7.4 AIRPORT DEVELOPMENT MASTER PLAN

7.4.1 Summary

Master planning for development of Tacloban Airport was conducted in the First Study Work in Japan. This section summarizes the results of the master planning.

This master plan was prepared based on a set of air traffic demand forecasts and future facility requirements described in Chapters 3 and 4 respectively. Target years of the master planning are;

a) Medium Term Development : Year 2005, and

b) Long Term Development : Year 2015.

As a first step of the master planning study, two alternative development plans of the existing Tacloban Airport were prepared. These alternative plans were, then, comparatively evaluated, and the development scheme shown in Figure 7.4.1 was selected as the optimum development plan for Tacloban Airport. Table 7.4.1 summarizes outline of airport development works.

Planning of airspace use, cost estimates, initial environmental evaluation, economic analysis and financial analysis were conducted based on the optimum development plan to confirm viability of the development.

As a result of the study it is concluded that the development of the existing Tacloban Airport to accommodate the anticipated traffic in the year 2015 is economically and financially feasible. Special attention and care from the environmental protection viewpoint are required during the preparation and implementation of the development since there is a mangrove area to the northwest of the existing airport.

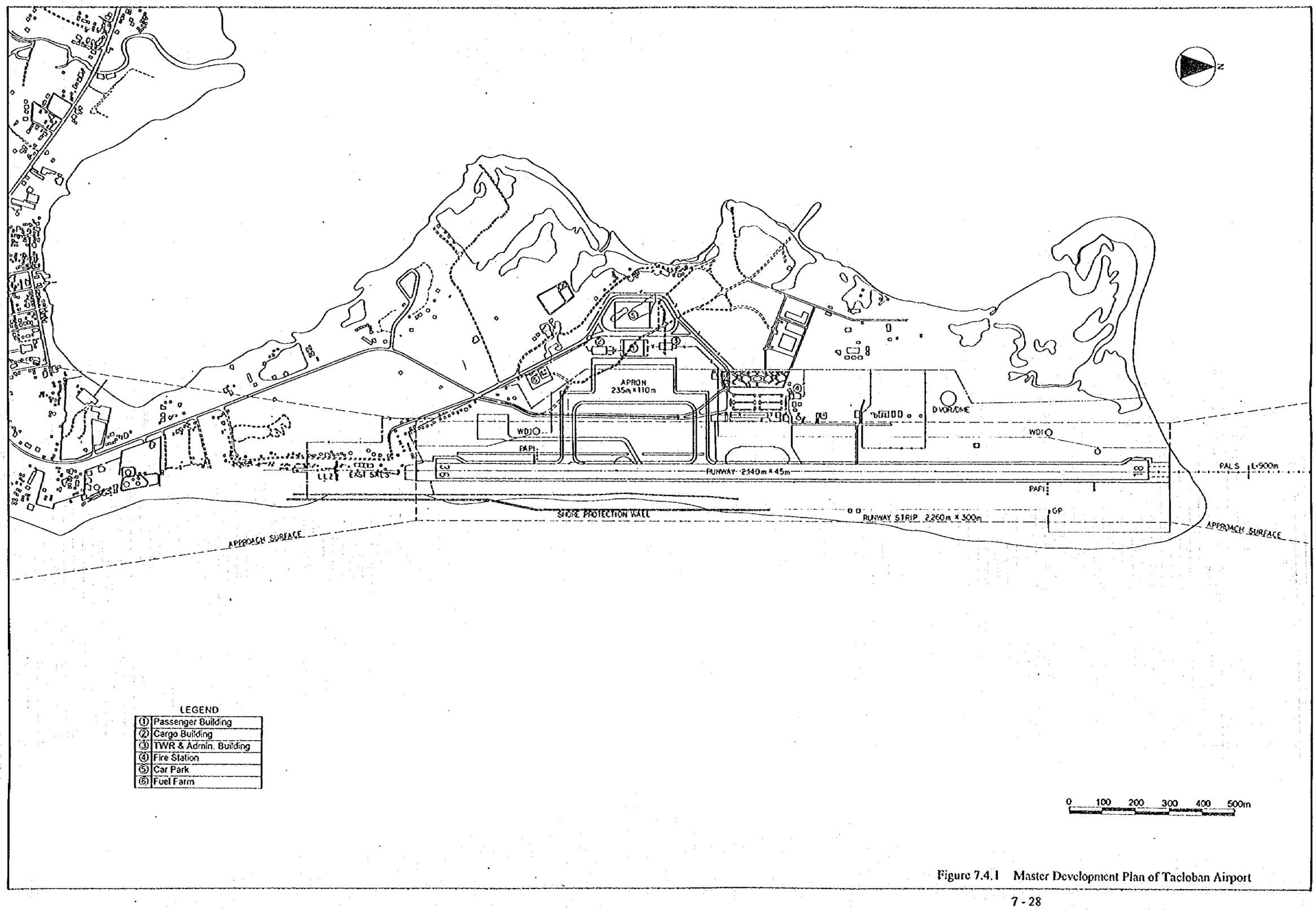


Figure 7.4.1 Master Development Plan of Tacloban Airport

Table 7.4.1 Outline of Tacloban Airport Development

Item	Medium Term	Long Term
Shore Protection Wall	1,450m	-
Earthworks	Cut 40,000 m^3, Fill 270,000 m^3	-
Runway	Asphalt overlay 8 cm	-
Taxiway	New taxiway 17,000 m^2	-
Apron	New apron 26,000 m^2	-
Passenger Terminal Building	New building 4,800 m^2	Expansion 1,200 m^2
Cargo Terminal Building	New building 840 m^2	Expansion 360 m^2
Administration Building	New building 1,800 m^2	-
Control Tower	New building	-
Fire Station	New building 550 m^2	-
Car Park	New car park 8,400 m^2	Expansion 2,100 m^2
Roads	6.0 km	-
Air Navigation Systems	ILS Cat I, PALS, etc.	-
Fuel Supply Facility	New facility 300 kl	Expansion 100 kl
Obstacle Removal	Terminal Building, Control Tower, Fire Station, etc.	-
Land Acquisition	15 ha	-
Diversion / Relocation	73 houses	-

7.4.2 Alternative Airport Development Plans

1) Constraints and Policy of Planning

As mentioned in the previous section, Tacloban Airport is located at the east coast of Cataisan Peninsular, and facing the sea on the north and east. Therefore, major development areas are practically limited to the west and south of the runway.

It is assumed that the following will be completed before the Medium Term Development.

a) rehabilitation of SALS,
b) rehabilitation of PAPI power line,
c) construction of shore protection at the existing alignment,
d) installation/replacement of PC/fax machine, VSAT, D-VOR/DME including their shelter and site preparation.

The following policies are applied for planning of the Tacloban Airport development.

a) The airside facilities should comply with international standards.

b) The landside facilities including terminal buildings should be developed to cope with local needs.

c) The existing facilities should be used effectively to optimize the development cost.

d) The existing airport boundary and magnitude of relocation of houses should be considered in facility layout planning.

e) Existence of Mangrove area near the airport should be taken into account in the facility layout planning.

2) Formulation of Development Alternatives

(1) Runway

The existing runway will require strengthening of the pavement to cope with heavier aircraft such as A320 and A300. Required thickness of asphalt overlay would be about 8cm (refer to Appendix 7.4.1 for details).

(2) Runway Strip

Figure 7.4.2 shows the runway strips of 150m and 300m wide. As seen, the 300m wide runway strip is almost within the existing airport property line. Relocation of the shore protection wall will be required in the both cases since it is located about 70m from the runway center line. The existing control tower and aircraft on the existing apron penetrate the transitional surface in the both cases.

From the above findings, it is recommended to widen the runway strip to 300m, although it will require a reclamation of about 2ha more area to provide graded area shown in Figure 7.4.2.

(3) Air Navigation Systems

A Doppler VOR and DME are assumed to be installed before the Medium Term Development at about 600m inside from the Runway 18 threshold and about 220m west of the runway center line taking account of the site condition and future development plan of the airport. Wind coverage of Runway 18 and 36 are 92.5% and 88.0% respectively at the maximum 20kt cross wind and 5kt tail wind. Therefore, it is recommend to install ILS for Runway 18 approach, and locations of glide path (GP) and localizer (LLZ) antennas and their critical areas are planned as shown in Figure 7.4.3.

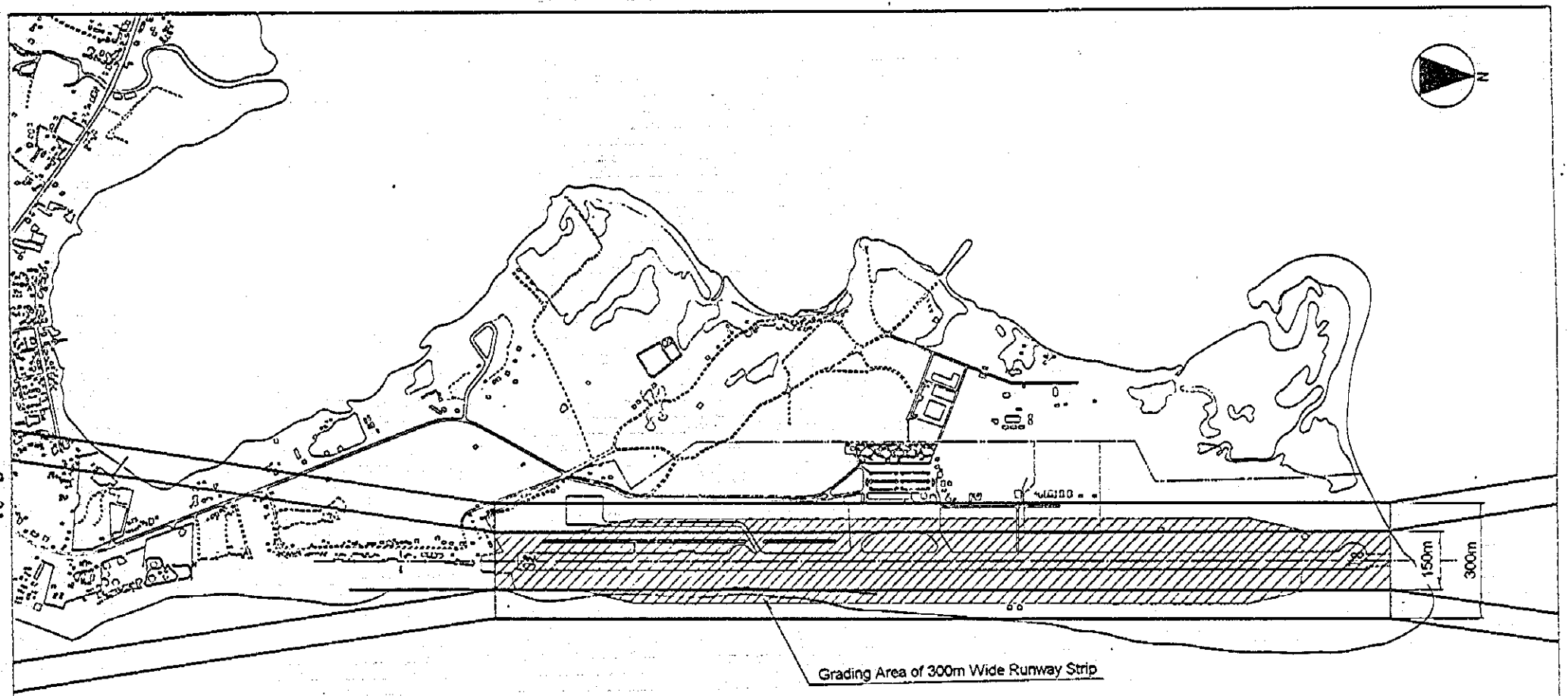
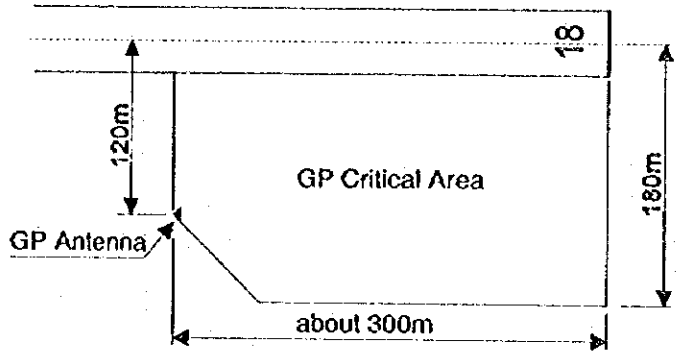
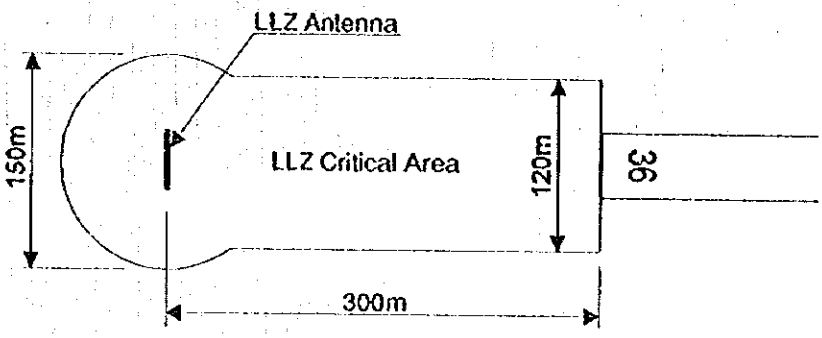


Figure 7.4.2 150m and 300m Wide Runway Strips



Glide Path Antenna and Critical Area



Localizer Antenna and Critical Area

Figure 7.4.3 Proposed Locations of Air Navigation Systems

(4) Aircraft Parking Configuration

A nose-in / push-out aircraft parking configuration, which normally associates with passenger loading bridges, is recommended for the following reasons.

a) Passenger loading bridges will improve safety on the apron, minimize the turnaround time and provide better passenger service.

b) A nose-in parking configuration requires wider separation distance between runway and terminal building than a self-maneuvering angled or parallel parking configuration. Therefore, it is not easy to adopt nose-in parking configuration at a terminal which is designed for angled or parallel parking.

Typical separation distance between the runway center line and passenger terminal building is set at 350m so that the tail wing of A300 does not infringe the transitional surface from the 300m wide runway strip.

(5) Location of Terminal Area

As the existing apron will be in the 300m wide runway strip, new terminal area needs to be developed. Possible locations of the new terminal areas are (refer to Figure 7.4.4);

a) Alternative T1: on the south of the existing terminal area; and

b) Alternative T2: on the north of the existing terminal area.

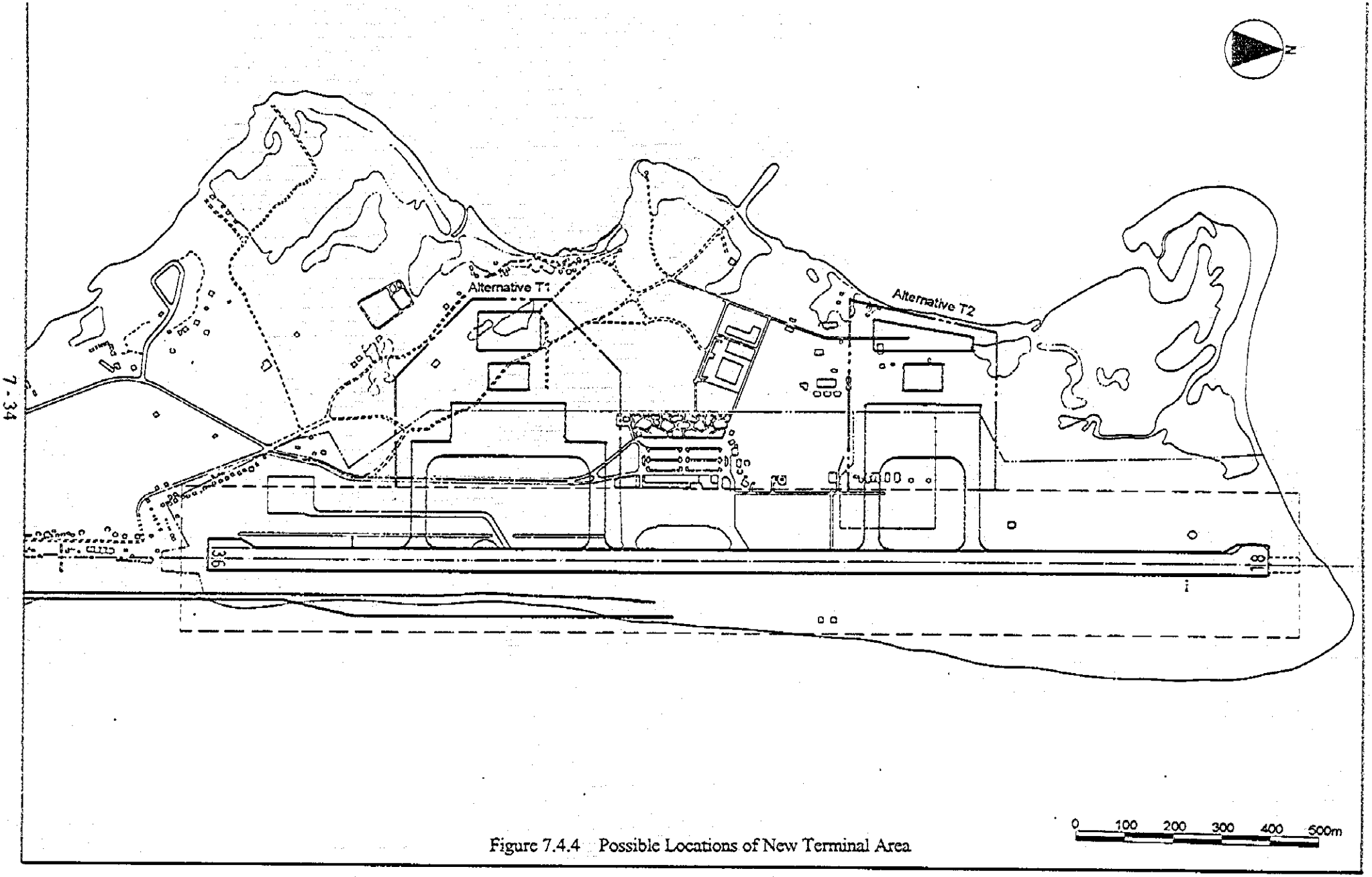


Figure 7.4.4 Possible Locations of New Terminal Area

7.4.3 Selection of Optimum Development Plans

Two alternative development plans formulated in Section 7.4.2 are evaluated from the various viewpoints. The following sections summarize the evaluation results.

1) Convenience of Users

Terminal area of Alternative T1 is about 800m closer to the city center than Alternative T2, and will be convenient for airport access.

2) Operational Conditions

Terminal area of Alternative T2 is located near the threshold of the main approach runway. Therefore, taxing distance of departing aircraft (which are heavier and require more fuel for taxiing) will be shorter in average than the case of Alternative T1.

It should, however, be noted that most of the aircraft landing from Runway 18 (main approach runway) under the dry condition would be able to get into the terminal area without turnaround at the Runway 36 end in the case of Alternative T1. Therefore, taxing distance of arriving aircraft and total runway occupancy time will be shorter in average in the case of Alternative T1.

3) Expandability

Western edge of the terminal area of Alternative T2 faces to the sea shore, and there is a mangrove area on the north of the new terminal area. Therefore, the future expansion will be limited to the southern area. With regard to Alternative T1 there is no limitation in direction of the terminal area expansion in the future.

4) Environmental Considerations

In Alternative T2, the new terminal area is located close to the mangrove area. There will, therefore, be more threat to the natural environment in the case of Alternative T2.

In addition, Alternative T2 will require relocation of more inhabitants than the case of Alternative T1. Therefore, it has larger potential of social and cultural maladjustment to the new settlement site.

5) Project Cost and Ease of Construction

Cost of land acquisition and compensation of Alternative T1 will be slightly less than that of Alternative T2 because of less number of houses to be relocated.

Table 7.4.2 Comparison of Cost (unit : PHP million)

Item	Alternative T1	Alternative T2
Land Acquisition	0.2	0.1
Compensation for Houses	0.2	1.6
Total	0.4	1.7

6) Conclusion

Table 7.4.3 summarizes relative advantages of alternatives.

Table 7.4.3 Relative Advantages of Alternatives

Item	Alternative T1	Alternative T2
1)Convenience of Users	- 800m closer to city center.	-
2)Operational Conditions	- Shorter average taxing distance for arriving aircraft. - Shorter total runway occupancy time.	- Shorter average taxiing distance for departing aircraft.
3)Expandability	- No limitation in direction of future expansion.	-
4)Environmental Considerations	- Less threat to the mangrove area. - Less relocation of inhabitants.	-
5)Project Cost and Ease of Construction	- Slightly less project cost.	-

As a conclusion, Alternative T1 is selected mainly for the following reasons:

a) Number of inhabitants to be relocated will be less than the other alternative.

b) The terminal area is closer to city center, and it is better for airport accessibility.

c) There will be less threat to the mangrove area near Runway 18 end.

7.4.4 Planning of Airspace Use

1) Existing Airspace Use

(1) Control Zone (CTR) and Aerodrome Traffic Zone (ATZ)

A controlled zone and an aerodrome traffic zone are established with dimensions as shown in Table 7.4.4 at this airport.

Table 7.4.4 Dimensions of CTR and ATZ at Tacloban Airport

TOWER	HOURS (UTC)	LATERAL LIMITS	UPPER LIMIT(ft)	LAN-GUAGE	REMARKS
1	2	3	4	5	6
TACLOBAN TOWER	2030-1200*	CTR: Circle, 10 NM radius centered on TACLOBAN VOR/DME (11 13 09 N 125 01 35 E)	1,500 ft.	En	Instrument / Visual flts. are controlled. CTR controlled by TACLOBAN APP.
		ATZ: Circle, 5 NM radius centered on ARP (11 13 59 N 125 01 36 E).	Up to but excluding 2,000 ft.		VFR, aerodrome traffic are controlled. Acft with IAS of 200 knots shall not penetrate ATZ without ATC authorization.

(2) Instrument Flight Procedures

An instrument approach procedure using VOR for Runway 36 is established as shown in Figure 7.4.5. Straight-in approach to Runway 18 is not established due to obstacles.

Standard instrument departure (SID) routes are not published in the AIP. However, actually three SIDs are cleared to aircraft departing from the airport as shown in Table 7.4.5. These SIDs should be authorized and published in the AIP after flight calibration tests.

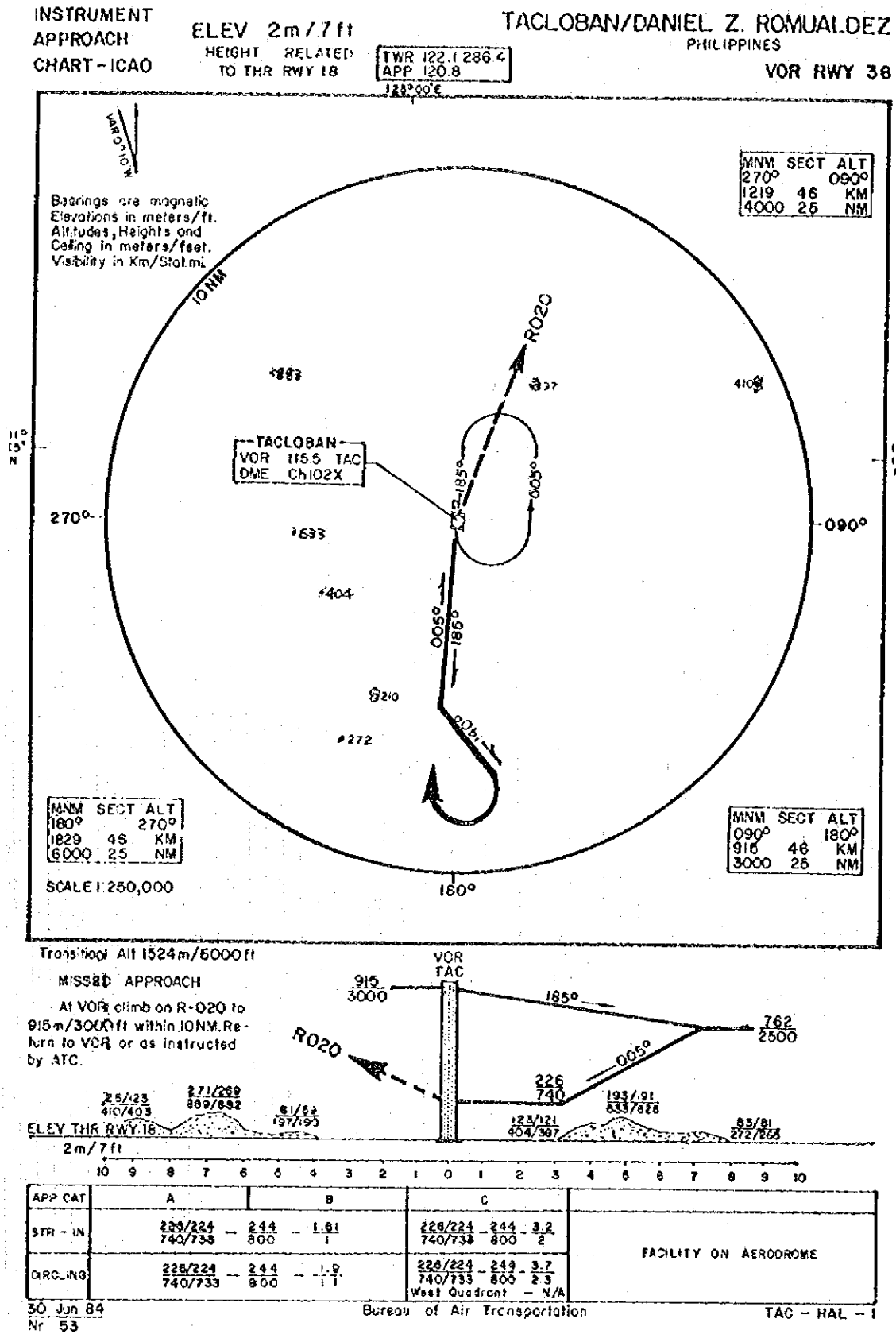


Figure 7.4.5 Instrument Approach Procedure: VOR RWY 36

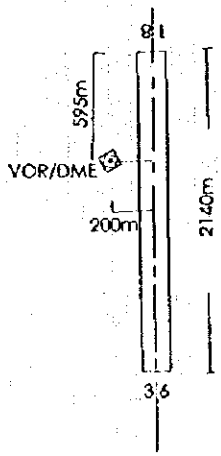
Table 7.4.5 SIDs Actually Cleared by ATC at Tacloban Airport

SID No. 1	Take off runway 36 turn left; Take off runway 18 right turn within 5nm; Climb via R-310 of Tacloban VOR/DME to Masbate VOR. Cross Masbate VOR at an assigned altitude or an altitude specified by ATC.
SID No. 2	Take off runway 36 right turn within 5nm; Take off runway 18 left turn; Climb via R-229 of Tacloban VOR/DME to Mactan VOR. Cross Mactan VOR at an assigned altitude or an altitude specified by ATC.
SID No. 3	Take off runway 36 right turn within 5nm; Take off runway 18 left turn with 5nm; Cross Tacloban VOR/DME at an assigned altitude or an altitude specified by ATC.

2) Modification of Existing Airspace Use

Modification of existing airspace use is planned with the following assumptions.

a) Existing VOR/DME will be relocated to 11°13'58"N/125°01'29"E. Relationship between new VOR/DME and runway is as shown below.



b) Legaspi VOR/DME will also be relocated to 13°09'55"N/123°44'42"E as planned in Chapter 8.

(1) Terminal Control Area (TMA)

Figure 7.4.6 shows the new Terminal Control Area for Tacloban Airport. Some minor changes are made based on the relocation of Tacloban VOR/DME.

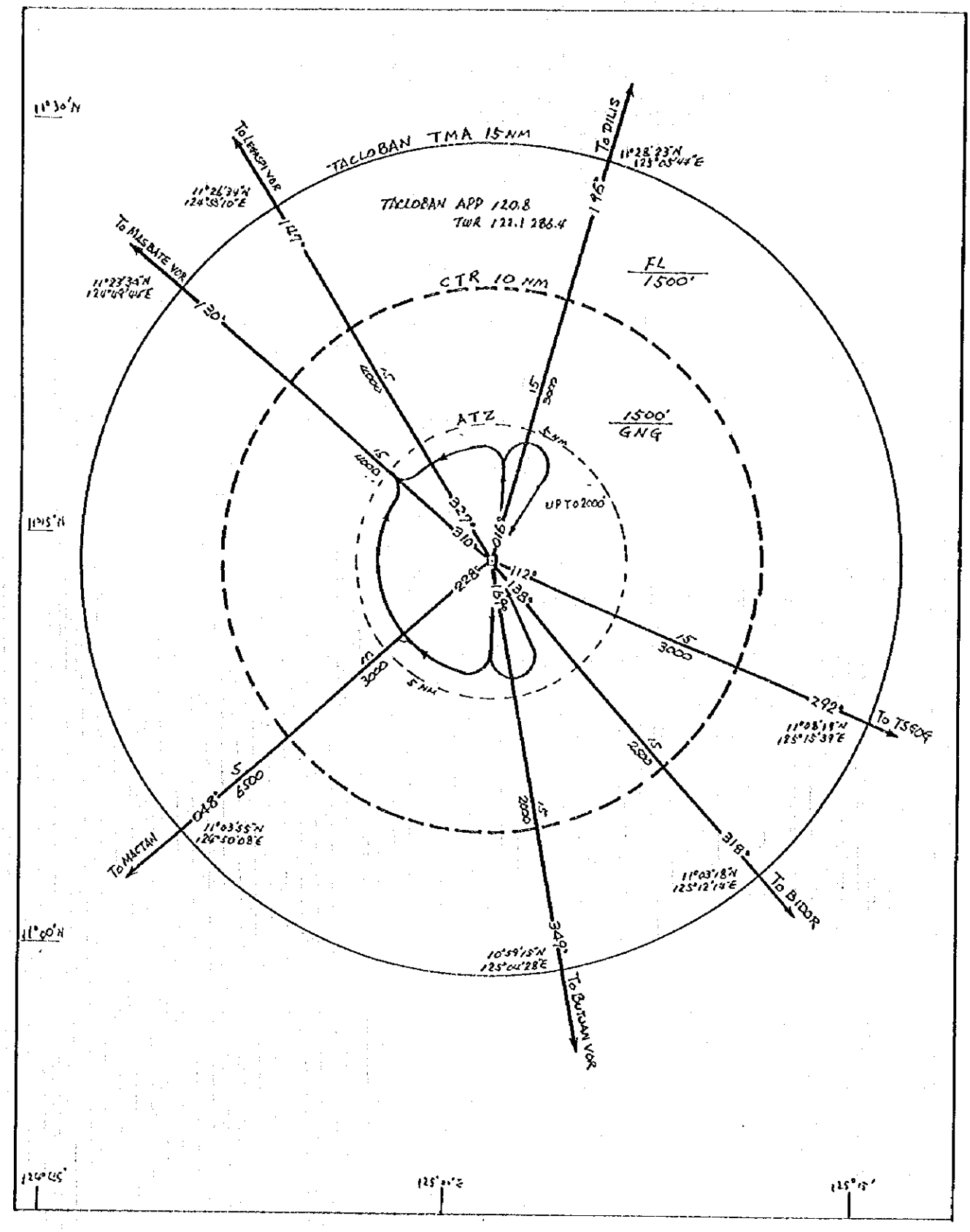


Figure 7.4.6 Suggested Terminal Control Area for Tacloban Airport

(2) Instrument Approach Procedure

The existing instrument approach procedure of VOR RWY 36 shown in Figures 7.4.5 can be used with adjustment of the intermediate and final course from 185° and 005° to 180° and 360° respectively. No change will be required in the obstacle clearance altitude (OCA) for each procedure.

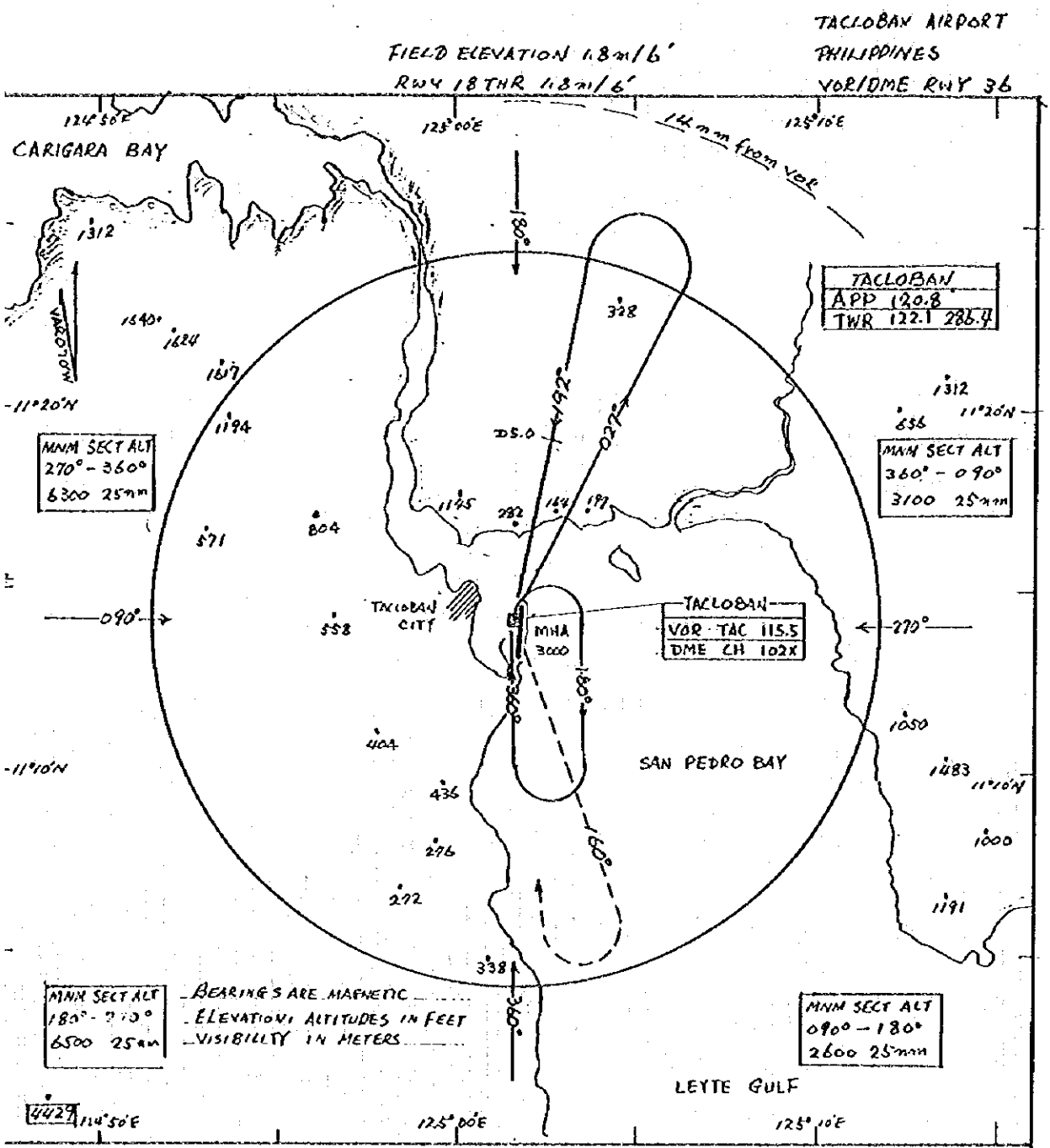
From a study using geographical maps of scales 1:250,000 and 1:50,000, it is considered possible to establish an approach procedure for Runway 18 using VOR/DME as shown in Figure 7.4.7.

(3) Standard Instrument Departures

Standard instrument departure routes described in Table 7.4.5 can be used with modification of R-229 in SID No. 2 to R-228. Weather minimum for takeoff from Runways 18 and 36 will be 300 feet ceiling and 1,000m visibility provided that takeoff alternate airport is filed.

(4) ILS Approach Procedure

Instrument approach procedure ILS RWY 18 can be established without major restriction, because no significant obstacle is found in the final approach area with final course of 004° on the geographical map with scale of 1:50,000.



	A OCA - VIS	B OCA - VIS	C OCA - VIS	D OCA - VIS	REMARKS
STA to RWY 18	640' - 1200m			640'-1400m	* Circling is restricted to the east side of runway only.
CIRCLING *	640'-1900m	680'-2800m	780'-3700m	1420'-4600m	

Figure 7.4.7 Proposed VOR/DME RWY 36

7.4.5 Cost Estimates

A preliminary cost estimate of the master plan has been prepared based on the following conditions:

a) Construction costs were estimated based on the 1996 prices.

b) Exchange rates were fixed at US$ 1.00 = PHP 26.00 = Yen 110.

c) Price escalation (inflation) was not included.

d) Cost for engineering services was estimated to be about 10% of the construction cost.

e) Contingencies were estimated to be about 10% of the total cost.

Table 7.4.6 summarizes results of preliminary cost estimates.

Table 7.4.6 Preliminary Cost Estimate for Tacloban Airport Development (Unit: million PHP)

Item	Medium Term	Long Term	Total
Construction Cost	1,121.3	136.9	1,258.2
Airport Civil Works	331.9	3.3	335.2
Earthworks & Drainage	74.7	0.7	75.4
Runway, Taxiway & Apron	156.3	0.0	156.3
Roads & Car Park	30.2	1.5	31.4
Other Civil Works	70.7	1.1	71.8
Building Works	262.5	49.4	311.9
Passenger Terminal Building	166.9	41.7	208.6
Cargo Terminal Building	18.0	7.7	25.7
Control Tower & Administration Building	53.9	0.0	53.9
Fire Station	12.9	0.0	12.9
Other Buildings	10.7	0.0	10.7
Special Equipment & Fire Fighting Vehicles	84.5	22.5	107
Airport Utilities	58.9	8.6	67.5
Fuel Supply System	140.2	47.1	187.3
Air Navigation Systems	193.3	0.0	193.3
Miscellaneous	50.1	6.1	56.2
Land Acquisition & Compensation	21.0	0.0	21.0
Consultancy Services	112.2	13.7	125.9
Contingency	123.0	15.1	138.1
Total Cost	1,377.4	165.7	1,543.1

7.4.6 Initial Environmental Evaluation

1) Environmental Condition of the Project Site

Table 7.4.7 and the following paragraphs summarize the environment of existing Tacloban Airport based on the site reconnaissance and available data.

Table 7.4.7 Environmental Condition of Existing Tacloban Airport

Item	Condition
Social Environment	
Population (residents, former inhabitants, area division)	Only few residents in the project area. However, there are squatter area and accommodation facility for the airport employees.
Land Use (city, village, historic spot, scenic spot, factories, school, hospital, tourist facilities, Natural park, preservation area)	Sandy seashore is located at the north side of the airport while sandy place and grasslands at east. At west there are public building such as police station, police academy and naval base. At south there are grasslands, residential houses, small beach resorts and fisherman's village.
Economic and Traffic (commercial industry, agricultural industry, bus terminal)	Small villages are present in the vicinity. They are making a living by farming and fishing.
Natural Environment	
Topography, Geology (fault, slope, soft ground, land subsidence, ground water)	Located at the peninsula facing both San Pedro and San Pablo Bay. Area is a flat sandy place.
Valuable Animals and Plants (rare species, special species, decrease of the place for extinct species, rare plants and animals)	The entire vicinity of the airport is covered by grasslands and sandy place. Dump ground and vast mangrove forest are present at the northwest side of the runway.
Pollution	
Occurrence of Complaints (remarkable pollution)	No pollution around the airport.
Counter Measure (Law and Compensation)	Nothing in particular.
Others	Nothing in particular

(1) Social Environment

The existing Tacloban Airport is located at the peninsula surrounded by San Pedo and San Pablo Bay and Canbat Bay which occupies the area of approximately 60has. The airport is located at southeast of Tacloban City with distance around 10km via national road No. 1, takes around 15 minutes by car. Around the airport is sandy seashore at north and likewise sandy seashore with grassland at east. Public buildings, such as police station, police academy and naval base, and small villages that has accommodation facilities for the airport employees are located westward. At south, on the other hand, a numbers of residential houses, beaches and fisherman's villages exist.

The major industry of the area is agriculture and fishery. With regards to the road traffic condition of the area, the National Road No. 1 which provides access from Samar Island all the way to the south of Leyte Island is passing through Tacloban City. This is the main access to the airport via town of San Jose. Educational and welfare facilities such as schools and hospitals are not found in the vicinity of the airport.

(2) Natural Environment

The area around the airport is mostly surrounded by the grasslands and sandy place. At southeast and east side of the ocean is partly developed as beach resort. Sandy seashore at the north side of the airport is remaining its natural feature and since it has no coast protection facility around, the area is suffering from flood several times every year.

A vast distribution of mangrove forest can be identified at inlet and the dump area of the northwest part of the peninsula where existing Tacloban Airport is located. Moreover, since the water area around peninsula is providing favorable living condition for aquatic animals and plants such as mangrove trees, fishes and shells including sea grass, the ocean is blessed with lots of various fishes and thus many fishermen are living along the coastline. Also, fish sanctuary is established around the islands at the north side of peninsula where fishes are being protected.

Thus the presence of mangrove forest around the island is very important for the inhabitants in the area. Among these mangrove forest, the distribution of the one at the inlet and damp ground located at northwest part of peninsula covers a largest portion of the area which is considered to have great role in maintaining the ecological system not only in Cancabat Bay but

may also include the ecological system in Leyte Island around San Pedro Bay and even in Samar Island.

(3) Pollution

No pollution is being reported at existing airport. However, the noise and vibration caused by the aircraft and the condition of underground water should be investigated in detail.

2) Evaluation of Environmental Impacts

Environmental impacts of the Tacloban Airport development project was evaluated based on the site reconnaissance and existing data, and the results are summarized in a standard form of JICA as shown in table 7.4.8.

Table 7.4.8 Evaluation of Environmental Impact of Tacloban Airport Development Project

Issue		Evaluation	
Social Environment			
1.	Resettlement	A	Relocation of some 70 houses will be required.
2.	Economic Activities	B	Some impacts to the beach resorts at the south of the airport.
3.	Traffic and Public Facilities	B	There will be some impacts to the villages and police academy to the north of the new terminal area..
4.	Split of Communities	B	There will be some impacts to the villages and police academy to the north of the new terminal area..
5.	Cultural Property	C	No cultural heritage is known, but attention should be given to buried heritage during the implementation of the project.
6.	Water Rights and Rights of Common	C	Detail is indistinct.
7.	Public Health Condition	D	There will be no impact on public health condition, if the garbage from the airport is disposed properly.
8.	Waste	D	As the volume of waste created by the project is not large, there will be no impact if the waste is disposed properly.
9.	Hazards	C	Bird hazard might become a problem as aircraft operations increase.

Note: Classification of Evaluation
A : Significant impact is expected
B : Some impact is expected
C : Not clear (Necessary to be examined in detail. In case new information was acquired in the future, take it to consideration as well.)
D : No impact. Not necessary to be examined by EIA.

Table 7.4.8 Evaluation of Environmental Impact of Tacloban Airport Development Project (Cont'd)

Issue		Evaluation	
Natural Environment			
10.	Topography and Geology	B	Reclamation is included in the project.
11.	Soil Erosion	D	No soil erosion is expected, as the ground after the development will be relatively flat and covered by pavements or grasses.
12.	Groundwater	D	No activity which may have impact on groundwater.
13.	Hydrological Situation	D	Runoff from the airport will be discharged into the sea and no impact on rivers, lakes and/or swamps.
14.	Coastal Zone	B	Some impacts will occur due to the reclamation work. Erosion or sedimentation of sand might occur.
15.	Flora and Fauna	B	Although there is no plan to destroy the mangrove area to the northwest of the project site, there will be some indirect impacts.
16.	Meteorology	D	There will be no activity that may have impact on meteorological conditions.
17.	Landscape,	B	Land reclamation will have some impacts on landscape from the beach resorts at the south.
Pollution			
18.	Air Pollution	B	Increase of vehicle traffic and aircraft operations will have some impacts on air quality.
19.	Water Pollution	B	Muddy water generated by the construction works and increase of waste water from the airport operations will have some impacts on water quality.
20.	Soil Contamination	D	No activity which may cause soil contamination is expected.
21.	Noise and Vibration	B	There will be some impact on noise due to the increase of aircraft operations and airport related vehicle traffic.
22.	Land Subsidence	D	No activity which may cause land subsidence is expected.
23.	Offensive Odor	D	No activity which may cause offensive odor is expected.

Note: Classification of Evaluation

A : Significant impact is expected

B : Some impact is expected

C : Not clear (Necessary to be examined in detail. In case new information was acquired in the future, take it to consideration as well.)

D : No impact. Not necessary to be examined by EIA.

3) Scope of Environmental Impact Assessment

Table 7.4.9 summarizes major environmental issues and investigation items which need detailed examination in the Environmental Impact Assessment.

Table 7.4.9 Overall Evaluation of Existing Tacloban Airport

Issue	Evaluation	Investigation Plan
Resettlement	A	Investigate population, age, occupation and others of the residents subject for resettlement.
Economic Activities	B	Investigate existing conditions of economic activities around the airport, and estimate the impacts of reclamation.
Traffic and Public Facilities	B	Investigate current traffic and facilities around the airport, and estimate the impacts during the construction and utilization stages.
Split of Communities	B	Investigate distribution of communities, traffic pattern, and others around the airport, and evaluate the impact of the project.
Topography and Geology	B	Investigate topography and geology of the project site, and evaluate the impact of the project.
Coastal Zone	B	Investigate reclamation/coast protection plan, tide, current, seabed soil, etc., and estimate possible erosion or sedimentation.
Flora and Fauna	B	Investigate existing conditions of flora and fauna, possibility of resettlement, etc., and evaluate the impacts of the project.
Landscape	B	Investigate existing landscape around the airport, and evaluate the impact of the project.
Air Pollution	B	Investigate air quality around the airport, and estimate the changes by the project.
Water Pollution	B	Investigate quality of surface water and groundwater around the airport, and estimate the changes by the project.
Noise and Vibration	B	Investigate land use, population and current noise level around the airport, and estimate future noise level and impacts.
Cultural Property	C	Conduct site reconnaissance and hearing, and establish a procedure to be applied if buried cultural property is found during the construction.
Water Rights and Rights of Common	C	Investigate existing conditions of water rights, and estimate the impacts of the project.
Hazards	C	Investigate land use and population around the airport, past accidents, and evaluate the future risk of accidents.

Note: Classification of Evaluation
A : Significant impact is expected
B : Some impact is expected
C : Not clear (Necessary to be examined in detail. In case new information was acquired in the future, take it to consideration as well.)

Special attention and care is required for the implementation of development project, particularly for the development of northwest portion of peninsula where mangrove forest is distributed. Special care should likewise be taken in cutting mangrove trees. Make sure that development project will not affect the present movement of water current since mangrove trees lives at the seashore.

7.4.7 Economic Analysis

1) General

The economic analysis is carried out for the selected alternative development plan for Tacloban Airport, i.e., Alternative T1. The methodology and general assumptions are the same as those employed for Bacolod Airport in Section 5.5.6. Therefore, only the calculation results are shown in this section.

2) Economic Evaluation

The comparison of costs and benefits incrementally by implementing the Project is indicated in Table 7.4.10. (Refer to Appendix 7.4.2 for estimation of economic benefits.) The economic internal rate of return (EIRR) and net present value (NPV) are calculated as shown below.

Table 7.4.11 EIRR and NPV of the Project: Tacloban

Cases/Financial Indicators	EIRR	NPV at 15% discount rate (PHP million)
• Redevelopment of Existing Tacloban Airport	19.7%	409

The results indicate that the redevelopment of existing Tacloban Airport is economically feasible.

Table 7.4.10 Comparison of Costs and Benefits by the Project for Existing Tacloban Airport

Unit: PHP '000 at 1996 prices

Year	Costs					Benefits					Net Cash Flow
	Construction Cost	Maintenance Cost	Personnel, Overhead & Other Cost	Utilities Cost	Total Incremental Costs	Time Savings Benefit	Tourism Earnings Benefit	Benefit from Cargo	Value of Existing Airport	Total Benefits	
	(1)	(2)	(3)	(4)	(5)=(1)+(2)+(3)+(4)	(6)	(7)	(8)	(9)	(10)=(6)+(7)+(8)+(9)	(11)=(10)-(5)
1995	0	0	0	0	0	0	0	0	0	0	
1996	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	0	0	0	0	0	0	0	0
1998	39,903	0	0	0	39,903	0	0	0	0	0	-39,903
1999	39,903	0	0	0	39,903	0	0	0	0	0	-39,903
2000	538,755	0	0	0	538,755	0	0	0	0	0	-538,755
2001	538,755	0	0	0	538,755	0	0	0	0	0	-538,755
2002	0	17,618	468	562	18,648	34,441	32,003	8,381	0	74,825	56,177
2003	0	17,618	468	562	18,648	54,238	38,580	9,367	0	102,185	83,536
2004	0	17,618	468	562	18,648	75,342	46,105	10,353	0	131,800	113,152
2005	139,183	17,618	468	562	157,831	109,414	54,534	12,325	0	176,274	18,442
2006	0	19,800	819	622	21,241	137,909	61,637	13,311	0	212,857	191,616
2007	0	19,800	819	622	21,241	173,265	69,498	14,297	0	257,059	235,818
2008	0	19,800	819	622	21,241	212,982	78,359	15,283	0	306,623	285,382
2009	0	19,800	819	622	21,241	261,055	88,137	16,269	0	365,462	344,220
2010	0	19,800	819	622	21,241	314,058	98,915	18,241	0	431,214	409,973
2011	0	19,800	819	622	21,241	362,063	108,216	19,227	0	489,506	468,264
2012	0	19,800	819	622	21,241	418,739	118,344	20,213	0	557,295	536,054
2013	0	19,800	819	622	21,241	479,848	129,363	21,199	0	630,409	609,168
2014	0	19,800	819	622	21,241	550,966	141,339	22,185	0	714,491	693,249
2015	0	19,800	819	622	21,241	627,441	154,346	24,157	0	805,944	784,702
2016	0	19,800	819	622	21,241	678,019	160,365	24,157	0	862,542	841,300
2017	0	19,800	819	622	21,241	728,598	166,619	24,157	0	919,374	898,133
2018	0	19,800	819	622	21,241	779,176	173,118	24,157	0	976,451	955,209
2019	0	19,800	819	622	21,241	840,994	179,869	24,157	0	1,045,020	1,023,779
2020	0	19,800	819	622	21,241	897,192	186,884	24,157	0	1,108,233	1,086,992
2021	0	19,800	819	622	21,241	953,390	193,425	24,157	0	1,170,972	1,149,731
2022	0	19,800	819	622	21,241	1,009,588	200,195	24,157	0	1,233,940	1,212,699
2023	0	19,800	819	622	21,241	1,071,406	207,202	24,157	0	1,302,765	1,281,523
2024	0	19,800	819	622	21,241	1,138,844	214,454	24,157	0	1,377,455	1,356,213
2025	0	19,800	819	622	21,241	1,206,282	221,960	24,157	0	1,452,398	1,431,157
2026	-194,237	19,800	819	622	-172,995	1,206,282	229,728	24,157	0	1,460,167	1,633,162
						EIRR =					19.7%
						NPV (at 15% discount rate) =					408,861

7.4.8 Financial Analysis

1) General

The financial analysis is carried out for the selected alternative development plan for Tacloban Airport, i.e., Alternative T1. The methodology and general assumptions are the same as those employed for Bacolod Airport in Section 5.5.7. Therefore, only the calculation results are shown in this section.

2) Financial Evaluation

The comparison of costs and revenues incrementally incurred by implementing the Project with increased prices of airport charges is indicated in Table 7.4.12. (Refer to Appendix 7.4.3 for estimation of incremental revenues.)

The financial internal rate of return (FIRR) and net present value (NPV) are calculated as shown below. A discount rate of 2.7%, current interest rate of OECF loan for the Philippines, is used for calculating NPV.

Table 7.4.13 FIRR and NPV of the Project: Tacloban

Cases/Financial Indicators	FIRR	NPV at 2.7% discount rate (PHP million)
At Current Level of Charges • Redevelopment of Existing Tacloban Airport	negative	-1,455
At Increased Prices of Charges* • Redevelopment of Existing Tacloban Airport	4.1%	268

Note*: Increase all charges by 300% in 2001 when new facilities start operation, and further 100% increase in 2006 when the facilities are expanded as the long term development.

The results indicate that the redevelopment of existing Tacloban Airport will require further increase in the prices of airport charges than ones assumed in this Study. Even in that case, the use of low interest loan is essential for the Project to be financial feasible.

Table 7.4.12 Comparison of Incremental Costs and Revenues by the Project for Existing Tacloban Airport

(Increased Rates of Airport Charges)

Unit: PHP '000 at 1996 prices

Year	Costs					Revenues						Net Cash Flow
	Construction Cost	Maintenance Cost	Personnel, Overhead & Other Cost	Utilities Cost	Total Incremental Costs	Traffic Related Services	Commercial Services	Miscella-neous Revenue	Sale of Existing Airport Land	Sale of Existing Airport Land	Total Incremental Revenue	
	(1)	(2)	(3)	(4)	(5)=(1)+(2)+(3)+(4)	(6)	(7)	(8)	(9)	(9)	(10)=(6)+(7)+(8)+(9)	(11)=(10)-(5)
1995					0	0	0	0			0	
1996					0	0	0	0			0	
1997					0	0	0	0			0	0
1998	47,503				47,503	0	0	0			0	-47,503
1999	47,503				47,503	0	0	0			0	-47,503
2000	641,375				641,375	0	0	0			0	-641,375
2001	641,375				641,375	0	0	0			0	-641,375
2002		20,974	520	562	22,056	67,843	12,304	618			80,765	58,709
2003		20,974	520	562	22,056	72,647	12,498	618			85,763	63,707
2004		20,974	520	562	22,056	77,909	12,691	618			91,218	69,162
2005	165,694	20,974	520	562	187,750	83,236	12,885	618			96,739	-91,011
2006		23,572	910	622	25,104	86,908	15,626	684			103,218	78,114
2007		23,572	910	622	25,104	90,916	15,698	684			107,299	82,195
2008		23,572	910	622	25,104	95,144	15,771	684			111,599	86,495
2009		23,572	910	622	25,104	99,296	15,843	684			115,823	90,719
2010		23,572	910	622	25,104	103,898	15,915	684			120,498	95,394
2011		23,572	910	622	25,104	107,409	16,025	684			124,118	99,014
2012		23,572	910	622	25,104	110,960	16,134	684			127,778	102,674
2013		23,572	910	622	25,104	114,821	16,244	684			131,749	106,645
2014		23,572	910	622	25,104	118,640	16,353	684			135,678	110,574
2015		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2016		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2017		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2018		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2019		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2020		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2021		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2022		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2023		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2024		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2025		23,572	910	622	25,104	122,687	16,463	684			139,834	114,730
2026	-231,234	23,572	910	622	-206,130	122,687	16,463	684			139,834	345,964
							FIRR =					4.1%
							NPV (at 2.7% discount rate) =					267,687

7.4.9 Conclusion

The study on development of existing Tacloban Airport was conducted based on the original Scope of the Study agreed between DOTC and JICA. As a result of the master planning study described in the previous sections, it can be concluded that the development of existing Tacloban Airport to accommodate the anticipated traffic in the year 2015 is economically and financially (at increased prices and charges) feasible. Special attention and care from the environmental protection viewpoint are required during the preparation and implementation of the development since there is a mangrove area to the northwest of the existing airport.

7.5 SCOPE OF MEDIUM TERM DEVELOPMENT

On the basis of the optimum development plan of the existing Tacloban Airport established in the previous sections, the scope of the phased development plan is identified and outlined in Table 7.5.1.

Table 7.5.1 Scope of the Phased Development Plan of Tacloban Airport

Item	Before Mid Term	Medium Term	Long Term
1. Civil Works			
1.1 Construction of shore protection at the existing alignment	X		
1.2 Construction of new shore protection wall		X	
1.3 Grading/reclamation of runway strip (210m wide)		X	
1.4 Removal of obstacles on 300m wide runway strip		X	
1.5 Earthworks and drainage works of new terminal area		X	
1.6 Overlay of the existing runway		X	
1.7 Construction of new apron and taxiways		X	
1.8 Construction of shoulders for runway, taxiways and apron		X	
1.9 Construction of new access road		X	
1.10 Construction of new car park		X	
1.11 Construction of airside service roads		X	
1.12 Construction of perimeter fence		X	
1.13 Expansion of car park			X
2. Building Works			
2.1 Construction of new passenger terminal building		X	
2.2 Construction of new cargo terminal building		X	
2.3 Construction of new control tower		X	
2.4 Construction of new fire station		X	
2.5 Construction of new administration building		X	
2.6 Expansion of passenger terminal building			X
2.6 Expansion of cargo terminal building			X
3. Air Navigation Systems			
3.1 Radio Navigation Aids			
3.1.1 Installation of ILS Cat I		X	
3.1.2 Installation of D-VOR/DME		X	

(to be continued)

Table 7.5.1 Scope of the Phased Development Plan of Tacloban Airport (Continued)

Item	Before Mid Term	Medium Term	Long Term
3.2 ATC and Communication Systems			
3.2.1 Installation of PC/fax machine	X		
3.2.2 Installation of VSAT	X		
3.2.3 Installation of ATC equipment for new control tower		X	
3.3 Aeronautical Ground Lighting System			
3.3.1 Rehabilitation of SALS for Runway 36	X		
3.3.2 Rehabilitation of PAPI	X		
3.3.3 Installation of PALS for Runway 18		X	
4. Airport Utilities			
4.1 Installation of power supply system for new terminal area		X	
4.2 Installation of telephone system for new terminal area		X	
4.3 Construction of water supply system for new terminal area		X	
4.4 Construction of new sewerage system		X	
4.5 Installation of new incinerator		X	
4.6 Construction of new aircraft fuel supply system		X	
4.7 Expansion of aircraft fuel supply system			X
5. Land Acquisition and Relocation			
5.1 Land acquisition and resettlement of households		X	

Chapter 8 Master Planning for Legaspi Airport

CHAPTER 8 MASTER PLANNING FOR LEGASPI AIRPORT

8.1 GENERAL

Legaspi Airport is located at about 2km north of Legaspi City, the capitol of Arbay Province, Region 5 (Bicol). Down town of Legaspi is about 2km east of the airport. Figures 8.1.1 and 8.1.2 are the airport vicinity map and the existing airport facility layout plan.

This chapter describes the existing conditions of Legaspi Airport and its surroundings, evaluation of the existing airport facilities, airport development master plan and scope of medium term development. Socio-economic conditions of the airport surrounding area are described in Section 2.2.

8.2 EXISTING CONDITIONS OF THE AIRPORT AND ITS SURROUNDINGS

8.2.1 Airport History

Legaspi Airport was built by Japanese during World War II. The location of the initial runway was some 1,000m from the existing runway 06 threshold. During the 1970s the runway was extended to the east to 1,600m and paved with cement concrete. The existing apron was also constructed at the same time. Since then the runway was further extended to the east in phases to the present length of 2,280m. PAL initiated B737 service for Manila-Legaspi in 1989. The overlay work of the runway pavement was commenced in 1993.

The terminal building was initially located on the northern side of the runway. The control tower and its ancillary building, now used as the DOTC office, and a fire station were also located besides the old terminal building. The existing control tower building was constructed in 1970. The new terminal building was build in the new terminal area on the southern side of the runway by PAL in the late 1970s. It was later transferred to ATO. The new fire station, as a replacement of the old one destroyed by a typhoon, was completed in 1988. The terminal building was extended to the west in 1994, by constructing a new arrival area.

There was a few major accident at Legaspi Airport in the past. In 1966 Air Manila's DC3 conducted a landing to the runway 24 under poor visibility and tail wind conditions. It overshot the runway and then conducted a missed approach with a sharp left turn. The aircraft crashed against a building in Daraga. Two crews were killed, and many passengers were wounded. In 1973 a PAF's light aircraft collided on the ground shortly after the takeoff from the runway 06 due to strong cross-wind. Five people were killed. In the early 1980s, there was a belly landing of the PAF aircraft on the runway 06.

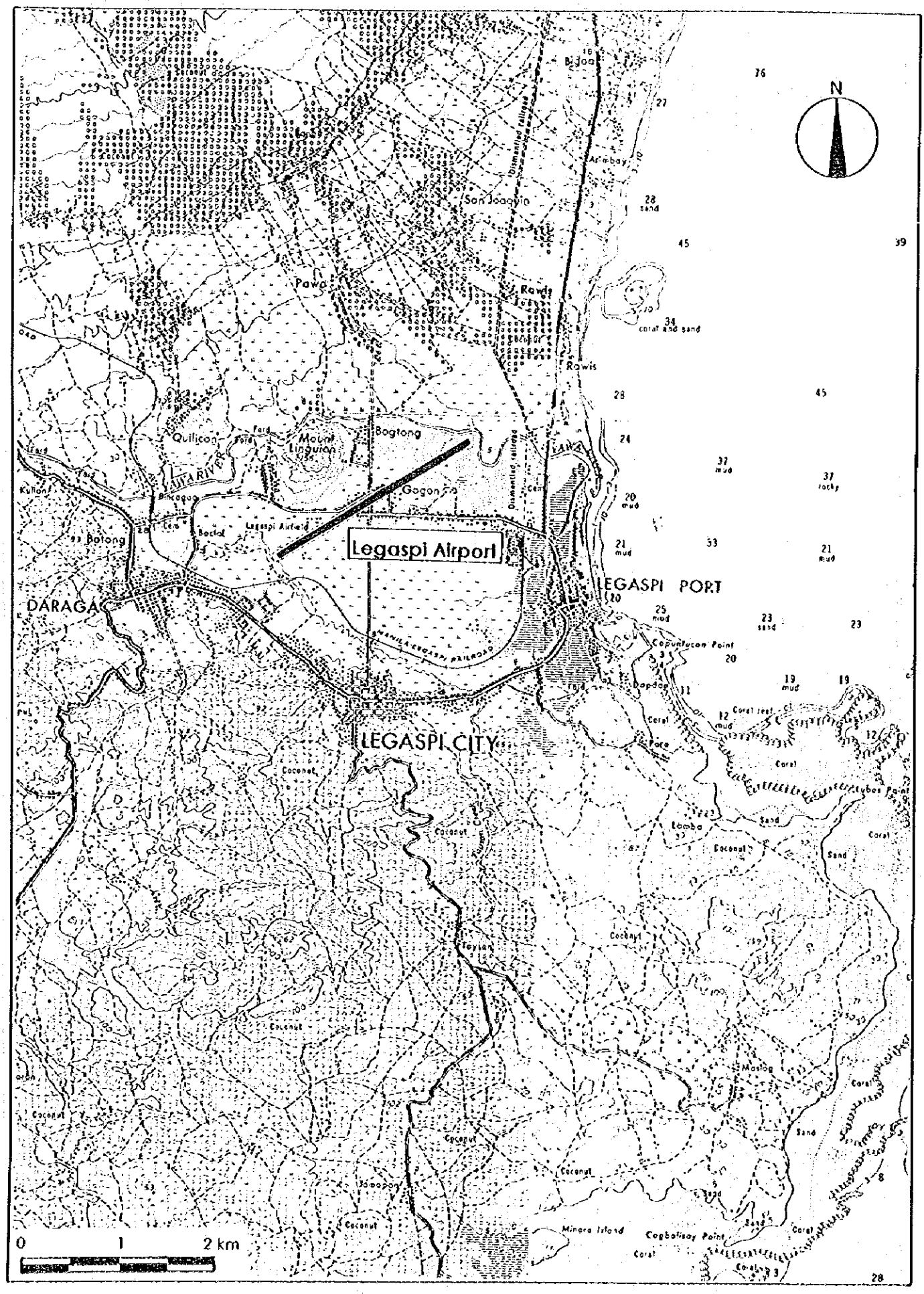


Figure 8.1.1 Vicinity Map of Legaspi Airport

Legend
① Passenger Terminal Building
② Cargo and PAL Office Building
③ Control Tower and
ATO Administration Building
④ Fire Station
⑤ ATO Power House - 1
⑥ ATO Power House - 2
⑦ PAL Power House
⑧ Aviation Security Command Building
⑨ PAGASA Building
⑩ Concessions
⑪ PAL Fuel Farm

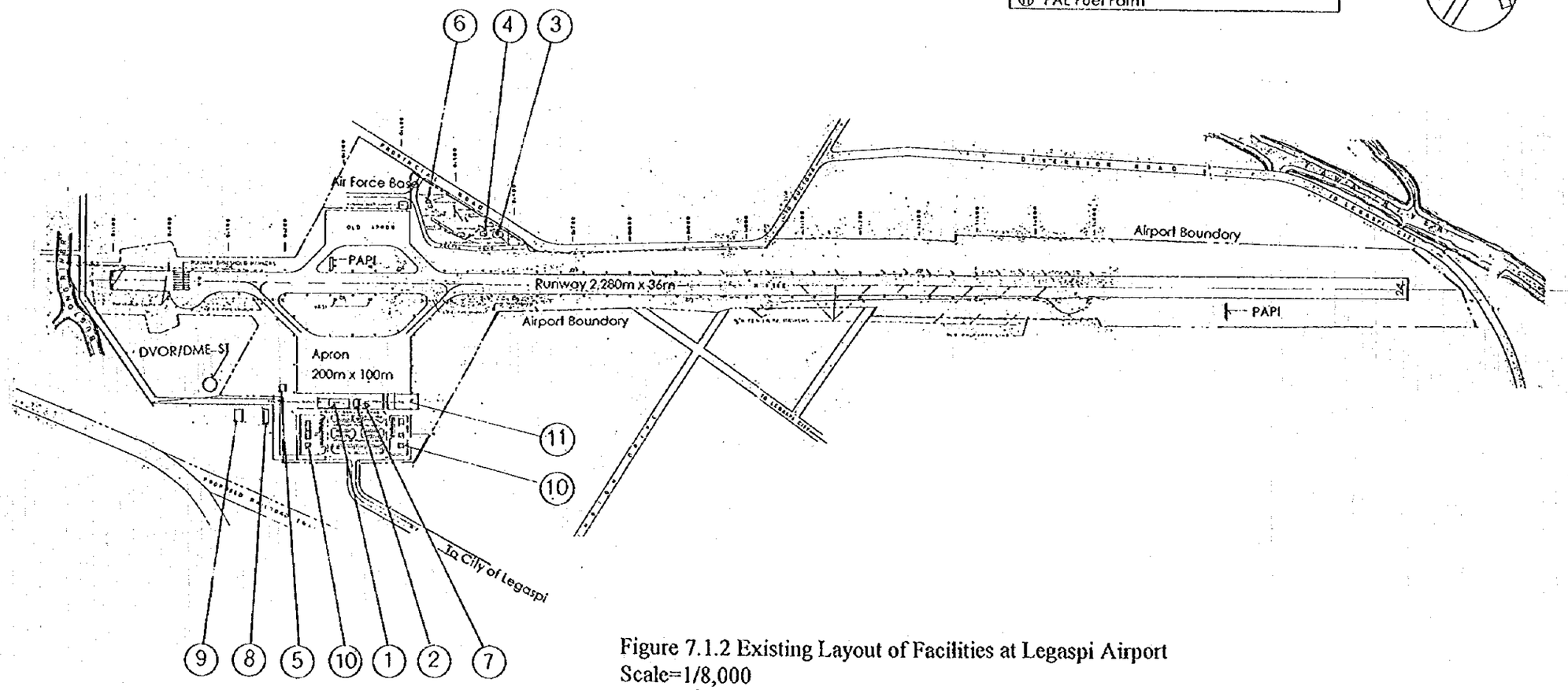


Figure 7.1.2 Existing Layout of Facilities at Legaspi Airport
Scale=1/8,000

8.2.2 Airport Inventory

Table 8.2.1 shows an inventory of Legaspi Airport.

Table 8.2.1 Inventory of Legaspi Airport

Items	Description
1. Aerodrome Data	
City / Aerodrome	Legaspi / Legaspi Airport
Domestic/International	Domestic (Trunkline, Area 4, Center)
ICAO Reference Code	4C
Aerodrome Reference Point	13°10'03"N, 123°43'48"E
Distance and Direction from City	2km north of city center
Elevation	20m
Reference Temperature	32.2 °C
Magnetic Variation	N00°10'W
Operational Hours	Sunrise to sunset (0600-1800 local time)
Seasonal Availability	All seasons
Supervising Authority	Air Transportation Office, DOTC
Transportation Available	Taxi and motor tricycle
2. Aircraft Operational Data	
Wind Coverage	Data not available
Operational Category	Non-Instrument Approach
Established Procedures	Nil
Transition Altitude	10,000 ft
Local Flying Restriction	Left hand traffic circuit for RWY 24 Right hand traffic circuit for RWY 06
3. Facilities	
Runway	
Designation	06/24
True Bearing	N56°58'E
Dimension	2,280m x 36m - 100m displacement for RWY06 - 200m displacement for RWY24
Longitudinal Slope	0.71% uphill to the NE
Stopway	Nil
Clearway	Nil
Runway Strip	2,380m x 150m
Surface	Asphalt overlay on cement concrete
Strength	PCN 35R/B/W/T
Taxiway	
Configuration	2 connection with apron (2 x 60m)
Width	21m
Surface	Concrete
Strength	PCN 29.6R/B/W/T

Table 8.2.1 Inventory of Legaspi Airport (Continued)

Items	Description
Apron	
Aircraft Stands	B737 x 3
Parking Configuration	Self-maneuvering
Area	200m x 100m
Surface	Concrete
Strength	PCN 29.6R/B/W/T
Passenger Terminal Buildings	
Structure	Reinforced concrete, 1 story
Floor Area	Departure terminal: 635 sq.m Arrival Terminal: 275 sq.m Total: 910 sq.m
Cargo Terminal Building	(PAL owned)
Structure	Reinforced concrete, 1 story
Floor Area	210 sq.m (including ticketing office)
Control Tower Building	
Structure	Reinforced concrete, 4 stories
Floor Area	357 sq.m (including administration office)
Floor Height	11.7m
Administration Building	
Structure	1st floor of control tower building
Floor Area	190 sq.m
Fire Station	
Structure	Reinforced concrete, 1 story
Floor Area	370 sq.m
Vehicle Parking Area	
Area	6,500 sq.m
Capacity	93 cars
Surface	Asphalt
Access Road	
Number of Lanes	2 lanes
Width	12 m
Surface	Asphalt
Air Navigation System	
Radio Navigation Aids	D-VOR "LP": 112.2MHz DME: Ch. 59X NDB "Jovellar": 360KHz
Telecommunication Systems	TWR: 123.3MHz FSS: 5,447.5, 3,834, and 8,364KHz
Aeronautical Ground Lighting Systems	Approach Lighting System (RWY06/24) Approach Path Indicator (RWY 06/24) Runway Edge Lights Runway Threshold and End Lights (RWY 06/24) Apron/Taxiway Edge Lights Aerodrome Beacon Apron Flood Lights

Table 8.2.1 Inventory of Legaspi Airport (Continued)

Items	Description
Air Navigation System (continued)	
Meteorological Observation Systems	Basic items, manual system (PAGASA) Wind, temperature and air pressure sensors for control tower
Rescue and Fire Fighting Facilities	
Fire Fighting Vehicles	Two major vehicles: - 2,500L water and 300L foam - 2,000L water, 200L foam and 300 lb. dry chemical Two RIVs: - 1,250L water and 150L foam - 20L foam and 250 lb. dry chemical
Level of Protection	Category 4 (Category 6 in AIP)
Number of Trained Personnel	13 plus 10 trained staff from other section
Public Utilities	
Power Supply	
Receiving Voltage	13,200V and 220V (for terminal building)
Capacity of Transformers	50KVA x 3
Stand-by Generators	80KVA x 3, and 15KVA x 1 PAL has a 12KVA set.
Water Supply	
Water Source	3 deep wells for ATO, 1 deep well for PAL
Supply capacity	Data not available
Water tank	Pressure tanks Elevated tank (2,000KL), presently not used
Sewerage System	
Type of Treatment	Septic tanks for individual buildings
Solid Waste Disposal System	Collected by the city authority
Telephone System	3 external lines (1 DDD) for ATO 1 PABX for external/internal, 1 PABX for internal (for operations only) Separate contract with PLDT by other users 2 telephone booths of MATELCO for public use
Other Facilities	
Aviation Fuel Supply System	(PAL owned)
Type of Fuel	Jet-A1
Storage Capacity	11,000 gal. tank x 2
Supply System	Hydrant system with 3 pits
Aircraft Maintenance Hangar	Nil
Airport Vehicles	2 pick-ups
Airport Maintenance Equipment	Handy grass cutters
Airport Staff Housing	1

8.2.3 Current Airport Development Projects

Major projects ongoing at Legaspi Airport are the asphalt overlay of the remaining section (approx. 260m) of the runway, land acquisition for runway strip widening and the construction of concrete hollow block fence for the widened runway strip.

The Five Year National Airport Development Program (1995-2000) describes the following projects, including the ongoing ones:

Infrastructure:

a) Asphalt overlay of runway
b) Relocation/construction of perimeter fence to the newly acquired site (CHB)
c) Runway shoulder grade correction
d) Improvement of terminal building
e) Payment of site (old obligation)
f) Improvement of administrative building/control tower building
g) Widening of runway from 36m to 45m (2,080m x 9m)
h) Asphalt overlay of vehicle parking area and access road in front of control tower building
i) Site acquisition for runway extension
j) Construction of runway extension (from 2,080m to 2,400m)
k) Asphalt overlay of apron including 2 taxiways (18m x 100m) with plastic treated asphalt

Air Navigation Systems:

a) Rehabilitation of runway lighting system
b) Concreting of access road from VOR to terminal building
c) Construction of VOR perimeter fence
d) Construction of Tower/APP control facility
e) Repair of SALS
f) Purchase/install of beacon lights
g) Purchase/install of wind direction indicator

Total investment requirement is PHP 135.25 million for infrastructure and PHP 16.345 million for airnavigation systems.

The estimaed costs of the projects to be implemented in the fiscal year 1996 are as follws:

a)	Construction of CHB perimeter fence	PHP 5,700,000
b)	Runway shoulder grade correction	PHP 4,750,000
c)	Payment of old obligation (for the runway extension and runway strip widening, to be continued in FY1997)	PHP 10,450,000

d) Improvement of existing terminal building PHP 950,000

In addition, the Legaspi ATO identified the improvement of drainage system, construction of ANS warehouse and workshop, construction of FSS/FOBS building, rehabilitation and expansion of the fire station, relocation of the control tower building, etc. as necessary works up to the year 2000.

Japan's OECF financed Nationwide Air Navigation Facility Modernization Project Phase III will include following equipment:

a) PC /Fax Machine
b) VSAT

8.2.4 Airport Access

Figure 8.2.1 shows existing major road network around Legaspi Airport. The access road, which connects the airport terminal and Washington Drive, is a 11 m wide road with 6.6 m wide cement concrete surface carriage way and 2.2 m asphalt paved shoulder each side. The road is in a good condition at the time of investigation. It normally takes less than 5 minutes from the center (capitol) of Legaspi City to the airport. Tricycles and taxis are public transportation available at the airport.

There is a 5 m wide asphalt paved road which provides access to the airport terminal from the west. However, this road is planned to be closed, because it creates through traffic which disturbs vehicular circulation in the airport terminal.

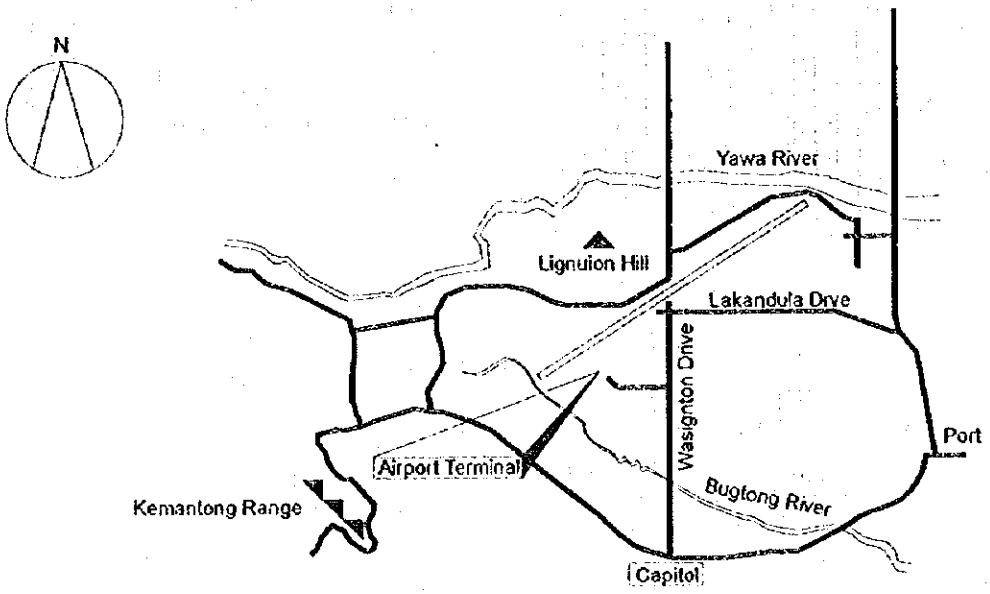


Figure 8.2.1 Existing Major Road Network around Legaspi Airport

8.2.5 Public Utilities

1) Water Supply

Legaspi City Water District supplies water in the City of Legaspi. Sources of water are three springs and 11 deep wells. Existing supply capacity is about 6,000 cu.m per day, but is not enough to meet current demand. A 250mm dia pipe and 150mm dia pipe run along Washington Drive and the road on the north of control tower respectively. However, they are not supplying the water to the airport, and the airport has its own wells. There is a plan to install a 150mm dia pipe from Washington Drive to the airport terminal.

2) Power Supply

Electric power in Albay Province is supplied by Albay Electric Cooperative (ALECO). Legaspi Sub-Station, at about 1km south of the airport terminal, supplies power in Legaspi City including the airport. It has total capacity of 15.6MVA, but is already over loaded (current load is about 16MVA). New Daraga Sub-Station, at about 2 km west of Runway 06, with 10MVA capacity is expected to start operation in June 1996 to solve the over load problem. There are two power transmission lines (13.2KV, 3-phase, 4-wire, 60Hz) to the airport, one along the access road and another along the road behind the control tower. There will be no problems in capacity of power lines because of proximity to the sub-stations.

3) Telephone Facility

Telephone facility is provided by Mayon Telephone Company (MATELCO). MATELCO has three exchanges; Legaspi Exchange, Albay Exchange and Daraga Exchange with 2,500, 1,800 and 700 line exchange capacities. There is a plan to expand the capacities of Legaspi, Albay and Daraga Exchanges by 1,500, 700 and 500 lines, respectively. The airport terminal is in the service area of Albay, and the control tower is in the service area of Daraga. A 25-pair cable comes to the airport terminal, and a 60-pair cable runs along the road behind the control tower.

International Communication Corporation (ICC), a subsidery of Bayan Tel, will start telephone services in Albay Province in 1996. ICC is constructing an exchange (100,000 line capacity) at about 2km southeast of the airport terminal, and fiber optic cable network.

8.2.6 Airport Surroundings

Legaspi Airport is located at about 2km north of Legaspi City center (capitol). Its elevation is about 20m above the Mean Sea Level (MSL), and there are Linguion Hill (156m above MSL) and Kemantong Range (about 100m above MSL) about 600m northwest and 2km southwest of the airport respectively. Peak of Mayon Volcano (2,421m above MSL) is about 12km north of the airport. There are Yawa River and Bugtong River to the northeast and southwest of the airport respectively.

Figure 7.2.2 shows existing land use around Legaspi Airport. As seen, northern and eastern area of the airport is agriculture land. Southern area is mainly residential with some industrial and institutional areas. The area near the airport terminal is an institutional area. There are Bicol University School of Arts and Trades, Albay Provincial Hospital, Regional Health Office and Philippines National Red Cross within 500m south to southwest of the runway 06. Bicol University, Bicol College, United Institute and Bicol University College of Education and Laboratory School II exist within 1,000m from the runway 06. Aquinas University of Legaspi is located about 800m east of Runway 24.

Names and populations (as of 1990) of communities are as follows:

a) Barangay Em's Barrio: 2,475
b) Barangay Cruzada: 2,886
c) Barangay Gogon: 3,349
d) Barangay Bogtong: 2,236
e) Barangay Tagas 4,493
f) Barangay Maroroy 3,599
g) Barangay Sagpon 6,731

Future land use plan prepared by the City of Legaspi and Municipality of Daraga is shown in Figure 6.2.3. As seen, further urbanization is planned in the vicinity of the airport. The existing agricultural area to the north and east of the airport is proposed to be changed to residential, and existing industrial area to the south of the airport is proposed to be a commercial area.

It seems that there are no historical or cultural properties in the vicinity of the airport, except Daraga Church, about 1,500m west of the runway 06. It was built in 1773. Mayon Volcano National Park is located about 8km north of the airport. There were odor and water pollution from Isarog Paper Mill Factory, 1.3km northwest of the runway 06, during 1990-1992. There was also complaints regarding soil erosion of Linguion Hill due to activities of quarry. No problem in air quality around the airport was reported, but there have been complaints regarding air quality by vehicle traffic along major roads.

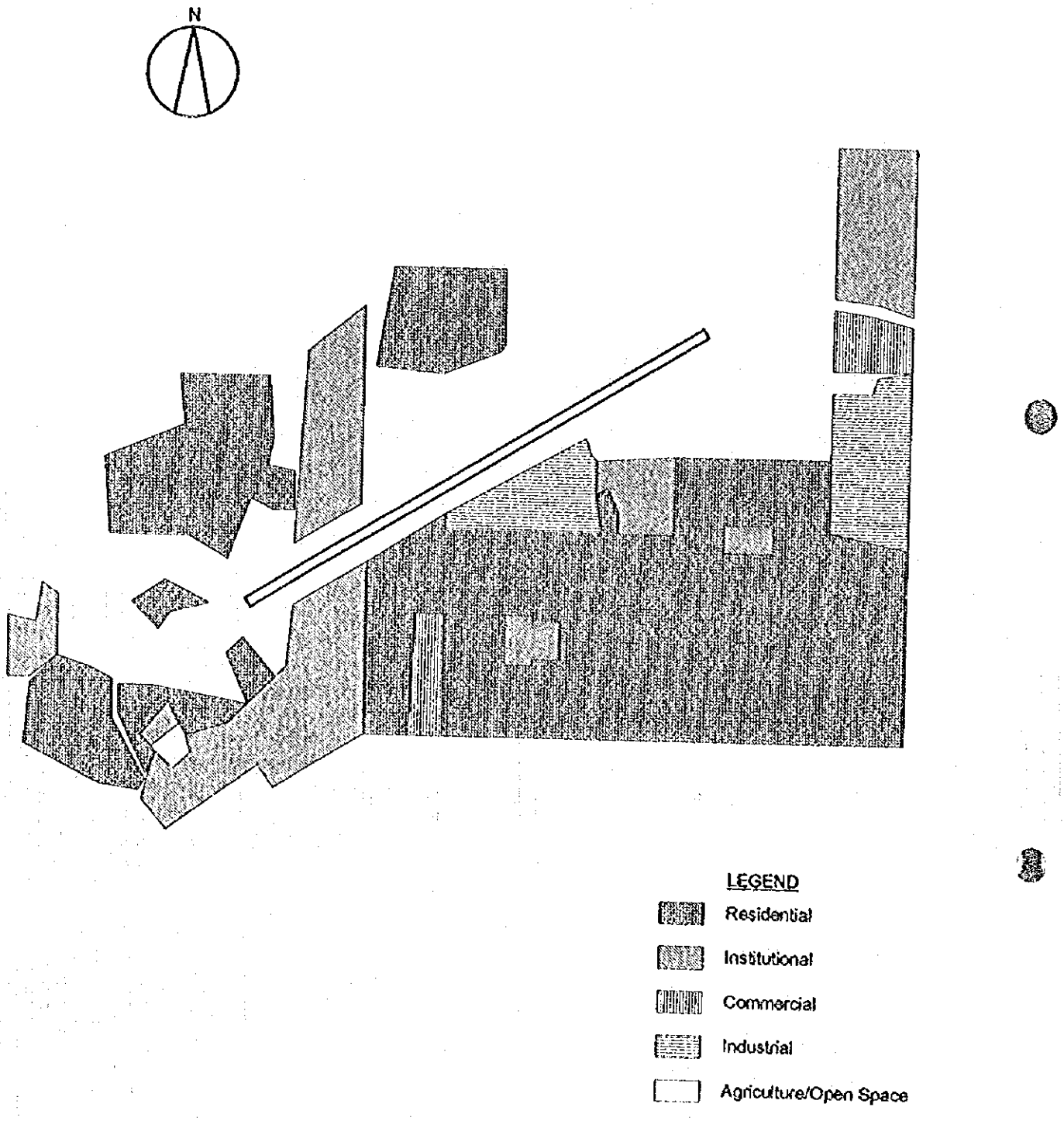


Figure 8.2.2 Existing Land Use around Legaspi Airport

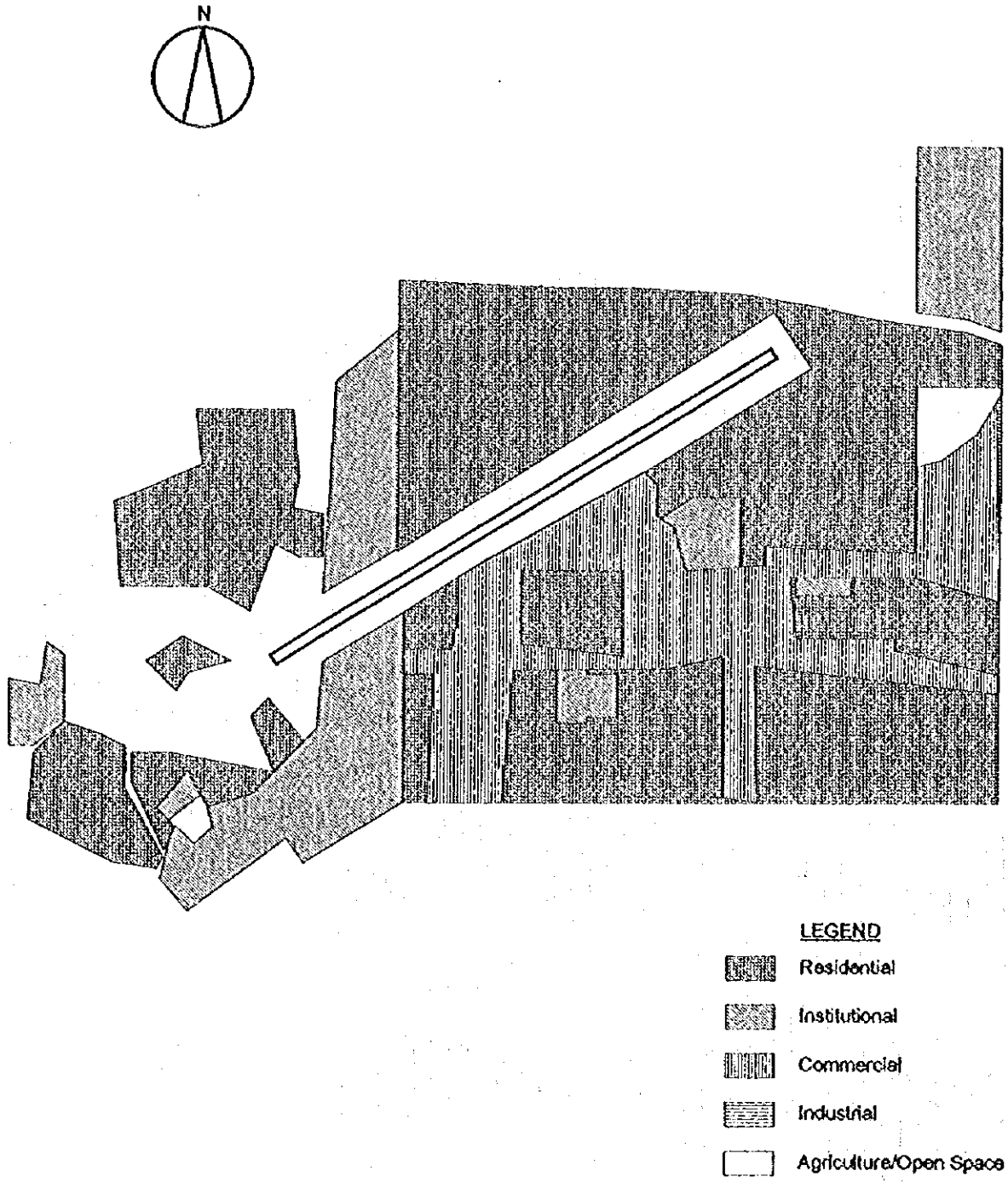


Figure 8.2.3 Future Land Use Plan of Legaspi City around Legaspi Airport

8.3 EVALUATION OF EXISTING AIRPORT FACILITIES

8.3.1 Summary

The evaluation of existing facilities at Legaspi Airport is summarized in Table 8.3.1.

8.3.2 Runway Strip and Obstacle Limitation Surfaces

1) Runway Strip

The size of the runway strip for Legaspi Airport is not officially declared. However, the Civil Air Regulation of the Philippines requires the airport to have a 150m wide runway strip, to cover entire length of the runway plus 60m each from respective ends. This is the same size as required by the Japanese Standard. The ICAO's recommendation for a non-instrument runway also require a 150m wide strip.[1]

The widening of airport property area for each side up to 75m from the runway centerline is ongoing at Legaspi Airport. However, even after the runway strip is widened, it still have problems. Legaspi Diversion Road runs within the runway strip on the runway 24 side. Bogtong Road, which runs the northern side of the airport in parallel with the runway, is only 60m away from the runway centerline, and thus still within the runway strip. Transverse slope of the runway strip exceed the ICAO's recommendation, which may endanger aircraft in the event of its running off the runway. Canals are located on the both side of the runway only 40m from the centerline.

The maintenance of the runway strip is relatively satisfactory, although grass cutting of the main canals along the both sides of the runway is not well done.

If a 300m wide runway strip is applied, the existing apron and terminal building will be within the 300m wide strip.

[1] Although the width of the runway strip for a non-instrument runway is 150m, instead of 300m for a non-precision instrument runway, according to ICAO's recommendation, the grading and slope requirements for a non-instrument runway are same as those for a non-precision instrument runway. Namely, a portion with a distance of at least 75m from the centerline of the runway and its extended centerline should provide a graded area for airplanes in the event of running off the runway. The maximum slope on the graded area for the code number 4 should be 1.5% longitudinally and 2.5% transversely.

Table 8.3.1 Evaluation of Existing Facilities at Legaspi Airport

Facilities		Year 2000	2005	2010	2015	Remarks
1) Runway Strip and Obstacle Limitation Surfaces		X				• A road on the northern side of the airport is located within the 150m wide runway strip. The runway strip does not complying with the ICAO's obstacle removal and grading recommendations. • Hilly terrain on the west to north of the airport constitute obstacles, which seriously affect safe aircraft operations. Kemantong Range infringes the runway 06 approach surface as much as 40m. • There are many trees outside the 150m wide strip, which infringe transitional surface. The foothill of Mayon Volcano protrude upon the inner horizontal and conical surfaces.
2) Runway	- Length					• The existing 2,280m long runway is adequate for operations of B737, A320 and A300 for anticipated domestic destinations by 2015, provided that no obstacles exist.
	- Width	X				• The width of the runway is 36m for the entire length, which should be widened to 45m as planned in DOTC's Five Year National Airport Development Plan.
3) Taxiway	- Aircraft Handling Capacity					• No parallel taxiway will be required for anticipated peak hour aircraft movements before 2015.
4) Apron	- Aircraft Stand Capacity					• The existing apron can accommodate up to 4 B737s by rearranging parking positions. It has enough capacity for the present level of aircraft movements, but will be saturated in 2006 when A300 will operate at Legaspi Airport.
5) Airfield Pavements						• The existing pavements designed for B737 will need asphalt overlay to accommodate A300, which is anticipated for Legaspi-Manila sector in 2006 according to our forecast.
6) Passenger Terminal Building	- Passenger Handling Capacity	X				• The existing 910 sq.m passenger terminal area is much smaller than the standard requirement of 2,800 sq.m to handle 280 peak hour passengers at present. The additional capacity will be needed to cope with increasing traffic volume.
	- Quality of Services	X				• No baggage screening device is available. No baggage claim conveyor is available. No air conditioning is provided for check-in lobby and arrival area. • The building is structurally in good condition.
7) Cargo Terminal Building	- Cargo Handling Capacity					• The cargo terminal area has sufficient capacity to handle present level of cargo traffic. The expansion of capacity will be required before 2000.
8) Control Tower and Administration Building		X				• The control tower has good visibility for entire airport area. It is structurally sound but rain water leakage is reported. The administration office has adequate space for daily activity. • However, the existing control tower constitutes an obstacle to transitional surface, and thus discounting safe aircraft operations.
9) Vehicle Parking Area	- Vehicle Parking Capacity					• The vehicle parking area has sufficient capacity for the present peak hour vehicular traffic volume and vehicular traffic is well regulated. However, the expansion of capacity will be required to cope with increasing vehicular traffic volume before
10) Radio Navigation Aids		X				• There is no ILS, which is a standard equipment for modern jet aircraft.
11) ATC and Communication Systems						• The existing systems were renewed recently by USAID. PC/Fax machine, VSAT, etc. are planed to be installed under Nationwide Air Navigation Facility Modernization Project - Phase III.
12) Airfield Lighting Systems		X				• The existing approach lights do not comply with ICAO's requirements for precision Category-I approach operations.
13) Meteorological Observation System		X				• PAGASA station is located in the proximity of Tacloban Airport. However, observation sensors are not adequately located for civil aviation purpose.
14) Rescue and Fire Fighting		X				• The existing category 4 level of protection is insufficient for the present requirements of category 5. An increase of CRF capability is required. The replacement of an old major vehicle needs to be considered.
15) Power Supply System		X				• The existing back-up generators have enough capacity for the present demand and in good working condition. The expansion of capacity will be needed to cope with increasing electricity demand.
16) Telephone System		X				• The existing telephone system at the airport is adequate for present needs. However, a greater capacity may be needed for more efficient airport operation and better service for passengers.
17) Water Supply System						• The airport uses deep wells. The capacity is enough, but water quality is poor.
18) Sewage Disposal System		X				• The septic tanks used at the airport are working in good condition. However, increasing effluent will require more sophisticated treatment system.
19) Aviation Fuel Supply System						• PAL has own fuel supply system with hydrant pits on the apron. The existing system is working in normal condition. The increase of storage capacity will be needed to satisfy standard storage requirement of one-week consumption before 2005.

Legend	
	X : Indicates that the capacity or quality of existing facility is inadequate at present.
	▬▬ : Indicates the serviceable period of existing facility in terms of capacity or span of life.
	▨▨ : Indicates the serviceable period of existing facility upon completion of ongoing or planned project.

2) Approach Surface

Hilly terrain on the west of the airport, Kemantong Range, protrudes above the runway 06 approach surface. The distance from the runway 06 threshold to the highest portion of the hill is about 2,100m. The degree of infringement is more than 40m. Another hilly terrain beyond Kemantong Range, approx. 2,500-3,000m from the runway 06 threshold, has an elevation of about 140m. The degree of infringement is as high as 80m. Those range and hill constitute a serious problem for safe aircraft operations. There were a few trees protruding upon the runway 24 approach surface. Because of those trees, the runway 24 threshold is displaced by 200m. Since those trees were already removed, the displacement of the runway 24 threshold will soon be reduced by 100m.

3) Transitional Surface

There are many trees outside the 150m wide strip, which infringe transitional surface.

4) Other Obstacle Limitation Surfaces

The hilly terrain on the western side of the airport including Kemantong Range, Linguion Hill and the foothill of Mayon Volcano infringe the inner horizontal surface. Many hills on the western side of the airport and the foothill of Mayon Volcano protrude upon the conical surface.

8.3.3 Runway, Taxiway and Apron

1) Runway

Legaspi Airport has a 2,280m long runway, which is adequate for B737-300 for the present flight destination of Manila. However because of obstacles over the runway 24 takeoff surface, PAL's B737-300 is subject to the payload penalty of 1,590kg, which is equivalent to 25% of maximum payload or 95% of cargo capacity for full passenger flights.[2, 3]

The introduction of A300 for Legaspi is not under consideration of PAL in its "Airport Development Requirements, Priority 1: 1995-1997".

B737-300 requires a longer takeoff runway than A300-B4, which is anticipated to be introduced for Legaspi-Manila sector in 2006. According to our calculation, a 1,910m long runway is sufficient for entire planning horizon up to 2015.

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[2] Under 30°C and zero wind condition. 80kg per passenger is assumed including bags.

[3] The required takeoff runway length for PAL's B737-300, A300-B4 and A320 for Legaspi-Manila (328km) under full payload, 30°C and zero wind condition is as follows:
B737-300 (141 seats): 1,860m, A300-B4 (246 seats): 1,740m and A320 (150 seats): 1,635m.

The runway thresholds are displaced by 100m at the runway 06 threshold and 200m at the runway 24 threshold. The 200m displacement of the runway 24 will soon be reduced by about 100m since obstacle removal has completed. The width of the runway is 36m, which is 9m narrower than the ICAO's recommendation. The DOTC plans to widen it under its Five Year National Airport Development Program (1995-2000). There are no paved shoulders for the runway.

The utilization of the runway 06 for approach is slightly higher than the runway 24 threshold. It is generally used from October to April, while the runway 24 from May to September.

Legaspi Airport is subject to frequent poor weather condition, i.e., low visibility and low ceiling. Approximately 90-100 flights, including arrivals and departures, are canceled annually due to poor weather condition, which correspond to nearly 10% of the total annual commercial scheduled flights. This high percentage of cancellation has significant adverse effects on airline patronage.

All weather wind coverage of the runway 06/24 was calculated based on the data from PAGASA in 1995 as follows:

Cross wind component less than 13 knot:	99.79%
Cross wind component less than 20 knot:	99.99%

The result of correlation analysis on visibility and cloud height indicates the coverage of 61.7% for existing VMC minima of 1,000ft - 5.0km. This value is significantly lower than the ICAO recommended minimum usability factor of 95%, explaining high flight cancellation rate at Legaspi Airport. By establishing instrument flight procedure with existing VOR/DME, the minima can be reduced to 720ft - 2.0km, and the estimated coverage will be improved to 84.2%. (Refer to Appendix 8.3.1 for more detailed analysis on meteorological data.)

2) **Apron and Taxiway**

The size of the apron is 200m by 80m. It has designated parking spaces for three B737s, which are sufficient for the present needs. However, the apron capacity will become insufficient due to increasing air traffic in 2006 when A300 will operate at this airport. The apron is connected to the runway with two stub taxiways of 21m wide, which will need to be widened to standard width of 23m. No parallel taxiway will be required for anticipated peak hour aircraft movements up to 2015. The old apron is not maintained and no longer used.

3) Pavement

The strength of the runway pavement is PCN35/R/B/W/T, which is adequate for B737 class aircraft. The structure of the runway pavement is 30cm aggregate base, 28cm cement concrete slab and 7.5cm thick asphalt overlay on it. The remaining section of the overlay will be completed in 1996. The condition of the pavement appeared relatively good, although major reflection cracks and unevenness of the surface were observed.

The taxiway and apron pavement is of 28cm cement concrete slab on top of 30cm aggregate base. The standard size of a slab is 6.0m by 3.0m and 4.0m by 3.0m. The condition of the concrete slab is relatively poor with loose stones on the surface. Joint sealant is deteriorated and has lost flexibility. A detailed investigation report on the existing pavements is shown in the Appendix 8.3.2.

The existing pavements will require a strengthening work to accept A300, which is anticipated for Legaspi-Manila sector in 2006 according to our forecast. The required overlay thickness is estimated in Section 8.4.

4) General Aviation Area

There is no hangar for general aviation at Legaspi Airport. General aviation aircraft usually use the eastern side of the apron.

8.3.4 Passenger Terminal Building

1) General

The terminal building is one story with a reinforced concrete structure and has a total floor area of about 910 sq.m. The terminal building is divided into departure area and arrival area. The departure and the arrival area were constructed in 1971 and 1994 respectively. The structure of the terminal building is in good conditions. Floor plan of the terminal building is shown in Figure 8.3.1.

Departure and arrival area are as follows:

Departure area:	635 sq.m
Arrivl area:	275 sq.m
Total	910 sq.m

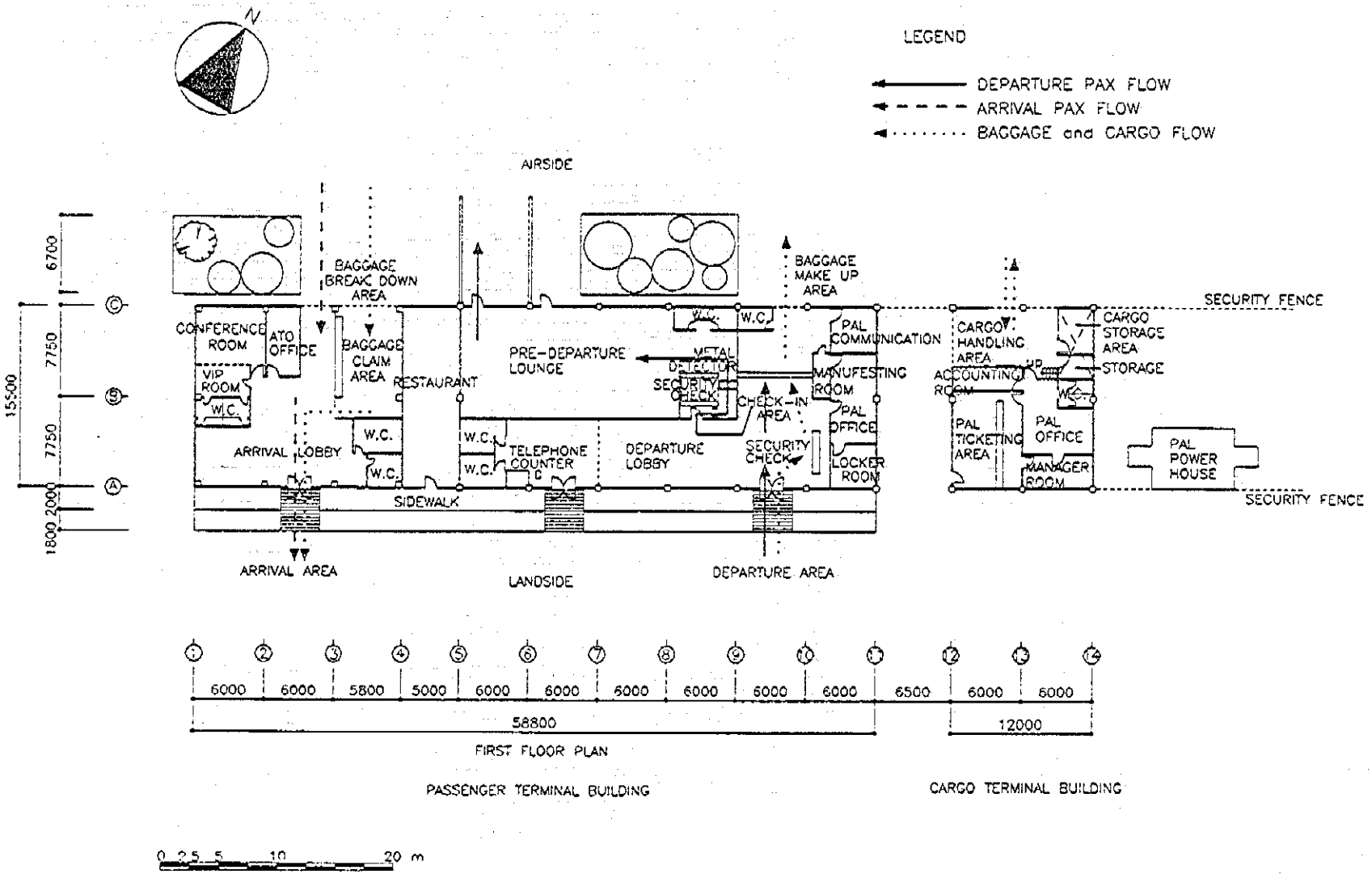


Figure 8.3.1 Passenger and Cargo Terminal Building

2) Total Floor Area

As previously stated in Section 4.4, the unit floor area of 10 sq.m per peak hour passenger is considered adequate for estimating the required floor area for the passenger terminal building. Since the current peak hour passengers in two ways are estimated to be 280 passengers based on the current flight schedule, the required floor area is estimated to be 2,800 sq.m, which indicates that the present available floor area of 910 sq.m is far from sufficient even for the present peak hour passenger volume.

3) Operational and Functional Aspects

Departing and arriving passengers flows, including baggage flow are shown in Figure 8.3.1. Actual conditions of the major terminal components are compared with the standard requirements in order to evaluate the existing terminal building. As a result, there are many insufficient spaces and facilities at the existing terminal building as shown in Table 8.3.2 below.

Table 8.3.2 Comparison of Standard Requirements and Existing Conditions of Major Components of the Passenger Terminal Building: Legaspi

Major Components and Facilities	Requirements*	Existing	Remarks
Peak Hour Pax 140 One Way			
1. Departure Curb	9m	18m	Sufficient
2. Departure Concourse	326 sq.m	190 sq.m	Insufficient
3. Security Check-Check-in Bag	1 unit X-ray equipment	No x-ray equipment	Insufficient
4. Check-in Queuing Area	39 sq.m	40 sq.m	Sufficient
5. Check-in Counters - Common Use	6 Counters	2 Counters	Insufficient
6. Security Check-Gate Lounge	1 unit x ray equipment & Magnetometer	1 unit Magnetometer No x-ray equipment	Insufficient
7. Gate Lounge (Pre-Departure Area)	125 sq.m	360 sq.m	
8. Baggage Claim Area	139 sq.m	50 sq.m	Insufficient
9. Number of Bag. Claim Devices	1 unit 30 m long	No Bag claim Device	Insufficient
10. Arrival Concourse	300 sq.m	140 sq.m	Insufficient
11. Arrival Curb	9 m	18 m	Sufficient

Note*: The requirements were calculated by using IATA formulas and the more details are explained in Appendix 8.3.3.

Major problems observed in the terminal building are summarized as follows:

i) Congestion at Forecourt

Due to narrow space available at the passenger terminal building, visitors are not allowed to enter into the passenger building. Thus, visitors including some passengers crowd at building forecourt during peak hours. Those people at forecourt and curbside are exposed to rain since no adequate awning and canopy are provided.

ii) Necessity of X-Ray Equipment for Check-in Baggage

Passengers are obliged to open all check-in baggage for manual security check because no x-ray equipment is provided. Thus, passenger congestion occurs during peak hour due to slow process of manual baggage inspection. For passenger convenience, efficient security check and safety reliability, X-ray equipment should be provided.

iii) Necessity of X-Ray Equipment for Cabin Baggage

A magnetometer (metal detector equipment) is provided for the security check prior to entering the pre-departure area. However, no x-ray equipment is provided for security check of cabin baggage. As a result, passenger congestion takes place during peak hour at this airport. By the same token as above b), X-ray equipment should be provided for cabin baggage security check.

iv) Insufficient Check-in Counters

Two check-in counters are provided at the check-in lobby. Since two flights (one B737 and one F50) take place within a certain one hour period of the day (three times a week), long queues occur during these particular moments. It is recommended to increase the number of check-in counters for better passenger service level.

v) Congestion in Baggage Claim Area

Passenger congestion is taken place in the baggage claim area at peak hour because no baggage claim conveyor is provided.

8.3.5 Cargo Terminal and PAL Office Building

1) General

The building is owned by PAL, and accommodates cargo terminal area and ticketing office. It is one story including mezzanine floor and of reinforced concrete structures, with a total floor area of about 210 sq.m. Floor plan of the building is shown in Figure 8.3.1. As per PAL

information, the building will be expanded on the second floor to meet cargo demands near future. The building is generally in good conditions.

2) Major Problems

No particular problems were observed in the cargo terminal building and PAL office in terms of cargo operation. However, the expansion of capacity will be required after 2000 to cope with increasing cargo traffic volume.

8.3.6 Control Tower and Administration Building

The building is located to the north of the runway. It accommodates the control tower and the administration area. The total floor area is about 360 sq.m, which is not sufficient for daily activity of airport operations. The administration area including ATO engineering rooms is two stories and of a reinforced concrete structure.

The control tower is four stories and of a reinforced concrete structure (1F-3F) and steel frame structures (4F, VFR room). The VFR room is a hexagonal configuration with about 11.7m floor height. It has good visibility for entire airport area. Generally, the building is in good conditions except water proofing problems at VFR room. Water proofing repair work on the roof of the control tower should be carried out.

It is noted that the existing control tower constitute an obstacle to transitional surface, and thus discounting safe aircraft operations.

8.3.7 Other Buildings

1) Fire Station Building

The building is located to the west of the control tower and administration building. It is one story and of a reinforced concrete structure with a total floor area of about 370 sq.m. The building is generally in good conditions.

2) Power House Buildings

The following three power house buildings exist and are generally in good conditions:

	Building	Location	Structure	Approx. Floor Area
a)	ATO Power House 1	West of PTB	RC, One story	20 sq.m
b)	PAL Power House	East of CTB	RC, One story	30 sq.m
c)	ATO Power House 2	East of TWR	RC, One story	40 sq.m

Note: RC: Reinforced Concrete Structure, PTB: Passenger Terminal Building
CTB: Cargo Terminal Building, TWR: Control Tower

8.3.8 Roads and Vehicle Parking Area

The terminal road system of Legaspi Airport consists of a one-way circulation road, which serve the terminal frontage, and well-designated vehicle parking area. The circulation road in front of the terminal building is 11m wide, sufficiently wide for a loading/unloading lane and a through lane. The vehicle parking area has 94 slots, which is sufficient for the present peak hour traffic. However, it was overcrowded in 1995 when one B737 and two F50s were scheduled in 20-minute intervals. The expansion of parking capacity will become needed before 2000.

A road from the northern part of the airport passes around the runway 06 threshold and the western side of the vehicle parking area, and then connects to the access road of the airport. Traffic on this road is almost through traffic and nothing to do with the airport. At present, outgoing vehicles from the parking area have to cross traffic on this road. There is a plan to close this road.

The vehicle parking area is paved with asphalt concrete, which is in good condition. The drainage of storm water from the vehicle terminal area also appears good.

8.3.9 Air Navigation Systems

1) Radio Navigation Aids

(1) VHF Omni-directional Radio Range/Distance Measuring Equipment (VOR/DME)

A Doppler VOR and an DME collocated with the DVOR which was manufactured by Airport Systems International Inc. have been operated since 1993 at this airport. Dimensions of VOR/DME are as shown in Table 8.3.3.

Table 8.3.3 Dimensions of Legaspi DVOR/DME

STATION	SERVICE	CALL SIGN OR IDENTIFICATION	EMISSION	TRANSMITS		RECEIVES		HOURS UTC	COORDINATES	LOCATION		OPERATING AGENCY AND REMARKS
				kHz	MHz	kHz	MHz			Mag	NM	
1	2	3	4	5	6	7	8	9	10	11	12	13
LEGASPI	DVOR/ DME	LP	89W PON		112.2 CH59X			H24	13 09.1 N 123 43 6 E	ON	AD	40M FROM END OF RWY 24 & 180M LEFT OF CENTERLINE. DME OUTPUT = 100W DVOR OUTPUT = 100W

System No.2 of VOR/DME is out of service due to no procurement of module/spare parts. Now this VOR/DME is operating by system No.1 only. It requires the urgent supply of the necessary module/spare parts. VOR/DME is located very close to the runway, approximately 110m eastern side of the runway, and constitutes as an obstacle against aircraft operations. Flight calibration tests has not been carried out in the last few years and only ground checked has been done.

(2) Non-directional Radio Beacon (NDB)

An NDB which is located on the extended runway center line and approximately 8.8nm from the runway 06 threshold is operative as shown in Table 8.3.2. This NDB is used as a Locator for the approach to Runway 06.

Table 8.3.2 Dimensions of NDB "Jovellar"

STATION	SERVICE	CALL SIGN OR IDENTIFICATION	EMISSION	TRANSMITS		RECEIVES		HOURS UTC	COORDINATES	LOCATION		OPERATING AGENCY AND REMARKS
				kHz	MHz	kHz	MHz			Mag	NM	
1	2	3	4	5	6	7	8	9	10	11	12	13
JOVELLAR	NDB	JV	A2A	369				2100-1030	13 04.8 N 123 35.7 E	56	9	TO LEGASPI AIRPORT OUTPUT= 200 W

(3) Evaluation of Existing Radio Navigation Aids

The existing systems are operating with some local problems. However, the addition of ILS is desirable since it is the standard requirement for modern jet aircraft.

2) ATC and Aeronautical Telecommunication System

(1) Approach Control

Approach control facility has not been established at this airport due to lack of air traffic volume at present.

(2) Aerodrome Control

Legaspi Tower has the responsibilities to control the aircraft operating within the ATZ with the frequency of 123.3MHz between hours 2100 and 1030. The console and light gun provided in the Tower were installed in 1993 by USAID.

(3) Flight Service Station (FSS)

Flight service station, call sign Legaspi Radio, which is installed on the downstairs of VFR room for transmitting/receiving flight data with the frequencies of 5447.5, 3834 and 8364KHz between Manila FSS from sunrise to sunset.

(4) Equipment Room

Transmitter/receiver and standby equipment of VHF and HF and voice recorder are installed in 1993 by USAID in the equipment room which is located downstairs of the VFR room. These equipment are maintained in good conditions.

(5) Evaluation of Existing ATC and Aeronautical Telecommunication Systems

The existing systems were renewed recently by USAID, and generally operating in good condition. PC/Fax machine and VSAT will be added under Nationwide Air Navigation Facilities Modernization Project - Phase III. The existing systems are adequate for operational needs for anticipated air traffic volume up to 2015 if necessary maintenance and replacement of aging equipment are undertaken.

3) **Airfield Lighting Systems**

(1) Existing Systems

The following systems which are controlled by control tower are operative at this airport.

- Runway edge lights
- Threshold lights for the both runways 06/24
- Taxiway edge lights
- Apron flood lights
- Aerodrome beacon
- PAPI for the both runways 06/24
- Approach lights for the both runways 06/24

Aerodrome beacon is installed on top of the Lingnon Hill, 156 m AMSL located approximately 600 m NW of the airport. The length of approach lighting is 220m for Runway 24 and 330m for Runway 06.

(2) Evaluation of Existing Air Field Lighting Systems

The existing systems are operating normally although some of them are obsolescent. The existing approach lights do not comply with precision approach Category I operations, which are the standard requirement for modern jet aircraft. It is desirable to install Precision Approach Category I Lighting System (PALS) for the main approach runway and Simple Approach Lighting System (SALS) for the other side of the runway.

4) **Meteorological Services**

There is a local office of PAGASA proximity to the airport. This office sends the meteorological data to be observed to the control tower on an hourly basis. However, PAGASA's aerovane is located at a distance of approximately 150m off the runway centerline. Sometimes these wind data are not conformable to actual conditions at the runway thresholds. So that controllers inform the wind data to be read through the gauges installed in the console of

the tower which have the sensors near the runway. More sophisticated observation and recording systems are required for civil aviation purpose.

8.3.10 Rescue and Fire Fighting Services

The crash, rescue and fire fighting services declared for Legaspi Airport are the ICAO's category 6 level of protection, which corresponds to B737 class aircraft. There are two RIVs and two major vehicles. An old RIV deployed in 1985 can discharge 75L (20 gal.) form and 113kg (250 lb.) dry chemical. A new RIV was introduced in 1992, which has a 1,250L water capacity. The older major vehicle was made in 1961, and has 2,000L water tank capacity. Another major vehicle deployed in 1992 has a water tank of 2,500L. Working condition of those vehicles is generally good, except that the new RIV's engine has been troubled for a long time. The older major vehicle has a spare parts problem. The total water tank capacity of the fire vehicles is 4,750L, which is adequate for category 4 aerodrome only. Since the number of operations of B737 at Legaspi Airport during the busiest three consecutive months is only about 360, i.e., less than 700, the category 5, which corresponds to F50, is the required level of protection. An increase of CRF capability is necessary. There are 13 trained personnel for the services. In addition, 10 trained staff are available from other sections to supplement the insufficient number of regular staff in case of emergency.

The level of protection should further be increased at least to category 7 for operating A300, which is anticipated for Legaspi-Manila sector in 2006 according to our forecast.

8.3.11 Airport Utilities

1) Storm Water Drainage

Storm water on the airport is mainly drained to the Yawa River, which runs besides the runway 24 threshold. A main canal of 3m wide running along the northern side of the runway. A shorter canal runs along the southern side of the runway collects storm water on the apron and terminal facilities and join the main canal via a culvert beneath the runway. The two canals along the northern and southern sides of the runway have two pipe culverts of approximately 80cm diameter to cross the taxiways. The main canal flows to the south along the Legaspi Diversion Road and discharges storm water into the Yawa River via a culvert to cross the said road.

Those canals are functioning well even though they are not well maintained. The runway of Legaspi Airport has been rarely inundated in the past even when severe typhoons came. However, the outlet culvert to the Yawa River often invites backwater when the river's water level is high. As a result, water often stagnates on the northern side of the runway 24. The Legaspi ATO plans to construct an additional culvert to facilitate the good drainage for stagnant water in the area.

Storm water on the western end of the airport flows into the Bugtong Creek, which rarely overflowed in the past.

2) **Fencing**

The airport is now placing concrete hollow block fence where the runway strip was widened. Approximately 50% of the newly acquired has been installed with the concrete hollow block fence by 1995. The contract for the remaining half has already been awarded, and it will be completed in 1996.

Temporary stairs are provided on the fence at the location of the old road so as to maintain pedestrian traffic of the surrounding communities. According to the area manager, these stairs will be remove once public transportation (jeepney) become available around the airport.

3) **Power Supply System**

Electric power for the airport is supplied by Albay Electric Cooperative (ALECO). The ATO receives electricity at 13,200V at the power plant, and at 220V for the terminal building. The received electricity at the power plant is stepped down to 220V with three 50KVA transformers of 1995 made, and then distributed to the control tower, administration office, VOR/DME, aeronautical lighting system, with CCRs for some equipment. Average consumption of the commercial power is about 1,600KWH per month.

There are frequent power failures, twice to three times a week on average. The power plant has two emergency generators of 150KVA (installed in 1972 and 1989), which covers control tower, administration office, and aeronautical lighting system. The ATO installed a 80KVA generator on the western side of the terminal building in 1995 to back up the terminal building. In addition, VOR/DME has an exclusive 15KVA. The Legaspi ATO plans to back up VOR/DME from the new 80KVA generator. All the generators are manually started. It takes less than one minute to switch over from the commercial supply to the backup system.

PAL has a power plant besides the cargo terminal building. One 12KVA generator can supply emergency power for the cargo terminal and ticketing office.

4) **Telephone System**

The Legaspi ATO has three external telephone lines connected to the PABX system. Two PABX were installed in 1994, one which works for general external and internal communications, while the other is used for operation purpose, connecting control tower, FSS, power plant, fire station, VOR/DME, PAGASA, etc. The system has an adequate capacity

for daily airport operation and is in good working condition. In addition, there is an internal communication system between the ATO and PAL.

There is two telephone booths of Mayon Telephone Company (MATELCO) in the terminal building for public use.

5) **Water Supply System**

The Legaspi ATO has three deep wells to supply drinking water. One of them is for the terminal building, and other two, inter-connected each other, serve control tower, administration office, power plant and fire station. Water from the well is pressurized with the pressure tanks and sent to consuming points. There is an small elevated water tank for fire vehicles behind the fire station. The wells have enough capacity to supply water to airport facilities. Water quality is said to be slightly rusty, but adequate for drinking.

There is an unused elevated water tank of 2,000L behind the fire station. The Legaspi ATO plans to reactivate this water tank as emergency backup. There is an underground pipe from this water tank to the terminal area.

PAL also has a deep well besides the cargo terminal/ticketing office building.

6) **Sewerage System**

Sewage is treated by septic tanks for individual buildings. The present system is not the one which ensures effluent quality, but is working without problem. More sophisticated treatment system is desirable to cope with increasing effluent.

7) **Solid Disposal System**

Solid disposal from the airport is collected by the Public Service Department of Legaspi City. There is no incinerating place within the airport.

8.3.12 Fuel Supply System

The aviation fuel supply system at Legaspi Airport is owned and operated by PAL. There are two vertical fuel tank of some 41,640L (11,000 gals.) each, a total storage capacity of 83,280L (22,000 gals.). The fuel is supplied to aircraft from three pits on the apron through the hydrant system. Average consumption of fuel at the airport is about 380L (100 gals.) per day. The fuel is supplied by PETRON's fuel truck once a month. The system is in normal working condition. The system uses engine driven pumps, which will be replaced by electric pumps by June 1996.

The increase of storage capacity will become necessary to satisfy standard storage requirement of seven-day consumption.

8.4 AIRPORT DEVELOPMENT MASTER PLAN

8.4.1 Summary

Master planning for development of Legaspi Airport was conducted in the First Study Work in Japan. This section summarizes the results of the master planning.

This master plan was prepared based on a set of air traffic demand forecasts and future facility requirements described in Chapters 3 and 4 respectively. Target years of the master planning are;

a) Medium Term Development : Year 2005, and

b) Long Term Development : Year 2015.

Kemantong Range is a significant obstacle against the Runway 06 approach. As removal of the hill will cost about PHP 2 billion, it is recommended to conduct a study on alternative sites of Legaspi Airport. A study on development at the existing site was, however, conducted based on the original Scope of the Study agreed between DOTC and JICA.

As a first step of the Study, two alternative development plans of the existing Legaspi Airport were prepared. These alternative plans were, then, comparatively evaluated, and the development scheme shown in Figure 8.4.1 was selected as the optimum development plan for Legaspi Airport. Table 8.4.1 summarizes outline of airport development works.

Planning of airspace use, cost estimates, initial environmental evaluation, economic analysis and financial analysis were conducted based on the optimum development plan to evaluate viability of the development.

As a result of the study it is concluded that the development of the existing Legaspi Airport to accommodate the anticipated traffic in the year 2015 is economically and environmentally unfeasible. It is, therefore, recommended to conduct a study on new airport development as soon as possible.

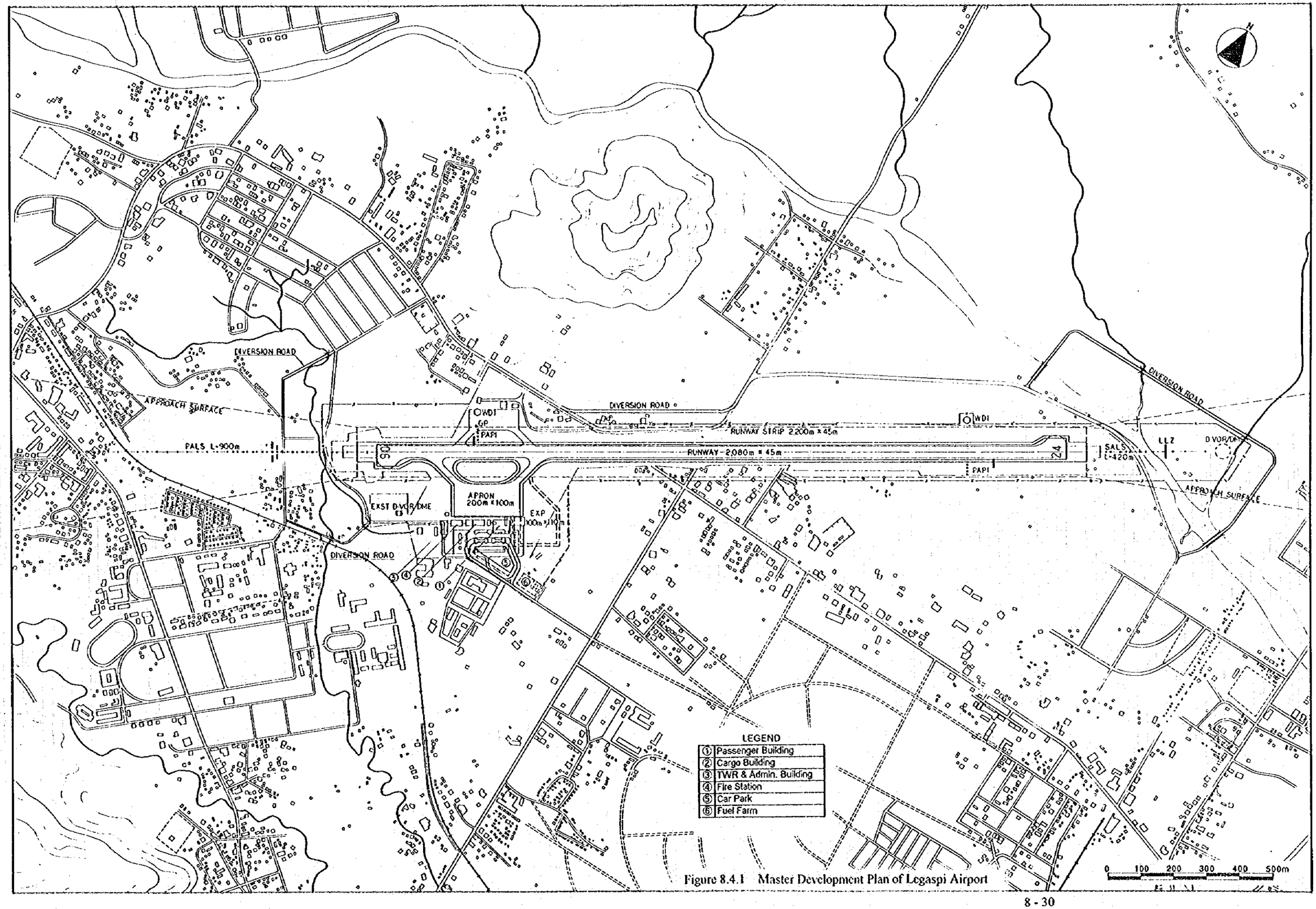


Figure 8.4.1 Master Development Plan of Legaspi Airport

Table 8.4.1 Outline of Legaspi Airport Development

Item	Medium Term	Long Term
Earthworks	Cut 10,000 m^3, Fill 140,000 m^3	cut 2,000 m^3
Runway	Asphalt overlay 4 cm	-
Taxiway	Asphalt overlay 10 cm	-
Apron	Asphalt overlay 10 cm	Expansion 17,000 m^2
Passenger Terminal Building	New building 2,900 m^2	Expansion 900 m^2
Cargo Terminal Building	Expansion 80 m^2	Expansion 120 m^2
Administration Building	New building 1,800 m^2	-
Control Tower	New building	-
Fire Station	New building 550 m^2	-
Car Park	New car park 5,250 m^2	Expansion 1,400 m^2
Roads	5.3 km	-
Air Navigation Systems	ILS Cat I, PALS, SALS, etc.	D-VOR/DME
Fuel Supply Facility	Expansion 20kl	New facility 150kl
Obstacle Removal	Kemantong Range, Control Tower, Fire Station, etc.	-
Land Acquisition	21 ha	2 ha
Diversion / Relocation	42 houses, Road 2.4 km	4 houses

8.4.2 Alternative Airport Development Plans

1) Constraints and Policy of Planning

As mentioned in the previous section, Kemantong Range to the southwest of the airport is a natural obstacle to the approach surface. On the other hand, there is Yawa River, which is considered difficult to divert, on the northeast of the runway. There is Lignuion Hill to the northwest of the airport. It is an obstacle to the inner horizontal surface, and a part of it will become an obstacle to the transitional surface if the runway strip is widened to 300m.

With regard to the future land use, it is assumed possible to alter the zoning for development of the airport.

It is also assumed that the following projects and plans will be completed before the Medium Term Development.

a) complete the overlay of runway,

b) construction of perimeter fence around the existing airport property,

c) installation/replacement of PC/fax machine and VSAT.

The following policies are applied for planning of the Legaspi Airport development.

a) The airside facilities should, in principle, comply with international standards.

b) The landside facilities including terminal buildings should be developed to cope with local needs.

c) The existing facilities should be used effectively to optimize the development cost.

d) The existing airport boundary and magnitude of relocation of houses should be considered in facility layout planning.

2) Formulation of Development Alternatives

(1) Runway

The existing runway will require strengthening of the pavement to cope with heavier aircraft such as A320 and A300. Required thickness of asphalt overlay would be about 4cm (refer to Appendix 8.4.1 for details).

(2) Removal of Obstacle on the Approach Surface

There are, in theory, two alternatives to avoid the obstacle on the Runway 06 approach surface as follows:

a) relocating the runway thresholds, and

b) cutting Kemantong Range.

In the case of relocating the runway thresholds, more than 2,000m displacement of the threshold is required. It is almost same as new airport construction, and there is no justification to construct a new airport at this location. Therefore, cutting the hills is considered in this master planning study.

Figure 8.4.2 shows the area needs to be cut to clear the approach surface (based on a 150m wide runway strip). Total volume of cut is in the order of 20 million cu. m, and total area to be affected by cutting is about 140 ha.

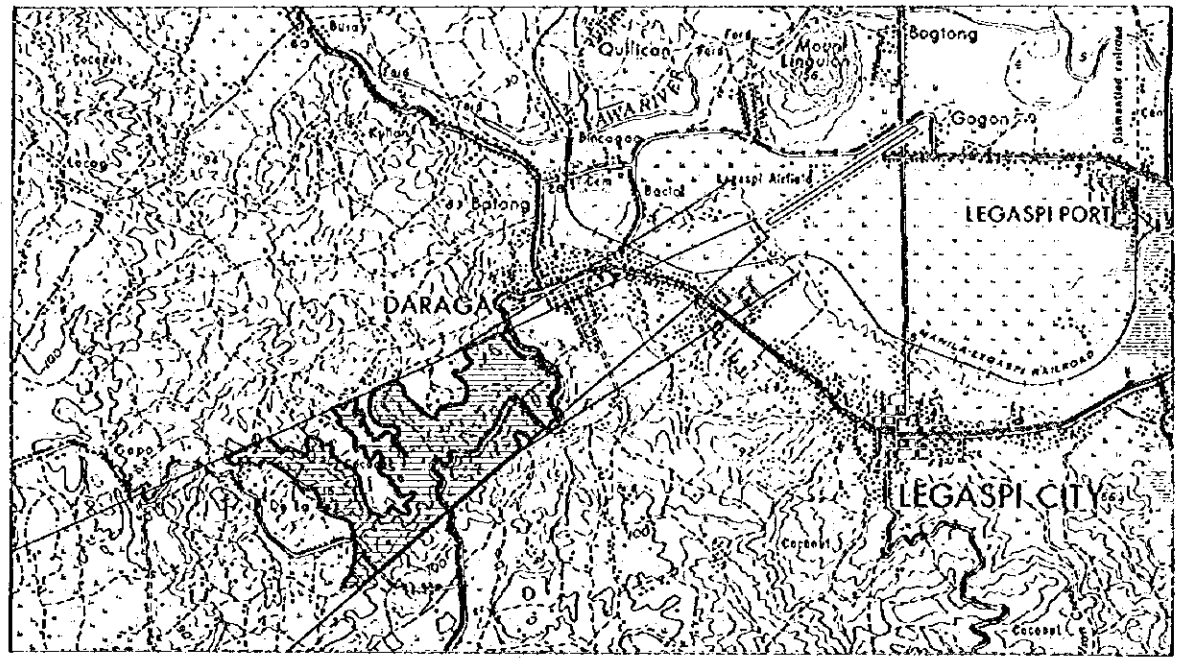


Figure 8.4.2 Removal of Hills on Runway 06 Approach Surface

(3) Runway Strip

Figure 8.4.3 shows the runway strips of 150m and 300m wide. As seen, the 300m wide runway strip will require much larger land acquisition and relocation of inhabitants than the case of 150m wide runway strip (additional 38ha and about 70 houses). In addition, if the 300m wide runway strip is adopted, volume of cut for obstacle removal will increase. Therefore, it is considered impractical to widen the runway strip to 300m at the existing site of Legaspi Airport.

(4) Air Navigation Systems

It is planned to install ILS for Runway 06 approach based on the prevailing wind direction. Locations of ILS glide path (GP) and localizer (LLZ) antennas and their critical areas are planned as shown in Figure 8.4.4. Existing Doppler VOR/DME will be used in the Medium Term. It will be replaced at about 480m from the Runway 24 threshold on the extended center line of the runway so that straight in approach can be established for both runways.

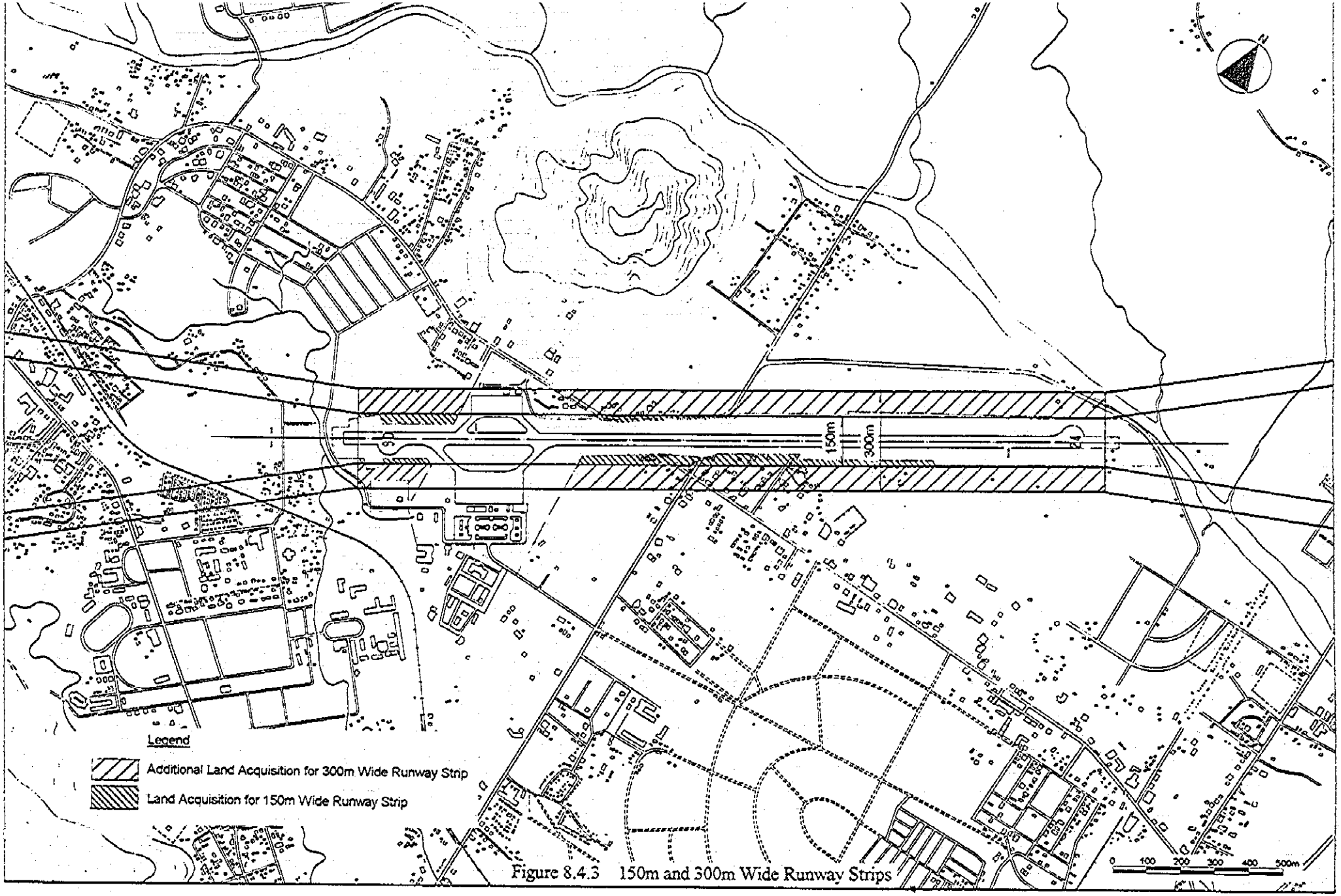
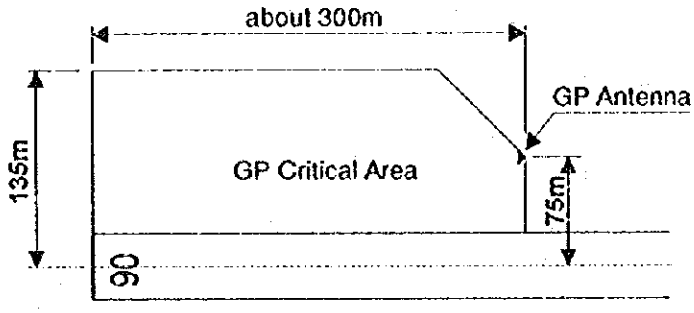
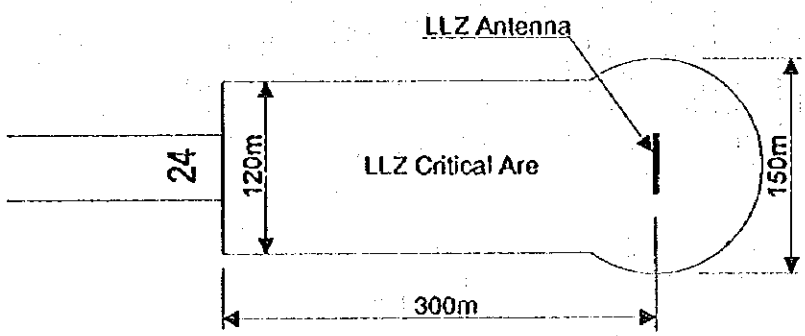


Figure 8.4.3 150m and 300m Wide Runway Strips



Glide Path Antenna and Critical Area



Localizer Antenna and Critical Area

Figure 8.4.4 Proposed Locations of Air Navigation Systems

(5) Location of Terminal Area

The existing apron can accommodates four B737 class aircraft without penetrating into the transitional surface. It is, therefore, planned to use the existing terminal area in the Medium Term. In the Long Term, operation of A300 class aircraft, which can not be accommodated on the existing apron, is anticipated. Therefore, optimum location of new A300 class aircraft stands is studied. Possible locations of A300 class aircraft stands are as follows (refer to Figure 8.4.5).

a) Alternative L1: on the west of the existing apron; and
b) Alternative L2: on the east of the existing apron.

In the case of Alternative L1, a new passenger terminal building will be constructed at the same location as the existing passenger terminal building in the Medium Term. In order to construct the new passenger terminal building and roads, the existing passenger terminal building and concessions' building will be demolished. In the Long Term, a power house and buildings for AVSECOM and PAGASA will be demolished, and the apron will be expanded on the southwest of the existing apron. Aircraft parking configuration on the expanded apron will be in parallel with the runway and facing to the passenger terminal building. The existing fuel hydrant system will be extended to the new aircraft stands. However, the capacity of the existing fuel hydrant pipes may not be sufficient to supply the fuel to A300s on the new aircraft stands. If the capacity is insufficient, longer turnaround time might be required for slower refueling operation.

In the case of Alternative L2, a new passenger terminal building will be constructed between the existing cargo terminal building and fuel farm in the Medium Term. In order to construct the new passenger terminal building the PAL power house will be demolished. In the Long Term, the existing fuel farm will be demolished, and the apron will be expanded on the east of the existing apron. New fuel farm will be constructed, and the fuel can be supplied to the A300s on the new aircraft stands without using the existing hydrant pipes. There will, therefore, be no problems in the capacity of the existing fuel hydrant pipes. Aircraft parking configuration on the expanded apron will be in parallel with the runway and facing to the passenger terminal building.

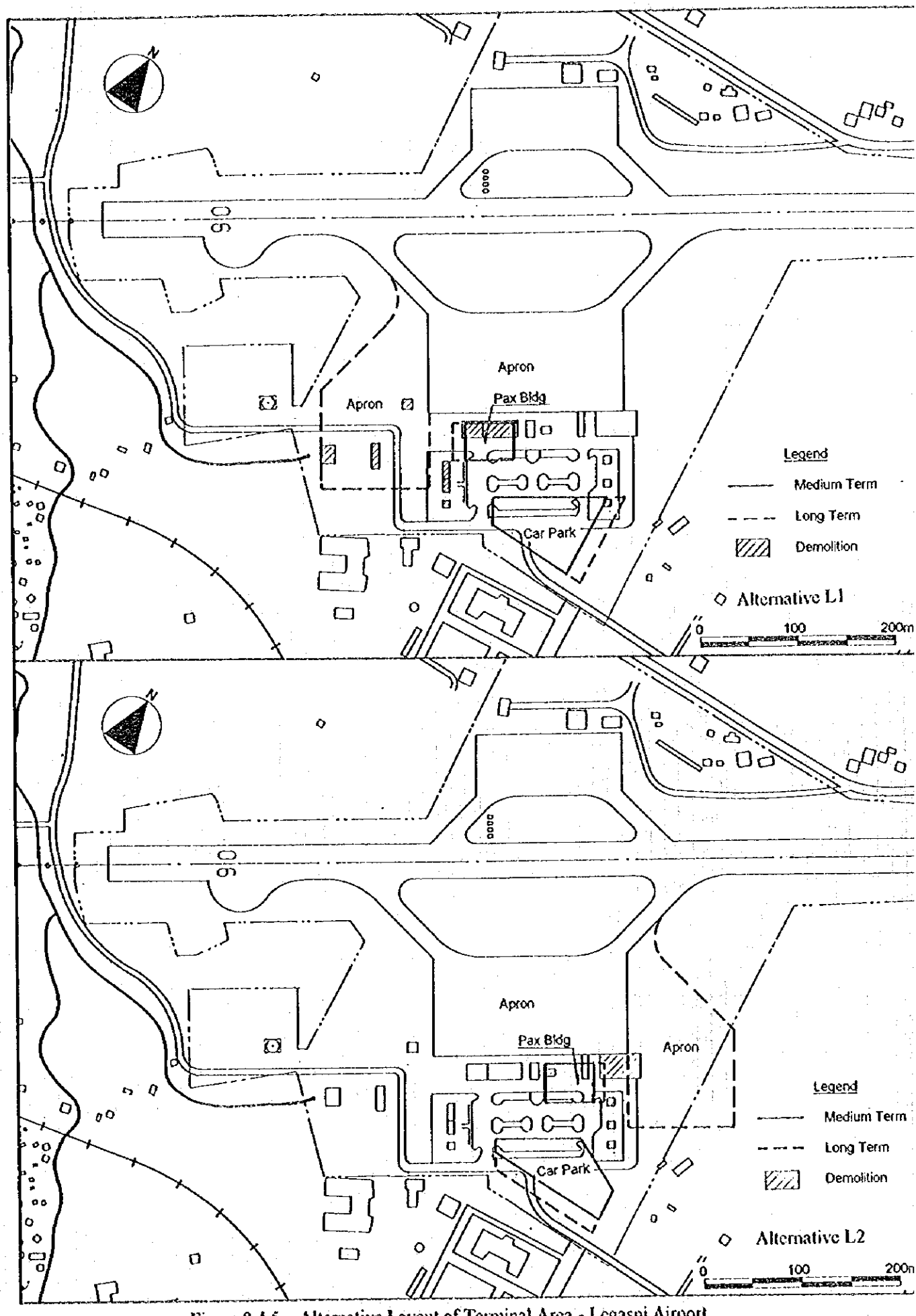


Figure 8.4.5 Alternative Layout of Terminal Area - Legaspi Airport

8.4.3 Selection of Optimum Development Plans

Two alternative terminal area layout plans formulated in Section 8.4.2 are evaluated from the various viewpoints. The following sections summarize the evaluation results.

1) Convenience of Users

Alternative L2 has a small advantage in convenience of users because more vehicle parking space can be provided near the passenger terminal building.

2) Operational Conditions

There is no significant difference in operational conditions between two alternatives.

3) Expandability

There is no significant difference in the future expandability. However, it is considered more logical to expand the terminal towards the east, because the terminal area is located very close to the Runway 06 end.

4) Environmental Considerations

Difference in environmental impacts of the two alternatives will be an additional land acquisition required for apron expansion in Alternative L2. However, the magnitude of impact will be small, because the area of land acquisition and number of houses to be relocated are relatively small (2.3 ha and 4 houses).

5) Project Cost and Ease of Construction

Table 8.4.2 shows comparison of costs for Alternatives L1 and L2. As seen, Alternative L1 will cost PHP 12.4 million more than Alternative L2 in the Medium Term, but cost PHP 60.2 million less in the Long Term. Thus, total costs of Alternative L1 will be PHP 47.8 million less than Alternative L2.

It should be noted that the capacity of the existing fuel hydrant pipes may not be sufficient to supply the fuel to A300s on the new aircraft stands in the case of Alternative L1, and it may require additional cost for improvement of the fuel hydrant pipes in Long Term.

Any way, it is considered impractical to take the cost of Long Term Development into account because the airport would be relocated to a new site before the Long Term Development due to the hill obstructions around the existing airport.

Table 8.4.2 Comparison of Costs (PHP million)

Item	Alternative L1	Alternative L2
Medium Term Development		
Temporary Passenger Building	12.4	-
New Passenger Building	94.3	94.3
Sub-total	106.7	94.3
Long Term Development		
Land Acquisition & Compensation	-	5.4
Fuel Supply System	27.2	82.0
Sub-total	27.2	87.4
Total	133.9	181.7

6) **Conclusion**

Table 8.4.3 summarizes relative advantages of alternatives.

Table 8.4.3 Relative Advantages of Alternatives

Item	Alternative L1	Alternative L2
1) Convenience of Users	-	- More vehicle parking space near the terminal building.
2) Operational Conditions	-	-
3) Expandability	-	- Logical to expand the terminal area toward the east.
4) Environmental Considerations	- No land acquisition for terminal development.	
5) Project Cost and Ease of Construction	- PHP 60.2 million less in Long Term. - PHP 47.8 million less in total cost.	- Effective use of existing facilities in Medium Term. - PHP 12.4 million less in Medium Term. - No problem in capacity of existing fuel hydrant pipes in Long Term.

As a conclusion, Alternative L1 is selected mainly for the following reasons:

a) The existing facilities can be used effectively (especially in the Medium Term).

b) There will be no problem in the capacity of the existing fuel hydrant pipes in the Long Term, since the fuel can be supplied to the A300s on the new aircraft stands without using the existing hydrant pipes.

Cost of the Long Term Development is not considered seriously because it is believed that the airport will be relocated to a new site due to the hill obstructions around the existing airport.

8.4.4 Planning of Airspace Use

1) Existing Airspace Use

a) Aerodrome Traffic Zone (ATZ)

An aerodrome traffic zone is established with dimensions as shown in Table 8.4.4 at this airport.

Table 8.4.4 Dimensions of ATZ at Legaspi Airport

TOWER	HOURS (UTC)	LATERAL LIMITS	UPPER LIMIT(ft)	LAN-GUAGE	REMARKS
1	2	3	4	5	6
LEGAZPI TOWER	2100-1030*	ATS: Circle, 5 nm radius centered on aerodrome reference point (13 09 18 N 123 43 35 E)	Up to but excluding 2,000 ft.	En	VFR, aerodrome traffic are controlled.

b) Instrument Flight Procedures

At present no instrument approach and departure procedures are established. Usually aircraft coming from Manila are cleared via airway W-15 at an FL270, then descend to Jovellar (JV) NDB to 10,000 feet, then descend to Legaspi VOR/DME at 5,000 feet, then make visual approach to the airport.

There are high mountain, Mayon Volcano, 2,421 m AMSL approximately 12 km (6.5nm) northwest of airport and Lingnon Hill, 156m AMSL 600m northwest of the airport. The geographical condition stated above makes severe limitations on aircraft operations.

To ensure the safe aircraft operations, instrument approach and departure procedures should be established urgently taking into account the geographical condition mentioned above.

2) Modification of Existing Airspace Use

Instrument approach and standard instrument departure procedures have not been established at Legaspi Airport. This airport has only Air Traffic Zone (ATZ) with 5 NM radius centered on aerodrome reference point, and no Control Zone (CTR) and Terminal Control Area (TMA) have been established.

It is indispensable for the safety of aircraft operations and expedition of air traffic flow to establish instrument approach and departure procedures for an airport where scheduled flights are operated. It is also necessary to establish CTR and TMA to ensure the matters mentioned above.

This airport is controlled by the Manila ACC. However it is located at the remote place from Manila. Therefore, it is strongly recommended to establish the TMA for this airport.

(1) Terminal Control Area and Control Zone

A Terminal Control Area (TMA) and a Control Zone (CTR) with 25NM and 10NM radius respectively centered on Legaspi VOR/DME are planned as shown in Figure 8.4.6. Establishment of new routes are planned taking into account the obstacles which are located west side of the airport.

(2) Instrument Approach Procedures

Two instrument approach procedures using Legaspi VOR/DME, i.e. VOR/DME RWY 06 and VOR/DME RWY 24, are planned as shown in Figures 8.4.7 and 8.4.8 respectively. Since approach from north has few obstacles than that from south, obstacle clearance altitude (OCA) for straight in approach for VOR/DME RWY 06 and VOR/DME RWY 24 will be 880 feet and 600 feet respectively.

(3) Standard Instrument Departures

Basic standard instrument departure routes are planned as shown in Table 8.4.5. Transition routes should be added based on the future requirements. The weather minimum for takeoff on Runways 06 and 24 will be 300 feet ceiling and 1,000m visibility provided that takeoff alternate airport is filed.

Table 8.4.5 Suggested SID for Legaspi Airport

No. 1	Takeoff Runway 06, climb via R-054 of Legaspi VOR/DME to 20 DME, then left turn, climb via 20 DME arc of Legaspi VOR/DME until intercepting R102 of Legaspi VOR/DME, then climb via R102 of Naga VOR to Naga VOR.
No. 2	Takeoff Runway 06, climb via R-054 of Legaspi VOR/DME to 10 DME to 3,000feet, then right turn proceed to Legaspi VOR/DME.
No. 3	Takeoff Runway 24, climb via R-247 of Legaspi VOR/DME to point R247/D19 to 6,000 feet or above.
No. 4	Takeoff Runway 24, climb via R-247 of Legaspi VOR/DME to 3,000 feet, then left turn proceed to Legaspi VOR/DME.

(4) ILS Approach Procedure

Category I ILS is planned for Runway 06. An ILS approach procedure can be established without significant restrictions if the top of Lignuion Hill is cut by at least 8m in addition to the cutting of Kemantong Range.

(5) Modifications in Long Term

The existing VOR/DME will be relocated to about 480m from the Runway 24 threshold on the extended center line of the runway in Long Term. This relocation of Legaspi VOR/DME will require some minor changes in directions and distances between navaids and fixes and others of TMA, instrument approach procedures and standard instrument departure routes.

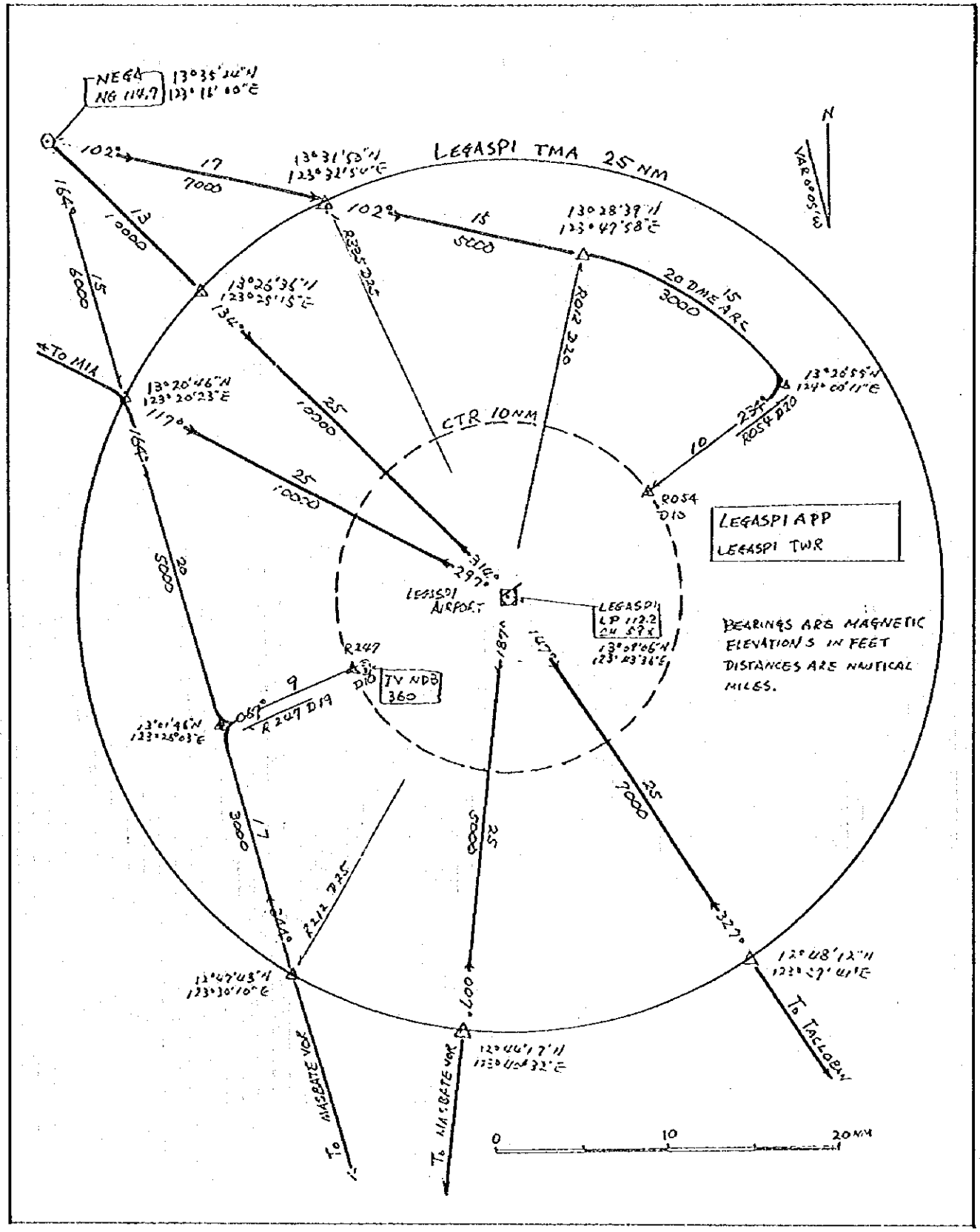
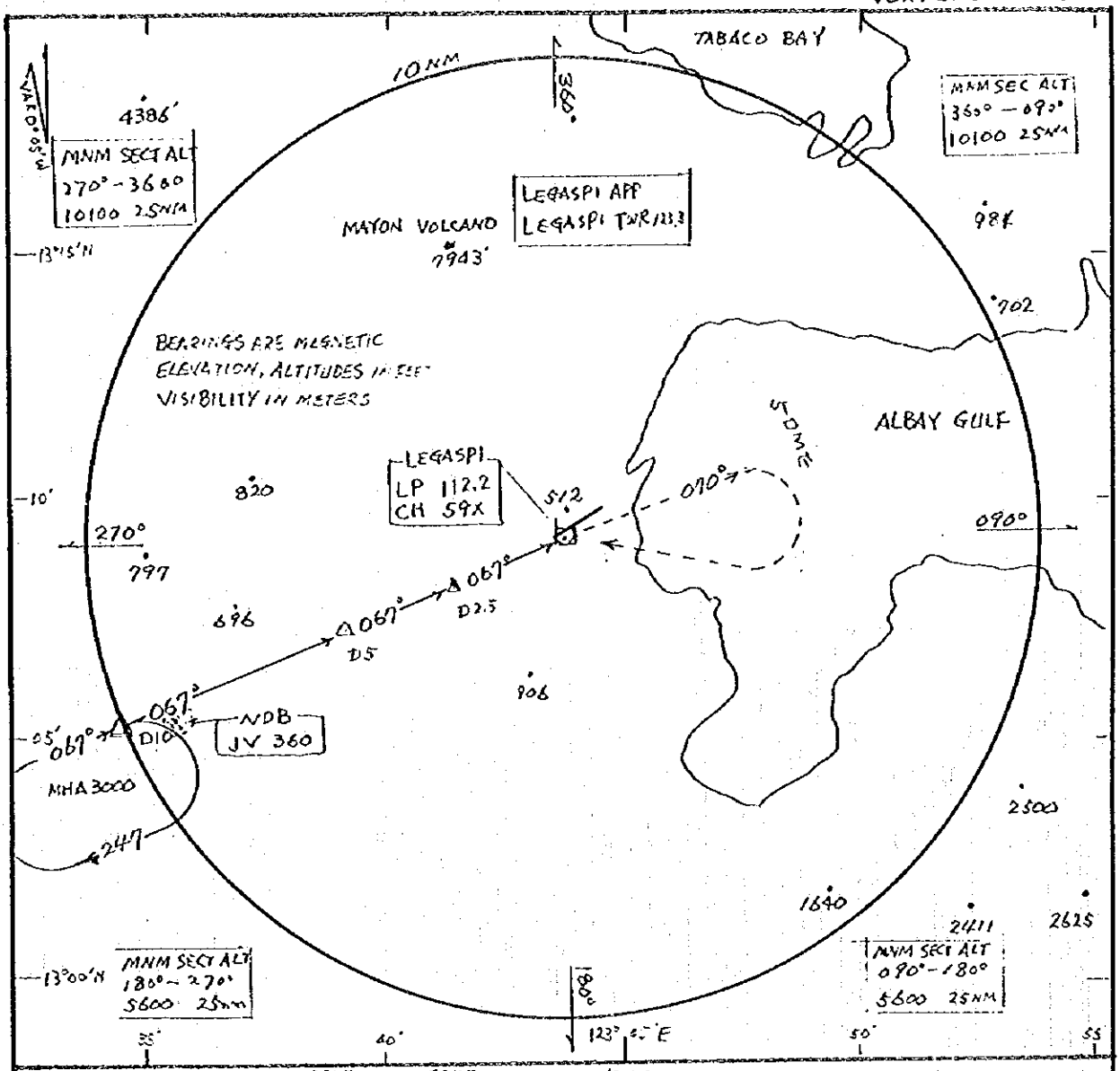


Figure 8.4.6 Proposed Terminal Control Area for Legaspi Airport

ELEVATION 20m/66ft

LEGASPI/LEGAZPI
PHILIPPINES
VOR/DME RWY 06



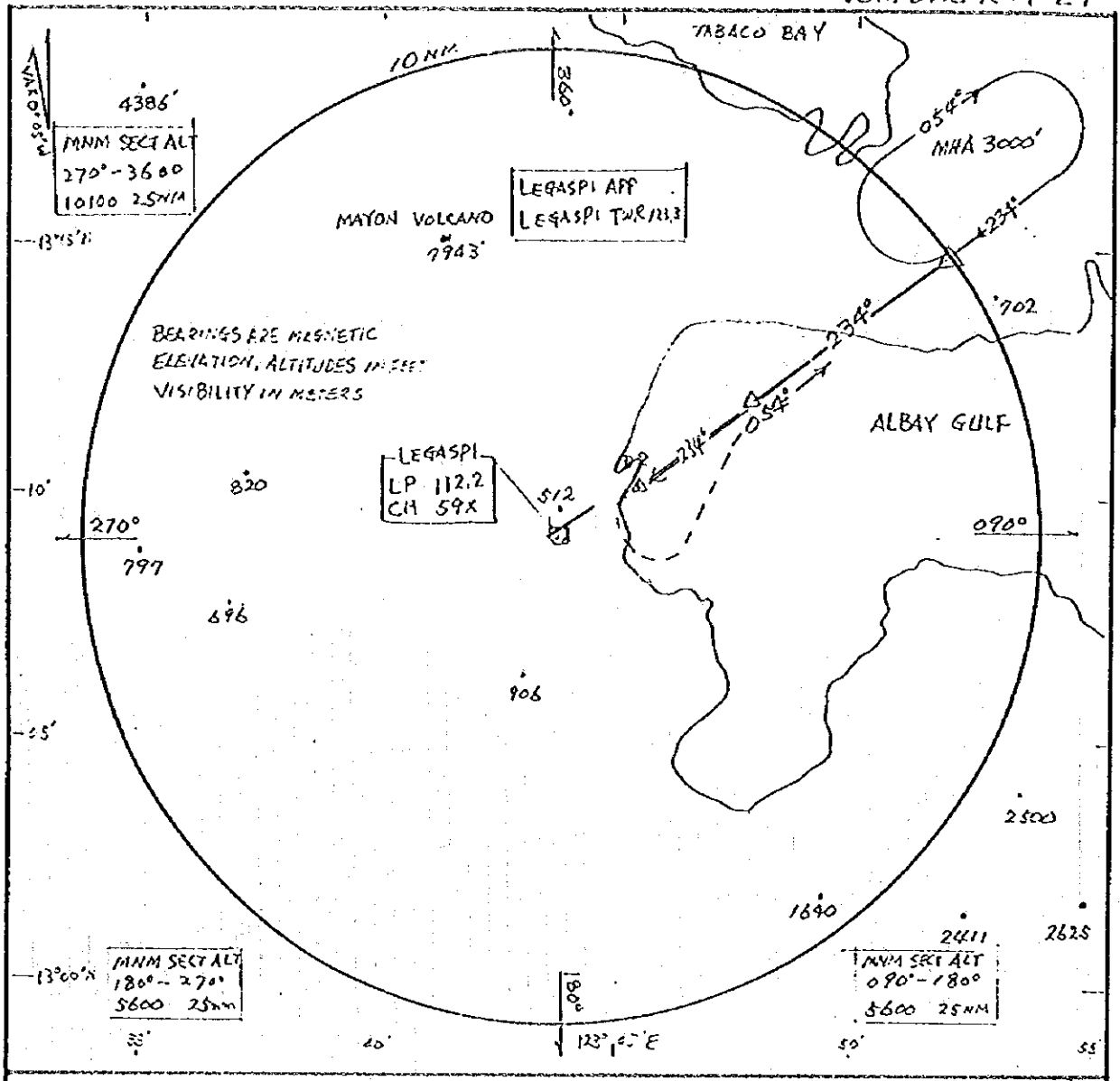
	A	B	C	D
	OCA - VIS	OCA - VIS	OCA - VIS	OCA - VIS
STA RWY 06	880'-1600m			—
CIRCLING *	880'-[illegible]	1160'-2800m	1160'-3700m	—

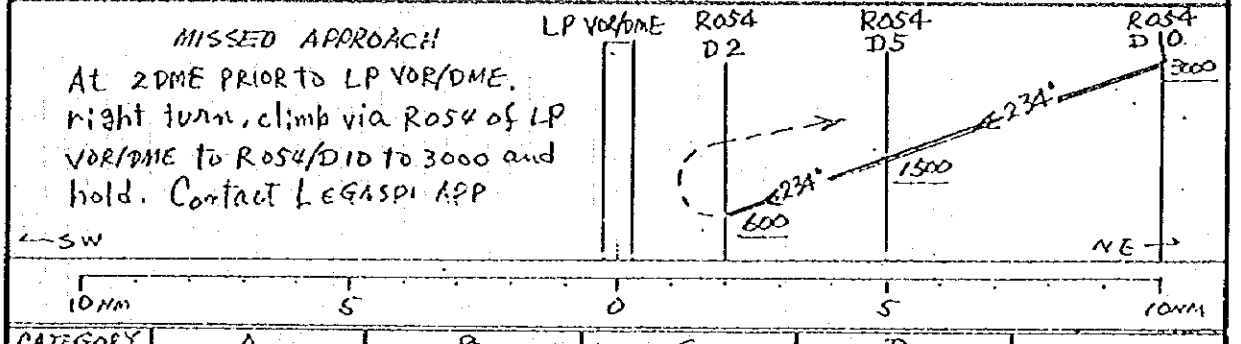
* Note : Circling is strictly restricted to east side of runway only.

Figure 8.4.7 Proposed VOR/DME RWY 06

ELEVATION 20M/66ft

LEGASPI/LEGASPI
PHILIPPINES
VOR/DME RWY 24





CATEGORY	A	B	C	D
STA RWY 24	OCA – VIS	OCA – VIS	OCA – VIS	OCA – VIS
	600'-1400m			—
CIRCLING *	840'-1900m	1160'-2800m	1160'-3700m	—

* Circling is strictly restricted to east side of runway only.

Figure 8.4.8 Proposed VOR/DME RWY 24

8.4.5 Cost Estimates

Table 8.4.6 summarizes results of preliminary cost estimates based on the following conditions:

a) Construction costs were estimated based on the 1996 prices.

b) Exchange rates were fixed at US$ 1.00 = PHP 26.00 = Yen 110.

c) Price escalation (inflation) was not included.

d) Cost for engineering services was estimated to be about 10% of the construction cost.

e) Contingencies were estimated to be about 10% of the total cost.

Table 8.4.6 Preliminary Cost Estimate for Legaspi Airport Development (Unit: million PHP)

Item	Medium Term	Long Term	Total
Construction Cost	2,369.7	214.2	2,583.9
Hill Obstacle Removal	1,555.5	0.0	1,555.5
Road Diversion	33.4	0.0	33.4
Airport Civil Works	174.2	33.2	207.4
Earthworks & Drainage	52.5	2.0	54.5
Runway, Taxiway & Apron	75.1	28.5	103.6
Roads & Car Park	17.3	1.0	18.3
Other Civil Works	29.3	1.7	31.0
Building Works	181.5	32.6	214.1
Passenger Terminal Building	100.8	31.3	132.1
Cargo Terminal Building	3.1	1.3	4.4
Control Tower & Administration Building	53.9	0.0	53.9
Fire Station	12.9	0.0	12.9
Other Buildings	10.7	0.0	10.7
Special Equipment & Fire Fighting Vehicles	71.7	18.2	89.9
Airport Utilities	41.2	7.5	48.7
Fuel Supply System	8.6	87.7	96.3
Air Navigation Systems	198.0	25.7	223.7
Miscellaneous	105.8	9.6	115.4
Land Acquisition & Compensation	181.4	5.7	187.1
for Airport Development	69.4	5.7	75.1
for Hill Obstacle Removal	112.0	0.0	112.0
Consultancy Services	237.0	21.4	258.4
Contingency	260.7	23.1	283.8
Total Cost	3,048.8	264.4	3,313.2

8.4.6 Initial Environmental Evaluation

1) Environmental Conditions of the Project Site

Table 8.4.7 and the following paragraphs summarize the environment of existing Legaspi Airport based on the site reconnaissance and available data.

(1) Social Environment

The existing Legaspi Airport is located at southeast of Mayon Volcano and west of Albay Bay while its north and west side are surrounded by mountains. The airport has a size of around 75has. It is located right beside Legaspi City to the north with distance around 2.5km, takes around 10 minutes by car. Since this airport was originally constructed by dividing the existing road, there is a mark of dividing road in two. Several residential houses can also be seen in the area. The vicinity of the airport is mostly covered by paddy fields. River is traversing both side of runway while Lingnon Hill (156m) is closely located at northwest side of it.

The major industry of the area is agriculture, fishery and tourism. Most of the agricultural area are rice fields and coconut forests. With regards to the road traffic condition of the area, road is running from Metro Manila via Naga City and Legaspi City and further it reaches up to Samar Island. Several educational and welfare facilities such as schools and hospitals can be found in the vicinity of the airport. Garbage and waste is being disposed by burning.

(2) Natural Environment

The area around the airport is mostly surrounded by paddy fields and pastures. The natural resources to be protected such as vast forest and dump ground are none in this area. However, river is traversing both side of runway and detailed investigation is required since there is a possibility to find a valuable animal or plants. Moreover, it is reported that the river running both side of runway is not an irrigation water but it seem to be serving as an important water source for the farms around it. Also, according to the project plan, great portion of a hill, which is located near Daraga area at southwest of the airport, are need to be leveled and therefore, detailed investigation on flora and fauna is necessary.

(3) Pollution

The complaint for existing airport is indistinct. However, air pollution and noise problem may occur in the future considering the rapid urbanization in the area.

Table 8.4.7 Environmental Conditions of Existing Legaspi Airport

Item	Condition
Social Environment	
Population	Many residents are residing at the east side of project site.
Land Use	Mayon Volcano is located close to the airport and the area is No.1 scenic spot in the Philippines because of the Volcano. The area around the airport is mostly surrounded by paddy fields and pastures.
Economic and Traffic	Major economic activities are agriculture and tourism. Legaspi City has a bus terminal to provide junction point for land transportation.
Natural Environment	
Topography, Geology	Paddy fields and pastures are located. River is at southnorth. The foundation is seem to be weak. Hills are located at the area of around 1 to 2km to the west as well as at south. Right at the north of runway is a hill with the height of 150m.
Valuable Animals and Plants	Indistinct.
Pollution	
Occurrence of Complaints	Complaint at the proposed project area is unknown. It is reported that there might be no complaint because of less number of flights.
Countermeasure	Indistinct.
Others	Nothing in particular.

2) Evaluation of Environmental Impacts

Environmental impacts of the Legaspi Airport development project was evaluated based on the site reconnaissance and existing data, and the results are summarized in a standard form of JICA as shown in Table 8.4.8.

Table 8.4.8 Evaluation of Environmental Impact of Legaspi Airport Development Project

Issue		Evaluation	
Social Environment			
1.	Resettlement	A	Relocation of some 50 houses will be required.
2.	Economic Activities	B	Some paddy fields and pastures will be lost.
3.	Traffic and Public Facilities	B	Increase of airport related vehicle traffic will have some impacts on traffic conditions. Diversion of roads is included in the project.
4.	Split of Communities	B	Some impacts are expected due to the diversion of roads.
5.	Cultural Property	C	No cultural heritage is known, but attention should be given to buried heritage during the implementation of the project.
6.	Water Rights and Rights of Common	B	There will be some impacts due to large scale cut of the hills.
7.	Public Health Condition	D	There will be no impact on public health condition, if the garbage from the airport is disposed properly.
8.	Waste	A	Huge volume of soils and rocks removed from the hills needs to be dumped.
9.	Hazards	B	Increase of aircraft operations with narrow runway strip and poor weather conditions will be hazardous. The surroundings are urbanized.
Natural Environment			
10.	Topography and Geology	B	Cutting of hills will have some impacts on topography and geology.
11.	Soil Erosion	B	Some soil erosion will occur after cutting the hills.
12.	Groundwater	B	Cutting of hills will have some impacts on groundwater.
13.	Hydrological Situation	A	Cutting of hills will cause significant changes in hydrological situation.
14.	Coastal Zone	D	No impact since it is far from the coastal zone.
15.	Flora and Fauna	A	Although detail of existing flora and fauna is unknown, cutting of hills will have significant impacts on them.
16.	Meteorology	B	Cutting of hills will have some impacts on local meteorological conditions.
17.	Landscape	A	Cutting of hills will have significant impact on landscape from the city.

Note: Classification of Evaluation

A : Significant impact is expected

B : Some impact is expected

C : Not clear (Necessary to be examined in detail. In case new information was acquired in the future, take it to consideration as well.)

D : No impact. Not necessary to be examined by EIA.

Table 8.4.8 Evaluation of Environmental Impact of Legaspi Airport Development Project (Continued)

Issue		Evaluation	
Pollution			
18.	Air Pollution	B	Increase of vehicle traffic and aircraft operations will have some impacts on air quality.
19.	Water Pollution	B	Muddy water generated by the construction works and increase of waste water from the airport operations will have some impacts on water quality.
20.	Soil Contamination	D	No activity which may cause soil contamination is expected.
21.	Noise and Vibration	A	Since the surroundings are urbanized, there will be significant impact on noise due to increase of aircraft operations and vehicle traffic.
22.	Land Subsidence	D	No activity which may cause land subsidence is expected.
23.	Offensive Odor	D	No activity which may cause offensive odor is expected.

Note: Classification of Evaluation
- A : Significant impact is expected
- B : Some impact is expected
- C : Not clear (Necessary to be examined in detail. In case new information was acquired in the future, take it to consideration as well.)
- D : No impact. Not necessary to be examined by EIA.

3) Scope of Environmental Impact Assessment

Table 8.4.9 summarizes major environmental issues and investigation items which need detailed examination in the Environmental Impact Assessment .

Table 8.4.9 Major Environmental Issues and Investigation Plan

Issue	Evaluation	Investigation Plan
Resettlement	A	Investigate population, age, occupation and others of the residents subject for resettlement.
Waste	A	Investigate possible dump sites and construction plan, and evaluate the impact of the project.
Hydrological Situation	A	Investigate existing hydrological situation around the project sites, and estimate the changes by the project.
Flora and Fauna	A	Investigate existing conditions of flora and fauna, possibility of resettlement, etc., and evaluate the impacts of the project.
Landscape	A	Investigate existing landscape around the project sites, and evaluate the impact of the project.
Noise and Vibration	A	Investigate land use, population and current noise level around the airport, and estimate future noise level and impacts.
Economic Activities	B	Investigate existing conditions of agricultural activities around the airport and scheme of compensation, and estimate the impacts of reclamation.
Traffic and Public Facilities	B	Investigate current traffic and facilities around the airport, and estimate the impacts during the construction and utilization stages.
Split of Communities	B	Investigate distribution of communities, traffic pattern, and others around the airport, and evaluate the impact of the project.
Water Rights and Rights of Common	B	Investigate existing conditions of water rights around the project sites, and estimate the impacts of the project.
Hazards	B	Investigate land use and population around the airport, past accidents, and evaluate the future risk of accidents.
Topography and Geology	B	Investigate topography and geology of the project sites, and evaluate the impacts of the project.
Soil Erosion	B	Investigate soil of the hills and design/ construction plan of cutting the hills, evaluate the possibility of the soil erosion.
Groundwater	B	Investigate conditions of ground water, and evaluate possible impact of the project.
Meteorology	B	Investigate local meteorological conditions, and evaluate possible impact by hill removal.
Air Pollution	B	Investigate air quality around the airport, and estimate the changes by the project.
Water Pollution	B	Investigate quality of surface water and groundwater around the airport, and estimate the changes by the project.
Cultural Property	C	Conduct site reconnaissance and hearing, and establish a procedure to be applied if buried cultural property is found during the construction.

Note: Classification of Evaluation
A : Significant impact is expected
B : Some impact is expected
C : Not clear (Necessary to be examined in detail. In case new information was acquired in the future, take it to consideration as well.)

8.4.7 Economic Analysis

1) General

The economic analysis is carried out for the selected alternative development plan for Legaspi Airport, i.e., Alternative L2. The methodology and general assumptions are the same as those employed for Bacolod Airport in Section 5.5.6. Therefore, only the calculation results are shown in this section.

Since the redevelopment of existing Legaspi Airport may involve massive earthwork to remove hilly terrain over the runway 06 approach surface, the following two cases are analyzed to clarify economic impact of the cost for this earthwork on the Project.

a) Redevelopment of Existing Legaspi Airport with Cutting Kemantong Range

b) Redevelopment of Existing Legaspi Airport without Cutting Kemantong Range

2) Economic Evaluation

The comparison of costs and benefits incurred by implementing the Project is indicated in Tables 8.4.10 and 8.4.11 for the cases of with and without cutting Kemantong Range respectively. (Refer to Appendix 8.4.2 for estimation of economic benefits.) The economic internal rate of return (FIRR) and net present value (NPV) are calculated as shown below.

Table 8.4.12 EIRR and NPV of the Project: Legaspi

Cases/Financial Indicators	EIRR	NPV at 15% discount rate (PHP million)
• Redevelopment of Existing Legaspi Airport with Cutting Kemantong Range	6.1%	-985
• Redevelopment of Existing Legaspi Airport without Cutting Kemantong Range	14.9%	-3

The results indicate that the redevelopment of existing Legaspi Airport is not economically feasible with cutting of hills which are obstructing the approach surface. Without cutting the hills, EIRR will improve to an feasible level although aircraft operational problem will not be solved in this case.

Table 8.4.10 Comparison of Costs and Benefits by the Project for Existing Legaspi Airport
(With Cutting of Kemantong Range)

Unit: PHP '000 at 1996 prices

Year	Costs					Benefits					Net Cash Flow
	Construction Cost	Maintenance Cost	Personnel, Overhead & Other Cost	Utilities Cost	Total Incremental Costs	Time Savings Benefit	Tourism Earnings Benefit	Benefit from Cargo	Value of Existing Airport	Total Benefits	
	(1)	(2)	(3)	(4)	(5)=(1)+(2)+(3)+(4)	(6)	(7)	(8)	(9)	(10)=(6)+(7)+(8)+(9)	(11)=(10)-(5)
1995	0	0	0	0	0	0	0	0	0	0	
1996	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	0	0	0	0	0	0	0	0
1998	141,892	0	0	0	141,892	0	0	0	0	0	-141,892
1999	141,892	0	0	0	141,892	0	0	0	0	0	-141,892
2000	1,138,615	0	0	0	1,138,615	0	0	0	0	0	-1,138,615
2001	1,138,615	0	0	0	1,138,615	0	0	0	0	0	-1,138,615
2002	0	12,749	468	442	13,659	29,775	18,570	2,979	0	51,324	37,665
2003	0	12,749	468	442	13,659	39,205	22,516	3,404	0	65,125	51,467
2004	0	12,749	468	442	13,659	50,553	27,013	3,830	0	81,396	67,737
2005	222,492	12,749	468	442	236,150	64,064	32,123	3,830	0	100,017	-136,133
2006	0	16,945	819	517	18,281	76,517	36,484	4,255	0	117,256	98,975
2007	0	16,945	819	517	18,281	90,466	41,211	4,681	0	136,357	118,076
2008	0	16,945	819	517	18,281	106,442	46,517	5,106	0	158,065	139,783
2009	0	16,945	819	517	18,281	124,679	52,459	5,532	0	182,670	164,389
2010	0	16,945	819	517	18,281	144,924	58,893	5,532	0	209,349	191,068
2011	0	16,945	819	517	18,281	162,850	64,433	5,957	0	233,240	214,958
2012	0	16,945	819	517	18,281	182,855	70,564	6,383	0	259,801	241,520
2013	0	16,945	819	517	18,281	204,524	77,102	6,808	0	288,435	270,153
2014	0	16,945	819	517	18,281	228,615	84,317	7,234	0	320,166	301,884
2015	0	16,945	819	517	18,281	255,358	92,263	7,234	0	354,855	336,574
2016	0	16,945	819	517	18,281	270,031	95,862	7,234	0	373,126	354,845
2017	0	16,945	819	517	18,281	285,276	99,600	7,234	0	392,109	373,828
2018	0	16,945	819	517	18,281	301,115	103,485	7,234	0	411,833	393,552
2019	0	16,945	819	517	18,281	317,572	107,521	7,234	0	432,326	414,045
2020	0	16,945	819	517	18,281	334,671	111,714	7,234	0	453,619	435,337
2021	0	16,945	819	517	18,281	350,615	115,624	7,234	0	473,472	455,191
2022	0	16,945	819	517	18,281	367,117	119,671	7,234	0	494,021	475,739
2023	0	16,945	819	517	18,281	384,196	123,859	7,234	0	515,289	497,007
2024	0	16,945	819	517	18,281	401,873	128,194	7,234	0	537,301	519,019
2025	0	16,945	819	517	18,281	420,169	132,681	7,234	0	560,083	541,802
2026	-56,395	16,945	819	517	-38,114	439,105	137,325	7,234	0	583,663	621,777
									EIRR =		6.1%
									NPV (at 15% discount rate) =		-984,996

Table 8.4.11 Comparison of Costs and Benefits by the Project for Existing Legaspi Airport
(Without Cutting of Kemantong Range)

Unit: PHP '000 at 1996 prices

Year	Costs					Benefits					Net Cash Flow
	Construction Cost	Maintenance Cost	Personnel, Overhead & Other Cost	Utilities Cost	Total Incremental Costs	Time Savings Benefit	Tourism Earnings Benefit	Benefit from Cargo	Value of Existing Airport	Total Benefits	
	(1)	(2)	(3)	(4)	(5)=(1)+(2)+(3)+(4)	(6)	(7)	(8)	(9)	(10)=(6)+(7)+(8)+(9)	(11)=(10)-(5)
1995	0	0	0	0	0	0	0	0	0	0	
1996	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	0	0	0	0	0	0	0	0
1998	49,899	0	0	0	49,899	0	0	0	0	0	-49,899
1999	49,899	0	0	0	49,899	0	0	0	0	0	-49,899
2000	359,444	0	0	0	359,444	0	0	0	0	0	-359,444
2001	359,444	0	0	0	359,444	0	0	0	0	0	-359,444
2002	0	12,749	468	442	13,659	29,775	18,570	2,979	0	51,324	37,665
2003	0	12,749	468	442	13,659	39,205	22,516	3,404	0	65,125	51,467
2004	0	12,749	468	442	13,659	50,553	27,013	3,830	0	81,396	67,737
2005	161,475	12,749	468	442	175,134	64,064	32,123	3,830	0	100,017	-75,117
2006	0	16,945	819	517	18,281	76,517	36,484	4,255	0	117,256	98,975
2007	0	16,945	819	517	18,281	90,466	41,211	4,681	0	136,357	118,076
2008	0	16,945	819	517	18,281	106,442	46,517	5,106	0	158,065	139,783
2009	0	16,945	819	517	18,281	124,679	52,459	5,532	0	182,670	164,389
2010	0	16,945	819	517	18,281	144,924	58,893	5,532	0	209,349	191,068
2011	0	16,945	819	517	18,281	162,850	64,433	5,957	0	233,240	214,958
2012	0	16,945	819	517	18,281	182,855	70,564	6,383	0	259,801	241,520
2013	0	16,945	819	517	18,281	204,524	77,102	6,808	0	288,435	270,153
2014	0	16,945	819	517	18,281	228,615	84,317	7,234	0	320,166	301,884
2015	0	16,945	819	517	18,281	255,358	92,263	7,234	0	354,855	336,574
2016	0	16,945	819	517	18,281	270,031	95,862	7,234	0	373,126	354,845
2017	0	16,945	819	517	18,281	285,276	99,600	7,234	0	392,109	373,828
2018	0	16,945	819	517	18,281	301,115	103,485	7,234	0	411,833	393,552
2019	0	16,945	819	517	18,281	317,572	107,521	7,234	0	432,326	414,045
2020	0	16,945	819	517	18,281	334,671	111,714	7,234	0	453,619	435,337
2021	0	16,945	819	517	18,281	350,615	115,624	7,234	0	473,472	455,191
2022	0	16,945	819	517	18,281	367,117	119,671	7,234	0	494,021	475,739
2023	0	16,945	819	517	18,281	384,196	123,859	7,234	0	515,289	497,007
2024	0	16,945	819	517	18,281	401,873	128,194	7,234	0	537,301	519,019
2025	0	16,945	819	517	18,281	420,169	132,681	7,234	0	560,083	541,802
2026	-144,485	16,945	819	517	-126,204	439,105	137,325	7,234	0	583,663	709,867
										EIRR =	14.9%
										NPV (at 15% discount rate) =	-3,395

8.4.8 FINANCIAL ANALYSIS

1) General

The financial analysis is carried out for the selected alternative development plan for Legaspi Airport, i.e., Alternative L2. The methodology and general assumptions are the same as those employed for Bacolod Airport in Section 5.5.7. Therefore, only the calculation results are shown in this section.

The two cases of the redevelopment plans for existing Legaspi Airport, with and without cutting Kemantong Range, are analyzed for the same reason explained in the economic analysis.

2) Financial Evaluation

The comparison of costs and revenues incrementally incurred by implementing the Project with increased prices of airport charges is indicated in Tables 8.4.13 and 8.4.14 for the cases of with and without cutting Kemantong Range respectively. (Refer to Appendix 8.4.3 for estimation of incremental revenues.)

The financial internal rate of return (FIRR) and net present value (NPV) are calculated as shown below. A discount rate of 2.7%, current interest rate of OECF loan for the Philippines, is used for calculating NPV.

Table 8.4.15 FIRR and NPV of the Project: Legaspi

Cases/Financial Indicators	FIRR	NPV at 2.7% discount rate (PHP million)
At Current Level of Charges		
• Redevelopment of Existing Legaspi Airport with Cutting Kemantong Range	negative	-3,123
• Redevelopment of Existing Legaspi Airport without Cutting Kemantong Range	negative	-1,169
At Increased Prices of Charges*		
• Redevelopment of Existing Legaspi Airport with Cutting Kemantong Range	negative	-2,163
• Redevelopment of Existing Legaspi Airport without Cutting Kemantong Range	1.1%	-208

Note*: Increase all charges by 300% in 2001 when new facilities start operation, and further 100% increase in 2006 when the facilities are expanded as the long term development.

Table 8.4.10 Comparison of Incremental Costs and Revenues by the Project for Existing Legaspi Airport

(With Cutting of Kemantong Range) (Increased Rates of Airport Charges)

Unit: PHP '000 at 1996 prices

Year	Costs					Revenues					Net Cash Flow
	Construction Cost	Maintenance Cost	Personnel, Overhead & Other Cost	Utilities Cost	Total Incremental Costs	Traffic Related Services	Commercial Services	Miscella-neous Revenue	Sale of Existing Airport Land	Total Incremental Revenue	
	(1)	(2)	(3)	(4)	(5)=(1)+(2)+(3)+(4)	(6)	(7)	(8)	(9)	(10)=(6)+(7)+(8)+(9)	(11)=(10)-(5)
1995					0	0	0	0		0	
1996					0	0	0	0		0	
1997					0	0	0	0		0	0
1998	168,919				168,919	0	0	0		0	-168,919
1999	168,919				168,919	0	0	0		0	-168,919
2000	1,355,494				1,355,494	0	0	0		0	-1,355,494
2001	1,355,494				1,355,494	0	0	0		0	-1,355,494
2002		15,177	520	442	16,139	36,774	6,217	486		43,477	27,338
2003		15,177	520	442	16,139	39,331	6,285	486		46,102	29,963
2004		15,177	520	442	16,139	42,058	6,352	486		48,896	32,757
2005	264,871	15,177	520	442	281,010	44,581	6,420	486		51,487	-229,523
2006		20,173	910	517	21,600	48,753	8,328	569		57,649	36,049
2007		20,173	910	517	21,600	50,881	8,421	569		59,870	38,270
2008		20,173	910	517	21,600	53,193	8,514	569		62,275	40,675
2009		20,173	910	517	21,600	55,508	8,607	569		64,684	43,084
2010		20,173	910	517	21,600	58,220	8,701	569		67,489	45,889
2011		20,173	910	517	21,600	60,261	8,701	569		69,530	47,930
2012		20,173	910	517	21,600	62,246	8,701	569		71,516	49,916
2013		20,173	910	517	21,600	64,253	8,701	569		73,522	51,922
2014		20,173	910	517	21,600	66,631	8,701	569		75,900	54,300
2015		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2016		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2017		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2018		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2019		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2020		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2021		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2022		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2023		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2024		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2025		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2026	-67,137	20,173	910	517	-45,537	68,906	8,701	569		78,175	123,712
							FIRR =				negative
							NPV (at 2.7% discount rate) =				-2,162,681

Table 8.4.11 Comparison of Incremental Costs and Revenues by the Project for Existing Legaspi Airport

(Without Cutting of Kemantong Range)

(Increased Rates of Airport Charges)

Unit: PHP '000 at 1996 prices

Year	Costs					Revenues					Net Cash Flow
	Construction Cost	Maintenance Cost	Personnel, Overhead & Other Cost	Utilities Cost	Total Incremental Costs	Traffic Related Services	Commercial Services	Miscella-neous Revenue	Sale of Existing Airport Land	Total Incremental Revenue	
	(1)	(2)	(3)	(4)	(5)=(1)+(2)+(3)+(4)	(6)	(7)	(8)	(9)	(10)=(6)+(7)+(8)+(9)	(11)=(10)-(5)
1995					0	0	0	0		0	
1996					0	0	0	0		0	
1997					0	0	0	0		0	0
1998	59,404				59,404	0	0	0		0	-59,404
1999	59,404				59,404	0	0	0		0	-59,404
2000	427,909				427,909	0	0	0		0	-427,909
2001	427,909				427,909	0	0	0		0	-427,909
2002		15,177	520	442	16,139	36,774	6,217	486		43,477	27,338
2003		15,177	520	442	16,139	39,331	6,285	486		46,102	29,963
2004		15,177	520	442	16,139	42,058	6,352	486		48,896	32,757
2005	192,232	15,177	520	442	208,371	44,581	6,420	486		51,487	-156,884
2006		20,173	910	517	21,600	48,753	8,328	569		57,649	36,049
2007		20,173	910	517	21,600	50,881	8,421	569		59,870	38,270
2008		20,173	910	517	21,600	53,193	8,514	569		62,275	40,675
2009		20,173	910	517	21,600	55,508	8,607	569		64,684	43,084
2010		20,173	910	517	21,600	58,220	8,701	569		67,489	45,889
2011		20,173	910	517	21,600	60,261	8,701	569		69,530	47,930
2012		20,173	910	517	21,600	62,246	8,701	569		71,516	49,916
2013		20,173	910	517	21,600	64,253	8,701	569		73,522	51,922
2014		20,173	910	517	21,600	66,631	8,701	569		75,900	54,300
2015		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2016		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2017		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2018		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2019		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2020		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2021		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2022		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2023		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2024		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2025		20,173	910	517	21,600	68,906	8,701	569		78,175	56,575
2026	-172,006	20,173	910	517	-150,406	68,906	8,701	569		78,175	228,581
									FIRR =		1.1%
									NPV (at 2.7% discount rate) =		-207,720

The results indicate that the redevelopment of existing Legaspi Airport will require further increase in the prices of airport charges than ones assumed in this Study. However, such high increases in the prices of airport charges may discourage airline companies to serve Legaspi Airport.

8.4.9 Conclusion

The study on development of existing Legaspi Airport was conducted based on the original Scope of the Study agreed between DOTC and JICA. As a result of the master planning study described in the previous sections, it can be concluded that the development of existing Legaspi Airport to accommodate the anticipated traffic in the year 2015 is economically and environmentally infeasible.