6.3.11 Air Navigation Systems

1) Radio Navigation Aids

The VOR and the collocated DME will be installed at Liberia Airport. It is desirable to introduce an ILS to Runway 07 to ensure safe operations of aircraft.

2) Aeronautical Telecommunication System

Upon completion of the development work, the DGAC plans to establish an airport traffic zone for airspace around Liberia Airport. Although only the FIS was available before the development work at the airport, air to ground VHF communications (TWR) and AFTN message exchange and teletypewriters will be operational.

3) Aeronautical Ground Lights

Aeronautical ground lights available after the completion of the development work are PAPIs, runway edge lights, runway threshold lights, runway end lights, taxiway edge lights, apron floodlights and aerodrome beacon. These provisions are insufficient for international standards. It is recommended that an approach lighting system be installed for runway 07 and simple approach lighting system be installed for runway 25.

4) Meteorological System

The meteorological system which consisted of observation sensors, weather teletypewriter and ground to ground HF communications before the development work will be continued at the airport. These provisions satisfy the minimum requirements.

6.3.12 Rescue and Fire Fighting Services

A fire station of 290m² is planned in the new terminal area. However, the details of the fire fighting services at the airport are not available to date. It is necessary to provide the facilities in compliance with the ICAO category -7 for the introduction of DC-10.

6.3.13 Aviation Fuel Supply System

No information was available concerning the aviation fuel supply system at Liberia Airport after the development work. Since fuel supply is an essential service at the airport, appropriate provision should be considered as soon as possible.

6.4 Limon International Airport

The evaluation for Limon Airport was carried out by focusing on the adequacy of existing facilities for the maintenance of the present role of the airport for general aviation.

6.4.1 Runway

The existing runway is 1,800m in length and 30m in width. It is adequate for all types of general aviation aircraft up to DC-3 using Limon Airport. The runway usability at the airport is excellent with wind coverage of 92.8% and 99.4% for cross-wind component less than 13kt and 20kt respectively. Therefore, it is expected that some diverting flights from Juan Santamaria Airport will use Limon Airport. However, those diverting flights may be limited to small aircraft due to poor airport facilities and limited accommodations in the city. It is impractical to develop this airport only for the reason of accommodating diverting flights of jet aircraft such as A-320 and DC-10.

6.4.2 Runway Strip

The required width of the runway strip for aircraft operating with the non-instrument procedures at Limon Airport (ICAO code number 2) is 80m. However, the disance from the runway centerline to the Caribbean coastline is only 30m, and this distance becomes smaller when the tide is high. In addition, apron, terminal building and some other terminal facilities are located within the runway strip . This situation cannot be accepted.

6.4.3 Obstacle Limitation Surfaces

The establishment of obstacle limitation surfaces did not seem to be considered at Limon Airport. Principal Route No.36 is an obstacle to the runway 32 approach surface. Virtually no transitional surface exists because of the fact that most terminal facilities are located inside the runway strip as aforementioned.

6.4.4 Apron

An apron of 185m wide by 38m deep is located directly adjacent to the runway without a taxiway. The size of the apron is sufficient for the present traffic, however, its location should be changed so as not to be an obstacle to aircraft operations.

6.4.5 Aircraft Pavement

The pavement of Limon Airport was seriously damaged by the earthquake on April 22, 1991. The DGAC undertook the emergency rehabilitation work in September 1991. The typical composition of the runway pavement is 12cm thick asphalt surface course on top of 24cm thick base course. This pavement is sufficient for general aviation activity.

6.4.6 Passenger Terminal Building

The existing passenger terminal building is a small single story building of approximately 35m by 13.5m. The building accommodates a passenger waiting hall with a catering facility, immigration office, meteorological, administration offices, reception, store, and toilet, among others. The exposed structural members of the

building, columns and roof beams, are of timber. The roof is covered with steel corrugated sheets. The building is generally well maintained. The terminal building does not seem necessary to be expanded. Its location, however, should be changed to secure safe aircraft operations.

6.4.7 Roads and Carpark

A five meter wide and 150m long access road connects the terminal area with Principal Road No.36. A 50m by 40m area in front of the passenger terminal building is used for car parking and vehicle circulation. These provisions are sufficient for the present activities.

6.4.8 Air Navigation Systems

1) Radio Navigation Aids

The VOR collocated with the DME is provided at the airport. It was installed in 1975 and has been used for enroute flights. Since the operational life of the equipment is expected to be reached soon, its replacement needs to be considered.

2) Aeronautical Telecommunication System

An aerodrome flight information system (AFIS) is available at the airport. Due to limited number of aircraft movements, the existing AFIS is considered adequate for the foreseeable future. The existing equipment installed around 1980 will need to be replaced around 2000.

3) Aeronautical Ground Lights

Aeronautical ground lights available at the airport are runway threshold identification lights, runway edge lights, apron floodlights and an aerodrome beacon. These provisions are adequate for general aviation activity. The existing system installed in 1975 will need to be replaced around 1995.

4) Meteorological System

The existing meteorological system which consists of observation sensors, weather teletypewriter and ground to ground HF communications satisfy the minimum requirements for the airport operations. However, the replacement of equipment may be considered before 2000.

6.4.9 Rescue and Fire Fighting Services

The rescue and fire fighting services at Limon Airport are only available upon a report to the nearby fire station in the city. No provision of services at the airport will be a problem in the event of aircraft accidents. The level of protection of the ICAO category-2 may be applied as a minimum requirement.

6.4.10 Aviation Fuel Supply System

Aviation fuel is supplied from drums. This method can be continued due to light traffic at the airport.

CHAPTER 7 ESTABLISHMENT OF LONG-TERM DEVELOPMENT POLICY

CHAPTER 7 ESTABLISHMENT OF LONG-TERM DEVELOPMENT POLICY

7.1 General

This chapter describes the roles of the three airports and their long-term development policy.

7.2 Juan Santamaria International Airport

Juan Santamaria Airport plays a role as the national gateway airport and a beam center of domestic air transport. There are two major factors which should be considered in establishing the long-term development policy of Juan Santamaria Airport. Those are the fundamental deficiency of Juan Santamaria Airport and the future of Tobias Bolaños Airport.

1) Fundamental Deficiency of Juan Santamaria Airport

Existing Juan Santamaria Airport has a fundamental deficiency in its obstacle clearance in light of international standards. This problem will inevitably require the construction of a new runway as has been clarified in this Study as well as previous master planning studies. However, it is obvious that the new runway construction at the airport will be a huge investment due to topographic conditions. Nevertheless, other unsolvable problems related to aircraft noise and poor meteorological conditions will remain as they are even if the new runway is constructed.

This situation naturally results in a concept for the new airport construction to fundamentally solve the various problems at Juan Santamaria Airport. Actually, several new airport sites are being considered by the Government. Depending on the timing of the new airport construction, it may not be necessary to provide a long-term guidance such as for 2010 or beyond with Juan Santamaria Airport. However, the idea of the new airport construction is still in its initial stage and has not been embodied yet. In addition, it is normally expected that considerable time will be required for various studies including site selection, meteorological observation, topographic survey, geotechnical investigation, master planning, feasibility study, etc., and also for actual designing and construction before the inauguration of the new airport.

Under these circumstances, it is practical, as a short-term development policy, that the existing airport will be used with minimum investment by the maximum utilization of existing facilities. This is because the immediate improvement of the airport to comply with international standards will be a wasteful investment if the new airport construction project is examined to be feasible and its implementation is decided. It is not only because of money, but also because of timing. The new runway construction will take at least five years to complete, and the problems of terminal facilities are much more serious than that of the runway in terms of capacity at present. Therefore, it is reasonable to concentrate on the development effort for the increase of the terminal capacity by use of existing facilities in the short term.

As for the long-term development policy, it is assumed that the airport will be improved to comply with international standards in order to achieve the ultimate concept of the airport and also to provide a significant comparison to judge the feasibility of the new airport construction project.

2) Tobias Bolaños International Airport

The air traffic zone closely located by Juan Santamaria and Tobias Bolaños Airports is controllable with various measures including classification of airspace, establishment of control zones and airport traffic zones, separation of airport traffic patterns and positive control with the ATC radar as described in Chapter 11. However, a major problem will occur at Juan Santamaria Airport from the view point of airport capacity in the event of the closure of Tobias Bolaños Airport. There is opposition to the operation of the airport mainly because of a possible accident occurring over the residential area.

If all the aircraft presently based at Tobias Bolaños airport are transferred to Juan Santamaria Airport, the aircraft movements at the airport will exceed the runway capacity soon. Since laying out a parallel runway in addition to a new runway in compliance with international standards is practically not possible due to the topography, this transfer problem cannot be solved simply within the master planning of Juan Santamaria Airport. A study with a wider scope including the new airport construction project and a utilization plan of Juan Santamaria Airport after the completion of the new airport will be necessary.

Therefore, the long-term development of Juan Santamaria Airport assumes the continuous operations of Tobias Bolaños Airport.

3) Long-term Development Policy

The long-term development policy of Juan Santamaria Airport is summarized as follows:

Short-term Policy:	Increase of airport capacity by the maximum use of the existing facilities
Long-term Policy: (Assumption)	Improvement of the airport to comply with international standards

7.3 Liberia International Airport

Liberia airport will function as the second air gateway of Costa Rica relating to tourism development of the region, and also as an alternate airport of Juan Santamaria Airport taking advantage of its excellent meteorological conditions, adequate airport facilities and availability of accommodation facilities for passengers and crew. Domestically, it will support the decentralization policy of the Government.

Since the basic concept of the ongoing development work at Liberia Airport by the DGAC is adequate, the long-term development policy of the airport will focus on the expansion of the facilities in accordance with the increase of air traffic demands. In addition, as the alternate airport for international flights, the facilities related to safe aircraft operations such as the air navigation systems should be of equivalent standards to Juan Santamaria Airport.

7.4 Limon International Airport

Limon Airport maintains its role as a general aviation airport. Although the meteorological conditions at Limon Airport are the best among the three airports, it is impractical to develop this airport only to accommodate diverted flights of jet aircraft such as A-320 and DC-10.

Nevertheless, the improvement of Limon Airport is necessary from the viewpoint of air safety.

CHAPTER 8 AIRPORT MASTER PLANS

CHAPTER 8 AIRPORT MASTER PLANS

8.1 General

This chapter explains the master plans of the three airports which are to be produced based on the long-term development policy in Chapter 7. The following sections describe the master plans of Juan Santamaria, Liberia and Limon Airports to satisfy the future facility requirements and be compatible with conditions of existing airport facilities.

Since airport development requires substantial construction and capital investment, it is a general practice to implement it in phases to achieve cost-effectiveness. A concept of the ultimate development (called long-term development) is prepared to visualize foreseeable future requirements of the airport. Actual first phase development of the airport (called short-term development), however, will be carried out as required by the short-term forecasts which are less susceptible to major errors, and yet in line with the ultimate development concept.

Taking into account the general implementation schedule of the airport development, the short-term developments are planned to cope with air traffic demands up to 2000. The long-term development plans are established with a design target year of 2010 in order to indicate the ultimate development concept of the airports.

The phases of the airport development are thus set forth as follows:

Short-Term Development Plan:	Design Target Year 2000
Long-Term Development Plan:	Design Target Year 2010

8.2 Juan Santamaria International Airport

8.2.1 Basic Development Policy

Various problems which have been clarified for Juan Santamaria Airport in previous sections are summarized by categorizing them into three groups as follows:

Group A: Problems of not conforming to international standards

- Insufficient width of the runway strip
- Existence of obstacles protruding upon the runway 07 take-off climb surface
- Insufficient separation distance between centerlines of the runway and parallel taxiway

Group B: Problems of not complying with the growth of air traffic demands

- Low runway capacity
- Insufficient number of aircraft stands
- Inadequate space and nonfunctional layout of the international passenger terminal building
- Inadequate space of international cargo terminal building
- Insufficient carpark capacity

Group C: Other problems

- Serious aircraft noise problems
- Low runway usability due to poor meteorological condition

Among the above problems, Group A problems are mainly related to layout of the runway and taxiways. Group B problems concern the capacity of the existing facilities. Other problems in Group C are basically not solvable except the low runway usability which can partly be supplemented by the provision of an adequate alternate airport in Costa Rica. Therefore, the basic development policy for Juan Santamaria Airport is focussed on finding solutions for Group A and B problems with due consideration on practical implementation of future development work.

The master planning of Juan Santamaria Airport is produced in two steps, i.e., layout planning of the runway and the taxiway in the first step, and development planning of the terminal area in the second step.

8.2.2 Layout Planning of the Runway and Taxiway

1) Alternative Layouts of the Runway and Taxiway

For the purpose of comparative study, six alternatives are prepared as follows:

Alt. R-A1 (New runway parallel to existing runway, 300m wide runway strip, ICAO recommended approach surface and runway-taxiway separation: Figure 8.2.1)

A 3,000m long new runway will be laid out in parallel to the existing runway with a separation distance of 182.5m. The existing runway will be used as a part of the parallel taxiway. The Runway 25 threshold will be located in a position which will be 1,000m west of the existing runway 25 threshold (1,600m west of the existing runway 07 end) to secure obstacle-free 2% slope approach surface.

Alt. R-A2 (Angled layout of new runway, ICAO recommended approach surface and runway-taxiway separation: Figure 8.2.2)

A 3,000m long new runway will be laid out with 7° clock-wise angle to the existing runway to obtain larger space for the terminal area than Alt. R-A1. A full length of the parallel taxiway will be constructed at a 182.5m separation distance from the runway. This alternative was originally produced in the 1988 report to improve runway usability factor. However, the location of the Runway 26 threshold should be 1,000m west of the existing Runway 25 threshold instead of 400m (in the 1988 report) to secure an obstacle-free 2% slope approach surface.

Alt. R-A3 (New runway parallel to existing runway, 300m wide runway strip, FAA standard approach surface and runway-taxiway separation: Figure 8.2.3)

A 3,000m long new runway will be laid out parallel to the existing runway with a separation distance of 135m (minimum separation without acute-angled exit taxiways). The existing runway will be used as the parallel taxiway. The Runway 25 threshold will be located just south of the existing Runway 25 threshold (600m west of the existing Runway 07 end) to secure obstacle-free 2.9% slope approach surface which the FAA stipulates for a non-precision instrument runway.

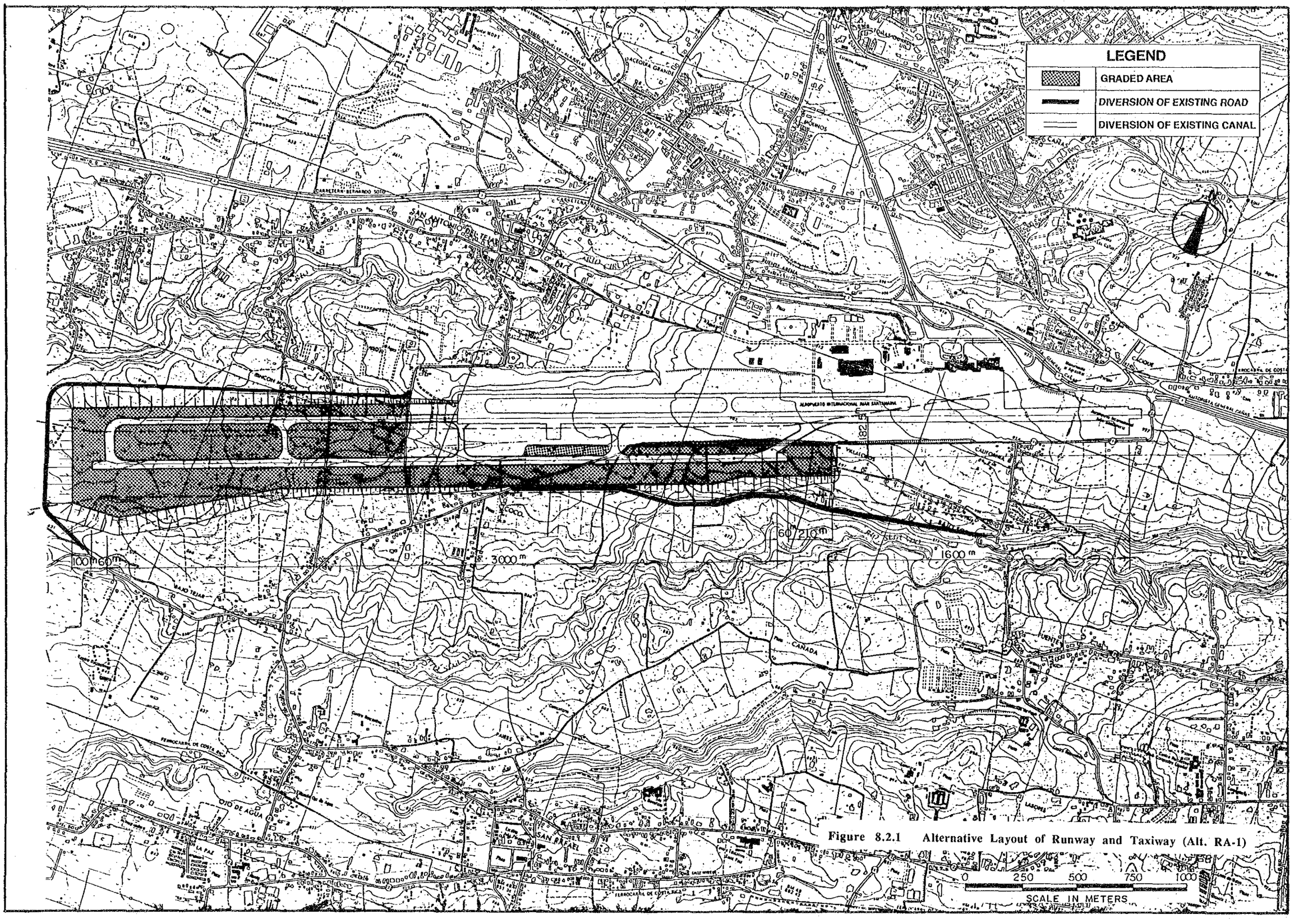


Figure 8.2.1 Alternative Layout of Runway and Taxiway (Alt. RA-1)

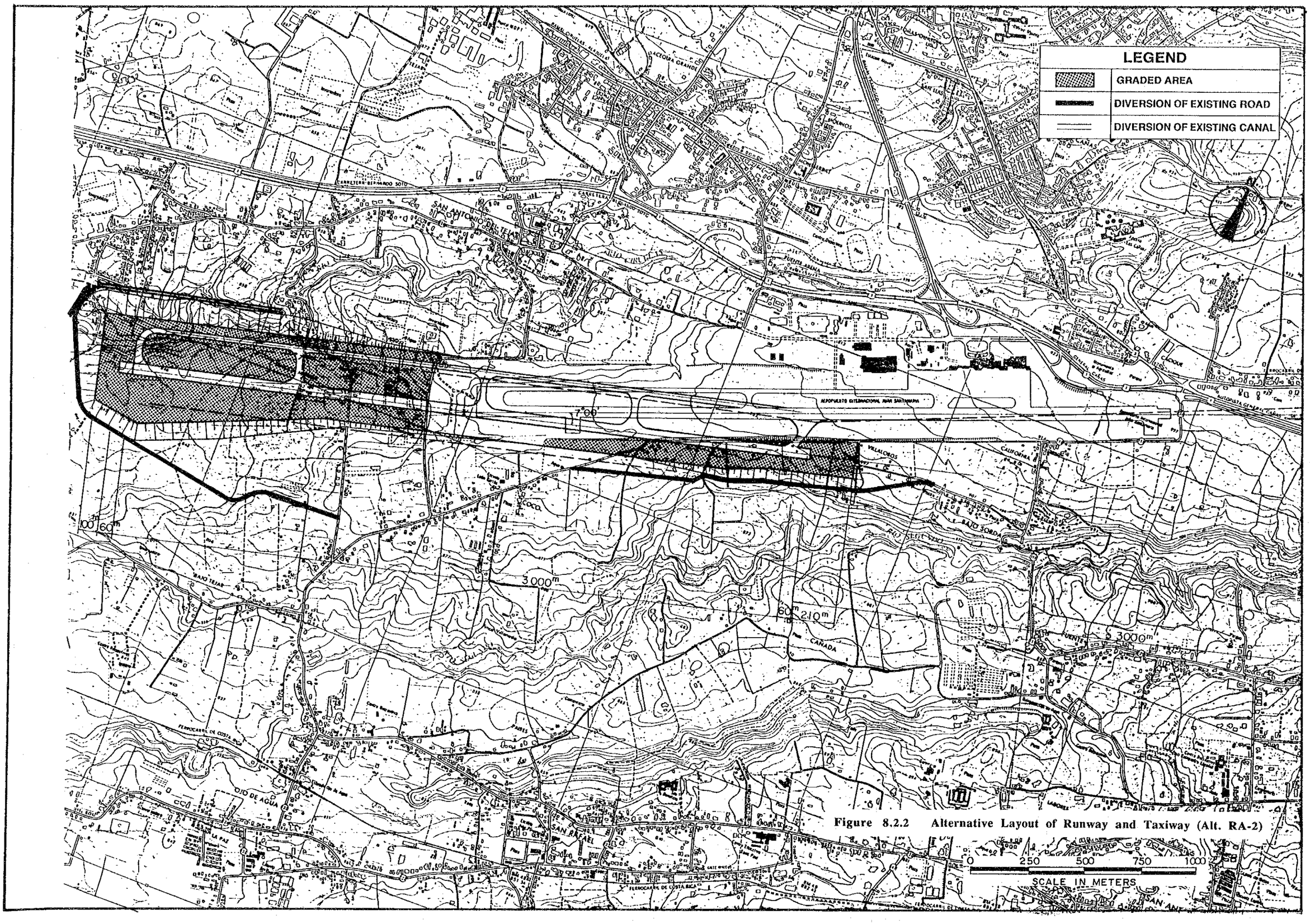


Figure 8.2.2 Alternative Layout of Runway and Taxiway (Alt. RA-2)

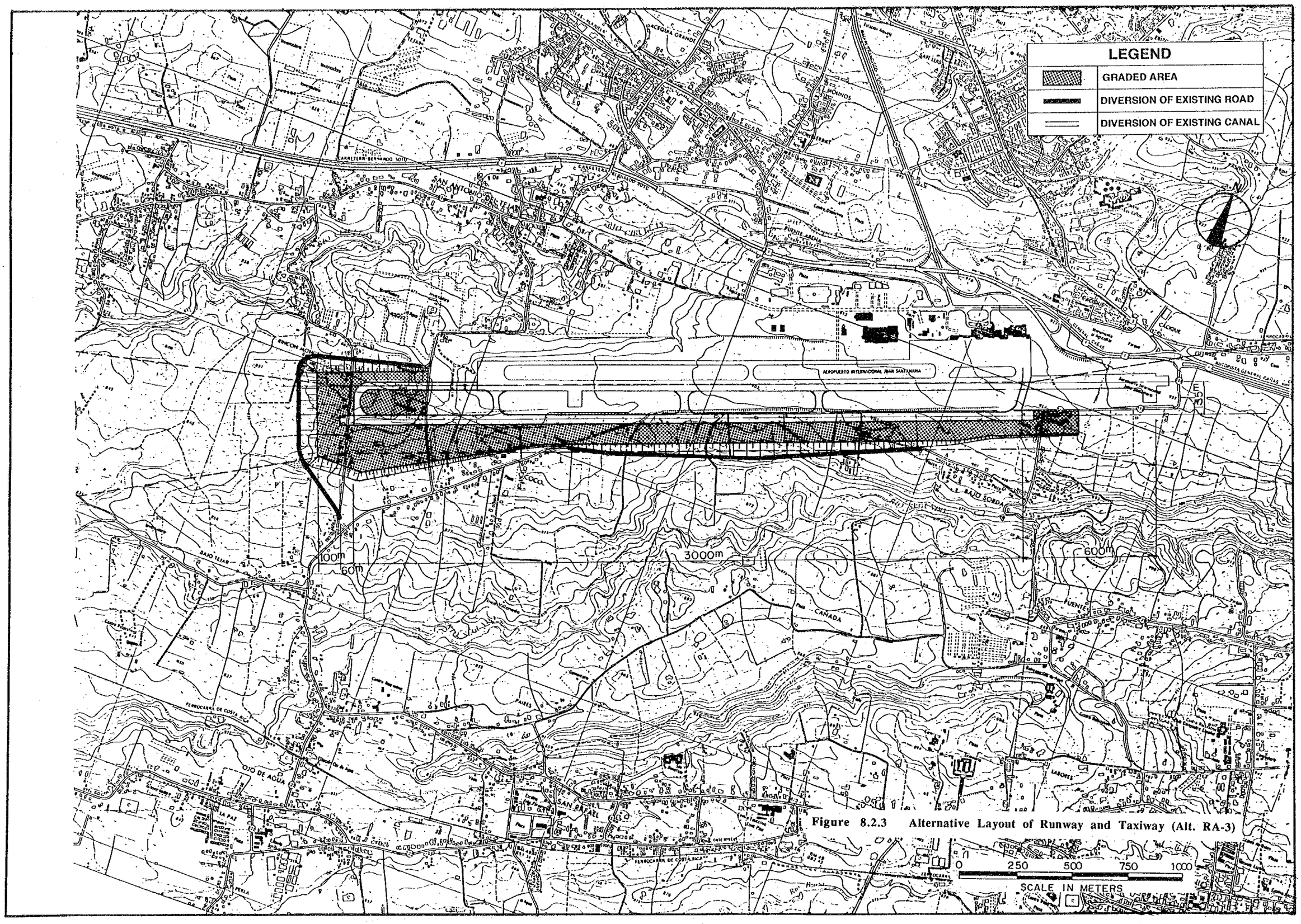


Figure 8.2.3 Alternative Layout of Runway and Taxiway (Alt. RA-3)

Alt. R-B1 (Continuous use of existing runway with taxiway improvement measures 1 plus 2 - addition of parallel taxiway to Runway 25 threshold and improvement of existing western section of parallel taxiway for use of wide-body jets: Figure 8.2.4)

The existing runway will continuously be used with a taxiway system improvement to increase runway capacity. A 1,000m long partial parallel taxiway will be constructed to connect the terminal area with the Runway 25 threshold. Due to the existence of the Pan-American Highway on the north side of the airport property, this taxiway will be constructed parallel with runway on the opposite side of the terminal area with a separation distance of 135m from the runway centerline. In addition, the 1,800m long western section of the existing parallel taxiway, which is not used by wide-body jet aircraft due to a substandard separation of 101m from the runway centerline, will be reconstructed at a location of 135m from the runway centerline (24m northward shift).

Alt. R-B2 (Continuous use of existing runway with taxiway improvement measure 1 - addition of parallel taxiway to runway 25 threshold: Figure 8.2.5)

The existing runway will continuously be used with minimum taxiway system improvements to increase runway capacity. A 1,000m long partial parallel taxiway connecting the terminal area with the Runway 25 threshold will only be constructed to avoid long runway occupancy of jet aircraft departing from Runway 25.

Alt. R-C (Continuous use of existing runway without any improvement: Figure 8.2.6)

No improvement will be carried out for the runway and taxiway system. In this alternative, the runway capacity will be saturated before 2005. Administrative measures such as restriction of general aviation aircraft during peak hours or allocation of aircraft stands to off-peak hours by the DGAC may be required in this alternative.

A table showing which existing problems will be solved in each alternative is as follows:

Table 8.2.1 Problems to be Solved by Alternative Layouts of Runway and Taxiway

Legend, O: Problem to be solved or no problem with existing facility
X: Problem cannot be solved

Problems			Alternatives for Layout of Runway and Taxiway					
			R-A1	R-A2	R-A3	R-B1	R-B2	R-C
Group A	1) Insufficient Width of Runway Strip		O	O	O	X	X	X
	2) Obstacles to 07 Take-off Climb Surface		O	O	O	X	X	X
	3) Obstacles to Transitional Surface		X	O	O	X	X	X
	4) Insufficient Separation Distance between Centerlines of Runway and Taxiway		O	O	O	O*	X	X
Group B	5) Runway Capacity	Year 2000	O	O	O	O	O	O
		Year 2010	O	O	O	O	O	X

Note: A part of the parallel taxiway, i.e., apron taxiway in front of the existing passenger terminal building will remain substandard.*

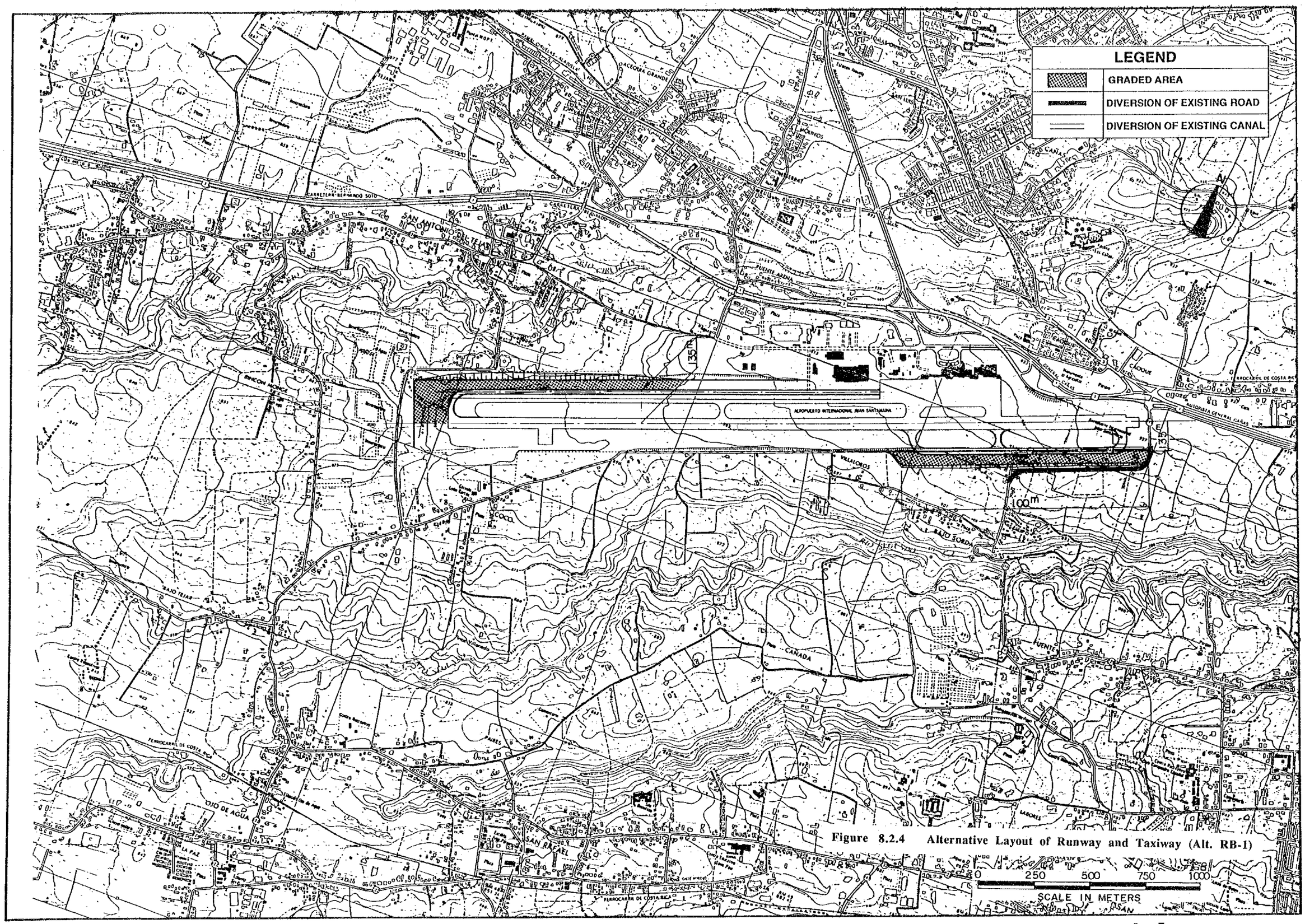


Figure 8.2.4 Alternative Layout of Runway and Taxiway (Alt. RB-1)

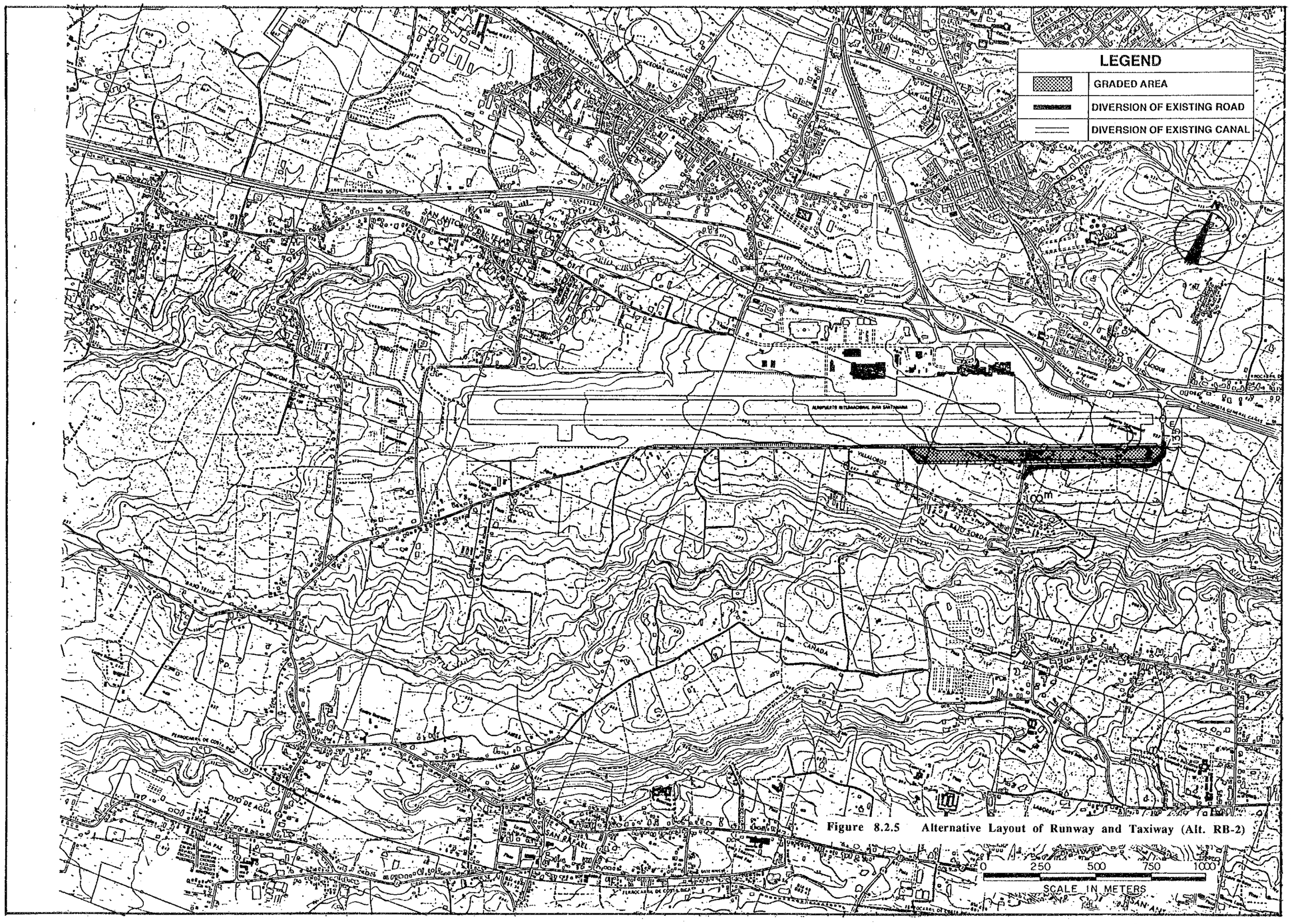


Figure 8.2.5 Alternative Layout of Runway and Taxiway (Alt. RB-2)

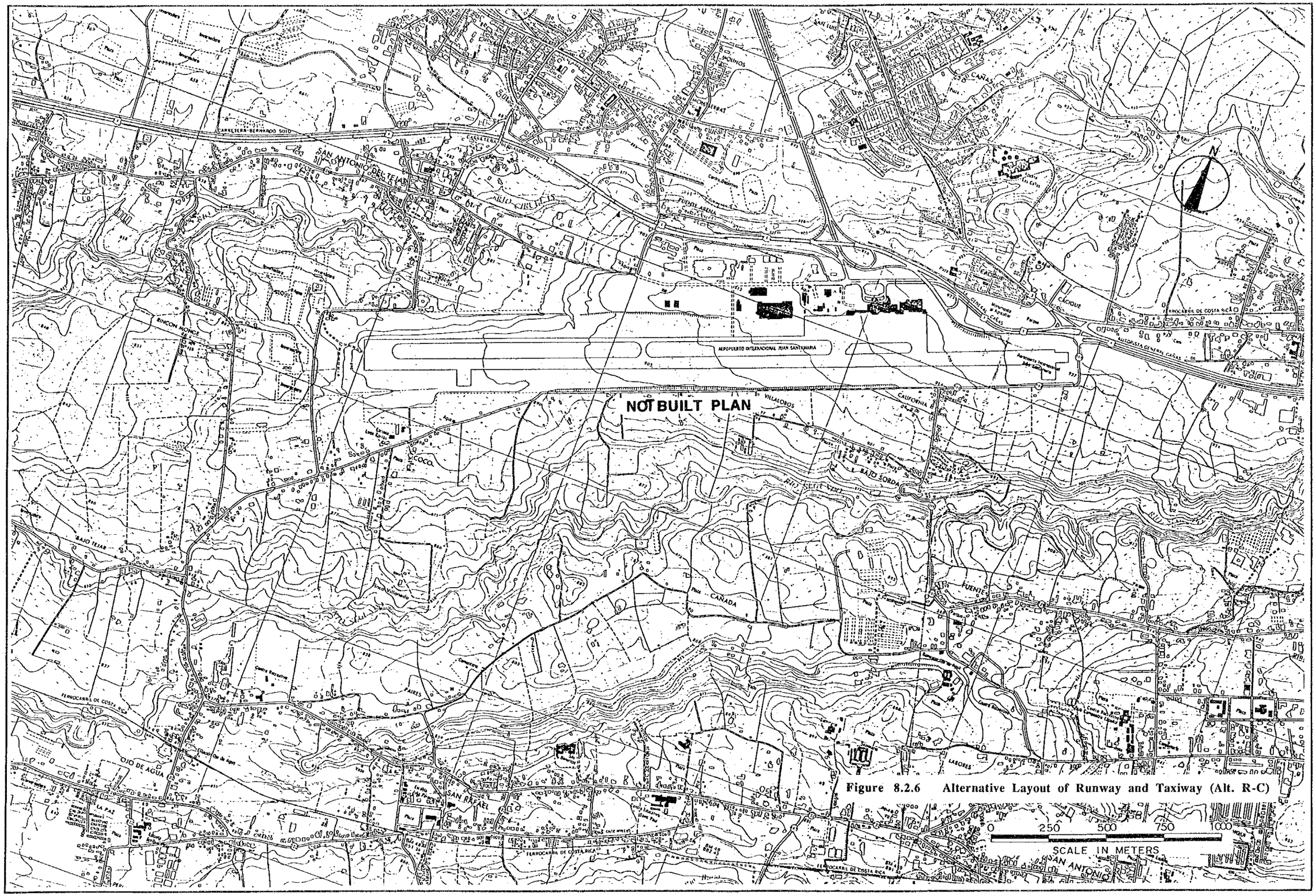


Figure 8.2.6 Alternative Layout of Runway and Taxiway (Alt. R-C)

2) Comparative Evaluation

The six alternatives were comprehensively evaluated from the following viewpoints:

- Conformity with International Standards
- Aircraft Operational Aspects
- Airport Expandability
- Construction Aspects

The details of the comparison are shown in Table 8.2.2. Alt. R-A3 was selected as the best alternative for the layout of runway and taxiway mainly for the following reasons:

- Safety of aircraft operations will be improved by complying with international standards.
- Least construction cost to achieve above objective
- The runway can be used beyond 2010 because of increased capacity.

3) Phased Implementation

Alt. R-A3 was selected in the previous sub-section as the best alternative for the runway. However, there is an important problem that should be solved together with the provision of the new runway. That is insufficient capacity of existing terminal facilities. As evaluated in Section 6.2, most terminal facilities including the apron, passenger terminal building, cargo terminal building, carpark, etc. need to be expanded immediately to cope with rapidly increasing air traffic. In relation to the expansion of the terminal facilities, continuous use of the existing runway during the short-term development period is practical for the following reasons:

- The construction of the new runway in Alt. R-A3 is desirable from the viewpoint of safe aircraft operations; however, its necessity from the viewpoint of capacity will become critical only around 2005. The terminal capacity problem is much more serious than the runway capacity problem at present.
- Simultaneous development of the new runway and terminal facilities will be very expensive and result in low cost-effectiveness.
- It is difficult to include the construction of the new runway in the short-term development because it is unlikely that it could be completed before 2000 even if it was decided to begin construction.

As a result, the layout plan of the runway and taxiway is recommended to follow the phased implementation shown below:

Short-Term Development Plan:	Alt. R-C	(Continuous use of the existing runway)
Long-Term Development Plan:	Alt. R-A3	(Construction of the new runway based on FAA standards)

Table 8.2.2 Comparative Evaluation of Alternative Layouts for Runway and Taxiway

Legend, ○ : Good, △ : Fair, × : Poor

	Item	Alt. R-A1	Alt. R-A2	Alt. R-A3	Alt. R-B1	Alt. R-B2	Alt. R-C
Outline of Alternatives	• Sketch						
	• Runway Strip	300m	300m	300m	150m	150m	150m
	• Approach Surface (Slope) - RWY07 - RWY25	2% 2%	2% 2%	2% 2.9% (trees to be felled)	2% 2.9% (trees to be felled)	2% 2.9% (trees to be felled)	2% 2.9% (trees to be felled)
	• Take-Off Climb Surface (Slope) - RWY 07 - RWY 25	2% 2%	2% 2%	2.9% (trees to be felled) 2%	2.9% (obstructed) 2%	2.9% (obstructed) 2%	2.9% (obstructed) 2%
	• Transitional Surface	1/7 (obstructed)	1/7	1/7	1/7 (obstructed)	1/7 (obstructed)	1/7 (obstructed)
	• Separation Distance between Centerlines of RWY and TWY	182.5m	182.5m	135m	135m	101m	101m
Conformity with International Standards	• Runway Strip	○ ICAO/FAA	○ ICAO/FAA	○ ICAO/FAA	× Substandard	× Substandard	× Substandard
	• Approach Surface - RWY 07 - RWY 25	○ ICAO/FAA ICAO/FAA	○ ICAO/FAA ICAO/FAA	○ ICAO/FAA FAA	○ ICAO/FAA FAA	○ ICAO/FAA FAA	○ ICAO/FAA FAA
	• Take-off Climb Surface - RWY 07 - RWY 25	○ ICAO/FAA ICAO/FAA	○ ICAO/FAA ICAO/FAA	○ FAA ICAO/FAA	× Substandard ICAO/FAA	× Substandard ICAO/FAA	× Substandard ICAO/FAA
	• Transitional Surface	× Wide body jet on existing apron protrudes upon the surface.	○ • ICAO/FAA	○ ICAO/FAA	× Many obstacles	× Many obstacles	× Many obstacles
	• Separation Distance between Centerlines of RWY and TWY	○ ICAO/FAA	○ ICAO/FAA	○ FAA	○ FAA	× Substandard	× Substandard
Aircraft Operational Aspects	• Runway Length - RWY 07 T/O - RWY 25 T/O - RWY 07 L/D - RWY 25 L/D	○ 3,000m 3,000m 3,000m 3,000m	○ 3,000m 3,000m 3,000m 3,000m	○ 3,000m 3,000m 3,000m 3,000m	△ 3,000m 3,000m 3,000m 2,400m	△ 3,000m 3,000m 3,000m 2,400m	△ 3,000m 3,000m 3,000m 2,400m
	• Runway Capacity	○ Beyond 2010	○ Beyond 2010	○ Beyond 2010	△ Up to 2010	△ Up to 2010	× Up to 2004
	• Runway Usability Factor	× 89.7%	△ 93.0%	× 89.7%	× 89.7%	× 89.7%	× 89.7%
	• Taxiway Distance (from existing terminal to farther towards threshold)	× 4,200m	× 4,200m	△ 3,200m	○ 2,600m	○ 2,600m	○ 2,600m
Airport Expandability	• Expandability of Terminal Area	○ Large	○ Large	○ Large	△ Medium	△ Medium	△ Medium
	• Provision of Actual Angle Exit Taxiway	○ Sufficient RWY/TWY separation	○ Sufficient RWY/TWY separation	× Insufficient RWY/TWY separation	× Insufficient RWY/TWY separation	× Insufficient RWY/TWY separation	× Insufficient RWY/TWY separation

Table 8.2.2 (Continued)

Legend, ○ : Good, △ : Fair, × : Poor

Item		Alt. R-A1	Alt. R-A2	Alt. R-A3	Alt. R-B1	Alt. R-B2	Alt. R-C
Construction Aspects	• Earth Work - Fill Volume - Cut Volume - Bank Height	× 23,250,000 m³ 24,700 m³ 45 m	× 27,000,000 m³ 22,000 m³ 55 m	△ 8,500,000 m³ 20,000 m³ 30 m	○ 1,100,000 m³ 78,000 m³ 20 m	○ 490,000 m³ - 15 m	○ Nil
	• Pavement Work	× 315,000 m²	× 405,000 m²	× 225,000 m²	△ 130,000 m²	○ 50,000 m²	○ Nil
	• Land Acquisition	× 125 ha	× 104 ha	△ 76 ha	○ 9 ha	○ 9 ha	○ Nil
	• Compensation - Houses - Road - Canal	× 110 houses 4.6 km Nil	× 150 houses 3.9 km 1.8 km	× 80 houses 3.0 km Nil	△ 40 houses 1.1 km Nil	△ 30 houses 1.1 km Nil	○ Nil Nil Nil
	• Difficulty of Work	× High embankment	× High embankment and temporary displacement of RWY 07 threshold	△ Medium-high embankment	○ No difficulty	○ No difficulty	○ Nil
	• Construction Cost (land preparation and RWY/TWY pavements only) (including compensation)	× US$ 400 million	× US$ 480 million	△ US$ 170 million	○ US$ 34 million	○ US$ 15 million	○ Nil
	• Construction Period	× 80 months	× 84 months	× 60 months	○ 30 months	○ 20 months	○ Nil
Overall Evaluation		Poor	Poor	Good	Poor	Poor	Fair
		• Very high construction cost • There is no remarkable merit over Alt. R-A3.	• Very high construction cost • There is no remarkable merit over Alt. R-A3.	• Best alternative which conforms to international standards though the construction cost is high. • Runway can be used beyond 2010.	• There is no remarkable merit over Alt. R-B2.	• This alternative is superior to Alt. R-C only after 2005. • Capacity improvement of runway is only effective until 2010.	• Possible alternative until the completion of Alt. R-A3. • Better than Alt. R-B1 and R-B2 until the capacity of the existing runway is saturated.

8.2.3 Terminal Area Development

1) Alternative Terminal Area Developments

Three alternatives, Alt. T-A, T-B and T-C, are considered for the development planning of the terminal area. The concept of Alt. T-A is ideal zoning of terminal facilities and Alt. T-B was prepared so that the existing terminal facilities may be utilized continuously as much as possible in the short-term. Alt. T-C was prepared by using merits of Alt. T-A and Alt. T-B. These three alternatives were planned to be free of the 1:7 transitional surface starting from the edge of the 150m wide strip in order not to worsen existing infringement of obstacles as shown in Figure 8.2.7. The short-term terminal area development based on the new runway location of Alt. R-A3 which will be completed in the long-term development cannot be allowed from the air safety aspect.

Alt. T-A (Figure 8.2.8)

The terminal area development in Alt. T-A assumes that the COOPESA hangar can be relocated in the short-term development in order not to hinder the westward expansion of the terminal area. This alternative allows an adequate layout of three major functional areas, i.e., passenger (P), cargo (C) and maintenance (M) facilities from the east to the west in order. The leather factory will not have to be relocated even in the long-term development.

Alt. T-B (Figure 8.2.9)

This alternative aims at maximum utilization of the existing facilities, and will cope with a situation in which the relocation of the COOPESA hangar and the automobile workshop cannot be carried out in the short-term development. This alternative generally follows a zoning of passenger (P), maintenance (M) and cargo (C) facilities from the east to the west. However, remote aircraft stands will be constructed on the west side of the maintenance area in the short-term development.

Alt. T-C (Figure 8.2.10)

This alternative also aims at utilization of the existing facilities as much as possible. However, the COOPESA automobile workshop and the leather factory will need to be relocated to outside of the airport in the short-term and the long-term development, respectively. This alternative allows an ideal zoning of passenger (P), cargo (C), and maintenance (M) facilities from the east to the west same as Alt. T-A. Since the layout of the apron spot is the same as Alt-B, remote stands will be constructed on the west side of the maintenance area in the short-term development.

Utilization of the existing and new apron is summarized in Figure 8.2.11.

A list of facilities to be constructed in the short-term development plans in each alternative is prepared in Table 8.2.3 to clarify the differences. The detailed explanation of the three alternatives is described in Table 8.2.4.

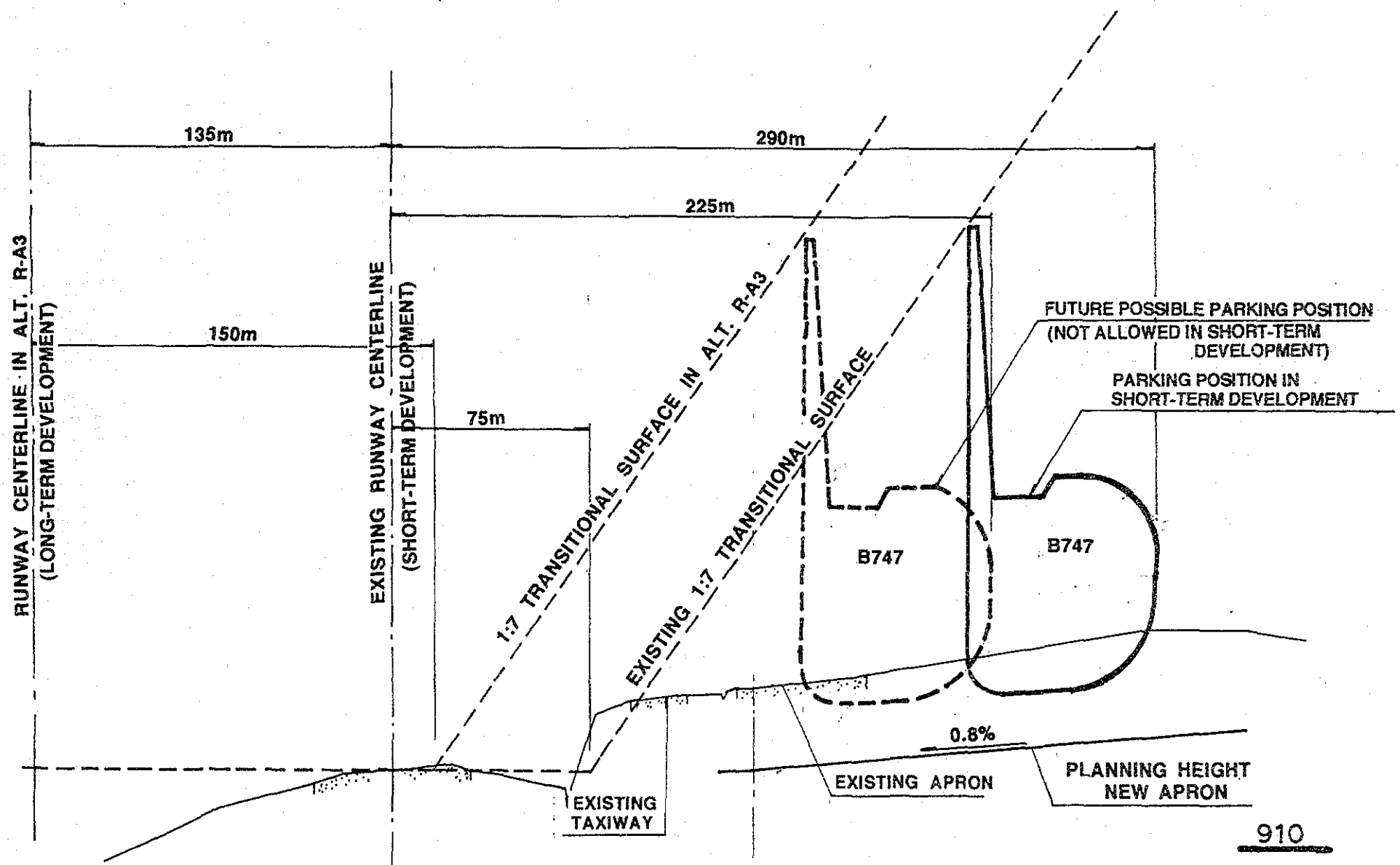


Figure 8.2.7 Obstacle Clearance Requirement for Terminal Area Development

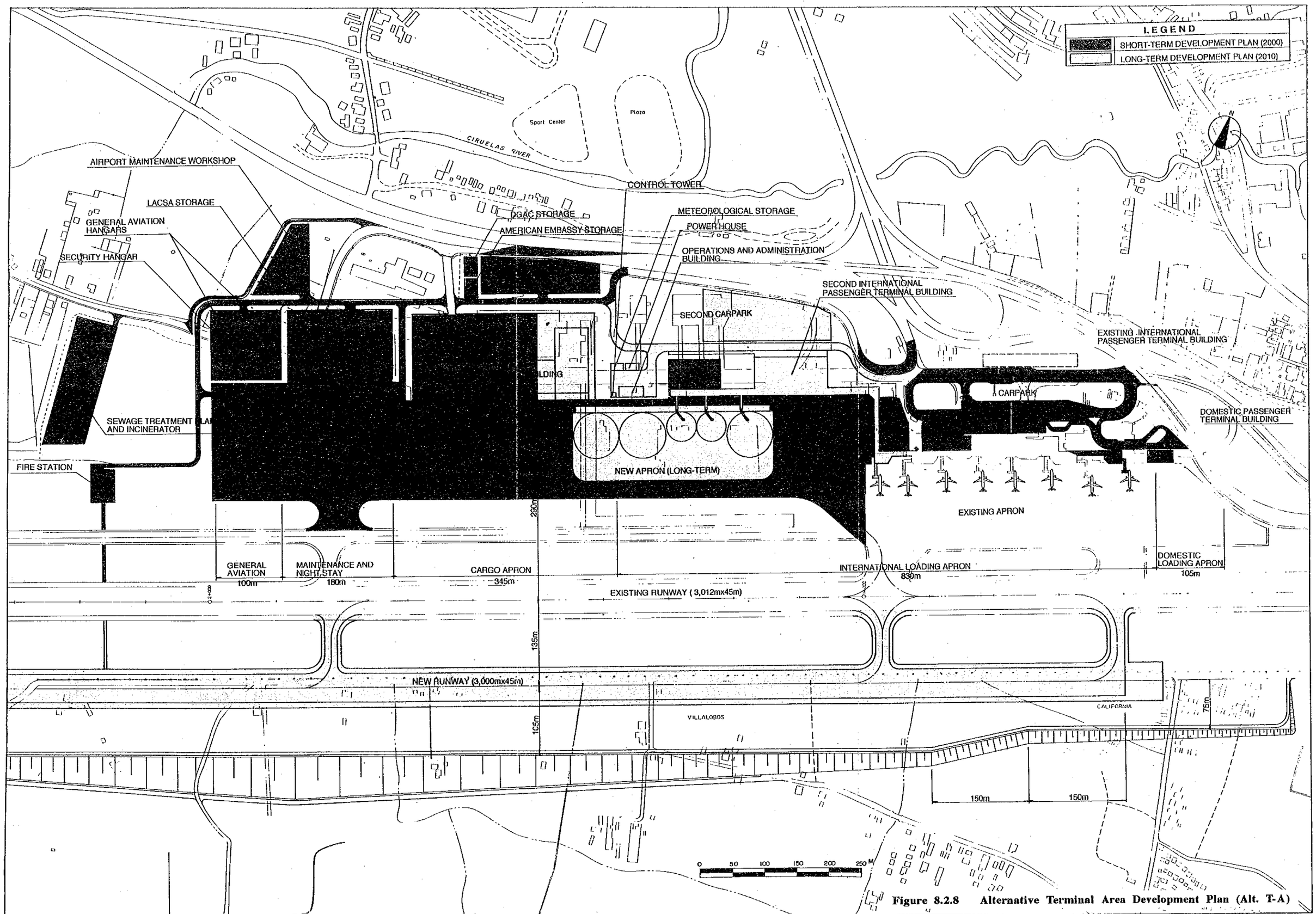


Figure 8.2.8 Alternative Terminal Area Development Plan (Alt. T-A)

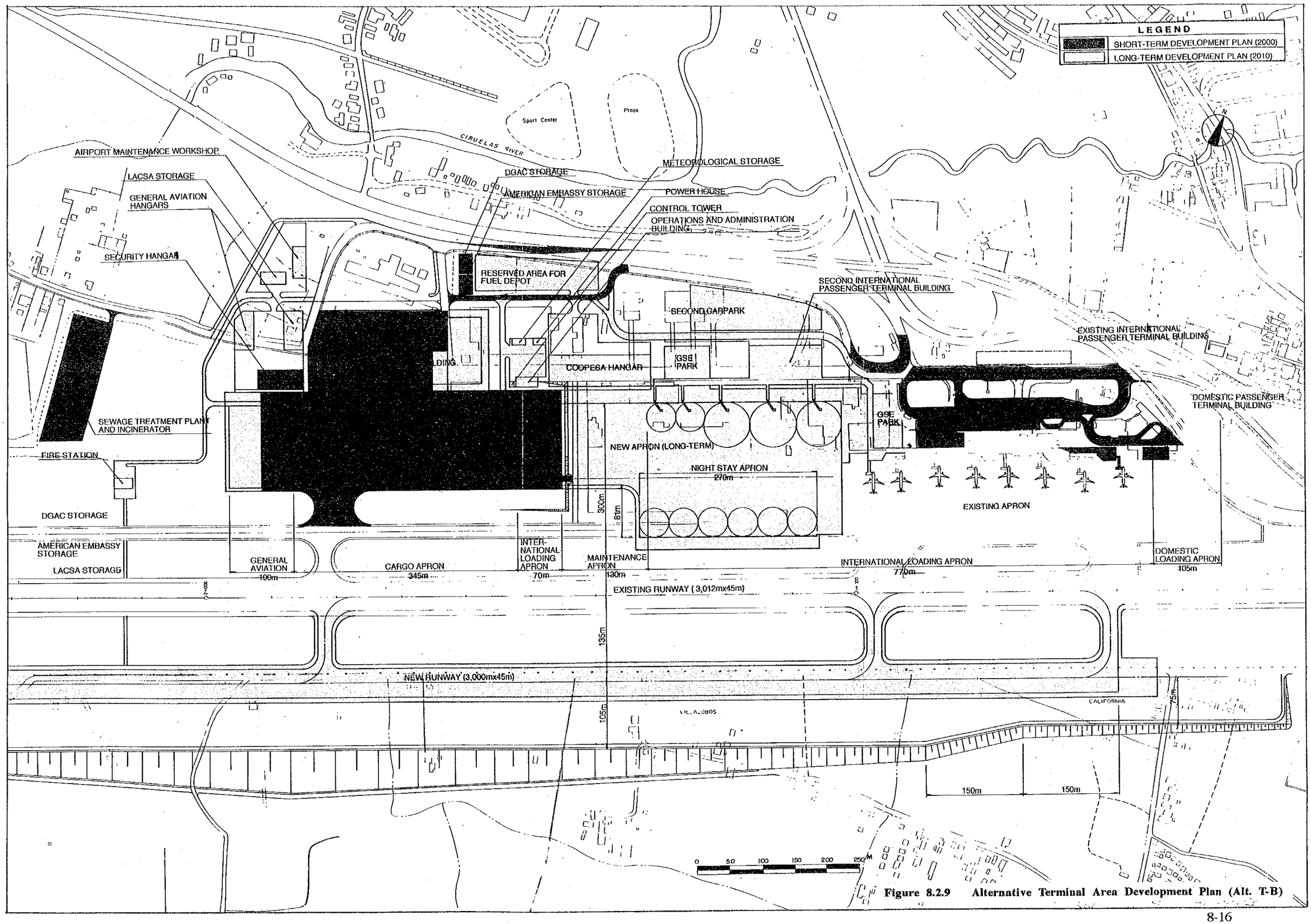


Figure 8.2.9 Alternative Terminal Area Development Plan (Alt. T-B)

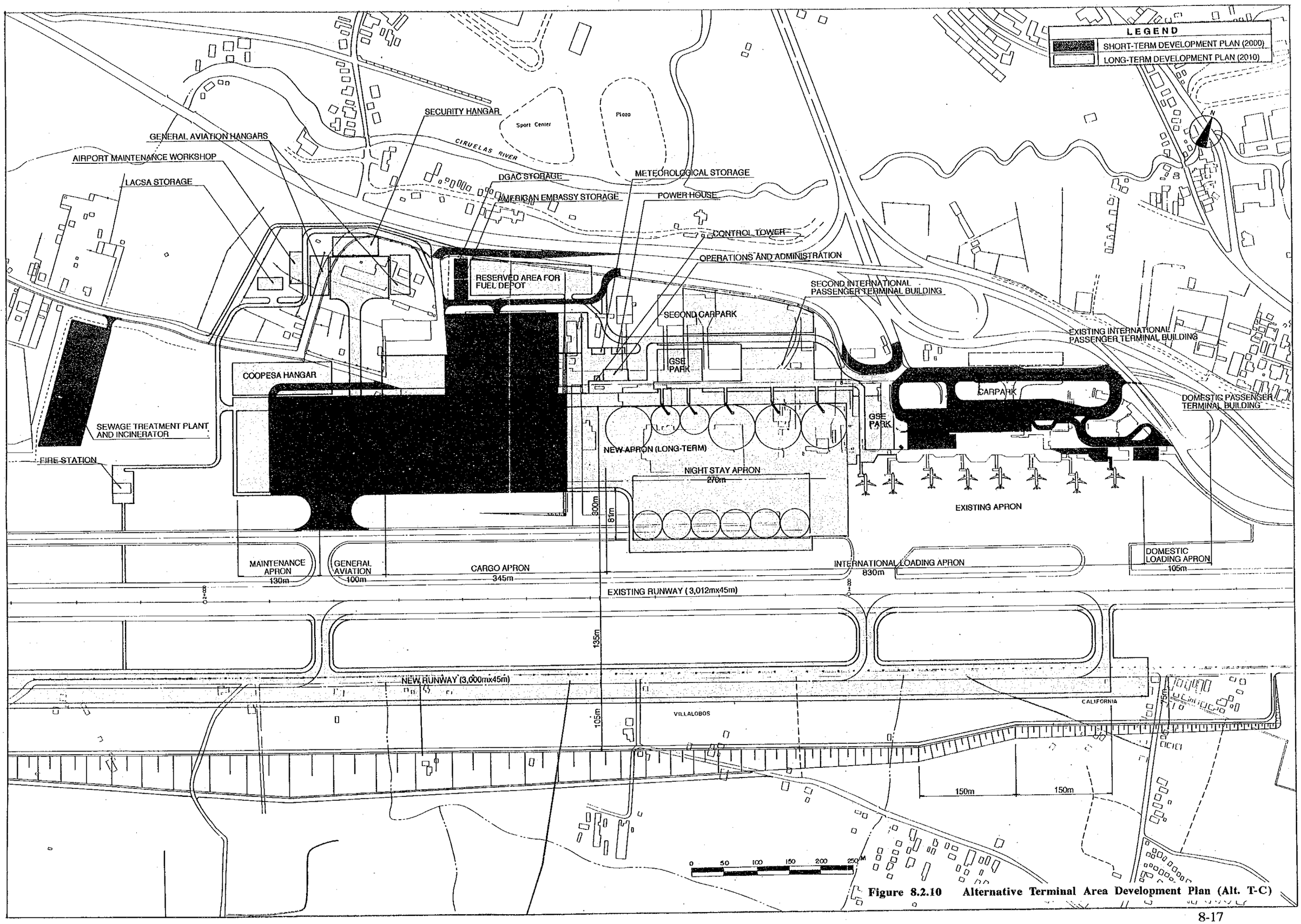
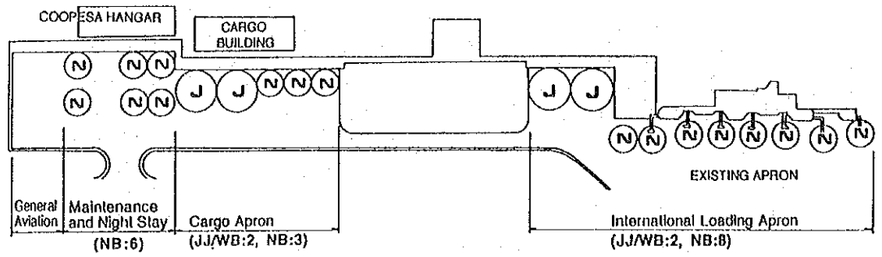
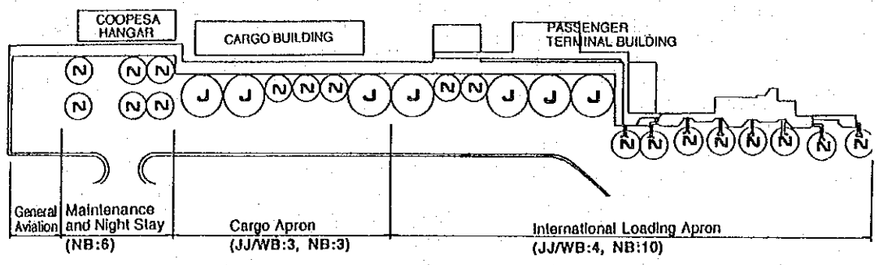


Figure 8.2.10 Alternative Terminal Area Development Plan (Alt. T-C)

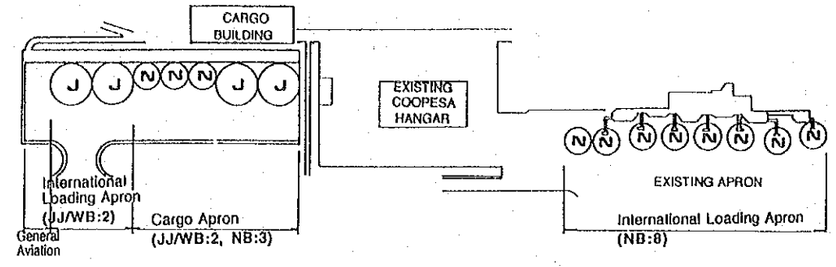


<Short - term Development>



<Long - term Development>

Alt.T-A



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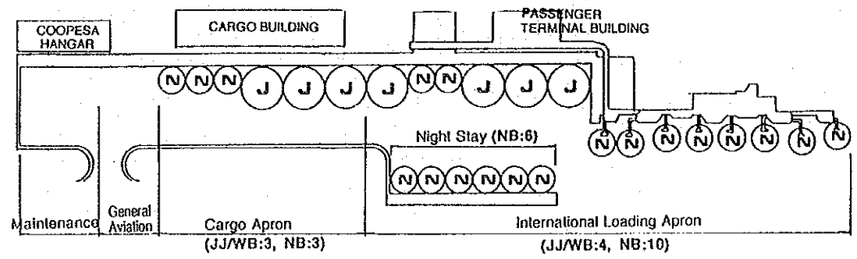

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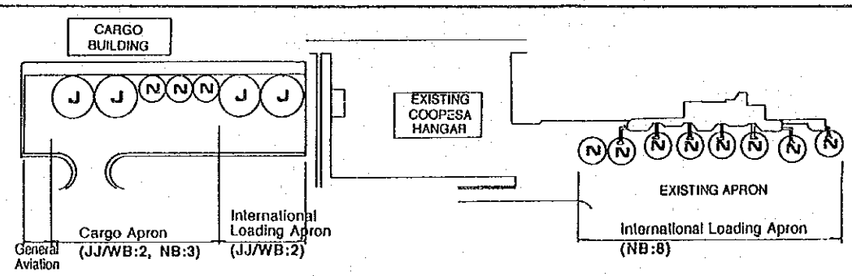
Alt.T-C



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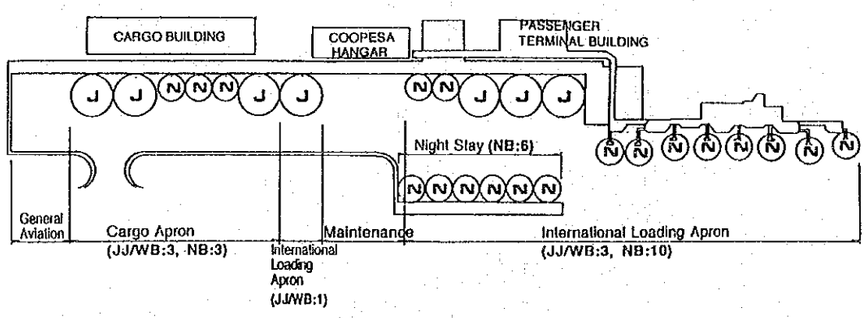

<Long - term Development>

Alt.T-B

LEGEND	
J	Jumbo Jet and Wide Body Jet
N	Narrow Body Jet

Figure 8.2.11 Comparison of Layout Plan

2) Comparative Evaluation

The three alternatives were comprehensively evaluated from the following viewpoints:

- Aircraft Operational Aspects
- Passenger and Cargo Handling Aspects
- Expendability and Flexibility of Facility Development
- Utilization of Existing Facilities
- Ease of Project Implementation
- Construction Cost

The details of the comparison are shown in Table 8.2.5. Alt. T-C was selected as an optimum alternative for the terminal area development mainly 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 is expected because of lower costs, no land acquisition and the least compensation in the short-term development.

8.2.4 Air Navigation System Development

All radio facilities in Juan Santamaria International Airport were installed before 1980. The life cycle of the radio navigation and telecommunication equipment is generally estimated to be fifteen to twenty years at the view point of reliability. Therefore, the existing air navigation facilities should be , in principle, replaced by the year of 2000 due to the saturation of operational life.

However, replacement of radio facilities should be implemented to maintain coordination with other related works in the project such as the new runway construction and the new operation building construction. Radio navigation aids for the new runway i.e. *ILS, VOR/DME* and *NDB*, which have been operated at the existing runway, should be replaced in the same stage as the new runway construction. The ATC facility should also be replaced along with the construction plan of the new operation building because of easy transition and change over operations to a new function.

1) Radio Navigation System

The existing radio navigation aids consisting of the ILS, VOR/DME, and NDB will be used until 2000. It is planned that all these radio navigation aids will be renewed together with the construction of the new runway in the long-term development.

Introduction of MLS will be a subject to be scheduled in the long-term development.

2) Air Traffic Control System

The Aerodrome Surveillance Radar (ASR) which is scheduled to be replaced by the COCESNA in 1992 will be used for the short-term and long-term development periods.

The existing Air to Ground radio, Automatic Terminal Information Service (ATIS) and tape recorder/reproducer will be replaced in the short-term development. The other ATC equipment, i.e. ATC console will be replaced in the long-term development.

3) Aeronautical Telecommunications System

The existing aeronautical telecommunication system can be used until the year 2000. The renewal of the existing equipment is planned for the long-term development.

4) Aeronautical Ground Lights

The additional taxiway and apron lighting required for the new terminal area is considered to be installed in the short-term development.

A lighting system for the new runway and taxiway lights for the parallel taxiway (existing runway) and expanded taxiway are required in the long-term development. A standard approach lighting system (ALS) for precision approach category I will be provided for the new runway 07. A simple approach lighting system (SALS) will also be provided for the new Runway 25.

5) Meteorological Observation System

The existing meteorological observation field which is located between the fire station and public car park will be relocated around touch down points of the runway to comply with the recommendation of ICAO Annex 3. All of the observation sensors and data processors will be replaced in the short-term development. A meteorological Office is planned to be located as a part of the new operation building.

A runway visual range (RVR) transmissometer and a ceilometer for cloud height measuring will be provided to the system, additionally.

A weather satellite NOAA receiver and radio sonde will also be replaced in the short-term development.

Table 8.2.3 List of Facilities to be Constructed in Each Alternative

Legend, ○ : Facility to be newly constructed.
△ : Expansion of Existing Facilities.
● : Utilization of Exisiting Facilities.
× : Relocation to Outside of Airport.

Facilities	Alt. T-A		Alt. T-B		Alt. T-C	
	Short-term Development	Long-term Development	Short-term Development	Long-term Development	Short-term Development	Long-term Development
Public Facitilies						
-Apron Int'l Loading	△ (Adjacent)	△	△ (Remote)	△	△ (Remote)	△
Overnight Stay	○	●	●	○	●	○
Cargo	○	△	○	△	○	△
Domestic	●	●	●	●	●	●
General Aviation	○	●	●	○	●	○
-Int'l Passenger Terminal Building	△	○ (2nd Bldg.)	△	○ (2nd Bldg.)	△	○ (2nd Bldg.)
-Dom. Passenger Terminal Building	○	●	○*	●	○	●
-Cargo Terminal Building	○	△	○	△	○	△
-Operations and Administration Building	●	○	●	○	●	○
-Control Tower	●	○	●	○	●	○
-Meteorological Office	●	○	●	○	●	○
-Carpark	△	○ (2nd Park)	△	○ (2nd Park)	△	○ (2nd Park)
-Fire Station	○	●	●	○	●	○
-Airport Maintenance Workshop	○	●	●	○	●	○
-Power House	○	△	●	○	●	○
-Sewage Treatment Plant	○	△	○	△	○	△
-Security Hangar	○	●	○*	●	●	○
-Storage(DGAC)	○	●	○	●	○	●
-Storage(Meteorological)	○	●	●	○	●	○
Private Facilities(Compensation)						
-Fuel Depot	○	△	●	○	●	○
-COOPESA Hangar	○	●	●	○	●	○
-General Aviation Hangar	○	●	●	○	●	○
-COOPESA Automobile Workshop	×		●	×	×	
-Leather Factory	●	●	●	●	●	×
-Storage(American Embassy)	○	●	○	●	○	●
-Storage(LACSA)	○	●	●	○	●	○

Table 8.2.4 Details of Alternative Terminal Area Development Plan

	Alt.T-A	Alt.T-B	Alt.T-C
1. Apron-int'l Loading	**Short-term** Two international passenger loading stands of B-747 size will be constructed on the west side of the existing international passenger terminal building. The landside edge of the apron will be 290m from the existing runway centerline to secure the 1:7 transitional surface from the existing 150m wide runway strip. Passengers using these stands will be transported to/from the existing terminal building by bus. The construction of this apron together with the new apron taxiway (part of parallel taxiway) will require relocation of the COOPESA hangar, fire station, fuel depot, general aviation hangars, etc. because lowering of apron elevation should be carried out to enable one level continuous apron in the future. Eight narrow-body stands are planned to be provided in front of the existing passenger terminal building. (Two DC-10s can be parked.) Of which, seven will have boarding bridges. **Long-term** The apron completed in the short-term development will be expanded to the west by adding 2 B-747 stands and 2 narrow-body stands.	**Short-term** Two international passenger loading stands of B-747 size will be constructed as remote stands on the west side of the existing COOPESA hangar. The land side edge of the apron will be 300m from the existing runway centerline to secure necessary separation distance for aircraft ground movements. This location is more or less the same as planned by the DGAC, and immediate construction without the relocation of the COOPESA hangar is possible. **Long-term** The lowering of ground level between the existing passenger loading apron and remote stands completed in the short-term development will be carried out, and 3 B-747 stands and 2 narrow-body stands will be constructed. One out of 2 remote stands completed in the short-term development will be used as an extra stand for passenger loading. (Another for cargo stand.)	**Short-term** Two international passenger loading stands of B-747 size will be constructed as remote stands next to the cargo apron prepared on the west side of the existing COOPESA hangar. **Long-term** The existing apron will be lowered to the same level as the remote stands completed in the short-term development, and 4 B-747 stands and 2 narrow body stands will be constructed. 2 remote stands completed in the short-term development will be used as maintenance apron and general aviation.
2. Apron-Overnight Stay	**Short-term** Six narrow-body stands will be constructed for aircraft overnight stay in front of the new COOPESA hangar. Every 2 aircraft will be parked in a file to save apron space. **Long-term** No additional requirement is expected.	**Short-term** Six narrow-body jet aircraft which will be crowded out from passenger loading apron during night will be parked around the COOPESA hangar and domestic terminal building as practiced at present. **Long-term** Six narrow-body stands will be constructed between the new apron taxiway and new parallel taxiway. (The existing runway will be used as parallel taxiway when the new runway is completed in the long-term development.)	The same concept as Alt.T-B will be applied.
3. Apron-Cargo	**Short-term** Five cargo aircraft stands, 2 for B-747 and 3 for narrow-body jets will be constructed on the west side of the COOPESA hangar. This location will enable immediate construction of cargo apron without waiting for the relocation of the COOPESA hangar. **Long-term** The cargo apron will be expanded to the east by adding one stand of B-747 size.	**Short-term** Five cargo aircraft stands will be constructed on the west side of the remote stands for passenger loading. **Long-term** One out of 2 remote stands completed in the short-term development for passenger loading will be used for the additional cargo stand required in the long-term development.	**Short-term** Five cargo aircraft stands will be constructed on the west side of the existing COOPESA hangar. **Long-term** One additional B-747 stand will be constructed on the west side of the international loading apron.
4. Apron-Domestic	**Short-term** The existing aircraft stands for cargo aircraft will be used for parking area for 3 domestic passenger aircraft **Long-term** No additional requirement is expected.	The same concept as Alt.T-A will be applied.	The same concept as Alt.T-A will be applied.