

THE REPUBLIC OF COSTA RICA

THE STUDY ON THE DEVELOPMENT
OF
THREE INTERNATIONAL AIRPORTS
IN
THE REPUBLIC OF COSTA RICA

FINAL REPORT

VOLUME 2 : MAIN REPORT

NOVEMBER 1982

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

SSF

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(JICA)**



PREFACE

In response to a request from the Government of the Republic of Costa Rica, the Government of Japan decided to conduct the study on the Development of Three International Airports in the Republic of Costa Rica and entrusted the study to the Japan International Cooperation Agency (JICA).

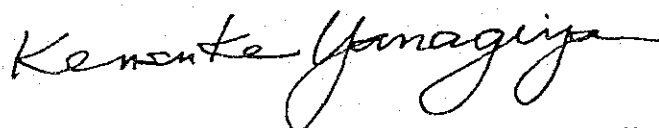
JICA sent to Costa Rica a study team headed by Messrs. Naonori Takahata and Keikichi Yoshida of the Pacific Consultants International three times between August 1991 and September 1992.

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

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Costa Rica for their close cooperation extended to the team.

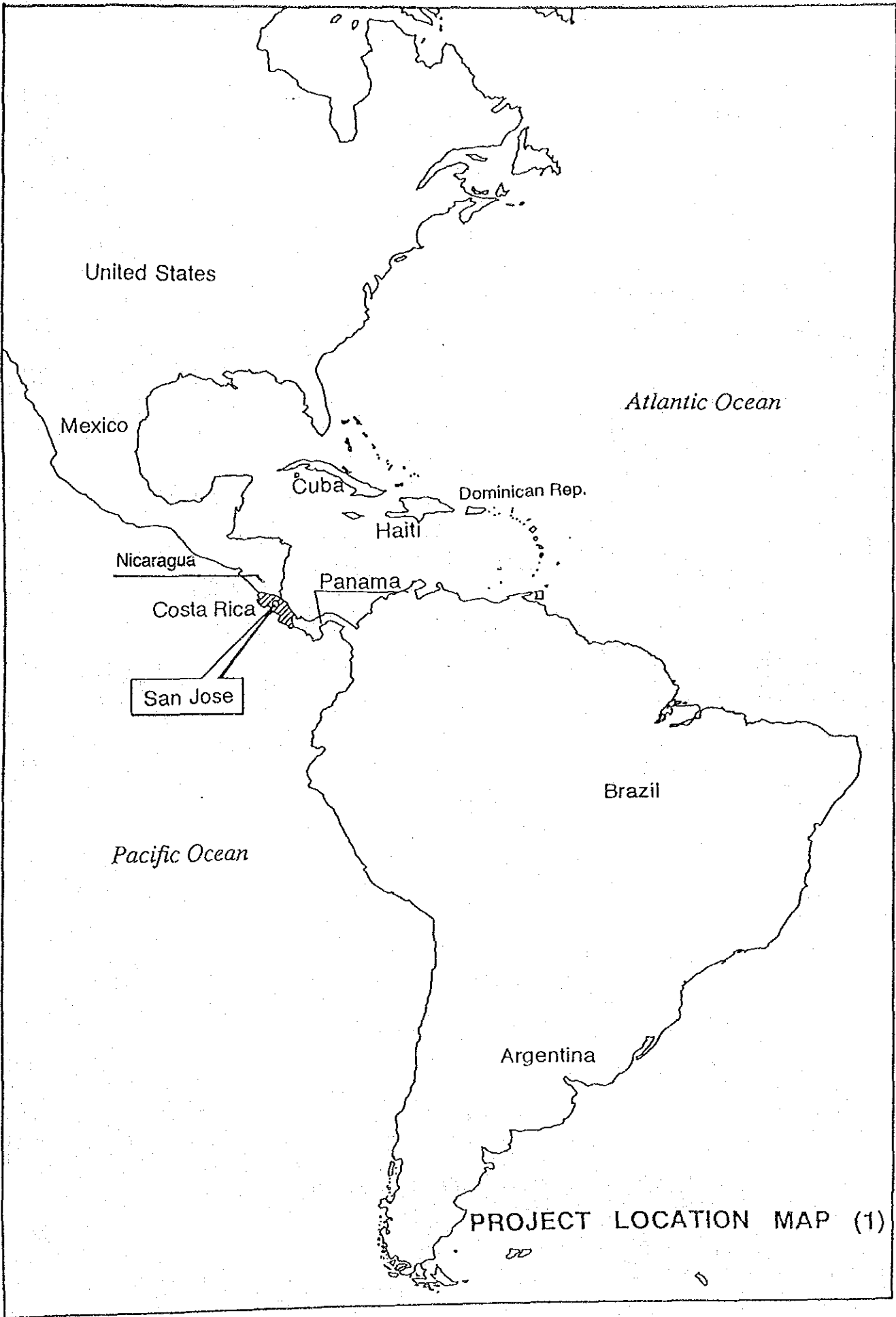
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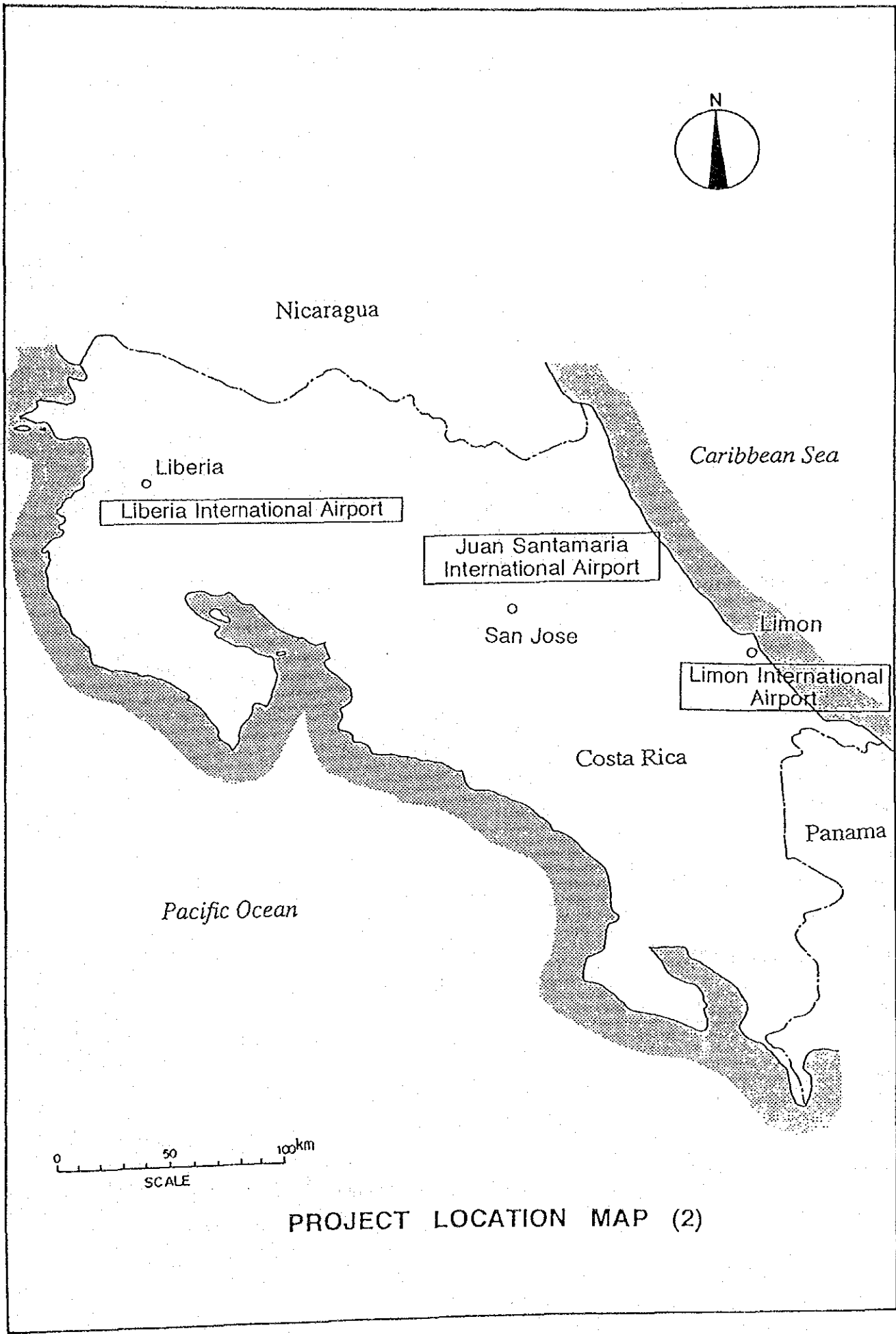


.....
Kensuke Yanagiya

President

Japan International Cooperation Agency





PROJECT LOCATION MAP (2)

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CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background

The Republic of Costa Rica is located in the southern part of Central America between the Caribbean Sea and the Pacific Ocean. Its territory, with a total area of 51,000km² is 75% mountainous terrain, and the remaining part is made up of plains. The total population of Costa Rica was 3.0 million in 1990, of which approximately 60% reside in the urban areas including major cities such as San Jose, Cartago and Alajuela in the Central Valley.

The gross domestic product (GDP) was US\$ 5.67 billion in 1990, and the socioeconomic sector is mainly based on agriculture. Coffee, bananas and foliage plants are the main products, and are exported around the world. The GDP has shown an increasing trend since 1983 due to the promotion of government policies to encourage foreign trade, to develop the tourism industry and to introduce foreign investment.

An appropriate air transport system is very important for this resource poor country in order to promote its economic development through the enhancement of foreign trade, the introduction of foreign investment and the attraction of foreign tourists. Air traffic demands in Costa Rica are increasing at a rapid pace, reflecting the economic growth of the country. However, the major three international airports, viz., Juan Santamaria, Liberia and Limon which could not be developed due to stringent government physical management are now facing various problems.

Under these circumstances, the Government of the Republic of Costa Rica (hereinafter referred to as "the Government of Costa Rica") recognized the necessity of urgent improvement of the existing international airport system in an effective and efficient manner, and requested the Government of Japan to assist in preparing the master plan and feasibility study on the development of the three international airports.

In response to the request of the Government of Costa Rica, the Government of Japan decided to conduct the Study on the Development of the Three International Airports in the Republic of Costa Rica (hereinafter referred to as "the Study") in accordance with the Agreement of Technical Cooperation between the Government of Japan and the Government of Costa Rica.

Based on this decision, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency of the Government of Japan responsible for the implementation of technical cooperation programs, was commissioned to undertake the Study in close coordination with the authorities from the Government of Costa Rica. The agreed scope of work between JICA and the counterpart agency of the Government of Costa Rica, the Ministry of Public Works and Transport (hereinafter referred to as "MOPT"), and the minutes of the meeting at the time of the agreement are included in Appendices-1.1.1 and 1.1.2 respectively.

1.2 Objectives of the Study

The objectives of the Study are summarized in the following two categories:

- a) To prepare long-term master plans for Juan Santamaria, Liberia (Tomas Guardia) and Limon International Airports up to the year 2010, and to identify priority project(s) to be implemented urgently; and

- b) To assess the technical, economic and financial feasibility of the short-term development plan of the priority project(s) within the framework of the long-term master plans.

1.3 Scope of the Study

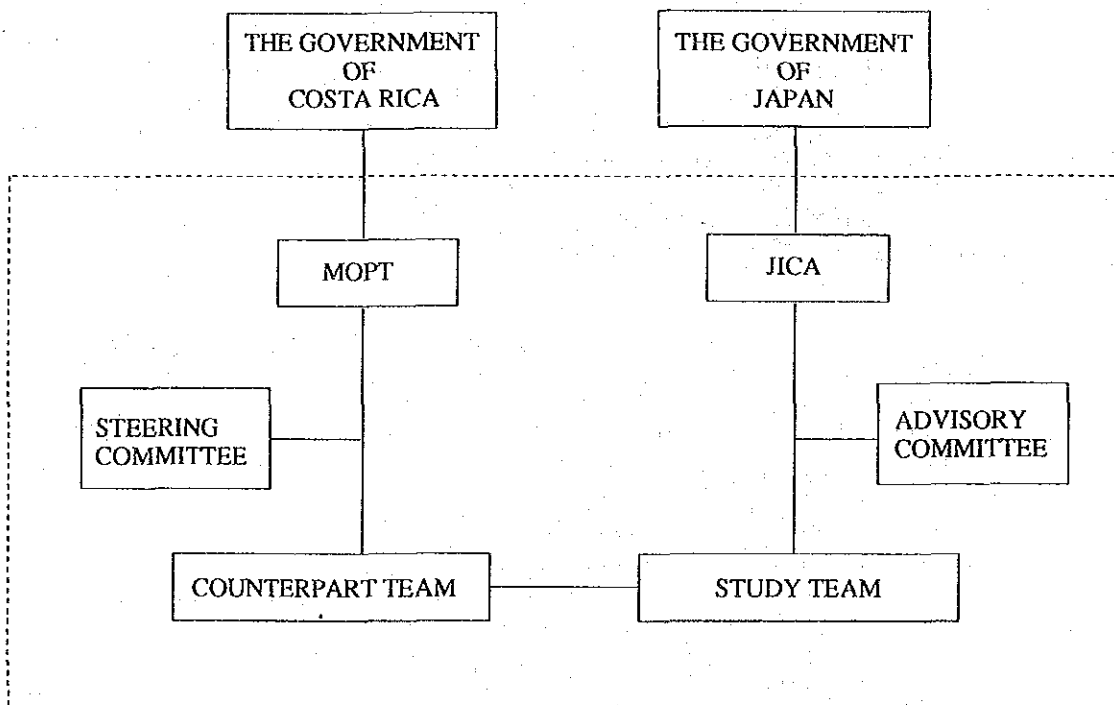
The Study comprises 28 major work items which fully cover "Scope of the Study" in the Scope of Work agreed upon between MOPT and JICA on October 10, 1990. The above agreed scope is shown in Appendix-1.1.1. The main work flow of the Study with the 28 work items is shown in Figure 1.3.1.

1.4 Study Organization

The Study will be carried out by the JICA Study Team under the direction of the Advisory Committee which has also been organized by JICA. The Study will be conducted in close coordination with concerned authorities of the Government of Costa Rica.

1) Overall Concept of Study Organization

The overall organization frame is shown below:



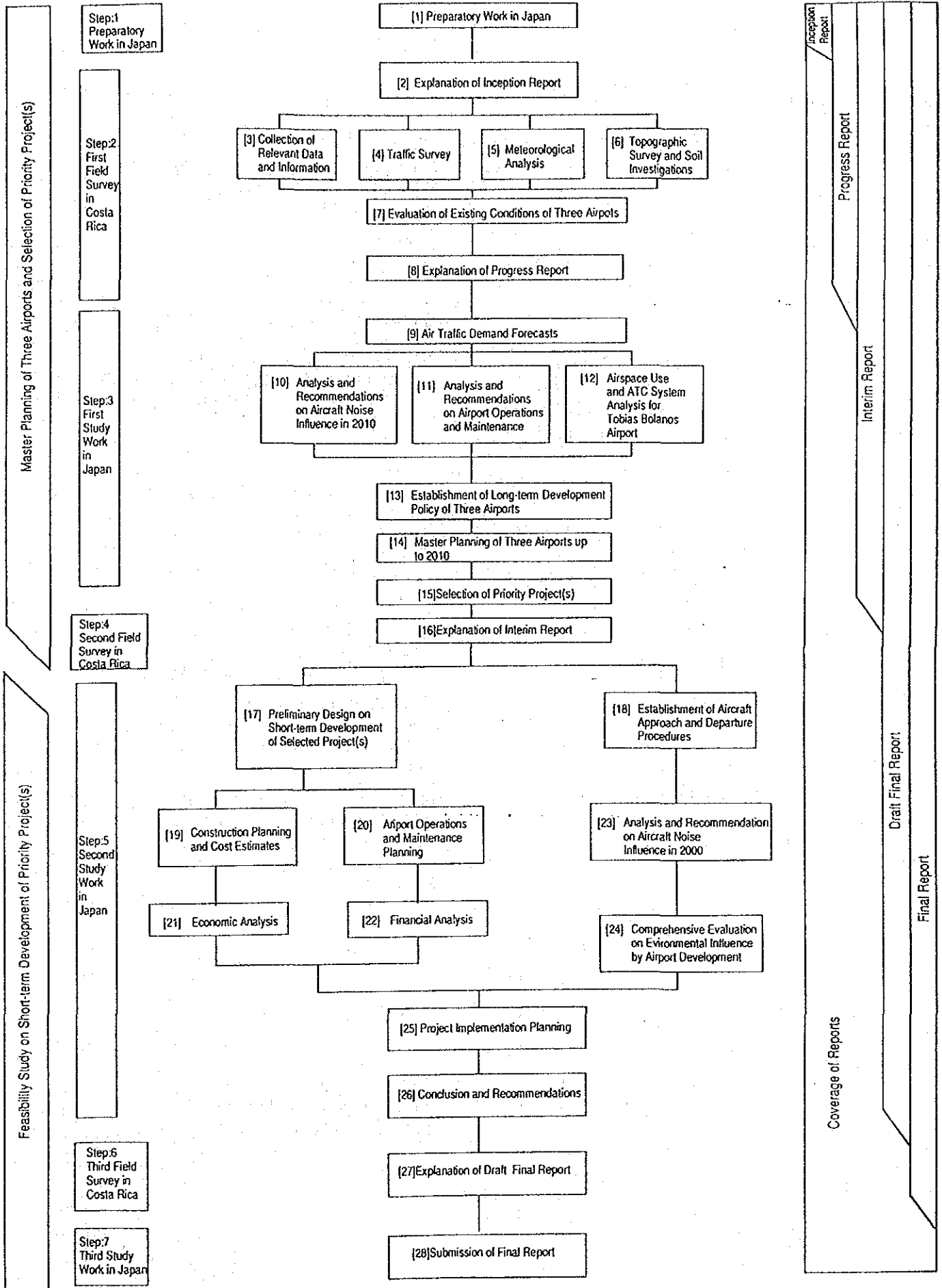


Figure 1.3.1 Main Work Flow Chart

2) Members of the JICA Advisory Committee

- Mr. Yuji UMEKI
(Chairman) : Director,
Airport, Construction Division,
Public Works Department,
Fukushima Prefecture

(Former Position:
Deputy Director, Construction Division,
Aerodrome Department,
Civil Aviation Bureau,
Ministry of Transport)
- Mr. Kozo OTA : Special Assistant to the Director,
Tokyo International Airport Development
Office, Aerodrome Department,
Tokyo Civil Aviation Bureau,
Ministry of Transport

(Former Position:
Chief of Architectural Section,
Construction Division,
Aerodrome Department,
Civil Aviation Bureau,
Ministry of Transport)
- Mr. Atushi MATSUI : Senior Staff,
Space Activities Planning Division,
Research and Development Bureau,
The Science and Technology Agency

(Former Position:
Chief, Second International Affairs Division,
Transport Policy Bureau,
Ministry of Transport)
- Mr. Norio MURAI : Special Assistant to the Director,
ATS System Planning Division,
Air Traffic Services Department,
Civil Aviation Bureau,
Ministry of Transport

3) JICA Coordinator

- Mr. Shingo SAITOH : Project Officer,
First Development Study Division,
Social Development Study Department,
JICA
- Mr. Yukihiro EJIRI
(Predecessor) : Project Officer,
First Development Study Division,
Social Development Study Department,
JICA

4) Members of the JICA Study Team

Mr. Keikichi YOSHIDA	: Team Leader/Airport Planner
Mr. Naonori TAKAHATA (Predecessor)	: Team Leader/Airport Planner
Mr. Yaichi KOBAYASHI	: Traffic Forecaster/Economic Analyst
Mr. Tadamitsu ITO	: Airways Planner/Airport Operations Planner
Mr. Niso WADA	: Co-Airport Planner/Civil Engineer
Mr. Yoshiya NIINOMI	: Air Navigation System Engineer
Mr. Fumitomi FUJITA	: Architect
Mr. Toshiro SATO	: Mechanical and Electrical Engineer
Mr. Ryuji TAGUCHI	: Construction Planner/Cost Estimator
Mr. Yasuro HAGIWARA	: Topographic and Geotechnical Engineer

5) Members of Costa Rica Steering Committee

1. Mr. Mariano GUARDIA (Chairman)	: Vice Minister
2. Mr. Mario HERRERA	: Director General of Planning
3. Mr. Alvaro ESCALANTE	: Director General of Civil Aviation
4. Mr. Rodolfo MONGE	: Deputy Director General of Civil Aviation
5. Mr. Fernando MENDEZ	: Head of Infrastructure Department

6) Members of Costa Rica Counterpart Team

1. Mr. Fernando MENDEZ (Coordinator)	: Airport Planning/Civil Engineering Architecture
2. Ms. Isabel LOPEZ	: Airport Planning/Civil Engineering Architecture
3. Mr. Johnny ARRIETA	: Air Navigation System/Air Traffic Control
4. Mr. Jose ESCOBAR	: Finance and Accounting/Economics
5. Mr. Mario VIQUEZ	: Mechanical and Electrical Engineering/ Airport Maintenance

1.5 Activities of the Study Team

1) First Field Survey in Costa Rica

On August 11, 1991, the Study Team and its Advisory Committee organized by JICA arrived in San Jose, Costa Rica to carry out the eleven-week long First Field Survey. On August 14, 1991, the JICA Team held a meeting on the Inception Report with the representatives of the MOPT and other related agencies.

The objectives and intended procedures of the Study described in the Inception Report were accepted in principle by the MOPT. The minutes of meeting on the Inception Report are shown in Appendix-1.5.1. In accordance with the minutes of the meeting, the Government of Costa Rica organized the Counterpart Team and the Steering Committee. The list of members of the Counterpart Team and the Steering Committee is also shown in Appendix-1.5.1.

The major activity of the Study Team during the First Field Survey in Costa Rica included data collection and analysis, topographic survey, soil investigation and evaluation of existing airports. They were summarized in the Progress Report and explained to the Government of Costa Rica in October, 1991. It was accepted in principle by the Costa Rican side. The minutes of meeting on the Progress Report is shown in Appendix-1.5.2.

2) First Study Work in Japan

Upon arrival from Costa Rica, the Study Team immediately proceeded with the First Study Work in Japan which aimed to produce optimum master plans for the three international airports.

The work included air traffic demand forecasts, estimation of facility requirements, evaluation of existing facilities for future requirements, and the master planning for the three international airports up to 2010. The identification of priority projects and the scope of the short-term development for the succeeding feasibility study were also carried out within the framework of the airport master plan.

The Interim Report was prepared to summarize the achievement up to the First Study Work in Japan under the supervision of the Advisory Committee of the Study organized by JICA.

3) Second Field Survey in Costa Rica

The study team and Advisory Committee mobilized in San Jose on 16, February 1992 to carry out the four-week long Second Field Survey. They submitted the Interim Report to the government, and held three meetings for the presentation of the report and discussion to confirm the major design policies. As a result of the meetings, the Interim Report was accepted and agreed upon by the Costa Rica side including several conditions as mentioned in the minutes of meeting in Appendix-1.5.3.

4) Second Study Work in Japan

The Study Team proceeded with the Second Study Work in Japan upon arrival from Costa Rica. The objective of the Second Work was to carry out a feasibility study on the short-term development plan determined by the airport master planning. The work included modification of the demand forecasts, preliminary design, airspace use study, aircraft noise analysis, airport management study, implementation planning, cost estimate, economic and financial analyses, conclusions of the whole study and recommendations to the Government.

A report substantially compiling all the results of the Study was prepared as the Draft Final Report.

5) Third field Survey in Solomon Islands

The Study Team and Advisory Committee mobilized in San Jose on 27st August 1992 to carry out the two-week long Third Field Survey. They submitted the Draft Final Report to the Government, and held meetings for the presentation of the report, discussion on the report contents and finalization of minutes of meetings. The Draft Final Report was accepted by the Costa Rica side with minor modifications recorded in the minutes of the meeting in Appendix 1.5.4.

6) Third Study Work in Japan

The Study Team upon arrival from the Costa Rica carried out the Third Study Work in Japan. The Final Report was produced by modifying the Draft Final Report in accordance with the minutes of the meeting agreed upon between the two parties. And the Final Report was completed on November 1992.

1.6 Organization of the Report

This Final Report consists of 16 chapters and a series of appendices in a separate volume. Chapter 1 is the introduction and the remaining 15 chapters cover the following study items:

a) Chapter 2 Natural and Socioeconomic Conditions

It reviews the natural and socioeconomic conditions and outlines tourism, transportation and engineering/construction aspects of Costa Rica.

b) Chapter 3 Existing Airports and Surroundings

It describes the airport's history, inventory and traffic characteristics of the three airports. Existing land use in airport's surroundings, meteorological, topographic and soil conditions are also dealt with in this chapter.

c) Chapter 4 Air Traffic Demand Forecasts

Air traffic analysis and demand forecasts which provide the design basis of air traffic with the airport master planning are described in this chapter.

d) Chapter 5 Airport Facility Requirements

In this chapter, the number, concept, type, size and performance necessary for airport facilities are estimated based on the air traffic demand forecasts.

e) Chapter 6 Evaluation of Existing Airports

It evaluates the facilities of the three airports from various aspects. A demand vs. capacity analysis clarifies the usable life of each facility against future requirements.

f) Chapter 7 Establishment of Long-term Development Policy

In this chapter, long-term development policy of the three airports are established in relation to the air traffic demand forecasts and in consideration of expected roles and functions of the three airports.

g) Chapter 8 Airport Master Plans

It produces optimum master plans of the three airports up to the long-term target year of 2010 with the short-term target in 2000. The best alternative is selected as a result of comprehensive evaluation of alternatives.

h) Chapter 9 Selection of Priority Project and Its Scope of Work

This chapter identifies the priority project from the airport master plans of the three airports. From the viewpoints of importance and urgency in the international airport system in Costa Rica, the development of Juan Santamaria Airport is selected as the highest priority project to be examined for its feasibility. The work items of the priority project at Juan Santamaria Airport is also shown in this chapter.

i) Chapter 10 Preliminary Design

The preliminary design is carried out on the facilities of the short-term development project. This chapter designates the size, dimensions, performance and materials to be used for each airport facility.

j) Chapter 11 Airspace Use

This chapter evaluates the air space use of the three airports and Tobias Bolaños Airport located adjacent to Juan Santamaria Airport. The relationship between airspace use of Juan Santamaria and Tobias Bolaños Airport is explained in detail.

k) Chapter 12 Aircraft Noise Analysis

This chapter describes the aircraft noise influence on the surrounding community of the airport as the evaluation of the airport development from the environmental aspect. Influence of aircraft noise is analyzed by computer.

l) Chapter 13 Study of Airport Operations and Maintenance

This chapter mentions and analyzes the existing condition of operations and maintenance of the airport and describes the requirements for the operation and maintenance of the developed facilities in the short-term development.

m) Chapter 14 Project Implementation Schedule and Cost Estimates

This chapter explains the implementation planning and the project costs together with the short-term development.

n) Chapter 15 Economic and Financial Analyses

This chapter evaluates the economic and financial impact of the short-term development project on the national economy and the airport management.

o) Chapter 16 Conclusions and Recommendations

The conclusions of the whole study and recommendations on how to implement the short-term development project are described in this chapter as a final result of the study.

CHAPTER 2 NATURAL AND SOCIOECONOMIC CONDITIONS

CHAPTER 2 NATURAL AND SOCIOECONOMIC CONDITIONS

2.1 General

Air transport plays an important role in the public welfare and socioeconomic development of a nation. This is especially true for Costa Rica because international air transportation is very important to accomplish the outward development policy required for this resource poor country. As the scale of the airport development is closely related to the natural and socioeconomic conditions of the nation, this chapter provides a summary of these conditions of Costa Rica.

2.2 Geographic and Climatic Characteristics

The Republic of Costa Rica is situated in the southern part of Central America at 8°-11° north latitude and 83°-86° west longitude. The country lies between the Caribbean Sea to the east and the Pacific Ocean to the west, and shares its borders with Nicaragua to the north and Panama to the south. Along the central part of the country, the mountain ranges including Guanacaste, Central and Talamanca run from northwest to southeast, and the country is classified into three zones: the Central Valley, the Coastlands facing the Pacific Ocean and the Caribbean Sea, respectively, according to altitude and geographic features.

There are two seasons, namely the dry and rainy seasons. The rainy season runs from May to November, and the dry season covers the remaining December to April period. Temperature changes show a wide range from 0°C in the highlands to 30°C in the coastlands. The average temperature in the Central Valley is 20°C.

The annual rainfall for major areas is approximately 2,500mm for the Central Valley, 2,000 to 3,500mm for the Pacific Coastland and 4,000mm for Atlantic Coastland.

2.3 Socioeconomic Conditions

2.3.1 Population

The total population of Costa Rica was 3,014,598 in 1990, of which approximately 60% reside in urban areas. The growth rate of the population from 1980 to 1990 was 2.9% per annum.

2.3.2 Gross Domestic Product (GDP)

The gross domestic product (GDP) of Costa Rica was US\$5.67 billion in 1990, with a per capita income of US\$1,900. The economy experienced a minus growth in the early 1980's mainly due to the sluggishness of the international market for agricultural products, a protective policy and decrease of imports by industrialized countries, and difficulties in conducting a proper policy because of the country's high debts.

However, the GDP turned to an increasing trend since 1983 and achieved a stable growth of 4.6% per annum from 1985 to 1990. The breakdown of GDP by industrial sector is shown in Table 2.3.1.

Table 2.3.1. GDP by Industrial Sector in 1990

(Unit: Million Colones)

Sectors	Amount	Percentage
- Agriculture	83,807	16.1
- Manufacturing	99,999	19.2
- Electricity and Water	16,706	3.2
- Construction	17,079	3.3
- Commercial	104,607	20.0
- Transportation & Communications	25,777	4.9
- Financial	44,634	8.5
- Real Estate	18,661	3.6
- Government	79,442	15.2
- Other Services	31,508	6.0
- Total	522,219	100.0

The Costa Rican economy, judging from the relatively large share of agriculture and other industries related to agriculture, may be defined as an agro-base economy. The major agricultural products are coffee, bananas, flowers and foliage plants, and are at the same time major export items.

2.3.3 Activity of Trade

The trend of exports and imports since 1987 is shown below:

Table 2.3.2. Exports, Imports and Trade Balance

(Unit: Million US\$)

Year	Exports	Imports	Balance
1987	1,158	1,380	-222
1988	1,246	1,410	-164
1989	1,415	1,737	-322
1990	1,458	2,026	-568
Annual Growth Rate	8.0%	13.7%	

The above trend indicates the sharp increase in imports and the trade deficit. The breakdown of export products between traditional and non-traditional products is as follows:

Table 2.3.3 Breakdown of Exports

Year	Type of Product	
	Traditional	Non-traditional
1987	60%	40%
1988	57%	43%
1989	52%	48%
1990	52%	48%

The table indicates the increase in non-traditional products such as pineapple, fresh frozen fish, garments, jewelry and ornamental plants.

2.3.4 Outline of the National Development Plan

Under the title "Plan Nacional de Desarrollo 1990/1994", the national development plan for the 1990-1994 period has been established. The main strategic programs for the achievement of the development plan are summarized as follows:

a) Agro-industrial Development

In order to encourage a modern and competitive agro-industry, the strengthening of the links between agriculture, industry, commerce and services is required based on the potential requirement of the market and its inter-sectoral relationship.

b) Industry Reconversion

The objective is to encourage a significant internal restructuring of the manufacturing sector such as textiles, electronics, food processing industry, etc., for an increase of productivity.

c) Development of Tourism

The objective is to develop the effective involvement of the public sector into the private sector, and to professionalize the human resources for the encouragement of tourism activities. Top priorities in this program are to be given to the provinces of Guanacaste, Puntarenas and Limon.

d) Foreign Trade

The objective is to encourage plugging into the foreign market by the reorganization of the foreign trade institutions framework, thus facilitating the definition of policies by the private sector and the modernization of the mechanisms to provide information on foreign trade.

High priorities in this program are given to the following projects:

- Industrial Park in Santa Rosa, Puntarenas
- Puntarenas Tuna Free Zone
- Reactivating Limon Free Zone
- Guanacaste Free Zone

The goals set by the strategy are as follows:

Table 2.3.4 Economic Indices Targetted in National Development Plan

Economical Indices	Plan for 1990 - 1994	Actual for 1989/1990
- GNP	Average 4.0%	3.6%
- Export	Average 7.0%	7.3%
- Internal demand	Average 2.4%	3.0%

2.3.5 Outline of Regional Development Plan

1) Liberia Area

The Ministry of National Planning and Economic Policy prepared the development plan for the Liberia area named "Plan Regional de Desarrollo: Region Chorotega." in May, 1991. The outline of the plan is summarized as follows:

"The overall objective of economic development for the region is to improve the living standard of the region's population through the reactivation and promotion of agriculture and livestock-raising industry, fishery and tourism."

To achieve this objective, the following target sectors are selected as high priority:

- Encouragement of agriculture, livestock-raising industry and fishery
- Development of tourism
- Development of infrastructures to support the enhancement of the above activities

The plan stresses the need to develop Liberia Airport as soon as possible, so as to encourage agriculture, livestock-raising industry, the fishing industry and tourism. Based on this basic policy, the following projects are now ongoing and planned.

a) Ongoing Projects:

- Development of Liberia International Airport
- Implementation of Papagayo Tourist Project covering 2,000ha with the construction of accommodation facilities with total 12,000 rooms

b) Planned Projects:

- Nine projects for the improvement and development of transportation and infrastructure
- Two projects for the implementation of "agriculture and stock raising program"
- Others

2) Limon Area

Limon area has traditionally been one of the most underdeveloped areas in Costa Rica. In addition to this, the region was severely damaged by the earthquake that struck the area on April 22, 1991. This has made the depressive situation in that

region even more serious. The Ministry of National Planning and Economic Policy prepared, in May of 1991, the development plan of the Limon area which was included in "Plan de Desarrollo, Region Huetaar Atlantica". This plan sets up the following main targets of development:

- Encouragement of agriculture and livestock-raising industry, including ornamental plants for exportation
- Development of small and medium-sized enterprises related to banana and forestry industries
- Promotion of tourism
- Improvement of infrastructure including the development of Limon Airport and Limon Port facilities

To achieve the above main targets of development, the following projects are now ongoing and planned.

a) Ongoing Projects:

- Industrialization of Coconut

b) Planned Projects:

- Construction of highways to support tourism development
- Improvement of railways
- Construction of a third pier for banana exports at Moin Port
- Development of hydroelectric supply

At the same time, the regional development plan establishes the following projects as emergency measures to help the region recover from the destruction caused by the earthquake:

- Repair and reconstruction of aqueducts
- Reconstruction of Limon Airport
- Reconstruction of the railway network
- Reconstruction of Limon Port
- Improvement of neighboring roads with a total length of 200km
- Repair of the electric and telephone systems
- Repair of the refinery and wharf for oil tankers

2.4 Tourism

2.4.1 Trend of Tourist Flow

In 1990, 435,000 tourists entered Costa Rica. The annual average growth rate of tourism from 1987 to 1990 shows a peak rate of 16%. Tourist arrivals are 73.0% by air, 26.5% by land and 0.5% by sea. This percentage has remained steady during the last few years.

The places of origin for tourists arriving in the country are as follows:

Table 2.4.1 Share of Tourists by Country/Region of Origin

Origins	Share
- North America	34.5%
- Europe	13.1%
- South America	7.5%
- Panama	13.3%
- Canada	7.1%
- Others	24.4%
- Total	100.0%

2.4.2 Main Tourist Spots

The main destinations of tourists in Costa Rica can be classified by two geographic locations: the highland area of the Central Valley, and the marine resort areas of the Pacific and Caribbean Coastlands. Classification by provinces is as follows:

- Mountainous Areas: San Jose, Cartago, Heredia and Alajuela
- Coastal Areas destinations: Guanacaste, Limon and Puntarenas

The main tourism in each province are as follows:

- a) San Jose : - Museums in the City
- Chirripo National Park
- b) Alajuela : - Volcan Poas National Park
- Sarchi (woodcraft)
- c) Cartago : - Volcan Irazu National Park
- Guayabo National Park (famous ruins)
- Old Churches
- d) Heredia : - Braulio Carrillo National Park
- e) Guanacaste : - Marine parks such as Barra Honda, Palo Verde, Guanacaste and Santa Rosa
- f) Limon : - Tortuguero and Cahuita National Parks
- Barra del Colorado Sanctuary Park
- g) Puntarenas : - Carara National Park (Biological Sanctuary)
- Marine resort parks such as Dona Ana, Jaco, Manuel Antonio, Corcovado and Isla del Cano

The Tourist Bureau of Costa Rica (ICT) has classified the above resort spots or areas as shown in Figure 2.4.1. The number of enterprises engaged in the tourist industry in 1990 is shown in Table 2.4.2:

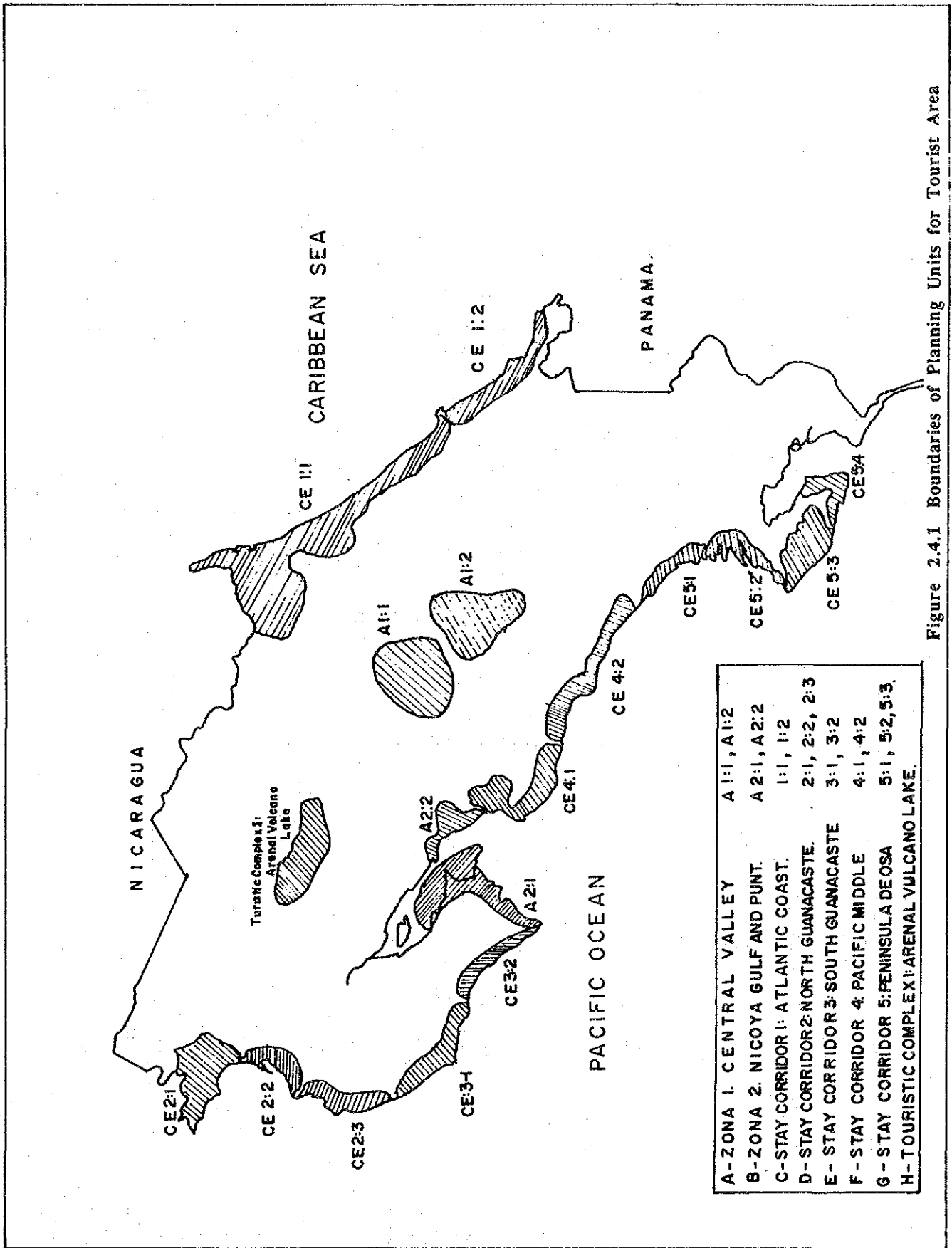


Figure 2.4.1 Boundaries of Planning Units for Tourist Area

Table 2.4.2 Number of Tourism Enterprises by Tourist Zones in 1990

Tourist Zone	No. of Enterprises	Percentage	Related Airports
- Zone 1	369	64.1	Juan Santamaria
- Zone 2	59	10.2	
- C.E.1: Atlantic	28	4.9	Limon
- C.E.2: North Guanacaste	50	8.7	Liberia
- C.E.3: South Guanacaste	7	1.2	
- C.E.4: Middle Pacific	26	4.5	
- C.E.5: Osa	18	3.1	
- C.T.No. 1 Arenal	19	3.3	
- Total	576	100.0	

Juan Santamaria, Liberia and Limon Airports are located in Zone 1, C.E.2 and C.E.1. respectively.

The breakdown of types of tourism enterprises in 1990 was as follows:

Table 2.4.3 Number of Tourism Enterprises by Types in 1990

Type	No. of Enterprises	Percentage
- Hotel	208	36.1
- Travel agent	125	21.7
- Restaurant	118	20.5
- Land transportation and car rental	40	6.9
- Amusement facility	26	4.5
- Internal navigation	42	7.3
- Air transportation	17	3.0
- Total	576	100.0

2.4.3 Accommodations Facilities

1) Accommodation Establishments and Number of Rooms

The number of accommodations establishments and rooms available by type in 1990 is shown as below:

Table 2.4.4 Number of Accommodation Establishments by Types in 1990

Type	No. of Establishments	No. of rooms	Percentage of rooms
- Hotels	143	5,783	86.2
- Lodges	37	473	7.1
- Cabin facilities	13	211	3.1
- Motels	14	237	3.5
- Inns	1	9	0.1
- Total	208	6,713	100.0

2) Number of Hotels by Province

The number of rooms by quality and province in 1990 is spelled out below:

Table 2.4.5 Number of Rooms by Quality and Province in 1990

Province	Category (No. of Stars)						Total
	5	4	3	2	1	0	
- San Jose	254 (0)	201 (201)	1,248 (1,099)	262 (409)	421 (381)	665 (240)	3,051 (2,330)
- Heredia		326 (326)	92 (88)	45 (35)	12 (12)	5 (25)	480 (486)
- Alajuela				37 (4)	118 (83)	78 (42)	233 (129)
- Cartage					22 (22)	32 (7)	54 (29)
- Limon				126 (88)	192 (153)	340 (132)	658 (373)
- Guanacaste			362 (273)	227 (167)	326 (290)	317 (262)	1,232 (992)
- Puntarenas			234 (60)	219 (186)	200 (414)	1,344 (457)	1,997 (117)
- Total	254 (0)	527 (527)	1,936 (1,520)	916 (889)	1,291 (1,355)	2,781 (1,165)	7,705 (5,056)

Note: Numbers in parenthesis indicate figures for 1989

The number of rooms increased by 52% from 1989 to 1990. This complies with the government policy of developing the tourism industry to cope with the increased tourists.

2.4.4 Contribution of Tourism Industry to the National Economy

The share and increase ratio of foreign exchange earning by tourism industry from 1989 to 1990 are compared with those of agricultural products in the following table:

Table 2.4.6 Foreign Exchange Earnings by Tourism Industry and Other Major Agricultural Products

(Unit: Million US\$)

Sector	1989		1990		Increase Ratio for 1990/1989
- Tourism	206.6	(24.9)	275.0	(29.9)	1.33
- Coffee Product	286.2	(34.5)	245.0	(26.7)	0.86
- Banana Product	272.8	(32.9)	318.4	(34.7)	1.17
- Beef Product	47.4	(5.7)	46.2	(5.0)	0.97
- Sugar Product	15.4	(1.9)	33.6	(3.7)	2.18
- Total	828.4	(100.0)	918.2	(100.0)	1.11

The above data indicate that the foreign exchange earnings from the tourism industry sharply increased in 1990, accounted for 30% share of the total and ranked second in the major products. By promoting the efficient development of tourism in the country, the Government of Costa Rica is anticipating high income from the tourism industry.

2.5 Air Transport

2.5.1 General

There are 112 airports in Costa Rica, consisting of 34 airports managed by the DGAC, 45 airports operated by the private sector, and 33 private owned airports. There are four airports classified as international airports, namely Juan Santamaria, Tobias Bolaños, Liberia and Limon.

The national gateway to accommodate international flights to Costa Rica is Juan Santamaria Airport. The flag carriers of Costa Rica viz. LACSA and Aero Costa Rica, and thirteen foreign airlines are operating at Juan Santamaria Airport. In addition, the airport now serves the domestic flights by SANSA and general aviation activity.

The existing international and domestic air routes from to Juan Santamaria Airport are shown in Figures 2.5.1 and 2.5.2 respectively. The lists of international and domestic flight services from/to Juan Santamaria are shown in Tables 2.5.1 and 2.5.2. More than 30 cities are connected with San Jose.

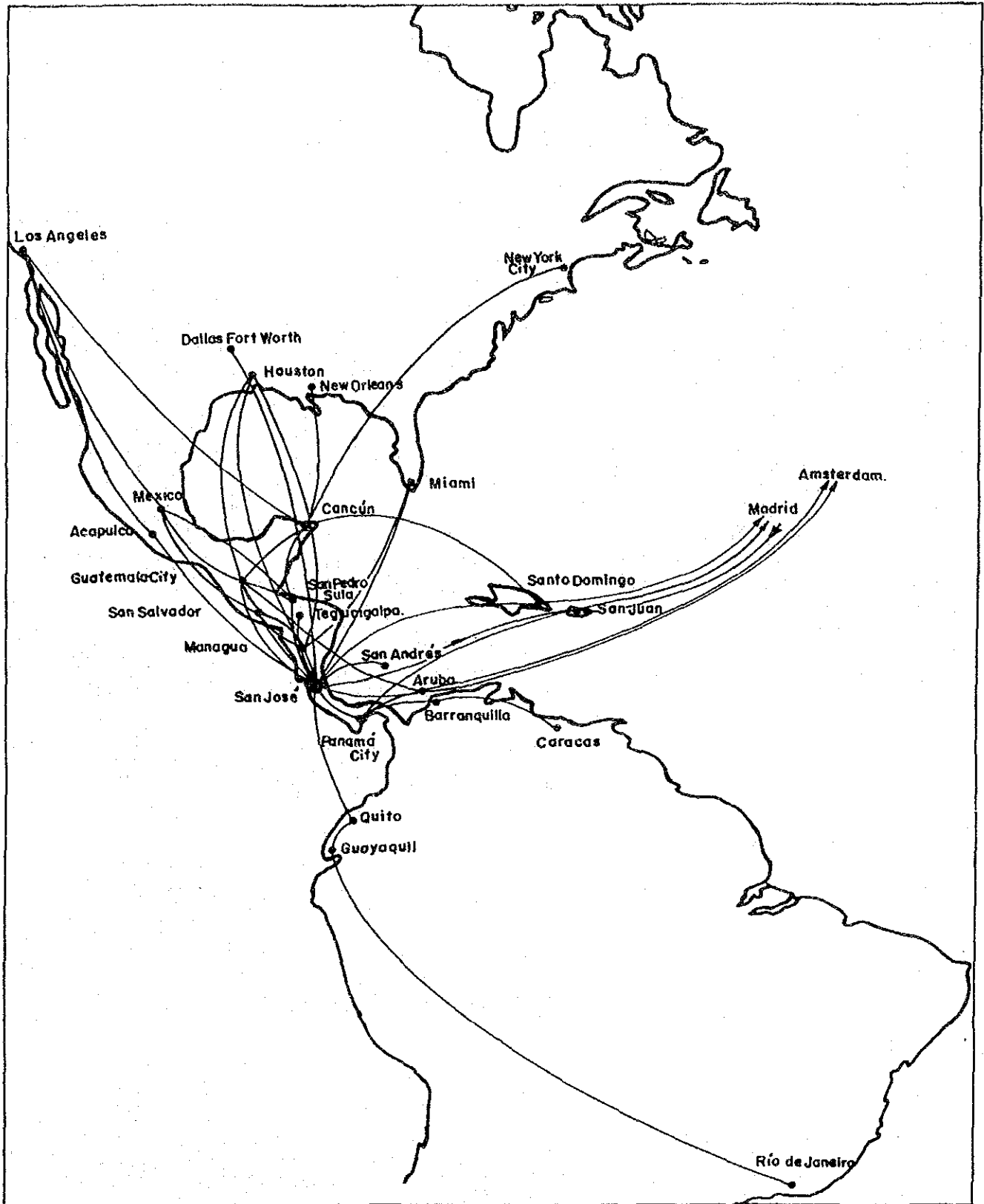


Figure 2.5.1 International Flight Services From/to San Jose

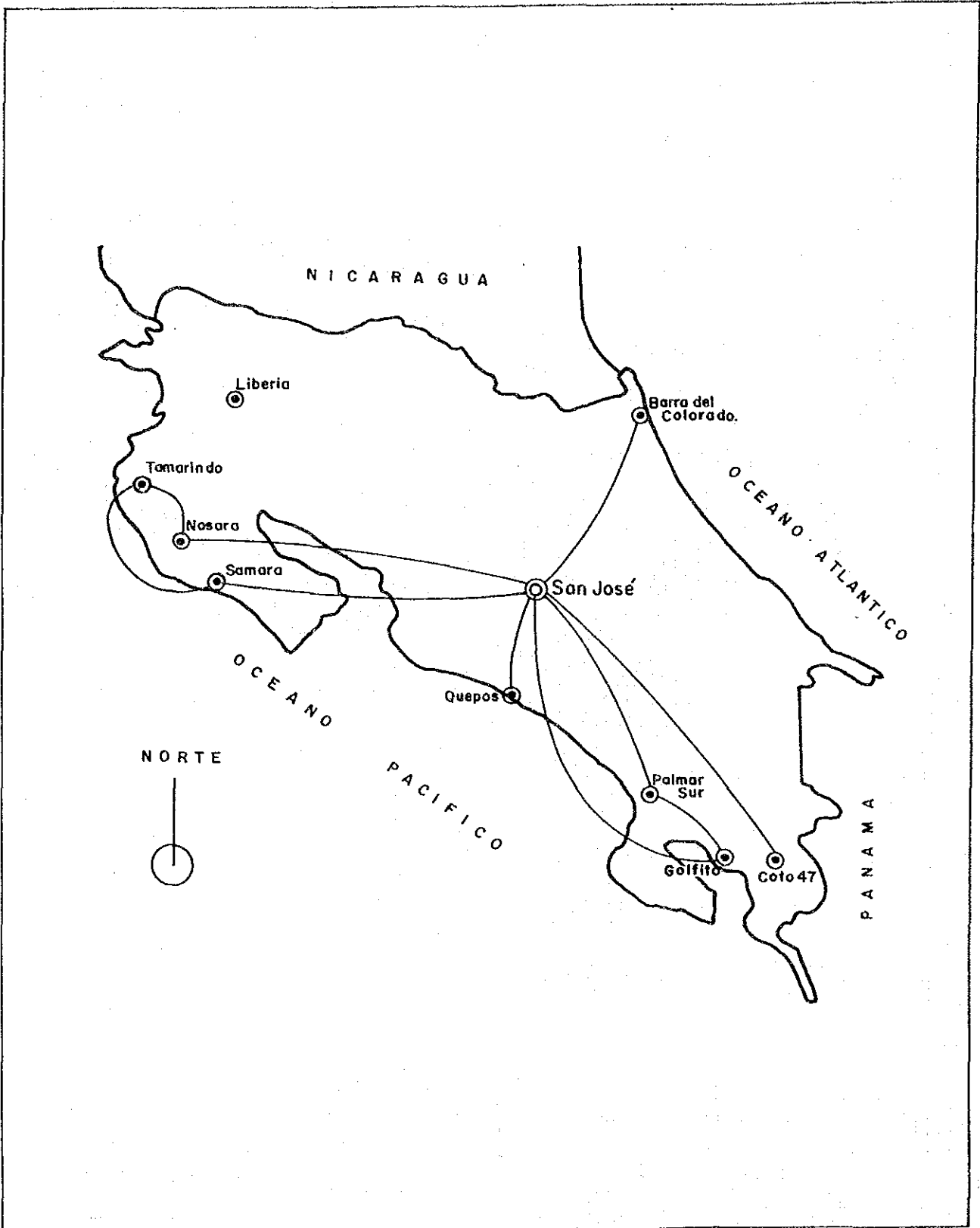


Figure 2.5.2 Domestic Flight Services From/to San Jose

Table 2.5.1 List of International Flights Services

Route	Airline	Aircraft	Flights per Week
San Jose - Miami	AA	B-727	14
San Jose - Dallas	AA	B-727	7
Guatemala - Salvador - Managua - San Jose - Panama	CM	B-737	17
San Jose - Guatemala - Houston	CO	B-727	3
San Jose - Managua - Houston	CO	B-727	4
Guatemala - Managua - San Jose	GU	B-737	7
San Jose - San Juan - Madrid	IB	DC-10	2
San Jose - Sto. Domingo - Madrid	IB	DC-10	2
Amsterdam - Aruba - San Jose - Panama - Aruba - Amsterdam	KL	DC-10	1
Amsterdam - Aruba - Guatemala - San Jose - Panama - Aruba - Amsterdam	KL	DC-10	1
San Jose - Panama - Barraquilla - Caracas	LR	B-727	3
San Jose - Miami	LR	A-320	7
San Jose - Managua - Miami	LR	A-320	3
San Jose - San Pedro Sula - Mexico - Los Angeles	LR	A-320	4
San Jose - Salvador - Mexico - Los Angeles	LR	A-320	3
San Jose - Sto Domingo - Cancun - Los Angeles - Mexico - Salvador	LR	A-320	1
San Jose - Acapulco - Los Angeles	LR	A-320	2
San Jose - Panama - San Juan	LR	B-727	2
San Jose - San Pedro Sula - Cancun - New Orleans	LR	B-727	2
San Jose - San Pedro Sula - Guatemala - Cancun - New York	LR	A-320	2
San Jose - San Pedro Sula - Cancun - New York	LR	A-320	1
Guatemala - San Jose - San Andres	MM	B-727	7
San Andres - San Jose - Guatemala	MM	B-727	7
San Jose - Guatemala - Mexico	MX	B-727	7
San Andres - San Jose - Guatemala	MM	B-727	3
San Jose - Miami	PA	B-727	7
Rio De Janeiro - Guayaquil - Quito - San Jose	RG	B-767	1
Panama - San Jose - Managua	RL	B-707	8
Tegucigalpa - Managua - San Jose	SH	B-737	4
San Jose - Tegucigalpa	SH	B-737	1
Panama - San Jose - Salvador	TA	B-737	14
Mexico - Guatemala - San Jose	MX	B-727	7
Total			One Way: 152 Both Way: 304

Note 1: Flight service as of September 1991.

Note 2: Designator in the column of Airline stand for the following airlines:

AA : American Airlines	CM : COPA
CO : Continental Airlines	GU : Aviateca
IB : Iberia	KL : KLM
LR : LACSA	MM : SAM
MX : Mexicana	PA : Pan American
RG : Varig	SH : Sahsa
TA : Taca International Airlines	

Table 2.5.2 List of Domestic Flights Services by SANSA

Route	Aircraft	Flights per Week
San Jose - Golfito	Aviocar (C-212)	6
San Jose - Quepos	Aviocar	6
San Jose - Samasa - Tamarindo - Nosara - San Jose	Aviocar	3
San Jose - Coto 47	Aviocar	6
San Jose - Palmar Sur - Golfito - San Jose	Aviocar	3
San Jose - Barra Colorado	Aviocar	3
Total		One Way: 27 Both Way: 54

Note: As of June 1991

At present there are no scheduled flights to Liberia Airport. As for Limon Airport, operations of scheduled flights were abolished in 1987 because of drastic drop of demand caused by the completion of the highway.

2.5.2 International Passenger Traffic

The outline of International passenger traffic at Juan Santamaria International Airport is shown in Table 2.5.3. From 1985 to 1990, the growth rate in the number of passengers was 9.3% per annum.

Table 2.5.3 International Air Passengers at Juan Santamaria Airport

(Unit: 1,000 passengers)

Year	North America	Central America	South America	Caribbean	Europe	Total
1985	308	199	28	34	22	591
1986	337	206	29	48	23	643
1987	385	215	31	53	24	708
1988	416	211	36	43	24	730
1989	461	245	39	53	28	826
1990	530	258	44	60	31	923
Annual Growth Rate	11.5%	5.3%	9.5%	12.0%	7.1%	9.3%

Traffic characteristics were analyzed as follows:

- Shares of scheduled and non-scheduled flights were 98.5% and 1.5%.
- Shares of foreign and resident passengers, were 64% and 36%.
- Shares by originating/terminating countries in 1990 were as follows:

Table 2.5.4 Share of International Passengers by Areas of Origin and Destination in 1990

Zone	Share
- North America	57.4%
- Central America	28.0%
- South America	4.7%
- Caribbean	6.5%
- Europe	3.4%
- Total	100%

- The share of arrival passengers carried by LACSA in 1990 was 34.1%. That of U.S. airlines was 29.5%. The share of LACSA has been decreasing since 1980. On the other hand, the share of U.S. airlines has been increasing because of the steady increase of American tourists to Costa Rica.

2.5.3 International Cargo Traffic

The record of international cargo volume is shown in Tables 2.5.5. and 2.5.6. The average growth rates of export, import and total cargo volume from 1985 to 1990 are 21.8%, 16.8% and 19.8%, respectively.

Such drastic growth of imports and exports via Juan Santamaria Airport explains the activation of the Costa Rican economy. In addition, this growth rate has been achieved despite the current critical conditions of the cargo terminal facilities at the airport. Accordingly, in order to cope with the sharp growth of cargo traffic demand in the future, an urgent improvement of the cargo terminal facility at the airport is desired.

Table 2.5.5 Air Cargo Exported from Juan Santamaria Airport (Unit: Ton)

Year	North America	Central America	South America	Caribbean	Europe	Total
1985	11,531	1,891	162	1,209	802	15,595
1986	15,045	1,516	245	1,539	1,281	19,626
1987	17,600	1,554	152	1,767	2,004	23,077
1988	21,325	1,376	103	2,132	2,559	27,495
1989	29,112	1,507	92	1,604	2,910	35,225
1990	36,194	1,843	131	1,282	2,333	41,783
Annual Growth Rate	25.7%	-0.5%	-4.2%	1.2%	23.8%	21.8%

Table 2.5.6 Air Cargo Imported to Juan Santamaria Airport
(Unit: Ton)

Year	North America	Central America	South America	Caribbean	Europe	Total
1985	8,025	1,988	448	295	794	11,550
1986	8,886	2,111	368	369	785	12,499
1987	10,185	2,286	264	546	603	13,884
1988	13,916	2,065	171	638	541	17,331
1989	18,994	3,920	185	800	807	24,656
1990	21,072	2,121	368	855	704	25,120
Annual Growth Rate	21.3%	1.3%	-3.9%	23.7%	-2.4%	16.8%

Traffic characteristics are analyzed as follows:

- The total volume of cargo handled in 1990 reached to 66,900 tons consisting of 25,100 tons of import and 41,800 tons of export cargo. The shares were 37.5% and 62.5%.
- The average growth rates of export, import and total cargo volume from 1985 to 1990 were 21.8%, 16.8% and 19.7%, respectively.
- The volume handled by LACSA was 33.3% and 30.6% of the imported and exported cargo in 1990, respectively.
- The major area to/from export and import is North America with 86% of the total volume in 1990.
- The share by origin and destination area in 1990 and growth rates during the period from 1985 to 1990 are as follows:

Table 2.5.7 Share and Growth Rate of International Cargo by Areas of Origin and Destination

Zone	Share as of 1990 (%)		Annual Growth Rate (%) (1985 - 1990)		
	Exported	Imported	Export	Import	Total
- North America	86.6	83.9	25.7	21.3	23.9
- Central America	4.4	8.4	-0.5	1.3	0.4
- South America	0.3	1.5	-4.2	-3.9	-3.9
- Caribbean	3.0	3.4	1.2	23.7	7.3
- Europe	5.6	2.8	23.8	-2.4	13.7
- Total	100.0	100.0	21.8	16.8	19.7

2.5.4 Domestic Passengers Traffic

The total volume of domestic passengers carried by the major domestic airlines of SANSa in 1989 was 89,000. Main domestic flights are operating on eight routes connecting Juan Santamaria with Quepos, Nosara, Samara, Tamarindo, Barra del Colorado, Coto 47, Golfito and Palmar Sur. Liberia will be connected with Juan Santamaria after the completion of the ongoing airport development. The other 26 routes are operating by charter flights.

More than 70% of total domestic passengers used the routes to Quepos, Golfito and Coto 47. The routes to Golfito and Coto 47 are mainly used by business passengers, while other routes are used by tourists.

The total volume of domestic passengers at Juan Santamaria Airport in 1990 was 64,801, and the annual growth rate from 1981 to 1990 was -6.5%. From the peak of 330,000 passengers in 1975, the number of domestic air passengers continued to decline. After reaching the bottom with 27,172 passengers in 1985, the volume of domestic passengers started to increase. The decline of domestic air passengers in the early 1980s was caused by the improvement and development of the road network and the increase in vehicle ownership. Some recovery of the domestic air passengers in recent years is likely due to the recovery of the economy.

Historical records of domestic passengers at Juan Santamaria Airport and at Liberia Airport before the interruption of airport operation in 1990 are shown in Table 2.5.8.

Table 2.5.8 Domestic Passengers at Juan Santamaria and Liberia Airports

Airport	1985	1986	1987	1988	1989	1990
- Juan Santamaria	27,172	29,712	36,558	54,620	67,070	64,801
- Liberia	836	392	577	1,004	2,296	-

Note: Not including charter flights

2.5.5 Aircraft Movements

1) Juan Santamaria International Airport

The number of aircraft movements at Juan Santamaria Airport in the past is shown in Tables 2.5.9.

Table 2.5.9 Aircraft Movements at Juan Santamaria Airport

Year	Int'l Scheduled	Int'l Freighters	Dom. Scheduled	General Aviation(*)	Total
1985	9,157	n.a.	1,600	14,233	24,990
1986	10,777	n.a.	1,604	13,544	25,925
1987	11,795	n.a.	2,006	12,937	26,738
1988	11,990	1,442	2,872	13,279	29,583
1989	11,836	1,917	3,076	13,641	30,470
1990	14,532	2,198	3,190	15,649	35,569
Annual Growth Rate	9.7%	23.5% (1988 - 90)	14.8%	1.9%	7.3%

Note : (*) including charter flights

The growth of aircraft movements at Juan Santamaria Airport is high for international passenger and cargo transport in particular. The high growth rate of domestic scheduled flights was the result of increases in the share of scheduled flights for passenger transport. Therefore, the number of charter flights for passenger transport was constant over the same period.

The share of major types of services was as follows:

Table 2.5.10 Share of Aircraft Movements by Category at Juan Santamaria Airport in 1990

Category	Share
- International Scheduled Flights (*)	40.9%
- International Freighters	6.1%
- Domestic Scheduled Flights	9.0%
- General Aviation	44.0%
- Total	100.0%

Note : (*) including charter flights

2) Liberia International Airport

Almost all aircraft operation in Liberia International Airport was general aviation.

The past trend of aircraft movements at Liberia International Airport are shown below:

Table 2.5.11 Aircraft Movements at Liberia Airport

Year	1982	1983	1984	1985	1986	1987	1988	1989
Aircraft Movements	5,351	6,140	4,762	3,337	3,031	2,708	3,324	2,450

The share of aircraft movements by type of service in 1989 was as follows:

Table 2.5.12 Share of Aircraft Movements by Type of Service at Liberia Airport

Category	Share
- Charter	14.6%
- Private	0.93%
- Flight Club	14.6%
- School	2.6%
- Government	3.6%
- Registered Foreigners	5.7%
- Agriculture	57.8%
- Total	100%

Note*: Including charter flights

The above composition has not changed since 1982. The major function of the airport is for agricultural fumigation around this area. However this trend is anticipated to drastically change after the completion of the development. Rapid growth of passenger traffic is expected because of the introduction of high capability aircraft (DC-10 class), transfer of tourist passengers from Juan Santamaria Airport and promotion of tourism development in this region.

3) Limon International Airport

Limon International Airport now serves only general aviation.

The past trend of aircraft movements at Limon Airport is as follows:

Table 2.5.13 Aircraft Movements at Limon Airport

Year	1982	1983	1984	1985	1986	1987	1988	1989
Aircraft Movements	6,009	4,402	3,456	2,642	3,118	2,201	1,888	1,326

The number of aircraft movements is decreasing year by year. The share of aircraft movements by type of service in 1989 was as follows:

Table 2.5.14 Share of Aircraft Movements by Type of Service at Limon Airport

Category	Share
- Charter	15.3 %
- Private	7.7 %
- Flight Club	48.0 %
- School	1.2 %
- Government	16.7 %
- Registered Foreigners	10.9 %
- Agriculture	0.2 %
- Total	100.0 %

4) Tobias Bolaños International Airport

The major services in Tobias Bolaños Airport were for general aviation.

The past trend of aircraft movement at Tobias Bolaños Airport is tabulated in Table 2.5.15.

Table 2.5.15 Aircraft Movements at Tobias Bolaños Airport

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990
Aircraft Movements	32,829	25,107	18,650	n.a.	21,944	24,855	24,325	28,401	28,258

Since reaching the recorded bottom of air traffic volume in 1984, it has increased at an average rate of 8.7% per annum up to 1990. The share of aircraft movements by type of service in 1990 was as follows:

Table 2.5.16 Share of Aircraft Movements by Type of Service at Tobias Bolaños Airport in 1990

Category	Share
- Charter	33.5 %
- Private	3.6 %
- Flight Club	29.3 %
- School	25.3 %
- Government	0.7 %
- Registered Foreigners	6.8 %
- Agriculture	0.8 %
- Total	100.0 %

2.5.6 Frequency of Divert

The total number of diverted flights from Juan Santamaria International Airport was 67 in 1989. 60 flights of the total diverted to countries out of Costa Rica. The most frequent airport was Tocumen International Airport at Panama (counted 34 out of 67 divers). The number of flights diverted within Costa Rica was only seven, six to Liberia and one to Limon.

2.5.7 Future Flights Plan

Some airlines such as LACSA, American Airlines, Pan American, LTU and KLM were scheduled to increase the number of flights from Juan Santamaria Airport by the end of 1991. Other airlines such as IBERIA, CONDOL, AVIATECA and AVENSA are also considering increasing the number of flights or developing new routes. The increase in flights scheduled by airlines are summarized in Appendix-2.5.1.

Concerning Liberia Airport, LACSA, AIR CANADA and LTU are considering direct charter flights from their points of origin.

2.6 Other Transport

2.6.1 Railway Transport

The railway system in Costa Rica is composed of two lines, namely the Pacific Railway from San Jose to Puntarenas and the Atlantic Railway from San Jose to Limon. Railway trackages are 116 and 167 km respectively. Railway transportation as a share of the whole is very small (1.0%). In addition, its traffic is decreasing year by year. Railway traffic in 1990 is shown below:

Table 2.6.1 Railway Traffic of Costa Rica in 1990

Lines	No. of Passengers	Cargo (TON)
- Pacific Railway	29,029	29,420
- Atlantic Railway	80,802	51,463
- Total	109,832	80,884

From the peak in 1983, the number of passengers began to decline, and the rate of decline shows an average 13% per annum. The reason for this decrease can be explained as follows:

- In terms of punctuality and speed, the aged railway system of Costa Rica is inferior to the modernized highway network. Favorable progress in the improvement of the highway network resulted in the shift of railway passengers to the highway.
- The investment for the renovation of deteriorated railway facilities has been neglected.

2.6.2 Highway Transport

The growth trend in highway transport between 1986 and 1990 is shown below:

Table 2.6.2 Highway Transport of Costa Rica

Indices	1986	1990	Annual Growth Rate (1986 -1990)
- Extension of Paved Highways (km)	1,927	2,797	9.8%
- Vehicle ownership (1,000)	246	319	6.7%
- Vehicle - km (million vehicle km)	2,405	3,240	7.7%
- Passengers - km (million passengers km)	7,047	9,288	7.1%
- Ton - km (million tons km)	1,678	8,096	48.2%

The continuous decline in railway and domestic air transport is the reflection of the sharp growth in road transportation.

2.6.3 Marine Transport

There are two seaports, namely, called Caldera on the Pacific coast and Limon on the Atlantic coast. The total cargo tonnage of the two ports reached 4,374,000 tons in 1989, of which 80% belonged to the Port of Limon. The tonnage of the Limon Port had a 5.5% yearly growth during the last four years. Maritime cruising passengers who entered this country from the Port of Limon numbered 2,155 persons in 1989. However, the facility at the Limon Port was devastated by the earthquake of April 22, 1991. The recovery of this destroyed facility will require enormous cost and time. Therefore, the above-mentioned increasing trend of cargo handling at Limon Port is likely to change from now on.

2.7 **Engineering and Construction**

2.7.1 Regulations and Rules

The regulations and rules for the planning, design and construction for buildings, infrastructure such as roads, bridges and others, and mechanical and electrical works are stipulated in "Reglamento de Construccion, I.N.V.U. and C.F.I.A." According to this regulation, the regulations for mechanical and electrical works are mostly referred to American standards such a ASTM, AWS, and AWWA.

In relation to the engineering of urban development, "Reglamentos de Construccion" by Instituto Nacional de Vivienda y Urbanismo was established and notified as government notification of "La Gaceta 117 dated June 22, 1987". Special consideration for the earthquake proofing of structures was established in "Codigo Sismico de Costa Rica" in 1986.

The technical specification for civil works was established as the "Especificaciones Generales para la Construccion de Caminos Carreteras y Puentes" (CR-77) by MOPT in 1978. However, as for the specifications for airport civil facilities, FAA standards are mostly applied.

The general conditions for contract were established in a "Ley de la Administration Financiera de la Republica, Reglamento de la Contratacion Administrativa, Textos Conexos" in 1986.

2.7.2 Engineering and Construction Companies

According to the classification by "Camera Costarricense de la Construccion", the following categorized companies are registered:

Type A:	General Construction Contractors	:	97 companies
Type B:	Consultants	:	6 companies
Type C:	Construction Material Suppliers	:	44 companies

2.7.3 Construction Material and Equipment

The materials for civil and architectural work such as asphalt, concrete, steel bars, aluminum, and interior and exterior finishing for building construction can be easily obtained on the market. As for mechanical works, most of materials such as steel plate and insulation materials for air-conditioning ducts, cast iron pipe, and steel pipe can also be obtained in the market. Most materials for electrical work can be obtained in the market. However, special or big capacity equipment and materials such as transformers greater than 150KVA capacity, high quality multi-core communication cables, or high voltage cables more than 5000V need to be imported from foreign countries.

There are some rental companies for construction equipment such as bulldozers, front wheel loaders, asphalt finishers, scarifiers, scrapers, dump trucks, three axle rollers, vibrators, concrete mixer trucks, etc. The contractor for the overlay work at Juan Santamaria International Airport arranged all construction equipment from rental companies.

2.7.4 Latest Airport Project

The following airport projects are being carrying out or were completed by the Costa Rican contractors:

- Overlay work on runway and apron at Juan Santamaria Airport
- Renewal of airfield lighting system of runway at Juan Santamaria Airport
- Overlay work on runway at Limon Airport
- Runway extension and overlay work at Liberia Airport
- Construction of terminal and control tower building at Liberia Airport (ongoing)

CHAPTER 3 EXISTING AIRPORTS AND SURROUNDINGS

CHAPTER 3 EXISTING AIRPORTS AND SURROUNDINGS

3.1 General

This chapter describes the historical aspects, outline of airport facilities, conditions of off-airport land use and meteorological conditions at Juan Santamaria, Liberia and Limon International Airports.

In addition to the explanation of those three airports, Tobias Bolaños International Airport in San Jose is also outlined because it may affect the future development plan of Juan Santamaria International Airport.

The results of the topographic survey, pavement structure investigation, soil investigation and airspace obstruction survey of Juan Santamaria International Airport are described in this chapter. The results of the pavement structure investigation at Limon International Airport are also reported.

3.2 Juan Santamaria International Airport

3.2.1 General

Juan Santamaria International Airport, located about 17 km to the northwest of San Jose, is the sole airport which accommodates international scheduled flights among the four Costa Rican international airports. The role of Juan Santamaria International Airport is very crucial not only for domestic and international air communications but also for the enhancement of trade and tourism which are emphasized in the national development plan.

In the last five years, this airport recorded a rapid increase in air traffic volume, viz. annual growth rate of 9% for passenger traffic and 20% for cargo movement. However, many airport facilities do not have adequate capacity in size and function to handle present air traffic demands because no major developments have been carried out due to the financial constraint of the Government. The layout plan of the existing airport is shown in Figure 3.2.1.

3.2.2 Airport History

Juan Santamaria International Airport was inaugurated in July 1955, with the operation of DC-6 and Convair 340 aircraft. In 1975, a 3,000m runway was completed together with the extension of the apron and a new parallel taxiway. Major navigational facilities such as ILS, VOR, radar, aeronautical telecommunication systems and SALS were installed in 1977 to cope with the operation of DC-10 class jet aircraft. In 1982, six boarding bridges were connected to the passenger terminal building along with the expansion of passenger waiting lounges. In 1982, a new fire station was constructed and the runway was overlaid. The latest improvement at Juan Santamaria Airport was overlay work on the runway, taxiway and apron for the rehabilitation of pavement surfaces and was completed in October 1991.

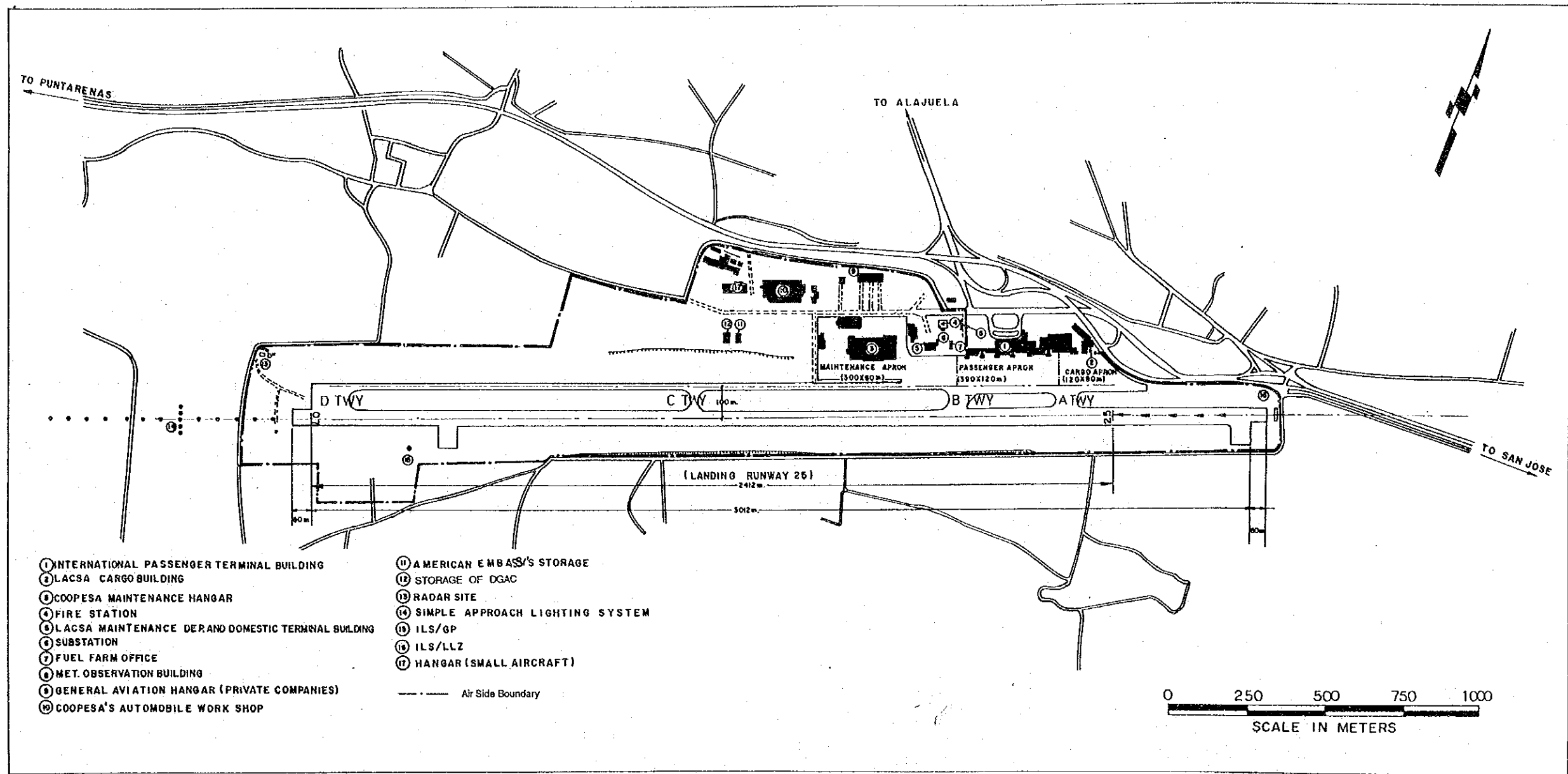


Figure 3.2.1 Layout Plan of Existing Juan Santamaria International Airport

A few studies for the development of the airport have been carried out by foreign consultants, who established the master plan to solve existing constraints of the airport facilities. In 1977 an overall master plan was prepared by MOPT with the assistance of Dixon Engineering. The cargo terminal facilities were studied by a Japanese Airport Consultant in 1988. The revision of the master plan and feasibility study were carried out in 1990 by Bell Engineering. Although minor renovation based on these studies was carried out, full-scale development was not realized because of a financial shortage and legal problems.

The above history is chronologically listed in the table of Appendix-3.2.1.

3.2.3 Airport Inventory

An inventory of Juan Santamaria Airport is given in Table 3.2.1.

Table 3.2.1 Inventory of Juan Santamaria International Airport

(Juan Santamaria-1)

Item	Description
1. Aerodrome Data	
a. City/Aerodrome	: Alajuela/Juan Santamaria
b. International/Domestic	: International and Domestic
c. ICAO Reference Code	: 4D
d. Aerodrome Reference Point	: N 09°59', W 84°12'
e. Distance and Direction from City	: 2.3km south of Alajuela City
f. Elevation	: 920m
g. Reference Temperature	: 29.8°C
h. Magnetic Variation	: 3°00' east (1990)
i. Operational Hours	: 24 hours
j. Seasonal Availability	: All seasons
k. Aerodrome Operator	: DGAC/MOPT
l. Transportation Available	: Taxi, bus and car
2. Aircraft Operational Data	
a. Wind Coverage	
- Cross wind component not exceeding 13Kt	: 81.9%
- Cross wind component not exceeding 20Kt	: 90.1%
b. Operational Category	: Precision Instrument Approach
c. Established Procedures	: ILS/DME and VOR/DME RWY 07 VOR RWY 07, ASR RWY 07
d. Transitional Altitude	: 19,000 feet
e. Pre-flight Altimeter Check Point	: Apron, elevation 920m

Table 3.2.1 (continued)

(Juan Santamaria-2)

Item	Description
3.	Runway
a.	Designation : 07/25
b.	True Bearing : 070/250
c.	Dimension : 3,012m x 45m
d.	Shoulders : 7.5m on each side
e.	Longitudinal Slope : 1.1%
f.	Surface : Asphalt concrete
g.	Strength : Design aircraft: B727
4.	Apron
4.1	International Apron
a.	Aircraft Stands : A320 x 7 (6 with boarding bridge)
b.	Parking Configuration : Nose-in push-out
c.	Area : 350m x 125m
d.	Surface : Asphalt concrete
e.	Strength : Design aircraft B727
4.2	Domestic Apron
a.	Aircraft Stand : C-212 x 2
b.	Parking Configuration : Self-maneuvering
c.	Area : 70m x 125m
d.	Surface : Asphalt concrete
e.	Strength : Design aircraft: B727
4.3	Cargo Apron
a.	Aircraft Stand : A320 x 2
b.	Parking Configuration : Self-maneuvering
c.	Area : 160m x 125m
d.	Surface : Asphalt concrete
e.	Strength : Design aircraft: B727

Table 3.2.1 (continued)

(Juan Santamaria-3)

Item	Description
4.4 Maintenance Apron (COOPESA Apron)	
a. Aircraft Stand	: A320 x 6
b. Parking Configuration	: Nose-in push-out
c. Area	: 230m x 195m
d. Surface	: Asphalt
e. Strength	: Design Aircraft: B727
5. Taxiway	
5.1 A-Taxiway	
a. Configuration	: Exit taxiway
b. Dimension	: 45m x 52m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: B727
5.2 B-Taxiway	
a. Configuration	: Exit taxiway
b. Dimension	: 65m x 52m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: B727
5.3 C-Taxiway	
a. Configuration	: Exit taxiway
b. Dimension	: 19m x 52m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: B727
5.4 D-Taxiway	
a. Configuration	: Parallel taxiway
b. Dimension	: 18m x 1,850m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: B727

Table 3.2.1 (continued)

(Juan Santamaria-4)

Item	Description
5.5 E-Taxiway a. Configuration b. Dimension c. Surface d. Strength	: Connection taxiway between parallel taxiway and small aircraft hangars : 12m x 230m : Asphalt concrete : Design aircraft: General aviation
5.6 F-Taxiway a. Configuration b. Dimension c. Surface d. Strength	: Connecting taxiway to small aircraft hangars : 12m x 500m : Asphalt concrete : Design aircraft: General aviation
6. International Passenger Terminal Building The size of the building is 46m x 280m at ground level and 24m in height at the part of Control Tower (6 stories). The total floor area is 15,730m ² of which 9,060m ² is related to passenger terminal functions. The structure is of reinforced concrete and of steel roof trusses at some parts.	
6.1 Basement a. Function b. Dimension c. Total floor area	: Arrival and baggage handling area, airline offices, VIP room, etc. : 46m x 280m : 6,560m ²
6.2 First Floor a. Function b. Dimension c. Total floor area	: Check-in lobby, departure lounge, etc. : 46m x 280m : 6,360m ²
6.3 Second Floor a. Function b. Dimension c. Total floor area	: Restaurant, airline offices, etc. : 32m x 70m : 1,810m ²

Table 3.2.1 (continued)

(Juan Santamaria-5)

Item	Description
6.4 Third Floor a. Function b. Dimension c. Total floor area	: Administration office of DGAC : 18m x 39m : 740m ²
6.5 Fourth Floor a. Function b. Dimension c. Total floor area	: Operations office of DGAC : 6m x 30m, 6m x 8m : 230m ²
6.6 Fifth Floor a. Function b. Dimension c. Total floor area	: VFR room (Control Tower) : 5m x 6.5m : 30m ²
7. Cargo Terminal Building 7.1 Customs Building 7.2 Other Facilities	: Handling storage areas and customs offices Total floor area: 3,470m ² : Storage and offices of airlines and agents, truck yard, etc. Cargo
8. Domestic Passenger Terminal Building a. Total Floor Area	: 324m ² (18m x 18m)
9. Carpark a. Area b. Capacity	: 8,000m ² : 324 cars (public) : 31 cars (taxi)
10. Access Road a. Lanes b. Width c. Surface	: Two lanes in each direction : 7.5m in one direction : Asphalt concrete

Table 3.2.1 (continued)

(Juan Santamaria-6)

Item	Description
11. Air Navigation Systems	
a. Radio Navigation System	: ASR/SSR, VOR/DME, NDB, ILS/LLZ, GP, MM
b. Telecommunication System	: Air to Ground VHF Communications
	: Air to Ground HF Communications
	: AFTN Message Exchange and Teletype Writers
c. Aeronautical Ground Lights	: Approach Lights(RWY 07)
	: VASIS (RWY 07/25)
	: Runway Threshold/End Lights
	: Runway Edge Lights
	: Taxiway Edge Lights
	: Apron Floodlights
	: Aerodrome Beacon
	: Obstruction Lights
d. Meteorological System	: Observation Sensors
	: Weather Facsimile
	: Receiver of NOAA
	: Ground/Ground HF
	: Radiosonde
e. Emergency Power Supply System	: Emergency Generators (375KVA)
12. Airport Utilities	
a. Power Supply System	: 500KVA capacity
b. Water Supply System	: 170 ton/day supplied by 15cm main pipe from city
c. Sewage Disposal System	: Septic tank
d. Telephone System	: 400 lines without exchange
e. Solid Waste Treatment	: Incinerator

Table 3.2.1 (continued)

(Juan Santamaria-7)

Item	Description
13. Rescue and Fire Fighting Facilities <ul style="list-style-type: none"> a. Fire Vehicles b. Fire Station c. Level of Protection d. Trained Personnel 	<ul style="list-style-type: none"> : 1 medium tender vehicle : 2 rapid intervention vehicle : Water tank capacity: 4,800 gallons : Type of agents: Flourprotein foam and aqueous film forming : Amount of agents: 640 gallons : 600m² (Garage for 3 vehicles) : Category - 8 : 12 persons
14. Other Facilities <ul style="list-style-type: none"> a. Airport Maintenance Equipment b. Maintenance Building c. Aviation Fuel Supply d. COOPESA Hangar 	<ul style="list-style-type: none"> : Mower/sweeper/tractor etc. : Wooden building : Fuel supplied by tank truck from the depot at La Garita Storage Yard : Fuel depot capacity: 155000 gallons of Jet-A1 35,800 gallons of Avigas : Hydrant system (24 pits on the apron) for Jet-A1 : Central hangar for airplanes 3,960m² : East wing for store and shops 3,500m² : West wing for engine reconditioning shop 3,500m²

3.2.4 Off-Airport Land Use

A land use map around Juan Santamaria International Airport is shown in Figure 3.2.2. There is a regulation for land use around the airport, and it is included in Figure 3.2.3.

Existing land use around Juan Santamaria Airport is designated by the following three zones:

- On the north side of the airport, is the residential area of Alajuela City, which is the capital of Alajuela Province with a population of 35,000.
- On the south and west sides, is an agricultural zone. Although the small residential areas of Bajo Sordo and Coco Village are in this zone, most of this area is used for agricultural purposes up to the bank of the Segundo River. The agricultural area is used for the production of coffee, vegetables, maize and sugarcane, and for grazing lands. The western part of this area is a chrysanthemum plantation for export.
- On the east side of the airport, is an agricultural park adjacent to a residential area of the town of Segundo River. On the south side of the town of Grande River is an industrial area called the "Free Zone", which is devoted to producing export items such as T-shirts, sports shoes and electronic parts for tax free exporting.

Principal Route No.1 (Pan-American Highway) passes along the north side of the airport.

Land use in the areas surrounding the airport is controlled by INVU (Instituto Nacional de Vivienda y Urbanismo), DGAC, Ministry of Health and Welfare and the Municipality for the maintenance of airport operations and to protect the residents of this area from noise pollution.

Juan Santamaria Airport is built on the highest part of a terrace in the form of a cape in the Central Valley between Ciruelas River and Segundo River, so that agricultural land near the airport slopes down towards both rivers.

3.2.5 Meteorological Conditions

(1) Wind Speed and Direction

In the Costa Rica Central Valley, prevailing winds from December to April are northwest. Based on the analysis of meteorological data of wind velocity and direction at this airport from 1987 to 1989, the wind coverage is estimated to be 81.9% and 90.1% for cross-wind component less than 13Kt and 20Kt respectively as shown in Appendix-3.2.3. The characteristics of wind distribution are summarized as follows:

- a) The calm condition (wind speed from nil up to 5 kt) accounts for 21.9% of the total observations.
- b) Occurrence of wide speed of more than 10 kt is 55.7% of the total observations.
- c) The northwest wind direction prevails in the dry season. The wind direction during the wet season is variable as compared with the dry season.

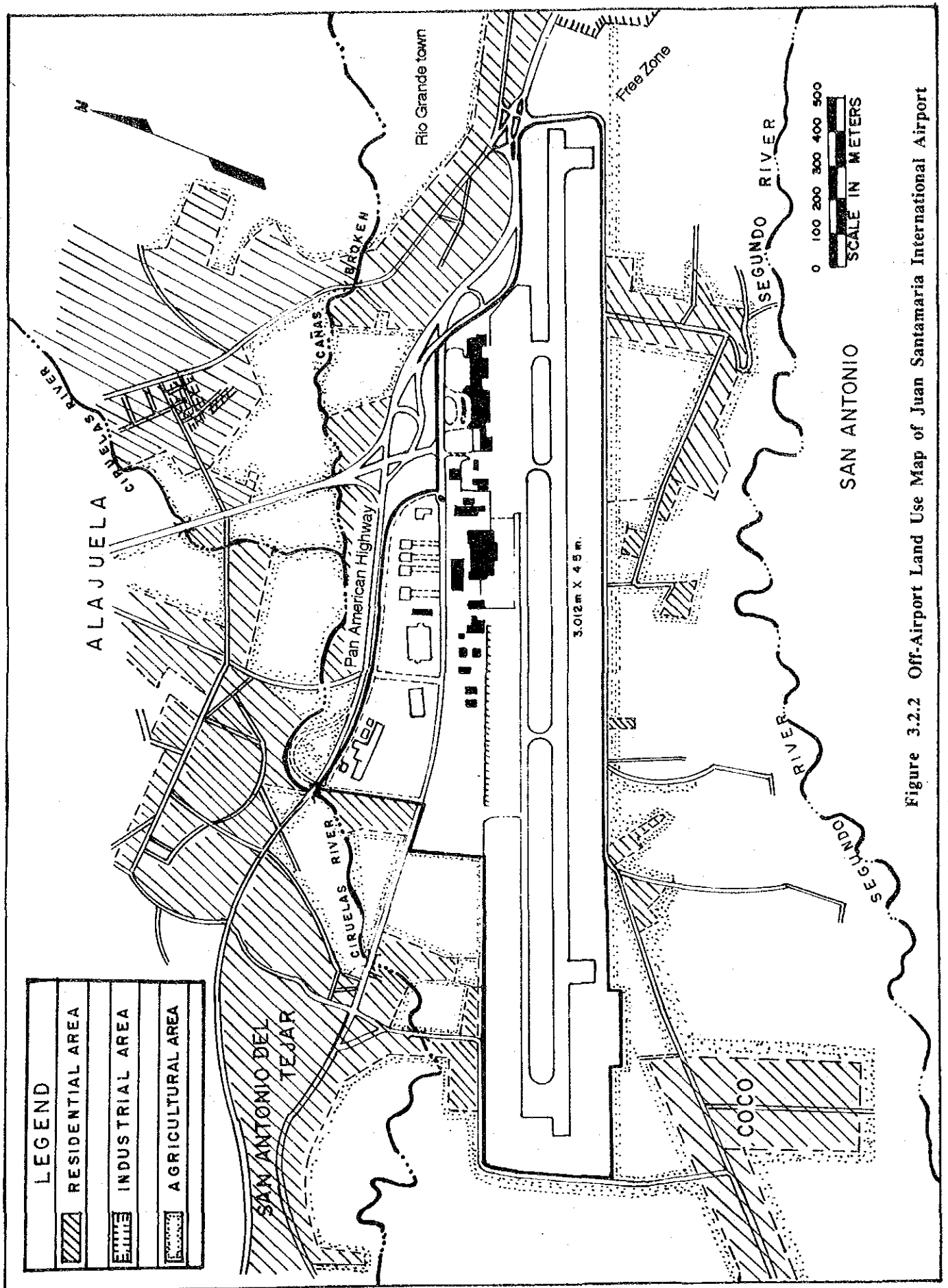


Figure 3.2.2 Off-Airport Land Use Map of Juan Santamaria International Airport

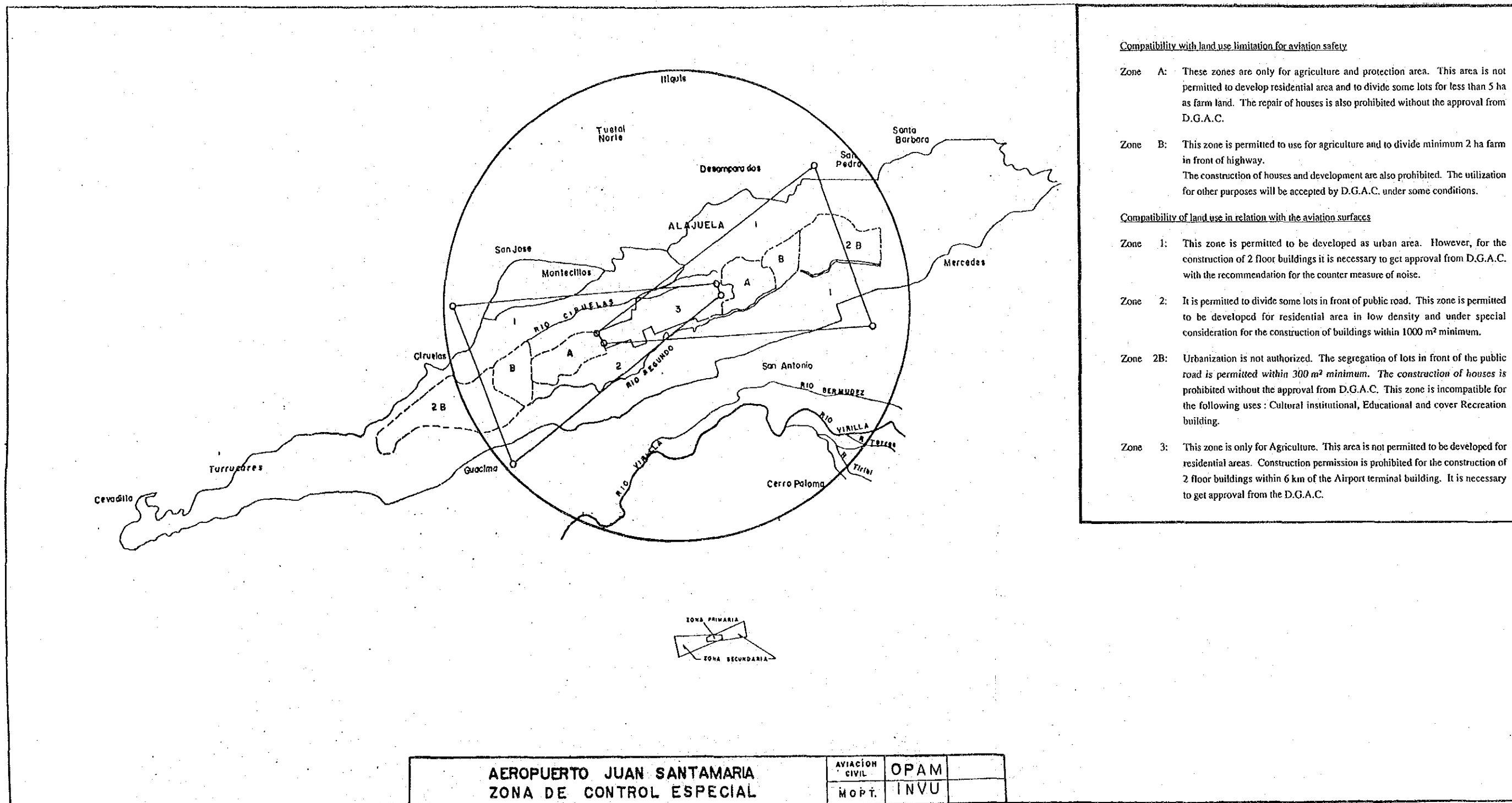


Figure 3.2.3 Regulation of Land Use around Juan Santamaria International Airport

2) Ceiling and Visibility

This airport is located at an elevation of 921m in the highland of the country. The low ceiling height and low visibility due to heavy rain and fog, especially during the rainy season, causes difficulties for aircraft landing at Juan Santamaria Airport. Sixty seven international flights were diverted from Juan Santamaria Airport to other airports in 1989. The distribution of diverted destinations is shown in Appendix-3.2.4. 87% of jet aircraft were diverted to other countries due to poor alternate facilities in Costa Rica.

The weather conditions below the minima of precision approach procedure (visibility : 1.2km, ceiling: 200ft) occurred in 1.4% of the total observations as shown in Appendix-3.2.5.

3) Temperature and Rainfall

The people of San Jose enjoy a mild temperature range (average maximum 28°C, average minimum 17°C). The rainy season is characterized by sunshine in the morning and heavy rains in the afternoon.

3.2.6 Topographic and Obstruction Surveys

1) Topographic Survey

The topographic survey was carried out for the centerline of the runway and cross-section lines as shown in Figure 3.2.4.

The runway centerline profile survey was carried out with 39 sections for a total length of 13.6km. Mapping was also done based on the survey results of cross sections, referring to the existing maps of scales 1:10,000 and 1:1000, and made by means of the mosaic Method. The map coverage is 1km wide from the basic line to the north and south of the runway center, and 1km and 2km to the east and west sides from the runway threshold respectively.

The profiles and typical cross sections are shown in Appendix-3.2.6.

2) Obstruction Survey

A survey of obstacles around the airport was carried out. The summary of the results is shown in Figure 3.2.5. A list of obstacles to ICAO recommended obstacle limitation surfaces is shown in Appendix-3.2.7.

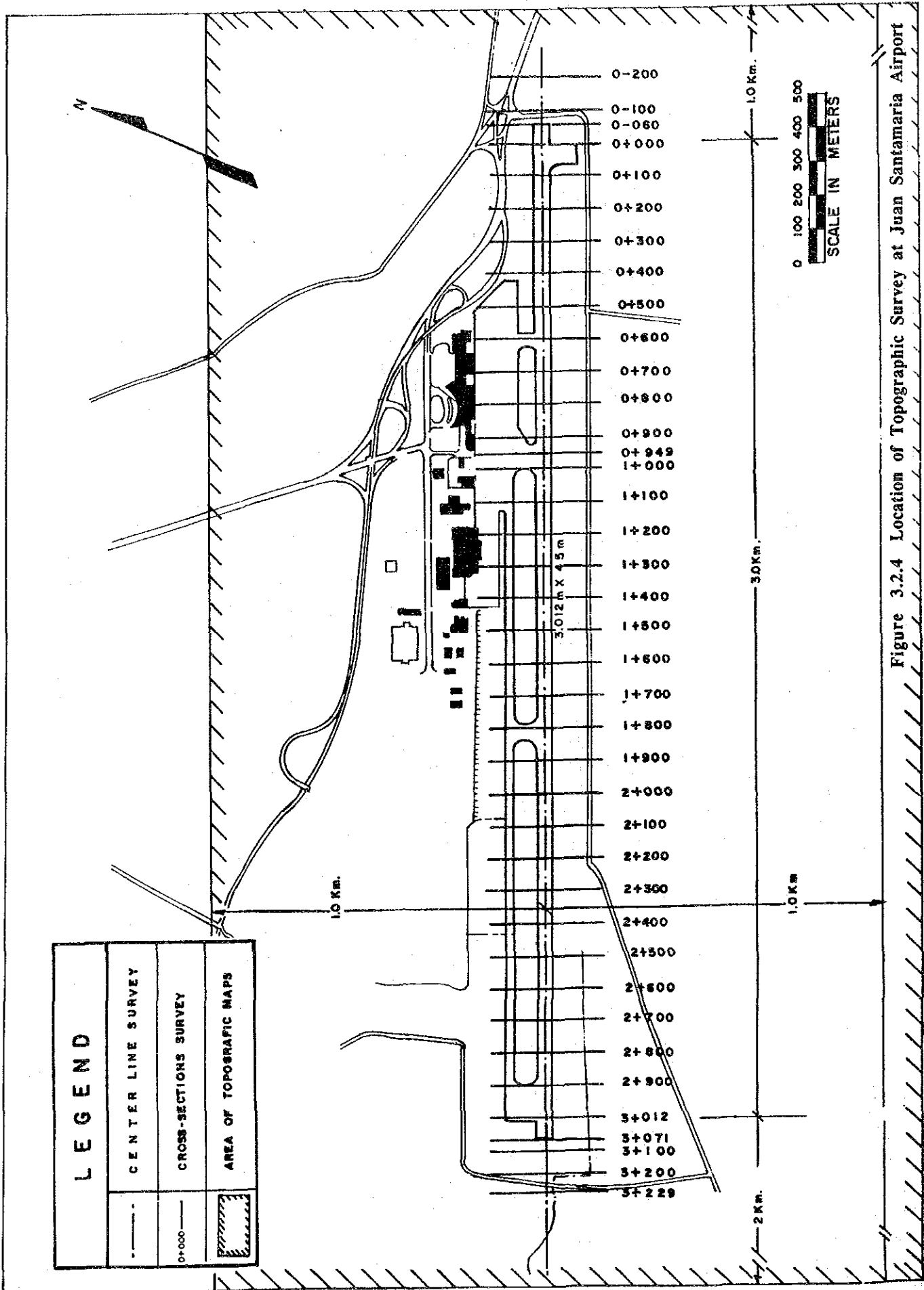


Figure 3.2.4 Location of Topographic Survey at Juan Santamaria Airport

3.2.7 Soil and Pavement Structure Investigations

The soil and pavement structure investigations for Juan Santamaria Airport were carried out on the points as shown in Figure 3.2.6. Test items and quantities were as follows:

Table 3.2.2 Items and Quantity of Soil and Pavement Structure Investigations

Item	Quantity
a) Mechanical Boring and Standard Penetration Test	8 places
b) Core Sampling	12 places
c) Field Density Test	3 tests
d) Field CBR Test	6 tests
e) Soil Compaction Test	3 tests
f) Physical Properties Test	L.S.
g) Mechanical Properties Test	3 tests
h) Marshall Stability Test	12 tests
i) Pavement Visual Investigation	L.S.

Physical properties tests included specific gravity test, natural water content test, particle size analysis, consistency test.

1) Field Test

a) Mechanical Boring and Standard Penetration Test

The results of the mechanical boring and standard penetration test are shown in Appendix-3.2.8.

According to the test results, the following are commented on:

- Geologically speaking, the airport area is mainly located on the down Barva formation, consisting of lavas from the Quaternary period of which stratum is 30m in depth from the ground surface.
- Residual soils appear at the surface as weathered lava, with a maximum thickness of 10m. Because of its stiff composition of soil stratum, the foundation of this area is generally regarded as sound and strong.

b) Core Sampling

Core sampling tests and observation of pavement structure were carried out at the runway, apron and parallel taxiway, so as to analyze the strength of asphalt pavement and visually grasp the pavement condition.

Thickness of asphalt pavement, base course and sub-base course are shown in Appendix-3.2.9. The thickness of asphalt pavement varies in a wide range from 10cm to 60cm due to frequent overlay and extension works.

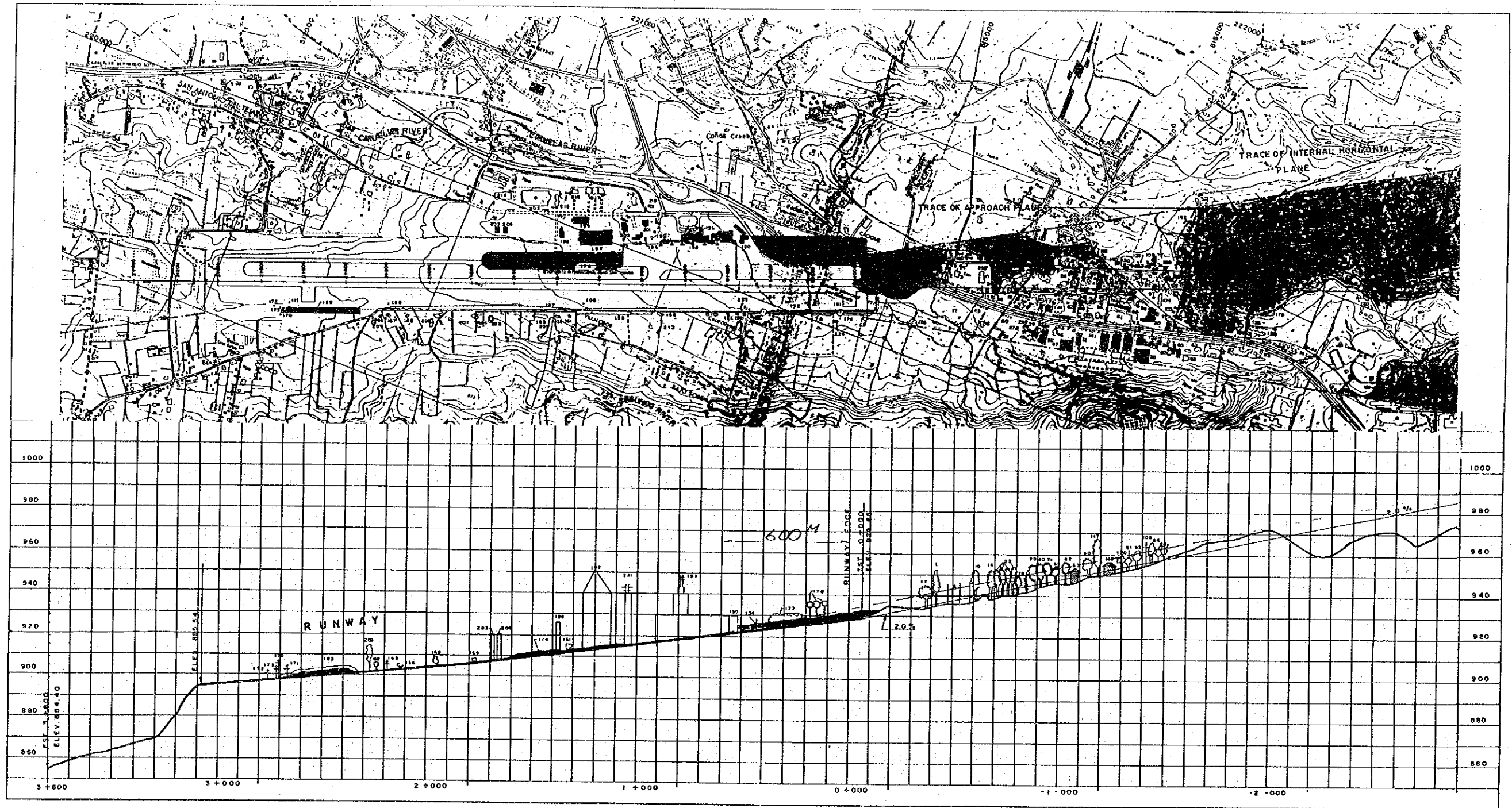
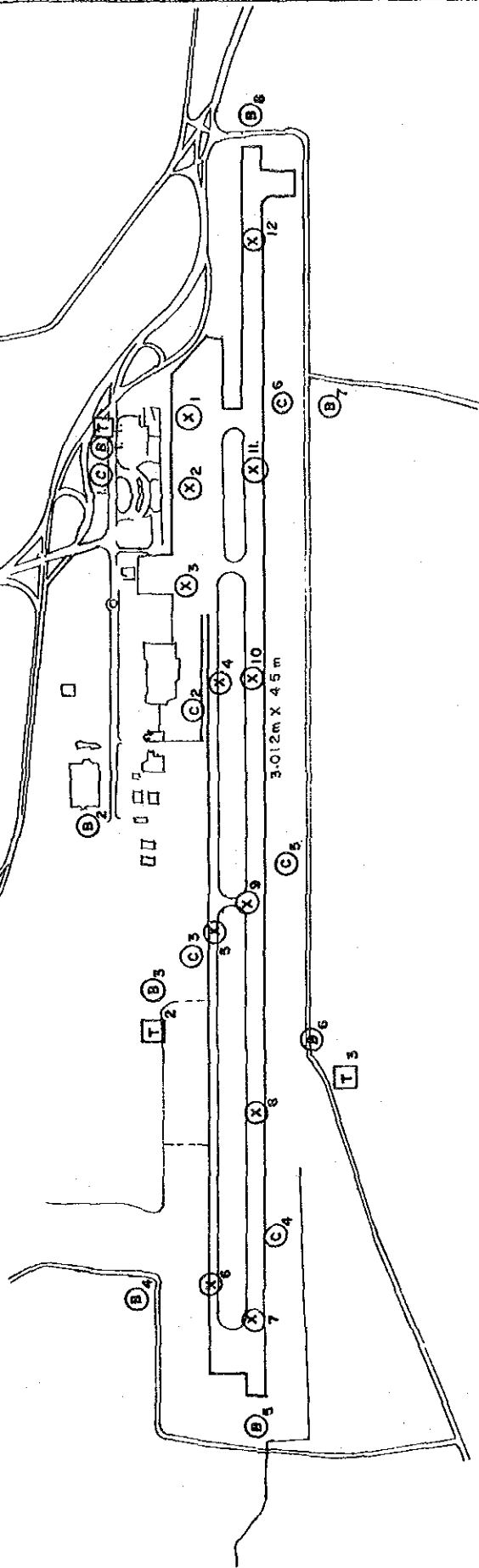


Figure 3.2.5 Obstacles to ICAO Recommended Limitation Surfaces at Juan Santamaria Airport

L E G E N D	
(B)	MECHANICAL BORING AND STANDARD. PENETRATION TEST (8 PLACES)
(T)	TEST PIT (3 PLACES)
(X)	CORE SAMPLING 12 PLACES
(C)	C.B.R. INSITU 6 PLACES



NOTE:
ONE TEST PIT IS SITUATED
IN THE SAN ANTONIO TOWN.



Figure 3.2.6 Location Map of Soil Investigation Performed at Juan Santamaria Airport

c) Field Density Test

Dry density and natural water content at three test pits are tabulated below:

Table 3.2.3 Dry Density and Water Content

Site	Dry Density (kg/m ³)	Water Content (%)	Location
- TP-1	1,045	23.2	Asphalt area
- TP-2	1,028	21.6	South area
- TP-3	1,440	18.0	Quarry site in El Pedregal, San Antonio de Belen

d) Field CBR Test

Results of field CBR test are as follows:

Table 3.2.4 Results of Field CBR Test

Place	1	2	3	4	5	6
CBR (%)	0.7	7.5	4.6	2.2	2.3	6.0

2) Laboratory Test

a) Test Pit and Soil Compaction Test

Some representative samples were taken for the analysis of the superficial layer (less than one meter). Laboratory tests show a representative behavior of the sampled soil. The results of the tests are shown in Table 3.2.5.

Table 3.2.5 Results of Soil Compaction Test

Test Item	Test Pit 1	Test Pit 2	Test Pit 3
- Modified Proctor Test			
Mat. Dry density (kg/m ³)	1,138	1,202	1,124
Opt. Water Content (%)	53	47	64
- Soil Classification			
Liquid Limit	86	97	47
Plastic Limit	56	42	17
Plastic Index	30	55	-
Pass sieve No. 10 (%)	100	10	-
Pass sieve No. 40 (%)	99	97	-
Pass sieve No. 200 (%)	94	91	-
Natural Water Content (%)	56	49	39
Specific Gravity (ton/m ³)	2.64	2.64	2.45
- C.B.R.* (%)	21	26	32

Note *: 95% of Modified Proctor Compaction

b) Physical Properties Test

Laboratory tests for physical properties were performed using the disturbed split spoon samples obtained from boring or excavated materials from test pits. The results of the physical properties test are included in Appendix-3.2.10.

The soils can be classified as MG, brown in color and with 5 to 20% of fine sand. The principal feature of these soils is characterized as silty condition, with a very low percentage of clay.

c) Mechanical Properties Test

- Consolidation Test

From this test an average value of C_c (compression index) of 0.25 is obtained. Some secondary consolidation was observed from the consolidation curves, but this is normal for this type of soil resulting from weathered rock.

- Triaxial Test

From this test a friction value varying from 27° to 33° is obtained, and an adhesion varying from 0.15 to 0.8 kg/cm². The details of the consolidation test and the triaxial test are shown in Appendix-3.2.11.

d) Marshal Stability Test

As can be seen from the results of the Marshall test done at 12 different sites, the results cover a wide range, pointing to the different types of pavements encountered:

Table 3.2.6 Location of Marshall Stability Tests

Area	Location
- Area of apron	No. 1, 2, 3
- Area of old runway pavement	No. 4, 5, 6, 7
- Area of new runway pavement	No. 8, 9, 10, 11, 12

The Marshall values obtained from the newly overlaid pavement are lower than that from the old pavement. This could be explained by the fact that the test specimens of the newly overlaid pavement is made of two layers combined with new and old pavement. The low value of the new pavement is assumed to be the results from a fresh bonded sample. Detailed data are shown in Appendix-3.2.12.

3) Pavement Visual Investigation

The surface condition of existing pavement was surveyed by means of measuring the location, area (width and length) and depth of cracks. The results are illustrated in Appendix 3.2.13.

3.3 Liberia International Airport

3.3.1 General

Liberia (Tomas Guardia) Airport is located about 13km west of Liberia City, to the north of the Pacific shoreline and 10km from the beaches of Tamarindo, Flamingo and Panama in the center of the resort area of Guanacaste Province.

The airport was closed to implement the development work of runway extension and overlay pavement as well as the new construction of the apron, taxiway and terminal areas in February, 1990, and was substantially opened on February, 1992, but development work is still on-going. Socioeconomic activity around this area depends mainly on the tourism industry taking advantage of suitable geographical conditions for tourist attraction. Since the climatic conditions of the Liberia area are superior to that of San Jose in terms of rainfall intensity and visibility, Liberia International Airport is expected to function as an alternate airport for Juan Santamaria Airport. The layout plan of the existing airport is shown in Figure 3.3.1.

3.3.2 Airport History


Liberia Airport was inaugurated in January, 1975, with a runway 1,216m long and 30m wide, plus a temporary terminal building and a small hangar. Radio navigation aids were not provided at that time.

A master plan and a feasibility study on the development of the airport for the target year of 1996 was prepared by R. Dixon Speas Associates in May, 1977. The design aircraft was the DC-10.

The development work of the Phase I project based on the master plan is now ongoing. This development includes the extension of the runway up to 2,740m, the construction of a right angle exit taxiway, turnaround taxiways, a new passenger terminal building and new control tower, and the installation of new air navigation facilities.

3.3.3 Airport Inventory

An inventory of Liberia International Airport (in August, 1992) is shown in Table 3.3.1.

LEGEND	
①	PASSENGER TERMINAL BUILDING
②	CONTROL TOWER
③	FIRE STATION
④	POWER HOUSE
⑤	MECHANICAL ROOM
⑥	WATER TANK
	PREVIOUS AIRPORT FACILITIES

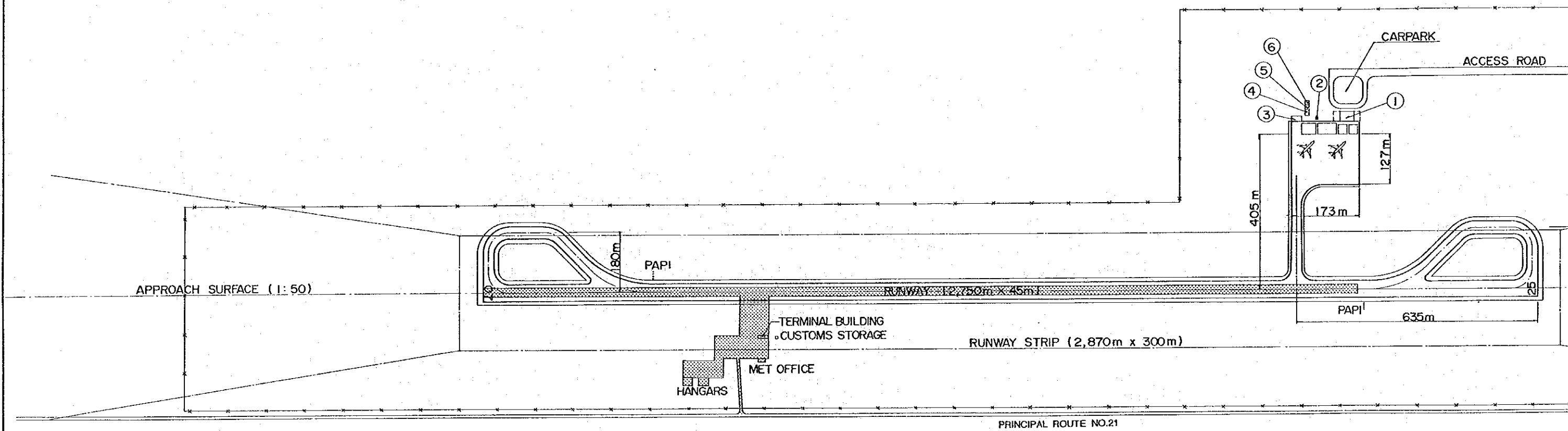


Figure 3.3

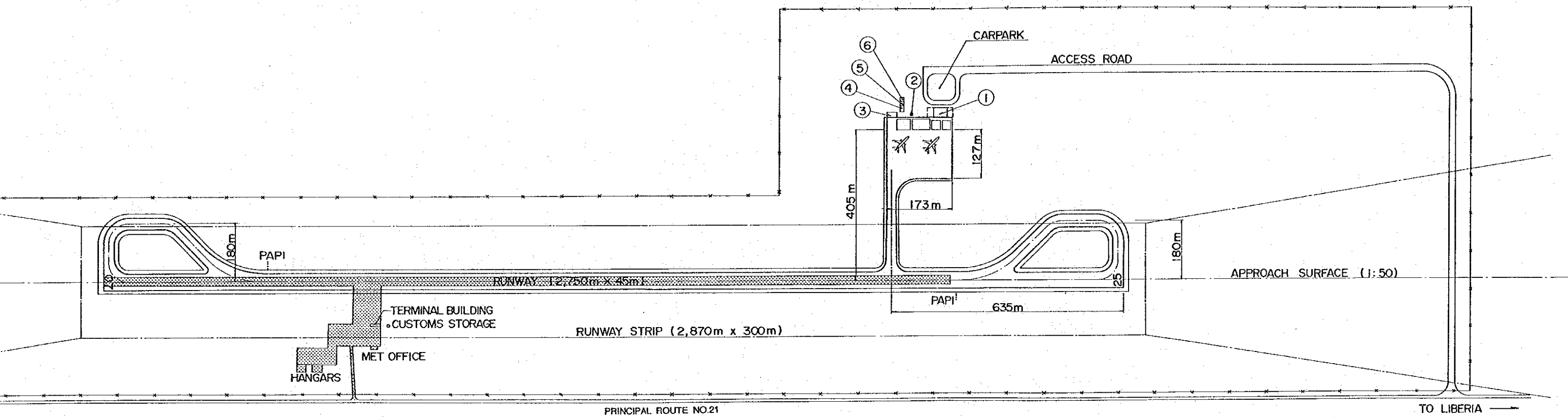


Figure 3.3.1 Layout Plan of Liberia International Airport

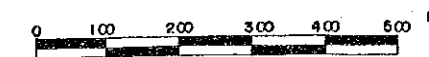


Table 3.3.1 Inventory of Liberia International Airport

(Liberia - 1)

Item	Description
<p>1. Aerodrome Data</p> <p>a. City/Aerodrome</p> <p>b. International/Domestic</p> <p>c. ICAO Reference Code</p> <p>d. Aerodrome Reference Point</p> <p>e. Distance and Direction from City</p> <p>f. Elevation</p> <p>g. Reference Temperature</p> <p>h. Magnetic Variation</p> <p>i. Operational Hours</p> <p>j. Seasonal Availability</p> <p>k. Aerodrome Operator</p> <p>l. Transportation Available</p>	<p>Liberia/Tomas Guardia International</p> <p>International and Domestic</p> <p>4D</p> <p>N 10°36', W 85°33'</p> <p>13km west of Liberia City</p> <p>80m</p> <p>36°C</p> <p>3°30' east (1990)</p> <p>Opened for General Aviation in May 1992.</p> <p>All seasons</p> <p>DGAC/MOPT</p>
<p>2. Aircraft Operational Data</p> <p>a. Wind Coverage</p> <p>- Cross-wind component not exceeding 13Kt</p> <p>- Cross-wind component not exceeding 20Kt</p> <p>b. Operational Category</p> <p>c. Established Procedures</p> <p>d. Transition Altitude</p> <p>e. Preflight Altimeter Check Point</p>	<p>87.4%</p> <p>95.8%</p> <p>Non-precision Instrument Approach</p> <p>None</p> <p>19,000 feet</p> <p>Apron, elevation 80m</p>

Table 3.3.1 (continued)

(Liberia - 2)

Item	Description
3. Runway	
a. Designation	: 07/25
b. True Bearing	: 070/250
c. Dimension	: 2,750m x 45m
d. Shoulders	: 7.5m on each side
e. Longitudinal Slope	: 0.2%
f. Surface	: Asphalt concrete
g. Strength	: Design aircraft: DC-10
4. Taxiway	
a. Configuration	: One right angle exit and turnarounds at both ends of runway
b. Dimension	: 500m x 23m x 2 + 278m x 23m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: DC-10
5. Apron	
a. Aircraft Stands	: DC-10 x 2
b. Parking Configuration	: Self-maneuvering
c. Area	: 173m x 127m
d. Surface	: Asphalt concrete
e. Strength	: Design aircraft : DC-10
6. Passenger Terminal Building	
a. Total Floor Area	: 1,100 m ²
b. Structure	: Reinforced concrete

Table 3.3.1 (continued)

(Liberia - 3)

Item	Description
7. Cargo Terminal Building	: None
8. Operations and Administration Office	: Included in terminal building
9. Control Tower	: Independent Tower
10. Carpark	
a. Area	: 5,000m ² under construction
b. Capacity	: 100 cars
11. Access Road	
a. Lanes	: One lane in each direction
b. Width	: 18 m
c. Surface	: Asphalt concrete
12. Air Navigation Systems	
a. Radio Navigation System	: VOR/DME
b. Telecommunication System	: Air to ground radio communication
c. Aeronautical Ground Lights	: PAPI (RWY 07/25) under calculation
	: Runway Threshold/End Lights>
	: Runway Edge Lights under installation
	: Taxiway Edge Lights under installation
	: Apron Floodlights under installation
	: Aerodrome Beacon under installation
d. Meteorological System	: Observation Sensors
	: Weather Teletypewriter
	: Ground/Ground HF
e. Emergency Power Supply System	: Emergency Generator (50KVA)
13. Airport Utilities	
a. Power Supply System	: 25KVA capacity
b. Water Supply System	: Supply from well
c. Sewage Disposal System	: Septic tank
d. Telephone System	: Direct lines

Table 3.3.1 (continued)

(Liberia - 4)

Item	Description
14. Rescue and Fire Fighting Facilities	: None
15. Other Facilities	
a. Airport Maintenance Equipment	: None
b. Aviation Fuel Supply	: None
c. Airport Vehicles	: None
d. Airport Housing	: None
e. Hangar	: 2 (for small aircraft)

3.3.4 Off-Airport Land Use

Liberia Airport is situated on the plateau of Nicoya Peninsula, 13km west from Liberia City, along the north side of Principal Route No. 21 which branches off from the Pan-American Highway. Land use around the Liberia International Airport is mainly agriculture, forest and uncultivated plain, with farmers' houses scattered along the Principal Route. Uncultivated plains and pastures in this zone are utilized for agricultural and livestock grazing area. The area is famous for cattle breeding in Costa Rica, and the extensive plains are used as pasturage. Agricultural land produces vegetables and crops such as maize and sugar cane.

In the airport property area, tuff rock is disclosed on the ground surface. Since the airport area is not suitable for cultivation because of its shallow soil layer, the airport can be said to be appropriately located taking the advantage of stiff and strong foundations for the construction of facilities.

At the northeast side of the airport the new terminal area is under development, and the construction of an access road to the new terminal is planned for the east side of the airport to be connected with Principal Route No. 21.

3.3.5 Meteorological Conditions

1) Wind Speed and Direction

The wind coverage is estimated to be 87.4% and 95.8% for the cross-wind component less than 13kt and 20kt respectively from the data between 1987 to 1989 as shown in Appendix-3.2.3. The characteristics of wind direction are summarized as follows:

- a) The calm condition accounts for 37.0% of the total observations.
- b) Occurrence of the wind speed of more than 10kt is 45.6% of the total observations.
- c) The east wind direction prevails throughout the year.

2) Ceiling and Visibility

The weather conditions below the minimums of precision approach procedure (visibility: 0.8km, ceiling: 1.2km) occurred in only 0.3% of the total observations as shown in Appendix 3.2.4.

3) Temperature and Rainfall

The temperature of the Liberia area varies from 17 to 28°C. Annual precipitation varies from 1,400mm to 2,500mm. The amount of rainfall in September and October exceeds other months.

3.4 **Limon International Airport**

3.4.1 General

Limon Airport is situated 2km southeast of Limon City on the south coast of the Caribbean Sea.

The socioeconomic activity in the Limon area is stagnated. The Government made a high priority program to encourage employment opportunities and the development of socioeconomic activities in its Limon area. Limon and Moin Ports are very important sea ports to import and export trading goods from/to the Caribbean Sea side. The main container base in Costa Rica is established in the Limon Port. The main products of this area are bananas, foliage plants, agro-industrial products and fresh fish. Eighty percent of the total export volume of bananas is shipped out from the Limon Port.

On April 22, 1991, a big earthquake hit Limon City, and major sea port facilities were seriously damaged. Some of the wharves in Limon Port became unserviceable due to a 1.5m lift of the platforms. The earthquake also impacted the facilities of Limon Airport. The runway pavement was so damaged that its 800m long section was abandoned for operation.

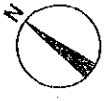
At present Limon Airport does not serve for scheduled flights. Before the completion of the highway connecting San Jose and Limon City in 1987, domestic scheduled flights used Juan Santamaria Airport. Presently, only general aviation utilizes this airport. The layout plan of the existing airport is shown in Figure 3.4.1.

3.4.2 Airport History

Limon International Airport was completed with a 1,200m long runway in 1954. The runway was extended to 1,400m and 1,800m in 1955 and 1975, respectively. In the first stage, the runway pavement structure was sand and coral for the operation of DC - 3 and C - 46 aircraft. The LACSA used the airport as an alternate to Juan Santamaria. The runway was covered with asphalt pavement in 1977. Later in 1979, the SANSa started domestic flight service for passengers and cargo with Aviocar C - 212's and DC - 3's in 1979. In the peak seasons, three regular domestic flights were operated in a day. Scheduled flight service continued up to the completion of the highway from San Jose to Limon in 1987.

A master plan and a feasibility study on the development of Limon International Airport for the target year of 1995 were prepared by PRC Speas Associates in 1981. However, the implementation of this development plan has not been realized.

Repair work of the runway pavement damaged by the earthquake was started in September, 1991 as emergency work. This work was completed at the end of November, 1991.



LEDGEND	
①	PASSENGER TERMINAL BUILDING
②	CUSTOMS STORAGE
③	HANGAR
④	HANGAR
⑤	GENERATOR ROOM
⑥	WATER TANK
⑦	FUEL TANK

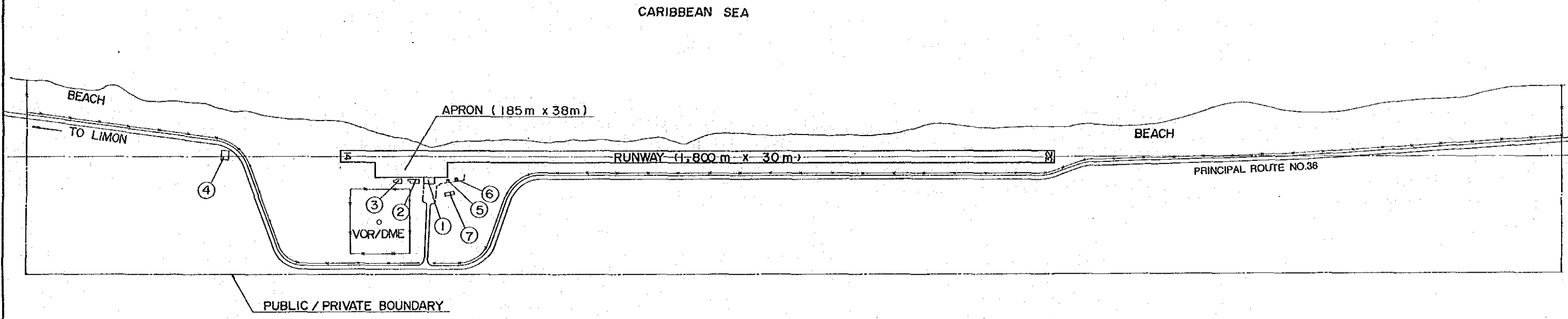
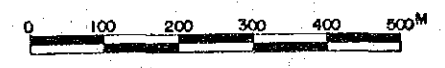


Figure 3.4.1 Layout Plan of Existing Limon International Airport



3.4.3 Airport Inventory

An inventory of Limon International Airport is shown in Table 3.4.1

Table 3.4.1 Inventory of Limon International Airport

(Limon - 1)

Item	Description
1. Aerodrome Data	
a. City/Aerodrome	: Limon/Limon
b. International/Domestic	: International and Domestic
c. ICAO Reference Code	: 4C
d. Aerodrome Reference Point	: N 09°57'30", W 83°01'30"
e. Distance and Direction from City	: 2km southeast of Limon City
f. Elevation	: 2.0m
g. Reference Temperature	: 30.9°C
h. Magnetic Variation	: 2°30' east (1990)
i. Operational Hours	: Day time (Night time by prior request)
j. Seasonal Availability	: All seasons
k. Aerodrome Operator	: DGAC/MOPT
l. Transportation Available	:
2. Aircraft Operational Data	
a. Wind Coverage	
- Cross wind component not exceeding 13Kt	: 92.8%
- Cross wind component not exceeding 20Kt	: 99.4%
b. Operational Category	: Non-precision Instrument Approach
c. Established Procedures	: None
d. Transition Altitude	: 19,000 feet
e. Pre-flight Altimeter Check Point	: Apron, elevation 2m

Table 3.4.1 (continued)

(Limon - 2)

	Item	Description
3.	Runway	
	a. Designation	: 14/32
	b. True Bearing	: 144/324
	c. Dimension	: 1,800m x 30m
	d. Shoulders	: 3m on each side
	e. Longitudinal Slope	: 0.2%
	f. Surface	: Asphalt concrete
	g. Strength	: BAC1-11
4.	Taxiway	: None
5.	Apron	
	a. Aircraft Stands	: BAC1-11
	b. Parking Configuration	: Self-maneuvering
	c. Area	: 196m x 35m
	d. Surface	: Asphalt concrete
	e. Strength	: Design aircraft: BAC1-11
6.	Passenger Terminal Building	
	a. Total Floor Area	: 450m ²
	b. Structure	: Concrete block/timber frame
7.	Cargo Terminal Building	: None
8.	Operations and Administration Office	: Including in terminal building
9.	Control Tower	: None
10.	Carpark	
	a. Area	: 150m ²
	b. Capacity	: 10 cars
11.	Access Road (Limon-La Bomba Road)	
	a. Lanes	: One lane in each direction
	b. Width	: 5.0m
	c. Surface	: Asphalt concrete

Table 3.4.1 (continued)

(Limon - 3)

Item	Description
12. Air Navigation Systems	
a. Radio Navigation System	: D - VOR/DME
b. Telecommunication System	: AFIS
c. Aeronautical Ground Lights	: RWYTIL
	: Runway Edge Lights
	: Apron Floodlights
	: Aerodrome Beacon
d. Meteorological System	: Observation Sensors
	: Weather Teletypewriter
	: Ground/Ground HF
e. Emergency Power Supply System	: Emergency Generator (50KVA)
13. Airport Utilities	
a. Power Supply System	: 15KVA capacity
b. Water Supply System	: Supplied by main pipe from city
c. Sewage Disposal System	: Septic tank
d. Telephone System	: Direct lines
14. Rescue and Fire Fighting Facilities	: None (only service from city)
15. Other Facilities	
a. Airport Maintenance Equipment	: None
b. Aviation Fuel Supply System	: Supplied by drums (11KL tank available)
c. Airport Vehicles	: None
d. Airport Housing	: None
e. Hangar	: 2 nos. (for small aircraft)

3.4.4 Off-Airport Land Use

Limon Airport is situated along Principal Route No.36 running parallel to the coast line of the Caribbean Sea. The width of airport property from runway center to the sea side (East-North) is about 50m, while the land side (West-South) is 300m. The length of the airport area is about 3,870m.

The land surrounding Limon Airport is swampy and its effective land use is very limited. Although the Limon area is generally famous for agricultural production such as bananas, sugar cane, maize and rice, those agricultural zones are not found in the vicinity of the airport.

3.4.5 Meteorological Conditions

1) Wind Speed and Direction

The wind coverage is estimated to be 92.8% and 99.4% for the cross-wind component less than 13kt and 20kt respectively from the data from 1987 to 1989 as shown in Appendix - 3.2.3. The characteristics of wind directions are summarized as follows:

- a) The calm condition accounts for 27.0% of the total observations.
- b) The Occurrence of the wind speed more than 10Kt is 20.2% of the total observations.

2) Ceiling and Visibility

The weather conditions below the minimas of VOR approach procedure (visibility: 3.2km, ceiling: 600ft) occurred in only 1.0% of the total observations as shown in Appendix - 3.2.5.

3) Temperature and Rainfall

The average temperature of the hottest month of the Limon area is about 31°C. The annual precipitation amount varies from 3,000mm to 4,500mm.

3.4.6 Pavement Structure Investigation

The pavement structure investigation at Limon Airport was performed on the runway as shown in Figure 3.4.3. It was carried out by means of core sampling for the Marshall stability test and visual observation of pavement structure up to a depth of 2m. The thickness of the asphalt surface course ranges from 10cm to 15cm. The base course material is of gravel sand. The subgrade and original ground is the typical silty sand.

The surface condition of existing pavement was surveyed on the runway and apron by means of measuring the location, length, width and depth of cracks. The observation results are shown in Appendix - 3.2.13.

3.5 **Tobias Bolaños International Airport**

3.5.1 General

Tobias Bolaños Airport is located about 8km northwest of San Jose and 11km southeast of Juan Santamaria Airport.

The airport serves as the base for general aviation, such as flying clubs, training, charter and tourist flights around the San Jose area. Eighty percent of general aviation aircraft in Costa Rica, about 100 planes, are based at the airport. The layout plan of the existing airport is shown in Figure 3.5.1.

LEGEND

..... Asphalt

..... Base (Gravel and Sand)

..... Sub Soil (Sand)

1:800 x 1:30m

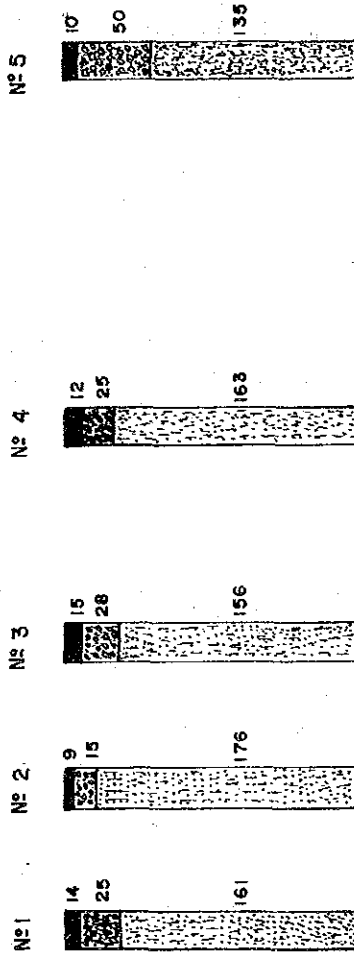
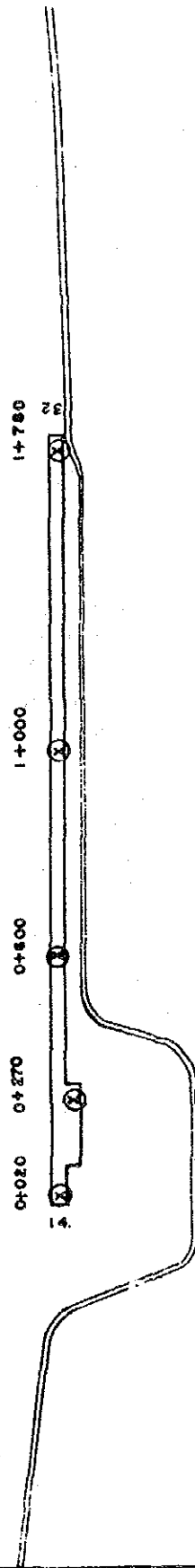


Figure 3.4.3 Results of Pavement Structure Investigation at Limon International Airport

3.5.2 Airport History

The construction of the airport was started in 1968 in order to remove the Sabana Airport located from the center of San Jose City. The airport was completed in 1975 and was inaugurated as an international airport.

Although small renovation works were carried out in 1985, most airport facilities are maintained at the original condition in 1975.

3.5.3 Airport Inventory

An inventory of Tobias Bolaños International Airport is shown in Table 3.5.1.

3.5.4 Off-Airport Land Use

The land use map around Tobias Bolaños International Airport is shown in Figure 3.5.2. The airport is situated on the plain along Torres River. The land condition around the airport is classified in the following zones:

- On the east to northeast side, residential areas were developed and are being expanded.
- On the west side, there is a densely populated residential area.
- On the north side, the valley of Torres River is close to the airport property.
- On the south side, major land use is residential area of high density, however, there are some industrial establishments and a psychiatric hospital
- It is a major problem for this airport that most of the airport surroundings are used for residential areas subject to claims of aircraft noise and danger of aircraft accidents.

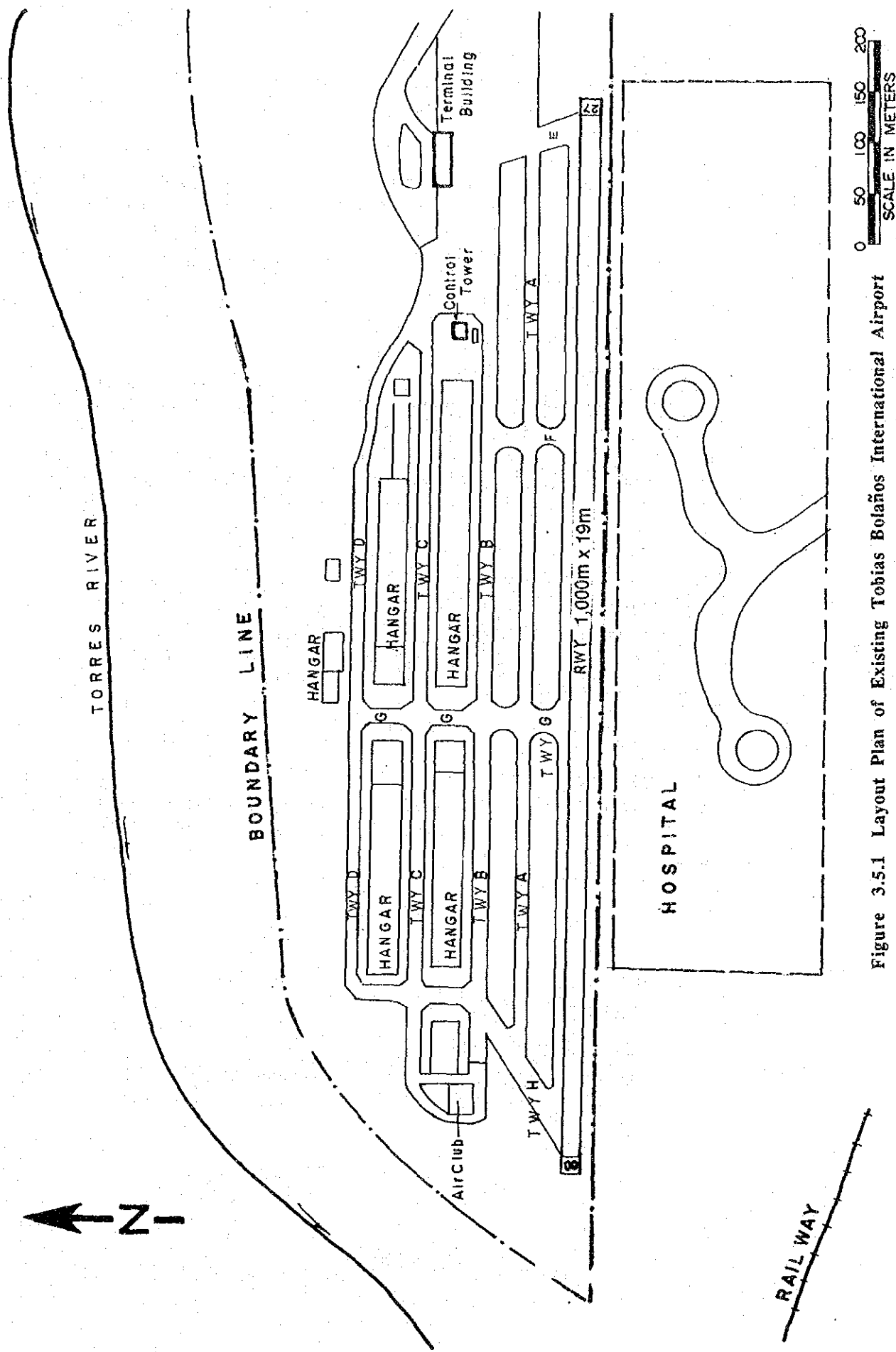


Figure 3.5.1 Layout Plan of Existing Tobias Bolaños International Airport

Table 3.5.1 Inventory of Tobias Bolaños International Airport

(Tobias Bolaños - 1)

Item	Description
<p>1. Aerodrome Data</p> <p>a. City/Aerodrome : San Jose/Tobias Bolaños</p> <p>b. International/Domestic : International and Domestic</p> <p>c. ICAO Reference Code : 2B</p> <p>d. Aerodrome Reference Point : N 09°58', W 84°09'</p> <p>e. Distance and Direction from City : 8km northwest of San Jose</p> <p>f. Elevation : 990m</p> <p>g. Reference Temperature : 27.5°C</p> <p>h. Magnetic Variation : 40' east (1990)</p> <p>i. Operational Hours : 1400 to 0200 (UTC)</p> <p>j. Seasonal Availability : All seasons</p> <p>k. Aerodrome Operator : DGAC/MOPT</p> <p>l. Transportation Available : Taxi and car</p>	
<p>2. Aircraft Operational Data</p> <p>a. Operational Category : Non-Instrument Approach</p> <p>b. Established Procedures : None</p> <p>c. Pre-flight Altimeter Check Point : Apron, elevation 990m</p>	
<p>3. Runway</p> <p>a. Designation : 09/27</p> <p>b. True Bearing : 090/270</p> <p>c. Dimension : 1,000m x 19m</p> <p>d. Shoulders : None</p> <p>e. Longitudinal Slope : 2.0%</p> <p>f. Surface : Asphalt concrete</p> <p>g. Strength : Design Aircraft: C-212</p>	

Table 3.5.1 (continued)

(Tobias Bolaños - 2)

Item	Description
4. Runway	
4.1 Taxiway-A and B	
a. Configuration	: Parallel taxiway
b. Dimension	: 1,530m x 6m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: DC-3
4.2 Taxiway-C and D	
a. Configuration	: Taxiway for hangar area
b. Dimension	: 1,210m x 6m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: DC-3
4.3 Taxiway-E	
a. Configuration	: Exit taxiway at RWY27 threshold
b. Dimension	: 800m x 6m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: DC-3
4.4 Taxiway-F and G	
a. Configuration	: Exit taxiway
b. Dimension	: 265m x 6m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: DC-3
4.5 Taxiway-H	
a. Configuration	: Exit taxiway at RWY09 threshold
b. Dimension	: 240m x 6m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: DC-3

Table 3.5.1 (continued)

(Tobias Bolaños - 3)

Item	Description
5. Apron	
a. Parking Configuration	: Self-maneuvering
b. Area	: 270m x 40m
c. Surface	: Asphalt concrete
d. Strength	: Design aircraft: DC-3 or C-212
6. Passenger Terminal Building	
a. Total Floor Area	: 697 m ²
b. Structure	: Reinforced concrete
7. Cargo Terminal Building	: None
8. Control Tower	
a. Floor Area (VFR Room)	: 80 m ²
b. Structure	: Reinforced concrete/steel frame
9. Operations and Administration Office	: Included in terminal building
10. Carpark	
a. Area	: 100 m ²
b. Capacity	: 10 cars
11. Access Road	
a. Lanes	: One lane for each direction
b. Width	: 7.5m
c. Surface	: Asphalt concrete

Table 3.5.1 (continued)

(Tobias Bolaños - 4)

Item	Description
12 Air Navigation Systems <ul style="list-style-type: none"> a. Radio Navigation System b. Telecommunication System c. Aeronautical Ground Light d. Meteorological System e. Emergency Power Supply System 	<ul style="list-style-type: none"> : NDB (Out of order at present) : Air Ground VHF Communications : Apron Floodlights : Aerodrome Beacon : Obstruction Lights : Observation Sensors : Weather Teletypewriter : Ground/Ground HF : Emergency Generator (75KVA)
13. Airport Utilities <ul style="list-style-type: none"> a. Power Supply System b. Water Supply System c. Sewage Disposal System d. Telephone System 	<ul style="list-style-type: none"> : About 100KVA capacity : Supplied by main pipe from city : Septic tank : Direct lines
14. Rescue and Fire Fighting Facilities <ul style="list-style-type: none"> a. Fire Vehicles b. Fire Station c. Level Protection d. Trained Personnel 	<ul style="list-style-type: none"> : None : None : Category 4 (Required 5) : 6 persons
15. Other Facilities <ul style="list-style-type: none"> a. Airport Maintenance Equipment b. Aviation Fuel Supply System c. Hangar and workshop (General Aviation) <ul style="list-style-type: none"> - Number - Total Floor Area 	<ul style="list-style-type: none"> : None : By Refueller (RECOPE) : 71 hangers (Private: 10, Airtaxi: 6, Workshops: 5) : 27,200 m²

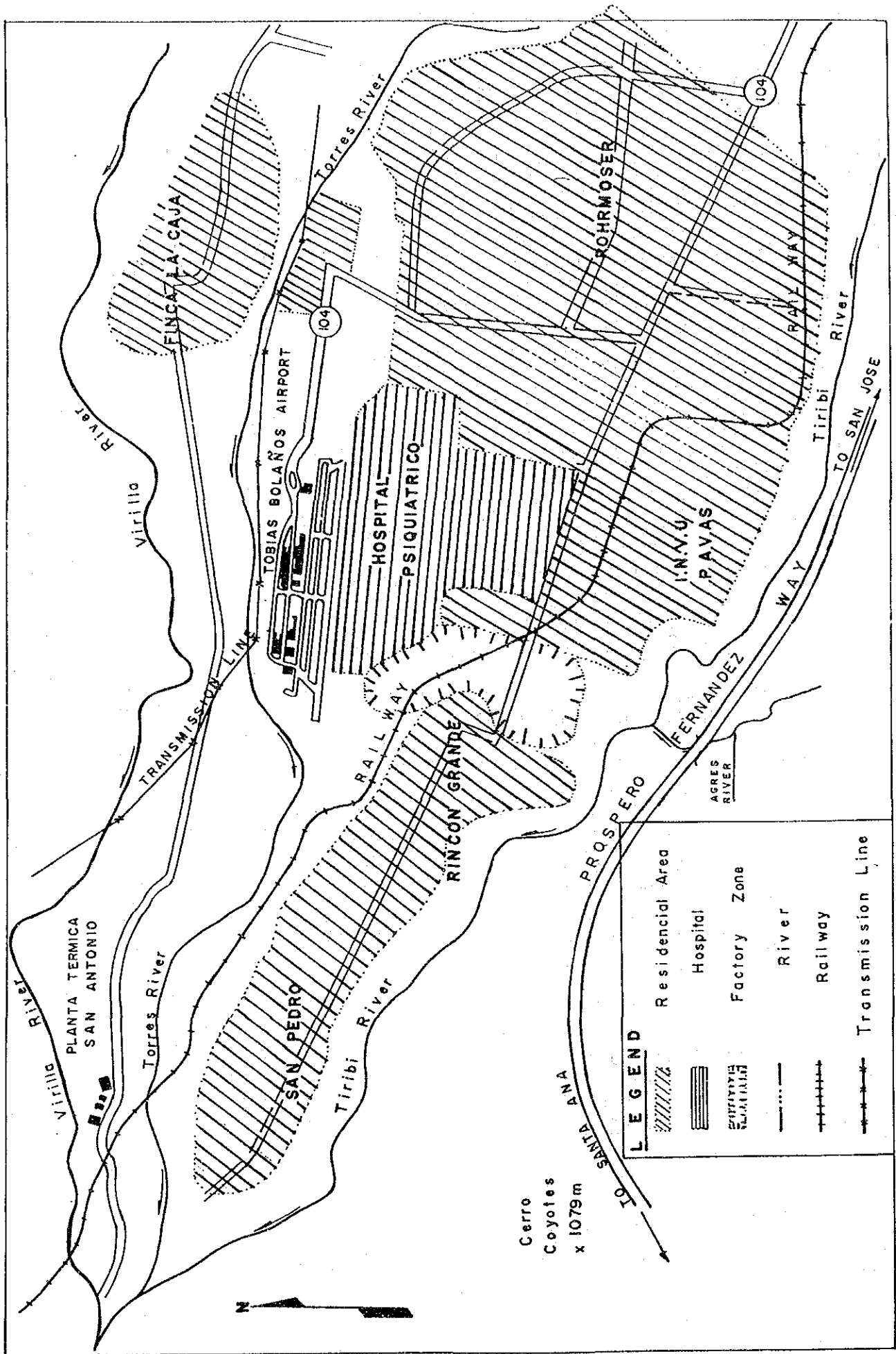


Figure 3.5.2 Off-Airport Land Use Map of Tobias Bolaños International Airport

CHAPTER 4 AIR TRAFFIC DEMAND FORECASTS

CHAPTER 4 AIR TRAFFIC DEMAND FORECASTS

4.1 General

Air traffic demands for the airports, which are the principal planning factors for all airport facilities, are forecast up to the year 2010 covering the following categories:

- a) International Passengers
- b) Domestic Passengers
- c) International Cargo
- d) Domestic Cargo
- e) International Aircraft Movements
- f) Domestic Aircraft Movements

The results of the forecast are summarized in Table 4.1.1. The forecasts for annual demands of international passengers, domestic passengers, international cargo and domestic cargo at Juan Santamaria and Liberia Airports are illustrated in Figures in 4.1.1, 4.1.2 and 4.1.3.

4.2 Estimation of Economic Indices

As the later sections will indicate, the Gross Domestic Product (hereinafter referred to as "GDP") of Costa Rica and major foreign countries are used as the variable to indicate demand. In consequence, prior to touching on the subject of demand forecast, it is necessary to forecast the GDP of these countries.

The statistics pertaining to international air traffic of Costa Rica are classified and totalized according to five categories, vis. North America, Central America, South America, the Caribbean countries and Europe. Therefore, the forecasting of GDP will also have to be conducted for all the these five categories. From the viewpoint of available data, etc., we have had one country, and in the case of Central America two countries, representative of the entire area for the relevant calculations. They are the United States of America for North America, Guatemala and Costa Rica for Central America, Chile for South America, Dominican Republic for the Caribbean Countries and Germany for Europe.

How the GDP has changed in the past and what the forecast for the future for the countries concerned are as shown in Table 4.2.1. The past values given in Table 4.2.1 are expressed in U.S. dollars and the exchange rate applicable in 1985. In the conversion to U.S. dollars, the GDP of the respective countries was initially converted to 1985 values and thereafter converted to U.S. dollars by the exchange rate applicable in 1985. The values for the future have been obtained by applying the following growth rates to the GDP figure of 1990:

- North America:	3.15 %
- Central America:	1.32 %
- South America:	2.40 %
- Caribbean Countries:	2.28 %
- Europe	2.19 %
- Costa Rica	3.00 %

The above-mentioned growth rates have been derived based on past growth and also considering recent economical developments in the respective areas.

Table 4.1.1 Summary of Air Traffic Demand Forecast

Item	Juan Santamaria Airport					Liberia Airport					Limon Airport				
	1990 (Actual)	1995	2000	2005	2010	1990 (Actual)	1995	2000	2005	2010	1990 (Actual)	1995	2000	2005	2010
1. Annual Passengers															
a) International	922,969	1,171,000	1,640,000	2,128,000	2,595,000	-	232,000	324,000	421,000	513,000	-	-	-	-	-
b) Domestic	64,778	114,000	138,900	165,700	193,000	2,296	41,100	56,800	73,200	88,900	-	-	-	-	-
c) Total	987,747	1,285,000	1,778,900	2,293,700	2,788,000	2,296	273,100	349,800	494,200	601,900	-	-	-	-	-
2. Annual Cargo															
a) International	66,903	122,131	225,172	316,140	365,619	-	6,838	11,758	15,947	18,207	-	-	-	-	-
b) Domestic	279*	582	709	845	984	-	210	290	373	453	-	-	-	-	-
c) Total	67,182	122,713	225,881	316,985	366,603	-	7,048	12,048	16,320	18,660	-	-	-	-	-
3. Annual Aircraft Movements															
a) International Passenger Aircraft	14,532	17,000	22,100	26,600	30,100	-	2,200	3,000	3,900	4,700	-	-	-	-	-
b) Domestic Passenger Aircraft	3,190	5,700	6,900	8,300	9,700	-	2,100	2,800	3,700	4,400	-	-	-	-	-
c) International Freighters	2,198	4,000	8,100	10,800	10,800	-	-	-	-	-	-	-	-	-	-
d) General Aviation	15,649	17,900	20,400	23,300	26,700	3,450	3,900	4,500	5,100	5,900	1,326	1,500	1,700	2,000	2,300
e) Total	35,569	44,800	57,800	69,400	77,700	3,450	8,200	10,300	12,700	15,000	1,326	1,500	1,700	2,000	2,300
4. Peak Hour Passengers (2-way)															
a) International	560	760	840	1,120	1,520	-	310	310	420	420	-	-	-	-	-
b) Domestic	60	80	80	100	100	-	40	40	60	60	-	-	-	-	-
c) Total	620	840	920	1,220	1,620	-	350	350	480	480	-	-	-	-	-
5. Peak Hour Aircraft Movements (2-way)															
a) International	7	8	9	11	13	-	2	2	3	3	-	-	-	-	-
b) Domestic	3	4	4	5	5	-	2	2	3	3	-	-	-	-	-
c) General Aviation	7	8	9	10	11	-	2	2	2	3	-	-	-	-	-
e) Total	17	20	22	26	29	-	6	7	8	9	-	-	-	-	-
6. Peak Hour Passengers (1-way)															
a) International	400	480	600	760	1,080	-	200	200	310	310	-	-	-	-	-
b) Domestic	40	60	60	60	60	-	20	20	40	40	-	-	-	-	-
c) Total	440	540	660	820	1,140	-	220	220	350	350	-	-	-	-	-
7. Peak Hour Aircraft Movements (1-way)															
a) International	5	6	6	8	9	-	1	1	2	2	-	-	-	-	-
b) Domestic	2	3	3	3	3	-	1	2	2	2	-	-	-	-	-
c) General Aviation	5	5	6	7	8	-	2	2	2	2	-	-	-	-	-
e) Total	12	14	15	18	20	-	4	5	6	6	-	-	-	-	-

Note (*): Figure in 1988

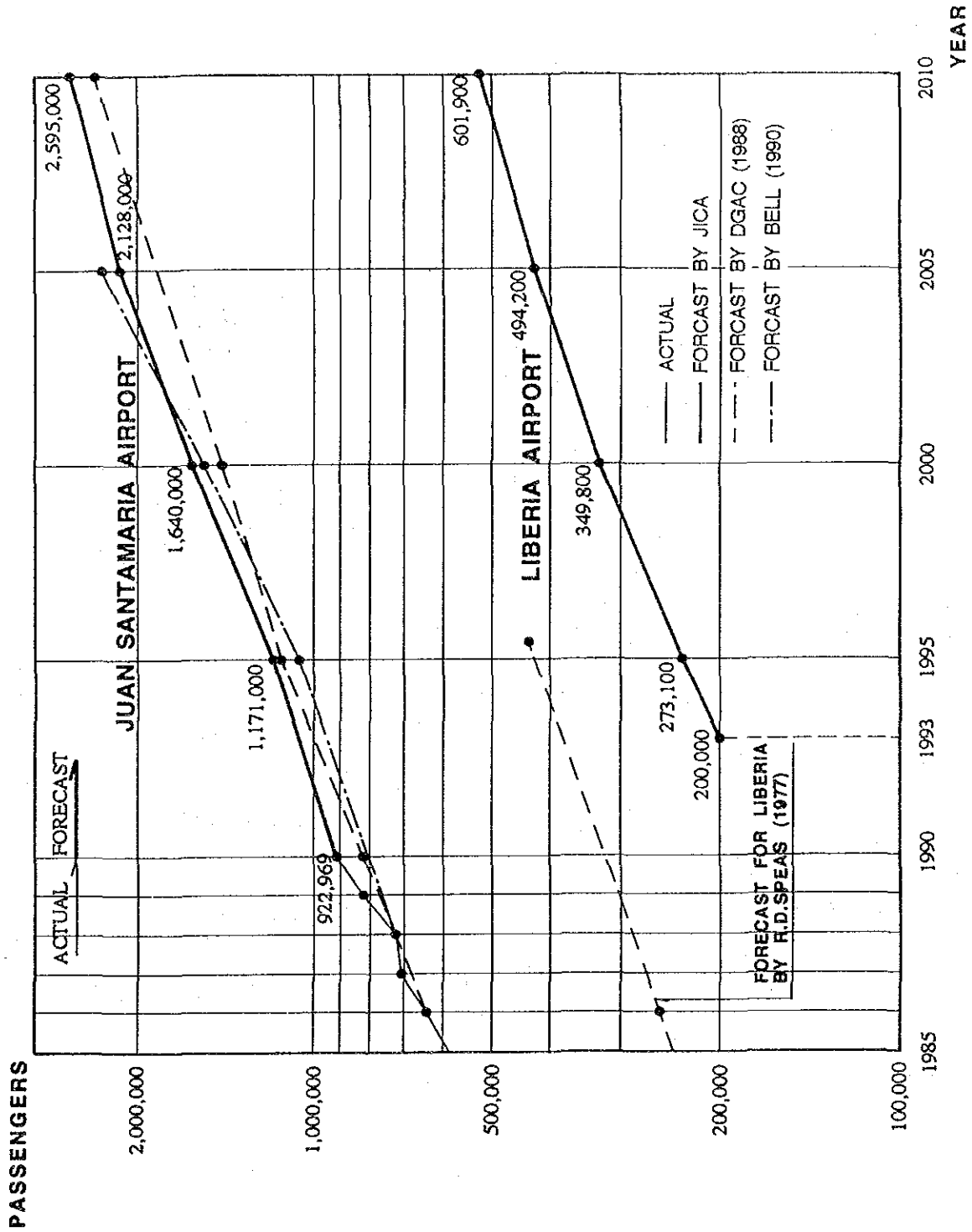


Figure 4.1.1 Forecast of Annual International Passenger Demands at Juan Santamaria and Liberia Airports

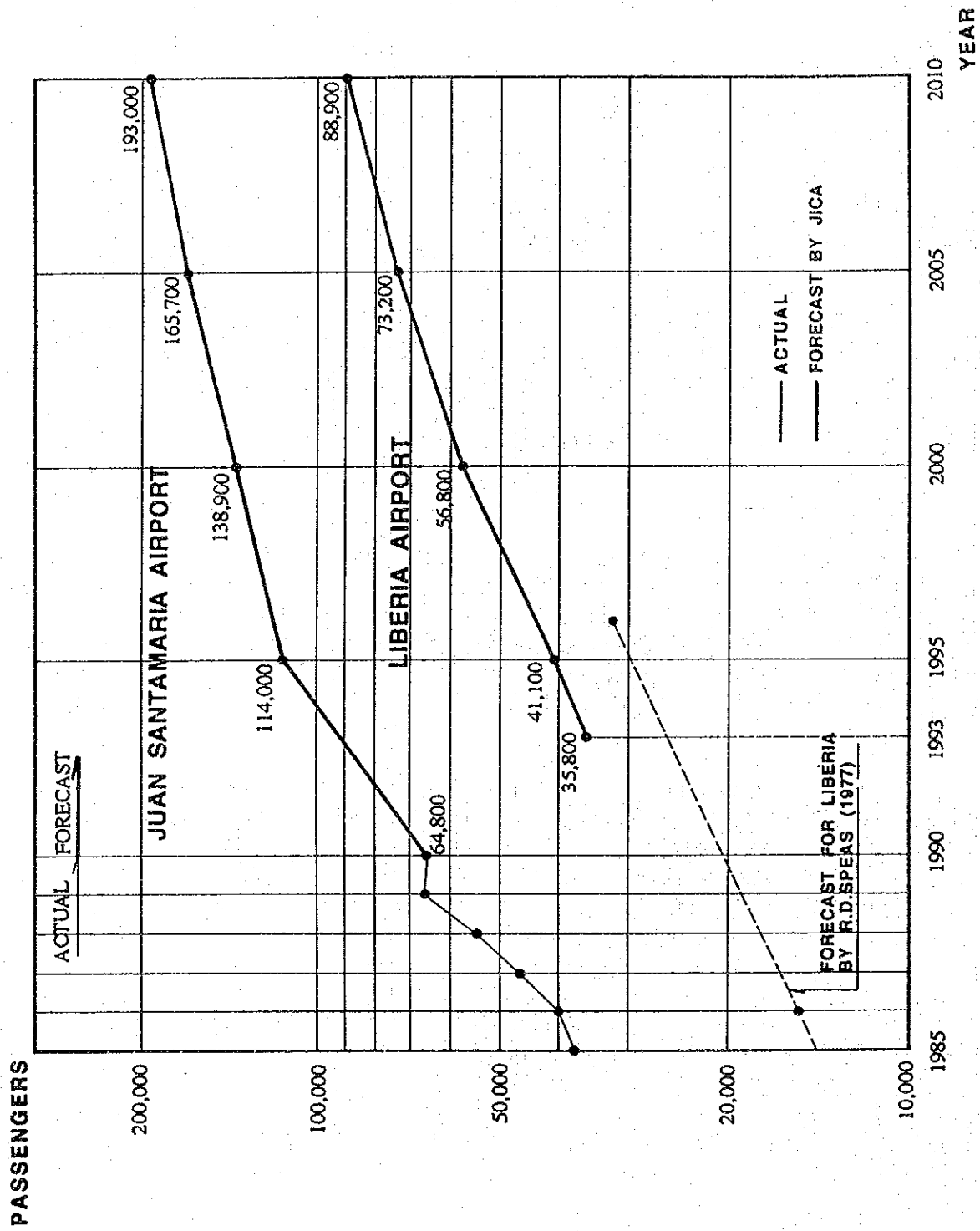


Figure 4.1.2 Forecast of Annual Domestic Passenger Demands at Juan Santamaria and Liberia Airports

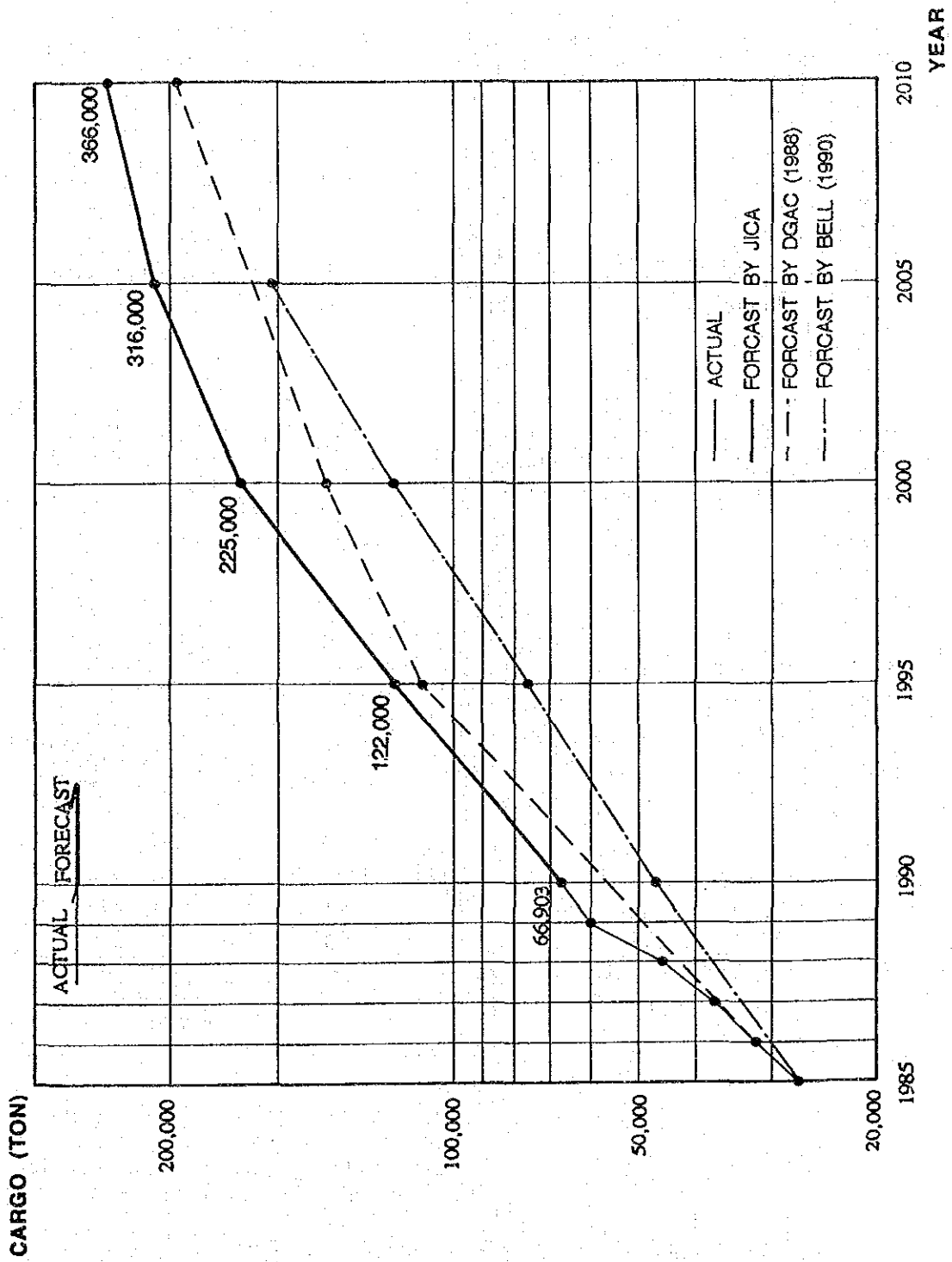


Figure 4.1.3 Forecast of Annual International Cargo Demand at Juan Santamaria Airport

Table 4.2.1 Past Trend and Future Estimation of GDP by Zone

(Unit: Billion US\$ in 1985 Price and in 1985 Exchange Rate)

Year	North America	Central America	South America	Caribbeans	Europe	Costa Rica
1980	3472.00	15.69	16.31	4.16	587.00	3.86
1981	3543.00	15.70	17.21	4.33	588.00	3.79
1982	3457.00	15.00	14.79	4.40	584.00	3.51
1983	3585.00	14.80	14.68	4.60	593.00	3.61
1984	3828.00	15.15	15.61	4.61	610.00	3.90
1985	3974.00	15.10	16.00	4.49	622.00	3.92
1986	4094.00	15.33	16.90	4.63	636.00	4.14
1987	4238.00	15.93	17.87	4.96	648.00	4.34
1988	4435.00	16.51	19.19	5.02	672.00	4.48
1989	4568.00	17.25	21.09	5.21	695.00	4.74
1990	4736.00	17.88	22.36	5.21	729.00	4.92
1991	4885.34	18.12	22.90	5.33	744.97	5.07
1992	5039.39	18.35	23.45	5.45	761.28	5.22
1993	5198.30	18.59	24.01	5.57	777.96	5.38
1994	5362.22	18.84	24.59	5.70	794.99	5.54
1995	5531.30	19.09	25.18	5.83	812.40	5.70
1996	5705.72	19.34	25.78	5.96	830.20	5.87
1997	5885.64	19.59	26.40	6.10	848.38	6.05
1998	6071.23	19.85	27.03	6.24	866.96	6.23
1999	6262.68	20.11	27.68	6.38	885.95	6.42
2000	6460.16	20.38	28.34	6.53	905.35	6.61
2001	6663.87	20.64	29.03	6.67	925.18	6.81
2002	6874.00	20.92	29.72	6.83	945.44	7.01
2003	7090.76	21.19	30.43	6.98	966.15	7.23
2004	7314.35	21.47	31.17	7.14	987.31	7.44
2005	7544.99	21.75	31.91	7.30	1008.93	7.67
2006	7782.91	22.04	32.68	7.47	1031.03	7.90
2007	8028.33	22.33	33.46	7.64	1053.61	8.13
2008	8281.49	22.62	34.27	7.81	1076.68	8.38
2009	8542.63	22.92	35.09	7.99	1100.26	8.63
2010	8812.00	23.22	35.93	8.17	1124.36	8.89

- Note:*
- The figures up to 1990 are actual GDP by International Financial Statistics Yearbook 1990. After 1991, the figures were estimated by the Study Team.
 - The North America is represented by the United States
 - Central America is represented by Guatemala and Costa Rica
 - The South America is represented by Chile
 - Caribbeans is represented by Dominica
 - Europe is represented by Western Germany disregarding East Germany.