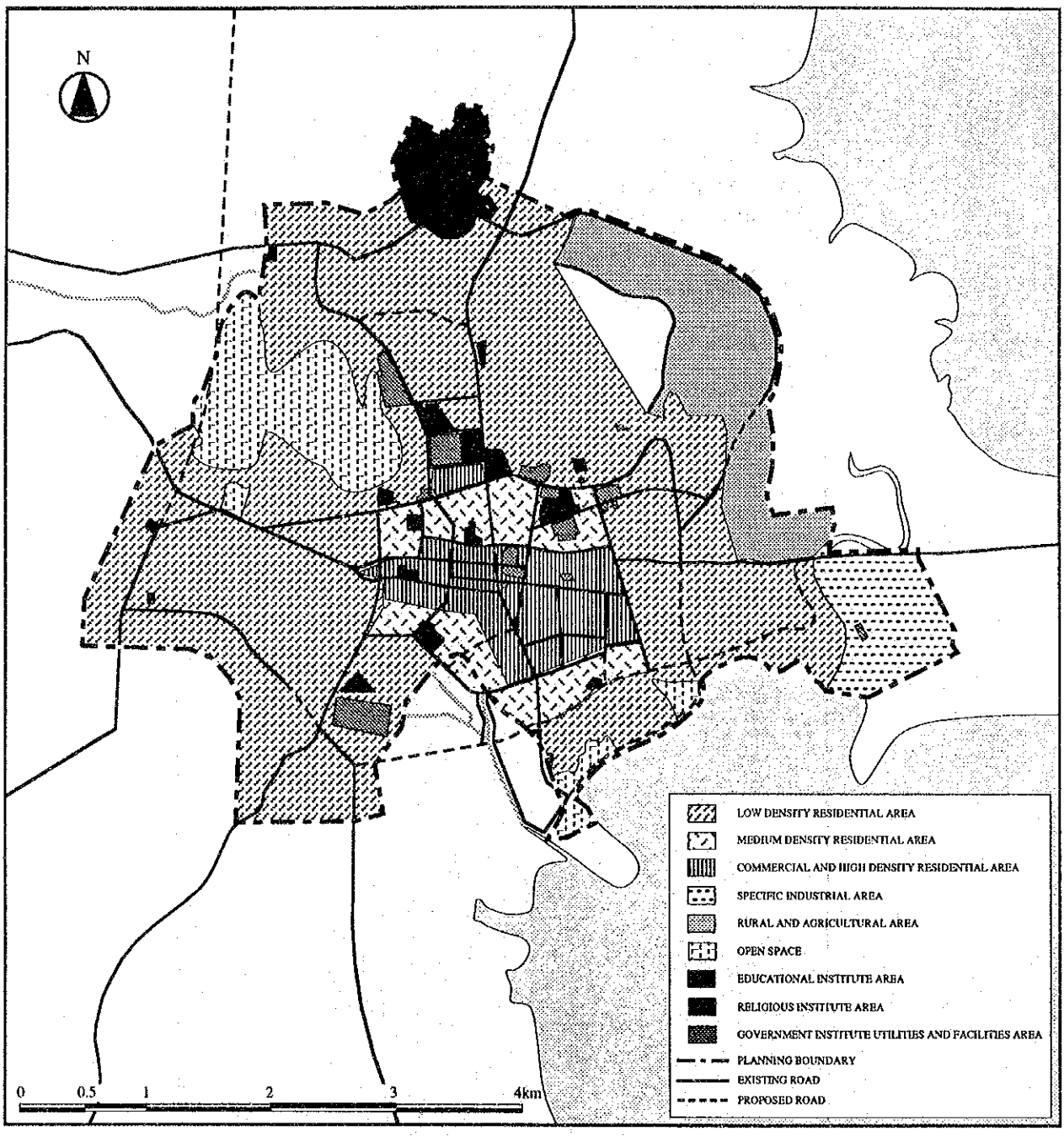
SR.

APPENDIX TO CHAPTER 2

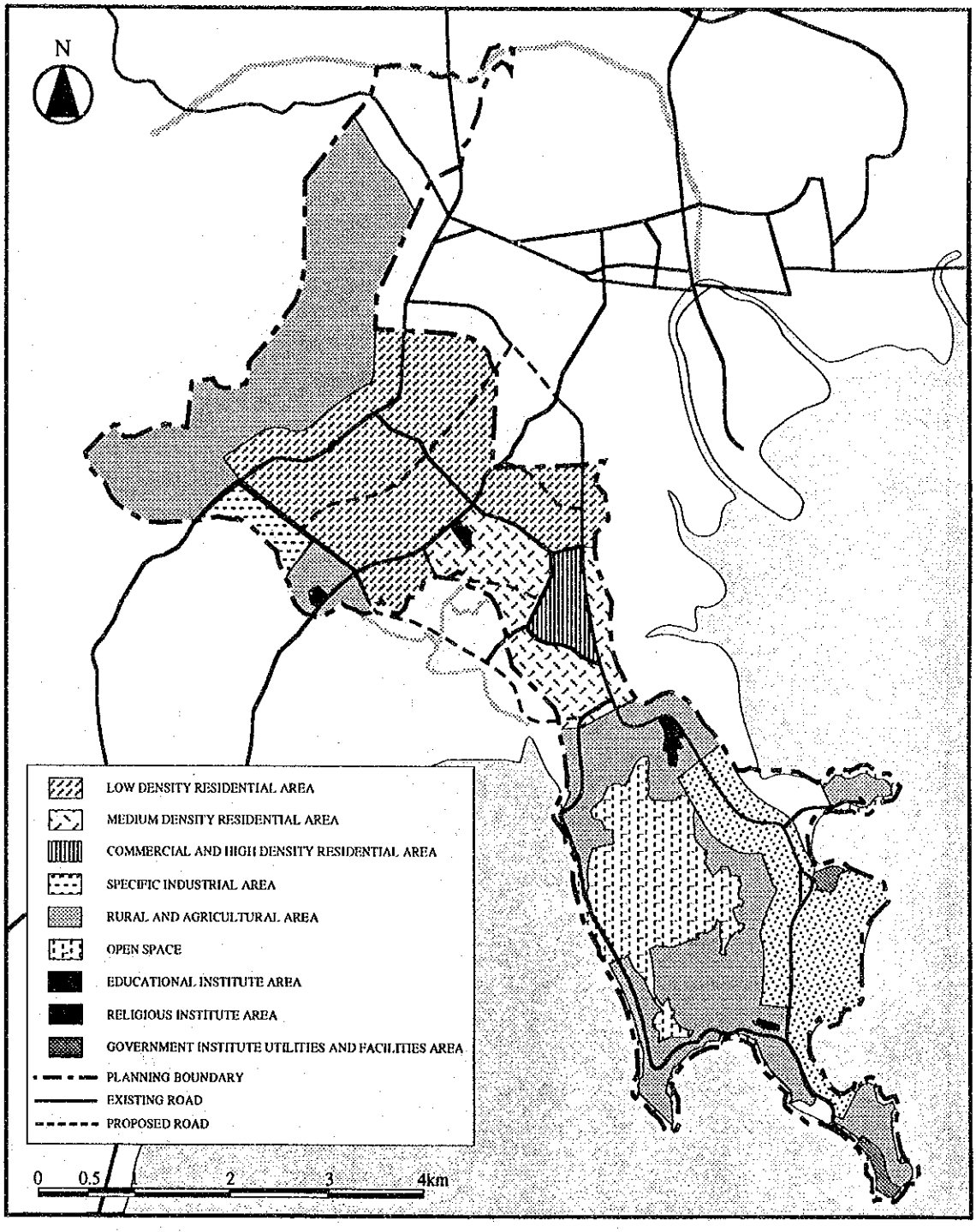
General Plans in Phuket

1) Phuket General Plan
2) Phuket Port and Vinchit General Plan
3) Chalong and Rawai General Plan
4) Pathong and Karon General Plan
5) Chang-Talag and Kamala General Plan
6) Mai-Khao and Sakru General Plan
7) Kok Kathu, Rasada and Kathu General Plan
8) Thap Kasat-tri and Pa-Klog and Sri-Soon Torn General Plan

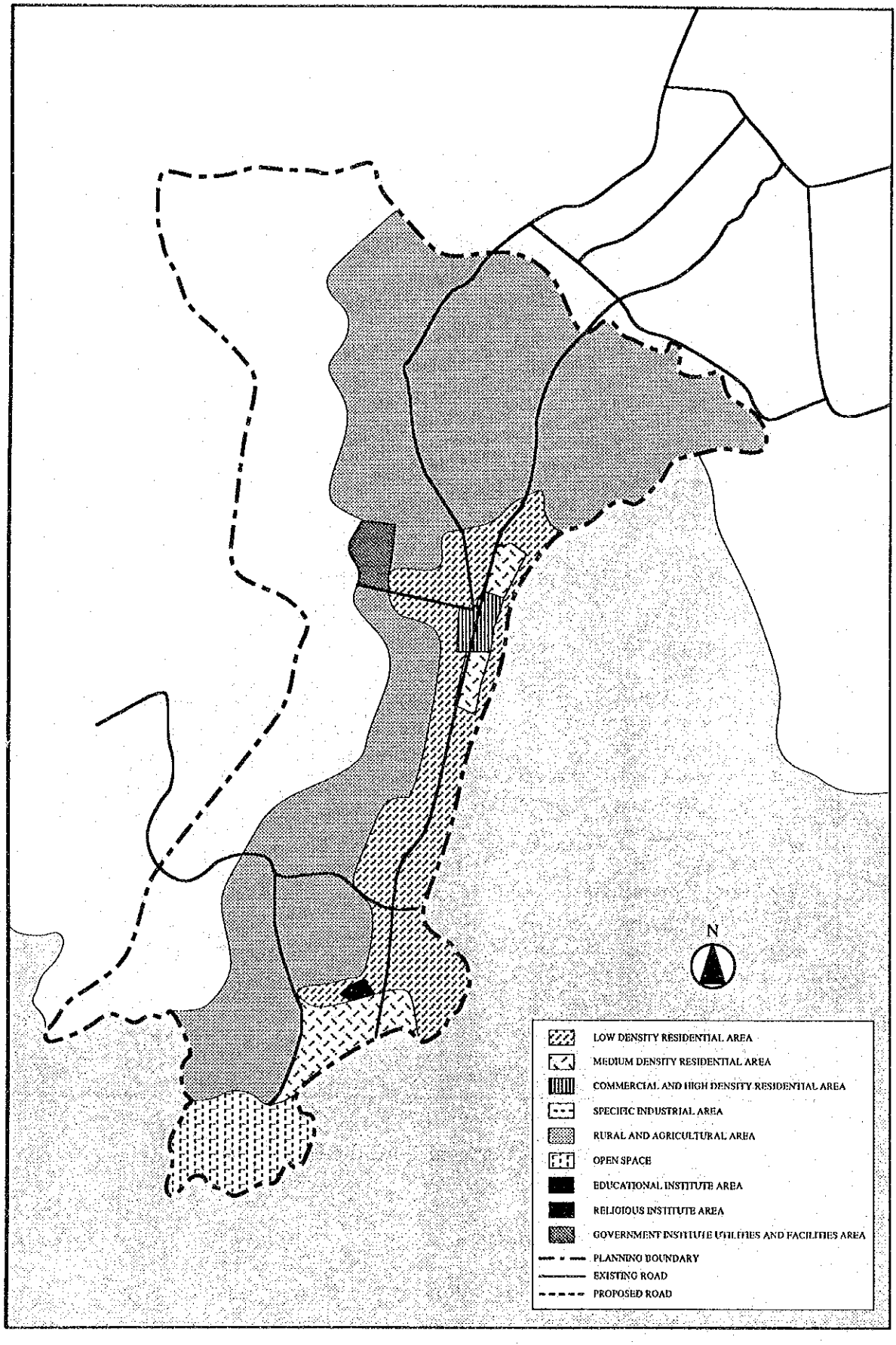




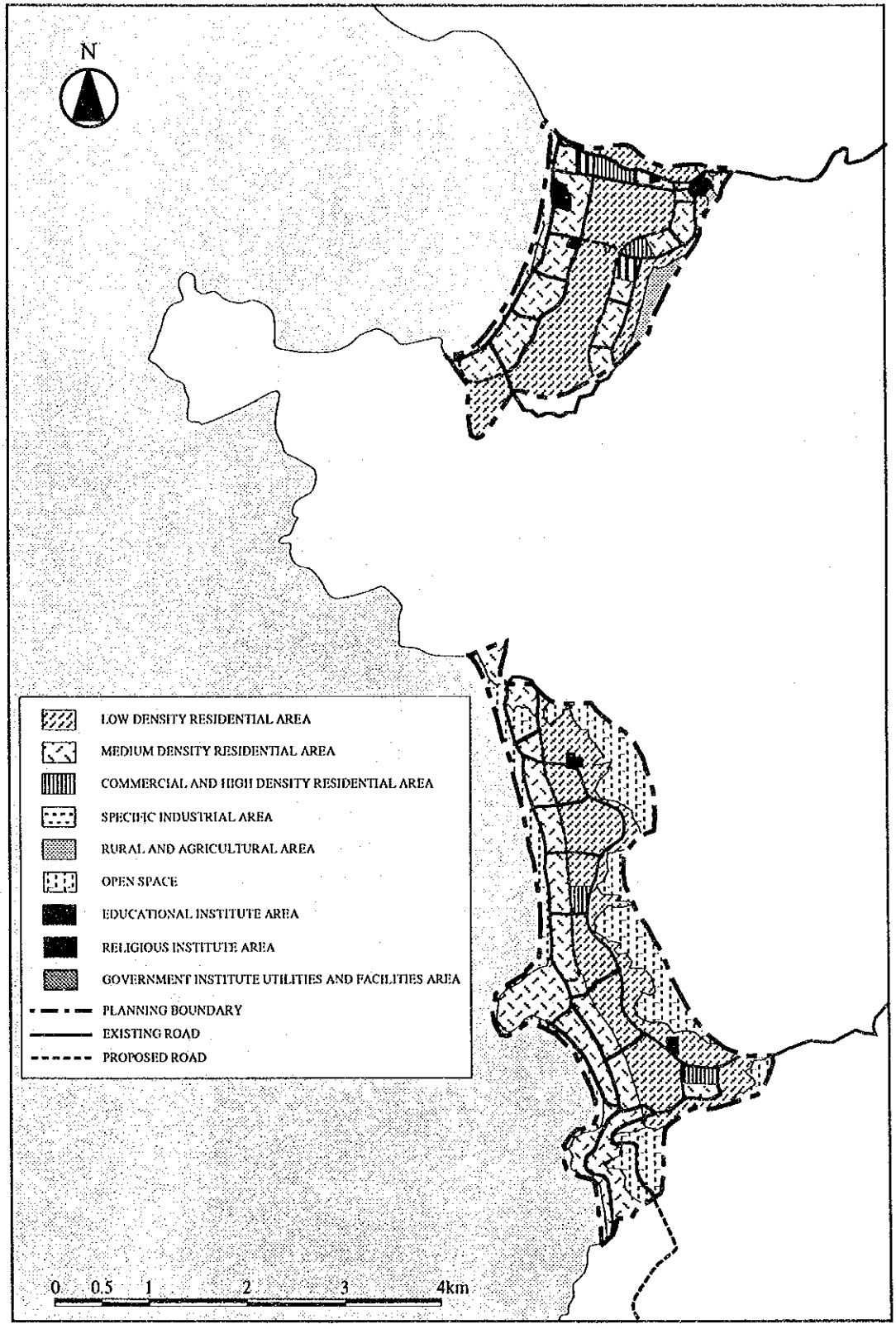
Phuket General Plan



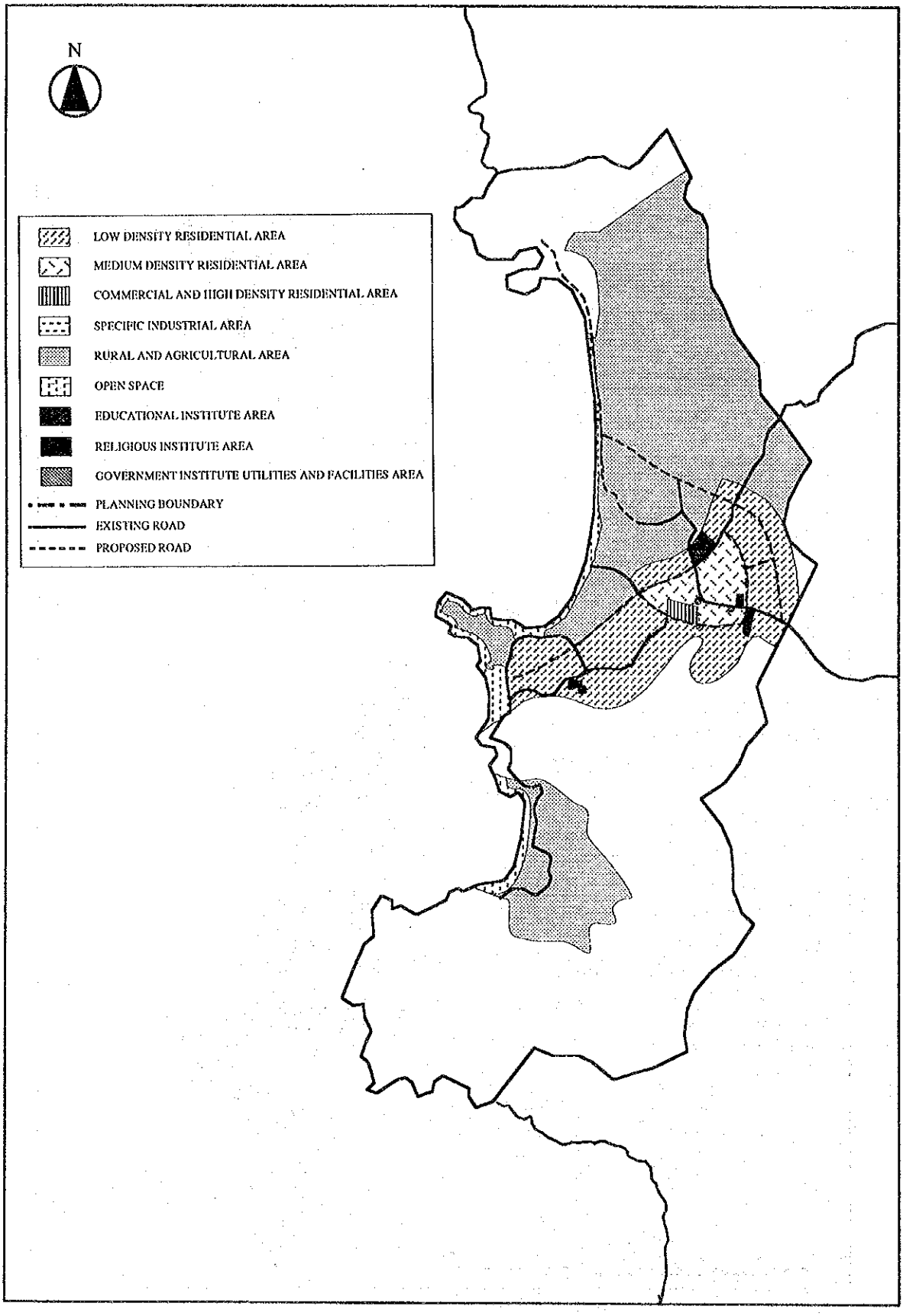
Phuket Port and Vinchit General Plan



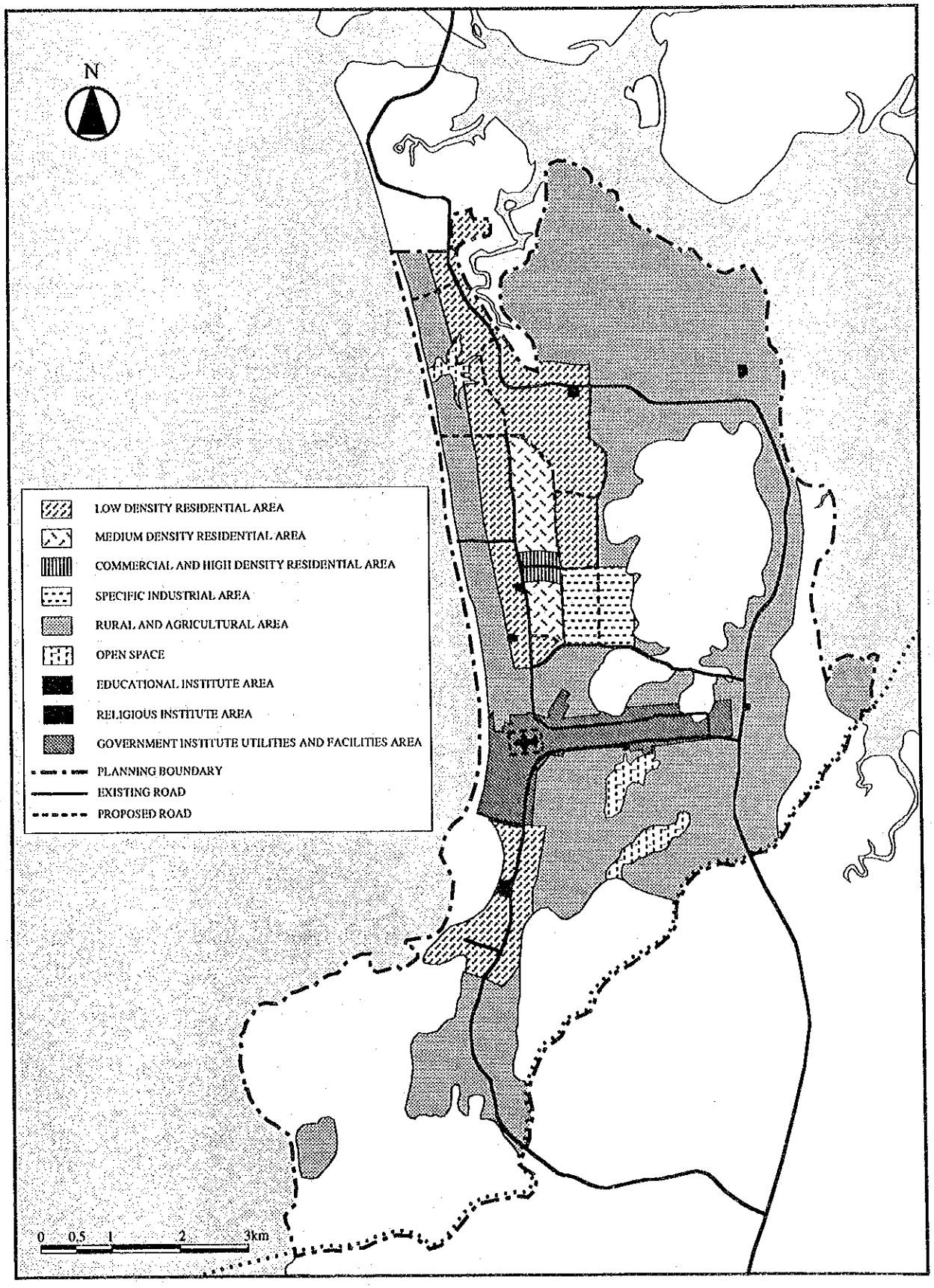
Chalong and Rawai General Plan



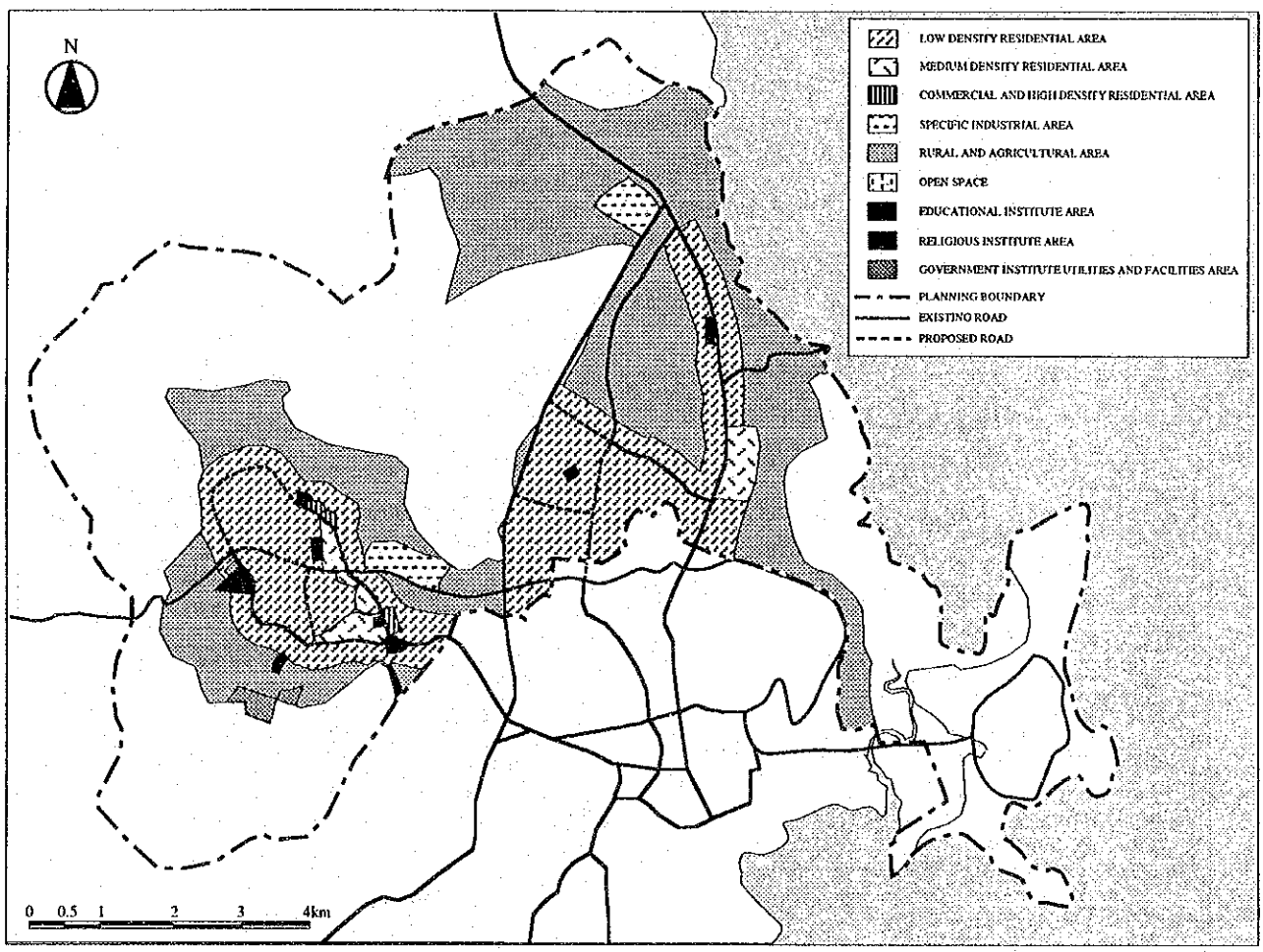
Pathong and Karon General Plan



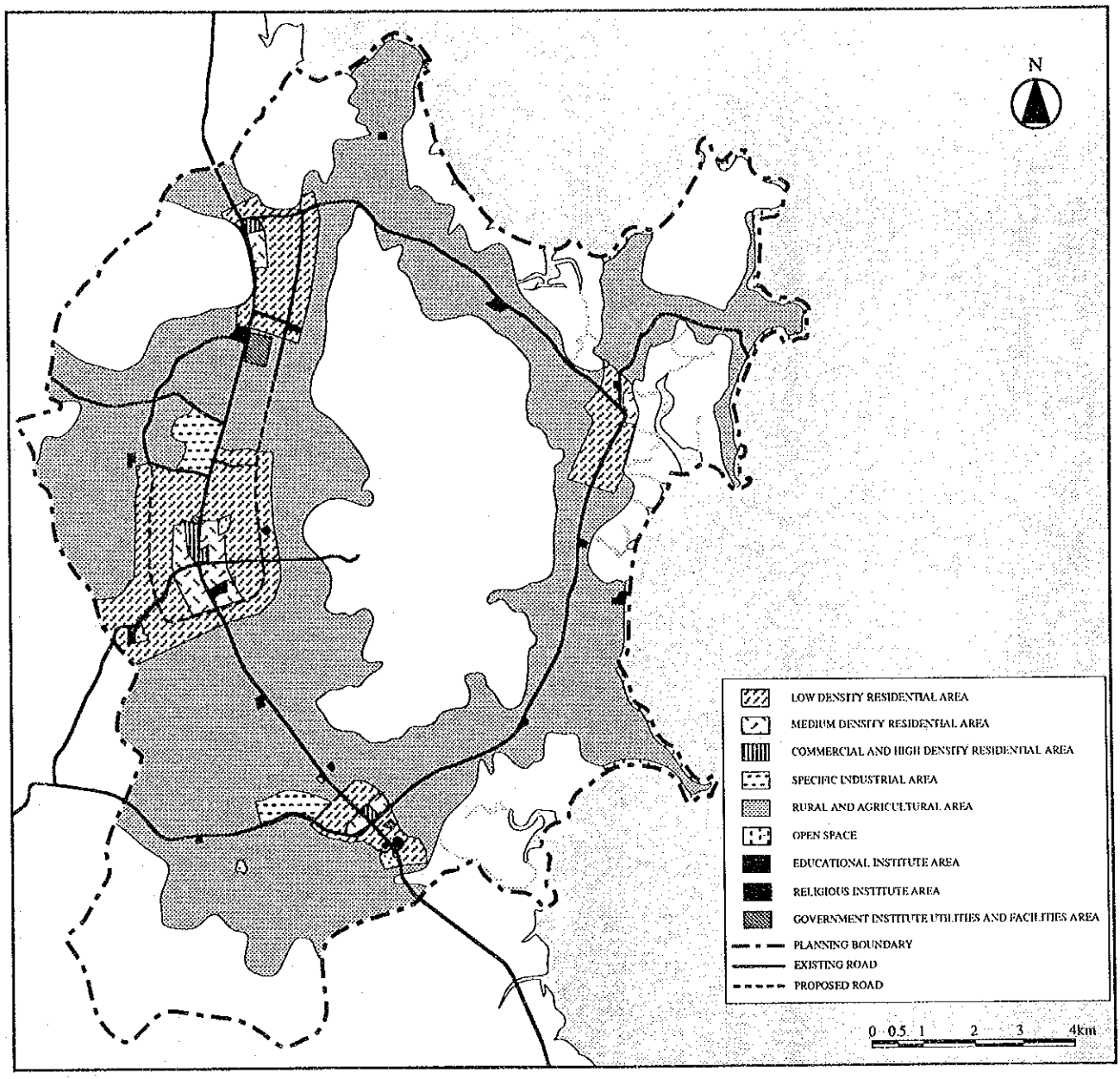
Chang-Talag and Kamala General Plan



Mai-Khao and Sakru General Plan



Kok Kathu, Rasada and Kathu General Plan

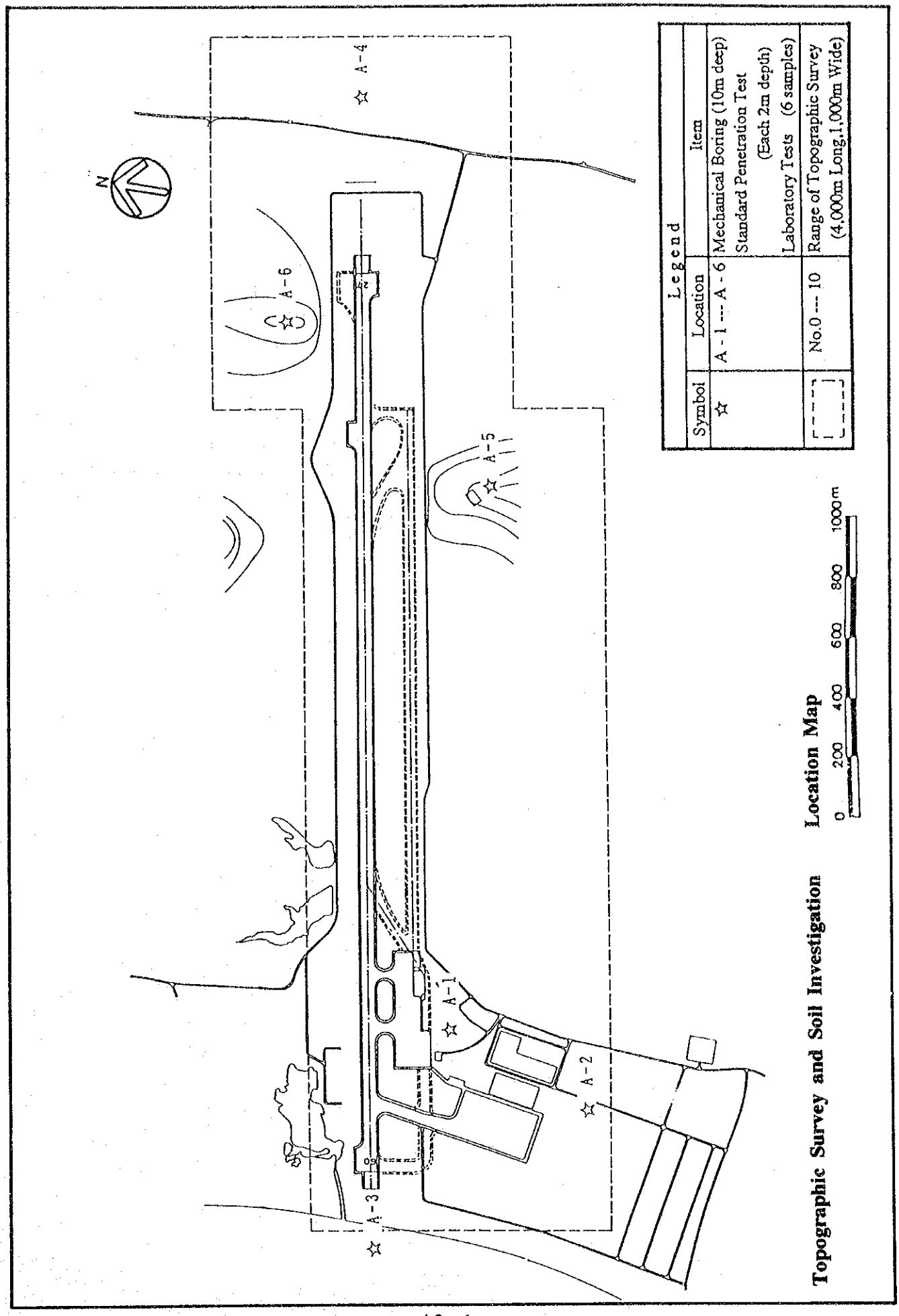


Thap Kasat-tri and Pa-Klog and Sri-Soon Torn General Plan

APPENDIX TO CHAPTER 3

Appendix - 3.3.1

Location Map of Soil Investigation and Topographic Survey



Appendix - 3.3.2

Result of Soil Investigation

A. PURPOSE AND SCOPE OF WORK

The purpose of this investigation is to provide the engineer with an information of subsurface condition beneath the project site for the execution of the Study on Phuket International Airport Development Plan in the Kingdom of Thailand.

The project site is located on Southern region of Thailand which is approximately 860 meter from Bangkok. Six (6) borings to a depth of approximately 10.0 meter or to firm soil strata which blows count more than 50 blows/ft is reached. All locations are selected and shown in Figure 2.

Standard Penetration test (ASTM D-1586) were performed at every 2.0 meter interval blow to determine the soil strength existing ground level in the field condition and Unconfined Compression Tests were carried out in the laboratory. When weak soil of SPT N-value less than five (5) is encountered, undisturbed sampling shall be carried out by using thin-walled sampler (ASTM D-1587)

The site investigation was executed during September 20, 1992 to September 25, 1992.

B. DESCRIPTION OF INVESTIGATION

1. FIELD INVESTIGATION

Six (6) 10.00 m. deep borings were drilled by the method of wash boring. The undisturbed samples were collected at 2.00 m. interval by a thin-walled sampler while the disturbed soil samples were collected at 2.00 m. interval by split spoon sampler down to the end of borings. Representative samples were carefully protected and transported to the laboratory for testing.

Field tests were made in conjunction with wash drilling to determine the in-situ soil properties by performing standard penetration tests for stiff and hard clay or sand at 2.00 meter interval and 1.50-2.00 m. deep test pit were dug nearby the soil drilling to collect soil sample for compaction and soaked CBR-test procedure in the laboratory. Water level of each borehole was also measured and recorded at 24 hours after completion of boring.

2. LABORATORY TESTS

The laboratory testing program was carried out on representative samples collected from the site. Physical properties such as natural water content, bulk unit weight, specific gravity and grading tests were performed in the laboratory. Soil strength were carried out by Unconfined Compression tests with compressibility by consolidation test. (if any). The standard methods of testing are as follows :

Title	ASTM Standard
Water Content Determination.	D2216
Compressive Strength, Unconfined, of Cohesive Soils.	D2166
One-Dimensional Consolidation Properties of Soils.	D2435
Grading Test	D422
Specific Gravity	D854
Consistency Test and Indices	
- Liquid Limit.	D423
- Plastic Limit and Plasticity Index.	D424
Moisture-Density Test.	D1557
Laboratory CBR Test (96 hours soak, 15 kg. surcharge) & Compaction Test	D1883

The soil classification has been done by Visual Soil Identification and based on Unified Soil Classification System.

C. RESULT OF INVESTIGATION

1. SITE DESCRIPTION

The project site is located in the Southern region of Thailand which is approximately 860 kilometers south of Bangkok. Project site is on the northern part of Amphoe Muang, Changwat Phuket about 32 kilometer form the town. The general geological condition of the project site is granite/granodiorite diorite covered with alluvial and coastal residual soil which consists of combination layers of silt and fine to coarse sand with gravel.

2. TEST RESULTS OF INVESTIGATION

A summary of the test results are shown in Appendix A and their boring logs are presented in Appendix B. The subsoil down to the depth of 10 meters consists of different soil layers which can be separately described as follow:-

2.1 In the Western zone of the project site (for boring no.A-1, A-2 and A-3)

Top soil layer of silty fine sand attains a thickness of approximately 1.65 meters which is generally yellowish brown, loose to medium dense condition. Below this layer is yellowish brown of very loose to medium dense sand (SP/SM) with trace of fine to coarse sand. The thickness of this layer is in the range of 3.50-6.85 meter as tabulated in Table 1. The laboratory test results show that the natural water content varies from 16.0-31.6% with non-plasticity characteristic and total unit weight varies from 1.67-1.74 t/m^3. The Standard Penetration N-value is in the range of 2-9 blows/ft. The last soil layer encountered during the investigation is dense to very dense, silty fine sand (SP/SM) which attained a thickness of 1.65-8.50 meter to end of boring at 10.15 meter depth. The general soil property of this soil layer are natural water content is 17.7-21.0%, plasticity index is non-plastic to 5.90%, total unit weight is 2.03-2.24 t/m^3, specific gravity is 2.67-2.70. The insitu soil strength performed by Standard Penetration Test is in the range of 37-50 blows/15 cm.

2.2 In the Eastern zone of the project site (for boring no.A-4, A-5 and A-6)

Top soil layer is fill material of brown laterite and medium dense, silty fine sand with trace to little of fine gravel and coarse sand about 1.00-1.65 meter thick. Beneath this layer is reddish brown and grey of medium to hard clayey silt (MH,ML) with trace of fine to coarse sand, little of fine gravel founded during the investigation. This layer attains a thickness of 1.85-9.05 meter from the top layer. The laboratory test results as shown in Appendix B indicate that the natural water content varies from 17.9-34.8% with plasticity index of non-plastic to 33.2%, the total unit weight of 1.92-2.19 t/m^3. The Standard Penetration N-value is in the range of 7-33 blows/ft. The third layer is medium to very dense, silty fine sand (SM) which attained a thickness of 2.80 meter to the end of drilling which encountered bed rock formation (at A-5 boring location) at 6.30 meter depth from top of boring elevation.

According to the disturbed soil sampling from each soil boring, therefore the consolidation test can not be performed for all representative soil specimens. But for the modified compaction test (ASTM 1557) and soaked CBR test at 95% of maximum dry density is performed and also tabulated in Table 2.

TABLE 1 : INDEX PROPERTIES AND SOIL STRENGTH OF SUBSOIL (WESTERN ZONE OF THE PROJECT SITE, A–1, A–2 & A–3)

Soil Description	Approximate Thickness (m.)	Natural Water Content (%)	Plasticity Index (%)	Total Unit Weight (t/cu.m.)	SPT (blows/ft.)	Specific Gravity	Unconfined Comp. Test (qu/2)
Top soil layer of silty SAND, yellowish brown; trace of coarse sand. (SP/SM)	1.65						
Very loose to medium dense, fine to medium SAND, yellowish brown; trace of coarse sand. (A–1 ; 1.65–5.15 m. depth) (A–2 ; 1.65–8.50 m. depth) (SP/SM)	3.50–6.85	16.0–31.6	– NP –	1.67–1.74	2 – 19	– 2.68 –	–
Dense to very dense, silty fine SAND to end of boring. (SP/SM) (A–1 ; 5.15–10.08 m. depth) (A–2 ; 8.50–10.15 m. depth) (A–3 ; 1.65–10.15 m. depth)	1.65–8.50	17.7–21.0	– NP – 5.9	2.03–2.24	37–50/15 cm.	2.67–2.70	–

TABLE 2 : INDEX PROPERTIES AND SOIL STRENGTH OF SUBSOIL (EASTERN ZONE OF THE PROJECT SITE, A–4, A–5 & A–6)

Soil Description	Approximate Thickness (m.)	Natural Water Content (%)	Plasticity Index (%)	Total Unit Weight (t/cu.m.)	SPT (blows/ft.)	Specific Gravity	Unconfined Comp. Test (qu/2)
Fill material; Laterite/medium, silty fine SAND, brown; little to trace of fine gravel.	1.00–1.65						
Medium to hard, clayey SILT, grey and reddish brown. (MH, ML) (A–4 ; 1.10 – 10.15 m. depth); to end of boring (A–5 ; 1.65 – 3.50 m. depth) (A–6 ; 1.65 – 10.15 m. depth); to end of boring	1.85–9.05	17.9–34.8	– NP – 33.2	1.92–2.19	7–33	2.66–2.70	–
Medium to v.dense, silty fine SAND, brown/light grey. (SM) (A–5 ; 3.50–6.30 m. depth, to bed rock)	– 2.80 –	– 7.8 –	– NP –	– 2.02	>50/22 cm.	– 2.68 –	–

TABLE 3 SUMMARY OF TEST RESULTS OF TEST PIT A-1 TO A-6 LOCATION
(PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN PROJECT)

STATION	SAMPLE NO.	DEPTH (M)	GRAIN SIZE ANALYSIS PERCENT FINER									ATTERBERG LIMITS		COMPACTION MOD TEST ASTM 1557		CBR **		SOIL CLASSIFICATION		MOIS-TURE CONTENT %	FIELD DENSITY (T/M^3)
			1 1/2"	1"	3/4"	3/8"	NO. 4	NO. 10	NO. 40	NO. 100	NO. 200	LL %	PI %	MDD (T/M^3)	OMC %	95 %	SWELL %	AASHTO	UNIFIED		
A-1	TPA1-1	0.00-1.70	-	-	-	-	-	100	31.6	4.6	3.1	<——NP——>		1.76	14.7	10.6	0.00	-	SP	9.1	-
A-2	TPA2-1	0.00-1.80	-	-	-	100	99.9	99.8	35.1	4.6	3.4	<——NP——>		1.80	12.7	18.0	0.00	-	SP	16.0	-
A-3	TPA3-1	0.00-1.80	-	-	-	-	100	99.4	15.2	1.4	0.3	<——NP——>		1.82	12.8	18.0	0.00	-	SP	4.4	-
A-4	TPA4-1	0.20-1.10	-	-	100	89.2	72.8	58.7	53.3	51.5	50.3	64.9	30.2	1.71	21.5	14.6	0.18	-	SC/MH	28.0	-
	TPA4-2	1.10-1.60	-	100	94.2	87.7	83.1	80.6	77.8	75.2	73.2	72.4	36.3	1.58	25.2	11.4	1.53	-	MH & OH	25.8	-
A-5	TPA5-1	0.20-1.50	-	-	100	98.2	92.2	73.0	50.0	38.2	33.7	42.4	18.0	1.75	13.2	10.3	0.89	-	SC	22.0	-
	TPA5-2	1.50-2.00	-	-	100	99.1	98.1	86.7	68.3	58.9	54.8	52.2	23.4	1.79	14.5	18.3	3.87	-	MH & OH	20.5	-
A-6	TPA6-1	0.00-2.00	-	-	-	-	100	98.1	65.7	53.3	49.5	46.7	17.0	1.73	17.5	13.7	0.04	-	SM/ML	18.5	-

** Laboratory CBR Test (96 hours soak, 15 kg surcharge) following ASTM D1883

THAI ENGINEERING CONSULTANTS CO., LTD.

BORING LOG NO. A-1

PROJECT : PHUKET INTERNATIONAL AIRPORT DEVELOPMENT DATE START SEP. 21, 1992

LOCATION : AMPHOE MUANG, CHANGWAT PHUKET DATE FINISHED SEP. 21, 1992

ABBREVIATIONS
ST = UNDISTURBED SAMPLING
SP = STANDARD PENETRATION TEST
WO = WASH OUT
VS = FIELD VANE SHEAR TEST
HA = HAND AUGERING

GROUND ELEV. 0.00 M.
WATER ELEV. — NA — M.

SOIL DESCRIPTION	GRAPHIC LOG	DEPTH M.	SAMPLING METHOD
0.00-1.65 m; silty SAND, yellowish brown; trace of coarse sand. (SP/SM)		0	HA
		1.65	
Very loose to loose, fine to medium SAND, yellowish brown; trace of coarse sand. (SP/SM)		2	S/P
			WO
		4	S/P
			WO
		5.15	
Very dense, fine to medium SAND yellowish brown; trace of coarse sand (SP) interbedded with very soft, clayey SILT, dark grey (MH) at 8.90-9.50 m. depth. (SP/SM)		6	S/P
			WO
		8	S/P
			WO
		8.90	
		9.50	S/P
		10	WO
		10.08	S/P
End of boring			

P.L. w_n L.L. %

STANDARD PENETRATION TEST BLS/FT

20 40 60 80 100 120 (%)

10 20 30 40 50

NP NP NP NP NP

50/15 cm 50/15 cm. 50/22cm.

THAI ENGINEERING CONSULTANTS CO., LTD.

BORING LOG NO. A-2

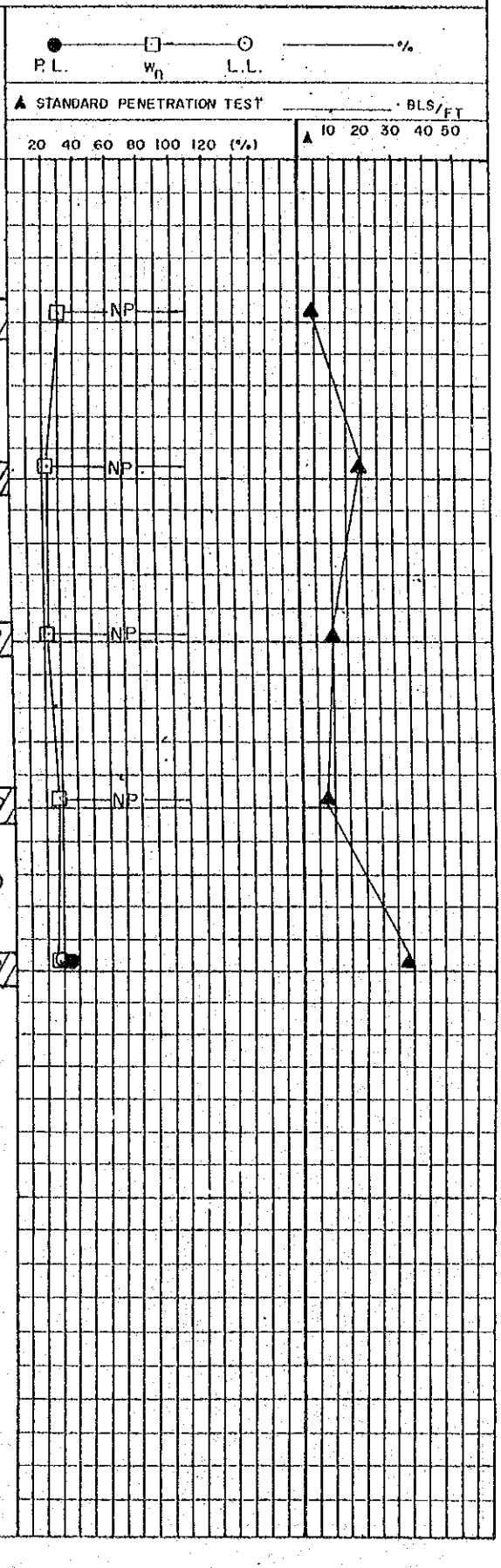
PROJECT : PHUKET INTERNATIONAL AIRPORT DEVELOPMENT DATE START SEP. 22, 1992

LOCATION : AMPHOE MUANG, CHANGWAT PHUKET DATE FINISHED SEP. 22, 1992

ABBREVIATIONS
ST = UNDISTURBED SAMPLING
SP = STANDARD PENETRATION TEST
WO = WASH OUT
VS = FIELD VANE SHEAR TEST
HA = HAND AUGERING

GROUND ELEV. 0.00 M.
WATER ELEV. −0.10 M.

SOIL DESCRIPTION	GRAPHIC LOG	DEPTH M.	SAMPLING METHOD
0.00-1.65 m; silty SAND, yellowish brown. (SP/SM)		0.10	HA
		1.65	SP
Loose to medium dense, fine to medium SAND, yellowish brown/ light grey; little of fine to coarse sand. (SP/SM)		2	WO
		4	SP
			WO
		6	SP
			WO
		8	SP
		8.50	WO
Dense, silty fine SAND, light grey; some of fine to medium sand. (SM)		10	SP
		10.15	
End of boring			



THAI ENGINEERING CONSULTANTS CO., LTD.

BORING LOG NO. A-3

PROJECT : PHUKET INTERNATIONAL AIRPORT DEVELOPMENT DATE START SEP. 24, 1992

LOCATION : AMPHOE MUANG, CHANGWAT PHUKET DATE FINISHED SEP. 24, 1992

ABBREVIATIONS
ST = UNDISTURBED SAMPLING
SP = STANDARD PENETRATION TEST
WO = WASH OUT
VS = FIELD VANE SHEAR TEST
HA = HAND AUGERING

GROUND ELEV. 0.00 M.
WATER ELEV. -2.00 M.

SOIL DESCRIPTION	GRAPHIC LOG	DEPTH M.	SAMPLING METHOD
0.00-1.65 m; silty SAND, yellowish brown; trace of shell bit. (SP/SM)		1.65	HA
Medium to very dense, silty fine to medium SAND, yellowish brown/grey; little to trace of medium sand, trace of fine gravel (SP/SM) interbedded with medium dense SAND, at 3.70-4.15 and 7.70-8.15 m. depth.		2.00 2	SP
			HA
		3.70 4	SP
		4.15	HA
		6	SP
			HA
		7.70 8	SP
		8.15	HA
		10	SP
End of boring		10.15	

P.L. w_n L.L. %

STANDARD PENETRATION TEST BLS/FT

20 40 60 80 100 120 (%)

10 20 30 40 60

NP NP NP NP NP

>50/24cm >50/22cm

THAI ENGINEERING CONSULTANTS CO., LTD.

BORING LOG NO. A-4

PROJECT : PHUKET INTERNATIONAL AIRPORT DEVELOPMENT DATE START SEP. 19, 1992

LOCATION : AMPHOE MUANG, CHANGWAT PHUKET DATE FINISHED SEP. 19, 1992

ABBREVIATIONS
ST = UNDISTURBED SAMPLING
SP = STANDARD PENETRATION TEST
WO = WASH OUT
VS = FIELD VANE SHEAR TEST
HA = HAND AUGERING

GROUND ELEV. 0.00 M.
WATER ELEV. −2.60 M.

SOIL DESCRIPTION	DEPTH M.	SAMPLING METHOD
0.00-1.10 m; Laterite, yellowish brown mottled with grey; little of gravel.	1.10	HA
1.10-9.70; Very stiff, clayey SILT, grey and reddish brown; trace of fine to coarse sand, little of fine gravel. (MH,ML)	2	S/P
	2.60	WO
	4	S/P
		WO
	6	S/P
		WO
	8	S/P
		WO
9.70-10.15m; Hard, clayey SILT, reddish brown; little of fine to medium sand. (ML)	9.70 10	S/P
	10.15	
End of boring		

P.L. w_n L.L. %

▲ STANDARD PENETRATION TEST BLS/FT

20 40 60 80 100 120 (%)

▲ 10 20 30 40 50

NP NP NP

THAI ENGINEERING CONSULTANTS CO., LTD.

BORING LOG NO. A-5

PROJECT : PHUKET INTERNATIONAL AIRPORT DEVELOPMENT DATE START SEP. 23, 1992

LOCATION : AMPHOE MUANG, CHANGWAT PHUKET DATE FINISHED SEP. 23, 1992

ABBREVIATIONS
ST = UNDISTURBED SAMPLING
SP = STANDARD PENETRATION TEST
WO = WASH OUT
VS = FIELD VANE SHEAR TEST
HA = HAND AUGERING

GROUND ELEV. 0.00 M.
WATER ELEV. — M.

SOIL DESCRIPTION	GRAPHIC LOG	DEPTH M.	SAMPLING METHOD
0.00-1.00 m; Fill material, medium silty CLAY, brown; little of gravel.			
1.00-1.65 m; Laterite, clayey GRAVEL with silty clay, brown.		1.00	HA
		1.65	
Medium stiff, clayey SILT, brown; some of fine to medium sand, trace of coarse sand. (MH)		2	SP
			WO
		3.50	
Medium to very dense, silty fine SAND, brown/light grey; some of medium to coarse sand, little of fine gravel. (SM)		4	SP
			WO
		6	SP
		6.30	
End of boring	BEDROCK FORMATION	8	
		10	

P.L. — w_n — L.L. — %

▲ STANDARD PENETRATION TEST ——— BLS/FT

20 40 60 80 100 120 (%)

10 20 30 40 50

NP

NP

50/22cm

THAI ENGINEERING CONSULTANTS CO., LTD.

BORING LOG NO. A-6

PROJECT : PHUKET INTERNATIONAL AIRPORT DEVELOPMENT DATE START SEP. 20, 1992

LOCATION : AMPHOE MUANG, CHANGWAT PHUKET DATE FINISHED SEP. 20, 1992

ABBREVIATIONS
ST = UNDISTURBED SAMPLING
SP = STANDARD PENETRATION TEST
WO = WASH OUT
VS = FIELD VANE SHEAR TEST
HA = HAND AUGERING

GROUND ELEV. 0.00 M.
WATER ELEV. -7.80 M.

SOIL DESCRIPTION	GRAPHIC LOG	DEPTH M.	SAMPLING METHOD
0.00-1.65 m; Medium dense, clayey-silty fine SAND, brown.			HA
		1.65	
Stiff to hard, clayey SILT, brown, reddish brown and grey; some of medium sand, little of fine sand, trace of coarse sand and fine gravel. (MH,ML)		2	SP
			WO
		3.70	
		4	SP
		4.15	
			WO
		6	SP
			WO
		7.80	
		8	SP
			WO
		10	SP
		10.15	
End of boring			

P.L. w_n L.L. %

▲ STANDARD PENETRATION TEST BLS/F.T

20 40 60 80 100 120 (%)

10 20 30 40 50

NP NP NP

Sample No.	Depth m.	Description of Soil	Soil Classification		Natural Water Content %	Atterberg Limits %			Grain Size, Percent Finer %					Total Unit Weight t/m^3	Specific Gravity	Standard Penetration Blows/ft.	In - situ Vane Shear Strength t/m²		Pocket penetration meter t/m²	Unconfined Compressive Strength		Remark
			AASHTO	UNIFIED		LL	PL	PI	NO. 4	NO. 10	NO. 40	NO. 100	NO. 200				Undis-turbed	remolded		Qu t/m²	Ef %	
A1-1	1.70-2.15	Loose, fine to medium SAND, yellowish brown; trace of coarse sand.	-	SP/SM	16.0	<--	NP	-->	100	99.8	45.6	7.5	5.5	1.74	2.68	9	-	-	-	-	-	Ground water level= -NA-
A1-2	3.70-4.15	Very loose, medium SAND, yellowish brown; some of fine sand. ----------LOSS SAMPLE----------	-	SP/SM	24.9	<--	NP	-->	-	-	-	-	-	-	-	2	-	-	-	-	-	
A1-3	5.70-6.15	Very dense, medium SAND, yellowish brown/ grey; some of fine sand, trace of coarse sand.	-	SP/SM	17.7	<--	NP	-->	-	-	-	-	-	2.09	-	>50/15 cm.	-	-	-	-	-	
A1-4	7.70-8.15	Very dense, fine to medium SAND, yellowish brown. ----------LOSS SAMPLE----------	-	SP	17.8	<--	NP	-->	-	-	-	-	-	-	-	>50/15 cm.	-	-	-	-	-	
A1-5	9.00-9.45	Very soft, clayey SILT, dark grey; little of fine sand, trace of medium sand.	-	MH	50.6	51.0	28.5	22.5	-	-	-	-	-	1.53	2.54	1	-	-	-	-	-	SUMMARY OF TEST DATA IN BORE HOLE
A1-6	9.70-10.15	Very dense medium to fine SAND, yellowish brown; trace of coarse sand. ----------LOSS SAMPLE----------	-	SP/SM	21.0	<--	NP	-->	-	-	-	-	-	-	-	>50/22 cm.	-	-	-	-	-	
	End of boring																					SOIL INVESTIGATION FOR: PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN PROJECT
																						BORING NO. A-1 STATION LOCATION PHUKET AIRPORT DATE START SEP. 21, 1992 DATE FINISH SEP. 21, 1992
																						Thai Engineering Consultants Co., Ltd. Bangkok Thailand

Sample No.	Depth m.	Description of Soil	Soil Classification		Natural Water Content %	Atterberg Limits %			Grain Size, Percent Finer %					Total Unit Weight t/m^3	Specific Gravity	Standard Penetration Blows/ft.	In - situ Vane Shear Strength t/m²		Pocket penetration meter t/m²	Unconfined Compressive Strength		Remark
			AASHTO	UNIFIED		LL	PL	PI	NO. 4	NO. 10	NO. 40	NO. 100	NO. 200				Undis-turbed	remolded		Qu t/m²	Ef %	
A2-1	1.70 – 2.15	Loose, fine to medium SAND, yellowish brown. ——————LOSS SAMPLE——————	–	SP/SM	31.6	<———	NP	———>	–	–	–	–	–	–	–	4	–	–	–	–	–	Ground water level= -0.10 m.
A2-2	3.70–4.15	Medium dense, fine to medium SAND, yellowish brown; trace of coarse sand.	–	SP/SM	22.8	<———	NP	———>	–	–	–	–	–	1.70	2.68	19	–	–	–	–	–	
A2-3	5.70–6.15	Loose to medium dense, medium SAND, yellowish brown; some of fine sand, trace of coarse sand.	–	SP/SM	22.3	<———	NP	———>	–	–	–	–	–	–	–	10	–	–	–	–	–	
A2-4	7.70–8.15	Loose, medium SAND, light grey; little of fine to coarse sand. ——————LOSS SAMPLE——————	–	SP/SM	28.8	<———	NP	———>	–	–	–	–	–	–	–	8	–	–	–	–	–	
A2-5	9.70–10.15	Dense, silty SAND, light grey; some of fine to medium sand, trace of coarse sand.	–	SM	27.9	34.4	28.5	5.9	100	96.0	70.6	53.2	44.0	2.24	2.70	33	–	–	–	–	–	SUMMARY OF TEST DATA IN SORE HOLE
	End of boring																					

SOIL INVESTIGATION FOR:
PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN PROJECT

BORING NO. A-2
STATION

LOCATION
PHUKET AIRPORT

DATE START SEP. 22, 1992

DATE FINISH SEP. 22, 1992

Thai Engineering Consultants Co.,Ltd.
Bangkok Thailand

Sample No.	Depth m.	Description of Soil	Soil Classification		Natural Water Content %	Atterberg Limits %			Grain Size, Percent Finer %					Total Unit Weight t/m^3	Specific Gravity	Standard Penetration Blows/ft.	In - situ Vane Shear Strength t/m²		Pocket penetration meter t/m²	Unconfined Compressive Strength		Remark
			AASHTO	UNIFIED		LL	PL	PI	NO. 4	NO. 10	NO. 40	NO. 100	NO. 200				Undisturbed	remoulded		Qu t/m²	Ef %	
A3-1	1.70-2.15	Very dense, medium SAND, yellowish brown; trace of fine to coarse sand. ——————LOSS SAMPLE——————	-	SP/SM	23.5	<——NP——>			-	-	-	-	-	-	-	>50/24 cm.	-	-	-	-	-	Ground water level= -2.00 m.
A3-2	3.70-4.15	Medium dense, medium SAND, yellowish brown; little of fine sand, trace of coarse sand. ——————LOSS SAMPLE——————	-	SP/SM	23.6	<——NP——>			-	-	-	-	-	-	-	13	-	-	-	-	-	
A3-3	5.70-6.15	Very dense, fine to medium SAND, yellowish brown. ——————LOSS SAMPLE——————	-	SP/SM	24.0	<——NP——>			-	-	-	-	-	-	-	>50/22 cm.	-	-	-	-	-	
A3-4	7.70-8.15	Medium, silty fine SAND, grey; little of medium sand, trace of coarse sand.	-	SM	37.0	<——NP——>			100	99.8	88.9	74.9	49.7	1.67	-	11	-	-	-	-	-	
A3-5	9.70-10.15	Dense, silty SAND, grey; some of fine, medium to coarse sand, trace of fine gravel.	-	SM	15.8	<——NP——>			-	-	-	-	-	2.03	2.67	37	-	-	-	-	-	SUMMARY OF TEST DATA IN BORE HOLE
	End of boring																					
																						SOIL INVESTIGATION FOR: PHUKET INTERNATIONAL AIRPORT DEVELOPMENT PLAN PROJECT.
																						BORING NO. A-3 STATION LOCATION PHUKET AIRPORT DATE START SEP. 24, 1992 DATE FINISH SEP. 24, 1992
																						Thai Engineering Consultants Co.,Ltd. Bangkok Thailand