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THE REPUBLIC OF INDONESIA

THE STUDY ON THE MASTER PLAN OF AIRPORT MAINTENANCE AND REHABILITATION IN THE REPUBLIC OF INDONESIA

FINAL REPORT

VOL. 2

MAIN REPORT

MARCH 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

THE STUDY ON THE MASTER PLAN OF AIRPORT MAINTENANCE AND REHABILITATION IN THE REPUBLIC OF INDONESIA

FINAL REPORT VOL. 2 MAIN REPORT

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Japanese Government decided to conduct a study on the Master Plan of Airport maintenance and Rehabilitation in the Republic of Indonesia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a study team headed by Mr. Shota MORITA, Pacific Consultants International, from January 1990 to March 1991.

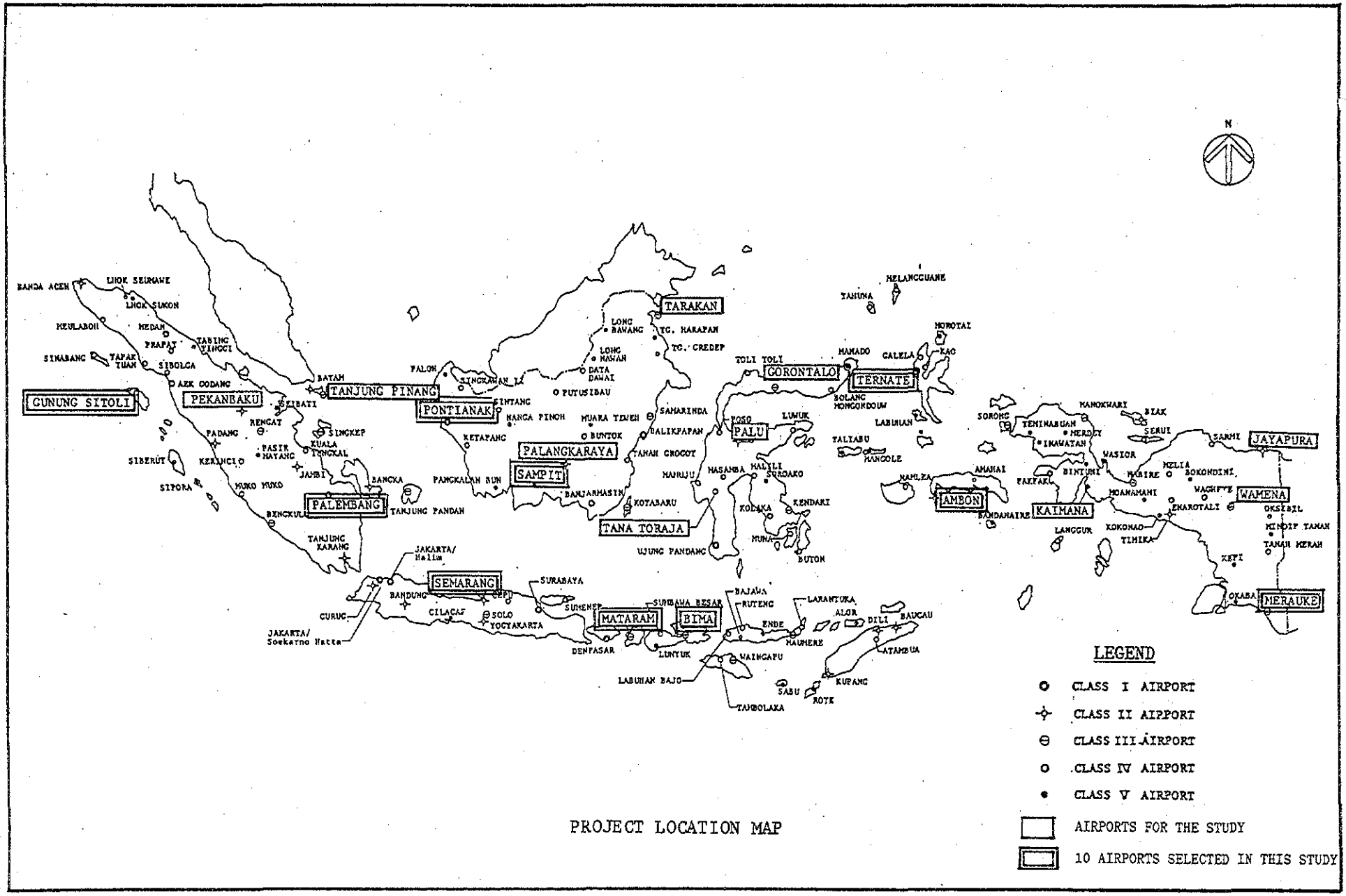
The team held discussions with the officials concerned of the Government of Indonesia, and conducted field surveys. After the team returned to Japan, further studies were made and the present report was prepared.

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 the Republic of Indonesia for their close cooperation extended to the team.

March 1991

Kensuke Yanagiya
President
Japan International Cooperation Agency



PROJECT LOCATION MAP

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CHAPTER 1. INTRODUCTION

CHAPTER 1. INTRODUCTION

1.1 General

Indonesia is the largest archipelago in the world, consisting of about 3,000 inhabited islands, which are spread over some 5,100km from east to west, and some 1,800km from north to south. Due to the dispersion of the islands over such a vast area, air transportation plays a vital role in promoting economic activities, national integration, regional economic balance, etc.

At present, there are 146 airports in Indonesia which are under the supervision of the Directorate General of Air Communications ("DGAC"). However, due mainly to financial constraints, most of these airports lack the facilities to provide a level of service appropriate for present air traffic needs.

Indonesia's current policy regarding the air transportation sector is detailed in the fifth Five-Year Development Plan (REPELITA V) embarked upon during the 1989/90 fiscal year. This policy is designed to increase aircraft operational efficiency, to enhance aviation safety and capabilities of aviation personnel, and to effectively utilize existing airport facilities. The latter is to be achieved by proper maintenance and rehabilitation, which should overcome the operational and capacity problems of the existing airports which have resulted from insufficient investment in the past and/or the deterioration of aging facilities.

It is therefore considered urgent to implement cost effective improvements to the existing facilities, so as to assure both aviation safety and unrestricted civil air services for the present and short term traffic needs.

Under these circumstances, the Government of the Republic of Indonesia ("the Government of Indonesia") and the Government of Japan agreed that the Government of Japan could render technical assistance for the Study on the Master Plan of Airport Maintenance and Rehabilitation ("the Study") in the Republic of Indonesia. The scope of work was agreed upon between both Governments in October 1989.

Based on this agreement, the Japan International Cooperation Agency ("JICA"), the official agency responsible for the implementation of technical cooperation programs of the Government of Japan, has been entrusted to carry out the Study.

JICA organized the Study Team and officially commenced the Study in January 1990.

1.2 Objectives and Scope of the Study

The objectives of the Study are to: evaluate the present conditions of 20 airports which were chosen by the Government of Indonesia for the Study; to establish short-term master plans for airport maintenance and rehabilitation for 10 airports to be selected from the 20 airports; and to prepare a maintenance manual for the major airport facilities and maintenance equipment.

The selected 20 airports are as follows:

(1) Tanjung Pinang, (2) Pekanbaru, (3) Gunung Sitoli,
(4) Palembang, (5) Semarang, (6) Pontianak, (7) Sampit,
(8) Palangkaraya, (9) Tarakan, (10) Tana Toraja, (11) Palu,
(12) Gorontalo, (13) Ambon, (14) Ternate, (15) Mataram,
(16) Bima, (17) Jayapura, (18) Wamena, (19) Kaimana, (20) Merauke.

The facilities and equipment to be covered in the Study consist of the following:

1) Civil facilities : Runway, Runway Strip, Taxiway and Apron

2) Building facilities: Passenger terminal building, control tower, administration and operation building, and ancillary equipment for the buildings (air conditioning, baggage claim device, X-ray baggage screening unit, walk through metal detector, and sanitary facilities including toilets and faucets)

3) Airport maintenance equipment: Mowers, Tractors, Handy Mowers, Sweepers and Dump Trucks

Note: In this Study, the terms administration and operation building are applied to the building(s) accommodating administrative personnel such as airport manager, staff of general affairs, personnel affairs, logistics section, etc.

The Study comprises the following twenty-one (21) major items;

(1) Preparatory work in Japan
(2) Site surveys of the 20 airports
(3) Collection and analysis of relevant data and information
(4) Preparation of airport inventories
(5) Review of air traffic demand forecasts by the previous JICA Study
(6) Facility requirement analyses
(7) Identification of the problems of the 20 airports
(8) Preparation of facility evaluation criteria
(9) Evaluation of existing facilities
(10) Identification of detailed site survey items

(11) Selection of 10 airports for maintenance and rehabilitation planning
(12) Detailed site surveys for the selected airports
(13) Preparation of criteria for assessing priorities
(14) Selection of facilities and equipment for the maintenance and rehabilitation plans
(15) Preparation of airport maintenance plans
(16) Preparation of airport rehabilitation plans
(17) Project appraisal
(18) Collection and analyses of available manuals
(19) Study on the skeleton of the maintenance manual
(20) Preparation of maintenance manual
(21) Overall recommendations

1.3 Executing Method and Reporting System

The Study was executed in accordance with the work flow of FIGURE 1.3.1 and procedures outlined in the Inception Report, which was submitted immediately after Study Team's mobilization in Indonesia in January, 1990.

After the Inception Report was basically accepted by DGAC which is the counterpart agency to the Study Team, the Study Team proceeded with the site surveys for the 20 airports, collection and analysis of relevant data and information, and preparation of airport inventories. The result of these studies during a 2-month stay in Indonesia was summarized in the Site Survey Report, which was submitted at the end of March, 1990 and accepted in principle by DGAC.

In continuation of the first site study, the Study Team returned to Indonesia on July, 1990 to execute the second site study. The second site study period was spent for preparing the Progress Report which covered study items (5) "Review Forecast" through (11) "Selection of 10 airports" in the work flow of FIGURE 1.3.1, then followed by the detailed site surveys of the selected 10 airports for the succeeding maintenance and rehabilitation plans.

After the Study Team's return to Japan, they commenced to prepare the maintenance and rehabilitation plans for the facilities and equipment selected for each of the 10 airports, based on the results of detailed site surveys comprising topographic survey, soil investigation and building survey and incorporating the comments of DGAC on the Progress Report. The Interim Report summarizing the planning results and skeleton of the maintenance manual was prepared and submitted to DGAC on December, 1990.

The Draft Final Report was prepared to summarize the overall results of the Study and to finalize the maintenance manual by incorporating the comments of DGAC on the Interim Report.

The Draft Final Report was submitted in February, 1991 and was accepted.

This Final Report is finalized incorporating DGAC's comments on the Draft Final Report and consists of the following 4 volumes:

1) Volume - 1 Executive Summary
2) Volume - 2 Main Report
3) Volume - 3 Airport Maintenance Manual
4) Volume - 4 Drawings

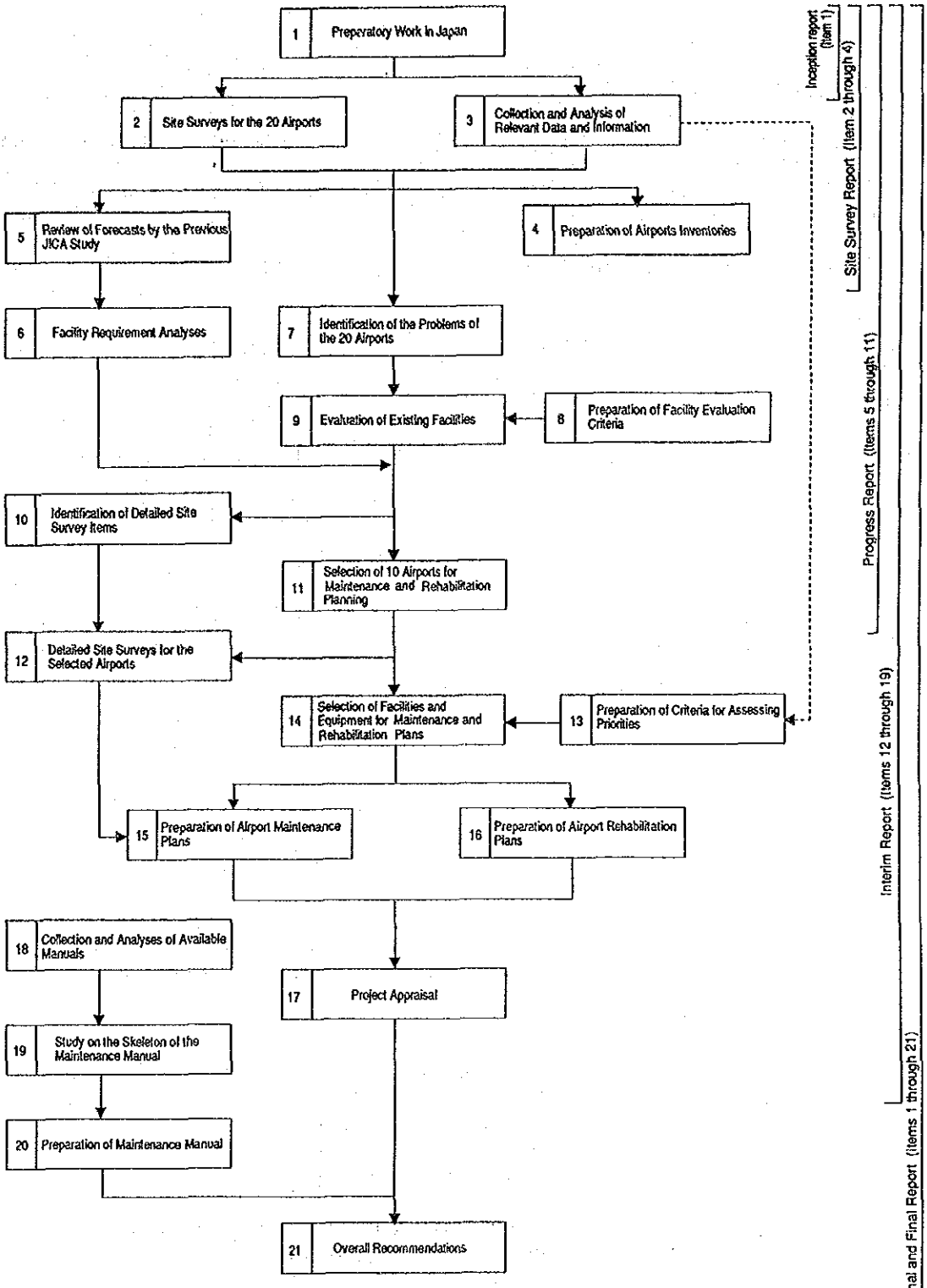


FIGURE 1.3.1 Main Work Flowchart

1.4 Study Organization

The Study was carried out by the JICA Study Team under the direction of the Advisory Committee which has also been organized by JICA, and with the close coordination with the Sterring Committee and Counterpart Team of the Government of Indonesia.

The overall organization frame is shown in FIGURE 1.4.1.

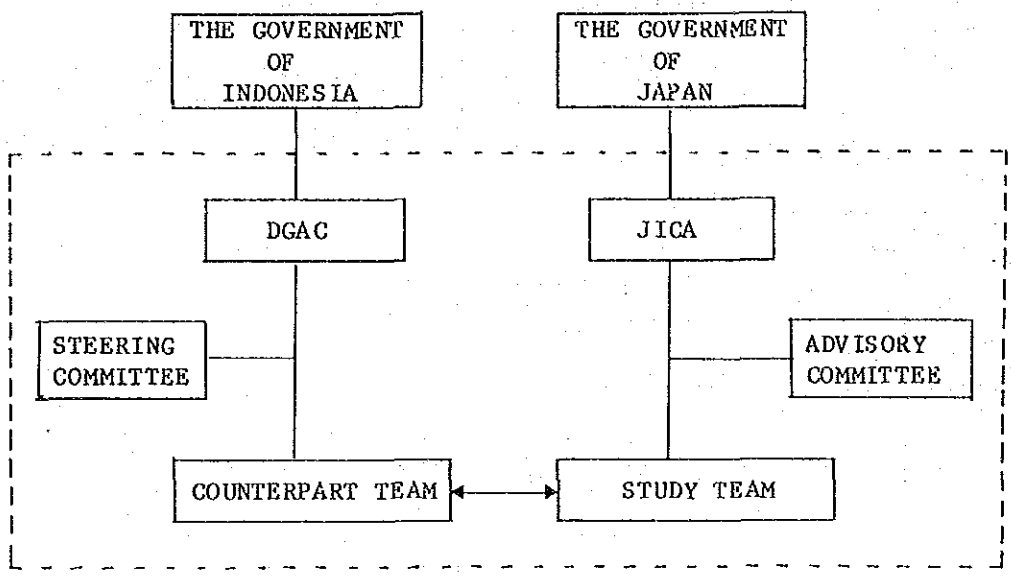


FIGURE 1.4.1 Study Organization Frame

The members of JICA Advisory Committee, Study Team, Indonesian Steering Committee and Counterpart Team are presented in the following list.

JICA Advisory Committee

Mr. Kazuo YOKOTA (Chairman)	: Director for Regional Aviation Facilities, Planning Division, Aerodrome Department, Civil Aviation Bereau, Ministry of Transport
Mr. Toshimitsu SAKAI (successor of Chairman)	: Director of Construction Division Aerodrome Department, Civil Aviation Bereau, Ministry of Transport

Mr. Mitsuhiro NISHIMOTO	: Special Assistant to the Director of Construction Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport
Mr. Kiyoshi WATANABE	: Special Assistant to the Director of Construction Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport
Mr. Toshiaki SUZUKI	: Chief of Machine Facilities Section, Construction Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport
Mr. Tsuyoshi KOISO	: Special Assistant to the Director of Construction Division, Aerodrome Department, Civil Aviation Bureau, Ministry of Transport

JICA Coordinator

Mr. Tadashi SHINOURA	: Director, First Development Study Division, Social Development Study Department, JICA
Mr. Hiroshi YAMAMOTO	: First Development Study Division, Social Development Study Department, JICA
Mr. Juichi MASAKI	: Operation Division Tokyo International Center JICA

Study Team

Mr. Shota MORITA	: Team Leader/Airport Planner
Mr. Niso WADA	: Airport Civil Engineer (1)
Mr. Kimihiro MAETA	: Airport Civil Engineer (2)
Mr. Ryujiro YAMAGISHI	: Traffic Forecaster and Economic Analyst
Mr. Tokio ODA	: Airport Architect (1)

Mr. Hiroshi IJIMA	: Airport Architect (2)
Mr. Tsutomu HAMADA	: Airport Maintenance Specialist (1)
Mr. Saburo KOBAYASHI	: Airport Maintenance Specialist (2)

Indonesian Steering Committee

Mr. Soenaryo. Y. (Chairman)	: Secretary of Directorate General of Air Communications
Mr. Samoedro. S.A (Vice Chairman)	: Chief of Airport Engineering Directorate
Mr. Soewardi SH.	: Chief of Air Transportation Directorate
Mr. A.T.E. Liando	: Chief of Telcom., Nav. and Electrical Facilities Directorate
Mr. D. Sartono	: Chief of Aviation Safety Directorate
Mr. S.P. Simatupang	: Chief of Transportation and Tourism Bureau, BAPPENAS
Mr. Harmaini	: Chief of Planning Bureau, Ministry of Communications (MOC)
Mr. H.B. Zainudin Zainun	: Chief of Financing Bureau, MOC
Mr. Umar Rusdi	: Chief of Logistics Bureau, MOC
Mr. Situmorang	: Chief of Research and Development of Air Communication, MOC
Mr. Karman Kardia	: Chief of Planning Division, DGAC

Counterpart Team

Mr. Soegito. M. (Chairman)	: Chief of Airport Classification Subdirectorate, DGAC
Mr. Yayoen Wahyoe	: Secretary of Steering Committee
Mr. Sri Kadarisno	: Secretary of Counterpart Team
Mr. Sunarjo. S.	: Member of Counterpart Team
Mr. M. Arief. SH	: Ditto
Mr. Imam Pamudji	: Ditto

Mr. Moch. Fuschad	: Ditto
Mr. Iman Soelvan	: Ditto
Mr. Kistubaka	: Ditto
Mr. Lucky Surachman	: Ditto
Mr. Sandjojo	: Ditto
Mr. Justam Kadir	: Ditto
Mr. Mian Simatupang	: Ditto
Mr. Widjojo MSC	: Ditto
Mr. Mochtar Santosa	: Ditto
Mr. Petrus	: Ditto
Mr. E.B. Suradi	: Ditto

1.5 Definition of Maintenance and Rehabilitation in the Study

"Maintenance" is defined in this Study as any activity to keep the operational functions in working order as well as to check and evaluate the present functioning of facilities and equipment. The basic components of maintenance are;

- Inspection,
- Routine maintenance, and
- Repair

"Routine maintenance" or "Preventive maintenance" is meant to secure the use of facilities and equipment through inspection and examination processes under given circumstances such as climate, present pattern of operations, etc., and to keep such facilities and equipment in good working condition.

"Corrective maintenance" is addressed to actual breakdowns such as malfunctioning equipment, potholes, etc.

Proper maintenance brings immediate and future benefit by enhancing the present capability and retarding the depreciation of facilities. If a facility has deteriorated beyond a certain point, maintenance may prove of little value and the only choice may be to rehabilitate such facility entirely.

"Rehabilitation" is defined in this Study as follows:

1) Restoration of the capacity or performance of a facility without expanding the facility beyond its original condition. (e.g., restoration of pavement, renovation of buildings, renewal of equipment, etc.)

2) Expansion to allow more effective use of existing facilities, such as extensions of runways to allow aircraft presently in service to carry an increased payload, expansion of aprons and/or passenger terminal buildings to accommodate the potential demands presently restricted.

CHAPTER 2. IDENTIFICATION OF THE PROBLEMS OF THE 20 AIRPORTS

CHAPTER 2. IDENTIFICATION OF THE PROBLEMS OF THE 20 AIRPORTS

2.1 General

This chapter sets forth the present condition and problems of the 20 airports in terms of adequacy for present traffic demands, deterioration of facilities, aviation safety, structural deficiencies, etc., which were identified from the results of the first site surveys carried out in February and March, 1990.

The problems identified for each facility and equipment of respective airports will quantitatively or qualitatively be evaluated in Chapter 6 in accordance with the evaluation criteria to be prepared in Chapter 3.

2.2 Civil Facilities

Table 2.2.1 summarizes the present condition and problems of airport civil facilities such as runways, runway strips, taxiways and aprons at each of the 20 airports, together with the general airport situations including airport characteristics, air transport services, etc.

The 20 airports can be classified by the following major problem items.

1) Weight restrictions to present aircraft due to short runway length:

   Tanjung Pinang, Semarang, Pontianak, Ternate, Mataram, Bima and Wamena.

2) Insufficient runway width:

   Wamena

3) Steeper runway slope than criteria:

   Tana Toraja

4) Pavement distresses on runway:

   Gunung Sitoli, Palembang, Sampit, Tarakan, Ambon, Kaimana and Merauke.

5) Insufficient runway strip width:

   Most of the 20 airports have no declared data on the runway strip width. However judging from the positions of aprons and terminal facilities, and the circumstances beyond the drainage parallel to runways, all the 20 airports do not meet the requirement on runway strip width recommended by ICAO.

6) Insufficient width of graded area in runway strip:

- To be widened to 105 m : Pekanbaru, Palembang and Jayapura
- To be widened to 75 m : Palangkaraya, Tarakan, Ternate, Wamena, and Merauke
- To be widened to 40 m : Sampit and Tana Toraja.

7) Insufficient taxiway width:

Wamena

8) Pavement distresses on taxiway:

Gunung Sitoli, Pontianak, Ambon, Bima, Wamena, Kaimana and Merauke

9) Insufficient number of aircraft stands:

Palangkaraya, Tarakan, Palu, Mataram, Bima, Jayapura, Wamena and Merauke

10) Apron location too close to runway:

Tanjung Pinang, Pekanbaru, Palembang, Pontianak, Ternate, Bima and Wamena.

11) Pavement distresses on apron:

Gunung Sitoli, Palembang, Ambon, Mataram, Bima, Wamena, Kaimana and Merauke.

TABLE 2.2.1 General Condition and Problems of Civil Facilities (1)

Items \ Airport	1. Tanjung Pinang	2. Pekanbaru	3. Gunung Sitoli	4. Palembang
1. Airport Class	III	II	IV	I
II. Airport Characteristics	- Border airport to Singapore	- Gateway to Riau province	- Airport on Nias island	- Gateway to South Sumatra province - Border airport
III. Air Transport (1) Annual Pax. (As of 1989)	69,000	337,000	9,000	526,000
(2) Peak Hour A/C Movements	4	5	2	12
(3) Largest Aircraft (Longest Sector)	F27 (Tanjung Pinang - Jakarta)	F28 (Pekanbaru - Jakarta)	DHC6 (Gunung Sitoli - Medan)	DC9 (Palembang - Padang)
IV. Operational Category	Non precision	Precision	Non precision	Precision
V. Civil Facilities 1. Runway	- 1,406 m x 30 m - Weight restriction to F27 due to short runway length - No pavement problems (Overlaid in 1989) - Site preparation for extension for F28 under progress	- 2,150 m x 30 m - No weight restriction - No cracks, but raveling and weathering (Low severity)	- 900 m x 30 m - No weight restriction - Severe raveling and weathering on the unoverlaid part - Steep tapering between overlaid and unoverlaid section	- 2,200 m x 45 m - No weight restriction - Overlay (1,500 m x 30 m) completed in 1988, but serious undulation not improved due to budget limitation
2. Runway Strip	- Width 75 m - Improvement of lateral slope of runway strip at runway 22 side required	- Width 75 m	- Width 40 m	- Width 75 m
3. Taxiway	- No problems (Overlaid in 1989)	- Raveling and weathering on old taxiway (Low severity)	- Severe raveling and weathering	- Cracks and rutting (Overlay scheduled by DIP 1990/1991
4. Apron	- Aircraft infringing the present transitional surface - 4 stands for F27, enough - Some partial depressions	- Aircraft infringing the present transitional surface - 4 stands for F28, 2 for F27 and 4 for CN235, enough - Old asphalt pavement seriously damaged by spilt oil (Low severity)	- 2 stands for DHC6, enough - Severe raveling and weathering	- Aircraft infringing the present transitional surface - 7 stands for DC9 and 7 for CS212, enough - Apron-A seriously damaged due to spilt oil (Overlay scheduled by DIP 1990/1991)
5. Others	- No boundary fences	- No boundary fences	- No boundary fences	- No boundary fences

TABLE 2.2.1 General Condition and Problems of Civil Facilities (2)

Items \ Airport	5. Semarang	6. Pontianak	7. Sampit	8. Palangkaraya
I. Airport Class	II	I	V	II
II. Airport Characteristics	- Gateway to Central Java Province - Joint operation with Army	- Gateway to West Kalimantan Province - Border airport to Singapore and Brunei	- Busiest airport in Class V	- Gateway to Central Kalimantan province - Hub airport for 5 pioneer airports in the province
III. Air Transport (1) Annual Pax. (As of 1989)	524,000	372,000	70,000	133,000
(2) Peak Hour A/C Movements	6	9	8	8
(3) Largest Aircraft (Longest Sector)	F28 (Semarang - Jakarta)	F28 (Pontianak - Balikpapan)	CS212 (Sampit - Banjarmasin)	F28 (Palangkaraya - Jakarta)
IV. Operational Category	Non precision	Non Precision	Non precision	Non Precision
V. Civil Facilities 1. Runway	- 1,650 m x 30 m - Weight restriction to F28 due to short runway length - Extension to be carefully studied for the hills of RWY 31 side - No pavement problems (Overlaid in 1989)	- 1,650 m x 30 m - Weight restriction to F28 due to short runway length - No pavement problems (Overlaid in 1990)	- 855 m x 23 m - No weight restriction - Many alligator cracks on center portion due to high ground water level and weathering on RWY 13 side. Base course appears.	- 1,850 m x 30 m - No weight restriction - No pavement problems
2. Runway Strip	- Width 75 m	- Width 75 m	- Width 30 m - North graded area to be widened from 34 m to 40 m	- Width 60 m (South) and 75 m (North) - South graded area of 60 m width to be widened to 75 m
3. Taxiway	- No problems (Overlaid in 1989)	- Serious alligator cracks on whole A-TWY - Some partial depressions on B-TWY.	- New taxiway already completed in 1990	- No problems
4. Apron	- 4 stands for F28, 1 for HS-748 and 3 for CN235, enough - No pavement problems (Overlay and expansion in 1989)	- Aircraft infringing the present transitional surface - 9 stands for F28, enough for peak movements, but narrow for manuevering - Weathering in total area and some partial depressions	- New apron with 4 stands for CS212 already completed in 1990 - No capacity problems	- 3 stands for F28 and 1 for BN2A not enough for peak season - No pavement problems
5. Others	- No boundary fences	- No boundary fences	- No boundary or security fences	- No boundary or security fences

TABLE 2.2.1 General Condition and Problems of Civil Facilities (3)

Items \ Airport	9. Tarakan	10. Tana Toraja	11. Palu	12. Gorontalo
I. Airport Class	III	IV	II	III
II. Airport Characteristics	- Border airport to Brunei	- Main infrastructure for foreign tourists (90% of total air passengers are foreign tourists)	- Gateway to Central Sulawesi province - Hub airport for 4 pioneer airports in the province	- Transit airport from Palu to Manado
III. Air Transport (1) Annual Pax. (As of 1989)	82,000	5,000	143,000	50,000
(2) Peak Hour A/C Movements	4	2	6	4
(3) Largest Aircraft (Longest Sector)	F27/HS748 (Tarakan - Balikpapan)	CS212 (Tana Toraja - Ujung Pandang)	F28 (Palu - Ujung Pandang)	F27/HS748 (Gorontalo - Palu)
IV. Operational Category	Non precision	Non Precision	Non precision	Non Precision
V. Civil Facilities 1. Runway	- 1,650 m x 30 m - No weight restriction - Many linear cracks on un-overlaid part of 637 m of RWY 18 side	- 900 m x 23 m (Extended in 1989) - Overlaid with asphalt penetration in 1989 but covered by spreading sand and grass - Longitudinal slope partly exceed 2.0% due to consolidation settlement	- Runway extension to 1,850 m x 30 m for full load operation completed in 1990 - No pavement problems (Overlaid in 1989)	- 1,650 m x 30 m - No weight restriction - No pavement problems
2. Runway Strip	- Width 45 m - 45 m wide graded area to be widened to 75 m	- Width 32 m - 32 m wide graded area to be widened to 40 m	- Width 75 m	- Width 75 m - Improvement of lateral slope of runway strip required (Scheduled by DIP 1990/1991)
3. Taxiway	- Some partial depressions - No cracks	- Grass growing on pavement	- No problems	- No pavement problems
4. Apron	- 4 stands for F27, not enough (Site preparation for expansion completed) - No serious pavement problems	- 2 stands for CS212, enough for present movements - Grass growing on pavement	- 1 stand for F28, 1 for HS-748 and 2 for CS212, not enough in peak season - No pavement problems (Overlaid in 1989)	- 3 stands for F27/HS748 and 1 for CS212, enough - No pavement problems
5. Others	- No boundary fences	- No security or boundary fences	- Grass difficult to grow due to sandy soil	

TABLE 2.2.1 General Condition and Problems of Civil Facilities (4)

Items \ Airport	13. Ambon	14. Ternate	15. Mataram	16. Bima
I. Airport Class	II	III	III	III
II. Airport Characteristics	- Gateway to Maluku Province - Border airport	- Hub airport for pioneer airports in North part of Maluku Province	- Gateway to NTB province - 70% of total passengers are tourists	- Transit airport for small aircraft from east and F27/HS748 from west
III. Air Transport (1) Annual Pax. (As of 1989)	147,000	57,000	187,000	49,000
(2) Peak Hour A/C Movements	6	4	8	9
(3) Largest Aircraft (Longest Sector)	F28/L100 (Ambon - Ujung Pandang)	F28/HS748 (Ternate - Ambon)	F28 (Mataram - Surabaya)	F27/HS748 (Bima - Mataram)
IV. Operational Category	Non precision	Non Precision	Non precision	Non Precision
V. Civil Facilities 1. Runway	- 1,850 m x 45 m - No weight restriction - Raveling at central part (300 m x 20 m)	- 1,420 m x 30 m - Weight restriction to F27-MK500 due to short runway length (No weight restriction for F27-MK200) - Many depressions after 1.5 cm thick overlay with site mixed asphalt (additional 5 cm thick overlay scheduled by DIP 1990/91)	- 1,600 m x 30 m - Weight restriction imposed - No pavement problems (overlaid in 1989)	- 1,400 m x 30 m - Weight restriction due to no refueling facilities in Mataram - No pavement problems (Overlaid in 1989)
2. Runway Strip	- Width 75 m	- Width 45 m (South), 75 (North) - South graded area to be widened to 75 m - Lateral slope of the above area exceed 2.5% partially	- Width 75 m	- Width 75 m - Runway strip flooded every month during high tide
3. Taxiway	- Raveling observed	- Many depressions (5 cm overlay scheduled by DIP 1990/1991)	- No serious problems	- Severe raveling due to sea water. Alligator cracks at wheel track
4. Apron	- 5 stands for F28, enough - Serious reflection crack and damage by oil in old part	- Aircraft infringing the present transitional surface - 2 stands for F27/HS748 and 2 for CS212, enough for present demand	- 1 stand for F28 and 2 for F27 and 2 for CS212, not enough for unscheduled flight - Many alligator cracks	- Aircraft infringing the present transitional surface - 3 stands for F27 and 1 for CS212, not enough for normal peak hour movements - Severe raveling
5. Others	- Capacity of drainage not enough for stormwater from outside	- Some obstruction to transitional surface - No fences	- Boundary fences to be relocated (Obstacle to the transitional surface)	- Fences corroded by sea water

TABLE 2.2.1 General Conditions and Problems of Civil Facilities (5)

Items \ Airport	17. Jayapura	18. Wamena	19. Kaimana	20. Merauke
I. Airport Class	II	III	V	III
II. Airport Characteristics	- Gateway to Irian Jaya	- Air transportation is sole mode to other cities - Main infrastructure for tourists - Hub airport for 4 pioneer airports	- Pioneer airport - 40 % of total passengers are transit	- Border airport located south west edge of Irian Jaya - Hub airport for 9 pioneer airports
III. Air Transport (1) Annual Pax. (As of 1989)	144,000	48,000	7,000	28,000
(2) Peak Hour A/C Movements	5	5	2	6
(3) Largest Aircraft (Longest Sector)	DC9/L100 (Jayapura - Biak)	F27/L100 (Wamena - Jayapura)	DHC6 (Kaimana - Timika)	F28 (Merauke - Jayapura)
IV. Operational Category	Precision	Non precision	Non precision	Non Precision
V. Civil Facilities 1. Runway	- 1,850 m x 45 m - No weight restriction - Cracks and ravelings (Low severity)	- 1,500 m x 30 m - Weight restriction to F27 due to high altitude (1,550 m AMSL) - Extension difficult due to hills infringing approach surface - 45 m width required for L100 - Steep tapering at 10 m from center	- 1,500 m x 30 m - No weight restriction - Partial overlay completed in 1989 and severe block cracks on the remaining portion (Additional partial overlay scheduled by DIP 1990/91)	- 1,850 m x 30 m - No weight restriction - New runway completed in 1984 and the old abandoned - Severe raveling/weathering in central portion (500 x 20 m)
2. Runway Strip	- Width 75 m	- Width 30 m (South), 35 m (North) - Graded area of both sides of runway to be widened to 75 m	- Width 40 m (East), 50 m (West)	- Width 75 m - West graded area of 45.5 m width to be widened to 75 m
3. Taxiway	- Ruttings and weatherings on B-taxiway (Scheduled to be reconstructed by DIP 1990/91)	- 20 m wide taxiway to be widened to 23 m for L100 - Partial alligator cracks (Scheduled to be overlaid by DIP 1990/91)	- Severe block cracks in all areas (Scheduled to be overlaid by DIP 1990/91)	- Severe cracks on apron side
4. Apron	- 7 stands for DC9, not enough for unscheduled flights - No pavement problems (Replacement with concrete in 1989)	- Aircraft infringing the present transitional surface - 3 stands for F27/HS748, not enough for unscheduled flight - Severe cracks (scheduled to be overlaid by DIP 1990/91)	- 3 stands for DHC6, enough - Severe block cracks in all areas (Scheduled to be overlaid by DIP 1990/91)	- 2 stands for F28, not enough for unscheduled flights - Many cracks
5. Others	- No boundary fences	- No boundary fences	- No security or boundary fences	- No serious problems

2.3 Building Facilities and Ancillary Equipment

Table 2.3.1 summarizes the present condition and problems of building facilities including passenger terminal building, administration and operation building, and control tower at each of the 20 airports.

The condition and problems of the ancillary equipment in buildings such as X-ray baggage screening units, walk-through metal detectors, baggage claim devices, air conditioning, etc., are also shown in the same table.

The 20 airports can be classified by the following major problem items.

1) Insufficient floor space of passenger terminal building:

   Palembang, Semarang, Pontianak, Tarakan, Ternate, Bima, Wamena and Merauke.

2) Deterioration or distresses on structures or finishings of passenger terminal building:

   Tanjung Pinang, Pekanbaru, Palembang, Palangkaraya, Ambon, Bima, Jayapura and Merauke.

3) Insufficient floor space of administration and operation building:

   Pekanbaru, Palembang, Sampit and Ternate.

4) Deterioration or distresses on structures or finishings of administration and operation building:

   Pekanbaru, Palembang, Sampit, Ambon, Jayapura and Merauke.

5) Deterioration or distresses on structures or finishings of control tower:

   Pekanbaru and Merauke.

6) Unserviceable condition of X-ray baggage screening units and walk through metal detectors:

   Tanjung Pinang, Pekanbaru, Palangkaraya, Tarakan, Gorontalo, Ternate (Not available), Mataram, Bima (Not available), Wamena (Not available) and Merauke.

TABLE 2.3.1 Present Condition and Problems of Building Facilities and Ancillary Equipment (1)

Items \ Airport	1. Tanjung Pinang	2. Pekanbaru	3. Gunung Sitoli	4. Palembang
1. Passenger Terminal Building	- Total floor area 1,062 sq.m - Connected with Tower - No space problems except for lack of public lobby (Renovation scheduled by DIP 1990/91) - Serious leaks in clad and flat roofs - Stormwater overflows from concealed eaves gutter	- Total floor area 4,728 sq.m Two-storey bldg. completed in 1984 based on the previous master plan - No space problems - Serious leaks in waterproofing at roof	- New bldg. with total floor area of 216 sq.m completed in 1989 (Not yet operating. Furnishing scheduled by DIP 1990/91) - No problems	(1) Dom. Dep. Bldg. - Total floor area of 1,402 sq.m, enough - Many columns in check-in lobby hinder normal services to passengers - Roof members and wooden sash rotted by leaks and termites (2) Dom. Arr. and Int'l. Bldg. - Total floor area 714 sq.m, not enough - Leaks in flat roof
2. Administration and Operation Building	- No serious problems	- Duplex bldg. with C-TWR - Not enough space (New bldg. completed in 1989 but not operated yet) - Breakdown of beams and walls at construction joint	- Old pax. terminal scheduled to be utilized for operation bldg. (Leaks in roof to be repaired)	- Duplex bldg. with C-TWR - Space not enough - Leaks at construction joint
3. Control Tower	- H = 10.5 m - No serious problems	- H = 15.5 m - No problems on visibility of RWY - Catwalk too narrow	- No control tower	- H = 16.35 m - No problems on visibility of RWY.
4. Ancillary Equipment				
1) X-ray Baggage Screening Unit	- 1 unit not operational - To be renewed	- 2 units not operational - To be renewed	- Not available	- 1 unit operational but CRT to be replaced
2) Walk-Through Metal Detector	- 1 unit not operational due to no control unit - To be renewed	- 2 units not operational - to be renewed	- Not available	- 1 unit operational
3) Explosives Detector	- 1 unit operational	- 2 of 4 units operational but not used due to complicated adjustment	- Not available	- 5 units not operational
4) Hand Metal Detector	- 1 unit operational	- 5 units operational but not used	- Not available	- 4 of 8 units operational but not used
5) Baggage Claim Device	- Not available	- 5 units operational	- Not available	- Not available
6) Air Conditioning	- Not available in Pax. bldg.	- Air conditioned with chilled water for Pax. bldg. - No problems	- Not available - No power supply by PLN and capacity of Generator not enough	- 4 of 7 units in Pax. bldg. not operational, capacity not enough
7) Sanitary Facilities	- No problems on toilet - Leakage of faucet to be repaired	- No problems on toilet - Faucet in Adm. bldg. to be repaired	- No problems	- Faucet in Pax. bldg. and Adm. bldg. to be repaired

TABLE 2.3.1 Present Condition and Problems of Building Facilities and Ancillary Equipment (2)

Items \ Airport	5. Semarang	6. Pontianak	7. Sampit	8. Palangkaraya
1. Passenger Terminal Building	- Total floor area 1,850 sq.m - Check-in lobby and baggage claim area especially crowded - No problems on structure or finishings	(1) Dom. Dep. Bldg. - Total floor area 885 sq.m, not enough - Rotted totally and leaks in roof (2) Dom. Arr. and Int'l Bldg. - Total floor area 1,395 sq.m - Airline complains of passenger flow from/to int'l check-in counter - Rotted totally and leaks in roof	- New terminal bldg. with floor area of 216 sq.m completed in 1989 but not yet operating due to no access road. (Scheduled to be provided by DIP 1990/91)	- Total floor area 600 sq.m enough - Floor settlement at check-in lobby and arrival lobby (Scheduled to be repaired by DIP 1990/91)
2. Administration and Operation Building	- Consists of 2 Adm. bldgs. - Acceptable condition	- Consists of 2 Adm. bldgs. - Connected with C-TWR - No serious problems	- Very old temporary bldg.	- No problems
3. Control Tower	- H = 10.95 m - No problems	- H = 14.2 m - No problems	- No control tower	- H = 14.2 m - No problems on visibility of RWY - Leaks from roof drains
4. Ancillary Equipment 1) X-ray Baggage Screening Unit	- 1 unit operational	- 2 units operational	- Not available	- 1 unit not operational - To be renewed
2) Walk-Through Metal Detector	- 1 unit operational	- 2 units operational	- Not available	- 1 unit not operational - To be renewed
3) Explosives Detector	- 2 units not operational	- Not available	- Not available	- 1 unit operational
4) Hand Metal Detector	- 4 units operational	- Not available	- Not available	- 1 unit operational
5) Baggage Claim Device	- Not available	- Not available	- Not available	- Not available
6) Air Conditioning	- 2 of 3 units in C-TWR not operational - No problems for VFR room and Pax. bldg.	- Not available in Dom. Dep. lounge - Capacity not enough for Int'l Dep. lounge	- Not available	- Capacity not enough for Pax. bldg.
7) Sanitary Facilities	- No problems	- No problems	- No problems for the new bldg.	- Breakdown of toilet to be repaired.

TABLE 2.3.1 Present Condition and Problems of Building Facilities and Ancillary Equipment (3)

Items \ Airport	9. Tarakan	10. Tana Toraja	11. Palu	12. Gorontalo
1. Passenger Terminal Building	- Total floor area 440 sq.m very crowded - Infringing transitional surface - New terminal bldg. with floor area of 1,000 sq.m scheduled to be completed by DIP 1990/91	- Total floor area 128 sq.m (completed in 1989) - Floor space enough for 1 Flt/day movement - No power supply by PLN	- Total floor area of 1,610 sq.m, enough (extended and renovated in 1989) - No structural and finishing problems	- Total floor area of 1,254 sq.m incl. VIP room, enough (Extended and renovated in 1989) - No structural and finishing problems
2. Administration and Operation Building	- No problems	- Old Pax. bldg. is utilized for administration bldg. - Located far from passenger terminal	- No problems	- No problems
3. Control Tower	- H = 14.2 m - No problems	- No control tower	- H = 12.4 m - No problems	- H = 11.2 m - No problems
4. Ancillary Equipment				
1) X-ray Baggage Screening Unit	- 1 unit not operational - To be renewed	- Not available	- 1 unit operational, but CRT not clear	- 1 unit not operational - To be renewed
2) Walk-Through Metal Detector	- 1 unit not operational - To be renewed	- Not available	- 1 unit operational	- 1 unit not operational - To be renewed
3) Explosives Detector	- 1 unit operational	- Not available	- 1 of 2 units operational but not used	- 2 units not operational
4) Hand Metal Detector	- 1 unit operational	- Not available	- 2 units operational	- 4 units operational
5) Baggage Claim Device	- Not available	- Not available	- Not available	- Not available
6) Air Conditioning	- Capacity not enough for Pax. bldg. and C-TWR	- Not available	- Capacity for C-TWR not enough	- Not available in Pax. bldg, to be provided
7) Sanitary Facilities	- No serious problems	- No problems	- No problems	- No problems

TABLE 2.3.1 Present Condition and Problems of Building Facilities and Ancillary Equipment (4)

Items \ Airport	13. Ambon	14. Ternate	15. Mataram	16. Bima
1. Passenger Terminal Building	- Total floor area 2,569 sq.m (Extension underway) - Leaks in flat roof under high and steep roof. - High and steep roof and ceiling difficult to maintain.	- Total floor area 400 sq.m - Departure lounge, check-in lobby and baggage claim area too crowded. - More than 10 m gap in elevation between apron and bldg. level. - No problems on structure or finishings	- Total floor area 1,604 sq.m, enough (Expanded and renovated in 1989) - No problems	- Total floor area 500 sq.m, not enough for present demand (Expansion scheduled by DIP 1990/1991) - Ceiling deformed
2. Administration and Operation Building	- Duplex bldg. with C-TWR - Leaks in roof and cracks in beams at construction joint.	- Space not enough - Finishing and structure, no problems	- Consists of 2 bldgs. - Duplex bldg. with C-TWR - Acceptable condition	- Administration and operation bldg. separated - Adm. bldg., no problems
3. Control Tower	- H = 10.5 m - No problems on visibility of RWY	- H = 12.4 m - No problems	- H = 11.2 m - No problems	- Construction of new control tower underway
4. Ancillary Equipment				
1) X-ray Baggage Screening Unit	- 2 units operational	- Not available - 1 unit to be provided	- 1 unit not operational - To be renewed	- Not available - 1 unit to be provided
2) Walk-Through Metal Detector	- 2 units operational	- Not available - 1 unit to be provided	- 1 unit sometimes not operational - To be renewed	- Not available - 1 unit to be provided
3) Explosives Detector	- 4 units operational but not used	- 1 unit operational	- 2 units not operational	- 2 units operational
4) Hand Metal Detector	- 6 units operational	- 2 units operational	- 4 units operational	- 4 units operational
5) Baggage Claim Device	- Not available	- Not available	- Not available	- Not available
6) Air Conditioning	- Capacity for C-TWR not enough	- Not available in Pax. bldg. - Capacity for C-TWR not enough	- Not available in Pax. bldg. - 3 of 6 units in C-TWR not operational	- Not available
7) Sanitary Facilities	- No problem for Pax. bldg. - Toilet and faucet in Adm. bldg. to be repaired	- Toilet in Adm. bldg to be replaced	- Toilet in Pax. bldg and Adm. bldg. to be repaired	- Toilet and faucet in Pax. bldg. and Adm. bldg. to be repaired.

TABLE 2.3.1 Present Condition and Problems of Building Facilities and Ancillary Equipment (5)

Items \ Airport	17. Jayapura	18. Wamena	19. Kaimana	20. Merauke
1. Passenger Terminal Building	- Total floor area 1,804 sq.m enough - Connected with Tower and Adm. bldg. - Deterioration of concrete wall by neutralization - Wooden roof frames deformed - Leaks in roof and concealed eaves gutter	- Total floor area 708 sq.m - Check-in area too crowded with passengers and visitors	- Total floor area only 90 sq.m but no serious problems for present small A/C movements - Old but no serious structural problems	- Total floor area 910 sq.m incl. Adm. function area - Check-in lobby and departure lounge too crowded - Rotted totally and wooden roof frames deformed
2. Administration and Operation Building	- Duplex bldg. with C-TWR - Same finishing condition as Pax. bldg.	- No serious problems but leaks in the ceiling of entrance hall observed	- Old but no serious problems	- Same finishing condition as Pax. bldg.
3. Control Tower	- H = 9.9 m - No problems on visibility of RWY	- New control tower not operating due to no equipment or staff - H = 12.5 m - No problems	- No control tower	- H = 6.0 m - No problems on visibility of RWY. - Leaning and vibrating during take-off
4. Ancillary Equipment				
1) X-ray Baggage Screening Unit	- 1 unit not operational	- Not available - 1 unit to be provided	- Not available	- 1 unit not operational - To be renewed
2) Walk Through Metal Detector	- 1 unit operational	- Not available - 1 unit to be provided	- Not available	- 1 unit not operational - To be renewed
3) Explosives Detector	- 2 units not operational	- 2 units operational but not used	- Not available	- 2 units operational
4) Hand Metal Detector	- 3 units not operational	- 4 units operational	- Not available	- 5 units operational
5) Baggage Claim Device	- Not available	- Not available	- Not available	- Not available
6) Air Conditioning	- Not available in Pax. bldg.	- Not available in Pax. bldg. and C-TWR	- Not available in Pax. terminal bldg. - No power supply	- Not available in Pax. bldg.
7) Sanitary Facilities	- Faucet in Pax. bldg. to be repaired	- No problems	- No problems	- Toilet and faucet in Pax. bldg. to be repaired.

2.4 Problems on Airport Maintenance

At present, various kinds of maintenance for existing facilities are executed at each airport under various constraints.

Table 2.4.1 describes the present conditions and problems of major maintenance items at each of the 20 airports, for which maintenance manuals will be prepared in succeeding stage of this Study, such as grass cutting, pavement sweeping, pavement repair and repainting of buildings.

The overall problems on the airport maintenance in terms of staffing, qualification of maintenance staff, availability of spare parts, availability of supporting facilities such as workshop and maintenance tools therein, maintenance budget, etc., are also summarized in the same table by respective airports, based mainly on interview results during the first site surveys.

General conditions and problems on the airport maintenance at study airports can be summarized as follows:

1) Grass Cutting

Grass cutting in airside is carried out by DGAC staff at the airports where mowers are available, while it is done by contractor manually where mowers are not available.
Most airports suffer from the lack of mowers and tractors. The existing mowers and tractors have generally been used for more than 10 years and the spare parts are difficult to be purchased because of obsolescence.

2) Pavement Sweeping

Most airports have no sweepers. The pavement sweeping at such airports is executed by picking up the dust on daily checking of pavements by DGAC staff.

3) Pavement Repair (Patching and Sealing)

Due to insufficient maintenance budget and the lack of paving equipment, the pavement repair as corrective maintenance is generally not executed. Even at the airports where pavement repair is executed, it is general practice to use site-mixed asphalt with much poor quality as compared with the hot mixed asphalt concrete.

4) Repainting of Buildings

This maintenance is generally executed by contractor with a frequency of once or twice a year. The insufficient maintenance budget causes only partial repainting of buildings at most airports.

TABLE 2.4.1 Present Condition and Problems of Airports Maintenance and Maintenance Equipment (1)

Items \ Airport	1. Tanjung Pinang	2. Pekanbaru	3. Gunung Sitoli	4. Palembang
1. Grass Cutting	- Executed by DGAC staff with mower - Frequency: 1/month in dry season 2/month in rainy season - Insufficient number of mowers to maintain all areas - Renewal and addition of mowers required	- Executed by DGAC staff with mower - Frequency: 2/month - Insufficient number of mowers to maintain all areas - Renewal and addition of mowers required	- Executed by contractor manually - Frequency: 4/year - Mower not available, the provision of mower and tractor required	- Executed by DGAC staff and contractor - Frequency: 8/month - Additional mower required
2. Pavement Sweeping	- Sweeper not available - By manpower on daily checking of runway - No problems	- Executed by DGAC staff with sweeper - No problems	- Sweeper not available - By manpower on daily checking of runway - No problems	- Executed by DGAC staff with sweeper - Frequency: 4/month - No problems
3. Pavement Repair (Patching and Sealing)	- Executed by DGAC as necessary - Portable asphalt mixing plant to be provided due to difficulty in mobilization of fixed type mixing plant	- Not executed	- Not executed	- Executed by DGAC as necessary
4. Repainting of Building	- Executed by contractor - Well painted and maintained for walls and ceiling only	- Executed by contractor periodically	- No problems	- Executed by contractor periodically for low part of walls only
5. Overall Problems on Airport Maintenance	- Number of staff not enough - Difficult to purchase spare parts - Workshop available, but tools insufficient - Limited maintenance budget	- No problems on staff. - Some spare parts available in Pekanbaru city - Workshop available, but tools insufficient - Limited maintenance budget	- Qualified staff not enough - Difficults to purchase spare parts - No specific workshop available , tools insufficient - Limited maintenance budget	- No problems on staff - Difficult to purchase spare parts - Workshop available, but tools insufficient - Limited maintenance budget.

TABLE 2.4.1 Present Condition and Problems of Airports Maintenance and Maintenance Equipment (2)

Items \ Airport	5. Semarang	6. Pontianak	7. Sampit	8. Palangkaraya
1. Grass Cutting	- Executed by Army with mower - Frequency: 1/month - Renewal and addition of mower and tractor required	- Executed by DGAC staff with mower - Because of no boundary fence, local people enter the airport and cut the grass at a part of the area - Renewal and addition of mower required	- Executed by contractor for airside manually - Frequency: 4/year - For landside, by DGAC staff manually - Mower not available, provision required	- Executed by DGAC staff with mower - Frequency: 2/month - For the area beyond graded area, executed by DGAC staff or contractor with handy mower - Number of mowers and tractors insufficient but the area relatively well maintained
2. Pavement Sweeping	- Sweeper not available, the provision of sweeper required - By manpower on daily checking of runway	- Sweeper not available, the provision of sweeper required - By manpower on daily checking of runway	- Sweeper not available - Executed by contractor manually, 4/year - No problems	- Sweeper not available - By manpower on daily checking of runway - Provision of sweeper required
3. Pavement Repair (Patching and Sealing)	- Executed by contractor incidentally	- Not executed - Portable asphalt mixing plant to be provided due to difficulty in mobilization from Java Island to cover also neighbouring airports	- Not executed	- Not executed - Portable asphalt mixing plant to be provided due to difficulty in mobilization from Java Island to cover also neighbouring airports
4. Repainting of Building	- Executed by contractor, 1/year - Not for all buildings due to budget limitation	- Executed by contractor - Frequency: 1/year for adm. bldg. and 2/year for pax. bldg.	- Not executed	- No serious problems
5. Overall Problems on Airport Maintenance	- No problems on number of staff, but qualified staff not enough - No special training programs - Difficult to purchase spare parts - Workshop available, but tools insufficient - Limited maintenance budget	- Number of staff, not enough - Difficult to purchase spare-parts - Workshop and almost all the tools available - Limited maintenance budget	- Number of staff insufficient for airport activities - Qualified staff insufficient - As no equipment available at present, no workshop nore spareparts - Limited maintenance budget	- No problems on number of staff, but qualified staff not enough - Difficult to purchase spare-parts - Workshop and maintenance tools available - Limited maintenance budget.

TABLE 2.4.1 Present Condition and Problems of Airports Maintenance and Maintenance Equipment (3)

Items \ Airport	9. Tarakan	10. Tana Toraja	11. Palu	12. Gorontalo
1. Grass Cutting	- Executed by DGAC Staff with mower - Frequency: 2/month - For the area beyond the graded area, executed by contractor with hand mower - Number of mowers insufficient	- Executed by contractor manually - Frequency: 1/month - Mower not available, provision required - Growth speed of grass very slow due to sterile soil	- Executed by DGAC staff with mower - Frequency: 1/year - Number of mowers sufficient - Grass difficult to grow due to sandy soil	- Executed by DGAC staff with mower - Frequency: 1/month - Number of mowers insufficient but area well maintained
2. Pavement Sweeping	- Sweeper not available - By manpower on daily checking of runway - No problems	- Sweeper not available - Executed occasionally and manually by contractor - No problems	- Sweeper not available but not required due to strong wind	- Sweeper not available - By manpower on daily checking of runway - No problems
3. Pavement Repair (Patching and Sealing)	- Not executed - Portable asphalt mixing plant to be provided due to difficulty in mobilization from Java Island to cover also neighbouring airports	- Not executed	- Not executed	- Executed by DGAC as necessary using site mixed asphalt - Asphalt mixing plant remains at airport after runway overlay work
4. Repainting of Building	- Executed by contractor, 1/year	- No problems	- Executed by contractor - Frequency: 1 ~ 2/year (depending on budget)	- Executed by contractor, 1/year
5. Overall Problems on Airport Maintenance	- No problems on staff - Difficult to purchase spare parts - Workshop and tools available - Limited maintenance budget	- Number of staff insufficient (Total airport staff : 6) - As no equipment available, no workshop or spare parts - Limited maintenance budget	- Qualified staff not enough - No fixed training program - Difficult to purchase spare parts - Workshop and maintenance tools available - Limited maintenance budget	- Qualified staff not enough - Workshop and tools available - Limited maintenance budget

TABLE 2.4.1 Present Condition and Problems of Airports Maintenance and Maintenance Equipment (4)

Items \ Airport	13. Ambon	14. Ternate	15. Mataram	16. Bima
1. Grass Cutting	- Executed by DGAC staff with mower for graded area, other areas by contractor manually - Frequency: 1/3 weeks - Insufficient number of mowers to maintain all areas - Growth speed of grass: 120 ~ 150 cm in rainy season	- Executed by DGAC with mower - Frequency: 1/month - Special grass difficult to cut with mower	- Executed by DGAC staff with mower - No problems.	- Executed by DGAC staff with mower - Grass difficult to grow due to erosion of RWY strip by sea water - Stand-by mower required
2. Pavement Sweeping	- Executed by DGAC with sweeper - No problems	- Sweeper not available - By manpower on daily checking of runway - No problems	- Sweeper not available - By manpower on daily checking of runway - Provision of sweeper required	- Sweeper not available - By manpower on daily checking of runway - No problems
3. Pavement Repair (Patching and Sealing)	- Executed by contractor, as necessary - Portable asphalt mixing plant to be provided to cover also neighbouring airports due to difficulty in mobilization of fixed type mixing plant	- Not executed (- Asphalt mixing plant purchased recently by local government)	- Executed by contractor as necessary - No problems	- Executed by contractor as necessary - No problems
4. Repainting of Building	- Executed by contractor for low part of walls only - Frequency: 2/year	- Executed by contractor, 1/year	- Executed by contractor, 1/year - Not for all buildings due to budget limitation	- Executed by contractor, 1/year
5. Overall Problems on Airport Maintenance	- Qualified staff not enough - Difficult to purchase spare parts - Workshop available, but tools insufficient - Limited maintenance budget	- Number of staff, not enough - Difficult to purchase spare parts - Workshop and tools available - Limited maintenance budget	- No problems on staff - Difficult to purchase spare parts - Workshop and tools available - Limited maintenance budget	- Number of staff, not enough - Difficult to purchase spare parts - Workshop available but insufficient space to accomodate all the maintenance sufficient equipment - Tools are insufficient - Limited maintenance budget.

TABLE 2.4.1 Present Condition and Problems of Airports Maintenance and Maintenance Equipment (5)

Items \ Airport	17. Jayapura	18. Wamena	19. Kaimana	20. Merauke
1. Grass Cutting	- Executed by DGAC staff with mower - Frequency: 4/month - All the existing mowers out of order. To be renewed and increased in number	- Executed by DGAC staff with mower - Frequency: 1/month in dry season : 3/month in rainy season - Growth speed of grass relatively slow due to cool atmosphere - Renewal and addition of mowers required	- Executed by contractor manually - Frequency: 1/month - No mowers or tractor available	- Executed by DGAC staff with mower - Frequency: 1/month in dry season : 4/month in rainy season - All the existing out of order. To be renewed
2. Pavement Sweeping	- Sweeper not available - By manpower on daily checking of runway - Provision of sweeper required	- Sweeper not available but not required due to strong wind - No problems	- Sweeper not available - Not executed - No problems	- Sweeper not available - Executed by DGAC occasionally and manually - Provision of sweeper required
3. Pavement Repair (Patching and Sealing)	- Executed by DGAC as necessary - Portable asphalt mixing plant to be provided due to difficulty in mobilization of fixed type mixing plant to cover also neighbouring airports	- Executed by DGAC as necessary	- Not executed	- Not executed
4. Repainting of Building	- Executed by contractor for low part of walls only - Frequency: 4/year	- Executed by contractor - No problems	- No problems	- Executed by contractor for low part of walls only - Frequency: 1/year
5. Overall Problems on Airport Maintenance	- Number of staff insufficient - Difficult to purchase spare parts - Workshop available, rearrangement of equipment required - Limited maintenance budget	- Number of staff insufficient - Difficult to purchase spare parts - Workshop available but insufficient space for additional equipment - Limited maintenance budget	- Number of staff insufficient (Total airport staff: 8) - As no equipment available, no workshop or spare parts - Limited maintenance budget	- Number of staff insufficient - Difficult to purchase spare parts - Space of storage in workshop insufficient, tools available - Limited maintenance budget.

CHAPTER 3. FACILITY EVALUATION CRITERIA

CHAPTER 3. FACILITY EVALUATION CRITERIA

3.1 General

In order to objectively grasp the problems at each airport as identified in the previous chapter, the evaluation criteria for existing facilities and equipment are now examined.

The evaluation of facilities and equipment is broadly classified into quantitative evaluation and qualitative evaluation. The former is made in terms of sufficiency in size and dimensions such as for the widths and lengths of runway, floor area of buildings, pavement strengths, etc., while the latter is made in terms of deterioration such as for pavement surface conditions, structure and finishing conditions of buildings, performance of equipment, etc.

In the criteria of quantitative evaluation, three degrees of urgency are assigned to the rehabilitation of facilities, while three degrees are also assigned corresponding to the necessity of rehabilitation or repair in the qualitative evaluation criteria.

3.2 Civil Facilities

The evaluation criteria in terms of urgency of rehabilitation are prepared for the following civil facilities :

- Runways
- Runway strips
- Taxiways
- Aprons

In the evaluation criteria for the civil facilities, the following meanings are assigned to each evaluation rank A, B and C respectively :

A : Rehabilitation urgently required
B : Rehabilitation desirable in near future
C : Rehabilitation not required

3.2.1 Quantitative Evaluation Criteria

(1) Runways

The quantitative evaluation criteria for runways are prepared for the evaluation items of length, width, maximum longitudinal slope and transverse slope as shown in TABLE 3.2.1.

As these evaluation items link directly to aircraft operations, in other words, aviation safety, the evaluation is categorized into only two groups, A and C.

TABLE 3.2.1 Evaluation Criteria for Runways

Evaluation Items	A	B	C	Remarks
1) Length	l < L	-	L ≦ l	L : Required Length l : Present Length
2) Width	w < W	-	W ≦ w	W : Required Width w : Present Width
3) Maximum Longitudinal Slope	I < i	-	i ≦ I	I : Allowable Slope i : Present Slope
4) Transverse Slope	S < s	-	s ≦ S	S : Allowable Slope s : Present Slope

Note : 1) L to be determined based on aircraft characteristics for specific route distance.
2) W, I and S to be selected corresponding to the type of aircraft operated at present, in accordance with ICAO ANNEX-14.

(2) Runway Strips

The runways strips are evaluated for the items of width, graded area width and transverse slope by comparing present dimensions with the requirements recommended in ICAO ANNEX-14.

For the same reasons as for runway, the evaluation is categorized into A and C only. (see TABLE 3.2.2)

TABLE 3.2.2 Evaluation Criteria for Runway Strips

Evaluation Items	A	B	C	Remarks
1) Width	w < W	-	W ≦ w	W : Required ~~Length~~ w : Present ~~Length~~
2) Width of Graded Area	w < W	-	W ≦ w	W : Required Width w : Present Width
3) Transverse Slope	S < s	-	s ≦ S	S : Allowable Slope s : Present Slope

Note : W and S to be selected corresponding to the type of aircraft operated at present in accordance with ICAO ANNEX-14.

(3) Taxiways

The present width, longitudinal and transverse slope of taxiways can be evaluated in accordance with TABLE 3.2.3.

TABLE 3.2.3 Evaluation Criteria for Taxiways

Evaluation Items	A	B	C	Remarks
1) Width	$w < W$	-	$W \leqq w$	W : Required Length w : Present Length
2) Maximum Longitudinal Slope	$I < i$	-	$i \leqq I$	I : Allowable Slope i : Present Width
3) Transverse Slope	$S < s$	-	$s \leqq S$	S : Allowable Slope s : Present Slope

Note : W, I and S to be selected corresponding to the type of aircraft operated at present, in accordance with ICAO ANNEX-14.

(4) Aprons

The quantitative evaluation criteria for aprons consider the items of number of aircraft stands, apron location and apron slope as shown in TABLE 3.2.4.

TABLE 3.2.4 Evaluation Criteria for Aprons

Evaluation Items	A	B	C	Remarks
1) Number of Aircraft Stands	$n < N+1$	-	$N+1 \leqq n$	N : Required No. of Spots for present scheduled flights n : Present No. of Spots
2) Location (Relationship between Aircraft on Apron with Transitional Surface)	Obstacle to the transitional surface for present runway strip	Located between A and C	Not obstacle to the transitional surface for required runway strip	
3) Slope	$1\% < s$	-	$s \leqq 1\ \%$	s : Present Slope

The above evaluation criteria are established taking into account the following :

1) In general practice in the planning of aprons, one additional aircraft stand is provided for delayed aircraft or unscheduled flights.

   The number of aircraft stands required for present scheduled flights can be estimated from airline timetables.

2) The present widths of runway strips at Indonesian airports do not generally meet the minimum requirements recommended in ICAO ANNEX-14. For example, few of the 20 airports are provided with a 300m wide runway strip as recommended by ICAO standards. Aprons are generally located beyond 75m from runway centerline but within 150m.

   In the evaluation therefore, the apron location is categorized as "A" where parking aircraft infringe the transitional surface corresponding to present runway strip width, and "C" where parking aircraft do not infringe the transitional surface corresponding to the runway strip width recommended by ICAO.

   Apron locations between A and C, i.e., where aircraft do not infringe the transitional surface for present runway strip width but infringe that for recommended runway strip width, are categorized "B" considering the above-mentioned general conditions of Indonesian airports.

(5) Pavement Strengths

The pavement strengths of runways, taxiways and aprons can be evaluated in terms of ACN (Aircraft Classification Number) and PCN (Pavement Classification Number).

Based on the criteria on overload aircraft operations suggested in ICAO ANNEX-14, the following evaluation criteria are established as shown in TABLE 3.2.5 for flexible and rigid pavement respectively.

TABLE 3.2.5 Evaluation Criteria of Pavement Strengths

Pavement	EVALUATION		
	A	B	C
Flexible	ACN$\geqq$1.1xPCN	1.1xPCN>ACN>PCN	ACN$\leqq$PCN
Rigid	ACN$\geqq$1.05xPCN	1.05xPCN>ACN>PCN	ACN$\leqq$PCN

3.2.2 Qualitative Evaluation Criteria

(1) Deterioration of Pavement Surface

The condition of deterioration of pavement surfaces is difficult to evaluate quantitatively because by nature, various types of distress such as crackings, corrugations, depressions, ruttings, raveling etc., occur to flexible pavements, and crackings, settlements, corner breaks, etc., to rigid pavements.

In order to evaluate such conditions of deterioration objectively, the following criteria are prepared for flexible and rigid pavements with reference to the airport pavement rehabilitation manual published by Japan Civil Aviation Bureau with minor modifications for simplified inspection and evaluation (see TABLES 3.2.6 and 3.2.7).

TABLE 3.2.6 Evaluation Criteria for Flexible Pavements

Item	Pavement	EVALUATION		
		A	B	C
Crack Ratio (K) (%)	Runway	$K \geqq 7$	$7 > K \geqq 0.1$	$0.1 > K$
	Taxiway	$K \geqq 13$	$13 > K \geqq 1$	$1 > K$
	Apron	$K \geqq 17$	$17 > K \geqq 2$	$2 > K$
Maximum Rut Depth (L) (mm)	Runway	$L \geqq 40$	$40 > L \geqq 10$	$10 > L$
	Taxiway	$L \geqq 60$	$60 > L \geqq 20$	$20 > L$
	Apron	$L \geqq 70$	$70 > L \geqq 25$	$25 > L$

TABLE 3.2.7 Evaluation Criteria for Rigid Pavements

Item	Pavement	EVALUATION		
		A	B	C
Crack Ratio (N) (cm/m^2)	Runway	$N \geqq 6$	$6 > N \geqq 0.2$	$0.2 > N$
	Taxiway	$N \geqq 8$	$8 > N \geqq 0.6$	$0.6 > N$
	Apron	$N \geqq 11$	$11 > N \geqq 1$	$1 > N$
Failure Ratio of Joint (P) (%)	Runway	$P \geqq 1$	$1 > P \geqq 0.1$	$0.1 > P$
	Taxiway	$P \geqq 3$	$3 > P \geqq 0.1$	$0.1 > P$
	Apron	$P \geqq 6$	$6 > P \geqq 0.1$	$0.1 > P$
Maximum Level Difference (Q) (mm)	Runway	$Q \geqq 10$	$10 > Q \geqq 5$	$5 > Q$
	Taxiway	$Q \geqq 12$	$12 > Q \geqq 5$	$5 > Q$
	Apron	$Q \geqq 14$	$14 > Q \geqq 5$	$5 > Q$

Detailed methods for inspection and evaluation of pavement surface conditions are indicated in Appendix-3.2.1 together with calculation examples.

If any one of the above items is evaluated "A", the pavement surface condition is judged "A" as a total evaluation.

3.3 Building Facilities

3.3.1 Quantitative Evaluation Criteria

The quantitative evaluation criteria of buildings are made below for the sufficiency of present floor area of passenger terminal buildings, and administration and operation buildings.

The evaluation criteria for the height of control towers are also prepared hereinafter for quantitative evaluation.

In the evaluation criteria for the above, the following meanings are assigned to each evaluation rank respectively :

A : Rehabilitation urgently required
B : Rehabilitation desirable in near future
C : Rehabilitation not required

(1) Domestic Passenger Terminal Buildings

The floor area of domestic passenger terminal buildings can be evaluated from the criteria shown in TABLE 3.3.1 which are established taking the following into account :

- The unit floor space per two-way domestic passenger in peak hour is set at 6.0 sq.m as a planning value.

  This unit floor space is determined based on the following conditions:

  *1 The floor area which can be estimated by applying the above unit floor space contains:

  . Departure lounge, check-in lobby, concourse, baggage claim area, arrival lobby and airline office.
  . Security office.
  . Concessions and toilets.
  . Administrative area for controlling passengers, such as branch office of airport staff.

  *2 Six sq.m per passenger is applied to a one story domestic terminal building and ten to twelve sq.m per passenger for one and a half or two story domestic terminal building.

  *3 In accordance with DGAC's practice, four to six sq.m per passenger are adopted for domestic terminal.

  Assuming the tolerable space per passenger to be 0.3 sq.m for passenger processing areas such as departure lounge, check-in lobby etc., the acceptable unit floor space per two-way domestic passenger is set at 4.0 sq.m.

- Functional areas such as check-in lobby, departure lounge, baggage claim area etc., are evaluated by comparing with the required area estimated in accordance with IATA standards.

TABLE 3.3.1 Evaluation Criteria for Domestic Passenger Terminal Building

unit : sq.m

Evaluation Items	A	B	C	Remarks
1) Unit floor area per 2-way peak hour pax	$a \leqq 4.0$	$4.0 \leqq a < 6.0$	$6.0 \leqq a$	a:Present unit floor area
2) Check-in lobby	$a < A_1$	-	$A_1 \leqq a$	A_1:Required area a:Present area
3) Departure lounge	$a < A_2$	-	$A_2 \leqq a$	A_2:Required area a:Present area
4) Baggage claim area	$a < A_3$	-	$A_3 \leqq a$	A_3:Required area a:Present area

In the above table, A_1, A_2 and A_3 are calculated respectively as follows :

$$A_1 = \frac{(a+b)t_1}{60} \times 1.1 \times 1.8 \times 10.0 \times 1.1$$ (for sterile check-in lobby)

where, a : Number of originating passengers in peak hour
b : Number of transfer passengers
t_1 : Average processing time (assumed to be 1.5 minutes)

$$A_1 = s \times \frac{y}{60} \times \frac{3\,[a(1+v)+b]}{2}$$ (for non-sterile check-in lobby)

where, s : Unit space per passenger/visitor (assumed to be 1.5 sq.m)
y : Average occupancy time by passenger/visitor (assumed to be 20 min.)
a : Number of originating passengers in peak hour
b : Number of transfer passengers
v : Number of visitors per passenger (assumed to be 1.5 persons)

$$A_2 = s \times \frac{cui+cvk}{60} \times 1.1$$

where, s : Unit space per passenger
(assumed to be 2.0 sq.m)
c : Number of departing passengers in peak hour
u : Average occupancy time by long-haul passengers
(assumed 50 min. for international only)
v : Average occupancy time by short-haul passengers (assumed to be 30 min.)
i : Proportion of long-haul passengers
k : Proportion of short-haul passengers

$$A_3 = \frac{ews}{60} \times 1.1$$

where, e : Number of terminating passengers
w : Average occupancy time by passenger
(assumed to be 30 min.)
s : Unit space per passenger
(assumed to be 1.8 sq.m)

Supplementary information to the above formulars is provided in the Appendix 3.3.1.

For total evaluation, the function of the domestic passenger terminal building is basically judged "A", if any one of these 3 functional areas is evaluated "A".

(2) International Passenger Terminal Building

The functional evaluation criteria for international passenger terminal buildings are established as shown in TABLE 3.3.2 taking the following into account :

- Nine sq.m is adopted as a planning value of unit floor area for international buildings with reference to IATA standards.

The floor area which can be estimated by applying the above unit floor space contains:

. Departure lounge, check-in lobby, concourse, baggage claim area, arrival lobby and airline office.
. CIQ and security office.
. Concessions and toilets.
. Administrative area for controlling passengers, such as branch office of airport staff.

Applying the same principle as the domestic passenger buildings, five sq.m per passenger is considered to be a tolerable limit of unit floor space per international passenger.

- The evaluation criteria for check-in lobby of international passenger buildings is eliminated because the check-in lobby for domestic passengers serves also for international passengers in practice.

- Sufficiency in number of immigration counters for departure and arrival and customs counters for arrival represents the sufficiency in areas related to respective counters.

TABLE 3.3.2 Evaluation Criteria for International Passenger Terminal Building.

Evaluation Items	A	B	C	Remarks
1) Unit floor per 2-way peak hour pax.(m^2)	$a<5.0$	$5.0 \leqq a<9.0$	$9.0 \leqq a$	a :Present area
2) Departure Lounge	$a<A_2$	-	$A_2 \leqq a$	A_2:Required area a :Present area
3) Baggage claim area	$a<A_3$	-	$A_3 \leqq a$	A_3:Required area a :Present area
4) Number of departure immigration counters	$n<N_1$	-	$N_1 \leqq n$	N_1:Required number n :Present number
5) Number of arrival immigration counters	$n<N_2$	-	$N_2 \leqq n$	N_2:Required number n :Present number
6) Number of arrival customs counters	$n<N_3$	-	$N_3 \leqq n$	N_3:Required number n :Present number

In the above table, A_2 and A_3 are calculated by the aforementioned equations.

N_1, N_2 and N_3 are calculated in accordance with IATA standards as follows :

$$N_1 = \frac{(a+b)t_2}{60} \times 1.1$$

where, a : Number of originating passengers in peak hour
b : Number of transfer passengers
t_2 : Average processing time per passenger (assumed to be 1.0 min)

$$N_2 = \frac{(d+b)t_3}{60} \times 1.1$$

where, d : Number of terminating passengers in peak hour
b : Number of transfer passengers
t_3 : Average processing time per passenger (assumed to be 1.0 min)

$$N_3 = \frac{eft_4}{60} \times 1.1$$

where, e : Number of terminating passengers including int'l/dom. transfer
f : Proportion of passengers to be customs-checked
t_4 : Average processing time per passenger (assumed to be 1.5 min)

(3) Control Tower

The functional evaluation of control tower is made in terms of eye level elevation which can be determined in accordance with FAA criteria as follows:

$$E_e = E_{as} + D \text{ Tan. } (35 \text{ min.} + Gs)$$

where, E_e : Eye level elevation
E_{as} : Average elevation for section of runway surface
D : Distance from tower site to the section of runway surface
Gs : Angular slope of runway surface measured from horizontal and in direction of tower site.

Based on the above requirement, the evaluation criteria on the function of control tower is established as shown in TABLE 3.3.3.

TABLE 3.3.3 Evaluation Criteria for Control Tower

Evaluation Item	A	B	C	Remarks
Eye Level Elevation	$e < E_e$	-	$E_e \leqq e$	e : Present eye level (m) E_e : Required eye level (m)

(4) Administration and Operation Building

The floor area of administration buildings can be evaluated from the evaluation criteria established in TABLE 3.3.4.

TABLE 3.3.4 Evaluation Criteria for Administration and Operation Buildings

Evaluation Items		A	B	C	Remarks
Unit Floor Area	Class I Airport	a<11	$11 \leqq a < 17$	$17 \leqq a$	a:Present unit floor area per adm. staff (sq.m)
	Class II	a<10	$10 \leqq a < 16$	$16 \leqq a$	
	Class III	a< 9	$9 \leqq a < 13$	$13 \leqq a$	
	Class IV & V	a<13	$13 \leqq a < 20$	$20 \leqq a$	

The above criteria are established taking into account that :

- The unit floor area of the building per administrative staff member is set at 17, 16, 13 and 20 sq.m as planning values for respective airport classes as explained in Chapter 5 in detail.

- Four sq.m per staff member is considered to be a tolerable limit of floor space for administrative staff working at their office as compared with 6 sq.m for general planning value of office spaces.

  Based on this unit space and the proportion of administrative area to total floor area to be explained in Chapter 5, the acceptable unit spaces (minimum required total area/number of administrative staff) for each airport class are calculated as 11, 10, 9 and 13 sq.m respectively.

3.3.2 Qualitative Evaluation Criteria

(1) Building Structure

In order to objectively evaluate the magnitude of deterioration or distress on the structural element of buildings, the evaluation criteria indicated in TABLE 3.3.5 are prepared by referring to "Building Maintenance Manual" and "Judgment Method of Need of Repair to Government Buildings" published by the Building Maintenance Center under the supervision of the Japanese Ministry of Construction.

In the table, the following meanings are assigned to each of A , B and C ;

A : Rehabilitation or reconstruction urgently required
B : Rehabilitation desirable in near future
C : Rehabilitation not required

TABLE 3.3.5 Evaluation Criteria for Building Structure

K = Percentage of damaged area or members
W = Width in m/m

Evaluation Items	A	B	C	Remarks
1. Foundation 1) Level line differential correlation among near buildings	Easy to find out	By measurement only	Normal Condition	
2) Building deformation by settling or heaving	Ditto	Ditto	Ditto	
2. Super Structure 2.1 R.C. Structure 1) Cracking of Structural members by bending moment or shearing force (Width of crack and percentage of number cracked members)	$W \geqq 0.3$ and $K \geqq 30$	$W \geqq 0.3$ and $K < 30$	$W < 0.3$	
2) Discoloration or breaking of concrete surface by rusting of reinforcing bar due to concrete neutrality or damage from salt water	In part of main bars	In sub bars only	Almost normal condition	
2.2 Steel Structure 1) Deformation, losing of bolts and loosening of joints	In main frame	In sub frame only	Almost normal condition	
2.3 Wooden Structure 1) Deformation of frames and loosening of joints	Easy to find out	By measurement only	Normal condition	
2) Corroded area in main frame by termite infestation or other factors (%)	$K \geqq 30$	$30 > K \geqq 5$	$5 > K$	

(2) Building Finishings

The magnitude of deterioration or damages to building finishings such as floors, walls, roofs etc., is difficult to evaluate quantitatively.

Based on the same Japanese manuals referred to for the evaluation criteria on building structure, TABLE 3.3.6 is prepared as the evaluation criteria for building finishings, so as to facilitate an objective evaluation.

In the table, A, B and C have the following meanings respectively :

A : Rehabilitation urgently required
B : Repair required
C : Rehabilitation not required

TABLE 3.3.6 Evaluation Criteria for Building Finishings

K : Percentage of damaged area or members

Evaluation Items	A	B	C	Remarks
1 Floor 1) Floated area to total area (%)	$K \geqq 50$	$50 > K > 0$	0	
2) Deteriorated area on finishing materials to total area (%)	$K \geqq 50$	$50 > K > 0$	0	
2. Walls 2.1 Interior walls 1) Cracked area to total area (%)	$K \geqq 50$	$50 > K > 0$	0	
2) Deteriorated area on finishing materials to total area (%)	$K \geqq 50$	$50 > K > 0$	0	
2.2 External walls 1) Cracked area to total area (%)	$K \geqq 50$	$50 > K > 0$	0	
2) Broken area to total area (%)	$K \geqq 10$	$10 > K > 0$	0	

TABLE 3.3.6 (continued)

K : Percentage of damaged area or members

Evaluation Items	A	B	C	Remarks
3. Doors & windows 1) Dangerous condition liable to collapse	Dange-rous	Not so dangerous	No problem	
2) Difficulty of operation due to deformation	Diffi - cult	Still possible	No problem	
4. Ceiling 1) Damaged by leaks over total area (%)	$K \geq 30$	$30 > K > 0$	0	
2) Deterioration in finishing materials to total area (%)	$K \geq 50$	$50 > K > 0$	0	
5. Roof 5.1 Flat roof	Leakage	-	No leakage	
5.2 Clad Roof 1) Deterioration in roofing materials to total area (%)	$K \geq 50$	$50 > K > 0$	0	
2) Deformation, corrosion or rust in roof sheeting to total area (%)	$K \geq 50$	$50 > K > 0$	0	
6. Roof Drains and Guttering 1) Damages	Serious damages to be replaced with new	Slightly damaged. Possible to repair	No problem	
7. Handrails 1) Damage such as rus-ting, deterioration,etc.	Ditto	Ditto	No problem	

3.4 Ancillary Equipment in Buildings and Airport Maintenance Equipment

3.4.1 Qualitative Evaluation Criteria

The performance of ancillary equipment in airport buildings such as X-ray baggage screening units, walk-through metal detectors, baggage claim devices etc., and airport maintenance equipment such as mowers, sweepers etc., is qualitatively evaluated in terms of magnitude of damages or failures based on the evaluation criteria shown in TABLE 3.4.1.

In this table, the evaluations of A, B and C have the following meanings respectively :

A : Replacement of parts or complete renewal of equipment required
B : Repair required
C : Normal condition

Total evaluation of equipment itself is made judging comprehensively the evaluation results for each evaluation item.

TABLE 3.4.1 Qualitative Evaluation Criteria for Ancillary Equipment in Building and Airport Maintenance Equipment.

Evaluation Items	A	B	C
1) Rusting	Heavy rusting; holes in surface of main body	Possible to maintain by scraping off the rust and repainting with a rust preventive agent.	No problem
2) Break Down (Damage)	Completely broken	Possible to repair	"
3) Leakage	Leakage of water (or exhaust gas)	Seepage of water (or exhaust gas)	"
4) Strike (Check by inspection hammer)	Dull sound	----------	Normal Sound
5) Abrasion	Already abraded	----------	No problem
6) Smell	Unusual smell	----------	"
7) Noise	Unusual sound	Unusual sound is not so remarkable	"
8) Stain	No possibility to clean up	Possible to clean up	"

The main parts to be checked and evaluated in accordance with the above evaluation criteria are shown in TABLES 3.4.2 and 3.4.3 for the ancillary equipment in buildings and the airport maintenance equipment, respectively.

TABLE 3.4.2 Main Parts of Building Ancillary Equipment to be Checked and Evaluated

Evaluation Items	X-Ray	Walk Through Metal Detector	Baggage Claim	Air Condition	Toilet	Faucet
1. Rusting	- Main body	- Control Box - Gate	- Main body - Casing	- Main body	----	- Pipe - Cock
2. Break Down	- Electrical Mechanism - Mechanical Mechanism	- Control Box - Gate	- Belt	- Mechanical Mechanism	- Vessel	- Pipe - Cock
3. Leakage	----	----	----	----	- Waste Water	- Portable water
4. Strike	----	----	- Bolt	----	----	----
5. Abrasion	- Belt	----	- Belt	----	----	----
6. Smell	- Belt - Control Box	- Control Box - Gate	- Belt - Control Box	- Mechanical Mechanism - Electrical Mechanism	----	----
7. Noise	- Operation sound	----	- Operation sound	- Operation sound	----	----
8. Stain	- Casing	- Casing	- Casing	- Casing	- Vessel	- Cock

TABLE 3.4.3 Main Parts of Airport Maintenance Equipment to be Checked and Evaluated

Evaluation Items	Mower	Tractor	Handy Mower	Sweeper	Dump Truck	Trailer	Roller
1. Rusting	- Main body	- Main body - Casing	- Main body	- Main body - Casing	- Main body	- Main body	- Main body
2. Break Down	- Main body	- Main body - Engine - Transmission	- Engine - Drive Mechanism	- Main body - Engine - Transmission - Sweep unit	- Engine - Transmission	- Main body	- Engine - Transmission
3. Leakage	- Gear oil	- Exhaust gas of engine - Radiator water of Engine - Oil of Engine	- Exhaust gas of engine	- Exhaust gas of engine - Radiator water of Engine - Oil of Engine	- Exhaust gas of Engine - Radiator water of Engine - Oil of Engine	----	- Exhaust gas of engine - Radiator Water of Engine - Oil of Engine
4. Strike	- Bolt	- Tyre bolt - Engine bolt	----	- Tyre bolt	Tyre bolt	Tyre bolt	- Bolt
5. Abrasion	----	----	----	----	----	----	----
6. Smell	----	- Exhaust gas of Engine	- Exhaust gas of Engine	- Exhaust gas of Engine	- Exhaust gas of Engine	----	Exhaust gas of Engine
7. Noise	- Operation sound	- Operation sound	- Operation sound	- Operation sound	- Operation sound	- Operation sound	- Operation sound
8. Stain	- Casing	- Casing	- Casing	- Casing	- Casing	- Casing	- Casing

3.4.2 Quantitative Evaluation Criteria

In the quantitative evaluation of building ancillary equipment or airport maintenance equipment, the sufficiency is expressed in terms of percentage of the number/capacity of equipment available at present to that of equipment required which can be estimated from the requirement criteria discussed in Chapter 5.

The criteria for the above evaluation is prepared as indicated in TABLE 3.4.4, based on engineering experience.

In the table below, the following meanings are assigned to each evaluation rank respectively.

A: Renewal or addition of equipment urgently required
B: Renewal or addition of equipment desirable in near future
C: Renewal or addition of equipment not required.

TABLE 3.4.4 Quantitative Evaluation Criteria for Equipment

Evaluation Items	A	B	C
Percentage of equipment available to that required (S)	$S \leq 50\%$	$50\% < S \leq 75\%$	$75\% < S$

For practical evaluation, the existing equipment ranked "B" (i.e., repair required) in qualitative evaluation is not included in the available equipment considering that :

- Although equipment ranked "B" can technically be repaired, it is practically difficult under the present situation because such equipment is too aged to purchase spare parts.

3.5 Summary of Evaluation Criteria

The evaluation criteria were establised for civil and building facilities, and equipment in the above sections. In order to easily grasp the items and to conveniently refer to the evaluation of the existing facilities discussed in Capter 6, evaluation items and classifications are summarized in Table 3.5.1.

Table 3.5.1 Item of Evaluation Criteria (1)

Facility		Evaluation Item	Classification
Civil Facilities	1. Runway	1) Quantitaive Evaluation Length, Width, Longitudinal Slope Transverse Slope, Pavement Strength 2) Qualitative Evaluation Pavement Deterioration	A: Rehabilitation urgently required B: Rehabilitation desirable in near future C: Rehabilitation not required
	2. Runway Strip	1) Quantitative Evaluation Width, Width of Graded Area Transverse Slope	
	3. Taxiway	1) Quantitative Evaluation Width, Longitudinal Slope, Transverse Slope, Pavement Strength 2) Qualitative Evaluation Pavement Deterioration	
	4. Apron	1) Quantitative Evaluation Number of Aircraft Stands, Location, Slope, Pavement Strength 2) Qualitative Evaluation Pavement Deterioration	

Table 3.5.1 Item of Evaluation Criteria (2)

Facility		Evaluation Item	Classification
Building Facilities	5. Passenger Terminal Building Administration & Operation Building and Control Tower	1) Quantitative Evaluation Function (Floor Area, Number of Counters), Eye Level Elevation of Control Tower 2) Qualitative Evaluation Structure (Foundation, Super Structure Steel Structure)	
		3) Qualitaive Evaluation Finishing (Floor, Walls, Doors, Windows, Ceiling, Roof, Roof Drains, Handrails)	A: Rehabilitation urgently required B: Repair future required C: Rehabilitation not required
Equipment	6. X-Ray Metal Detector, Walk Through Metal Detector, Baggage Claim Device and Air Conditioning	1) Quantitative Evaluation Equipment Availability	A: Renewal or addition of equipment urgently required B: Renewal or addition of equipment desirable in near future C: Renewal or addition of equipment not required

Table 3.5.1 Item of Evaluation Criteria (3)

Facility		Evaluation Item	Classification
		2) Qualitative Evaluation Rusting, Break Down, Leakage, Strike, Abrasion, Smell, Noise Stain	A: Replacement of parts or complete renewal of equipment required B: Repair required C: Normal condition

CHAPTER 4. REVIEW OF AIR TRAFFIC DEMAND FORECASTS

CHAPTER 4. REVIEW OF AIR TRAFFIC DEMAND FORECASTS

4.1 General

This chapter sets forth the demand forecasts of future air traffic at the 20 airports.

As defined in Chapter 1 of this report, the term of rehabilitation in this Study means not only the restoration to original function or service levels but also the extension or expansion to allow more effective use of existing facilities which constrain present air traffic demands. Such rehabilitation work should at least cope with the future demands when completed.

In this Study, the forecasts are made for the year 1995 being the target year of rehabilitation plans taking into account the probable implementation schedule of the rehabilitation work after the Study.

The forecasts also cover the air traffic demands in 2004 so as to check if the rehabilitation works to be planned for existing facilities are in compliance with the long-term airport development framework.

4.2 Annual Demand Forecasts

4.2.1 Methodology

(1) Four Step Estimate Method

The study of the annual traffic demand forecast is carried out fundamentally by reviewing the latest study report, i.e. "The Study on the Future Demand of the Inter-Island Traffic in the Republic of Indonesia, JICA, 1988" (hereafter referred to as the "PREVIOUS STUDY").

Because of the evident differences in the purpose, scope of work and implemented time between the PREVIOUS STUDY and this Study, the review is made in accordance with the "Four step estimate model" as used in the PREVIOUS STUDY, in principle weighing on the latest statistical data and specific traffic data for the 20 airports. The concept of the above-mentioned method is shown in FIGURE 4.2.1

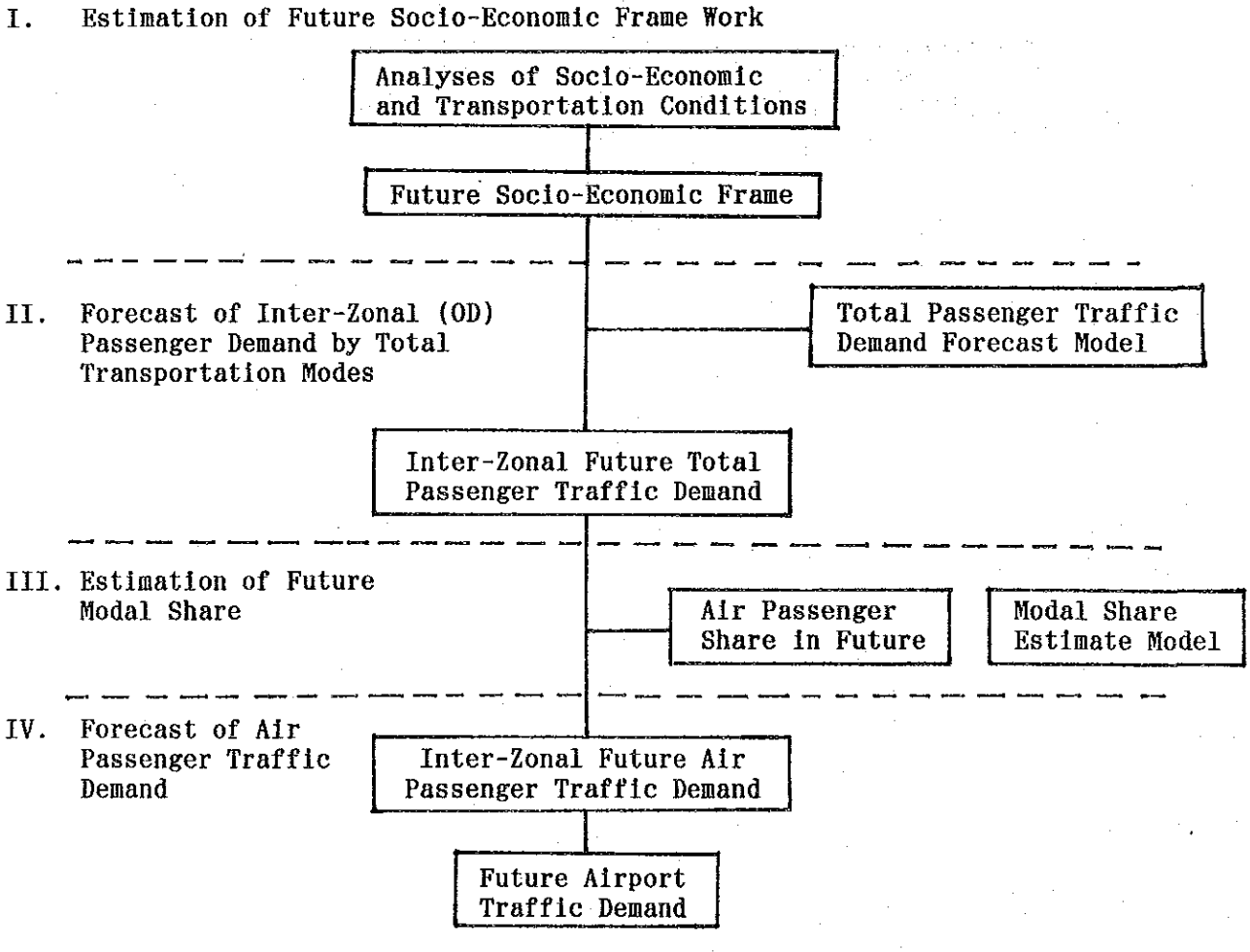


FIGURE 4.2.1 Concept of Four Step Estimate Method

(2) Method of "Reproduction of Original Situation"

Methodologically, this Study aims at a steady and realistic demand forecast laying special stress on the present situation of socio-economic and transportation activities in the Republic of Indonesia.

In the review process, various and latest data and information provided by governmental and semi-governmental authorities are analysed and applied, while on the other side various devices and methods are developed and applied for the data processing.

One of the most characteristic devices applied for this Study is the method of "Reproduction of original situation". The application of this method makes it possible to adjust and avoid any unrealistic alienation and deviation which may possibly be caused by the errors in input data and which may be brought about by model applications. (See FIGURE 4.2.2)

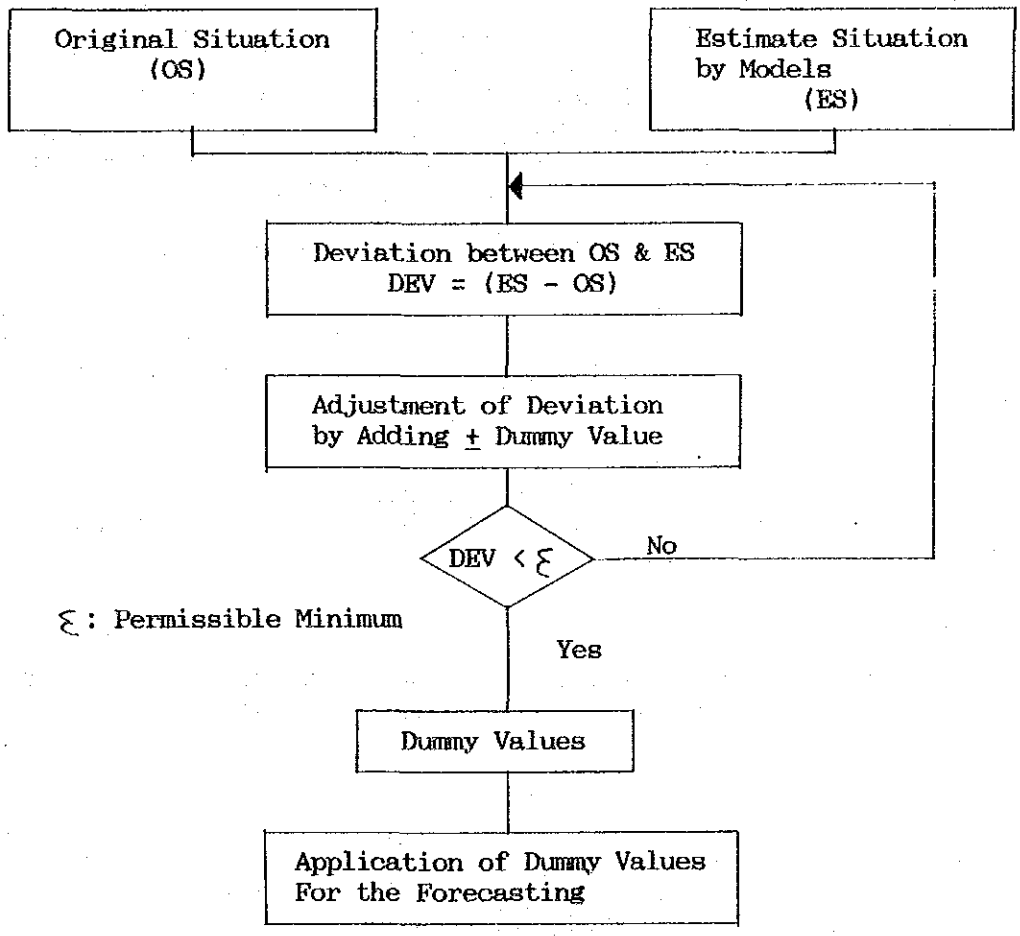


FIGURE 4.2.2 Concept of Reproduction of Original Situation

The above-mentioned "Reproduction Method" is mainly oriented to obtain the most realistic future values of the respective air passenger traffic.

It should be noted that the various intermediate outputs e.g., the zonal O.D traffic demand by total transportation modes, the zonal O.D traffic share by other transportation modes than that of air transportation, etc., are hypothetical or temporary, because the other transport modes are not direct targets of the reproduction method.

(3) "Aggregation Type" of Four Step Estimate Method

In this study, so called "aggregation type" of 4 Step Estimate Method is employed as opposed to the "Non aggregation type" used in the PREVIOUS STUDY. In the non aggregation type, the traffic demand forecast is carried out based on interview or site survey of passenger traffic and passenger travel behavior, while this study is based on statistical data only.

Since the statistical data for passenger traffic flow among zones ("pure" or "net" zone OD passenger table) are very limited at present, the air passenger traffic flows among province zones for the year 1984 in the PREVIOUS STUDY are utilized in this Study after due data processing so that these data may be adopted to the present traffic situations, by application of an "iteration" method.

(4) Utilization of Latest Data and Cross-section Analyses

In this study, various cross-sectional and trend analyses are carried out on the latest data in the year 1989 and the past data up to 1989. Base year for the forecast in this Study is 1989, while 1984 was used in the PREVIOUS STUDY.

Various newly designed devices and procedures are also applied in this Study for up-dating the analyses, although the socio-economic and traffic data as of 1989 are quite limited apart from the traffic data of the respective 20 airports.

(5) Transport Modes Studied

Transport modes studied are the four modes of railway, bus, seaway and airway, while only the two modes of seaway and airway were studied in the PREVIOUS STUDY.

(6) International Air Passenger Traffic

Demand forecasts for international air passenger traffic are taken together with the forecast for the domestic air passengers, because the former is too small to be assessed independently.

(7) Zoning

Province zones and airport zones are both included in this study, but province zones only were included in the PREVIOUS STUDY.

The zoning of this Study is defined as follows :

a) Province Zone

A province Zone in this Study means the same zone as the administrative unit of province in the Republic of Indonesia.

b) Airport Zone

"Airport Zone" in this Study is not geographically defined but defined as the relativity to the province in which the respective airport is located (See Formula 4.2.1).

$$ZNAPn = APPRVi \cdot \frac{TIOn}{TIOim} \quad \text{---------- (4.2.1)}$$

where,

ZNAPn	:	Area of airport (n) (km^2)
APPRVi	:	Area of the province (i) in which the airport (n) is located (km^2)
TIOn	:	Number of air passengers in- and out-bound at airport (n)
TIOim	:	Aggregated number of air passengers in- and out-bound at airport (m) (m = 1,2,3,...n,...m) within province (i).

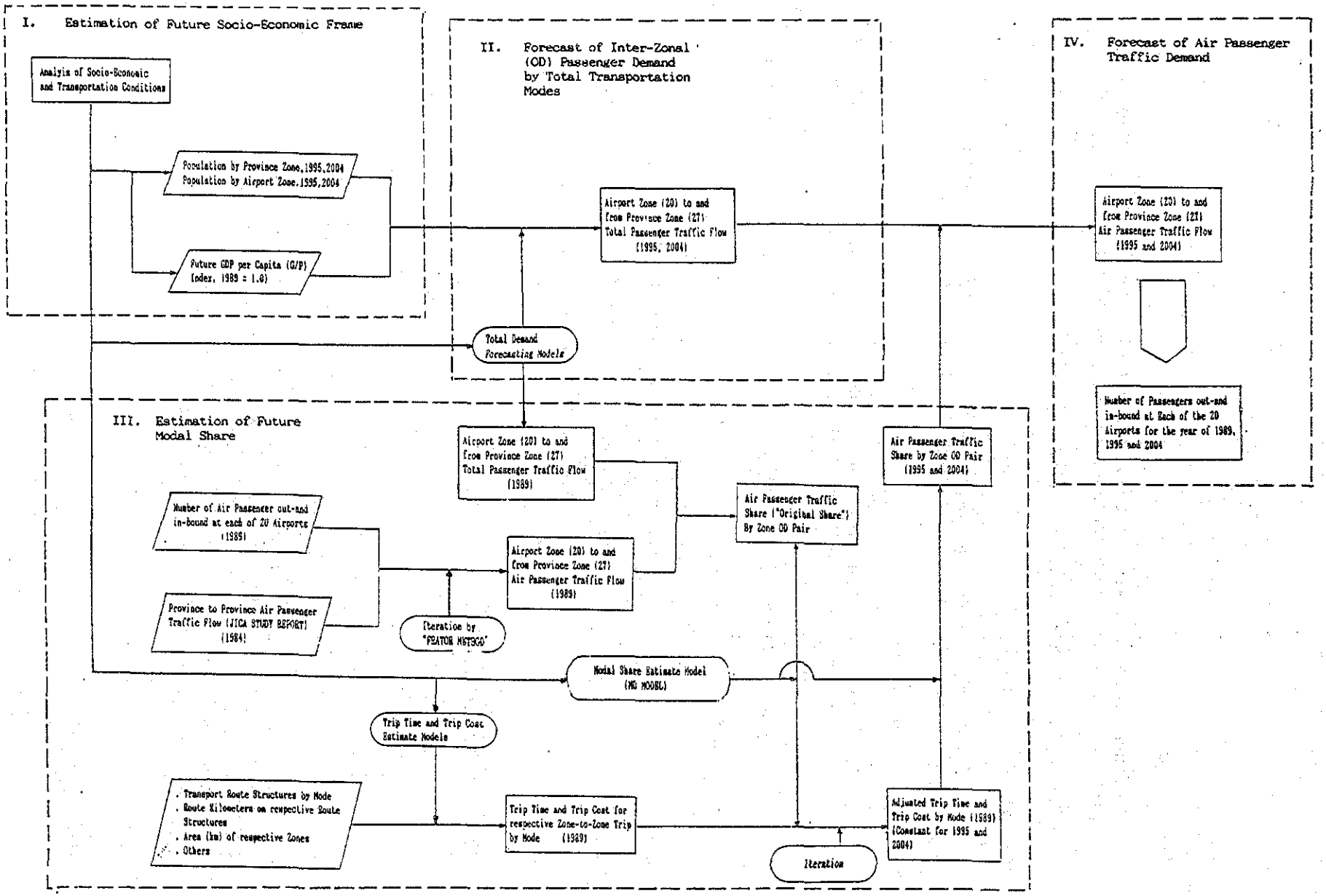
(8) Work Flow for the Demand Forecasting

The implementation work flow based on the foregoing methodology is shown in FIGURE 4.2.3.

(9) Forecast of Possible Air Passenger Traffic Demand

This study aims at forecasting the "would be realized" number of "possible" air passengers, that is, available number of passengers at each of 20 airports, provided with no special restrictions on airport facilities, etc. but does not aim at assessing the incremental number of passengers accompanied by the implementation of rehabilitation. The assessment in the incremental number of passengers will be discussed later in the chapter on economic analyses.

FIGURE 4.2.3 TRAFFIC DEMAND FORECASTING WORK FLOW



4.2.2 Socio-Economic Frame and Air Transportation Conditions

(1) Analyses of Socio-Economic and Air Transportation Conditions

1) Past Trend of Socio-economic and Air Transportation

Past Trends of population, GDP and air passengers at national level are shown in TABLE 4.2.1.

TABLE 4.2.1 Past Trend of Socio-Economic Condition and Air Transportation (National Level)

	Population (x1,000)	GDP (bil. Rp.)	Air Passengers (x1,000)
1980	147,490	60,408 *	11,270
Average Growth Rate	2.3%	5.1%	4.7%
1984	161,580	73,698	13,539
Average Growth Rate	2.1%	4.0% (by REPELITA V)	3.9% (by REPELITA V)
1989	179,136	n.a	n.a

* At 1983 Constant Prices

2) Past Trend of Air Passengers at 20 Airports

Number of air passengers out- and in-bound at each of 20 airports 1982 ~ 1989 are shown in TABLE 4.2.2.

TABLE 4.2.2 Air Passengers at 20 Airports

	Tanjung Pinang	Pekan-baru	Gunung Sitoli	Palembang	Semarang	Pontianak	Sampit
1982	113370	266962	10333	535384	356395	251443	38392
1983	108037	256860	8236	485546	346994	260046	47703
1984	96156	278507	8088	482704	353244	280854	55364
1985	87515	290950	8417	441650	358600	281733	48931
1986	69396	317970	8400	480736	399837	312340	45211
1987	67707	285903	9226	456061	418252	317141	50918
1988	65777	322671	10234	512891	482834	344632	66661
1989	74280	355231	9381	545750	530815	364762	72014

	Palang-karaya	Tarakan	Tana Toraja	Palu	Goron-talo	Ambon	Ternate
1982	68908	70313	0	153345	51579	150522	40297
1983	80852	83600	0	129094	43309	125853	47272
1984	115656	86204	249	128022	45606	130013	50383
1985	128421	78960	1449	118395	42594	121957	51500
1986	126992	80998	1447	129437	51223	128167	54349
1987	116268	72416	2780	123438	50252	137008	59984
1988	114791	90344	0	145894	50331	140201	60200
1989	154131	82811	5115	166351	63294	146870	59882

	Mataram	Bima	Jayapura	Wamena	Kaimana	Merauke	Total
1982	120549	23442	102552	27759	0	18156	2399500
1983	97252	23495	109698	26757	0	25391	2306070
1984	119552	29621	125185	28176	1893	31395	2446860
1985	132203	43120	135100	24491	0	36941	2432930
1986	145533	38266	163362	77555	0	39458	2670680
1987	151890	36809	127389	47859	3090	31851	2567040
1988	159989	42689	128840	49069	5162	33463	2826670
1989	204896	72049	145152	48461	9660	27982	3138890

Source : DGAC and respective airports

(2) Population and GDP

1) Total population

Average growth rate of total population in future is estimated with due consideration to the achievement in the past years and to the projection in the 5th Five-Year Plan (See TABLE 4.2.3).

The estimated growth rate for the future is shown in TABLE 4.2.4.

TABLE 4.2.3 Yearly Average Growth Rate during Past Years

Year	Yearly average growth rate (%)	Remarks
Final year of the 2nd Five-Year plan (1978)	2.3	Referred to 5th 5-Year Plan
Final year of the 3rd Five-Year plan (1983)	2.2	Ditto
Final year of the 4th Five-Year plan (1988)	2.1	Ditto
Final year of the 5th Five-Year plan (1993)	1.8	Projection of the 5th 5-Year Plan

Source : 5th Five-Year Plan

TABLE 4.2.4 Population Growth Rate in Future

Period	Average yearly growth rate
1989 - 1993	1.8 %
1993 - 1995	1.7 %
1995 - 2004	1.3 %

2) GDP

Average growth rate of GDP in the future is estimated taking account of Governmental projections. (See TABLE 4.2.5).

TABLE 4.2.5 GDP Growth Rate

Period	Average yearly growth rate
1989 - 1995	5.0 %
1995 - 2004	4.0 %

3) Population by Province Zones

Future population by province zone is obtained by "trend analyses" for each of 27 provinces and afterwards controlled by the total population which has been forecast based on the average yearly growth rate in TABLE 4.2.4. (See Appendix 4.2.1).

The forecast population by provinces is shown in TABLE 4.2.6.

TABLE 4.2.6 Population by Province

Administrative Units of Province	Projected By 5th 5 Year Plan						FORECAST BY THIS STUDY	
	1985	1986	1987	1988	1989	1990	1995	2004
1. DAERAH ISTIMEWA ACEH	2,982.7	3,069.2	3,155.0	3,239.5	3,323.7	3,407.2	3,820.46	4,441.75
2. SUMATERA UTARA	9,455.6	9,678.5	9,901.9	10,115.9	10,330.1	10,541.2	11,573.37	13,025.86
3. SUMATERA BARAT	3,711.3	3.674.4	3,814.1	3,860.4	3,904.7	3,947.4	4,125.33	4,251.43
4. RIAU	2,557.3	2,639.8	2,719.5	2,802.1	2,882.8	2,963.8	3,371.67	4,023.12
5. JAMBI	1,750.9	1,818.6	1,884.1	1,954.0	2,022.6	2,092.2	2,456.58	3,109.10
6. SUMATERA SELATAN	5,388.9	5,561.0	5,728.3	5,902.3	6,072.5	6,243.2	7,110.38	8,521.84
7. BENGKULU	946.6	987.4	1,027.7	1,071.2	1,114.2	1,158.2	1,390.32	1,827.16
8. LAMPUNG	5,926.5	6,239.5	6,555.6	6,890.1	7,231.4	7,585.8	9,527.21	13,599.57
S U M A T E R A	32,719.8	33,758.3	34,786.2	35,835.5	36,882.0	37,939.0	43,375.31	52,799.82
9. D.K.I JAKARTA	7,913.5	8,207.2	8,498.7	8,803.7	9,104.8	9,406.5	10,988.21	13,780.69
10. JAWA BARAT	30,939.9	31,684.6	32,399.1	33,093.6	33,769.4	34,433.9	37,594.74	41,651.93
11. JAWA TENGAH	27,040.7	27,457.0	27,881.2	28,259.7	28,644.3	29,016.7	30,665.29	32,283.52
12. D.I. YOGYAKARTA	2,940.7	2,987.9	3,037.1	3,081.2	3,127.0	3,171.7	3,365.60	3,563.17
13. JAWA TIMUR	31,372.6	31,768.8	32,168.6	32,516.4	32,868.3	33,205.8	34,507.38	35,219.23
J A W A	100,207.5	102,105.4	103,984.6	105,754.6	107,513.8	109,234.6	117,121.22	126,498.54
14. BALI	2,658.8	2,690.3	2,722.5	2,752.0	2,782.0	2,811.5	2,915.84	2,964.00
15. NUSA TENGGARA BARAT	3,005.4	3,083.0	3,159.2	3,232.4	3,305.0	3,376.8	3,720.79	4,187.59
16. NUSA TENGGARA TIMUR	3,072.1	3,153.8	3,232.8	3,308.8	3,383.5	3,457.3	3,822.71	4,340.81
17. TIMOR TIMUR	632.9	654.3	674.1	695.1	714.8	734.5	837.85	1,006.83
N U S A T E N G G A R A	9,369.2	9,581.3	9,788.5	9,988.2	10,185.4	10,380.0	11,297.19	12,499.24
18. KALIMANTAN BARAT	2,829.5	2,909.4	2,985.0	3,068.6	3,148.2	3,227.8	3,617.80	4,209.23
19. KALIMANTAN TENGAH	1,121.9	1,159.9	1,196.6	1,235.7	1,273.9	1,312.7	1,507.90	1,831.47
20. KALIMANTAN SELATAN	2,280.7	2,327.6	2,373.9	2,419.2	2,463.8	2,507.5	2,711.22	2,963.61
21. KALIMANTAN TIMUR	1,517.0	1,584.5	1,650.0	1,721.5	1,791.6	1,863.1	2,249.51	2,997.78
K A L I M A N T A N	7,749.1	7,981.4	8,205.5	8,445.0	8,677.5	8,911.1	10,086.43	12,002.09
22. SULAWESI UTARA	2,320.8	2,360.3	2,398.6	2,436.2	2,472.9	2,509.1	2,665.11	2,821.16
23. SULAWESI TENGAH	1,516.3	1,570.2	1,622.4	1,679.0	1,734.2	1,790.3	2,073.58	2,553.21
24. SULAWESI SELATAN	6,633.1	6,734.7	6,832.2	6,917.8	7,001.8	7,082.1	7,435.42	7,727.07
25. SULAWESI TENGGARA	1,123.7	1,167.8	1,211.7	1,255.1	1,298.7	1,342.4	1,576.92	1,999.76
S U L A W E S I	11,593.9	11,832.9	12,064.9	12,288.1	12,507.7	12,724.0	13,751.02	15,101.20
26. MALUKU	1,614.3	1,667.0	1,716.7	1,766.4	1,814.2	1,861.2	2,110.10	2,509.44
27. IRIAN JAYA	1,375.8	1,421.1	1,463.0	1,511.0	1,555.7	1,600.4	1,829.02	2,203.69
M A L U K U & I R I A N J A Y A	2,990.1	3,038.1	3,179.7	3,277.4	3,369.8	3,461.6	3,939.12	4,713.13
I N D O N E S I A	164,629.6	168,347.5	172,009.5	175,588.8	179,136.1	182,650.4	199,570.29	223,614.03

4.2.3 Total Demand Forecasting

(1) Total Demand Forecasting Model

Total passenger traffic demand between airport zone (i) and province zone (j) is obtained by applying the Formula (4.2.2).

$$\log e Ti_{j(t)} = K \log e (G/P)_{(t)} + A + B \log e (Pi\ Pj)_{(t)} - C \log e Dij + \log e Qij \quad \text{---------- (4.2.2)}$$

where,

$Ti_{j(t)}$: Traffic demand between zone (i) and zone (j) for the year (t) (1000 persons)

Pi, Pj : Population of zone (i) and zone (j) respectively

Dij : Transport distance between zone (i) and zone (j).

A,B,C : Parameters obtained by the multi-regression analysis;
A = 18.3148 , B = 0.442451 , C = -2.97755

$(G/P)_t$: Index for the GDP per capita (1989 = 1.0)
(See TABLE 4.2.7)

K : Elasticity value : 0.7123 (See Appendix 4.2.2)

Qij : QIJ is obtained by Formula (4.2.3)

$$Qij = \frac{TR89ij}{T89ij} \quad \text{---------- (4.2.3)}$$

where,

TR89ij : Probable present total passengers between zone (i) and zone (j) for the year 1989 (See Appendix 4.2.3).

T89ij : Calculated total passengers obtained by the application of the part :

$$LogeTij_{(t)} = A + B \log e (Pi\ Pj)_{(t)} - C \log Dij$$

in the Formula (4.2.2)

Qij in the formulas (4.2.2) and (4.2.3) means the coefficient value of the adjustment to avoid contradictory outputs, such as the estimated

traffic volume is smaller than the airway traffic volume which is obtained independently for the same respective origin and destination. (See the following paragraphs).

TABLE 4.2.7 Index of G/P

Variables \ t : year		1989	1995	2004
G : GDP	(1)	1.000	1.314691	1.871215
P : POPULATION	(2)	1.000	1.11407	1.24829
G/P : {(1) / (2)}	(3)	1.000	1.18008	1.49902

Data utilized for the formulation of the abovementioned model is shown in Appendix 4.2.4.

Origin and destination traffic data by mode have been estimated based on the statistical data provided from various relevant authorities. (See Appendix 4.2.5).

(2) Zone OD Air Passengers in 1989

Zone OD (Airport zone to and from province zone) air passengers in 1989 are obtained by "Frator Method" using the respective province zone to province zone air passenger traffic flow 1984 in the PREVIOUS STUDY as the flow pattern, and using the inbound and outbound passenger including transit passengers at each of the 20 airports as "the generation" and "the attraction" of the respective airport zone.

Frator Method is one of the most practical iteration techniques to obtain the most approximate origin and destination TABLE, given the generation (out-bound) and attraction (in-bound) values by zone and the traffic flow pattern among zones.

Formulas for iteration by Frator Method are shown in Appendix 4.2.6.

(3) Outputs of Passenger Traffic Flow

Passenger traffic flows obtained by the beforementioned formulas in this chapter are as follows.

a) Airport zone to & from province zone total passenger traffic flow 1989 (See Appendix 4.2.7).

b) Airport zone to & from province zone total passenger traffic flow 1995, 2004 (See TABLES 4.2.8 (1), 4.2.8 (2)).

c) Airport zone to & from province zone air passenger traffic flow 1989 (See TABLE 4.2.9).

TABLE 4.2.8 (1) AIRPORT ZONE TO & FROM PROVINCE ZONE TOTAL PASSENGER TRAFFIC FLOW (hipothetically estimated), 1995

	T.PINAN	P.BARU	G.SITOL	PALMBAN	SEMARAN	PONTIAC	SAMPIT	PLNKARY	TARAKAN	T.TORJA	PALU	GORNTAL	AMBON	TERNATE	MATARAN	BIMA	JAYAPUR	WAMENA	KAIMANA	MERAUKE	TOTAL
DI.ACEH	15703	88818	29724	36891	13557	7572	1284	1424	658	656	785	683	573	448	1545	839	242	211	168	176	201784
SUM.UTA	71688	731486	233214	101898	37702	25437	6466	9631	2114	2316	6902	3539	1684	1282	5128	3835	698	614	495	514	1244868
SUM.BAR	67716	583238	18835	355158	50408	28142	6854	9875	1451	1648	4398	1342	1577	1028	3929	2802	487	358	278	284	1129228
RIAU	98176	524263	28159	361863	50454	16934	8168	10789	1186	1328	1439	2988	968	714	3584	1658	338	211	219	231	1185578
JAMBI	42636	462639	11888	621994	91347	14685	3323	4385	1228	1274	1588	1284	1815	716	4491	1821	312	258	191	283	1266388
SUM.SEL	37852	358754	12787	932822	195256	37841	13222	19193	3351	3796	8841	4827	2336	1714	9597	4894	1314	841	541	636	1648818
BENGKUL	6348	57582	918	513928	99781	9365	2486	3458	862	835	1387	663	886	542	4898	1365	221	174	122	133	784389
LAMPUNG	33922	74511	6385	311319	484857	45139	19833	26192	5223	5899	5495	4163	3436	2477	16214	7977	1857	986	687	722	1851838
JAKARTA	81146	237878	11287	962463	1495888	192827	48157	58792	12286	9298	28986	11628	29888	13578	58447	28875	11156	4437	1538	2811	3266888
JAW.BAR	94867	121893	29713	811691	2276678	145882	78933	86087	23498	28687	28122	14818	16576	10326	51893	28374	7831	4287	2556	3187	3837448
JAW.TEN	42944	58149	12424	288182	2542758	82845	133488	58995	48399	36592	49349	32991	23174	13835	199138	75174	12695	6345	3145	4367	3628818
YOGCYA	18268	26885	3148	88842	1698378	25177	17367	8298	32222	5186	3714	1847	2558	1485	15631	6878	9166	3286	868	1975	1945478
JAW.TIM	33791	48766	18931	128148	2163438	68545	187227	78791	38888	78839	86827	37294	58477	26619	583288	181688	28733	9783	4366	6472	3819848
BALI	4883	14428	1414	19551	532881	9849	4726	8272	18783	18881	23313	6618	14673	6956	234243	188873	7478	2932	948	1889	1838818
NT.BAR	2888	3325	1886	8238	169651	6788	2269	2753	6742	15342	12851	6549	5882	3443	218614	189588	1284	882	583	646	579867
NT.TIM	1245	1587	596	3836	32255	11582	1323	1825	28186	3561	3488	5886	4745	2538	49927	63281	584	488	368	382	215828
TIM.TIM	488	783	157	1659	26988	5836	297	423	372	746	1322	1551	777	496	13851	18821	185	138	98	181	66825
KAL.BAR	5612	9264	1775	28385	64588	58898	17883	31683	7679	1637	16573	7497	1156	846	7413	3136	398	331	252	266	256369
KAL.TEN	3846	7881	778	17881	161848	43912	66456	71971	7832	719	29866	18872	649	452	2773	1822	618	388	143	285	426735
KAL.SEL	4649	11389	1217	28119	338898	25142	93489	138896	14181	1198	43581	14414	851	622	9139	3537	292	246	186	197	712475
KAL.TIM	2277	4768	984	17745	154487	76868	69783	188478	27477	6967	99241	36444	5286	8777	2129	917	212	176	328	142	614358
SUL.UTA	1161	2918	448	4965	21332	5285	1755	3218	6842	6235	78455	91183	43595	95257	7748	3883	7884	2939	858	1789	386831
SUL.TEN	1218	1279	458	5446	42248	16341	17345	27619	9489	15325	147758	69598	9887	19385	12346	3911	1978	991	468	655	483533
SUL.SEL	4593	8278	1752	17369	75969	22277	5162	8854	13654	545831	198964	58213	58869	25817	87214	27416	38262	11589	3411	6958	1195568
SUL.TGR	863	1291	424	7776	46487	7659	673	884	1818	18468	36683	18515	18238	4764	14929	4861	1828	633	355	429	169881
MALUKU	671	934	314	1977	19256	1266	558	683	1229	5782	11844	16588	137546	88518	6883	2225	13694	5985	2868	3399	312436
IRIAN	244	359	132	1285	12964	471	412	788	347	1118	3332	5859	18536	7768	1587	654	138532	76428	49381	63132	382369
TOTAL	661731	3415798	618876	5588768	12888588	971667	798996	746543	386282	881275	989965	447578	447349	332383	1616598	669328	269694	135522	74486	181743	31586188

TABLE 4.2.8 (2) AIRPORT ZONE TO & FROM PROVINCE ZONE TOTAL PASSENGER TRAFFIC FLOW (hipothetically estimated), 2004

	T.PINAN	P.BARU	G.SITOL	PALMBAN	SEMARAN	PONTIAC	SAMPIT	PLNKARY	TARAKAN	T.TORJA	PALU	GORNTAL	AMBON	TERNATE	MATARAN	BIMA	JAYAPUR	WAMENA	KAIMANA	MERAUKE	TOTAL
DI.ACEH	21522	121738	39714	50537	17579	10263	1664	1967	947	845	1105	887	784	613	2063	1120	334	290	231	242	274437
SUM.UTA	96743	988261	307156	136845	48191	33985	8805	13114	3000	2942	9580	4534	2164	1729	6741	3996	936	833	672	698	1678920
SUM.BAR	87987	757832	22845	462390	61969	25881	7929	12932	1980	2813	5750	1654	2846	1334	4975	2535	531	456	353	371	1463768
RIAU	125819	726843	38057	582677	66179	23216	11492	15076	1727	1731	2849	3919	1339	988	4734	2239	478	294	385	322	1528598
JAMBI	66671	658346	15371	886853	122984	28665	4765	6289	1824	1795	2322	1624	1442	1017	6228	2525	446	369	272	291	1796018
SUM.SEL	52581	487242	17315	1298360	256619	51982	18513	26872	4888	4958	11475	5385	3248	2377	12992	6626	1833	1173	755	887	2265998
BENGKUL	9173	83317	1295	745873	136487	13401	3589	5031	1389	1136	1943	909	1164	783	5778	1925	321	253	177	193	1013188
LAMPUNG	49568	111029	9225	468158	687335	66994	28791	36594	8232	8323	8472	5926	5149	3712	23713	11667	1593	1366	1036	1088	1538760
JAKARTA	115807	336009	15484	1366788	2004668	269139	57364	83982	18286	12378	38448	15619	42185	19284	69672	28831	15879	6315	2177	4001	4513488
JAW.BAR	127277	162464	27891	1891158	2889888	192489	106737	116489	33186	25991	27735	17826	22286	13834	67845	37897	9473	5669	3445	4186	4981918
JAW.TEN	56329	65779	15887	273581	3155538	186422	176361	67417	55648	45121	66588	41848	38352	18128	254526	96088	16722	8359	4144	5751	4559688
YOGCYA	13582	34195	4836	186512	2182968	32738	23817	18987	44495	6411	5817	2383	3359	1949	28829	7778	12184	4348	1136	2688	2439488
JAW.TIM	43719	52743	13787	166125	2648228	87788	24415#	92312	51648	86162	115489	45768	65212	34388	735386	228968	26939	12688	5674	8488	4765388
BALI	6386	18633	1788	25388	658851	12579	6152	18767	25475	21953	38932	8895	18922	8978	294549	125946	9689	3883	1229	2346	1283488
NT.BAR	3793	4492	1438	11151	216848	9858	3898	3749	9565	19485	17836	8398	7828	4644	287888	144168	1634	1197	791	877	757826
NT.TIM	1688	2044	788	4126	41391	15428	1889	2495	48833	4541	4868	6542	6427	3427	65998	83641	795	664	491	528	287788
TIM.TIM	556	978	213	2312	35395	6926	416	593	544	975	1889	2845	1878	688	18772	14665	258	193	126	141	88764
KAL.BAR	7694	12782	2373	38992	83664	67912	24712	43781	11855	2118	23344	9747	1583	1159	9984	4198	538	456	347	367	346626
KAL.TEN	4257	9895	1849	23883	213968	68679	93596	181361	11493	944	42874	13347	985	638	3776	1392	867	421	281	287	585743
KAL.SEL	6288	15882	1583	26885	426682	33159	125668	174874	19862	1582	59683	18231	1133	829	11877	4596	391	329	249	264	928921
KAL.TIM	3315	6931	1284	25885	212683	189517	182281	147425	42888	9535	148432	58319	7569	12759	3821	1381	318	258	479	287	885519
SUL.UTA	1527	3826	564	6541	26537	6872	2325	4254	8343	7787	185978	113683	57238	125863	9918	3958	18411	3882	1123	2363	582824
SUL.TEN	1781	1799	616	7671	56182	22718	24577	39133	13979	28254	213388	92798	13767	27898	16913	5358	2793	1399	661	924	563721
SUL.SEL	5998	18786	2227	22696	93738	28731	6785	18586	18788	669219	255862	62186	76665	33619	118839	34843	39636	15874	4469	9112	1511688
SUL.TGR	1238	1838	589	11897	62534	18788	966	1269	2788	24727	53674	14283	14549	6775	28721	5636	1478	985	588	614	256888
MALUKU	929	1294	424	2743	25228	1733	768	953	1787	7524	16844	21663	198137	111299	8898	3881	19838	8321	2865	4725	429366
IRIAN	339	588	188	1793	17878	649	578	994	587	1463	4766	6681	25771	18888	2153	887	193789	186873	68948	88265	532934
TOTAL	984613	4677398	542361	7765958	16368588	1321628	1886738	1831218	433139	991653	1268888	575868	684215	447887	2879828	864953	369119	186899	182863	148858	41752588

TABLE 4.2.9 Airport Zone to & from Province Zone Air Passenger Traffic Flow, 1989

	T.PINAN	P.BARU	G.SITOL	PALMBAN	SEMARAN	PONTIAC	SAMPIT	PLNKARY	TARAKAN	T.TORJA	PALU	GORNTAL	AMBON	TERNATE	MATARAN	BIMA	JAYAPUR	WAMENA	KAIMANA	MERAUKE	TOTAL
DI.ACEH	5262	25164	386	16288	4282	4158	0	0	0	4	0	126	0	0	0	0	0	0	0	0	55579
SUM.UTA	11596	55458	194	21654	16252	15086	1720	3760	0	94	3652	1578	0	0	804	284	0	0	0	0	132131
SUM.BAR	5042	24116	474	18884	7448	10688	2876	4562	0	118	2180	218	360	146	0	0	0	0	0	0	76129
RIAU	1278	6098	2078	65866	7960	8322	4112	5604	0	94	0	1672	0	0	0	0	0	0	0	0	102286
JAMBI	1388	6638	120	23284	3842	4384	0	0	0	26	0	232	0	0	0	0	0	0	0	0	39915
SUM.SEL	7044	33686	420	88568	17646	13270	2288	5002	0	186	3372	1346	0	0	0	0	422	148	28	82	173424
BENGKUL	792	3784	48	8982	0	714	0	0	0	6	0	0	0	0	0	0	0	0	0	0	14243
LAMPUNG	4896	23422	368	8319	0	3024	0	0	0	18	0	482	0	0	0	0	0	0	0	0	40521
JAKARTA	24984	119892	2032	173888	288368	88552	5340	11678	3586	438	9876	5296	19214	7834	19466	6844	7456	2490	496	1438	718121
JAW.BAR	1886	9816	482	21484	26734	16944	914	2002	386	112	2330	1874	4542	1852	3578	1254	2816	948	188	542	99863
JAW.TEN	874	4188	328	17936	5508	23376	4456	9738	9420	144	0	4170	6826	2454	8348	2934	6944	2318	468	1338	118948
YOGCYA	1954	9346	918	6792	0	8988	304	666	21754	76	1144	488	902	378	7468	2622	6984	2332	464	1344	74888
JAW.TIM	1756	8418	314	24084	52182	24352	15168	33178	3316	1892	21568	3246	28938	8534	35818	12594	12382	4134	824	2386	286264
BALI	1738	8312	348	5558	18188	4152	2968	4586	12374	678	7248	298	7966	2882	58486	20536	5282	1764	352	1018	162672
NT.BAR	0	0	0	0	3864	1784	0	0	2748	28	0	398	0	0	26516	9324	142	46	18	28	44818
NT.TIM	0	0	0	0	6866	7548	218	458	28382	288	0	2482	2088	852	25574	8994	0	0	0	0	74855
TIM.TIM	0	0	0	0	9838	2848	0	0	0	38	0	764	0	0	5694	2884	0	0	0	0	19579
KAL.BAR	584	2802	198	8632	14968	39364	7174	15694	1368	92	2792	1188	0	0	2356	838	0	0	0	0	98828
KAL.TEN	618	2948	74	5888	9738	24534	2756	6828	0	52	0	1114	0	0	0	0	322	108	22	62	53462
KAL.SEL	1242	5942	142	7284	26818	9374	11586	25164	2466	142	7332	2254	0	0	4838	1702	0	0	0	0	186199
KAL.TIM	368	1752	198	8516	48874	34868	9242	20216	898	278	7194	5268	1376	568	0	0	0	0	0	0	138776
SUL.UTA	322	1542	54	2398	7288	3228	898	1958	1392	132	18728	7438	12644	5154	1472	518	5788	1932	386	1116	66347
SUL.TEN	0	0	42	1948	0	2488	0	0	0	278	32984	3494	3382	1388	0	0	938	318	64	188	47385
SUL.SEL	734	3516	128	7426	9988	9976	1642	3592	2816	124	32928	5282	28288	8278	4246	1492	21886	7386	1456	4218	147143
SUL.TGR	0	0	68	3548	13914	4462	0	0	0	198	14982	3772	3318	1358	0	0	246	82	18	48	45998
MALUKU	0	0	0	0	4588	0	0	0	0	218	4448	5482	34554	14888	0	0	6992	2334	464	1348	76341
IRIAN	0	0	0	468	7558	0	168	358	0	344	1776	3682	18188	4154	336	116	66562	22222	4438	12832	135898
TOTAL	74288	355231	9381	545758	538815	364762	72814	154131	82811	5115	166351	63294	146878	59882	284896	72849	145152	48461	9668	27982	3138898

4.2.4 Modal Share Forecast

(1) Present Situation of the Air Passenger Traffic Share

Airport zone to and from province zone air passenger traffic shares are obtained by the Formula (4.2.4).

$$ARSH89ij = \frac{AR89ij}{Tij(89)} \quad \text{---------- (4.2.4)}$$

where,

ARSH89ij : Air passenger traffic share between airport zone (i) and province zone (j) for the year 1989.

AR89ij : Air passenger traffic flow between airport zone (i) and province zone (j). (See TABLE 4.2.9.)

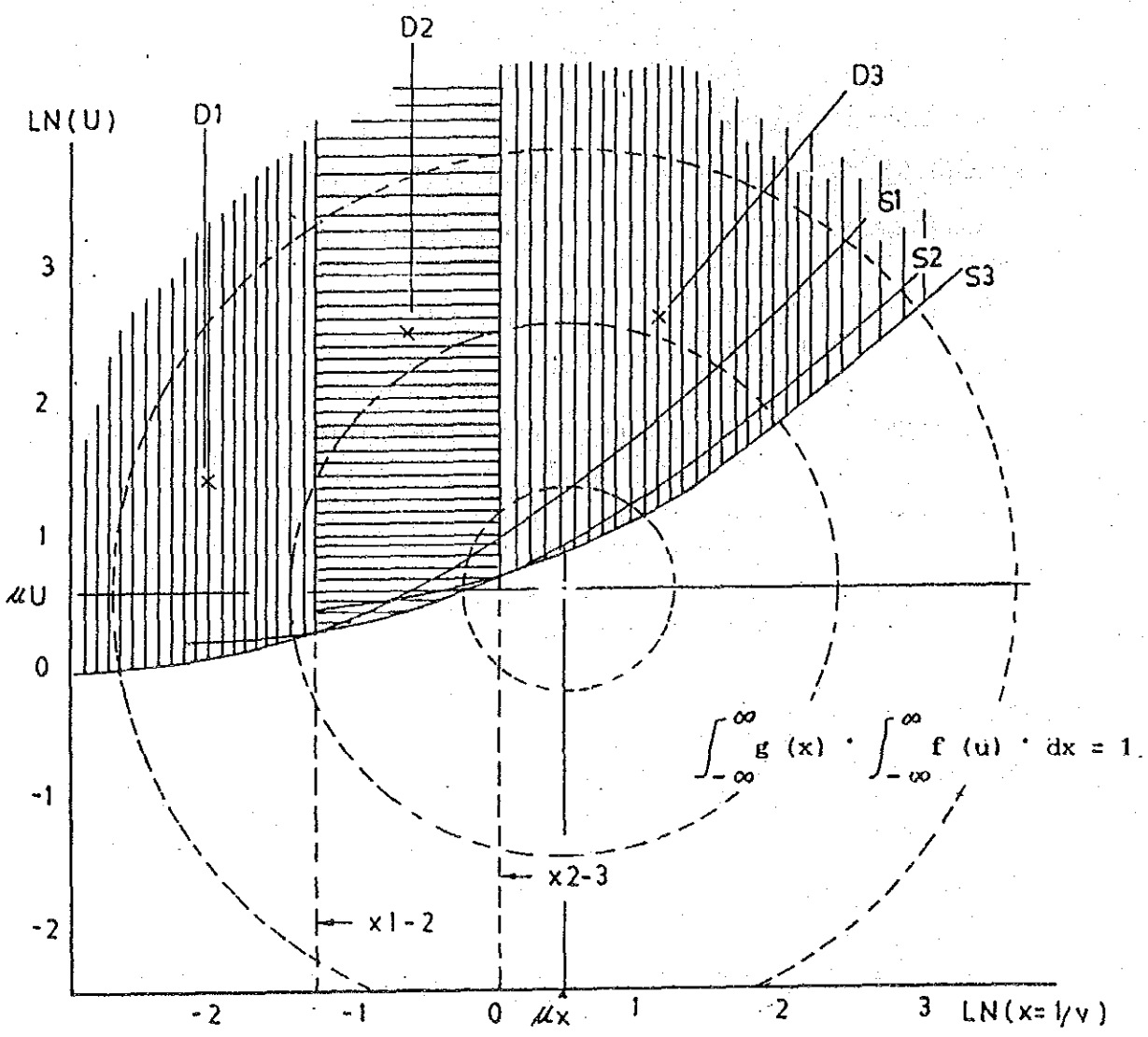
Tij(89) : Total passenger traffic flow between airport zone (i) and province zone (j). (See Appendix 4.2.7.)

(2) MD. MODEL

The market shares of airway and its competitive transport modes between zone (i) and zone (j) are forecast by applying the Modal demand Model (MD. MODEL).

The basic concept of the MD. MODEL is that the traffic demand for each of the competitive modes is generated as the result of the rational modal selection by individual passengers after their due comparison and weighing, so that each of the passengers total cost (the aggregation of his trip time and his trip cost) may be the least.

A rough concept of the MD. MODEL and relevant formula are shown in FIGURE 4.2.4.



$$D1 = \int_{-\infty}^{x1-2} g(x) \cdot \int_{S1 = LN(t1 + x \,.\, c1)}^{\infty} f(u) \cdot dx \quad \text{---------- (1)}$$

$$D2 = \int_{x1-2}^{v2-3} g(x) \cdot \int_{S2 = LN(t2 + x \,.\, c2)}^{\infty} f(u) \cdot dx \quad \text{---------- (2)}$$

$$D3 = \int_{x2-3}^{\infty} g(x) \cdot \int_{S3 = LN(t3 + x \,.\, c3)}^{\infty} f(u) \cdot dx \quad \text{---------- (3)}$$

FIGURE 4.2.4 Concept of the "M.D. MODEL" (a rough sketch)

In the formula (1) ~ (3) shown in FIGURE 4.2.4 ;

D1, D2 and D3 : To-be-realized effective traffic demand (indicated by the ratio to the possible demand) for the transport mode 1, 2 and 3 respectively

x (=1/v) : v is the time value (1000 Rupiah/Hour)

t1, t2 and t3 : Trip time for the mode 1, 2 and 3 respectively

c1, c2 and c3 : Trip cost for the mode 1, 2 and 3 respectively

x1-2 and x2-3 : Substitutional rate between the mode 1 and 2, and the mode 2 and 3 respectively for the trip time and trip cost of the respective two modes, indicated by formulas (4.2.5) and (4.2.6)

$$X1\text{-}2 = LN \frac{t2 - t1}{C1 - C2} \quad , \quad t2 > t1,\ C1 > C2 \quad \text{--------- (4.2.5)}$$

$$X2\text{-}3 = LN \frac{t3 - t2}{C2 - C3} \quad , \quad t3 > t2,\ C2 > C3 \quad \text{--------- (4.2.6)}$$

This model is composed of two different types of logarithmic normal distribution, one for the utility of the trip and another for the time value of the passengers.

Parameters of the abovementioned two types of normal distribution (uloge U, σ loge U, u loge V, σ loge V) are obtained by the "calibration" method. (See Appendix 4.2.8).

Input data utilized for this "calibration" are the passenger OD traffic data in Appendix 4.2.4 and the trip time and trip cost shown in Appendix 4.2.9.

Time and cost by modes between zone (i) and zone (j) in this study is computed by application of the models and units with distance (km) between zone (i) and zone (j) as the main input data.

The distance by zone pair utilized as the input data for the time and cost in Appendix 4.2.9 are shown in Appendix 4.2.10.
The abovementioned models and units are shown in Appendix 4.2.11.

The data and information utilized for the analyses and formulations of the models and units for the output of modal trip time and trip cost by zone pair are shown in Appendix 4.2.12.

The parameters obtained by calibration are shown in TABLE 4.2.10, where the values for the years 1995 and 2004 are obtained by Formulas (4.2.7) and (4.2.8).

TABLE 4.2.10 Values of Parameters for MD MODEL

	1989	1995	2004
μ loge (1/v)	-0.438	-0.5560	-0.7263
σ loge (1/v)	2.021	2.021	2.021
μ loge U	3.75	3.75	3.75
σ loge U	2.09	2.09	2.09

$$TV(t) = TV89 \ (G/P)^{k}_{(t)} \quad \text{---------- (4.2.7)}$$

$$\mu \text{ loge } (1/v) = \text{loge } \left(1 \ / \ TV(t)\right) \quad \text{---------- (4.2.8)}$$

where,

TV(t) : Average time value for the year (t) (Rupiah/hour) (See Appendix 4.2.13)

TV89 : Average time value for the year of 1989

(3) Application of the MD. MODEL and the Reproduction Method

Any type of the modal share estimate model cannot explain the original situation of modal shares just as it is, even though the model has been formulated based on the same original situation.

Therefore, a device of "reproduction method" is developed and applied in this Study for the application of the MD. MODEL so that the discrepancy may possibly be dissolved.
The reproduction method employed here means that the dummy time estimated for the modal trip time are applied on the forecast of the future modal shares.

The dummy time means non-negative or negative quantity of time added to the original modal trip time so that the calculated modal share by MD. MODEL may be nearly equal to the original modal share.

The method for estimating the dummy time is shown in Appendix 4.2.14.

(4) Outputs of Air Passenger Traffic Share

Air passenger traffic shares obtained by application of the MD. MODEL and reproduction method are as follows :

a) Airport zone to and from province zone air passenger traffic share 1989 (See Appendix 4.2.15 (1)).

b) Airport zone to and from province zone air passenger traffic share 1989 (reproduced by model) (See Appendix 4.2.15 (2)).

c) Airport zone to and from province zone air passenger traffic share 1995, 2004 (Forecast) (See TABLES 4.2.11 (1) and 4.2.11 (2)).

TABLE 4.2.11 (1) Airport Zone To & From Province Zone Air Passenger Traffic Share (Forecasted), 1995

	T.PINAN	P.BARU	G.SITOL	PALMBAN	SEMARAN	PONTIAC	SAMPIT	PLNKARY	TARAKAN	T.TORJA	PALU	GORNTAL	AMBON	TERNATE	MATARAN	BIMA	JAYAPUR	WAMENA	KAIMANA	MERAUKE	TOTAL
DI.ACEH	0.440233	0.373514	0.025377	0.575271	0.401761	0.694533	0.000000	0.000000	0.000000	0.017414	0.000000	0.236395	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUM.UTA	0.212390	0.105874	0.001144	0.284619	0.536144	0.750941	0.348157	0.587774	0.000000	0.957020	0.691697	0.557961	0.000000	0.000000	0.201752	0.118511	0.000000	0.000000	0.000000	0.000000	0.000000
SUM.BAR	0.094686	0.059522	0.040288	0.075658	0.180078	0.658682	0.436039	0.594874	0.000000	0.096323	0.581789	0.199212	0.362906	0.178881	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
RIAU	0.022816	0.024856	0.101794	0.240964	0.282031	0.638541	0.662388	0.683851	0.000000	0.097786	0.000000	0.786730	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
JAMBI	0.045574	0.027967	0.021786	0.060151	0.056622	0.399418	0.000000	0.000000	0.000000	0.036412	0.000000	0.253391	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUM.SEL	0.249692	0.135284	0.051813	0.125468	0.113672	0.468396	0.231134	0.347860	0.000000	0.042334	0.564492	0.430314	0.000000	0.000000	0.000000	0.000000	0.425928	0.229705	0.064896	0.182276	0.000000
BENGKUL	0.169824	0.095578	0.075218	0.038963	0.000000	0.185587	0.000000	0.000000	0.000000	0.014854	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
LAMPUNG	0.287618	0.439343	0.085067	0.046445	0.000000	0.099269	0.000000	0.000000	0.000000	0.013562	0.000000	0.156186	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
JAKARTA	0.412693	0.666385	0.245399	0.258143	0.180761	0.689817	0.182883	0.278866	0.394776	0.070884	0.638744	0.589246	0.857448	0.761245	0.589826	0.432688	0.883753	0.747296	0.438885	0.694188	0.000000
JAW.BAR	0.030692	0.104642	0.038309	0.042648	0.021812	0.155697	0.024670	0.036142	0.029218	0.015157	0.151785	0.168212	0.367499	0.232571	0.084919	0.052257	0.517341	0.387949	0.093097	0.238354	0.000000
JAW.TEN	0.030814	0.114266	0.048242	0.119870	0.000000	0.361507	0.051570	0.245133	0.312477	0.013911	0.000000	0.142286	0.347123	0.229149	0.052959	0.040813	0.688631	0.480688	0.188968	0.482585	0.000000
YOGCYA	0.243325	0.458396	0.367844	0.116543	0.000000	0.452386	0.030420	0.181655	0.865864	0.026991	0.480868	0.267478	0.464281	0.321051	0.594136	0.543573	0.943422	0.897818	0.688852	0.852883	0.000000
JAW.TIM	0.069652	0.269765	0.046964	0.251736	0.037046	0.452081	0.113761	0.591432	0.129897	0.028293	0.319763	0.183903	0.533699	0.486945	0.075397	0.084444	0.742564	0.551791	0.241180	0.481222	0.000000
BALI	0.458428	0.731848	0.321842	0.375374	0.051251	0.535586	0.566365	0.682592	0.852241	0.057758	0.398864	0.857563	0.613875	0.534674	0.312558	0.258582	0.885254	0.762248	0.468887	0.716273	0.000000
NT.BAR	0.000000	0.000000	0.019383	0.000000	0.039203	0.348543	0.000000	0.000000	0.560495	0.011522	0.000000	0.000416	0.000000	0.000000	0.161347	0.107563	0.169798	0.881122	0.827086	0.869294	0.000000
NT.TIM	0.000000	0.000000	0.000000	0.000000	0.242157	0.844291	0.225149	0.338079	0.958754	0.083889	0.000000	0.688354	0.568641	0.453688	0.649881	0.183464	0.000000	0.000000	0.000000	0.000000	0.000000
TIM.TIM	0.000000	0.000000	0.000000	0.000000	0.429898	0.547169	0.000000	0.000000	0.000000	0.078892	0.000000	0.623678	0.000000	0.000000	0.533085	0.245333	0.000000	0.000000	0.000000	0.000000	0.000000
KAL.BAR	0.137326	0.397972	0.149584	0.485929	0.296448	0.994000	0.529466	0.646731	0.243849	0.081819	0.225899	0.288904	0.000000	0.000000	0.418947	0.344727	0.000000	0.000000	0.000000	0.000000	0.000000
KAL.TEN	0.270972	0.551486	0.137748	0.481749	0.079518	0.725887	0.059587	0.128349	0.000000	0.101875	0.000000	0.141398	0.000000	0.000000	0.000000	0.000000	0.685849	0.494964	0.285078	0.413864	0.000000
KAL.SEL	0.345268	0.668572	0.168125	0.481847	0.194465	0.482275	0.168869	0.252757	0.240909	0.160644	0.222345	0.194267	0.000000	0.000000	0.665862	0.605636	0.000000	0.000000	0.000000	0.000000	0.000000
KAL.TIM	0.223044	0.509492	0.298152	0.663579	0.415867	0.668927	0.181768	0.277286	0.954656	0.860274	0.181337	0.191421	0.376787	0.897844	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUL.UTA	0.355396	0.677707	0.160826	0.613212	0.419816	0.761763	0.646474	0.765787	0.312218	0.836818	0.178953	0.898561	0.387458	0.874088	0.239574	0.212863	0.922501	0.836987	0.578914	0.787577	0.000000
SUL.TEN	0.000000	0.000000	0.137488	0.492999	0.000000	0.216602	0.000000	0.000000	0.000000	0.033602	0.384891	0.068214	0.474959	0.186728	0.000000	0.000000	0.625836	0.432989	0.183194	0.385021	0.000000
SUL.SEL	0.283613	0.537998	0.102886	0.554387	0.158477	0.559983	0.488038	0.565894	0.271687	0.088638	0.223976	0.125516	0.451977	0.485543	0.059129	0.064780	0.984924	0.885756	0.541833	0.772872	0.000000
SUL.TGR	0.000000	0.000000	0.283383	0.615412	0.389628	0.775171	0.000000	0.000000	0.000000	0.022629	0.555411	0.465683	0.458859	0.398688	0.000000	0.000000	0.326314	0.191289	0.064684	0.166723	0.000000
MALUKU	0.000000	0.000000	0.000000	0.000000	0.299925	0.000000	0.000000	0.000000	0.000000	0.055174	0.454242	0.419127	0.343546	0.231631	0.000000	0.000000	0.667376	0.519329	0.381258	0.526127	0.000000
IRIAN	0.000000	0.000000	0.000000	0.484675	0.738419	0.000000	0.515554	0.653166	0.000000	0.391965	0.718565	0.886418	0.729899	0.699386	0.277113	0.253316	0.621128	0.394984	0.118315	0.277944	0.000000
TOTAL	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

TABLE 4.2.11 (2) Airport Zone To & From Province Zone Air Passenger Traffic Share (Forecasted), 2004

	T.PINAN	P.BARU	G.SITOL	PALMBAN	SEMARAN	PONTIAC	SAMPIT	PLNKARY	TARAKAN	T.TORJA	PALU	GORNTAL	AMBON	TERNATE	MATARAN	BIMA	JAYAPUR	WAMENA	KAIMANA	MERAUKE	TOTAL
DI.ACEH	0.478822	0.483488	0.838838	0.685686	0.431922	0.720737	0.000000	0.000000	0.000000	0.828858	0.000000	0.259591	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUM.UTA	0.235319	0.128784	0.081249	0.311365	0.567867	0.774488	0.376336	0.537938	0.000000	0.066867	0.717689	0.587448	0.000000	0.000000	0.223389	0.133738	0.000000	0.000000	0.000000	0.000000	0.000000
SUM.BAR	0.187726	0.069575	0.047588	0.087328	0.288836	0.686398	0.466855	0.624837	0.000000	0.189551	0.611817	0.228444	0.329333	0.198645	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
RIAU	0.027481	0.029918	0.115316	0.265648	0.224191	0.666721	0.689538	0.718122	0.000000	0.111159	0.000000	0.731947	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
JAMBI	0.053496	0.033364	0.025877	0.078237	0.065876	0.429343	0.000000	0.000000	0.000000	0.042778	0.000000	0.277748	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUM.SEL	0.275653	0.152643	0.059298	0.142674	0.129182	0.491019	0.254592	0.376080	0.000000	0.049517	0.594855	0.460834	0.000000	0.000000	0.000000	0.000000	0.455118	0.252432	0.074679	0.282884	0.000000
BENGKUL	0.189166	0.109434	0.086865	0.036911	0.000000	0.119774	0.000000	0.000000	0.000000	0.017885	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
LAMPUNG	0.230153	0.478681	0.897398	0.854728	0.000000	0.113242	0.000000	0.000000	0.000000	0.016416	0.000000	0.174520	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
JAKARTA	0.443187	0.694180	0.278827	0.275566	0.202469	0.638630	0.283564	0.296438	0.423808	0.081653	0.666824	0.618599	0.873397	0.783844	0.539912	0.462688	0.897153	0.778486	0.468887	0.719723	0.000000
JAW.BAR	0.036392	0.119188	0.045816	0.058179	0.026388	0.174721	0.029389	0.042558	0.034584	0.018295	0.169911	0.187558	0.396262	0.255886	0.097386	0.068736	0.547969	0.333432	0.185933	0.261587	0.000000
JAW.TEN	0.036347	0.129596	0.047847	0.135884	0.000000	0.391355	0.059888	0.269127	0.338834	0.016888	0.000000	0.159385	0.374873	0.251942	0.061523	0.047738	0.714288	0.518182	0.289479	0.431177	0.000000
YOGCYA	0.266936	0.489268	0.396168	0.132278	0.000000	0.483646	0.036115	0.116059	0.388624	0.031996	0.438227	0.292578	0.494326	0.348187	0.623837	0.573652	0.958563	0.989827	0.787368	0.868834	0.000000
JAW.TIM	0.088287	0.295615	0.054758	0.276975	0.044889	0.482673	0.129372	0.623835	0.136514	0.033635	0.347138	0.118887	0.564086	0.436446	0.086995	0.096728	0.766159	0.581373	0.265118	0.511135	0.000000
BALI	0.488948	0.756816	0.349415	0.495246	0.059961	0.566063	0.597898	0.710691	0.868842	0.867188	0.428387	0.866731	0.642837	0.564697	0.341667	0.283344	0.898689	0.784883	0.499568	0.741169	0.000000
NT.BAR	0.000000	0.000000	0.023179	0.000000	0.045983	0.368878	0.000000	0.000000	0.598949	0.013847	0.000000	0.092226	0.000000	0.000000	0.181727	0.122173	0.189188	0.892739	0.832889	0.879597	0.000000
NT.TIM	0.000000	0.000000	0.000000	0.000000	0.265623	0.861197	0.248435	0.358135	0.964178	0.096174	0.000000	0.637748	0.598816	0.483978	0.676663	0.284518	0.000000	0.000000	0.000000	0.000000	0.000000
TIM.TIM	0.000000	0.000000	0.000000	0.000000	0.459838	0.576311	0.000000	0.000000	0.000000	0.089748	0.000000	0.652566	0.000000	0.000000	0.563831	0.269949	0.000000	0.000000	0.000000	0.000000	0.000000
KAL.BAR	0.154547	0.427485	0.167598	0.435925	0.324033	0.994000	0.559763	0.674571	0.266285	0.092779	0.247396	0.221889	0.000000	0.000000	0.448955	0.372842	0.000000	0.000000	0.000000	0.000000	0.000000
KAL.TEN	0.296384	0.581858	0.154724	0.431284	0.891561	0.758512	0.065859	0.131401	0.000000	0.116866	0.000000	0.158428	0.000000	0.000000	0.000000	0.000000	0.712187	0.524955	0.226857	0.443884	0.000000
KAL.SEL	0.373592	0.695552	0.178985	0.511447	0.119878	0.512794	0.189127	0.279124	0.264239	0.180186	0.244675	0.215846	0.000000	0.000000	0.694798	0.635723	0.000000	0.000000	0.000000	0.000000	0.000000
KAL.TIM	0.245728	0.538769	0.316857	0.698455	0.443686	0.628211	0.201614	0.381831	0.863718	0.078898	0.115885	0.213714	0.496173	0.118325	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUL.UTA	0.383486	0.783911	0.179387	0.641786	0.448138	0.784265	0.674738	0.788568	0.339732	0.042391	0.199918	0.112751	0.415383	0.000885	0.263518	0.234618	0.932987	0.854298	0.688441	0.888296	0.000000
SUL.TEN	0.000000	0.000000	0.154171	0.525888	0.000000	0.238438	0.000000	0.000000	0.000000	0.039718	0.332384	0.078757	0.565026	0.128768	0.000000	0.000000	0.653115	0.462517	0.283686	0.413788	0.000000
SUL.SEL	0.225452	0.568084	0.115886	0.584499	0.177875	0.589528	0.438973	0.597888	0.297736	0.810707	0.246287	0.141885	0.482414	0.435899	0.868834	0.875358	0.916489	0.825648	0.571878	0.794113	0.000000
SUL.TGR	0.000000	0.000000	0.224895	0.644246	0.418522	0.797181	0.000000	0.000000	0.000000	0.027144	0.585229	0.495964	0.482642	0.420783	0.000000	0.000000	0.354283	0.212486	0.074786	0.186825	0.000000
MALUKU	0.000000	0.000000	0.000000	0.000000	0.326189	0.000000	0.000000	0.000000	0.000000	0.064138	0.484227	0.448885	0.371893	0.255742	0.000000	0.000000	0.694685	0.549766	0.329167	0.556582	0.000000
IRIAN	0.000000	0.000000	0.000000	0.514271	0.754289	0.000000	0.545543	0.686608	0.000000	0.421198	0.735575	0.899878	0.753647	0.725688	0.382575	0.256748	0.658584	0.424891	0.134386	0.384562	0.000000
TOTAL	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

4.2.5 Forecasting of Annual Air Passengers

(1) Procedure to output the Annual Air Passengers

Airport zone to and from province zone air passengers for the years 1995 and 2004 are obtained by Formula (4.2.9).

$$APi,j_{(t)} = Ti,j_{(t)} \; ARSHi,j_{(t)} \quad \text{---------- (4.2.9)}$$

where,

$APi,j_{(t)}$: Number of air passengers between airport zone (i) and province zone (j) for year (t) (t = 1995 or 2004).

$Ti,j_{(t)}$: Number of total passengers between airport zone (i) and province zone (j) for year (t) (See Formula (4.2.2).

$ARSHi,j_{(t)}$: Market share of air passenger traffic between airport zone (i) and province zone (j) for year (t), which has been obtained in Subsection 4.2.4.

Number of air passengers in- and out-bound at each of 20 airports is obtained by Formula (4.2.10).

$$TAPi_{(t)} = \sum_{j} APi,j_{(t)} \quad \text{---------- (4.2.10)}$$

where,

$TAPi_{(t)}$: Number of air passengers in-and out-bound at the airport (i) for year (t) (t = 1995 or 2004).

$\sum_{j} APi,j_{(t)}$: Aggregated total air passengers of airport (i) to and from the airport (j) for year (t).

(2) Outputs of the Annual Air Passengers

Forecast of the annual air passengers for each of the 20 airports are as follows:

a) Airport zone to and from province zone air passengeers for the year 1995 (See TABLE 4.2.12).

b) Airport zone to and from province zone air passengers for the year 2004 (See TABLE 4.2.13).

c) Number of air passengers in- and out-bound at each of the 20 airports for the years 1989 ~ 2004. (See TABLE 4.2.14)

d) Yearly Trend of the Number of Air Passengers in-bound and out-bound at each of the 20 airports. (See FIGURES 4.2.5 (1) ~ 4.2.5 (10)).

4.2.6 Conclusions

The future average yearly growth rate for the total of 20 airports during the periods 1989 ~ 1995 and 1995 ~ 2004 are respectively 5.0% and 4.5%, as compared with 2.8% (1984 ~ 1994) and 2.9% (1994 ~ 2004) of the PREVIOUS STUDY.

The future prospects on air passenger traffic by other studies are shown in TABLE 4.2.15.

The average yearly growth rates as the forecast results in this Study are considerably higher than those of the PREVIOUS STUDY, while relatively lower than those of other studies.

However, the results of this Study are regarded to be reasonable and conservative in the light of the relativity between the past average yearly growth rates of GDP and air passenger traffic in the Republic of Indonesia, which shows slightly less than 1.0 in the elasticity of the air passenger traffic demand to the GDP growth rate.

The elasticity of the air passenger traffic demand to the GDP growth rate in this Study is Approximately 1.0 which is considered reasonable in the light of the world-wide increasing tendencies of passengers appreciation for saving trip time, that is, increasing demand for the faster mode of air transportation.

TABLE 4.2.15 Future Prospect on Air Passenger Traffic by Other Studies

REPELITA V	8.6	(1989 - 1993)
Audit Study (1984)	8.8 7.4	(1985 - 1995) (1995 - 2005)
Market Study (1986)	7.9	(1990 - 2000)
Padang Airport D/D (1987)	7.0 6.7	(1985 - 1995) (1995 - 2005)
IATA (1989)	7.5 *	(1989 - 1993) * for Int'l Traffic

TABLE 4.2.12 Airport Zone to & from Province Zone Air Passenger Traffic Flow, 1995

	T.PINAN	P.BARU	G.SITOL	PALMBAN	SEMARAN	PONTIAC	SAMPIT	PLNKARY	TARAKAN	T.TORJA	PALU	GORNTAL	AMBON	TERNATE	MATARAM	BIMA	JAYAPUR	WAMENA	KAIMANA	MERAUKE	TOTAL
DI.ACEH	6913	33175	754	21171	5446	5259	0	0	0	11	0	161	0	0	0	0	0	0	0	0	72891
SUM.UTA	15289	77445	267	28772	20214	19102	2251	4898	0	134	4774	1974	0	0	1833	360	0	0	0	0	176425
SUM.BAR	6412	34715	726	26871	9877	13266	2640	5874	0	159	2586	267	478	184	0	0	0	0	0	0	103175
RIAU	2857	13031	2866	87196	10193	10813	5405	7378	0	130	0	2106	0	0	0	0	0	0	0	0	141175
JAMBI	1943	12939	241	37413	5172	5865	0	0	0	46	0	305	0	0	0	0	0	0	0	0	63925
SUM.SEL	9451	47423	652	117039	22195	17422	3856	6676	0	161	4539	1733	0	0	0	0	568	193	35	116	231252
BENGKUL	1877	5504	69	15912	0	989	0	0	0	12	0	0	0	0	0	0	0	0	0	0	23563
LAMPUNG	6856	32736	536	14459	0	4481	0	0	0	80	0	650	0	0	0	0	0	0	0	0	59798
JAKARTA	33489	157985	2758	248754	278237	116948	7344	15925	4858	659	13354	6847	25559	10338	25679	9831	9859	3315	671	1951	957535
JAW.BAR	2912	12671	793	34617	49658	22589	1947	3111	687	312	3054	2357	6892	2482	4407	1483	3637	1292	238	741	155000
JAW.TEN	1323	5738	588	24779	0	29668	6879	12501	12624	589	0	4694	8044	3178	10546	3868	8742	3858	594	1758	138171
YOGCYA	2499	11928	1158	9422	0	11388	528	843	27900	148	1489	494	1187	477	9287	3388	8647	2950	585	1685	95899
JAW.TIM	2354	18997	513	32259	88145	38982	21299	41868	4595	2884	27764	3875	26940	10832	43978	15335	15395	5353	1853	3114	388656
BALI	2238	10547	455	7339	27265	5275	2677	5646	16088	1844	9299	388	9887	3719	73158	25869	6613	2235	444	1296	218588
NT.BAR	0	0	21	0	6651	2389	0	0	3779	174	0	527	0	0	35273	11778	285	72	16	45	68847
NT.TIM	0	0	0	0	7811	9711	298	603	26947	298	0	3894	2698	1148	32403	11618	0	0	0	0	96621
TIM.TIM	0	0	0	0	11564	2755	0	0	0	58	0	967	0	0	7383	2655	0	0	0	0	25382
KAL.BAR	771	3687	265	11522	19121	49798	9468	28491	1866	133	3731	1586	0	0	3846	1881	0	0	0	0	126477
KAL.TEN	825	3985	186	6838	12878	31875	3968	8662	0	73	0	1424	0	0	0	0	424	148	29	85	71216
KAL.SEL	1665	7561	195	9678	35319	12125	15713	32883	3416	192	9672	2868	0	0	6885	2142	0	0	0	0	139387
KAL.TIM	588	2424	262	11775	64892	45711	12669	27858	1582	428	10857	6976	1961	852	0	0	0	0	0	0	187867
SUL.UTA	413	1972	71	3845	8938	4826	1134	2458	1886	225	14848	8979	16891	7858	1854	654	7273	2468	492	1499	85271
SUL.TEN	0	0	62	2685	0	3548	0	0	0	515	45848	4748	4658	2868	0	0	1237	429	86	252	65318
SUL.SEL	935	4449	179	9629	12839	12473	2186	4557	3788	4715	42688	6382	26688	10478	5157	1776	27385	9273	1846	5372	191588
SUL.TGR	0	0	86	4786	18881	5937	0	0	0	418	28374	4896	4612	1861	0	0	335	121	23	72	61682
MALUKU	0	0	0	0	5775	0	0	0	0	319	5388	6916	47254	18658	0	0	9139	3188	621	1788	98958
IRIAN	0	0	0	623	9469	0	212	462	0	438	2368	4485	13514	5433	448	153	86846	38182	5833	17547	177285
TOTAL	99789	490816	13538	758574	711335	474289	99588	282686	109769	13388	228847	79464	195583	78637	259728	98292	185496	64185	12567	37231	4196988

TABLE 4.2.13 Airport Zone to & from Province Zone Air Passenger Traffic Flow, 2004

	T.PINAN	P.BARU	G.SITOL	PALMBAN	SEMARAN	PONTIAC	SAMPIT	PLNKARY	TARAKAN	T.TORJA	PALU	GORNTAL	AMBON	TERNATE	MATARAN	BIMA	JAYAPUR	WAMENA	KAIMANA	MERAUKE	TOTAL
DI.ACEH	10133	49106	1193	30618	7593	7397	0	0	0	18	0	230	0	0	0	0	0	0	0	0	106279
SUM.UTA	22765	119366	384	42689	27328	26321	3313	7855	0	197	6875	2663	0	0	1506	534	0	0	0	0	260916
SUM.BAR	9479	52726	1885	40388	12446	17765	3695	8078	0	228	3514	365	674	265	0	0	0	0	0	0	158683
RIAU	3426	21748	4389	133531	14837	15479	7862	10795	0	192	0	2868	0	0	0	0	0	0	0	0	215829
JAMBI	3246	21965	398	62298	8101	8872	0	0	0	73	0	451	0	0	0	0	0	0	0	0	105395
SUM.SEL	14494	74374	1827	185242	33151	25524	4713	10106	0	245	6817	2441	0	0	0	0	834	296	56	179	359500
BENGKUL	1735	9118	112	27501	0	1685	0	0	0	28	0	0	0	0	0	0	0	0	0	0	40892
LAMPUNG	11486	52636	898	25621	0	7567	0	0	0	137	0	1834	0	0	0	0	0	0	0	0	99519
JAKARTA	58960	233258	4181	376636	485881	171888	11677	24895	7758	1011	28298	9662	36844	15853	37617	13348	14246	4865	1821	2888	1443958
JAW.BAR	4632	19358	1228	54753	76883	33632	3137	4954	1142	476	4713	3343	8799	3539	6602	2253	5183	1898	365	1895	237879
JAW.TEN	2847	8525	747	36946	0	41649	10562	18144	18855	758	0	6541	11378	4565	15659	4587	11944	4264	868	2488	200520
YOGCYA	3684	16738	1599	14889	0	15834	831	1275	39183	285	2159	674	1668	679	12495	4462	11586	3948	883	2266	134883
JAW.TIM	3510	15592	755	46813	116545	42338	31586	57514	7858	2898	40862	5488	36788	15089	63975	22147	28639	7338	1584	4298	540935
BALI	3883	14887	622	18253	38978	7121	3678	7652	22134	1475	13251	548	12164	5865	188638	35686	8787	2985	614	1739	298478
NT.BAR	0	0	33	0	9971	3341	0	0	5653	278	0	774	0	0	52383	17612	389	111	25	78	98472
NT.TIM	0	0	0	0	18994	13287	449	894	38599	437	0	4172	3849	1658	44653	17185	0	0	0	0	136897
TIM.TIM	0	0	0	0	16248	3991	0	0	0	88	0	1335	0	0	10569	3959	0	0	0	0	36189
KAL.BAR	1189	5438	398	16998	27118	67585	13833	29533	2944	196	5775	2163	0	0	4367	1562	0	0	0	0	179001
KAL.TEN	1262	5758	162	18264	19578	45548	6889	13319	0	118	0	2114	0	0	0	0	617	221	46	127	105199
KAL.SEL	2316	18491	283	13756	58796	17884	23767	48812	5248	271	14583	3921	0	0	8252	2922	0	0	0	0	282415
KAL.TIM	815	3734	486	17872	94363	68888	20621	44585	2676	668	17281	10754	3874	1488	0	0	0	0	0	0	286897
SUL.UTA	586	2693	181	4198	11892	5398	1569	3355	2834	327	21186	12889	23771	10186	2614	927	9783	3316	683	1918	119968
SUL.TEN	0	0	95	4813	0	5417	0	0	0	884	78927	7388	6953	3272	0	0	1824	647	135	382	101777
SUL.SEL	1358	6127	258	13266	16599	16938	2978	6328	5568	7165	63815	8887	36984	14628	7629	2625	36322	12446	2555	7236	268817
SUL.TGR	0	0	132	7149	26172	8688	0	0	0	671	31412	7844	7822	2851	0	0	521	192	38	114	91918
MALUKU	0	0	0	0	8225	0	0	0	0	483	8156	9787	78711	28464	0	0	13224	4575	943	2629	147116
IRIAN	0	0	0	922	12881	0	316	676	0	616	3586	6812	19422	7838	651	228	126889	45418	9266	26882	268633
TOTAL	152039	742788	20478	1174918	1845698	678885	158678	297782	159636	20838	333448	113131	288886	114398	369529	129958	261587	92496	18923	54287	6218668

TABLE 4.2.14 Number of Passenger Out- and In-Bound at the 20 Airport for the Year of 1989, 1995 and 2004

	T.PINAN	P.BARU	G.SITOL	PALMBAN	SEMARAN	PONTIAC	SAMPIT	PLNKARY	TARAKAN	T.TORJA	PALU	GORNTAL	AMBON	TERNATE	MATARAM	BIMA	JAYAPUR	WAMENA	KAIMANA	MERAUKE	TOTAL
1989	74288	355231	9381	545758	538815	364762	72814	154131	82811	5115	166351	63294	146878	59882	284896	72849	145152	48461	9668	27982	3138890
1995	99789	498816	13539	758574	711335	474289	99588	282686	169769	13389	228847	79464	195593	78637	259728	98292	185496	64183	12567	37231	4196900
2004	152939	742788	20478	1174918	1045698	678885	158678	297782	159636	20838	333448	113131	288886	116398	369529	129958	261587	92496	18923	54287	6216668

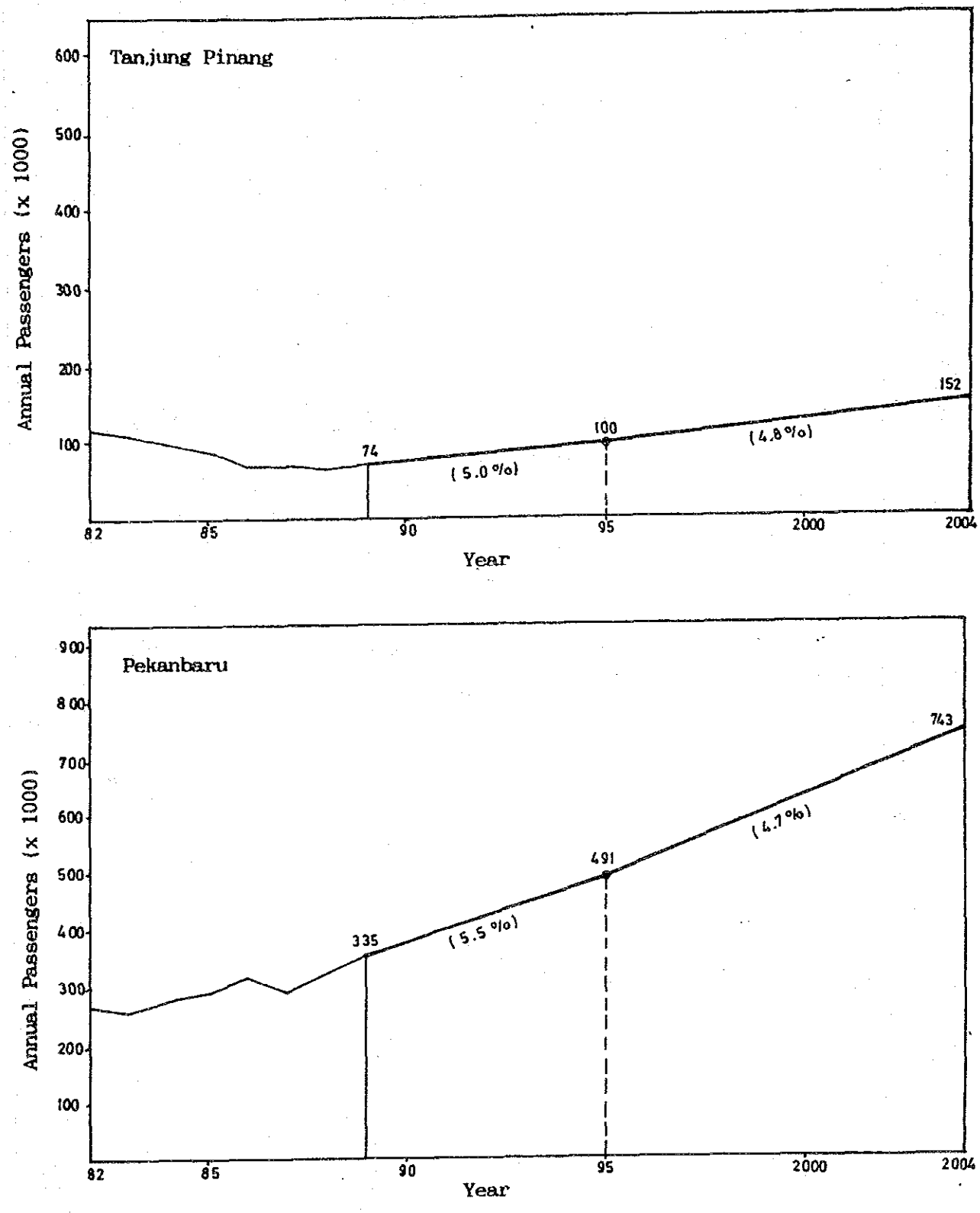
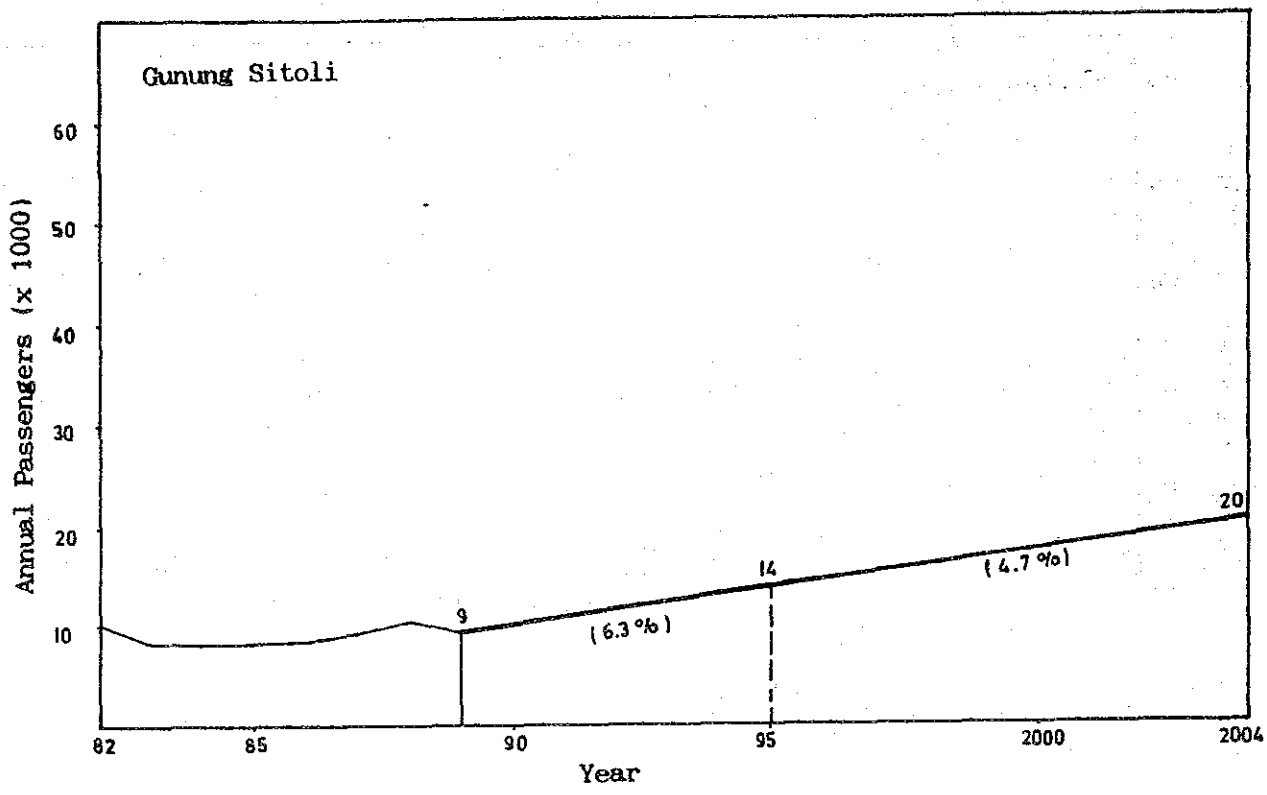


FIGURE 4.2.5 Forecast of Annual Air Passengers (1)



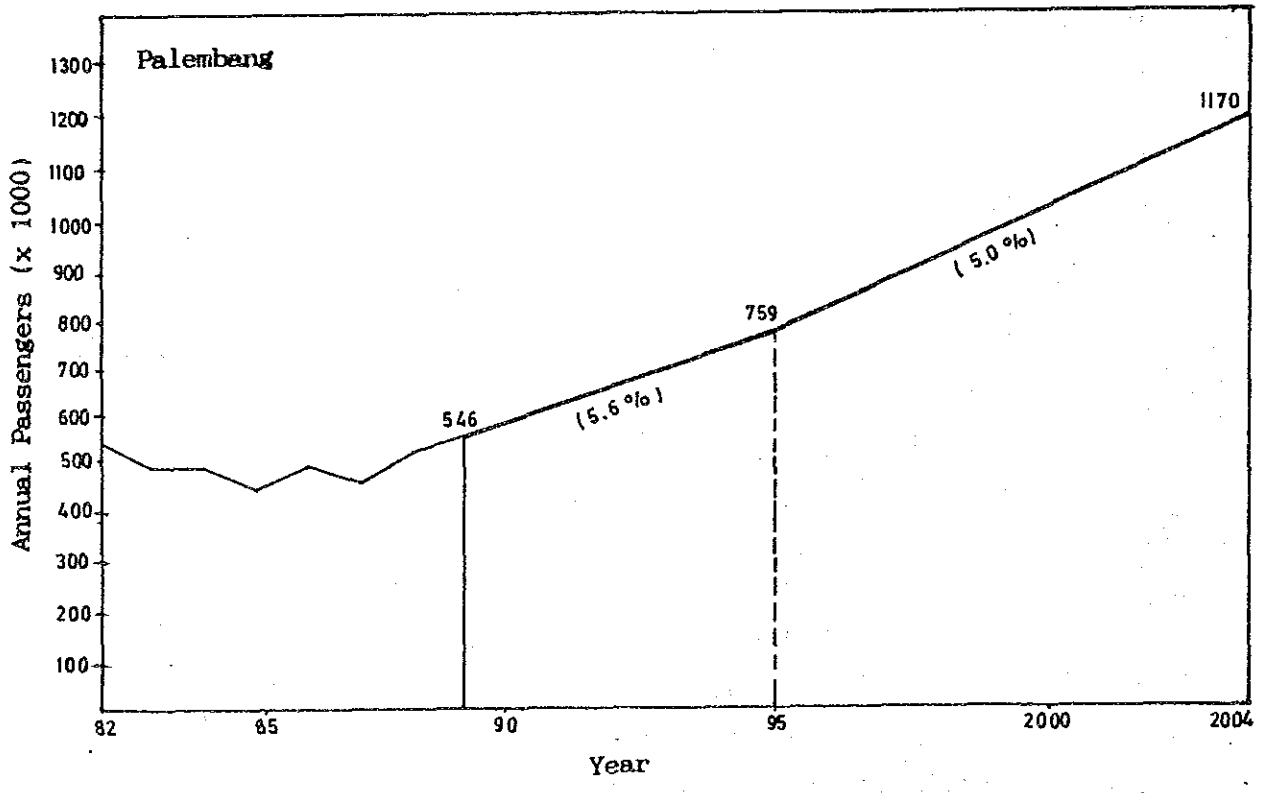


FIGURE 4.2.5 Forecast of Annual Air Passengers (2)

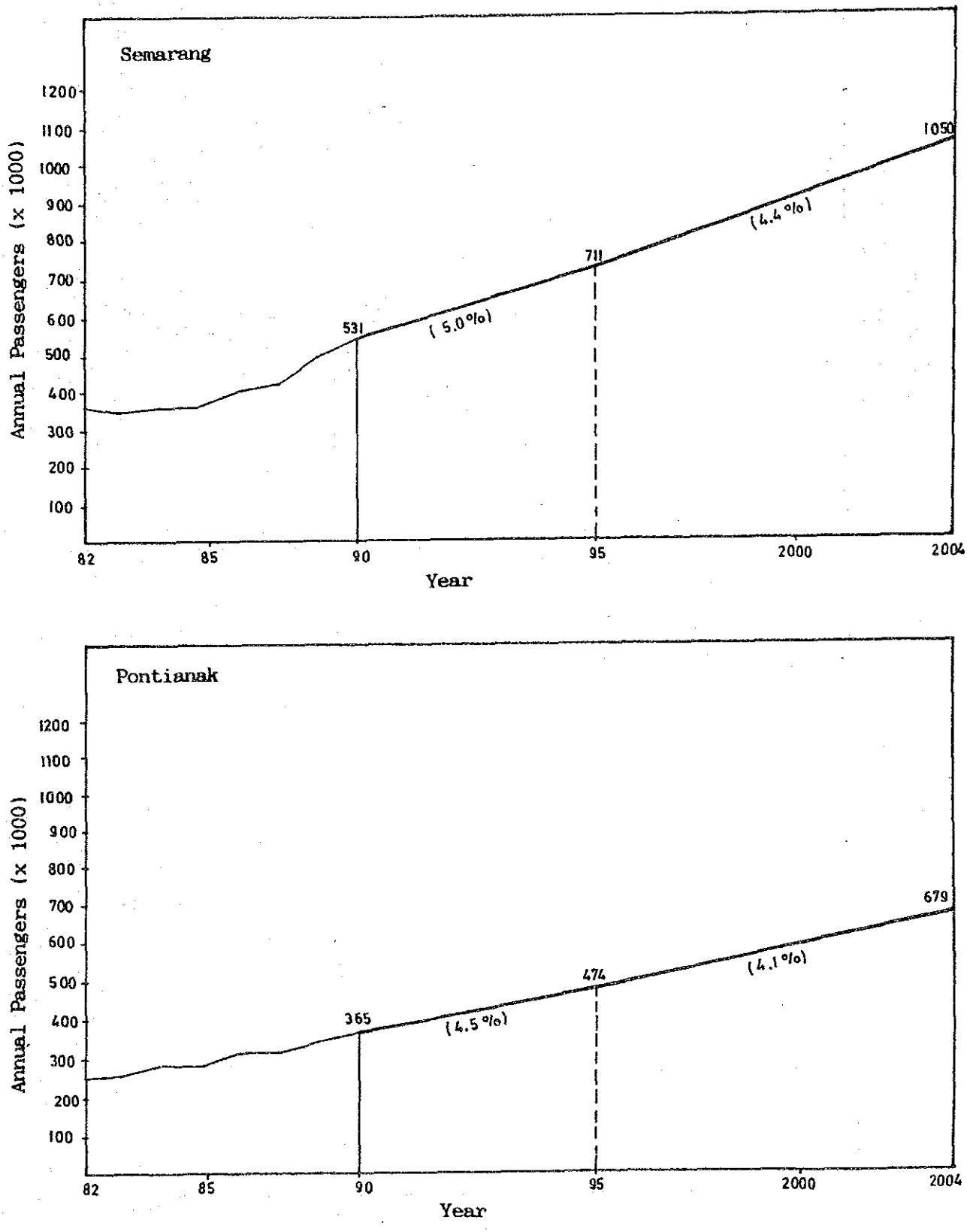
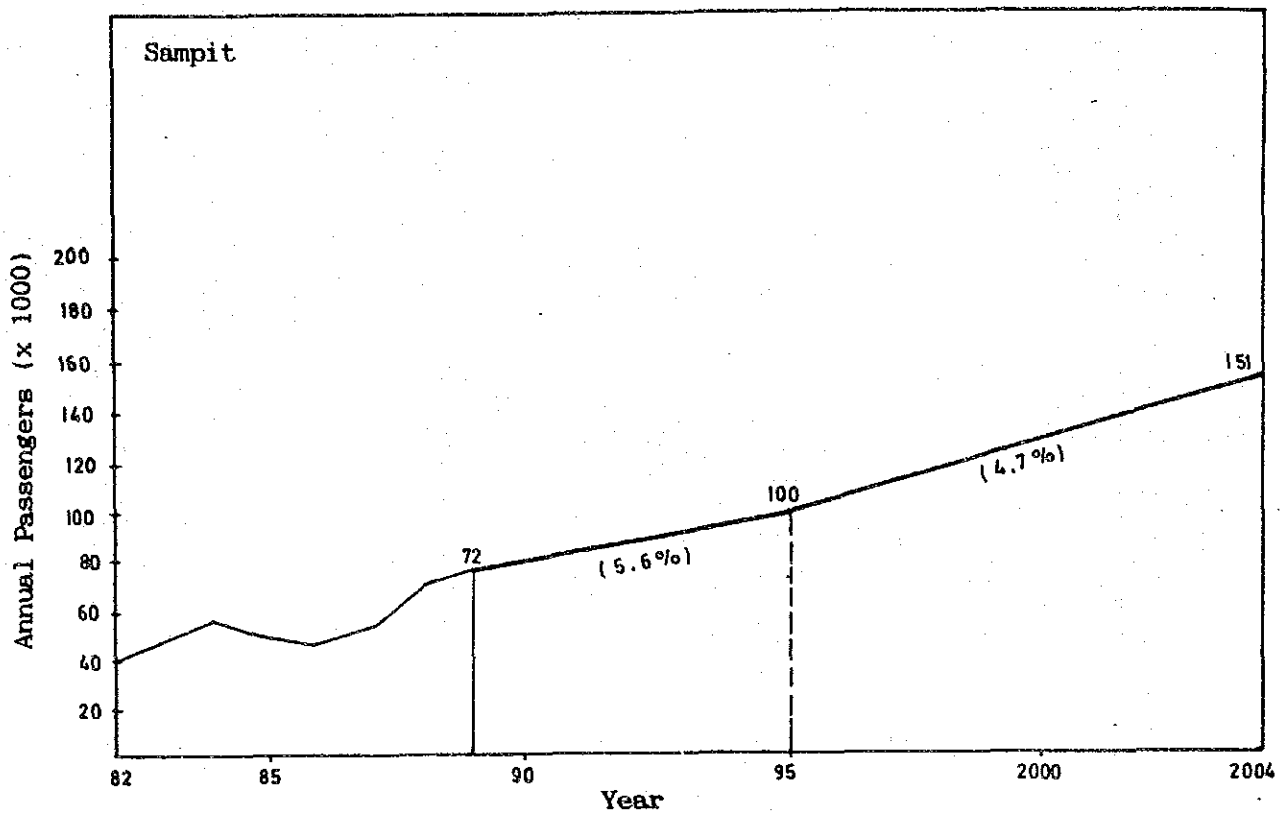


FIGURE 4.2.5 Forecast of Annual Air Passengers (3)



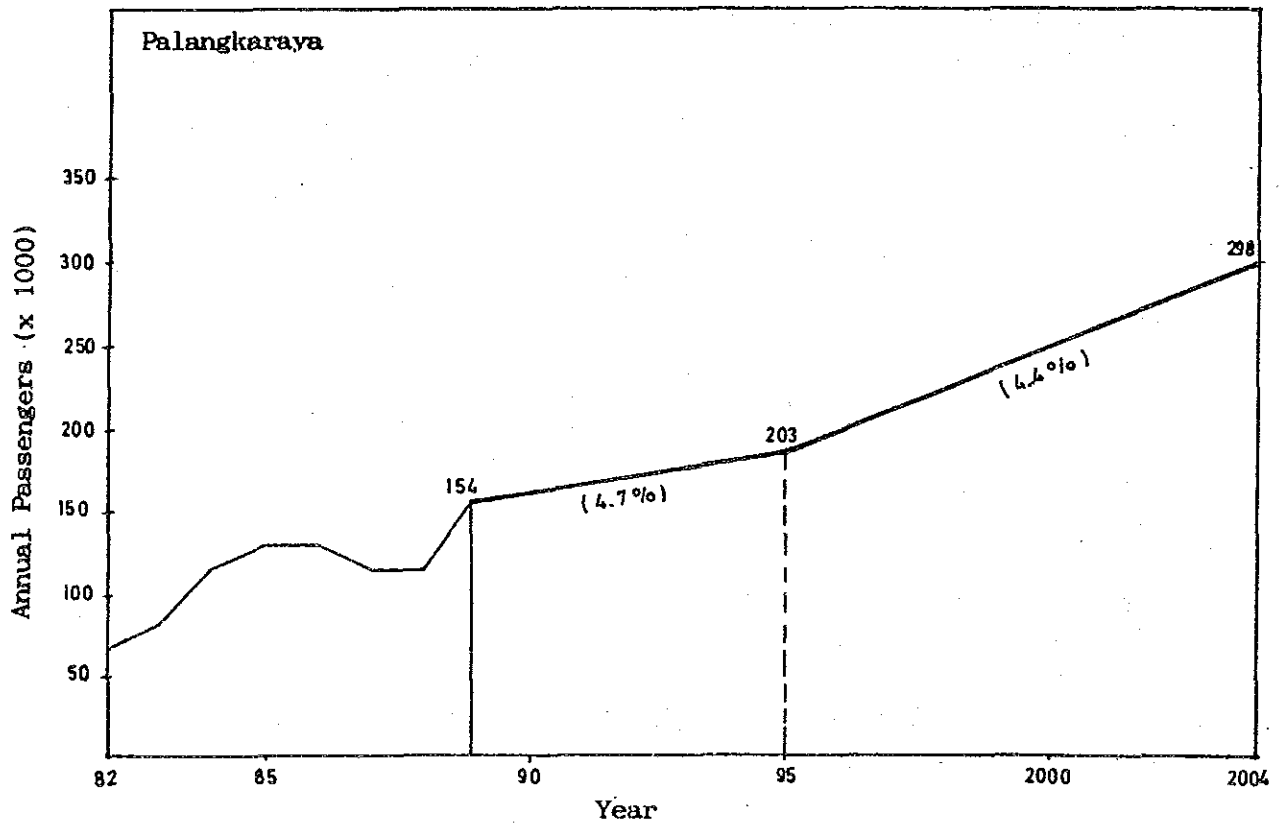
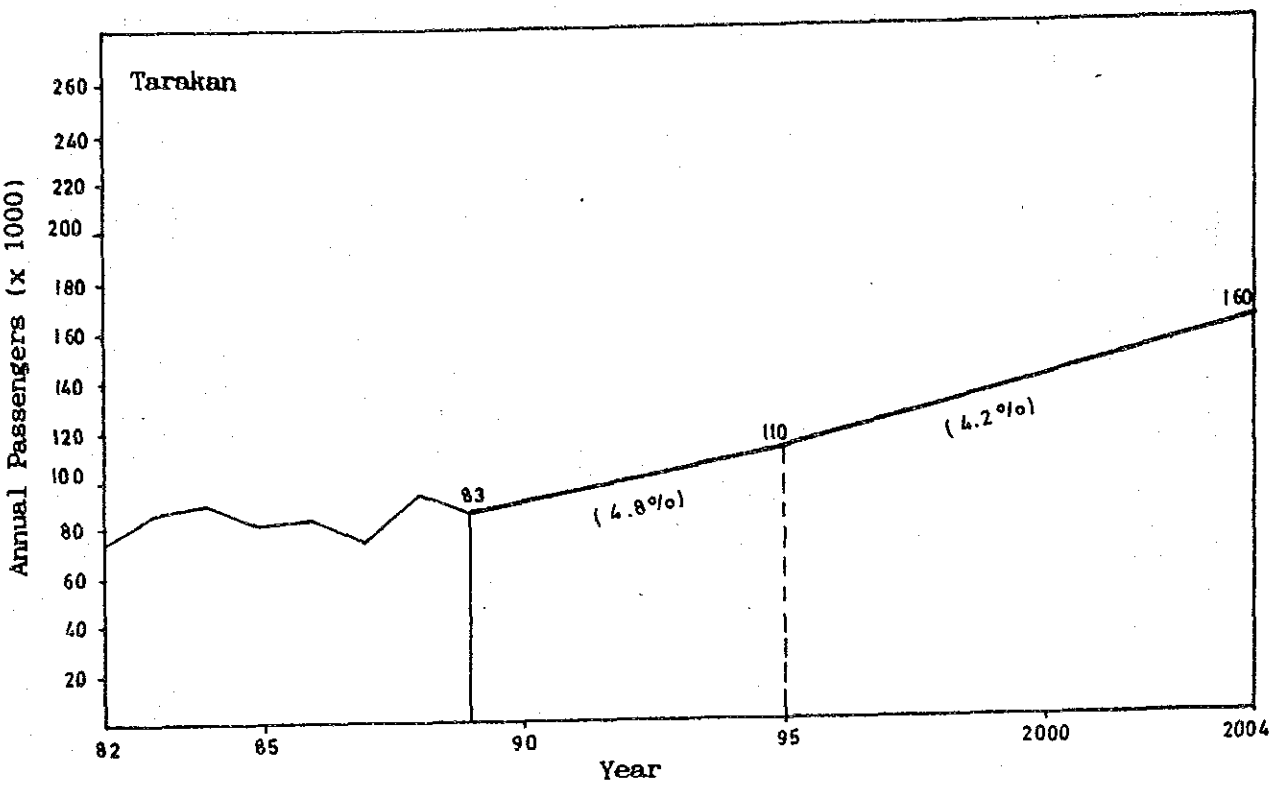


FIGURE 4.2.5 Forecast of Annual Air Passengers (4)



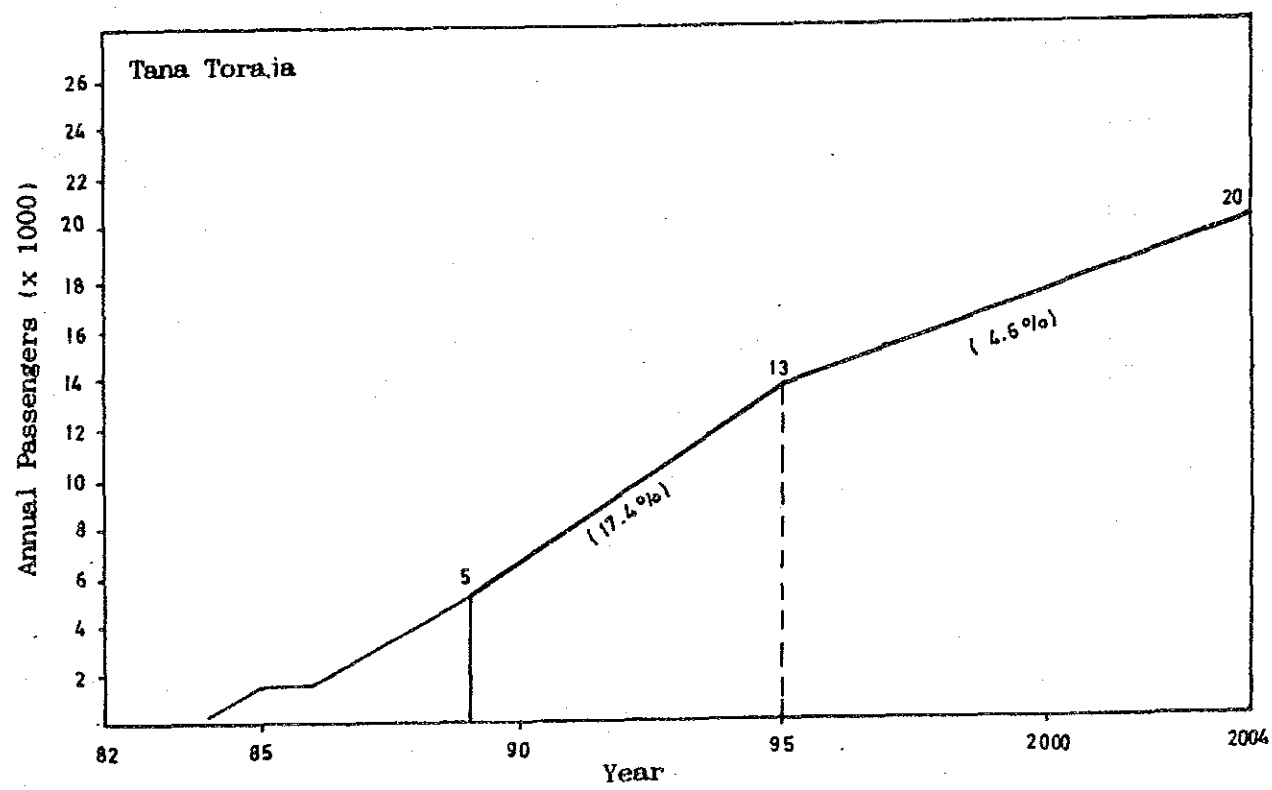


FIGURE 4.2.5 Forecast of Annual Air Passengers (5)

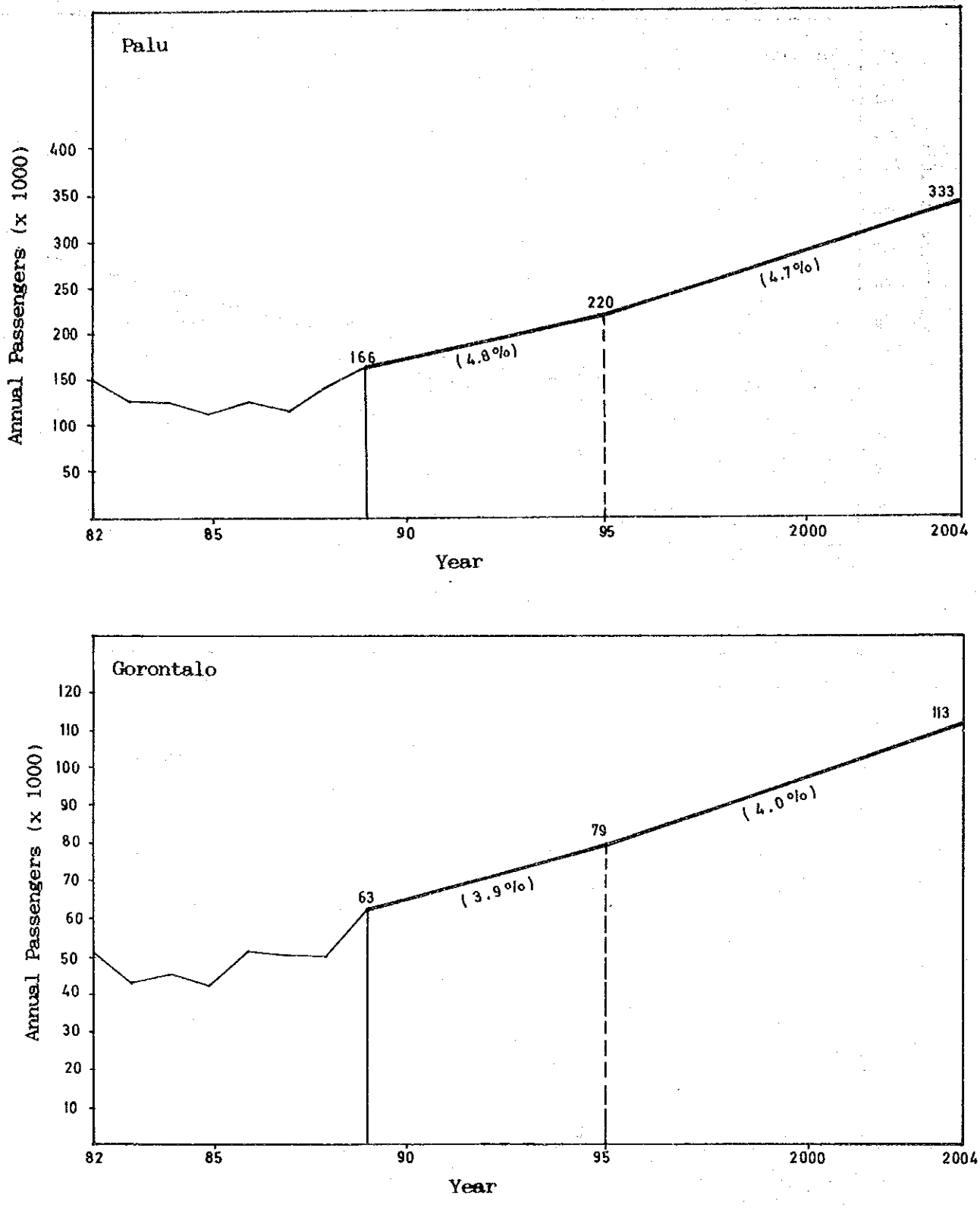
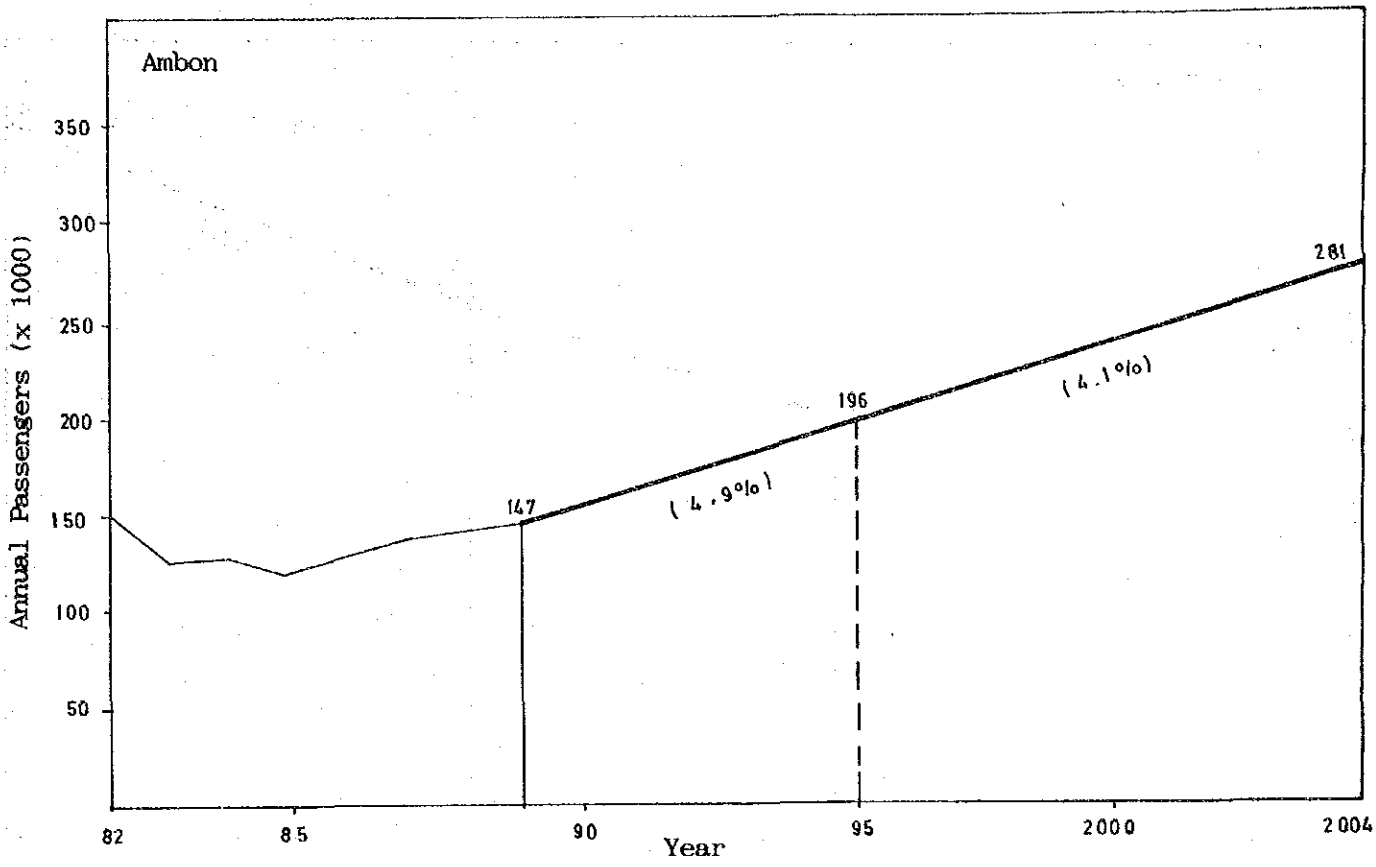


FIGURE 4.2.5 Forecast of Annual Air Passengers (6)



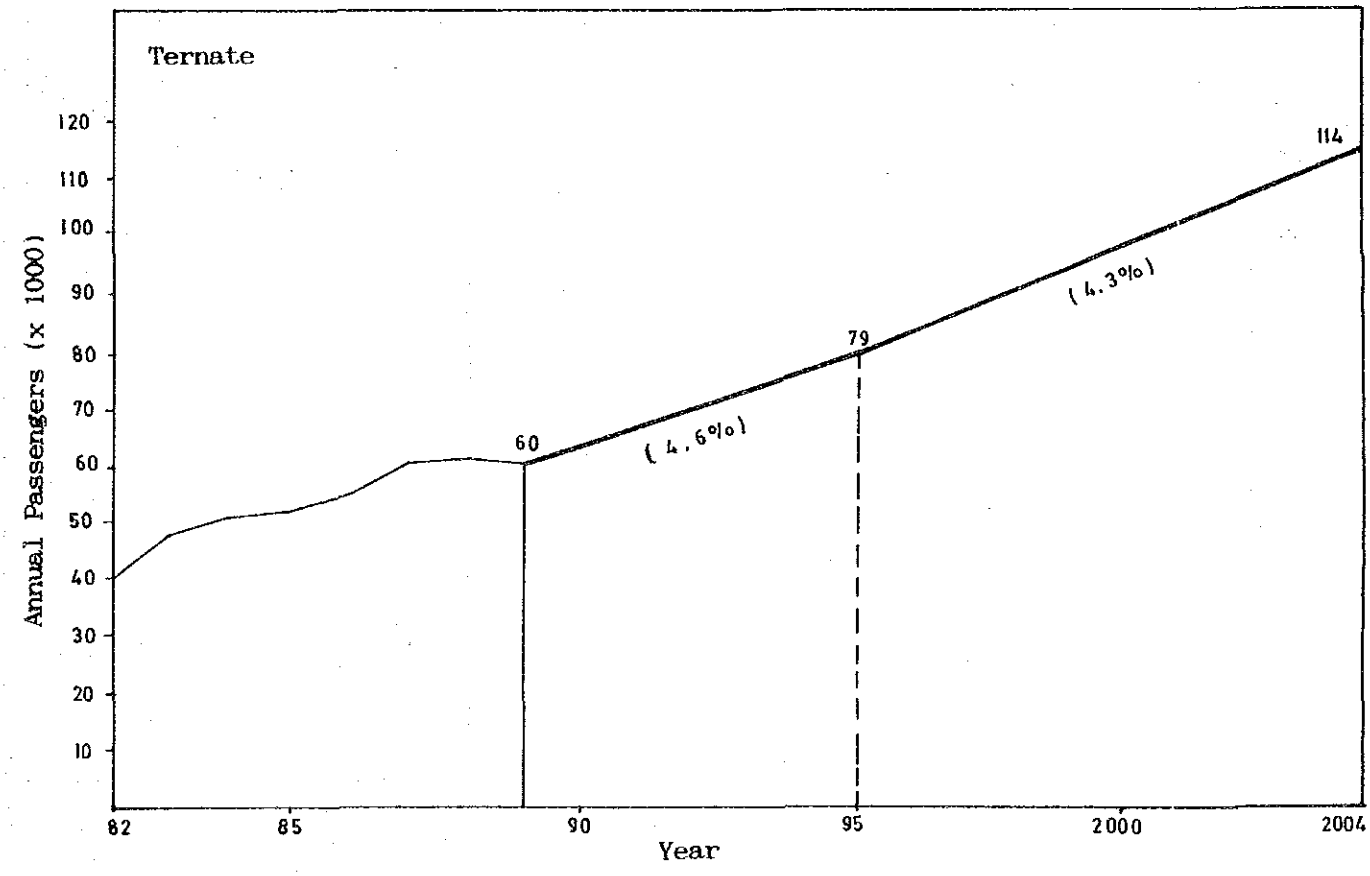


FIGURE 4.2.5 Forecast of Annual Air Passengers (7)

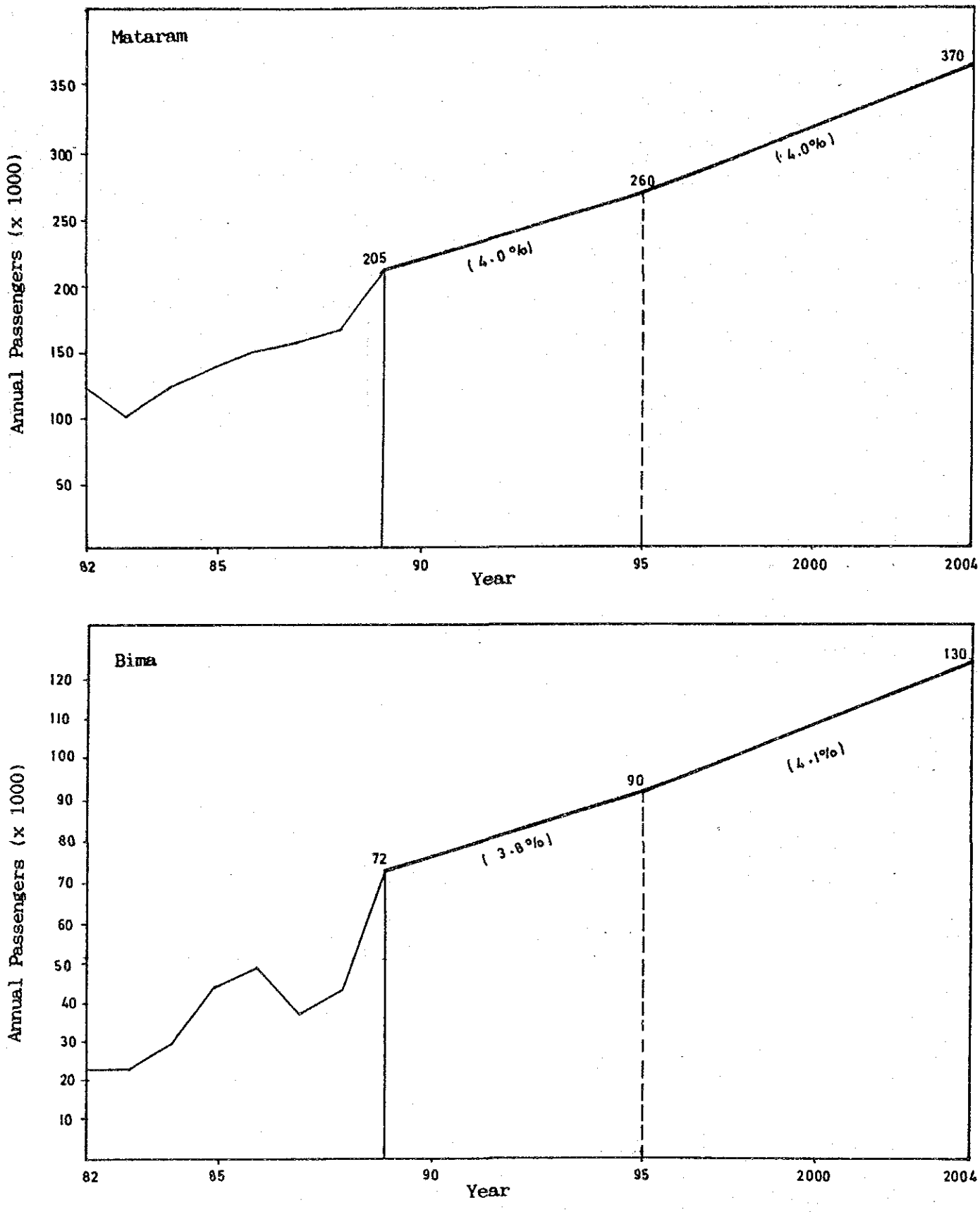
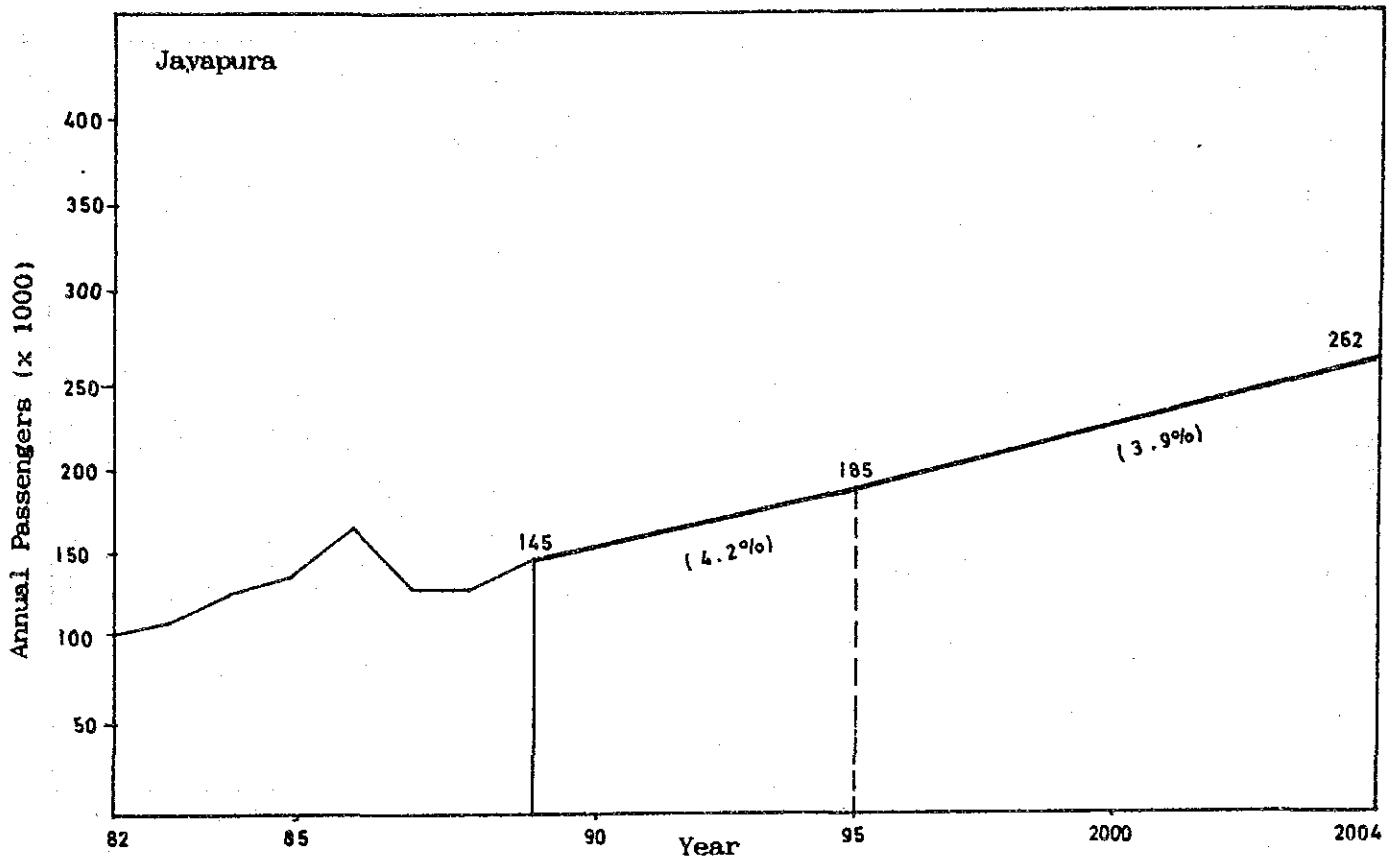


FIGURE 4.2.5 Forecast of Annual Air Passengers (8)



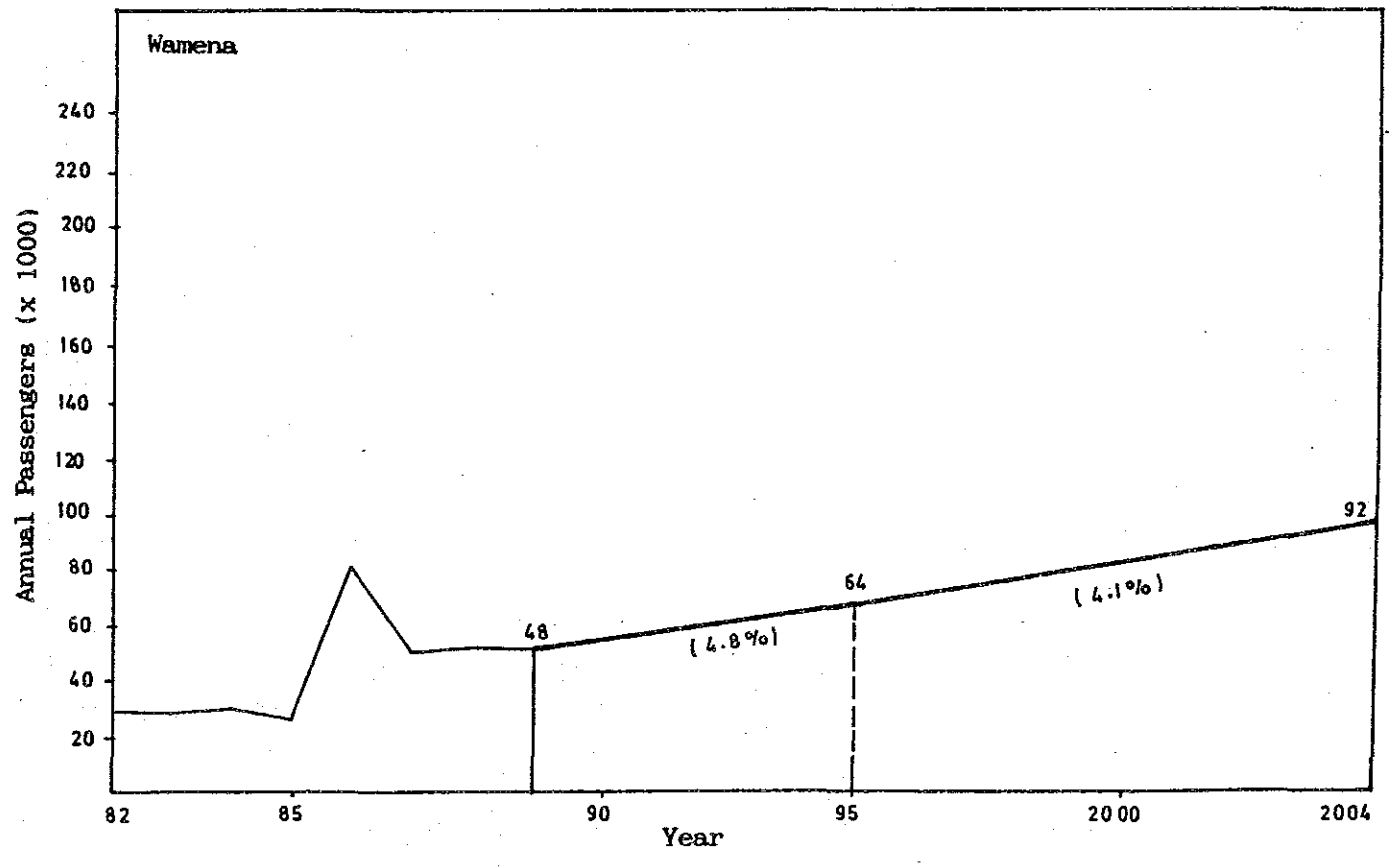
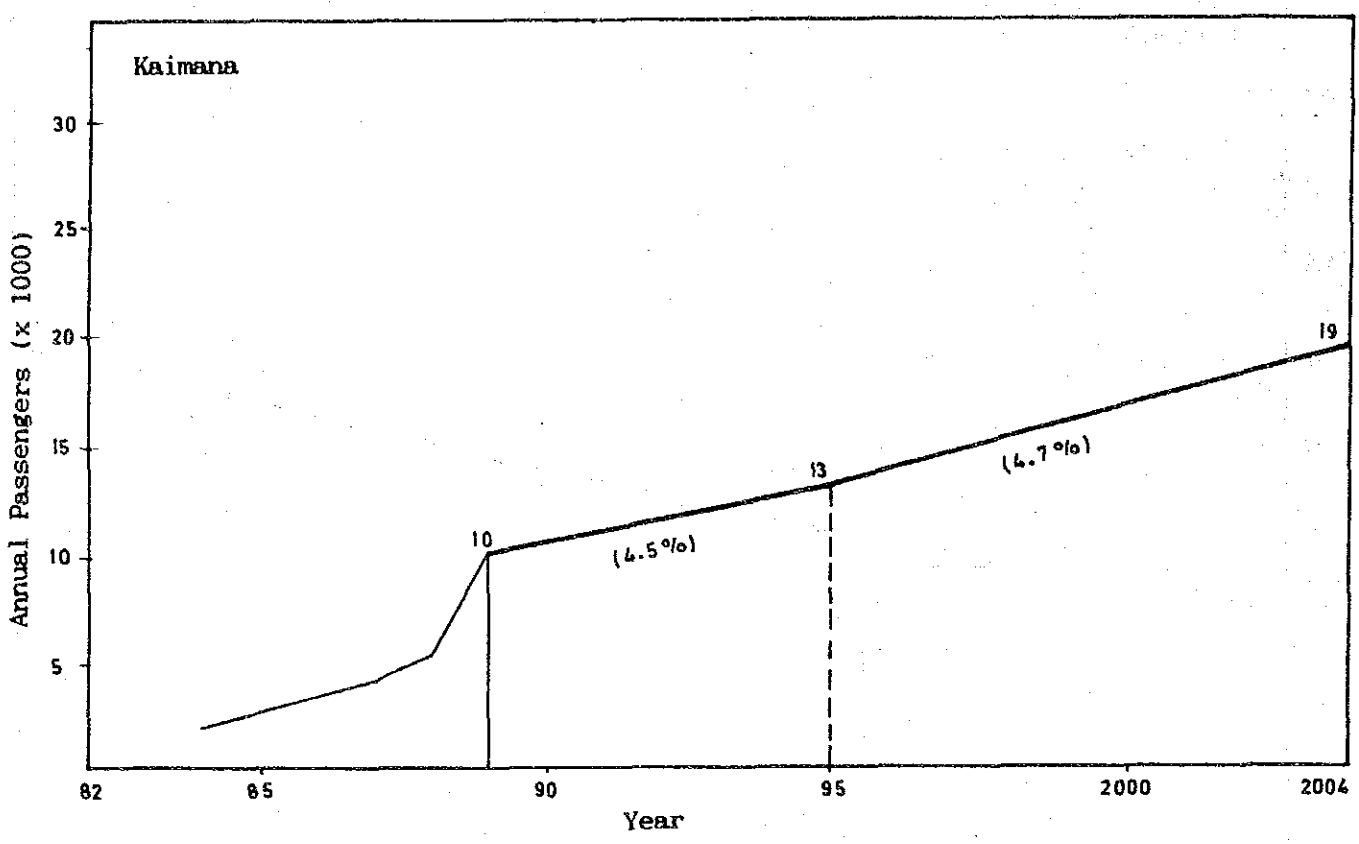


FIGURE 4.2.5 Forecast of Annual Air Passengers (9)



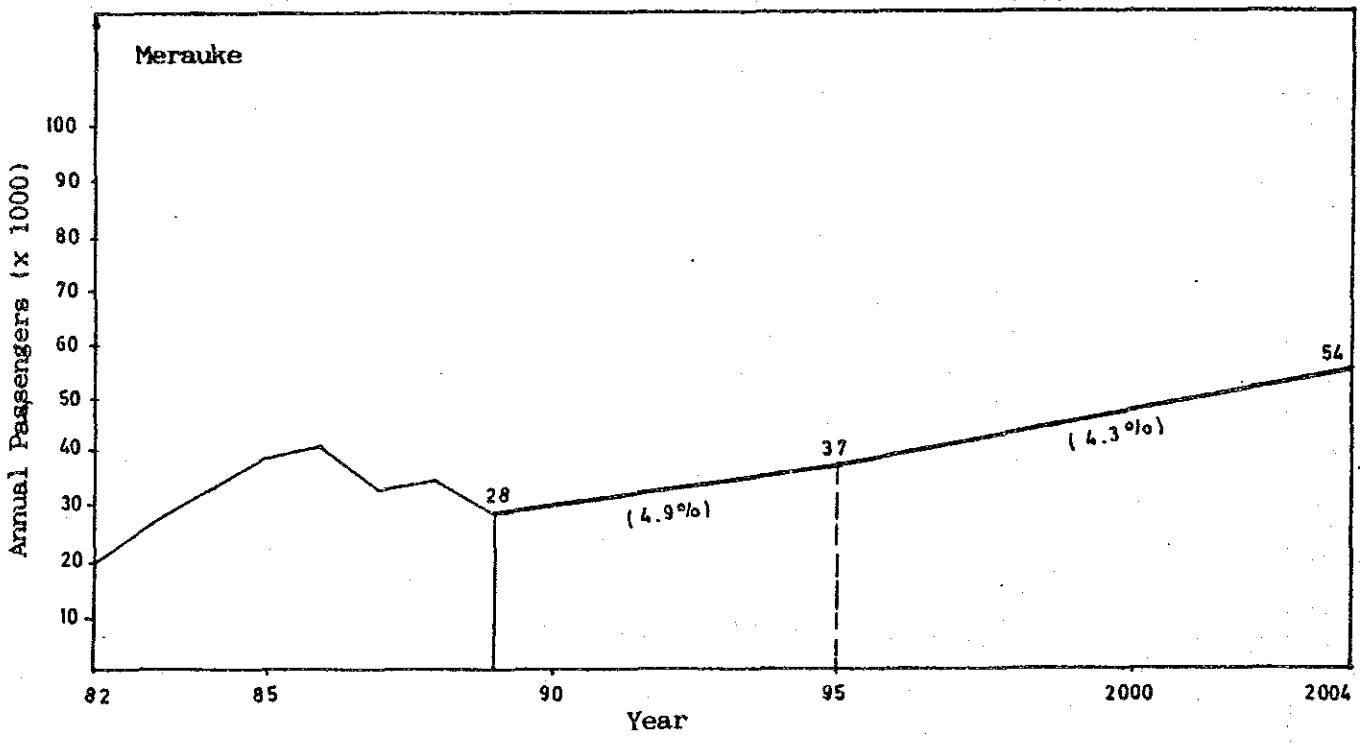


FIGURE 4.2.5 Forecast of Annual Air Passenger (10)