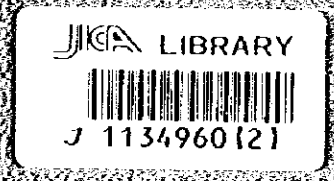


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
CIVIL AVIATION ADMINISTRATION OF VIETNAM

FEASIBILITY STUDY
ON
NEW DEVELOPMENT PLAN
OF
HANOI INTERNATIONAL AIRPORT
IN
THE SOCIALIST REPUBLIC OF VIETNAM

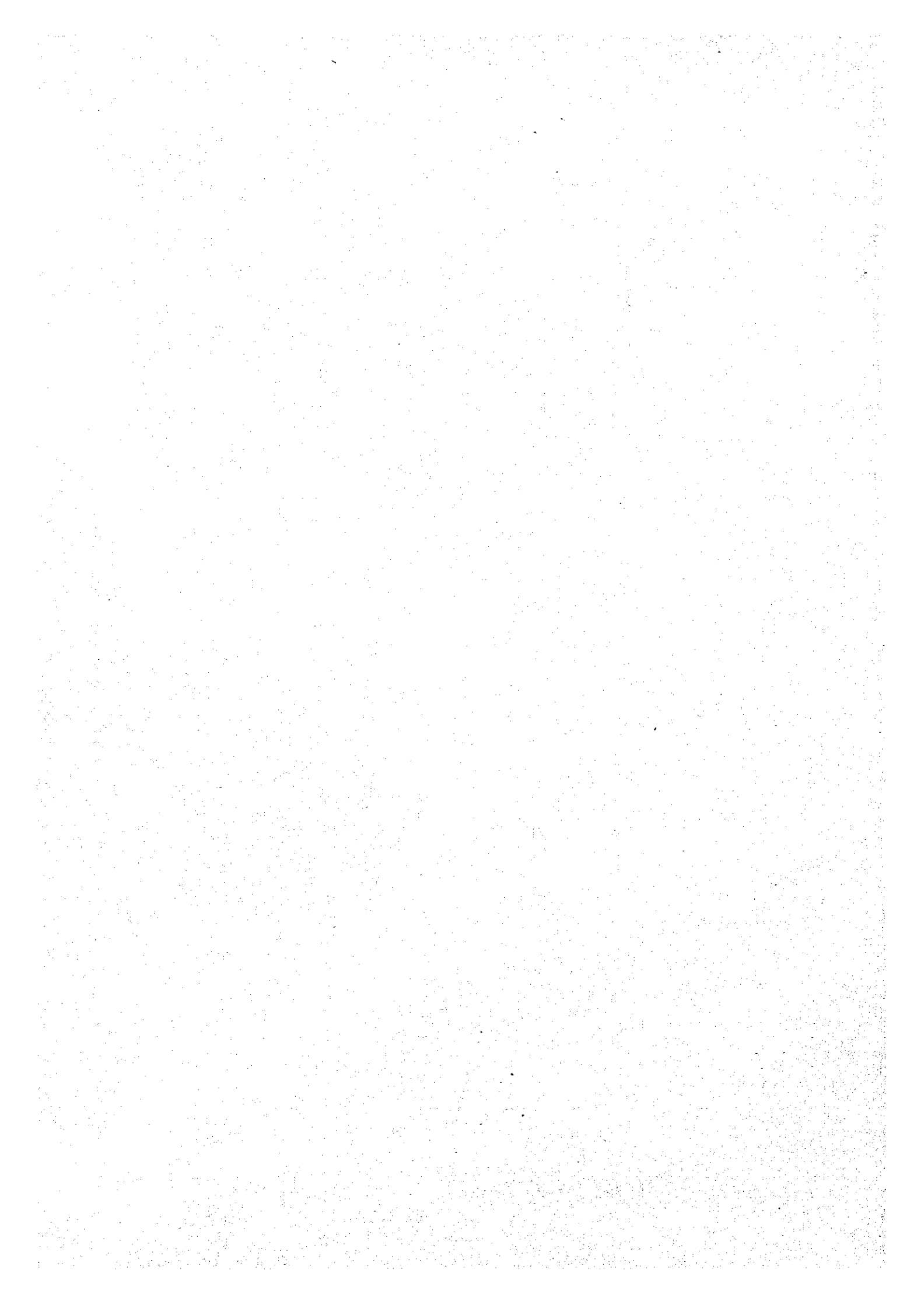
FINAL REPORT
Volume I: SUMMARY

March 1997



PACIFIC CONSULTANTS INTERNATIONAL
TOKYO, JAPAN

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1134960 (2)

NOTE

The following exchange rate was adopted throughout this report:

US\$ 1.00 = VND 11,000 = Yen 100 (August 1995)

VND 110 = Yen 1

PREFACE

In response to a request from the Government of the Socialist Republic of Viet Nam, the Government of Japan decided to conduct a study on the New Development Plan of Hanoi International Airport and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Vietnam a study team headed by Mr. Hideki Murata of Pacific Consultants International four times between March 1995 and October 1996.

The team held discussions with the officials concerned of the Government of Vietnam, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

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 Vietnam for their close cooperation extended to the team.

March 1997



Kimio Fujita

President

Japan International Cooperation Agency

March 1997

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Fujita

Letter of Transmittal

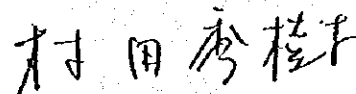
We are pleased to submit to you the final report on the New Development Plan of Hanoi International Airport in the Socialist Republic of Vietnam. The report contains the advice and suggestions of the authorities concerned of the Government of Japan and your Agency as well as the formulation of the above-mentioned project.

The report presents a new development plan for Hanoi International Airport at the southern area to the existing airport. In accordance with the Scope of Work, this study does not include the scheme to develop the northern area (the existing airport side) although it was considered to be a possible option. The study results indicate that the project is technically, financially (with some increase of airport charges) and economically feasible. With regard to the environmental feasibility, appropriate mitigation measures, including residents resettlement programme, are considered necessary.

As a conclusion, it can be said that the new development of the southern area of Hanoi International Airport for international services is a viable option to cope with anticipated traffic demand to the year 2010, and to ensure a reliable gateway to Hanoi and northern Vietnam. However, we recommend first to complete, as soon as possible, the current development projects which were considered as the existing facilities in the study.

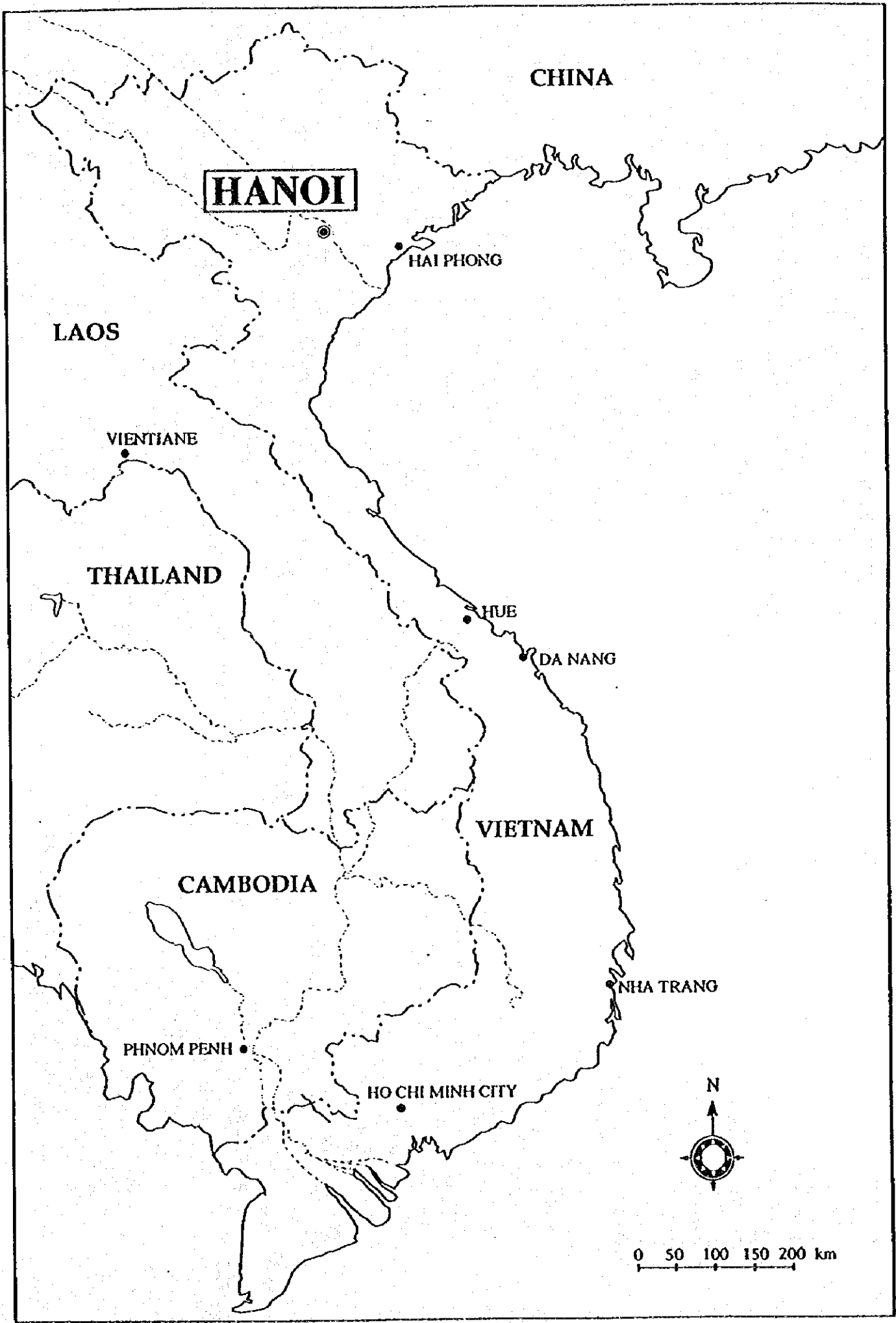
We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs, the Ministry of Transport and the Overseas Economic Cooperation Fund of Japan. We also wish to express our deep gratitude to the Civil Aviation Administration of Vietnam and other authorities concerned of the Socialist Republic of Vietnam for the close cooperation and assistance extended to us during our study.

Very truly yours,



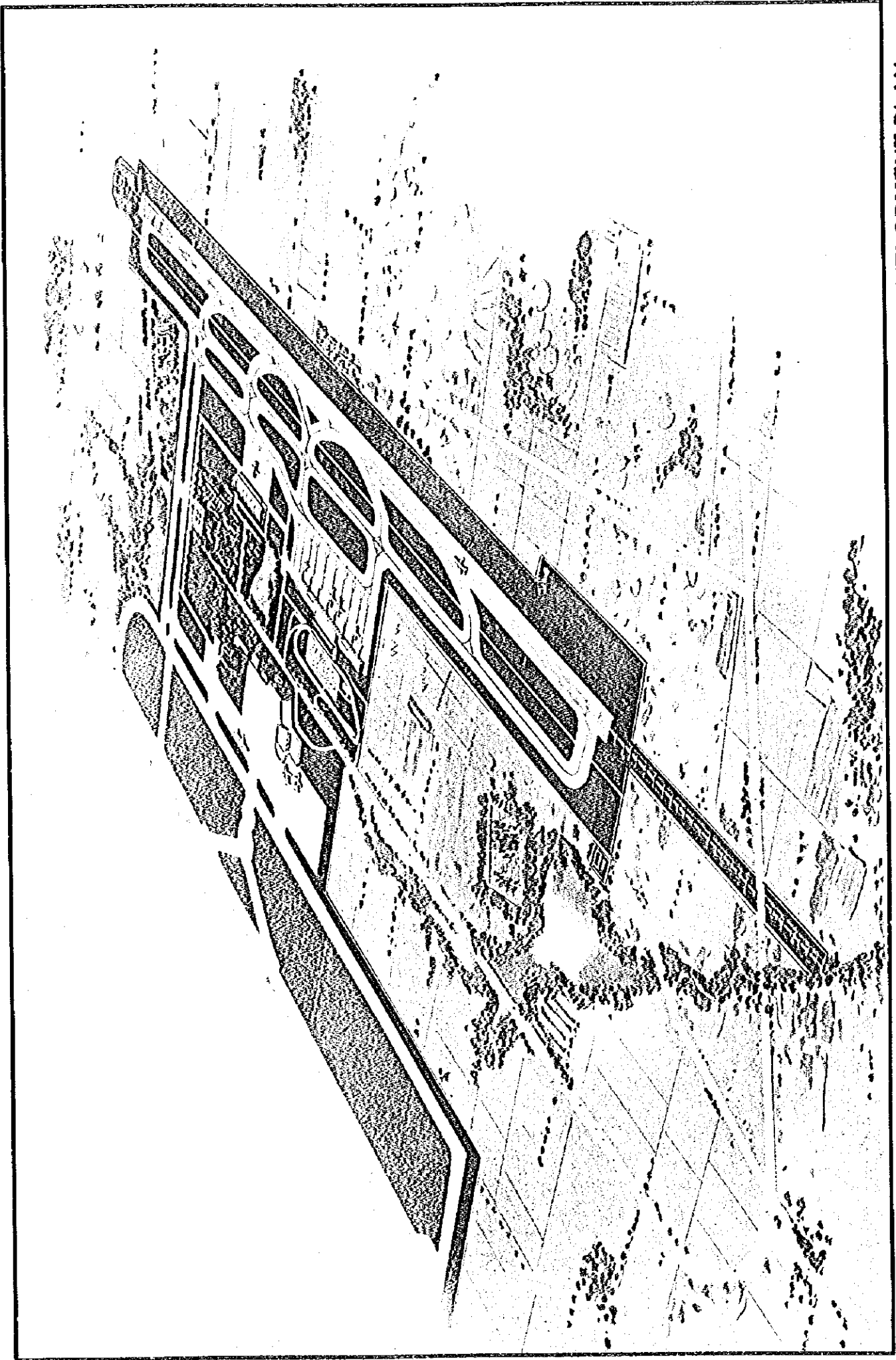
Hideki Murata
Team Leader

Study Team for the Feasibility Study on
New Development Plan of Hanoi International Airport

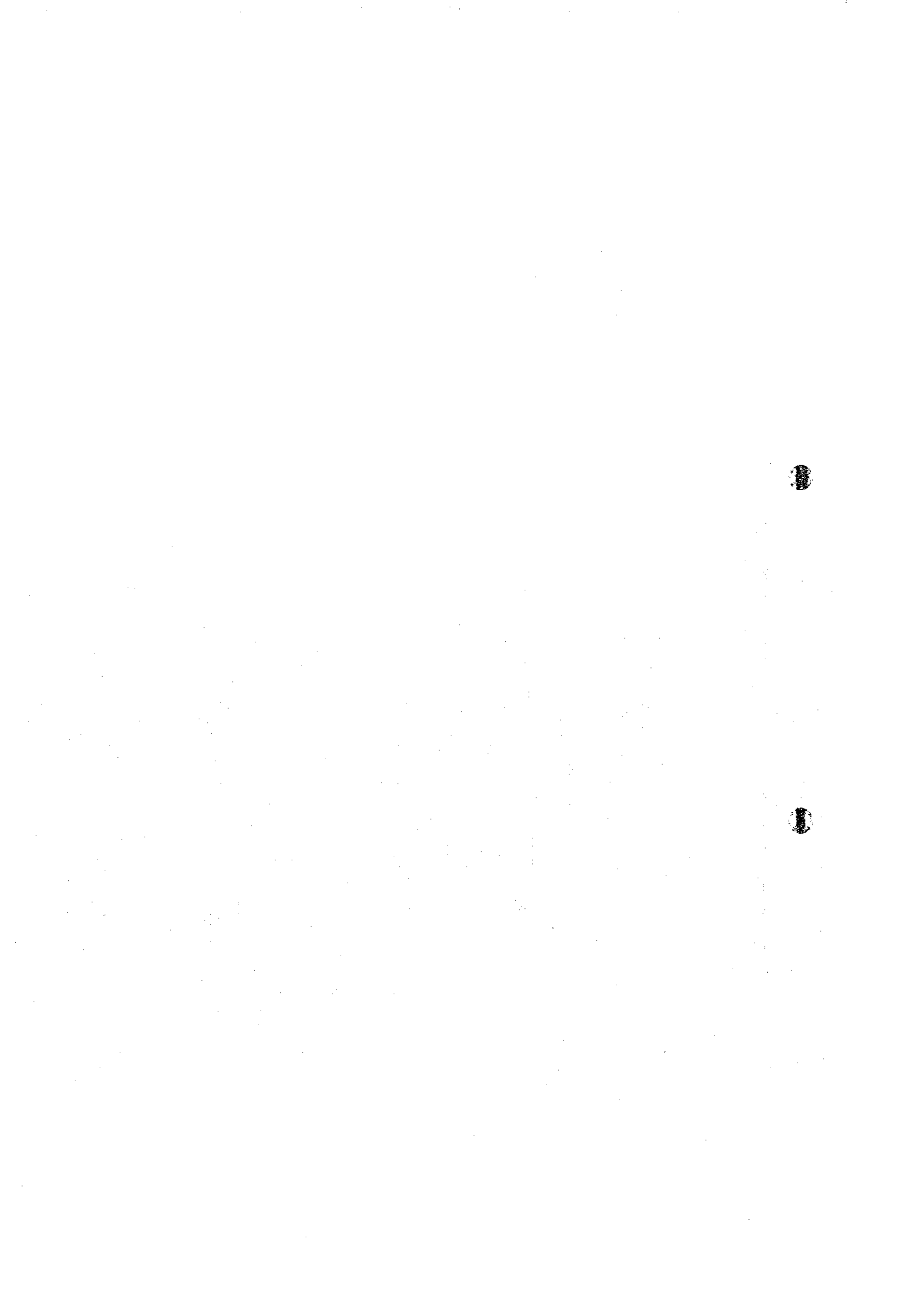


PROJECT LOCATION MAP





NEW DEVELOPMENT PLAN OF HANOI INTERNATIONAL AIRPORT - MEDIUM TERM DEVELOPMENT PLAN



**FEASIBILITY STUDY
ON
NEW DEVELOPMENT PLAN OF HANOI INTERNATIONAL AIRPORT
IN
THE SOCIALIST REPUBLIC OF VIET NAM**

EXECUTIVE SUMMARY

1. OUTLINE OF THE PROJECT

1) Objective

The current development projects at Hanoi/Noi Bai International Airport are capable of accommodating anticipated air traffic demand to the year 2005. The Project is intended to develop the southern area of the existing airport to accommodate air traffic demand after the year 2005. It must be noted that further development of the existing airport facilities was not included in this study, although it was considered to be a possible option of the development of the airport as a whole.

2) Design Target Year

Medium Term Development Plan	Year 2010
Long Term Development Plan	Year 2015

3) Future Air Traffic Demand

Annual Traffic	Actual (in 1994)	Forecast			
		2000	2005	2010	2015
1. Passengers					
Domestic	711,997	2,126,000	3,411,000	5,183,000	7,243,000
International	370,307	1,141,000	2,047,000	3,337,000	4,981,000
Total	1,082,304	3,267,000	5,458,000	8,520,000	12,224,000
2. Cargo (tons)					
Domestic	10,374	42,900	73,100	116,600	171,600
International	10,884	19,700	43,600	85,800	150,800
Total	21,258	62,600	116,700	202,400	322,400
3. Aircraft Movements					
Domestic	7,642	17,980	25,260	34,040	42,180
International	6,188	9,430	15,790	23,520	31,610
Others	6,000	6,000	6,000	6,000	6,000
Total	19,830	33,410	47,050	63,560	79,790

4) Long Term Development Plan

The proposed development plan incorporates the following major features:

- a) construction of new airport facilities for international services in an area south of the

existing airport;

- b) utilization of the existing airport facilities for domestic services;
- c) location of the new runway 1,850m to the south of and parallel with the existing runway; and
- d) dual taxiways connecting the existing and new airport facilities on the eastern side.

5) **Scope of the Medium Term Development Project**

- a) Construction of a new 3,600m x 45m runway and associated taxiway system.
- b) Construction of a new international passenger terminal, and conversion of the passenger terminal T1 to the domestic terminal.
- c) Construction of a new international cargo terminal.
- d) Installation of air navigation systems for the new runway and taxiways.
- e) Construction of power supply, telephone, water supply, sewerage, solid waste disposal and aviation fuel supply systems.
- f) Procurement of fire fighting vehicles and airport maintenance equipment.

6) **Project Implementation Schedule**

- Land Acquisition and Compensation: by March 2001
- Foreign Financing Arrangements: from July 1997 to March 1998
- Selection of Consultants: from April 1998 to September 1998
- Preparation of Design: from October 1998 to March 2000
- Tender Documentation and Approval: from April 2000 to June 2000
- Selection of Contractor: from July 2000 to June 2001
- Construction Period: from July 2001 to June 2005
- Facility Tenants' Preparation Period: from April 2005 to December 2005
- Inauguration: January 2006

2. **COST OF THE PROJECT**

	Local Portion	Foreign Portion	Total
Land Acquisition and Compensation	US\$28,464,000	US\$0	US\$28,464,000
Construction Cost	US\$89,181,000	US\$296,749,000	US\$385,930,000
Consultancy Services	US\$3,855,000	US\$34,751,000	US\$38,606,000
Total	US\$121,500,000	US\$331,500,000	US\$453,000,000

Note: At 1995 price, exchange rates US\$1.00 = VND11,000 = Yen100, include about 10% contingency.

3. FEASIBILITY OF THE PROJECT

1) Financial Feasibility

The Project will be financially feasible if a soft loan with 2.3% interest rate and a state subsidy equal to 15% of total project cost are available.

Financial Internal Rate of Return : 3.1%

2) Economic Feasibility

The Project is considered feasible in terms of benefits to the national economy since the Economic Internal Rate of Returns is much greater than the 'opportunity cost of capital' of 12% used by the World Bank.

Economic Internal Rate of Return : 19.5%

Net Present Value (at 12% discount rate): US\$ 186 million

3) Environmental Feasibility

The Project will be viable if proper mitigation measures are applied during the implementation of the Project. Special attention should be given to the impact by resettlement and aircraft noise.

4. CONCLUSION AND RECOMMENDATIONS

1) Conclusion

As a result of the Study of the new development of the southern area of Hanoi International Airport for the international service, it can be concluded that proposed Medium Term Development Plan is a viable option to cope with anticipated traffic demand up to the year 2010. This will ensure a reliable gateway to the capital city of Hanoi and to northern Vietnam.

2) Recommendations

- a) Complete the current development projects (such as construction of new passenger terminal T1 and control tower, and extension of parallel taxiway and apron A1 in the existing airport area) as soon as possible in order to cope with the increasing traffic demand.
- b) Approve the Medium Term Development Plan by the Government of Vietnam, and designate the CAAV as the executing agency for the development.

- c) Provide sufficient project information, at appropriate times, to the organizations concerned, including the; State Planning Committee; Ministry of Science, Technology and Environment; Ministry of Defence; Ministry of Finance; and the Hanoi People's Committee.
- d) Initiate local financing arrangements as soon as possible to allow enough time for a peaceful resettlement of the residents.
- e) Prepare, as soon as possible, a detailed resettlement program including method of public hearing, planning of resettlement site, job training, time schedule, budgeting, etc.
- f) Establish proper environmental protection and monitoring systems for the development.
- g) Implement the modernization and upgrading of air navigation systems, including replacement of the ILS, installation of a SALS and a PAPI for Runway 29, and installation of a ASR/SSR, before the year 2000 to improve the safety of operation and increase the capacity of the runway.
- h) Implement, as soon as possible, a comprehensive managerial and organizational restructuring at Hanoi International Airport to both improve levels of service and achieve financial self-sufficiency.

TABLE OF CONTENTS

Project Location Map

Chapter 1	Background and Objectives of the Study	1
Chapter 2	Future Air Traffic Demand and Problems of the Existing Airport	
2.1	Outline of the Existing Airport	2
2.2	Air Traffic Demand Forecast	2
2.3	Airport Facility Requirements	5
2.4	Evaluation of the Existing Airport Facilities	7
Chapter 3	Formulation of Long Term Development Plan	
3.1	Prerequisites for Long Term Development Planning	9
3.2	Selected Long Term Development Plan	10
3.3	Scope of Medium Term Development Project	14
Chapter 4	Feasibility Study on the Medium Term Development Project	
4.1	Planning and Preliminary Design	15
4.2	Environmental Impact Assessment	17
4.3	Planning of Management, Operation and Training	19
4.4	Planning of Airspace Use	20
4.5	Cost Estimates	20
4.6	Financial and Economic Analyses	21
4.7	Project Implementation Plan	24
Chapter 5	Conclusion and Recommendations	25
5.1	Conclusion	25
5.2	Recommendations	25

CHAPTER 1 BACKGROUND AND OBJECTIVES OF THE STUDY

The Socialist Republic of Viet Nam is situated on the eastern seaboard of the Indochinese Peninsular, and bordered by China to the North, and by Laos and Cambodia to the West. Its total land area is about 331,000 sq. km, and population was 71 million in 1993.

The economy of Vietnam has grown rapidly due to the transformation to a market economy under the "Doi Moi" policy formally initiated in 1986. It is expected to grow further as foreign investment to the country has been increasing since the lifting of the trade embargo by United States in February 1994. Air transport demand has increased at the same time. The number of passengers handled at Hanoi/Noi Bai International Airport increased by about 35% per annum during 1991-1993.

The development of infrastructures in Vietnam, however, is generally in the early stages, and efforts have been made to cope with the air transport demand at Hanoi International Airport. As Hanoi International Airport is one of two gateways to the country along with Ho Chi Minh City/Tan Son Nhat International Airport, improvements in the operation, safety and reliability of the Airport is indispensable for the economic development of not only Hanoi but also northern Vietnam. The New Development of Hanoi International Airport is, therefore, considered to be one of the most important projects for the balanced growth of Northern and Southern Vietnam and the social stability of the whole country.

Under these circumstances, the Government of Vietnam decided to develop Hanoi International Airport and approved a master plan which included development of a second runway in an area south of the existing airport in April 1994. In order to realize this master plan, the Government of Vietnam requested the Government of Japan to conduct a study on the New Development Plan of Hanoi International Airport. In response to this request, the Government of Japan decided to conduct the Feasibility Study on the New Development Plan of Hanoi International Airport. Based on this decision, the Japan International Cooperation Agency, which is responsible for the implementation of the technical cooperation programs of the Government of Japan, was entrusted to undertake the Study in close coordination with the Government of Vietnam.

The objectives of the Study, as agreed to between the two parties, are as follows:

- a) To formulate a comprehensive development plan of the Airport for the year 2015.
- b) To conduct a feasibility study for the year 2010.

CHAPTER 2 FUTURE AIR TRAFFIC DEMAND AND PROBLEMS OF THE EXISTING AIRPORT

2.1 Outline of the Existing Airport

Hanoi/Noi Bai International Airport (herein after referred to as NBIA) is located some 20 km north of Hanoi, the capital of Vietnam. The NBIA now consists of a 3,200 m long runway, taxiways, aprons, passenger terminal buildings, and other supporting facilities. Figure 1 shows the existing airport layout. The NBIA is currently used by civil and military aviation. The two operations are reasonably segregated, the civil area being to the south of the runway and the military area to the north. The civil area is managed by the Civil Aviation Administration of Vietnam through its Northern Airports Region.

In order to cope with the increasing demand, the following development projects are being implemented at the Airport.

- a) Construction of the western half of the parallel taxiway
- b) Expansion of a passenger loading apron - A1
- c) Construction of a new control tower
- d) Construction of a new aircraft maintenance hangar
- e) Construction of a new passenger terminal - T1

These projects are, in principle, being executed in accordance with the Master Plan approved by the Government of Vietnam in April 1994.

2.2 Air Traffic Demand Forecast

Based on the analysis of air traffic records of Vietnam and its neighbouring countries, future air traffic demand, which is principal planning factor for airport facilities, has been forecast up to the year 2015. Due to the significant changes in the economy and air transport sub-sector of Vietnam in recent years, conventional approaches to the air traffic demand forecast, i.e. time-series trend analysis, econometric modelling and factor analysis, were not suitable for the Study. Annual passenger throughputs and cargo volumes for all of Vietnam were forecast based on the anticipated growth rates of the Gross Domestic Product of Vietnam and the relative elasticity of demand for air transport which were determined from past experiences of other countries. The relations between air passenger traffic and Gross Domestic Products in selected countries are shown in Figures 2 and 3.

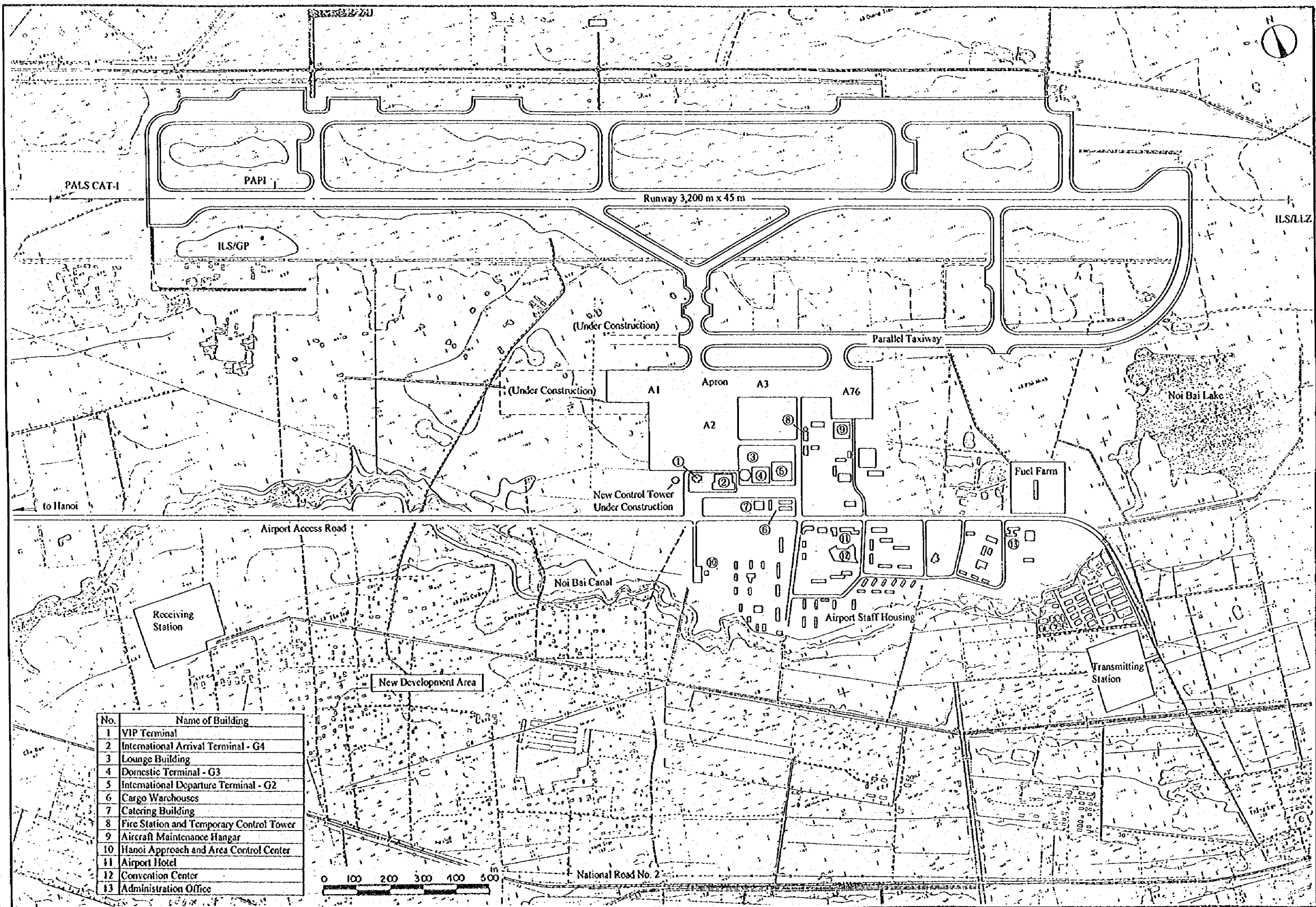
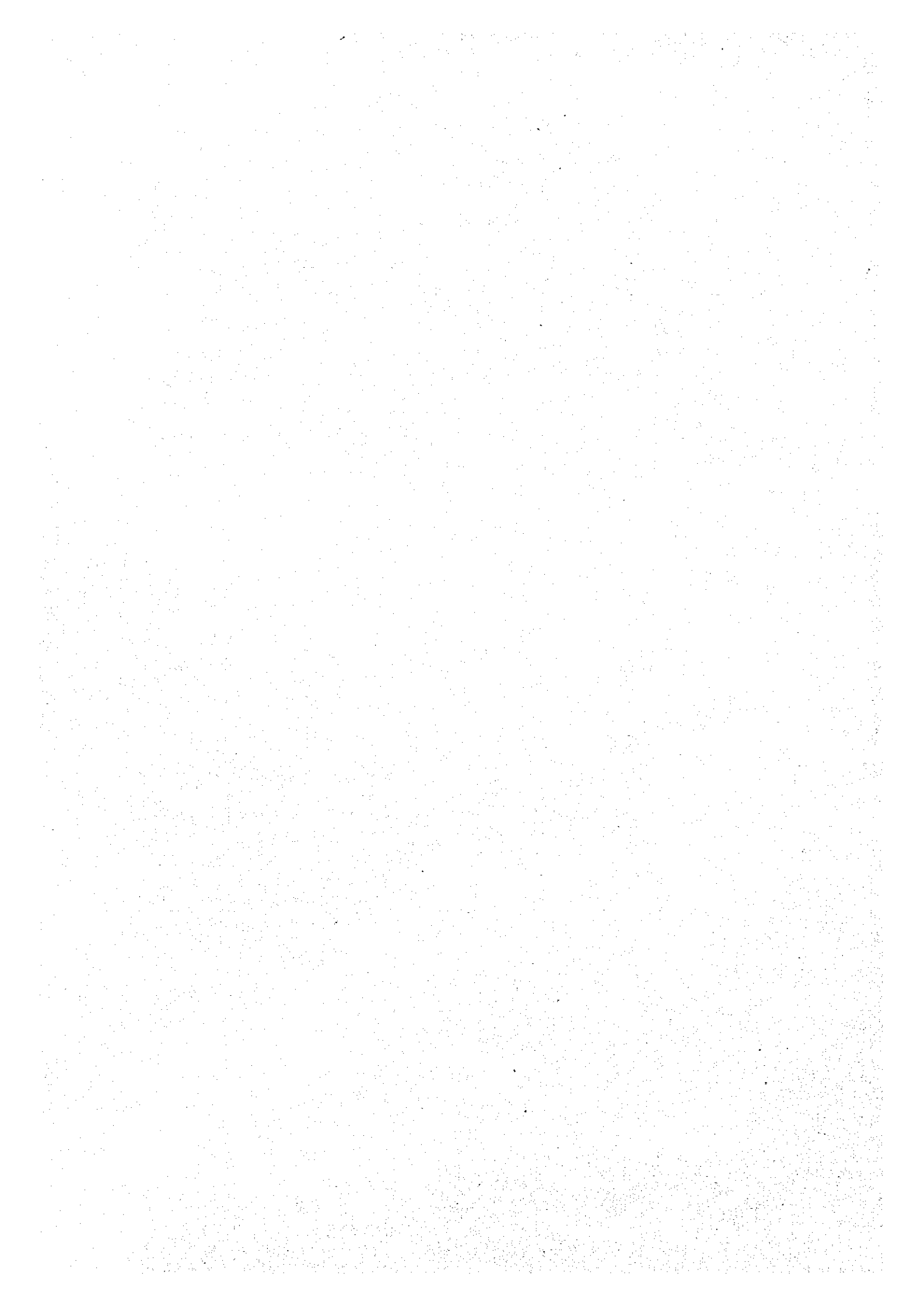


Figure 1 Existing Airport Layout Plan



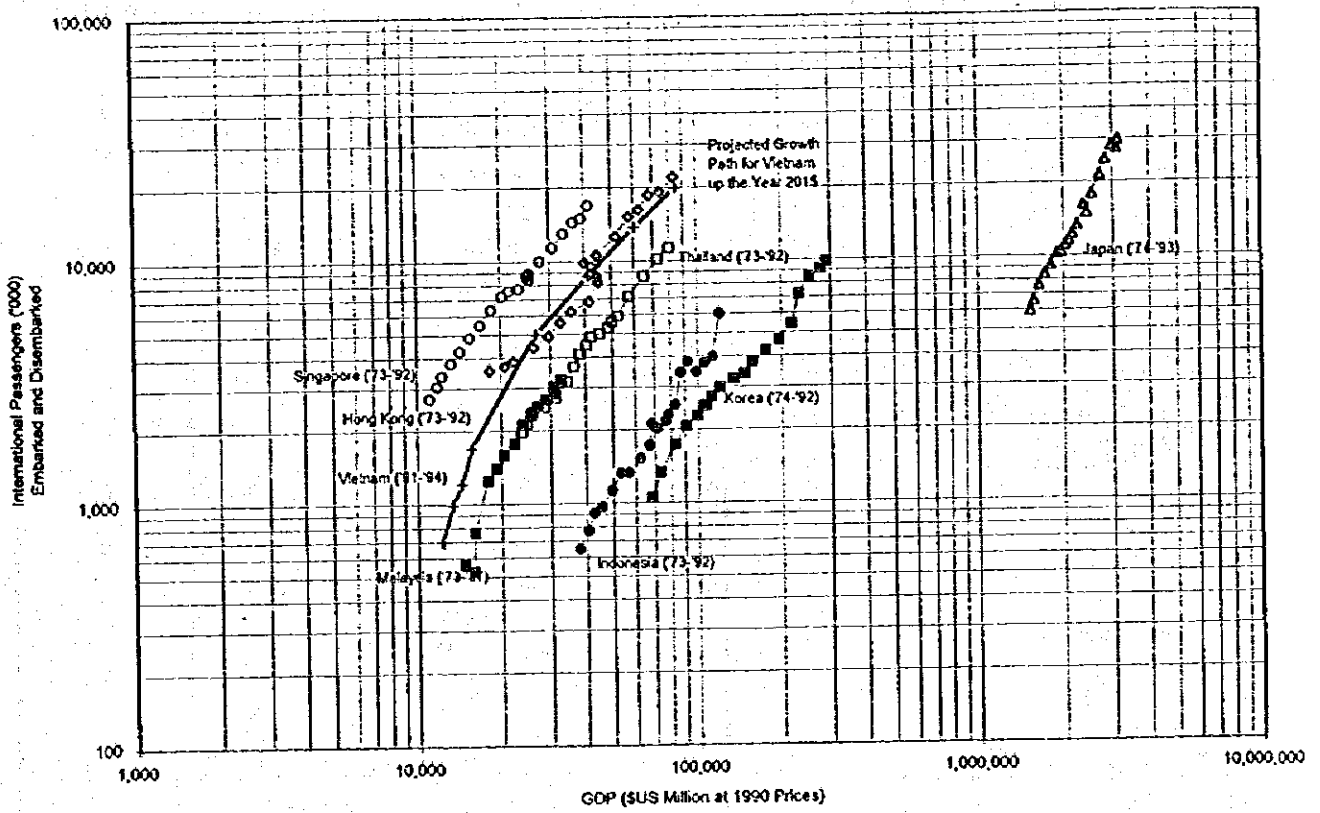


Figure 2 International Passenger Traffic vs. GDP

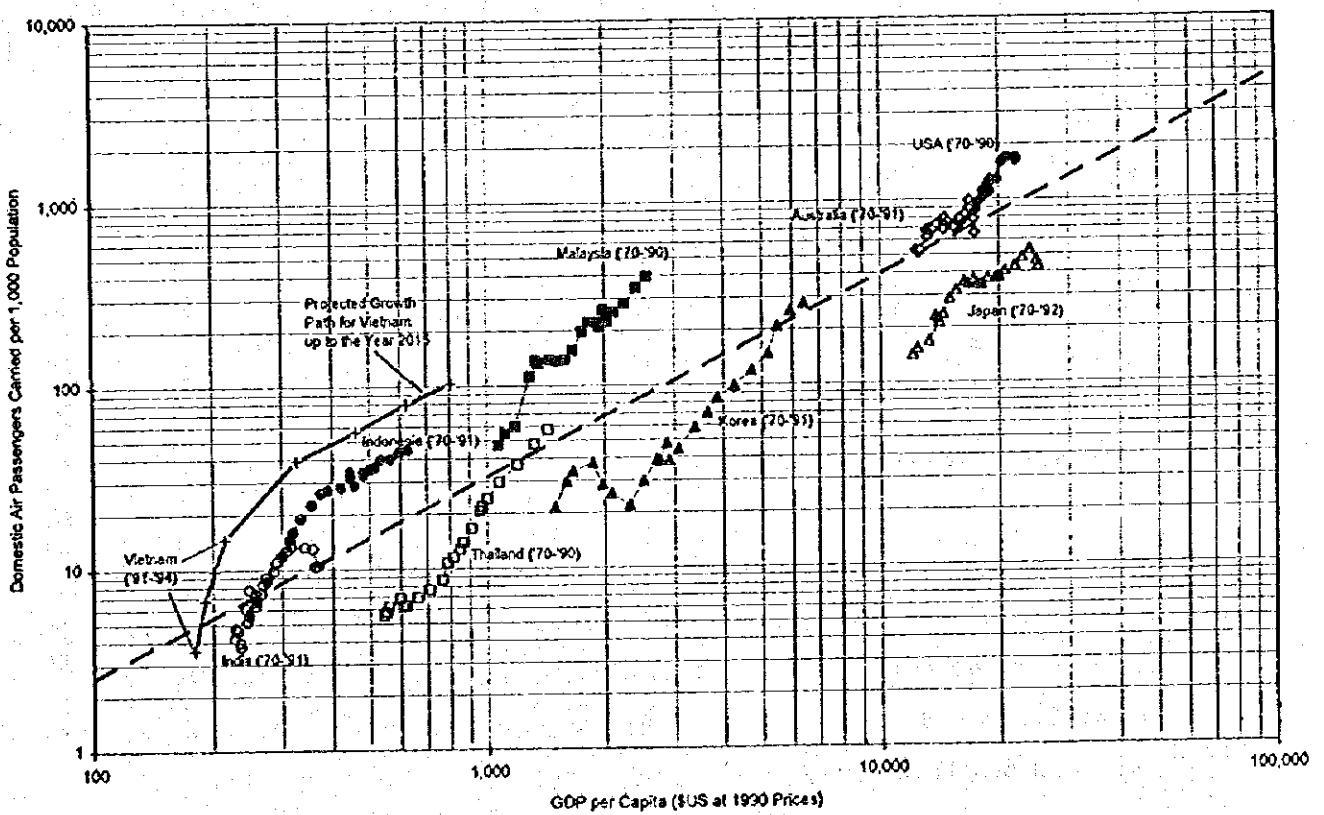


Figure 3 Domestic Passenger Traffic per 1,000 Population vs. GDP per Capita

Air traffic at Hanoi International Airport was estimated as a share of that for the whole Vietnam taking into account the future estimates of the Gross Domestic Products of the north, central and south regions. The results of the forecasts for Hanoi International Airport, including design day and peak hour forecasts, are summarized in Table 1.

Table 1 Results of Air Traffic Demand Forecast for Hanoi International Airport

Item	Present Condition as of 1994	Forecast (Medium Projection)			
		2000	2005	2010	2015
1. Annual Passengers					
Domestic	711,997	2,126,000	3,411,000	5,183,000	7,243,000
International	370,307	1,141,000	2,047,000	3,337,000	4,981,000
Total	1,082,304	3,267,000	5,458,000	8,520,000	12,224,000
2. Annual Cargo (tons)					
Domestic	10,374	42,900	73,100	116,600	171,600
International	10,884	19,700	43,600	85,800	150,800
Total	21,258	62,600	116,700	202,400	322,400
3. Annual Aircraft Movements					
Domestic	7,642	17,980	25,260	34,040	42,180
International	6,188	9,430	15,790	23,520	31,610
Others (assumed number)	6,000	6,000	6,000	6,000	6,000
Total	19,830	33,410	47,050	63,560	79,790
4. Design Day Passengers					
Domestic	n.a.	7,340	11,790	17,910	25,030
International		3,950	7,070	11,530	17,210
Overall		11,290	18,860	29,440	42,240
5. Design Day Aircraft Movements					
Domestic		58	81	110	136
International	n.a.	30	51	76	102
Others (assumed number)		n.a.	n.a.	n.a.	n.a.
Total		88	132	186	238
6. Peak Hour Passengers (2 ways)					
Domestic	470	1,100	1,680	2,370	3,010
International	510	930	1,300	1,830	2,500
Overall	840	1,730	2,530	3,570	4,680
7. Peak Hour Passengers (1 ways)					
Domestic	470	740	1,120	1,590	2,010
International	510	620	870	1,230	1,680
Overall	840	1,160	1,690	2,400	3,140
8. Peak Hour Aircraft Movements (2 ways)					
Domestic	3	8.2	10.9	13.6	15.3
International	2	6.7	8.8	11.3	13.9
Overall Commercial	4	12.7	16.7	21.2	24.8
Others (assumed number)	1	1	1	1	1
Total	6	15	19	24	27
9. Largest Aircraft	B747	B747	B747	B747	B747

Note: n.a.; Not Available

2.3 Airport Facility Requirements

Future airport facility requirements, as shown in Table 2, were established based on the air traffic demand forecasts. These comply with the standards and recommended practices of the International Civil Aviation Organization. If there was no available standard and recommendation of the International Civil Aviation Organization, the standards and recommendations of the International Air Transport Association, Federal Aviation Administration of USA and Civil Aviation Bureau of Japan were used.

Table 2 Future Airport Facility Requirements

Item	Present Condition as of 1994	Future Requirements			
		2000	2005	2010	2015
1. Aerodrome Reference Code	4E	4E	4E	4E	4E
2. Runway Number Length Width	1 3,200 m 45 m	1 3,600 m 45 m	2 3,600 m 45 m	2 3,600 m 45 m	2 3,600 m 45 m
3. Runway Strip Length Width	3,320 m 300 m	3,720 m 300 m	3,720 m 300 m	3,720 m 300 m	3,720 m 300 m
4. Taxiway System Width	Partial Parallel Taxiway 23 m	Full Parallel Taxiway 23 m	Full Parallel Taxiway 23 m	Full Parallel Taxiway 23 m	Full Parallel Taxiway & Holding Bays 23 m
5. Passenger Loading Apron Domestic International	JJ : 1 LJMJ : 6 SJ/TP : 10 Total : 17	JJ : 0 LJ : 3 MJ : 0 SJ : 2 TP : 1 Total : 6 JJ : 2 LJ : 1 MJ : 1 SJ : 2 TP : 1 Total : 7	JJ : 2 LJ : 2 MJ : 1 SJ : 1 TP : 1 Total : 7 JJ : 3 LJ : 1 MJ : 1 SJ : 3 TP : 1 Total : 9	JJ : 3 LJ : 3 MJ : 1 SJ : 1 TP : 1 Total : 9 JJ : 4 LJ : 2 MJ : 1 SJ : 3 TP : 1 Total : 11	JJ : 4 LJ : 3 MJ : 2 SJ : 0 TP : 1 Total : 10 JJ : 5 LJ : 5 MJ : 1 SJ : 2 TP : 1 Total : 14
6. Passenger Terminal Building Domestic International	total 8,570 m ²	16,500 m ² 23,300 m ²	25,200 m ² 32,500 m ²	35,600 m ² 45,800 m ²	45,200 m ² 62,550 m ²
7. Cargo Terminal Building Domestic International	total 1,900 m ²	2,900 m ² 2,800 m ²	4,800 m ² 6,200 m ²	7,800 m ² 12,300 m ²	11,400 m ² 21,500 m ²
8. Administration Building	m ²	2,800 m ²	2,800 m ²	2,800 m ²	2,800 m ²
9. Access Road	4 lanes	2 lanes	4 lanes	4 lanes	4 lanes
10. Car Park Domestic International	total approx. 14,000 m ²	15,400 m ² 13,000 m ²	23,500 m ² 18,200 m ²	33,300 m ² 25,600 m ²	42,000 m ² 35,000 m ²
11. Air Navigation Systems	Precision Category I	Precision Category II	Precision Category II	Precision Category II	Precision Category II
12. Public Utilities Power Supply Water Supply Sewage Disposal Solid waste Disposal Telephone Trunk Line	1,260 kVA 3,000 t/day n.a. n.a.	5,000 kVA 1,000 t/day 1,000 t/day 4.2 t/day 31 lines	7,100 kVA 1,400 t/day 1,400 t/day 6.2 t/day 43 lines	10,000 kVA 2,000 t/day 2,000 t/day 9.2 t/day 59 lines	13,400 kVA 2,500 t/day 2,500 t/day 13.0 t/day 79 lines
13. Rescue and Fire Fighting Category Fire Vehicles Fire Station	Category 8 3 approx. 200 m ²	Category 8 3 600 m ²	Category 9 3 600 m ²	Category 9 3 600 m ²	Category 9 3 600 m ²
14. Fuel Supply Facility Tank Capacity Fuel Farm	8,000 kl approx. 60,000 m ²	3,800 kl 10,400 m ²	7,800 kl 21,000 m ²	13,600 kl 27,000 m ²	21,400 kl 33,000 m ²

Note: JJ (Jumbo Jet); B747, B777, A340, A330 class
LJ (Large Jet); MD11, L-1011, B767-300, A300 class
MJ (Medium Jet); B767-200, A310 class
SJ (Small Jet); A320, B737 class
TP (Turbo Prop); ATR72, Tul 54 class
n.a.; Not Available

2.4 Evaluation of the Existing Airport Facilities

The condition, including capacity, of the existing facilities and current projects at Hanoi International Airport were evaluated against future facility requirements to identify the problem areas. The results of the evaluation are summarized in Figure 4.

The major problem areas of the airport facilities, even after completion of the current projects, are as follows:

- a) The length of the existing runway is insufficient for operating a B747 aircraft at the maximum take-off weight. Payload restriction, intermediate stopover or combination of both would be required for long haul flights. Construction of the second runway can be justified economically by the anticipated aircraft movements in the year 2005, but it is not essential to meet capacity requirements, even in the year 2015.
- b) Current peak hour traffic exceeds the capacity of the existing passenger terminal building. After the completion of Passenger Terminal T1, the handling capacity will increase, but the passenger terminal will become saturated again before 2005.
- c) There is no proper cargo terminal on the boundary of the airside and landside areas. The existing passenger terminal buildings will be converted to a cargo terminal after the completion of T1, and they will become saturated before 2005.
- d) Improvements to air navigation systems are required such as: replacement of old equipment, provision of automatic monitoring systems, provision of an approach lighting system and visual approach slope indicator system for Runway 29, and installation of ATC radars for approach control.
- e) The capacities of utilities needs to increase in line with traffic levels including the: electric power supply, telephone, sewerage and aviation fuel supply systems.

Figure 4 Result of Evaluation of the Existing Airport Facilities

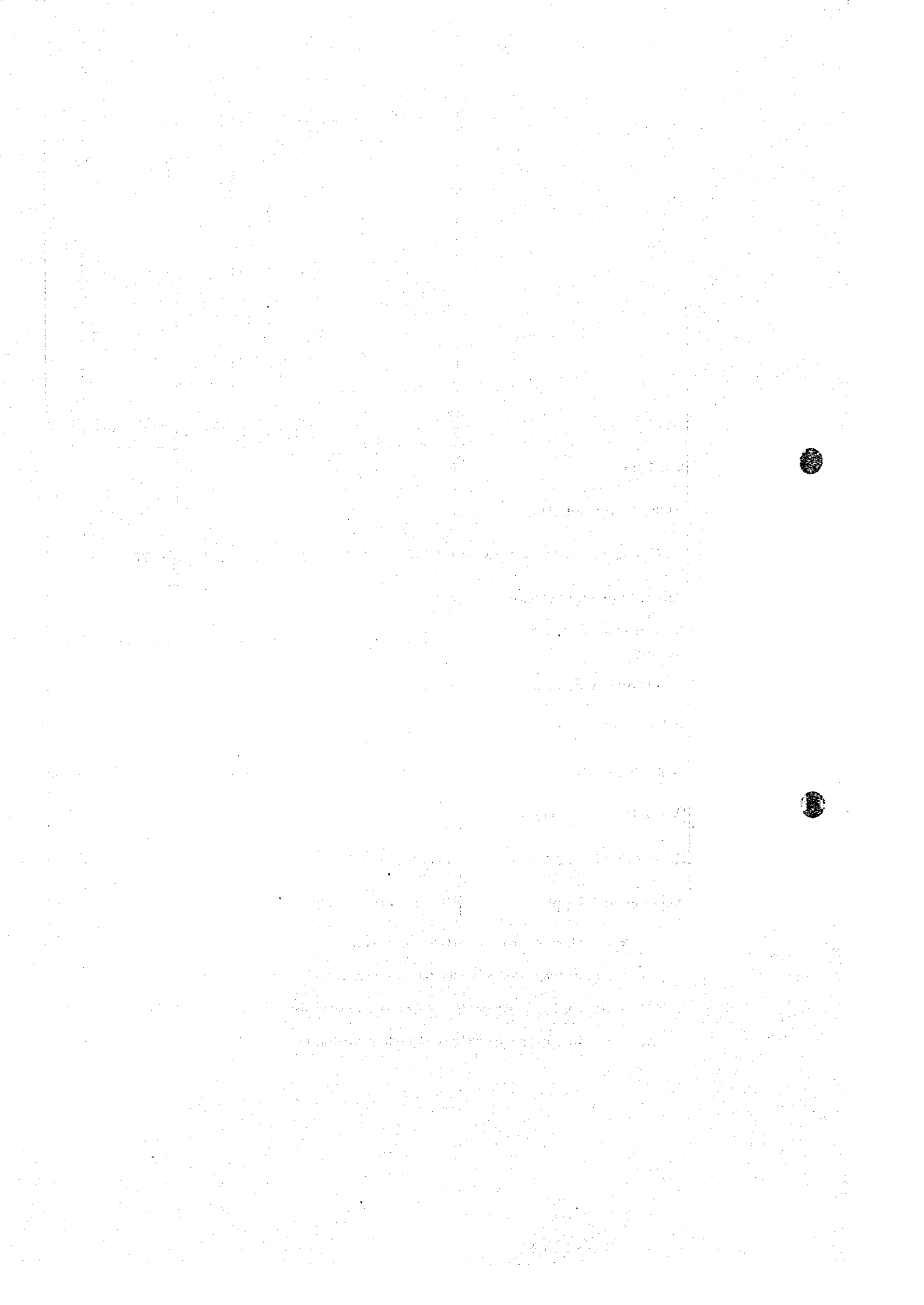
Facility \ Year	2000	2005	2010	2015
Runway	▨			
Taxiway	▨			
Apron	▨			
Passenger Terminal Building	X	▨		
Cargo Terminal Building	X	▨		
Access Road	▨			
Car Park	X			
Radio Navigation Aids	X			
ATC & Communication System	X	▨		
Airfield Lighting System	X			
Meteorological Observation System	X	▨		
Power Supply System	▨			
Telephone System	▨			
Water Supply System	▨			
Waste Disposal System	X			
Rescue & Fire Fighting	▨			
Aviation Fuel Supply	▨			

X : Demand already exceeds the existing capacity.

▨ : Existing capacity is sufficient for accomodating the anticipated demand.

▨ : Existing facility is sufficient for accomodating the anticipated demand with some restriction.

▨ : On going project will meet the anticipated demand.



CHAPTER 3 FORMULATION OF LONG TERM DEVELOPMENT PLAN

3.1 Prerequisites for Long Term Development Planning

On the basis of the Terms of Reference, the Master Plan for Development of Hanoi International Airport and discussions with the Vietnamese Counterparts, the following parameters were identified for developing the long term development plan.

- a) Joint use of the existing runway by civil and military aircraft will remain unchanged for some time to come.
- b) Civil facilities are located in the area south of the existing runway, and military facilities are in the area to the north. This zoning will remain unchanged.
- c) The area to the south of the existing airport shall be developed mainly for international services.
- d) The second runway, if it is constructed, shall be in parallel with the existing runway with sufficient separation distance for independent operations under the Instrument Flight Rules (open parallel runways).
- e) Current development projects, i.e. extension of the parallel taxiway, expansion of the apron A1 and construction of the new control tower, new aircraft maintenance hangar and new passenger terminal T1, are expected to be completed by 1997, and are outside of the scope of the new development plan, for which this Feasibility Study has been conducted.

It should be noted that further development of the existing airport facilities at the north side of the airport access road was not included in this Study, although it was considered to be a possible option of the development of the Hanoi International Airport as shown in the Master Plan. This is in accordance with the statement in the Scope of Work agreed between the CAAV and JICA, i.e. "the Study shall be conducted solely for the civil aviation purpose".

The target years for phased development appear in Table 3 and were established taking account of the airport capacity after the completion of the current development projects (especially construction of T1) and period for implementation of the Medium Term Development. The target years for facility sizing were set at five years after the completion of the development so that major expansion and/or renovation will not be necessary for at least several years after completion.

Table 3 Target Years of Developments

	Inauguration of New Facility	Sizing of Facility
Medium Term Development	2005	2010
Long Term Development	2010	2015

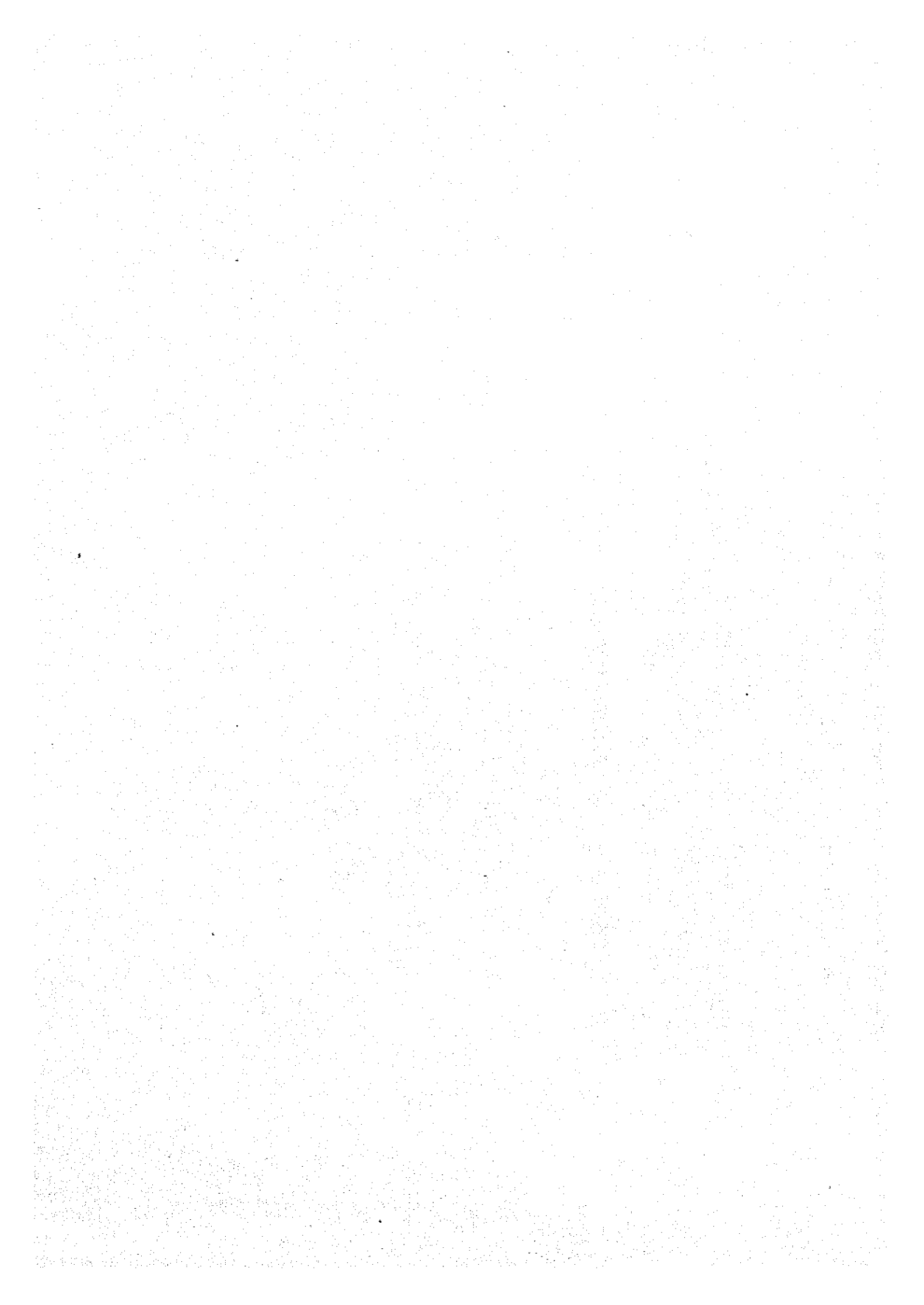
3.2 Selected Long Term Development Plan

A long term development plan was selected as the best for the southern area through an alternative study. Figure 5 shows the four alternatives prepared for the comparison. As can be seen, the major differences among the alternatives are the location of connecting taxiways and the location of the new terminals. The results of comparative study are summarized in Table 4.

Table 4 Comparison of Alternative Development Plans

Item	Alt-1(a)	Alt-1(b)	Alt-2(a)	Alt-2(b)
1. Aircraft Operation				
1.1 Obstacles	F	F	F	F
1.2 Establishment of Flight Procedure	G	G	G	G
1.3 Taxiing Distance	F	F	F	F
2. Convenience of Passengers				
2.1 Walking Distance	G	G	G	G
2.2 Walking Distance - Transfer	F	F	F	F
3. Convenience of Airline				
3.1 Handling of Baggage	G	G	G	G
3.2 Handling of Baggage - Transfer	F	F	F	F
3.3 Handling of Cargo	F	F	F	F
3.4 Flexibility in Use of Aircraft	P	P	P	P
4. Convenience of Airport Authority				
4.1 Proximity of Major Functions	F	P	F	P
4.2 Visibility from Control Tower	F	F	F	F
4.3 Response Time of RFF	F	F	F	F
5. Flexibility to Cope with Unexpected Demand Change	F	F	F	F
6. Expandability	F	F	G	G
7. Environmental Impact				
7.1 Land Acquisition	P	P	G	F
7.2 Relocation of Households	F	F	F	F
7.3 Relocation of Public Facilities	F	F	G	G
7.4 Aircraft Noise Pollution	F	F	F	F
8. Construction				
8.1 Construction Cost	F	F	F	F
8.2 Land Acquisition	P	P	G	F
8.3 Relocation of Airport Facilities	F	F	F	F
8.4 Relocation of Public Facilities	F	F	G	G
Overall Score	G: 3 F: 16 P: 3	G: 3 F: 15 P: 4	G: 8 F: 13 P: 1	G: 6 F: 14 P: 2

Note: G : Good, F : Fair, P : Poor



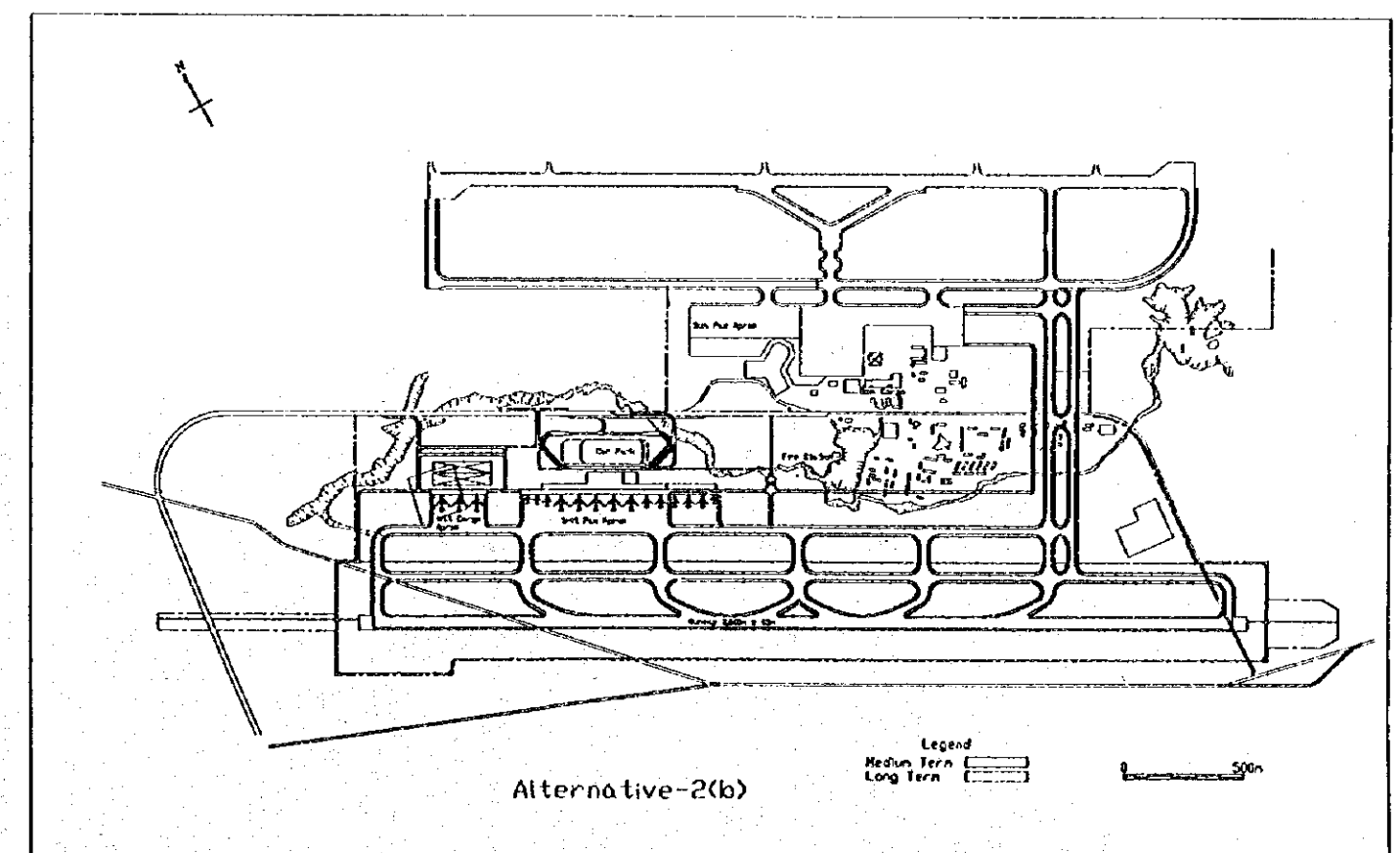
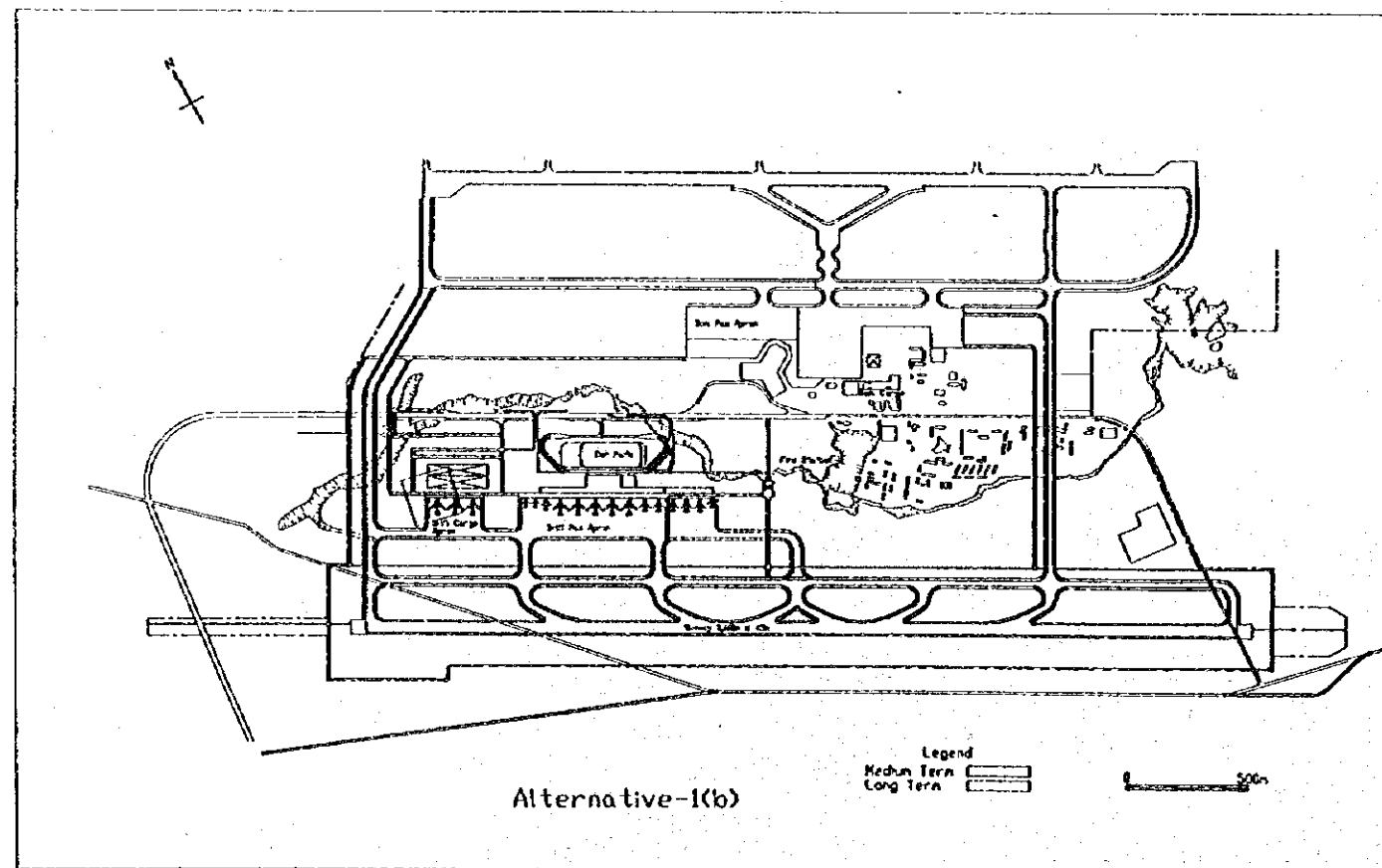
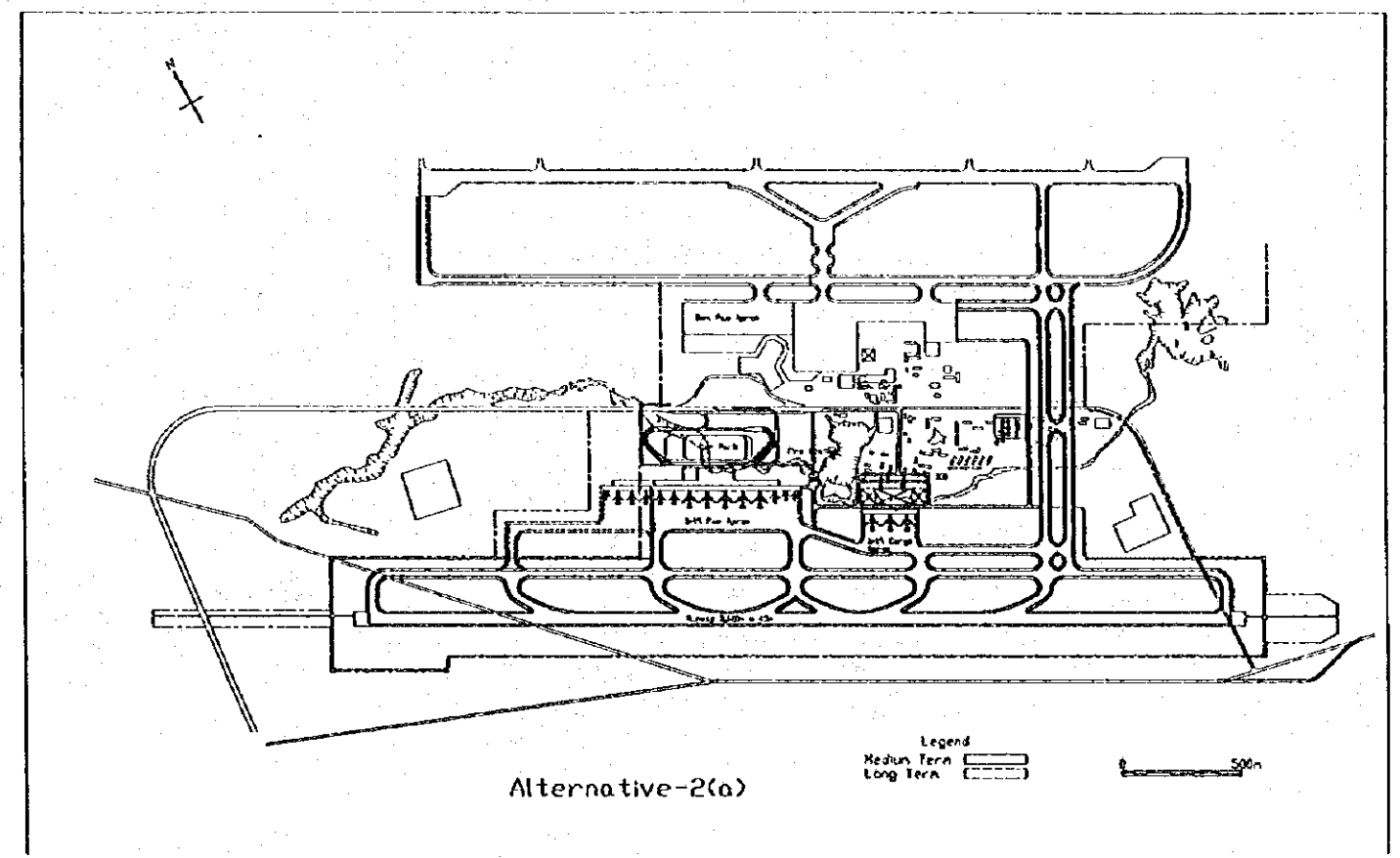
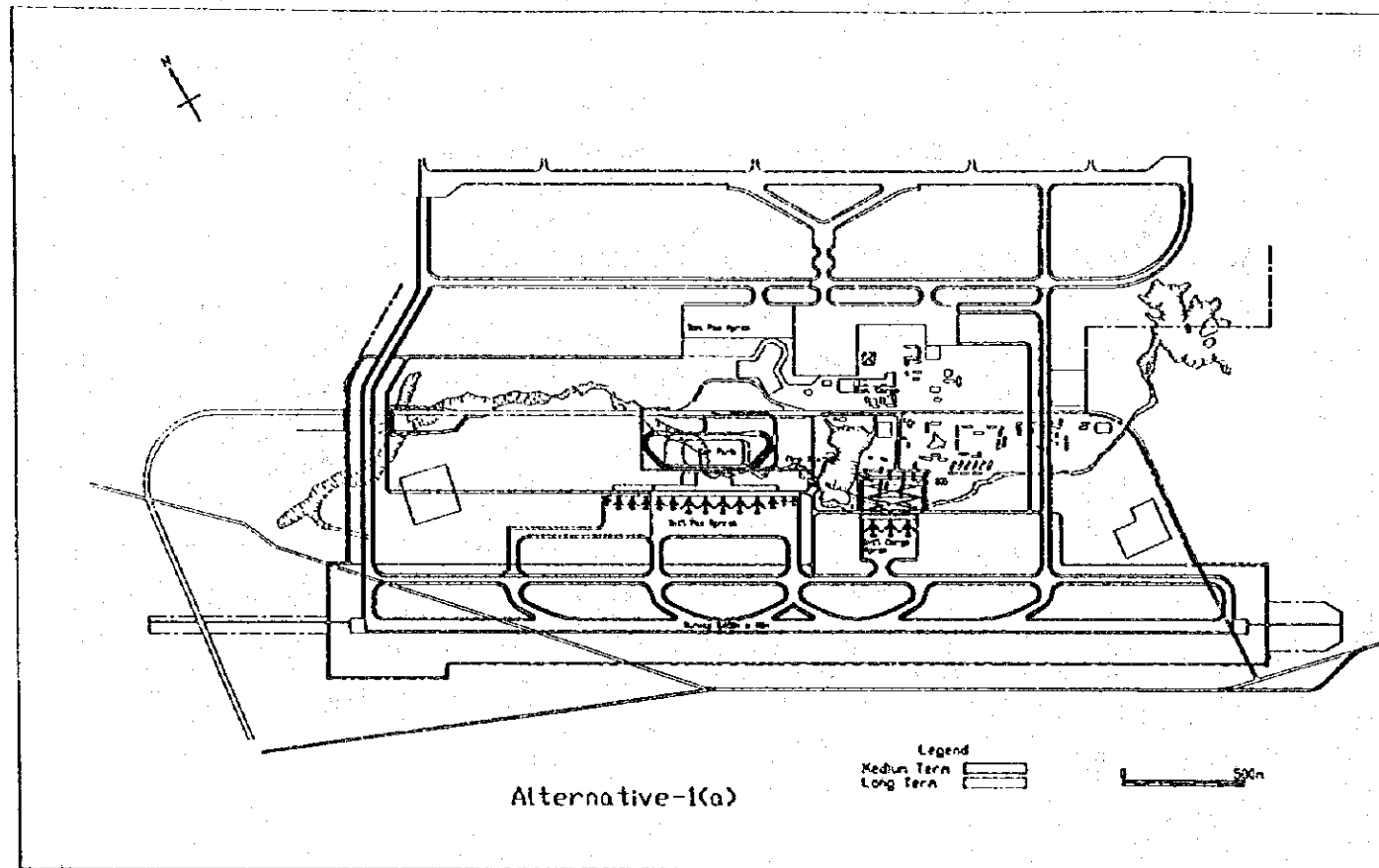


Figure 5 Scheme of Alternatives

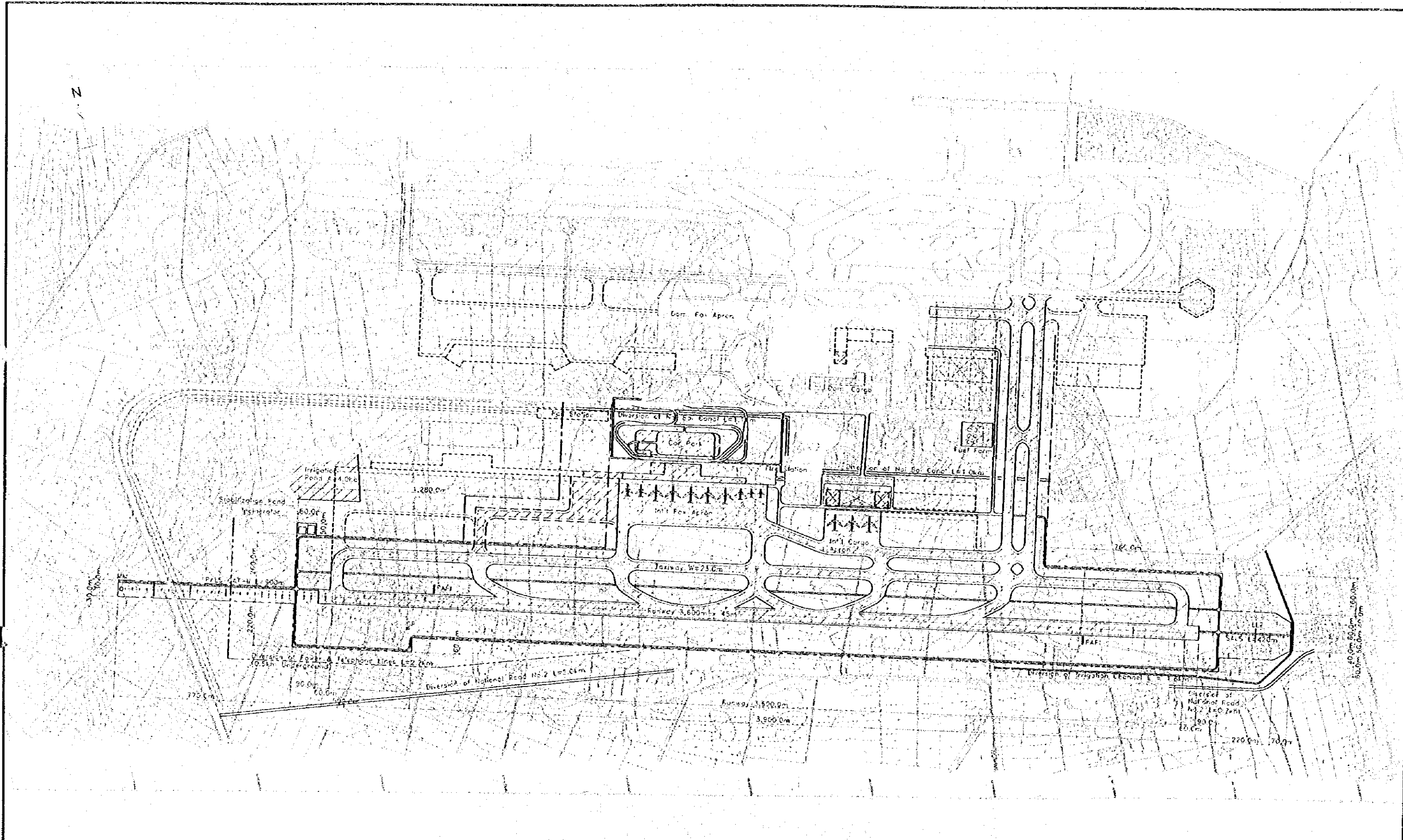
Alternative-2(a) was selected for the following reasons:

- a) It will provide the maximum flexibility for future development beyond the year 2015, since there is no physical restriction of expansion to the west by a connecting taxiway.
- b) Lowering of Access Road is not required, since no connecting taxiway is planned at the west side.
- c) Major facilities will not be scattered over a wide area making them easier to operate and maintain.

Figure 6 illustrates the facility layout for the selected development plan (Alternative-2(a)). As can be seen, the Airport will have the second runway 1,850 m to the south of the existing runway, and dual connecting taxiways at about 600 m from the east end of the existing runway. The existing fuel storage facility at the Airport will be relocated so as to clear space for the connecting taxiways. The main office and housing complex of the fuel company will also be relocated outside of the Airport, possibly near the main fuel storage. The existing road in front of the fuel storage facility at the Airport will be abandoned, since it is not considered economically justifiable to provide grade separation between this road and the new taxiway. The Airport Administration Building needs to be relocated at the location where good access to/from the major facilities is provided.

International passenger and cargo terminals will be constructed during the Medium Term Development at the site across the access road, and opposite to the Passenger Terminal T1 and the existing passenger terminal. Passenger Terminal T1 will be renovated and transformed into the domestic passenger terminal. The cargo terminal, converted from the existing passenger terminal, will be used as the domestic cargo terminal. The area presently used for customs and immigration complexes and a part of the staff housing will be used for the international cargo terminal. A part of Noi Bai Canal will be diverted so as to clear the site the new international passenger and cargo terminals, and other facilities. During the Long Term Development and thereafter, the international passenger and cargo terminals will be expanded towards the west and east respectively. A satellite fire station will be built between the international passenger and cargo terminals in the Medium Term Development.





- Legend
- Medium term
 - Long term
 - Future



Note: CAAV's development plans for the existing airport area are indicated as future developments for reference purposes.

Figure 6 Selected Long Term Development Plan

3.3 Scope of Medium Term Development Project

Scope of the Medium Term Development Project is identified in Table 5.

Table 5 Scope of the Phased Development Plan

Item
1. Civil Works <ul style="list-style-type: none"> 1.1 Site preparation and earthworks in the south area 1.2 Construction of storm water drainage system in the south area 1.3 Construction of the second runway and connecting taxiways 1.4 Construction of new taxiways for the south area 1.5 Construction of new international aprons 1.6 Construction of roads and car parks for the new international passenger and cargo terminals 1.7 Construction of airside service roads in the south area 1.8 Construction of boundary and security fence
2. Building Works <ul style="list-style-type: none"> 2.1 Construction of a new international passenger terminal building 2.2 Conversion of T1 to a domestic passenger terminal building 2.3 Construction of a new international cargo terminal building 2.4 Construction of a fire station for the southern area
3. Air Navigation Systems <ul style="list-style-type: none"> 3.1 Installation of ILS Cat-II for the new runway 3.2 Installation of additional ATC consoles for the second runway 3.3 Installation of PALS Cat-II for the new runway 11R 3.4 Installation of PAPI for the new runway 11R and 29L 3.5 Installation of airfield lighting system for the south runway and taxiways 3.6 Installation of RVR's for the new runway
4. Airport Utilities <ul style="list-style-type: none"> 4.1 Installation of power supply system for the south area 4.2 Installation of telephone system for the south area 4.3 Construction of water supply system for the south area 4.4 Construction of a new sewerage system 4.5 Installation of a new incinerator 4.6 Installation of aircraft refuelling system for the south area
5. Land Acquisition and Relocation <ul style="list-style-type: none"> 5.1 Land acquisition and resettlement of households 5.2 Relocation of National Road No. 2 5.3 Relocation of Noi Bai Canal 5.4 Relocation of irrigation channels 5.5 Relocation of telephone lines 5.5 Relocation of power transmission lines

CHAPTER 4 FEASIBILITY STUDY ON MEDIUM TERM DEVELOPMENT PROJECT

4.1 Planning and Preliminary Design

Facility planning and preliminary design for the Medium Term Development Project was conducted so as to describe the facilities sufficiently for cost estimation in a feasibility study. Brief descriptions of the major facilities to be constructed during the Project are as follows:

- a) **Runway:** A 3,600m x 45m runway in parallel with and 1,850m to the south of the existing runway with a strength rating of PCN 73 R/D/W/T.
- b) **Taxiway:** A 23m wide full parallel taxiway and six rapid exit taxiways for the new runway, and dual connecting taxiways between the existing and new runways and terminals.
- c) **Apron:** A 605m x 160.5m international passenger apron and 210m x 160.5m international cargo apron.
- d) **International Passenger Terminal Building:** A combination of linear and transporter concepts with two processing levels; two story building with mezzanine; a steel-reinforced concrete structure; total floor area about 41,150 sq. m.
- e) **International Cargo Terminal Building:** One story (with a partial second story) building with steel frame structure; total floor area about 12,300 sq. m.
- f) **Fire Station:** One story building with steel frame structure; total floor area about 540 sq.m.
- g) **Road and Car Park:** A road network to the international passenger and cargo terminals, car parks for 730 vehicles, and airside service roads.
- h) **Radio Navigation Aids:** A Category II Instrument Landing System, and a locator for Runway 11R.
- i) **ATC and Communication System:** Three ATC consoles with communication facilities.

- j) **Aeronautical Ground Lighting System:** A Precision Approach Lighting System (Category II) for Runway 11R; a Simple Approach Lighting System for Runway 29L; Precision Approach Path Indicators for Runways 11R and 29L; Runway Edge Lights, Runway Threshold and Wing Bar Lights, Runway End Lights, and Stopway Lights for the new runway; Taxiway Edge Lights for the new taxiways; Runway Center Line Lights, and Runway Touchdown Zone Lights for Runway 11R, Taxiway Center line Lights, Stop Bar Lights, and Taxi-holding Position Lights for the taxiways related to Runway 11R; Apron Flood Lights; and an Aeronautical Ground Light Monitoring and Control System.
- k) **Meteorological Observation Systems:** Three RVR transmissometers, two ceilometers, anemometers, and wind direction indicators.
- l) **Power Supply System:** A 6.35kV power supply network for the southern area with step down (35kV/6.35kV) transformers with the total capacity of 7,000kVA, 3,500kVA standby generators and a separate secondary power supply system conforming to the specifications for Precision Approach Category II operations.
- m) **Telephone System:** An automatic telephone exchange system with a capacity of 300 extension lines and 60 external lines.
- n) **Water Supply System:** A water distribution pipe network for the southern area.
- o) **Sewerage System:** A combination of septic tanks and a stabilization pond with a capacity of 1,100 ton/day.
- p) **Solid Waste Disposal System:** An incinerator with a capacity of 5 ton/day.
- q) **Aviation Fuel Supply System:** A new secondary storage area with four 2,000kl storage tanks and eight 180kl/hr fuel hydrant pumps, and a fuel hydrant system for the new international passenger apron.
- r) **Rescue and Fire Fighting Equipment:** Three fire fighting vehicles with 8,100 liter water capacity.
- s) **Airport Maintenance Equipment:** One pavement friction test device, one mechanical sweeper,

four disk type mowers, and four hand mowers.

4.2 Environmental Impact Assessment

Twenty-three environmental issues are examined initially and nine issues are selected for further examination as shown in Table 6.

Table 6 Environmental Issues to be Examined in EIA

Major Facilities/Activities Activities which may cause impacts		Airports / Access roads					
		Overall Evaluation	Before Operation		After Operation		
Environmental			Reclamation and Spatial Occupancy	Operation of Construction Equipment and Vehicles	Spatial Occupancy	Operation of Vehicles	Operation of Airplanes
Social Environment	1 Resettlement	○	○				
	2 Economic Activities						
	3 Traffic and Public Facilities						
	4 Split of Communities						
	5 Cultural Property	○	○			○	
	6 Water Rights/Rights of Common	○			○	○	
	7 Public Health Condition						
	8 Waste	○	○				○
	9 Hazards (Risk)						
Natural Environment	10 Topography and Geology						
	11 Soil Erosion						
	12 Groundwater						
	13 Hydrological Situation	○	○		○		○
	14 Coastal Zone						
	15 Fauna and Flora	○	○	○	○	○	○
	16 Meteorology						
	17 Landscape						
Pollution	18 Air Pollution	○		○	○	○	
	19 Water Pollution	○	○				○
	20 Soil Contamination						
	21 Noise and Vibration	○		○	○	○	
	22 Land Subsidence						
	23 Offensive Odor						

Note ○ : The environmental issues to which special attention has to be paid, because they might cause serious adverse impacts that may affect the project formulation, depending on the magnitude of the impacts and the possible countermeasures
 No mark : The environmental items which require no impact assessment since the anticipated impacts are not significant.

As a result of site survey and examination of the proposed project, the environmental impacts were assessed as follows:

- 1) **Resettlement:** Resettlement of the people due to the airport development project will have impacts on the social environment. Detailed resettlement program, including not only time schedule and budgeting but also method of public hearing, planning of resettlement site, job training, etc., should carefully be prepared and implemented.
- 2) **Cultural Property:** As there are no cultural properties in the development site, no impacts by the airport development project are foreseen.
- 3) **Water Rights and Rights of Common:** As mitigation measures such as diversion of an irrigation channel have been planned, the impacts by airport development will be insignificant.
- 4) **Waste:** As an incinerator has been planned in the development project, it will have positive impacts on the waste.
- 5) **Hydrological Situation:** As about 60% of the new development area will remain as unpaved ground, the changes in groundwater and surface water regimes will not be so significant.
- 6) **Flora and Fauna:** As the existing conditions of flora and fauna in the development area are not good, the impact by the airport development project is considered insignificant.
- 7) **Air Pollution:** There will be local air pollution at the construction site and along the airport access roads. Monitoring of air quality and implementation of appropriate mitigation measures will be required during the construction and operation stages.
- 8) **Water Pollution:** Muddy water generated during the construction is a potential problem. Monitoring of water quality and implementation of appropriate mitigation measures will be required during the construction.
- 9) **Noise and Vibration:** Aircraft noise will be increased by the airport development, especially in the areas under the flight path to/from the new runway. Land use plan should be established and implemented for the surrounding areas of the Airport.

It is recommended to establish a committee to monitor the environmental conditions around the NBIA and to ensure the implementation of appropriate mitigation measures.

4.3 Planning of Management, Operation and Training

An airport is an integrated system with its primary products being Groundside, Airside and Terminal Airspace Capacity. Its secondary products are commercial services, such as retail, hotel and ground transportation services, which represent an important source of revenue to help fund capacity production. The full productive potential of the many complex and expensive physical assets needed for the development of the NBIA can only be achieved through efficient operation and maintenance, within a sound framework of good management, rational organization and financial self-sufficiency.

A plan to create such a framework has been developed. This involves:

- a) establishing clear corporate goals and objectives for the NBIA;
- b) designing and implementing an organizational structure which will promote the efficient production of capacity and commercial services;
- c) designing and implementing a staff reduction programme which will both reduce costs and minimize any adverse impact on affected employees;
- d) establishing the NBIA as an autonomous business enterprise for producing safe and high quality services, regardless of whether it is owned by government or the private sector; and
- e) establishing financial systems which will facilitate sound management and measure the overall performance of the NBIA as a business enterprise.

With the necessary commitment from the Government of Vietnam and the CAAV, and through a well managed programme of outside assistance and training of national staff, all of these activities could be carried out over a four year period.

Specific attention has been given to describing activities which will improve three important functions at NBIA: security, facilitation, and the maintenance of all facilities and equipment. Again, these activities have been presented to involve the careful use of outside experts and training of national staff. Improved airport facilitation cannot be achieved without the full cooperation of the Customs and Immigration organizations and other border control agencies; therefore, the proposed assistance and training for facilitation should also be provided to these agencies.

In addition to covering training needs in the critical area already covered, recommendations have also been made regarding the development of a training plan for all employees at the NBIA, dealing specifically with choice of training locations and the allocation of training time for planning purposes.

4.4 Planning of Airspace Use

There are currently no obstacles which will adversely affect the safety of aircraft operations around the NBIA. Height restrictions against man-made structures shall be applied to the areas around the airport, especially under the approach surfaces.

There is a prohibited area, a number of restricted areas and a danger area within 40NM (74km) of the NBIA. Standard arrival routes and standard instrument departure routes were planned which will allow these existing areas. Instrument approach procedures for the Runways 11R and 29L were planned based on the proposed facilities for the Medium Term Development. The existing instrument approach procedures will be applicable for the Runway 11L/29R.

Changes in responsibilities of Aerodrome and Approach Controllers and in the dimensions of the Control Zone are recommended, and assumed to be implemented when the ASR/SSR become operational (before the Medium Term Development).

4.5 Cost Estimates

Project costs are estimated based on the following conditions, and the results are summarized in the Table 7.

- a) Construction costs are estimated based on the 1995 prices for works of international quality standards.
- b) Exchange rates are fixed at US\$ 1.00 = VND 11,000 = ¥ 100
- c) Price escalation is not included.

Table 7 Summary of Project Costs (US\$)

Item	Local	Foreign	Total
Construction Cost	81,210,000	269,840,000	351,050,000
Diversion & Relocation	1,250,000	3,230,000	4,480,000
Diversion of Noi Bai Canal	140,000	330,000	470,000
Diversion of Irrigation Channel	280,000	660,000	940,000
Diversion of Power Transmission Line	10,000	240,000	250,000
Diversion of Telephone Line	10,000	110,000	120,000
Diversion of National Road No. 2	810,000	1,890,000	2,700,000
Airport Civil Works	50,550,000	124,590,000	175,140,000
Earthworks & Drainage	8,280,000	31,670,000	39,950,000
Runway, Taxiway and Apron	27,090,000	63,220,000	90,310,000
Roads & Car Park	2,650,000	21,480,000	24,130,000
Miscellaneous Works	12,530,000	8,220,000	20,750,000
Building Works	25,770,000	59,440,000	85,210,000
New Passenger Terminal Building	21,010,000	49,030,000	70,040,000
Renovation of Passenger Terminal Building	800,000	1,200,000	2,000,000
New Cargo Terminal Building	2,580,000	6,030,000	8,610,000
Other Buildings	1,380,000	3,180,000	4,560,000
Special Equipment	310,000	12,080,000	12,390,000
Airport Utilities	1,070,000	17,630,000	18,700,000
Fuel Supply System	1,750,000	33,250,000	35,000,000
Fire Fighting Vehicles	0	1,800,000	1,800,000
Airport Maintenance Equipment	0	630,000	630,000
Air Navigation System	510,000	17,190,000	17,700,000
Land Acquisition & Compensation	25,920,000	0	25,920,000
Consultancy Services	3,510,000	31,600,000	35,110,000
Contingency	10,860,000	30,060,000	40,920,000
Total Cost	121,500,000	331,500,000	453,000,000

4.6 Financial and Economic Analyses

1) Methodology and General Assumptions

Since the Medium Term Development Plan is an additional investment plan after the T1 Project, its financial (as well as economic) returns will be incremental revenues resulting from the expansion of airport capacity. The evaluation of the Medium Term Development Plan should, therefore, be made by comparing revenues and costs between two cases:

- **With Project Case:** The Medium Term Development Plan will be implemented and airport capacity will be increased to 10.6 million passengers per annum, which is the maximum allowable capacity of the Medium Term Development Plan.
- **Without Project Case:** No investments will be made after the T1 Project, and thus airport capacity

will remain at the maximum of the T1 Project, i.e. 5.5 million passenger per annum.

Other key assumptions made for the analyses are as follows:

- a) The period for calculating the internal rate of returns is set at 20 years from the completion of the Medium Term Development.
- b) The residual value of completed facilities are calculated with 30 year depreciation period for civil and building facilities. No residual values are considered for equipment since their depreciation periods are less than 15 years.
- c) The entity (owner) of the Project in this Study is a hypothetical organization which invests and operate facilities to be planned in the Medium Term Development. It incorporates the five line departments of the Northern Airport Region at the NBIA, but also includes fuel supply operations and management of car parks, which are respectively under the Vietnam Air Petro Company and Northern Airport Services Company at present.

2) Financial Analysis and Evaluation

Financial costs include construction costs, other costs for implementation of the Project, and operation and maintenance costs. Revenues include landing charges, parking charges, passenger service charges, terminal equipment charges, concession fees, car parking charges, passenger terminal rents, fuel surcharges, and advertising revenue.

The financial internal rate of returns (FIRR) is calculated as 3.1% for the base case. This result suggests that the Project is unfeasible at commercial interest rates, and that an injection of state subsidies and/or the use of low interest loans will be necessary for the implementation of the Project. The sensitivity analysis revealed that the Project will require generous term of borrowing for financial feasibility, e.g., interest rate of 2.3% per annum, 20 year repayment period after 10 year grace period and finance up to 85% of the total cost as offered by the Japan's OECF. The state subsidy (15% of the total cost) will cover the cost for land acquisition and compensation, relocation and diversion of existing canals and roads, renovation of the T1 terminal, turnover tax on construction works, etc. In addition, it is preferable that the percentage of state subsidy be increased, as far as the budget allows, in order to reduce financial risks against possible slowdowns in air traffic growth or unexpected rises in construction cost.

3) Economic Analysis and Evaluation

Economic analysis was conducted to evaluate the viability of the Project in terms of the impact on the national economy. Costs of the Project were converted to economic prices, and the following economic benefits are considered in the analysis.

- a) Time saving benefits to business passengers on international routes
- b) Time saving benefits to business passengers on domestic routes
- c) Benefits from increased tourist passengers on international routes
- d) Benefits from increased tourist passengers on domestic routes
- e) Benefits from increased cargo

The economic internal rate of returns was calculated as 19.5% for the base case. This value is much higher than the opportunity cost of capital of 12%, which is a general standard used to evaluate infrastructure projects in developing countries by the World Bank. The EIRRs for the cases of low forecast of air traffic and construction costs up by 20% were respectively calculated as 17.0% and 17.6%. The Project is, therefore, expected to produce sufficient economic benefits to the national economy to justify its implementation.

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The Study was carried out for the new development of Hanoi International Airport in the southern area located next to the existing Hanoi International Airport. The target area of the Study was fixed only to the southern area by the both GOV and GOJ.

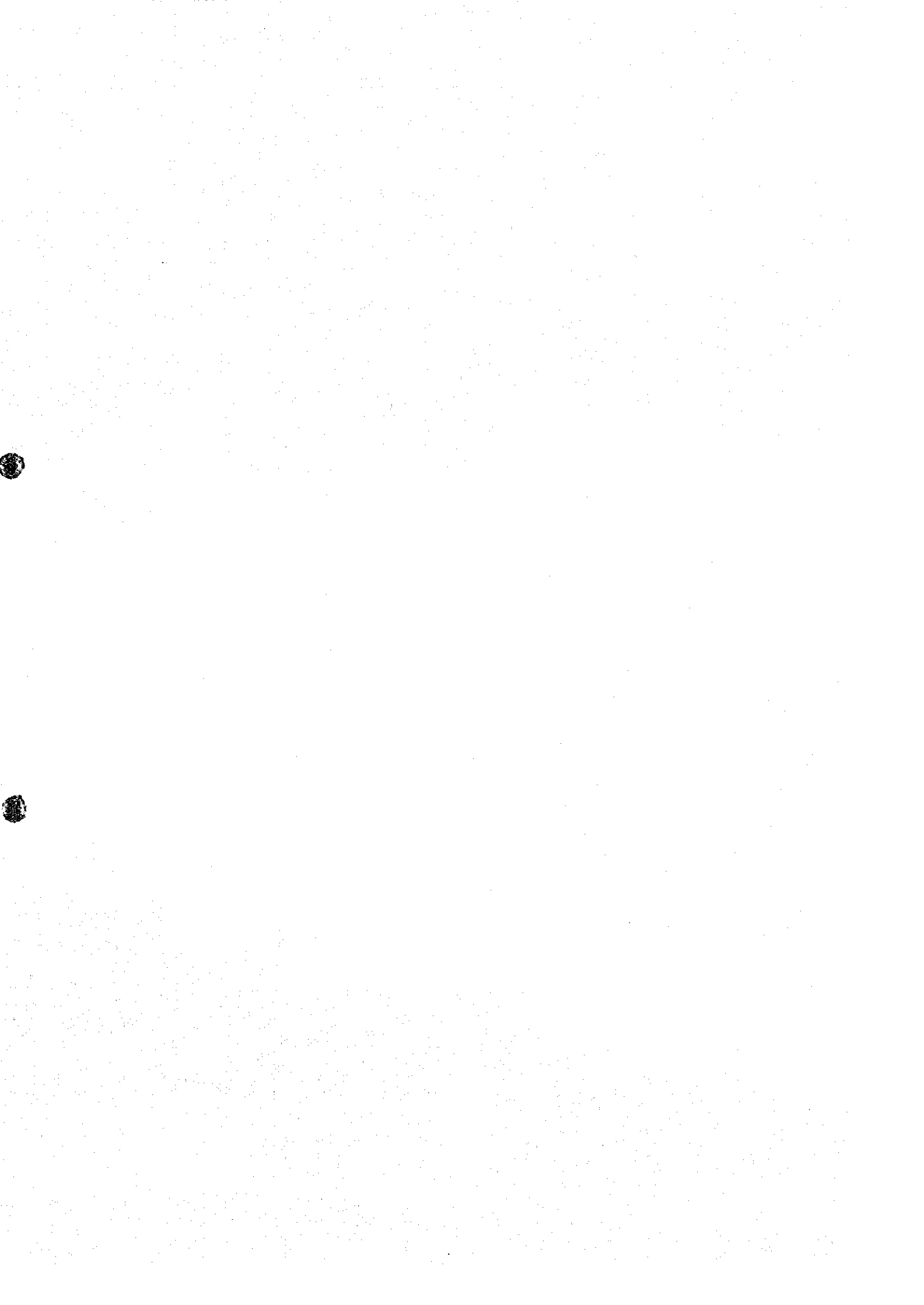
As a result of the comprehensive study of the southern area development, including formulation of Long and Medium Term Development Plans and a feasibility study on the Medium Term Development Plan, it can be concluded that the new development of the southern area of Hanoi International Airport for the international services is a viable option to cope with anticipated traffic demand to the year 2010, and to ensure a reliable gateway to Hanoi and northern Vietnam.

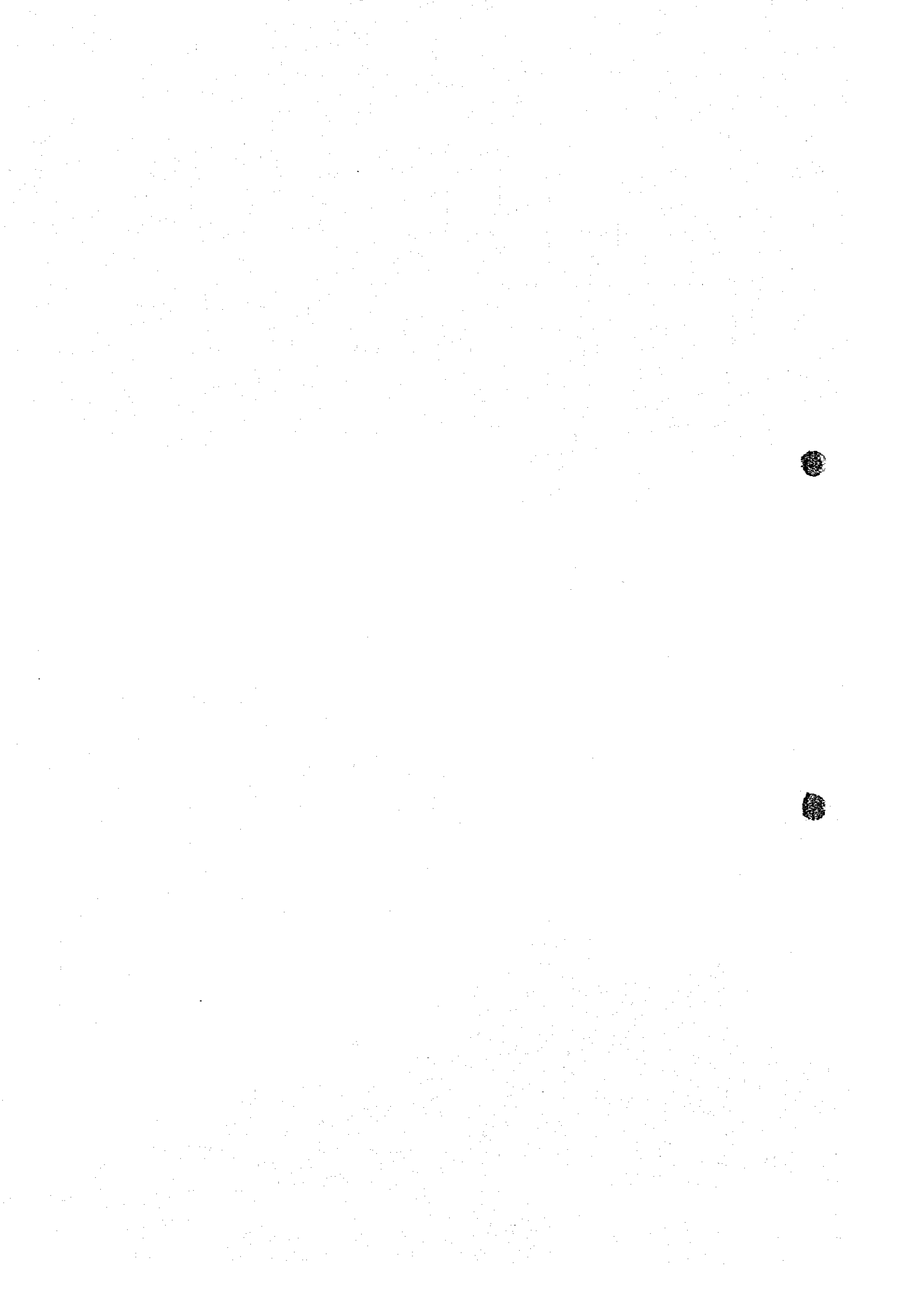
The construction works for the Medium Term Development should commence in the year 2001 and be completed in 2005 when the demand is expected to exceed the capacity of the Airport.

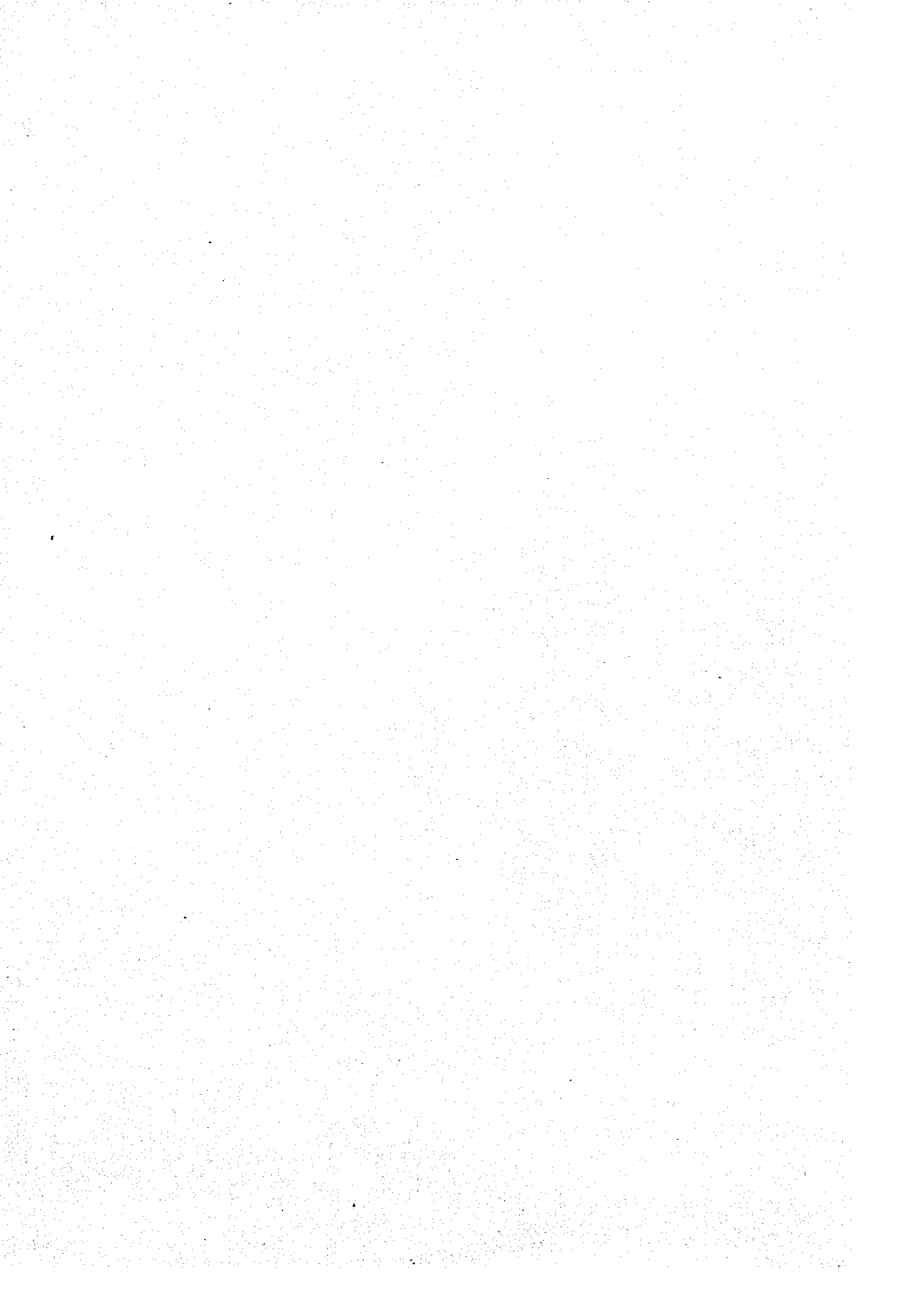
5.2 Recommendations

- a) Complete the current development projects (such as construction of new passenger terminal T1 and control tower, and extension of parallel taxiway and apron A1 in the existing airport area) as soon as possible in order to cope with the increasing traffic demand.
- b) Approve the Medium Term Development Plan by the Government of Vietnam, and designate the CAAV as the executing agency for the development.
- c) Provide sufficient project information, at appropriate times, to the organizations concerned, including the; State Planning Committee; Ministry of Science, Technology and Environment; Ministry of Defence; Ministry of Finance; and the Hanoi People's Committee.
- d) Initiate local financing arrangements as soon as possible to allow enough time for a peaceful resettlement of the residents.
- e) Prepare, as soon as possible, a detailed resettlement program including method of public hearing, planning of resettlement site, job training, time schedule, budgeting, etc.

- f) **Establish proper environmental protection and monitoring systems for the development.**
- g) **Implement the modernization and upgrading of air navigation systems, including replacement of the ILS, installation of a SALS and a PAPI for Runway 29, and installation of a ASR/SSR, before the year 2000 to improve the safety of operation and increase the capacity of the runway.**
- h) **Implement, as soon as possible, a comprehensive managerial and organizational restructuring at Hanoi International Airport to both improve levels of service and achieve financial self-sufficiency.**







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