

Figure 3.27 Alternative Layout of Runway and Taxiway (Alt. R-C)

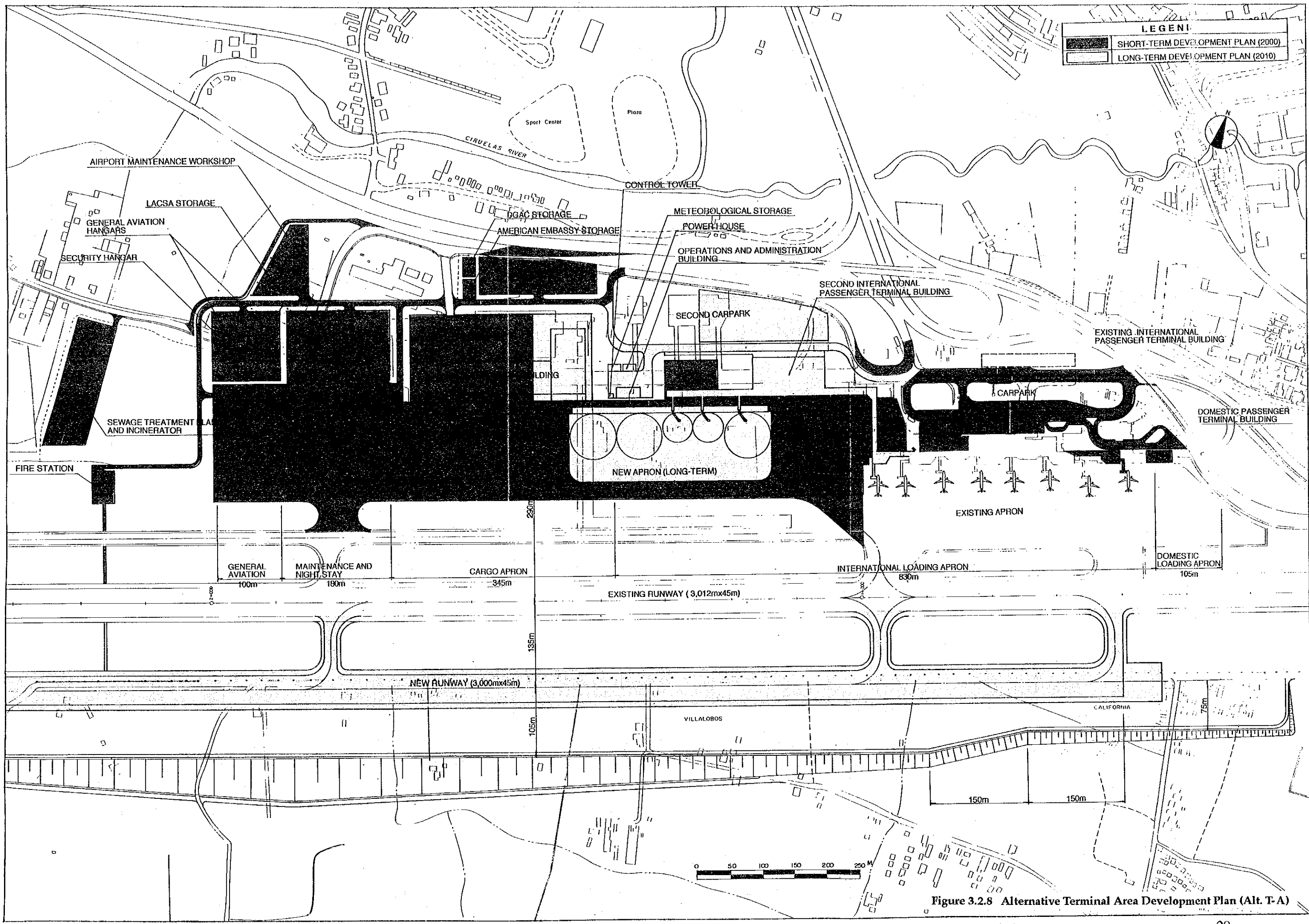


Figure 3.2.8 Alternative Terminal Area Development Plan (Alt. T-A)

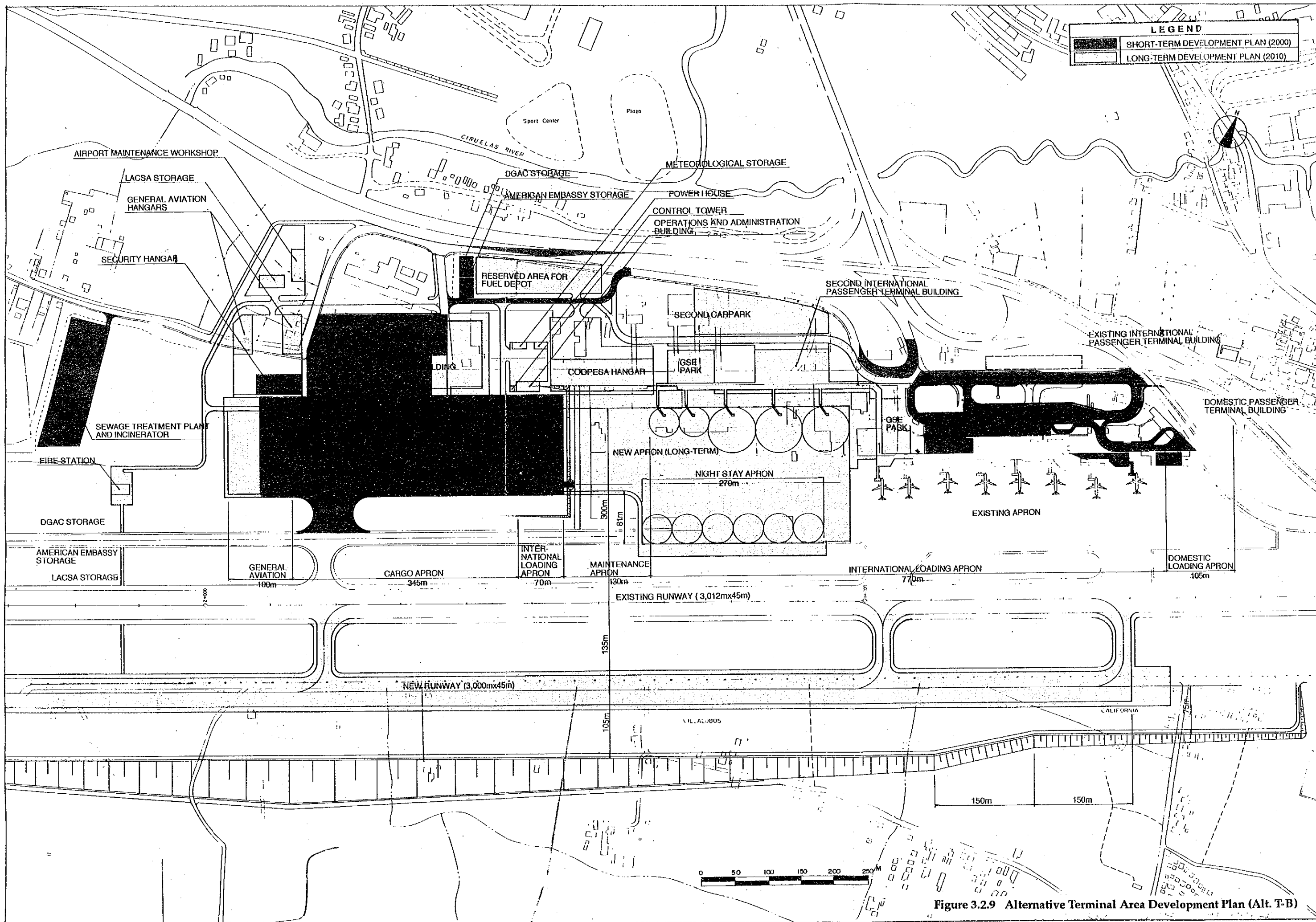


Figure 3.2.9 Alternative Terminal Area Development Plan (Alt. T-B)





As a result of a comparative evaluation, Alt. T-C was selected for the following reasons:

- Practical solution to increase the capacity of terminal facilities in the short-term
- Utilization of large number of existing facilities in the short-term development compared with Alt. T-A.
- Smooth project implementation because of lower cost, minimum land acquisition and the least compensation in the short-term development

### 3.2.3 Liberia Airport

The airport master plan for Liberia Airport was prepared to focus on the expansion of the facilities to be completed by the DGAC's ongoing development work and as shown in Figure 3.2.11. The outline of the improvement plan is as follows:


- 1) The expansion of the apron to the east by 185m so as to secure the aircraft stands for two wide-body, two narrow-body and two small props aircraft
- 2) The expansion of the passenger terminal building to the east by 3,800sq. m
- 3) The expansion of the carpark and the terminal circulation road in accordance with the terminal building expansion
- 4) The construction of a cargo terminal building
- 5) The installation of the instrumental landing system (ILS) consisting of a localizer (LLZ), glide path (GP) and a middle marker (MM) for runway 07
- 6) The installation of the 900m long standard approach lighting system (ALS) and the simple approach lighting system (SALS) for runways 07 and 25 respectively
- 7) The construction of the perimeter road of 5.5m width
- 8) The expansion of airport utilities.

### 3.2.4 Limon International Airport

The development plan for Limon Airport was produced to improve the air safety at the airport. Although the increase of the airport capacity is not very important, the future provision as a regular transport airport should be considered. The improvement plan of Limon Airport is shown in Figure 3.2.12 and its outline is as follows:

- 1) The diversion of obstacles which infringe the obstacle limitation surface (ex. Diversion of principal route No.36)
- 2) The construction of the taxiway and apron
- 3) The construction of a passenger terminal building, customs storage, terminal road and carpark
- 4) Replacement of VOR/DME, VHF communications for ATIS, aeronautical ground lights and meteorological system
- 5) The preparation of the airport utility.



LEGEND	
	PROPOSED IMPROVEMENT PLAN
①	PASSEGER TERMINAL BUILDING EXPANSION
②	EXISTING CONTROL TOWER
③	EXISTING FIRE STATION
④	CARGO TERMINAL BUILDING
⑤	UTILITY COMPLEX (POWER HOUSE, MECHANICAL ROOM, WATER TANK)
⑥	FUEL DEPOT
- - -	BOUNDARY OR SECURITY FENCE
- · - · -	AIRPORT PROPERTY LINE
- - - - -	LINES OF OBSTACLE LIMITATION SURFACE AND RUNWAY CENTER

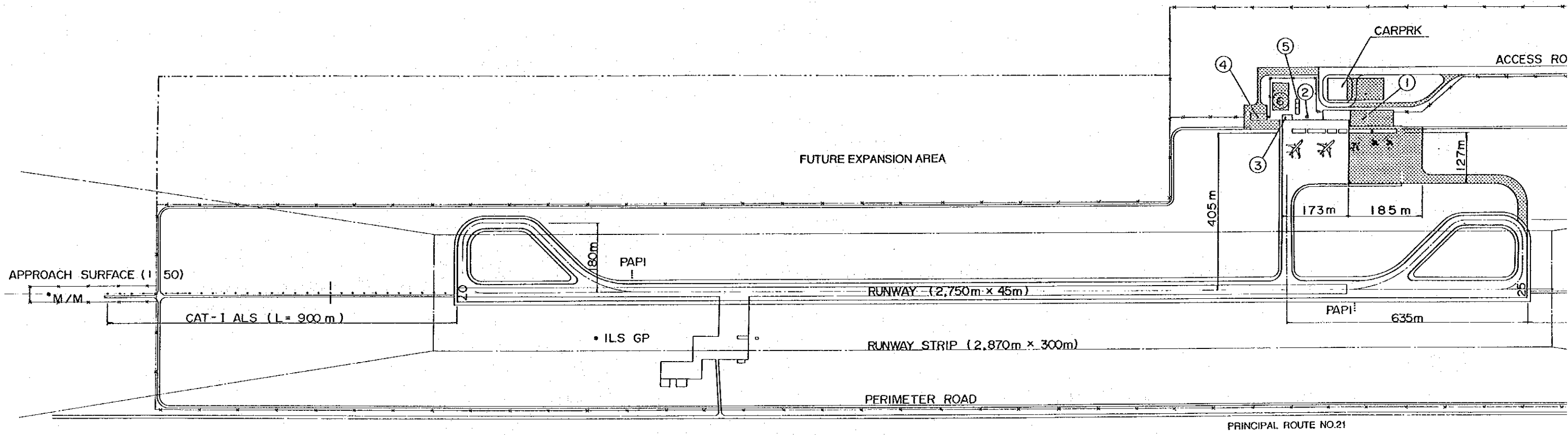


Figure 3.2.11 I







LEGEND	
	PROPOSED IMPROVEMENT PLAN
①	PASSENGER TERMINAL BUILDING
②	CUSTOMS STORAGE

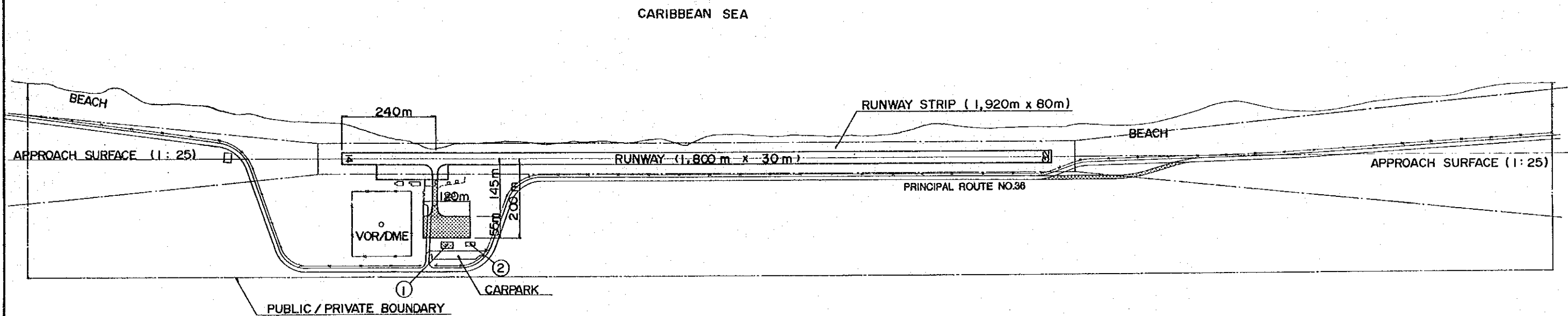
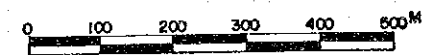


Figure 3.2.12 Improvement Plan of Limon International Airport





## CHAPTER 4 SELECTION OF PRIORITY PROJECT AND ITS SCOPE OF WORK

### 4.1 Selection of Priority Project

The short-term development of Juan Santamaria Airport is selected as the highest priority project from the viewpoint of importance and urgency in the international airport system in Costa Rica. The reasons are as follows:

- As for Juan Santamaria Airport, it is obvious that the short-term development should be immediately implemented and its economic return is the largest among the three airports because of the elimination of the present capacity restriction by development.
- As for Liberia Airport, the improvement plan should be carried out after the actual inauguration of the airport because the ongoing development work satisfies the minimum requirements to inaugurate international service by wide-body jet aircraft.
- As for Limon Airport, the urgency of the improvement plan is low due to very limited activity.

### 4.2 Scope of the Project

The scope of the short-term development project of Juan Santamaria Airport is identified in Table 4.2.1.

**Table 4.2.1 Work Items of the Priority Project  
(Short-term Development of Juan Santamaria Airport)**

1) Overlay of Existing Runway
2) Connecting of Taxiway for New Apron(50m x 57m)
3) Expansion of Apron for Passenger and Cargo Loading Stands(130.5m x 415m)
4) Security Apron (130.5m x 50m)
5) Expansion of International Passenger Terminal Building (2,600sq.m)
6) Domestic Passenger Terminal Building (700sq.m, including Cargo Handling Area)
7) Cargo Terminal Building (16,000sq.m)
8) GSE Road and Other Airside Road
9) Terminal Circulation Road
10) Carpark (550 cars)
11) ATC System
12) Meteorological Observation System
13) Taxiway and Apron Lighting
14) Expansion of Airport Utility (Power Supply System, Telephone System, Water Supply System and Sewerage Treatment System)
15) Compensation (American Embassy Storage, COOPESA Automobile Workshop and DGAC Storage)
16) Land Acquisition

## CHAPTER 5 FEASIBILITY STUDY ON THE SHORT-TERM DEVELOPMENT PROJECT

### 5.1 Preliminary Design

The preliminary design is carried out for the facilities to be constructed in the priority project selected in Chapter 4.

An outline of the runway overlay work, grading of the new terminal area, storm water drainage, pavement structures of the taxiway, apron, new cargo terminal building, expansion of the existing terminal building, air navigation systems and airport utilities is specified by the preliminary design.

### 5.2 Plan of Airspace Use

The existing airspace for the Juan Santamaria and Tobias Bolaños airports are segregated by the control zone and airport traffic zone. In order to promote air safety and to make more convenient airspace around Juan Santamaria Airport, the authority is planning to revise the control zone of Juan Santamaria Airport and the airport traffic zone of Tobias Bolaños Airport.

It is felt that the above measures are appropriate to manage closely located airspace at Juan Santamaria and Tobias Bolaños Airports. However, at present, it is also felt that the safety of aircraft operations can be enhanced by the following additional measures:

- a) The airport traffic patterns of the two airports and the circling approach area for Juan Santamaria Airport should be strictly separated.
- b) All aircraft operating around the airspace of Juan Santamaria Airport are to be positively controlled by Coco Control, particularly in the final approach areas for runways 07 and 25.

Figure 5.2.1 shows a circling area plan for Juan Santamaria and Tobias Bolaños airports.

### 5.3 Aircraft Noise Analysis

Aircraft noise has been forecast by computer simulation on the communities surrounding Juan Santamaria and Liberia airports.

#### 5.3.1 Juan Santamaria Airport

The analyses clarify the present aircraft noise levels around Juan Santamaria Airport and the noise level is particularly serious with a WECPNL of more than 80 at Rio Grande Area, Bajo Sorda, Coco and Rincon Herrera.

The current land use regulation around the airport is compatible with the expected noise influence, since the areas controlled by the land use regulation coincide with the zone influenced by high magnitude of WECPNL contours. It is, however, a fact that the location of Juan Santamaria Airport is not appropriate from the viewpoint of aircraft noise.



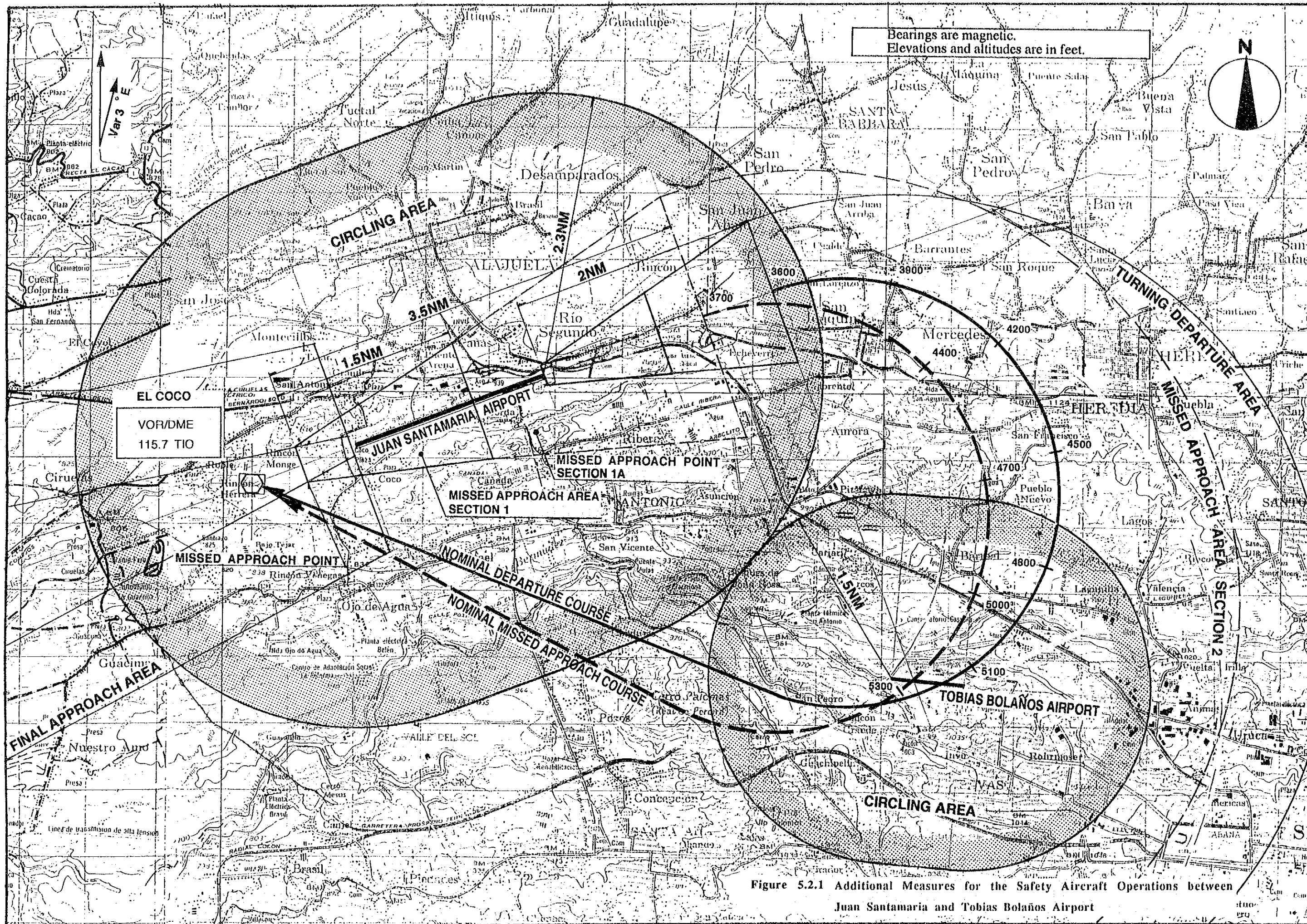


Figure 5.2.1 Additional Measures for the Safety Aircraft Operations between Juan Santamaria and Tobias Bolaños Airport





5.3.2 Liberia Airport

The aircraft noise at Libera Airport will not affect the surrounding community even in 2010.

5.4 **Study of Airport Operations and Maintenance**

The existing airports in Costa Rica are administrated by the DGAC belonging to the MOPT. At Juan Santamaria Airport, 205 staff are assigned from the DGAC, COCESNA and National Institute of Insurance (INS) for airport operation and maintenance.

An additional 57 staffs will be required for operation and maintenance of Juan Santamaria Airport when the short-term development is completed.

5.5 **Project Implementation Schedule and Cost Estimates**

5.5.1 Implementation Schedule

The implementation schedule of the short-term development projects is shown in Table 5.5.1.

Table 5.5.1 Project Implementation Schedule

	1992	1993	1994	1995	1996
<b>1 Service Period</b>					Short-term
<b>2 Feasibility Study</b>	██████████				
<b>3 Financial Arrangement</b>		████			
<b>4 Topographic Survey and Soil Investigation</b>		████			
<b>5 Basic Design</b>		████			
<b>6 Detailed Design and Tendering</b>			██████████		
<b>7 Construction Works</b>					
7.1 Runway Overlay			██████████		
7.2 Taxiway and Apron			██████████		
7.3 Landside Facilities			████████████████		
7.4 Buildings			████████████████		
7.5 Airport Utilities				██████████	
7.6 Air Navigation Systems				██████████	
<b>8 Test Operation and Flight Check</b>					████

## 5.5.2 Project Cost Estimates

### (1) Assumption of the Cost Estimates

The costs were estimated using the following assumptions:

- a) The costs are based on the unit construction prices at the end of 1991.
- b) The exchange rates are Costa Rica colone 130 per US dollar.
- c) The costs are estimated in Colones.
- d) No price escalation is considered for cost estimates.
- e) The facilities to be provided by the oil company and the airlines such as the fuel supply system and ground service equipment are not included in the project cost.
- f) All costs are subject to  $\pm 10\%$  error.
- g) The foreign currency portion of the project cost includes the following items:
  - Procurement cost for the imported materials and equipment
  - Procurement cost for the imported construction equipment
  - The general expenses and profit for the foreign contractors and engineering firms
  - Wages for foreign staff
- h) The Costa Rica currency portion of the project cost includes the following items:
  - Operation cost of the construction equipment including fuel and lubricants
  - Procurement costs of the construction materials which are available in Costa Rica such as aggregate and others
  - Transportation costs for procured materials and labor employed in Costa Rica
  - The contractors' expenses and profits, for both foreign and local, for the amounts paid in Costa Rican currency
  - Wages for Costa Rican laborers
  - Compensation and land acquisition
- i) Contingencies are estimated to be about 10% of the sum of the total cost of construction work, soil investigations, topographic surveys and engineering services cost.

### (2) Cost Estimates for the Short-term Development Project

The cost of the short-term development project is shown in Table 5.5.2. The total cost of the project is estimated to be 6,863 million colones (US\$53 million)

Table 5.5.2 Cost Estimates for the Short-term Development Project

(Unit:1,000xColones)

ITEM	FOREIGN PORTION	COSTA RICAN PORTION	TOTAL
<b>CIVIL WORKS</b>			
Earth Works	94,756	61,741	156,497
Drainage	15,380	10,172	25,552
Runway Overlay	164,260	84,040	248,300
Taxiway	12,586	7,070	19,656
Apron	389,540	248,730	638,270
GSE Road & Park	19,552	10,810	30,362
Access Road & Car Park	56,754	31,701	88,455
Pedestrian Bridge	135,000	33,750	168,750
Miscellaneous	4,790	2,290	7,080
Sub-total	892,618	490,304	1,382,922
<b>ARCHITECTURAL WORKS</b>			
Int'l. Passenger Terminal	1,337,745	379,863	1,717,608
Dom. Passenger Terminal	58,047	19,867	77,914
Int'l. Cargo Terminal	794,917	288,964	1,083,881
Sub-total	2,190,709	688,694	2,879,403
<b>AIR NAVIGATION SYSTEMS</b>			
ATC System	108,376	344	108,720
Meteorological System	138,813	2,002	140,815
Airfield Lighting System	72,967	8,645	81,612
Sub-total	320,156	10,991	331,147
<b>AIRPORT UTILITIES</b>			
Water Supply	21,622	5,418	27,040
Sewerage	249,240	33,570	282,810
Waste Disposal	42,300	4,700	47,000
Power supply	101,675	10,825	112,500
Telephone	12,800	19,200	32,000
Sub-total	427,637	73,713	501,350
<b>TOTAL OF CONSTRUCTION COST</b>	<b>3,831,120</b>	<b>1,263,702</b>	<b>5,094,822</b>
<b>COMPENSATION AND LAND ACQUISITION</b>		<b>536,000</b>	<b>536,000</b>
<b>ENGINEERING SERVICES</b>	<b>537,278</b>	<b>185,320</b>	<b>722,598</b>
<b>CONTINGENCY</b>	<b>383,112</b>	<b>126,370</b>	<b>509,482</b>
<b>TOTAL OF PROJECT COST</b>	<b>4,751,510</b>	<b>2,111,392</b>	<b>6,862,902</b>

## 5.6 Economic and Financial Analyses

### 5.6.1 Economic Analysis

The short-term development was evaluated from the viewpoint of its contribution to the national economy.

#### (1) Costs and Benefits

The economic cost of the project is composed of the construction, replacement, operation and maintenance costs.

The development of Juan Santamaria Airport will, offer various benefits to the national and regional economies. In this Study, the following economic benefits were quantified and evaluated:

- (a) Benefits due to accommodation of the overflow of foreign passengers
- (b) Benefits of increasing foreign earnings from foreign visitors
- (c) Benefits due to increase of LACSA'S revenue
- (d) Time saving benefits to Costa Rican passengers
- (e) Benefits due to accommodation of the overflow of export cargo.
- (f) Benefits due to the increase of employment by construction work

#### (2) Result of Economic Evaluation

The economic feasibility was assessed in terms of Economic Internal Rate of Return (EIRR), Benefit/Cost Ratio (B/C Ratio) and Net Present Value (NPV) of the Project which are calculated and summarized in Table 5.6.1.

Table 5.6.1 Evaluation Indicators

EIRR (%)	B/C Ratio (*)	NPV (Colones) (*)
27.5	2.44	7,456,000,000

Note (\*) At discount rate of 12 %.

The result of the economic analysis shows that the development of Juan Santamaria Airport is feasible because the EIRR of 27.5% exceeds the opportunity cost of capital (12%) in Costa Rica.

#### (3) Sensitivity Analyses

Sensitivity analyses were also carried out to provide probablistic judgement on the investment. The EIRRs were calculated on various projections and summarized in Table 5.6.2.

**Table 5.6.2 Results of Sensitivity Analyses**

Projections		EIRR (%)
Original Case		27.5
Case 1	Costs down by 10% and Traffic Demands up by 10%	35.2
Case 2	Costs up by 10%	25.5
Case 3	Traffic Demands down by 10%	22.2
Case 4	Costs up by 10% and Traffic Demands down by 10%	20.4

The above sensitivity analyses show that even if the project costs go up by 10% and traffic demands go down by 10% simultaneously, the project maintains a high EIRR of 20.4% more than the opportunity cost 12%.

(4) Indirect/Intangible Benefits

Although the cost-benefit analysis has been executed based on direct and tangible benefits, projects in the transport sector are generally characterized by extensive indirect and intangible benefits which are not quantified by the cost-benefit analysis.

In this particular case, the implementation of the Project will bring the following indirect and intangible benefits:

- (a) Promotion of safety, reliability and punctuality in the aircraft operation and air transport.
- (b) Promotion of convenience and comfortability for the airport users such as air passengers, welcomers, and well wishers.
- (c) Promotion of foreign investment:  
Development of the airport will promote foreign investment to Costa Rica by offering high speed and efficient air transportation.
- (d) Enhancement of foreign trade and communication:  
Costa Rica with a long tradition of democracy and political stability has the potential to play an important role as a trading and communication center in Central America. Satisfactory air transport enhances foreign trade and communications with the countries of Central, North and South America, and Europe.

5.6.3 Financial Analysis

Financial analysis is carried out to investigate the financial impact by the implementation of the project by DGAC.

(1) Expenditure and Revenue

Expenditure is composed of the construction, replacement, operation and maintenance costs. The revenues are quantified from the overflow of international passengers and cargo.



(2) Result of Financial Evaluation

The FIRR (Financial Internal Rate of Return) is calculated by comparing the expected revenues and expenditures. The calculated FIRR is as low as 5.7 %. The project, therefore, will not be financially feasible unless a loan with low interest is available.

However, if it is possible to increase the existing charges quantified in the above analysis by 30 percent at the time of completion of the project and then increase them by 40 percent every ten years, the FIRR increase to 12.4 % which is considered more or less financially feasible.

## CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

### 1. Conclusions

As a result of the comprehensive study presented in this report which includes airport master planning of three airports, selection of a priority project and the feasibility study on the short-term development project of Juan Santamaria Airport (the Project), it is concluded that the existing Juan Santamaria Airport be rehabilitated and developed in order to solve the present capacity problems and to cope with the traffic requirements anticipated up to the year 2000. The Project will consist of construction of a new apron, taxiway, new domestic building and new cargo building, improvement of the existing runway and road pavement, expansion of the passenger terminal building, replacement of air navigation facilities and installation of airport utilities.

These conclusions have been reached for the following major reasons:

- a) The short-term development of Juan Santamaria Airport was selected as having the highest priority project from the viewpoints of importance and urgency in the international airport system of Costa Rica.
- b) The Project offers maximum use of the existing facilities with minimum investment and enables flexible selection for the implementation of the long-term development to comply with international standards.
- c) The project cost is estimated at 6,863 million Colones in the short-term development and the economic internal rate of return (EIRR) is 27.5 percent. Hence, the Project is feasible from the viewpoint of the optimum allocation of resources in the national economy.
- d) The value of the financial internal rate of return (FIRR) is estimated as low as 5.7 %. This is because the financial analysis of the Project was carried out as a public utility work under the condition that revenue and expenditures are controlled by the Government of Costa Rica.
- e) The implementation of the Project will have impacts on:
  - Contribution to international tourism development,
  - Contribution to increase opportunities for trade and business,
  - Enhancing foreign investment,
  - Generating employment opportunities, and
  - Assurance of air transport safety.

## **2. Recommendations**

- (1) It is recommended that the Project be implemented as soon as possible and, therefore that the preparatory work be initiated at the earliest possible date.
- (2) This study proposes the long-term development plan of Juan Santamaria Airport in which airport facilities will meet with international standards. However, some problems related to poor meteorological conditions and the aircraft noise will remain unsolvable if the airport remains at the existing site.

It is, therefore, recommended that a comprehensive study be started to determine the feasibility of a new airport development, to compare that with the long-term development plan proposed in this study, and to finally decide on the development of the existing airport or the construction of a new airport.



