Republic of the Philippines

Preparatory Survey for New Bohol Airport Construction and Sustainable Environment Protection Project

Draft Final Report

August 2012

Japan International Cooperation Agency (JICA)

Japan Airport Consultants, Inc. (JAC)

Nippon Koei Co., Ltd. (NK)

NJS Consultants Co., Ltd. (NJS)

PricewaterhouseCoopers (PwC)

Joint Venture


CEBU
CEBU CITY
MACTAN
BOHOL
Rajah Sikatuna National Park
Existing Airport
TAGBILARAN
PANGLAO
BOHOL SEA
BOHOL
PHILIPPINES MAP
DAUIS
PANGLAO
PANGLAO
Proposed New Bohol Airport
PANGLAO MAP

Executive Summary

Table of Contents

1. Introduction

1.1. Preface

1) Background of the Project

Due to the archipelago geography, the Government of the Republic of the Philippines (GRP) has continued its effort to establish safe and capable nationwide aviation network to enhance nation's socio-economic activities. As such, both domestic and international air traffic volumes in the Philippines are fast increasing, i.e. more than 10 % particularly for the past 5 years.

Lately, air traffic demand at the existing Tagbilaran Airport at Bohol Province has been dramatically increased (from 39 thousand in 2001, to 573 thousand in 2010), average annual growth rate of which is more than 35 %. More than 99% of the air passengers are to/from Manila. This is partly because the runway at the existing Tagbilaran airport was extended in 2002, upon which jet aircraft (B737, A320) operations were commenced.

The majority of Bohol residents have availed of Airlines because of high competition of services among four (4) domestic Airlines, attractive LCC's promo airfare, frequency and higher safety of 80-minutes air services from Manila in comparison with 30-hour travel by ship/ferry. Average seat occupancy through the year of Manila flight is more than 80%.

Meanwhile, the existing airport facilities are obsolete, not in accordance with safety requirements, and the capacity almost saturated. The narrow runway strip alongside the densely-populated Tagbilaran downtown continues to give danger to human life. Hence, GRP plans to construct a new Bohol Airport to meet international standard in Panglao Island, for which feasibility studies had been made twice in 2000 and 2007. In 2010, the New Aquino Administration defined the New Airport Construction Project being one of the priority infrastructure development projects to be implemented under Public Private Partnership (PPP).

Eight (8) environmental conservation areas are designated along the coast of Panglao Island where protection of natural environment is important.

2) Objective of the Project

The Project has two objectives interrelated each other, as expressed in the title of the Study, namely "New Bohol Airport Construction and Sustainable Environmental Protection", more specifically as follows:

1) To construct a new airport at Panglao Island to replace the existing Tagbilaran airport which is narrowly situated thereby giving danger to human life at densely-populated downtown, and to enhance aircraft operational safety and effective air transportation system to meet international standard; and

2) In anticipation of increase in the number of passengers as a result of new airport construction, to provide technical support to aim environmental protection in the Island, (specifically, in the improvement of sewerage system and sustainable environmental conservation in line with tourism development program).

3) Objective of the Study and Composition of Report

Objectives of this Study are as follows:

1) To review the previous feasibility studies and to analyse viable modalities of PPP Scheme for the development New Bohol Airport;

2) To prepare a project implementation program for the New Bohol Airport Construction in anticipation of the Special Terms for Economic Partnership (STEP) of Japanese ODA loan;

3) To program tourism development in line with sustainable environmental conservation;

4) To study the current water supply conditions at Panglao Island, and come up with the basic plan for the water supply system to the New Bohol Airport; and

5) To collect basic information in relation to sewerage system and/or applicability of individual sewage disposal system, so as to solve the untreated-water discharge problem in the Island.

This report consists of the two volumes, namely, the Volume 1 incorporating summary of the entire Reports and studies for New Bohol Airport Construction; and the Volume 2 includes studies for tourism development, water supply and sewerage system.

1.2. Current socio-economic conditions

The population of the Philippines in 1995 was 68.6 Million, and continuously increased to 88.6 Million in 2007 with an average annual growth of 2.15 %. The great majority of the population (53 % or 47.3 Million) resided in the Northern Philippines (i.e. Luzon Island).

The population in the Central Philippines in 2007 was 19.7 Million (22% of the total population), distributed to Region IV-B (Mimaropa; 3% or 2.6 Million), Region VI (Western Visayas; 8% or 6.8 Million), Region VII (Central Visayas; 7% or 6.4 Million), Region VIII (Eastern Visayas; 4% or 3.9 Million). Of the population in the Region VII (Central Visayas; 6.4 Million), the great majority (3.8 Million) resides in Cebu, 1.2 Million in Negros Oriental, and 1.2 Million in Bohol Province. The population of Bohol represents 1.4% of the national population, 6.2% of the Central Philippines, or 19% of Region VII (Central Visayas).

In current pricing, the GDP of the Philippines in 2007 was Pesos 7,678,917 million, and the GDP per Capita was Pesos 83,261. The GDP in the Philippines has steadily increased, with an average annual growth rate from 2000 to 2009 of 4.39%., and the GRDP at the Central Visayas has increased with a growth rate of 4.49%.

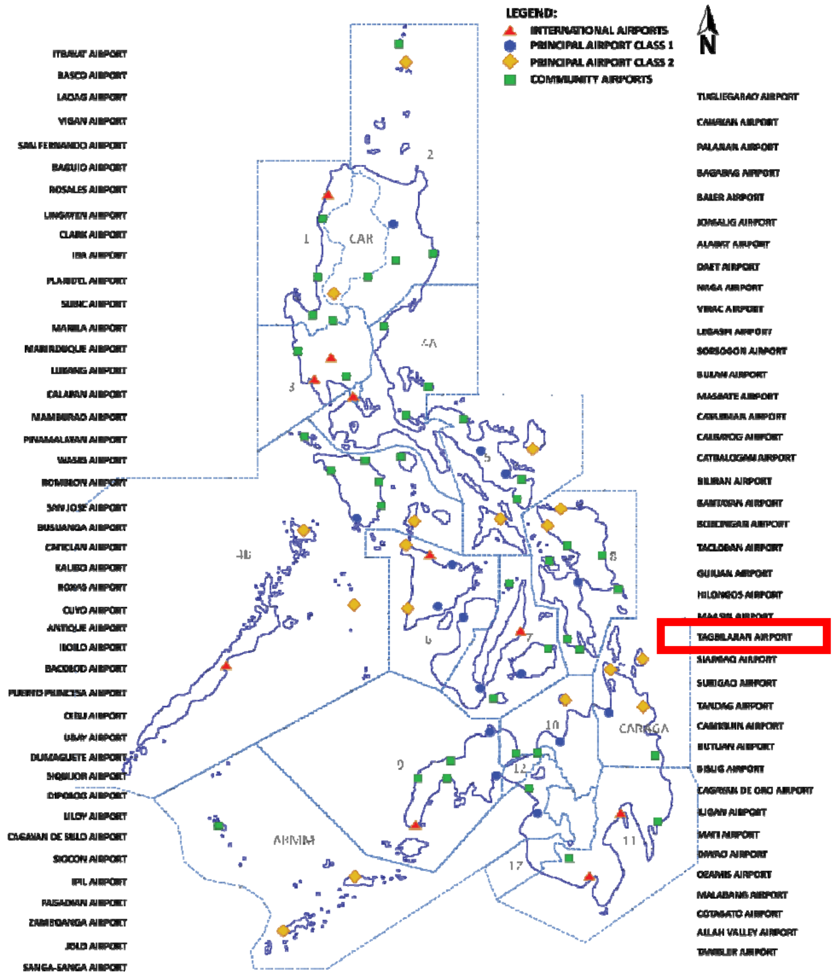
1.3. Current Situation of Air Transportation

1) The Entire Philippines

In the Philippines, there are a total of 83 airports, in which 10 airports are designated as international airports, 15 as principal airports class 1, 17 as class 2, and 41 as community airports.

The existing Tagbilaran Airport is playing an important role as one of the 15 principal airport class 1.

In 2010, the number of air passengers movements in the entire Philippines was 41.87 million, and air cargo volumes was 562 thousand tons, aircraft movements was 613 thousand.

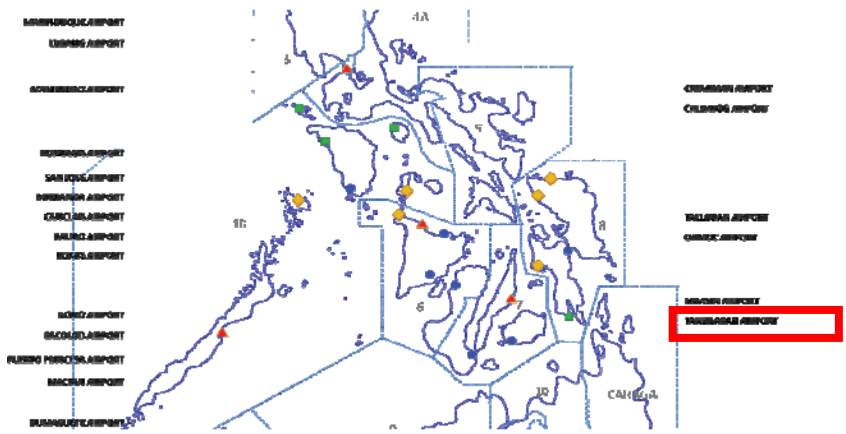


Source: JICA Study Team

Figure1-1 Location of Airports in The Entire Philippines

2) The Central Philippines

Among these 20 airports in the Central Philippines, 13 airports are located in "Visayas", namely, 2 international airports (Mactan, Kalibo), 6 principal airports class 1 (Iloilo, Bacolod, Tacloban, Tagbilaran, Dumaguete, Roxas), 4 class 2 airports (Caticlan and others), and 1 community airport.



Source: JICA Study Team

Figure1-2 Location of Airports in the Central Philippines

The Table1-1 shows the past domestic traffic record (2001 to 2010) for aircraft movements and air passengers at 10 major airports in the Central Philippines.

Table1-1 Domestic Air Traffic Record at major 10 Airports in the Central Philippines

Region	IVb	VI					VII			VIII	Total
Island	Palawan	Panay				Negros		Cebu	Bohol	Leyte	
Airport	Puerto Princesa	Caticlan	Kalibo	Roxas	Iloilo	Bacolod	Dumaguete	Mactan	Tagbilaran	Tacloban	
Runway	2650 m	834 m	2187 m	1890 m	2500 m	2000 m	1845 m	3300 m	1779 m	2138 m	
Population	892,660	495,122	515,265	701,664	2,261,826	2,869,766	1,231,904	3,850,989	1,230,110	724,240	
Aircraft	A330	DH3	A320	A320	A320	A320	A320	A330	A320	A320	
Anual Domestic Aircraft Movements											
2001	2,695	7,512	5,264	1,440	13,425	8,032	2,184	24,047	1,154	6,448	72,201
2002	2,000	11,124	5,796	1,440	17,864	7,052	2,164	26,005	2,134	6,708	82,287
2003	2,792	11,426	2,858	1,438	17,412	6,680	2,540	24,541	1,920	6,367	77,974
2004	3,170	14,242	5,938	1,460	17,736	6,904	2,162	23,892	1,816	6,500	83,820
2005	3,232	19,172	2,822	1,182	8,224	6,114	1,922	24,219	2,262	4,046	73,195
2006	2,914	18,880	3,398	1,230	8,232	6,188	1,898	23,977	2,194	4,432	73,343
2007	3,352	18,662	4,307	1,142	9,070	7,782	2,690	25,895	2,810	4,186	79,896
2008	4,012	23,362	3,486	1,288	9,366	8,510	2,714	25,113	3,300	5,032	86,183
2009	6,292	19,875	3,888	1,822	12,136	9,676	2,630	37,311	4,478	8,912	107,020
2010	5,882	24,516	7,774	1,558	16,034	15,780	3,048	38,397	4,664	7,616	125,269
increase for 2005-2010	182%	128%	275%	132%	195%	258%	159%	159%	206%	188%	171%
Annual Domestic Passengers											Total
2001	188,713	162,786	236,968	86,915	696,587	534,832	137,334	1,860,461	39,268	297,878	4,241,742
2002	147,000	196,315	274,560	81,804	676,015	512,240	134,877	1,733,273	76,314	302,281	4,134,679
2003	194,176	234,911	229,068	84,552	681,360	522,395	152,316	1,850,453	104,934	308,454	4,362,619
2004	267,507	392,484	267,172	100,550	739,494	572,666	173,496	1,947,057	159,073	345,668	4,965,167
2005	284,042	519,349	239,851	102,183	708,469	562,062	162,915	2,263,777	196,707	327,912	5,367,267
2006	306,607	516,631	341,097	119,944	863,018	663,882	188,465	2,467,517	240,176	398,909	6,106,246
2007	388,083	545,015	511,051	133,418	1,001,273	782,573	275,991	2,985,695	344,068	510,683	7,477,850
2008	477,293	793,478	381,436	153,488	1,073,788	840,711	306,182	2,940,830	398,661	626,856	7,992,723
2009	584,232	797,312	500,713	188,237	1,324,148	1,044,623	360,360	3,835,163	561,774	892,856	10,089,418
2010	822,358	672,919	754,372	203,840	1,581,304	1,218,213	362,551	4,206,651	572,476	1,148,728	11,543,412
increase for 2005-2010	290%	130%	315%	199%	223%	217%	223%	186%	291%	350%	215%
average Pax onboard	140	27	97	131	99	77	119	110	123	151	92

Source: JICA Study Team

The above table reveals that extraordinary growth of domestic air traffic has been recorded in the Central Philippines, particularly for the past 5 years. The total volume of domestic passengers at these 10 airports has drastically increased from 5.37 million in 2005 to 11.54 million in 2010. Consequently, the total number of domestic aircraft movements in the Central Philippines has increased from 73 thousand in 2005 to 125 thousand in 2010. Similarly, domestic passengers at Tagbilaran Airport has increased from 196 thousand in 2005 to 572 thousand in 2010, the annual passengers have grown by 290% during the past 5years. More than 80 % of origin and destination of the domestic flights in the Central Philippines is Manila.

At NAIA annual total passengers of 27.2 million (i.e. 14.8 million for domestic, and 12.4 million for international) are handled with a single runway (in fact, which is with a short runway of crossed configuration interfering each other), which seems to be very congested compared with the neighboring Capital airports, e.g. 42 million in Singapore with 2 open-parallel simultaneously -operational runways, 43 million in Bangkok with 2 open-parallel simultaneously-operational runways, 32 million with 2 open-parallel simultaneously-operational runways in Narita.

Annual total aircraft movements of 236 thousand (133 thousand for domestic, 67 thousand for international and 36 thousand for general aviation) have most probably reached the maximum runway capacity.

Therefore, to alleviate the perennial congestion at NAIA, an Executive Order no.29 concerning the open sky policy was signed in March 2011, promoting Philippines aviation sector to manage international flight operations at local airports.

2. Air Traffic Demand Forecast

2.1. General

The actual passengers' demand in 2010 has already exceeded the one forecasted merely 3 years ago in the 2007 FS, i.e. 447 thousand of medium-case scenario, or even 535 thousand of high-case scenario.

The sea and air passengers statistics for 2005 through 2010 revealed that air passengers are constantly increasing, while sea passengers are rather stable within the range between 3 and 3.5 million. Share of air passengers has increased from 5 % in 2005 to 14 % in 2010 of the total sea and air passengers.

Although the precise record for origin and destination of sea passengers is not available, most of sea passengers are traveling to/from neighboring islands such as Cebu judging from the scheduled route and frequency. It is therefore analyzed that the recent drastic increase in air passengers is attributable to a discovery of new passengers' demand as a result of successful expansion of LCC's business model, e.g. attractive promo airfare and flight frequency, in addition to the change in the mode of transportation chosen by Bohol residents between Manila and Bohol.

Through the questionnaire survey, 45 % of the foreign tourists who visited Bohol answered that his intended main destination in the Philippines was Bohol. Meanwhile, domestic operations at NAIA are restricted due to limitation of the runway capacity. When the new Bohol Airport would have such function to accept international flights, foreign tourist who wants to visit Bohol would like to take international flight if available, to access directly to Bohol without one stop at the congested NAIA.

2.2. Forecasting Methodology

First, air passenger demand for Bohol Province has been analyzed based on the chronological trend model with GRDP (of Region IIV) as explanatory variables, in consideration of the following aspects:

- Currently, air traffic demand at Tagbilaran Airport is only for Manila route, which has been grown with unexpected rate.
- There is no competition between the modes of transportation (i.e. air, sea or road).
- Great majority of air passengers are Bohol residents who travel to Manila (e.g. 67 % in 2010).

Next, triangle relationship has been analyzed among the development status of 10 major airports in the Central Philippines, GRDP and total air and sea traffic volumes in the vicinities. Then, magnitude of the latent air traffic demand if the current restriction due to short runway, narrow airstrip or lack of infrastructure at Tagbilaran airport could be released, have been analyzed.

With the integration of the above 2 different approaches together, air traffic demand for the new Bohol Airport has been forecast. In addition, based on the share of foreigners with individual nationalities surveyed through questionnaire, future air traffic routes with new origin/ destination are analyzed.

2.3. Result of Air Traffic Forecast

As a result, annual air passenger and cargo demand, and aircraft movements are forecasted as shown in Tables 2-1 and 2.

Table 2-1 Annual Passengers and Cargo Demand Forecast for new Bohol Airport

(Passenger : '000 , Cargo : '000 MT)

Case	CY	Air Passenger Demand										Air Cargo Demand	
		Domestic (*1)		International Passengers (*2)						Grand Total		Total (*3)	
		Passengers	G/R (%)	Scheduled	G/R (%)	Non-Sche.	G/R (%)	Total	G/R (%)	Passengers	G/R (%)	Cargoes	G/R (%)
Actual	2010	572								572		5	
Low Case	2015	898	9.4			2		2		900	9.5	7	8.6
	2020	1,125	4.6			6	19.0	6	19.0	1,131	4.7	9	4.1
	2025	1,295	2.8	41		10	10.5	50	53.4	1,345	3.5	10	2.6
	2030	1,343	0.7	125	25.1	12	4.1	137	22.0	1,479	1.9	10	0.7
	2035	1,414	1.0	149	3.7	15	5.1	164	3.8	1,579	1.3	11	0.9
	2040	1,469	0.8	171	2.8	18	2.8	189	2.8	1,658	1.0	11	0.7
	2045	1,508	0.5	190	2.1	20	2.2	209	2.1	1,718	0.7	12	0.5
Medium Case	2015	1,037	12.6			3		3		1,040	12.7	8	11.4
	2020	1,393	6.1	34		8	23.2	43	71.0	1,436	6.7	11	5.5
	2025	1,566	2.4	124	29.3	12	7.4	136	26.1	1,702	3.5	12	2.2
	2030	1,773	2.5	167	6.1	17	7.7	185	6.3	1,958	2.8	13	2.3
	2035	1,937	1.8	246	8.0	21	4.6	268	7.7	2,205	2.4	15	1.7
	2040	2,117	1.8	298	3.9	26	4.0	324	3.9	2,441	2.1	16	1.7
	2045	2,285	1.5	349	3.2	31	3.3	380	3.2	2,666	1.8	17	1.5
High Case	2015	1,185	15.7			3		3		1,188	15.7	9	14.1
	2020	1,615	6.4	40		10	23.5	50	71.4	1,665	7.0	12	5.8
	2025	1,908	3.4	153	30.7	16	10.0	169	27.6	2,077	4.5	14	3.1
	2030	2,231	3.2	252	10.4	22	7.0	274	10.1	2,505	3.8	17	3.0
	2035	2,590	3.0	333	5.8	29	5.9	362	5.8	2,952	3.3	19	2.9
	2040	2,960	2.7	422	4.8	37	4.9	459	4.8	3,419	3.0	22	2.6
	2045	3,342	2.5	518	4.2	45	4.2	563	4.2	3,905	2.7	24	2.4

notes : (*1) including some new route between Bohol and other islands
(*2) 4 new routes (BHL-SHA, BHL-HKG, BHL-TPE & BHL-SEL) and charter flights to/from many asian countries
(*3) excluding international cargoes and domestic cargoes of new domestic routes

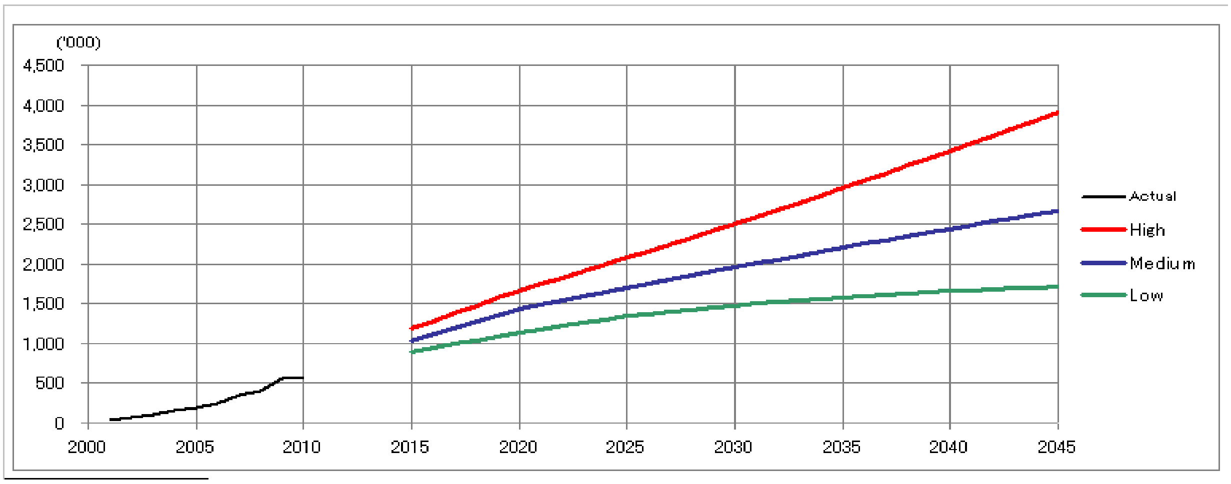
Source: JICA Study Team

Table 2-2 Annual Aircraft Movements Forecast for new Bohol Airport

Case	CY	Aircraft Movement												
		Domestic Flights (*1)				International Flights (*2)				Grand Total				
		PLOP	S-Jet	L-Jet	Total	S-Jet	M-Jet	L-Jet	Total	PLOP	S-Jet	M-Jet	L-Jet	Total
Actual	2010		4,664		4,664						4,664			4,664
Low Case	2011	2,560	4,892		7,452					2,560	4,892			7,452
	2015	2,560	7,216		9,776		12		12	2,560	7,216	12		9,788
	2020	2,560	9,250		11,810		30		30	2,560	9,250	30		11,840
	2025	2,560	10,240	280	13,080	392	48		440	2,560	10,632	48	280	13,520
	2030	2,560	10,240	508	13,308	1,196	58		1,254	2,560	11,436	58	508	14,562
	2035	2,560	10,240	848	13,648	1,432	74		1,506	2,560	11,672	74	848	15,154
	2040	2,560	10,240	1,110	13,910	1,642	86		1,728	2,560	11,882	86	1,110	15,638
	2045	2,560	10,240	1,294	14,094	1,770	96	32	1,898	2,560	12,010	96	1,326	15,992
Medium Case	2015	2,560	8,462		11,022		16		16	2,560	8,462	16		11,038
	2020	2,560	10,240	748	13,548	330	40		370	2,560	10,570	40	748	13,918
	2025	2,560	10,240	1,570	14,370	1,196	58		1,254	2,560	11,436	58	1,570	15,624
	2030	2,560	10,240	2,558	15,358	1,608	84		1,692	2,560	11,848	84	2,558	17,050
	2035	2,560	10,240	3,336	16,136	2,226	104	76	2,406	2,560	12,466	104	3,412	18,542
	2040	2,560	10,240	4,192	16,992	2,480	126	208	2,814	2,560	12,720	126	4,400	19,806
	2045	2,560	10,240	4,996	17,796	2,650	148	380	3,178	2,560	12,890	148	5,376	20,974
High Case	2015	2,560	9,782		12,342		18		18	2,560	9,782	18		12,360
	2020	2,560	10,240	1,804	14,604	386	48		434	2,560	10,626	48	1,804	15,038
	2025	2,560	10,240	3,198	15,998	1,472	76		1,548	2,560	11,712	76	3,198	17,546
	2030	2,560	10,240	4,738	17,538	2,266	106	84	2,456	2,560	12,506	106	4,822	19,994
	2035	2,560	10,240	6,446	19,246	2,612	140	320	3,072	2,560	12,852	140	6,766	22,318
	2040	2,560	10,240	8,208	21,008	2,754	178	698	3,630	2,560	12,994	178	8,906	24,638
	2045	2,560	10,240	10,028	22,828	2,884	220	1,118	4,222	2,560	13,124	220	11,146	27,050

notes : (*1) including some new route between Bohol and other islands
(*2) 4 new routes (BHL-SHA, BHL-HKG, BHL-TPE & BHL-SEL) and charter flights to/from many asian countries

Source: JICA Study Team



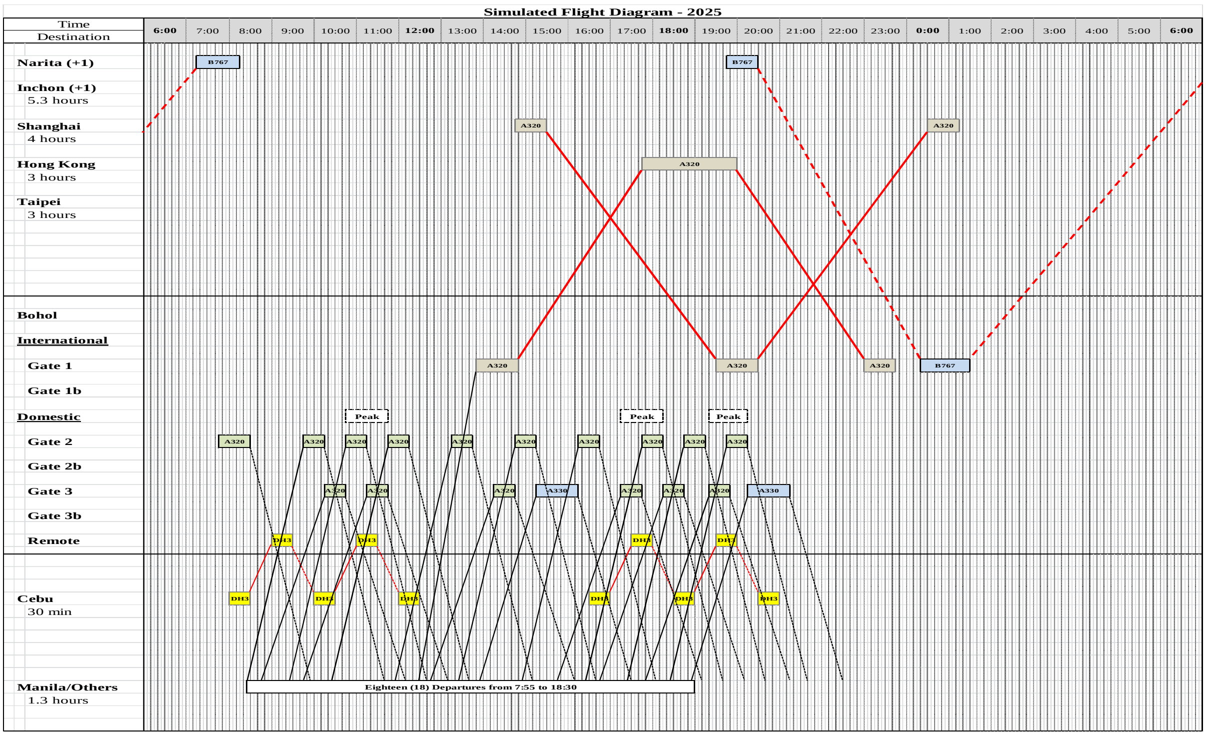
Source: JICA Study Team

Figure 2-1 Annual Passengers Demand Forecast for new Bohol Airport

2.4. Simulated Flight Schedule

Based on the current flight schedule, together with the questionnaire survey from the four (4) domestic Airlines, aircraft turn-around time is assumed to be 30 minutes for domestic A320/321, 60 minutes for domestic A330, and 60 minutes for international flights of both A320 and A330.

Flight Diagram for 2025 has been simulated as shown in Figure 2-2.



Source: JICA Study Team

Figure 2-2 Simulated Flight Diagram for New Bohol Airport (for 2025)

In the diagram, domestic flight operations are assumed to be made, as normal case, from 7 am to 9 pm, similar to the other lately-developed airports (e.g. Iloilo, Bacolod) where night landing facilities are available. Hours of operations may be extended, and night landing/ takeoff may be necessitated due to possibly-unavailable runway during daytime at NAIA.

2.5. Comparison with Past Studies

In the past, air traffic demand forecasts for the New Bohol Airport were conducted three (3) times, namely, in 2000 by DOTC (2000 FS), in 2006 by JICA Master Plan Study on the Improvement of National Airport in the Philippines, and in 2007 by MIAA (2007 FS).

The annual passenger traffic forecast in comparison with those forecasted in the previous studies is summarized as shown in Table 2-3.

Table 2-3 Air Traffic Demand Forecast in comparison with the past studies

CY	2000 FS				2006 JICA	2007 FS			2011 JICA Study			
	Filipino Tourist	Foreign Tourist	Filipino Resident	Total	Total	Filipino	Foreig-ner	Total	Case	Domestic	Inter-national	Total
	Actual Record											
2001	39,268	-	-	39,268								
	Forecast					Actual Record						
2006	96,000	64,000	57,000	217,000		240,176	-	240,176				
						Froecast						
						403,000		413,400		Actual Record		
2010	198,000	111,000	84,000	393,000	245,392	437,000	10,400	447,400		572,476	-	572,476
						525,000		535,400		Froecast		
						519,000		534,000	Low	898,000	2,000	900,000
2015	318,000	178,000	128,000	624,000	353,698	656,000	15,000	671,000	Midium	1,037,000	3,000	1,040,000
						992,000		1,007,000	High	1,185,000	3,000	1,188,000
						627,000		658,200	Low	1,125,000	6,000	1,131,000
2020	514,000	288,000	189,000	991,000	494,712	938,000	31,200	969,200	Midium	1,393,000	43,000	1,436,000
						1,561,000		1,592,200	High	1,615,000	50,000	1,665,000
						716,000		793,400	Low	1,295,000	50,000	1,345,000
2025	827,000	463,000	271,000	1,561,000	679,707	1,262,000	77,400	1,339,400	Midium	1,566,000	136,000	1,702,000
						2,019,000		2,096,400	High	1,908,000	169,000	2,077,000
						782,000		963,400	Low	1,343,000	137,000	1,480,000
2030	n/a				n/a	1,590,000	181,400	1,771,400	Midium	1,773,000	185,000	1,958,000
						2,333,000		2,514,400	High	2,231,000	274,000	2,505,000
						828,000		1,209,400	Low	1,414,000	164,000	1,578,000
2035						1,882,000	381,400	2,263,400	Midium	1,937,000	268,000	2,205,000
						2,479,000		2,860,400	High	2,590,000	362,000	2,952,000
						n/a			Low	1,469,000	189,000	1,658,000
2040									Midium	2,117,000	324,000	2,441,000
									High	2,960,000	459,000	3,419,000
									Low	1,508,000	209,000	1,717,000
2045									Midium	2,285,000	380,000	2,665,000
									High	3,342,000	563,000	3,905,000

Source: JICA Study Team

The above Table shows that in 2030 onwards, increase in the annual passengers is estimated at a similar level to the Medium Case scenario of the 2007 FS.

3. Tagbilaran Airport

3.1. Existing Conditions

Situations and problems at the existing Tagbilaran Airport are summarized below.

①	Runway Strip	It does not meet the requirement for ICAO Code3, i.e. 150 m (75 m on both side) in case of non instrument landings.
②	Runway length	Due to lack of stop-way and runway-end-safety area (ICAO requires minimum of 150 m in total) on both ends of the runway, effective runway length is considerably shorter than the announced 1790 m (e.g. only some 1500m is available), which could have endangered passengers' life safety and/or imposed payload restriction on predominant aircraft (A320) from the operators safety point of view.
③	Passenger Terminal	It situates too close to the runway, where aircraft parking on the apron falls inside the non-instrument runway strip, and not cleared from the runway transitional surface.
④	Apron Spot	There are two (2) aircraft stands parking to face uni-direction in tandem position without bypass taxiing lane. This first-come-first-serve basis parking style is observed in the morning peak-hour to causes the 3rd aircraft on hold in the air until the 2 stands have been vacated.

Features of the existing Tagbilaran Airport are explained in the Photo below:

<table>
<tr><td></td><td>
</td></tr>
<tr><td>Adequate width of runway strip and runway-end -safety area are not provided, where densely populated housings are observed under aircraft wing just before landing Runway 35.</td><td>Runway-end safety area is not provided, where stiff slope immediately before the runway 35 threshold is observed.</td></tr>
<tr><td colspan="2">
</td></tr>
<tr><td colspan="2">Densely-populated housings are located inside the non-instrument runway strip.
Stiff slope exists before the Runway 35 threshold.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Pre-departure area is fully crowded.
No room for passengers even to stand when 2 departures are simultaneously operated in peak hours.</td><td>Apron locates inside the runway strip.
Passengers walk in narrow apron crossing with ground handling operations and/or aircraft full blast winds occasionally.</td></tr>
</table>

Source: JICA Study Team

Figure 3-1 Features of the Existing Tagbilaran Airport

3.2. Review of the Possible Tagbilaran Airport Development

If the Tagbilaran Airport will have to attain safe aircraft operations and continue to accept the growing air traffic demand, the following aspects are anticipated.

4) Surrounding Topography and Airspace

Areas immediately beyond the both runway ends sharply drop down. Normally, the runway ends should be safeguarded by a 60-m long runway strip and a 90-m long runway-end-safety-area (RESA). In other words, the effective runway length at the existing Tagbilaran airport should not be 1779 m as currently declared in AIP but should be less than 1,500 m.

To enable the currently-used jet aircraft e.g. A319/A320, and its advanced version, A321 which the biggest Carrier in the Philippines (Cebu Pacific Airlines) schedules to introduce from 2017, the minimum runway length should be at least 2000m.

Currently, Tagbilaran airport is operated on daytime only (from sunrise to sunset) which is absolutely inconvenient for Bohol residents who come back from Manila. At least night landing facilities with minimum air navigation facilities are assumed to be indispensable, therefore, an instrument approach runway is assumed to be provided, where width of the runway strip is 300 m (i.e. 150 m on both sides). This Tagbilaran airport redevelopment option on Google Earth is shown in Figure 3-2.

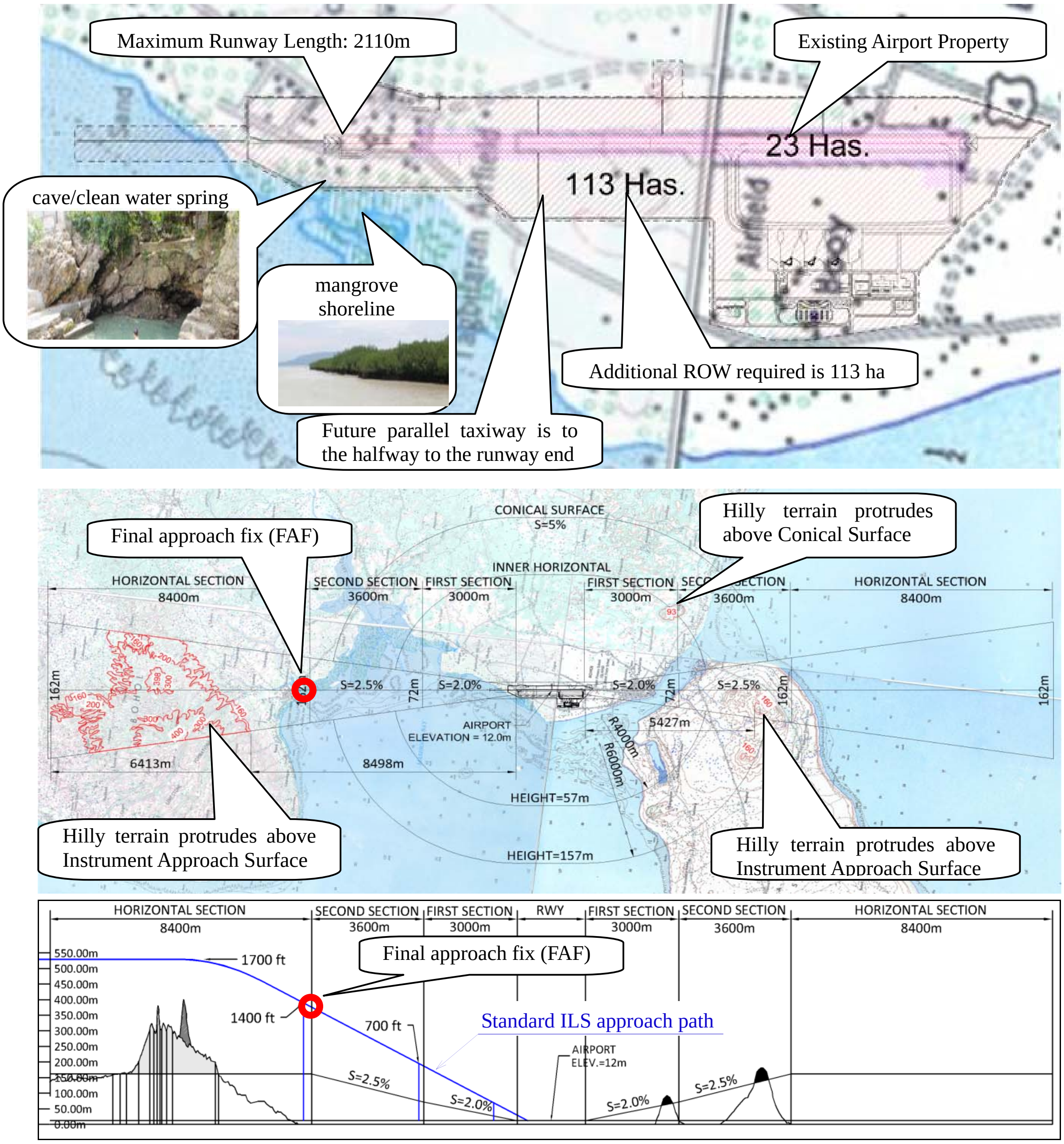
<table>
<tr><th>Description</th><th>Layout on Google Earth</th></tr>
<tr><td><u>Existing Tagbilaran Airport</u>
Non-instrument approach
Runway: 30m x 1779 m
Runway Strip: 100 m</td><td>
</td></tr>
<tr><td><u>Option</u>
<u>Original Scenario "Phase-1"</u>
Instrument Approach
Runway: 45m x <u>2110 m</u>
Runway Strip: 300 m</td><td>
</td></tr>
</table>

Source: JICA Study Team

Figure 3-2 Tagbilaran Airport Re-development Option

Due to the mangrove shoreline, the future parallel taxiway could not be provided in full but only to the halfway to the runway end so as to keep minimal efficiency/ frequency of aircraft movements. When the airport will be equipped with instrument approach system (either of precision or non-precision approach), the following should be noted.

- A series of hilly terrain exists along northern part of approach surface (approximately 5NM from the runway threshold), which are protruding above the obstacle limitation surfaces for the instrument runway, thereby giving difficulty to establish an instrument approach procedure in accordance with ICAO Annex 14.



Source: JICA Study Team

Figure 3-3 Option "Original Scenario Phase-1"
Obstacle Limitation Surface and Instrument Flight Path

- If standard ILS approach procedure is implemented, the pilot must face toward the exact runway orientation at the Final Approach Fix (FAF). However, approaching to the FAF from any direction the aircraft must pass over such hilly terrain at an extraordinary close distance.
- There exist wide area of clean mangrove, cave, and clean water spring observed at vertical face of limestone precipice in the immediate vicinity of the runway extension area. This will not only give difficulty in 10-m high embankment, but also special considerations must be given to how to protect such natural environment especially during construction period.

In view of the above, it is difficult to redevelop the Tagbilaran airport.

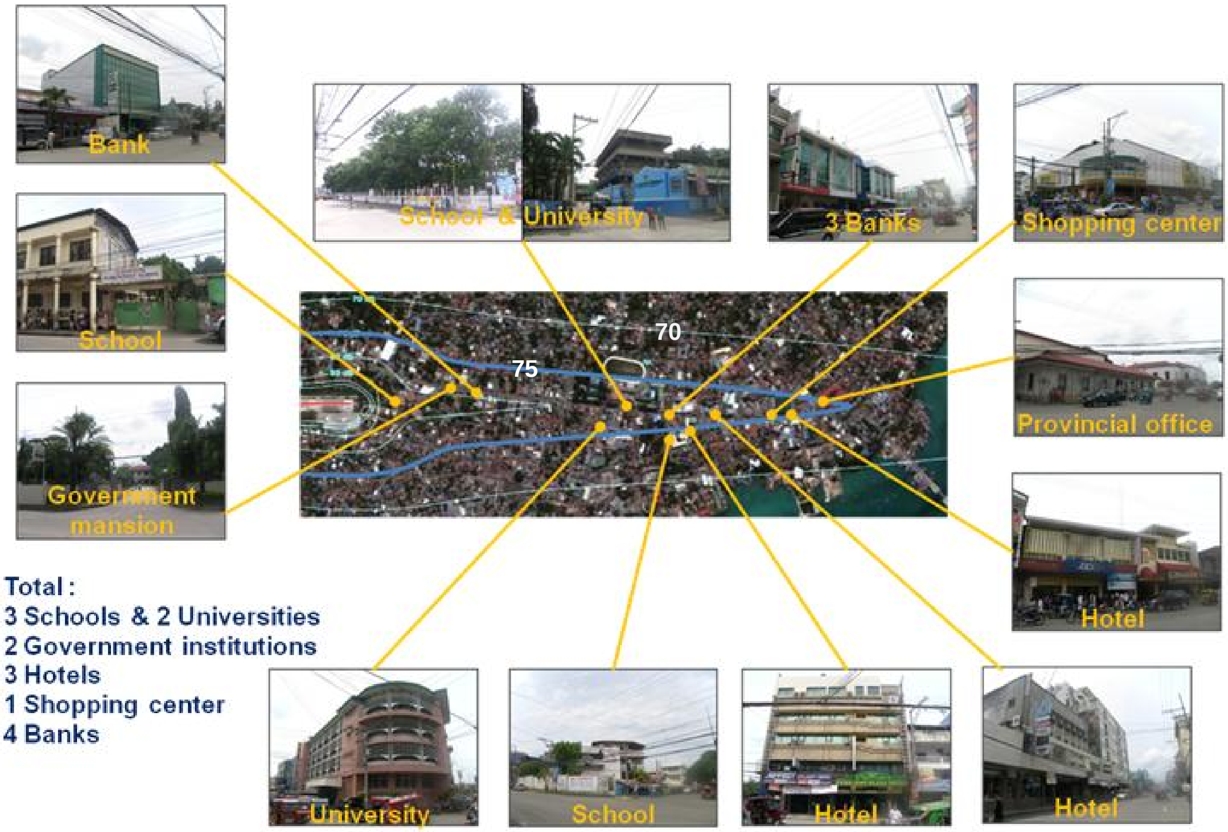
5) Areas affected by Noise Polution

The Tagbilaran Airport is situated right in the middle of downtown, where heavy noise pollution already occurs especially along-with the main street.

Effect of the noise pollution has been computed by using FAA software, and measured by means of Weighted Equivalent Continuous Perceived Noise Level (WECPNL).

The WECPNL is a parameter of noise pollution based on ICAO Annex 16. In Japan, properties affected by more than WECPNL75 are subject to compensation of noise preventive measures, e.g. provision of sound proof windows, walls, roofs and/or air-conditioning.

Possible noise contours for the years 2030, and the properties affected by the noise pollution (above WECPNL75) are shown in Figure 3-4.



Source: JICA Study Team

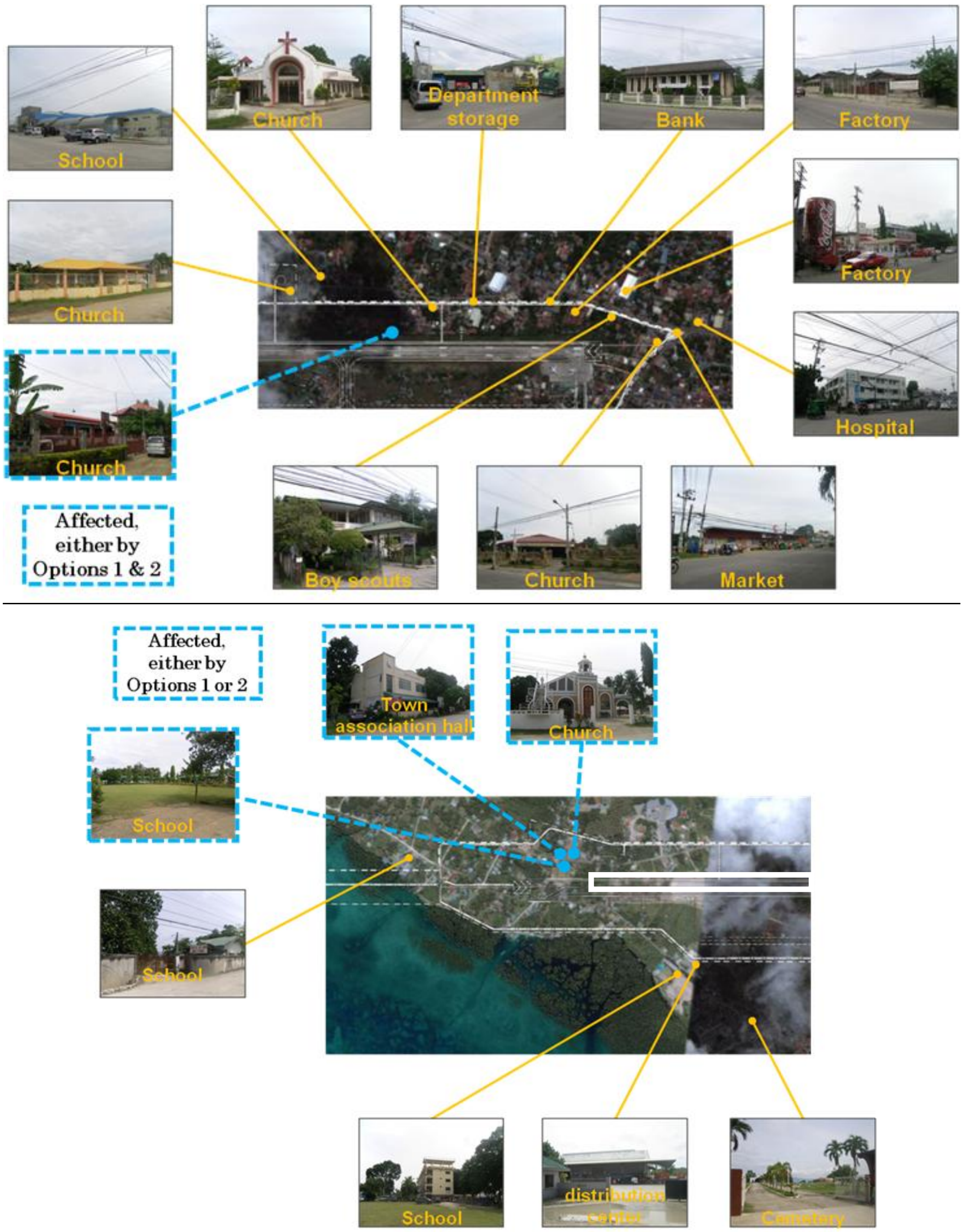
Figure 3-4 Areas possibly affected by noise in excess of WECPNL75 at Tagbilaran Downtown

As shown in the above pictures, in the area affected by the noise in excess of WECPNL75 there exist 3 schools, 2 University, 2 Government Institutions, 3 Hotels, 4 banks, and numerous housing complex, among others. Those structures were supposed to have existed since long time ago when the Tagbilaran Airport handled only propeller-driven aircraft of low noise level.

However, after introduction of jet aircraft operations (from 2002), the area and structures should not only be designated as noise polluted area but also should be recognized as partly being given a serious danger to human life both of Bohol residents and air passengers, because the airport has no runway-end-safety-area.

6) Areas to be safely cleared

Densely-populated housings are located inside the non-instrument runway strip at Tagbilaran Airport. If the airport would continue aircraft operations, those properties affected should be cleared. Those areas requiring ROW, demolition and replacement/ resettlement of the residents are shown in Figure 3-5.



Source: JICA Study Team

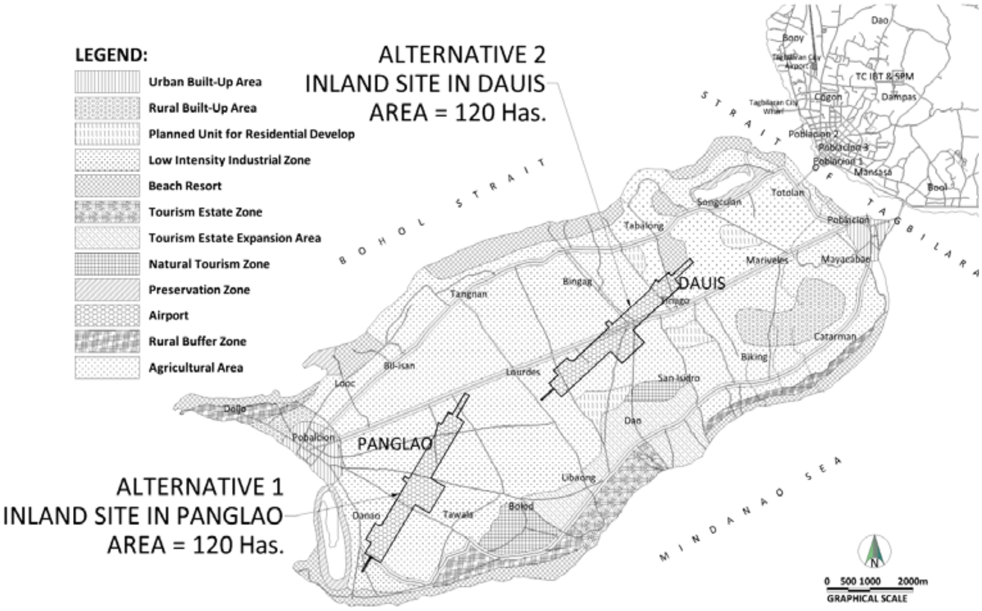
Figure 3-5 Properties affected by Tagbilaran Airport development

As shown in the above pictures, the areas to be safely cleared for instrument approach operations (either of precision or non-precision approach runway) include 5 schools, 8 churches, 2 hospitals, 2 Government Institutions, and 870 housings.

4. Proposed New Bohol Airport

4.1. Conditions of the Construction Site

The New Bohol Airport location on Panglao Island was earlier decided during the year 2000 Feasibility Study, for the main reason that mainland Bohol is mountainous and has very few flat areas, where if an airport would be developed, natural topography would project above obstacle limitation surface of the runway. Panglao Island was a logical alternative site and the municipalities of Dauis and Panglao had been earmarked as the possible alternative sites, as shown in Figure 4-1.



Source: JICA Study Team

Figure 4-1 Alternative Sites for New Bohol Airport (in 2000 FS)

Item	Alternative 1 - Panglao Site	Alternative 2 - Dauis Site
General	In Barangays Bolod and Tawala. The land is flat and predominantly agricultural and rural in character.	In Barangays Tabalong, Tinago and Bingag. The land is undulated in northern part, undeveloped with marginal agriculture and coconut plantation.
Distance from Tagbilaran city	15 km, 20-30 minutes by car	8 km; 15-20 minutes by car
Airspace	Approach/departure for either direction has no obstruction. The site is within the outer horizon surface of Tagbilaran airport.	Direction is toward Tagbilaran Airport. Low hills exist at 2.5km east that may protrude into the inner horizontal surface. The site is within the conical surface of Tagbilalann airport
Wind Coverage	Both Alternatives suite against prevailing wind direction which is northeast (NE). Wind coverage is 99.79% when cross wind is 5 knots.	
Social Environment	No diversion is necessary.	Paved spine road (highway) and power line must be diverted.
Natural Environment	Adverse impacts on natural environment on both alternatives will be little.	
Pollution	The aircraft noise problem will be minimal if land use surrounding the new airport is appropriately controlled in the future. Noise modeling study conducted by the Consultant shows that noise generated by airport operations will be within a tolerable limit.	
Resident perception	Local residents are aware of the project benefits and possible livelihood opportunities. 40% of Panglao site was acquired in 2000, while no acquisition was made in Dauis.	
Conclusion	**Recommended**	Not recommended

Source: JICA Study Team

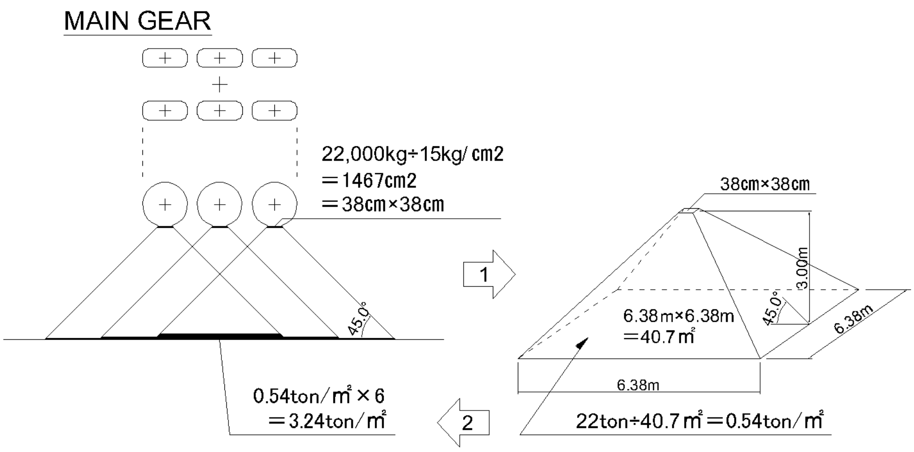
The project site is situated at 6 to 8 m above MSL, and underlain by Late Oligocene to Middle Miocene sediments and volcanic, mainly marine sandstone, shale and reef limestone; with some conglomerate, coal measure and marine and elastic-basaltic pyroclastic and lavas. A thick layer of coralline limestone underlain by thin layer of mostly medium plastic stiff to hard brown sandy elastic silt at the surface are the prevalent soil-rock formation as evidenced through the boreholes and test pits conducted. Information obtained from exploratory boreholes and test pits indicate that the site area is mostly consisting of cohesive deposits on top and under laying rock formations.

In 2009, Ground Penetration Radar (GPR) survey, 36 boreholes and 9 test pits investigation were conducted to identify the existence of cavity. As a result, one (1) 80-cm deep cavity was discovered at an elevation of 2.5 m below the ground. In addition, two (2) borehole logs show relatively lower N-Value. Such lower N-values were explained by geological specialist that even if the location had originally been likely an cavity, it was already filled up with soil by storm-water penetration. Ground water table was entirely not found, therefore the subsoil below is permeable and not saturated by water

With the exception of the three (3) Boreholes mentioned above, subsoil below the bottom of runway subgrade excavation level are generally covered by durable coralline limestone strata, similar to Mactan International Airport, and in some part are elastic silt or silty sand with the N-values of more than 15, generally having its bearing strength of more than 10 tons/m².

The designed thickness of the runway pavement is 1 m, beneath which a 2-m thick compacted subgrade is designed. Therefore, in total 3-m thick pavement structure is designed to be built up. The said cavity discovered would situate above the subgrade excavation bottom which is eventually filled up by suitable materials and compacted in every 20 cm, as a part of 2-m high subgrade.

The load of the aircraft main gear is vertically distributed to the depth to the bottom of subgrade with a horizontal distribution of 45-degree below the pavement surface. Therefore, the subsoil at the bottom of the 3-m thick pavement structure will not have direct impact from aircraft main load.



Source: JICA Study Team

Figure 4-2 Distribution of Main Gear Load at the bottom of Pavement Structure

During construction, the entire subgrade bottom should be, upon excavation, investigated once again (by GPR and confirmatory boreholes). When cavity is found during the course of earthwork, the cavity should be removed to the bottom irrespective of the designated subgrade thickness, be filled up by lean concrete, or be replaced with a good soil, or grouted or covered by concrete slabs when necessary, subject to further Engineering practice.

4.2. Facility Requirements

Through the course of the previous studies, i.e. in 2000 FS, 2007 FS, and 2009 Design, the runway length for the new Bohol Airport was constantly recommended thus designed to be 2,500 m.

Upon discussion between DOTC and JICA Study Team (JST) in July 2011, it was agreed that the Project would be split into 2 Phases, namely the Phase 1 wherein the 2,110-m long runway and a 9,660-m² PTB will mainly cope with the domestic operations but possibly accommodate international operations during the domestic off-peak hours, and the Phase 2 in which the Runway is extended to be 2,500 m and the PTB extended to be 15,470 m² to accommodate simultaneous domestic and international flight operations by larger-sized aircraft even during day time.

Upon submission of Draft Final Report in October 2011, JST was requested to study Cost Saving Scenario (Phase 1) in which the runway is minimized to be 2,000 m to cope with non-precision approach of domestic A321 (initially without ILS), and the single-story PTB of 8,271 m² without PBB can barely cope with domestic operations. Facility Requirements for the Airport were planned based on the air traffic demand forecast as shown in Table 4-1.

Table 4-1 Airport Facility Requirements

	Description	At present	Original Scenario			Cost Saving Scenario
		2010	2020	2030	2040	2020
1	Annual Passengers (2-way)	572	1,436	1,958	2,441	1,436
	Domestic	572	1,393	1,773	2,117	1,393
	International	-	43	185	324	43
2	Annual Cargo (tons)	4,791	10,812	13,274	15,968	10,812
3.	Annual Air traffic Movements (2-way)	4,664	13,915	17,047	19,807	13,915
	Domestic	4,664	13,545	15,355	16,993	13,545
	International	-	370	1,692	2,814	370
4	Peak-day Passengers (2-way)	1,790	4,892	6,511	8,099	4,892
	Domestic	1,790	4,353	5,541	6,616	4,353
	International	-	539	970	1,483	539
5	Peak-Hour Passengers (1-way)					
	Domestic (PH factor)	400	375 (15.1 %)	464 (14.6 %)	542 (14.3 %)	375 (15.1 %)
	International (PH aircraft)	-	128 (A320)	208 (B767)	240 (A330)	128 (A320)
6	Peak-Hour Passengers (2-way)					
	Domestic	600	577	714	834	577
	International	-	197	320	369	197
7	Peak-Hour Aircraft (1-way)					
	Domestic	3	3.19	3.51	3.81	3.19
	International	-	1	1	1	1
8	Design Aircraft	A320	A320	A321/B767/A330		A321
9	Longest Destination	Manila	Inchong/ Beijin/ Narita			Manila
10	Aerodrome Reference Code	3C	4C	4E		4E
11	Fire Fighting Category	Cat 6	Cat 6	Cat 9		Cat 6
12	Operational Category	VFR	IFR: Cat-1 Precision			Non-Precision
13	Runway Length (m)	1,779	2,110	2,500		2,000
	Width (m)	30	45	45		45
14	Runway Strip Length (m)	1,800	2,230	2,620		2,120
	Width (m)	100	300	300		300
15	Taxiway	2 stub	2stub	Parallel Taxiway		2 Stub
16	Passenger Terminal Floor (m²)	850	9,660	15,470	20,010	8,271
	Dom (13-16m²/2-way peak Pax)	850	9,660	9,660	12,630	8,271
	Intl (16-20m²/2-way peak Pax)	-	Common	5,810	7,380	Common
17	Water Demand (m³ /day)	-	325	425	525	325
18	Electricity (KVA for contract)	-	3,000			

Source: JICA Study Team

4.3. Conceptual Design of the New Bohol Airport

1) Airport Layout

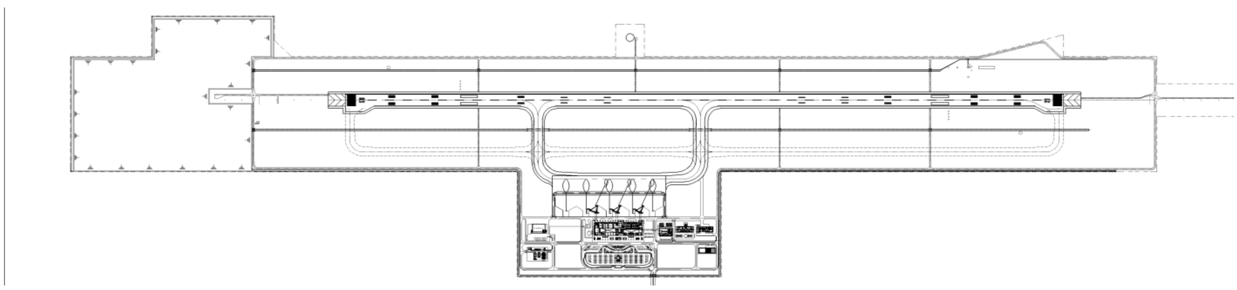
As mentioned above, the eventual runway length is 2,500 m which is designated as Phase-2 requirement for the Original Scenario.

The Phase-1 runway length requirement for the Original Scenario is 2,110 m which can accommodate small jet operations. This 390-m reduction of the runway length has been proposed in consideration of the future cut-and-reinstall of every 30-m spacing of lighting barrette for the 900-m long Precision Approach Lighting System.

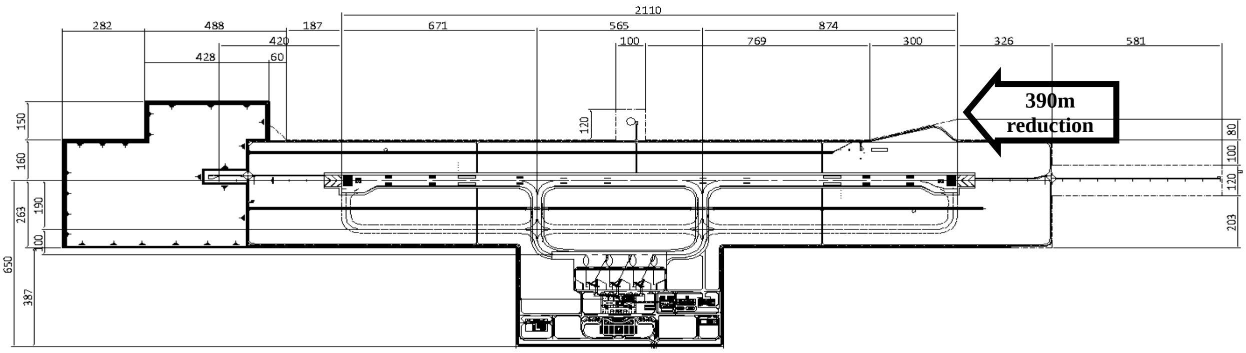
The Phase-1 runway length requirement for the Cost Saving Scenario is 2,000 m which can accommodate small jet mainly for domestic operations. This provision is not for an ILS precision approach runway but VOR/DME non-precision approach runway.

Airport Layout Plan for the Original Scenario Phase 2 and Phase 1 and the Cost Saving Scenario Phase 1 are shown in Figure 4-3.

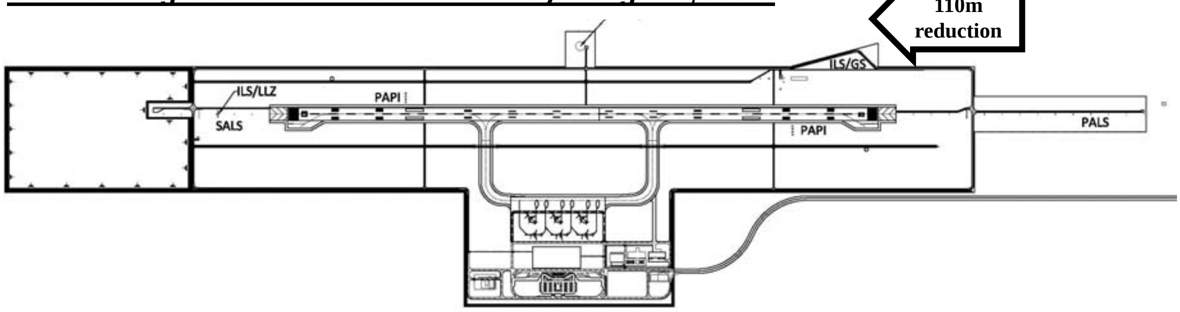
Original Scenario Phase 2: Runway Length 2,500m



Original Scenario Phase 1: Runway Length 2,110m



Cost Saving Scenario Phase 1: Runway Length 2,000m



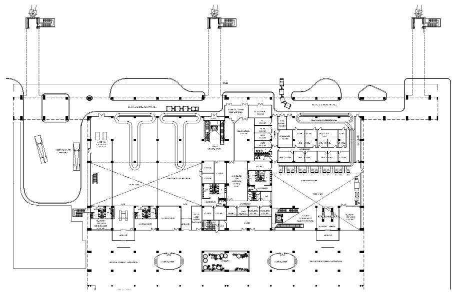
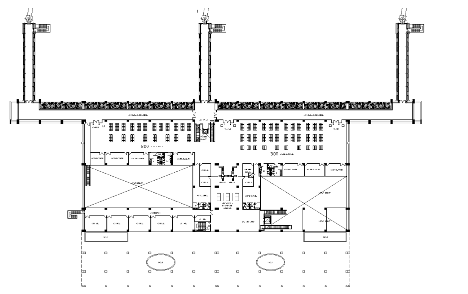
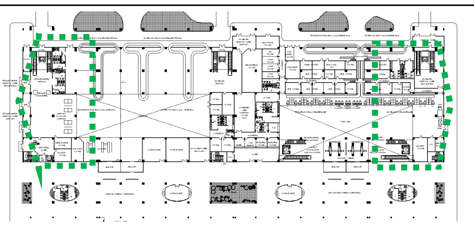
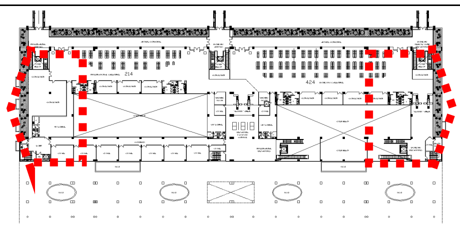
Source: JICA Study Team

Figure 4-3 Airport Layout Plan

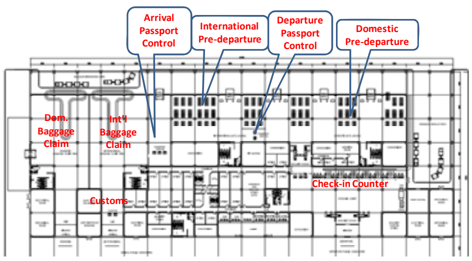
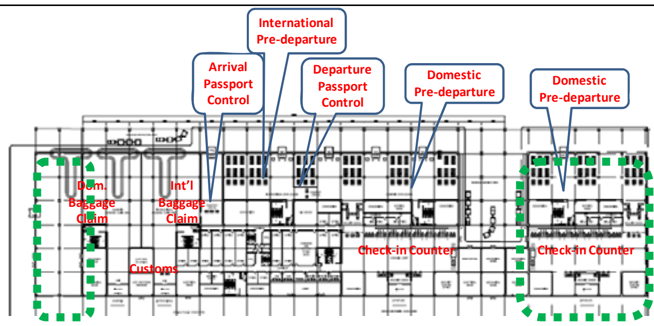
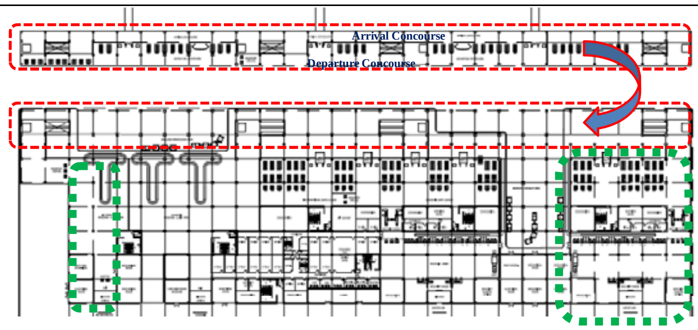
2) Passenger Terminal Building (PTB)

Development Phases for Passenger Terminal Building (PTB) are as shown in Figure 4-4.

Original Scenario (2-story building)

	Ground Floor	2nd Floor
Phase 1		
Phase 2		

Cost Saving Scenario (single-story low-cost terminal)

Phase 1	8,271m²	
Phase 2 Ground Floor Expansio 2nd Floor Expansio	**Stage 1 Horizontal Expansion** **11,903m²**	
	Stage 2 Vertical Expansion **16,318m²**	

Source: JICA Study Team

Figure 4-4 Development Phases for PTB

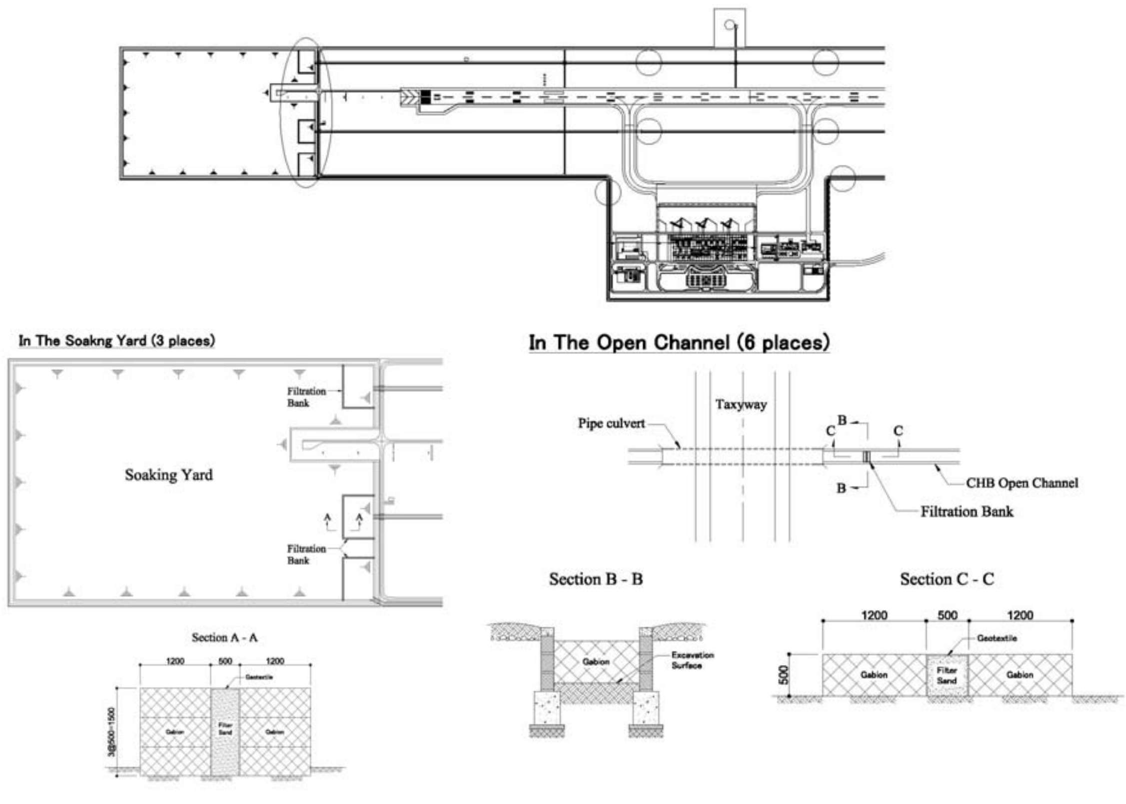
Solar Power Generation is adopted in the Cost Saving Scenario to save O&M cost.

3) Airport Drainage

One of the prerequisite conditions for environmental protection is that any dirty water should not overflow from the new airport to the ocean. Toward this objective, storm water along airfield is planned to be collected through rip-rapped (or CHB-walled) open ditch, so that storm water is locally detained and soaked into the ground as much as possible, then only a minimal volume of storm water would overflow into the soaking yard.

Daily maximum rainfall occurred for the last 10 years was 94 mm recorded in October 2010. Assuming 50 % of the rainfall is naturally absorbed into the ground of approximately 200ha, reservoir capacity of detention pond (soaking yard) should not be less than 94,000 tons of water (i.e. 50% x 0.094 m x 2,000,000 m²). In addition, maximum 420 tons in total of water used for the building complex (including PTB, CTB, control tower, operation building, fire station and maintenance building) will be discharged via sewage treatment plant to the same soaking yard, which culminate a total of 94,420 ton of water. The environmental / social advisory committee of JICA suggests that the area of soaking yard should be planed as large as possible to prevent overflow of storm water due to extraordinary weather condition recently encountered worldwide. Meanwhile, the area of soaking yard is approximately 20 ha where the bottom is lowered by 1 m, in average hence 200,000 tons of water can be detained which can cope with the requirements.

To preserve the soaking function in the open ditch, filtration bank covered with geo-textile and gabion should be designed to be strategically located as shown in Figure 4-6.   If necessary, the bottom of the soaking yard could be covered by geo-textile materials so that fine sand stuck into the natural underground-watercourse could be prevented.

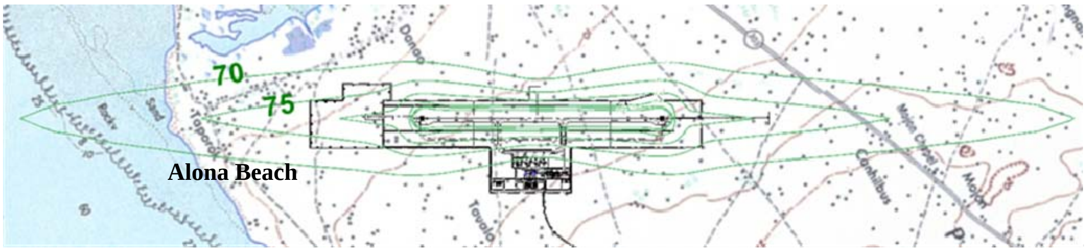


Source: JICA Study Team

Figure 4-5 Filtration Bank to Prevent fine soil effluences

4.4. Noise Pollution Aspect

There are only a few, or possibly no residents affected by the noise level of more than WECPNL75 since ROW for the 1-km long Precision Approach Lighting System in the north-east, and wide areas for a Storm-water Soaking Yard in the south-west have already been acquired.

WECPNL for 2020	
WECPNL for 2030	

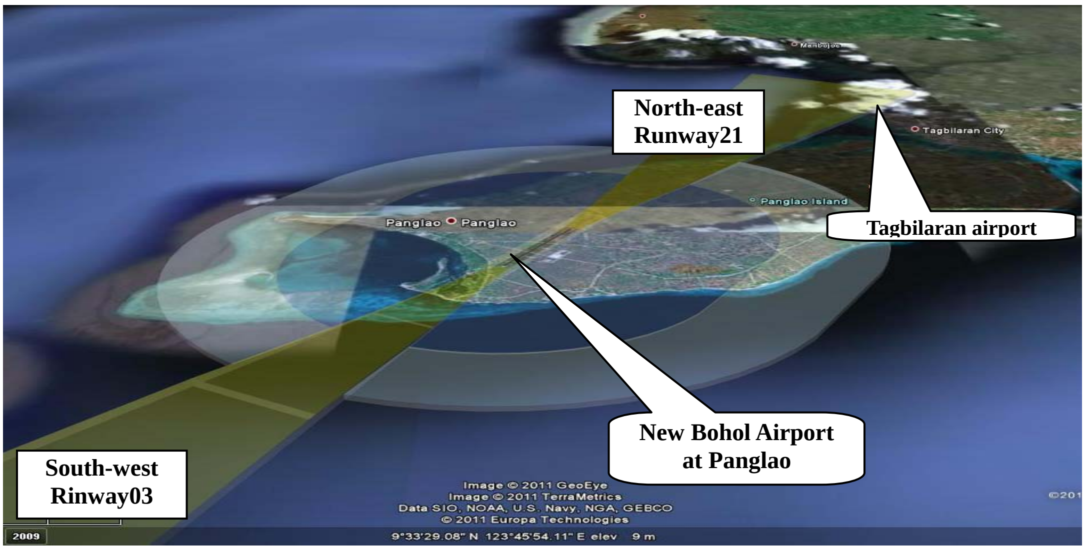
Source: JICA Study Team

Figure 4-6 Noise Contour (WECPNL) for New Bohol Airport at Panglao

The noise contour WECPNL70 may approach to a part of Alona Beach Resort, which is the most popular destination, sometime after 2030. When main approach direction is set from the north-east (Runway21), noise problem will be able to be avoided even if the night landing is occasionally made.

4.5. Obstacle Limitation Surface

The new Bohol Airport will have no obstruction that protrude above the obstacle limitation surfaces for instrument approach runway, thus fully complying with ICAO standard.



Source: JICA Study Team

Figure 4-7 Obstacle Limitation Surface for New Bohol Airport at Panglao

5. Project Cost and Implementation Schedule

5.1. Project Cost

Project Cost is estimated as shown in Table 5-2.

Table 5-1 Project Cost (000)

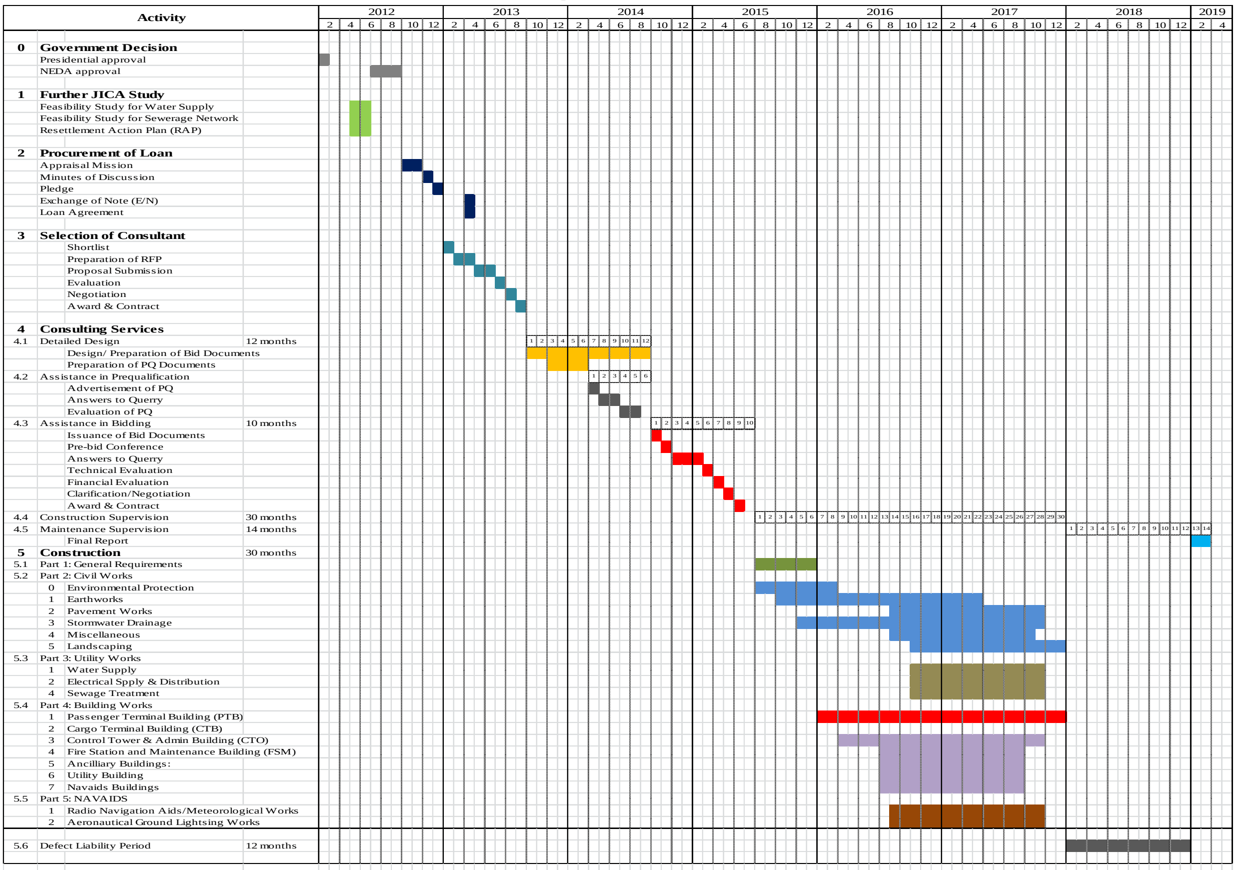
Description		Original Scenario		Cost Saving Scenario
		Phase 2	Phase 1	Phase 1
Base Cost	Base Construction Cost	5,828,184	4,977,566	4,164,553
	Contingency: 5 %	291409	248,878	208,228
	subtotal	6,119,593	5,226,444	4,372,780
	Consultancy	887,341	757,834	714,335
	Total	7,006,934	5,984,278	5,087,115
	Equivalent Japanese Yen	JPY 14.0 bil	JPY 12.0 bil	JPY 10.2 bil
Project Cost including 12 %VAT and Price Escalation	Construction Cost with VAT	6,527,566	5,574,873	4,664,299
	Contingency: 5 %	326,378	278,744	233,215
	subtotal	6,853,944	5,853,617	4,897,514
	Consultancy	988,751	844,444	796,313
	Total	7,842,695	6,698,061	5,693,827
	Provision for Future Price Escalation From 2011 to 2018	1,084,353	894,733	763,242
	Grand Total	8,927,048	7,592,794	6,457,069
	Equivalent Japanese Yen	JPY 17.9 bil	JPY 15.2 bil	JPY 12.9 bil

Source: JICA Study Team

5.2. Implementation Schedule

Proposed Implementation Schedule is shown in Table 5-2.

Table 5-2 Implementation Schedule



Source: JICA Study Team

6. Financial Analysis

6.1. Preamble

The objective of financial analysis is to evaluate whether or not the implementation of the Project is feasible and viable for the project executing body under its financial circumstances. The financial benefit from the project is figured out through computation of financial internal rate of returns (FIRR), based on the following assumptions:

1) Revenues and expenditures are estimated at the constant price as of 2011 in Philippines Pesos (Php).

2) Price escalation is not taken into account in financial analysis, and it has been assumed that the general increase of the prices will equally affect the costs and revenues.

3) The New Bohol Airport is expected to become operational in 2018.

4) The project evaluation period is assumed to be 30 years upon commencement of the operations in 2018, i.e. until 2047.

6.2. Financial Internal rate of Return

Particulars of each case studied are explained as shown in Table 6-1.

Table 6-1 Particulars of the Cases

	Case	Develop-ment	Runway (m)	ILS	PTB (m^2)	CTB (m^2)	PBB	Solar Power	FFV	Revenue considered		
										Pax	Cargo	PBB
Original Scenario	1	Up to Phase 1	2,110	Yes	9,761	None	3	None	None	All	None	All
	2	Up to Phase 2	2,500	Yes	15,470	1,500	3	None	2	All	after Phase2	All
Cost Saving Scenario	1	Up to Phase 1	2,000	None	8,271	None	None	Yes	None	All	None	None
	2	Up to Phase 2 Stage 1	2,000	None	11,903	1,500	None	Yes	2	All	after Phase2	None
	3	Up to Phase 2 Stage 2	2,500	Yes	16,318	1,500	3	Yes	2	All	after Phase2	after Phase2

Source: JICA Study Team

Cumulative revenue and expenditures, and FIRR for 30 years of the Project Evaluation Period for each case are shown in Table 6-2.

Table 6-2 Revenue, Expenditure and FIRR (30years)

	Case	Develop-ment	Revenue (2018-2047)	Investment	O&M cost (2018-2047)	Net Cash Balance	FIRR
Original Scenario	1	Up to Phase 1	P 14,531 mil	P 6,698 mil	P 5,581 mil	P 2,251 mil	**1.85%**
	2	Up to Phase 2	P 14,602 mil	P 7,843 mil	P 5,581 mil	P 1,178 mil	**0.97%**
Cost Saving Scenario	1	Up to Phase 1	P 14,172 mil	P 5,694 mil	P 4,414 mil	P 4,064 mil	**3.63%**
	2	Up to Phase 2 Stage 1	P 14,263 mil	P 6,172 mil	P 4,414 mil	P 3,677 mil	**3.22%**
	3	Up to Phase 2 Stage 2	P 14,492 mil	P 7,414 mil	P 4,414 mil	P 2,663 mil	**2.31%**

Source: JICA Study Team

7. Economic Analysis

7.1. Preamble

The objective of economic analysis is to evaluate whether the implementation of the Project would be given a viable benefit from the viewpoint of the national economy. The economic benefit from the Project is figured out through computation of economic internal rate of returns (EIRR).

In order to figure out the net economic benefits, it is normally focused into the difference in economical productivity between the case with implementation of the Project (With Project Case) and the case without implementation of the Project (Without Project case).

With Project Case :

The Project will be implemented and the airport capacity will be expanded to cope with air passengers up to 2047.

Without Project Case :

No investments will be made on the existing facilities. Capacity limit of the existing airport is set at 700,000 passengers, thereafter no increase in traffic is assumed.

The expected return of the Project should be evaluated as incremental revenues attributable to improvement of the facilities. Consequently, revenues and costs should be compared between the cases.

7.2. Economic Internal rate of Return

Upon the review and update of the air traffic demand forecast, the project cost, projection of expenditure and economic benefit, the Economic Internal Rate of Return (EIRR) have been evaluated.

The economic analyses are made in the respective cases corresponding to the financial analysis as shown in the forgoing Table 6-1.

EIRR computation with sensitivity analysis (negative cases) are summarized in Table 7-1.

Table 7-1 Economic Analysis (EIRR) with Sensitivity Analysis

	Case	Conditions	Base Case	Negative Case	
		Construction	+/- 0 %	+ 10 %	+ 20 %
		O & M cost	+/- 0 %	+ 10 %	+ 20 %
		Benefit	+/- 0 %	- 10 %	- 20 %
Original Scenario	1	Up to Phase 1	26.25 %	22.58 %	19.32 %
	2	Up to Phase 2	26.10 %	22.39 %	19.09 %
Cost Saving Scenario	1	Up to Phase 1	29.70 %	25.60 %	21.92 %
	2	Up to Phase 2 Stage 1	29.49 %	25.36 %	21.71 %
	3	Up to Phase 2 Stage 2	29.34 %	25.16 %	21.46 %

Source: JICA Study Team

As a result, the EIRR has been calculated as over 26 % for each base case, and even in the worst case (i.e. cost +20%, benefit -20%) the EIRR is calculated as over 19 %.

Based on the result, the New Bohol Airport Development Project even with its full-scale development (Original Scenario Phase 2) has been evaluated to be highly viable from the view point of national economy.

8. Environmental and Social Consideration

8.1. Environmental Compliance Certificate

The Environmental Management Bureau (EMB) of Department of Environment and Natural Resources, Region VII issued Environmental Compliance Certificate (ECC) for the Project in 4th, June 2003. The ECC is in compliance to the requirements of presidential Decree No.1586, in accordance to Department Administrative Order No.2003-30. The ECC is valid for five years, DOTC submitted the documents to EMB to extent the ECC in 2008. EMB issued again new ECC in 3rd, June 2008. The reissued ECC is valid until 2nd, June 2013. The number of ECC is R07-0804-0133-25.

8.2. Outline of the Project Area

Panglao Island is located in the southwestern part of Bohol Province in Central Visayas in the Philippines. It is particularly located at 123’48’21 east longitude and 9’32.871’ north latitude. The travel time from Tagbilaran City is just 30 minutes away from the mainland Bohol. Project Area is located in south-west area of Panglao Island, the island is connected to Bohol Island by two course ways. Site area for new airport is 229.18 hectares.

UNDP carried out the Bohol Marine Triangle Project to develop the sustainable management system of marine diversity and resources at sea area of Panglao island. The local government units and non-government organizations are carrying out the systematic monitoring developed by the project at protected area periodically.

Area of Panglao Island is 10,500 m^2, and there are some fifty three (53) thousand residents. Agricultural land and brush land are accounted for ninety percent of total area. Major industries of the Island are agriculture and fishery. Agricultural products are coon, dry-land rice, vegetable, banana and coconut. However, agriculture activities can not provide good profit to farmers due to limited water and poor soil. Fishery activities and marine tourism industry provide some profit the residents along the coastal area.

The new airport site was selected from three alternative sites in 2000. The site is basically an open area dominated by residential and agricultural lands with occasional patches of fruit trees and bamboo thickets. About 30% of the sites are regulated with native shrubs and bamboo thickets. About 30% of the sites are regulated with native shrubs and grasses.

The biodiversity assessment in 2012 came up with the following conclusions, the overall, species diversity of both flora and fauna is moderately high in the impact areas. Although vast floral and faunal populations will be lost or wiped in the mega construction, it is believed that no species will be locally extinct as there still be residual populations in the rest of the island. And there are no Threatened Species and Endangered Species in the area.

8.3. Resettlement and Environmental Impact of the Project

According to the record obtained from Bohol Provincial Government, 64 households were affected with their houses and had to resettle outside of the ROW. Out of the 64 households above, 61 households were already paid their eligible compensation. Out of remaining 3 households, 2 are under expropriation and waiting for the final decision on compensation amount by the court. The other household is not eligible for any types of compensation, since the family had settled before the cut-off date. Out of the 64 households affected with their houses, 32 households had been already resettled outside of the ROW, mostly to nearby areas in Panglao or Bohol Island. There are still 32 households remaining in the project site, since they were allowed, by the Provincial Government, to remain until the commencement of the construction of the new airport. And after cut-off date, 11 households move in the site from outside, then there are 43 household in May, 2012. Most important issue is that the re-movement of remaining 43 families will be done smoothly without problems. DOTC shall consider following actions, 1) Development of Resettlement Site and 2) Establishment of Systematic Grievance Redress Mechanism. Resettlement activities will be monitored and reported by DOTC.

There are two significant environmental impacts at the site in operation phase.

Noise contour at the proposed New Bohol Airport site in Panglao for the years 2020 and 2030 are computed. There are only a few, or possibly no residents affected by the noise level of more than 75 WECPNL since ROW for the 1-km long Precision Approach Lighting System in the north-east, and wide areas for a Storm-water Soaking Yard in the south-west have already been acquired. The new Bohol Airport will have no topographical obstruction that protrude above the obstacle limitation surfaces for instrument approach runway, thus fully complying with ICAO standard.

To protect Pollution or contamination of coastal area from the rainfall water and waste water in the airport, final effluent water treatment is considered as closed systems. Pavement area is limited only runway area, rainfall water from the pavement area and airport area flow into and seepage in the effluent ditch without concrete bottom, and minimized rainfall water reach to Storm-water Soaking Yard. The waste water is generated from toilet, restaurant, cleaning of the floor. The waste water is treated by in-site treatment plant built in main building and treated water is conducted to Storm-water Soaking Yard.

Environmental monitoring will be carried out by project implementation agency and MMT(Multi-Partite Monitoring Team). The monitoring results shall be reported to EMB periodically. The original environmental monitoring plan was formulated by EIS report approved by EMB.

Table of Contents

Table of Contents

Executive Summary

Chapter 1. Introduction

Chapter 2. Background of the Project

Chapter 3. Air Traffic Demand Forecast

Chapter 4. Airport Facility Requirements

Chapter 5. Conceptual Design

Chapter 6. Project Cost and Implementation Schedule

Chapter 7. Project Viability Review

Chapter 8. Environmental and Social Consideration

List of Illustrations

Chapter 1. Introduction

Chapter 2. Background of the Project

Chapter 3. Air Traffic Demand Forecast

Chapter 4. Airport Facility Requirements

Chapter 5. Conceptual Design

Chapter 6. Project Cost and Implementation Schedule

Chapter 7. Project Viability Review

Chapter 8. Environmental and Social Consideration

List of Tabulations

Chapter 1. Introduction

Chapter 2. Background of the Project

Chapter 3. Air Traffic Demand Forecast

Chapter 4. Airport Facility Requirements

Chapter 5. Conceptual Design

Chapter 6. Project Cost and Implementation Schedule

Chapter 7. Project Viability Review

List of Abbreviations

List of Abbreviations

A

AAZ	**Aerodrome Advisory Zones**
AAGR	**Average Annual Growth Rate**
ABC	**A: Common Combustibles, B: Flammable Liquids & Gas, C: Live Electrical Equipment**
ACC	**Area Control Center**
ACB	**Ancillary Building**
ADB	**Asian Development Bank**
ADRM	**Airport Development Reference Manual**
AFP	**Armed Force of the Philippines**
AFTN	**Aeronautical Fixed Telecommunication Network**
A/G	**Air to Ground**
AGL	**Aeronautical Ground Light**
AHU	**Air-Handling Units**
AIS	**Aeronautical Information Service**
AIP	**Aeronautical Information Publication**
AMDS	**Airport Development Reference Manual**
AMHS	**ATS Message Handling System**
ANS	**Air Navigation Service**
APEC	**Asia-Pacific Economic Cooperation**
ATC	**Air Traffic Control**
ATZs	**Aerodrome Traffic Zones**
ATM	**Air Traffic Management**
ATS	**Air Traffic Service**
AUSAID	**Australian Agency for International Development**
AWOS	**Automated Weather Observing System**

B

BANGON	**Bohol Alliance of NGOs**
BBP	**Bohol Business Park**
BH	**Borehole**
BHS	**Baggage Handling System**
BIMP-EAGA	**Brunei, Indonesia, Malaysia and the Philippines – East ASEAN Growth Area**
BIR	**Bureau of Internal Revenue**
BMS	**Building Management System**
BMT	**BOHOL Marine Triangle**
BOHECO	**BOHOL Electric Cooperative Inc.**
BOD	**Biochemical Oxygen Demand**
BOI	**Board of Investment**
BOO	**Built – Own – and – Operate**
BOT	**Built – Operate – and – Transfer**
BSP	**Bangko Sentral ng Pilipinas**
BTO	**Built – Transfer – and – Operate**
BTO	**Bohol Tourism Office**
BWUI	**Bohol Water Utilities, Inc**

C

CAAP	**Civil Aviation Authority of Philippines**
CAO	**Contract- Add-and- Operate**
CAT	**Category**
CBR	**California Bearing Ratio**
CCO	**Command and Control Office**
CCPAP	**Coordinating Council of the Philippine Assistance Program**
CCR	**Constant Current Regulator**
CCTV	**Closed Circuit Television**

CFF	**Coral Reefs, Fisheries and Food Security**
CHB	**Concrete Hollow Block**
CI	**Conservation International**
CID	**Citizens Intelligence Division**
CIP	**Commercial Important Person**
CIQ	**Custom, Immigration, Quarantine**
CLUP	**Comprehensive land use plan**
CNC	**Certificate of Non-Coverage**
CNS	**Communication, Navigation, Surveillance**
COD	**Chemical Oxygen Demand**
CT	**Coral Triangle**
CTB	**Cargo Terminal Building**
CTI	**Coral Triangle Initiative**
CTRs	**Control Zones**
CWA	**Clean Water Act**

D

DAO	**DENR Administrative Order**
DBP	**Development Bank of the Philippines**
D/E	**Debt/Equity**
DENR	**Department of Environment and Natural Resources**
DFA	**Department of Foreign Affaires**
DGS	**Direct Government Subsidy**
DH	**Decision Height**
DME	**Distance Measuring Equipment**
DOF	**Department of Finance**
DOT	**Department of Tourism**
DOLE	**Department of Labor and Employment**
DOTC	**Department of Transportation and Communication**

DPWH	**Department of Public Works and Highways**
DSCR	**Debt Service Coverage Ratio**
DSRA	**Debt Service Reserve Account**
DTI	**Department of Trade and Industry**
DVOR	**Doppler Type VHF Omni-directional Radio Range**

E

ECC	**Environmental Clearance Certification**
EIA	**Environmental Impact Assessment**
EIAMD	**Environmental Impact Assessment Management Division**
EIRR	**Economic Internal Rate of Return**
EIS	**Environmental Impact Statement**
EMB	**Environmental Management Bureau**
EPS	**Electrical Pipe Shaft**
ESWM	**Ecological Solid Waste Management**

F

FAA	**Federal Aviation Administration**
FAARFIELD	**FAA Rigid and Flexible Iterative Elastic Layered Design**
FADS	**Fire Alarm Detection System**
FARMCs	**Fisheries and Aquatic Resources Management Councils**
FCU	**Fan Coil Unit**
F/D	**Flight Data**
FIC	**Facility In Charge**
FIDS	**Flight Information Display System**
FIR	**Flight Information Region**
FIRR	**Financial Internal Rate of Return**
FOBS	**Flight Observation**
FPE	**Foundation for Philippine Environment**
FS	**Feasibility Study**

FSS	**Flight Service Station**

G

GCR	**Greater Capital Region**
GDP	**Gross Domestic Product**
GFS	**Government Financial Statistics**
GIS	**Geographic Information System**
GOCC	**Government-Owned and Controlled Corporations**
GOJ	**Government of Japan**
GOP	**Government of the Philippines**
GS	**Glide Slope**
GPR	**Ground Penetrating Radar**
GRDP	**Gross Regional Domestic Product**
GRP	**Government of the Republic of the Philippines**
GTZ	**German Agency for Technical Cooperation**
GWL	**Ground Water Level**

H

HF	**High Frequency**

I

IAS	**Indicated Air Speed**
IATA	**International Air Transportation Association**
ICAO	**International Civil Aviation Organization**
ICB	**International Competitive Bidding**
ICC	**Investment Coordination Committee**
IEEC	**Initial Environmental Examination Checklist**
IEER	**Initial Environmental Examination Report**
IFR	**Instrument Flight Rule**
ILS	**Instrument Landing System**
IRR	**Implementing Rules and Regulations**

ITB	**Invitation to Bid**
IUCN	**International Union for Conservation of Nature**

J

JCAB	**Japan Civil Aviation Bureau**
JICA	**Japan International Cooperation Agency**

L

LAN	**Local Area Network**
LCC	**Low Cost Carriers**
LED	**Light Emitting Diode**
LGUs	**Local Government Units**
LLCR	**Loan Life Coverage Ratio**
LLZ	**Localizer**
LPDA	**Log Periodic Dipole Array**
LPG	**Liquefied Petroleum Gas**
LV	**Low Voltage**
LWUA	**Local Water Utilities Administration**

M

MC	**Management Contract**
MCIAA	**MACTAN-CEBU International Airport Authority**
MDA	**Minimum Descent Altitude**
MET	**Meteorological Equipment**
METAR	**Regular airport Weather Report**
MIAA	**Manila International Airport Authority**
MPDO	**Municipal Planning and Development Office**
MSL	**Mean Sea Level**
MWS	**Municipal Waterworks System**
MWSI	**Maynilad Water Service Inc.**

N

NAAQS	**National Ambient Air Quality Standards**
NAIA	**Ninoy Aquino International Airport**
NAPOCOR	**National Power Corporation**
NAVAID(s)	**Navigation Aid (s)**
NAWASA	**National Waterworks and Sewerage Authority**
NBSAP	**National Biodiversity Strategy and Action Plan**
NCCC	**National CTI Coordination Committee**
NCR	**National Capital Region**
NDB	**Non-Directional Beacon**
NEDA	**National Economic Development Authority**
NFPA	**National Fire Protection Association**
NGO	**Non-Governmental Organization**
NIPAS	**National Integrated Protected Area System**
NOTAM	**Notice to Airmen**
NPV	**Net Present Value**
NSCB	**National Statistical Coordination Board**
NSO	**National Statistics Office**
NSWMC	**National Solid Waste Management Commission**
NWRB	**National Water Resources Board**

O

ODA	**Official Development Assistance**
OJT	**On-the-job training**
OLS	**Obstacle Limitation Surface**
O/M	**Operation and Maintenance**

P

PAL	**Philippine Airlines**
PABX	**Private Automatic Branch Exchange**
PACAP	**Philippines Australia Community Assistance Program**
PALS	**Precision Approach Lighting System**
PANS	**Procedures for Air Navigation Services**
PANS/OPS	**PANS-Aircraft Operations**
PAPI	**Precision Approach Path Indicator**
PAU	**Primary Air-Handling Units**
PAWB	**Protected Area and Wildlife Bureau**
PBB	**Passenger Boarding Bridge**
PBN	**Performance Based Navigation**
PC	**Personnel Computer**
PCCP	**Portland Cement Concrete Pavement**
PCGRDP	**GRDP Per Capita**
PD	**Presidential Decree**
PDPFP	**Provincial Development and Physical Framework Plan**
PEIS	**Programmatic EIS**
PHILVOLCS	**Philippine Institute of Volcanology and Seismology**
PHO	**Provincial Health Office**
PIRR	**Project Internal Rate of Return**
PLC	**Programming Logic Controller**
PMO	**Project Management Office**
PNP	**Philippine National Police**
PNSDW	**Philippine National Standard for Drinking Water**
PPA	**Philippine Port Authority**
PPDO	**Provincial Planning and Development Office**
PPP	**Public Private Partnership**

PSC	**Public Sector Comparator**
PSFC	**Passenger Service Facility Charge**
PTA	**Philippines Tourism Authority**
PTB	**Passenger Terminal Building**
PTWG	**Provincial Technical Working Group**
PWS	**Provincial Waterworks System**

Q

QNH	**Altimeter sub-scale setting to obtain elevation when on the ground**
QFE	**Atmospheric pressure at aerodrome elevation**

R

RAP	**Resettlement Action Plan**
REDCOM	**Review and Development Committee**
REDL	**Runway Edge Light**
RENL	**Runway End Light**
RESA	**Runway End Safety Area**
RNAV	**Area Navigation**
ROO	**Rehabilitate – Own – and – Operate**
ROT	**Rehabilitate – Operate – and – Transfer**
ROW	**Right Of Way**
RPOA	**Regional Plan Of Action**
RTHL	**Runway Threshold Light**
RVR	**Runway Visual Range**
R/W	**Runway**
RWDC	**Rural Waterworks Development Corporation**
RX	**Receiver**

S

SARS	**Severe Acute Respiratory Syndrome**
SALS	**Simplified Approach Lighting System**

SEC	**Securities & Exchange Commission**
SPC	**Special Purpose Company**
SPECI	**Special Weather Report**
SPV	**Special Purpose Vehicle**
SSB	**Single Sideband**
SSS	**Social Security Service**
STAR	**Standard Terminal Approach Route**
STEP	**Special Terms for Economic Partnership**
STP	**Sewage Treatment Plant**

T

TB	**Treasury Bond**
T-DME	**Terminal DME**
TEDL	**Taxiway Edge Light**
TIEZA	**Tourism Infrastructure and Enterprise Zone Authority**
TMA	**Terminal Control Area**
TNC	**The Nature Conservancy**
TOC	**Toll Operation Certificate**
TRB	**Toll Regulatory Board**
TRCV	**Transceiver**
T/W	**Taxiway**
TWS	**Tagbilaran Waterworks System**
TX	**Transmitter**
TXGL	**Taxiway Guidance Sign**

U

UPS	**Uninterruptible Power Supply**
USAID	**U.S. Agency for International Development**
USEPA	**United States Environmental Protection Agency**
UTC	**Universal Time Coordinated**

V

VAT	**Value Added Tax**
VCCS	**Voice Communication Control System**
VFM	**Value For Money**
VFR	**Visual Flight Rules**
VHF	**Very High Frequency Range**
VIP	**Very Important Person**
VOR	**VHF Omni-directional Radio Range**
VRS	**Voice Recording System**
VSAT	**Very Small Aperture Terminal**

W

WB	**World Bank**
WBRL	**Wing Bar Light**
WC	**Working Capital**
WD	**Wind Direction**
WDPS	**Weather Data Processing System**
WDIL	**Wing Direction Indicator Light**
WECPNL	**Weighted Equivalent Continuous Perceived Noise Level**
WGS84	**World Geodetic System-84**
WHO	**World Health Organization**
WMO	**World Meteorological Organization**
WS	**Wind Speed**
WQMA	**Water Quality Management Areas**
WQMS	**Water Quality Management Section**
WRS	**Water Refill Station**
WWF	**World Wild Fund**
WWTP	**Wastewater Treatment Plant**

Chapter 1

Introduction

Table of Contents

Chapter 1. Introduction

1.1. Preface

Due to the archipelago geography, the Government of the Republic of the Philippines (GRP) has continued its effort to establish safe and capable nationwide aviation network to enhance nation's socio-economic activities (including e.g. for tourism industry). As such, both domestic and international air traffic volumes in the Philippines are fast increasing, i.e. more than 10 % particularly for the past 5 years.

The Central Philippines consist of 4 Regions (IV-b, and VI to VIII) spreading over 7 major islands, namely, Palawan, Panay, Negros, Cebu, Bohol, Leyte, and Samar. Those except Region IV-b (Palawan) are referred to as "Visayas" that comprise 6 islands, i.e. Panay, Negros, Cebu, Bohol, Leyte, and Samar.

In Visayas, the Government of Japan (GOJ) has continuously extended its financial assistance to enhance numerous airport and aviation projects, e.g. comprehensive airport developments at Cebu, Iloilo and Bacolod airports, new control towers at Kalibo and Caticlan airports, and other nationwide air navigation facilities modernization since 1980.

Lately, air traffic demand at Bohol airport has been dramatically increased (from 39 thousand in 2000, to 573 thousand in 2010), average annual growth rate of which is more than 30 %. This is partly because the runway at the existing Tagbilaran airport was extended in 2002, upon which jet aircraft (B737, A320) operations were commenced. Since then, the number of Filipino passenger increases because of attractive promo fair of LCC, safe and frequent 80-minutes air services compared with 30-hour ferry from Manila. Also, foreign visitors increases owing to abundant tourism resources and famous heritage.

In addition to the air passengers of 573 thousand, 3,593 thousand passengers availed ten (10) sea ports situated along shoreline of Bohol Province in 2010, the most numbers of which recorded are 1,673 thousand passengers at Tagbilaran port. Considering the fact that daily fifteen (15) round trips of speed boats are scheduled between Cebu and Tagbilaran Ports, considerable number of potentially-overflowed air passengers exists since Tagbilaran airport is operated only on daytime while sea ports are operated through the day and night. Among the total combined air and sea passengers of 4,165 thousand, 86 % are sea and 14 % are air passengers, or only 5 % are Foreigner and 95 % are Filipino (84 % are Bohol residents).

However, the existing airport facilities are obsolete, not in accordance with safety requirements, and the capacity almost saturated. Hence, GRP plans to construct a new Bohol Airport to meet international standard in Panglao Island, for which feasibility studies had been made twice in 2000 and 2007. In 2010, the New Aquino Administration defined the New Airport Construction Project being one of the priority infrastructure development projects to be implemented under Public Private Partnership (PPP).

Meanwhile, enhancement of tourism and other socio-economic activities in Bohol has accompanied by environmental problems being associated with lack of water supply capacity, or underwater pollution. Hence, infrastructure for water supply and sewerage capacities, enhancement of eco-tourism together with the protection of natural environment and biological mega-diversity therein are earmarked as urgent needs to be studied.

In 2009-2010 the Japan International Cooperation Agency (JICA) made a Preparatory Study for Central Philippines Comprehensive Infrastructure Development Project, and now focused as priority on the Bohol area.

In view of the above, JICA decided to dispatch its Study Team for the combined objectives mentioned-above, namely for “New Bohol Airport Construction and Sustainable Environment Protection Project”.

1.2. Outline of the Study

1.2.1. Objective of the Project

The Project has two objectives interrelated each other, as expressed in the title of the Study, namely “New Bohol Airport Construction and Sustainable Environmental Protection”, more specifically as follows:

1) To construct a new airport at Panglao Island to replace the existing Tagbilaran airport which is narrowly situated thereby giving danger to human life at densely-populated downtown, and to enhance aircraft operational safety and effective air transportation system to meet international standard; and

2) In anticipation of increase in the number of passengers as a result of new airport construction, to provide technical support to aim environmental protection in the Island, (specifically, in the improvement of sewerage system and sustainable environmental conservation in line with tourism development program).

1.2.2. Objective of the Study and Composition of Report

Objectives of this Study are as follows:

1) To review the previous feasibility studies and to analyse viable modalities of PPP Scheme for the development New Bohol Airport;

2) To prepare a project implementation program for the New Bohol Airport Construction in anticipation of the Special Terms for Economic Partnership (STEP) of Japanese ODA loan;

3) To program tourism development in line with sustainable environmental conservation;

4) To study the current water supply conditions at Panglao Island, and come up with the basic plan for the water supply system to the New Bohol Airport; and

5) To collect basic information in relation to sewerage system and/or applicability of individual sewage disposal system, so as to solve the untreated-water discharge problem

in the Island.

This report consists of the two volumes, namely, the Volume 1 incorporating summary of the entire Reports and studies for New Bohol Airport Construction; and the Volume 2 includes studies for tourism development, water supply and sewerage system.

1.2.3. Area of the Study

Areas of the Study are Manila, Bohol, and/or Central Philippines.

1.2.4. Executing Agencies

Executing Agencies are as follows:

Field	Main Office	Sub Offices
General	National Economic & Development Authority (NEDA) Department of Environment & Natural Resources (DENR)	
Airport	Department of Transportation & Communications (DOTC) Provincial Government of Bohol	Civil Aviation Authority of the Philippines Tagbilaran Airport Office
Tourism	Department of Tourism (DOT) Provincial Government of Bohol	Tourism Infrastructure & Enterprise Zone Authority (TIEZA)
Sewerage	Provincial Government of Bohol	Provincial Planning & Development Office City of Tagbilaran
Water Supply	Provincial Government of Bohol Bohol Water Utilities Inc.	Provincial Planning & Development Office City of Tagbilaran

1.3. Scope of the Study

The Study has been carried out based on the Flowchart shown in Figure 1.3-1.

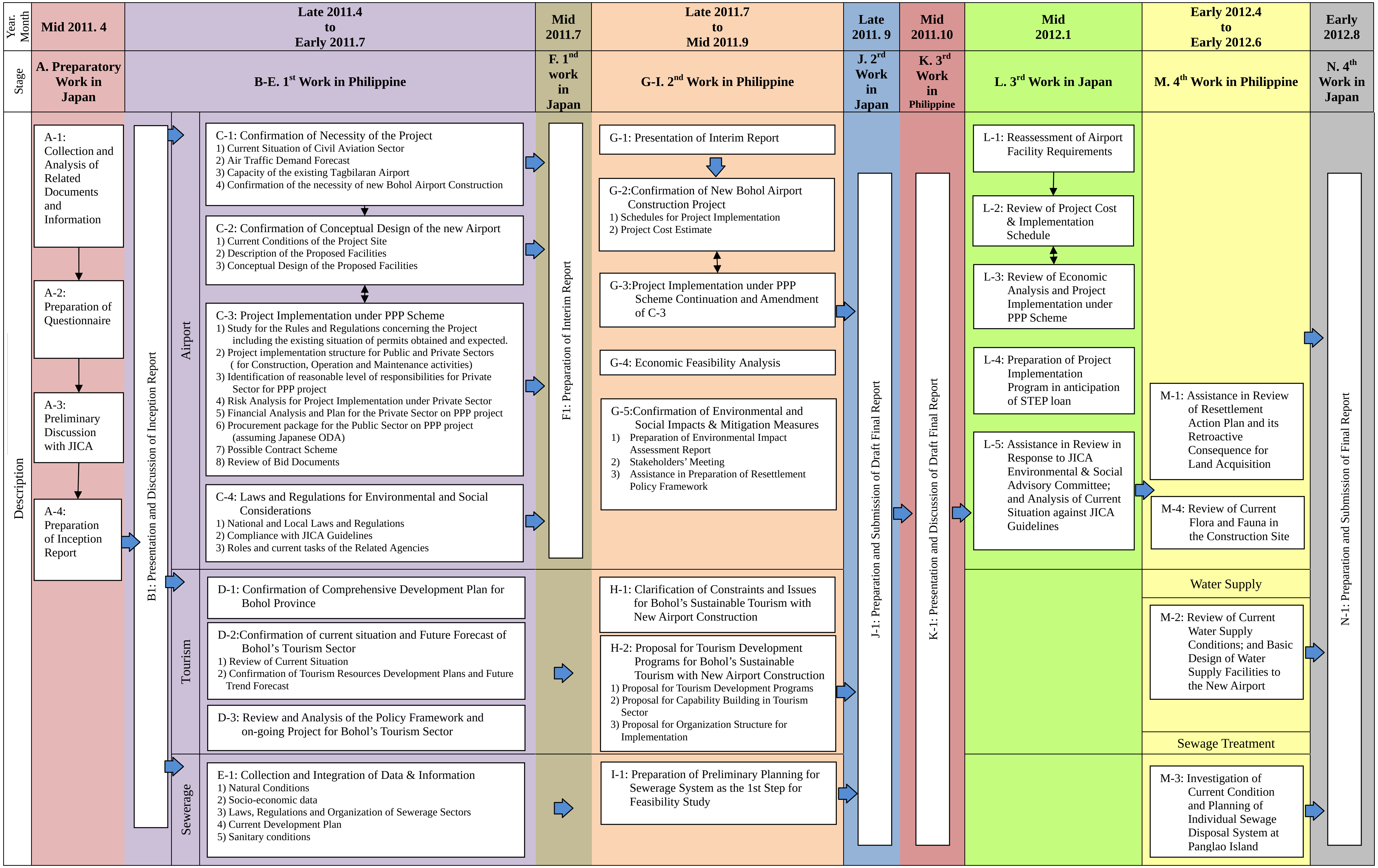


Figure 1.3-1 Flowchart of the Study

1.4. Schedule of the Study

The Study is being carried out in accordance with the schedule shown in Table 1.4-1.

Table 1.4-1 Schedule of the Study

Period / Description	Year 2011									Year 2012							
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
A Preparatory Work in Japan																	
A1 Collection and Analysis of Related Documents and Information																	
A2 Preparation of Questionnaire																	
A3 Preliminary Discussion with JICA																	
A4 Preparation of Inception Report																	
B-E 1st Work in Philippine																	
B1 Presentation and Discussion of Inception Report																	
C Airport																	
C1 Confirmation of Necessity of the Project																	
C2 Confirmation of Conceptual Design of the new Airport																	
C3 Possible Project Implementation in consideration of the PPP Scheme																	
C4 Laws and Regulations for Environmental and Social Considerations																	
D Tourism Development																	
D1 Confirmation of current situation of Tourism Sectors, and Future Development																	
D2 Confirmation of Comprehensive Development Plan for Bohol Province																	
E Sewage																	
E1 Collection and Integration of Data & Information																	
F 1st Work in Japan																	
F1 Preparation of Interim Report																	
G-I 2nd Work in Philippine																	
G Airport																	
G1 Presentation of Interim Report																	
G2 Confirmation of Panglao Airport Development Project																	
G3 Project Implementation under PPP Scheme																	
G4 Economic Feasibility Analysis																	
G5 Confirmation of Environmental and Social Impacts & Litigation Measures																	
H Tourism																	
H1 Confirmation of the Policy Framework and on-going Development for Sustainable Eco-tourism for Bohol Province																	
H2 Identification of Issues and Concerns on Sustainable Eco-tourism for Bohol Province																	
H3 Identification of Issues and Concerns on Sustainable Eco-tourism for Bohol Province																	
I Sewage																	
I1 Review of current development plan for Sewerage Systems																	
I2 Preparation of Preliminary Planning for Sewerage System as the 1st step for Feasibility Study																	
J 2nd Work in Japan																	
J1 Preparation and Submission of Draft Final Report																	
K 3rd Work in Philippine																	
K1 Presentation and Discussion of Draft Final Report																	
L 3rd Work in Japan																	
L1 Reassessment of airport facility requirements																	
L2 Review of Project Cost & Implementation Schedule																	
L3 Review of Economic Analysis and Project Implementation under PPP Scheme																	
L4 Preparation of Project Implementation Program in anticipation of STEP loan																	
L5 Assistance in review in response to JICA Environmental & Social Advisory Committee; and analysis of current situation against JICA Guidelines																	
M 4th Work in Philippine																	
M1 Assistance in review of Resettlement Action Plan and its retroactive consequence for land acquisition																	
M2 Review of current water supply conditions; and Basic Design of Water Supply Facilities to the New Airport																	
M3 Investigation of current condition and Planning of Individual Sewage Disposal System at Panglao Island																	
M4 Review of current Flora and Fauna in the construction site																	
N 4th Work in Japan																	
N1 Preparation and Submission of Final Report																	

Legend : Work in Philippines; Work in Japan; Presentation of Report; Submission of Report

1.5. Study Team

Organization of the Study Team is shown in Figure 1.5-1.

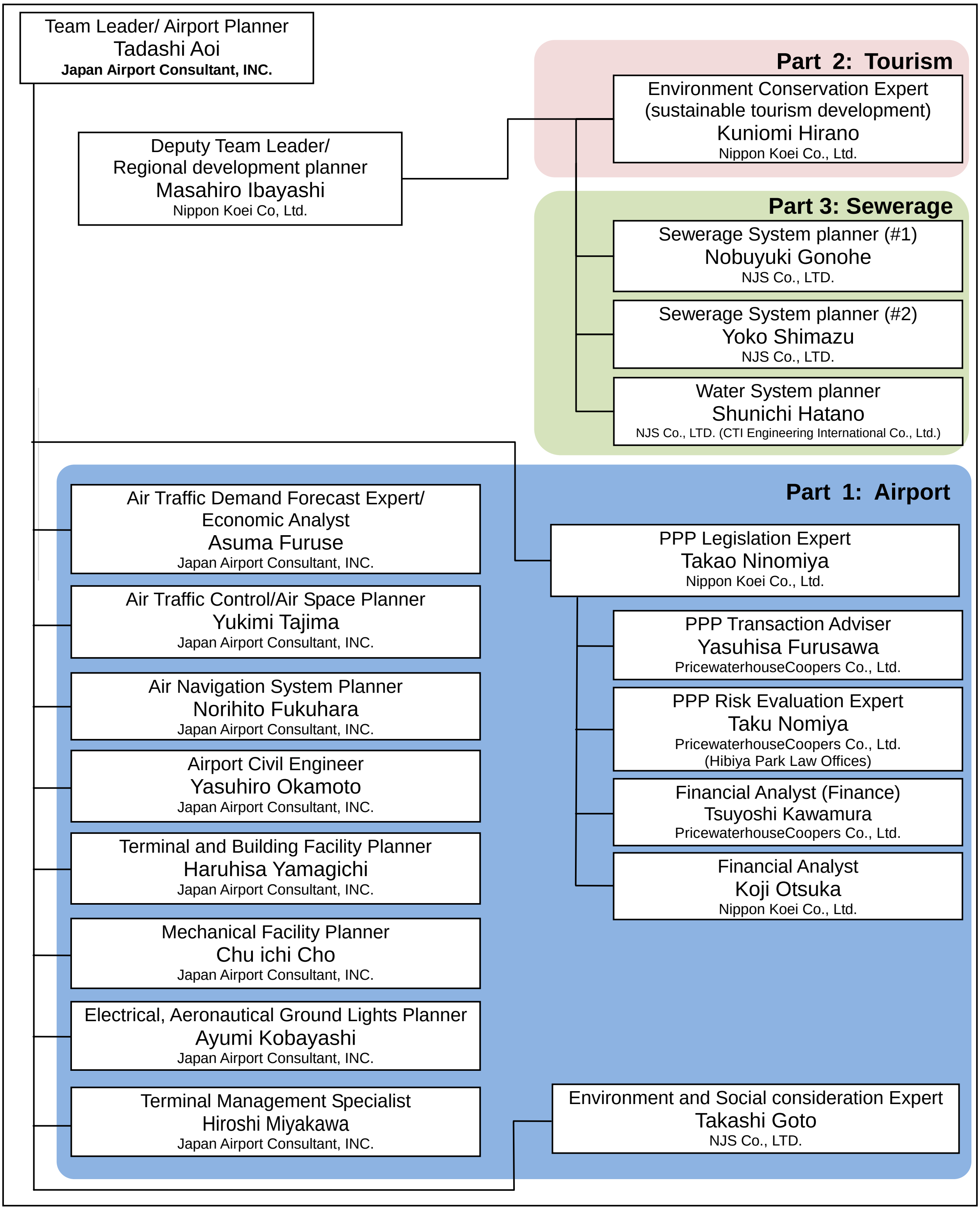


Figure 1.5-1 Study Team Organization

The Study Team is composed of twenty (20) experts as listed in Table 1.5-1.

Table 1.5-1 List of Members of the Study Team

	Assignment	Name	Firm
1	Team Leader/ Airport Planner	Tadashi Aoi	Japan Airport Consultants, INC.
2	Deputy Team Leader/ Regional Development Planner	Masahiro Ibayashi	Nippon Koei Co., Ltd.
3	Environment Conservation Expert (sustainable tourism development)	Kuniomi Hirano	Nippon Koei Co., Ltd.
4	Sewerage System planner (#1)	Nobuyuki Gonohe	NJS Co., LTD.
5	Sewerage System planner (#2)	Yoko Shimazu	NJS Co., LTD.
6	Air Traffic Demand Forecast Expert/ Economic Analyst	Azuma Furuse	Japan Airport Consultants, INC.
7	Air Traffic Control/Air Space Planner	Yokimi Tajima	Japan Airport Consultants, INC.
8	Air Navigation System Planner	Norihito Fukuhara	Japan Airport Consultants, INC.
9	Airport Civil Engineer	Yasuhiro Okamoto	Japan Airport Consultants, INC.
10	Terminal and Building Facility Planner	Haruhisa Yamaguchi	Japan Airport Consultants, INC.
11	Mechanical Facility Planner	Chu Ichi Cho	Japan Airport Consultants, INC.
12	Electrical, Aeronautical Ground Lights Planner	Ayumi Kobayashi	Japan Airport Consultants, INC.
13	Terminal Management Specialist	Hiroshi Miyakawa	Japan Airport Consultants, INC.
14	PPP Legislation System Expert	Takao Ninomiya	Nippon Koei Co., Ltd.
15	PPP Transaction Adviser	Yasuhisa Furusawa	PricewaterhouseCoopers Co., Ltd.
16	PPP Risk Evaluation Expert	Taku Nomiya	PricewaterhouseCoopers Co., Ltd. (Hibiya Park Law Offices)
17	Financial Analyst (Funding)	Tsuyoshi Kawamura	PricewaterhouseCoopers Co., Ltd.
18	Financial Analyst	Koji Otsuka	Nippon Koei Co., Ltd.
19	Environment and Social consideration Expert	Kenji Igarashi	NJS Co., LTD.
20	Water System Pnlanner	Shunichi Hatano	NJS Co., LTD. (CTI Engineering International Co.,Ltd.)

The entire team has been headed by Mr. Tadashi Aoi, the Team Leader/ Airport Planner who is primarily responsible for the Study in relation to the New Bohol Airport Construction, herein defined as Part 1: Airport.

Mr. Masahiro Ibayashi, the Deputy Team Leader/ Regional Development Planner has been responsible for the works in relation to the Sustainable Environment Protection, herein defined as Part 2: Tourism and Part 3: Sewerage.

1.6. Assignment Schedule

Assignment of individual members of the Study Team was made as shown in Table 1.6-1.

Table 1.6-1 Assignment Schedule

Assignment	Name	Company	Year 2011									Year 2012							
			4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
Team Leader / Airport Planner	Tadashi Aoi	JAC	24 (30)	21	06 (30)	07 24 (45)		06	09 15 (7)										
Deputy Team Leader / Regional Development Planner	Masahiro Ibayashi	NK	24 (7)	30	21 (14)	04	01 27 (27)		09 15 (7)										
Environment Conservation Expert (Sustainable Tourism Development)	Kuniomi Hirano	NK	24 (30)	23			04 (40)	12											
Sewerage System Planner (#1)	Nobuyuki Gonohe	NJS	24 (30)	23		24 (45)		06	09 15 (7)										
Sewerage System Planner (#2)	Yoko Shimazu	NJS				24 (45)		06							10	(60)	8		
Air Traffic Demand Forecast Expert / Economic Analyst	Azuma Furuse	JAC		01 30 (30)	10 24 (15)	24 (45)		06	09 15 (7)										
Air Traffic Control / Air Space Planner	Yokimi Tajima	JAC			05 25 (21)														
Air Navigation System Planner	Norihito Fukuhara	JAC		01 21 (21)															
Airport Civil Engineer	Yasuhiro Okamoto	JAC		01 21 (21)			08 (30)	06	09 15 (7)							10 (30)	8		
Terminal and Building Facility Planner	Haruhisa Yamaguchi	JAC			05 25 (21)		08 (30)	06											
Mechanical Facility Planner	Chu Ichi Cho	JAC			05 25 (21)		21 (15)	04											
Electrical, Aeronautical Ground Lights Planner	Ayumi Kobayashi	JAC			13 (21)	3	15 (21)	04											
Terminal Management Specialist	Hiroshi Miyakawa	JAC	26 (8)	03	05 21 (17)		01 (35)	04	09 15 (7)										
PPP Legislation System Expert	Takao Ninomiya	NK			05 (30)	04	01 (45)	14	09 15 (7)										
PPP Transaction Adviser	Yasuhisa Furusawa	PwC	24 (7)	30	05 17 (13)		14 30 (17)		09 15 (7)										
PPP Risk Evaluation Expert	Taku Nomiya	PwC (HPLO)			05 09 (5)		17 26 (10)												
Financial Analyst (Funding)	Tsuyoshi Kawamura	PwC			05 15 (11)		14 24 (11)												
Financial Analyst	Koji Otsuka	NK			05 13 (9)		14 (27)	10											
Environment and Social Consideration Expert	Takashi Goto	NJS		02 31 (30)			08 (30)	06	1	5 (5)					10 (30)	9 25	8 (15)		
Water System Pnlanner	Shunichi Hatano	NJS (CTI)		02 31 (30)			08 (30)	06							10	(60)	8		

Legend : ▬ Work in Philippines

JAC = Japan Airport Consultants, Inc.
NK = Nippon Koei Co.,Ltd.
NJS = NJS Co.,Ltd.
PwC = PricewaterhouseCoopers Co.,Ltd.
CTI = CTI Engineering International Co.,Ltd.
HPLO = Hibiya Park Law Offices

Chapter 2

Background of the Project

Table of Contents

Chapter 2. Background of the Project

2.1. Current socio-economic conditions

2.1.1. Population

The population of the Philippines in 2007 was 88.6 Million. Chronological change in the population since 1995 is shown in Table 2.1-1.

Table 2.1-1 Population and Annual Growth Rates by Region

Region/Province/City/Municipality	Population						Average Growth Rate (%)		
	1995		2000		2007		1995 - 2000	1995 - 2007	2000 - 2007
	population	share (%)	population	share (%)	population	share (%)			
Philippines	68,616,536	-	76,506,928	-	88,566,732	-	2.20	2.15	2.11
National Capital Region (NCR)	9,454,040	13.78	9,932,560	12.99	11,566,325	13.06	0.99	1.69	2.20
Cordillera Administrative Region	1,254,838	1.83	1,365,220	1.79	1,520,847	1.72	1.70	1.62	1.55
Region I - Ilocos Region	3,803,890	5.54	4,200,478	5.49	4,546,789	5.13	2.00	1.50	1.14
Region II - Cagayan Valley	2,536,035	3.70	2,813,159	3.68	3,051,487	3.45	2.10	1.55	1.17
Region III - Central Luzon	7,092,191	10.34	8,204,742	10.73	9,709,177	10.96	2.96	2.65	2.43
Region IV-A - CALABARZON	7,750,204	11.30	9,320,629	12.19	11,757,755	13.28	3.76	3.53	3.37
Region IV-B - MIMAROPA	2,033,271	2.96	2,299,229	3.01	2,559,791	2.89	2.49	1.94	1.55
Marinduque	199,910	0.29	217,392	0.28	229,636	0.26	1.69	1.16	0.79
Occidental Mindoro	339,605	0.49	380,250	0.50	421,952	0.48	2.29	1.83	1.50
Oriental Mindoro	608,616	0.89	681,818	0.89	735,769	0.83	2.30	1.59	1.09
Palawan (excluding Puerto Princesa City)	510,909	0.74	593,500	0.78	682,152	0.77	3.04	2.44	2.01
Puerto Princesa City	129,577	0.19	161,912	0.21	210,508	0.24	4.56	4.13	3.82
Romblon	244,654	0.36	264,357	0.35	279,774	0.32	1.56	1.12	0.81
Region V - Bicol Region	4,325,307	6.30	4,674,855	6.11	5,106,160	5.77	1.57	1.39	1.27
Region VI - Western Visayas	5,776,938	8.42	6,211,038	8.12	6,843,643	7.73	1.46	1.42	1.40
Aklan	410,539	0.60	451,314	0.59	495,122	0.56	1.91	1.57	1.33
Antique	431,713	0.63	472,822	0.62	515,265	0.58	1.84	1.49	1.24
Capiz	624,469	0.91	654,156	0.86	701,664	0.79	0.93	0.98	1.01
Guimaras	126,470	0.18	141,450	0.18	151,238	0.17	2.26	1.50	0.96
Iloilo (excluding Iloilo City)	1,415,022	2.06	1,559,182	2.04	1,691,878	1.91	1.96	1.50	1.17
Iloilo City	334,539	0.49	366,391	0.48	418,710	0.47	1.84	1.89	1.93
Negros Occidental (excluding Bacolod City)	2,031,841	2.96	2,136,647	2.79	2,370,269	2.68	1.01	1.29	1.49
Bacolod City	402,345	0.59	429,076	0.56	499,497	0.56	1.29	1.82	2.19
Region VII - Central Visayas	5,014,588	7.31	5,706,953	7.46	6,400,698	7.23	2.62	2.05	1.65
Bohol	994,440	1.45	1,139,130	1.49	1,230,110	1.39	2.75	1.79	1.10
Cebu (ex. Cebu City, Lapu-lapu City, Mandaue City)	1,890,357	2.76	2,160,569	2.83	2,440,120	2.76	2.71	2.15	1.75
Cebu City	662,299	0.97	718,821	0.94	799,762	0.90	1.65	1.58	1.54
Lapu-lapu City	173,744	0.25	217,019	0.28	292,530	0.33	4.55	4.44	4.36
Mandaue City	194,745	0.28	259,728	0.34	318,577	0.36	5.93	4.19	2.96
Negros Oriental	1,025,247	1.49	1,130,088	1.48	1,231,904	1.39	1.97	1.54	1.24
Siquijor	73,756	0.11	81,598	0.11	87,695	0.10	2.04	1.45	1.03
Region VIII - Eastern Visayas	3,366,917	4.91	3,610,355	4.72	3,915,140	4.42	1.41	1.27	1.16
Biliran	132,209	0.19	140,274	0.18	150,031	0.17	1.19	1.06	0.97
Eastern Samar	362,324	0.53	375,822	0.49	405,114	0.46	0.73	0.93	1.08
Leyte	1,511,251	2.20	1,592,336	2.08	1,724,240	1.95	1.05	1.10	1.14
Northern Samar	454,195	0.66	500,639	0.65	549,759	0.62	1.97	1.60	1.35
Samer (Western Samar)	589,373	0.86	641,124	0.84	695,149	0.78	1.70	1.39	1.16
Southern Leyte	317,565	0.46	360,160	0.47	390,847	0.44	2.55	1.75	1.17
Region IX - Zamboanga Peninsula	2,567,651	3.74	2,831,412	3.70	3,230,094	3.65	1.97	1.93	1.90
Region X - Northern Mindanao	3,197,059	4.66	3,505,708	4.58	3,952,437	4.46	1.86	1.78	1.73
Region XI - Davao Region	3,288,824	4.79	3,676,163	4.81	4,159,469	4.70	2.25	1.98	1.78
Region XII - SOCCSKSARGEN	2,846,966	4.15	3,222,169	4.21	3,830,500	4.33	2.51	2.50	2.50
Autonomous Region of Muslim Mindanao	2,362,300	3.44	2,803,045	3.67	4,120,795	4.65	3.48	4.75	5.66
CARAGA	1,942,687	2.83	2,095,367	2.74	2,293,346	2.59	1.52	1.39	1.30

Sources : 1995, 2000 and 2007 Census of Population (NSO : National Statistics Office)

The population of the Philippines in 1995 was 68.6 Million, and continuously increased to 88.6 Million in 2007 with an average annual growth of 2.15 %.

In 2007, the great majority of the population (53 % or 47.3 Million) resided in the Northern Philippines, i.e. Luzon Island consisting of the National Capital Region with its cordillera (GCR; 15 % or 13.1 Million), Region I (Ilocos; 5 % or 4.5 Million), Region II (Cagayan Valley; 3% or 3.1 Million), Region III (Central Luzon; 11% or 9.7 Million), Region IV-A (Calabarzon; 13% or 11.8 Million) and Region V (Bicol; 6% or 5.1 Million). The most increase in the population through 1995 to 2007 appeared in Calabarzon (average annual increase of 3.76%) and Central Luzon (2.96%).

The population in the Central Philippines in 2007 was 19.7 Million (22% of the total population), distributed to Region IV-B (Mimaropa; 3% or 2.6 Million), Region VI (Western Visayas; 8% or 6.8 Million), Region VII (Central Visayas; 7% or 6.4 Million), Region VIII (Eastern Visayas; 4% or 3.9 Million).

The rest of the population (24% or 21.6 Million) resides in the Southern Philippines, i.e. Mindanao Islands consisting of Regions IX to XII.

Of the population in the Region VII (Central Visayas; 6.4 Million), the great majority (3.8 Million) resides in Cebu, 1.2 Million in Negros Oriental, and 1.2 Million in Bohol Province. The population of Bohol represents 1.4% of the national population, 6.2% of the Central Philippines, or 19% of Region VII (Central Visayas).

2.1.2. GDP and GRDP

In current pricing, the GDP of the Philippines in 2007 was Pesos 7,678,917 million, and the GDP per Capita was Pesos 83,261.

In constant 1985 pricing, the GDP of the Philippines in 2007 was Pesos 1,432,115 million, and the GDP per Capita was Pesos 15,528.

The chronological changes in the GDP (Gross Domestic Product) and the GRDP (Gross Regional Domestic Product) in the respective regions are shown in Table 2.1-2.

Table 2.1-2 GDP and GRDP with Annual Growth Rate

(mil. Php)

Region	1995 GRDP	1995 share (%)	2000 GRDP	2000 share (%)	2009 GRDP	2009 share (%)	Average Growth Rate (%) 1995 - 2000	1995 - 2009	2000 - 2009
at Current Prices									
GDP in the Philippines	1,905,951	100	3,354,727	100	7,678,917	100	11.97	10.47	9.64
GRDP (Gross Regional Gross Product)									
National Capital Region (NCR)	623,939	32.74	1,179,471	35.16	2,813,802	36.64	13.58	11.36	10.14
Cordillera Administrative Region	38,453	2.02	79,541	2.37	149,450	1.95	15.65	10.18	7.26
Region I - Ilocos Region	58,810	3.09	103,376	3.08	215,073	2.80	11.94	9.70	8.48
Region II - Cagayan Valley	40,374	2.12	73,830	2.20	138,872	1.81	12.83	9.22	7.27
Region III - Central Luzon	159,939	8.39	263,944	7.87	576,550	7.51	10.54	9.59	9.07
Region IV - Southern Tagalog	273,578	14.35	469,477	13.99	-	-	11.41	-	-
Region IV-A - CALABARZON	-	-	-	-	802,837	10.46	-	-	-
Region IV-B - MIMAROPA	-	-	-	-	161,986	2.11	-	-	-
Region V - Bicol Region	55,885	2.93	86,430	2.58	213,099	2.78	9.11	10.03	10.55
Region VI - Western Visayas	132,112	6.93	218,779	6.52	543,140	7.07	10.61	10.63	10.63
Region VII - Central Visayas	121,438	6.37	236,043	7.04	518,329	6.75	14.22	10.92	9.13
Region VIII - Eastern Visayas	47,854	2.51	81,003	2.41	173,326	2.26	11.10	9.63	8.82
Region IX - Zamboanga Peninsula	52,904	2.78	78,196	2.33	186,433	2.43	8.13	9.41	10.14
Region X - Northern Mindanao	97,682	5.13	124,525	3.71	389,624	5.07	4.98	10.39	13.51
Region XI - Davao Region	129,205	6.78	195,198	5.82	367,903	4.79	8.60	7.76	7.30
Region XII - SOCCSKSARGEN	54,788	2.87	84,720	2.53	258,936	3.37	9.11	11.73	13.22
Autonomous Region of Muslim Mindanao	-	-	48,907	1.46	103,822	1.35	-	-	8.72
CARAGA	18,991	1.01	31,285	0.93	65,733	0.86	10.50	9.27	8.60
at constant 1985 prices									
GDP in the Philippines	802,224	100	972,961	100	1,432,115	100	3.93	4.23	4.39
GRDP (Gross Regional Gross Product)									
National Capital Region (NCR)	242,167	30.19	297,065	30.53	465,689	32.52	4.17	4.78	5.12
Cordillera Administrative Region	16,075	2.00	24,730	2.54	31,547	2.20	9.00	4.93	2.74
Region I - Ilocos Region	24,225	3.02	29,737	3.06	40,737	2.84	4.19	3.78	3.56
Region II - Cagayan Valley	16,142	2.01	22,619	2.32	28,157	1.97	6.98	4.05	2.46
Region III - Central Luzon	78,487	9.78	87,227	8.97	115,948	8.10	2.13	2.83	3.21
Region IV - Southern Tagalog	125,248	15.61	148,608	15.27	(204,678)	(14.29)	3.48	(3.57)	(3.62)
Region IV-A - CALABARZON	-	-	-	-	165,572	11.56	-	-	-
Region IV-B - MIMAROPA	-	-	-	-	39,106	2.73	-	-	-
Region V - Bicol Region	23,517	2.93	27,117	2.79	42,878	2.99	2.89	4.38	5.22
Region VI - Western Visayas	57,597	7.18	68,461	7.04	109,252	7.63	3.52	4.68	5.33
Region VII - Central Visayas	52,327	6.52	68,715	7.06	102,053	7.13	5.60	4.89	4.49
Region VIII - Eastern Visayas	18,969	2.36	22,746	2.34	30,482	2.13	3.70	3.45	3.31
Region IX - Zamboanga Peninsula	21,813	2.72	27,064	2.78	38,197	2.67	4.41	4.08	3.90
Region X - Northern Mindanao	41,866	5.22	37,481	3.85	73,207	5.11	-2.19	4.07	7.72
Region XI - Davao Region	53,501	6.67	61,864	6.36	67,367	4.70	2.95	1.66	0.95
Region XII - SOCCSKSARGEN	22,174	2.76	25,762	2.65	50,556	3.53	3.05	6.06	7.78
Autonomous Region of Muslim Mindanao	-	-	14,566	1.50	18,958	1.32	-	-	2.97
CARAGA	8,116	1.01	9,200	0.95	12,409	0.87	2.54	3.08	3.38

Sources : NSCB

This Table indicates that the GDP at constant 1985 pricing in the Philippines has steadily increased since late 1990's, with an average annual growth rate from 2000 to 2009 of 4.39%., and the GRDP at the Central Visayas has increased with a growth rate of 4.49%

Also, changes in the GDP and GRDP per Capita in the respective regions are shown in Table 2.1-3.

Table 2.1-3 GDP and GRDP Per Capita with Annual Growth Rate

(Php)

Region	1995 GRDP	1995 share (%)	2000 GRDP	2000 share (%)	2009 GRDP	2009 share (%)	Average Growth Rate (%) 1995 - 2000	1995 - 2009	2000 - 2009
at Current Prices									
GDP per Capita in the Philippines	27,124	100.0	43,685	100.0	83,261	100.0	10.00	8.34	7.43
GRDP per Capita									
National Capital Region (NCR)	68,429	252.3	118,259	270.7	246,753	296.4	11.56	9.59	8.52
Cordillera Administrative Region	28,912	106.6	58,069	132.9	90,041	108.1	14.97	8.45	4.99
Region I - Ilocos Region	14,589	53.8	24,532	56.2	42,395	50.9	10.95	7.92	6.27
Region II - Cagayan Valley	14,882	54.9	26,153	59.9	41,992	50.4	11.94	7.69	5.40
Region III - Central Luzon	22,316	82.3	32,711	74.9	57,862	69.5	7.95	7.04	6.54
Region IV - Southern Tagalog	28,210	104.0	39,556	90.5	()	0.0	6.99	-	-
Region IV-A - CALABARZON	-	-	-	-	68,895	82.7	-	-	-
Region IV-B - MIMAROPA	-	-	-	-	55,071	66.1	-	-	-
Region V - Bicol Region	12,447	45.9	18,426	42.2	38,022	45.7	8.16	8.30	8.38
Region VI - Western Visayas	21,464	79.1	35,140	80.4	73,077	87.8	10.36	9.15	8.48
Region VII - Central Visayas	23,008	84.8	41,238	94.4	75,220	90.3	12.38	8.83	6.91
Region VIII - Eastern Visayas	13,568	50.0	22,365	51.2	39,764	47.8	10.51	7.98	6.60
Region IX - Zamboanga Peninsula	18,306	67.5	25,190	57.7	54,532	65.5	6.59	8.11	8.96
Region X - Northern Mindanao	23,761	87.6	45,134	103.3	91,453	109.8	13.69	10.11	8.16
Region XI - Davao Region	24,508	90.4	37,438	85.7	85,720	103.0	8.84	9.36	9.64
Region XII - SOCCSKSARGEN	22,943	84.6	32,460	74.3	64,867	77.9	7.19	7.71	8.00
Autonomous Region of Muslim Mindanao	-	-	23,264	53.3	41,506	49.8	-	-	6.64
CARAGA	9,047	33.4	12,906	29.5	18,924	22.7	7.36	5.41	4.34
at constant 1985 prices									
GDP per Capita in the Philippines	11,417	100.0	12,670	100.0	15,528	100.0	2.10	2.22	2.29
GRDP per Capita									
National Capital Region (NCR)	26,559	232.6	29,785	235.1	40,838	263.0	2.32	3.12	3.57
Cordillera Administrative Region	12,087	105.9	18,054	142.5	19,007	122.4	8.36	3.29	0.57
Region I - Ilocos Region	6,010	52.6	7,057	55.7	8,030	51.7	3.26	2.09	1.45
Region II - Cagayan Valley	5,950	52.1	8,013	63.2	8,514	54.8	6.13	2.59	0.68
Region III - Central Luzon	10,951	95.9	10,810	85.3	11,636	74.9	-0.26	0.43	0.82
Region IV - Southern Tagalog	12,915	113.1	12,521	98.8	(14,024)	(90.3)	-0.62	(0.59)	(1.27)
Region IV-A - CALABARZON	-	-	-	-	14,209	91.5	-	-	-
Region IV-B - MIMAROPA	-	-	-	-	13,295	85.6	-	-	-
Region V - Bicol Region	5,238	45.9	5,781	45.6	7,650	49.3	1.99	2.74	3.16
Region VI - Western Visayas	9,358	82.0	10,996	86.8	14,699	94.7	3.28	3.28	3.28
Region VII - Central Visayas	9,914	86.8	12,005	94.8	14,810	95.4	3.90	2.91	2.36
Region VIII - Eastern Visayas	5,378	47.1	6,280	49.6	6,993	45.0	3.15	1.89	1.20
Region IX - Zamboanga Peninsula	7,548	66.1	8,718	68.8	11,173	71.9	2.92	2.84	2.79
Region X - Northern Mindanao	10,184	89.2	13,585	107.2	17,183	110.7	5.93	3.81	2.65
Region XI - Davao Region	10,148	88.9	11,865	93.6	15,696	101.1	3.18	3.16	3.16
Region XII - SOCCSKSARGEN	9,285	81.3	9,871	77.9	12,665	81.6	1.23	2.24	2.81
Autonomous Region of Muslim Mindanao	-	-	6,929	54.7	7,579	48.8	-	-	1.00
CARAGA	3,866	33.9	3,795	30.0	3,572	23.0	-0.37	-0.56	-0.67

Sources : NSCB

The Table indicates that the GDP per Capita at constant 1985 pricing in the Philippines has correspondingly increased, with an average annual growth rate from 2000 to 2009 of 2.29%, and the GRDP of the Central Visayas region has increased at a growth rate of 2.36%.

Either the GRDP (Php 102 billion) or GRDP per capita (Php 14,810) of the Central Visayas in 2009 ranks the 5th in the Philippines.

The share of the service sector in Central Visayas is 60.86% of its GRDP which is larger than the share in the whole of the Philippines. It shows that tourism is the major industry in Central Visayas. Recent increase of visitors to the Central Visayas and Bohol are due to the industrial conditions of the region.

Table 2.1-4 GDPR by Industrial Origin (2007)

(in 2007 at current prices)

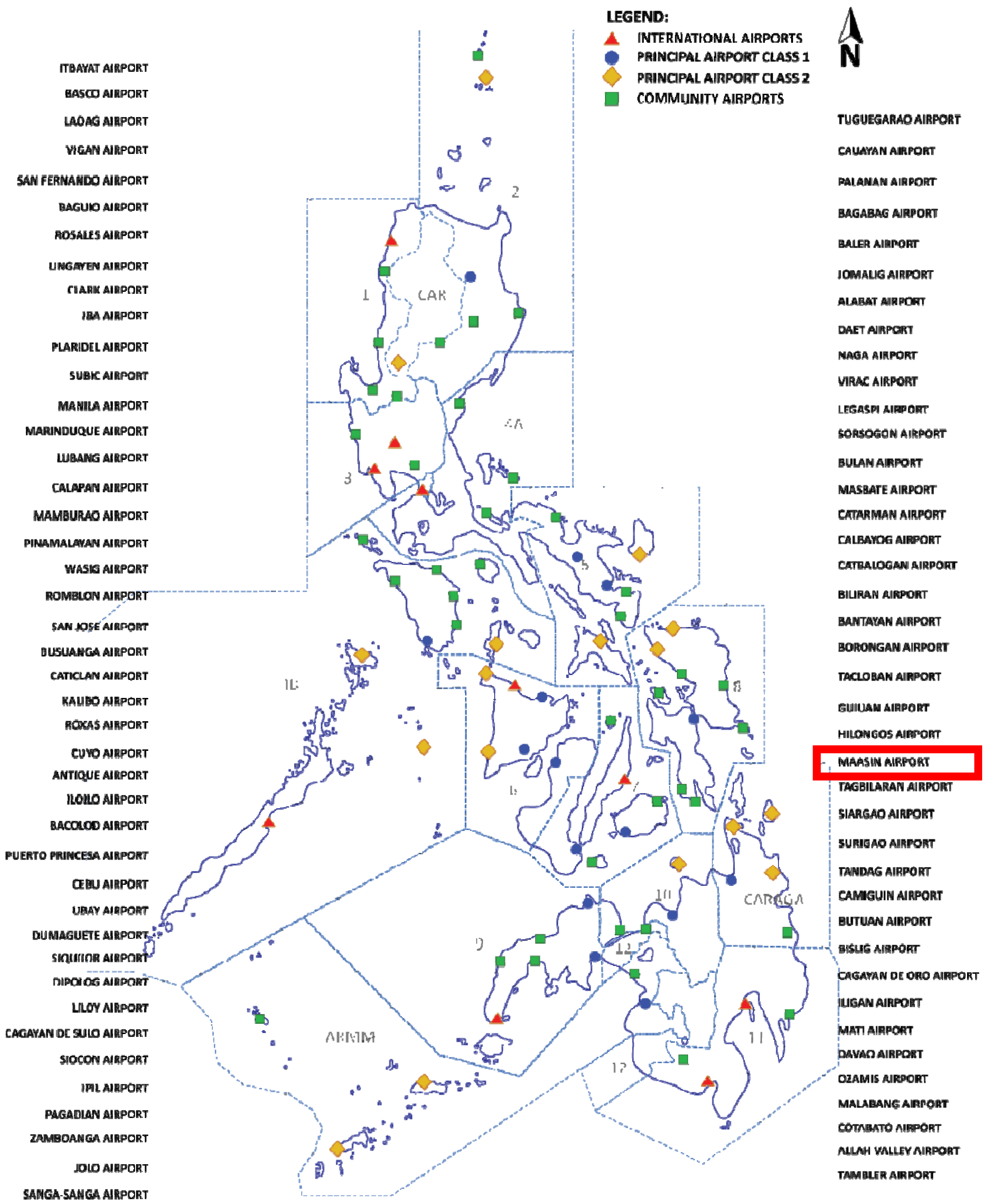
Industry	(a) Philippines		(b) Region VII		Share of
	GDP (bil. Php)	share (%)	GRDP (bil. Php)	share (%)	Region-VII [(b)/(a)]
AGRICULTURE SECTOR	944	14.20	36	7.86	3.85%
INDUSTRY SECTOR	2,099	31.57	144	31.28	6.88%
Mining and Quarrying	108	1.63	2	0.37	1.57%
Manufacturing	1,459	21.95	99	21.51	6.81%
Construction	300	4.52	28	6.13	9.42%
Electricity, Gas and Water	231	3.47	15	3.27	6.54%
SERVICE SECTOR	3,606	54.24	281	60.86	7.79%
TOTAL	6,649	100.00	462	100.00	6.94%

Source: NSCB

2.2. Current Situation of Civil Aviation Sector

2.2.1. Air transportation in the Philippines

Locations of all the airports in the Philippines are shown in Fig, 2.2-1.



Note
10 International Airport: accommodating scheduled international flights, with CIQ facilities
15 Principal Airport Class 1: accommodateing scheduled domestic flights of jet aircraft
17 Principal Airport Class 2: accommodating scheduled domestic flights by turbo-prop aircraft
41 Community Airport: to accommodate commuter and/or general aviation flights

Source: CAAP

Figure 2.2-1 Location of Airports in the entire Philippines

In the Philippines, there are a total of 83 airports, in which 10 airports are designated as international airports, 15 as principal airports class 1, 17 as class 2, and 41 as community airports.

Table 2.2-1 shows chronological change in the nationwide air traffic volumes in the Philippines.

Table 2.2-1 Nationwide Air traffic record in the Philippines

Year	Total Passenger Movement	Total Cargo Movement (in Kgs.)	Total Aircraft Movement
1992	13,768,005	381,138,752	412,460
1993	15,090,872	415,638,687	370,833
1994	16,468,004	428,203,923	407,986
1995	17,730,347	488,366,467	446,755
1996	19,864,800	526,277,040	495,273
1997	22,756,438	680,670,144	528,612
1998	19,444,029	502,131,976	365,816
1998	19,444,029	502,131,976	365,816
1999	20,279,201	510,628,738	468,756
2000	20,592,932	553,168,592	472,140
2001	19,329,924	505,665,011	357,689
2002	20,606,090	549,720,662	409,308
2003	20,232,889	526,869,575	372,666
2004	23,634,313	590,505,446	358,725
2005	24,675,383	590,989,124	329,336
2006	26,684,128	531,180,991	286,181
2007	34,209,248	642,542,728	607,837
2008	36,044,167	534,377,275	562,818
2009	39,139,222	480,636,808	591,540
2010	41,872,041	561,614,178	612,826

Source: Civil Aviation Authority of the Philippines (CAAP)

This Table shows that the number of air passengers and aircraft movements in the entire Philippines keeps increasing. For the past decade, the number of air passengers increased from 20.6 million (in 2000) to 41.9 million (in 2010) with an average annual growth of 7.4 % and aircraft movements increased from 472 thousand (in 2000) to 613 thousand (in 2010) with an average annual growth of 2.6 %.

Air cargo volumes for the past decade remained fairly constant and stayed between 500 thousand to 650 thousand tons.

In the past, although the number of air passengers dropped upon certain historical events, e.g. the Asian financial crisis in 1997-1998, the September 11 attacks in 2001, the SARS epidemics in 2003, however each time the air traffic volume caught up and ended back in the positive growth trend.

Lately, Low Cost Carriers (LCC's), or so called budget airlines, have quickly established their successful business models, which greatly contributed to the dramatic increase in air passengers' traffic for the past 5 years, i.e. from 24.7 million (in 2005) to 41.9 million (in 2010).

The nation's premier airport is Ninoy Aquino International Airport (NAIA), where some 90% of all the international air traffic demand and half of the domestic air traffic demand of the Philippines is handled. At present, thirty-one (31) foreign airlines and five (5) domestic airlines are in service at NAIA .

Table 2.2-2 shows the air traffic records at NAIA for the past 16 years. In 2010, NAIA handled approximately 27.1 million passengers, consisting of 12.4 million international passengers and 14.8 million domestic passengers and total cargo volumes of 424 thousand tons consisting of 306 thousand tons for international and 117 thousand tons for domestic cargo.

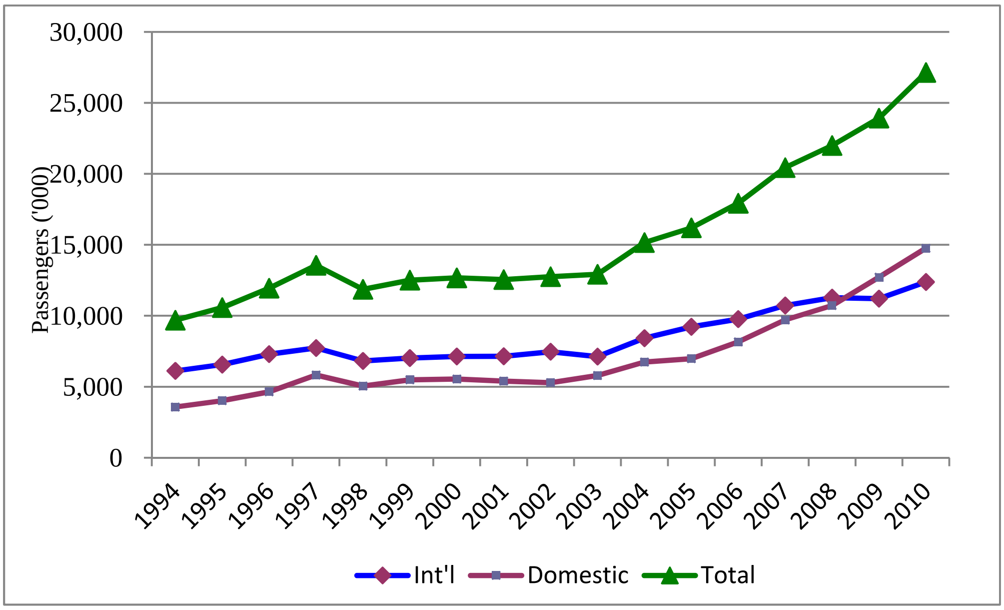
Table 2.2-2 Statistics of Air Passengers and Cargo at NAIA

Year	Passengers ('000)			Cargo (tons)		
	Int'l	Domestic	Total	Int'l	Domestic	Total
1994	6,116	3,569	9,685	221,461	60,097	281,559
1995	6,560	4,015	10,575	274,838	70,057	344,895
1996	7,297	4,641	11,938	293,323	92,225	385,548
1997	7,726	5,827	13,553	395,283	93,058	488,341
1998	6,814	5,050	11,863	291,246	75,175	366,421
1999	7,019	5,491	12,509	290,684	74,218	364,902
2000	7,130	5,538	12,668	286,973	112,476	399,449
2001	7,144	5,401	12,545	235,908	120,839	356,747
2002	7,466	5,282	12,749	265,902	116,298	382,200
2003	7,126	5,791	12,917	255,249	116,924	372,173
2004	8,416	6,741	15,157	299,243	122,245	421,488
2005	9,222	6,972	16,194	296,090	116,077	412,167
2006	9,767	8,159	17,926	300,427	109,817	410,244
2007	10,724	9,707	20,431	294,634	93,917	388,551
2008	11,273	10,720	21,994	262,297	89,651	351,948
2009	11,203	12,717	23,920	252,214	97,029	349,243
2010	12,381	14,755	27,136	306,361	117,467	423,828
AAGR 1994-2010	4.5%	9.3%	6.7%	2.0%	4.3%	2.6%

Source: JICA Study Team

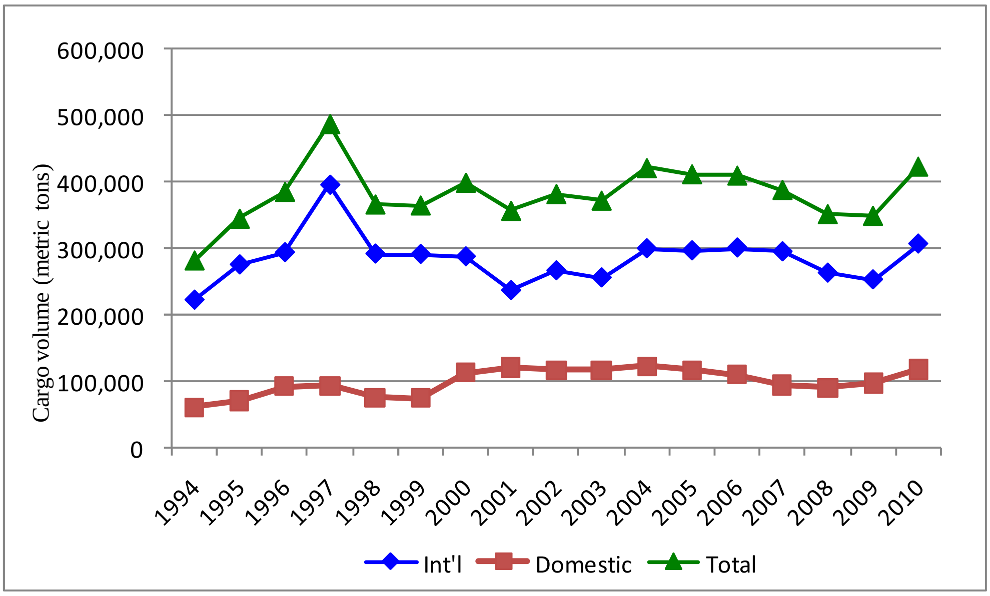
The above table particularly shows that the number of domestic passengers at NAIA more than doubled during the past 5 years, i.e. from 7 million in 2005 to 14.8 million in 2010. This trend is attributed to the recent emerging business model of the LCC's.

Chronological changes in the air passengers and cargo at NAIA for the past 16 years are graphed in Figures 2.2-2 and 3.



Source: JICA Study Team

Figure 2.2-2 Chronological Change in Air Passengers' Traffic at NAIA



Source: JICA Study Team

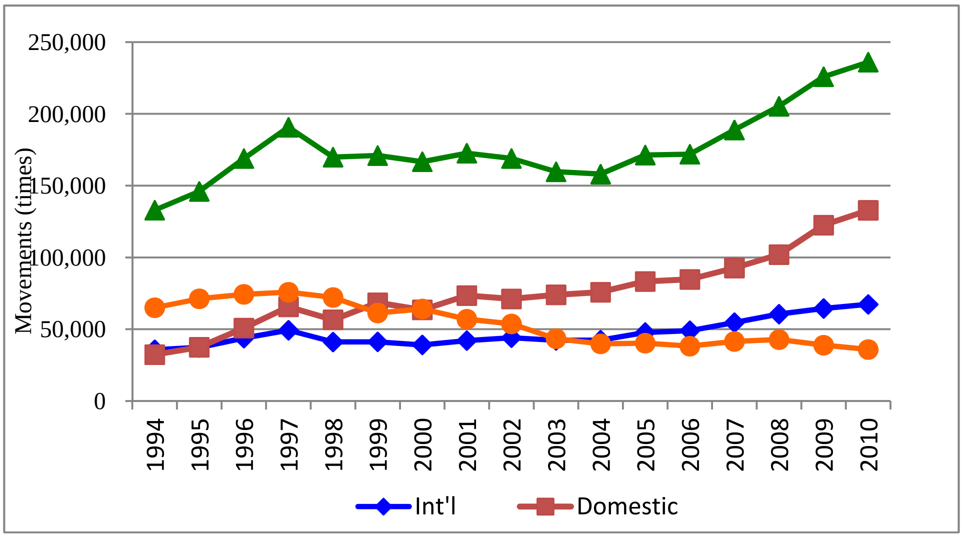
Figure 2.2-3 Chronological Change in Air Cargo Traffic at NAIA

Table 2.2-3 Statistics of Aircraft Movements at NAIA

Year	Aircraft Movements (times)			
	Int'l	Domestic	GA	Total
1994	35,702	32,267	65,002	132,971
1995	37,311	37,444	71,239	145,994
1996	43,805	50,787	74,314	168,906
1997	49,301	65,593	75,778	190,672
1998	41,138	56,598	72,135	169,871
1999	41,207	68,453	61,336	170,996
2000	39,083	63,485	64,126	166,694
2001	42,099	73,473	57,019	172,591
2002	44,112	71,111	53,729	168,952
2003	42,300	73,952	43,456	159,708
2004	42,385	75,786	39,854	158,025
2005	47,746	83,273	40,312	171,331
2006	48,980	84,698	38,235	171,913
2007	54,643	92,648	41,506	188,797
2008	60,525	101,968	42,794	205,287
2009	64,461	122,505	38,897	225,863
2010	67,321	132,786	35,887	235,994
AAGR 1994-2010	4.0%	9.2%	-3.6%	3.7%

Source: MIAA

Chronological change in the aircraft movements at NAIA for the last 16 years are graphed in Figure 2.2-4.



Source: JICA Study Team

Figure 2.2-4 Chronological Change in Aircraft Movements at NAIA

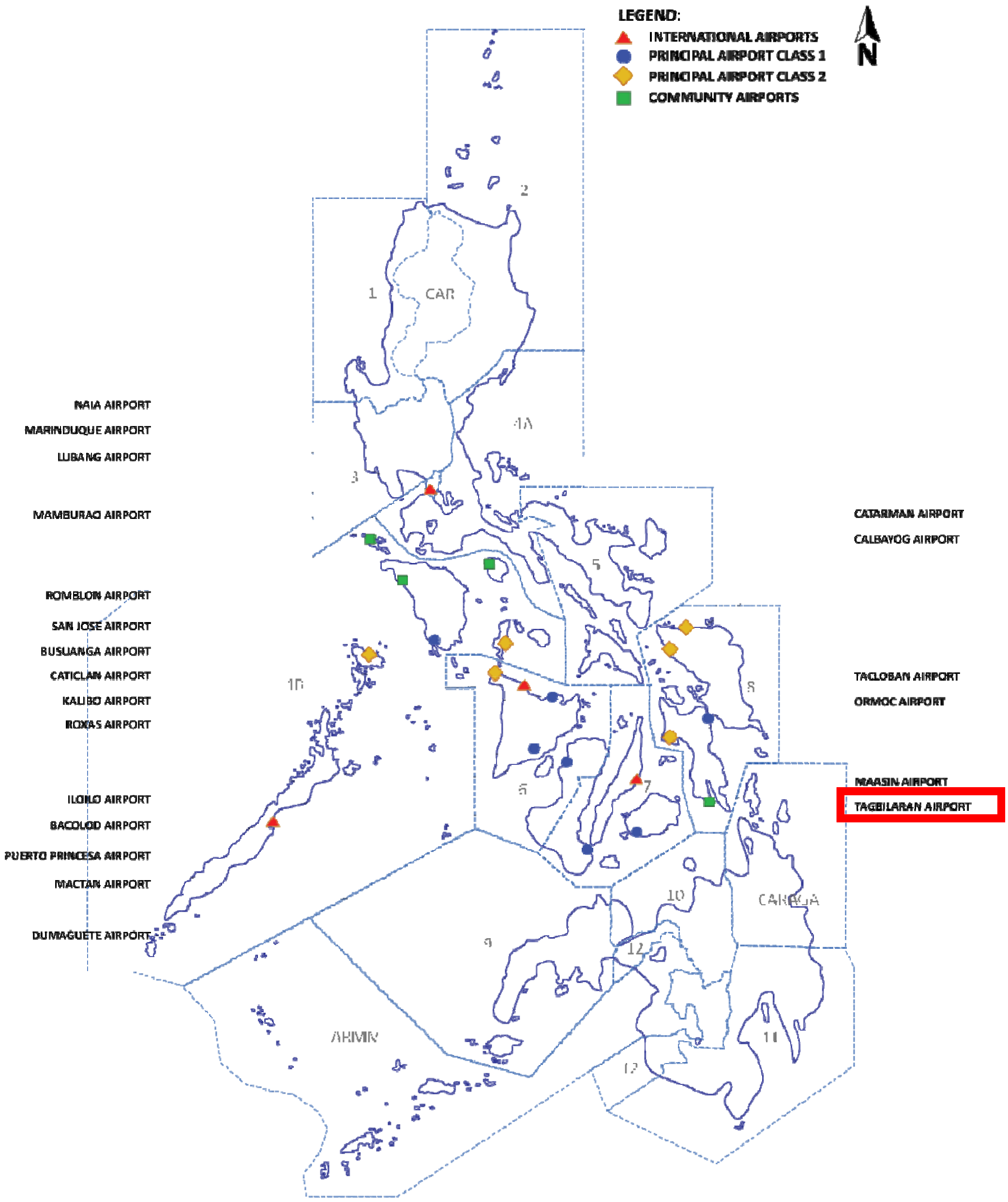
Table 2.2-4 shows the annual aircraft movements at NAIA for the past 16 years. Aircraft movements at NAIA have rapidly increased during the past decade. In 2010, NAIA handled approximately 67 thousand international, 133 thousand domestic, and 36 thousand aircraft movements for general aviation.

The above total annual aircraft movements at NAIA of 236 thousand (i.e. nearly 700 operations a day, or 65 operations in a peak hour) have most probably reached the maximum runway capacity at NAIA.

2.2.2. Air transportation in the Central Philippines

In the Central Philippines, there are a total of 20 airports, in which 3 airports are designated as international airport (Mactan, Puerto Princesa, and Kalibo), 7 as principal airports class 1, 6 as class 2, and 4 airports are designated as community airports.

Locations of these 20 airports are shown in Fig 2.2-5.



Source: CAAP

Figure 2.2-5 Location of Airports in the Central Philippines

Among these 20 airports in the Central Philippines, 13 airports are located in “Visayas”, namely, 2 international airports (Mactan, Kalibo), 6 principal airports class 1 (Iloilo, Bacolod, Tacloban, Tagbilaran, Dumaguete, Roxas), 4 class 2 airports (Caticlan and others), and 1 community airport.

1) Air Traffic in the Central Philippines

Due to the archipelago geography, together with the recent steady growth in the tourism industries, domestic air traffic in the Central Philippines, keeps increasing.

Table 2.2-4 shows the past domestic traffic record (2001 to 2010) for aircraft movements and air passengers at 10 major airports in the Central Philippines.

Table 2.2-4 Domestic Air Traffic Record at major 10 Airports in the Central Philippines

Region	IVb	VI					VII			VIII	Total
Island	Palawan	Panay				Negros		Cebu	Bohol	Leyte	
Airport	Puerto Princesa	Caticlan	Kalibo	Roxas	Iloilo	Bacolod	Dumaguete	Mactan	Tagbilaran	Tacloban	
Runway	2650 m	834 m	2187 m	1890 m	2500 m	2000 m	1845 m	3300 m	1779 m	2138 m	
Population	892,660	495,122	515,265	701,664	2,261,826	2,869,766	1,231,904	3,850,989	1,230,110	724,240	
Aircraft	A330	DH3	A320	A320	A320	A320	A320	A330	A320	A320	
Anual Domestic Aircraft Movements											
2001	2,695	7,512	5,264	1,440	13,425	8,032	2,184	24,047	1,154	6,448	72,201
2002	2,000	11,124	5,796	1,440	17,864	7,052	2,164	26,005	2,134	6,708	82,287
2003	2,792	11,426	2,858	1,438	17,412	6,680	2,540	24,541	1,920	6,367	77,974
2004	3,170	14,242	5,938	1,460	17,736	6,904	2,162	23,892	1,816	6,500	83,820
2005	3,232	19,172	2,822	1,182	8,224	6,114	1,922	24,219	2,262	4,046	73,195
2006	2,914	18,880	3,398	1,230	8,232	6,188	1,898	23,977	2,194	4,432	73,343
2007	3,352	18,662	4,307	1,142	9,070	7,782	2,690	25,895	2,810	4,186	79,896
2008	4,012	23,362	3,486	1,288	9,366	8,510	2,714	25,113	3,300	5,032	86,183
2009	6,292	19,875	3,888	1,822	12,136	9,676	2,630	37,311	4,478	8,912	107,020
2010	5,882	24,516	7,774	1,558	16,034	15,780	3,048	38,397	4,664	7,616	125,269
increase for 2005-2010	182%	128%	275%	132%	195%	258%	159%	159%	206%	188%	171%
Annual Domestic Passengers											Total
2001	188,713	162,786	236,968	86,915	696,587	534,832	137,334	1,860,461	39,268	297,878	4,241,742
2002	147,000	196,315	274,560	81,804	676,015	512,240	134,877	1,733,273	76,314	302,281	4,134,679
2003	194,176	234,911	229,068	84,552	681,360	522,395	152,316	1,850,453	104,934	308,454	4,362,619
2004	267,507	392,484	267,172	100,550	739,494	572,666	173,496	1,947,057	159,073	345,668	4,965,167
2005	284,042	519,349	239,851	102,183	708,469	562,062	162,915	2,263,777	196,707	327,912	5,367,267
2006	306,607	516,631	341,097	119,944	863,018	663,882	188,465	2,467,517	240,176	398,909	6,106,246
2007	388,083	545,015	511,051	133,418	1,001,273	782,573	275,991	2,985,695	344,068	510,683	7,477,850
2008	477,293	793,478	381,436	153,488	1,073,788	840,711	306,182	2,940,830	398,661	626,856	7,992,723
2009	584,232	797,312	500,713	188,237	1,324,148	1,044,623	360,360	3,835,163	561,774	892,856	10,089,418
2010	822,358	672,919	754,372	203,840	1,581,304	1,218,213	362,551	4,206,651	572,476	1,148,728	11,543,412
increase for 2005-2010	290%	130%	315%	199%	223%	217%	223%	186%	291%	350%	215%
average Pax onboard	140	27	97	131	99	77	119	110	123	151	92

Source: JICA Study Team

The above table reveals the extraordinary growth of domestic air traffic in the Central Philippines. Particularly for the past 5 years, the total volume of domestic passengers at these 10 airports has drastically increased from 5.4 million in 2005 to 11.5 million in 2010. Consequently, the total number of domestic aircraft movements in the Central Philippines has increased from 73 thousand in 2005 to 125 thousand in 2010.

This table also shows that the number of domestic passengers at most of those major airports increased 200% to 350% for the past 5 years, except Caticlan where only turbo-prop operations are allowed by fully availing to the short runway of only 834 m.

It is remarkable to note that at Tacloban Airport the annual passengers increased dramatically by 350 % for the past 5 years. In 2010, 1.15 million passengers were transported on 7,616 flights i.e. on a yearly average a total of 151 passengers onboard each flight. Considering the fact that the present aircraft in service is 100% SJ (A320/A319), it means that all flights would have been 100 % loaded.

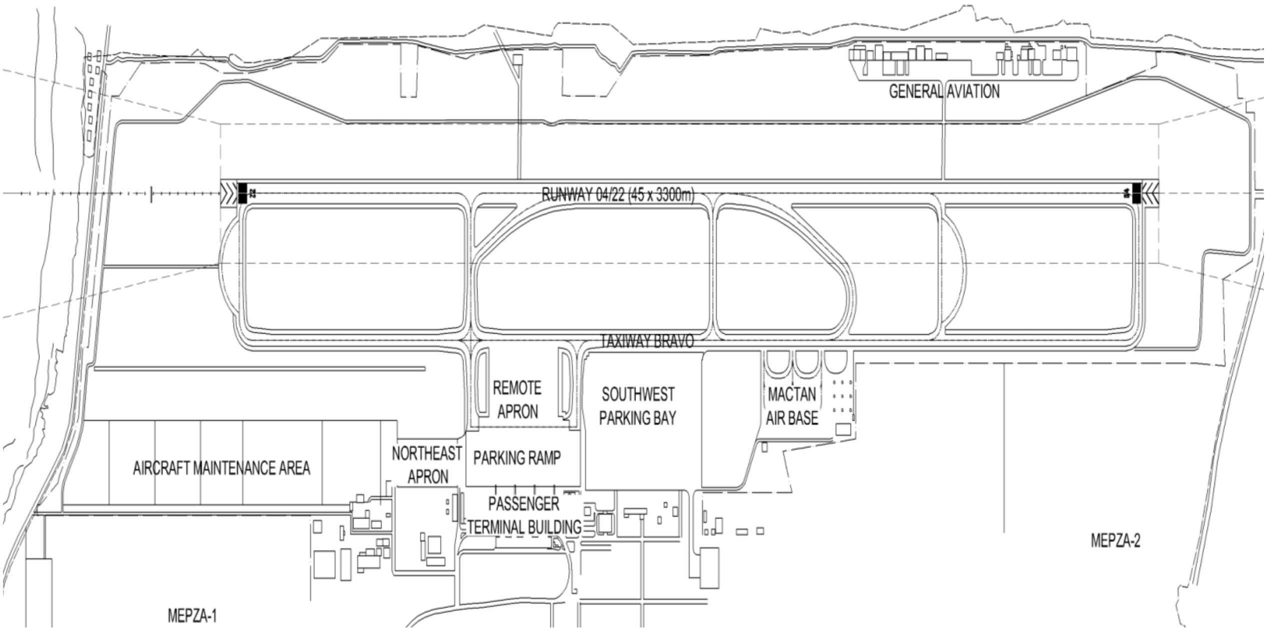
Similarly, at Tagbilaran Airport, the annual passengers grew by 290% during the past 5years, and yearly a total of 572 thousand passengers were transported via 4,664 movements of A320/A319's, thus on a yearly average a total 123 passengers are onboard each flight, an occupancy of nearly 80%.

2) Particulars of Major Airports in the Central Philippines

a) Mactan International Airport

1. Airport layout

The Mactan International Airport located in Lapu-Lapu City, is owned and operated by Mactan-Cebu International Airport Authority (MCIAA). The Airport has a 3,300-m long runway, full parallel taxiway, separate international and domestic passenger terminal buildings, cargo terminal buildings, control tower, power house, sewage treatment plant, fuel farm, general aviation facilities, rescue and fire station, apron (10 aircraft parking stands) and air navigation facilities (ILS- Cat-1).



Source: JICA Study Team

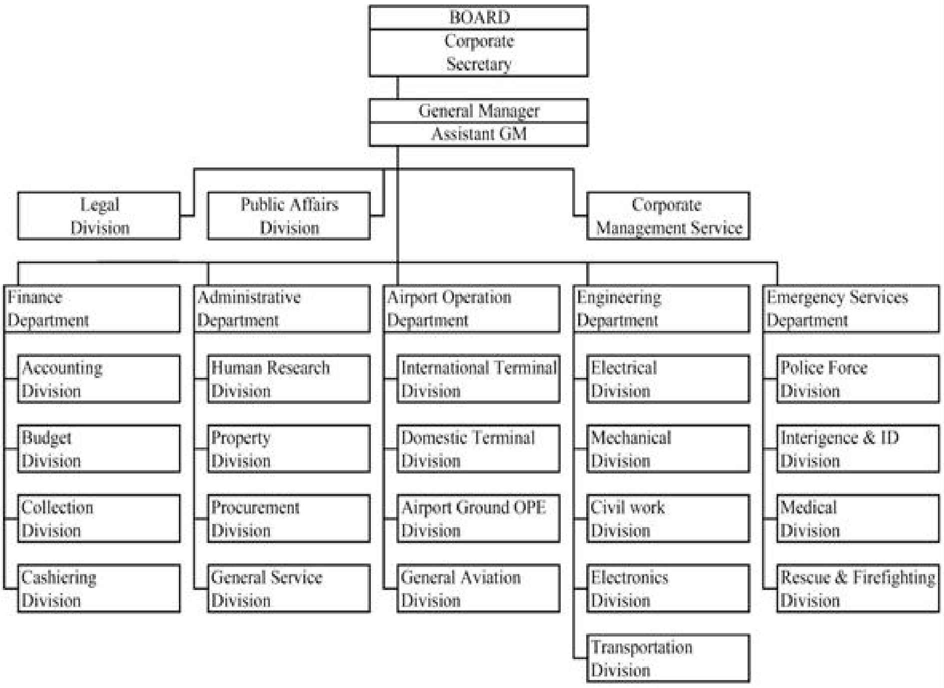
Figure 2.2-6 Mactan International Airport Layout

The number of passengers have been steadily growing for the past decade.

Domestic passengers in 2010 were 4.2 million; which increased by an average annual growth rate of 9.5 % since 2001 (of 1.86 million). International passengers in 2010 were 1.2 million; which increased by an average annual growth rate of 10 % since 2001 (of 0.5 million).

2. Airport Staff Organization Structure

Organization structure of MCIAA is shown below:



Source: JICA Study Team

Figure 2.2-7 Organization Structure for Mactan International Airport

3. Airport Revenue

Although details were not available, through a hearing and information collected from the airport officials, the approximate average of annual revenues for the past years are estimated as follows:

- Aeronautical Fee: Php 235 million
- Terminal Fee: Php 600 million
- Others: Php 370 million

4. Operation and Maintenance Cost

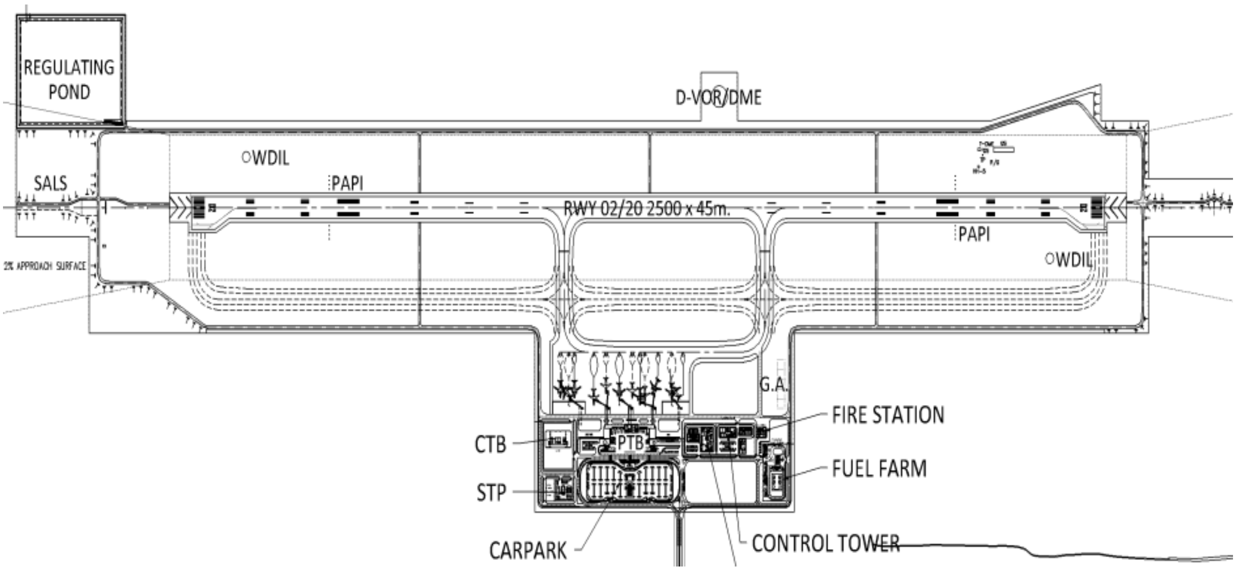
Through a hearing and information collected from the airport officials, the approximate average of annual operation and maintenance costs for the past years are estimated as follows:

- Administrative Cost: Php 145 million
- Maintenance Cost: Php 136 million
- Water/Electricity: Php 125 million

b) Iloilo Airport

1. Airport layout

The Iloilo Airport located in Cabatuan/ Santabarbara Cities, is owned and operated by Civil Aviation Authority of Philippines (CAAP). The Airport has a 2,500-m long runway, taxiway, passenger terminal building, cargo terminal building, fire rescue station, power house, mechanical house, control tower, administrator building, maintenance building, sewage treatment plant, apron (6 aircraft parking stands), and air navigation facilities (ILS-CAT-1).



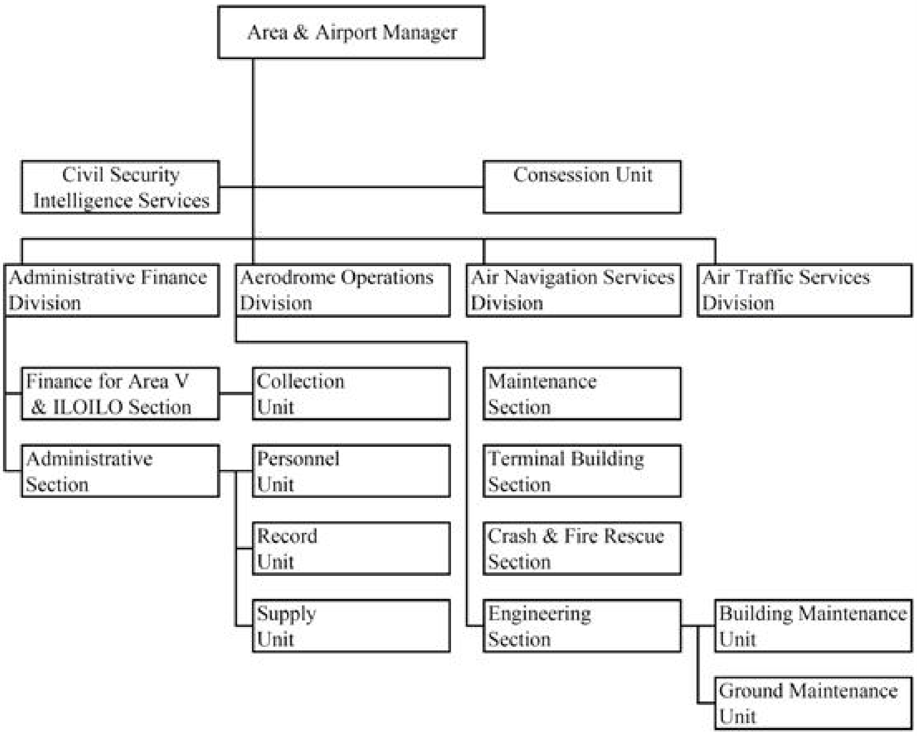
Source: JICA Study Team

Figure 2.2-8 ILOILO International Airport layout

Upon opening of the new airport in 2007, the number of domestic passengers dramatically increased to reach 1.58 million in 2010, which increased by an average annual growth rate of 16.3 % since 2006 (of 863 thousand).

2. Airport Staff Organization Structure

Organization structure of CAAP staff at Iloilo Airport is shown below:



Source: JICA Study Team

Figure 2.2-9 Organization Structure for Iloilo Airport

3. Airport Revenue

Although not all details were available, through a hearing and information collected from the airport officials, the approximate average of annual revenues for the past years are estimated as follows:

- Aeronautical Fee: Php 28 million
- Terminal Fee: Php 154 million
- Others: Php 39 million

4. Operation and Maintenance Cost

Through a hearing and information collected from the airport officials, the approximate average of annual operation and maintenance costs for the past years are estimated as follows:

- Administrative Cost: Php 54 million
- Maintenance Cost: Php 18 million
- Water/Electricity: Php 35 million

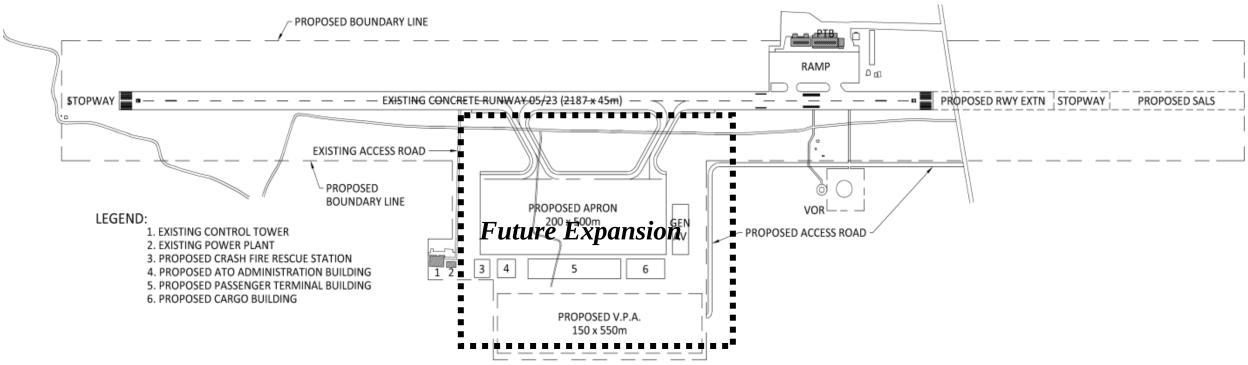
c) Kalibo International Airport

1. Airport layout

The Kalibo international airport is owned and operated by CAAP. The Airport has a 2,187-m long runway, taxiway, passenger terminal building, cargo terminal building, fire and rescue station, power house, control tower, administration building, apron and air navigation facilities (ILS- CAT1).

In addition to the old terminal building (floor area of 2,600 m^2), a new terminal building of 3,990 m^2 was completed in 2010.

Figure 2.2-8 shows the Airport layout.



Source: JICA Study Team

Figure 2.2-10 Kalibo Airport Layout

Kalibo and Caticlan are known as the two (2) disembarkation airports to the world famous beach resorts in Boracay.

The number of domestic passengers in 2010 was 754 thousand; which increased by an average annual growth rate of 13.7 % since 2001 (237 thousand).

Kalibo airport commenced international operations in 2008. The number of international passengers was 35 thousand in 2009 and rapidly increased to 236 thousand in 2010.

Particulars of the international flights operated at Kalibo Airport in 2010 are shown in Table 2.2-5.

Table 2.2-5 International Operations at Kalibo Airport in 2010

	Total in 2010			Peak month (August 2010)			
Airlines	Flights 2way	Annual Pax	Average Pax onboard	Flights 2way	Manthly Pax	Average Pax onboard	Peak-day flights 1way
Philippine Airlines	312	41,508	133	36	5,266	146	1
Spirit of Manila Airline	132	17,872	136	32	4,483	140	1
Zest Airways	896	107,931	120	102	12,884	126	2
China Airlines	342	42,443	124	46	5,830	127	1
Mandarin	224	21,070	94	32	3,010	94	1
Chaina South Airline	42	4,873	116	18	2,050	114	
Total	1,948	235,697	124	266	33,523	126	4 ~ 6

Source: JICA Study Team

The above table shows that in the peak month of the year 2010 (i.e. August), 266 international flights (133 departures and 133 arrivals) were operated, and most probably 4 to 6 flights (1 way) operated on a peak-day of the month. All the international flights were of the SJ-type (A320/A319; on average 150 seating capacity) and the average number of passengers on board were 124 (83 %) through the year and 126 (84 %) in the peak month.

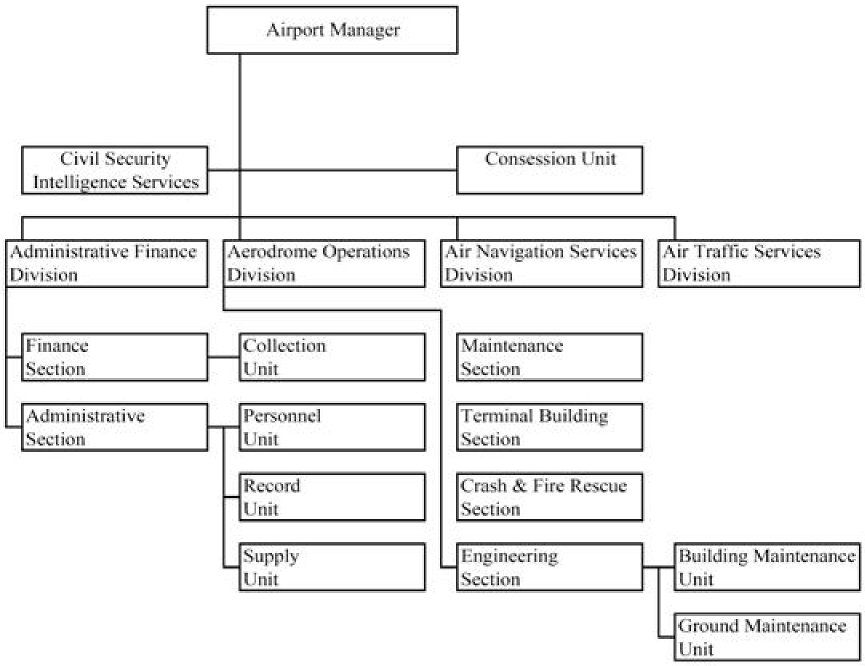
The most international passengers carried at Kalibo in 2010 were by Zest Airways, which now defines Kalibo as its hub and operates scheduled shuttle flights at Kalibo to and from Inchon (daily), Pusan (twice a week), and Shanghai (4 times a week). Those international traffic demands are considered to reflect a steady economic growth in China, Taiwan and South Korea.

Presumably, such rapid increase in the international operations at Kalibo is closely related to the limited capacity of NAIA's runway.

2. **Airport Staff Organization Structure**

Airport Division in CAAP consists of administrative & finance, aerodrome operations, air navigation services and air traffic services.

Organization structure of CAAP staff at Kalibo Airport is shown below:



Source: JICA Study Team

Figure 2.2-11 Organization Structure for Kalibo Airport

3. **Airport Revenue**

Although not all details were available, through a hearing and information collected from the airport officials, approximate average of annual revenues for the past years are estimated as follows:

- Aeronautical Fee: Php 63 million
- Terminal Fee: Php 92 million

4. **Operation and Maintenance Cost**

Through a hearing and information collected from the airport officials, the approximate annual average of operation and maintenance costs for the past years are estimated as follows:

- Administrative Cost: Php 54 million
- Maintenance Cost: Php 5 million
- Water/Electricity: Php 5 million

2.2.3. Fleet Plan of Major Domestic Airlines in the Philippines

Short-term fleet plans of the four (4) major domestic Airlines are summarized in Table2.2-6.

Table 2.2-6 Short-term Fleet Plan of major domestic Airlines in the Philippines

Aircraft		Philippine Airlines (PAL)		Airphil Express		Cebu Pacific Air		Zest Airways	
type	seats	in 2011	in 2015	in 2011	in 2015	in 2011	in 2015	in 2011	in 2015
B747	400	5	0						
B777	370	2	15						
A340	264	4	0						
A330	302	8	8						
A320	150-180	13	27	6	23	15	27	5	9
A319	140-156	4	4			14	14	1	1
ATR72	72					8	8		
MA60	56							3	5
DH3	56			3	3				
DH4	76			5	5				
Total		36	54	14	31	37	49	9	15
Remarks		Plan to later replace the A300 and A340 with B787 or A350 Hub at Manila		Sister company of Philippine Airlines Hub at Manila		Expects delivery of thirty (30) A321 from 2017 to 2021 Hub at Manila, Cebu and Clark		Formerly named as Asian Spirit Hub at Kalibo and Clark	

Source: JICA Study Team

Philippine Airlines (PAL), the legacy National Flag carrier, plans to increase from now up to 2015 the number of A320's from 13 to 27 and B777's from 2 to 15. It plans to phase out all its B747's and A340's, and replace them with A330's to B787's or A350's.

Airphil Express, a LCC established in 1996 by PAL as its sister company, plans to increase from now up to 2015 the number of A320's from 6 to 23, and maintain the current 3 DH3's and 5 DH 4's (of Bombardier).

Cebu Pacific Air, a LCC established in 1996, plans to increase from now up to 2015 the number of A320's from 15 to 27, and lately announced to introduce thirty (30) A321's progressively from 2017 to 2021. It now operates frequent regional international flights to Japan, South Korea, China, Hong Kong, Taiwan, Singapore, Thailand, Malaysia, Brunei and carried in 2010 the most numbers of passengers (international and domestic total) in the Philippines.

Zest Airways plans to increase the number of A320's from 5 to 9 and its MA60's (of Xian) from 3 to 5. It has its hub at Kalibo Airport, and started regional international flights to South Korea and China from Kalibo Airport since 2009. It carried the most numbers of international passengers to and from Kalibo in 2010.

2.2.4. Current issues and concerns

The great majority of origin and destination of the domestic flights in the Central Philippines is Manila. Considering the fact that there are other major airports in southern regions, e.g. Davao (2.2 million passengers with 20 thousand aircraft movements), Cagayan De Oro (1.3 million passengers with 13 thousand aircraft movements), Zamboanga (1.25 million passengers with 8 thousand aircraft movements), major origin and destination of either of which is also Manila, resulting that NAIA's domestic operations seems to have been fully loaded and may not allow further increase in the numbers of landings and takeoffs.

International operations at NAIA keep increasing, therefore, unless measures are taken to decrease the number of domestic operations, e.g. shifting to larger fleets for Manila routes, or until the second GCR airport (e.g. at Clark) will be materialized, increase in the domestic air traffic volumes may no longer be accepted at NAIA.

Among the above 10 airports in the central Philippines, Puerto Princesa and Mactan airports are accepting larger fleet operations (e.g.A330's of 300 seating capacity) for the Manila route with their runway length of more than 2,500 m. At Iloilo Airports however, although the 2,500-m long runway is capable to accept A330 flights, all Manila flights are operated by small jets (i.e. 19 daily round-trip of A320 to and from Manila). If for example, the fleet of Manila-Iloilo flights is shifted from A320's to A330's, aircraft movements will be halved for this route which could result in a possible solution to alleviate the saturation of NAIA's runway. Likewise, if the runways at other major airports are extended for larger aircraft to land and takeoff, it may greatly contribute to the solution to NAIA's runway congestion, thereby to enhance further growth of domestic air transportation.

2.3. Current situation of the Existing Tagbilaran Airport

2.3.1. General

Table 2.3-1 shows general information of Tagbilaran Airport.

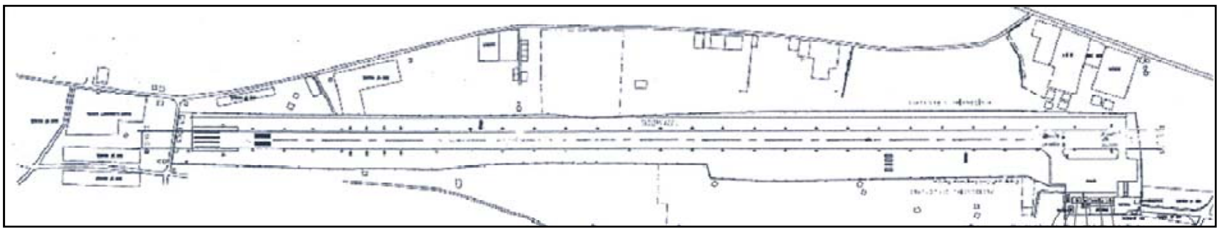
Table 2.3-1 General Information of Tagbilaran airport

Item	Description
City / Aerodrome	TAGBILARAN National Airport
Domestic or International	Domestic
ICAO Reference Code	3C
Airport Reference Point	Long. 123° 51’13.0665’’E, Lat. 09° 39’51.088’’N
Elevation	11.52m (38 FT) AMSL
Reference Temperature	28 degree Celsius
Operational Hours	0600 to 1800 (Local time)
Administered by	Civil Aviation Authority of the Philippines (CAAP)

Source: JICA Study Team

2.3.2. Airfield facilities

Figure 2.3-1 and Table 2.3-2 shows layout and configuration of airfield facilities.



Source: JICA Study Team

Figure 2.3-1 Airfield Layout of Tagbilaran Airport

Table 2.3-2 Airfield Facilities at Tagbilaran Airport

Item		Description
Runway	Direction	17/35
	Length	1,779 m.
	Width	30 m.
	Pavement	PCCP
	Runway strip	Width : 50 m. on both side, Length: 1,842.3 m.
Taxiway	-Configuration	2 Connections with Apron
	Width	21 m.
	Pavement	PCCP
Apron	Configuration	Passenger loading apron
	Aircraft stands	2 x A320
	Parking	Self maneuvering
	Area	126 m. x 40 m. (5,040 sq.m.)
	Pavement	PCCP

Source: JICA Study Team

2.3.3. Landside facilities

The existing landside facilities of Tagbilaran Airport consist of a passenger terminal building with car parking area, FSS building, fire station and power house. Configuration of existing landside facilities is shown below (Table 2.3-3).

Table 2.3-3 Landside facilities at Tagbilaran Airport

Building	Area	Description	
Passenger terminal building	Public area	Departure area	10 Check-In counters for the followings: •Philippines Airline •CEBU Pacific Airline •AIRPHIL-Express Airline •ZEST Airline
			3 X-Ray's located at departure area. •Operating one X-Ray only •2X-Rays (Out of Commission)
		Arrival area	Baggage loading area. •Baggage Handling System
	Restricted area	CAAP office	•Administrator staff •Aerodrome operation staff
		Airport manager's room	•Airport Manager •Secretary
		PASCOM (PNP)	•Airport Police staff
	Private area	Car parking	•Limited to 30 cars
		Concessionaire	20 Concessionaire as follows; •The Peacock Garden Luxury Resort and Spa •Island City Mall •BOHOL Quality Corp. •BOHOL Coconut Palm Resort •BOHOL Beach Club •La Construction Paradise Beach Resort •BOHOL Tropics Resort Corporation •Agricultural Promotion Centre •The Artist Shop Comp. Inc •Virginia Dumapias •Cionverge •Jocelyn Putian •Philippine Airline •CEBU Pacific Airline •ZEST Airline •AIRPHIL-Express Airline •SKYCAP •Airport Triciycle Driver Association (ATDA) •RAMER for Car and Van for hire •MPC for Car and Van for hire BIOD
FSS building	Restricted area	Rooftop	Radio communication facility •VHF antenna
		VFR room	Radio communication console •Aerodrome console •Fixed communication console •Flight data console
		Equipment room	Radio communication equipment •VHF Transmitter equipment •VHF Receiver equipment •HF Transceiver equipment •Voice communication control system •Voice recording system
		CAAP office	•Air traffic service staff •Air navigation operation staff
Fire station		Office	•Fire man staff
		Garage	•Fire major vehicle •Rapid intervention vehicle
Power house		Engine generator room	•Engine generator •Power receiving system
		Office	•Air navigation operation staff

Source: JICA Study Team

2.3.4. Air Navigation Facilities

The airport commenced its operation without radio navigation aids, these were never provided except for visual aids facilities. Existing radio facilities consist of VHF AM, VHF FM, HF SSB, Voice communication control system and Voice recording system in the ATS and telecommunication system, which is supporting the air traffic advisory service. Configuration of existing ATS and telecommunication system, Meteorological facilities and Aeronautical ground lights are shown below (Tables 2.3-4 to 6).

Table 2.3-4 ATS and Telecommunication

Item		Description
Air to ground communication system	VHF AM 122.2MHz	Configuration of VHF radio communication •50W VHF AM transmitter equipment •VHF AM receiver equipment •5W VHF AM transceiver equipment
Ground to ground communication system	VHF FM	Configuration of VHF radio communication •5W VHF FM transceiver equipment •5W VHF FM portable transceiver
Point to point communication system	HF SSB 5205KHz and 3872.5KHz	Configuration of HF SSB radio communication •100W HF SSB transceiver equipment
Radio, intercom & telephone line control system	Control system	Configuration of control system •Voice communication control system •Voice recording system
Air traffic advisory service	Service console	Configuration of console •Aerodrome console •Fixed communication console •Flight data console

Source: JICA Study Team

Table 2.3-5 Meteorological Facilities

Item		Description
Aerodrome weather information	Meteorological facilities	Configuration of meteorological facilities •Wind speed sensor •Wind direction sensor •Temperature sensor •Barometric pressure sensor •Operational status monitor

Source: JICA Study Team

Table 2.3-6 Aeronautical ground lights

Item		Description
Visual aids for navigation	Aeronautical ground lights	Configuration of aeronautical ground lights •Runway edge light •Runway threshold and wing bar light for both sides •Runway end light for 17 side •Taxiway edge light for North side •PAPI for both sides

Source: JICA Study Team

2.3.5. Flight Information Advisory Service by CAAP

1) General

ATS airspace classification of Tagbilaran Airport is "G" which is prescribed in ICAO Annex 11. It is not an air traffic control service but an aerodrome information advisory service for aircraft which are on the airfield ground or flying over within 5NM radius from the airport reference point and vertical limits with an altitude of less than 2,000 ft. The flight procedure for the airport is only VFR flight and no vertical separation is established. The service has been operated by Civil Aviation Authority of the Philippines (CAAP).

The operation hour of aerodrome information advisory service is from 06:00 to 18:00 local time. The advisory service is ordinarily carried out by two radio communicators, and in total six radio communicators are stationed for the airport advisory service with morning and afternoon shifts.

The following is particular information related to the flight information advisory service at Tagbilaran Airport as noted during the site observation:

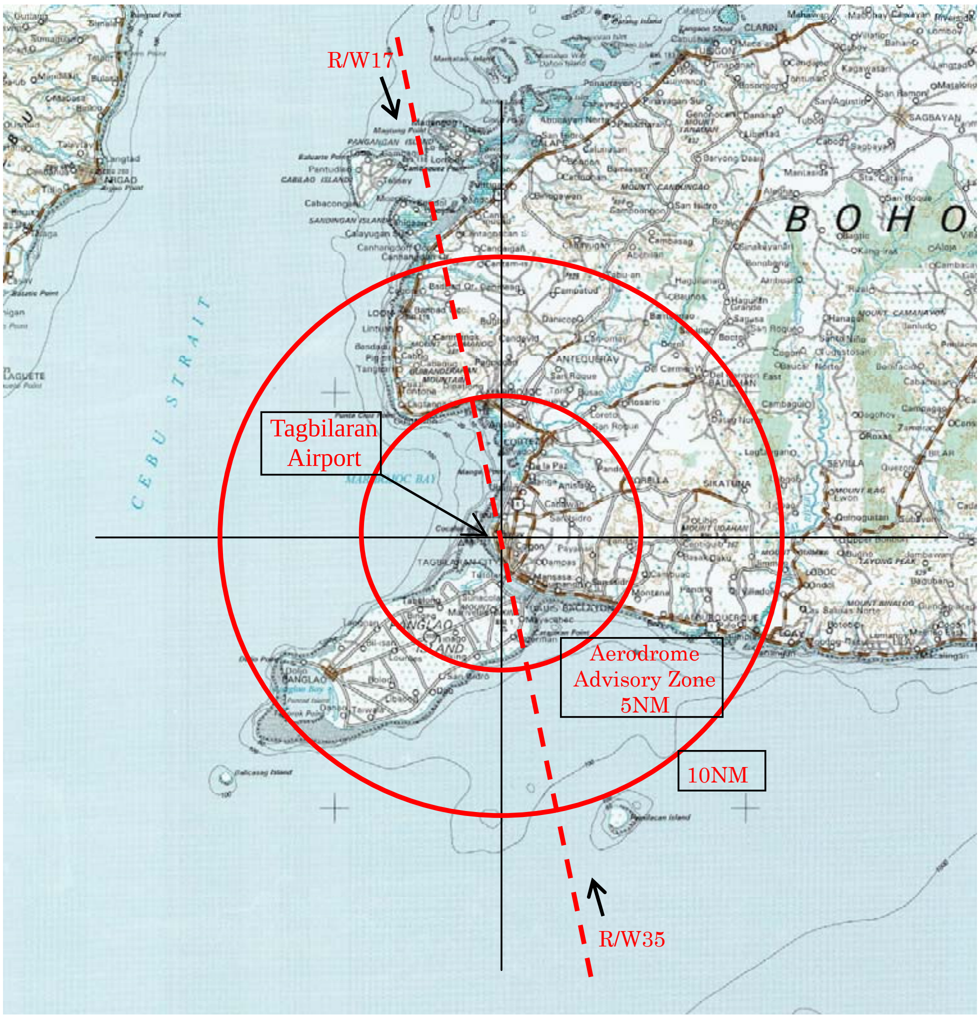
- Mainly inform aircraft pilots of the airport status such as the weather condition, landing /departure runway, etc.
- Initial contact with aircraft starts around 10NM from the airport. (There are cases that pilot requests airport weather conditions when they are flying on en-route around 100~130 NM from the airport.)
- FSS receives ATC Clearance for flight plan from Mactan ACC via Mactan Radar indirectly due to no establishment of direct hot line between the FSS and Mactan ACC.
- Phraseology of advisory service for aircraft's landing and taking-off is "YOU MAY LAND/TAKE-OFF" instead off "Cleared to Land/Cleared for Take-off".
- FSS staff is called "Communicator" not ATC controller, however they have an ATC Controller certificate.

FSS Tower in Tagbilaran Airport **FSS Console inside of Tower**

Figure 2.3-2 FSS Tower and VFR room at Tagbilaran Airport

2) Topography and Aircraft Operation

Figure 2.4-2 shows a general topographical map around Tagbilaran Airport marked with a distance approximately 10NM radius from the airport reference point. Regular flights for the airport are only to and from Manila. In addition there are some general aviation flights such as private & training flights by flying schools which are facilitated at Mactan and Dumaguete Airports. The number of general aviation flights at the airport is around 80~100 flights per month.



Source: JICA Study Team

Figure 2.3-3 Topography around Tagbilaran Airport

According to the information provided by the FSS staff, the following obstacles such as hills or mountains that the pilots have to pay attention to for their aircraft operations are located around Tagbilaran airport.

- Mountains with a height of around 1,500 ft. are located at 5 NM north of the airport.
- Hills with a height of around 650 ft. are located at 3.5 NM south of the airport.
- Buildings on the hills are located at 2 km south of the airport.

- There is an antenna tower for cell-phone base station in the vicinity of the airport.
- Many trees and residential houses are close to the airport boundary.

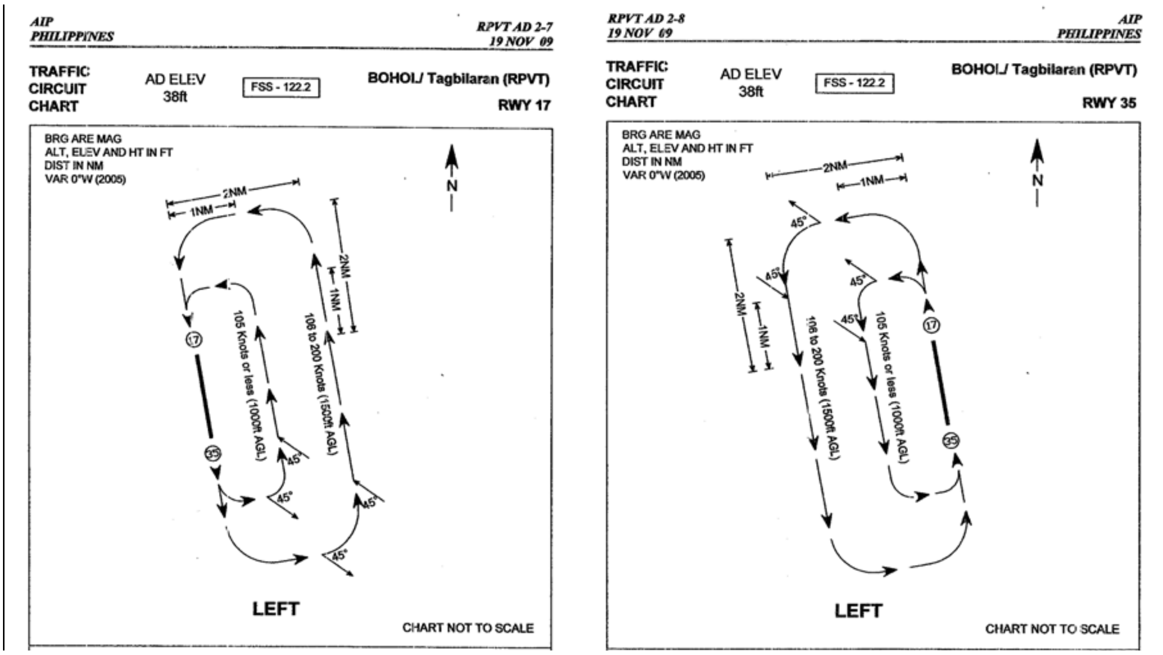
R/W17Approach direction

R/W35Approach direction

Figure 2.3-4 Runway 17 and Hilly Terrain for Runway 35 approach

3) Flight Procedure

There are no radio navigational aids such as ILS, VOR/DME or NDB for the airport, so that VFR traffic circuits are only established as left hand pattern for approach and departure procedure, which is prescribed in the airport's AIP. During the site observation, however, an Airbus 320 from Manila executed its approach to R/W 17 via the Right Base to Final course (right hand pattern) based on the pilot's observation.



Source: Philippines AIP

Figure 2.3-5 Approach/Departure Traffic Circuit Chart for Tagbilaran Airport

The VFR flight procedures for Tagbilaran Airport are as follows:

- Arriving aircraft shall enter the traffic circuit on the downwind leg at an angle of 45 degrees.

- Departing aircraft shall follow the traffic circuit after passing the aerodrome boundary, and then leave the circuit at an angle of 45 degrees from the crosswind leg.

4) Airspace Restrictions

Restricted, Prohibited and Danger Areas such as military/training activities and hazardous features that affect airspace usage or aircraft operations are presently not established around the Tagbilaran airport area.

2.3.6. Problem of the existing Tagbilaran Airport

Situations and problems at the existing Tagbilaran Airport are summarized in Table 2.3-7.

Table 2.3-7 Situation and Problem at Tagbilaran Airport

①	Runway Strip	It does not meet the requirement for ICAO Code3, i.e. 150 m (75 m on both side) in case of non-instrument landings.
②	Runway length	Due to lack of stop-way and runway-end-safety area (ICAO requires minimum of 150 m in total) on both ends of the runway, effective runway length is considerably shorter than the announced 1790 m (e.g. only some 1500m is available), which could have endangered passengers' life safety and/or imposed payload restriction on predominant aircraft (A320) from the operators safety point of view.
③	Passenger Terminal	It situates too close to the runway, where aircraft parking on the apron falls inside the non-instrument runway strip, and not cleared from the runway transitional surface.
④	Apron Spot	There are two (2) aircraft stands parking to face uni-direction in tandem position without bypass taxiing lane. This first-come-first-serve basis parking style is observed in the morning peak-hour to causes the 3rd aircraft on hold in the air until the 2 stands have been vacated.
⑤	VFR approach operations	Visual Flight Rule (VFR) approach is only applied for aircraft operations. Instrument Flight Rule (IFR) approach cannot be provided unless northern high mountains are removed.
⑥	Possibility for Expansion	Densely-populated housing and commercial area exist in close proximity. Further expansion, if required, would spend considerable cost and time for acquisition of ROW, replacement and resettlement.

Source: JICA Study Team

The Table implies that the Tagbilaran airport is suffered from serious infirmity in its current infrastructure.

Features of the existing Tagbilaran Airport are explained in the Photo below:

Adequate width of runway strip and runway-end -safety area is not provided, where densely populated housings are observed under aircraft wing just before landing Runway 35.

Runway-end safety area is not provided, where stiff slope immediately before the runway 35 threshold is observed.

Densely-populated housings are located inside the non-instrument runway strip.
Stiff slope exists before the Runway 35 threshold:

Pre-departure area is fully crowded.
No room for passengers even to stand when 2 departures are simultaneously operated in peak hours.

Apron locates inside the runway strip.
Passengers walk in narrow apron crossing with ground handling operations and/or aircraft full blast winds occasionally.

Source: JICA Study Team

Figure 2.3-6 Features of the Existing Tagbilaran Airport

2.3.7. Review of the Possible Tagbilaran Airport Development

1) Simulated Feature of Possible Tagbilaran Airport Development

Areas immediately beyond the both runway ends do not belong to the airport property, where the natural terrain sharply drops down. Normally, the runway ends should be safeguarded by a 60-m long runway strip and a 90-m long runway-end-safety-area (RESA). In other words, the effective runway length at the existing Tagbilaran airport should not be 1779 m as currently declared in AIP but should be less than 1,500 m; This could have not safely attained operations by the currently-used jet aircraft (i.e. A319/A320).

If the Tagbilaran airport will continue to accommodate increased number of air traffic volume, the following basic features of the development are possibly considered.

- Due to densely-populated downtown in the south of the airport, runway extension could be made only toward the north direction.
- The terminal area would be on the south-west of the runway (i.e. Barangay Booy).

The existing airport, together with the layout of "Phase-2" Development (as discussed in Chapter 6) simulated on the same Tagbilaran runway is shown in Figure 2.3-7.

Description	Layout on Google Earth
Existing Tagbilaran Airport Non-instrument approach Runway: 30m x 1779 m Runway Strip: 100 m	
"Phase-2" Development; as discussed in Chapter 6 superimposed on Tagbilaran Runway Instrument landing Runway: 45m x 2500 m Runway Strip: 300 m	

Figure 2.3-7 Existing Tagbilaran Airport and Phase-2 full Development

Judging from the above Google map, the "Phase-2" Development (runway length of 2,500 m) is eventually not possible due to the limitation of the land available.

Practically-possible maximum scenario for Tagbilaran airport development is similar to the "Phase-1" Development (runway length of 2,110 m; as discussed in Chapter 6), therefore which is hereinafter called as "Phase-1" Basic Development Scenario.

It is also practical to consider that full parallel taxiway to the runway could not be provided in the future, due to the existence of the mangrove shoreline,

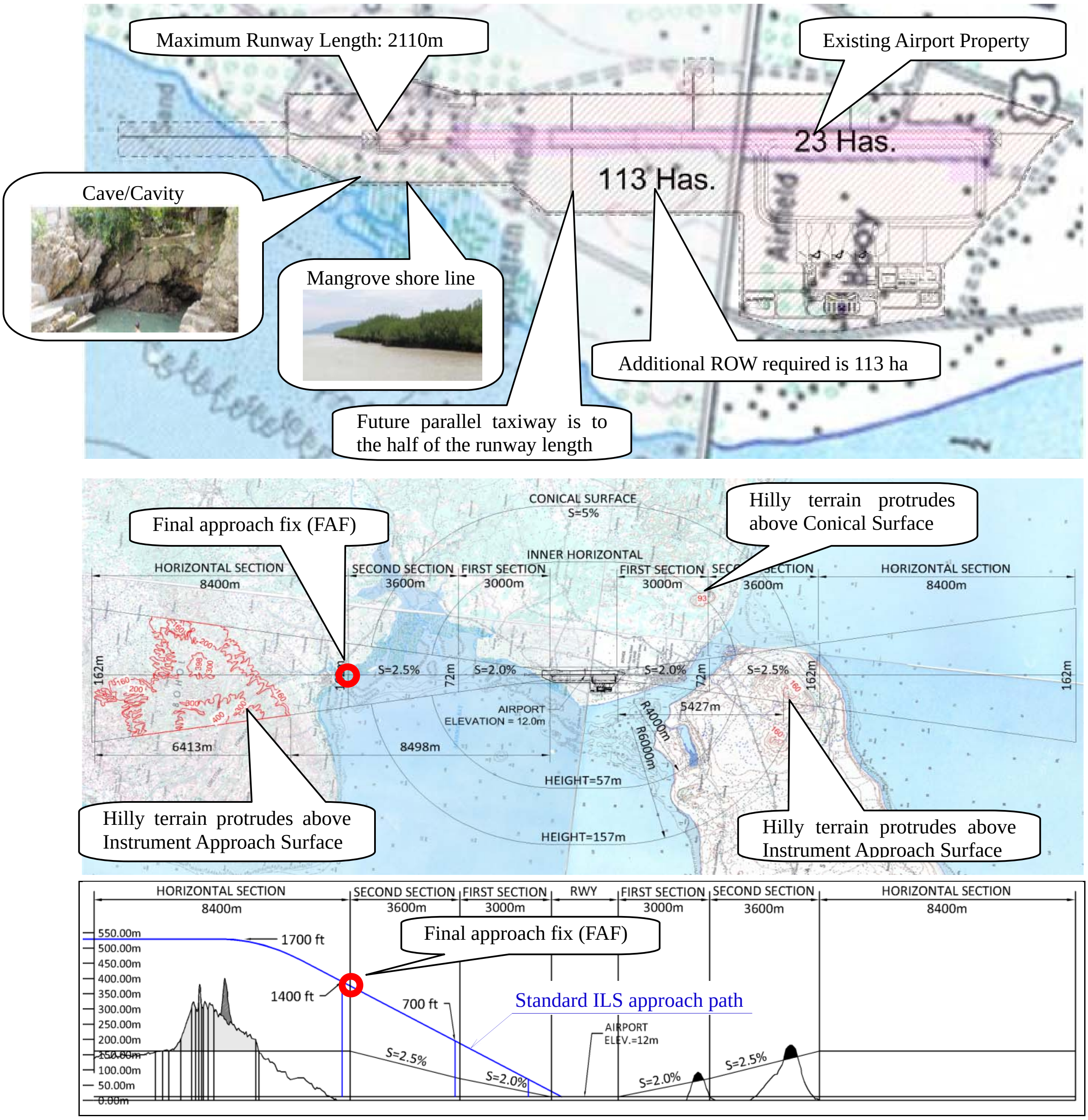
For the purpose of this Draft Final Report, the following two (2) Options are considered for the simulation of Tagbilaran airport development scenarios.

Options	Layout on Google Earth
Option 1: "Phase-1" Basic Development Scenario Instrument landing Runway: 45m x 2110 m Runway Strip: 300 m	
Option 2: Bare Minimum Development Scenario Non-instrument Runway: 45m x 2110 m Runway Strip: 150 m	

Figure 2.3-8 Possible Options for Tagbilaran Airport Development Scenario

a) Option 1: "Phase-1"Basic Development Scenario (Figure 7.1-3)

- Instrument approach runway is to be provided, where width of the runway strip is 300 m (i.e. 150 m on both sides)
- Parallel taxiway could be provided in the future but only to the half of the runway length so as to keep minimal efficiency/ frequency of aircraft movements.
- Appropriate air navigation systems, including CAT-1 Instrument Landing System (ILS) are to be provided.
- The Cat-1 ILS is to instrumentally lead the pilot to his decision height when the Runway Visual Range (RVR) is not less than 550 m and the Decision Height (DH) is not lower than 200 feet (i.e. 60 m) above airport level.
- Rest of the airport facilities are considered the same as Phase-1 Development discussed in Chapters 6 of this Draft Final Report.



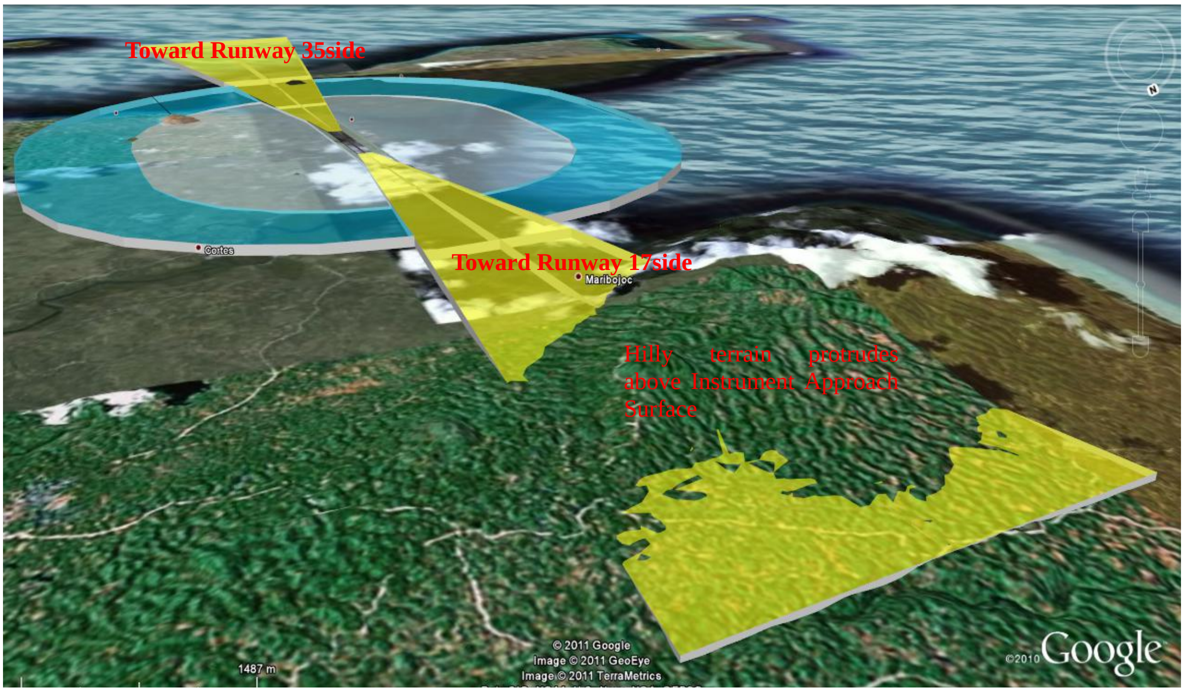
Source: JICA Study Team

Figure 2.3-9 Option 1: "Phase-1"Basic Development Scenario
2,110-long Runway for Instrument Approach

- However, a series of hilly terrain exists along northern part of approach surface (approximately 5NM from the runway threshold), which are protruding above the obstacle limitation surfaces for the instrument runway, thereby giving difficulty to establish an instrument approach procedure in accordance with ICAO Annex 14.
- When standard ILS approach procedure is implemented, the pilot must face toward the exact runway orientation at the Final Approach Fix (FAF). However, approaching to the FAF from from any direction the aircraft would pass over such topography at extraordinary near distance.

- Those hilly terrain projecting above the obstacle limitation surfaces are virtually shown in Figure 2.3-10.

View of Runway from North side



View of Runway from South side

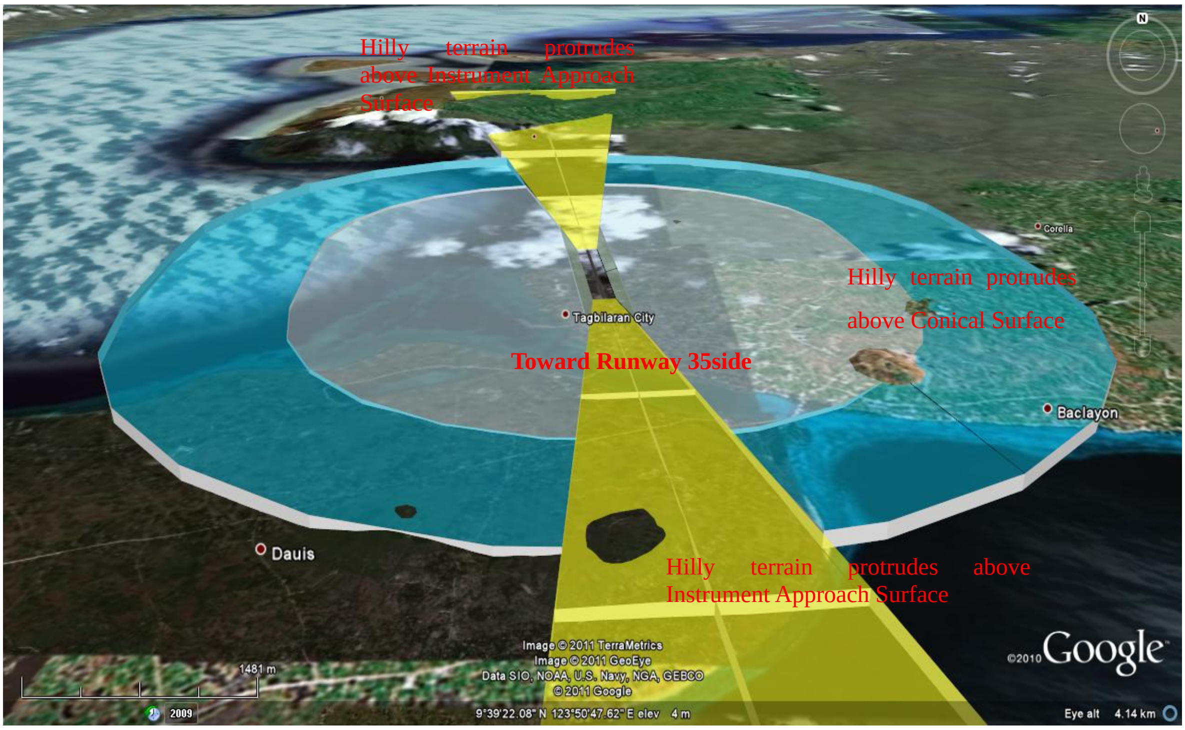
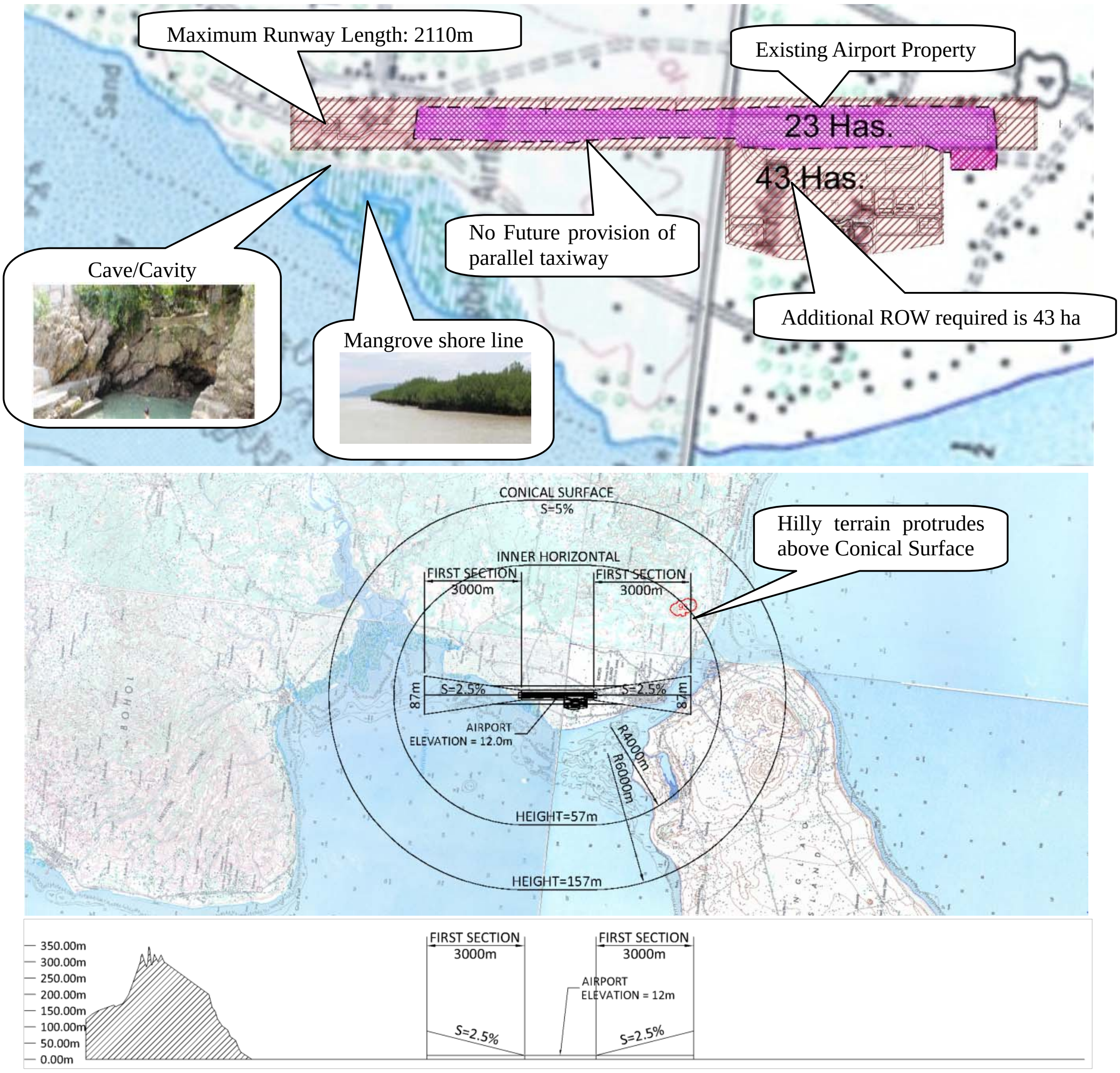


Figure 2.3-10 Obstacle Limitation Surface (Virtual Image) at Tagbilaran Airport In case of Instrument Approach Runway

b) Option 2: Bare Minimum Development Scenario (Figure 2.3-11)

- Non-instrument approach runway is to be provided, where width of the runway strip is 150 m (i.e. 75 m on both sides)
- Pilot can approach the runway under VFR, when the height of cloud (ceiling height) is higher than 1000 feet (300 m) above airport level and the visibility is not less than 5km.
- Non-instrument visual approach operation is normally allowed on daytime (i.e. from sunrise to sunset).
- Parallel taxiway could not be provided eventually, where frequency of flight operations could be limited soon or later.

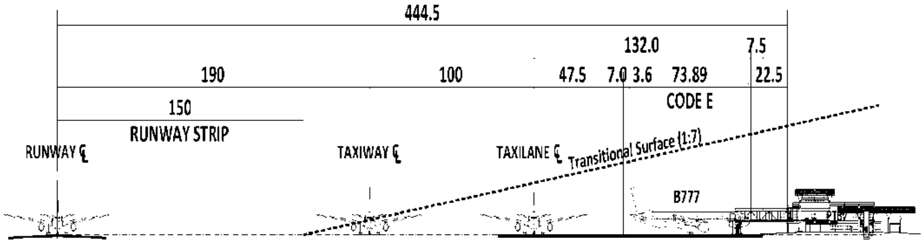
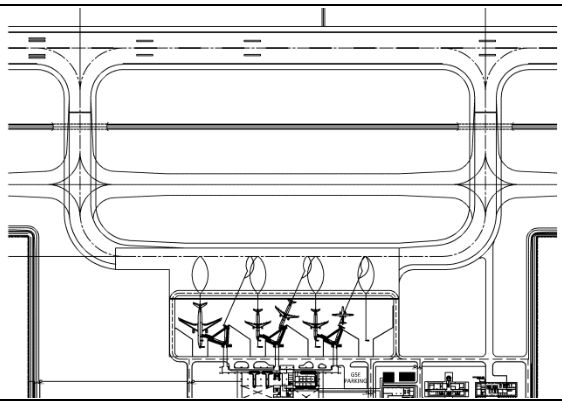
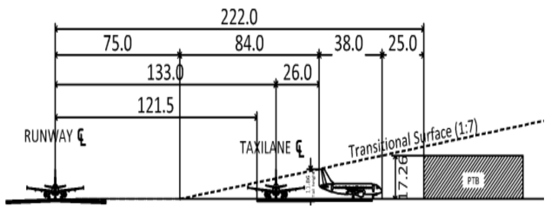
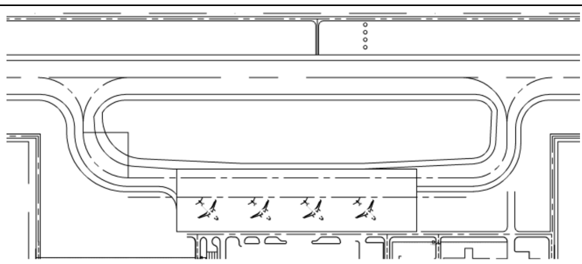


Source: JICA Study Team

Figure 2.3-11 Option 2: Bare Minimum Development Scenario 2,110-long Runway for Non-instrument Approach

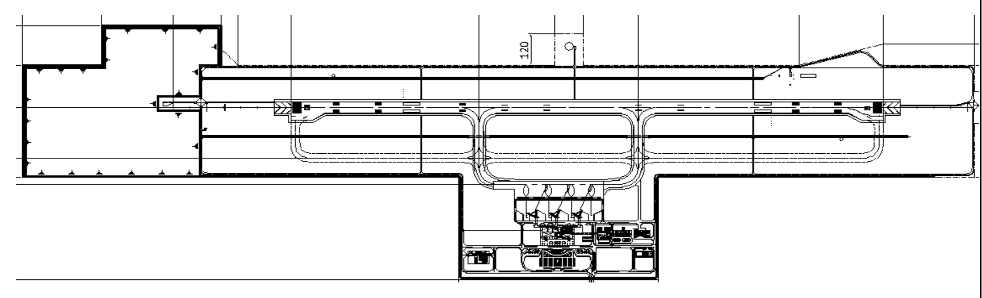
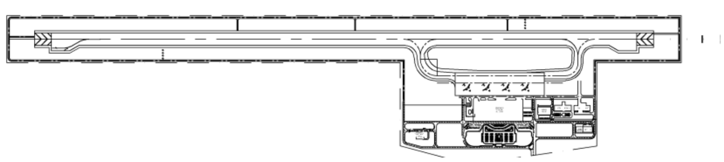
- A hilly terrain exists at eastern conical surface, which is protruding above the obstacle limitation surfaces for the non-instrument runway in accordance with ICAO Annex 14.
- Terminal area is only to accommodate domestic airlines' operations of the currently-used aircraft, A320.
- PTB is purely for domestic, for which a single-story building is considered.

Figures 2.3-12 to 14 show the features of the Bare Minimum Development Scenario (Option 2) in comparison with the Basic Development Scenario (Option 1).

<u>Option 1</u> **"Phase-1"Basic Development Scenario**	  Push-out Parking stands for 1 A330, 3 A320, and 1 DHC-3
<u>Option 2</u> **Bare Minimum Development Scenario**	  Self maneuvering Parking stands for 4 A320

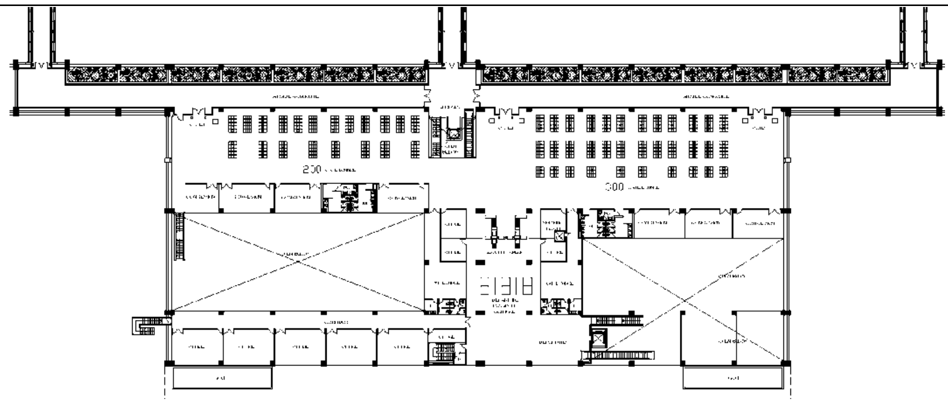
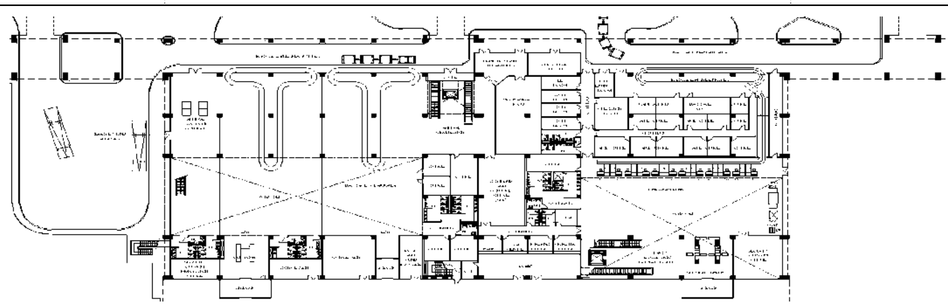
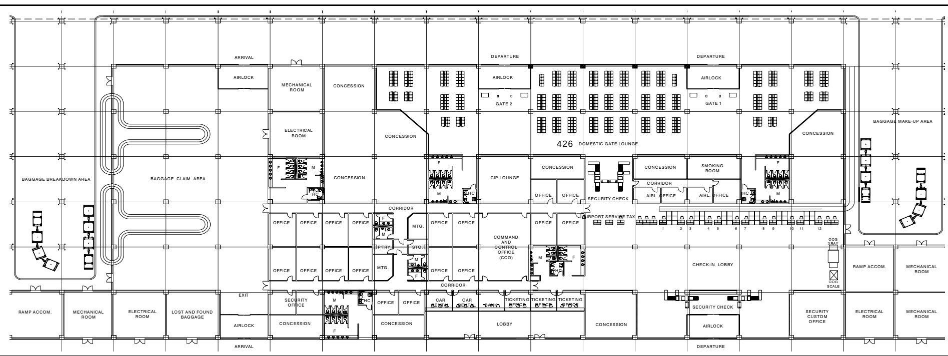
Source: JICA Study Team

Figure 2.3-12 Terminal Layout for Bare Minimum Development Scenario (Option 2) in comparison with the "Phase-1"Basic Development Scenario (Option 1)

Option 1 **“Phase-1”Basic Development Scenario**	
Option 2: **Bare Minimum Development Scenario**	

Source: JICA Study Team

Figure 2.3-13 Airport Layout for Bare Minimum Development Scenario (Option 2) in comparison with the “Phase-1”Basic Development Scenario (Option 1)

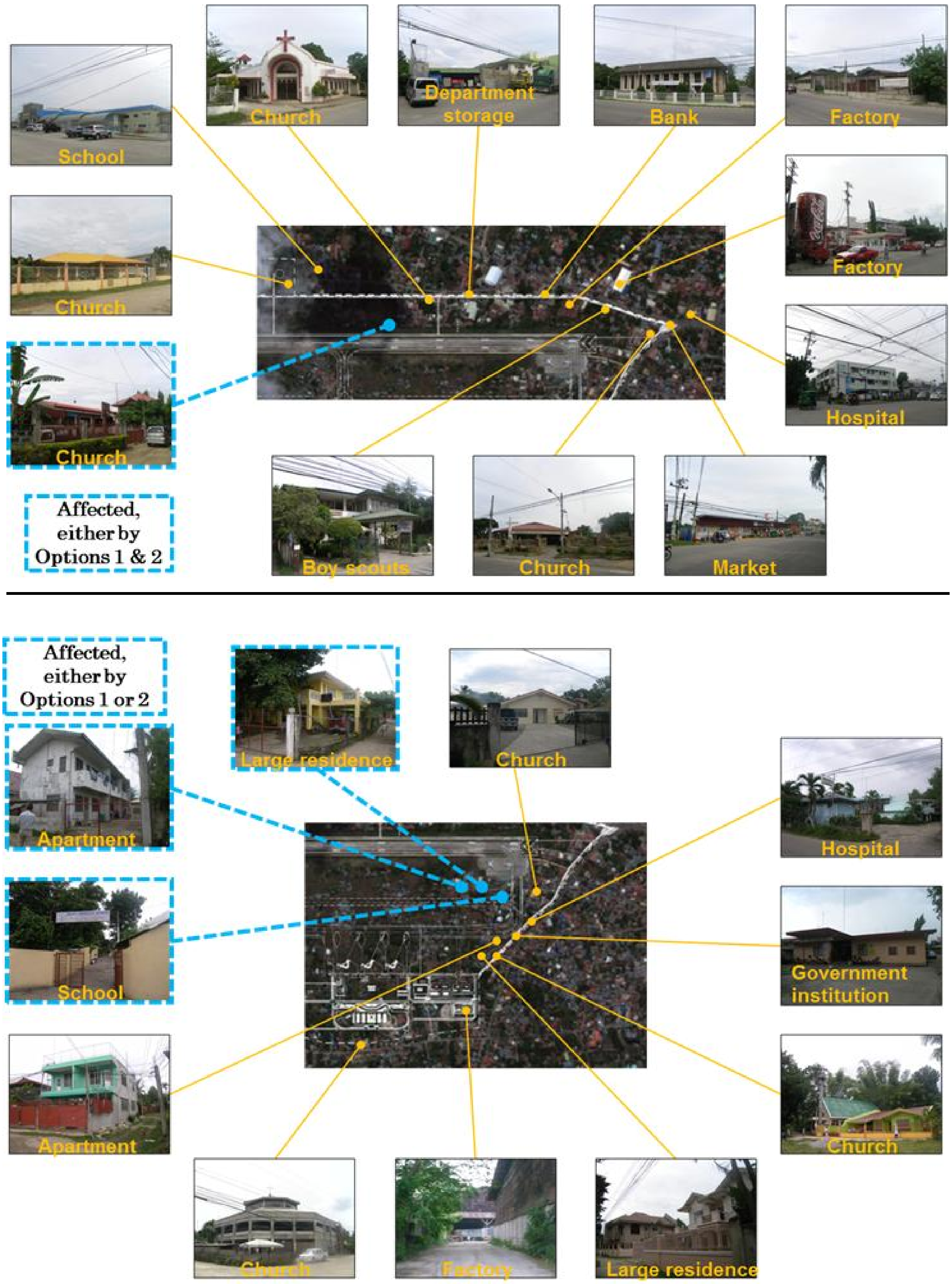
Option 1 **“Phase-1”Basic Development Scenario** **2nd Floor: 4,557 m²** **and** **Ground Floor: 5,204 m²**	
	
Option 2: **Bare Minimum Development Scenario** **Ground Floor: 7,550 m²** **Only**	

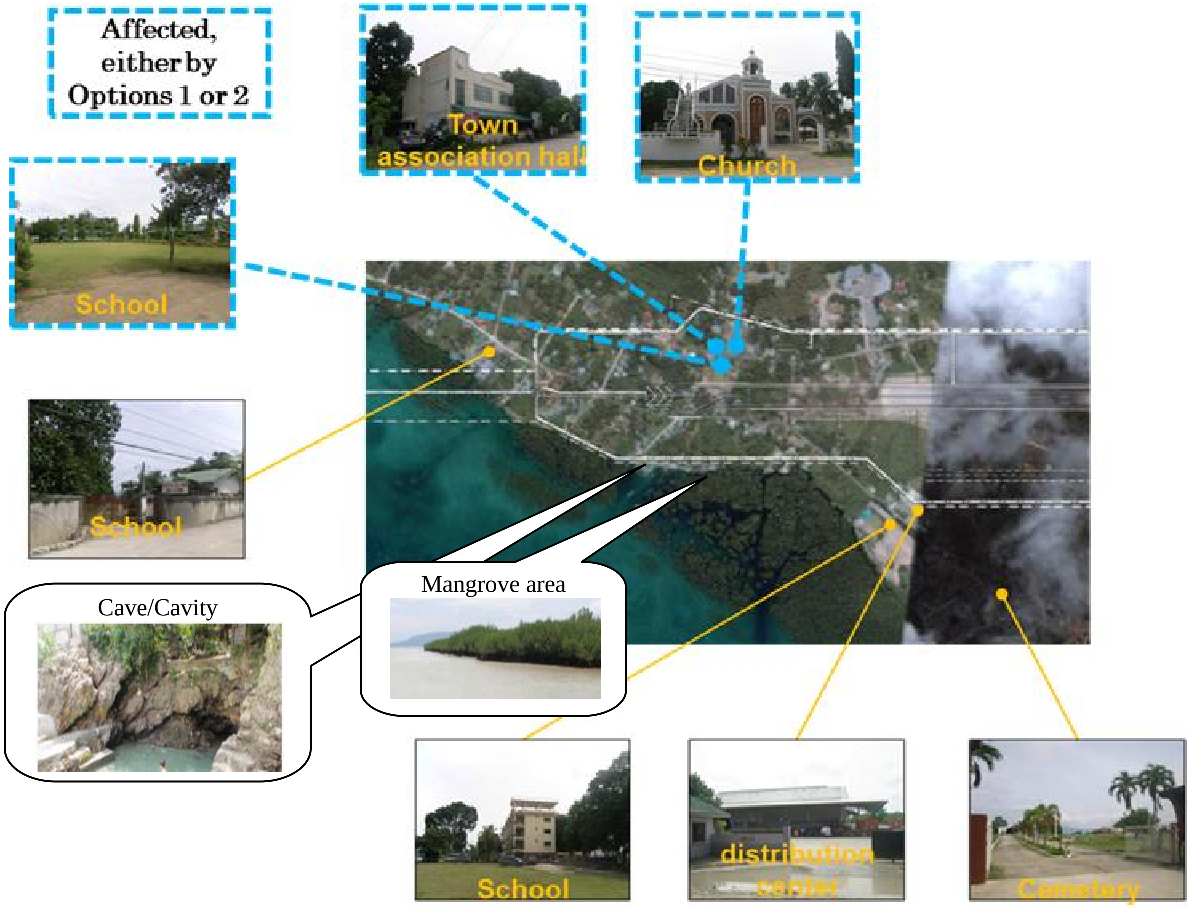
Source: JICA Study Team

Figure 2.3-14 Passenger Terminal (PTB) for Bare Minimum Development Scenario (Option 2) in comparison with the “Phase-1”Basic Development Scenario (Option 1)

2) Properties for acquisition of ROW, Demolition and Replacement

The properties affected thus requiring acquisition of ROW, demolition and replacement/ resettlement of the residents are shown in Figure 2.3-15.





Source: JICA Study Team

Figure 2.3-15 Properties affected by Tagbilaran Airport development

In addition, as shown in the above pictures, there exist wide area of clean mangrove and a cave observed at vertical face of limestone precipice in the immediate vicinity of the runway extension area. This will not only give difficulty in 10-m high embankment for the minimal width of non-instrument runway strip, but also special considerations must be given to how to protect such natural environment especially during construction period.

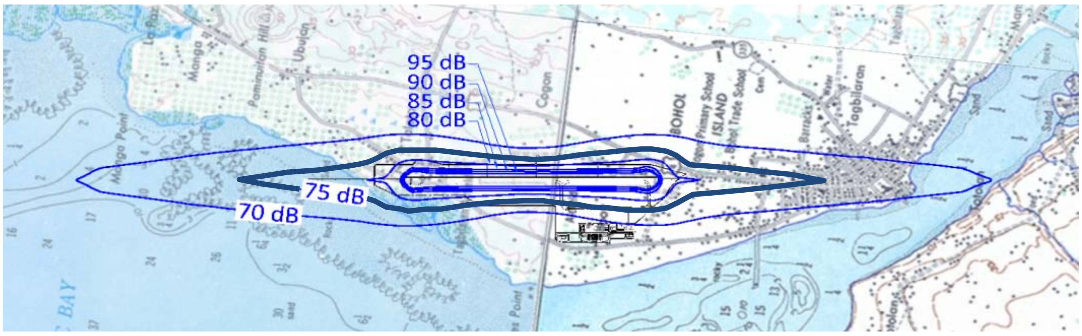
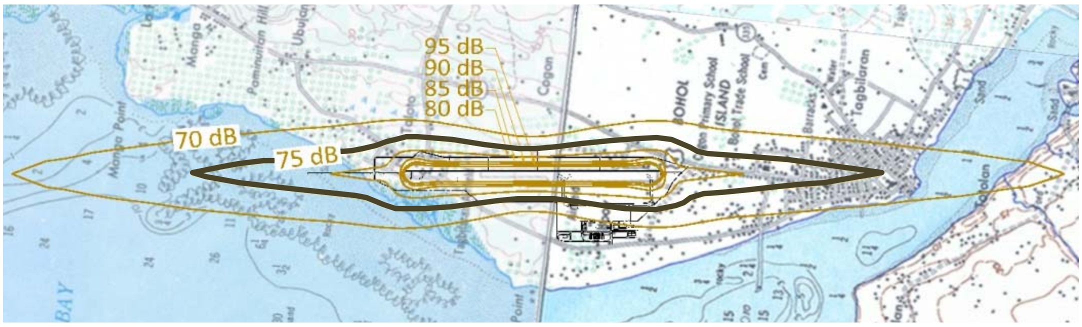
3) Properties affected by Possible Noise Pollution

When the Tagbilaran Airport is developed, possible noise pollution will be occurred along-with the main street in Tgbilaran City downtown. Effects of the noise pollution have been computed by using FAA software, and measured by means of Weighted Equivalent Continuous Perceived Noise Level (WECPNL).

The WECPNL is a parameter of noise pollution based on ICAO Annex 16.

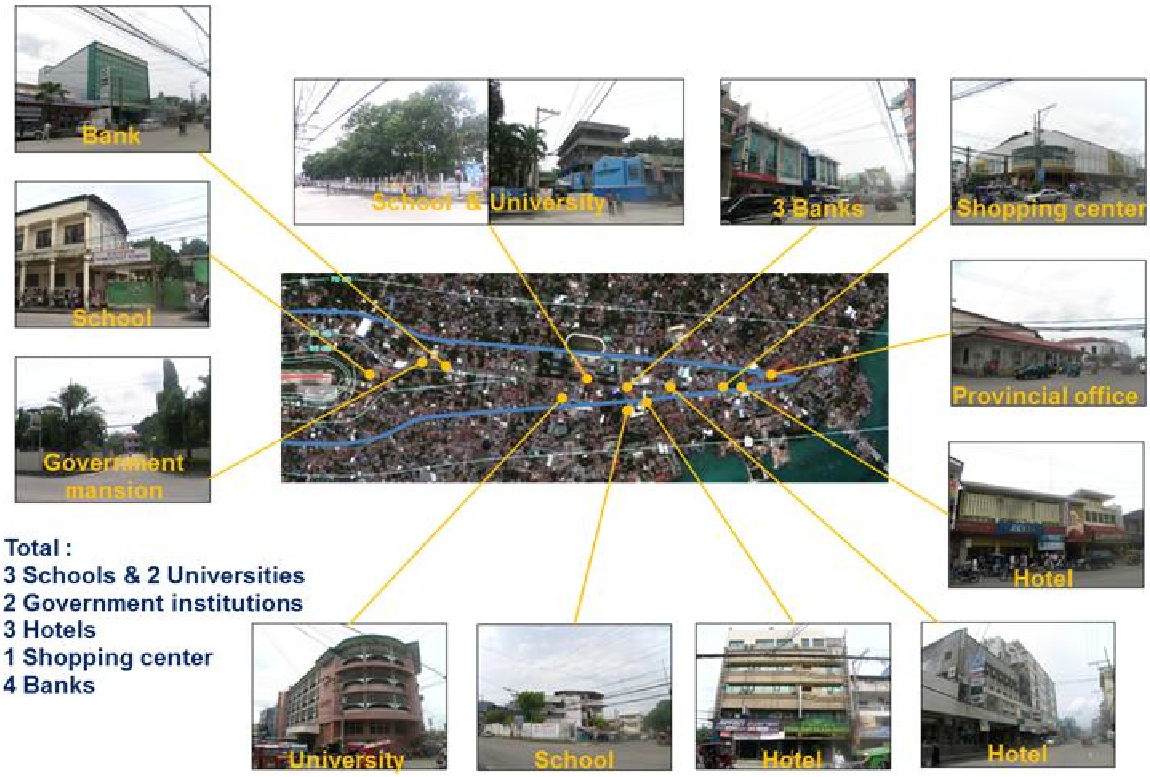
In Japan, properties affected by more than 75 WECPNL are subject to compensation of noise preventive measures, e.g. provision of sound proof windows, walls, roofs and/or air-conditioning.

Possible noise contours for the years 2020 and 2030, and the properties affected by the noise pollution (above WECPNL75) are shown in Figures 2.3-16 and 17, respectively.

WECPNL for the year 2020	
WECPNL for the year 2030	

Source: JICA Study Team

Figure 2.3-16 Noise Contour (WECPNL) if Tagbilaran Airport is developed



Source: JICA Study Team

Figure 2.3-17 Possible Noise pollution, if Tagbilaran Airport is developed

4) Assessment of Tagbilaran Airport Development Options

Those development options discussed above are assessed as summarized in Table 2.3-8.

Table 2.3-8 Assessment of the Simulated Tagbilaran Airport Development Options

<table>
<tr><th>Description</th><th colspan="2">Option1: Basic Development</th><th colspan="2">Option 2: Bare Minimum Development</th></tr>
<tr><td>Basic Project Cost</td><td colspan="4">Php 7.1 Billion, as the Phase-1 Project Cost estimated in Chapter 6 of this Report</td></tr>
<tr><td rowspan="2">Additional Cost for ROW Acquisition</td><td colspan="4">According to the Provincial Government, zonal value in 2011 of the airport land is Php 3,500/m² and its market value is generally Php 5,000/m², except areas along the road which are valued at 25,000 to 30,000/m² at current market.</td></tr>
<tr><td colspan="2">Php 5.5 Billion for 113 ha</td><td colspan="2">Php 2.15 Billion for 43 ha</td></tr>
<tr><td rowspan="9">Demolition/
Replacement</td><td>Residence</td><td>870</td><td>Residence</td><td>430</td></tr>
<tr><td>School</td><td>5</td><td>School</td><td>1</td></tr>
<tr><td>Church</td><td>8</td><td>Church</td><td>2</td></tr>
<tr><td>Government institution</td><td>2</td><td>Government institution</td><td>0</td></tr>
<tr><td>hospital</td><td>2</td><td>hospital</td><td>0</td></tr>
<tr><td>market</td><td>1</td><td>market</td><td>0</td></tr>
<tr><td>bank</td><td>1</td><td>bank</td><td>0</td></tr>
<tr><td>factory & storage</td><td>5</td><td>factory & storage</td><td>0</td></tr>
<tr><td colspan="2">Php 1.5 Billion,
assessed in the 2007FS</td><td colspan="2">Php 0.5 Billion, temporarily indicated,
subject to further assessment</td></tr>
<tr><td rowspan="4">Cost Reduction from Basic Project Cost (Phase-1)</td><td>Civil Works</td><td>None</td><td>Civil Works</td><td>Php 605 million</td></tr>
<tr><td>Building Works</td><td>None</td><td>Building Works</td><td>Php 695 million</td></tr>
<tr><td>Navaids Works</td><td>None</td><td>Navaids Works</td><td>Php 530 million</td></tr>
<tr><td>Total</td><td>None</td><td>Total</td><td>Php 1.83 Billion</td></tr>
<tr><td>Optional Project Cost</td><td colspan="2">Php 14.1 Billion</td><td colspan="2">Php 7.92 Billion</td></tr>
<tr><td colspan="5"><u>Aside from the above estimated Project Cost, the following aspects should be noted:</u></td></tr>
<tr><td>Possible compensation due to Noise Pollution</td><td colspan="4">Alongside the main street in downtown, 2 Universities, 4 schools, 1 hospital, 3 hotels, 4 banks, shopping centers, thousands of residents would be affected by the noise level of more than 75 WECPNL, as the aircraft movements increase as forecasted in Chapter 3 of this Draft Final Report.</td></tr>
<tr><td>Possible Closure of the existing airport</td><td colspan="4">The active runway pavement and runway strip should be rehabilitated, widened or overlaid, which would require closure of the airport at least for 6 months. Alternatively, passengers will have to once land at Mactan then take 2-hour speed boats to arrive at Tagbilaran, or may cancel their trips, which would give large negative impact on the tourism industries, local or national economies as a whole.</td></tr>
<tr><td>Environmental aspect</td><td colspan="4">To secure the minimum width of even non-instrument approach runway strip (i.e.75 m from the runway centerline), protection of mangrove and cave areas is necessary, which would take a longer process to assess and obtain the environmental clearance certificate (ECC).</td></tr>
<tr><td>Cost-effectiveness</td><td colspan="4">For the reasons of cost increase, no further space for future expansion, at least 6-month temporary closure of the existing Tagbilaran airport, negative environmental aspects, either option is found to be not cost-effective.</td></tr>
</table>

Source: JICA Study Team

2.4. Conditions of the New Bohol Airport Construction Site

2.4.1. General

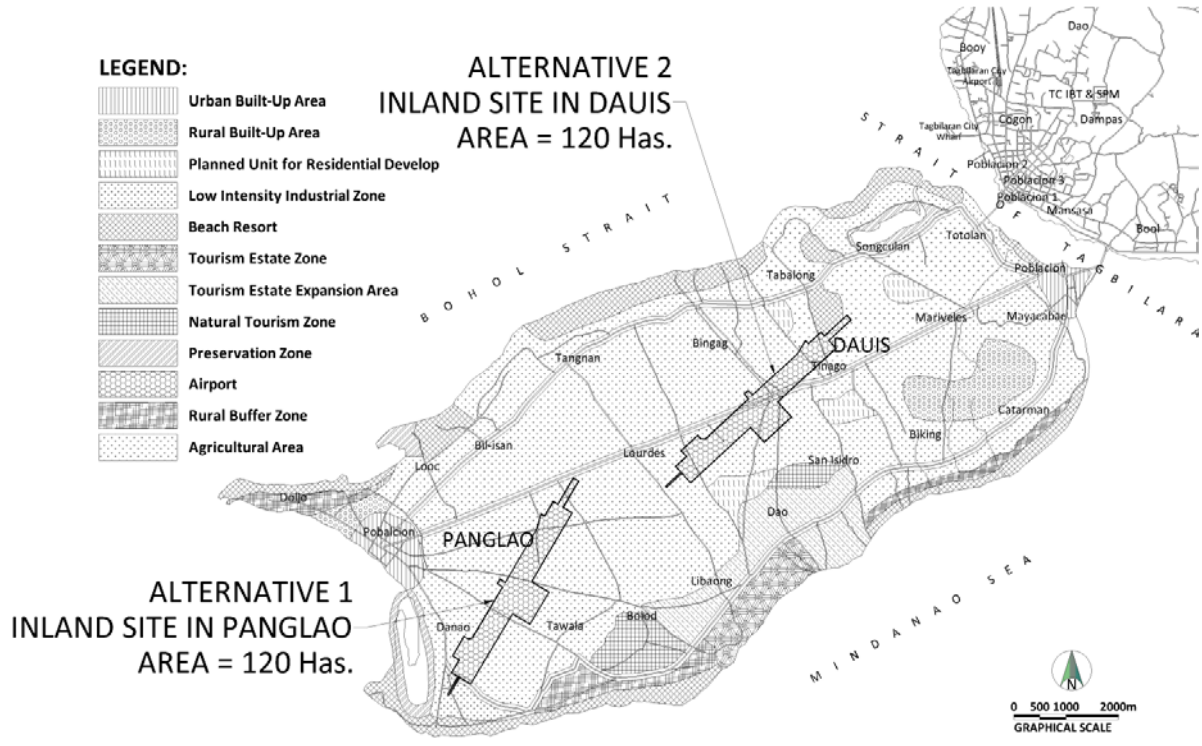
The New Bohol Airport location on Panglao Island was earlier decided during the year 2000 Feasibility Study, for the main reason that mainland Bohol is mountainous and has very few flat areas, where if an airport would be developed, natural topography would project into obstacle limitation surface of the runway.

Panglao Island is located south west of Bohol and elongates along its northeasterly - southwesterly axis. It is separated from mainland Bohol by a shallow 600 m. wide channel; two bridges connect Panglao to mainland Bohol.

The Island is monotonously flat interrupted by two low hills located at the northeastern end (Dayao and Bicag Hills, Dauis) and along southeastern side (Bolod Hill, Barangay Tawala). The average elevation of the island is 15 to 20 m. above MSL. The apex of Bicag Hill has the highest elevation with a peak height of 184 m. above MSL.

The Island is made up of coralline limestone. Being highly soluble even in slightly-acidic water, the limestone terrain is characterized by solution cavities which range in varying dimensions from fractures of few centimeters to caves and sinkholes. Another characteristic of the limestone terrain is the absence of a surface drainage system; instead surface run-off is diverted to subterranean drainage ways.

Panglao Island was a logical alternative site and the municipalities of Dauis and Panglao had been earmarked as the possible alternative sites, as shown in Figure 2.4-1.



Source: JICA Study Team

Figure 2.4-1 Alternative Sites for New Bohol Airport (in 2000 FS)

Alternative 1 (Panglao Site) was selected through evaluation mainly as shown in Table 2.4-1.

Table 2.4-1 Evaluation of Alternative Construction Sites

Item	Alternative 1 - Panglao Site	Alternative 2 - Dauis Site
General	In Barangays Bolod and Tawala. The land is flat and predominantly agricultural and rural in character.	In Barangays Tabalong, Tinago and Bingag. The land is undulated in northern part, undeveloped with marginal agriculture and coconut plantation.
Distance from Tagbilaran city	15 km, 20-30 minutes by car	8 km; 15-20 minutes by car
Airspace	Approach/departure for either direction has no obstruction. The site is within the outer horizon surface of Tagbilaran.	Direction is toward Tagbilaran Airport. Low hills exist at 2.5km east that may protrude into the inner horizontal surface. The site is within the conical surface of Tagbilaran.
Wind Coverage	Both Alternatives suite against prevailing wind direction which is northeast (NE). Wind coverage is 99.79% and cross wind is 5 miles per hour.	
Social Environment	No diversion is necessary.	Paved spine road (highway) and power line must be diverted.
Natural Environment	Adverse impacts on natural environment on both alternatives will be little.	
Pollution	The aircraft noise problem will be minimal if land use surrounding the new airport is appropriately controlled in the future. Noise modeling study conducted by the Consultant shows that noise generated by airport operations will be within a tolerable limit.	
Resident perception	Local residents are aware of the project benefits and possible livelihood opportunities. 40% of Panglao site was acquired in 2000, while no acquisition was made in Dauis.	
Conclusion	Recommended	Not recommended

Source: JICA Study Team

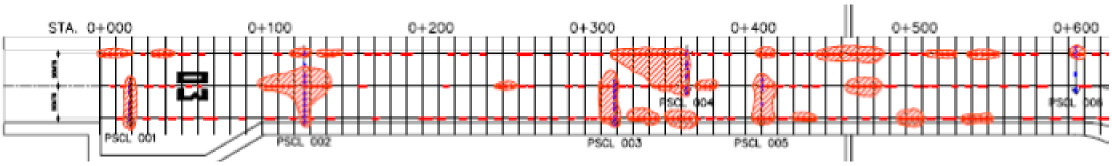
2.4.2. Geological Conditions

The project site is situated at 6 to 8 m. above mean sea level, and underlain by Late Oligocene to Middle Miocene sediments and volcanic, mainly marine sandstone, shale and reef limestone; with some conglomerate, coal measure and marine and elastic-basaltic pyroclastic and lavas. A thick layer of coralline limestone underlain by thin layer of mostly medium plastic stiff to hard brown sandy elastic silt at the surface are the prevalent soil-rock formation as evidenced through the boreholes and test pits conducted. Information obtained from exploratory boreholes and test pits indicate that the site area is mostly consisting of cohesive deposits on top and under laying rock formations.

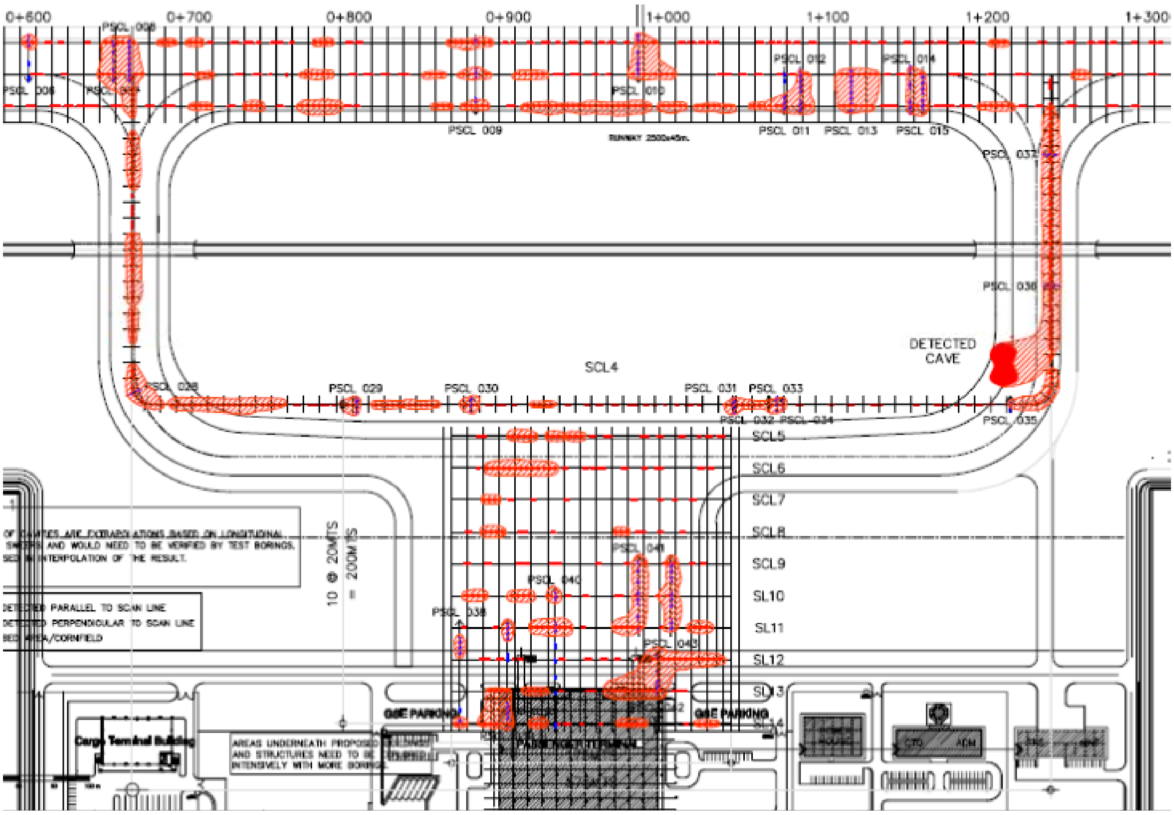
1) Geological Survey and Investigation

Ground Penetration Radar (GPR) survey was conducted in 2009, and there were numerous potential cavities found in the ground as shown in Figure 2.4-2.

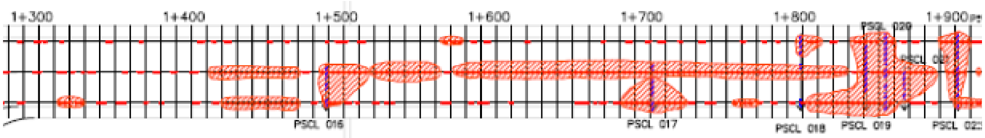
Runway STA 0-60 to STA 0+600



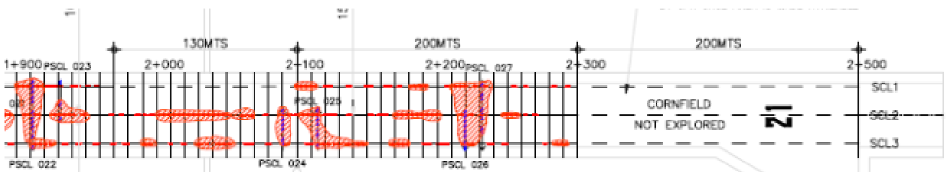
Runway STA + 600 to STA 1+300



Runway STA 1+300 to STA 1+900



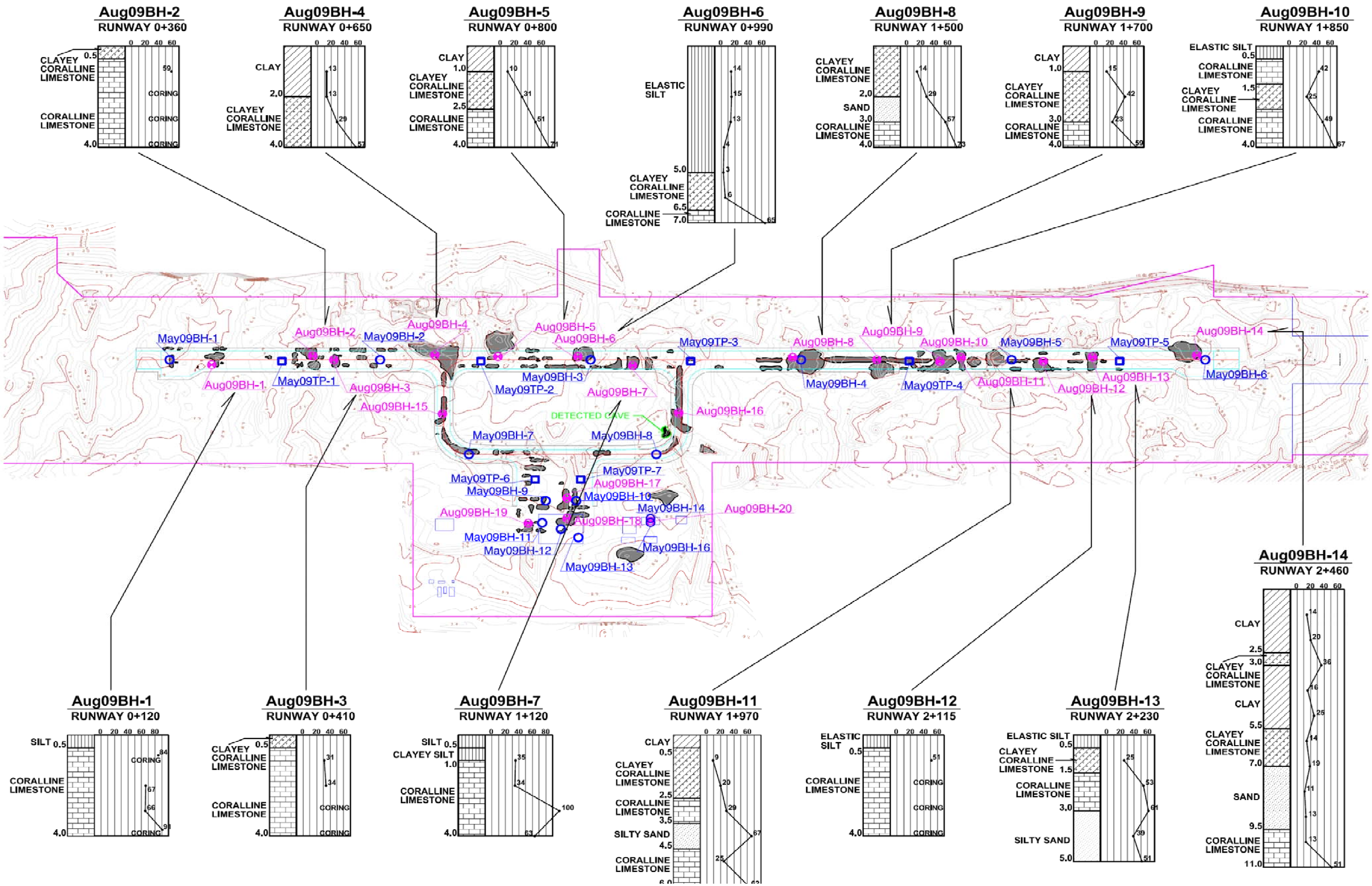
Runway STA 1+900 to STA 2+560



Source: JICA Study Team

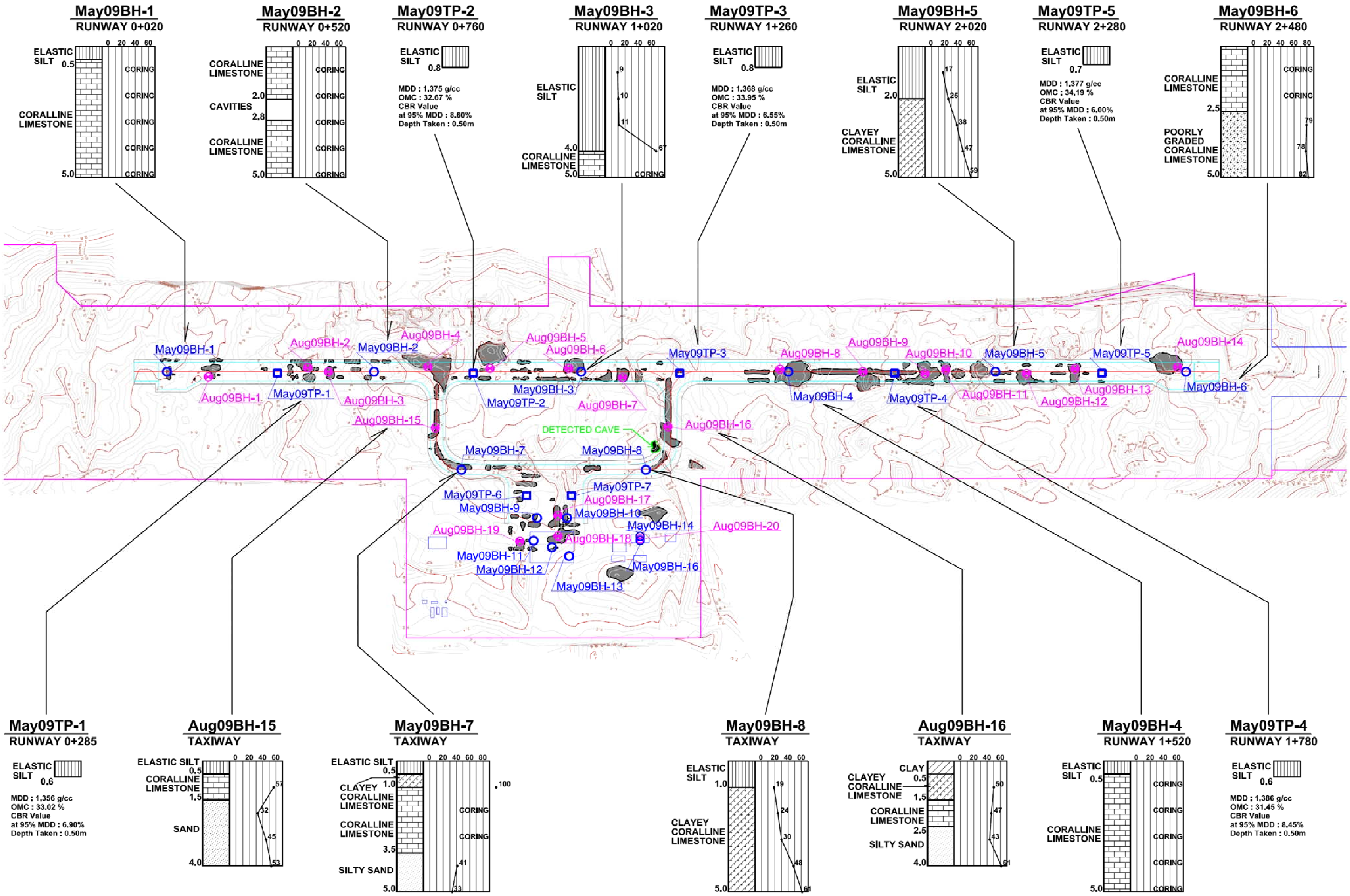
Figure 2.4-2 Potential Cavity suspected through GPR Survey

In line with the GPR survey, Geological Investigations by means of Borehole (BH) and Test Pits were implemented, locations and logs of which are summarized as shown in Figures 2.4-3 (1) to (3), with the runway centerline profile as shown in Figures 2.4-4 (1) to (4).



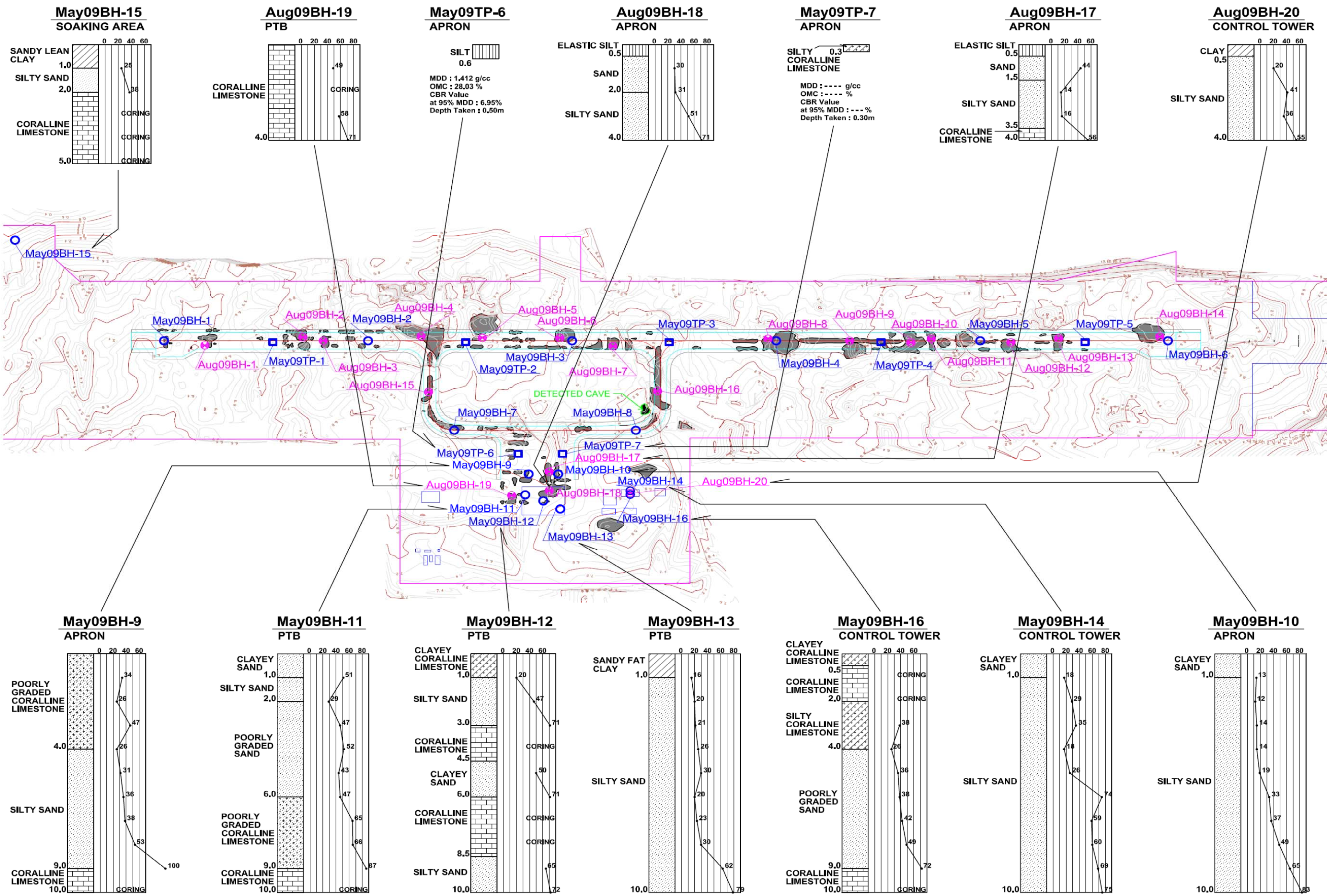
Source: JICA Study Team

Figure 2.4-3 (1) Boreholes and Test Pits investigated in August 2009 along Proposed Runway



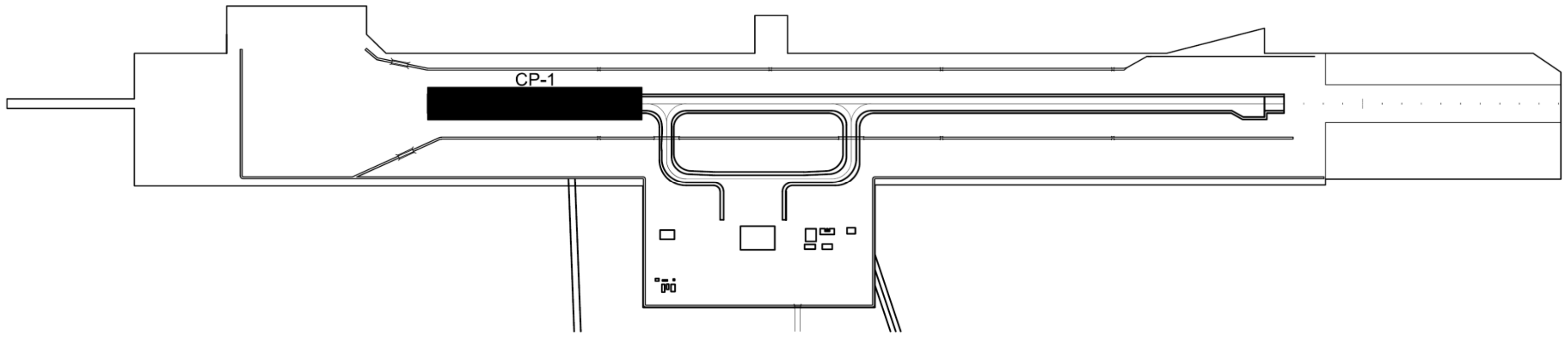
Source: JICA Study Team

Figure 2.4-3 (2) Boreholes and Test Pits investigated in May & August 2009 along Runway & Taxiways

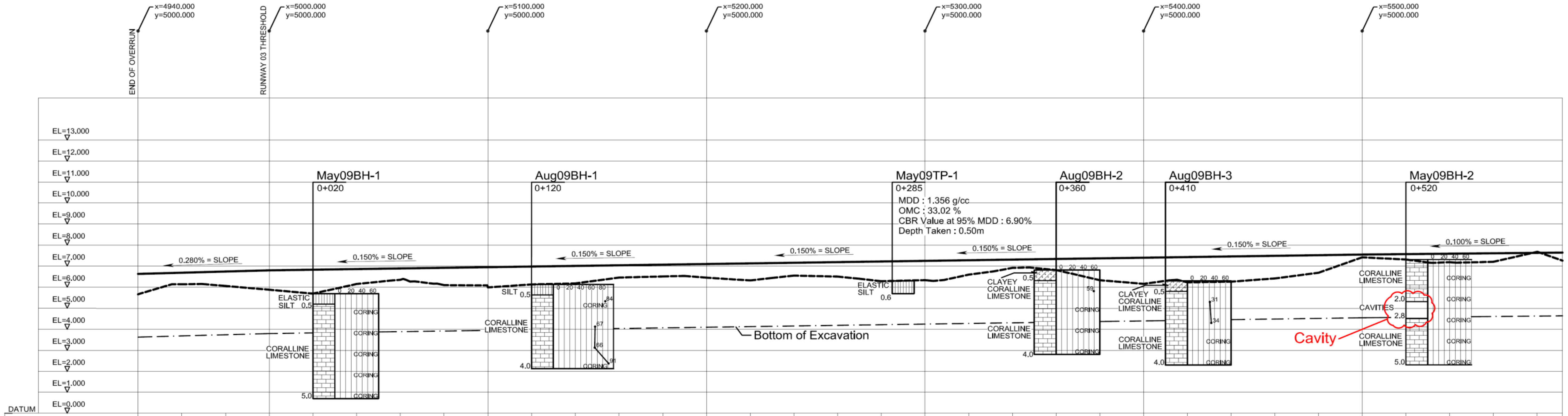


Source: JICA Study Team

Figure 2.4-3 (3) Boreholes and Test Pits investigated in May & August 2009 at Terminal Area



1 AIRSIDE KEYPLAN
SCALE 1:20000 MM.



STATION	0-060.000	0-040.000	0-020.000	0+000.000	0+020.000	0+040.000	0+060.000	0+080.000	0+100.000	0+120.000	0+140.000	0+160.000	0+180.000	0+200.000	0+220.000	0+240.000	0+260.000
DESIGN CENTERLINE ELEVATION	6.632	7.688	6.744	6.800	6.830	6.860	6.890	6.920	6.950	6.980	7.010	7.040	7.070	7.100	7.130	7.160	7.190
ORIGINAL GROUND CENTERLINE ELEVATION	5.665	6.140	6.059	5.881	5.697	6.152	6.354	6.099	6.015	6.131	6.180	6.458	6.511	6.456	6.321	6.552	6.503
HEIGHT	0.967	0.548	0.685	0.919	1.133	0.708	0.536	0.821	0.935	0.849	0.830	0.582	0.559	0.644	0.809	0.608	0.687

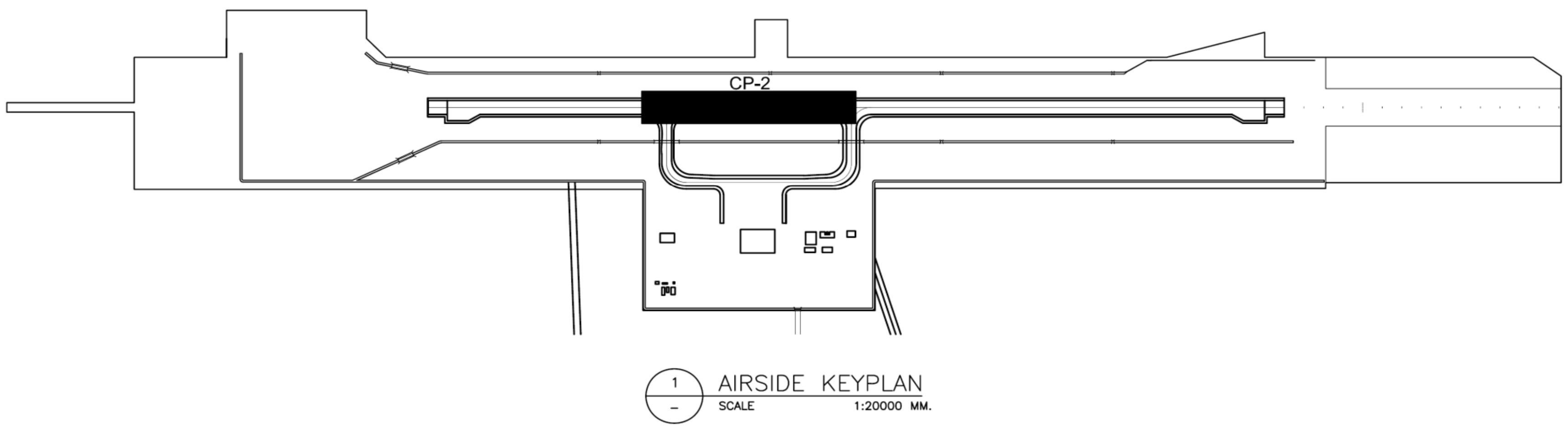
STATION	0+280.000	0+300.000	0+320.000	0+340.000	0+360.000	0+380.000	0+400.000	0+420.000	0+440.000	0+460.000	0+480.000	0+500.000	0+520.000	0+540.000	0+560.000	0+580.000
DESIGN CENTERLINE ELEVATION	7.220	7.250	7.280	7.310	7.340	7.370	7.400	7.430	7.460	7.490	7.520	7.550	7.570	7.590	7.610	7.630
ORIGINAL GROUND CENTERLINE ELEVATION	6.283	6.337	6.597	6.918	6.815	6.334	6.160	6.231	6.263	6.416	6.688	7.418	7.315	7.186	7.207	7.678
HEIGHT	0.937	0.913	0.683	0.392	0.525	1.036	1.240	1.199	1.197	1.074	0.832	0.132	0.255	0.404	0.403	-0.048

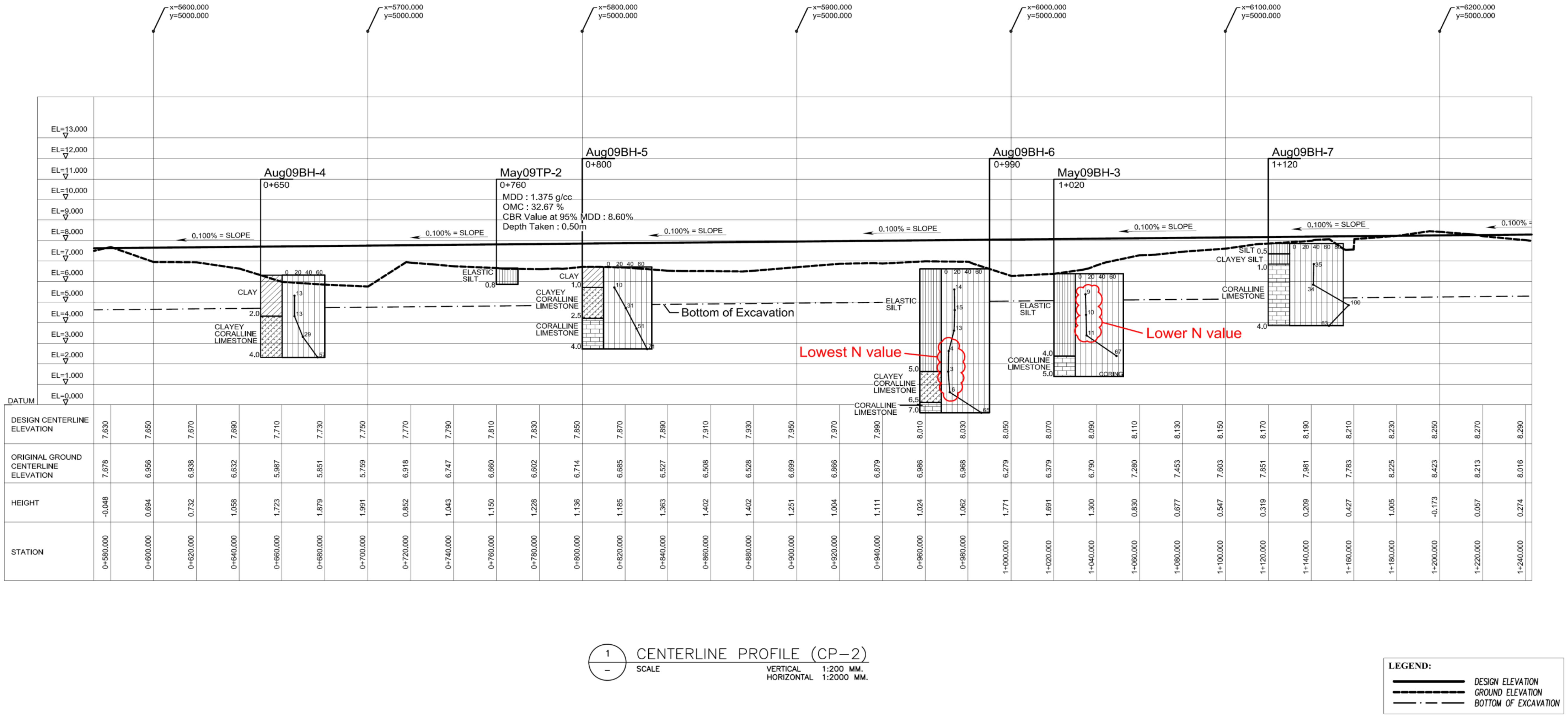
1 CENTERLINE PROFILE (CP-1)
SCALE VERTICAL 1:200 MM. HORIZONTAL 1:2000 MM.

LEGEND:
DESIGN ELEVATION
GROUND ELEVATION
BOTTOM OF EXCAVATION

Source: JICA Study Team

Figure 2.4-4 (1) Runway Centerline Profile with Borehole and Test Pit logs – 1st quarter (sta. –60 m - 600 m)



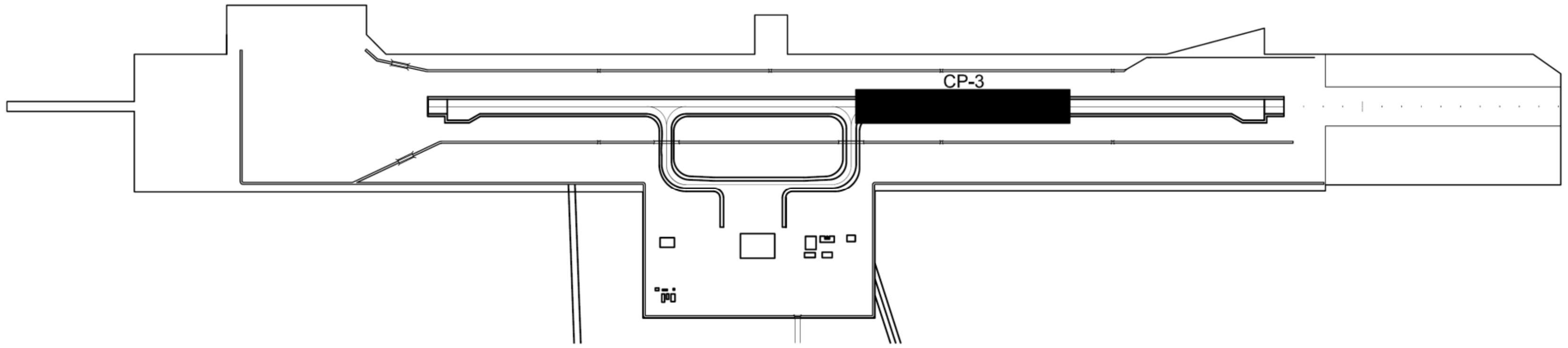


STATION	0+580.000	0+600.000	0+620.000	0+640.000	0+660.000	0+680.000	0+700.000	0+720.000	0+740.000	0+760.000	0+780.000	0+800.000	0+820.000	0+840.000	0+860.000	0+880.000	0+900.000
DESIGN CENTERLINE ELEVATION	7.630	7.650	7.670	7.690	7.710	7.730	7.750	7.770	7.790	7.810	7.830	7.850	7.870	7.890	7.910	7.930	7.950
ORIGINAL GROUND CENTERLINE ELEVATION	7.678	6.956	6.938	6.632	5.987	5.851	5.759	6.918	6.747	6.660	6.602	6.714	6.685	6.527	6.508	6.528	6.699
HEIGHT	-0.048	0.694	0.732	1.058	1.723	1.879	1.991	0.852	1.043	1.150	1.228	1.136	1.185	1.363	1.402	1.402	1.251

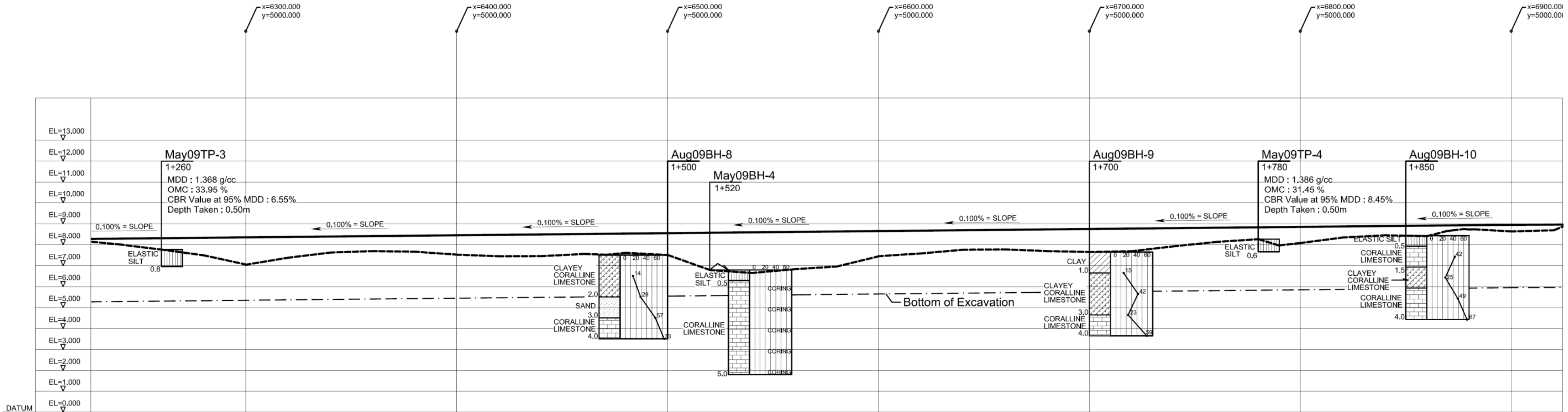
STATION	0+920.000	0+940.000	0+960.000	0+980.000	1+000.000	1+020.000	1+040.000	1+060.000	1+080.000	1+100.000	1+120.000	1+140.000	1+160.000	1+180.000	1+200.000	1+220.000	1+240.000
DESIGN CENTERLINE ELEVATION	7.970	7.990	8.010	8.030	8.050	8.070	8.090	8.110	8.130	8.150	8.170	8.190	8.210	8.230	8.250	8.270	8.290
ORIGINAL GROUND CENTERLINE ELEVATION	6.866	6.879	6.986	6.968	6.279	6.379	6.790	7.280	7.453	7.603	7.851	7.981	7.783	8.225	8.423	8.213	8.016
HEIGHT	1.004	1.111	1.024	1.062	1.771	1.691	1.300	0.830	0.677	0.547	0.319	0.209	0.427	1.005	-0.173	0.057	0.274

Source: JICA Study Team

Figure 2.4-4 (2) Runway Centerline Profile with Borehole and Test Pit logs – 2nd quarter (sta. 600 m - 1,200 m)



1 AIRSIDE KEYPLAN
SCALE 1:20000 MM.



DESIGN CENTERLINE ELEVATION	8.290	8.310	8.330	8.350	8.370	8.390	8.410	8.430	8.450	8.470	8.490	8.510	8.530	8.550	8.570	8.590	8.610	8.630
ORIGINAL GROUND CENTERLINE ELEVATION	8.016	7.768	7.497	7.057	7.379	7.626	7.694	7.668	7.528	7.450	7.457	7.557	7.614	7.510	6.795	6.655	6.831	6.961
HEIGHT	0.274	0.542	0.833	1.293	0.991	0.764	0.716	0.762	0.922	1.020	1.033	0.953	0.916	1.040	1.775	1.935	1.779	1.669
STATION	1+240.000	1+260.000	1+280.000	1+300.000	1+320.000	1+340.000	1+360.000	1+380.000	1+400.000	1+420.000	1+440.000	1+460.000	1+480.000	1+500.000	1+520.000	1+540.000	1+560.000	1+580.000

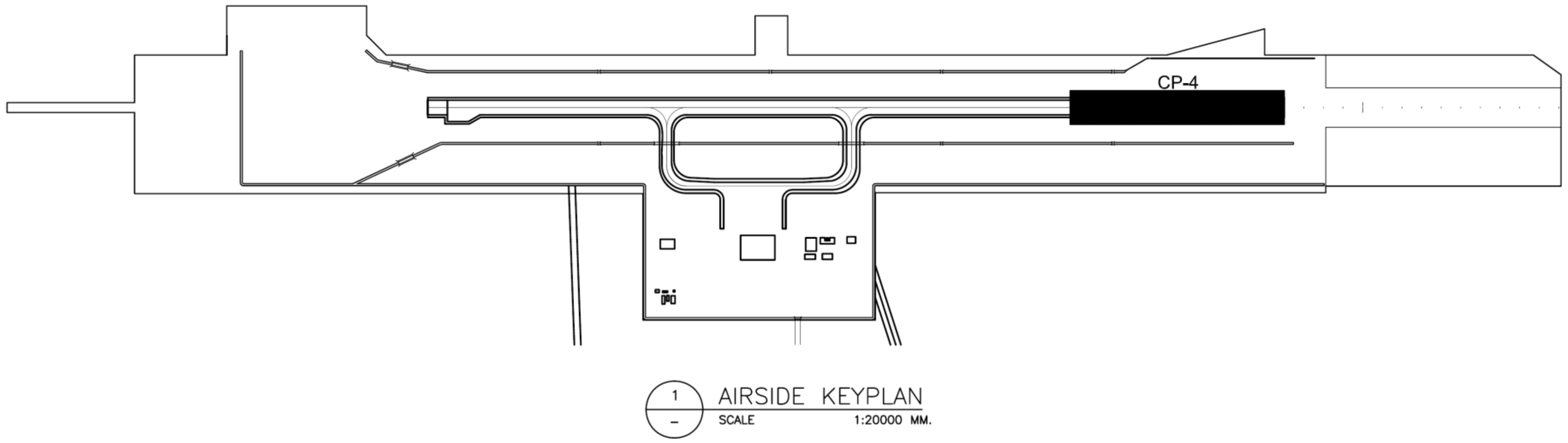
DESIGN CENTERLINE ELEVATION	8.650	8.670	8.690	8.710	8.730	8.750	8.770	8.790	8.810	8.830	8.850	8.870	8.890	8.910	8.930	8.950	8.960
ORIGINAL GROUND CENTERLINE ELEVATION	7.446	7.585	7.759	7.776	7.697	7.652	7.692	7.924	8.132	8.265	8.082	8.342	8.450	8.412	8.729	8.635	8.690
HEIGHT	1.204	1.085	0.931	0.934	1.033	1.098	1.078	0.866	0.678	0.565	0.768	0.528	0.440	0.498	0.201	0.315	0.270
STATION	1+600.000	1+620.000	1+640.000	1+660.000	1+680.000	1+700.000	1+720.000	1+740.000	1+760.000	1+780.000	1+800.000	1+820.000	1+840.000	1+860.000	1+880.000	1+900.000	1+920.000

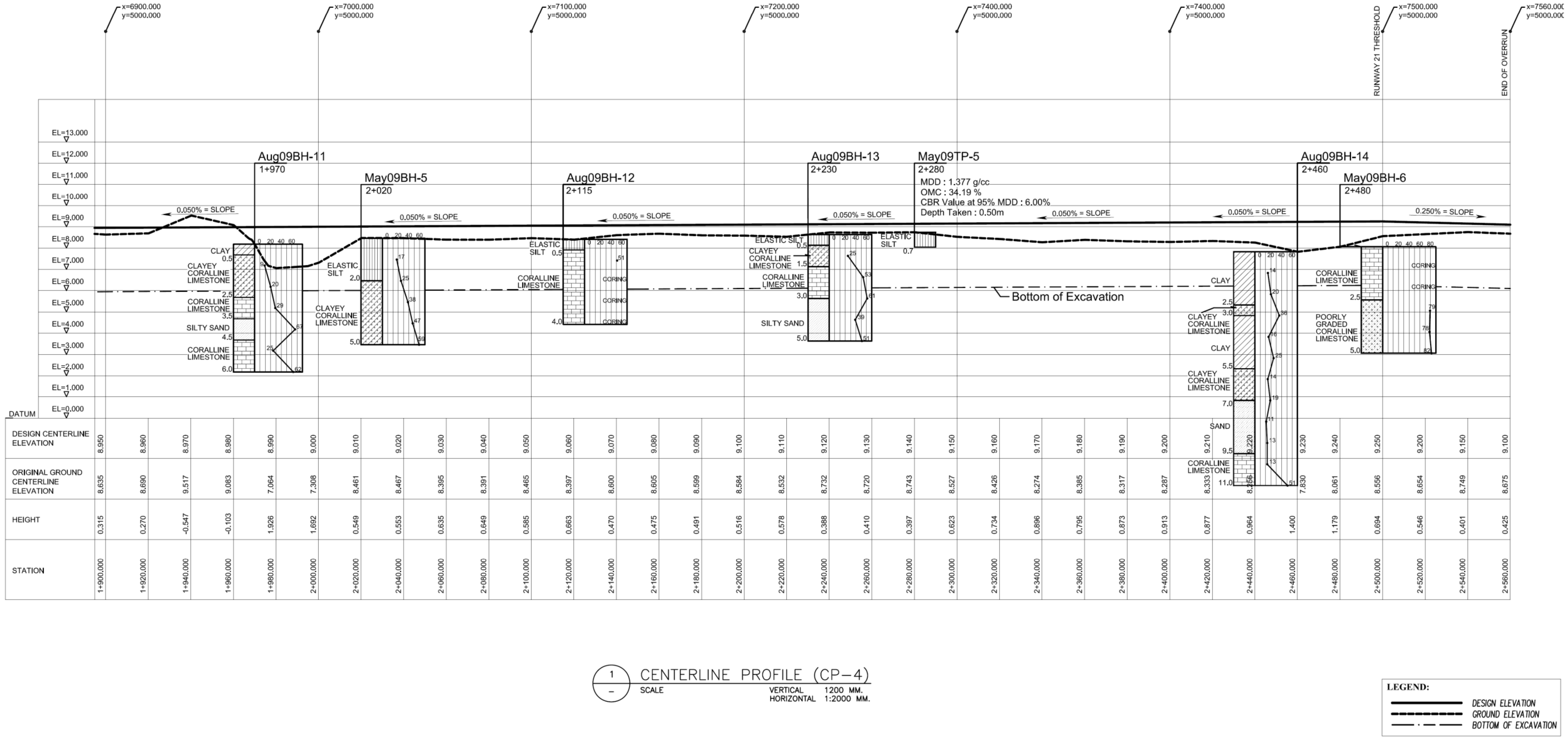
1 CENTERLINE PROFILE (CP-3)
SCALE VERTICAL 1:200 MM. HORIZONTAL 1:2000 MM.

LEGEND:
DESIGN ELEVATION
GROUND ELEVATION
BOTTOM OF EXCAVATION

Source: JICA Study Team

Figure 2.4-4 (3) Runway Centerline Profile with Borehole and Test Pit logs – 3rd quarter (sta. 1,200 m - 1,900 m)





Source: JICA Study Team

Figure 2.4-4 (4) Runway Centerline Profile with Borehole and Test Pit logs – 4th quarter (sta. 1,900 m - 2,560 m)

2) Characteristics of Subsoil

Characteristics of Boreholes are described as follows:

May 09 BH-1: 5 meters deep; Ground water table (GWT) was not detected.
Brown elastic silt was found as surface soil at 0.00-0.50 meter, underlain by dirty white to light brown porous Coralline LIMESTONE at 0.50 to 5.0 meters deep.

May 09 BH-2: 5 meters deep; Ground water table (GWT) was not detected.
A rock formation was encountered as dirty white moderately to highly weathered, porous, and fragmented to generally broken Coralline LIMESTONE from 0.00 to 5.0 meters deep, the extent of the borehole. Cavities were detected at 2.50 meters deep.

May 09 BH-3: 5 meters; Ground water table (GWT) was not detected.
Stiff brown elastic silt at 0-2 meters, hard brown sandy elastic silt at 2-4 meters, rock as dirty white to light brown generally broken moderately weathered Coralline LIMESTONE were encountered at 4-5 meters.

May 09 BH-4: 5 meters deep
Brown elastic silt was found as surface soil at 0.00-0.50 meter, underlain by dirty white to light brown highly weathered, porous, highly fractured Coralline LIMESTONE at 0.50 to 5.0 meters deep.

May 09 BH-5: 5 meters deep; Ground water table (GWT) was not detected.
Very stiff brown elastic silt at 0-1 meter, very stiff light brown to dirty white sandy elastic silt at 1-2 meters, dense to very dense dirty white light brown clayey coralline LIMESTONE fragments were encountered at 2-5 meters.

May 09 BH-6: 5 meters deep; Ground water table (GWT) was not detected.
Dirty white highly weathered massive, porous, generally broken Coralline LIMESTONE at 0-2.5 meters were detected underlain by very dense dirty white poorly graded coralline LIMESTONE fragments at 2.5-5 meters.

May 09 BH-7: 5 meters deep; Ground water table (GWT) was not detected.
Dark brown elastic silt found as surface soil at 0.00-0.50 meter, very dense dirty white, brown clayey coralline LIMESTONE fragments at 0.50-1.10 meters, dirty white to light brown moderately to highly weathered coralline LIMESTONE at 1.10-3.50 meters, dense dirty white silty SANDS at 3.5-5 meters.

May 09 BH-8: 5 meters deep; Ground water table (GWT) was not detected.
Very stiff dark brown sandy elastic silt at 0-1 meter, medium dense to dense brown to light brown clayey coralline LIMESTONE fragments at 1-4 meters, very dense light brown, dirty white clayey coralline LIMESTONE fragments at 4-5 meters.

May 09 BH-9: 10 meters; Ground water table (GWT) was not detected.
Dense to medium dense dirty white poorly graded coralline LIMESTONE fragments at 0-4 meters, dense to very dense dirty white silty SANDS at 4-9 meters, dirty white moderately weathered massive, porous, generally broken coralline LIMESTONE were encountered at 9-10 meters.

May 09 BH-10: 10 meters deep
Medium dense light white clayey SANDS with coralline limestone fragments at 0-1 meter, medium dense dirty white, light brown silty SANDS with little amount of coralline fragments, at 1-5 meters, dense dirty white silty SANDS with little amount of coralline fragments at 5-9 meters, very dense dirty white silty SANDS with little amount of coralline fragments at 9-10 meters.

May 09 BH-11: 10 meters deep
Very dense dirty white clayey SANDS at 0-1 meter, medium dense dirty white silty SANDS at 1-2 meters, dense light brown poorly graded SANDS at 2-3 meters, very dense light brown poorly graded SANDS at 3-4 meters, dense light brown poorly graded SANDS at 4-6 meters, very dense light brown to dirty white poorly graded coralline LIMESTONE fragments at 6-9 meters, light brown to dirty white porous, highly fractured coralline LIMESTONE were encountered at 9-10 meters.

May 09 BH-12: 10 meters deep
Medium dense yellowish light brown clayey coralline LIMESTONE fragments at 0-1 meter, dense to very dense light brown silty SANDS at 1-3 meters, dirty white to light brown porous, coralline LIMESTONE at 3-4.3 meters, dense to very dense brown clayey SANDS at 4.3-6 meters, dirty white to light brown coralline LIMESTONE at 6-8.5 meters, very dense yellowish light brown silty SANDS at 8.5-10 meters.

May 09 BH-13: 10 meters deep
Very stiff brown sandy fat CLAYS at 0-1 meter, medium dense dirty white silty SANDS with some amount of coralline limestone fragments at 1-4 meters, medium dense to dense dirty white silty SANDS with little amount of coralline limestone fragments at 4-8 meters, very dense dirty white silty SANDS with little amount of coralline fragments at 8-10 meters.

May 09 BH-14: 10 meters deep
Medium dense brown dirty white clayey SANDS at 0-1 meter, medium dense dirty white silty SANDS with little amount of coralline limestone fragments at 1-2 meters, dense dirty white silty SANDS at 2-3 meters, medium dense dirty white silty SANDS at 3-5 meters, very dense dirty white silty SANDS at 5-10 meters.

May 09 BH-15: 5 meters deep at proposed Soaking Yard
Very stiff dark brown sandy lean CLAYS at 0-1 meter, dense light brown silty SANDS with some amount of coralline limestone fragments at 1-2 meters, dirty white to light brown highly weathered, porous, highly fractured coralline LIMESTONE at 2-5 meters.

May 09 BH-16: 10 meters deep; Ground water table (GWT) was not detected.
Dark brown clayey coralline LIMESTONE fragments at 0.0-0.50 meter, dirty white to light brown porous, fragmented coralline LIMESTONE at 0.50-2 meters, dense to medium dense dirty white silty coralline LIMESTONE fragments at 2-4 meters, dense grayish white poorly graded SANDS with silts at 4-8 meters, very dense grayish white poorly graded SANDS with silts at 4-8 meters, very dense grayish white poorly graded SANDS at 8-9 meters, dirty white highly weathered porous, highly fractured coralline LIMESTONE at 9-10 meters.

Aug 09 BH-1: 4 meters deep
Brown silt with coralline limestone fragments as surface soil at 0.00-0.55 meter, underlain by dirty white to light brown coralline limestone fragments at depth 0.55 – 4.00 meter.

Aug 09 BH-2: 4 meters deep
Dirty white with brown clayey coralline limestone fragments at depth 0.00-0.55 meter, followed with dirty white to light brown coralline limestone fragments at 0.55-1.00 meter, underlain by dirty white, porous, fragmented, moderate to highly fractured coralline limestone to depth 4.0 meters.

Aug 09 BH-3: 4 meters deep
Dirty white with brown clayey coralline limestone fragments at depth 0.00-0.55 meter, underlain by dirty white to light brown coralline limestone fragments from 0.55-2.00 meters and dirty white porous, fragmented to generally broken, moderate to highly fractured coralline limestone at depth 2.00-4.00 meter.

Aug 09 BH-4: 4 meters deep
Brown clay with traces of roots at depth 0.00-0.55 meter, followed by brown clay with coralline limestone fragments from 0.55-2.00 meters, underlain with light brown to dirty white clayey coralline limestone fragments, at 2.00-4.00 meters deep.

Aug 09 BH-5: 4 meters deep
Brown clay with traces of coralline limestone fragments from 0.00-1.00 meter depth and dirty white to light brown clayey coralline limestone fragments from 1.00-2.55 meters, underlain by dirty white to light brown coralline limestone fragments at depth 2.55-4.00 meters.

Aug 09 BH-6: 7 meters deep
Dark brown to reddish brown elastic silt from 0.00-3.55 meters depth, followed by brown elastic silt with coralline limestone fragments at depth 3.55-5.00 meters, underlain by dirty white with brown clayey coralline limestone fragments at depth 5.00-6.55 meters and dirty white coralline limestone fragments, occupying rest of the depth of borehole. Relatively low N-values were detected between 3m to 6m below the ground, where original cavity was supposed to be filled up with soil by storm-water.

Aug 09 BH-7: 4 meters deep
From 0.00-0.55 meters depth, brown silt was encountered. Brown clayey silt with coralline limestone fragments at depth 0.55-1.00 meter, followed by dirty white coralline limestone fragments from 1.00-2.70 meters and dirty white to light brown highly fractured, fragmented to generally broken coralline limestone fragments from depth 2.70-4.00 meters.

Aug 09BH-8: 4 meters deep
Dirty white with brown clayey coralline limestone fragments from 0.00-2.00 meters depth, underlain by dirty white to light brown sand with coralline limestone fragments at depth 2.00-3.00 meters and dirty white to light brown coralline limestone fragments encountered at depth 3.00-4.00 meters.

Aug 09 BH-9: 4 meters deep
Brown clay with coralline limestone fragments is generally encountered at depth 0.00-1.00 meter and a dirty white with brown clayey coralline limestone fragments at depth 1.00-3.00 meters, followed by dirty white to light brown coralline limestone fragments from depth 3.00-4.00 meters.

Aug 09 BH-10: 4 meters deep
Dirty white to brown elastic silt with coralline limestone fragments at depth 0.00-0.55 meters, dirty white to light brown coralline limestone fragments from 0.55-1.55 meters and from 1.55-2.55 meters depth, a dirty white to light brown clayey coralline limestone fragments was recorded. Dirty white to light brown coralline limestone fragments was encountered at depth 2.55-4.00 meters.

Aug 09 BH-11: 6 meters deep
Dark brown clay with traces of roots at depth 0.00-0.55 meters, while dirty white with brown clayey coralline limestone fragments were detected at depth 0.55-2.55 meters. Dirty white to light brown coralline limestone fragments are encountered at depth 2.55-3.55 meters, underlain by dirty white to light brown silty sand with coralline limestone fragments from 3.55-4.55 meters, and from 4.55-6.00 meters, a dirty white to light brown coralline limestone fragments was detected.

Aug 09 BH-12: 4 meters deep
Brown elastic silt with traces of roots at depth 0.00-0.55 meter, underlain by dirty white to light brown coralline limestone fragments from 0.55-1.00 meter, and dirty white, fragmented, slightly fractured limestone recorded at depth 1.00-4.00 meters.

Aug 09 BH-13: 5 meters deep
Brown elastic silt with traces of roots at depth 0.00-0.55 meter, dirty white with brown clayey coralline limestone fragments at depth 0.55-1.55 meters. From 1.55-3.00 meters depth, a dirty white porous, fractured, fragmented to generally broken coralline limestone was recorded, and dirty white silty sand with coralline limestone fragments is encountered at depth 3.00-5.00 meters.

Aug 09 BH-14:11 meters deep
The extent of borehole from depth 0.00-7.00 meters is generally clayey with combination of dirty white to light brown to dark brown coralline limestone fragments. The depth from 7.00-9.55 meters consists of dirty white to light brown sand with coralline limestone fragments and from depth 9.55-11.00 meters, a dirty white coralline limestone fragments was encountered.

Aug 09 BH-15: 4 meters deep
The depth from 0.00-0.55 meter indicated a mottled brown elastic silt with coralline limestone fragments, while from depth 0.55-1.50 it described a dirty white to light brown coralline limestone fragments and porous, highly fractured, fragmented to generally broken limestone. The extent of the borehole from 1.50-4.00 meters consists of dirty white to light brown sand with coralline limestone fragments.

Aug 09 BH-16: 4 meters deep
Dirty white to light brown clay with coralline limestone fragments at depth 0.00-0.55 meters, while from depth 0.55-1.55 meters indicated a dirty white to brown clayey coralline limestone fragments. The depth from 1.55-2.55 meters basically indicated to contain dirty white porous, highly fractured, fragmented to generally broken coralline limestone. Dirty white silty sand with coralline limestone fragments are encountered at depth 2.55-4.00 meters.

Aug 09 BH-17: 4 meters deep
Brown elastic silt with traces of roots at depth 0.00-0.55 meters, while from depth 0.55-1.55 meters a dirty white to light brown sand with coralline limestone fragments. Dirty white silty sand with coralline limestone fragments are found at depth 1.55-4.00 meters.

Aug 09 BH-18: 4 meters deep
Brown elastic silt with traces of roots and coralline limestone fragments at depth 0.00-0.55. Depth 0.55-2.00 meters contain dirty white to light brown sand with coralline limestone fragments, while the rest from 2.00-4.00 meters indicated a dirty white silty sand with coralline limestone fragments.

Aug 09 BH-19: 4 meters deep
Dark to light brown coralline limestone fragments at depth 0.00-1.00 meter and while from depth 1.00-4.00 meters indicated to contain a dirty white coralline limestone fragments.

Aug 09 BH-20: 4 meters deep
Dark brown clay with coralline limestone fragments at 0.00-0.55 meter while from 0.55-4.00 meters depth, indicated a dark brown, dirty white and yellowish white silty sand with coralline limestone fragments.

3) Conclusion

In conclusion, only one (1) 80-cm deep cavity was detected at an elevation of 2.5 m below the ground (in the Borehole No. May 09 BH-2) as shown in Figure 2.4-3 (2). This shallow cavity however is situated above the runway subsoil excavation bottom which is eventually filled up by soil and compacted as a part of 2-m high subgrade embankment, which is explained in Figure 2.4-4 (1). Therefore, this cavity would not cause any problem in the runway pavement structure at all.

In the Borehole No. Aug 09 BH-6, a low N-value (of 3 to 6) was detected at an elevation of 4 to 6m below the ground level as shown in Figure 2.4-3 (1). Another relatively lower N-Value (of 9 to 11) was detected at an elevation of 1 to 3 m below the ground level (in the Borehole No. May 09 BH-3) as shown in Figure 2.4-3 (2). At the both Boreholes, ground water table was not found, therefore the subsoil below is permeable and not saturated by water.

Such lower N-values were explained by geological specialist that even if the location had originally been likely an cavity, it was already filled up with soil by storm-water penetration. As shown in Figure 2.4-4 (2) those 2 lower N-value strata are located below the excavation bottom which should be earmarked as the potential location of weak subsoil where soil stabilization may be necessary later before subgrade construction is commenced.

With the exception of the three (3) Boreholes mentioned above, subsoil below the bottom of runway subgrade excavation level are generally covered by durable coralline limestone strata, similar to Mactan International Airport, and in some part are elastic silt or silty sand with the N-values of more than 15, which is equivalent to or more than the geological conditions at Narita Airport and its surroundings.

4) Engineering Solution

The Table 2.4-2 gives general relationship between N-value and subsoil bearing strength.

Table 2.4-2 General relationship between N-value and subsoil bearing strength

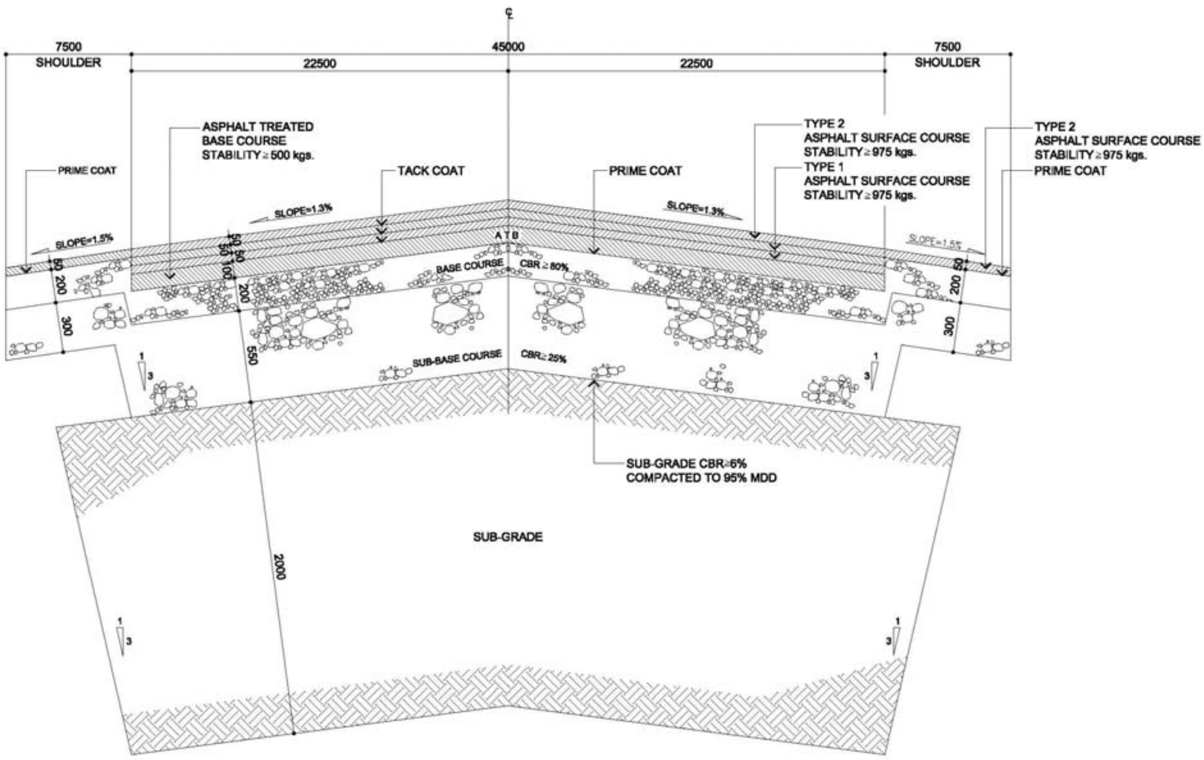
Classification of Soil		Bearing Strength （t/m2)	N value
Sand	dense	30	30～50
	medium	20	20～30
		10	10～20
	loose	5	5～10
Clay	dense	10	8～15
	medium	5	4～ 8
	loose	3	2～ 4

Source: JICA Study Team

The Table shows that the subsoil of N-value 15 could generally have its bearing strength of more than 10 tons/m².

Described hereunder is to check whether the subsoil at New Bohol Airport site can sustain the load of the critical aircraft, i.e. B777-300 (i.e. maximum aircraft weight of 280 tons, and maximum main gear load of 22 tons).

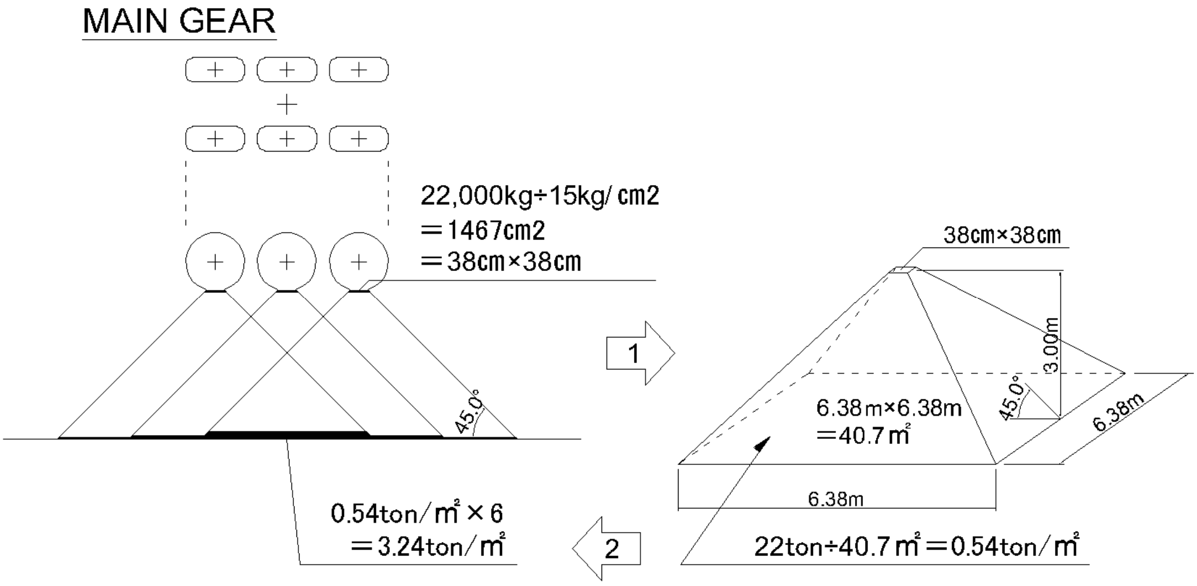
The designed thickness of the runway pavement is 1 m (refer to Chapter 5). Below the pavement structure, a compacted subgrade is necessary. Required thickness of the compacted subggrade is between 1.5 m (FAA standard in case of non-cohesive soil when 90 % compaction degree is achieved) and 2 m (Japanese standard, which is applied in the design on safe side). Therefore, in total 3-m thick pavement structure is considered for evaluation as shown in Figure 2.4-5.



Source: JICA Study Team

Figure 2.4-5 Designed Runway Pavement Structure (Chapter 5)

Philosophy of asphalt pavement design is that the load of main gear is vertically distributed to the depth to the bottom of subgrade with a horizontal distribution of 45-degree below the pavement surface. The main gear of B777-300 consists of 6 tires (dual triple-tandem configuration), and maximum tire pressure of B777 is 15 kg.cm² which requires 38 cm square (1,467 cm²) of the pavement top surface Consequently, the area of the load at the bottom of the 3-m thick pavement structure is 6.38 m square (or 40.7 m²). The load of a main gear at pavement surface is 22 tons (loaded at the surface area of 1,467 cm²) and the same load measured at the bottom of the pavement is 0.54 tons/m² (equally loaded at the area of 40.7 m²). The center of the main gear is affected by the same load of 6 accumulated tires, which is 3.24 tons/m² (i.e. 0.54 tons/m² x 6 tires) in total. This philosophy is explained in Figure 2.4-6:



Source: JICA Study Team

Figure 2.4-6 Philosophy of Design Load for Asphalt Pavement (B777-300)

In conclusion, the subsoil of N-value 15 (bearing strength of more than 10 tons/m^2) can safely sustain the pavement structure with the critical 6 accumulated main-gear load (3.24 tons/m^2 in total) of B777-300.

Several important aspects for engineering practice during detailed design and construction stage are as follows:

a. Airfield earthwork and pavement slope is so designed that any rainfall would not drain into the pavement structure.

b. When cavity is found during the course of earthwork, the cavity should be removed to the bottom irrespective of the designed subgrade thickness.

c. When excavation of the subgrade is completed, the entire subgrade bottom should be investigated once again (by means of Ground Penetration Radar and Confirmatory Boreholes).

d. Suspected cavity underneath should be excavated and if found, be filled up by lean concrete.

e. Suspected weak soil underneath, if found, should be replaced with a good soil as much as possible, or grouted or covered by concrete slabs when necessary, subject to further Engineers' solution.

Chapter 3

Air Traffic Demand Forecast

Table of Contents

Chapter 3. Air Traffic Demand Forecast

3.1. Preamble

Air traffic demand at the existing Tagbilaran Airport has been dramatically increasing with an average annual growth of more than 30% for the past decade, particularly after the runway was extended from 1,483 m. to 1,779 m. in 2002, when flight services of A319/A320 class (140-180 seats) were able to commence. Filipino passengers kept increasing because of high competition of services among four (4) domestic Airlines, attractive LCC's promo airfare, frequency and higher safety of 80-minutes air services from Manila in comparison with 30-hour travel by ship/ferry,. Also, foreign tourists from foreign countries (e.g. Chinese, Taiwanese, European, American, Korean, others) have been rapidly increasing owing to abundant tourism resources and famous heritage.

The number of air passengers in 2010 of 572 thousand has already exceeded the High Case scenario forecasted merely 3 years ago, i.e. in the 2007 Feasibility Study (i.e. 447 thousand in Medium Case scenario, or even 535 thousand in High Case scenario).

Aside from 573 thousand passengers at Tagbilaran Airport, another 3,593 passengers made use of five (5) major seaports (i.e. at Tagbilaran, Janga, Talibon, Tubigon and Ubay) at Bohol in 2010. The most numbers of seaport passengers recorded are 1,673 passengers at Tagbilaran port, where daily fifteen (15) round trips of speed boats are scheduled between Cebu and Tagbilaran, The next busy seaport is Tubigon seaport where over 1 million passengers have availed in 2010.

Past record for sea and air passengers from 2005 to 2010 are shown in Table 3.1-1. The record revealed that air passengers are constantly increasing, while sea passengers are rather stable within the range between 3 and 3.5 million. Share of air passengers has increased from 5 % in 2005 to 14 % in 2010 of the total sea and air passengers.

Table 3.1-1 Past Numbers of Air and Sea Passengers at Bohol

('000)

CY	(1) Sea Passengers		(2) Air Passengers			(3) Total	
	Passengers	Growth Rate	Passengers	Growth Rate	(2) / (3)	Passengers	Growth Rate
2005	3,677.9	-	196.7	-	5.1%	3,874.6	-
2006	2,990.3	-18.7%	240.2	22.1%	7.4%	3,230.5	-16.6%
2007	3,325.9	11.2%	344.1	43.3%	9.4%	3,669.9	13.6%
2008	3,278.2	-1.4%	398.7	15.9%	10.8%	3,676.8	0.2%
2009	3,313.7	1.1%	561.8	40.9%	14.5%	3,875.5	5.4%
2010	3,592.9	8.4%	572.5	1.9%	13.7%	4,165.4	7.5%

Source: JICA Study Team

Although the precise record for origin and destination of sea passengers is not available, most of sea passengers are traveling to/from neighboring islands such as Cebu judging from the scheduled route and frequency. It is therefore analyzed that the recent drastic increase in air passengers is attributable to a discovery of new passengers' demand as a result of successful expansion of LCC's business model, e.g. attractive promo airfare and flight frequency, in addition to the change in the mode of transportation chosen by Bohol residents between Manila and Bohol.

The total numbers of seaport and airport passengers in 2010 recorded at Bohol were shown in Table 3.1-2.

Table 3.1-2 Total Numbers of Air and Sea Passengers at Bohol in 2010

Description		Seaports ('000)			Airport ('000)			Total ('000)	
		Pax	share of Total	share of seaport	Pax	Share of Total	share of airport	Pax	share of Total
Tourist	Foreign	172	4.1%	4.8%	33	0.8%	5.8%	206	4.9%
	Local	306	7.3%	8.5%	157	3.8%	27.5%	462	11.1%
	Total	478	11.5%	13.3%	190	4.6%	33.3%	668	16.0%
Bohol Residents		3,115	74.8%	86.7%	382	9.1%	66.7%	3,497	84.0%
Total Passengers		3,593	86.3%	100.0%	572	13.7%	100.0%	4,165	100.0%

Source: JICA Study Team

The combined total of air and sea passengers are 4,165 thousand, 86 % of which are sea passengers and the rest (i.e. 14 %) are airport passengers. In either mode, Filipino nationals occupy 95 %, and the rest are foreigners (i.e. only 5 to 6 %). 87 % of the sea or 67 % of the air passengers are Bohol residents. Now, Bohol residents become the main user of the Tagbilaran Airport.

Due to obsolete infrastructure provided at the existing Tagbilaran Airport, e.g., only 2 aircraft parking stands, insufficient width of airfield, no air navigational aids, no airfield lighting, no runway end safety area, and absolute small passengers' holding spaces in the terminal, airline companies can only schedule a limited number of flights from sunrise to sunset (departure from Manila scheduled from 4:30 to 15:00). Annual average seat occupancy rates (Load Factor) in recent years are exceeding 80 % and those in peak months (April, May) reach 100%. Considering the fact that Tagbilaran airport is operated only from sunrise to sunset and only limited numbers of flights are available, while sea ports are operated through the day and night, it is most likely that potentially-overflowed air passengers (including overflow of international tourists) exists.

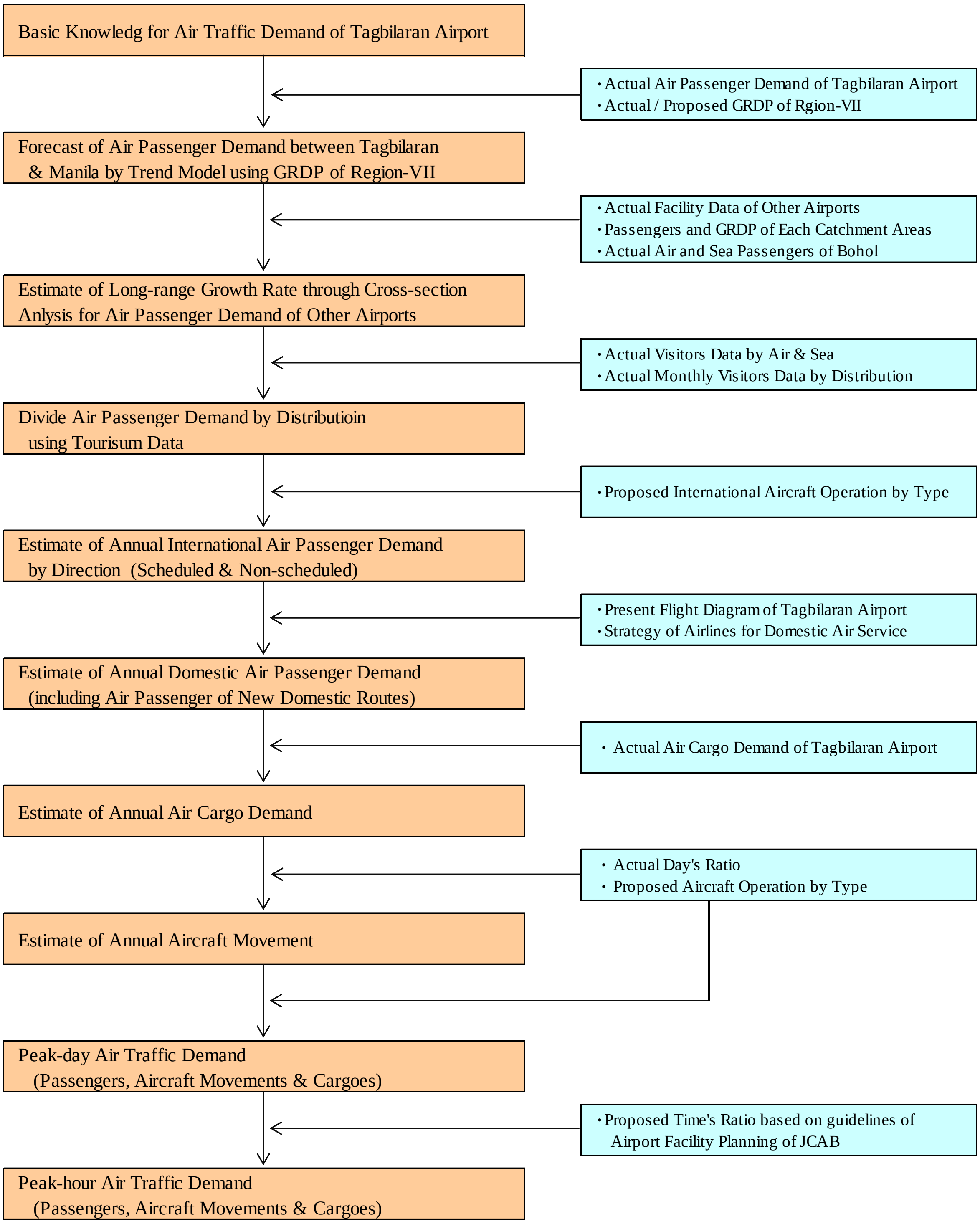
As mentioned in the foregoing Chapter 2, upon opening to international traffic in 2009 at Kalibo Airport, international flights bound for Seoul, Pusan, Shanghai, Taipei, Hong Kong were launched and the number of international passengers quickly reached 230 thousand in 2010.

Through the questionnaire survey, 45 % of the foreign tourists who visited Bohol answered that his intended main destination in the Philippines was Bohol. Meanwhile, domestic operations at NAIA are restricted due to limitation of the runway capacity. When the new Bohol Airport would have such function to accept international flights, foreign tourist who wants to visit Bohol would like to take international flight if available, to access directly to Bohol without one stop at the congested NAIA.

Air traffic demand forecasted herein however may be conservative, not as wanted by the domestic LCC's, but it is in line with our ongoing study for Eco-Tourism development and Environmental Conservation in Bohol.

3.2. Method of Air Traffic Demand Forecast

Air traffic demand for the New Bohol Airport has been forecasted for the years 2015, 2020, 2025, 2030, 2035, 2040, and 2045 in accordance with the procedures shown Figure 3.2-1.



Source: JICA Study Team

Figure 3.2-1 Flow-chart of Air Traffic Demand Forecast for New Bohol Airport

3.3. Projection of Future Socio-economic Framework

A chronological trend model where the GRDP in the Region-VII is explanatory variable, is used to express the past air traffic trend at the existing Tagbilaran Airport.

The GRDP in the future is computed based on the future population in the Region-VII projected by the Government, and the GRDP per Capita (PCGRDP) analyzed in this study.

The trend model where the GRDP growth in the Region-VII based on the future population projected by the Government is used, is called as the “Medium Case”, and the case the GRDP growth is 1.5 percent higher is defined as the “High Case”, and the case it is 1.5 percent lower is defined as the “Low Case”.

3.3.1. Past GRDP

Past GRDP and GRDP per capita (PCGRDP) in the Region-VII in comparison with national total (i.e. GDP), expressed in the constant 1985 pricing are chronologically shown in Table 3.3-1, annual growth of which were similar to those in the whole country. The ratio of GRDP against the national total (GDP) has been stable since 2000.

Table 3.3-1 Past GRDP in the Philippines and Region-VII

CY	GRDP (mil. PhP)			Per Capita GRDP “PCGRDP” (PhP)		
	[A] whole Philippines	Region-VII (C.Visayas)		[a] whole Philippines	Region-VII (C.Visayas)	
		[B] GRDP	[B/A]		[b] GRDP	[b/a]
1995	802,224	52,327	6.52%	11,417	9,914	86.84%
1996	849,121	56,615	6.67%	11,810	10,500	88.91%
1997	893,151	59,926	6.71%	12,147	10,884	89.60%
1998	888,001	61,174	6.89%	11,816	10,885	92.12%
1999	918,161	63,341	6.90%	11,958	11,046	92.38%
2000	972,961	68,715	7.06%	12,670	12,005	94.75%
2001	990,044	70,326	7.10%	12,597	12,026	95.47%
2002	1,034,095	72,496	7.01%	12,900	12,157	94.24%
2003	1,085,072	75,803	6.99%	13,252	12,419	93.71%
2004	1,154,295	81,274	7.04%	13,814	13,046	94.44%
2005	1,211,452	86,151	7.11%	14,209	13,550	95.37%
2006	1,276,156	90,298	7.08%	14,673	13,918	94.85%
2007	1,366,625	98,076	7.18%	15,406	14,816	96.17%
2008	1,417,087	101,292	7.15%	15,666	14,997	95.73%
2009	1,432,115	102,053	7.13%	15,528	14,810	95.37%

Source: JICA Study Team

3.3.2. Estimation of Future GRDP

Future GRDP per capita (PCGRDP) in the Region-VII where calendar year is explanatory variable, has been analyzed and come up with the following regression formula:

PCGRDP = 367.9607 x CY - 724192.6 ($r^2 = 0.9736$)

Where PCGRDP : GRDP per capita of Region-VII (PhP at constant price in 1985)

CY : Calendar Year

Future population of Region-VII estimated on the basis of census of population by National Statistics Office is shown in Table 3.3-2.

Table 3.3-2 Future Population of Region-VII

('000)

CY	Population	Growth Rate
2010	7,029.3	2.03%
2015	7,740.9	1.95%
2020	8,456.0	1.78%
2025	9,144.3	1.58%
2030	9,797.8	1.39%
2035	10,409.8	1.22%
2040	10,967.7	1.05%

Source: JICA Study Team

Future GRDP in the Region-VII based on the above future PCGRDP multiplied by the population is regarded as the Base Case (Medium Case) , and the case the GRDP growth is 1.5 percent higher is defined as "High Case", and the case 1.5 percent lower is "Low Case". The GRDP so estimates are shown in Table 3.3-3.

Table 3.3-3 Future GRDP of Region-VII

(mil. Php) ['85 price]

	CY	Base (Medium) Case		High Case (G/R:+1.5%)		Low Case (G/R:-1.5%)	
		Growth Rate	GRDP	Growth Rate	GRDP	Growth Rate	GRDP
Actual	2010		108,311		108,311		108,311
Future	2011-2015	4.3%	133,517	5.8%	143,401	2.8%	124,186
	2016-2020	3.9%	161,409	5.4%	186,242	2.4%	139,597
	2021-2025	3.5%	191,371	5.0%	237,291	2.0%	153,855
	2026-2030	3.1%	223,073	4.6%	297,313	1.6%	166,672
	2031-2035	2.8%	256,159	4.3%	367,055	1.3%	177,831
	2036-2040	2.5%	290,066	4.0%	446,951	1.0%	187,063
	2041-2045	2.3%	324,225	4.0%	537,321	1.0%	194,199

Source: JICA Study Team

3.4. Annual Air Traffic Demand Forecast

3.4.1. Past Air Traffic Records

Past Air Traffic records at Tagbilaran Airport in comparison with GDP in the Philippines are shown in Table 3.4-1.

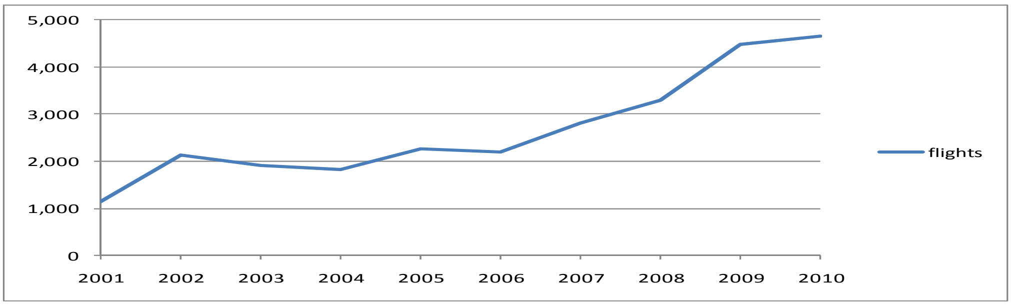
Table 3.4-1 Past Air Traffic Records at Tagbilaran Airport In comparison with GRDP in Region-VII

CY	Actual Air Traffic in TAG						GRDP of Region-VII (mil.Php) ['85 prices]	
	Flights		Passengers		Cargoes (MT)			
	Flights	Growth Rate	Passengers	Growth Rate	Cargoes	Growth Rate	GRDP	Growth Rate
2001	1,154	-	39,268	-	600	-	70,326	-
2002	2,134	84.9%	76,314	94.3%	1,770	194.8%	72,496	3.1%
2003	1,920	-10.0%	104,934	37.5%	2,125	20.0%	75,803	4.6%
2004	1,816	-5.4%	159,073	51.6%	2,294	7.9%	81,274	7.2%
2005	2,262	24.6%	196,707	23.7%	2,822	23.0%	86,151	6.0%
2006	2,194	-3.0%	240,176	22.1%	3,380	19.8%	90,298	4.8%
2007	2,810	28.1%	344,068	43.3%	4,997	47.8%	98,076	8.6%
2008	3,300	17.4%	398,661	15.9%	5,496	10.0%	101,292	3.3%
2009	4,478	35.7%	561,774	40.9%	5,097	-7.3%	102,053	0.8%
2010	4,664	4.2%	572,476	1.9%	4,791	-6.0%	108,311	6.1%

Source: CAAP and NSCB

Average annual growth of aircraft movements at Tagbilaran Airport is 16.8 % (increased from 1,154 in 2001, to 4,664 in 2011), and that for GRDP is 4.9 % (increased from Php

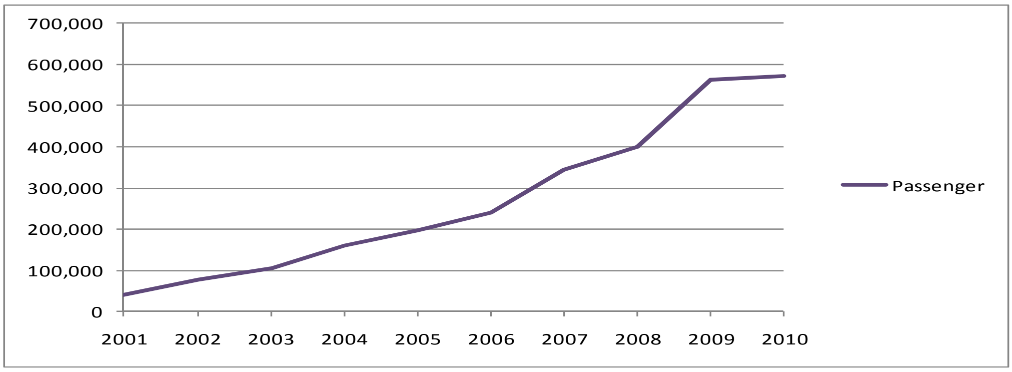
70,326 mil. in 2001 to Php 108,311 mil. in 2011); the GRDP elasticity is calculated at 3.43 (= 16.8 / 4.9).



Source: JICA Study Team

Figure 3.4-1 Past Aircraft Movements at Tagbilaran Airport

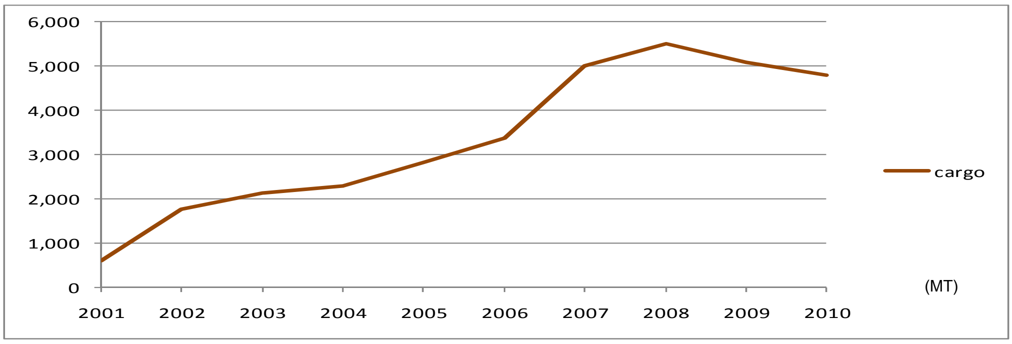
The number of air passengers at Tagbilaran Airport has increased at an average annual growth rate of 34.7 % (increased from 39.268 in 2000 to 572.476 in 2011); the GRDP elasticity is calculated at 7.08 (= 34.7 / 4.9).



Source: JICA Study Team

Figure 3.4-2 Past Air Passengers' Traffic at Tagbilaran Airport

Air cargo volume at Tagbilaran Airport has increased at an average annual growth rate of 26.0 % (increasing from 600 tons in 2001 to 4,791tons in 2010); the GRDP elasticity is calculated at 5.31 (= 26.0 / 4.9).



Source: JICA Study Team

Figure 3.4-3 Past Air Cargo Traffic at Tagbilaran Airport

3.4.2. Forecast of Annual Domestic Passengers

1) <u>Forecast of Air Passenger between Bohol and Manila</u>

First, air passenger demand for Bohol Province based on the chronological trend model where GRDP (of Region IIV) is explanatory variables, has been analyzed in consideration of the following aspects:

- Currently, air traffic demand at Tagbilaran Airport is only for Manila route, which has been grown with unexpected rate.
- There is no competition between the modes of transportation (i.e. air, sea or road).
- Great majority of air passengers are Bohol residents who travel to Manila (e.g. 67 % in 2010).

Next, triangle relationship has been analyzed among the development status of 10 major airports in the Central Philippines, GRDP and total air and sea traffic volumes in the vicinities. Then, the latent air traffic demand if the current restriction due to short runway, narrow airstrip or lack of infrastructure at Tagbilaran airport could be released, have been analyzed.

With the integration of the above 2 different approaches together, air traffic demand for the new Bohol Airport has been forecast. In addition, based on the share of foreigners indicated in the statistics data for travelers to Bohol (Table 3.4-9), future air traffic routes with new origin/ destination are analyzed.

a) Forecast by Trend Model

Through trend analysis after 2002 using actual air passenger traffic and GRDP of Region VII as explanatory variable, the forecast model for regression analysis has been come up with the following formula:

$$PAX_{TM} = 15.0020 \times GRDP - 1052398.7 \qquad r^2 = 0.9080$$

Where PAX_{TM} : Annual Air Passenger Demand of Bohol-Manila

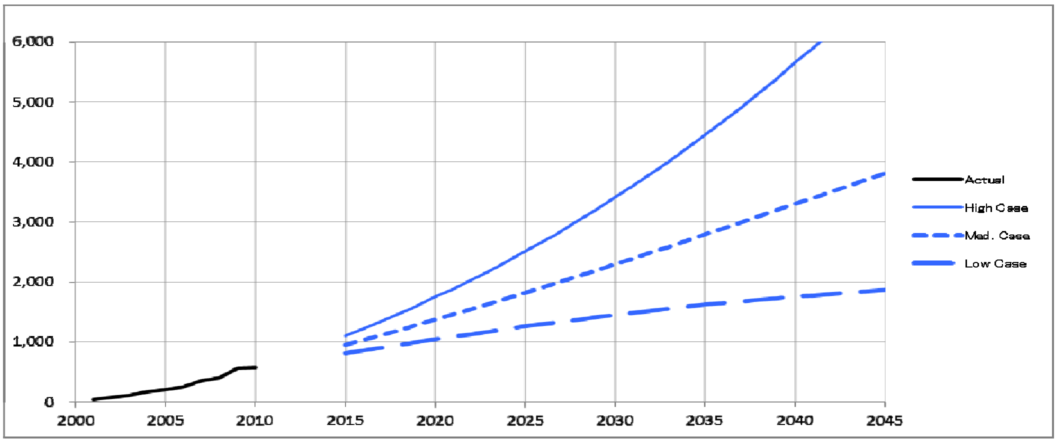
GRDP : GRDP of Region VII (mil. PhP at constant price in ‘85)

Future air passenger traffic demand between Bohol and Manila by inputting future economic framework (Future GRDP of Region-VII) has been forecasted as follows:

Table 3.4-2 Forecast of Annual Air Passenger between Bohol and Manila

CY	Low Case				Medium Case				High Case			
	GRDP (mil. Php)	Growth Rate (%)	Passenger ('000)	Growth Rate (%)	GRDP (mil. Php)	Growth Rate (%)	Passenger ('000)	Growth Rate (%)	GRDP (mil. Php)	Growth Rate (%)	Passenger ('000)	Growth Rate (%)
2010	108,311	-	572	-	108,311	-	572	-	108,311	-	572	-
2015	143,401	5.8	811	7.2	133,517	4.3	951	10.7	124,186	2.8	1,099	13.9
2020	186,242	5.4	1,042	5.1	161,409	3.9	1,369	7.6	139,597	2.4	1,742	9.6
2025	237,291	5.0	1,256	3.8	191,371	3.5	1,819	5.8	153,855	2.0	2,507	7.6
2030	297,313	4.6	1,448	2.9	223,073	3.1	2,294	4.8	166,672	1.6	3,408	6.3
2035	367,055	4.3	1,615	2.2	256,159	2.8	2,790	4.0	177,831	1.3	4,454	5.5
2040	446,951	4.0	1,754	1.7	290,066	2.5	3,299	3.4	187,063	1.0	5,653	4.9
2045	537,321	3.8	1,861	1.2	324,225	2.3	3,812	2.9	194,199	0.8	7,008	4.4

Source: JICA Study Team



Source: JICA Study Team

Figure 3.4-4 Trend Forecast of Annual Air Passenger between Bohol and Manila

b) Forecast by Cross-section Model

Through cross-section analysis using actual number of air and sea passengers in 2010 of the area where major airport in the central Philippines is located and GRDP of the catchment area of each airport, the forecast model for latent air passenger demand at the area where the new airport has been completed and released from any constraints has been analyzed as follows:

$$PAX_n = 64.7460 \text{ x } GRDP_n + 198728.6 \text{ x } DUM + 2895496.9 \qquad r^2 = 0.9758$$

Where PAX_n : Annual Air and Sea Passenger in catchment area of n Airport in 2010
$GRDP_n$: Annual GRDP in Catchment Area of the Airport in 2009 (mil. Php at constant price in 1985)
DUM: Dummy for Airport Status
1 : Developed Airport (Runway Length of more than 2000m)
0 : Undeveloped Airport (Runway Length of less than 2000m)

Table 3.4-3 GRDP and Passengers for Major 10 Airports of Central Philippines

	R-IVb	R-VI					R-VII			R-VIII	Average		
	Pto.Princesa	Caticlan	Kalibo	Roxas	Iloilo	Bacolod	Dumaguete	Cebu	Tagbilaran	Tacloban	Large AP	Others	All AP
RW (m)	2650	834	2187	1890	2500	2000	1845	3300	1779	2138	2463	1587	2112
dummy	1	0	1	0	1	1	0	1	0	1	-	-	-
GRDP	13,637	8,065	8,065	11,201	36,108	45,813	19,641	61,400	19,613	30,482	32,584	14,630	25,403
Annual Air Passengers by Sea and Air (2010)													
Sea	280,430	17,503	45,390	27,887	2,460,637	610,145	2,168,221	14,953,748	3,592,878	2,311,168	3,443,586	1,451,622	2,646,801
Air	822,358	672,919	754,372	203,840	1,581,304	1,218,213	362,551	4,206,651	572,476	1,148,728	1,621,938	452,947	1,154,341
Total	1,102,788	690,422	799,762	231,727	4,041,941	1,828,358	2,530,772	19,160,399	4,165,354	3,459,896	5,065,524	1,904,569	3,801,142
Annual Domestic Air Passengers													
2001	188,713	162,786	236,968	86,915	696,587	534,832	137,334	1,860,461	39,268	297,878	635,907	106,576	424,174
2002	147,000	196,315	274,560	81,804	676,015	512,240	134,877	1,733,273	76,314	302,281	607,562	122,328	413,468
2003	194,176	234,911	229,068	84,552	681,360	522,395	152,316	1,850,453	104,934	308,454	630,984	144,178	436,262
2004	267,507	392,484	267,172	100,550	739,494	572,666	173,496	1,947,057	159,073	345,668	689,927	206,401	496,517
2005	284,042	519,349	239,851	102,183	708,469	562,062	162,915	2,263,777	196,707	327,912	731,019	245,289	536,727
2006	306,607	516,631	341,097	119,944	863,018	663,882	188,465	2,467,517	240,176	398,909	840,172	266,304	610,625
2007	388,083	545,015	511,051	133,418	1,001,273	782,573	275,991	2,985,695	344,068	510,683	1,029,893	324,623	747,785
2008	477,293	793,478	381,436	153,488	1,073,788	840,711	306,182	2,940,830	398,661	626,856	1,056,819	412,952	799,272
2009	584,232	797,312	500,713	188,237	1,324,148	1,044,623	360,360	3,835,163	561,774	892,856	1,363,623	476,921	1,008,942
2010	822,358	672,919	754,372	203,840	1,581,304	1,218,213	362,551	4,206,651	572,476	1,148,728	1,621,938	452,947	1,154,341

Source: CAAP, NSCB and PAA

The latent passenger demand at the existing Tagbilaran Airport has been forecasted by inputting the dummy variable “1” and population of Bohol into the above model as follows:

Table 3.4-4 Latent Air Passenger Demand at Existing Tagbilaran Airport (2010)
(On the assumption that the airport had been already developed to larger airport)

	passengers
[a] Estimated Present Air & Sea Passengers in 2010	4,165,354
[b] Estimated Latent Passengers in 2010	4,364,083
[c] Present Sea Passengers in 2010	3,592,878
[d] Latent Air passengers in 2010 ([b] – [c])	771,205
(Latent Air Passengers/Actual Air Passengers)	(1.3471)

Source: JICA Study Team

Future air passenger demand is calculated by multiplying the future growth rate shown in Table 3.4-2. However, because actual average growth rate of the developed airports tabulated in Table 3.4-3 is lower than that of undeveloped airports, future growth rate of air passenger demand at Tagbilaran Airport has been modified as follows:

$$GR_{MFB} = GR_{FFT} \times (GL_{AD} / GR_{AT})$$

$$= GR_{FFT} \times (10.96 / 17.44)$$

$$= GR_{FFT} \times 0.6286$$

Where GR_{MFB} : Future Growth Rate of Air Traffic Demand

GR_{FFT} : Future Growth Rate forecasted by Trend Model (Table 3.4-2)

(ex.) 2010-2015 in Low Case : 7.2%

2010-2015 in Medium Case : 10.7%

2010-2015 in High Case : 13.9%

GL_{AD} : Actual Average Growth Rate of Developed Airports (Table 3.4-5)

GR_{AU} : Actual Average Growth Rate of Un-developed Airport (Table 3.4-5)

Table 3.4-5 Difference of Air Traffic Demand between Developed Airports and Others

	Average of 10 Airports in Central Philippines					
	Developed Airports (Runway length of more than 2000m)		Un-developed Airports (Runway length of less than 2000m)		All Airports	
Average R/W Length (m)	2463		1587		2112	
Average Annual Domestic Air Passenger						
CY	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)
2001	635,907	-	106,576	-	424,174	-
2002	607,562	-4.46	122,328	14.78	413,468	-2.52
2003	630,984	3.86	144,178	17.86	436,262	5.51
2004	689,927	9.34	206,401	43.16	496,517	13.81
2005	731,019	5.96	245,289	18.84	536,727	8.10
2006	840,172	14.93	266,304	8.57	610,625	13.77
2007	1,029,893	22.58	324,623	21.90	747,785	22.46
2008	1,056,819	2.61	412,952	27.21	799,272	6.89
2009	1,363,623	29.03	476,921	15.49	1,008,942	26.23
2010	1,621,938	18.94	452,947	-5.03	1,154,341	14.41
Average Growth Rate of Domestic Air Passenger						
'01 - '10	-	10.96	-	17.44	-	11.77

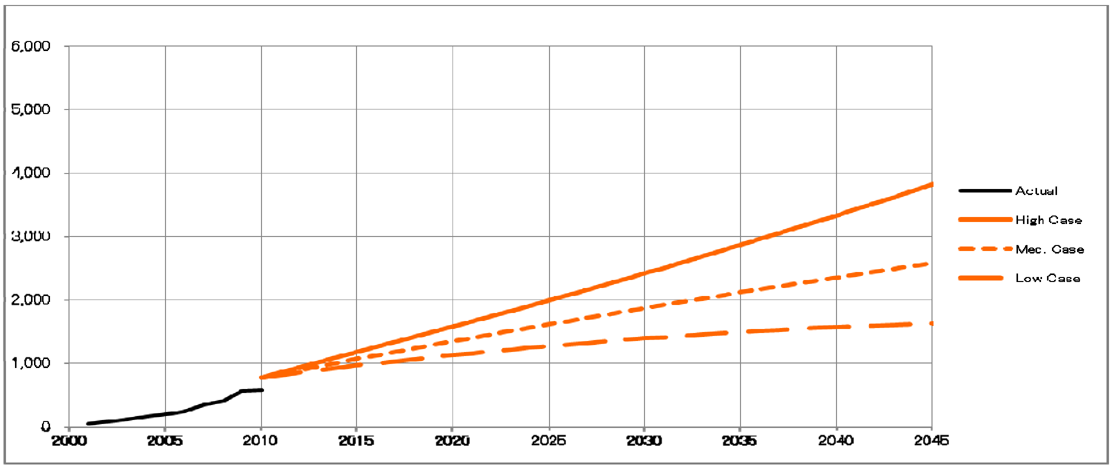
Source: JICA Study Team

As the result, latent air traffic demand between Bohol and Manila is computed as follows.

Table 3.4-6 Forecast of Latent Demand between Bohol and Manila

CY	Low Case		Medium Case		High Case	
	Passenger ('000)	Growth Rate (%)	Passenger ('000)	Growth Rate (%)	Passenger ('000)	Growth Rate (%)
2010	771	-	771	-	771	-
2015	962	4.5	1,067	6.7	1,174	8.8
2020	1,128	3.2	1,346	4.8	1,575	6.1
2025	1,270	2.4	1,612	3.7	1,987	4.8
2030	1,390	1.8	1,868	3.0	2,415	4.0
2035	1,489	1.4	2,115	2.5	2,862	3.5
2040	1,568	1.0	2,351	2.1	3,329	3.1
2045	1,628	0.7	2,576	1.8	3,815	2.8

Source: JICA Study Team



Source: JICA Study Team

Figure 3.4-5 Forecast of Latent Air Passenger at Bohol Airport

c) Future Air Passenger Demand between Bohol and Manila

Future air passenger demand between Bohol and Manila has been estimated by mixing demand forecasted by the trend model (Table 3.4-2) and the latent demand (Table 3.4-6).

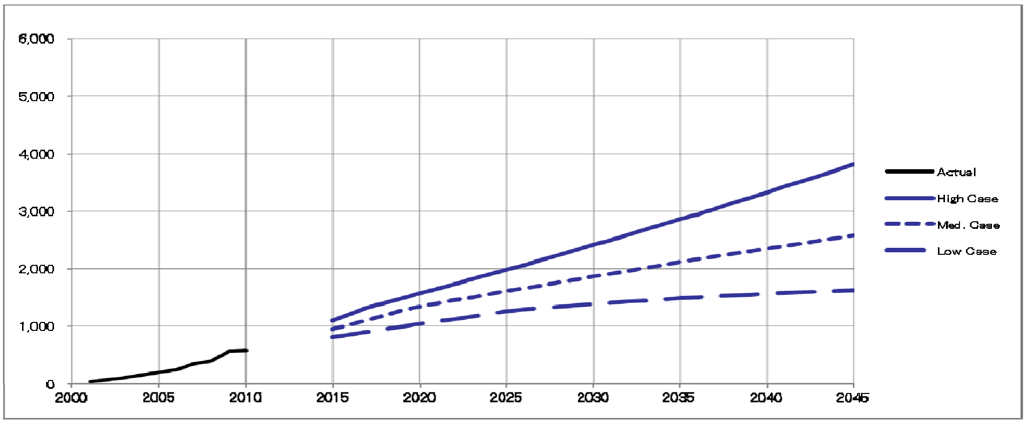
Consequently, the forecast by the trend model has been adopted before the point of intersection of the demand curve for forecast by the trend model and the demand curve for the latent demand, and the latent demand has been adopted after the point.

Accordingly, future air passenger demand between Bohol and Manila has been estimated as follows:

Table 3.4-7 Future Air Passenger Demand between Bohol and Manila

CY	Low Case		Medium Case		High Case	
	Passenger ('000)	Growth Rate (%)	Passenger ('000)	Growth Rate (%)	Passenger ('000)	Growth Rate (%)
2010	771	-	771	-	771	-
2015	962	4.5	1,067	6.7	1,174	8.8
2020	1,128	3.2	1,346	4.8	1,575	6.1
2025	1,270	2.4	1,612	3.7	1,987	4.8
2030	1,390	1.8	1,868	3.0	2,415	4.0
2035	1,489	1.4	2,115	2.5	2,862	3.5
2040	1,568	1.0	2,351	2.1	3,329	3.1
2045	1,628	0.7	2,576	1.8	3,815	2.8

Source: JICA Study Team



Source: JICA Study Team

Figure 3.4-6 Future Air Passenger Demand between Bohol and Manila

2) <u>Forecast of Future Air Passenger by Direction</u>

a) Actual Visitors to Bohol by Distribution

Two kinds of statistics data have been released by DOT as follows:

1) Annual Travelers to Bohol (Table 3.4-8): Statistics are taken for 10 years and divided by 9 regions, but not divided by mode.

2) Monthly Travelers to Bohol by Ship and Air (Table 3.4-9): Monthly statistics by mode but divided by only 4 regions and taken for a few recent years, however annual total are not equal to 1).

Table 3.4-8 Annual Visitors to Bohol by Air & Ship (non-Boholresidents)

CY	Actual Travellers in Bohol by Residence									
	China	Hong Kong	Japan	Korea	Taiwan	N. America	Europe	Others	Domestic	Total
2001	112	435	3,229	2,002	498	2,749	4,360	1,167	66,488	81,040
2002	127	367	3,323	2,102	2,527	2,787	4,655	1,468	75,396	92,752
2003	214	342	2,881	2,183	2,567	3,040	4,205	2,953	110,514	128,899
2004	539	569	3,647	3,023	2,861	4,023	6,574	5,685	134,740	161,661
2005	512	457	3,780	3,069	6,404	5,313	8,135	7,458	152,863	187,991
2006	1,024	614	4,565	5,221	8,069	7,274	11,327	12,159	169,058	219,311
2007	3,783	1,135	5,079	7,053	10,911	9,077	13,203	15,231	179,246	244,718
2008	10,311	1,155	4,502	8,778	23,413	9,357	12,546	12,826	199,610	282,498
2009	21,187	6,630	4,979	8,128	14,634	11,355	14,069	18,049	216,211	315,242
2010	20,883	6,098	6,225	9,608	13,778	12,139	14,256	19,943	231,282	334,212

Source: DOT

Table 3.4-9 Monthly Travelers to Bohol by Air

CY	month	American			Asian			European			Domestic			Grand Total		
		Sea	Air	Total	Sea	Air	Total	Sea	Air	Total	Sea	Air	Total	Sea	Air	Total
2006	Jan.	3,044	711	3,755	3,106	419	3,525	1,435	14	1,449	17,642	4,292	21,934	25,227	5,436	30,663
	Feb.	2,416	744	3,160	3,254	330	3,584	1,558	0	1,558	12,536	3,790	16,326	19,764	4,864	24,628
	Mar.	2,655	728	3,383	3,843	406	4,249	1,878	23	1,901	14,917	5,963	20,880	23,293	7,120	30,413
	Apr.	2,175	687	2,862	3,769	313	4,082	1,635	8	1,643	19,378	8,065	27,443	26,957	9,073	36,030
	May	2,046	455	2,501	4,943	397	5,340	1,290	65	1,355	23,603	9,591	33,194	31,882	10,508	42,390
	Jun.	1,690	373	2,063	4,091	328	4,419	902	42	944	17,225	6,850	24,075	23,908	7,593	31,501
	Jul.	2,595	798	3,393	3,713	467	4,180	889	14	903	17,896	7,195	25,091	25,093	8,474	33,567
	Aug.	2,809	609	3,418	4,513	400	4,913	562	12	574	22,485	7,628	30,113	30,369	8,649	39,018
	Sep.	2,704	407	3,111	3,902	272	4,174	342	0	342	20,386	7,214	27,600	27,334	7,893	35,227
	Oct.	2,660	667	3,327	3,783	340	4,123	710	15	725	21,240	7,843	29,083	28,393	8,865	37,258
	Nov.	2,809	607	3,416	4,513	274	4,787	642	49	691	22,485	6,346	28,831	30,449	7,276	37,725
	Dec.	2,689	779	3,468	4,243	501	4,744	994	90	1,084	21,326	8,988	30,314	29,252	10,358	39,610
	Total	30,292	7,565	37,857	47,673	4,447	52,120	12,837	332	13,169	231,119	83,765	314,884	321,921	96,109	418,030
2007	Jan.	3,463	371	3,834	6,190	91	6,281	1,050	51	1,101	24,213	4,368	28,581	34,916	4,881	39,797
	Feb.	3,520	670	4,190	5,593	516	6,109	890	319	1,209	25,288	6,451	31,739	35,291	7,956	43,247
	Mar.	3,022	604	3,626	5,357	459	5,816	1,003	325	1,328	30,738	9,873	40,611	40,120	11,261	51,381
	Apr.	3,309	539	3,848	4,417	417	4,834	1,359	266	1,625	24,368	8,282	32,650	33,453	9,504	42,957
	May	1,695	413	2,108	2,932	419	3,351	874	187	1,061	45,429	10,153	55,582	50,930	11,172	62,102
	Jun.	2,230	365	2,595	3,824	487	4,311	1,094	230	1,324	30,066	8,378	38,444	37,214	9,460	46,674
	Jul.	2,700	439	3,139	3,881	477	4,358	769	383	1,152	29,797	9,312	39,109	37,147	10,611	47,758
	Aug.	2,417	461	2,878	4,489	513	5,002	645	268	913	18,460	3,253	21,713	26,011	4,495	30,506
	Sep.	2,698	340	3,038	5,475	397	5,872	831	149	980	19,885	10,662	30,547	28,889	11,548	40,437
	Oct.	2,897	607	3,504	5,895	477	6,372	781	256	1,037	20,373	6,500	26,873	29,946	7,840	37,786
	Nov.	2,978	617	3,595	5,556	390	5,946	876	164	1,040	17,224	9,887	27,111	26,634	11,058	37,692
	Dec.	4,850	1,389	6,239	5,736	858	6,594	1,434	550	1,984	21,667	14,990	36,657	33,687	17,787	51,474
	Total	35,779	6,815	42,594	59,345	5,501	64,846	11,606	3,148	14,754	307,508	102,109	409,617	414,238	117,573	531,811
2008	Jan.	5,350	890	6,240	8,604	514	9,118	2,440	316	2,756	24,932	11,806	36,738	41,326	13,526	54,852
	Feb.	5,587	1,017	6,604	10,704	553	11,257	3,539	391	3,930	25,760	6,755	32,515	45,590	8,716	54,306
	Mar.	4,837	1,066	5,903	7,826	814	8,640	2,933	582	3,515	26,198	8,984	35,182	41,794	11,446	53,240
	Apr.	4,453	1,131	5,584	6,417	758	7,175	1,907	459	2,366	25,323	11,539	36,862	38,100	13,887	51,987
	May	2,082	761	2,843	4,894	735	5,629	1,483	327	1,810	36,765	19,049	55,814	45,224	20,872	66,096
	Jun.	3,438	947	4,385	7,113	693	7,806	2,032	406	2,438	27,198	8,978	36,176	39,781	11,024	50,805
	Jul.	4,519	673	5,192	9,148	516	9,664	2,367	477	2,844	25,249	11,785	37,034	41,283	13,451	54,734
	Aug.	4,107	655	4,762	7,510	848	8,358	1,873	431	2,304	22,671	7,143	29,814	36,161	9,077	45,238
	Sep.	3,322	365	3,687	6,669	650	7,319	1,427	460	1,887	21,596	6,945	28,541	33,014	8,420	41,434
	Oct.	3,527	343	3,870	6,465	457	6,922	1,253	812	2,065	20,412	2,149	22,561	31,657	3,761	35,418
	Nov.	2,476	507	2,983	4,188	559	4,747	1,204	631	1,835	16,574	2,334	18,908	24,442	4,031	28,473
	Dec.	2,533	765	3,298	5,010	808	5,818	1,750	843	2,593	16,347	2,535	18,882	25,640	4,951	30,591
	Total	46,231	9,120	55,351	84,548	7,905	92,453	24,208	6,135	30,343	289,025	100,002	389,027	444,012	123,162	567,174
2009	Jan.	3,936	686	4,622	6,618	705	7,323	1,954	676	2,630	19,387	807	20,194	31,895	2,874	34,769
	Feb.	3,086	792	3,878	4,923	550	5,473	1,406	669	2,075	15,624	3,192	18,816	25,039	5,203	30,242
	Mar.	3,246	416	3,662	4,634	587	5,221	1,398	730	2,128	19,471	6,907	26,378	28,749	8,640	37,389
	Apr.	2,816	697	3,513	5,054	631	5,685	1,324	677	2,001	23,364	15,780	39,144	32,558	17,785	50,343
	May	1,819	693	2,512	4,971	767	5,738	1,285	509	1,794	28,632	17,188	45,820	36,707	19,157	55,864
	Jun.	1,929	526	2,455	3,635	708	4,343	887	421	1,308	17,594	11,511	29,105	24,045	13,166	37,211
	Jul.	1,960	86	2,046	6,754	43	6,797	1,647	40	1,687	21,198	1,891	23,089	31,559	2,060	33,619
	Aug.	1,394	539	1,933	9,267	941	10,208	1,719	578	2,297	17,292	10,203	27,495	29,672	12,261	41,933
	Sep.	1,212	470	1,682	6,165	783	6,948	1,340	434	1,774	13,401	9,572	22,973	22,118	11,259	33,377
	Oct.	2,189	598	2,787	7,172	808	7,980	1,503	561	2,064	16,277	10,111	26,388	27,141	12,078	39,219
	Nov.	1,627	597	2,224	4,526	660	5,186	1,722	565	2,287	9,709	10,542	20,251	17,584	12,364	29,948
	Dec.	1,586	677	2,263	4,765	1,121	5,886	2,724	1,192	3,916	12,570	12,632	25,202	21,645	15,622	37,267
	Total	26,800	6,777	33,577	68,484	8,304	76,788	18,909	7,052	25,961	214,519	110,336	324,855	328,712	132,469	461,181

Source: BTO

According to Philippine Port Authority (PPA), 3,592,878 passengers use major ports in Bohol (sum of Base Port and Terminal Port) in 2010.

Passengers in the major ports in Bohol in 2010

Base Port	: 1,731,226 (Tagbilaran)
Terminal Port	: 1,861,652 (Jagna/Talibon/Tubigon)
Total	: 3,592,878

Source: Philippine Port Authority

b) Forecast Air Passenger in New Bohol Airport by Distribution

Using the above data, future air passengers by distribution has been estimated as follows:

1) Using Monthly Travelers to Bohol by Ship and Air (Table 3.4-9) in 2009, ship/air ratio for Bohol is estimated as follow.

	Number of Visitors			Constitution Rate (%)		
	Sea	Air	Total	Sea	Air	Total
Foreigner	114,193	22,133	136,326	83.8	16.2	100.0
Filipino	214,519	110,336	324,855	66.0	34.0	100.0
Total	328,712	132,469	461,181	71.3	28.7	100.0

Source: JICA Study Team

2) The sum of the sea passenger (3,592,878: according to PPA) and air passenger (572,476: according to CAAP) in 2010, i.e. 4,165,354, is regarded as the total number of (departing and arriving) passengers in Bohol. When the number of foreign visitors (102,930) and Filipino visitors (231,282) in 2010 are double-counted, the total (departing and arriving) passengers of visitors to Bohol (non-Bohol residents) were 668,424, while Bohol residents were 3,496,930.

	Number of Passengers			Constitution Rate (%)		
	Sea	Air	Total	Sea	Air	Total
Total	3,592,878	572,476	4,165,354	100.0	100.0	100.0
Visitor	477,894	190,530	668,424	13.3	33.3	16.0
(Foreigner)	172,438	33,422	205,860	4.8	5.8	4.9
(Filipino)	305,456	157,108	462,564	8.5	27.4	11.1
Bohol Residence	3,114,984	381,946	3,496,930	86.7	66.7	84.0

Source: JICA Study Team

- Subdividing by constitution ratio classified by Asian countries into average constitution ratio of Annual Travelers to Bohol (Table 3.4-8) in 2010 after foreign passenger ratio (5.8 %) of air passenger is distributed between three major area by constitution rate in 2009 of Monthly Travelers to Bohol by Ship and Air, ratio of air passengers classified by area is estimated as follows.

(%)

	Foreign share (above table)	BTO data (Tab.3.3-9)	DoT data (Tab.3.3-8)	Adopted Share
ASEAN (*)	5.84	6.27	0.49	0.05
CHINA			6.25	0.62
HONG KONG			1.82	0.18
JAPAN			1.86	0.19
KOREA			2.87	0.29
TAIWAN			4.12	0.41
SOUTH ASIA (*)			0.07	0.01
MIDDLE EAST (*)			3.63	0.36
OCEANIA (*)			0.82	0.08
NORTH AMERICA		5.12	4.27	1.79
EUROPE		5.32	0.29	0.16
OTHERS			3.02	1.70
DOMESTIC	94.16	(83.29)	(70.47)	94.16
Total	100.00	100.00	100.00	100.00

notes : (*) were included to "OTHERS" in forecast
(*2) including "Oversea Filipinos"

Source: JICA Study Team

- Future growth rate of air passengers by distribution has been analyzed through regression analysis using annual travelers to Bohol by air and ship (Table 3.4-10).

Growth Rate Model by Distribution

$PAX_{CHN} = 1.8722 \times CY - 3758.9$ $r^2 = 0.7582$

$PAX_{HKG} = 0.4841 \times CY - 971.8$ $r^2 = 0.6173$

$PAX_{JPN} = 0.2320 \times CY - 465.0$ $r^2 = 0.8533$

$PAX_{KOR} = 0.7028 \times CY - 1410.8$ $r^2 = 0.9343$

$PAX_{TPE} = 1.4069 \times CY - 2825.1$ $r^2 = 0.6827$

$PAX_{NA} = 0.8518 \times CY - 1702.0$ $r^2 = 0.9802$

$PAX_{EU} = 0.9431 \times CY - 1889.3$ $r^2 = 0.9235$

$PAX_{OTH} = 1.5669 \times CY - 3134.3$ $r^2 = 0.9568$

$PAX_{DOM} = 8.0599 \times CY - 15671.0$ $r^2 = 0.9682$

Where
PAX_{CHN} : Annual Air Passenger from China (‘000)
PAX_{HNG} : Annual Air Passenger from Hong Kong (‘000)
PAX_{JPN} : Annual Air Passenger from Japan (‘000)
PAX_{KOR} : Annual Air Passenger from Korea (‘000)
PAX_{TPE} : Annual Air Passenger from Taiwan (‘000)
PAX_{EU} : Annual Air Passenger from Europe (‘000)
PAX_{OTH} : Annual Air Passenger from Other Countries (‘000)
PAX_{DOM} : Annual Local Air Passenger (Filipino) (‘000)
CY : Calendar Year

Accordingly, estimated future air passengers by case are as follows:

Table 3.4-10 (1) Forecast Annual Air Passengers by Direction (Low Case)

Passenger										('000)
CY	China	Hong Kong	Japan	Korea	Taiwan	N. America	Europe	others	Domestic	Total
2010	4	1	1	2	3	10	6	15	529	572
2015	17	5	3	7	12	18	14	29	707	811
2020	33	9	5	13	24	27	22	44	866	1,042
2025	50	13	7	19	37	35	31	60	1,003	1,256
2030	65	17	9	25	48	42	39	72	1,072	1,390
2035	78	20	11	30	58	48	46	83	1,116	1,489
2040	90	23	12	34	67	53	51	92	1,145	1,568
2045	100	26	13	38	75	57	56	100	1,162	1,628

Growth Rate										(%)
CY	China	Hong Kong	Japan	Korea	Taiwan	N. America	Europe	others	Domestic	Total
'10-'15	32.0	29.8	19.0	28.4	34.4	11.9	16.9	13.4	6.0	7.2
'15-'20	14.1	13.7	11.1	13.5	14.5	8.2	10.4	8.9	4.1	5.1
'20-'25	8.9	8.7	7.5	8.6	9.0	5.9	7.2	6.4	3.0	3.8
'25-'30	5.4	5.3	4.6	5.2	5.4	3.6	4.4	3.9	1.4	2.0
'30-'35	3.8	3.7	3.3	3.7	3.8	2.6	3.1	2.8	0.8	1.4
'35-'40	2.9	2.8	2.5	2.8	2.9	2.0	2.4	2.2	0.5	1.0
'40-'45	2.2	2.2	1.9	2.1	2.2	1.5	1.9	1.7	0.3	0.7

Source: JICA Study Team

Table 3.4-10 (2) Forecast Annual Air Passengers by Direction (Medium Case)

Passenger										('000)
CY	China	Hong Kong	Japan	Korea	Taiwan	N. America	Europe	others	Domestic	Total
2010	4	1	1	2	3	10	6	15	529	572
2015	20	5	4	8	14	21	16	34	829	951
2020	42	11	7	16	31	34	29	57	1,119	1,346
2025	64	17	9	25	47	46	40	77	1,288	1,612
2030	87	23	12	33	65	57	52	97	1,442	1,868
2035	111	29	15	42	82	68	65	118	1,585	2,115
2040	134	35	18	51	100	80	77	139	1,717	2,351
2045	158	41	21	60	118	91	89	159	1,839	2,576

Growth Rate										(%)
CY	China	Hong Kong	Japan	Korea	Taiwan	N. America	Europe	others	Domestic	Total
'10-'15	36.2	34.0	22.9	32.6	38.7	15.6	20.7	17.1	9.4	10.7
'15-'20	16.3	16.0	13.3	15.7	16.7	10.3	12.5	11.0	6.2	7.2
'20-'25	8.7	8.6	7.4	8.5	8.9	5.8	7.0	6.2	2.8	3.7
'25-'30	6.3	6.3	5.6	6.2	6.4	4.6	5.4	4.9	2.3	3.0
'30-'35	4.9	4.9	4.4	4.8	5.0	3.7	4.3	3.9	1.9	2.5
'35-'40	4.0	3.9	3.6	3.9	4.0	3.1	3.5	3.3	1.6	2.1
'40-'45	3.3	3.3	3.0	3.2	3.3	2.6	3.0	2.8	1.4	1.8

Source: JICA Study Team

Table 3.4-10 (3) Forecast Annual Air Passengers by Direction (High Case)

Passenger										('000)
CY	China	Hong Kong	Japan	Korea	Taiwan	N. America	Europe	others	Domestic	Total
2010	4	1	1	2	3	10	6	15	529	572
2015	23	6	4	9	17	24	18	39	959	1,099
2020	49	13	8	19	36	40	34	66	1,310	1,575
2025	79	21	12	30	58	56	50	95	1,587	1,987
2030	112	29	16	43	83	74	68	126	1,864	2,415
2035	150	39	21	57	111	93	87	160	2,145	2,862
2040	190	50	26	73	142	113	109	196	2,431	3,329
2045	234	61	31	89	175	134	132	235	2,724	3,815

Growth Rate										(%)
CY	China	Hong Kong	Japan	Korea	Taiwan	N. America	Europe	others	Domestic	Total
'10-'15	40.2	37.9	26.5	36.5	42.8	19.0	24.2	20.6	12.6	13.9
'15-'20	16.6	16.2	13.6	16.0	17.0	10.5	12.8	11.3	6.4	7.5
'20-'25	9.9	9.7	8.5	9.6	10.0	6.9	8.1	7.3	3.9	4.8
'25-'30	7.4	7.3	6.6	7.2	7.4	5.6	6.4	5.9	3.3	4.0
'30-'35	5.9	5.8	5.4	5.8	5.9	4.7	5.3	4.9	2.8	3.5
'35-'40	4.9	4.9	4.6	4.9	5.0	4.0	4.5	4.2	2.5	3.1
'40-'45	4.2	4.2	4.0	4.2	4.2	3.6	3.9	3.7	2.3	2.8

Source: JICA Study Team

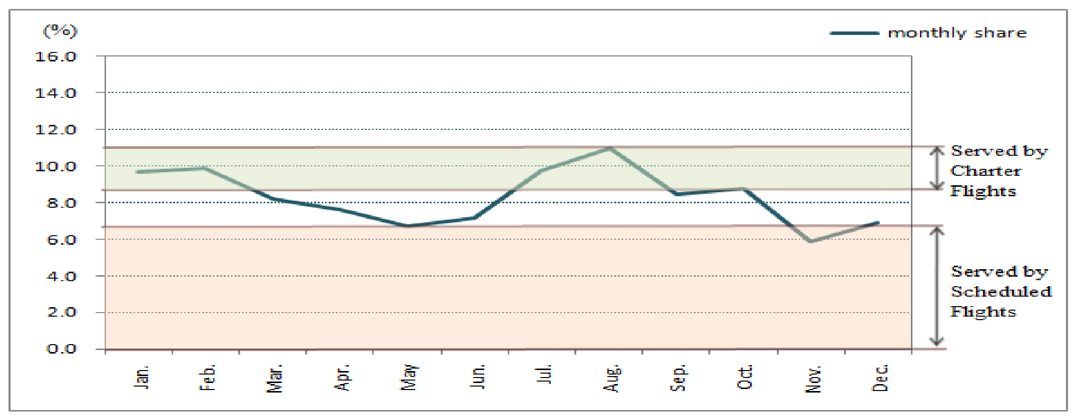
3) Forecast of International Air Passengers

a) International Passengers by Scheduled Flights

Air passenger demand of international scheduled flights has been estimated as follows:

- It is necessary that international scheduled flight will be operated so that the 2nd lowest monthly passenger load exceeds the number of passengers brought by 3 round flights per week.
- 160 seater aircrafts will be operated into new international scheduled routes at the first stage with over 65% of load-factor.
- Annual passengers to meet the demand are 32.4 thousand (= 160 x 0.65 x 6 x 52) (*).

(*) 160 : number of seat per flight
0.65 : average load-factor
6 : minimum number of one-way flights per week
52 : number of weeks per year



Source: JICA Study Team

Figure 3.4-7 Air Passengers Demand served by International Scheduled Flights and Charter Flights

Estimated international scheduled air passengers by case are forecasted as follows:

Table 3.4-11 (1) Annual International Passengers (Scheduled) (Low Case)

('000)

CY	China		Hong Kong		Korea		Taiwan		Total	
	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)
2010										
2015										
2020										
2025	41								41	
2030	53	5.4	33				39		125	25.1
2035	64	3.8	38	3.2			47	3.8	149	3.7
2040	73	2.9	43	2.5			55	2.9	171	2.8
2045	82	2.2	47	1.9			61	2.2	190	2.1

Source: JICA Study Team

Table 3.4-11 (2) Annual International Passengers (Scheduled) (Medium Case)

('000)

CY	China		Hong Kong		Korea		Taiwan		Total	
	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)
2010										
2015										
2020	34								34	
2025	52	8.7	33				39		124	29.3
2030	71	6.3	44	5.5			53	6.4	167	6.1
2035	90	4.9	54	4.4	35		67	5.0	246	8.0
2040	110	4.0	65	3.6	42	3.9	82	4.0	298	3.9
2045	129	3.3	75	3.0	49	3.2	96	3.3	349	3.2

Source: JICA Study Team

Table 3.4-11 (3) Annual International Passengers (Scheduled) (High Case)

('000)

CY	China		Hong Kong		Korea		Taiwan		Total	
	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)
2010										
2015										
2020	40								40	
2025	64	9.9	41				48		153	30.7
2030	92	7.4	56	6.5	35		68	7.4	252	10.4
2035	122	5.9	73	5.4	47	5.8	91	5.9	333	5.8
2040	155	4.9	92	4.5	59	4.9	116	5.0	422	4.8
2045	191	4.2	111	3.9	73	4.2	143	4.2	518	4.2

Source: JICA Study Team

b) International Passengers by Non-scheduled (Charter) Flights

Air passenger demand of international non-scheduled (charter) flights has been estimated as follows:

- Non-scheduled flights will operate from/to Asian countries.
- Non-scheduled flights will operate when the demand exceeds both the average monthly passengers and number of passengers on 2 round flights per week.
- 260 seater aircraft will operate for non-scheduled flight with over 80% of load-factor.
- Annual passengers to meet the demand is 0.8 thousand (= 260 x 0.80 x 4) (*).

(*) 260 : number of seat per flight
0.80 : average load-factor
4 : minimum number of one-way flights per week

Table 3.4-12 (1) Annual International Passengers (Non-scheduled) (Low Case)

('000)

	China		Hong Kong		Japan		Korea		Taiwan		Total	
CY	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)
2010												
2015	1								1		2	
2020	3	14.1					1		2	14.4	6	19.0
2025	4	6.7	1				2	8.6	3	9.0	10	10.5
2030	5	5.4	1	0.1			2	5.2	4	3.4	12	4.1
2035	6	3.8	1	3.9	1		3	3.7	4	3.8	15	5.1
2040	7	2.9	2	2.9	1	2.5	3	2.8	5	2.9	18	2.8
2045	8	2.2	2	2.2	1	1.9	3	2.1	6	2.2	20	2.2

Source: JICA Study Team

Table 3.4-12 (2) Annual International Passengers (Non-scheduled) (Medium Case)

('000)

	China		Hong Kong		Japan		Korea		Taiwan		Total	
CY	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)
2010												
2015	2								1		3	
2020	3	14.0	1				1		3	16.7	8	23.2
2025	5	8.7	1	3.0			2	8.5	4	6.7	12	7.4
2030	7	6.3	2	6.5	1		3	6.2	5	6.4	17	7.7
2035	9	4.9	2	5.0	1	4.5	3	2.8	6	5.0	21	4.6
2040	10	4.0	2	4.0	2	3.6	4	3.9	8	4.0	26	4.0
2045	12	3.3	3	3.3	2	3.0	5	3.2	9	3.3	31	3.3

Source: JICA Study Team

Table 3.4-12 (3) Annual International Passengers (Non-scheduled) (High Case)

('000)

	China		Hong Kong		Japan		Korea		Taiwan		Total	
CY	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)	Passenger	G/R (%)
2010												
2015	2								1		3	
2020	4	14.3	1				2		3	17.0	10	23.5
2025	6	9.9	1	4.1	1		3	9.6	5	7.8	16	10.0
2030	9	7.4	2	7.5	1	6.6	3	5.1	6	7.4	22	7.0
2035	12	5.9	3	6.0	2	5.4	4	5.8	9	5.9	29	5.9
2040	15	4.9	3	5.0	2	4.6	6	4.9	11	5.0	37	4.9
2045	18	4.2	4	4.3	3	4.0	7	4.2	14	4.2	45	4.2

Source: JICA Study Team

4) Forecast of Domestic Air Passengers

The domestic air passengers between New Bohol Airport (BHL) and NAIA have been calculated using the following formula:

[Domestic Air Passengers between BHL and NAIA] =
[Air Passenger Demand in Tagbilaran Airport (Table 3.4-)]
- [Annual International Scheduled Passengers (Table 3.4-11)]
- [Annual International Non-scheduled Passengers (Table 3.4-12)]

Additionally it is expected that some new domestic air routes are operated at new airport according to the air service provided at the existing larger airports together with the results of questionnaire survey from domestic Airlines upon its completion. Accordingly it has been estimated in this study that 4 round flights of new domestic air routes would be operated from the new airport though the demand is expected to be minimal but constant as shown in Table 3.4-13.

Table 3.4-13 Domestic Air Passengers of New Routes

Route	Some Islands
Aircraft	50 seater
L/F	70 %
Flights	8 /day
Peak Ratio	1/ 320
Annual Pax	89,600

Source: JICA Study Team

Estimated domestic air passengers by case are as shown in Table 3.4-14.

Table 3.4-14 Domestic Air Passengers at New Bohol Airport

CY	Low Case				Medium Case				High Case			
	Bohol - NAIA	New Routes	Total ('000)	Growth Rate (%)	Bohol - NAIA	New Routes	Total ('000)	Growth Rate (%)	Bohol - NAIA	New Routes	Total ('000)	Growth Rate (%)
2010	572	-	572	-	572	-	572	-	572	-	572	-
2015	808	90	898	9.4	948	90	1,037	12.6	1,096	90	1,185	15.7
2020	1,036	90	1,125	4.6	1,304	90	1,393	6.1	1,525	90	1,615	6.4
2025	1,205	90	1,295	2.8	1,476	90	1,566	2.4	1,818	90	1,908	3.4
2030	1,253	90	1,343	0.7	1,684	90	1,773	2.5	2,141	90	2,231	3.2
2035	1,325	90	1,414	1.0	1,847	90	1,937	1.8	2,500	90	2,590	3.0
2040	1,380	90	1,469	0.8	2,027	90	2,117	1.8	2,870	90	2,960	2.7
2045	1,419	90	1,508	0.5	2,196	90	2,285	1.5	3,252	90	3,342	2.5

Source: JICA Study Team

5) Future Air Passengers Demand

Following the above, the annual future air passenger demand has been forecasted as shown in Table 3.4-15 and Figure 3.4-8.

Table 3.4-15 (1)6 Future Annual Air Passengers Demand (Low Case)

('000)

CY	Domestic		International Passenger						Grand Total	
	Passengers	Growth Rate	Scheduled	Growth Rate	Non-Sche.	Growth Rate	Total	Growth Rate	Passengers	Growth Rate
2010	572								572	
2015	898	9.4%			2		2		900	9.5%
2020	1,125	4.6%			6	19.0%	6	19.0%	1,131	4.7%
2025	1,295	2.8%	41		10	10.5%	50	53.4%	1,345	3.5%
2030	1,343	0.7%	125	25.1%	12	4.1%	137	22.0%	1,479	1.9%
2035	1,414	1.0%	149	3.7%	15	5.1%	164	3.8%	1,579	1.3%
2040	1,469	0.8%	171	2.8%	18	2.8%	189	2.8%	1,658	1.0%
2045	1,508	0.5%	190	2.1%	20	2.2%	209	2.1%	1,718	0.7%

Source: JICA Study Team

Table 3.4-15 (2) Future Annual Air Passengers Demand (Medium Case)

('000)

CY	Domestic		International Passenger						Grand Total	
	Passengers	Growth Rate	Scheduled	Growth Rate	Non-Sche.	Growth Rate	Total	Growth Rate	Passengers	Growth Rate
2010	572								572	
2015	1,037	12.6%			3		3		1,040	12.7%
2020	1,393	6.1%	34		8	23.2%	43	71.0%	1,436	6.7%
2025	1,566	2.4%	124	29.3%	12	7.4%	136	26.1%	1,702	3.5%
2030	1,773	2.5%	167	6.1%	17	7.7%	185	6.3%	1,958	2.8%
2035	1,937	1.8%	246	8.0%	21	4.6%	268	7.7%	2,205	2.4%
2040	2,117	1.8%	298	3.9%	26	4.0%	324	3.9%	2,441	2.1%
2045	2,285	1.5%	349	3.2%	31	3.3%	380	3.2%	2,666	1.8%

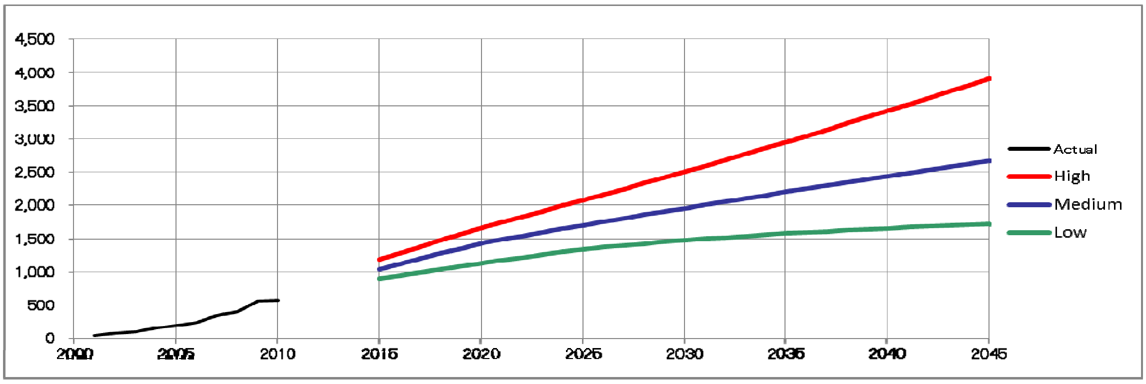
Source: JICA Study Team

Table 3.4-15 (3) Future Annual Air Passengers Demand (High Case)

('000)

CY	Domestic		International Passenger						Grand Total	
	Passengers	G/R (%)	Scheduled	G/R (%)	Non-Sche.	G/R (%)	Total	G/R (%)	Passengers	G/R (%)
2010	572								572	
2015	1,185	15.7%			3		3		1,188	15.7%
2020	1,615	6.4%	40		10	23.5%	50	71.4%	1,665	7.0%
2025	1,908	3.4%	153	30.7%	16	10.0%	169	27.6%	2,077	4.5%
2030	2,231	3.2%	252	10.4%	22	7.0%	274	10.1%	2,505	3.8%
2035	2,590	3.0%	333	5.8%	29	5.9%	362	5.8%	2,952	3.3%
2040	2,960	2.7%	422	4.8%	37	4.9%	459	4.8%	3,419	3.0%
2045	3,342	2.5%	518	4.2%	45	4.2%	563	4.2%	3,905	2.7%

Source: JICA Study Team



Source: JICA Study Team

Figure 3.4-8 Future Annual Air Passengers Demand (Total passengers for domestic and international)

3.4.3. Cargoes

Through trend analysis using actual air passenger traffic and actual cargo traffic, the forecast model for air cargo traffic demand between Bohol and NAIA as follow:

$$CGO = 7.025 \times PAX + 1569609.0 \qquad r^2 = 0.7987$$

Where CGO : Annual Air Cargo of Manila Route (kg)
PAX : Annual Air Passenger of Manila Route

According to the result of questionnaire surveys with local airlines, it is expected that the volume both of international air cargo brought by new international air routes and domestic air cargo brought by new domestic air routes will be very limited.

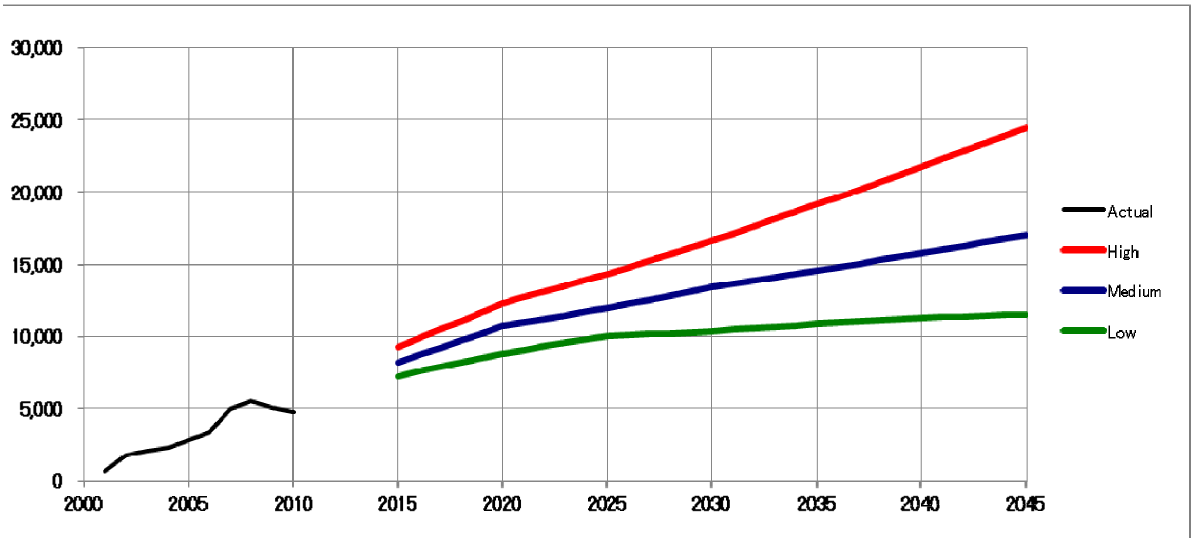
Accordingly, annual future air cargo demand has been forecasted as follows:

Table 3.4-16 Annual Air Cargo Demand

(MT)

CY	Low Case		Medium Case		High Case	
	Cargoes	G/R (%)	Cargoes	G/R (%)	Cargoes	G/R (%)
2010	4,791	0.0	4,791	0.0	4,791	0.0
2015	7,247	8.6	8,227	11.4	9,265	14.1
2020	8,846	4.1	10,728	5.5	12,285	5.8
2025	10,036	2.6	11,940	2.2	14,343	3.1
2030	10,373	0.7	13,397	2.3	16,613	3.0
2035	10,875	0.9	14,546	1.7	19,132	2.9
2040	11,262	0.7	15,810	1.7	21,734	2.6
2045	11,534	0.5	16,995	1.5	24,416	2.4

Source: JICA Study Team



Source: JICA Study Team

Figure 3.4-9 Future Annual Air Cargo Demand (tons/annum)

3.4.4. Aircraft Movements

1) Peak-Day Ratio and Aircraft Operation Guidelines

Peak-day's ratio of domestic passenger demand has been estimated as "1/320" using actual monthly domestic passenger traffic at Tagbilaran Airport in 2008, 2009 and 2010.

Table 3.4-17 Actual Day Ratio of Domestic Traffic at Tagbilaran Airport

Actual Monthly Domestic Traffic

CY	Jan.	Feb.	Mar.	Apr.	May	Jun.	JulUL.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Aircraft Movememt													
2008	246	234	248	284	356	328	252	250	240	286	280	296	3,300
2009	314	276	378	418	434	400	400	398	358	370	358	374	4,478
2010	366	336	386	382	396	380	370	374	358	412	430	474	4,664
Passenger													('000)
2008	33	30	31	36	46	31	30	30	29	31	33	38	399
2009	41	35	45	58	64	49	49	47	41	42	45	47	562
2010	47	44	49	53	55	48	48	48	43	45	43	49	572
Cargo													(MT)
2008	459	406	424	508	581	428	431	425	394	431	416	592	5,496
2009	653	481	357	404	454	371	442	340	313	324	417	540	5,097
2010	412	388	436	440	467	317	395	385	362	394	357	438	4,791

Average Day's Ratio by Month

CY	Jan.	Feb.	Mar.	Apr.	May	Jun.	JulUL.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Traffic													
2008	1/ 416	1/ 395	1/ 413	1/ 349	1/ 287	1/ 302	1/ 406	1/ 409	1/ 413	1/ 358	1/ 354	1/ 346	1/ 365
2009	1/ 442	1/ 454	1/ 367	1/ 321	1/ 320	1/ 336	1/ 347	1/ 349	1/ 375	1/ 375	1/ 375	1/ 371	1/ 365
2010	1/ 395	1/ 389	1/ 375	1/ 366	1/ 365	1/ 368	1/ 391	1/ 387	1/ 391	1/ 351	1/ 325	1/ 305	1/ 365
Average	1/ 418	1/ 413	1/ 385	1/ 345	1/ 324	1/ 335	1/ 381	1/ 382	1/ 393	1/ 361	1/ 351	1/ 341	1/ 365
Passenger													
2008	1/ 375	1/ 368	1/ 393	1/ 333	1/ 270	1/ 381	1/ 406	1/ 410	1/ 414	1/ 404	1/ 359	1/ 329	1/ 365
2009	1/ 423	1/ 445	1/ 385	1/ 293	1/ 274	1/ 343	1/ 357	1/ 373	1/ 415	1/ 418	1/ 377	1/ 369	1/ 365
2010	1/ 374	1/ 365	1/ 359	1/ 322	1/ 323	1/ 361	1/ 371	1/ 372	1/ 399	1/ 393	1/ 401	1/ 360	1/ 365
Average	1/ 391	1/ 393	1/ 379	1/ 316	1/ 289	1/ 362	1/ 378	1/ 385	1/ 409	1/ 405	1/ 379	1/ 353	1/ 365
Cargo													
2008	1/ 371	1/ 379	1/ 402	1/ 325	1/ 293	1/ 385	1/ 395	1/ 401	1/ 418	1/ 395	1/ 396	1/ 288	1/ 365
2009	1/ 242	1/ 297	1/ 443	1/ 379	1/ 348	1/ 412	1/ 357	1/ 465	1/ 488	1/ 488	1/ 366	1/ 292	1/ 356
2010	1/ 361	1/ 346	1/ 341	1/ 327	1/ 318	1/ 454	1/ 376	1/ 386	1/ 397	1/ 377	1/ 403	1/ 339	1/ 365
Average	1/ 325	1/ 340	1/ 395	1/ 343	1/ 320	1/ 417	1/ 376	1/ 417	1/ 434	1/ 420	1/ 388	1/ 306	1/ 365

Source: CAAP

Peak-day ratio of international passenger demand has been estimated as "1/280" using actual monthly domestic passenger traffic of Kalibo Airport in 2010.

Table 3.4-18 Actual Day Ratio of International Traffic at Kalibo Airport

Actual Monthly International Traffic of Kalibo Airport in 2010													
CY	Jan.	Feb.	Mar.	Apr.	May	Jun.	JulUL.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Traffic	66	120	114	122	122	128	212	266	210	226	168	194	1,948
Pax ('000)	8	12	15	17	11	17	27	34	25	26	19	25	236
Average Day's Ratio by Month													
CY	Jan.	Feb.	Mar.	Apr.	May	Jun.	JulUL.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Traffic	1/ 915	1/ 455	1/ 530	1/ 479	1/ 495	1/ 457	1/ 285	1/ 227	1/ 278	1/ 267	1/ 348	1/ 311	1/ 365
Pax ('000)	1/ 915	1/ 531	1/ 484	1/ 406	1/ 676	1/ 417	1/ 274	1/ 218	1/ 279	1/ 280	1/ 380	1/ 295	1/ 365

Source: CAAP

According the above, aircraft operation guidelines in this study are proposed as follows:

Table 3.4-19 Proposed Aircraft Operation Guidelines

	Domestic				International (Scheduled)			International (Charter)	
	PLOP	S-Jet	M-Jet	L-Jet	S-Jet	M-Jet	L-Jet	M-Jet	L-Jet
Seats per Flight	50	160	260	300	160	260	300	260	300
Ave. of Load Factor	70 %	70 %	70 %	70 %	65 %	65 %	65 %	80 %	80 %
Ave. Pax per Flight	35	112	182	210	104	169	195	208	240
Minmum Flights	4 /day	4 /day	2 /day	2 /day	4 /week	2 /week	2 /week	4 /week	4 /week
Maximum Flights	8 /day	18 /day	-	-	6 /week	-	-	-	-
Peak-day's Ratio	1/ 320	1/ 320	1/ 320	1/ 320	1/ 280	1/ 280	1/ 280	-	-

Source: JICA Study Team

2) Annual Aircraft Movement

Using the above guidelines, future annual aircraft movements have been forecasted as follows:

Table 3.4-20 (1) Annual Aircraft Movements (Low Case)

	Domestic		International Flights						Grand Total	
CY	Flights	G/R (%)	Scheduled	G/R (%)	Non-Sche.	G/R (%)	Total	G/R (%)	Flights	G/R (%)
2010	4,664								4,664	
2015	9,776	16.0			12		12		9,788	16.0
2020	11,810	3.9			30	20.1	30	20.1	11,840	3.9
2025	13,080	2.1	362		48	9.9	440	71.1	13,520	2.7
2030	13,308	0.3	844	18.4	58	3.9	1,254	23.3	14,562	1.5
2035	13,648	0.5	1,386	10.4	74	5.0	1,506	3.7	15,154	0.8
2040	13,910	0.4	1,602	2.9	86	3.1	1,728	2.8	15,638	0.6
2045	14,094	0.3	1,770	2.0	96	2.2	1,898	1.9	15,992	0.4

Source: JICA Study Team

Table 3.4-20 (2) Annual Aircraft Movements (Medium Case)

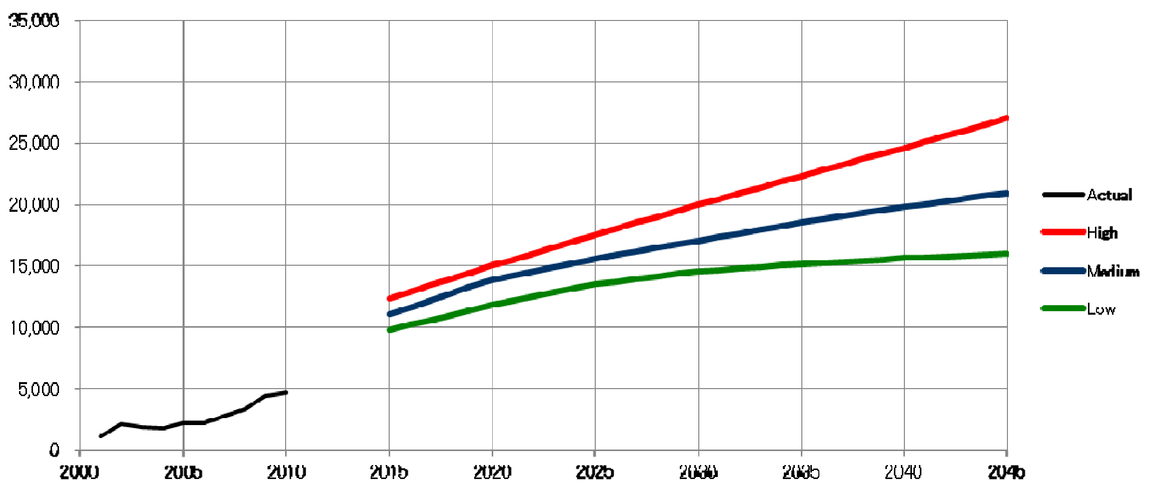
	Domestic		International Flights						Grand Total	
CY	Flights	G/R (%)	Scheduled	G/R (%)	Non-Sche.	G/R (%)	Total	G/R (%)	Flights	G/R (%)
2010	4,664								4,664	
2015	11,022	18.8			16		16		11,038	18.8
2020	13,548	4.2			40	20.1	370	87.4	13,918	4.7
2025	14,370	1.2	812		58	7.7	1,254	27.6	15,624	2.3
2030	15,358	1.3	1,526	13.4	84	7.7	1,692	6.2	17,050	1.8
2035	16,136	1.0	2,220	7.8	104	4.4	2,406	7.3	18,542	1.7
2040	16,992	1.0	2,620	3.4	126	3.9	2,814	3.2	19,806	1.3
2045	17,796	0.9	2,962	2.5	148	3.3	3,178	2.5	20,974	1.2

Source: JICA Study Team

Table 3.4-20 (3) Annual Aircraft Movements (High Case)

	Domestic		International Flights						Grand Total	
CY	Flights	G/R (%)	Scheduled	G/R (%)	Non-Sche.	G/R (%)	Total	G/R (%)	Flights	G/R (%)
2010	4,664								4,664	
2015	12,342	21.5			18		18		12,360	21.5
2020	14,604	3.4	344		48	21.7	434	89.0	15,038	4.0
2025	15,998	1.8	1,360	31.6	76	9.6	1,548	29.0	17,546	3.1
2030	17,538	1.9	2,232	10.4	106	6.9	2,456	9.7	19,994	2.6
2035	19,246	1.9	2,820	4.8	140	5.7	3,072	4.6	22,318	2.2
2040	21,008	1.8	3,352	3.5	178	4.9	3,630	3.4	24,638	2.0
2045	22,828	1.7	3,892	3.0	220	4.3	4,222	3.1	27,050	1.9

Source: JICA Study Team



Source: JICA Study Team

Figure 3.4-10 Future Annual Aircraft Movements
(Total aircraft movements of domestic and international)

3.5. Peak Day Air Traffic Demand Forecast

3.5.1. Passengers

According the aircraft operation guidelines of this study (Table 3.4-19), peak-day passengers have been forecasted as follows:

Table 3.5-1 (1) Peak Day Air Passengers (Low Case)

CY	Domestic		International Passengers					Grand Total	
	Passengers	G/R (%)	Scheduled	G/R (%)	Charter	Total	G/R (%)	Passengers	G/R (%)
2010	1,778							1,778	
2015	2,805	9.6			416	416		3,221	12.6
2020	3,517	4.6			416	416		3,933	4.1
2025	4,046	2.8	145		416	561	6.2	4,608	3.2
2030	4,196	0.7	445	25.1	416	861	8.9	5,057	1.9
2035	4,420	1.0	532	3.7	416	948	2.0	5,368	1.2
2040	4,592	0.8	610	2.8	416	1,026	1.6	5,618	0.9
2045	4,713	0.5	678	2.1	416	1,094	1.3	5,807	0.7

Source: JICA Study Team

Table 3.5-1 (2) Peak Day Air Passengers (Medium Case)

CY	Domestic		International Passengers					Grand Total	
	Passengers	G/R (%)	Scheduled	G/R (%)	Charter	Total	G/R (%)	Passengers	G/R (%)
2010	1,778							1,778	
2015	3,242	12.8			416	416		3,658	15.5
2020	4,354	6.1	123		416	539	5.3	4,893	6.0
2025	4,893	2.4	444	29.3	416	860	9.8	5,753	3.3
2030	5,542	2.5	598	6.1	416	1,014	3.4	6,556	2.6
2035	6,053	1.8	879	8.0	416	1,295	5.0	7,348	2.3
2040	6,615	1.8	1,065	3.9	416	1,481	2.7	8,095	2.0
2045	7,142	1.5	1,248	3.2	416	1,664	2.4	8,806	1.7

Source: JICA Study Team

Table 3.5-1 (3) Peak Day Air Passengers (High Case)

CY	Domestic		International Passengers					Grand Total	
	Passengers	G/R (%)	Scheduled	G/R (%)	Charter	Total	G/R (%)	Passengers	G/R (%)
2010	1,778							1,778	
2015	3,704	15.8			416	416		4,120	18.3
2020	5,047	6.4	144		416	560	6.1	5,606	6.4
2025	5,962	3.4	547	30.7	416	963	11.5	6,925	4.3
2030	6,972	3.2	899	10.4	416	1,315	6.4	8,287	3.7
2035	8,093	3.0	1,190	5.8	416	1,606	4.1	9,699	3.2
2040	9,250	2.7	1,507	4.8	416	1,923	3.7	11,174	2.9
2045	10,444	2.5	1,848	4.2	416	2,264	3.3	12,708	2.6

Source: JICA Study Team

3.5.2. Cargoes

According the aircraft operation guidelines of this study (Table 3.4-19), peak-day cargoes have been forecasted as follows:

Table 3.5-2 Peak Day Air Cargoes

(MT)

CY	Low Case		Medium Case		High Case	
	Cargoes	G/R (%)	Cargoes	G/R (%)	Cargoes	G/R (%)
2010	14.7		14.7		14.7	
2015	22.6	9.1	25.7	11.9	29.0	14.6
2020	27.6	4.1	33.5	5.5	38.4	5.8
2025	31.4	2.6	37.3	2.2	44.8	3.1
2030	32.4	0.7	41.9	2.3	51.9	3.0
2035	34.0	0.9	45.5	1.7	59.8	2.9
2040	35.2	0.7	49.4	1.7	67.9	2.6
2045	36.0	0.5	53.1	1.5	76.3	2.4

Source: JICA Study Team

3.5.3. Aircraft Movements

According aircraft operation guideline of this study (Table 3.4-19), peak day aircraft movements has been forecasted as follows:

Table 3.5-3 (1) Peak Day Aircraft Movements (Low Case)

CY	Domestic		International Flights					Grand Total	
	Flights	G/R (%)	Scheduled	G/R (%)	Non-Sche.	Total	G/R (%)	Flights	G/R (%)
2010	14							14	
2015	30	15.9			2	2		32	17.4
2020	36	3.7			2	2		38	3.5
2025	40	2.1	2		2	4	14.9	44	3.0
2030	42	1.0	6	24.6	2	8	14.9	50	2.6
2035	42		6		2	8		50	
2040	44	0.9	6		2	8		52	0.8
2045	44		8	5.9	2	10	4.6	54	0.8

Source: JICA Study Team

Table 3.5-3 (2) Peak Day Aircraft Movements (Medium Case)

CY	Domestic		International Flights					Grand Total	
	Flights	G/R (%)	Scheduled	G/R (%)	Non-Sche.	Total	G/R (%)	Flights	G/R (%)
2010	14							14	
2015	34	18.9			2	2		36	20.2
2020	42	4.3	2		2	4	14.9	46	5.0
2025	44	0.9	6	24.6	2	8	14.9	52	2.5
2030	48	1.8	6		2	8		56	1.5
2035	50	0.8	8	5.9	2	10	4.6	60	1.4
2040	54	1.6	10	4.6	2	12	3.7	66	1.9
2045	56	0.7	10		2	12		68	0.6

Source: JICA Study Team

Table 3.5-3 (3) Peak Day Aircraft Movements (High Case)

CY	Domestic		International Flights					Grand Total	
	Flights	G/R (%)	Scheduled	G/R (%)	Non-Sche.	Total	G/R (%)	Flights	G/R (%)
2010	14							14	
2015	38	21.5			2	2		40	22.8
2020	46	3.9	2		2	4	14.9	50	4.6
2025	50	1.7	6	24.6	2	8	14.9	58	3.0
2030	54	1.6	8	5.9	2	10	4.6	64	2.0
2035	60	2.1	10	4.6	2	12	3.7	72	2.4
2040	66	1.9	12	3.7	2	14	3.1	80	2.1
2045	72	1.8	14	3.1	2	16	2.7	88	1.9

Source: JICA Study Team

3.6. Peak Hour Air Traffic Demand Forecast

3.6.1. Peak Hour Air Traffic Demand

Peak hour domestic air traffic demand has been forecasted using peak hour coefficients calculated according to guideline of Japan Civil Aviation Bureau (JCAB). The formula to calculate peak-hour coefficients is follows:

[Peak hour coefficient] = 1.51 / (2-way peak-day movements) + 0.115

Peak hour international air traffic demand has been estimated in consideration of the simulated international flight schedules in line with expected regional cities in the neighboring countries.

Accordingly, peak hour air traffic demand by case has been forecasted as shown in Table 3.6-1.

Table 3.6-1 (1) Peak Hour Air Traffic Demand at New Bohol Airport (Low Case)

				CY	2015		2020		2025		2030		2035		2040		2045	
Domestic Traffic																		
Peak-days of the year					320	days	320	days	320	days	320	days	320	days	320	days	320	days
2-way Annual Passengers						898,000		1,125,000		1,295,000		1,343,000		1,414,000		1,469,000		1,508,000
2-way Peek-day Passengers					(1/320)	2,806	(1/320)	3,516	(1/320)	4,047	(1/320)	4,197	(1/320)	4,419	(1/320)	4,591	(1/320)	4,713
1-way Peek-day Passengers						1,403		1,758		2,023		2,098		2,209		2,295		2,356
1-way Peak-day Traffic	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	DH3	50	70%	35	4.00	140	4.00	140	4.00	140	4.00	140	4.00	140	4.00	140	4.00	140
	A320	160	70%	112	11.28	1,263	14.44	1,618	16.00	1,792	16.00	1,792	16.00	1,792	16.00	1,792	16.00	1,792
	B767	260	70%	182														
	A330	300	70%	210					0.44	91	0.79	166	1.32	277	1.73	363	2.02	424
	subtotal				15.28	1,403	18.44	1,758	20.44	2,023	20.79	2,098	21.32	2,209	21.73	2,295	22.02	2,356
2-way Annual Traffic	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	DH3	50	70%	35	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600
	A320	160	70%	112	7,218	808,400	9,245	1,035,400	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880
	B767	260	70%	182														
	A330	300	70%	210					279	58,520	507	106,520	845	177,520	1,107	232,520	1,293	271,520
	subtotal				9,778	898,000	11,805	1,125,000	13,079	1,295,000	13,307	1,343,000	13,645	1,414,000	13,907	1,469,000	14,093	1,508,000
PHF	1.51/ (2-way peak-day movements) + 0.115				16.4%		15.6%		15.2%		15.1%		15.0%		15.0%		14.9%	
1-way Peak-hour Traffic	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	DH3	50	80%	40	0.66	26	0.62	25	0.61	24	0.61	24	0.60	24	0.60	24	0.60	24
	A320	160	80%	128	1.85	237	2.25	288	2.43	311	2.42	310	2.41	308	2.40	307	2.39	306
	B767	260	80%	208														
	A330	300	80%	240					0.07	16	0.12	29	0.20	48	0.26	62	0.30	72
	subtotal				2.51	264	2.88	313	3.11	351	3.15	363	3.21	380	3.25	393	3.29	402
International Traffic																		
Peak-days of the year					5	days	14	days	89	days	159	days	176	days	194	days	191	days
2-way Annual Passengers						2,000		6,000		50,000		137,000		164,000		189,000		209,000
2-way Peek-day Passengers						416		416		562		863		930		974		1,096
1-way Peek-day Passengers						208		208		281		432		465		487		548
1-way Peak-day Traffic		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	A320	160	65%	104					0.70	73	2.15	224	2.47	257	2.68	279	2.82	293
	B767 charter	260	80%	208	1.00	208	1.00	208	1.00	208	1.00	208	1.00	208	1.00	208	1.00	208
	A330	300	65%	195													0.24	47
	subtotal				1.00	208	1.00	208	1.70	281	3.15	432	3.47	465	3.68	487	4.06	548
2-way Annual Traffic		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	A320	160	65%	104					392	40,768	1,196	124,384	1,432	148,928	1,642	170,768	1,770	184,080
	B767charter	260	80%	208	12	2,496	30	6,240	48	9,984	58	12,064	74	15,392	86	17,888	96	19,968
	A330	300	65%	195													32	6,240
	subtotal				12	2,496	30	6,240	440	50,752	1,254	136,448	1,506	164,320	1,728	188,656	1,898	210,288
PHF	according to Simulated International Flight Schedule				one(1) A320		one(1) A320		one(1) A320		one(1) A320		one(1) A320		one(1) A330		one(1) A330	
1-way Peak-hour Traffic		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	A320	160	80%	128	1.00	128	1.00	128	1.00	128	1.00	128	1.00	128	1.00	128		
	B767charter	260	80%	208														
	A330	300	80%	240													1.00	240
	subtotal				1.00	128	1.00	128	1.00	128	1.00	128	1.00	128	1.00	128	1.00	240
Cargo Traffic																		
Peak-day Volumes (MT)						22.6		27.6		31.4		32.4		34.0		35.2		36.0

Source: JICA Study Team

Table 3.6-1 (2) Peak Hour Air Traffic Demand at New Bohol Airport (Medium Case)

				CY	2015		2020		2025		2030		2035		2040		2045	
Domestic Traffic																		
Peak-days of the year					320	days	320	days	320	days	320	days	320	days	320	days	320	days
2-way Annual Passengers						1,037,000		1,393,000		1,566,000		1,773,000		1,937,000		2,117,000		2,285,000
2-way Peek-day Passengers					(1/320)	3,241	(1/320)	4,353	(1/320)	4,894	(1/320)	5,541	(1/320)	6,053	(1/320)	6,616	(1/320)	7,141
1-way Peek-day Passengers						1,620		2,177		2,447		2,770		3,027		3,308		3,570
1-way Peak-day Traffic	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	DH3	50	70%	35	4.00	140	4.00	140	4.00	140	4.00	140	4.00	140	4.00	140	4.00	140
	A320	160	70%	112	13.22	1,480	16.00	1,792	16.00	1,792	16.00	1,792	16.00	1,792	16.00	1,792	16.00	1,792
	B767	260	70%	182														
	A330	300	70%	210			1.16	245	2.45	515	3.99	838	5.21	1,095	6.55	1,376	7.80	1,638
	subtotal				17.22	1,620	21.16	2,177	22.45	2,447	23.99	2,770	25.21	3,027	26.55	3,308	27.80	3,570
2-way Annual Traffic	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	DH3	50	70%	35	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600
	A320	160	70%	112	8,459	947,400	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880
	B767	260	70%	182														
	A330	300	70%	210			745	156,520	1,569	329,520	2,555	536,520	3,336	700,520	4,193	880,520	4,993	1,048,520
	subtotal				11,019	1,037,000	13,545	1,393,000	14,369	1,566,000	15,355	1,773,000	16,136	1,937,000	16,993	2,117,000	17,793	2,285,000
PHF	1.51/ (2-way peak-day movements) + 0.115				15.9%		15.1%		14.9%		14.6%		14.5%		14.3%		14.2%	
1-way Peak-hour Traffic	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	DH3	50	80%	40	0.64	25	0.60	24	0.59	24	0.59	23	0.58	23	0.57	23	0.57	23
	A320	160	80%	128	2.10	269	2.41	309	2.38	304	2.34	300	2.32	297	2.29	294	2.27	291
	B767	260	80%	208														
	A330	300	80%	240			0.18	42	0.36	87	0.58	140	0.76	181	0.94	226	1.11	266
	subtotal				2.73	294	3.19	375	3.34	416	3.51	464	3.65	501	3.81	542	3.95	580
International Traffic																		
Peak-days of the year					7	days	80	days	158	days	191	days	207	days	218	days	228	days
2-way Annual Passengers						3,000		43,000		136,000		185,000		268,000		324,000		380,000
2-way Peek-day Passengers						416		539		861		970		1,297		1,483		1,665
1-way Peek-day Passengers						208		270		431		485		649		742		833
1-way Peak-day Traffic		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	A320	160	65%	104			0.59	62	2.14	223	2.66	277	3.53	367	3.72	387	3.85	400
	B767 charter	260	80%	208	1.00	208	1.00	208	1.00	208	1.00	208	1.00	208	1.00	208	1.00	208
	A330	300	65%	195									0.38	74	0.75	147	1.15	225
	subtotal				1.00	208	1.59	270	3.14	431	3.66	485	4.91	649	5.47	742	6.00	833
2-way Annual Traffic		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	A320	160	65%	104			330	34,320	1,196	124,384	1,608	167,232	2,226	231,504	2,480	257,920	2,650	275,600
	B767charter	260	80%	208	16	3,328	40	8,320	58	12,064	84	17,472	104	21,632	126	26,208	148	30,784
	A330	300	65%	195									76	14,820	208	40,560	380	74,100
	subtotal				16	3,328	370	42,640	1,254	136,448	1,692	184,704	2,406	267,956	2,814	324,688	3,178	380,484
PHF	according to Simulated International Flight Schedule				one(1) A320		one(1) A320		one(1) A320		one(1) A320		one(1) A330		one(1) A330		one(1) A330	
1-way Peak-hour Traffic		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
	A320	160	80%	128	1.00	128	1.00	128	1.00	128	1.00	128						
	B767charter	260	80%	208														
	A330	300	80%	240									1.00	240	1.00	240	1.00	240
	subtotal				1.00	128	1.00	128	1.00	128	1.00	128	1.00	240	1.00	240	1.00	240
Cargo Traffic																		
Peak-day Volumes (MT)						25.7		33.5		37.3		41.9		45.5		49.4		53.1

Source: JICA Study Team

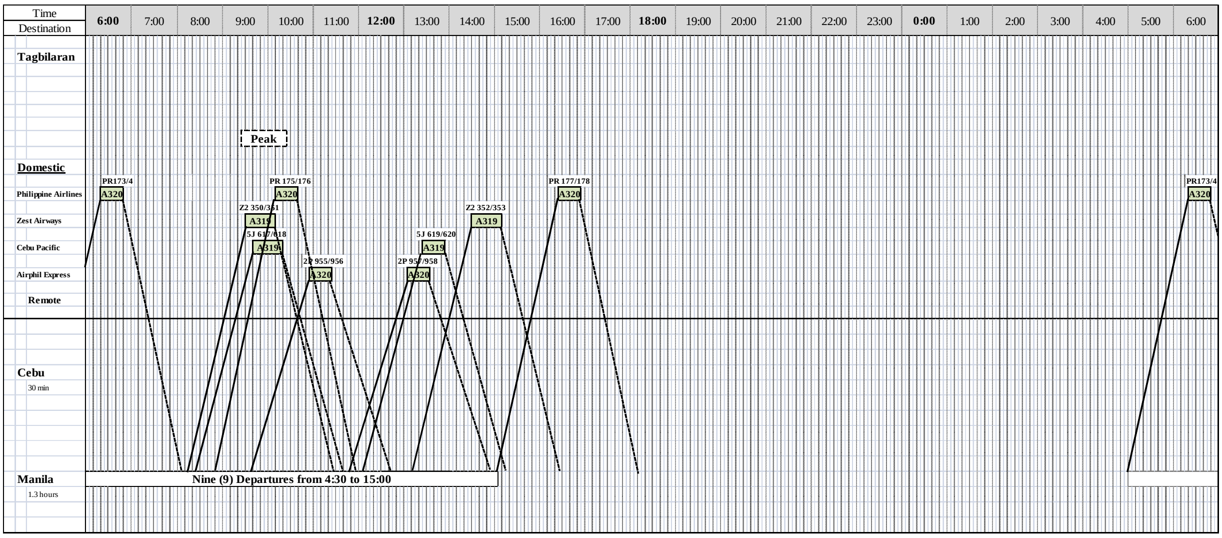
Table 3.6-1 (3) Peak Hour Air Traffic Demand at New Bohol Airport (High Case)

				CY	2015		2020		2025		2030		2035		2040		2045	
Domestic Traffic																		
Peak-days of the year					320	days	320	days	320	days	320	days	320	days	320	days	320	days
2-way Annual Passengers						1,185,000		1,615,000		1,908,000		2,231,000		2,590,000		2,960,000		3,342,000
2-way Peek-day Passengers					(1/320)	3,703	(1/320)	5,047	(1/320)	5,963	(1/320)	6,972	(1/320)	8,094	(1/320)	9,250	(1/320)	10,444
1-way Peek-day Passengers						1,852		2,523		2,981		3,486		4,047		4,625		5,222
	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
1-way	DH3	50	70%	35	4.00	140	4.00	140	4.00	140	4.00	140	4.00	140	4.00	140	4.00	140
Peak-day	A320	160	70%	112	15.28	1,712	16.00	1,792	16.00	1,792	16.00	1,792	16.00	1,792	16.00	1,792	16.00	1,792
Traffic	B767	260	70%	182														
	A330	300	70%	210			2.82	591	5.00	1,049	7.40	1,554	10.07	2,115	12.82	2,693	15.67	3,290
	subtotal				19.28	1,852	22.82	2,523	25.00	2,981	27.40	3,486	30.07	4,047	32.82	4,625	35.67	5,222
	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
2-way	DH3	50	70%	35	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600	2,560	89,600
Annual	A320	160	70%	112	9,780	1,095,400	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880	10,240	1,146,880
Traffic	B767	260	70%	182														
	A330	300	70%	210			1,802	378,520	3,198	671,520	4,736	994,520	6,445	1,353,520	8,207	1,723,520	10,026	2,105,520
	subtotal				12,340	1,185,000	14,602	1,615,000	15,998	1,908,000	17,536	2,231,000	19,245	2,590,000	21,007	2,960,000	22,826	3,342,000
PHF	1.51/ (2-way peak-day movements) + 0.115				15.4%		14.8%		14.5%		14.3%		14.0%		13.8%		13.6%	
	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
1-way	DH3	50	80%	40	0.62	25	0.59	24	0.58	23	0.57	23	0.56	22	0.55	22	0.54	22
Peak-hour	A320	160	80%	128	2.36	302	2.37	303	2.32	297	2.28	292	2.24	287	2.21	283	2.18	279
Traffic	B767	260	80%	208														
	A330	300	80%	240			0.42	100	0.73	174	1.05	253	1.41	339	1.77	425	2.13	512
	subtotal				2.97	326	3.38	427	3.63	495	3.91	568	4.21	648	4.53	729	4.86	813
International Traffic																		
Peak-days of the year					7	days	89	days	179	days	208	days	225	days	238	days	248	days
2-way Annual Passengers						3,000		50,000		169,000		274,000		362,000		459,000		563,000
2-way Peek-day Passengers						416		560		942		1,316		1,607		1,926		2,266
1-way Peek-day Passengers						208		280		471		658		804		963		1,133
		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
1-way	A320	160	65%	104			0.69	72	2.53	263	3.58	372	3.80	396	4.00	416	4.00	416
Peak-day	B767 charter	260	80%	208	1.00	208	1.00	208	1.00	208	1.00	208	1.00	208	1.00	208	1.00	208
Traffic	A330	300	65%	195							0.40	78	1.03	200	1.74	339	2.61	509
	subtotal				1.00	208	1.69	280	3.53	471	4.98	658	5.83	804	6.74	963	7.61	1,133
		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
2-way	A320	160	65%	104			386	40,144	1,472	153,088	2,266	235,664	2,612	271,648	2,754	286,416	2,884	299,936
Annual	B767charter	260	80%	208	18	3,744	48	9,984	76	15,808	106	22,048	140	29,120	178	37,024	220	45,760
Traffic	A330	300	65%	195							84	16,380	320	62,400	698	136,110	1,118	218,010
	subtotal				18	3,744	434	50,128	1,548	168,896	2,456	274,092	3,072	363,168	3,630	459,550	4,222	563,706
PHF	according to Simulated International Flight Schedule				one(1) A320		one(1) A320		one(1) A320		one(1) A330		one(1) A330		one(1) A330		one(1) A330	
		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
1-way	A320	160	80%	128	1.00	128	1.00	128	1.00	128								
Peak-hour	B767charter	260	80%	208														
Traffic	A330	300	80%	240							1.00	240	1.00	240	1.00	240	1.00	240
	subtotal				1.00	128	1.00	128	1.00	128	1.00	240	1.00	240	1.00	240	1.00	240
Cargo Traffic																		
Peak-day Volumes (MT)						29.0		38.4		44.8		51.9		59.8		67.9		76.3

Source: JICA Study Team

3.6.2. Simulated Flight Schedule

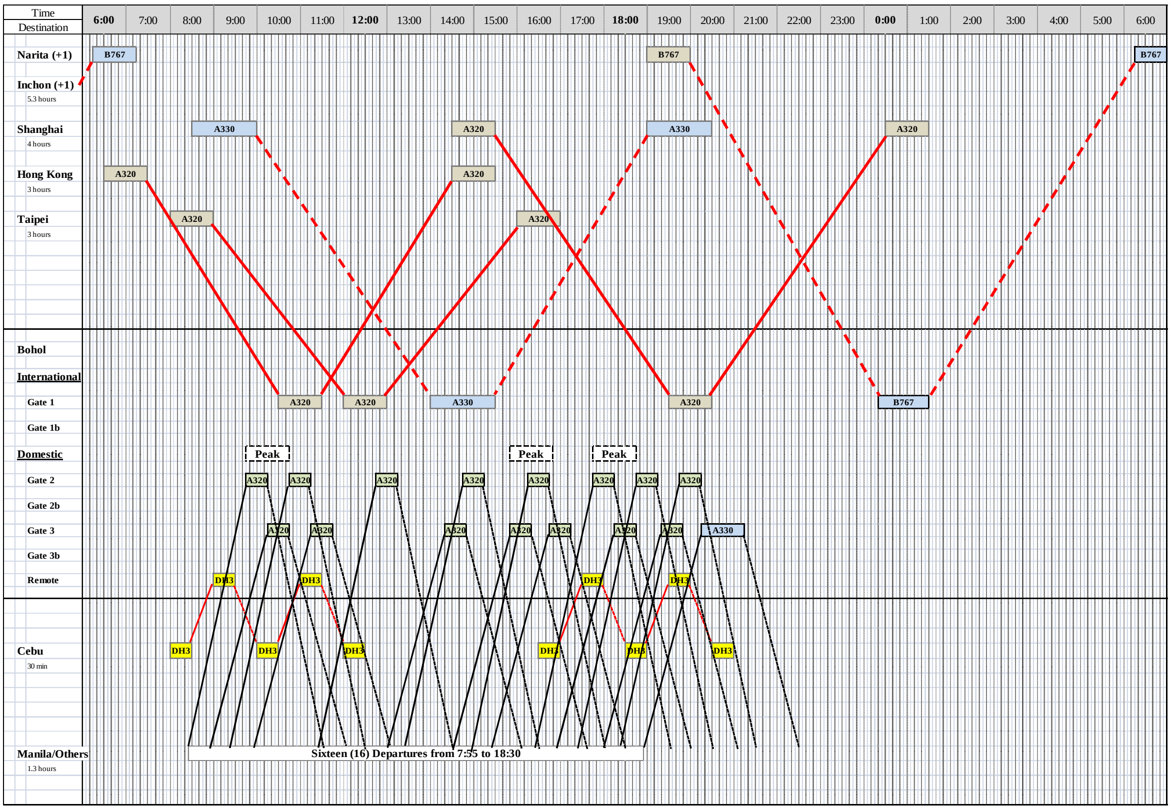
Current flight schedule at the existing Tagbilaran Airport is shown in Figure 3.6-1.



Source: JICA Study Team

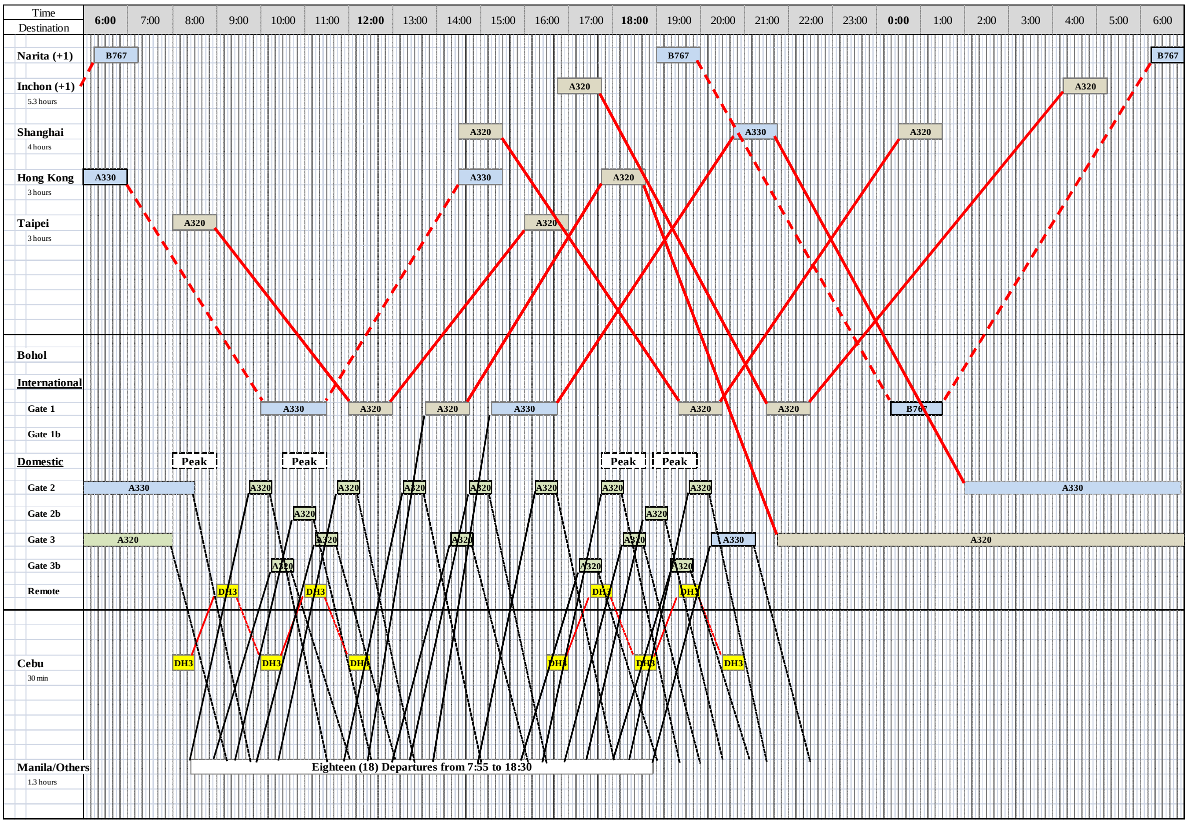
Figure 3.6-1 Present Flight Schedule at Tagbilaran Airport [2011]

Based on the current flight pattern adopted by the Airlines (turnaround time of 30-minutes for A320, 1 hour for A330) and forecasted peak hour traffic demand, flight schedule for the medium case scenario are simulated as follows:



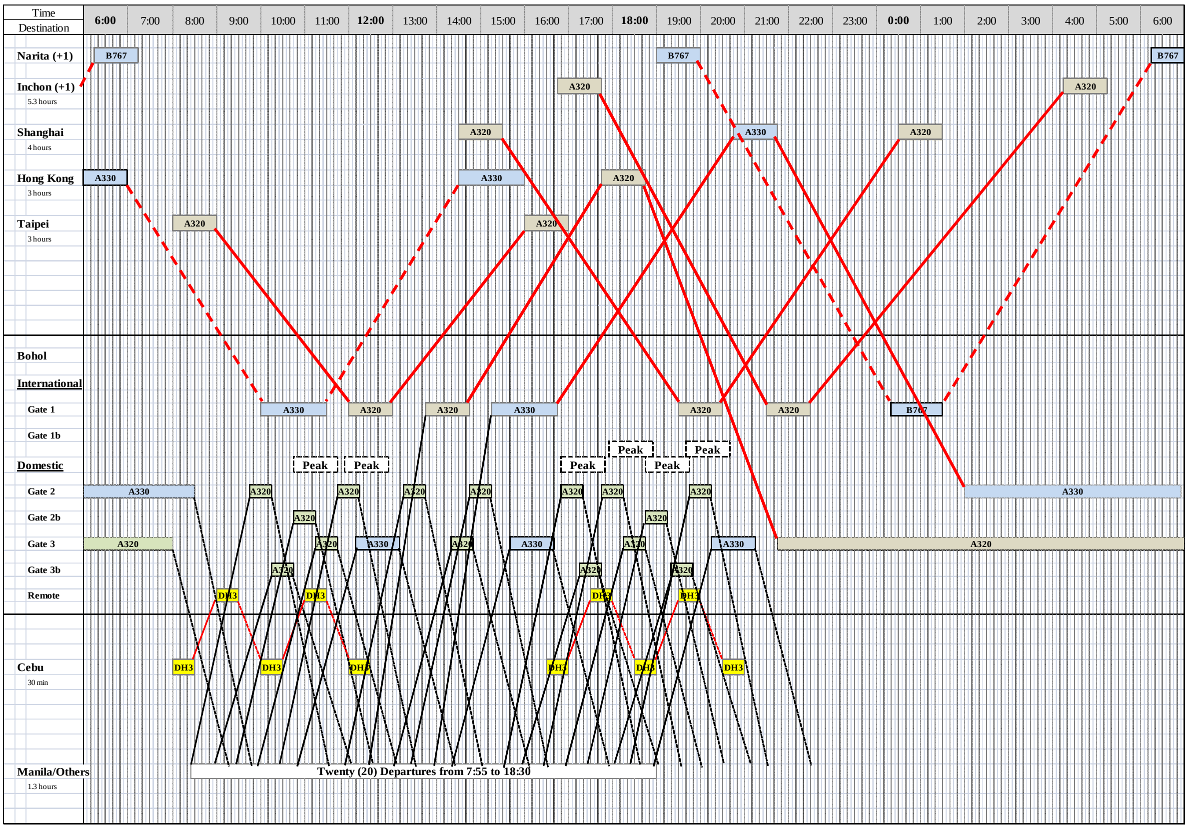
Source: JICA Study Team

Figure 3.6-2 Simulated Flight Schedule at New Bohol Airport [Medium Case] (2020)



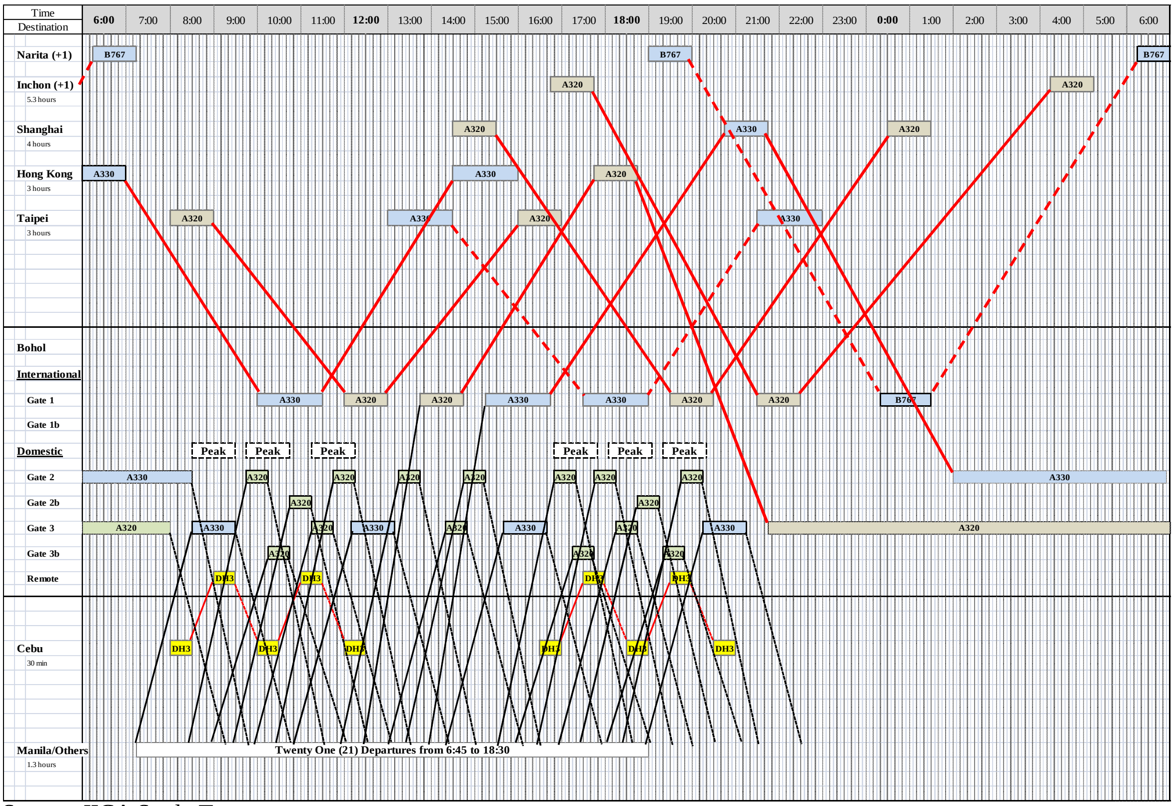
Source: JICA Study Team

Figure 3.6-3 Simulated Flight Schedule at New Bohol Airport [Medium Case] (2025)



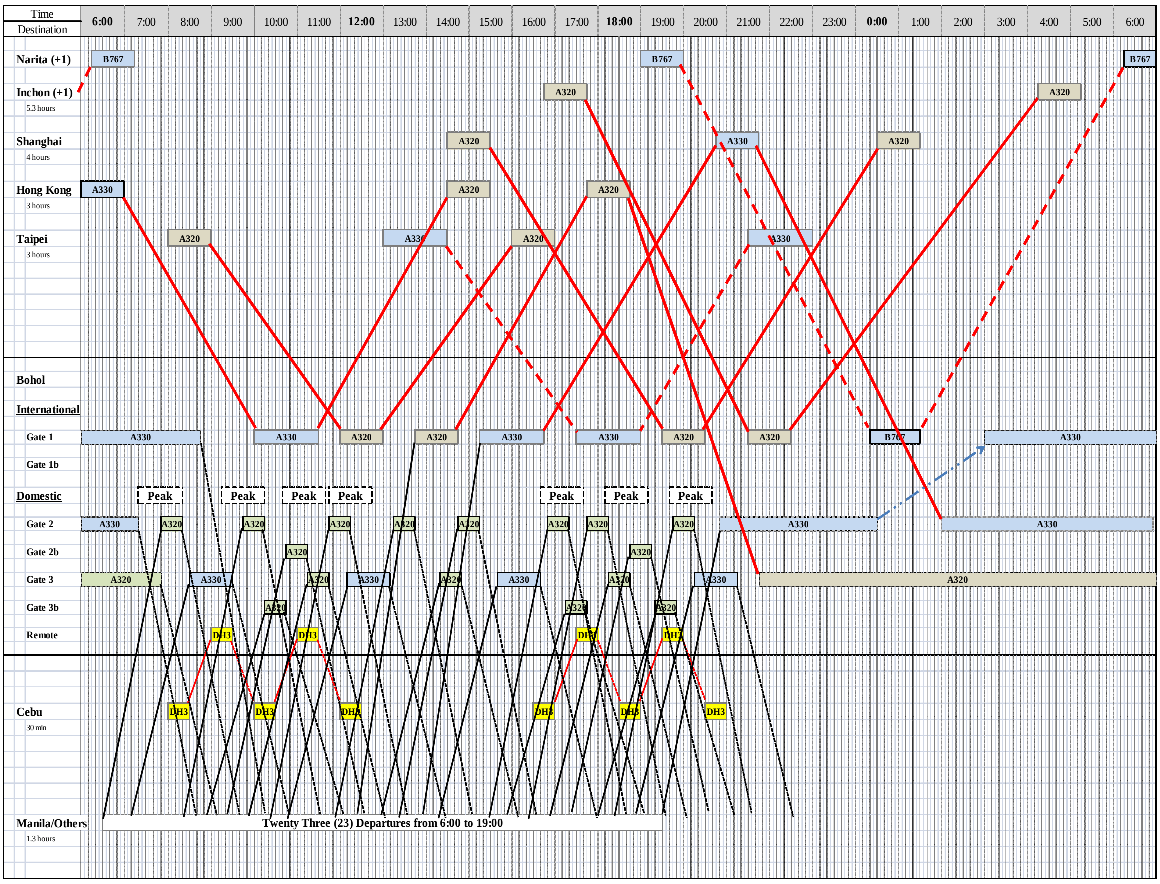
Source: JICA Study Team

Figure 3.6-4 Simulated Flight Schedule at New Bohol Airport [Medium Case] (2030)



Source: JICA Study Team

Figure 3.6-5 Simulated Flight Schedule at New Bohol Airport [Medium Case] (2035)



Source: JICA Study Team

Figure 3.6-6 Simulated Flight Schedule at New Bohol Airport [Medium Case] (2040)

3.7. Summary of Air Traffic Demand Forecast

The air traffic demand forecast of this study can be summarized as follows:

Table 3.7-1 Annual Air Passengers and Cargoes at New Bohol Airport

(Passenger : '000 , Cargo : '000 MT)

Case	CY	Air Passenger Demand										Air Cargo Demand	
		Domestic (*1)		International Passengers (*2)						Grand Total		Total (*3)	
		Passengers	G/R (%)	Scheduled	G/R (%)	Non-Sche.	G/R (%)	Total	G/R (%)	Passengers	G/R (%)	Cargoes	G/R (%)
Actual	2010	572								572		5	
Low Case	2015	898	9.4			2		2		900	9.5	7	8.6
	2020	1,125	4.6			6	19.0	6	19.0	1,131	4.7	9	4.1
	2025	1,295	2.8	41		10	10.5	50	53.4	1,345	3.5	10	2.6
	2030	1,343	0.7	125	25.1	12	4.1	137	22.0	1,479	1.9	10	0.7
	2035	1,414	1.0	149	3.7	15	5.1	164	3.8	1,579	1.3	11	0.9
	2040	1,469	0.8	171	2.8	18	2.8	189	2.8	1,658	1.0	11	0.7
	2045	1,508	0.5	190	2.1	20	2.2	209	2.1	1,718	0.7	12	0.5
Medium Case	2015	1,037	12.6			3		3		1,040	12.7	8	11.4
	2020	1,393	6.1	34		8	23.2	43	71.0	1,436	6.7	11	5.5
	2025	1,566	2.4	124	29.3	12	7.4	136	26.1	1,702	3.5	12	2.2
	2030	1,773	2.5	167	6.1	17	7.7	185	6.3	1,958	2.8	13	2.3
	2035	1,937	1.8	246	8.0	21	4.6	268	7.7	2,205	2.4	15	1.7
	2040	2,117	1.8	298	3.9	26	4.0	324	3.9	2,441	2.1	16	1.7
	2045	2,285	1.5	349	3.2	31	3.3	380	3.2	2,666	1.8	17	1.5
High Case	2015	1,185	15.7			3		3		1,188	15.7	9	14.1
	2020	1,615	6.4	40		10	23.5	50	71.4	1,665	7.0	12	5.8
	2025	1,908	3.4	153	30.7	16	10.0	169	27.6	2,077	4.5	14	3.1
	2030	2,231	3.2	252	10.4	22	7.0	274	10.1	2,505	3.8	17	3.0
	2035	2,590	3.0	333	5.8	29	5.9	362	5.8	2,952	3.3	19	2.9
	2040	2,960	2.7	422	4.8	37	4.9	459	4.8	3,419	3.0	22	2.6
	2045	3,342	2.5	518	4.2	45	4.2	563	4.2	3,905	2.7	24	2.4

notes : (*1) including some new route between Bohol and other islands
(*2) 4 new routes (BHL-SHA, BHL-HKG, BHL-TPE & BHL-SEL) and charter flights to/from many asian countries
(*3) excluding international cargoes and domestic cargoes of new domestic routes

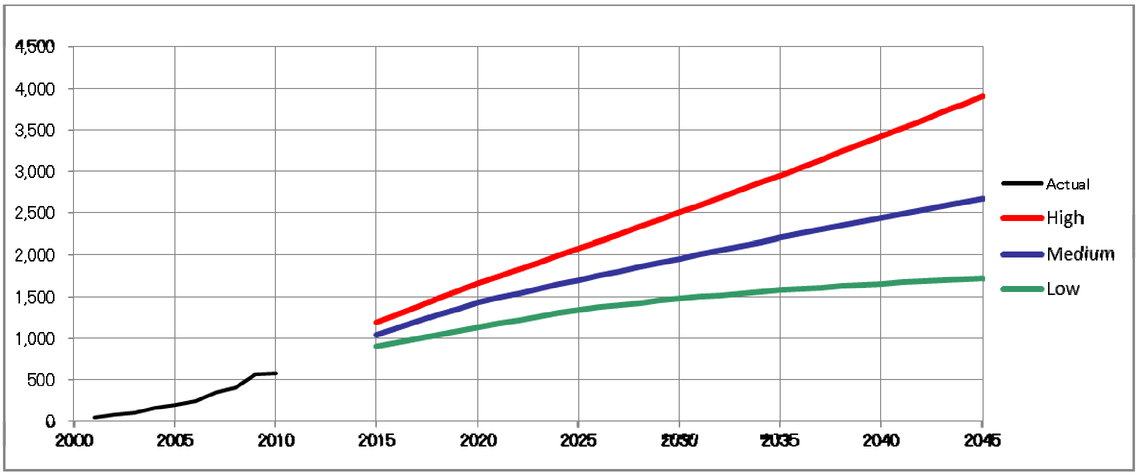
Source: JICA Study Team

Table 3.7-2 Annual Aircraft Movements at New Bohol Airport

Case	CY	Aircraft Movement												
		Domestic Flights (*1)				International Flights (*2)				Grand Total				
		PLOP	S-Jet	L-Jet	Total	S-Jet	M-Jet	L-Jet	Total	PLOP	S-Jet	M-Jet	L-Jet	Total
Actual	2010		4,664		4,664						4,664			4,664
Low Case	2011	2,560	4,892		7,452					2,560	4,892			7,452
	2015	2,560	7,216		9,776		12		12	2,560	7,216	12		9,788
	2020	2,560	9,250		11,810		30		30	2,560	9,250	30		11,840
	2025	2,560	10,240	280	13,080	392	48		440	2,560	10,632	48	280	13,520
	2030	2,560	10,240	508	13,308	1,196	58		1,254	2,560	11,436	58	508	14,562
	2035	2,560	10,240	848	13,648	1,432	74		1,506	2,560	11,672	74	848	15,154
	2040	2,560	10,240	1,110	13,910	1,642	86		1,728	2,560	11,882	86	1,110	15,638
	2045	2,560	10,240	1,294	14,094	1,770	96	32	1,898	2,560	12,010	96	1,326	15,992
Medium Case	2015	2,560	8,462		11,022		16		16	2,560	8,462	16		11,038
	2020	2,560	10,240	748	13,548	330	40		370	2,560	10,570	40	748	13,918
	2025	2,560	10,240	1,570	14,370	1,196	58		1,254	2,560	11,436	58	1,570	15,624
	2030	2,560	10,240	2,558	15,358	1,608	84		1,692	2,560	11,848	84	2,558	17,050
	2035	2,560	10,240	3,336	16,136	2,226	104	76	2,406	2,560	12,466	104	3,412	18,542
	2040	2,560	10,240	4,192	16,992	2,480	126	208	2,814	2,560	12,720	126	4,400	19,806
	2045	2,560	10,240	4,996	17,796	2,650	148	380	3,178	2,560	12,890	148	5,376	20,974
High Case	2015	2,560	9,782		12,342		18		18	2,560	9,782	18		12,360
	2020	2,560	10,240	1,804	14,604	386	48		434	2,560	10,626	48	1,804	15,038
	2025	2,560	10,240	3,198	15,998	1,472	76		1,548	2,560	11,712	76	3,198	17,546
	2030	2,560	10,240	4,738	17,538	2,266	106	84	2,456	2,560	12,506	106	4,822	19,994
	2035	2,560	10,240	6,446	19,246	2,612	140	320	3,072	2,560	12,852	140	6,766	22,318
	2040	2,560	10,240	8,208	21,008	2,754	178	698	3,630	2,560	12,994	178	8,906	24,638
	2045	2,560	10,240	10,028	22,828	2,884	220	1,118	4,222	2,560	13,124	220	11,146	27,050

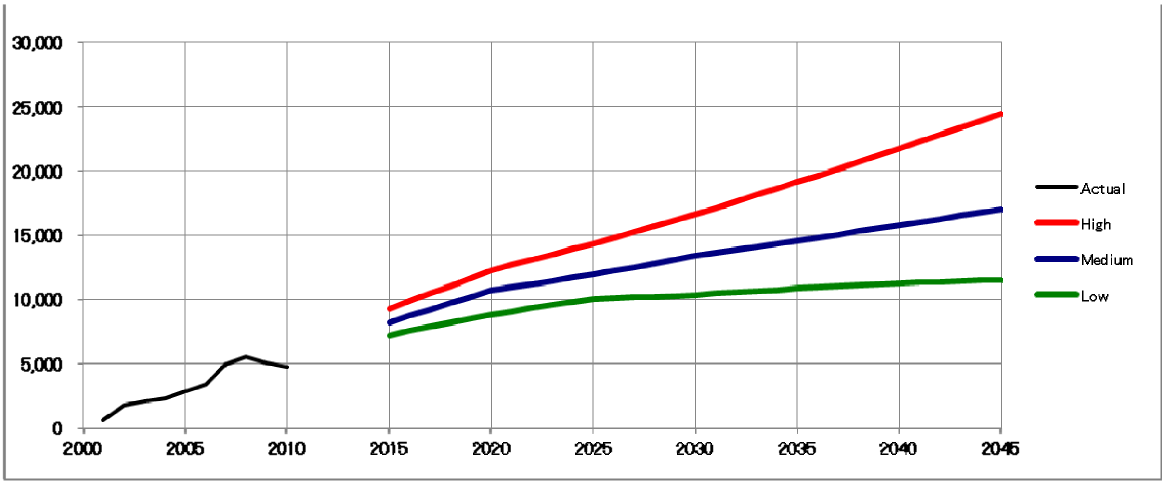
notes : (*1) including some new route between Bohol and other islands
(*2) 4 new routes (BHL-SHA, BHL-HKG, BHL-TPE & BHL-SEL) and charter flights to/from many asian countries

Source: JICA Study Team



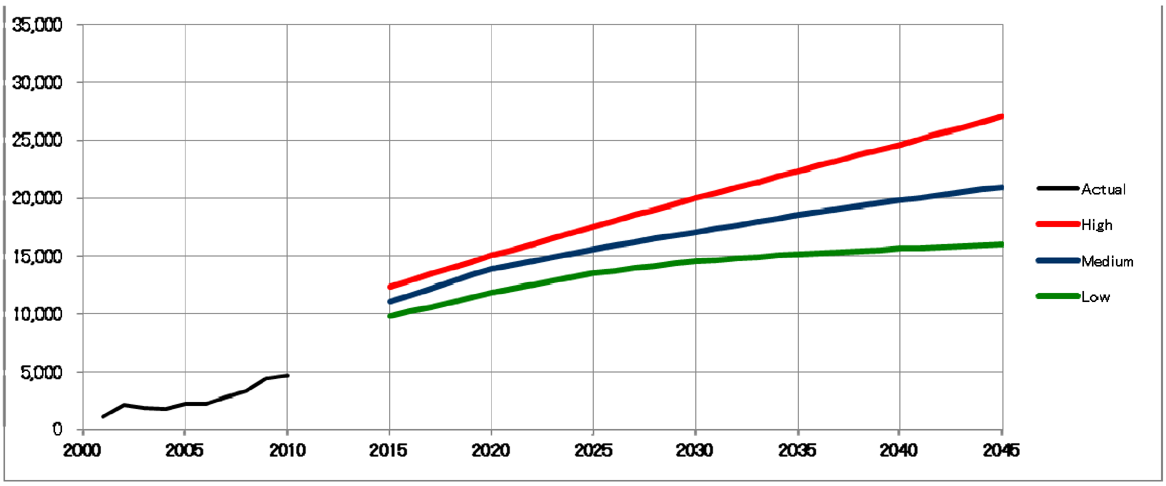
Source: JICA Study Team

Figure 3.7-1 Annual Air Passengers at New Bohol Airport



Source: JICA Study Team

Figure 3.7-2 Annual Air Cargoes at New Bohol Airport



Source: JICA Study Team

Figure 3.7-3 Annual Aircraft Movements at New Bohol Airport

3.8. Comparison with Previous Studies

In the past, three air traffic demand forecasts for the New Bohol Airport were conducted, namely, in 2000 by DOTC (2000 Feasibility Study), in 2006 by JICA Master Plan Study on the Improvement of National Airport in the Philippines, and in 2007 by the Manila International Airport Authority (MIAA).

The annual passenger traffic forecast in comparison with those forecasted in the previous studies is summarized as shown in Table 3.8-1.

Table 3.8-1 Annual Passenger Traffic Forecast In comparison to forecasts of previous studies

CY	2000 FS				2006 JICA	2007 FS			2011 JICA Study			
	Filipino Tourist	Foreign Tourist	Filipino Resident	Total	Total	Filipino	Foreig-ner	Total	Case	Domestic	Inter-national	Total
	Actual Record											
2001	39,268	-	-	39,268								
	Forecast					Actual Record						
2006	96,000	64,000	57,000	217,000		240,176	-	240,176				
						Froecast				Actual Record		
2010	198,000	111,000	84,000	393,000	245,392	403,000	10,400	413,400		572,476	-	572,476
						437,000		447,400				
						525,000		535,400		Froecast		
2015	318,000	178,000	128,000	624,000	353,698	519,000	15,000	534,000	Low	898,000	2,000	900,000
						656,000		671,000	Midium	1,037,000	3,000	1,040,000
						992,000		1,007,000	High	1,185,000	3,000	1,188,000
2020	514,000	288,000	189,000	991,000	494,712	627,000	31,200	658,200	Low	1,125,000	6,000	1,131,000
						938,000		969,200	Midium	1,393,000	43,000	1,436,000
						1,561,000		1,592,200	High	1,615,000	50,000	1,665,000
2025	827,000	463,000	271,000	1,561,000	679,707	716,000	77,400	793,400	Low	1,295,000	50,000	1,345,000
						1,262,000		1,339,400	Midium	1,566,000	136,000	1,702,000
						2,019,000		2,096,400	High	1,908,000	169,000	2,077,000
2030	n/a				n/a	782,000	181,400	963,400	Low	1,343,000	137,000	1,480,000
						1,590,000		1,771,400	Midium	1,773,000	185,000	1,958,000
						2,333,000		2,514,400	High	2,231,000	274,000	2,505,000
2035						828,000	381,400	1,209,400	Low	1,414,000	164,000	1,578,000
						1,882,000		2,263,400	Midium	1,937,000	268,000	2,205,000
						2,479,000		2,860,400	High	2,590,000	362,000	2,952,000
2040						n/a			Low	1,469,000	189,000	1,658,000
									Midium	2,117,000	324,000	2,441,000
									High	2,960,000	459,000	3,419,000
2045									Low	1,508,000	209,000	1,717,000
									Midium	2,285,000	380,000	2,665,000
									High	3,342,000	563,000	3,905,000

Source: JICA Study Team

The above Table shows differences in air traffic volumes as updated in comparison with those previously forecasted, particularly as follows:

a. Assuming the latent (or potentially-overflowed) domestic passengers and the latest trend in the increase of international tourists, the short-term growth of air passenger traffic forecasted for 2015-2025 is similar to the High Case scenario of the 2007 Feasibility Study.

b. In the long term, 2030 onwards, increase in the annual passengers is estimated at a similar level to the Medium Case scenario of the 2007 Feasibility Study, which is partly because the eco-tourism carrying capacity for the Bohol environment is expected to be observed.

Chapter 4

Airport Facility Requirements

Table of Contents

Chapter 4. Airport Facility Requirements

4.1. General

4.1.1. Design Year

In the previous feasibility study (2007 FS), the Design Year for the Project was assumed to be 2020, on the assumption that the New Bohol Airport was expected to complete by 2010 wholly under Government funding (i.e. DOTC and MIAA).

Now in 2011, acquisition of ROW and restructuring of the Project Implementation Scheme (under PPP) are being conducted. The New Bohol Airport is expected to open to public in 2017 to 2018.

For the purpose of this Final Report, the Project is aimed to be split into 2 Phases, and the Design Year for Phase-1 development is maintained as previously envisaged (i.e. 2020), where the Phase-1 facilities could mainly meet the initial requirements for domestic A320 flight operations, but possibly can accommodate international operations during the domestic off-peak hours (i.e. only nighttime).

The airport facilities are planned to be expanded by 2025 to 2030 (called as “Phase 2”), so that the Airport can accommodate simultaneously domestic and international flight operations by larger-sized aircraft throughout the day.

4.1.2. Design Aircraft and Runway Length

A Design Aircraft is normally defined as an aircraft either with:

- the maximum seating capacity;
- the maximum dimension of fuselage (wing span and length); and
- the longest runway length required.

The latest generation of aircraft with large fuselage however does not necessarily require a longer runway length, owing to its improved body structure and engine performance. Hence, the Design Aircraft is examined among probable future aircraft mix according to its manufacturer’s specifications.

In relation to a probable future aircraft mix for the operations at the New Bohol Airport, the following should be noted:

a) In the past, domestic flight operations in the Philippines were mostly made by B737, DC9 and A300, all of which were phased out and replaced by A320 or A330 in the past years.

b) At the existing Tagbilaran Airport, the types of aircraft being used by the 4 major Airlines are A319 and A320, which are categorized as small jet (SJ; seating capacity varies from 140 to 180), the majority of which are of the latest models.

c) B747 of PAL is mainly used for international routes and some used for domestic routes (e.g. for Davao and Cebu). PAL, however, plans to phase out B747's by 2015, as is the trend worldwide due to its high fuel consumption, thus this aircraft type is eliminated from the fleet planning for the New Bohol Airport.

d) B777 or A340 of PAL are exclusively used for long-range international routes, thus are not considered as a predominantly-used aircraft at the New Bohol Airport.

e) A330 is long used by PAL since 1997 with a good performance (low fuel consumption and requiring a shorter runway length). PAL intends in medium term to replace their A330 by A350, B787 or B777. Dimensions, weights and required runway lengths of those aircraft of this new generation are similar to A330, therefore A330 is assumed as the predominantly-used aircraft at the New Bohol Airport. However, the fuselage length of B777-300 (73.86 m) is considered as a critical dimension that is applied in the setting-up of building lines (to secure separation distance from taxiways required in the foreseeable future), because this -once defined- could not be easily altered in the future.

f) Since LCC's normally operate a single type of aircraft for their reason of easy maintenance, the A320 is assumed to be predominantly utilized in the Philippines. Cebu Pacific intends to add in their medium-term plan the A321 which is the advanced model and has the most critical dimension among A320's family. Thus, the dimension of the A321-200 (7 m longer and 1 m wider than the A320) is considered as the critical-sized SJ in the conceptual design of aircraft parking apron.

g) B737-800 (or -900), which is new Boeing version of SJ, equivalent to the Airbus 320 series, is gaining worldwide popularity for the use for regional flights or relatively-lower demand routes. This type of aircraft is now being operated by many foreign airlines in neighboring countries thus is considered to be occasionally operated at the New Bohol Airport.

h) B767's (MJ; 260 seats) are not owned by major domestic airlines in the Philippines, however are predominantly used for regional flight services by major foreign airlines in neighboring countries, thus is considered to be occasionally operated at the New Bohol Airport, but on a chartered base when initially commencing their international services to and from the New Bohol Airport.

Meanwhile, the required runway length is computed for each type of the above named aircraft, in consideration of the following

i) Distance from Bohol to Manila is 620 km, and that to Seoul, Tokyo or Beijing is almost the same, e.g. approximately 3,100 km, as shown in the Figure 4.1-1. For the computation of the takeoff runway required, the critical distance is thus assumed to be 3,100 km.

j) Reference Temperature (average in the hottest month) at the New Bohol Airport is assumed to be the same as at Tagbilaran Airport, which is 34° C.

k) When taking off on a day of bad weather, a tropical depression of up to 980 hPa is considered to be safe, which is equivalent to the airport elevation of 1,000 feet (above mean sea level).

Source: JICA Study Team

Figure 4.1-1 Distance to Regional Cities from Bohol

Following the above consideration, the runway length required for the above named aircraft, and Design Aircraft is selected among those tabulated in Table 4.1-1.

Table 4.1-1 Type of Design Aircraft by each ICAO category and required Runway Length

No	Description		Size	SJ			MJ	LJ			
			ICAO code	code C			code D	code E			
			Aircraft Type	A320 -200	B737 -800	A321 -200	B767 -300	A330 -300	B777 -200	B777 -300	B787 -8
1	Turbo Engine			CFM56		CFM56	CF6	CF6	GE	GE	GE
	Wing Span		m	34.10	35.79	35.48	47.57	60.30	60.93	60.93	60.12
	Fuselarge Length		m	37.57	38.02	44.50	54.94	63.69	63.73	73.86	56.72
2	Seating Capacity		1 class	180	184	220	290	335	418	500	375
			2 classes	150	160	185	261	303	375	451	286
			3 classes	-	-		-	253	305	368	224
3	Max Takeoff Weight		lb	166,449	174,200	191,802	350,000	467,380	535,000	632,500	502,500
			kg	75,500	79,016	87,000	158,758	212,000	242,630	286,900	227,930
4	Max Landing Weight		lb	142,198	146,301	166,449	300,000	390,218	445,000	524,000	380,000
			kg	64,500	66,361	75,500	136,078	177,000	201,800	237,680	172,365
5	Max Zero Fuel Weight		lb	133,380	138,300	157,630	278,000	368,172	420,000	495,000	355,000
			kg	60,500	62,732	71,500	126,099	167,000	190,470	224,530	161,025
6	Operating Empty Weight		lb	90,927	91,300	103,300	189,750	264,182	299,550	353,800	N/A
			kg	41,244	41,413	46,856	86,069	119,831	135,850	160,530	N/A
7	Max Structural Payload		lb	42,452	47,000	54,331	88,250	103,990	120,450	141,200	N/A
			kg	19,256	21,319	24,644	40,230	47,169	54,620	64,000	N/A
8	Fuel	Maximum Usable (0.785 kg/l)	litter	23,667	26,022	23,700	63,216	97,530	117,300	169,210	126,903
			lb	40,959	46,063	41,015	119,890	168,788	207,700	299,490	224,638
			kg	18,579	20,894	18,604	50,753	76,561	94,240	135,880	101,894
9		consumption per km	litter/km	3.10	3.39	4.80	7.01	6.62	7.92	7.78	N/A
			lb/km	5.36	5.86	8.31	12.13	11.46	13.71	13.47	N/A
			kg/km	2.43	2.66	3.77	5.50	5.20	6.22	6.11	N/A
10		consumption for TAG-MNL flight (620km)	litter	1,919	2,101	2,978	4,344	4,107	4,913	4,826	N/A
			lb	3,321	3,636	5,153	7,518	7,108	8,502	8,352	N/A
			kg	1,507	1,649	2,337	3,410	3,224	3,856	3,788	N/A
11		consumption for TAG-ICN flight (3,100 km)	litter	9,596	10,504	14,888	21,720	20,535	24,563	24,129	N/A
			lb	16,607	18,179	25,765	37,589	35,539	42,510	41,758	N/A
			kg	7,533	8,246	11,687	17,050	16,120	19,282	18,941	N/A
12		for Takeoff, Diversion, Holding	litter	750	750	750	3,200	3,700	3,700	3,700	N/A
			lb	1,298	1,298	1,298	5,538	6,403	6,403	6,403	N/A
			kg	589	589	589	2,512	2,905	2,905	2,905	N/A
13		total for TAG-ICN flight (3,100 km)	litter	10,346	11,254	15,638	24,920	24,235	28,263	27,829	N/A
			lb	17,905	19,477	27,063	43,127	41,942	48,913	48,161	N/A
			kg	8,122	8,835	12,276	19,562	19,025	22,187	21,846	N/A
14	Takeoff Weight for TAG-ICN flight (3,100 km)		lb	151,285	157,778	184,694	321,568	410,114	468,827	543,165	N/A
			kg	68,622	71,567	83,776	145,861	186,025	212,657	246,376	N/A
15	Takeoff Runway Length Required for TAG-ICN (3,100 km)	Elevation at sea level; or 1013 hPa	15°C	1,524	1,859	1,829	1,905	1,798	1,707	2,316	N/A
			30 ºC	1,646	1,920	1,920	2,012	1,875	1,813	2,423	N/A
			34 ºC	1,679	1,936	1,944	2,041	1,896	1,841	2,452	N/A
16		Elevation at 1000 feet; or 980 hPa	15°C	1,585	1,920	1,951	1,981	1,860	1,767	2,438	N/A
			30 ºC	1,707	2,027	2,042	2,073	1,951	1,859	2,560	N/A
			34 ºC	1,740	2,056	2,066	2,098	1,975	1,884	2,593	N/A
17	Landing Runway Length										
		at sea level	1013hPa	1,463	2,042	1,661	1,820	1,707	1,768	2,134	N/A
		at 1000 feet	980hPa	1,463	2,103	1,722	1,875	1,753	1,830	2,180	N/A

Source: JICA Study Team

The Table shows that, in case of the critical conditions (i.e. temperature of 34 °C with a tropical depression of 980 hPa) the critical aircraft requiring the longest runway length is the B777-300 .

At any rate, the eventual runway length required for the New Bohol Airport is 2,500 m as was envisaged in the previous study (2007 FS).

In view of the above notes, the Design Aircraft in each category of ICAO code is shown in Table 4.1-2.

Table 4.1-2 Design Aircraft in each category of ICAO code

Size	SJ			MJ	LJ	
ICAO code	C			D	E	
Aircraft	A320-200	A321-200	B737-800	B767-300	A330-300	B777-300
Airline	PAL/Cebu	Cebu	JAL	Asiana/JAL	PAL	PAL
Wing Span	34.10	35.48	35.79	47.57	60.30	60.93
Length	37.57	44.50	38.02	54.94	63.69	73.86
Takeoff Weight	60 ton	72 ton	84 ton	146 ton	186 ton	213 ton
Usage	scheduled	future	future	charter	scheduled	future
Runway Length	1800 m	2100 m	2100 m	2100 m	2000 m	2600 m
Critical or Not	not critical, but most frequent	longest in Code C	critical for takeoff runway	critical for takeoff runway	Critical size, and frequent	longest in Code E
Normal Seat	160	200	185	260	300	
For Design	○			○	◎	

Source: JICA Study Team

It should be considered that possibly the B747-400 (wing span of 64.92 m, and length of 70.67 m) shall occasionally be used, although it is in the process of retiring.

Therefore, the following dimensions are considered for the purpose of the airfield design,

- Critical Wingspan of Design Aircraft: 65 m (for B747-400 as maximum size of Code E).
- Critical Length of Design Aircraft: 74 m (for B777-300 as maximum size of Code E).
- Runway Length: eventually 2,500-m.

However, the runway length for Phase-1 Development is planned to be 2,110-m, on the assumption that initially the Airport would accommodate mainly domestic flight operations and possibly accommodate international flights during off-peak hours operated only by domestic carriers (e.g. A321 of Cebu Pacific or A330 of PAL at maximum).

4.2. Airfield Requirements

4.2.1. Runway

1) Aerodrome Reference Code

In accordance with ICAO Annex 14 (abstracted in Table 4.2-1), the 2,500-m long runway is defined as ICAO Code Number 4, and the wingspan of Design Aircraft of less than 65 m is defined as ICAO Code Letter E, thus the corresponding runway width shall be 45 m.

Table 4.2-1 ICAO Annex 14 (Aerodrome Reference Code and Width of Runway)

Code element 1		Code element 2		
Code number (1)	Aeroplane reference field length (2)	Code letter (3)	Wingspan (4)	Outer main gear wheel span[a] (5)
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1 200 m	B	15 m up to but not including 24 m	4.5 m up to but not including 6 m
3	1 200 m up to but not including 1 800 m	C	24 m up to but not including 36 m	6 m up to but not including 9 m
4	1 800 m and over	D	36 m up to but not including 52 m	9 m up to but not including 14 m
		E	52 m up to but not including 65 m	9 m up to but not including 14 m
		F	65 m up to but not including 80 m	14 m up to but not including 16 m

a. Distance between the outside edges of the main gear wheels.

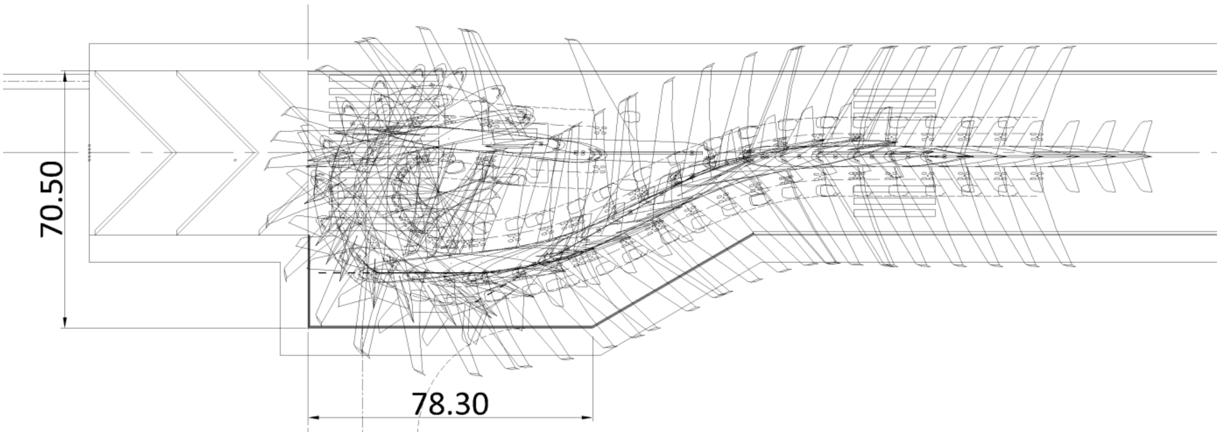
Width of Runway

Code number	Code letter A	B	C	D	E	F
1[a]	*18 m*	*18 m*	*23 m*	–	–	–
2[a]	*23 m*	*23 m*	*30 m*	–	–	–
3	*30 m*	*30 m*	*30 m*	*45 m*	–	–
4	–	–	*45 m*	*45 m*	*45 m*	*60 m*

Source: ICAO Annex 14

2) Runway Turn Pad

Since a parallel taxiway is not necessarily provided in the first phase, a turning pad shall be provided on both ends of the runway for the aircraft's U-turn. In simulating the maneuvering of 180-degree by the design aircraft (i.e.A300-300), the width and length of the turning pad is set as shown in Figure 4.2-1.



Source: JICA Study Team

Figure 4.2-1 Width and Length of Turning Pad for A300-300

The above turning pad is not wide enough for the most critical aircraft in the code-E classification, i.e. B777-300 having a triple-tandem main-gear configuration with a longer wheel-base. If and when such critical aircraft is introduced and by the time a parallel taxiway has not been provided yet, the runway turning pad will have to be expanded.

3) Runway Strip

In accordance with ICAO Annex 14, the runway strip for a precision approach runway should extend laterally to a distance of at least 150 m to both sides of runway centerline, and longitudinally for a distance of 60 m before the threshold and beyond the end of the runway.

4) Runway End Safety Area

In accordance with the recommendation of ICAO Annex 14 (Table 4.2-1), the runway-end safety area is extended to a distance of at least 240 m from the end of the runway strip where the Runway code number is 4, as shown in Figure 4.2-2.

Table 4.2-2 ICAO Annex 14
(Runway End Safety Area)

Dimensions of runway end safety areas

3.5.2 A runway end safety area shall extend from the end of a runway strip to a distance of at least 90 m.

3.5.3 **Recommendation.—** *A runway end safety area should, as far as practicable, extend from the end of a runway strip to a distance of at least:*

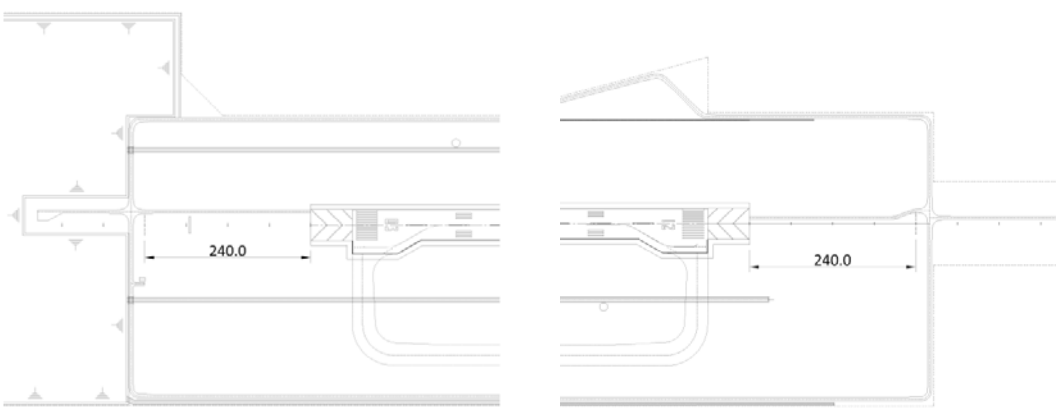
— *240 m where the code number is 3 or 4; and*

— *120 m where the code number is 1 or 2.*

3.5.4 The width of a runway end safety area shall be at least twice that of the associated runway.

3.5.5 **Recommendation.—** *The width of a runway end safety area should, wherever practicable, be equal to that of the graded portion of the associated runway strip.*

Source: ICAO Annex 14



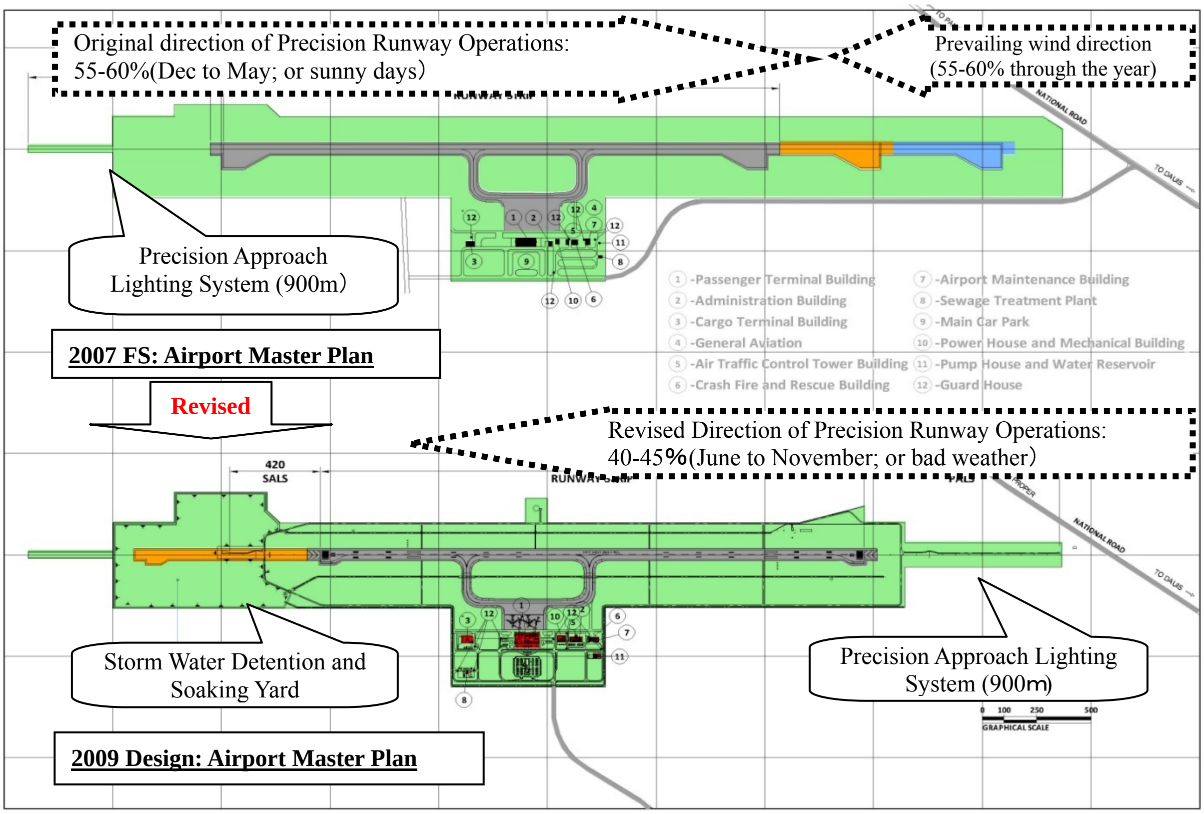
Source: JICA Study Team

Figure 4.2-2 Runway End Safety Area (240 m from the end of runway strip)

5) Precision Approach Direction

The airport master plan for the New Bohol Airport was first made through the 2000 FS conducted by DOTC, revised in the 2007 FS conducted by MIAA, and further revised through the previous engineering design under MIAA in 2009.

The revisions to the master plan made in 2009 were shown in Figure 4.2-3.



Source: JICA Study Team

Figure 4.2-3 Revision of Master Plan made in 2009

The following are the main reasons for the revision of the Airport Master Plan.

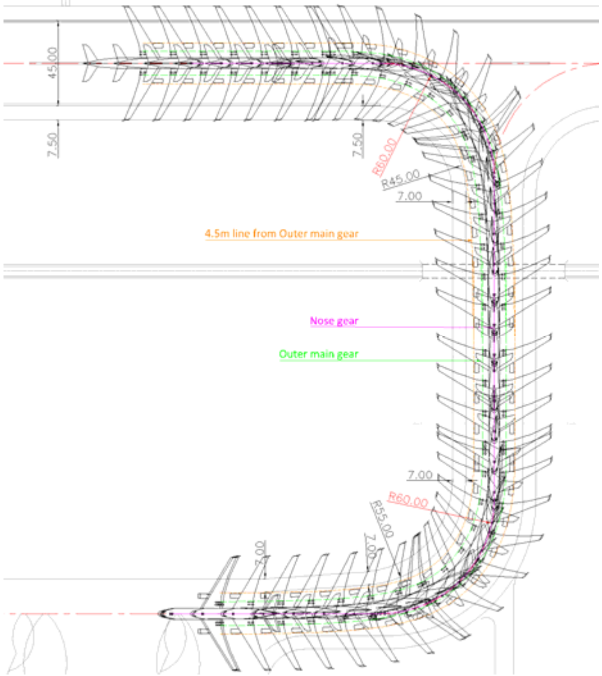
a)	Direction of Precision Runway Operations	Originally the ILS operations had been set from south-east direction against the prevailing wind which occurs normally on sunny days (55-60% throughout the year). However, the ILS is more required during bad weather (rainy season).Hence the ILS Precision Approach has been set from the opposite direction to cope with bad weather operations occurring 40-45% throughout the year.
b)	Runway Length	Originally the ultimate runway length had been set at 3,700 m. to accommodate long-haul B747's which however tend to be phased out. Considering regional international flights of the present aircraft (e.g. A330 or B777), a runway length of more than 2,500 m. may not be required in the foreseeable future.
c)	Storm water detention and Soaking Yard	Storm water will run along the natural slope of the existing terrain. Owing to the above revision a) and b), the existing coral ground at the south- west end of the airport site is planned to be lowered to create a storm water detention & soaking yard, so as to prevent any ocean contamination.

4.2.2. Taxiways

1) Width of Taxiway

ICAO Annex 14 recommends that a straight portion of a taxiway should have a width of not less than 23 m where the Runway code letter is E, meanwhile JCAB requires it to be 30 m.

The stub taxiways are perpendicular to the runway and not long enough, so that the width of 30 m is applied in the conceptual design so as to attain smooth maneuvering out from the runway by the critical design aircraft (A330-300). The trace of a A330-300 and required pavement fillet along the centerline turning radius of 60 m is shown in Figure 4.2-4.



Source: JICA Study Team

Figure 4.2-4 Proposed Taxiway Width with required Fillet for A330-300

It should be noted the most critical aircraft in the code-E classification is the B777-300 having a triple-tandem main-gear configuration with longer wheel-base. If and when such critical aircraft is introduced, the pavement fillet will have to be expanded.

2) Width of Taxiway Shoulder

In accordance with the recommendations of ICAO Annex 14, the taxiway and shoulder should cover a total width of 44 m where the Runway code letter is 4. Consequently, the required width of the taxiway shoulder shall be 7 m (i.e. 7 m + 30 m + 7 m = 44 m).

3) Separation between Airfield (Runway, Taxiways and Apron)

Airfield separations are determined basically to follow the minimum separation distances recommended by ICAO Annex 14, as shown in Table 4.2-3.

Table 4.2-3 ICAO Annex 14 (Taxiway Minimum Separation Distances)

Code letter	Distance between taxiway centre line and runway centre line (metres) — Instrument runways Code number 1	2	3	3	Non-instrument runways Code number 1	2	3	4	Taxiway centre line to taxiway centre line (metres)	Taxiway, other than aircraft stand taxilane, centre line to object (metres)	Aircraft stand taxilane centre line to object (metres)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
A	82.5	82.5	–	–	37.5	47.5	–	–	23.75	16.25	12
B	87	87	–	–	42	52	–	–	33.5	21.5	16.5
C	–	–	168	–	–	–	93	–	44	26	24.5
D	–	–	176	176	–	–	101	101	66.5	40.5	36
E	–	–	–	182.5	–	–	–	107.5	80	47.5	42.5
F	–	–	–	190	–	–	–	115	97.5	57.5	50.5

Note 1.— The separation distances shown in columns (2) to (9) represent ordinary combinations of runways and taxiways. The basis for development of these distances is given in the Aerodrome Design Manual *(Doc 9157), Part 2.*

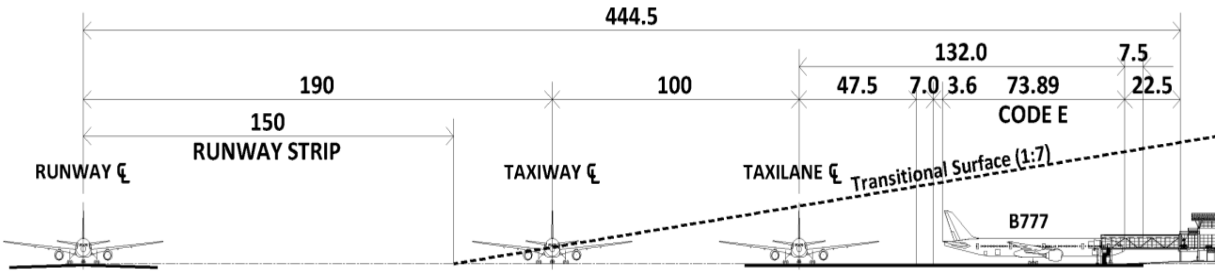
Note 2.— The distances in columns (2) to (9) do not guarantee sufficient clearance behind a holding aeroplane to permit the passing of another aeroplane on a parallel taxiway. See the Aerodrome Design Manual *(Doc 9157), Part 2.*

Source: ICAO Annex 14

The above minimum distances between runway and taxiways for Code E (182.5 m in column (5); and 80 m in column (10)) are not exactly followed worldwide since the aircraft wingspan keeps changing in the industry, and Code F aircraft are widely spread in a short period of time. Practically, the airfield and buildings, once constructed, cannot move in the future if the airport receives unforeseeable traffic demand in 30 to 40 years. It is recommended therefore, to apply a distance of 190 m between runway and taxiway and 100 m between two taxiways (for Code F).

ICAO notes that the distance between aircraft stand taxi-lane and object (42.5 m for Code E) may need to be increased if jet exhaust velocities cause hazardous conditions for ground servicing, therefore a distance of 47.5 m is used.

In view of the above, separation distances between runway, taxiways and objects are set as shown in Figure 4.2-5.



Source: JICA Study Team

Figure 4.2-5 Separation between Runway and Taxiways

4.3. Aeronautical Requirements

4.3.1. Approach Category

The Approach Category is classified as a precision approach equipped with an Instrument Landing System (ILS) providing horizontal and vertical guidance, and a non-precision instrument approach giving horizontal guidance only by DVOR/DME, NDB or Localizer. Each instrument approach has a ceiling and visibility limit, referred to as minimums. If the reported weather conditions fall below the approach minimums, the approach cannot be attempted.

ILS operational category defined by ICAO Manual of All Weather Operation is as follows:

Table 4.3-1 ILS Operational Category

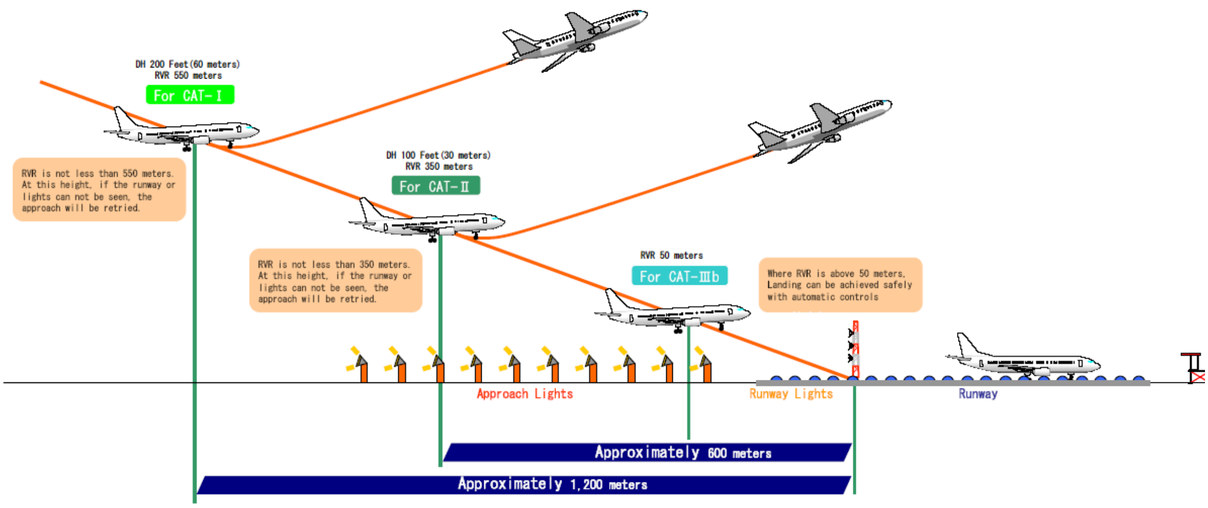
	DH	RVR
Category I	DH ≥ 60 m	RVR ≥ 550 m
Category II	60 m > DH ≥ 30 m	RVR ≥ 350 m
Category III A	30 m > DH ≥ 0 m	RVR ≥ 200 m
Category III B	15 m > DH ≥ 0 m	200 m ≥ RVR ≥ 50 m
Category III C	0 m	0 m

Note DH: Decision Height, RVR: Runway Visual Range

Source: ICAO Manual of All Weather Operation

- A decision height (DH) is a specified height in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been acquired.

- Runway Visual Range (RVR) is a term to define the distance over which a pilot of an aircraft on the centerline of the runway can see the runway surface markings delineating the runway or identifying its centre line.



Source: Modified JCAB catalogue

Figure 4.3-1 Category of Precision Approach

The approach category should be determined by weather conditions such as value of visibility and cloud ceiling around a new airport area. Poor weather conditions are usually occurring during the rainy season which is the period from June to February (The rainy season is extending due to changing world climate). According to the information by the Flight Service Station (FSS) staff, the value of the prevailing visibility during bad weather conditions is about 1 km, thus aircraft operations for landing and taking off at the airport during those conditions will have to be suspended. However, low visibility conditions are not continuing for long hours usually it last only for several tens of minutes.

Regarding the value of cloud ceiling, the FSS staff is observing it on an hourly basis by visual means, but do not collect any data by instruments. A low visibility, however, is usually accompanied with a low cloud ceiling during bad weather conditions.

Considering weather conditions mentioned above and the characteristic of the new airport which is required to be safe, reliable, to provide continuous efficient air traffic operations and serving as the main airport access for Bohol, it is necessary to provide a category I precision approach (CAT-I) by ILS for Runway 21, as south-westerly winds are predominating during bad weather conditions, while Runway 03 could be a non-precision instrument approach by DVOR/DME.

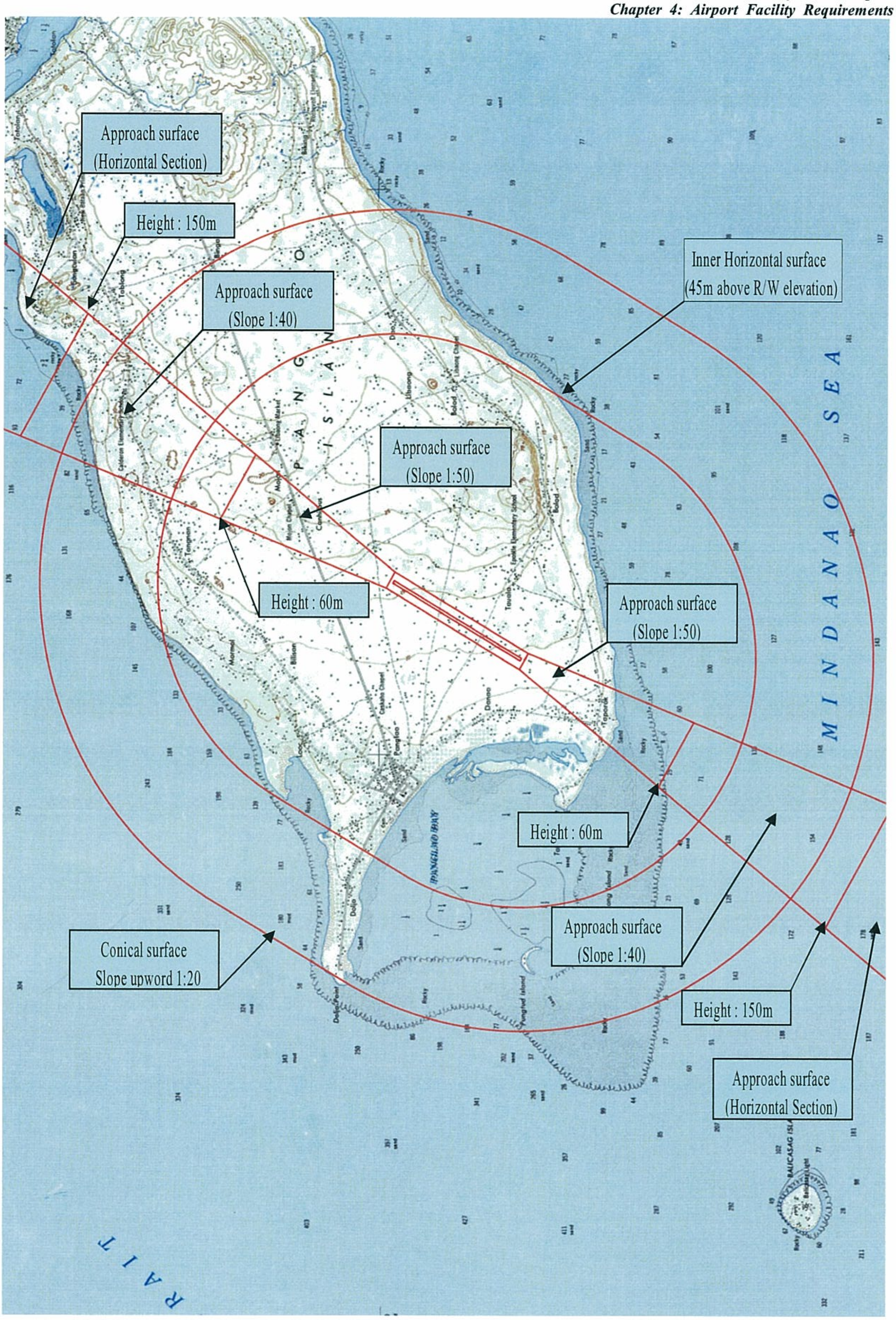
4.3.2. Obstacle Limitation Surfaces

Analysis of obstacles is to define the airspace around aerodromes to be maintained free from obstacles as to allow the intended aircraft operations at the aerodromes to be conducted safely.

Based on ICAO Annex 14 and the Airport Service Manual part 6, Obstacle Limitation Surface (OLS) such as Approach Surface, Inner Approach Surface, Transitional Surface, Inner Horizontal Surface and Conical Surface, etc. are established as shown in the Figures 4.3-2 and 4.3-3.

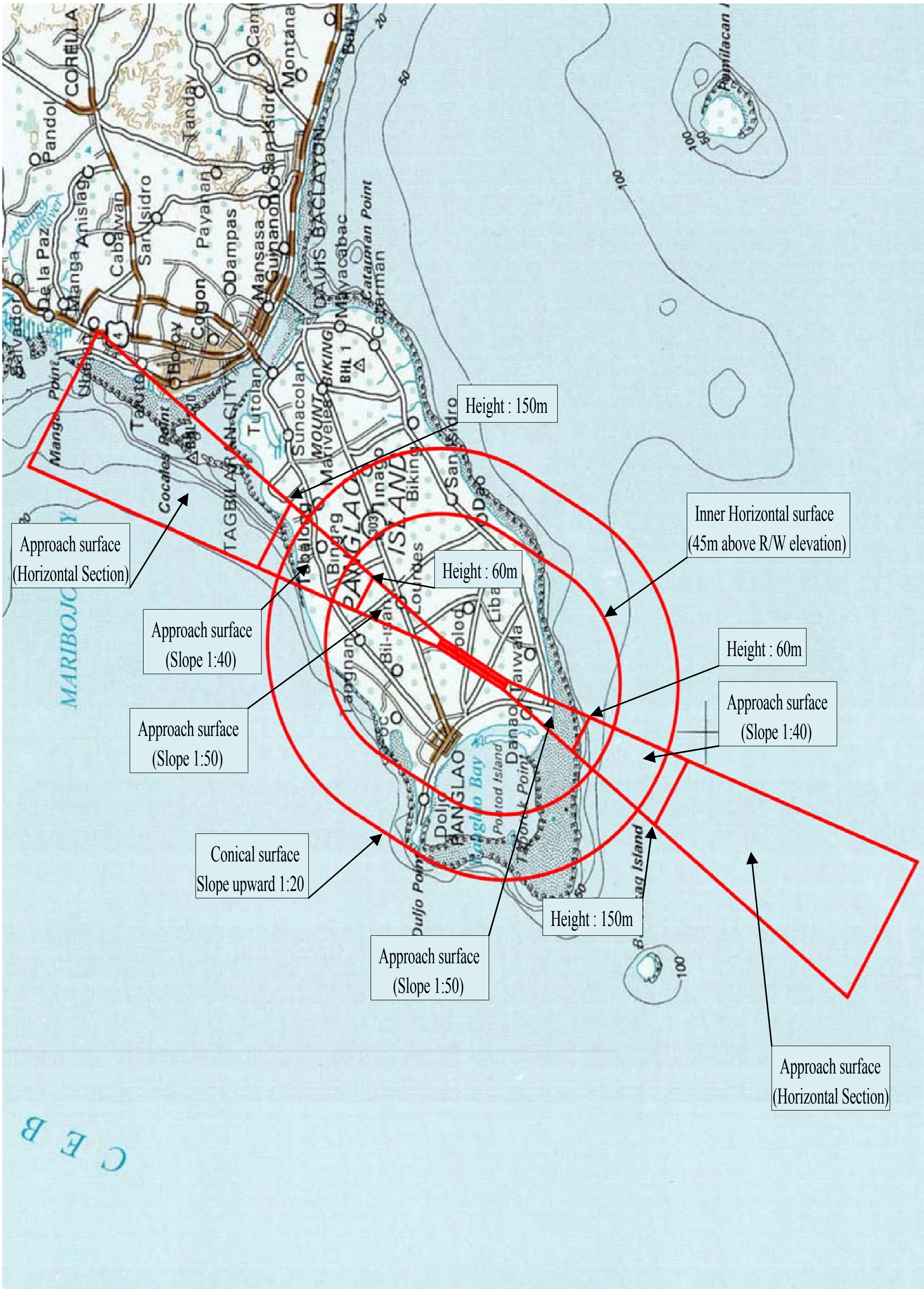
The screening of obstacles is examined by following conditions:

- ✓ Terrain condition by topographic maps of scale 1/50,000 and 1/250,000.
- ✓ The expected airport elevation is located 8.3 m above the sea level.
- ✓ To the height of screened terrain (mountains, hills), the height of 30 m trees shall be added.



Source: JICA Study Team

Figure 4.3-2 Obstacle Limitation Surface (1)



Source: JICA Study Team

Figure 4.3-3 Obstacle Limitation Surface (2)

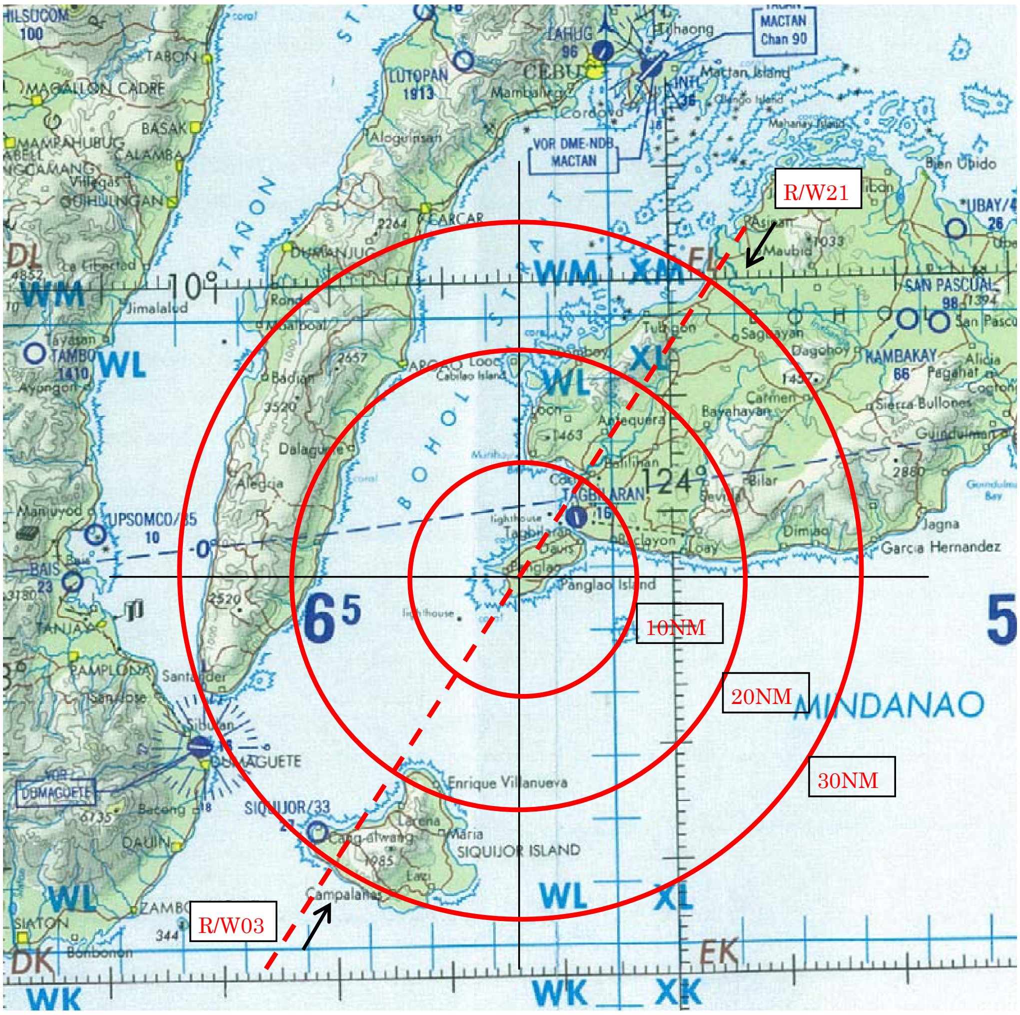
As a result of the analysis of terrain obstacles, there are not any particular natural obstructions such as hills or mountains that actually affect the operations of aircraft around the new airport site, neither are existing terrain obstacles above these surfaces observed on the topographical maps.

With regard to artificial obstacles such as buildings and towers surrounding the site, these should be examined using the aerial photo maps and actual measured locations by GPS meter and height by handy level meter in a further site reconnaissance stage in future.

4.3.3. Airspace

1) Topography and Navigation Warnings

Panglao Island is located southwest of the island of Bohol with an area of 80.5Km^2, and has an almost plain terrain with elevations of up to 10 to 30 m. Hilly to mountainous areas of up to an elevation of 100 to 160m are located at the northeast part of island. The new airport site will be located at the southwest part of the island. Figure 4.3-4 shows a general topographical map around Panglao Island with a marked distance of approximately 30NM from the new airport.



Source: JICA Study Team

Figure 4.3-4 Topography around Panglao Island

As mentioned in the paragraph 2.4 Current Situation of the existing Tagbilaran Airport, Restricted, Prohibited and Dangerous Areas are also not found around the New Bohol Airport's specific area.

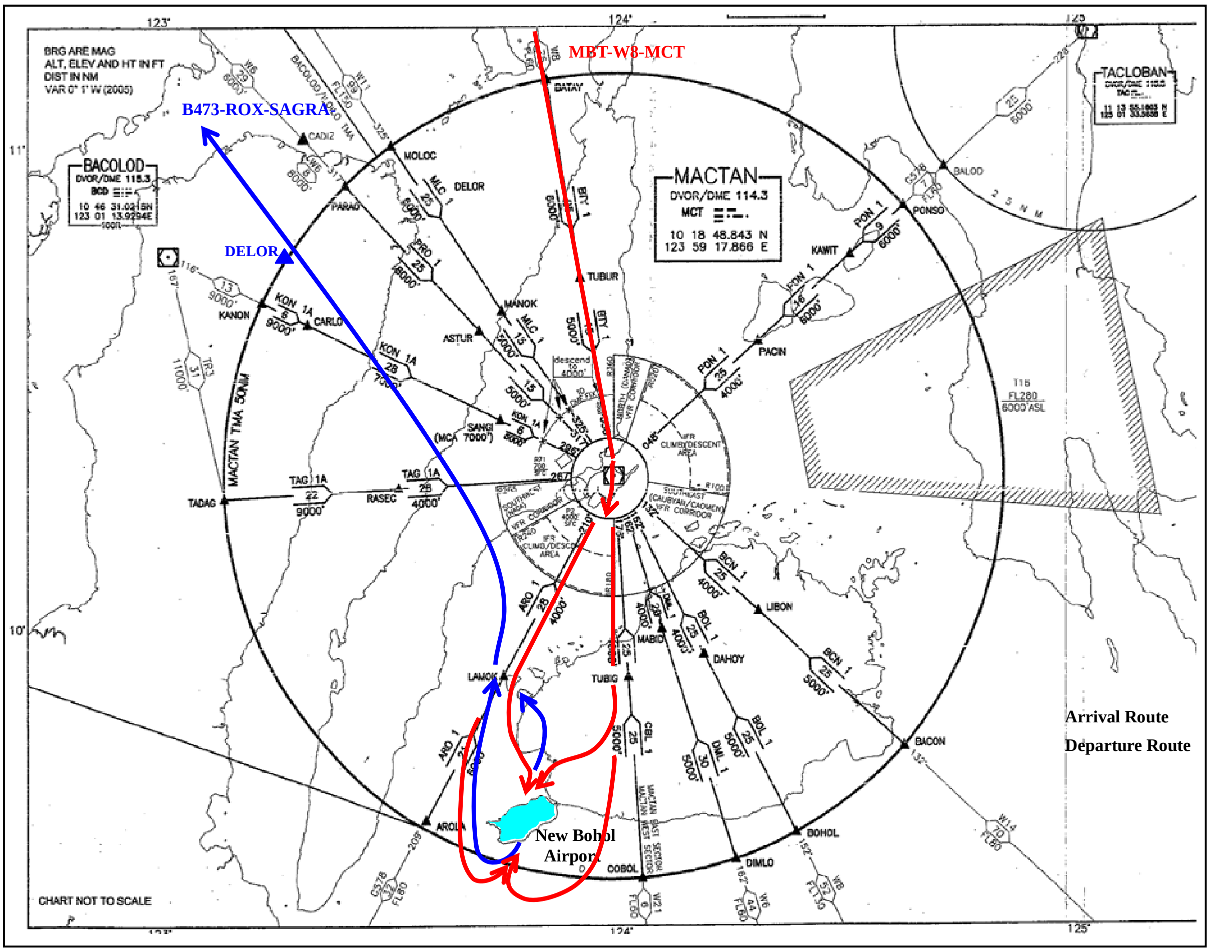
2) Traffic Flow

As the New Bohol Airport will be located at 14 km (7.5NM) south west of Tagbilaran Airport, it is desirable to maintain the existing arrival and departure routes for the new airport because the location of the new airport is comparatively near to the existing airport from the point of flight route and it is possible to use the existing reporting point of the Mactan TMA.

The assumed traffic flow for the new airport is as follows:

- Arriving traffic from the north will be via the reporting point LAMOK or TUBIG.
- Arriving traffic from the south will be via the reporting point AROLA or new point.
- Departing traffic to the north will be via LAMOK.
- Departing traffic to the south will be AROLA or a new point.

Figure 4.3-5 shows assumed traffic flow of arrival and departure for the new airport.



Source: JICA Study Team

Figure 4.3-5 Assumed Traffic Flow for New Bohol Airport

3) Airspace Classification

The airspace classification for the new airport should be established in accordance with Appendix 4 of ICAO Annex 11, and the details of classification and requirements are shown in Table 4.3-2 ~ 4.3-4 respectively.

Table 4.3-2 Airspace Classification in Manila FIR

Within the Manila FIR, the airspace is divided into the following classes.		
Class	Airspace	Levels
A	Manila FIR Upper Control Area (except special use airspace)	FL200 – UNL
A	Oceanic Airspace	Lower Limit – UNL
A	ATS Routes outside TMA	MEA – UNL
A	ATS Routes inside TMA at FL130 and above	FL130 – FL200
D	ATS Routes inside TMA below FL130	1,500 – <FL130
D	TMA (excluding ATS Routes at FL130 and above)	1,500 – FL200
D	Control Zones (CTRs)	Surface – Upper Limit
B	Aerodrome Traffic Zones (ATZs)	Surface – Upper Limit
G	Aerodrome Advisory Zones (AAZ)	Surface – Upper Limit
G	Uncontrolled Airspace	Nil

Source: AIP Philippines MEL: Minimum en-route altitude

Table 4.3-3 Requirements for the flights within each class of airspace

Class	Type of flight	Separation provided	Service provided	Speed limitation	Radio communication requirement	Subject to an ATC clearance
A	IFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
B	IFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
	VFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
D	IFR	IFR fm IFR	Air traffic control service, traffic information about VFR flights (and traffic avoidance advice on request)	250 kts IAS below 3050m (10,000ft) AMSL	Continuous two-way	Yes
	VFR	Nil	IFR/VFR and VFR/VFR traffic information (and traffic avoidance advice on request)	250 kts IAS below 3050m (10,000ft) AMSL	Continuous two-way	Yes
G	IFR	Nil	Flight information service	250 kts IAS below 3050m (10,000ft) AMSL	Continuous two-way	No
	VFR	Nil	Flight information service	250 kts IAS below 3050m (10,000ft) AMSL	No	No

Source: AIP Philippines AMSL: Above mean sea level

Table 4.3-4 ATS Airspace Class-Services Provided & Flight Requirements: Class C, E, F – Appendix of ICAO Annex 11

Class	Type of flight	Separation provided	Service provided	Speed limitation	Radio communication requirement	Subject to an ATC clearance
C	IFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
	VFR	VFR fm IFR	1) Air traffic control service for separation from IFR 2) VFR/VFR traffic information (and traffic avoidance advice on request)	250 kts IAS below 3050m (10,000ft) AMSL	Continuous two-way	Yes
E	IFR	IFR fm IFR	Air traffic control service and , as far as practical, traffic information about VFR flights	250 kts IAS below 3050m (10,000ft) AMSL	Continuous two-way	Yes
	VFR	Nil	Traffic information as far as practical	250 kts IAS below 3050m (10,000ft) AMSL	No	Yes
F	IFR	IFR fm IFR as far as practical	Air traffic advisory service; Flight information service	250 kts IAS below 3050m (10,000ft) AMSL	Continuous two-way	No
	VFR	Nil	Flight information service	250 kts IAS below 3050m (10,000ft) AMSL	No	No

Source: Appendix 4 of ICAO Annex 11

As ILS, VOR/DME and Aeronautical Ground Rights are installed for the new airport, instrument approach and departure procedures will be established for safety aircraft operations under adverse weather conditions. In view of past results, the airspace for the new airport should be established as a similar classification as in the case of Bacolod and Iloilo Airport development planning.

With regard to the Terminal Control Area (TMA), as the new airport will be located within the existing Mactan TMA and congested air traffic is not expected, a new independent TMA for the new airport is not necessary to be established. However, it should be considered expanding Mactan TMA for establishment of approach and departure procedures as required due to the south end location of Mactan TMA.

Table 4.3-5 shows airspace classification of Bacolod and Iloilo Airport as reference.

Table 4.3-5 Airspace Classification of Bacolod & Iloilo Airport

Airport	Airspace classification AIP, September **2004** (before new airport)	Airspace classification AIP, May **2008** (after new airport, latest)
Bacolod	E	ATZ – B, CTR – D TMA – D (ATS routes inside TMA below FL130) TMA – A (ATS routes inside TMA at FL130 & above)
Iloilo	E	ATZ – B, CTR – C TMA – E (ATS routes inside TMA below FL130) TMA – A (ATS routes inside TMA at FL130 & above)

Source: AIP Philippines

4.3.4. Air Traffic Control

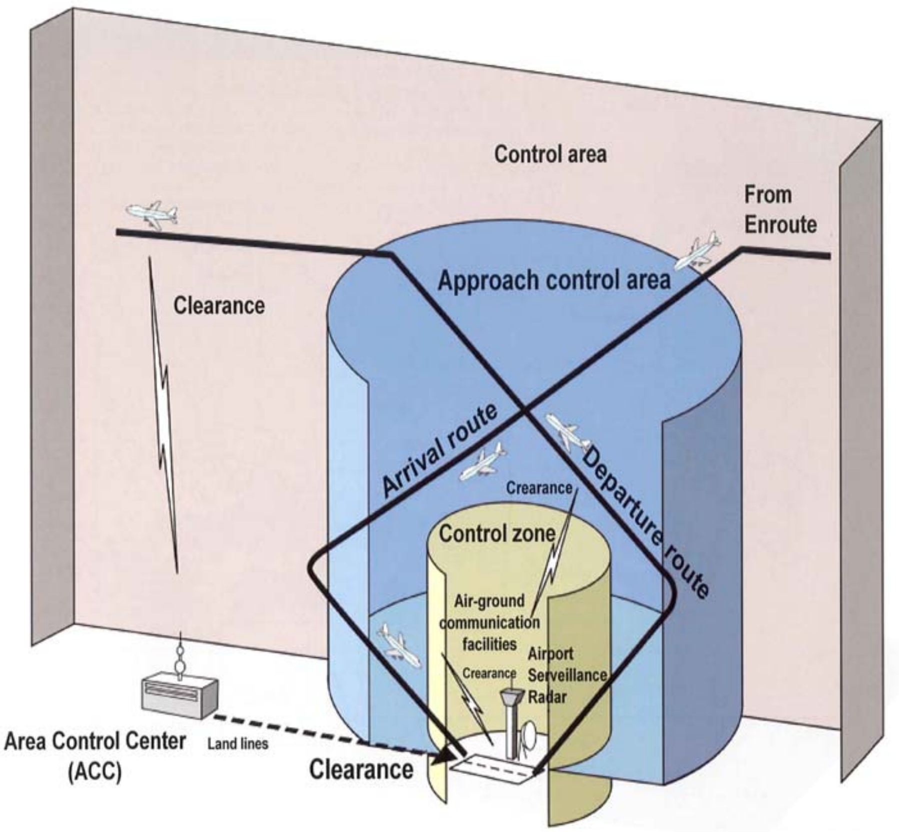
1) <u>ATC Service</u>

To manage IFR flights and establish separation for each aircraft, not only a flight information advisory service, but also an ATC service should be introduced for the new airport operations.

In accordance with the airport layout plan, the Air Traffic Control Tower (ATC Tower) will be located at the ATC complex area near the terminal building, the height of which helps them to see aircraft clearly in the airport and surrounding area.

The Aerodrome Control managed at the ATC Tower has the responsibility of controlling aircraft. The Aerodrome Control has the responsibility for the airport area including aircraft on taxiways, runways and apron bays, and an area of defined airspace (for example 5 NM radius around the airport up to 2,000 ft) during aircraft landings and taking-offs.

The Ground Control controls aircraft and vehicles on the runway, taxi-way and in the restricted movement areas, enabling them to safely move or stop. It also speedily liaises with pilots, ground support stations and other related organizations to ensure expeditious services for airport customers. Clearance delivery which is one of the ground controller's tasks is the service to deliver the ATC clearance determined through coordination with the ACC to the pilots based on their flight plan.



Source: Modified JCAB catalogue

Figure 4.3-6 Air Traffic Control Service

Regarding the approach control for the New Bohol Airport as described in the Airspace Classification, the new airport will be located around 84 km (45 NM) south of Mactan International Airport and within the Mactan TMA, so that the approach control for the new airport should be executed by Mactan Radar/Approach.

ATC operation hours should be considered as practically the same as airport operations and the necessary number of ATC controllers should be stationed in accordance with the regulations of personnel administration by CAAP.

2) ATC Procedure

ATC procedures for the new airport should be established in accordance with ATC regulations prescribed by CAAP. The following referenced ATC procedures are based on the "Procedure for Tagbilaran Arrival/Departure One-way Traffic Flow".

a) Flight departing from Manila for New Bohol Airport shall take following route:

IPATA – B462 – MBT – W8 – MCT – W21 – TUBIG OFF AIRWAYS

b) Flight departing from New Bohol Airport for Manila shall take the following route:

JOIN AIRWAYS LAMOK – B473 – ROX – SAGRA – W11 – CONDE

c) Air Traffic Control Service shall be provided to aircraft arriving to the New Bohol Airport until reporting point TUBIG and to aircraft departing from the New Bohol Airport at reporting point LAMOK by Mactan Radar/Approach.

d) Air Traffic Control Service shall be provided to aircraft arriving to the New Bohol Airport when out of control area at the reporting point and to aircraft upon departing from the New Bohol Airport prior to entering the control area at the reporting point LAMOK, by the New Bohol Airport Tower.

e) IFR departure at the New Bohol Airport shall contact Mactan Radar/Approach on Frequency 124.7 MHz upon airborne or prior to joining the control area at LAMOK. Mactan Radar/Approach shall monitor on radar the IFR departure at the New Bohol Airport.

f) Mactan Radar/Approach shall effect transfer of IFR arrivals to the New Bohol Airport Tower after TUBIG or when aircraft has cancelled its IFR clearance and proceeding VFR to the New Bohol Airport.

g) Any deviation by an aircraft from a) or b) might be permitted by the appropriate authority whenever there is an adverse weather condition along the route or a special flight operation is in progress.

h) In the case of g), prior coordination should be effected by facilities concerned for the intended deviation to be made from the route by an aircraft.

4.3.5. Air Navigational Facility

1) General

Air Navigation Facility will consist of four main items; radio navigation aids, aeronautical telecommunication system, aeronautical ground lights and a meteorological observation system. Based on the latest state-of-the-art technology and in consideration of safe, reliable and efficient air traffic operations, the following major air navigation facilities are required for the airport:

2) Radio Navigational Aids

a) DVOR/DME

Doppler VHF Omni-directional Radio Range/Distance Measuring Equipment (DVOR/DME) is one of essential navigational aids for the airport to provide aircraft accurate azimuth flight courses and distance for enhancing aircraft navigational safety. Azimuth and distance information by DVOR/DME structures the required airport terminal flight routes including Standard Instrument Departure and Standard Terminal Arrival Routes.

DVOR/DME should be installed at or near the airport for the purpose of providing aircraft guidance information while arriving, departing, or overflying the area under any weather condition.

b) ILS

Instrument Landing System (ILS) is the essential landing aid facility for aircraft precision approach to maintain normal airport operations in adverse weather conditions.

ILS provides an approach path for exact alignment and descent of an aircraft on final approach to a runway. The system provides three functions: guidance provided vertically by a glide pass (GP), horizontal guidance by a localizer (LLZ) and range furnished by marker beacons or DME.

3) Aeronautical Telecommunication System

a) VHF Air to Ground Equipment

VHF air to ground communication is an essential element of safe flight operations for ATC in the airport. The radio frequency ranges between 118-136 MHz and the required number of frequencies will be as follows:

- Aerodrome Control frequency
- Distress frequency

b) AMHS and AIS Terminal

Automatic Message Handling System (AMHS) is defined in a set of ICAO standard and recommended practices that are being adopted to replace the existing AFTN system for ground to ground communications. AMHS Message server and AFTN Gateway system will be introduced at Manila ATM Center in the near future, so that AMHS user terminals should be provided for exchanging ATS messages. The ATM messages will mainly contain:

- Flight data (Landing, takeoff, flight schedule, aircraft handover)
- Met message
- NOTAM message
- Aviation administrative message

c) VCCS and Voice Recorder

Voice Communication Control System (VCCS) is a system with the function of controlling and connecting voice communications between tower controllers and pilots in aerodrome area through VHF circuits, connecting telephone communications between tower controllers and relevant ATS unit, etc.

Voice recording system is legal evidence to enable authorities to determine the responsibilities of related parties when a problem occurs between a pilot and a controller, between controlling section and technical operation section.

A VCCS with necessary radio/ telephone channel capacity and Voice Recorder with adequate channel should be provided.

4) Aeronautical Ground Lights

Aeronautical ground lights should be provided and are planned to serve the CAT I operation in accordance with ICAO Annex 14 and Aerodrome Design Manual Part-4 “Visual Aids”.

The following are components of a CAT I AGL system:

a) Precision Approach Lighting System (PALS) for runway 21

PALS is provided to serve a precision approach. While the aircraft is making a decision approach to the runway, PALS assists the Pilot to ensure a proper alignment of the aircraft.

b) Simplified Approach Lighting System (SALS) for runway 03

SALS is provided to serve a non- precision approach, when the runway is used for above weather minimum of instrument approach such as VOR/DME approach or ADF approach, or visual approach during the night time or poor weather condition.

c) Precision Approach Path Indicator (PAPI) both Runway

PAPI is provided to serve the approach to a runway in a glide slope of 3 degrees. While the aircraft is making a decision approach to the runway, PAPI assists the pilot ensuring the proper angle of the aircraft.

d) Runway Edge Light

Runway edge lights are provided to serve the high visibility of the runway to assist the aircraft approaching to or taking off from a runway.

e) Runway Threshold/End Light

Runway threshold/end lights are provided to serve the high visibility of the runway to help aircraft approaching to or taking off from a runway and while runway edge lights are lit in operational condition, runway threshold end lights are operating simultaneously.

f) Taxiway Edge Light

Taxiway edge lights are provided to serve the high visibility of the taxiway to help aircraft taxiing to or from a runway.

g) Apron Floodlight

Apron floodlights are provided to serve the adequate illumination to aircraft on all apron service areas.

h) Wind Direction Indicators

Wind direction indicators are provided to serve the proper wind direction to aircraft before taking off in day time and night time with lights.

i) Aerodrome Beacon

Aerodrome beacons are provided to serve the airport location to aircraft which are flying around the airport with lights.

j) AGL Remote Control system

An AGL remote control system is provided to serve the status monitor, dimmer control and Switch ON/OFF in regard with AGL which appears on the display. While the AGL is in operational condition, the AGL Remote Control System is activated by air traffic controller.

k) AGL Power Supply System

AGL power supply system supplies adequate electric power for the AGL system and supplies constant output current throughout its rated output value to each light by Constant Current Regulator (CCR).

5) Meteorological Observation System

In accordance with ICAO Annex 3, the requirement of an Automated Weather Observation System (AWOS) should be installed and planned at the airport field for observing and reporting meteorological conditions such as surface wind, runway visual range, cloud base, air pressure, etc.

The Automated Weather Observing System (AWOS) should be provided for continuous, real–time weather reports, without human involvement, for users of aviation facilities. A new report is generated every minute from sensors located near the touchdown zone of the runway.

The followings are main component of MET system:

- Automatic Weather Observation System (AWOS)
- Runway Visual Rage (RVR)
- Ceilometer for both Runway

4.4. Landside Requirements

The entire airport planning has evolved from the orientation of the runway which was primarily considered at the start. The terminal facilities have been located at the eastern side to provide better access connecting to Tagbilaran passing thru the Panglao Island Circumferential Road.

Roads and car park have been designed to accommodate the anticipated traffic for the medium term development.

Traffic flow direction will be counter-clockwise to enable right side unloading and loading at the terminal curb. The road system serving the other landside facilities will be a two-lane, two-way road network considering the lighter traffic volume that is expected.

With the passenger terminal building centrally located within the landside development most other structures, such as powerhouse, control tower and administration building will be located on the northern side of the development, together with the fire station which is located on the centreline of the runway. Sufficient land has been reserved for the allocation of a fuel farm on the eastern part of the site adjacent to the water tank and pump house.

The cargo terminal and sewage waste facilities are located on the southern section of the landside development allowing sufficient areas for future expansion for the passenger terminal building and its related facilities such as tourist buses and taxi loading and unloading stations and car park, including expansion of the cargo terminal.

All buildings have been sited so that their functional relationships are enhanced and to obtain the most cost effective development to result in an optimum airport operation. All land side facilities with exception of public related facilities are fenced off from the public and access is controlled by means of manned guardhouses.

Public landside facilities such as drivers lounge and related toilets and tollbooths form part of the land side car park facilities, other land side facilities are related to the passenger terminal such as a large open-air departure and arrival public concourses for meeters, greeters and well-wishers to cater for the Filipino custom of sending off and welcoming passengers-relatives. These concoursesconnected to the passenger terminal curb side are shaded by a large canopy structures complemented by public toilets, concessions and green areas to provide a comfortable waiting area.

4.4.1. Passenger Terminal

The passenger terminal building will be located at the centre of the landside development with the cargo terminal building located towards the south and the power house and chiller yard towards the north, reserving sufficient space for expansion of each facility in the future

The required floor area of passenger building is estimated based on the passenger and aircraft movements during peak hour. The floor areas of the passenger building are determined based on passenger service levels and passenger processing concepts.

Historical airport floor areas and passenger data of various international airports in the Asia-Pacific region as published by IATA ADRM indicates that floor areas (m^2) per peak-hour international passengers ranges from 20 m^2 to 50m^2.

In planning of the passenger terminal building, for purpose of the design, a unit space of 15 m^2 and 20m^2 has been adopted for domestic and international, respectively.

Based on the adoption of the square meter units for international and domestic passengers, with the number of International Peak Hour Passenger (for 1- way) of 240 passengers and the number of Domestic Peak Hour Passenger (for 1- way) of 378 passengers, the total gross floor area of the PTB has been estimated taking into account the proportion of one way traffic to two way traffic of 65% to be 16,110m^2 Currently the passenger terminal plans have been designed with a total gross are of 15,470m^2 comfortable within the targeted area.

Space requirements for passenger processing area of terminal building are calculated in accordance with the formulas described in Airport Development Reference Manual of IATA and are shown in Table 4.4-1 Required Facilities Schedule.

Table 4.4-1 Required Facilities Schedule

Facility		Eqpt / Counter	Area(m2)
A. Passenger and Baggage Processing Area			
1	Centralized Security (Entrance)		160
	Hold & carried Baggage	4 units X-ray	
	Pssenger	4 units Magnetometers	
2	Check-in Hall		1,130
	International	8 check-in counters	
	Domestic	12 check-in counters	
	Departure Customs		
3	Passenger Fee Collection	2 desks	20
4	Passport control - Departure	6 desks	210
5	Security Check before Gate Lounge		
	International	2 units X-ray	160
		2 units Magnetometer	
	Domestic	2 units X-ray	160
		2 units Magnetometer	
6	Departure Gate Lounge		
	International	230 Chairs	870
	Domestic	460 Chairs	1,250
7	Airside Concourse (4m width)		720
8	Passport Control - Arrival	8 desks	370
	Arrival Health Check	2 desks	
9	Baggage Claim Hall	3 units	2,010
	Quarantines	2 units	
10	Arrival Customs Control	4 desks	180
11	Baggage Breakdown		440
12	baggage Make-up		400
	Subtotal		8,080
B. Other Area			
1	Office		1,230
3	Concessionaire		1,080
4	VIP / CIP Lounge		430
5	Technical Premises	with roof machine room	920
6	Circulation,toilet and other	with PH	3,730
	Subtotal		7,390
	Grand Total		15,470

Source: JICA Study Team

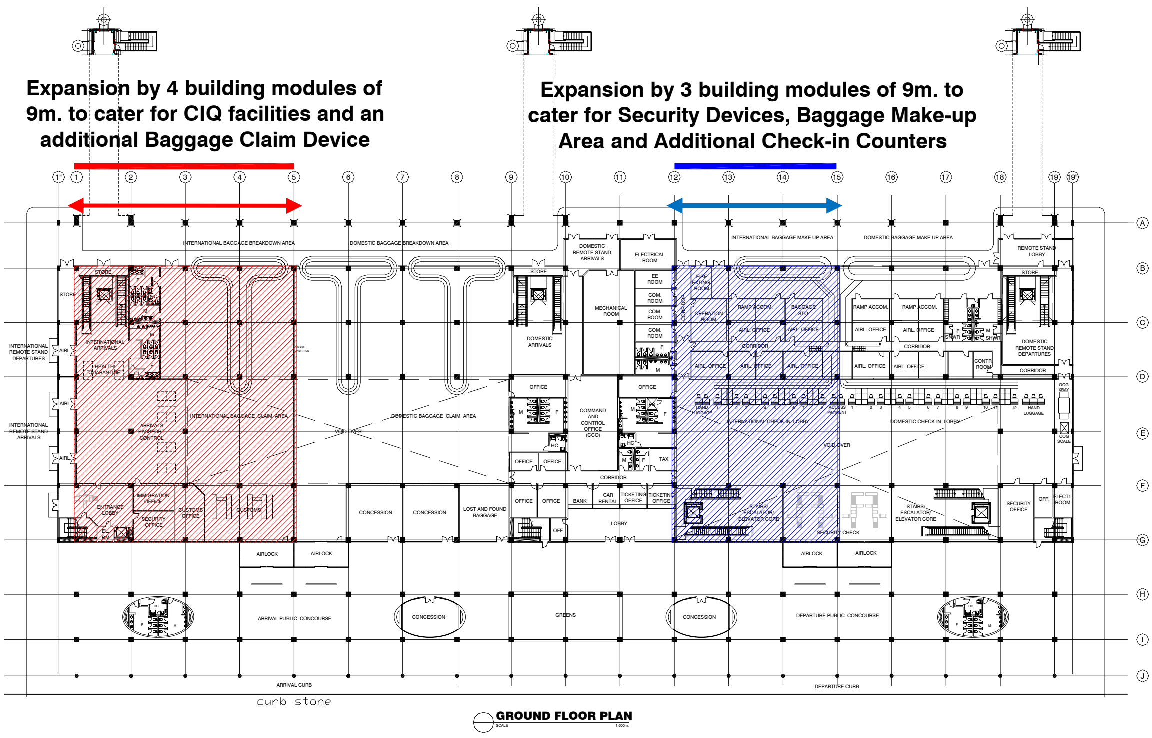
This total floor area is 3,140 m^2 larger than the passenger terminal building layout as of 2009. The reason for the increase of 25% of the gross floor area, is justified as follows:

a) In 2009 it was not required to have a simultaneous operation for domestic and international flights, as it was assumed that the domestic peak would not coincide with the international peak.

b) With the current estimated flight schedules a segregated operation of domestic and international flight is no longer viable.

c) The new passenger terminal layout is now required to handle simultaneous operations for domestic and international flights. This necessitates the increasement of check-in counters, doubling of baggage make-up and breakdown areas, separate flows to segregated departure lounges as international passengers require an immigration check, separate security checks and separate baggage claim halls, with international passengers subject to immigration and customs checks, thus necessitating separate arrival circulations.

d) In addition the number of fixed bridges has been increased from two (2) to three (3) to cater for the additional contact stand required based on the peak hour aircraft movement, refer Figure 4.4-1. However, the numbers of Passenger Boarding Bridges are decreased from 4 (2 each for 2 fixed bridges) to 3 (1 each to 3 fixed bridges).



Source: JICA Study Team

Figure 4.4-1 Enlargement of Footprint for Passenger Terminal Building

4.4.2. Cargo Terminal

The cargo terminal building has been located at the southern side of the landside airport development adjacent to the passenger terminal building.

The size of the cargo terminal building is based on total annual cargo movement estimates and the level of automation of cargo facilities. For 2020 the cargo volume is estimated at 10,728 ton/annum, it is expected that the majority of the cargo shall be mostly manually handled but with a percentage of automation. In accordance with IATA Airport Development Reference Manual, mostly manual processing can handle a throughput of 5 tons/ m^2 and average automation can reach to a throughput of 10 tons/ m^2. It is expected that cargo facilities at the New Bohol Airport could somehow operate with a moderate automation process and thus be able to handle 7 to 7.5 tons/ m^2 per annum.

Thus the cargo facility size is to be targeted at (average) 7.2 tons/ m^2 @ 10,728 tons/annum = 1,500 m^2. A modular concept, straight through traffic, sufficient preparation space for cargo handling and ample storage shall be the major design considerations of this building.

The cargo terminal building is expected to be used by multiple airlines and freight forwarders/cargo agents. Sufficient land reservation shall be made to allow for ample future expansion.

4.4.3. Rescue and Fire Station

In accordance with ICAO Annex 14, Chapter 9.2, airports should be categorized for rescue and fire fighting purposes and the level of protection provided should be appropriate to the airport category. The Aerodrome Category for fire fighting is based on the maximum aircraft size and traffic operation at the New Bohol Airport, thus the Category for fire services is Category 9, which requires a minimum of three (3) fire fighting vehicles, having a total water tank capacity of 24,300 liters with a foam solution discharge rate of 9,000 liters/minutes.

To ensure sufficient space for future expansion of passenger terminal and cargo terminal buildings, to reduce cost and increase the efficiency of the airport as a whole, it is proposed that certain facilities with common or shared features shall be housed in one structure. As such it is proposed that the fire station and maintenance building shall be within one structural shell. The airport maintenance facility will serve as a garage for various airport equipment, and maintenance thereof can be shared with the fire fighting vehicles.

The location of the fire station is on the centre line of both runway ends, and its distance to the runway end is 1,715 m in perpendicular, or 1,672 m along the curve as shown in Figure 4.4-2. Computation of the response time is made through Table 4.4-2, showing that the response time of 2.08 minutes with a maximum speed of 90 km/h type and 2.55 minutes with a speed of 80 km/h can meet ICAO requirements of maximum 3 minutes.

If further a high-speed rapid intervention vehicle (RIV) is introduced, the response time can be minimized to be less than 2 minutes, which is the latest recommendation of ICAO.

Table 4.4-2 Response Time of Fire Fighting Vehicles

	A. High-speed Fire Fighting Vehicle (6,000L water capacity)			B. Normal Fire Fighting Vehicle (10,000L water capacity)		
a Maximum Speed		**90 km/h**			**80 km/h**	
b Acceleration length & time		length	time		length	time
	0 - 90 km/h	461 m	29 sec	0 - 80 km/h	527 m	37 sec
	0 - 70 km/h	120 m	15 sec	0 - 70 km/h	400 m	25 sec
	0 - 50 km/h	76 m	11 sec	0 - 50 km/h	115 m	15 sec
	50 - 90 km/h	385 m	18 sec	50 - 80 km/h	412 m	22 sec
c Deceleration length & time						
	90 - 50 km/h	52 m	3.5 sec	80 - 50 km/h	48 m	3.5 sec
	70 - 50 km/h	20 m	1.5 sec			
	50 - 0 km/h	17 m	2.5 sec	50 - 0 km/h	19 m	3 sec
	90 - 0 km/h	68 m	4.5 sec	80 - 0 km/h	63 m	4.5 sec
d Curving speeed	50 km/h	R = 100 m		50 km/h	R = 100 m	
	90 km/h	R = 300 m		90 km/h	R = 300 m	

e Distance to runway end

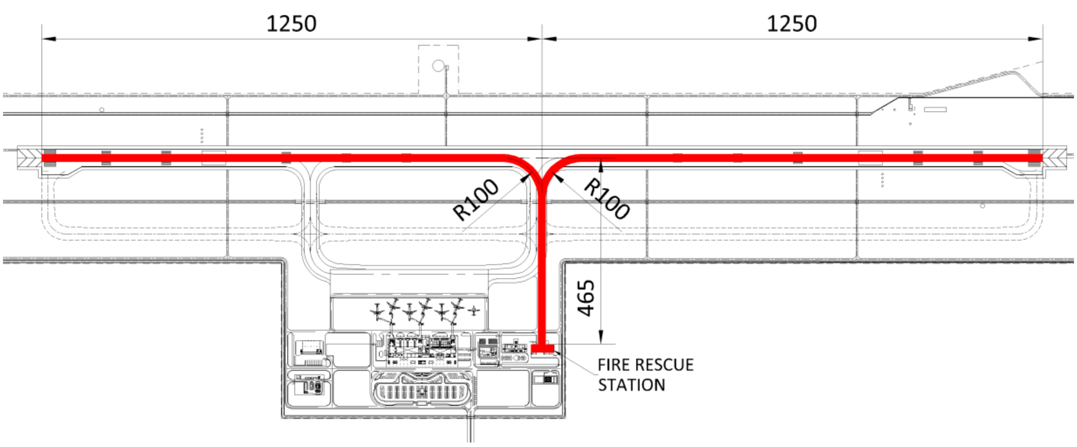
Fire station to start of curve	365m	Straight
to end of Curve	157 m	Curve (R=100 m)
to Runway end	1,150 m	Straight
Total distance from Fire Station	1,672 m	

A High-speed Fire Fighting Vehicle (Maximum Speed: 90 km/h)

Portion to run	Fire Station	Straight			Curve (R=100)	Straight			at Site	Response Time	
		through Road 13			to Runway	through Runway to end				(sec)	(min)
Length (m)	from fire call to start vehicle	365			157	1,150			to start dischrge foam at 50% rate of ICAO		
Speed (km/h)		0-70	70	70-50	50	50-90	90	90-0			
---in (m/sec)		varies	19.44	varies	13.89	varies	25.00	varies			
distance (m)		120	225	20	157	385	697	68			
Time (sec)	30.00	15.00	11.57	1.50	11.30	18.00	27.88	4.50	5.00	124.76	2.08

B Fire Fighting Vehicle (Maximum Speed: 80 km/h)

Portion to run	Fire Station	Straight			Curve (R=100)	Straight			at Site	Response Time	
		through Road 13			to Runway	through Runway to end				(sec)	(min)
Length (m)	from fire call to start vehicle	365			157	1,150			to start dischrge foam at 50% rate of ICAO		
Speed (km/h)		0-50	50	50	50	50-80	80	80-0			
---in (m/sec)		varies	13.89	13.89	13.89	varies	22.22	varies			
distance (m)		115	135	115	157	412	675	63			
Time (sec)	30.00	37.00	9.72	8.28	11.30	22.00	30.38	4.50		153.18	2.55



Source: JICA Study Team

Figure 4.4-2 Location of Fire station; and Distance to Runway ends

4.4.4. Utilities

1) Water Supply System

a) Design Year of Water Supply

The water demand projections and sizing of facilities shall be set on the design year 2020.

b) Water Demand Projection

Domestic water users have been categorized into passengers, well-wishers, employees and restaurants. Table 4.4-3 shows the water demand computations for year 2020.

Water demand variations during the year and during the day have also been analyzed. The Maximum Day Demand occurs during the airport's busy days.

The Peak Hour Demand happens during the time of day that the airport is at its busiest. This is commonly the case when several flights arrive and depart from the airport at the same time. A factor of 2.5 is applied to the Average Demand to obtain the Peak Hour Demand.

Table 4.4-3 Water Demand Projection

Category	Assumptions and Computation	Unit Consumption		Water Demand (m^3/d)
Passengers	Average daily passengers = 1,436,000/320 =4,488 person	20	L/day. person	90
Well-wishers	As per 1 passenger=3 well- wishers; (=3x4,488=13,464 person/day; assumed 30% to use water; =13,464x30% =4,039 person)	20	L/day. person	81
Employees	Traffic unit x 0.6 x 67% for average day =(annual passengers/1,000+annual cargo/100) x 0.6 x 67% =620 person	100	L/day. person	62
Restaurants	Floor area= 840m2; seating area 60% of floor area; 1 m^2/seat; meal turnover 5 times /day; 840 x 60% x 1 x 5 =2,520 meals/day	40	L/day. meal	100
Total Domestic Consumption [A]	Sum of the above [A] (m^3/d)			333
Cooling System [B]	Make-up water rate = 0.00			0
Average Day Demand [C]	[C]=[A]+[B]=333+0			333
Maximum Day Demand [D]	Busy days = 280 days/year; [D]=[A] x (320/280) + [B]			383
Peak Hour Demand [E]	Peak hour factor = 2.5 [E]=([A] x 2.5 +[B])/24hr =(333 x 2.5 + 0)/24			35 m^3/hr.

Note) Year 2020 Forecast: Annual Number of Passengers=1,436,000
, Annual Cargo=10,728 tons, Peak Days of Year=320 days

Source: JICA Study Team

2) Power Supply System

a) General

The power house, located between the passenger terminal building and the control tower, ATC operation and administration building will house the following for the purpose of achieving good maintenance and serviceability to all mechanical and electrical systems of the complex.

- Electric power substation
- Emergency generators
- Constant current regulator (CCR)
- Control room

From the power house, a series of underground concrete cable ducts will be installed to serve all the buildings and other electro-mechanical facilities inside the airport complex including the air navigation facilities.

b) Primary power source

The proposed New Bohol Airport is under the franchise area of BOHECO-1, which can supply the new airport by the planned 10MVA Substation to be installed along the Panglao Central Road. BOHECO-1 proposal for the 13.2 kV overhead lines will include supply and installation up to the receiving points of the project. Initial coordination with BOHECO-1 official concluded that the cost of the overhead facilities from the source going to the site shall be shouldered by the project. These overhead facilities will be solely used by the airport and nobody can tap on this line as per BOHECO-1 official.

At present, there are three (3) overhead lines that crisscross the island Municipalities of Dauisand Panglao which serve the whole of the island. The three (3) lines get power from the 10MVA DAMPAS Substation in Tagbilaran City, around 6km northeast of Dauis. The source of power is from NAPOCOR’s interconnection in Leyte.

c) Estimation load capacity

The total load capacity for the whole airport area, including road lighting for the access road, is roughly estimated at around 3,000kVA.

3) Sewerage System

a) Basis of Design

The sewage treatment plant to be constructed within the airport facility is designed to treat and dispose the sewage generated from domestic and commercial activities within acceptable environmental standards. The sewerage facility other than providing adequate sanitary conditions for the users and occupants of the airport is also to prevent water pollution in the surrounding environs.

This section covers the planning fundamentals for the system of sewage treatment to include its impact to the environment. The planning, more specifically, the criteria adopted, is in accordance with the development plan of the airport facilities established for the year 2035.

b) Design Consideration and Analysis

The final design year is established for the year 2035, which is the long-term target year of the airport development. The sewerage plan is prepared to follow the phasing of the airport development plan wherein the first phase of staged construction is planned for the target year of 2020. The succeeding sub-sections presents the basic fundamentals considered in establishing the design criteria and facility requirements.

c) Assumption of Sewage Flow

Although sewage flow projections are mostly derived by applying a return factor (the ratio of discharged sewage against consumed water), prudent design however dictates that sewage quantity is assumed to be equal to the distributed water quantity. Considering the water demand estimates for domestic and commercial activities as presented in the previous sections of this report, the design sewage flow (Table 4.4-4) was derived adopting a return factor of 100%.

Table 4.4-4 Projected Design Sewage Flow

Sewage Flow	Value
Daily Average Flow	325 m^3/day
Daily Maximum Flow	420 m^3/day ~ 0.29 m^3/min
Hourly Average Flow / Peak Flow (16 hours operations)	496 m^3/day ~ 0.52 m^3/min

Source: JICA Study Team

4.5. Summary of Airport Facility Requirements

Based on the discussion thorough Chapters 3 to 4, Airport Facility Requirements for 2020, 2030 and 2040 are summarized in Table 4.5-1.

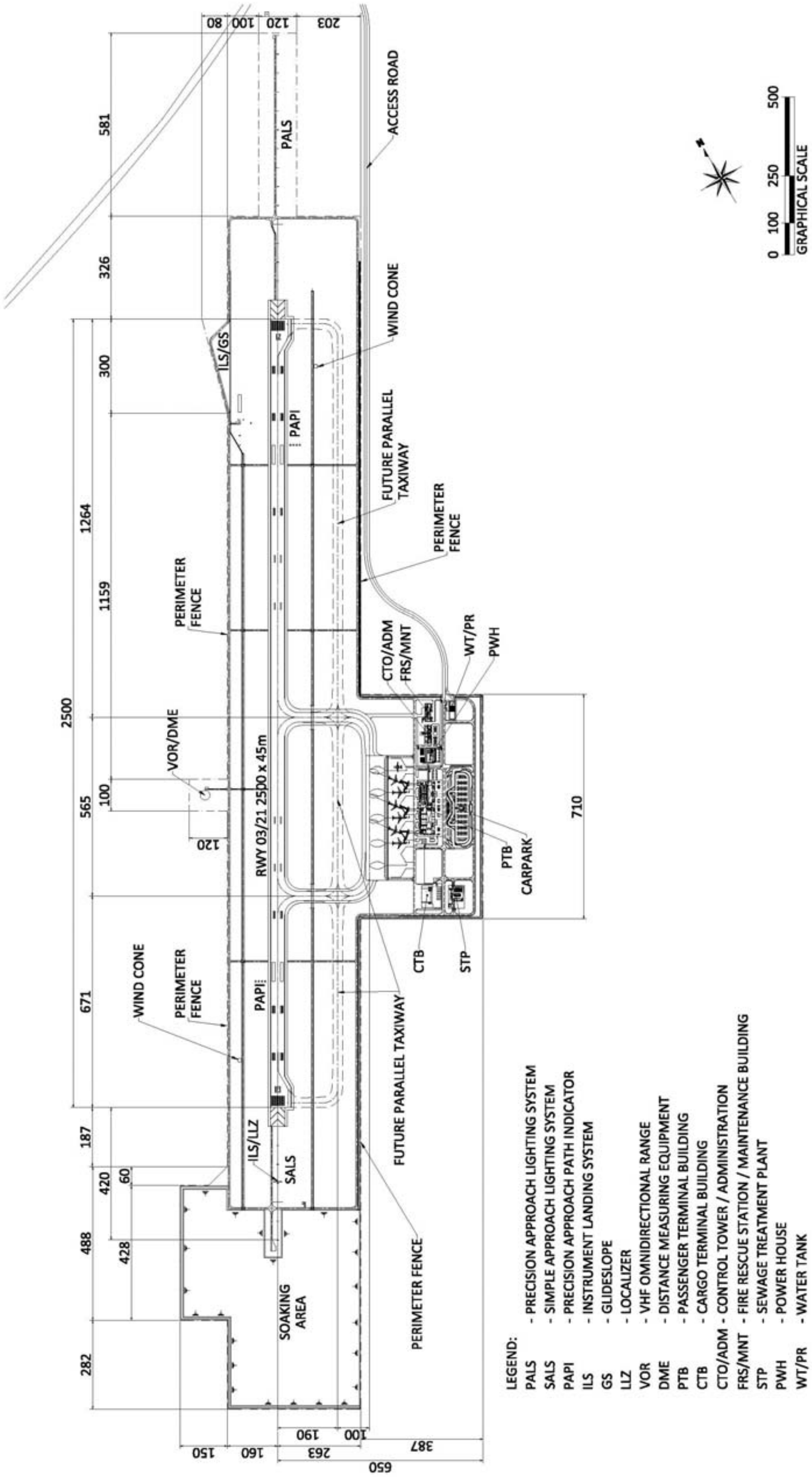
Table 4.5-1 Facility Requirements for New Bohol Airport

Item		at Present	Future Requirements		
		in 2010	2020	2030	2040
1	Annual Passengers (2-way)	572,476	1,435,640	1,957,704	2,441,688
	- Domestic	572,476	1,393,000	1,773,000	2,117,000
	- International	-	42,640	184,704	324,688
2	Annual Cargo (tons)	4,791	10,812	13,274	15,968
3.	Annual Air traffic Movements (2-way)	4,664	13,915	17,047	19,807
	- Domestic	4,664	13,545	15,355	16,993
	- International	-	370	1,692	2,814
4	Peak-day Passengers (2-way)	1,790	4,892	6,511	8,099
	- Domestic	1,790	4,353	5,541	6,616
	- International	-	539	970	1,483
5	Peak-Hour Passengers (1-way)				
	- Domestic (PH factor)	400	375 (15.1 %)	464 (14.6 %)	542 (14.3 %)
	- International (PH aircraft)	-	128 (A320)	208 (B767)	240 (A330)
6	Peak-Hour Passengers (2-way)				
	- Domestic	600	577	714	834
	- International	-	197	320	369
7	Peak-Hour Aircraft (1-way)				
	- Domestic	3	3.19	3.51	3.81
	- International	-	1	1	1
8	Design Aircraft	A320	A320	A321/B767/A330	
9	Longest Destination	Manila	Inchon/ Beijing/ Narita		
10	Aerodrome Reference Code	3C	4C	4E	
11	Fire Fighting Category	Cat 6	Cat 6	Cat 9	
12	Operational Category	VFR	Precision CAT 1: 24 hours		
13	Runway Length (m)	1,779 m	2,110 m	2,500 m	
	- Width (m)	30 m	45 m	45 m	
14	Runway Strip Length (m)	1,800 m	2,230 m	2,620 m	
	- Width (m)	100 m	300 m	300 m	
15	Taxiway	2 stub	2 stub		parallel
16	Passenger Terminal Floor (m²)	850	9,660	15,470	20,010
	- Dom (13-16m²/2-way peak Pax)	850	9,660	9,660	12,630
	- Intl (16-20m²/2-way peak Pax)	-	common use	5,810	7,380
17	Water Demand (m³ /day)	-	325	425	525
18	Electricity (KVA for contract)	-	3,000		

Source: JICA Study Team

4.6. Zoning of Airport Facilities

Proposed Zoning of Airport Facilities is shown in Figure 4.6-1.



Source: JICA Study Team

Figure 4.6-1 Proposed Zoning of Airport Facilities

Chapter 5

Conceptual Design

Table of Contents

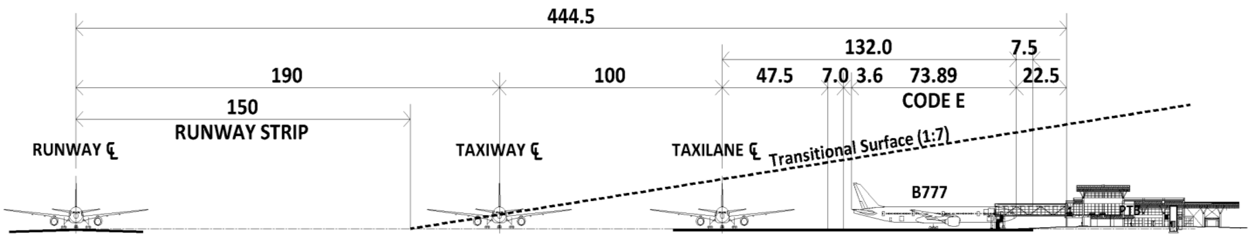
Chapter 5. Conceptual Design

5.1. General Concept

5.1.1. Terminal Concept

1) Location of Buildings

The location of the passenger terminal building is determined based on the airfield separation distance and building restriction line as shown in Figure 5.1-1.

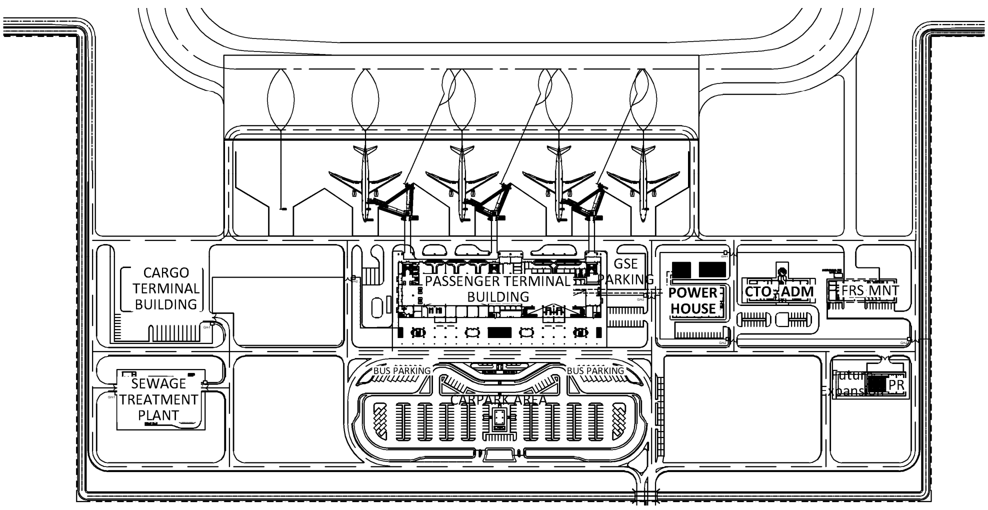


Source: JICA Study Team

Figure 5.1-1 Airfield Separation Distances

With regard to the terminal facilities, the following facilities need to be provided and are shown in Figure 5.1-2.

- Passenger aircraft parking apron
- Passenger terminal building
- Cargo terminal building
- Control tower, ATC operation and administration building
- Fire station and airport maintenance building
- Power house with chiller yard
- Water tank and pump house
- Roads and car park



Source: JICA Study Team

Figure 5.1-2 Terminal Area Site Plan

The terminal area layout plan has been made historically in consideration of the following requirements:

As stated in Chapter 4.4-3, location of Rescue and Fire Station is firstly selected at exactly in the middle of the 2,500-m long runway, so as to comply with the “Maximum 2-minutes Response Time” recommended in the latest ICAO Annex 14.

Axis of the Passenger Terminal Building (PTB) is selected exactly in the middle of the terminal area, in consideration of smooth entry-alignment of the access road. Therefore, indispensable airport lifeline facilities such as control tower, ATC operation and administration building, fire station and airport maintenance building, power house and chiller yard should be located in the northern area of the terminal, while the passenger and cargo terminal buildings should be in the south.

The proposed area for the future fuel farm will be situated to the east of the fire station and airport maintenance building so that it will not obstruct with the operations of the passenger and cargo terminal buildings

The sewage treatment plant has been located in the southern tip of the terminal area to allow sewage as much as possible to be transported by gravity.

2) Passenger Aircraft Parking Configurations

Based on the peak-hour aircraft movements, the aircraft parking stand requirements have been determined as 1 Code E (A330 class) for International, and 1 Code E (A330 class), 2 code C (A320 class) and 1 Code B (DH3 for regional shuttle) for domestic operations, or in total, 2 A330, 2 A320 and 1 DH3.

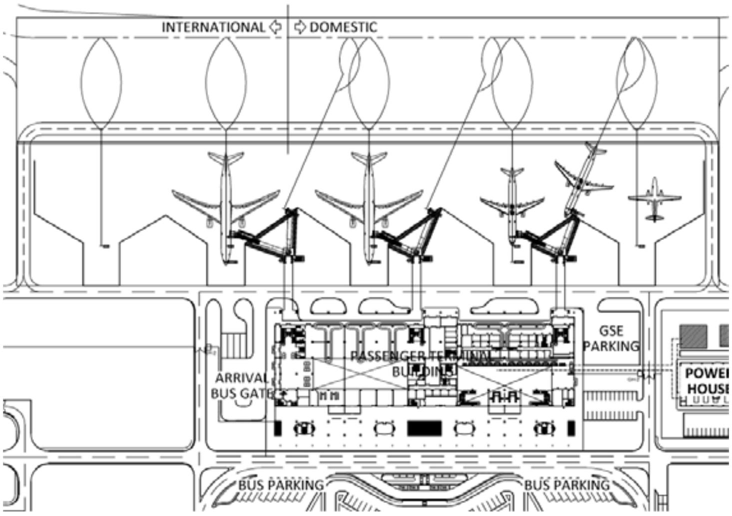
Meanwhile, the proposed arrangement of the passenger terminal building is to have 3 fixed gates each equipped with 1 passenger boarding bridge, with provisions for a second passenger boarding bridge at each gate.

shows the Aircraft Parking Configuration

<table>
<tr><th>Pattern</th><th>Parking Configuration</th></tr>
<tr><td><u>Basic Pattern</u>

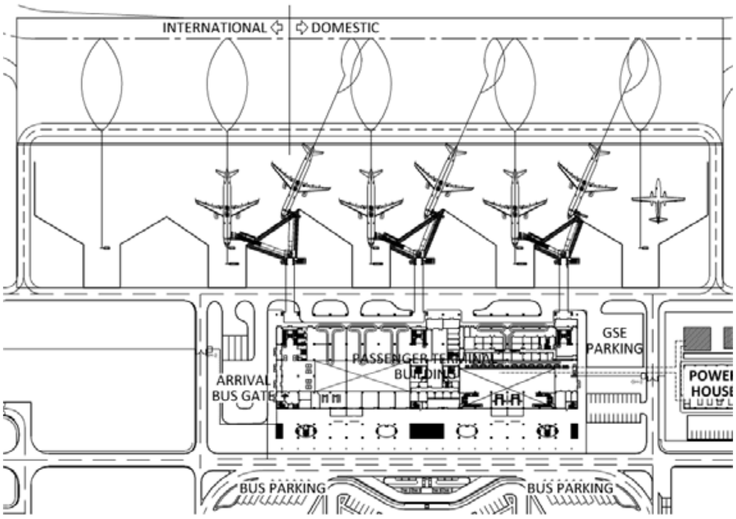
International
1 A330-300

Domestic
1 A330-300
2 A321-200
1 DH3

Emergency
1 A330-300</td><td>
</td></tr>
<tr><td><u>Variation 1</u>

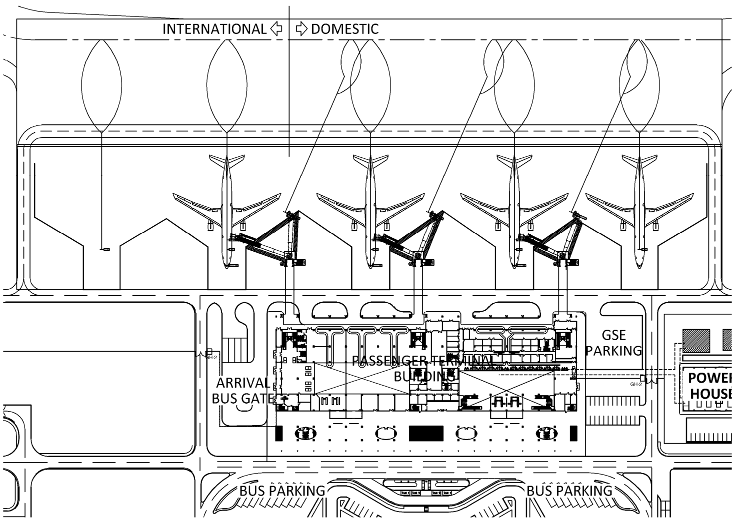
International
2 A321-200

Domestic
4 A321-200
1 DH3

Emergency
1 A330-300</td><td>
</td></tr>
<tr><td><u>Variation 2</u>

International
1 A330-300

Domestic
3 A330-300

Emergency
1 A330-300</td><td>
</td></tr>
</table>

Source: JICA Study Team

Figure 5.1-3 Aircraft Parking Configuration

3) Road and Car Parking Plan

The proposed car park layout in front of the passenger terminal building secures complete unidirectional two-lane vehicle traffic flow around the car park. In front of the passenger terminal building one lane is utilized for loading and unloading of passengers, a second lane will be used for maneuvering vehicles, a third lane is for other passenger-related traffic, such as bypass or thoroughfare to the car parking, whilst a fourth lane is to be utilized by staff vehicles and vehicular traffic to the cargo terminal.

The entrance to the car parking is from the opposite side of the terminal building to avoid congestion at the terminal entrance. The ingress and egress of the car park are controlled by tollbooths.

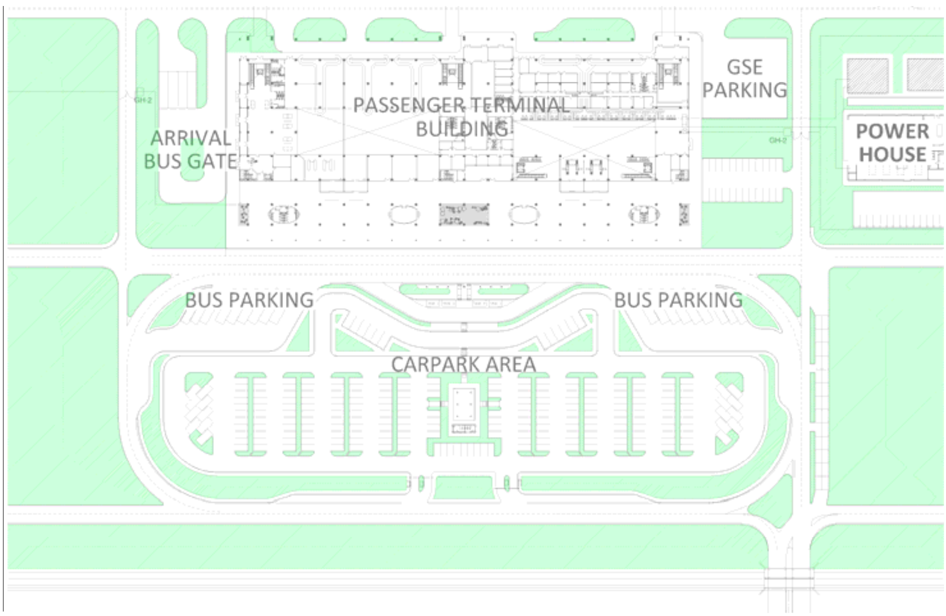
Apart from passenger vehicles and taxi's, ample space reservation is made for jeepney and tourist bus parking.

Car access to airside is provided at various points, to ensure full security each cross point from landside to airside is controlled by a manned guardhouse.

There are two airside access roads on either side of the passenger terminal building, two airside roads at either end to the south and the north of the landside terminal area.

Two more airside access roads are provided, one through the cargo terminal complex and another one through the Control Tower, ATC Operation/Administration Building (CTO) and Power House (PWH) complex.

The last two access roads are preceded by a guardhouse security with perimeter fence around the complex, one each for the cargo terminal and the CTO/PWH complex.



Source: JICA Study Team

Figure 5.1-4 Road and Car Park Plan

5.1.2. Energy Conservation Concept

1) Energy Saving in Mechanical Systems

Global earth warming is partly caused by numerous mechanical systems currently in use to increase the comfort level of human habitats.

Energy saving in mechanical systems is defined as to minimize the primary energy consumption while ensuring providing the required functions.

Basic factors to realize energy savings are as follow:

- to reduce heat loads.
- to reduce energy loss in the transfer route.
- to use high efficiency equipment and machinery.
- to use energy recovery and recycling.

The following energy saving technologies for the ventilation and air conditioning systems are considered applicable in the design of the New Bohol Airport.

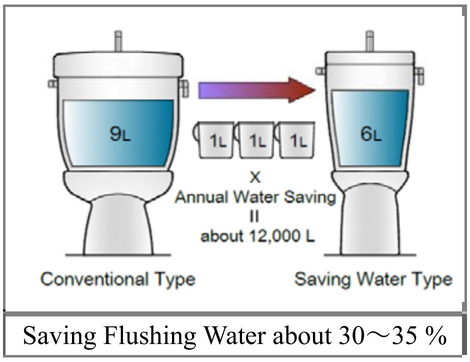
Table 5.1-1 List of Energy Saving Plan for Mechanical Systems

No	Item	Description
a	Saving Water Type's Sanitary Fixtures and Automatic Water Faucet	Water saving
b	High Efficiency Equipment for Chiller and Air Conditioning System	Improve the efficiency of system
c	Variable Water Volume (VWV) System	Reduce the conveyance power for pumps
d	Central Control & Monitoring System	Reduce the conveyance power for pumps
e	Division of Heat Source Equipment (Chiller)	Energy saving
f	Changing the Specification of Insulation (for chilled water pipe, etc)	Reduce the loss from chilled water pipe
g	Zoning of Air Conditioning System	Rational design and energy saving
h	Air Conditioning for Occupancy Zone only /Stratified Air Conditioning System with Natural Ventilation System	Energy saving

Source: JICA Study Team

a) Sanitary Fixtures of Saving Water Type

In order to reduce the water consumption and to protect the water resources, the use of saving water type sanitary fixtures can reduce the flushing water volume by approximately 30～35 % comparing to the use of conventional-type sanitary fixtures.



Source: Catalogue of Manufacturer

Figure 5.1-5 Sanitary Fixtures

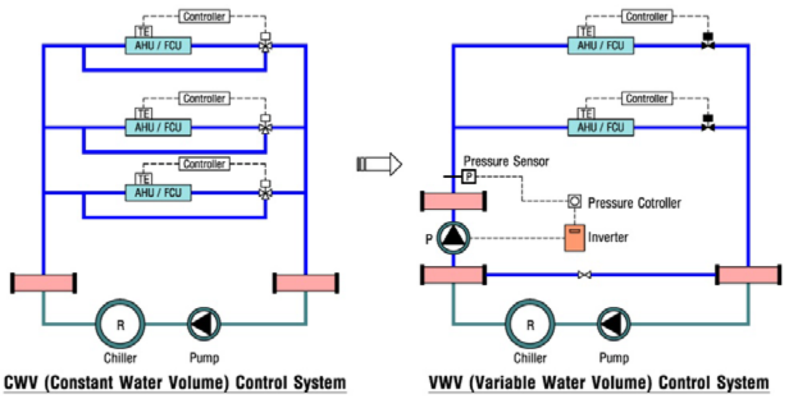
b) High Efficiency Equipment for Ventilation and Air Conditioning System

High efficiency ventilation and air conditioning equipment is defined as, in comparison to conventional typical equipment, equipment that can achieve a large efficiency combined with a reduction in energy consumption and operating cost.Therefore, the latest high efficiency equipment for ventilation and air conditioning systems should be actively considered for implementation at the New Bohol Airport.An air cooled chiller system that has a high Coefficient of Performance (COP) as compared to conventional chiller equipment shall be adopted. The chiller shall be a screw type compressor that can provide highly efficient operations with partial load.

In addition, air cooled heat pump’s packaged air conditioners (cooling only) and other such equipment shall also be considered to be adopted at the New Bohol Airport.

c) Variable Water Volume (VWV) System

Variable water volume systems shall be used for the secondary chilled water supply pump system whereby the circulatory chilled water volume can be changed according to a variation in the heat load by using a Multiple Control system with inverters. Compared to the constant water volume system, it is effective to achieve savings in the power consumption of the secondary chilled water pump.



Source: Catalogue of Manufacturer

Figure 5.1-6 Outline of Variable Water Volume (VWV) System

d) Central Control & Monitoring System (CCMS; a part BMS)

The CCMS for mechanical works shall record the operational conditions of each equipment, output of the chillers, heat volume for the cooling, consumption of service water, electrical consumption, etc.

The CCMS will provide a sufficient functional automation capacity so that further expansion of equipment will not lead to increase manpower due to a potentially increased workload.

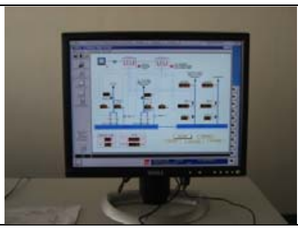


Diagram of Chiller System on Monitor

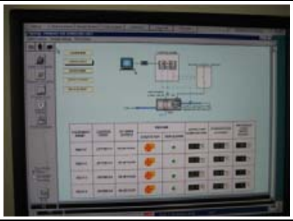


Diagram of AHU System on Monitor

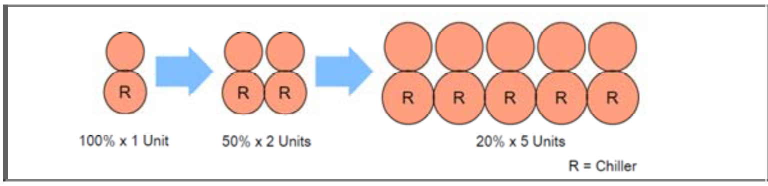
Source: JICA Study Team

Figure 5.1-7 Monitoring System

e) Division of Heat Source Equipment (Chiller)

In order to save energy, multiple numbers of heat source equipment (chillers) shall be adopted and multiple units control for chillers and chilled water pumps shall be used.

The required number of units shall be controlled by a digital sequence controller through the actual cooling load based on the chilled water temperature and flow meter.



Source: JICA Study Team

Figure 5.1-8 Outline of Division of Chillers

f) Changing the Specification of Insulation

To change the specification (material, thickness, etc.) of insulation for chilled water pipe in order to reduce the heat loss from chilled water pipes.

Pipe Insulation Materials

Insulation for Chiller & Chilled Water Pipes (TSN Airport)

Source: JICA Study Team

Figure 5.1-9 Insulation Materials

g) Zoning of Air Conditioning System

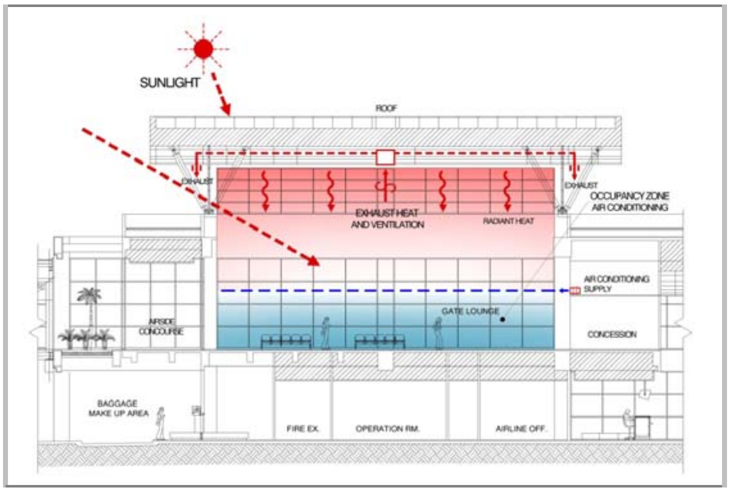
The zoning of air conditioning systems shall be designed in consideration of the operation time of each area/ room in order to be individually operated, depending on the demand. The passenger terminal building shall be zoned to meet the varying needs of different passenger areas, office areas, and concession tenant areas in order to save energy.

h) Air Conditioning for Occupancy Zone only /Stratified Air Conditioning System with natural ventilation system

In large and high ceiling areas such as the check in lobby or gate lounges, usually large amounts of energy are required to condition the entire volumes.

To ensure comfort and economy, the air conditioning for occupancy zones only, stratified air conditioning systems shall be adopted at the passenger terminal building. In this system, areas to be air conditioned shall be limited to the ambient space of occupants, which is the low level zone to avoid unnecessary air conditioning, and hot air accumulated in the upper part of the space shall be discharged by natural (or mechanical) ventilation to ensure energy saving.

Moreover, to use local air conditioning systems, including a floor-supply displacement air conditioning system and an individual (decentralized) air conditioning system shall be considered at future design stages.



Source: JICA Study Team

Figure 5.1-10 Outline of Air Conditioning in Occupancy Zone only

5.2. Civil Works

5.2.1. General

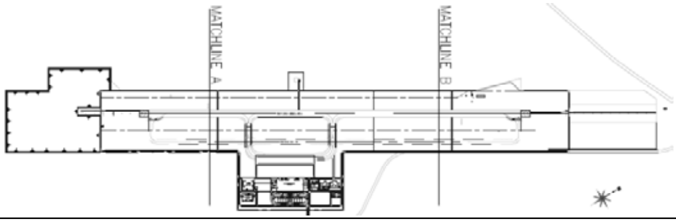
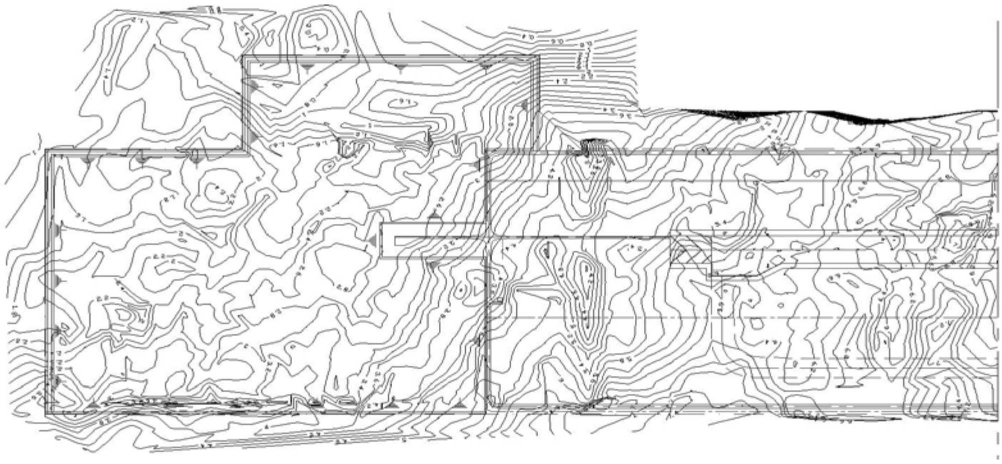
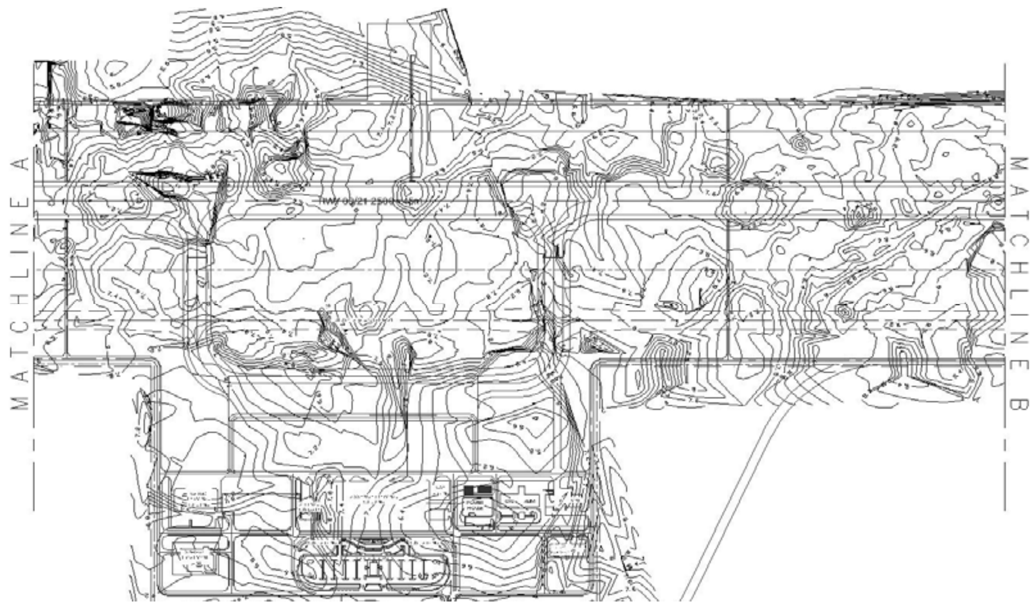
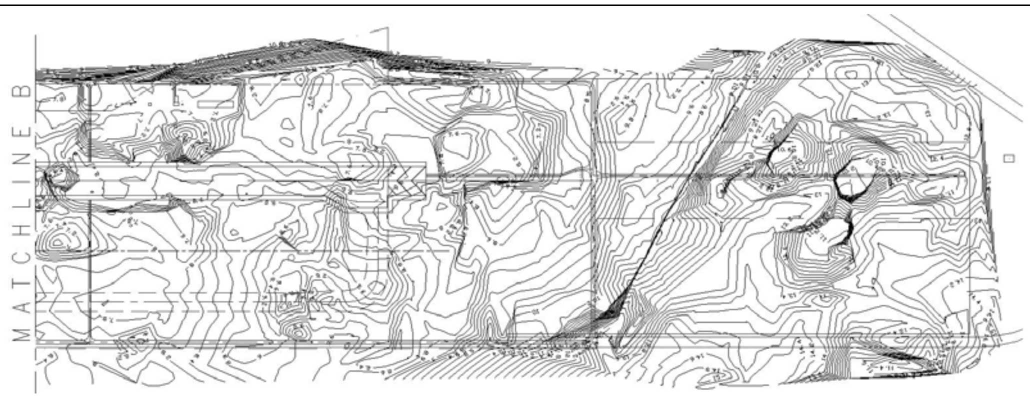
The site of the proposed New Bohol Airport is generally flat with a moderate slope in the general direction of north to south varying only within a few meters based on previous topographic survey conducted for the project site. For this particular project the requirements and criteria, as set forth in the ICAO and FAA standards, are as followed:

5.2.2. Earthworks

Considering the generally flat condition of the proposed site, the following shall be taken into account in preparing the detail of earthworks for the Project.

- The longitudinal and transversal slopes of the runway, taxiways, apron and other airfield facilities shall conform to the requirements of ICAO Annex 14 Standards and Recommended Practices.
- The grading plan shall have an effective drainage system considering the proximity of the site to the shoreline.
- The use of suitable embankment materials coming from the excavation for drainage and other structures within the project site.

Taking into consideration the above requirements and based on the results of site investigations, the design and method of earthworks implementation shall be the balanced cut and fill method to minimize the quantity of imported embankment materials from remote quarry sites. The finished level of earthworks and other civil facilities will be decided by a topographic survey during the detail design stage. Existing Topography is shown in the Figure 5.2-1.

Overall Keyplan	
South west Portion	
Central Potion	
North east Portion	

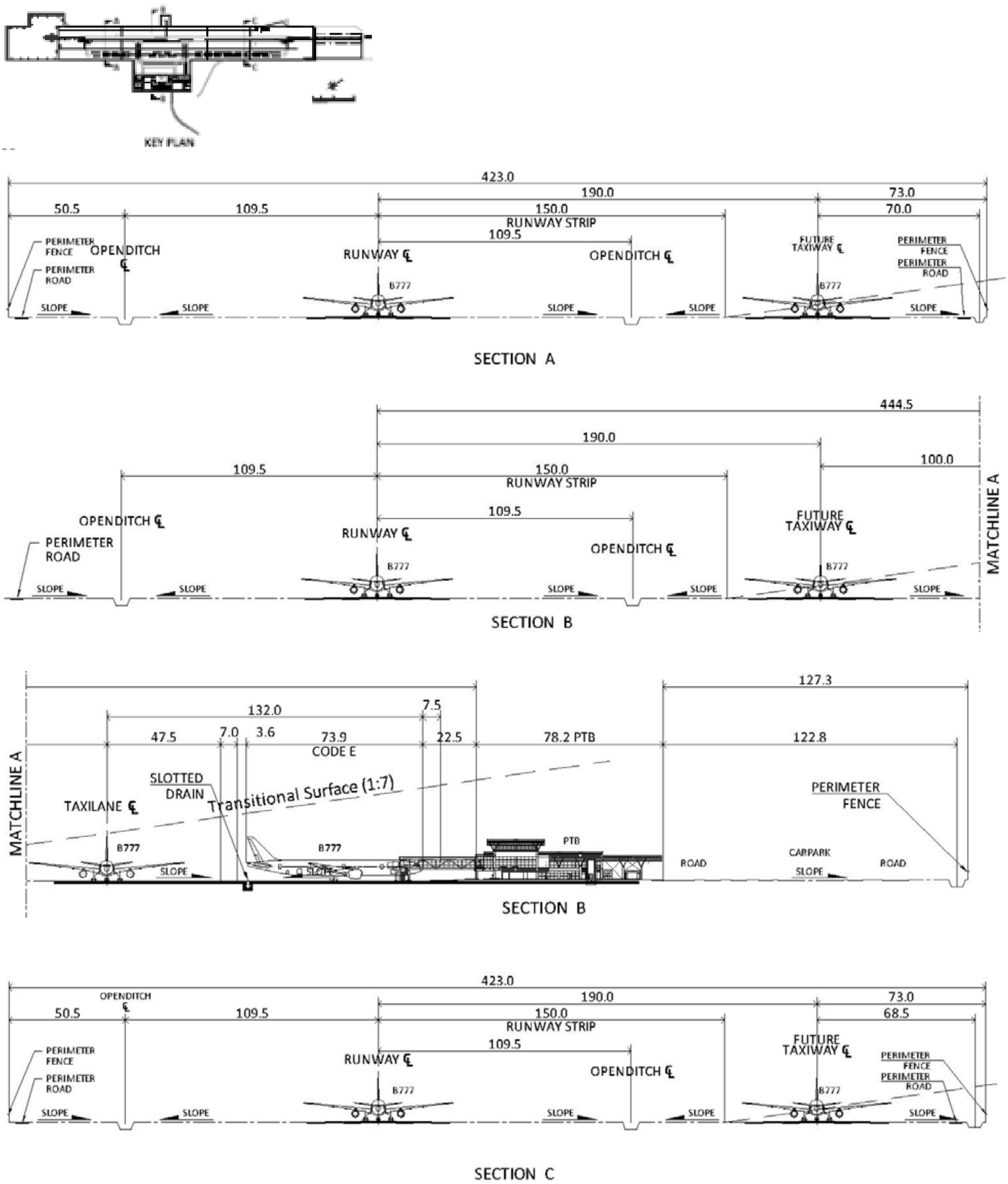
Source: JICA Study Team

Figure 5.2-1 Existing Topography

Runway profile and cross section of the proposed earthwork and grading plan are given in Figure 5.2-2 and Figure 5.2-3.

Source: JICA Study Team

Figure 5.2-2 Runway Profile



Source: JICA Study Team

Figure 5.2-3 Runway Cross Section

5.2.3. Pavement Works

The pavement structure shall be computed taking into consideration the following:

- Expected Volume of Traffic.
- Design Aircraft.
- Sub grade CBR and K value.

1) Annual Traffic

Annual aircraft movements for international and domestic operations for the design years are given in Chapter 3, from which annual departures for the Design Aircraft are computed as shown in Table 5.2-1.

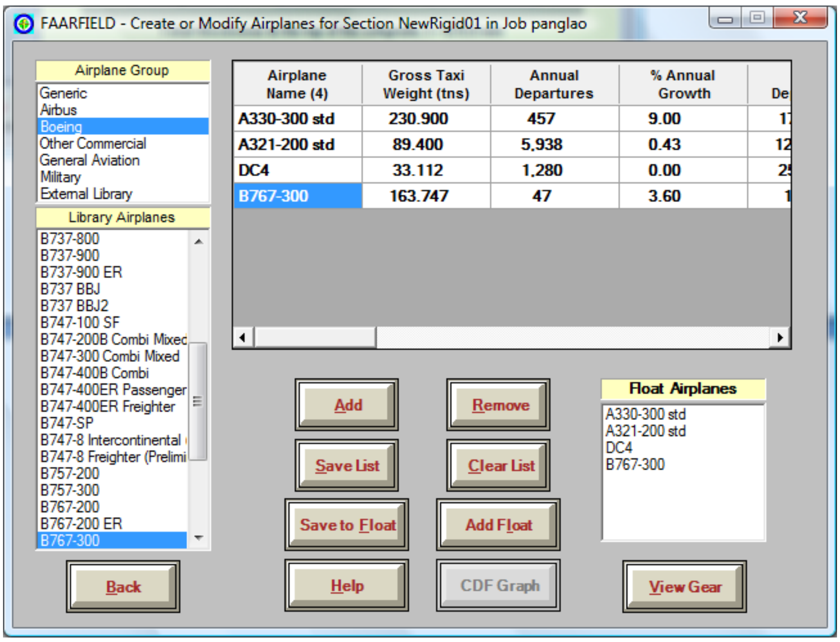
Table 5.2-1 Annual Departures of Design Aircraft

Aircraft/Years	2020	2040	Annual Growth
DH3	1,280	1,280	0 %
A321-200	5,938	6,469	0.43 %
B767-300	47	95	3.6 %
A330-300	457	2,552	9 %

Source: JICA Study Team

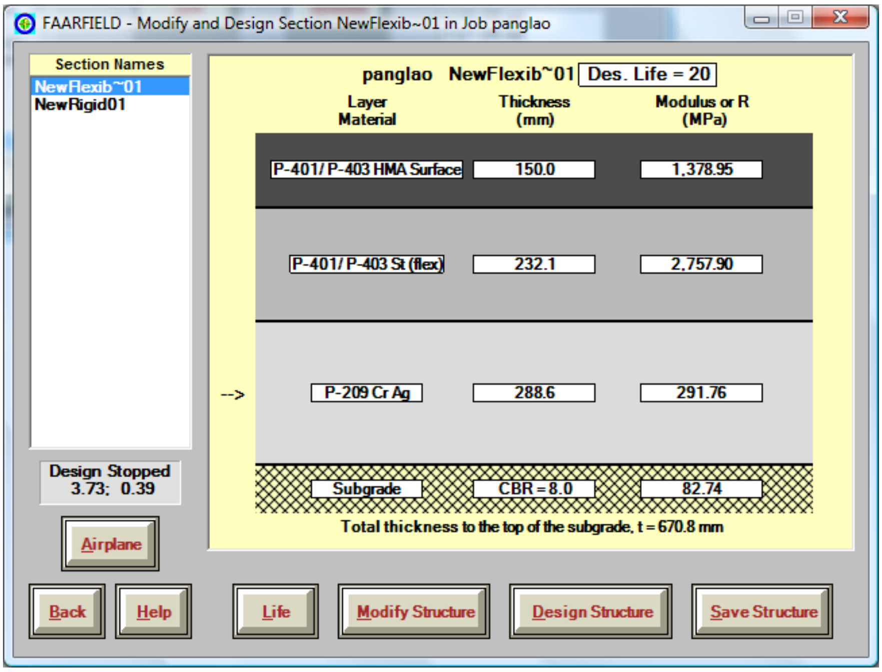
2) Pavement Thickness Calculation

The values of the above criteria have been entered into the FAARFIELD Pavement Design Program. Preliminary pavement design is shown in Figure 5.2-4, Figure 5.2-5 and Figure 5.2-6.



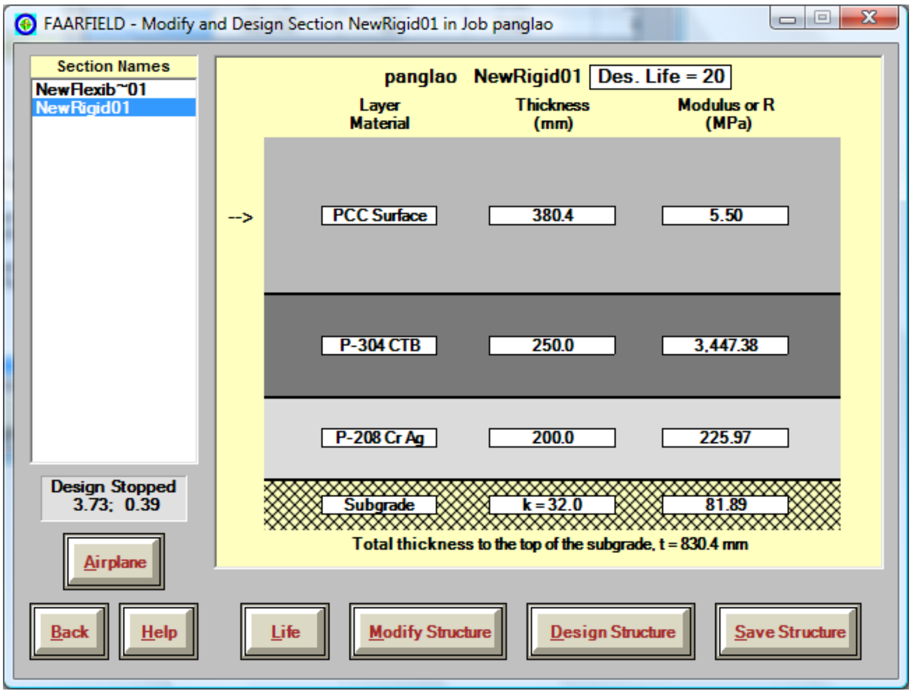
Source: FAA

Figure 5.2-4 Annual Departures for design Aircraft



Source: FAA

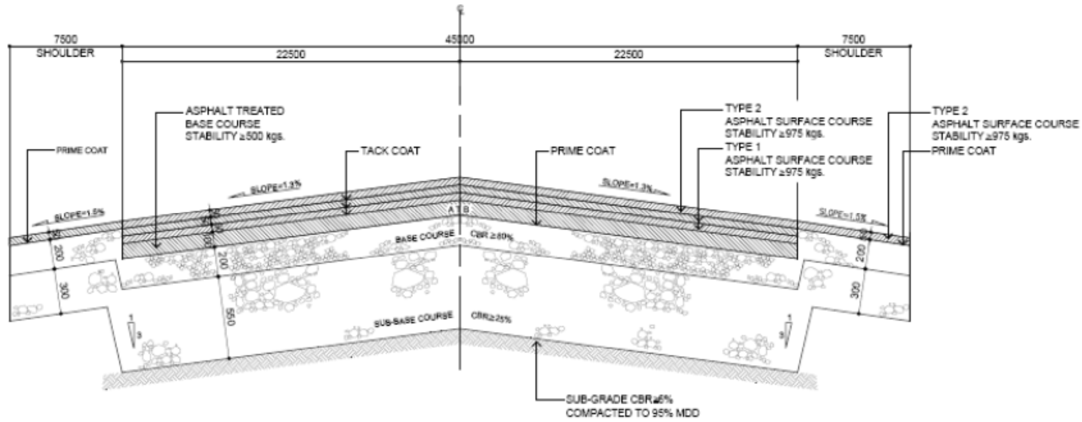
Figure 5.2-5 Thickness of Flexible Pavement



Source: FAA

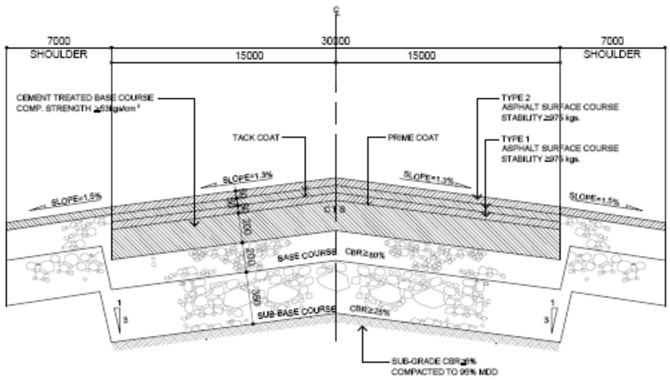
Figure 5.2-6 Thickness of Rigid Pavement

Based on the pavement thickness given from the FAARFIELD Pavement Design Program, pavement structures for runway, taxiways and apron are shown in Figure 5.2-7, Figure 5.2-8 and Figure 5.2-9.



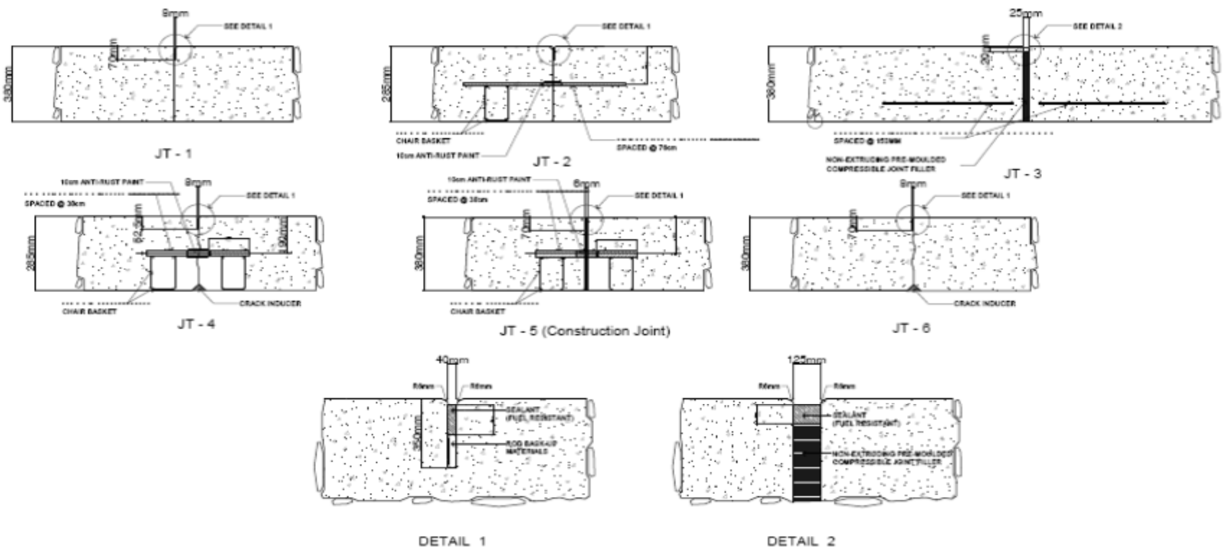
Source: JICA Study Team

Figure 5.2-7 Runway Pavement Structure



Source: JICA Study Team

Figure **5.2-8** Taxiway Pavement Structure



Source: JICA Study Team

Figure 5.2-9 Apron Pavement Structure

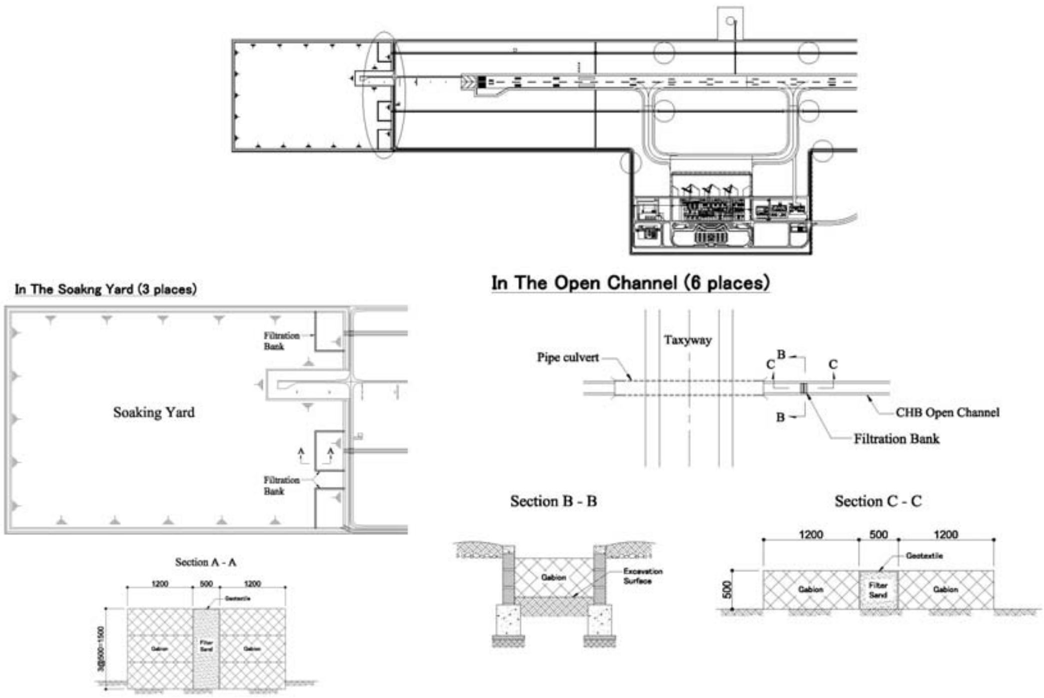
5.2.4. Drainage

1) Drainage System

One of the prerequisite conditions for environmental protection is that any dirty water should not overflow from the new airport to the ocean. Toward this objective, storm water along airfield is planned to be collected through rip-rapped (or CHB-walled) open ditch, so that storm water is locally detained and soaked into the ground as much as possible, then only a minimal volume of storm water would overflow into the soaking yard.

Daily maximum rainfall occurred for the last 10 years was 94 mm recorded in October 2010. Assuming 50 % of the rainfall is naturally absorbed into the ground of approximately 200ha, reservoir capacity of detention pond (soaking yard) should not be less than 94,000 tons of water (i.e. 50% x 0.094 m x 2,000,000 m²). In addition, maximum 420 tons in total of water used for the building complex (including PTB, CTB, control tower, operation building, fire station and maintenance building) will be discharged via sewage treatment plant to the same soaking yard, which culminate a total of 94,420 ton of water. The environmental / social advisory committee of JICA suggests that the area of soaking yard should be planed as large as possible to prevent overflow of storm water due to extraordinary weather condition recently encountered worldwide. Meanwhile, the area of soaking yard is approximately 20 ha where the bottom is lowered by 1 m, in average hence 200,000 tons of water can be detained which can cope with the requirements.

To preserve the soaking function in the open ditch, filtration bank covered with geo-textile and gabion should be designed to be strategically located as shown in Figure 4-6. If necessary, the bottom of the soaking yard could be covered by geo-textile materials so that fine sand stuck into the natural underground-watercourse could be prevented.



Source: JICA Study Team

Figure 5.2-10 Filtration Bank to Prevent fine soil effluences

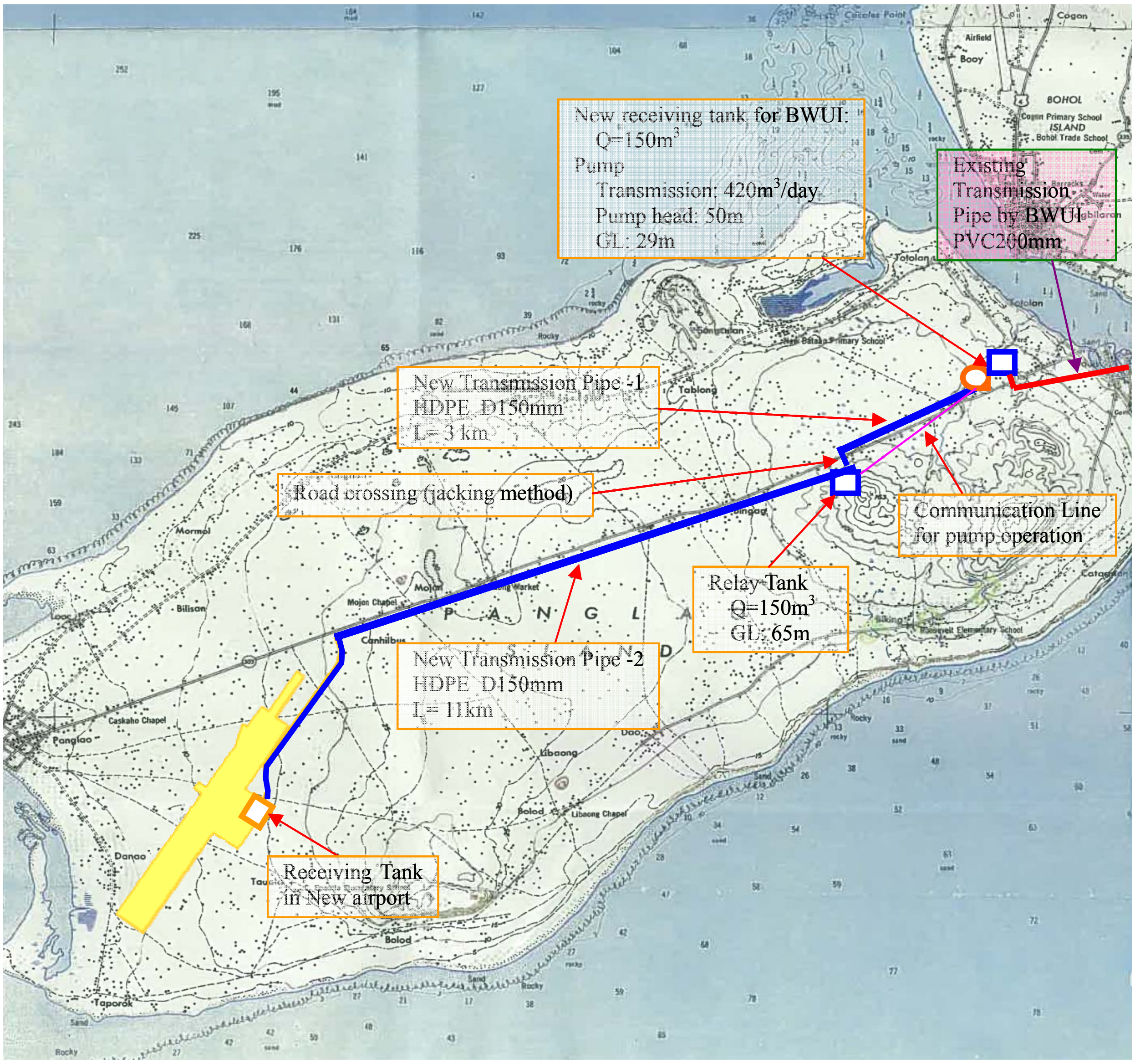
5.3. Utility Works

5.3.1. Water Supply System

1) Outside of New Airport Site

Receiving Tank of bulk water will be built at an elevation of 45m above MSL in the BWUI land in Dauis. For the purpose of measuring the quantity of water for airport usage, water meter is installed on the inlet pipe of the Receiving Tank.

The location of water supply facilities is shown in Figure 5.3-1



Source: JICA Study Team

Figure 5.3-1 Location of Water Supply Facilities

Water for the airport usage will be pumped up to the Relay Tank at an elevation of 62 to 65m above MSL via 3-km long transmission pipe. Then the water will be supplied by gravity flow to the new airport via about 11-km long transmission pipe. The transmission pipe will install in the shoulder of the center national highway.

According to facility requirement study for the new airport construction, daily maximum required quantity of water is estimated at 383m3/day. Required quantity of bulk water is estimated to be 420m3/day including about 10% to account for leakage along the way.

At present, BWUI's total water supply capacity in the summer season (in March 2012), is 23,487 m3/day, and actual maximum water supplied in March 2012 was 20,753 m3/day, the margin of the daily supply is 13% of about 3,000 m^3. Meanwhile the quantity demanded for the new airport is 420m3/day, and it will be about 2% of daily maximum of whole water supply in BWUI.

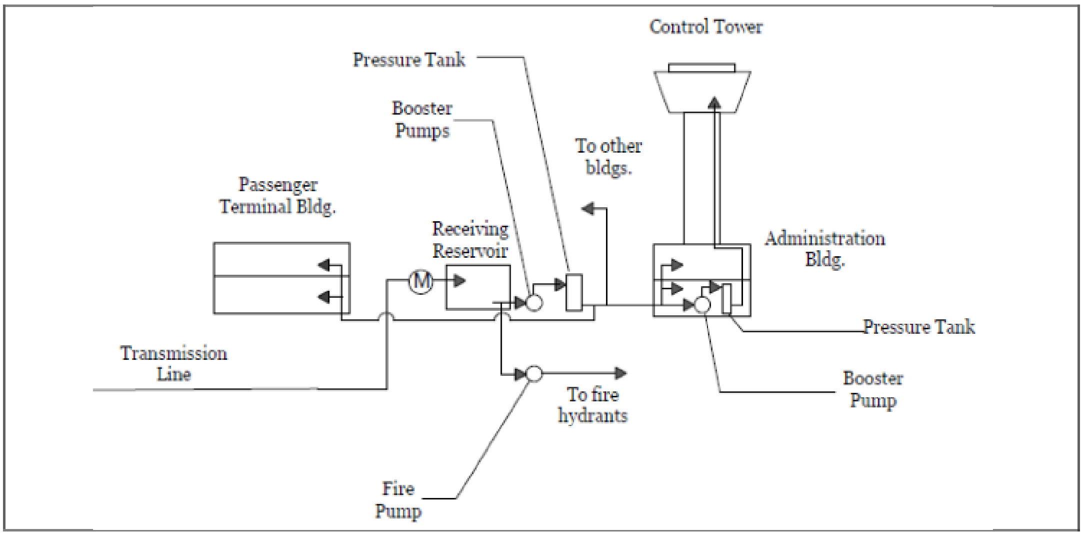
2) Inside of New Airport Site

Required water to each airport facility shall be supplied from the airport receiving reservoir tank by means of booster pumps and a pressure tank to maintain the pressure. An additional booster pump and pressure tank system will be provided to supply water up to the Control Tower cab.

Exterior fire protection facilities shall also be installed around the buildings. Fire hydrants shall be strategically located to facilitate fire fighting during emergency conditions. Fire fighting water shall also come from the receiving reservoir. A fire pump shall directly deliver to the fire hydrants the required flow and pressure during fire condition.

By-pass lines for water distribution and outdoor fire protection shall be provided.

Irrigation of landscaped areas of the airport terminal area is supposed to come from the effluent of the Sewage Treatment Plant (STP). But because of the expected low water output from STP, the irrigation system may be tapped from the outdoor fire protection system. The line bypassing the pump station shall be opened and the available pressure from the transmission shall be used for irrigation. Hose bibs shall be strategically located to supply water to plants and landscaped areas. The overall flow diagram is shown in Figure 5.3-2.



Source: JICA Study Team

Figure 5.3-2 Overall Flow Diagram of Water Supply System

5.3.2. Power Supply System

3) General

The electric power will be supplied by 13.2kV 60Hz, it is distributed from the power house to the passenger terminal building and the control tower & ATC operation and administration building, sewage treatment plant, cargo terminal building. The power for water tank, pump house and fire station is received from the control tower & ATC operation and administration building.

From the power house, a series of underground cable ducts and manholes will be installed to serve all the buildings and other electro-mechanical facilities inside the airport complex including the air navigation facilities.

4) System Design

a) Main System

Primary voltage from the electric company will be at 13.2 kV and secondary voltage at 460V and 230V.

Power transformers, power circuit breakers, medium voltage switchgears, distribution transformers, generators, and low voltage switchgear, power capacitors, aeronautical ground lights equipment, monitoring equipment and equipment for maintenance purposes will be housed in the Power House. Distribution of power to other buildings will be at high voltage, and low voltage feeders through a series of underground cable ducts.

Basic design load for Aeronautical Ground Lights and Apron Floodlights is 250 KVA at 230V, 3 phase, 65% of the design load will be energized by a generator during power failure.

Basic design load for car park and road lighting is 100 KVA at 230V, 3 phase, approximately 35% of the design load will be energized by a generator during power failure.

b) Generator Set

The tentative design load of the generator set is 1,100 KVA at 13.2 kV, 3 phase. The purpose of the generator is to provide power for the essential load of the airport during normal power failure. The total generator capacity of 1,100 KVA represents 50% of the total load of whole airport.

In consideration of the quality of the normal power source and the need to be prepared for periodical inspection and maintenance services of the generator, three sets of generators shall be provided with a rating of 500 KW (625 KVA) each.

The System will be linked with three sets of 625KVA generator system for auto synchronizing and load sharing capability.

A fuel tank will be provided for five (5) full days operating capacity of the generator at the power house. This estimate is based on the requirements of 72 hrs. (3 days) minimum of item

2.3.2 Engine Generator sets of ICAO Aerodrome Design Manual, Part 5 Electrical System and an allowance of two (2) days based the cycle of ordering and delivery of fuel in Bohol Island.

The diesel engine driven stand-by generator sets shall be controllable both manually and automatically.

Rating and characteristics of each generator set will be as follows:

- Type : 3 phase, 3 wires
- Rated voltage : 13,200 VAC
- Rated revolution : 1,800rpm (60Hz)
- Power factor : Lag. 80%
- Rating : Continuous
- Max. switch-over time : within 10 seconds (for navaids, communications)
  : within 40 seconds (for others)
- Cooling system : Radiator system

The standby generator set will be mounted on a common bed made of forged steel, and installed on the concrete foundation.

c) External lighting

Spacing for internal road lighting shall be approximately at a pitch of 45 m, and for access road at 50 m interval. The illumination level for road lighting shall be at least 15 lux for access road, 10.5 lux for internal road and 7.5 lux for other areas. The average horizontal illumination for car park lighting shall be 20 lux.

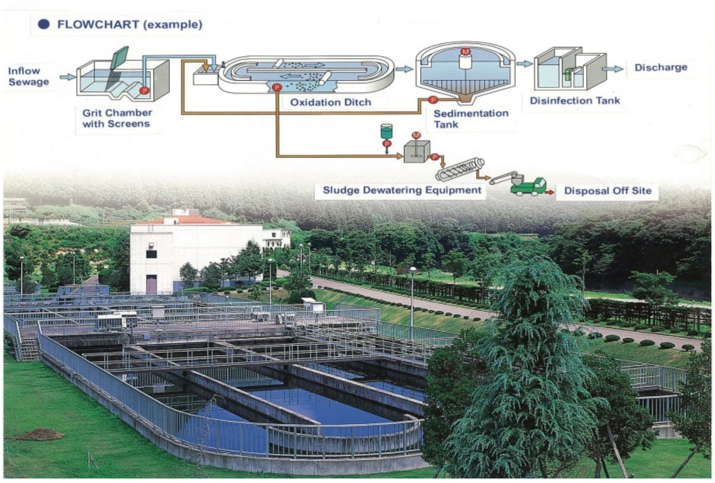
5.3.3. Sewerage System

Sewage from the New Bohol Airport shall be treated by a sewage treatment plant (STP) dedicated to the New Bohol Airport. Wide scale sewage treatment systems have not been developed around the site, so all sewage from the airport must be treated inside the airport. Discharge water quality shall be in accordance with Philippine standard BOD 30ppm and the treated water shall be discharged to the storm water drainage system or existing rivers.

The treatment process shall apply the latest technology at the construction stage, however at the moment Activated Sludge System (i.e. Oxidation Ditch System), which is widely used for similar airport facilities, is applied. The feature of the system is as follows:

- Simple facility design reduces the system construction cost.
- Stable treatment is able to cope with variations in inflow rate and quality of incoming raw wastewater and this makes the system easy to maintain and manage.
- Running cost is low.
- The system allows the removal of not only BOD (Biochemical Oxygen Demand), SS (Suspended Solids) and COD (Chemical Oxygen Demand), but also nitrogen.
- Less sludge production contributes to lower cost of sludge disposal.

As an example, a typical flowchart of an Oxidation Ditch System is shown in Figure 5.3-2 and according to approximate calculation, the STP is estimated to treat approx. 325 tons per day for the target year 2020.



Flowchart of Oxidation Ditch System	Iloilo Airport

Source: JICA Study Team

Figure 5.3-2 Similar Facilities of STP

5.4. Building Works

For the purpose of ease of reference, the Building Works are classified into the following 7 Division, some of which are further classified into subdivisions (small buildings) as shown below:

Division 1 : (B1) Passenger Terminal Building (PTB)	
Division 2 : (B2) Cargo Terminal Building (CTB)	
Division 3 : (B3) Control Tower, ATC Operation and Administration Building (ATO)	
Division 4 : (B4) Fire Station and Airport Maintenance Building (FSM)	
Division 5 : (B5) Ancillary Buildings (ACB)	
Sub-division 51 : (B51) Drivers Lounge (DRL)	
Sub-division 52 : (B52) Car Park Toilet (CPT)	
Sub-division 53 : (B53) Guard Houses (GDH)	
Sub-division 54 : (B54) Toll Booths (TLB)	
Division 6 : (B6) Utility Buildings (ULB)	
Sub-division 61 : (B61) Water Tank & Pump House (WPH)	
Sub-division 62 : (B62) Power House (PWH)	
Sub-division 63 : (B63) STP Control Room (STP)	
Sub-division 64 : (B64) Material Recovery Facility (MRF)	
Division 7 : (B7) Navaids Buildings (NAV)	
Sub-division 71 : (B71) LLZ Building (LLZ)	
Sub-division 72 : (B72) GS Building (GS)	
Sub-division 73 : (B73) VOR Building (VOR)	

5.4.1. Division 1: (B1) Passenger Terminal Building (PTB)

1) <u>Architectural Works</u>

a) Design Targets and Facility Requirement

Facility requirements were calculated based on the estimated peak-hour passenger movements as well as IATA design standards. Detailed facility requirements of the passenger terminal building have been computed as shown in Table 5.4-1.

The passenger terminal building concept also has taken into account the following:

- Global standard to meet IATA, ICAO and airlines' requirements;
- Provision of simultaneous domestic and international operations;
- Highest security;
- Barrier free;
- Easy expansion in future;

- Environment friendly;
- Ease of maintenance; and
- Reasonable construction and low maintenance costs.

b) Passenger Terminal Building Concept

Considering the design targets and facility requirements, the passenger terminal building layout is based on one and a half level passenger processing concept.

To provide for maximum smooth simultaneous domestic and international operations, the design of the passenger terminal building features a two level structure.

The first level (ground floor), with a total floor area of 8,256 m^2, houses the international and domestic check-in lobby, international and domestic baggage claim areas, airline and concession spaces. Immigration and customs counters are located along the international passenger flow for simultaneous operations. The baggage claim hall is divided into two separate areas each for domestic operatiosn and for international operations At times of sole domestic or sole international operations the two baggage claim halls can be combined to function as one, thus increasing the capacity of the domestic or international peak. In front of the terminal building, on the ground floor, are the departure and arrival public concourses for meeters, greeters and well-wishers. An external shaded area of 3,000 m^2 is provided to cater for the Filipino custom of sending off and welcoming passenger-relatives. This area has access to public toilets and various concessions spaces and is directly connected to the passenger terminal curb side and car park area

The second level, with a total floor area of 6,375m^2, houses the domestic and international departure lounges, government offices, concessions including duty free shops, airside corridors, CIP and VIP lounges. From the ground floor international and domestic passengers travel to the second floor by separate escalator/stairs and elevator, immigration counters are located along the passenger flow for international operations. Prior to entering their respective lounge areas separate central security check points are provided for each the domestic and international passengers.

The international arriving passengers at the airside concourse are directed to the southern stairs/elevator and escalator leading to the international baggage claim area below. Prior to entering the baggage claim hall the international passengers undergo a health check and report to the arrival immigration. Prior to exiting the building the international passengers will require a last inspection by the customs department. Thedomestic passengers arriving at the second floor airside corridor are directed to the central staircase leading to the domestic baggage claim hall on the ground floor.

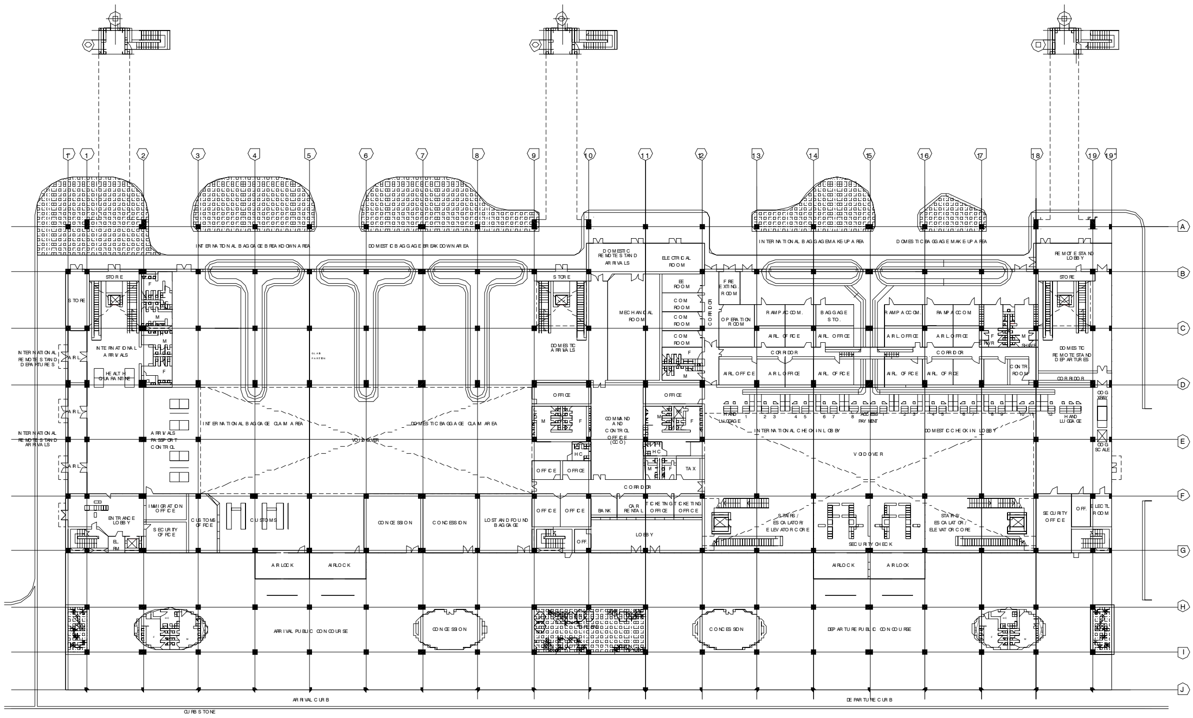
The roof level contains the ventilation and air conditioning equipment serving the second floor.

Vertical means of transportation, such as stairs, escalator and elevators (for handicapped, elederly and other special need passengers) are designed to maximize orientation. They are strategically located to transport passengers as direct and as straight as possible to their next processing destinations.

Table 5.4-1 Floor Area Summary of Passenger Terminal Building

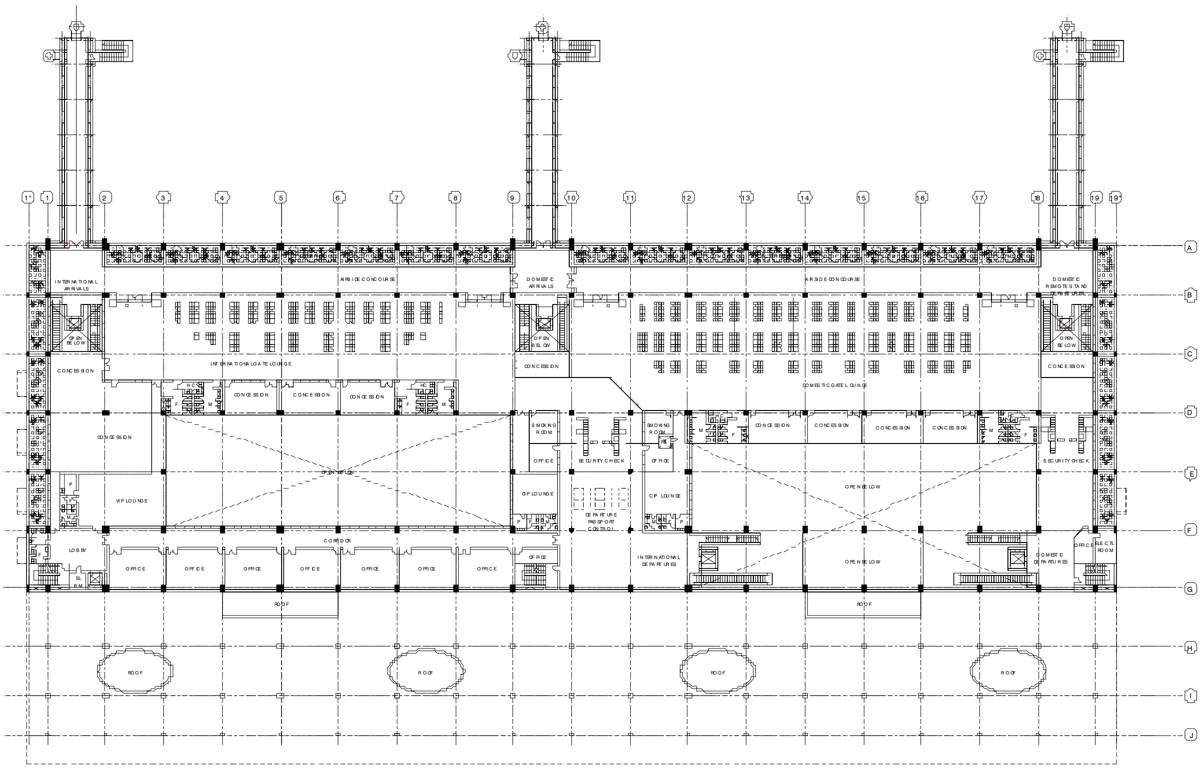
Ground Floor	
Security Check	170
Check-in Hall	1,127
Passport Control	317
International Baggage Claim Hall	716
Domestic Baggage Claim Hall	1,277
Custom Control	170
Office	814
Concession	444
Toilets	336
Technical Premises	298
Circulation and Structure	2,587
Gross Floor Area in m2	**8,256**
Second Floor	
Passport Control	200
International Security Check	158
International Departure Lounge	879
Airside Corridor	730
Domestic Security Check	156
Domestic Departure Lounge	1,234
Concession	638
Toilets	247
Smokers Rooms	45
Office	444
Lounges	447
Circulation and Structure	1,197
Gross Floor Area in m2	**6,375**
Roof	
Circulation	232
Technical Premises	607
Gross Floor Area in m2	**839**
Total Gross Floor Area in m2	**15,470**

Source: JICA Study Team



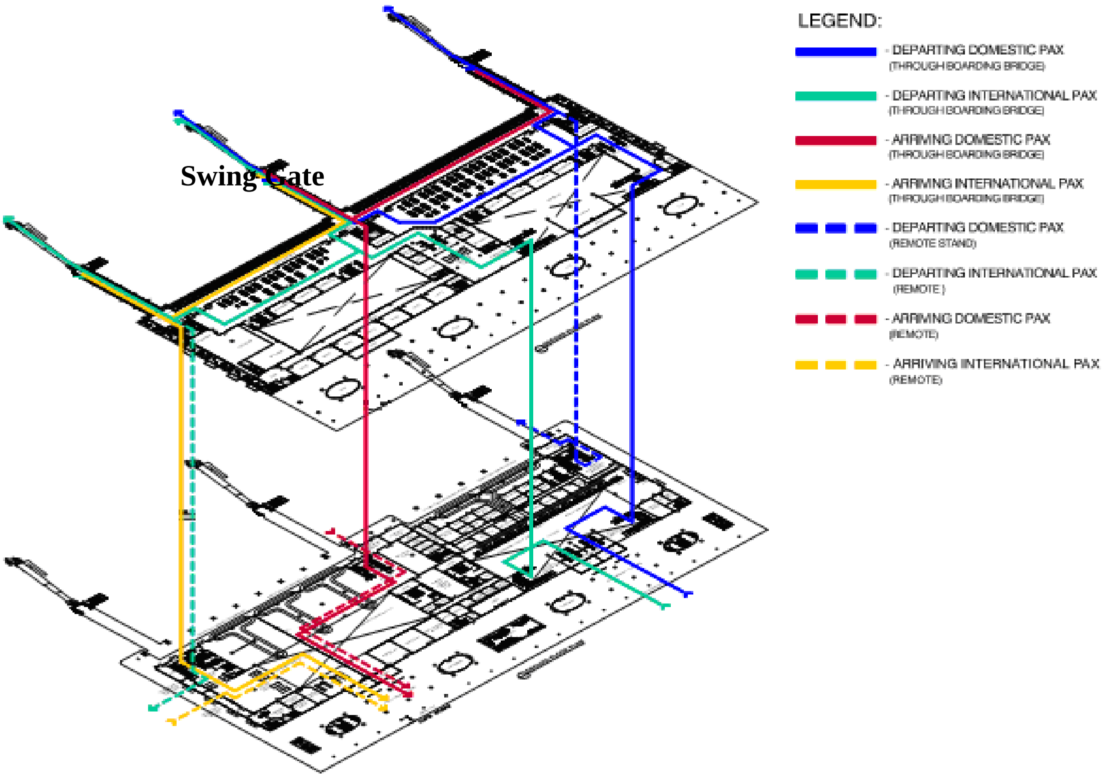
Source: JICA Study Team

Figure 5.4-1 Ground Floor Plan of Passenger Terminal Building



Source: JICA Study Team

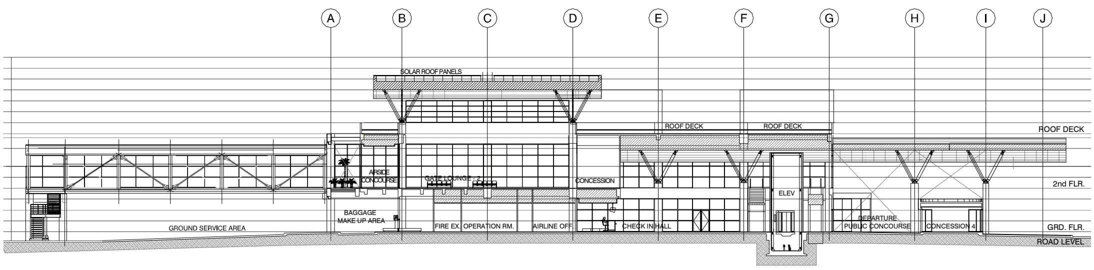
Figure 5.4-2 Second Floor Plan of Passenger Terminal Building



Source: JICA Study Team

Figure 5.4-3 Passenger Flow Diagram Passenger Terminal Building

The central passenger boarding bridge, principally used for domestic flights, can be used for international departures and arrivals at off peak hours when there are no domestic arrivals. At times of sole domestic or sole international operations the two gate lounges can be combined to function as one, thus increasing the capacity of the domestic or international peak.The interior design concept of the building provides for lofty and natural-lit public spaces. Thus the check-in and baggage claim areas have been designed with approximately 2-level high curved ceilings as well the departure hall ceiling which is extending up to an insulated and curving roof structure. The public concourse, as well, is designed with a 2-level high curved ceiling.



Source: JICA Study Team

Figure 5.4-4 Cross Section of Passenger Terminal Building

The multi curved ceilings are clad with natural wood panels, to symbolize the vernacular language of the Province of Bohol, the material selection is to ensure low maintenance. The high level curved ceilings depict an abstract image of rolling waves, symbolic for Bohol/Panglao being island structures surrounded by water.

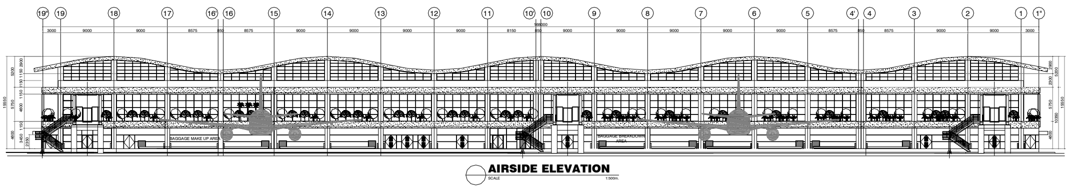
c) Facade Design

The external facades of the passenger terminal building enclosing the public areas, are mostly glazed areas, usage of heat absorbing glazing and external aluminum louvers ensure that the heat gain and solar glare shall be kept to a minimum. In addition, abundant landscaping in the form of "hanging" gardens will provide the departure lounges with pleasantly shade green filtered natural daylight, giving the passenger terminal building a green image, symbolic for the natural environment of the Province of Bohol.

Glazed Facades

External Louvers

Hanging Gardens



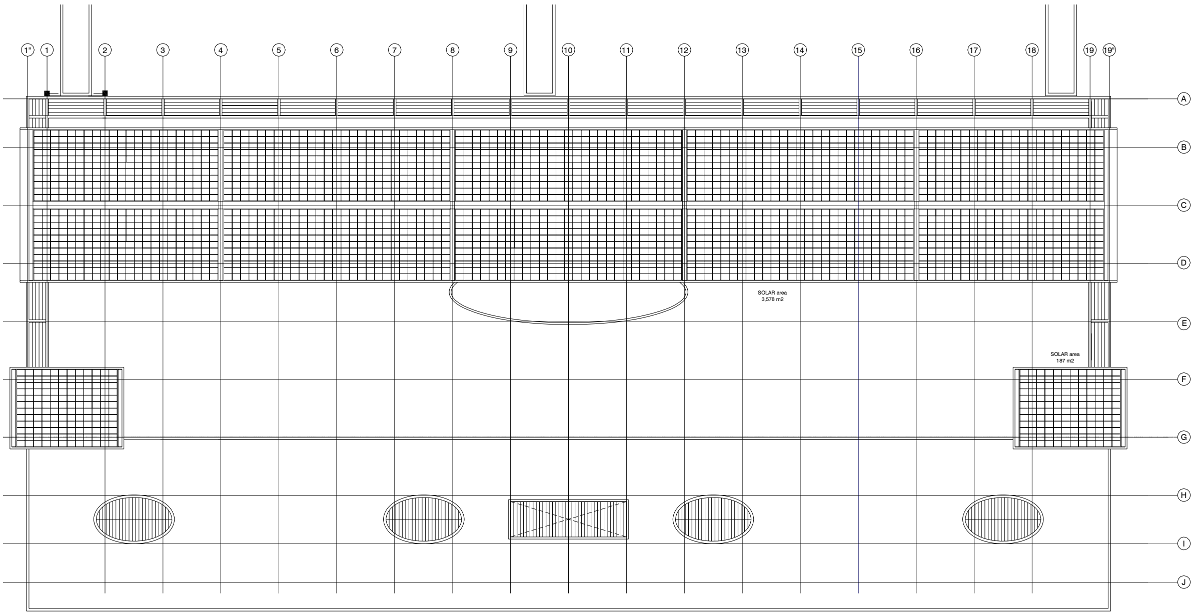
Source: JICA Study Team

Figure 5.4-5 Airside Elevation of Passenger Terminal Building

d) Roof Design

Although the passenger terminal building consists in principle of a simple two story rectangular structure with a modular design of a 9 by 9 meters structural grid, for ease of construction, expansion and economical considerations, a portion of the roof design consist of a multi curve structural steel deck covering the, departure lounges. This multi curve roof is inspired by the profile of Bohol's chocolate mountains and the structure appears to be floating over the Terminal Building imitating the "Rolling Waves" surrounding the islands of Bohol and Panglao.

A similar multi curved roof structure covers the landside public concourse areas, this curved roof structure is carried through into the check-in hall providing a seamless integration of exterior and interior spaces.



Source: JICA Study Team

Figure 5.4-6 Roof Plan of Passenger Terminal Building

1) Special Equipment

The basic requirements of special equipment for Terminal building such as Elevators, Escalators, Passenger Boarding Bridges (PBB), Baggage Handling Systems (BHS), Security Equipments and Flight Information Display System (FIDS).

a) Elevators

Six (6) elevators, mainly serving departing disabled passengers, elderly and passengers in special need, are provided in the PTB as follows:

Two (2) from check-in area to the departure lounges one each for domestic and international departing passengers;

Two (2) from airside concourse to the domestic and international baggage claim areas;

One (1) from airside concourse to the domestic remote stand departure gate;

One (1) from the south side entrance hall to second and roof deck levels mainly serves for VIP passengers, staff, terminal services and goods delivery.

b) Escalator

Five (5) escalators in consideration of passenger friendly access are provided in the PTB as follows:

Two (2) from the check-in area to the departure lounges on the second floor for departure passengers, one (1) for the international departure passengers and one (1) for the domestic departing passengers.

Two (2) from airside concourse to the international and domestic baggage claim areas for arrival passengers, and

One (1) from the airside concourse to the domestic remote stand departure gate.

Each escalator is located next to a staircase to ensure smooth passenger operation is case of malfunction or maintenance of the escalator.

c) Baggage handling system

Baggage handling system is provided as follows:

Check-in counter to baggage make-up area:

- Weighing conveyor: twenty (20) units, split into 8 units for international passengers and 12 for domestic passengers,
- Queuing conveyor: twelve (20) units,
- Belt conveyers of approx. 47m each for international and domestic baggage, ,
- Baggage make-up conveyors of 47m and 34m, respectively for international and domestic baggage.
- Baggage breakdown area to Baggage claim area
- Belt conveyors of approx. 69m each, three (3) units in total, two (2) units for domestic baggage and one (1) unit for international baggage.

d) Security system

Security system is provided as follows:

X-ray:

- Four (4) for hold baggage at the entrance to the check-in lobby, split into two areas for domestic and international passengers.
- One (1) Out of Gauge X-ray with weighing scale in the check-in lobby, for oversized baggage for domestic and international passengers.
- One (1) for hand baggage and small concession goods at entrance lobby on the ground floor .
- Four (4) for hand baggage at the entrances to the departure lounges on the second floor; one set of 2 X-rays's for domestic passengers and one set of 2 X-rays for international passengers.

Metal detector:

- Four (4) for passengers and staff at the entrance to the check-in lobby, split into two area's for domestic and international passengers.
- One (1) for VIP and staff at the entrance lobby on the ground floor.
- Four (4) for passengers and staff at the entrances to the departure lounges on the second floor; one set of 2 metal detectorsfor domestic passengers/staff and one set of 2 metal detectors for international passengers/staff.

e) Passenger boarding bridge

Three (3) passenger boarding bridges connected to three (3) fixed gangways are provided, with the provisions for an additional passenger boarding bridge at each gangway.

f) Flight information display system

Flight information displays are provided in the following locations:

Table 5.4-2 Location of Flight information display system

Location	Name of device and quantity	
Public concourses (Departure and Arrival)	➢ Flight Information Display	4
Concessions on ground floor	➢ Flight Information Display	2
Baggage claim areas	➢ Flight Information Display	2
Baggage breakdown areas	➢ Flight Information Display	3
Offices (CAAP, airlines etc…)	➢ Flight Information Display	15
VIP room	➢ Flight Information Display	1
CIP lounges	➢ Flight Information Display	2
Smoking rooms	➢ Flight Information Display	2
Gate lounges	➢ Flight Information Display	4
Gates	➢ Flight Information Display	4
Check-in counters	➢ Flight Information Display	28
Central monitor room	➢ Flight Information Display	2
Flight Information room	➢ Flight Information Display ➢ Host processor system ➢ PC for server system	2 1 1

Source: JICA Study Team

2) <u>Electrical Works</u>

a) Power Supply Line

The basic design loads of the passenger terminal building are 1,000 KVA for 460V, 3 phase and 500 KVA for 230V, 3 phase, single phase. Loads for 460V consists of chillers, cooling towers, pumps, air handling units, passenger boarding bridges and baggage handling equipment. Loads for 230V consist of lighting, receptacle outlets, FCU's, elevators and escalators. Around 45% of the total design load of the passenger terminal building will be energized by a stand-by generator during normal power failure.

b) Internal Lighting

Types of LED lighting fixtures to be used are as follows:

- LED Fluorescent Lamps – for Offices and Baggage Make-up Area andTechnical Rooms
- LED Compact Fluorescent / LED Pin light – for Toilets, Corridors and Hallways
- LED Metal Halide lamp – for Public Areas

c) Emergency Light System

This system will ensure a minimum illumination level and exit signing during total power failure. This will be considered as part of the regular lighting system.

d) Uninterruptible Power Supply (UPS)

The basic UPS shall consist of the following components:

- Rectifier/Charger
- Batteries
- Solid-State Inverter
- Static Transfer Switch

The UPS will be sized to ensure 30 minutes of supply of the connected load, this period will cover the maximum starting time of the emergency generators.

e) Fire Alarm system

A microprocessor controlled, addressable, automatic fire alarm system, forming a complete operative and coordinated system will be provided. The system will include alarm-initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies and wiring.

The main fire alarm control panel will be provided with the following facilities, as a minimum:

- Indication of an activated automatic fire detector giving location and zone.
- Indication of an activated break glass manual call point.
- Fireman's microphone providing remote control of the emergency message unit, forming part of the public address/voice alarm system on a zone by zone basis.
- Fire officers broadcast to any combination of individual zones.

All wiring of the fire alarm system will be carried out using cables which are capable of maintaining circuit integrity for a prolonged period under fire conditions.

f) Closed Circuit Television (CCTV) System

Monitoring the operation and use of the CCTV's will be handled under the centralized management at the Command and Control Office (CCO) at the passenger terminal building.

Equipment with all cabling and conduits will be provided as follows:

- Colour cameras (rotary, zoom type)
- Monitor control panels (colour monitor)

3) Mechanical Works

Mechanical works are planned to be design according to the following concepts.

- Mechanical systems shall be safe and reliable.

- Operation and maintenance works shall be easily and safely done.
- Major equipment shall be duplicated for maintenance and emergency cases. Important equipment shall have its reserved one.
- Flexible and expandable space and installation shall be considered to suit the fluctuation of demand.
- Energy saving shall be adopted.

a) (Plumbing) Cold Water Supply System

Cold water shall be distributed from Water Pump House (WPH) to the Passenger Terminal Building (PTB) by water supply pumps which shall consist of three duty pumps and one standby pump. The cold water supply main pipe shall be installed in the underground Utility Service Tunnel (UST).

Both pumps and tanks shall be provided with automatic controls and monitoring system through the Building Management System (BMS).

b) (Plumbing) Hot Water Supply System

Hot water demand in the PTB is very limited to such facilities as showers, lavatories or kitchens. Therefore electrical water heaters shall be installed individually in each place as required.

The type and location of electric water heater shall be the followings:

- Instantaneous single point for each shower/kitchen.
- Instantaneous multi point for under counter lavatories.

c) (Plumbing) Sewage Drainage and Vent System

1. Sewage Drainage

Sewage shall, in principle, be drained by gravity, however, the following drainage shall be lifted up by drainage pump:

- The section of external drainage pipes where it is difficult to keep the minimum inclination of the pipe.
- Drainage from underground levels.

Sewage drainage shall not be allowed to use for storm water drainage under any circumstance. Exclusive pipe and grease interceptors shall be installed for sewage from kitchens to prevent that grease fills the pipe and flows in the sewage treatment plant (STP).

2.Vent System

Water traps shall be used to prevent bad smell to escape or insects to enter the drainage pipes. Sewage flow increases the internal pressure of the sewage pipes. Vent pipes shall be connected to the drainage pipe to stabilize internal pressure of the pipe, to prevent blockage or breakage of the water trap-seal.

d) (Plumbing) Storm Water Drainage

Storm drainage pipes shall be installed from the roof drainage designed by architectural works to the outside of the building. External drainage piping shall be included in the civil works and excluded from mechanical works.

Drainage pump shall be provided for underground utility tunnel to drain off any seepage water.

e) (Plumbing) LP Gas Supply System

For safety reasons, the use of LPG shall be limited only in the kitchens of restaurants. Gas cylinder storage shall be located as such that the length of pipe is as short as possible and the ease of replacement of cylinders shall be taken into consideration.

Automatic gas breakers linked with a gas leakage alarm system and fire alarm system shall be installed on the gas supply pipe for safety. In addition the mechanical ventilation shall also be provided for the kitchen.

Gas meters shall be installed on the branch pipes for each restaurant for gas consumption charge. Gas meters shall be pulse dispatch type and measurement of gas consumption shall be done by the BMS.

LP Gas Cylinder Storage Room & Cylinders (TSN Airport)

Source: JICA Study Team

Figure 5.4-7 LPG Cylinder Storage (TSN airport)

f) (Air Conditioning) Chiller and Chilled Water Pump

Chiller yard and chilled water pump room, located at the northeast of the new passenger terminal building, will consist of the following equipments.

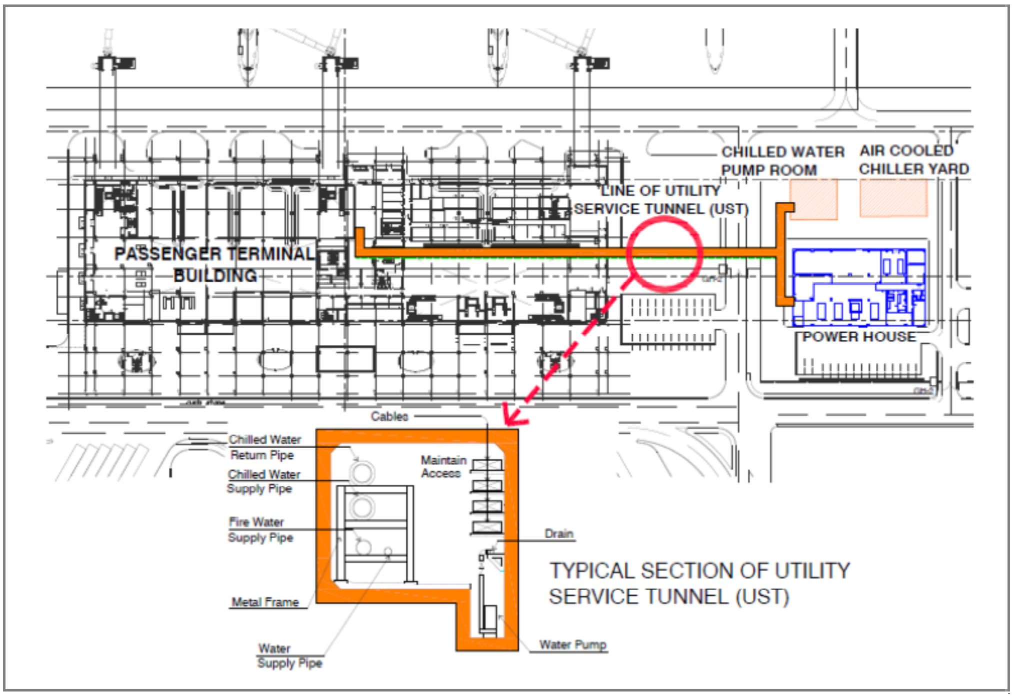
- Air cooled chillers
- Primary and secondary chilled water pumps
- Primary and secondary chilled water headers
- Expansion tank
- Electrical panel room
- Control room
- Maintenance and storage
- Underground utility service tunnel

The centralization of the above functions shall facilitate more efficient and easy operation and maintenance. The chiller system shall be used to provide the chilled water for air conditioning system. Five (5) units of the air cooled chillers with a screw type compressor, primary and secondary chilled water pumps and other accessory equipment shall be installed in chiller yard near the power house. Space for an additional chiller shall be provided to accommodate planned future expansion of the passenger terminal building.

Chilled water shall be circulated from the chillers to all air-handling units (AHU), primary air handling units (PAU) and fan coil units (FCU) through chilled water pipes installed in the underground Utility Service Tunnel (UST). Refer to Figure 5.4-8 layout plan of underground Utility Service Tunnel (UST).A controlled variable volume chilled water system shall be used for second chilled water pump. The number of chilled water pumps in operation at any time shall be capable of being variable dependent on demand to save operational cost.An expansion tank shall be provided as storage capacity for the variation in volume of chilled water in circulation. A closed type expansion tank shall be used and shall be installed in the chilled water pump room.Refrigerant type used in the chiller shall be R401.

A rough estimation of cooling capacity for chiller system is as follows.
a. Total cooling capacity (Rough estimation) = 15,471m^2 x 166kcal/m^{2}h = 2,568,186kcal/h = 2,986KW/h = 850 USRt/h
b. According to the rough estimation above and with the capacity of chiller of 600 kW/h (=170USRt/h), five (5) units are required, one unit is in reserve. In case the maintenance or malfunction of one (1) chiller occurs in a peak load period, the system can recover the shortage of capacity by the following two ways.

- Adjust the temperature of some air conditioning areas.
- Cut off some unimportant air conditioning area.



Source: JICA Study Team

Figure 5.4-8 Layout Plan of Underground Utility Service Tunnel (USL)


Chiller Yard & Air Cooled Chiller (Iloilo Airport)


Chilled Water Header & Expansion Tank & Pumps (Iloilo Airport)


Underground Utility Service Tunnel (Iloilo Airport)

Source: JICA Study Team

Figure 5.4-9 Chiller Yard & Chilled Water Pump Room

g) (Air Conditioning) Air handling unit (AHU)

A constant air volume single duct system connected to an air handling unit (AHU) shall be used to Baggage Claim Area, Check-in Lobby, Departure Lounge, Public Circulation Areas, Airside Concourse, other public areas and some large offices.

All air-handling units shall consist of an air supply fan section, cooling coil section, pre/medium air filter section and fresh/return air mixing section. Conditioned air shall be distributed through air ducts and shall be dispersed from the air diffusers or nozzles, etc. in locations to suite airflow patterns. Architectural aesthetics shall be also considered in the design of exposed air duct and air outlets, etc.

h) (Air Conditioning) Primary Air Handling Unit (PAU)

The primary air handling unit (PAU) shall be the same type of equipment as the AHU. The difference between the two units is that PAU shall operate with 100% of fresh air, the AHU circulating part return air and part fresh air. PAU shall be used with fan coil units (FCU). The pre-conditioned fresh air from primary air handling unit shall be directed to each area/room by air duct.

i) (Air Conditioning) Fan Coil Unit (FCU)

A fan coil unit is a small unit consists of cooling coil and air supply fan. It shall be generally used to limited areas/rooms as follows:

- Offices
- Concession Areas
- VIP/CIP Lounges/ Entrance
- Computer Rooms
- Service Entrance

If necessary, fan coil units shall also be used to treat heat gain at perimeter zones, this however is very variable depending on the zone orientation, weather and time. The fan coil units (FCU) shall also be used for electrical rooms such as computer room, etc., in this case the FCUs shall be carefully located to avoid the possibility of damage due to possible water leakage.

Ceiling cassette fan coil units can be considered for effective supply air distribution, better aesthetic quality and convenient temperature control.

A ceiling return plenum shall be used and return air opening around the internal building perimeter shall be provided.

 	
AHU- Air Handling Units (Iloilo Airport)	Air Conditioning in Departure Lounge Supplied by AHUs (Iloilo Airport)

Source: JICA Study Team

Figure 5.4-10 Chiller Yard & Chilled Water Pump Room

j) (Ventilation System) Toilet

All toilets shall be mechanically ventilated by the exhaust fan and internal space shall be maintained in negative pressure to avoid foul odor. The exhaust air inlet shall be installed at the ceiling above the water closets and urinals. Supply air for toilets shall enter through the door louvers, or via an under-cut of the doors.

k) (Ventilation System) Machine Rooms and Electrical Rooms

A cross airflow shall be formed by supply fans and exhaust fans for machine rooms and electrical rooms such as chiller room, generator room, MV-LV electrical rooms, transformer rooms, etc. The supply and exhaust fans shall be controlled by thermostat switches to keep the room temperature.

l) (Ventilation System) Smoking Room

Smoking rooms shall be ventilated by an exhaust fan to remove smoke and odor, and the internal space shall be maintained in negative pressure. Moreover, air cleaners shall be used to maintain the air quality.

m) (Ventilation System) Fresh Air

Fresh air shall be introduced to each room by using insulated ducts from air handling units. Fresh air shall be conditioned and shall suffice the requirement for each room. For the make-up air, door louvers and door undercuts shall be provided for the entry of fresh air.

n) Automatic Control and Monitoring System

The automatic control and monitoring dedicated to the air conditioning and ventilation system is integrated into the Building Management System (BMS), and shall consist of the following :

<u>1. Multiple units control of chillers and primary chilled water pumps:</u>

The required number of units shall be operated according to the actual cooling load calculated controller, based on chilled water temperature and flow meter.

<u>2. Variable Water Volume (VWV) Control of Secondary Chilled Water Pumps</u>

The required number of pumps shall be operated according to the actual cooling load calculated controller, based on chilled water temperature and flow meter. Proportional control of by-pass valve or rotational frequency control of chilled water pumps shall control the supply water pressure.

<u>3. Chilled Water Flow Control of Cooling Coil by 2-Way Control Valve:</u>

The cooling coils of the AHU and PAU shall be controlled by motorized 2-way valves and thermostats installed in return air ducts or in the rooms. The group of FCUs shall be controlled by motorized 2-way valve and thermostat.

<u>4. On/off Control of Ventilation Fan by Thermostat:</u>

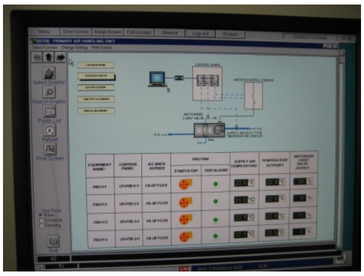
The supply and/or exhaust fans for the electrical rooms and machine rooms shall be operated by thermostat.

The main air conditioning and ventilation equipment, except small equipment such as small fans or air cleaners, shall be operated at their respective motor control panel. An auto/off/manual selector switch shall be provided at the motor control panel. In the "auto" position, the equipment shall start and stop via the BMS. All equipment shall stop (in manual or auto mode) when the fire alarm system is activated. The necessary interface is part of the Fire Alarm and Detection System (FADS).

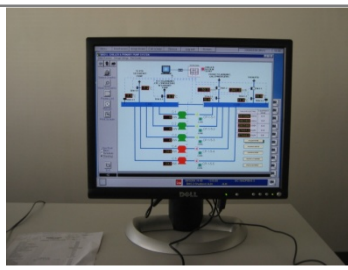
The room temperature, external air temperature and humidity, On/Off status and alarm status of main equipment, etc. shall all be monitored by the BMS.

The chiller and chilled water pumps shall be interlocked at the respective motor control panel in the auto mode. In case the space or room is ventilated by both supply and exhaust fans, both fans shall also be interlocked.

All air conditioning and ventilation system's main control panels or main equipment shall be equipped with built-in Programmable Logic Controller (PLC) allowing direct interface with the BMS. Such PLC shall receive a separated power supply ensured by UPS (part of Power Supply Section). The interface between the various PLCs shall be included in the BMS section.



AHU System (Iloilo Airport)



Chiller System (Iloilo Airport)

Source: JICA Study Team

Figure 5.4-11 Similar Central Control & Monitoring System

o) (Fire Fighting) Water Supply

The water supply for the fire fighting shall be fed from the site common water storage tank for general water usage and fire fighting, which has a permanent one hour fire fighting water storage, located at the Water Tank and Pump House.

The system shall be provided with its own fire pumps set consisting of one (1) motor driven duty pump, one (1) stand – by pump, driven by a diesel engine and two (2) motor driven jockey pumps, stand-by and duty. The independent fire fighting water reserve capacity shall be capable of supplying water for the sprinklers, wet standpipes, and hose requirements. The design capacity of the fire reserve tank shall be dependent on the required flow – rate of the pump and must be able to feed the system for not less than one hour duration.

The control system is to be arranged so that when the pressure level drops below the preset pressure (activation of sprinklers or opening of the stand pipe system) the controller is to activate the pumps to provide the required water to the fire fighting system.

Fire Water Pumps & Water Tanks (Iloilo Airport)

Source: JICA Study Team

Figure 5.4-12 Similar Fire Water Pumps & Water Tanks

p) (Fire Fighting) Sprinkler System

The Sprinkler System is an integrated system of underground and overhead piping, designed in accordance with NFPA 13 standard. The portion of the sprinkler system above ground is a network of hydraulically designed overhead piping, to which sprinklers are attached in a systematic pattern. Each sprinkler system riser includes a device for actuating an alarm when the system is in operation.

There shall be two (2) sprinkler risers located in opposite stairwell areas. These sprinkler risers shall serve ground floor, second floor and roof deck level. Stand hose pipes and fire hose cabinets are integrated to these risers.

In accordance with NFPA 13, all areas with suspended ceilings shall be provided with pendent type sprinklers while areas with no ceiling shall be provided with upright sprinklers.

q) (Fire Fighting) Stand Hose Pipe Connection and Fire Hose Cabinet System

The design of the Standpipe System shall be governed by the building height, floor area, occupancy classification, egress system design, required flow rate and residual pressure, and the distance of the hose connection from the source water supply. Standpipes shall be provided in each fire exit stairway.

Fire hose cabinets are provided throughout the entire passenger terminal building and are interconnected with the sprinkler system. The fire hose cabinets shall be of class III system, having a 40 mm. diameter for occupants use and a 65 mm. diameter hose valves for fireman's use. Fire hose cabinets shall be located not more than 60 m. travel distance and the hose nozzle shall be able to be taken into every room and within 6 meters of every part of a room.

r) (Fire Fighting) External Fire Hydrant System

Fire hydrants shall be provided on both the ramp and street sides of the terminal building. The Fire hydrants are strategically located around the perimeter of the building, to provide protection to the structure from potential exposure to fires.

Hydrants shall be provided in sufficient number and be located in a manner that shall enable the needed flow to be delivered through hose lines to all exterior sides of the terminal building and other areas to be protected.

The hydrants shall have a 65 mm. diameter x 3 way outlet connection.

A 65 mm. diameter x 45 m. (150 ft.) double jacketed house shall be stored inside the hose house near each hydrant for ready accessibility, including a special wrench, a fire extinguisher and an ax.

As a primary mean to supply water to the system, a Fire Department Inlet Connection shall be provided and located at a designated fire truck station.

Each hydrant shall be provided with a manually operated isolating valve (normally closed).

s) (Fire Fighting) Carbon Dioxide And FM 200 Gas System

FM200 fixed gas system shall be provided for all computer rooms and other manned electronic stations. The system for the rooms shall be by total automated flooding application. Each installation shall be a complete system and its status shall be indicated on the main addressable fire control panel.

Each COMS room shall be provided with an independent Total Flooding System (FM 200). The following FM 200 system components shall be provided for each room:

- Alarm Device System.
- Door Locking Mechanism.
- FM 200 Fire Suppression System.
- Control Panel.

Carbon dioxide (CO2) systems shall be provided for electrical equipment rooms such as HV / LV switch – gear rooms, transformer rooms and diesel generator rooms. Wheel type CO2 fire extinguishers shall be provided for other specified rooms., only carbon dioxide tank wheel types shall be allowed.

FM200 Gas System-Cylinder & Control/Operation Panel (Iloilo Airport)

Source: JICA Study Team

Figure 5.4-13 Similar FM 200 Gas System

t) (Fire Fighting) Fire Extinguisher

Fire extinguisher requirements shall conform to the provisions indicated in NFPA–10 and by the local fire code. The capacity and type of extinguisher shall be based on the parameters stipulated by the “authority having jurisdiction”.

Fire extinguishers shall be strategically located to every 22 m. (72 ft.) of travel distance at any point throughout the passenger terminal building.

u) (Fire Fighting) Water Mist System

This system shall protect the airside window glass from shattering due to intense heat in case of the outbreak of fire. The water mist sprays shall be located in the exterior of airside window glass.

When activated, water mist sprays shall cover all windows facing airside of airport. Special type water mist nozzles shall provide a total flooding mist effect that shall immediately reduce heat and extreme high temperatures.

The system to be used is a "Low Pressure Water Mist Atrium N-Pipe System (Deluge System). The standard atrium N-pipe system comes in 6 m. lengths with integrated nozzles at every 1 m. spacing. The N-pipe system consists of SS316 diameter tubing with ¾" BSP/NPT thread at each end. The water pressure is 6 bars at the nozzles. The flow rate per 6 m. is 91 l/min at 6 bar pressure. A detection system shall interface with the building Fire Alarm System.

v) (Fire Fighting) Control Panel

All the detected alarms from the Fire Alarm System shall be interfaced with the Fire Control Panel and the Sprinkler Supervisory Control Panel located in the COMS room and the Pump Control Panel located at the Water Tank and Pump House.

5.4.2. Division 2: (B2) Cargo Terminal Building (CTB)

1) Architectural Works

The cargo terminal building is located at the southern side of the terminal area adjacent to the passenger terminal building.

The cargo terminal building will be used by multiple airlines and freight forwarders/cargo agents. Considering the multiple users and future expansion, a module system has been adopted for the floor planning. One module has a total floor area of 51.84m^2 (7.2m x 7.2m).

The module proportions have been so designed so that the width and depth of each module provides sufficient space for trucks and vehicles to dock and to efficiently perform all other cargo processing and storage functions.

The building consists of a covered platform (loading and unloading dock), office areas, toilets, and a cargo handling area. The minimum interior height of the cargo handling area is 5.5 m. on both airside and landside to allow easy passage of forklifts and dollies.

Entrances with roll-up doors and the loading and unloading dock platform have been provided with ample length of roof covering for weather protection.

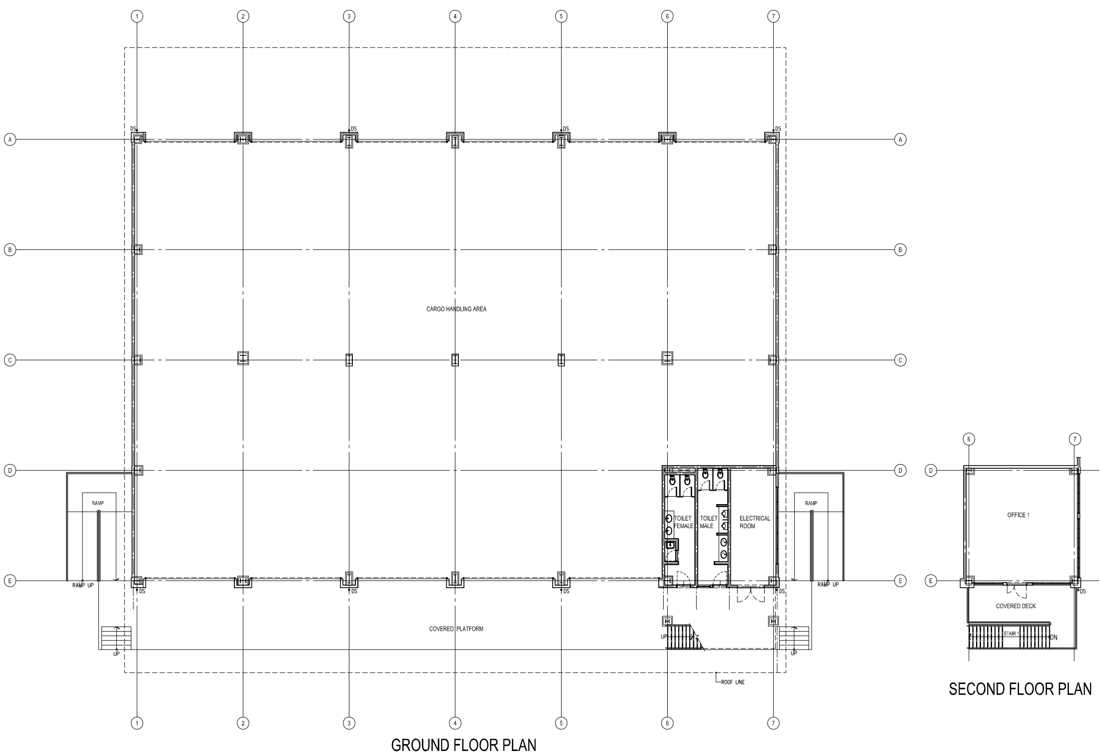
Louvered windows have been provided on two sides of the building to admit adequate natural daylight and allows ventilation by natural breezes to reduce energy costs and to provide comfortable working conditions.

A leveled floor from airside to truck dock has been provided to facilitate maximum flexibility and efficiency of movement of all cargo on equipment and load transfer.

Table 5.4-3 Floor Area of Cargo Terminal Building

Item	Floor Area (m^2)
Ground Floor	
1. Cargo Handling Area	1,194.00
2. Toilet (W)	16.40
3. Toilet (M)	17.35
4. Electrical Room	25.40
5. Covered Platform	164.20
Subtotal	**1,417.35**
Second Floor	
1. Office Area	58.85
2. Covered Deck	19.10
Subtotal	**77.95**
Total	**1,495.30**

Source: JICA Study Team



Source: JICA Study Team

Figure 5.4-14 Floor Plan of Cargo Terminal Building

2) Electrical Works

a) Power supply

A high voltage (13.2kV) power feeder will come from the power house through an underground cable in the pipe duct. The building will be supplied by a transformer approximately 50 KVA capacity at 230V, 3 Phase.

3) Mechanical Works

a) (Plumbing) Service Point

Plumbing shall be designed in accordance with following service conditions.

Table 5.4-4 Service List of Plumbing

No.	Location	Cold Water	Hot Water	Drainage & Vent	Remarks
1	**Toilet** -Water Closet -Urinal -Lavatory (wash basin) -Slop Sink -Floor Drain	○	-	○	

Source: JICA Study Team

b) (Plumbing) Cold Water Supply System

Cold water for toilets shall be provided from the water pump house (WPH).

c) (Plumbing) Sewage Drainage and Vent System

A gravity drainage system shall be provided separately for sanitary and storm water drainage throughout the building. All drainage water, including sewage discharged from the CTB, shall be collected to the sewage pits and shall be discharged to the sewer main for treatment at the sewage treatment plant (STP).

A water trap shall be used to prevent bad smells to escape or insects to enter the drainage pipe. A vent pipe shall be connected to the drainage pipe to stabilize internal pressure of the system.

d) (Plumbing) Storm Water System

Storm water drainage pipes shall be provided from roof drains designed by architectural works to the outside of the building. The external storm water main shall be provided by the civil works. Storm water shall be collected at the storm pits and will be drained to storm water drainage mains. Condensation drains from the air conditioning system also shall be drained to storm water pits.

e) Air conditioning and Ventilation System

Offices shall be air-conditioned by individual split air-conditioning system.

The cargo handling area shall be ventilated by in-line axial fans, exhaust air shall be suctioned by exhaust grilles through ductworks and fresh air shall be delivered by fresh air grilles through ductworks.

Toilets shall be ventilated by in-line centrifugal fans coming from exhaust grilles through ductworks.

f) Fire Protection System

The Cargo Terminal Building shall be equipped with portable fire extinguishers

The fire extinguisher requirements shall conform to the provisions indicated in the NFPA – 10 and by the local fire code. The capacity and type of extinguishers shall be based on the parameters stipulated by the “authority having jurisdiction”.

Types and capacity of Portable Fire Extinguishers shall be in accordance of the following:

Portable type 4.5 kg ABC multi – purpose extinguishers shall be used in cargo handling areas.

Portable type 9.0 kg CO2 extinguishers shall be used in electrical rooms.

5.4.3. Division 3: (B3) Control Tower, ATC Operation & Administration Building (ATC)

1) Architectural Works

The effective provision of airport services requires a clear and unobstructed view of the entire movement area of an airport and air traffic in the vicinity of the airport. The airport control tower should therefore be so located and be of such a height that apron, taxiway, runway and the airspace surrounding the airport, particularly the approach and departure areas are clearly visible from the control room and that future development of the manoeuvring area or future construction of buildings shall not restrict this view.

The control tower, ATC operation and administration building is located to the north of the passenger terminal building. This area is specifically assigned as the operations and administrative area and is separated from the passenger terminal area in order not to disrupt normal operations of the passenger terminal building and to provide optimum security for the ATC operations.

The building is a reinforced concrete structure consisting of a combination of a nine (9) storey control tower and a two (2) storey operation and administration building. Along both sides of the control tower are two office wings for operation and administration, connected by an access corridor to the control tower. An elevator and a staircase provide access to the VFR room which is located at the top of the control tower (9^{th} FL). The VFR room has a full sight glass screen sash around it, with a standard slanted angle of 15°.The ground floor right wing of the building contains support areas such as dining/kitchen, conference, briefing rooms and toilets while the second floor contains the air traffic control and navigational offices‘, areas for operations. Nap rooms, toilets and lockers are also provided to support the twenty-four hours monitoring of the air traffic control. The left wing contains the administration areas.

Control tower is required to be built with a height so that aprons, taxiways, runways, and the air space surrounding the airport are clearly visible from the VFR room. For the control tower, the eye level has been designed in accordance with the following calculation.

Calculation Formula for Control Tower Eye Level

Ee = Eas + D tan (0°35’ 00” ± GS)
Ee = Elevation of Eye Level
Eas = Runway Threshold Elevation
D=Distance from Eye Point to the Threshold
Gs=$\tan^{-1}$ (tan B cos C ± tan A sin C)
tan A = Transverse slope of the Runway
tan B = Longitudinal slope of the Runway
C = Crossing Angle of eye and runway center line

Source: JICA Study Team

Table 5.4-5 Runway Threshold Elevation

	RWY 03 (South)	RWY21 (North)
1.0 Longitudinal Slope	0.15%	0.05%
Transverse Slope	1.3%	1.3%
Runway Threshold Elevation	7.4m	9.85m

Source: JICA Study Team

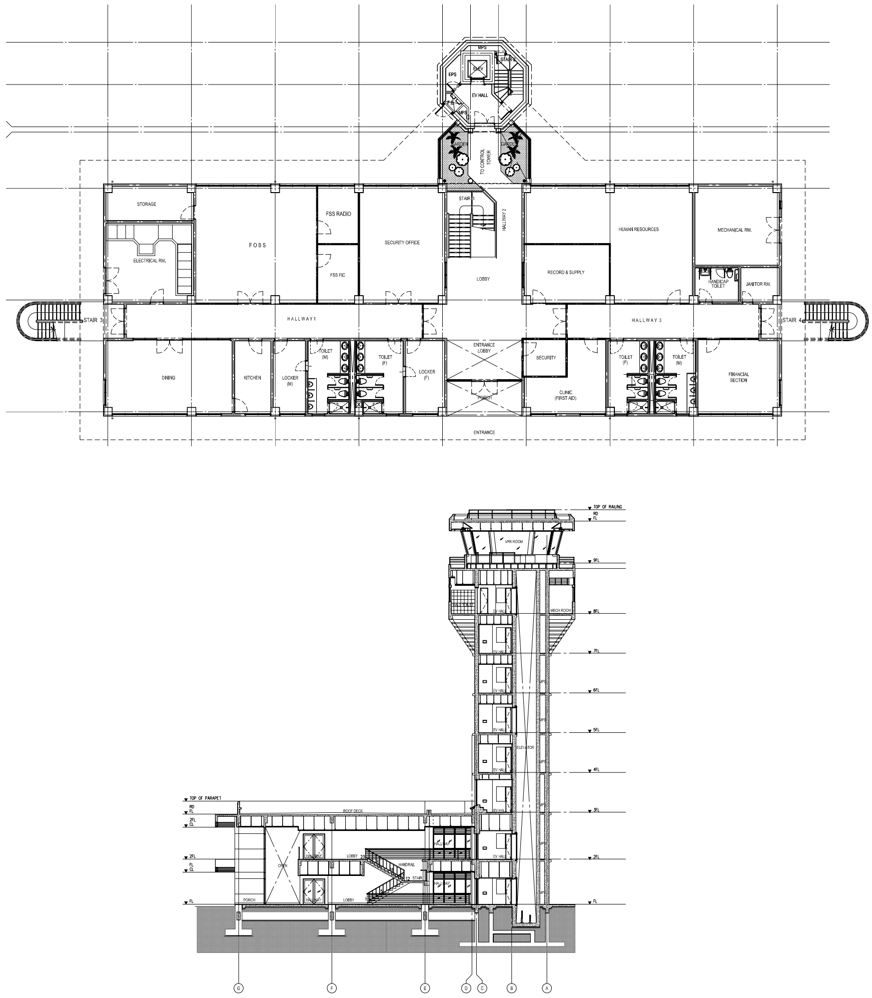
Table 5.4-6 Required Eye Level

	RWY 2,500m		RWY3,300m	
	RWY 03	RWY 21	RWY 03	RWY 21
2.0 Required Eye Level	<u>19.00m</u>	<u>15.50m</u>	<u>31.5m</u>	<u>15.50m</u>
Elevation of Eye Level	27.1m	23.6m	39.5m	23.6m
Control Tower Elevation	40.00 m			

Source: JICA Study Team

The space requirements for the air traffic control tower, ATC operation and administration building were computed from the assumed number of personnel and sizes of required equipment for the airport operation. The floor areas are listed and shown in Table 5.4-7.

Zoning plan of control tower, ATC operation and administration building takes into account grouping of divisions or sub-divisions and each department. The operations area are located from ground to second floor at the south end or left wing while the administration area is located at the north end or right wing of the building.



Source: JICA Study Team

Figure 5.4-15 Floor Area and Elevation of ATO Facilities

Table 5.4-7 Floor Area of Control Tower, ATC Operation and Administration Building

Item	Floor Area (m²)	Item	Floor Area (m²)	Item	Floor Area (m²)
Control Tower		ATC OPERATIONS		ADMINISTRATION	
G.FL	77.87	Ground Floor		Ground Floor	
2nd.FL	67.60	FSS Radio	12.80	Dining & kitchen	64.70
3rd.FL	59.10	FSS FIC	12.70	Locker (M)	32.50
4th.FL	30.30	FOBS	74.20	Toilet (M.F)	66.20
5th.FL	30.30	Electrical Rm.	38.00	Handican	8.80
6th.FL	30.30	Storage	17.00	Record & Supply	32.60
7th.FL	30.30			Financial Section	32.60
8th.Fl	75.60			Mechanical Rm.	36.60
9ti.FL	80.30			Human Resources	76.40
VFR (45.90)				Clinic (First Aid)	13.85
Others(34.40)				Security	13.80
				Security Office	53.00
				Janitor Rm.	7.80
				Stair & Hallway	143.50
				Lobby	40.25
		Subtotal	**154.70**	**Subtotal**	**622.60**
		Second Floor		Second Floor	
		ATC/FIC Office	33.0	Toilet (M.F)	48.60
		Store.	6.70	Janitor Room	1.40
		ATC Office	34.40	Nap Room (M)	32.85
		Store	6.30	Nap Room (F)	32.60
		ANS & FIC Office	53.00	Office	32.45
		Equipment Room	100.00	Airport Dept. Mgr.	51.00
		EPS	8.65	Airport Manager	52.90
		Workshop (Eqmt.)	34.00	Meeting Rm. (Conf.)	53.00
		Store	12.50	Lounge	23.40
				Hallway	116.00
		Subtotal	288.55	Subtotal	444.20
Total	481.67	Total	443.25	Total	1,066.8
Total Gross Floor Area					**1,9991.72**

Source: JICA Study Team

2) Electrical Works

a) Power supply

The low voltage feeder cable runs from the power house passing through an underground cable duct to the electrical room of the operation building. The basic design load of these facilities is approximately 500 KVA, at 230V, 3 phase. Around 70% of the total load of control tower, ATC operation and administration building will be energized by a stand-by generator during power failure. However, the navigation and communication equipment will be fully back-up during power failure. 100% of the design load of Navaids and MET will be energized by a stand-by generator during power failure.

3) Mechanical Works

a) (Plumbing System) Service Point

Plumbing shall be designed in accordance with following service conditions.

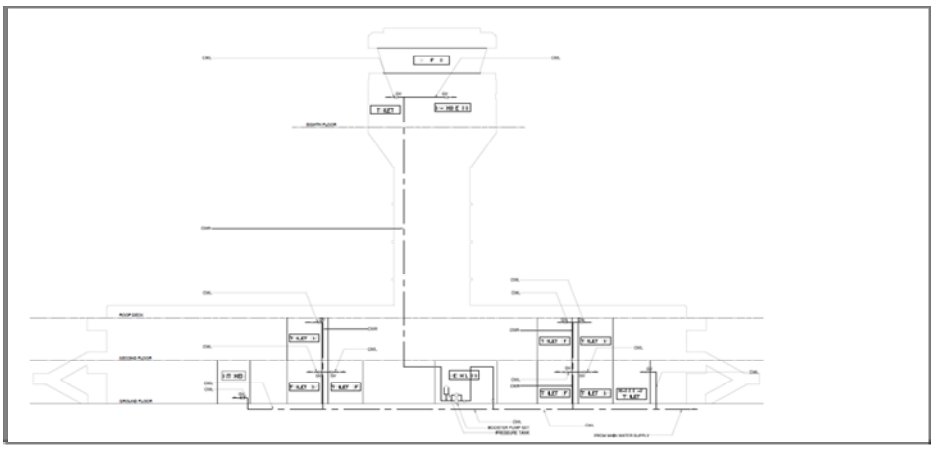
Table 5.4-8 Service List of Plumbing

No.	Location	Cold Water	Hot Water	Drainage & Vent	Remarks
1	**Toilet** -Water Closet -Urinal -Lavatory (wash basin) -Slop Sink -Floor Drain -Shower	○	○	○	Hot water shall be provided to shower & lavatory.
2	**Kitchen** -Kitchen Sink -Grease Interceptor	○	○	○	
3	**Mechanical Room** -Oil Interceptor -Floor Drain	-	-	○	

Source: JICA Study Team

b) (Plumbing System) Cold Water Supply System

Cold water for toilets and kitchen shall be provided from the water pump house (WPH). Due to its high location the cold water for control tower's toilet located in 8F requires a booster pump set which shall be installed in the mechanical room on the ground floor. The cold water supply piping system schematic diagram is shown in Figure 5.4-16.



Source: JICA Study Team

Figure 5.4-16 Cold Water Supply Piping System Schematic Diagram

c) (Plumbing System) Hot Water Supply System

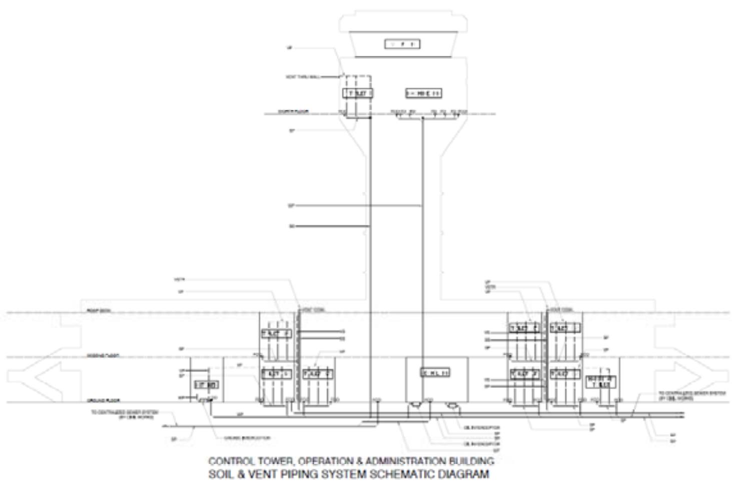
Hot water shall be used for showers and lavatories' vanity basins. Therefore, instantaneous type electrical water heaters shall be installed individually at each place as required.

d) (Plumbing System) Sewage Drainage and Vent System

Separate gravity drainage systems shall be provided for the sanitary and storm water drainage throughout the building. All drainage water including sewage discharged from the control tower and the operations and administration building (CTO) shall be collected at the sewage pits and shall be discharged to the sewer main for treatment at the sewage treatment plant (STP).

A water trap shall be used to prevent bad smells to escape or insects to enter the drainage pipes. Vent pipes shall be connected to the drainage pipes to stabilize internal pressure of the systems.

In addition grease traps shall be provided to the kitchen in order to separate grease from the drainage water before discharging to the building sewers. The soil & vent piping system schematic diagram is shown in Figure 5.4-17.

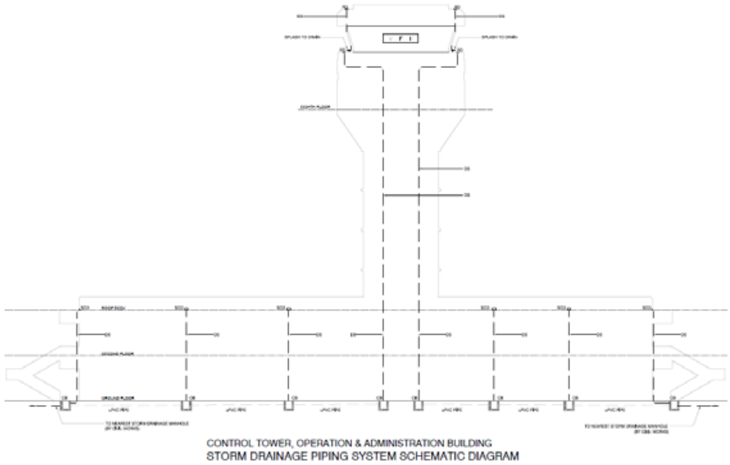


Source: JICA Study Team

Figure 5.4-17 Soil & Vent System Schematic Diagram

e) (Plumbing System) Storm Water System

Storm water drainage pipes shall be provided from roof drains, designed by architectural works, to the outside of the building. The external storm water main shall be provided by the civil works. Storm water shall be collected at the storm pits and shall be drained to the storm water drainage main. Condensation drains from the air conditioning system shall also be drained to the storm water pits. The storm drainage piping system schematic diagram is shown in Figure 5.4-18.



Source: JICA Study Team

Figure 5.4-18 Storm Drainage Piping System Schematic Diagram

f) (Air Conditioning and Ventilation) Operation/Administration Building

Ground level rooms including hallways, offices, dining, equipment room and FSS Radio room, shall be air-conditioned by one (1) Direct Expansion Air Handling Unit. Supply air, including the fresh air, shall be delivered by ceiling diffuser through ducting and return air shall be extracted via return grilles through ducting as well. The outdoor unit of the Air Handling Unit is located on the roof deck level.

Second level rooms including hallways, offices, FOBS, FSS Radio and nap rooms shall be a air-conditioned by two (2) Packaged Rooftop air conditioning units serving each room. Supply air shall be delivered by ceiling diffuser through ducting and return air extracted via return grilles through ducting as well. Fresh air shall be consistently supplied for the conditioned rooms.

Conditioned rooms, except; hallway, ANS staff room, nap room and ANS, shall be have a back-up air-conditioning system by means of VRF indoor units for every room with two (2) VRF outdoor units located on the roof deck level.

FOBS, FSS Radio, and Equipment room shall have two (2) VRF indoor units, of 50% cooling capacity, which shall serve as back-up in case of maintenance of the other VRF indoor units.

The workshop and storage rooms shall be ventilated by in-line axial fans coming from exhaust grilles through ductworks.

All toilets shall be ventilated by in-line centrifugal fans coming from exhaust grilles through ductworks. The exhaust air inlet shall be installed at the ceiling above the water closets and urinals. The fresh air for toilet shall be supplied through door louvers, to ensure the internal space of toilet shall be maintained in negative pressure to avoid foul odor.

A cross airflow shall be formed by supply and exhaust fan for the machine room, electrical rooms and kitchen. The supply and exhaust fans shall be controlled by thermostat switch to regulate the room temperature.

g) (Air Conditioning and Ventilation) Control Tower

The VFR room and Ready room shall be air-conditioned by individual split air conditioning systems. Two (2) duty and two (2) back-up split air conditioning units for the VFR room and one (1) duty and one (1) back-up for the Ready room. All six (6) outdoor units are located in the Mechanical Room in eighth floor with large louvers.

The EPS rooms shall be ventilated by in-line axial fans coming from exhaust grilles through ductworks.

The elevator halls shall be provided with fresh air by in-line axial fans coming from fresh air grilles through ductworks. Fan shall be in dual mode serving as Pressurization Fan and Exhaust Fan.

The stairwells shall be pressurized by in-line axial fan from air grilles for every two (2) floors. Ventilation for the stairwells shall be both ventilated, in normal condition, and pressurized for fire mode condition. Fans shall have two applications, as an exhaust fan and as a stairwell pressurization fan. The ventilation system shall be centralized particularly for the fresh and exhaust air.

h) (Fire Protection) Portable Fire Extinguisher

The fire extinguisher requirements shall conform to the provisions indicated in the NFPA – 10 and by the local fire code. The capacity and type of extinguishers shall be based on the parameters stipulated by the “authority having jurisdiction”.

The type and capacity of Portable Fire Extinguisher shall be in accordance of the following:

Portable type 4.5 kg ABC multi – purpose extinguishers shall be used in offices, hallways, mechanical and utility rooms.

Portable type 9.0 kg CO2 extinguishers shall be used in electrical, FOBS and kitchen area.

Wheel type 23.0kg CO2 extinguishers shall be used in equipment rooms.

i) (Fire Protection) Stand Hose Pipe Connection and Fire Hose Cabinet

A stand hose pipe connection and fire hose cabinet shall be installed in the control tower.

5.4.4. Division 4: (B4) Fire Station & Maintenance Building (FSM)

1) <u>Architectural Works</u>

The fire station and airport maintenance building has been located at the northern side of the Control Tower, ATC Operation & Administration Building, next to the water tank and pump house.

The requirements for the rescue and fire fighting facility have been determined based on the annual aircraft movements projection and Part 1 of ICAO Service Manual, which states category 9 as being the minimum requirement for this size of airport.

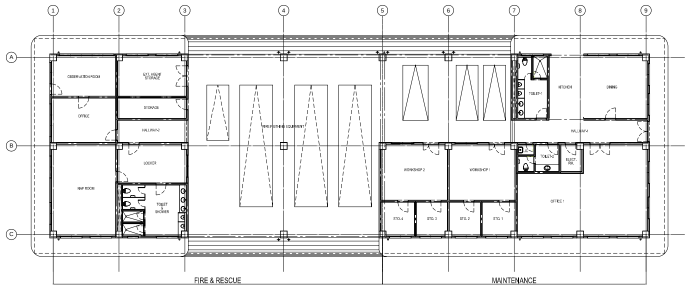
The airport maintenance building will be adjoining the northern side of the station. It will serve as garage for airport maintenance equipment such as mower, tractor and dump truck, workshop areas, nap rooms, locker rooms, dining and kitchen to support the daily maintenance activities. Adequate storage facilities are also provided.

The space requirements for the fire station and airport maintenance building were computed from the assumed number of personnel and required equipment. The floor areas are listed and shown in Table 5.4-9.

Table 5.4-9 Floor Area for Fire Station and Maintenance Building

Item	Floor Area (m^2)
1. Observation Room	22.80
2. Extinguishing Agent Storage	25.00
3. Storage	13.00
4. Office	25.30
5. Hallway-2	14.00
6. Locker	23.30
7. Toilet & Shower	31.00
8. Nap Room	51.00
9. Kitchen & Dining	53.00
10. Fire Fighting Equipment Garage	295.00
11. Maintenance Equipment Garage	96.00
12. Toilet-1 & Shower	19.15
13. Hallway-1	27.30
14. Toilet-2 & Janitor Room	10.20
15. Electrical Room	5.50
16. Office 1/ Secretary/Receptionist	85.00
17. Workshop 1	32.50
18. Workshop 2	32.25
19. Storage 1,2,3,4	40.00
Total	**901.30**

Source: JICA Study Team



Source: JICA Study Team

Figure 5.4-19 Layout Plan of Fire Station and Maintenance Building

2) Electrical Works

The low voltage power feeder will come from the LV Panel at the Control Tower. Around 20% of the total design load for the building will be energized by a stand-by generator during normal power failure.

3) Mechanical Works

a) (Plumbing System) Service Point

Plumbing shall be designed in accordance with following service conditions.

Table 5.4-10 Service List of Plumbing

No.	Location	Cold Water	Hot Water	Drainage & Vent	Remarks
1	**Toilet** -Water Closet -Urinal -Lavatory (wash basin) -Slop Sink -Floor Drain -Shower	○	○	○	Hot water shall be provided to shower & lavatory.

Source: JICA Study Team

b) (Plumbing System) Cold Water Supply

Cold water for toilets shall be provided from the water pump house (WPH).

c) (Plumbing System) Hot Water Supply System

Hot water shall be used for showers and lavatories. Instantaneous type electrical water heater shall be installed individually in each place as required.

d) (Plumbing System) Sewage Drainage and Vent System

Separate gravity drainage systems shall be provided for sanitary and storm water drainage throughout the building. All drainage water including sewage discharged from building shall be collected at the sewage pits and shall be discharged to the sewer main for treatment at the sewage treatment plant (STP).

A water trap shall be used to prevent bad smell to escape from or insects to enter the drainage pipe. A vent pipe shall be connected to the drainage pipe to stabilize the internal pressure of the system.

e) (Plumbing System) Storm Water System

Storm water drainage pipes shall be provided from roof drains, designed by architectural works, to the outside of the building. The external storm water main shall be provided by the civil works. Storm water shall be collected at the storm water pits and will be drained to the storm water drainage main. Condensation drains from the air conditioning system shall also be drained to the storm water pits.

f) Air Conditioning & Ventilation System

Offices, dining areas, kitchen and nap rooms shall be air-conditioned by individual split air-conditioning system.

Extinguishing agent storage, electrical room, workshop and storage rooms shall be ventilated by in-line axial fans coming from exhaust grilles through ductworks.

Toilets and lockers shall be ventilated by in-line centrifugal fans coming from exhaust grilles through ductworks

g) Fire Protection System

The Fire Station & Maintenance Building shall be equipped with portable fire extinguisher.

Fire extinguisher requirements shall conform to the provisions indicated in the NFPA – 10 and by the local fire code. The capacity and type of extinguishers shall be based on the parameters stipulated by the “authority having jurisdiction”.

Types and capacities of Portable Fire Extinguishers shall be in accordance to the following:

Portable type 4.5 kg. ABC multi – purpose extinguishers shall be used in hallways.

Portable type 9.0 kg. CO2 extinguishers shall be used in electrical rooms and kitchen areas.

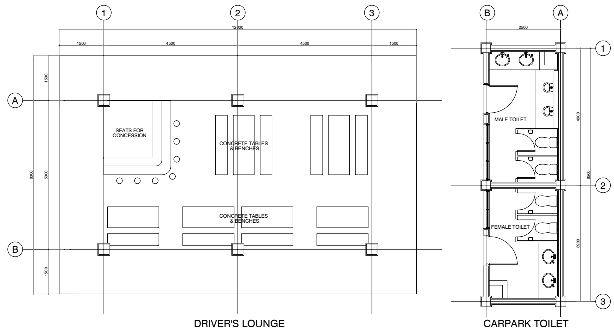
Wheel type 23.0 kg CO2 extinguishers shall be used in firefighting equipment areas.

5.4.5. Division 5: (B5) Ancillary Building (ACB)

1) <u>Architectural Works</u>

The ancillary buildings consist of a drivers’ lounge and public toilets, guard houses and tollbooths. All these building structures are single storey, reinforced concrete structures.

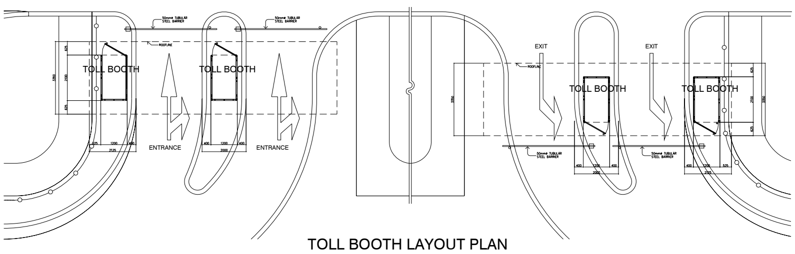
The drivers lounge is located at the land side car park area in front of the passenger terminal building, it is a roofed over open air facility with concrete benches and tables and space for a concessionaire to sell drinks. The floor area for this facility is $96m^2$. Adjacent to the drivers lounge are public toilet facilities, a floor area $21m^2$ for male with 2 toilets, 2 urinals and 2 vanity basins and for female with 2 toilets and 2 vanity basins.



Source: JICA Study Team

Figure 5.4-20 Layout Plan of Drivers Lounge and Car Park Toilets

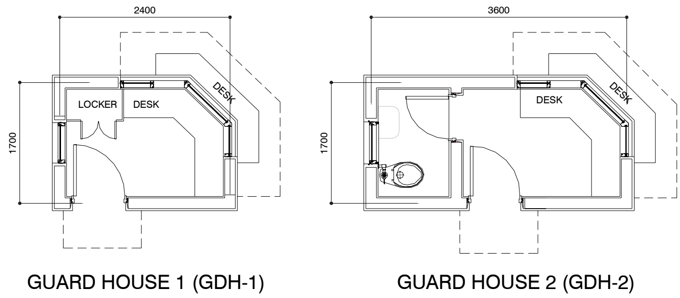
The tollbooths are located at the eastern entrance and exit of the car parking, they consist of prefabricated units of $2.5m^2$ each with 2 units per entry/exit. Each 2 units are roofed over with a steel canopy structure to provide shaded areas for workers and drivers collecting tickets and paying fees.



Source: JICA Study Team

Figure 5.4-21 Layout Plan of Tollbooths

The guardhouses are located at various locations on the airport site, guarding entry into facilities such as the cargo terminal complex, sewage treatment plant, control tower , power house areasand at the landside-airside entry points. The guardhouses, type 2, guarding the airside entry points are equipped with a toilet, the gross floor area for this type is 7 m2 The other guardhouses, type 1, consist of a room only, , the gross floor area for this type is 4.8 m2. There are in total five (5) Guardhouses of type 2 and four (4) guardhouse of type 1.



Source: JICA Study Team

Figure 5.4-22 Layout Plan of Guardhouses

2) Electrical Works

The low voltage power will be supplied from the LV Power of road and car parking to the Driver's lounge & Car Park Toilet, Guard Houses and Toll Booths. Around 50% of the total design load for these areas will be energized by a stand-by generator during normal power failure.

3) Mechanical Works

Mechanical works for Ancillary Buildings shall be as follows:

Table 5.4-11 Service List of Mechanical Works

No.	System	Driver's Lounge	Car Parking Toilet	Guard House	Toll Booth
1	**Plumbing System**				
	-Cold water supply	-	○	-	-
	-Sewage drainage & vent system	-	○	-	-
	-Storm water system	○	○	○	○
2	**Ventilation System**				
	-Mechanical Ventilation	○	○	-	○
3	**Fire Protection System**				
	-Portable fire extinguisher	○	○	○	○

Source: JICA Study Team

a) Plumbing System

Cold water supply and sewage drainage works shall be provided for Car Parking Toilet. A storm water system shall be provided for all ancillary buildings.

b) (Ventilation System) Car park toilet

Toilets shall be ventilated by ceiling cassette exhaust fans. Outside fresh air shall enter through door louvers.

c) (Ventilation System) Guard House 1

Rooms shall be ventilated by wall mounted propeller exhaust fans.

d) (Ventilation System) Guard House 2

Rooms shall be ventilated by wall mounted propeller exhaust fans. The toilets shall be ventilated by wall mounted propeller exhaust fans. Fresh air shall enter through the door louvers.

e) (Ventilation System) Toll Booths

Rooms shall be ventilated by wall mounted propeller exhaust fans.

f) Fire Protection System

Portable fire extinguishers shall be placed at the Driver's Lounge, Car Parking Toilets, Guard Houses and Tollbooths.

5.4.6. Division 6: (B6) Utility Buildings (ULB)

1) Sub-Division 61: Water Tank and Pump House (WPH)

a) Architectural Works

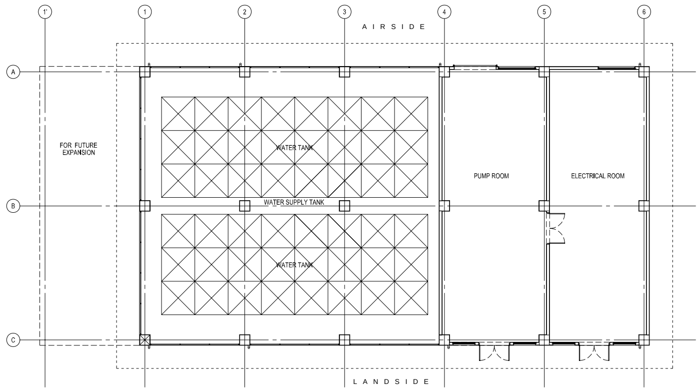
The water tank and pump house is located east of the fire station and maintenance building, adjacent to the area reserved for the future fuel farm. It is a single storey reinforced concrete building with three (3) main areas, electrical room, pump room and tank area. The tank is sufficient for the domestic and fire fighting requirements of the airport.

The space requirements for the water tank and pump house were determined from the total required storage capacity of $450m^3$ for the water reservoir tank and necessary equipment. The floor areas are listed and shown in Table 5.4-12.

Table 5.4-12 Floor Areas of Water Tank and Pump House

Item	Floor Area (m^2)
1. Electrical Room	98.00
2. Pump Room	105.00
3. Water Tank Area	297.00
Total	**500.00**

Source: JICA Study Team



Source: JICA Study Team

Figure 5.4-23 Floor Plan of Water tank and Pump House

b) Electrical Works

1. Power supply

The high voltage (13.2kV) power feeder will come from the power house through an underground cable in the pipe duct. The building will be supplied by a transformer approximately 300 KVA in capacity at 230V, 3 phase. All of the design load (100%) will be energized by stand-by generator during power failure.

c) Mechanical Works

1. (Plumbing System) Water Supply System

Portable water shall be supplied to the each of the buildings inside the airport. Two above ground storage tanks (Water Receiving Tanks) will be provided. The tanks will be equipped with high and low level alarms.

Water will be distributed to the Passenger Terminal Building and other buildings by water supply pump units which will consist of three duty pumps and one standby pump.

Both pumps and tanks will be provided with automatic controls and monitoring systems through the Building Management System (BMS).

The water receiving tanks, water supply pump unit, pressure tank and the motor control panel will be located inside the water tank and pump house.


Water Supply Pump Unit & Water Tanks (Iloilo Airport)

Source: JICA Study Team

Figure 5.4-24 Similar Water Supply Pump Unit and Water Tanks

2. Drainage System

Drainage water from the water tank & floor drain water from the pump house shall be collected at the drainage pits via an oil interceptor and will be discharged to the drainage main.

3. Storm Water System

Storm water drainage pipes shall be provided from roof drains, designed by architectural works, to the outside of the building. The external storm water main shall be provided by the civil works. Storm water shall be collected at the storm pits and will be drained to the storm water drainage main. Condensation drains from the air conditioning system also shall be drained to the storm water pits.

4. Air Conditioning and Ventilation System

There is no air conditioning requirement for this building. The pump room and electrical room shall be ventilated by in-line axial fans, exhaust air shall be suctioned by exhaust grilles through ductworks and fresh air shall be delivered by in-line axial fans from fresh air grilles through ductworks.

5. Fire Protection System

Portable fire extinguisher shall be placed in the water tank & pump house as follows:

The fire extinguisher requirements shall conform to the provisions indicated in the NFPA – 10 and by the local fire code. The capacity and type of extinguishers shall be based on the parameters stipulated by the “authority having jurisdiction”.

The types and capacities of Portable Fire Extinguishers shall be in accordance to the following:

Portable type 4.5 kg. ABC multi – purpose extinguishers shall be used in pump rooms.

Wheel type 23.0 kg. CO_2 extinguishers shall be used in all electrical rooms.

2) <u>Sub-Division 62: Power House (PWH)</u>

a) Architectural Works

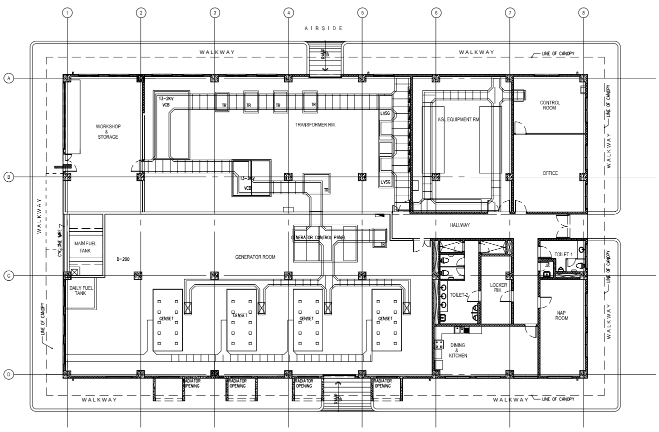
The power house is located between the passenger terminal building and the control tower operation and administration building. It is a single storey, reinforced building housing the transformers, switchgears, generator sets, etc. In addition to the technical spaces, the power house includes a workshop with storage area, a control room, office area, nap room, toilets, showers, locker room and a kitchen.

The space requirements of the power house were determined from the total required capacity of 3,000 KVA for the electrical supply. The floor areas are listed and shown in Table

Table 5.4-13 Floor Area Power House

Item	Floor Area (m^2)
1. Hallway	49.00
2. Office	39.00
3. Control Room	28.00
4. Constant Current Regulator Room	91.50
5. Transformer Room	246.00
6. Workshop & Storage	74.00
7. Main Fuel Tank	16.50
8. Daily Fuel Tank	9.00
9. Generator Room	374.00
10. Dining & Kitchen	36.00
11. Locker	15.00
12. Toilet 1	12.00
13. Toilet 2	30.00
14. Nap Room	30.50
Total	**1,050.50**

Source: JICA Study Team



Source: JICA Study Team

Figure 5.4-25 Floor Plan of Power House

b) Electrical Works

1. Power supply

Basic design load is approximately 100 KVA at 230V, 3 phase. The loads represented are lighting, receptacle outlets, FCU's, road, car park lights and others. Around 30% of the design load will be energized by stand-by generator during power failure.

c) Mechanical Works

1. Service Point

Plumbing shall be designed in accordance with following service conditions.

Table 5.4-14 Service List of Plumbing

No.	Location	Cold Water	Hot Water	Drainage & Vent	Remarks
1	**Toilet** -Water Closet -Urinal -Lavatory (wash basin) -Slop Sink -Floor Drain -Shower	○	○	○	

Source: JICA Study Team

2. Cold Water Supply System

Cold water from the water tank by water supply pump shall be provided for the toilets.

3. Hot Water Supply System

Hot water shall be used for showers and lavatories. Instantaneous type electrical water heaters shall be installed individually at each place as required.

4. Sewage Drainage and Vent System

Drainage water including sewage discharged from the Power House (PWH) shall be collected at the sewage pits and shall be discharged to the sewer main for treatment at the sewage treatment plant (STP).

Water traps shall be used to prevent bad smell to escape or insects to enter the drainage pipes. Vent pipes shall be connected to the drainage pipes to stabilize the internal pressure of the pipes.

5. Storm Water System

Storm water drainage pipes shall be provided from roof drains, designed by architectural works, to the outside of the building. The external storm water main shall be provided by the civil works. Storm water shall be collected at the storm pits and shall be drained to the storm water drainage main. Condensation drains from the air conditioning system shall also be drained to the storm water pits.

6. Air Conditioning and Ventilation System

The office and control room, nap room and dining & kitchen shall be air-conditioned by individual split type air conditioning systems.

The Airfield Ground Lighting (AGL) equipment room shall be air-conditioned by a package window type air-conditioning system. Two (2) window type units shall serve as duty while one (1) window type unit shall serve as back-up.

The Generator, Transformer, Workshop and Storage rooms shall be ventilated by in-line axial fans coming from exhaust grilles through ductworks.

The toilets shall be ventilated by in-line centrifugal fans coming from exhaust grilles through ductworks

7. Fire Protection System

Portable fire extinguisher shall be equipped in Power House as follows:

Fire extinguisher requirements shall conform to the provisions indicated in the NFPA – 10 and by the local fire code. The capacities and types of extinguishers shall be based on the parameters stipulated by the “authority having jurisdiction”.

The types and capacities of Portable Fire Extinguishers shall be in accordance tothe following:

Portable type 4.5 kg ABC multi – purpose extinguishers shall be used in hallways.

Portable type 9.0 kg CO_2 extinguishers shall be used in AGL room, control room, and dining & kitchen areas.

Wheel type 23.0 kg CO_2 extinguishers shall be used in the transformer room and the generator room.

3) Sub-Division 63: Sewage Treatment Plant Control Room (STP)

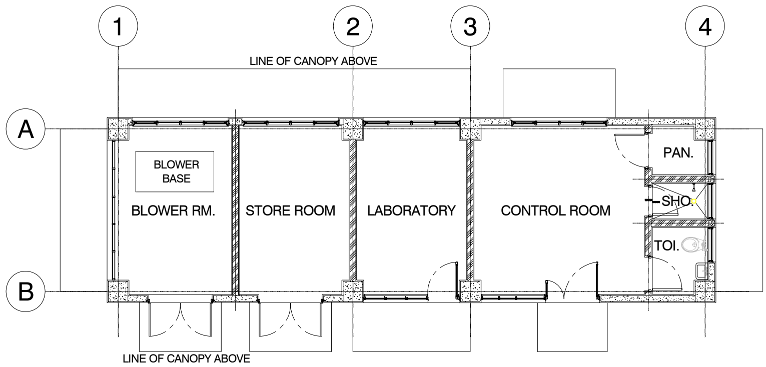
a) Architectural Works

The sewage treatment plant (STP) control room is located within the STP area at the southeastern corner of the terminal facility. It is a single storey, reinforced concrete structure. The building consists of blower room, store room, laboratory and control room with pantry, shower room and toilet.

Table 5.4-15 Floor Area STP

Item	Floor Area (m^2)
1. Blower Room	13.70
2. Store Room	13.05
3. Laboratory	13.05
4. Control Room	19.80
5. Toilet	3.00
6. Shower	1.80
7. Pantry	2.30
Total	**66.70**

Source: JICA Study Team



Source: JICA Study Team

Figure 5.4-26 Plan View of STP Control Room

b) Electrical Works

1. Power supply

The high voltage (13.2kV) power feeder will come from the power house through an underground cable in the pipe duct. The building will be supplied by a transformer approximately 50 KVA in capacity at 230V, 3 phase.

c) Mechanical Works

1. Service Point

Plumbing shall be designed in accordance with following service conditions.

Table 5.4-16 Service List of Plumbing

No.	Location	Cold Water	Hot Water	Drainage & Vent	Remarks
1	**Toilet** -Water Closet -Lavatory (wash basin) -Pantry Sink -Floor Drain -Shower	○	○	○	

Source: JICA Study Team

2. Cold Water Supply System

Cold water from the water tank by water supply pump shall be provided for the toilet.

3. Hot Water Supply System

Hot water shall be used for the shower, an instantaneous type electrical water heater shall be installed..

4. Sewage Drainage and Vent System

Drainage water including sewage discharged from the toilet of sewage water treatment plant control room shall be discharged to the adjacent sewage treatment plant (STP) for treatment.

A water trap shall be used to prevent bad smell to escape or insects to enter the drainage pipe. A vent pipe shall be connected to the drainage pipe to stabilize internal pressure of the system.

5. Storm Water System

Storm water drainage pipes shall be provided from roof drains, designed by architectural works, to the outside of the building. The external storm water main shall be provided by the civil works. Storm water shall be collected at the storm pits and will be drained to the storm water drainage main. Condensation drains from the air conditioning system shall also be drained to the storm water pits.

6. Air Conditioning and Ventilation System

The Laboratory and Control Rooms shall be air-conditioned by individual split type air conditioning systems.

Blower room, store room, pantry, toilet and shower rooms are ventilated by ceiling cassette exhaust fans, fresh air shall enter through door louvers.

7. Fire Protection System

Portable fire extinguisher shall be at the sewage water treatment plant control room .

The fire extinguisher requirements shall conform to the provisions indicated in the NFPA – 10 and by the local fire code. The capacities and types of extinguishers shall be based on the parameters stipulated by the “authority having jurisdiction”.

4) Sub-Division 64: Material Recovery Facility (MRF)

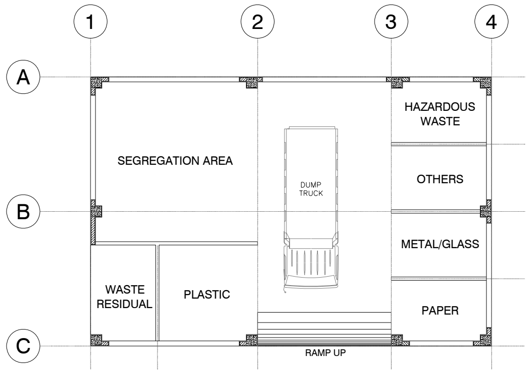
a) Architectural Works

The material recovery facility is located south west of the STP area. It is a single story, reinforced concrete structure with metal roofing. It serves the purpose to segregate solid waste material, in accordance to the DENR (Department of Environment and Natural Resources) guidelines to implement waste reduction.

Table 5.4-17 Floor Area MRF

Item	Floor Area (m^2)
1. Segregation area	55.70
2. Waste residual	5.70
3. Plastic	8.90
4. Paper	5.85
5. Metal/Glass	5.85
6. Others	5.85
7. Hazardous waste	5.65
Total	**93.50**

Source: JICA Study Team



Source: JICA Study Team

Figure 5.4-27 Floor Plan of MRF

b) Electrical Works

The low voltage power will come from the LV Panel of the sewage treatment plant. Lighting fixtures and outlets shall be explosion proof type.

c) Mechanical Works

1. Cold Water Supply System

Cold water from the water tank by a water supply pump shall be provided for the washing and cleaning at the segregation area.

2. Sewage Drainage and Vent System

Drainage water from floor drains shall be collected at the drainage pits and will be discharged to the drainage main.

3. Storm Water System

Storm water drainage pipes shall be provided from roof drains, designed by architectural works, to the outside of the building. The external storm water main shall be provided by the civil works. The storm water shall be collected at the storm pits and shall be drained to storm water drainage main..

5.4.7. Division 7: (B7) Navaids Building (NAV)

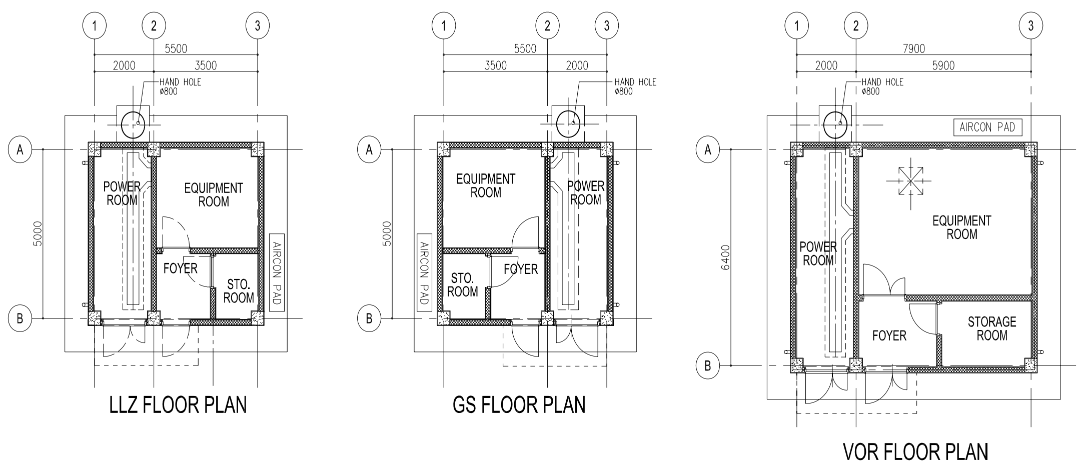
1) Architectural Works

The Navaids buildings are composed of a LLZ (Localizer) building, a GS (Glide Slope) building and a VOR (VHF Omni-Range) building. These are single storey, reinforced concrete structures, providing shelter and house power equipment for the various Navaid equipments.

Table 5.4-18 Summary of Floor Areas for Navaid Building Structures

Item	Floor Area (m^2)
Sub-Division 71: LLZ Building (LLZ)	
1. Equipment Room	11.33
2. Power Room	11.16
3. Foyer	4.25
4. Storage	3.45
Subtotal	**30.19**
Sub-Division 72: GS Building (GS)	
1. Equipment Room	11.33
2. Power Room	11.16
3. Foyer	4.25
4. Storage	3.45
Subtotal	**30.19**
Sub-Division 73: VOR Building (VOR)	
1. Equipment Room	27.26
2. Power Room	14.13
3. Foyer	5.95
4. Storage	6.85
Subtotal	**54.19**
Total	**114.57**

Source: JICA Study Team



Source: JICA Study Team

Figure 5.4-28 Basic Plans of 3 Facilities

2) Electrical Works

a) Power supply

Basic design load is 10 KVA at 230V, 3 phase for the LLZ Building

Basic design load is 10 KVA at 230V, 3 phase for the VOR/DME&GS Buildings

To provide 3- step-down transformer, 13.2KV/230V, 3 phase.

100% of the design load will be energized by the generator during power failure.

3) Mechanical Works

Mechanical works for Navaid Buildings shall be as follows:

Table 5.4-19 Service List of Mechanical Works

No.	System	LLZ Building	GS Building	VOR Building
1	Plumbing System			
	-Storm Water System	○	○	○
2	Air Conditioning System			
	-Air Conditioning (PAC)	○	○	○
	-Mechanical Ventilation	○	○	○
3	Fire Protection System			
	-Portable Fire Extinguisher	○	○	○

Source: JICA Study Team

a) Plumbing System

Only a storm water system shall be provided at each of the 3 buildings.

b) Air Conditioning and Ventilation System

The equipment rooms of the 3 buildings shall be air-conditioned by individual split air-conditioning system, One (1) duty and One (1) stand-by. Each power room at the 3 buildings shall be ventilated by in-line axial fans, exhaust air shall be suctioned by exhaust grilles. Fresh air shall enter through door louvers. The storage rooms shall be ventilated by wall mounted exhaust fans.

c) Fire Protection System

Portable fire extinguisher shall be placed in the above 3 Buildings.

The fire extinguisher requirements shall conform to the provisions indicated in the NFPA – 10 and by the local fire code. The capacities and types of extinguishers shall be based on the parameters stipulated by the “authority having jurisdiction”.

5.5. Air Navigation Works

5.5.1. General

The facility requirements for air navigation aids (ANS) are summarized in Table 5.5-1 and Table 5.5-2.

Table 5.5-1 Facility Requirements for Radio Navigation Aids and Communications

FACILITY	ITEM	GENERAL REQUIREMENT	
		DESCRIPTION	REMARKS
Radio Navigation	ILS	ILS Cat-1	Landing Aids for RWY 21/Facility Performance Cat-1
	VOR/DME	D-VOR/DME	Landing and Taking off Aids
ATS Facility	ATC Consoles	ATC Consoles	Approach, Aerodrome/Ground, F/D and Aux. and Supervisor Control
	VCCS	VCCS	ATC A/G and Fixed Communications
		Master Clock System	Distribute standard time for all ATS operations
		Voice Recorder (Recorder/Reproducer)	ATC Communication Recording
	Signaling Light	Light Gun	Emergency System
	Siren	Alarm Signal	Alarm for Runway Clearance
Telecommunication Facility	Air to Ground	VHF TX 3 freq.	Approach, Aerodrome/Ground and Emergency A/G Communications
		VHF RX 3 freq.	Ditto
		TRCV Multi channels	Ditto for Back Up (for each Frequency)
	AMHS	AMSS	ATS Fixed Communications
		Terminal	Operational Terminals for AMHS
	AIS	Terminal	ATS Fixed Communications
	VHF A/G Comm.	VHF Transceiver	ATS A/G Communications for fire truck
	Point to Point	VSAT	Voice and Data Communication
	Inter-comm.	Interphone	Maintenance Internal Communications
Meteorological Facility	Observation System	Transmissometer	RVR Observation
		Ceilometer	Ceiling Sensor
		Annemometer	Wind Sensor
		Barometer	Atmospheric Pressure Sensor
		Thermometer	Temperature Sensor
		Hygrometer	Dew Point Sensor
		Weather Data Processing and Display System	Weather Data Logging, processing and Weather Data Display

Source: JICA Study Team

Table 5.5-2 Facility Requirements for Visual Navigation Aids

FACILITY	ITEM	GENERAL REQUIREMENT	
		DESCRIPTION	REMARKS
Visual Aids	AGL	PALS	Operation with ILS toward RWY 21
		SALS	Operation with Instrument Approach toward RWY 03
		PAPI	While descent approach toward RWY 03/21
		REDL	Landing and Taking off Aids
		RTHL/ RENL	Landing Aids
		WBRL	Operation with ILS toward RWY 21
		TEDL	Assist to pilot toward RWY or Apron
		TXGS	Assist to pilot toward RWY or Apron
		Turning Point Indicator	Assist to aircraft turning on the end of RWY 03/21
		WDIL	Assist to pilot shown wind direction for RWY 03/21
		Apron Flood	Operation while Aircraft parking

Source: JICA Study Team

5.5.2. Radio Navigation Aids and Communications

1) ILS

ILS Cat-1 operating for RWY 21side which is realized a precise landing comparing to VFR approach, AGL approach only and VOR/DME approach during unstable weather condition. ILS is composed of LLZ, GS and T-DME.

All manufactured product shall withstand much hard weather in the tropical region and easily be structured for the maintenance.

LLZ and GS equipment shall be selected a type of 2 frequencies improving interference with antenna on the aircraft more efficient than conventional type.

When the brownout occurs under operation, automatically the power source shall be distributed from engine generator or UPS without affecting ILS equipment.

2) VOR/DME

VOR/DME operating for landing or taking off which is given to pilot the signal related to distance and direction maintaining the correct Air-route based on Aeronautical Information Publication.

Manufactured specification is composed of 100W (VOR output power), 1kW (DME output power) and Doppler type (VOR system).

When the brownout occurs under operation, automatically the power source shall be distributed from engine generator or UPS without affecting VOR/DME equipment.

3) ATS (Air Traffic Services) and Telecommunication

These facilities, services and operational procedures are required to form an integrated system designed to meet the requirements of all civil aircraft operations in the airport. Also, each component of these facilities is required to operate and to be maintained at an adequate performance level of ICAO standards and recommended practices.

Due to communication service to Aircraft with safe operation, communication console, VHF antenna, AMHS equipment, communication control system and recording system shall be provided and controlled by Air traffic controller in control tower.

When the brownout occurs under operation, automatically the power source shall be distributed from engine generator or UPS without affecting ATS and Telecommunication equipment.

4) Meteorological Facilities

These facilities and their services are required to meet the requirement of precision approach Category- I and all civil aircraft operations at the airport. Also, each component of these facilities is required to operate and be maintained at an adequate performance level to meet ICAO and WMO standards for Aeronautical Weather Observation and Data delivery.

Meteorological Facilities is composed of Runway Visual Range, Ceilometer, Anemometer, Temperature sensor, Hygrometer, Barometer, Weather Data Processing System and Weather Data Display system. All signals from outside of facilities are displayed on the communication control console passing through the data processing system.

After editing signal from outside of facilities in the data processing system, the data shall be formatted for METAR and SPECI keeping in hard disk.

When the brownout occurs under operation, automatically the power source shall be distributed from engine generator or UPS without affecting Meteorological Facilities.

5.5.3. Aeronautical Ground Lights

1) Approach Lighting System

In conjunction with ILS, PALS operating for RWY 21side and SALS operating with VOR/DME shall be assisted a pilot visually for contribution to safe approach during unstable weather condition or night time.

The controller shall be able to carry out the lighting alignment depending on weather conditions from the remote control console at the VFR room and from the local control console at the control room in the power house.

2) PAPI System

The lighting system for descent arrival shall be given to pilot and the location of PAPI shall be provided at left side of aircraft faced toward the runway. PAPI for RWY 21side must be compatible angle of descent arrival with GS.

The controller shall be able to carry out the lighting alignment depending on weather conditions from the remote control console at the VFR room and from the local control console at the control room in the power house.

3) Runway Edge Lights

Before the pilot prepares for landing or taking off, Runway Edge Lights, Runway Threshold lights, Wing Bar Lights, Runway End Lights and Stop way Lights shall be operated by controller during unstable weather condition or night time.

All the lights are same circuit of power distribution and the controller shall be able to carry out the lighting alignment depending on weather conditions from the remote control console at the VFR room and from the local control console at the control room in the power house.

4) Taxiway Edge Lights

The Lighting system shall be assisted to aircraft passing through the taxiway during unstable weather condition or night time.

The controller shall be able to carry out the lighting alignment depending on weather conditions from the remote control console at the VFR room and from the local control console at the control room in the power house.

5) Apron Floodlights

All floodlight fittings shall be specifically designed for apron floodlighting to provide sufficient illumination on the surface of the apron as stated in Chapter 13 of Aerodrome Design Manual Part 4, Visual Aids of ICAO.

The apron floodlighting will comprise of a mixture of high pressure sodium lamps and metal halide lamps. The controller shall be able to carry out the lighting alignment depending on weather conditions from the remote control console at the VFR room and from the local control console at the control room in the power house.

6) Taxiing Guidance Signs

The lighting system is compose of illuminated mandatory instruction signs and illuminated information signs. The illuminated mandatory instruction signs are usually located near intersection of taxiway and runway and most of the illuminated information signs are located near Apron area and Taxiway.

All the lights are same circuit of power distribution as Taxiway Edge Lights and the controller shall be able to carry out the lighting alignment depending on weather conditions from the remote control console at the VFR room and from the local control console at the control room in the power house.

7) Aerodrome Beacon

The lighting system shall be located on the roof of the control tower avoiding glare to ATC controllers and pilots of aircraft in flight. An obstacle light shall be installed and shall be illuminated when the lamp of the aerodrome beacon fails.

8) Wind Direction Indicators Lights

The two illuminated wind direction indicators shall be assisted to pilot choosing the direction of RWY while preparation for landing or taking off.

The cone shall be aviation orange and white in color and designed to give clear indication of the wind direction and wind speed when viewed from a height of not less than 300 m.

9) Monitoring and Control System

The remote control and monitoring system is composed of operation console, display and lighting control terminal for control of all the airfield lighting, apron floodlighting and taxiing guidance signs, except the signaling lamp at the control tower.

5.6. Cost Saving Scenario

Upon submission of the Draft Final Report to DOTC in October 2011, the JICA Study Team was requested to study whether the construction cost, and operation and maintenance cost as well, can be further saved in such a way that it can just meet minimum standard for aircraft operational safety and passengers' comfort but without sacrificing the functionality, security, convenience, punctuality and future expandability of the new airport. The study was made as described hereunder:

5.6.1. Cost Saving for Airfield Facilities

Cost saving for airfield facilities has been considered just to cope with the requirements for smallest aircraft that is expected to be operated in the initial stage of operations.

1) Minimum Runway Lengh

The runway length is determined to be 2,000 m, which is the minimum takeoff length required for A321, an advanced model of A320 family (1-m wider and 7-m longer than A320) that Cebu Pacific Airways announced to introduce from 2016.

2) Minimum Airfield Development

Irrespective of precision or non-precision approach procedure is to be aimed, when the instrument runway is pursued with an assistance of either ILS or VOR/DME signal, the minimum width of runway strip required is 300 m.

Site development (cut and fill, and gradation) is considered be made just to cover:

- ✓ 300-m wide instrument runway strip (150 m on both side of the runway centerline) which should extend by 60 m beyond the runway end;
- ✓ Runway-end-safety-area (RESA) of the same width of the runway strip, which should extend by 240 m beyond the runway strip (or 300 m beyond the runway end) as lately encouraged by ICAO..
- ✓ 7-m wide perimeter road for airfield maintenance and security,
- ✓ Soaking yard (storm water detention pond) as the integral part of environmental protection.

5.6.2. Cost Saving for Air Navigational Facilities

The existing Tagbilaran Airport is currently operated only with a visual flight rule (VFR) by four (4) domestic airlines without any air navigation facilities

Normally, airport should possess kinds of radio navigational aids, e.g. VOR/DME as the most practical one nowadays, to notify the exact location of the particular airport which is invisible from pilots in the air or above the cloud, in addition to ATC facilities at control tower. Therefore, it is firstly recommended that the VOR/DME should be installed as an indispensable facility for the new Bohol Airport.

In addition, ILS is normally set as an integral part of airport facility at most of airport where international flights are operated by foreign airlines. It is a normal practice for foreign pilots to avail the ILS signal, irrespective of weather conditions, as a common runway approach procedure worldwide. The ILS CAT-I precision approach procedure can, when the RVR (Runway Visual Range) shows more than 550 m, instrumentally navigate the pilot to decent to a Decision Height (DH) of as low as 200 feet.

Meanwhile, in case the ILS is not installed but as long as VOR/DME is provided, the pilot can still make a non-precision instrument approach to the runway by availing the signal of VOR/DME. The VOR/DME can, when the visibility is more than 2,000 m, instrumentally navigate the pilots to decent to a Minimum Decent Altitude (MDA) which is generally set at 500 to 600 feet case-by-case by the airport operator depending upon the specific weather and topographic conditions at particular airport. During such worst weather conditions, e.g. visibility is less than 2,000m or the height of cloud is lower than 500 to 600 feet especially at night, aircraft approach should be aborted.

There are not enough data to ascertain whether the non-precision approach procedure can safely assist the pilot to land most of the time at this particular airport, since no ceilometer is installed, and no weather data at night has been measured as the existing airport is operated on daytime only. However, it is more than certain that the provision of VOR/DME with necessary aeronautical ground lights can at least improve the aviation safety to meet allowable ICAO regulation when compared with that at existing Tagbilaran airport.

After the necessity of ILS has been justified through further accumulation of weather data at the new airport and/or depending upon actual demand from foreign airlines, the ILS equipment (GS & LLZ) can physically be installed later as long as the site is available.

Hence, it can be fairly compromised that installation of ILS and approach lighting system be differed, which would result in a corresponding deduction of initial investment (bare construction cost without tax) of Php 160 million.

5.6.3. Cost Saving for Passenger Terminal Building (PTB)

Whether a single-story PTB (i.e. so-called low cost terminal) could properly function has been studied, since the existing airport is currently being used by 3 LCC's as a majority of operations (except PAL).

1) General view of Single-story PTB

So-called low-cost terminal is generally a single-story passenger terminal building (single-story PTB) which is not provided with either Passenger Boarding Bridge (PBB) or ramp buses by the airport operator. Advantage and disadvantage of such terminal are described as follows:

a) Generally, a single-story building has no vertical circulation space, stairs and equipment (i.e. elevators, escalators) therefore, construction cost is considerably saved.

b) However, a footprint for single-story building generally requires wider area of ground than that for multi-story building when the same functional spaces are pursued. The valuable ground space in which originally a multi-story PTB had been planned to eventually require, would be fast occupied in full when a single-story PTB is adopted.

c) Absence of the Passenger Boarding Bridge (PBB) will make passengers exhausted while walking on the apron under sunshine, heavy rain, crossing with ground service equipment, or most often blown by aircraft full-blast maneuvering inside the apron.

d) In such a low-cost terminal, passengers, especially elderly or disabled person, are given physically hard burden being enforced a longer walking distance until reaching the remote aircraft parking stand, and step-up or down to/from aircraft while having luggage or children with them. Naturally, such terminal may not deserve to charge the PSC (Passenger Service Charge) of Php 200 as having been collected at the airports at Iloilo, Bacolod, Davao, Mactan, NAIA2.

e) Initially aircraft parking position may be within a walking distance, where passengers may be allowed to walk on the apron as long as great majority of operations are for domestic flights. However, when the air traffic increases the aircraft positions are widely spread over, and when international flights increases, soon or later the airport operator needs to purchase numbers of ramp buses, so as to segregate international and domestic passengers mingled while walking across on the apron hence to minimize the risk of smuggling or illegal entry of undesirable person or goods to the country.

f) At NAIA for example, the Tacking Fee of US$37 is charged by the Manila International

Airport Authority (MIAA) to Airlines per hourly usage of PBB, or per the usage of Ramp buses. This is a good income to the airport operators because the PBB or rump bus can be used for daily 3 to 5 times, and and can be recovered for 10 to 15 20 years. On the other hand it is considered to be a minimal surcharge to airfare (e.g. 15 cents = $37/ 250 pax) when such fee is equally shared by some 250 passengers in average (125 arriving and 125 departing passengers for A320).

g) A ramp bus costs equivalent amount to a PBB, that would be charged to the end-user (i.e. Airlines) per usage as one of the airport tariff (i.e. tacking fee). It should be noted that the PBB requires no fuel and less maintenance cost thus attains longer life than the ramp bus.

As the initial cost saving is a priority hence a single-story PTB is to be adopted, the PTB should be so designed to have doable variations for future expansion to timely rectify the above disadvantages c) to g) when the number of passengers increases.

2) Proposed Phase-1 Terminal with Options for Future Expansion

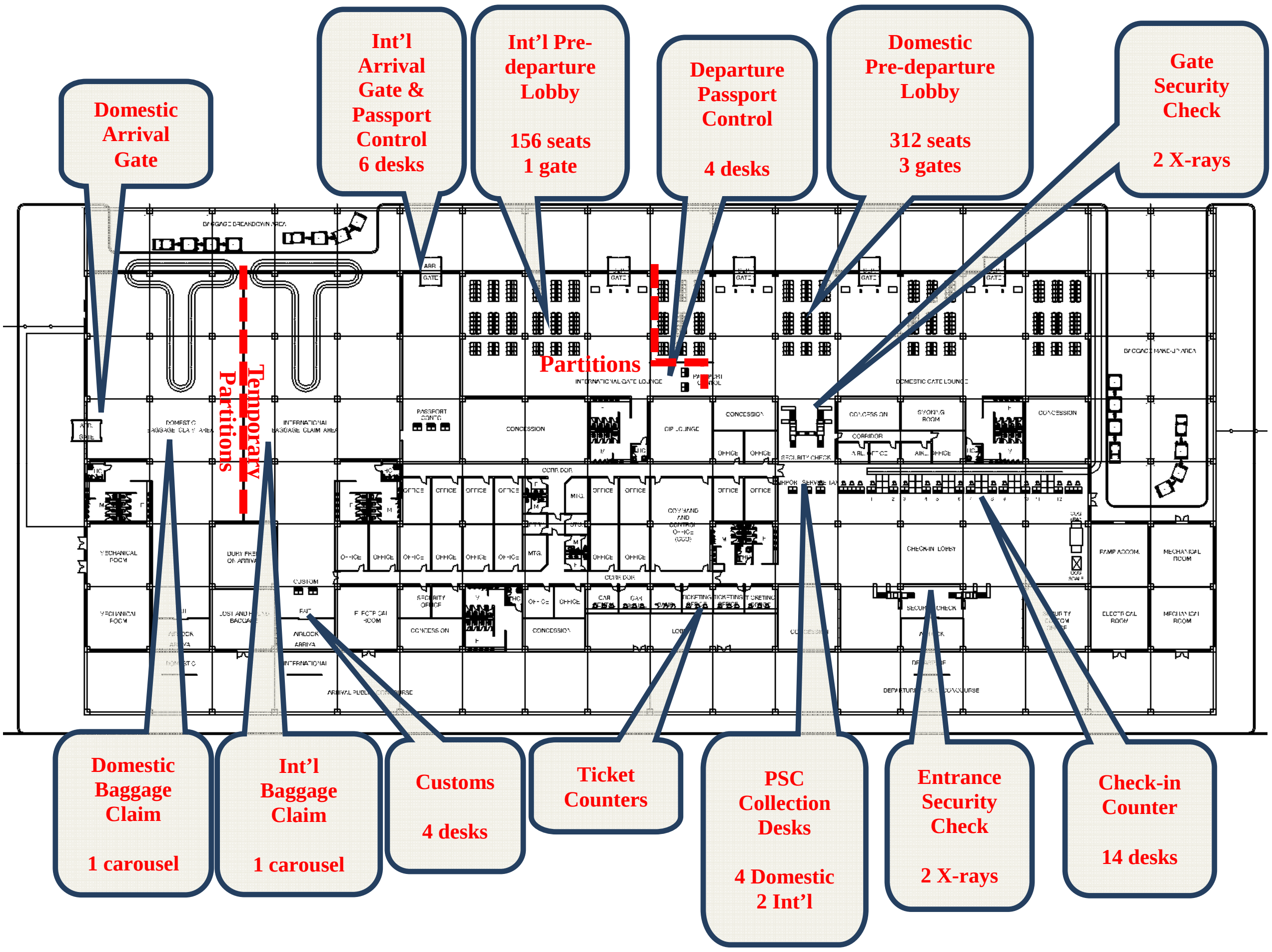
To meet the forecast annual passengers of 1.43 million (i.e. 1,393,000 for domestic, and 42,640 for international) for the year 2020, the following facilities, among the main PTB functions as enumerated in Table 5.6-1, are considered to be provided:

Table 5.6-1 Main Facilities to be provided for Phase-1 PTB (for 2020)

Main PTB Facilities		Initial Functions to be provided
A	PTB floor area 8,271 m²	The total floor would basically dedicate to domestic operations, but would be commonly used for international operations during night or off-peak hours. At pre-departure lobby and baggage claim areas, international and domestic functions are segregated by temporary partitions.
B	Check-in Counter 14 desks	14 check-in desks would be commonly used for both domestic and international operations.
C	Baggage Claim 2 carousels	2 carousels would be commonly used. In case international flight is operated simultaneously, 1 carousel each would be used. Separate arrival gates are to be provides for domestic and international.
D	Security Check 2 booths each	2 booths of security check (X-ray and walk-through detector) are provided for main entrance to PTB and for the entrance to pre-departure area. Those booths are commonly used for domestic and international operations.
E	Aircraft stands 4 for self-maneuvering or 6 for nose-in/ push-back	To cope with the current domestic flight schedule, i.e. 3 arrivals and 2.5 departures in a peak-hour, minimum 4 spots are required. Apron spot for self-maneuvering aircraft requires wider area than that for aircraft nose-in.
F	Passport Control 4 desks	4 desks for departure passport control; and 6 desks for arrival passport control are to be placed.
G	Customs Desks 4 desks	4 customs desks (bench) are provided.

Source: JICA Study Team

Based on the above-mentioned numbers and main functions to be provided at PTB, and baring in mind the future options for doable expansion, the Phase-1 terminal layout for this Cost Saving Scenario has been preliminarily planned as shown in Figure 5.6-1.



Source: JICA Study Team

Figure 5.6-1 Proposed Phase-1 Terminal - for Initial Cost Saving Scenario

The proposed internal floor area of the Phase-1 passenger terminal (PTB) shown above is 8,271 m^2,where no vertical circulation functions like the stairs, elevators and escalators is provided.

To meet the forecast annual passengers of 1.96 million (i.e. 1,773,000 for domestic, and 184,704 for international) for the year 2030, it is assumed that separate check-in counters and baggage claim area exclusively for international operations are desired to be provided. Therefore, the single-story PTB is assumed to be horizontally expanded to both sides.

As emphasized in the above 10.2.2.2), the single-story PTB would give physical burden to disabled or elderly person. Also, domestic and international passengers are possibly combined while walking on the apron it would offer a risk of smuggling of terrorist or undesirable goods or person to enter into the country. Therefore, when international traffic increases, it is desired to provide more secured access for passengers to board or un-board the aircraft, with the provision of Passenger Boarding Bridges.

In view of the foregoing discussion, the following future expansion options for Phase-2 terminal are necessarily addressed:

Stage 1. Future horizontal expansion.

Stage 2. Future vertical expansion for 2nd floor spaces so that it could have additional functions for extra lobby and concourses to connect PBBs.

3) Energy Saving Plan

At a moment, it is intended that the terminal building is made of typical tropical resort style, and natural lights and ventilation are planned to be adopted for most of public area except pre-departure lobby and office areas where air-condition is provided. It is further planned that operation and maintenance cost be saved in respects of the following aspects:

a) Adoption of Solar Power Generation Syste

To reduce fossil fuel, coal, oil, natural gas harnessing in the power plant which has emitted vast CO2 in the air, are worldwide encouraged so as to prevent global warming phenomenon. When solar power generation system is adopted in the PTB, the electricity cost is greatly saved. In case electricity consumption of 500 kwh is reduced, yearly 9 million of O&M cost is saved. The initial investment is recovered for 16 years of operations as shown in the comparison below.

Table 5.6-2 Cost Comparison between Commercial Power and Solar Power

Item			Power Source	
Description	*Rate*	*Unit*	*Commercial Power*	*Solar Power System*
1. Construction for HV	10,000,000	Peso	10,000,000	10,000,000
2. Solar power facilities	300,000	Peso/kWh	N/A	150,000,000
3. Power consumption	500	kWh	In case of Passenger Terminal Building	
Initial cost			10,000,000	160,000,000
1. Electric company rate	7.5	Peso/kWh	7.5	7.5
2. Operation hour	12	h/day	45,000	N/A
(Night operation)	5	h/day	N/A	18,750
3. Monthly cost	30	day	1,350,000	562,500
4. Yearly cost	365	day	16,425,000	6,843,750
5. 16 years cost	5,840	day	262,800,000	109,500,000
16 years running cost			262,800,000	109,500,000
Total Cost			272,800,000	269,500,000

Source: JICA Study Team

b) Use of LED lights

Power consumption of LED lights (Light-Emitting Diodes) is normally 10% to 15% of the conventional type of lights, and its life is normally 10 times more. Lately the price of LED lights has been drastically reduced owing to its mass production, hence should be considered to be applied in the most of building ceiling (i.e. for office and concession).

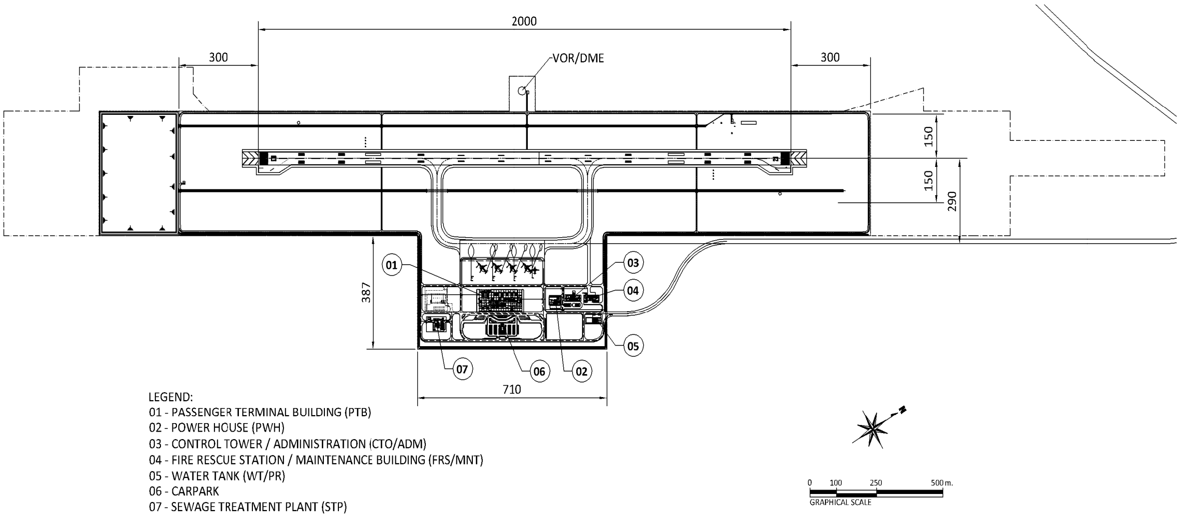
5.6.4. Airport Layout Plan for Cost Saving Scenario

1) Cost Saving Scenario Phase 1

In view of the foregoing discussion, the airfield specifications and airport layout for Phase-1 for the Cost Saving Scenario has been planned as shown in Table 5.6-2 and Figure 5.6-3.

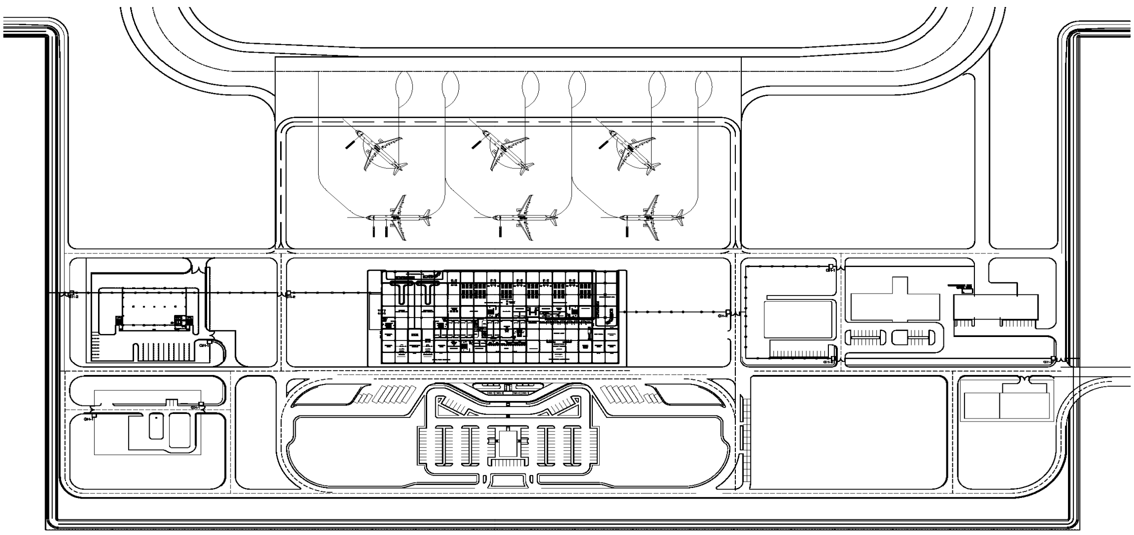
Table 5.6-3 Phase-1 Airfield Specification for Cost Saving Scenario

Runway:	2,000 m x 45 m, with 7.5-m shoulder on both side
Runway Strip:	2,120 m x 300 m
Runway-end-safety area:	240 m beyond the end of both runway strip
Approach Lighting System:	none
ILS:	none
VOR/DME	yes



Source: JICA Study Team

Figure 5.6-2 Phase-1 Airport Development – Cost Saving Scenario



Source: JICA Study Team

Figure 5.6-3 Phase-1 Terminal Layout – Cost Saving Scenario

2) Cost Saving Scenario Phase 2

The Phase 2 for this Cost Saving Scenario is planned to be implemented through the following two (2) stages in order of priority:

Stage 1.
1) Purchase of two (2) fire fighting vehicles of 12-ton water capacity
2) Horizontal expansion of the single-story PTB (from 8,271 to 11,903 m^2)
3) Construction of Cargo Terminal Building (1,500 m^2)

Stage 2.
4) Vertical expansion of PTB for 2nd floor to connect PBBs
5) Runway Extension from 2,000 m to 2,500 m
6) Installation of ILS
7) Installation of Approach Lighting System
8) Apron expansion (48,000 to 59,250 m^2)
9) Other airside development

The above order of priority 1) to 9) is described as follows:

Stage 1

1) The purchase of two (2) Fire Fighting Vehicles is, as a priority to replace the existing 2 fire vehicles at Tagbilaran Airport, which are only 2.5-ton water capacity each and are rather of obsolete model.

2) When the air traffic demand increases, horizontal expansion of the single-story PTB (from 8,271 to 11,903 m^2) would be necessary. Unit cost for single-story building is assumed to be Php 50,000/ m^2, hence the construction cost for additional 3,632 m^2 is provisionally estimated at Php 200 million (including additional solar panels).

3) Cargo terminal building is necessary when air traffic increase, the cost thereof is estimated at Php 55 million.

Stage 2

4) When international flights are increased, vertical expansion of the PTB to construct the 2nd floor to connect PBBs (from 11,903to 16,318 m^2) is necessary to attain users' comfort and convenience especially for disabled or elderly passengers. Unit cost of the 2-story building is assumed to be Php 100,000/ m^2, hence the construction cost for additional 4,415 m^2 is provisionally estimated at Php 500 milion (including 3 PBBs and 3 sets of vertical circulation, i.e. elevators and escalators).

5) When foreign major Airlines commence aircraft operations, the runway is desired to be extended from 2,000 to 2,500 m as originally envisaged. The pavement cost for the 500-extension of the runway is estimated at Php 94 million.

6) When foreign Airlines commence aircraft operations, installation of ILS-GS/LLZ is desired to be installed for the purpose of aviation safety, the cost thereof is estimated at Php 98 million.

7) In line with the start of ILS precision-approach procedure, the Approach Lighting System is necessary to be installed, the cost thereof is estimated at Php 63 million.

8) In relation to the above 5), apron expansion is necessary, the cost for which is estimated at Php 65 million.

9) In relation to the development of the above 5) to 8), additional airside development (e.g. for earthworks, drainage, road, fence and gates) is necessary, the cost for which is estimated at Php 151 million.

Chapter 6

Project Cost and Implementation Schedule

Table of Contents

Chapter 6. Project Cost and Implementation Schedule

6.1. Phasing and Scope of Construction Works

Through the course of the previous studies, i.e. in 2000 FS, 2007 FS, and 2009 Design, the runway length was constantly recommended thus designed to be 2,500 m.

Upon discussion between DOTC and JICA Study Team (JST) in July 2011, it was agreed that the Project would be split into 2 Phases, namely the Phase 1 wherein the 2,110-m long runway and a 9,660-m² PTB will mainly cope with the domestic operations but possibly accommodate international operations during the domestic off-peak hours, and the Phase 2 in which the Runway is extended to be 2,500 m and the PTB extended to be 15,470 m² to accommodate simultaneous domestic and international flight operations by B777-300.

Upon submission of Draft Final Report in October 2011, JST was requested to study Cost Saving Scenario (Phase 1) in which the runway is minimized to be 2,000 m to cope with non-precision approach of domestic A321 (initially without ILS), and the single-story PTB of 8,271 m² without PBB can barely cope with domestic operations.

Those chronological changes with the cost (expressed in the bare construction cost without VAT) are described in Table 6.1-1.

Table 6.1-1 Phasing of the New Bohol Airport Construction Project

Description		Original Scenario		Cost Saving Scenario
		Phase 2	Phase 1	Phase 1
Passenger Terminal Building	Area	15,470 m²	9,761 m²	8,271 m²
	Cost (Php)	1,445 million	989 million	500 million
	Function	Dom. & Int'l	Domestic	Domestic
Cargo Terminal Building	Area	1,500 m²	None	None
	Cost (Php)	55 million		
	Function	Dom. & Int'l		
Other 26 Buildings	Area	4,630 m²	4,630 m²	4,570 m²
	Cost (Php)	277 million	277 million	272 million
Utilities	Cost	280 million	255 million	622 million
	Function	Water/ Power/Sewerage		
Runway	Length	2,500 m	2,110 m	2,000 m
	Cost (Php)	693 million	618 million	599 million
	Function	All aircraft	A320/321, A330	A320/321
Apron	Area	59,250 m²	50,250 m²	48,000 m²
	Cost (Php)	324 million	272 million	258 million
	Function	1 A330, 4 A321, 1 DHC3		6 A321
Car Park	Lots	18 buses/ 229 cars	18 buses/ 145 cars	18 buses/ 145 cars
	Cost (Php)	24 million	14 million	14 million
Fire Fighting Vehicle (FFV)	Cost (Php)	101 million	None	None
	Function	To meet Category 9 (24.3 tons in total)	Now, two 2.5-ton FFVs and 3-ton tank car (8 tons in total) meet Category 6	
Navaids	Cost (Php)t	608 million	608 million	447 million
	Function	Precision CAT 1		Non-Precision VOR/DME
Total	Cost (Php)	5,828 million	4,978 million	4,165 million

Source: JICA Study Team

6.2. Conceptual Design of the New Bohol Airport

The eventual runway length is 2,500 m, designated as Phase-2 for the Original Scenario.

The Phase-1 runway length requirement for the Original Scenario is 2,110 m which can accommodate small jet operations. This 390-m reduction of the runway length has been proposed in consideration of the future cut-and-reinstall of every 30-m spacing of lighting barrette for the 900-m long Precision Approach Lighting System.

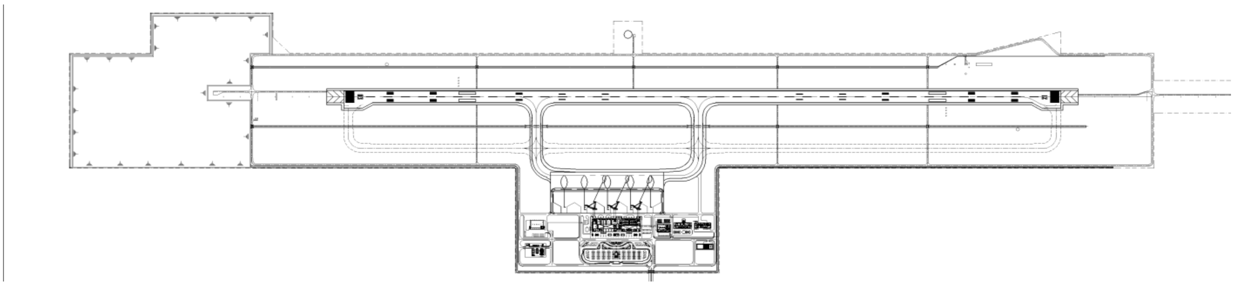
The Phase-1 runway length requirement for the Cost Saving Scenario is 2,000 m which can accommodate small jet mainly for domestic operations. This provision is not for an ILS precision approach runway but VOR/DME non-precision approach runway.

The Phase-1 runway length requirement for the Cost Saving Scenario is 2,000 m which can accommodate small jet mainly for domestic operations.

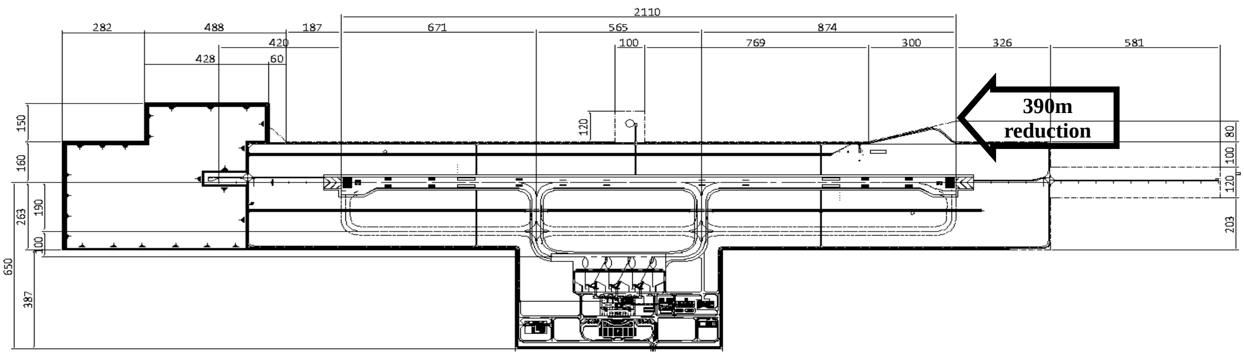
1) Airport Layout

Airport Layout Plan for the respective Scenarios are shown in Figure 6.2-1.

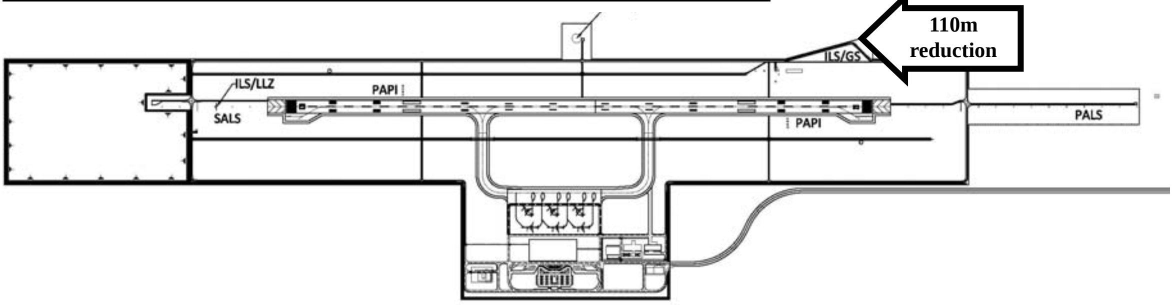
Original Scenario Phase 2: Runway Length 2,500m



Original Scenario Phase 1: Runway Length 2,110m



Cost Saving Scenario Phase 1: Runway Length 2,000m



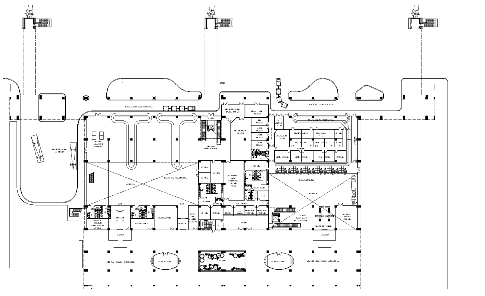
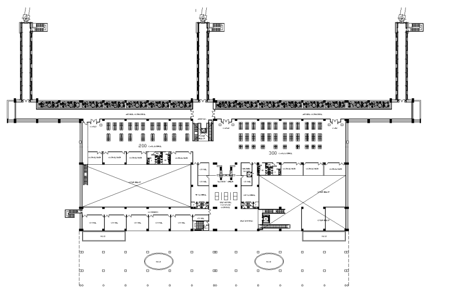
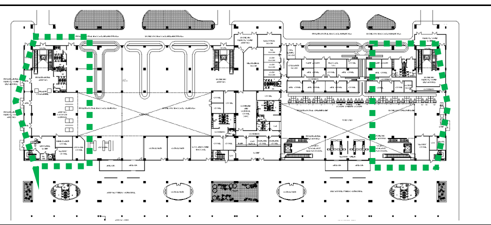
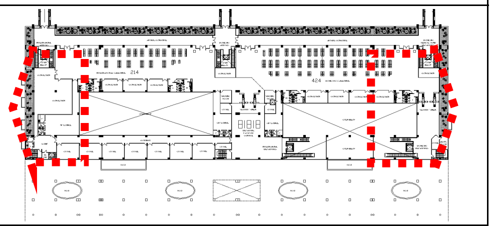
Source: JICA Study Team

Figure 6.2-1 Airport Layout Plan

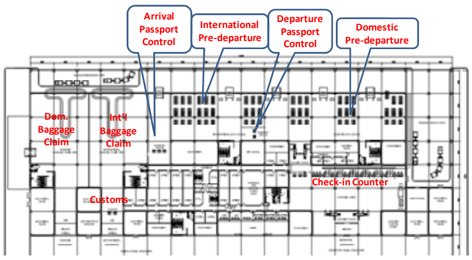
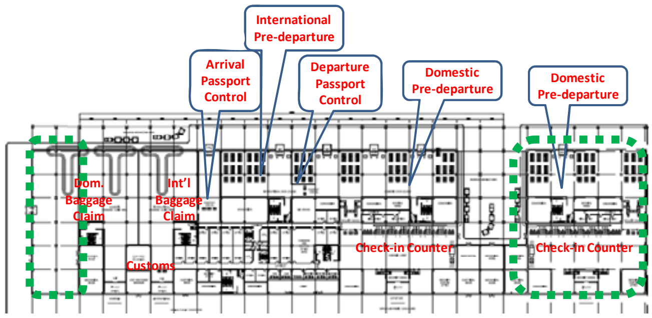
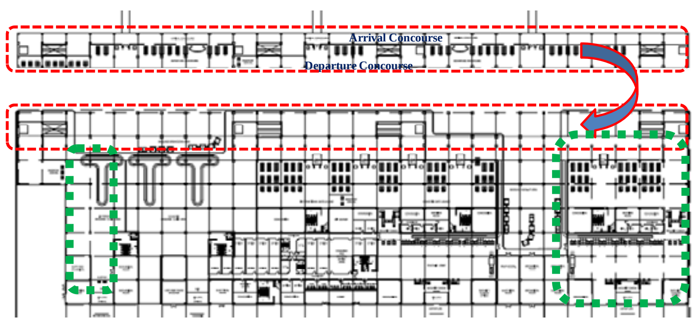
2) Passenger Terminal Building (PTB)

Development Phases for Passenger Terminal Building (PTB) are as shown in Figure 6.2-2.

Original Scenario (2-story building)

	Ground Floor	2nd Floor
Phase 1		
Phase 2		

Cost Saving Scenario (single-story low-cost terminal)

Phase 1	**8,271m²**	
Phase 2 **Ground Floor Expansio** **2nd Floor**	**Stage 1 Horizontal Expansion** **11,903m²**	
	Stage 2 Vertical Expansion **16,318m²**	

Source: JICA Study Team

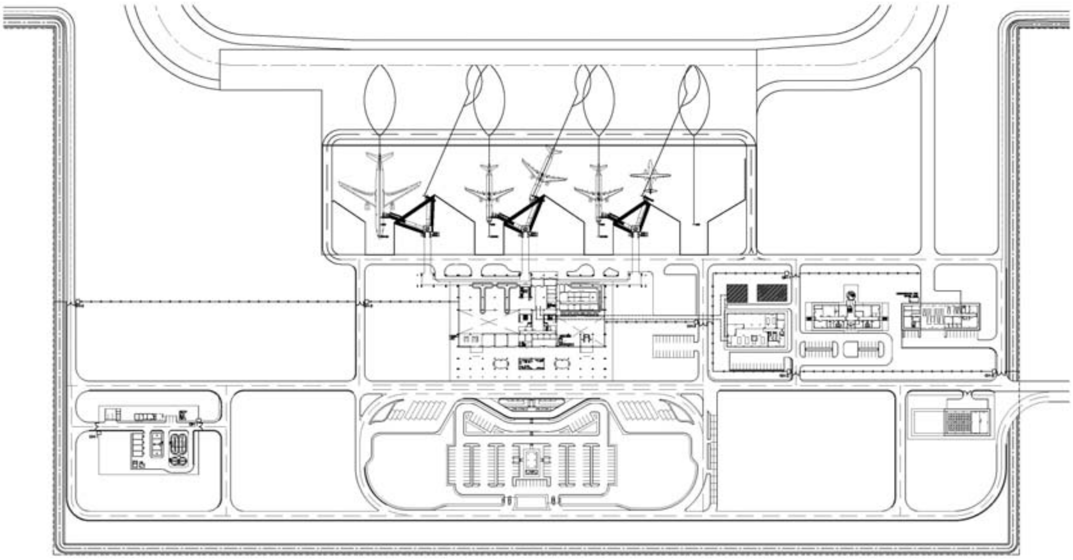
Figure 6.2-2 Development Phases for PTB

Solar Power Generation is adopted in the Cost Saving Scenario to minimize O&M cost.

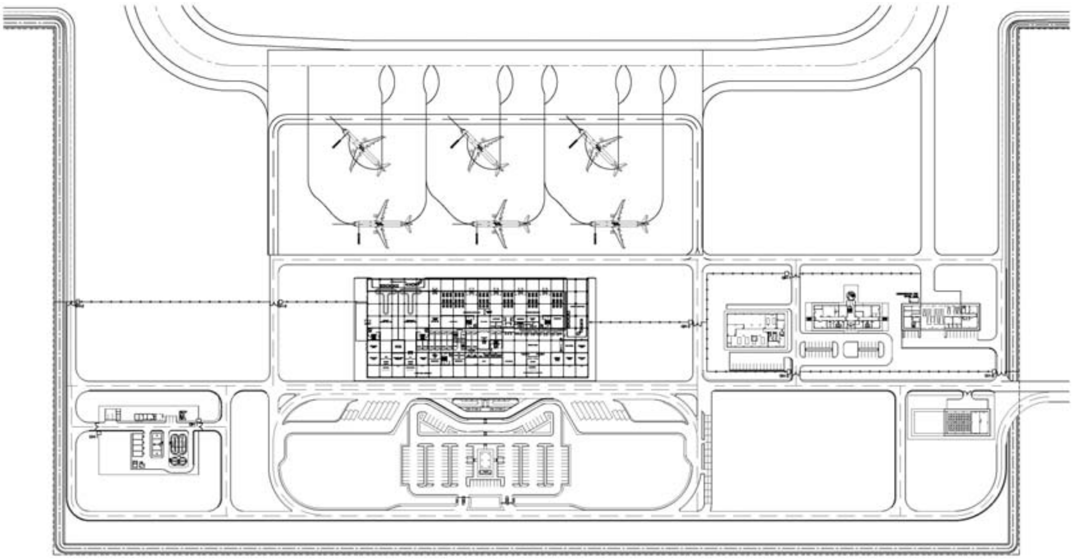
3) Terminal Area Plan

Terminal Area Layout Plan Phase 1 for both original and cost saving scenarios are shown in Figure 6.2-3.

Original Scenario Phase 1



Cost Saving Scenario Phase 1



Source: JICA Study Team

Figure 6.2-3 Terminal Area Layout Plan Phase 1

Located on the right side of the PTB airside are a power station, control tower and operation building, fire station and maintenance building, and on its landside are water tank and fuel farm to be directly connected with access road..

Located on the left side of PTB airside is reserved for future construction of cargo terminal, and on its landside is sewage treatment plant.

The cargo terminal is not built for Phase 1 but for Phase 2.

6.3. Project Implementation Schedule

Assuming that the Government would make decision early 2012 on the implementation of the new Bohol Airport Construction Project with a financial assistance from JICA, the following steps are assumed to be made:

a) Necessary supplementary studies would be conducted by JICA, e.g. on the feasibility of water supply and resettlement action plan, so that the Project would be timely appraised by JICA mission in the last quarter of 2012,

b) Exchange of Notes and Loan Agreement for the Project are expected to be executed between the two (2) Governments in the 1st quarter of 2013.

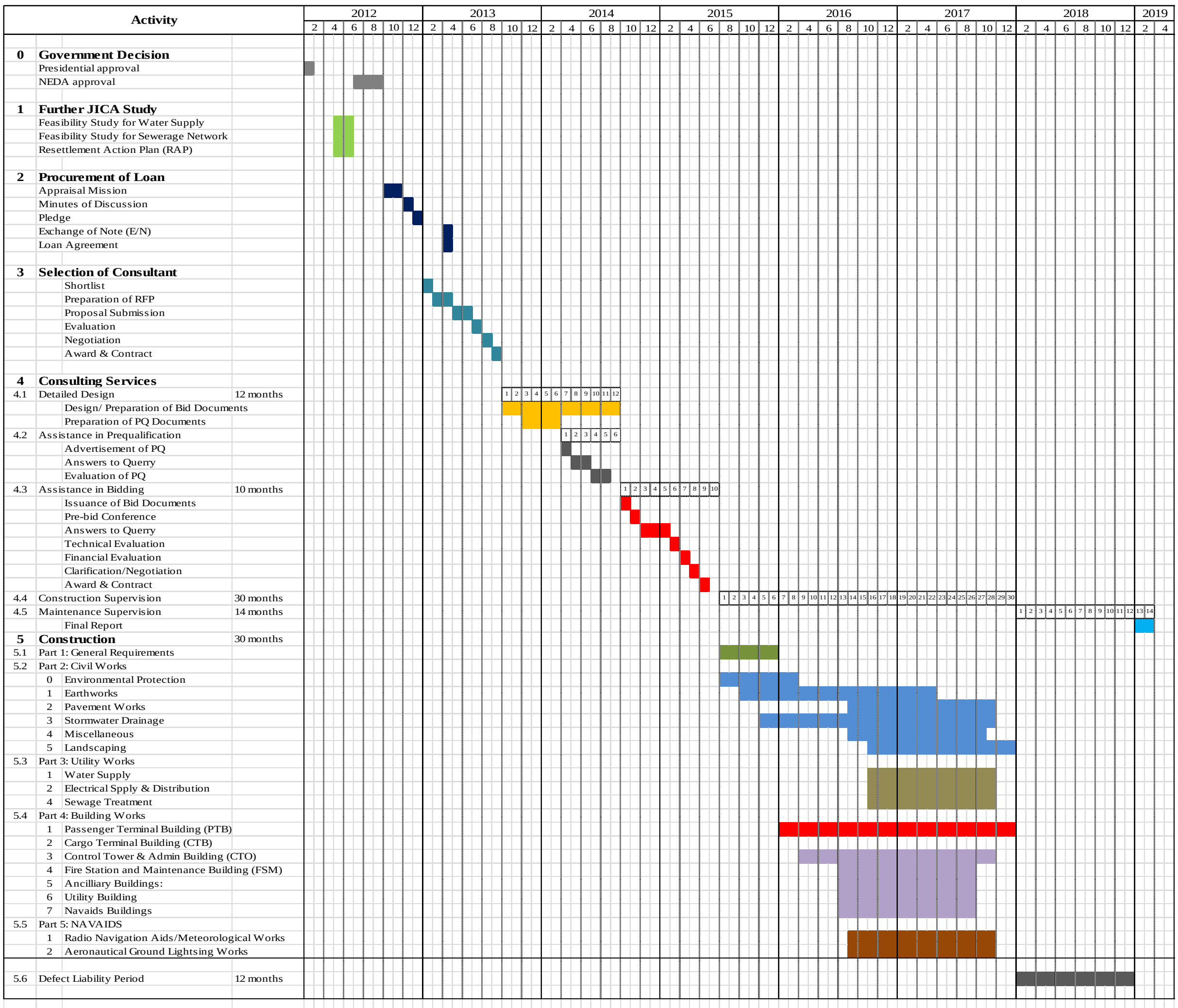
c) The Project consultant could be selected the Government by the 3rd quarter of 2013, then detailed design would be carried out by the consultant.

d) Prequalification of the applicants could be processed from the 2nd quarter, followed by the bidding process which could be completed by the 2nd quarter of 2015.

e) The construction is assumed to be completed in 30 months by the end of 2017.

For the purpose of this Final Report, the Project is proposed to be implemented as shown in Table 6.3-1.

Table 6.3-1 Project Implementation Schedule



Source: JICA Study Team

6.4. Project Cost Estimate

In 2011, the Exchange Rate of the Japanese Yen versus the US Dollar has been highly fluctuating, i.e. between US$ 1.0 = Yen 76.0~86.0 due to an unstable worldwide economy, where future fluctuation is unpredictable. While, the Exchange Rate of Philippine Peso versus the US Dollar has been stable, i.e. between US$ 1.0 = Php 41.5~42.5.   For the purpose of this Final Report, the exchange rate of Php 1.0 = Yen 2.0 is assumed.

JICA assumes that the escalation rates for the coming years are 4 % for Philippine Peso, and 1.6 % for Japanese Yen, the same are applied for the period of the Project Implementation from 2012 to 2118.

The difference in the Project Cost for the original Phase 2, the original Phase 1 and the Cost Saving Scenario-Phase 1 is summarized as shown in Table 6.4-1.

Table 6.4-1 Summary of Project Cost ('000)
Original Phase 2, Original Phase 1 and Cost Saving Scenario-Phase 1

Description		Original Phase 2	Original Phase 1	Cost Saving Scenario-Phase 1
Base Cost	Base Construction Cost	5,828,184	4,977,566	4,164,553
	Contingency: 5 %	291409	248,878	208,228
	subtotal	6,119,593	5,226,444	4,372,780
	Consultancy	887,341	757,834	714,335
	Total	7,006,934	5,984,278	5,087,115
Project Cost including 12 %VAT and Price Escalation	Construction Cost with VAT	6,527,566	5,574,873	4,664,299
	Contingency: 5 %	326,378	278,744	233,215
	subtotal	6,853,944	5,853,617	4,897,514
	Consultancy	988,751	844,444	796,313
	Total	7,842,695	6,698,061	5,693,827
	Provision for Future Price Escalation From 2011 to 2018	1,084,353	894,733	763,242
	Grand Total	8,927,048	7,592,794	6,457,069

Source: JICA Study Team

Chapter 7

Project Viability Review

Table of Contents

Chapter 7. Project Viability Review

7.1. Financial Analysis

7.1.1. Introduction

The objective of financial analysis is to evaluate whether or not the implementation of the Project is feasible and viable for the project executing body under its financial circumstances. The financial benefit from the project is figured out through computation of financial internal rate of returns (FIRR).

7.1.2. General Assumptions

1) Revenues and expenditures are estimated at the constant price as of 2011 in Philippines Pesos (Php).

2) Price escalation is not taken into account in financial analysis, and it has been assumed that the general increase of the prices will equally affect the costs and revenues.

3) The New Bohol Airport is expected to become operational in 2018.

4) The project evaluation period is assumed to be 30 years upon commencement of the operations in 2018, i.e. until 2047.

7.1.3. Financial Cost

The Financial costs of the Project consist of the following:

- Project implementation costs (Construction cost)
- Operating expenses for PTB and CTB (land side)
  - Administration cost (Wage, SSS, AD)
  - Maintenance and Replacement cost
  - Water and Electricity
- Operating expenses for air side
  - Administration cost (Wage, SSS, AD)
  - Maintenance and Replacement cost
  - Water and Electricity

7.1.4. Financial Revenue

The Financial revenues of the Project consist of the following:

- Airfield revenue
  - Landing fee
  - Parking Fee
  - Lighting charge
  - Air navigation charge
  - Royalty fee

- Vehicle parking fee

➢ Passenger terminal revenue
- Passenger service charge
- Check-in counter rental
- Tacking fee
- Floor rental
- Concession privilege fee
- Advertising
- Other fees and charges

➢ Cargo terminal revenue
- Floor rental
- Royalty fee

➢ Sale of the existing airport property

7.1.5. Financial Internal Rate of Return

Particulars of each case studied are as shown in Table 7.1-1.

Table 7.1-1 Particulars of the Cases

	Case	Develop-ment	Runway (m)	ILS	PTB (m^2)	CTB (m^2)	PBB	Solar Power	FFV	Revenue considered		
										Pax	Cargo	PBB
Original Scenario	1	Up to Phase 1	2,110	Yes	9,761	None	3	None	None	All	None	All
	2	Up to Phase 2	2,500	Yes	15,470	1,500	3	None	2	All	after Phase2	All
Cost Saving Scenario	1	Up to Phase 1	2,000	None	8,271	None	None	Yes	None	All	None	None
	2	Up to Phase 2 Stage 1	2,000	None	11,903	1,500	None	Yes	2	All	after Phase2	None
	3	Up to Phase 2 Stage 2	2,500	Yes	16,318	1,500	3	Yes	2	All	after Phase2	after Phase2

Source: JICA Study Team

Cumulative revenue and expenditures, and FIRR for 30 years of the Project Evaluation Period for each case are as shown in Table 7.1-2.

Table 7.1-2 Revenue, Expenditure and FIRR (30years)

	Case	Develop-ment	Revenue (2018-2047)	Investment	O&M cost (2018-2047)	Net Cash Balance	FIRR
Original Scenario	1	Up to Phase 1	P 14,531 mil	P 6,698 mil	P 5,581 mil	P 2,251 mil	**1.85%**
	2	Up to Phase 2	P 14,602 mil	P 7,843 mil	P 5,581 mil	P 1,178 mil	**0.97%**
Cost Saving Scenario	1	Up to Phase 1	P 14,172 mil	P 5,694 mil	P 4,414 mil	P 4,064 mil	**3.63%**
	2	Up to Phase 2 Stage 1	P 14,263 mil	P 6,172 mil	P 4,414 mil	P 3,677 mil	**3.22%**
	3	Up to Phase 2 Stage 2	P 14,492 mil	P 7,414 mil	P 4,414 mil	P 2,663 mil	**2.31%**

Source: JICA Study Team

Sensitivity analysis of the FIRR is made as shown in Table 7.1-3.

Table 7.1-3 Sensitivity Analysis (FIRR)

	Case	Conditions	Base Case	Negative Case	
		Investment	+/- 0 %	+ 10 %	+ 20 %
		O & M Cost	+/- 0 %	+ 10 %	+ 20 %
		Revenue	+/- 0 %	- 10 %	- 20 %
Original Scenario	1	Up to Phase 1	1.85 %	- 0.36 %	- 2.76 %
	2	Up to Phase 2	0.97 %	- 1.37 %	- 3.96 %
Cost Saving Scenario	1	Up to Phase 1	3.63 %	1.47 %	- 0.73 %
	2	Up to Phase 2 Stage 1	3.22 %	1.05 %	- 1.17 %
	3	Up to Phase 2 Stage 2	2.31 %	0.03 %	- 2.33 %

Source: JICA Study Team

Judging from the above sensitivity analysis, none of the above cases has arrived at positive FIRR value when the worst case (i.e. cost +20%, Revenue -20%) is considered.
Those low FIRR values are due to the following background:

- The new Bohol Airport is used mainly for domestic operations (approximately 90 %), while international operations are only 10 %, in terms of the number of total passengers in 2030.
- Revenues at the Airport are computed based on the current NAIA tariff structure, in which particularly the domestic tariff rates are so much discounted.
- Basically, the airport revenue consists of 72 % as passenger terminal revenue and 28 % for airfield revenue. 80% of the passenger terminal revenue is levied from Passenger Terminal Fee (PSC: Php 200 for domestic and Php 500 for international departing passengers) which seems to be attractive income for the Airport.
- 78% of the airfield revenue is landing fee, however, the domestic landing fee is 45% of that for international (e.g. in case of the same A320 landings, Php 7,824 for domestic while Php 17,342 for international).
- Parking fee is collectible only when aircraft spend more than an hour for aircraft handling. However, currently all airlines are encouraged to keep 30 minutes turn-around time, hence only a minimal number of spots are estimated to earn the overnight parking fee.
- Simple simulation is made as to if the domestic landing fee were raised to be the same level as international landing fee (e.g. increased by 2.2 times), the above FIRR value in either case could not be raised by more than 2 %; This would not improve the status of financial viability mentioned above.
- At the moment DOTC is reluctant to agree with the raise of tariff to be more than NAIA, because the matter is fully dependent upon CAAP and Congress approval.

Meanwhile, considerably higher EIRR value could be computed through the Economic Analysis (in the next section), by which the Project is evaluated to be highly viable from the view point of national economy.
Therefore, it is suggested as one of the best solutions, that the Project is implemented with a finance of ODA loan with the lowest interest and longer amortization period.

7.2. Economic Analysis

7.2.1. Introduction

The objective of economic analysis is to evaluate whether the implementation of the Project would be given a viable benefit from the viewpoint of the national economy. The economic benefit from the Project is figured out through computation of economic internal rate of returns (EIRR).

In order to figure out the net economic benefits, it is normally focused into the difference in economical productivity between the case with implementation of the Project (With Project Case) and the case without implementation of the Project (Without Project case).

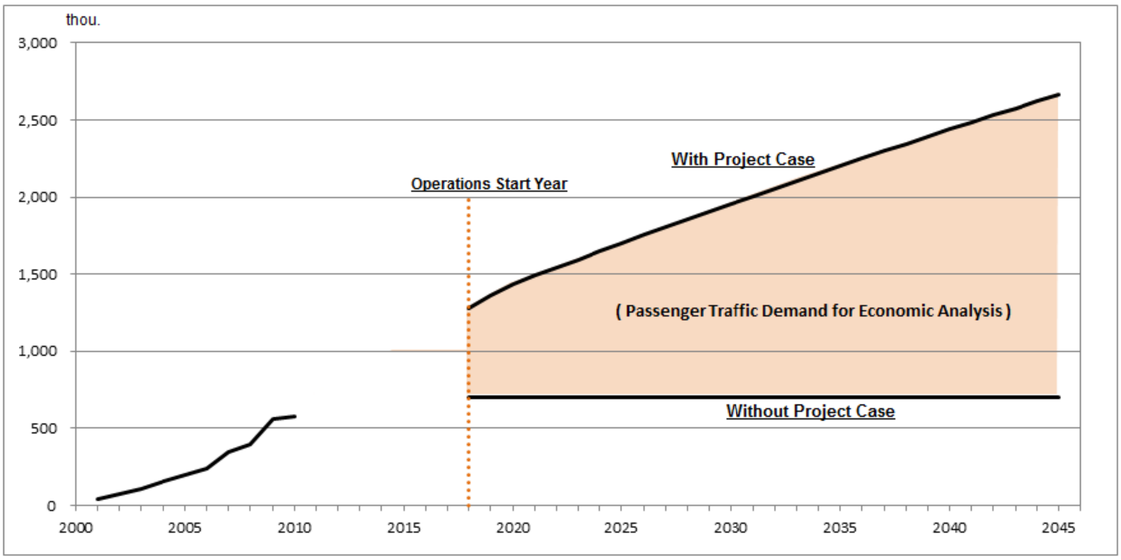
7.2.2. General Assumptions

1) With Project Case and Without Project Case

The expected return of the Project should be evaluated as incremental revenues attributable to improvement of the facilities. Consequently, revenues and costs should be compared between the following two cases.

<u>With Project Case</u> :
The Project will be implemented and the airport capacity will be expanded to cope with air passengers up to 2047.

<u>Without Project Case</u> :
No investments will be made on the existing facilities. Capacity limit of the existing airport is set at 700,000 passengers, thereafter no increase in traffic is assumed.



Source: JICA Study Team

Figure 7.2-1 Passenger Traffic Demand for Economic Analysis
(With Project Case and Without Project Case)

2) Project Costs and Revenues

All of the costs and revenues are estimated at the constant price as of 2011 in Philippines Peso (Php).

3) Project Evaluation Period

The New Bohol Airport is expected to become operational in 2018.
In this analysis, the project evaluation period is assumed to be 30 years upon commencement of the operations, i.e. until 2047.

7.2.3. Economic Cost

The implementation costs of the Project follow as result of Chapter 6.

7.2.4. Operating and Maintenance Costs

The operating and maintenance cost has been estimated as incremental cost.

The operating and maintenance cost of existing airport (Without Project Case) has been estimated using some ratio as follows:

Table 7.2-1 Ratio of Existing Airport / New Airport

(for estimate the operating and maintenance case in without project case)

Organization (Num. of Personel)

Tagbiralan Airport (Existing Airport)		New Bohol Airport			
		Airside (public potion)		Landside (private potion)	
Permanent	14	General Manager	1	General Manager	1
Casual	11	Assistant Manager	1	Assistant Manager	1
Job order	25	Finance & Admin.	3	Director	3
		Planning & Engi.	3	Administration	4
		Operation	18	Financial	5
		Maintenance	12	Facility & IT	5
		Safety Office	13	Operations	6
				Engineering	4
Total	50	Total	51	Total	29
Permanent	14			Graund Total	80
				(1) Tagbiralan / New Bohol	17.5%

Airport Facility (PTB)

	PTB (sq.m)
Tagbiralan Airport	850
New Bohol Airport (*1)	15,470
(2) Tagbiralan / New Bohol	5.5%

(*) excluding CTB

Airport Facility (Land)

	Land (sq.m)
Tagbiralan Airport	230,000
New Bohol Airport	2,035,000
(3) Tagbiralan / New Bohol	11.3%

Tagbiralan / New Bohol (Ratio)

(1) Personel	17.5%
(2) PTB	5.5%
(3) Land	11.3%
Average	11.4%

Source: JICA Study Team

In this study, the operating and maintenance cost of existing airport (Without Project Case) has been estimated using the average ratio (11.4%).

7.2.5. Economic Benefits of the Project

From the view point of national and regional economic, the following major categories of benefits have be considered for this analysis.

Benefits for the Philippines

- Cost saving of Filipino travelers
- Consumption by foreign travelers
- Revenue from foreign airlines
- Cost saving of local airlines
- Economic benefits by reusing land of existing Tagbiralan airport

1) Cost Saving of Filipino Travelers

In the absence of the existing Tagbiralan airport capacity, the next alternative of incremental Filipino passenger (overflowed Filipino passenger) travels using Manila-Cebu air route complemented by Cebu-Tagbiralan sea route. This travel diversion entails additional transportation cost calculated as follows:

Additional Transportation Cost per Passenger
= Additional Transportation Time x Time Value + Additional Transportation Fare

The comparison of the transportation cost and travel time for With Project Case and Without Project Case have are estimated as follows:

Table 7.2-2 Comparison of Travel Routes

case	mode	route	daily operation frequency	daily passenger capacity	average travel time (min/one way)	average fare (Php/one way)
With Project	Air	Manila - Tagbiralan	18	2,880	78	3,190
Without Project	Air	Manila - Cebu	52	8,320	73	2,422
	Ship	Cebu - Tagbiralan	15	4,012	118	483
	others	check out at Cebu airport	-	-	20	-
		from airport to port in Cebu	-	-	30	100
		check in at Cebu port	-	-	20	-
	Total		-	-	261	3,006

Source: JICA Study Team

The time value has calculated using labor productivity of the Philippines as follows:

Table 7.2-3 Time Value of Filipino Travelers

	Philippines		NCR		Region VII		Ave.of NCR & R-VII	
	Php/person	G/R (%)	Php/person	G/R (%)	Php/person	G/R (%)	Php/person	G/R (%)
2008	217,354	-	672,147	-	193,368	-	432,758	-
2009	219,016	0.76	675,907	0.56	193,840	0.24	434,874	0.49
2010	236,165	7.83	-	-	-	-	456,647	5.01

holyday	17 days	working days	243 days	working hrs	7.5 hrs/day	Time Value	250.56 Php/hr.

Source: JICA Study Team

The incremental Filipino passenger (overflowed Filipino passenger) traveled using the next alternative route has been estimated using percentage as follows:

Percentage based on passenger survey

- Percentage of Bohol residents : 66.7% (see Table 3.1-2)
- Percentage of Filipino passenger (Bohol residents) traveled using the next alternative route : 77.8%
- Percentage of Filipino passenger (other residents) traveled using the next alternative route : 53.7%

Table 7.2-4 Result of Air Passenger Survey (1)

		Arriving Passengers		Departing Passengers		Total	
categories	items	Frequency	Share (%)	Frequeny	Share (%)	Frequeny	Share (%)
Purpose	to Home	32	37.65	54	49.54	86	44.33
	to Works	12	14.12	9	8.26	21	10.82
	to School	3	3.53	11	10.09	14	7.22
	Social Visit	6	7.06	11	10.09	17	8.76
	Business	2	2.35	11	10.09	13	6.70
	Sub-total	-	-	-	-	-	77.84
	Leisure	28	32.94	11	10.09	39	20.10
	others	2	2.35	2	1.83	4	2.06
Total		85	100.00	109	100.00	194	100.00

Source : Feasibility Study for The Panglao Island Airport Development Project (Oct.2007)

Table 7.2-5 Result of Air Passenger Survey (2)

		1st Survey (5.13)		2st Survey (7.9&14)		Total	
categories	items	Frequency	Share (%)	Frequency	Share (%)	Frequency	Share (%)
Nationarlty	Domestic	43	71.67	47	61.84	90	66.18
	Chinese			2	2.63	2	1.47
	U.S.A	11	18.33	10	13.16	21	15.44
	Korean			4	5.26	4	2.94
	others	6	10.00	13	17.11	19	13.97
Purpose	Leisure	43	71.67	54	71.05	97	71.32
	Business	9	15.00	9	11.84	18	13.24
	VFR (*1)	6	10.00	11	14.47	17	12.50
	MICE (*2)	2	3.33	2	2.63	4	2.94
Spend Money per head		39,851 Php		28,391 Php		**33,575 Php**	
Trip Visit	only Bohol	32	53.33	41	53.95	73	**53.68**
	others	28	46.67	35	46.05	63	46.32
Total		60	100.00	76	100.00	136	100.00

VFR (*1) : Visiting friends and relatives

MICE (*2) : Meeting, Incentive, Convention and Exhibition

Source: JICA Study Team

2) Consumption by Foreign Visitors

Based on the result of passenger survey done in this study, the consumption by foreign visitors has been estimated as follows:

Average Consumption by Foreign Visitors to Bohol : 33,575 Php/visitor (see Table 7.2-5)

The incremental foreign passenger (overflowed foreign passenger) canceled the travel to the Philippines has be estimated using percentage as follows:

Percentage of Foreign Visitors canceled the visit to Bohol: 53.7% (see Table 7.2-5)

3) Revenues from Foreign Airlines

Revenues from foreign entities (i.e. Foreign Airlines) are assumed to contribute to the national economy. Normally, international flights are allotted based on the bi-lateral agreement between the two Countries (or the Area), therefore, 50 % of the international aeronautical revenues are counted for.

a) Aeronautical Revenues

The following aeronautical revenue from foreign airlines has been counted as economic revenues:

- Landing Fee : 50% of international flights
- Parking Fee : 50% of international flights
- Lighting Charge : 50% of international flights operated in night (18:00-06:00)
- Air navigation Charge : 50% of international flights

b) Passenger Terminal Revenue from Foreign Airlines

The following Terminal Revenues from foreign airlines has been counted as economic revenues:

- Check-in Counter Rental : 50% of international facilities
- Tacking Fee : 50% of international facilities
- Floor Rental : 50% of international facilities

4) Cost Saving of Local Airlines

The delay of arriving time and departing time on existing Tagbiralan airport will be disappeared on new Bohol airport. The needless operating cost of local airlines has been calculated as follows:

Table 7.2-6 Estimated Aircraft Delay Costs in LCC in Asia

(in Php per munite, 2007 prices)

	Low-cost carrier's (LCC) cost avantage	LCC's cost of delay, without network effect (in EU/minute, 2006 prices)		LCC's cost of delays, without network effect (in Php/minute, 2007 prices)	
		Ground	Airborne	Ground	Airborne
Fuel costs	12.90%	0.87	13.07	56.85	852.82
Maintenance costs	12.90%	0.87	0.87	56.85	56.85
Crew costs	33.30%	6.00	6.00	391.85	391.85
Passenger compnsation (*)	15.40%	11.84	11.84	773.12	773.12
Direct cost to an airline		19.59	31.78	**1,278.68**	**2,074.64**

notes : Cost advantage based on IBM Consulting Service, 2004, "Winning at the margin: The impact of low-cost carriers in Asia"

Exchange rates based on BSP statistics

(*) insurance, refund, etc.

Source : Feasibility Study for The Panglao Island Airport Development Project (Oct.2007)

Table 7.2-7 GDP Deflation in the Philippines

Subject Descriptor	Gross domestic product, constant prices			
	Billion pesos	Percent change	Index	
2007	1,366.625	7.1%	**486.50**	
2008	1,417.087	3.7%	522.86	
2009	1,432.117	1.1%	536.19	
2010	1,532.994	7.0%	559.42	
2011	1,601.343	4.5%	**581.99**	**1.1963**

Source : IMF

Table 7.2-8 Estimated Aircraft Delay Costs

	LCC's cost of delays **(in Php/minute, 2011 prices)**	
	Ground	Airborne
Fuel costs	68.01	1,020.22
Maintenance costs	68.01	68.01
Crew costs	468.76	468.76
Passenger compnsation	924.87	924.87
Direct cost to an airline	**1,529.66**	**2,481.86**

Average Delay Time per Day	15 min	15 min
Average Cost per Day	22,945 php	37,228 php
Daily Cost	60.17 thou.php	
Annual Cost	**21,963 thou.php**	

Rem.) Average delay time per day has been estimated from present air flight diagram in existing Tagbiralan airport.

Source: JICA Study Team

5) Economic Benefits by Reusing Land of Existing Tagbiralan Airport

The 23ha (230,000 sq.m) land of existing Tagbiralan airport will be freed up for other economic uses. The economic benefits have been calculated as approximately opportunity cost of the land based on following terms:

Table 7.2-9 Estimated Opportunity Cost of the Land

Land of existing airport	230,000	sq.m
80% of commercial land price in Tagbilaran	4,000	php/sq.m (= 5,000 x 0.8)
Opportunity cost of Land	920,000	thou.php

Source: JICA Study Team

7.2.6. Result of Analysis

Upon the review and update of the air traffic demand forecast, the project cost (for this cost saving scenario), projection of expenditure and economic benefit, the Economic Internal Rate of Return (EIRR) have been evaluated.

Corresponding to the forgoing financial analysis, the economic analyses are made on the following 5 cases:

Table 7.2-10 Particulars of the Cases

	Case	Develop-ment	Runway (m)	ILS	PTB (m^2)	CTB (m^2)	PBB	Solar Power	FFV	Revenue considered		
										Pax	Cargo	PBB
Original Scenario	1	Up to Phase 1	2,110	Yes	9,761	None	3	None	None	All	None	All
	2	Up to Phase 2	2,500	Yes	15,470	1,500	3	None	2	All	after Phase2	All
Cost Saving Scenario	1	Up to Phase 1	2,000	None	8,271	None	None	Yes	None	All	None	None
	2	Up to Phase 2 Stage 1	2,000	None	11,903	1,500	None	Yes	2	All	after Phase2	None
	3	Up to Phase 2 Stage 2	2,500	Yes	16,318	1,500	3	Yes	2	All	after Phase2	after Phase2

Source: JICA Study Team

EIRR are summarized with its sensitivity analysis as shown in Table 7.2-11.

Table- 7.2-11 Economic Analysis (EIRR) with Sensitivity Analysis

	Case	Conditions	Base Case	Negative Case	
		Construction	+/- 0 %	+ 10 %	+ 20 %
		O & M cost	+/- 0 %	+ 10 %	+ 20 %
		Benefit	+/- 0 %	- 10 %	- 20 %
Original Scenario	1	Up to Phase 1	26.25 %	22.58 %	19.32 %
	2	Up to Phase 2	26.10 %	22.39 %	19.09 %
Cost Saving Scenario	1	Up to Phase 1	29.70 %	25.60 %	21.92 %
	2	Up to Phase 2 Stage 1	29.49 %	25.36 %	21.71 %
	3	Up to Phase 2 Stage 2	29.34 %	25.16 %	21.46 %

Source: JICA Study Team

As a result, the EIRR has been calculated as over 26 % for each base case, and even in the worst case (i.e. cost +20%, benefit -20%) the EIRR is calculated as over 19 %.

Based on the result, the New Bohol Airport Development Project even with its full-scale development (Phase 1 and Phase 2 combined) has been evaluated to be highly viable from the view point of national economy.

Chapter 8

Environmental and Social Consideration

Table of Contents

Chapter 8. Environmental and Social Consideration

8.1. Outline of the EIA Study

8.1.1. Background

The construction of the New Bohol Airport at Panglao Island is considered very important, since it would replace the existing airport, in Tagbilaran City in mainland Bohol, which is very dangerous without enough buffers between the runway and surrounding houses and infrastructure.

For the project, environment and social consideration study carried out by DOTC in 2000 and DOTC formulated EIA report and which was approved by DENR (EMB). The ECC has been issued in 2003 and extended availability of the document by 2013. In this study, the EIA report and ECC conditions will be reviewed and the consistency of the JICA Guidelines for Environmental and Social Considerations, April 2010 (hereinafter referred to as “the JICA Guidelines”), also will be confirmed.

8.1.2. Compliance with JICA Guidelines

An EIS (Environmental Impact Statement) for the Proposed Panglao Airport Project was prepared in 2000 by which an ECC (Environmental Clearance Certificate) was issued by DENR (Department of Environment and Natural Resources) in 2003. The ECC existed for more than 5 years of the term of validity, with the result that a renewal procedure of the ECC has been made to extend the validity.

Contents written in the EIS shall be reviewed and be made a comparative study for identifying the discrepancy and misfit between the EIS and items indicated in the JICA Guidelines.

Thereby insufficient contents and items in the EIS which have not been fulfilled in the JICA Guidelines will be amended and updated; conclusively a revised draft Environmental Impact Statement (Assessment) Report on the new Bohol airport construction project will be elaborated in accordance with PEISS (Philippines Environmental Impact Statement System) and the JICA Guidelines in the JICA study.

8.2. National and Local Laws and Regulations on Environmental and Social Considerations

8.2.1. Environmental Administrative Management Organizations

Environmental Administration is managed by Department of Environmental Natural Resources (DENR). DENR’ duties are to manage the balance between development and environmental management. DENR has around 35,000 staffs; around 5,000 staffs are in head office and around 30,000 are in regional offices.

Environmental Impact Statement system, pollution control and environmental management are under controlled by Environmental Management Bureau (EMB) which is one of the

DENR organizations. EMB is authorized to issue of Environmental Compliance of Certificate (ECC). EMB has around 170 permanent staffs including regional office.

8.2.2. Laws and Regulations of Environmental and Social Consideration

To specify the relevant laws, decrees, and orders and standards on Environmental and Social Consideration (including Environmental Impact Assessment, Public Participation, information Disclosure and others) both in the central and local levels including newly amended and revised ones. The following shows the principal ones on environment:

- Presidential Decree (PD) No. 1151: Philippine Environmental Policy
- Presidential Decree (PD) No. 1586: Establishing an Environmental Impact Statement System including other Environmental Management Related Measures and Other Purposes
- DENR Administrative Order (DAO) 1992 No. 21:Amending Rules and Regulations implementing PD No. 1586
- DENR Administrative Order (DAO) 1996 No. 37: Revising DENR Administrative order No. 21 series of 1992, to Further Strengthen the Implementation of the Environmental Impact Statement (EIS) System
- DENR Administrative Order(DAO) No. 2000-05 Series of 1994 (Revised): Revising DENR Administrative Order (DAO) No. 94-11, Supplementing DENR Administrative Order No. 96-37, Series of 1996, and Providing for Programmatic Compliance Procedures within The Environmental Impact Statement (EIS) System
- DENR Administrative Order (DAO) 2003-30: Implementing Rules and Regulations (IRR) for the Philippine Environmental Impact Statement (EIS) System

To review of relevant procedures on the Philippines Environmental Impact Statement Systems (PEISS), Requirements for Environmental Impact Assessment System and Revised Procedural Manual including Information Disclosure systems and others.

8.2.3. Philippine Environmental Impact Statement System (PEISS)

Legal basis of Environmental Impact Assessment in Philippines is as follows.

To confirm legal systems was conducted to interview Department of Environment and Natural Resources (DENR), Environmental Management Bureau (EMB).

Philippines enact EIA systems, and they named generically PEISS (Philippine Environmental Impact Statement System).

For conducting EIA is based on kind of project and located area. The Project which have been declared as Environmentally Critical Projects or projects in Environmentally Critical Areas must have Environmental Compliance Commitment (ECC), and proponent have to conduct EIA. There are seven (7) major EIA report types which depend on kind of project (Table 8.2-1).

According to Revised Procedural Manual for DAO 03-30, the project is classified by project type, capacity and location. Reference is as follows;

<u>Environmental Critical Projects: ECPs or Non-Environmentally Critical Projects: NECPs</u>

ECP projects are defined in Proclamation No.2146 (1981)) as follows;

The steel industry, heavy chemical industry, petrochemical industry, mining industry, large scale deforestation, large-scale fish farming, large scale dam, electricity industry, large scale land development, etc.

<u>Environmental Critical Areas: ECAs or Non-Environmentally Critical areas: NECAs</u>

Area of ECA is also defined in Proclamation No.2146 (1981)) as follows;

National Park, Protected Area, Historical Area, Aborigines Area and etc.

The flowchart of EIA process is shown in Figure 8.2-1.

Table 8.2-1 Type of EIA Report

Type of Report		Description
(1)	Environmental Impact Statement (EIS)	The project correspond to; ● have been declared as Environmentally Critical Projects(ECPs) and projects in Environmentally Critical Areas(ECAs), ● have declared as Non-ECPs and in ECAs, ● locate ECAs and Non-ECAs
(2)	Programmatic EIS	
(3)	Initial Environmental Examination Report (IEER)	
(4)	IEE Checklist (IEEC)	
(5)	Project Description Report(PDR)	Requirement for Certificate of Non Coverage (CNC) of EIA. The Project should be Non-ECPs and located in ECAs or Non-ECAs.
(6)	Environmental Performance Report and Management Plan (EPRMP)	For operating projects with previous ECCs but planning or applying fore clearance to modify/expand or re-start operation, or for the projects operating without an ECC.
(7)	Programmatic EPRMP（PEPRMP）	

Source: Revised Procedural Manual(EMB-Environmental Impact Assessment and Management Division: EAIMD, August 2007)

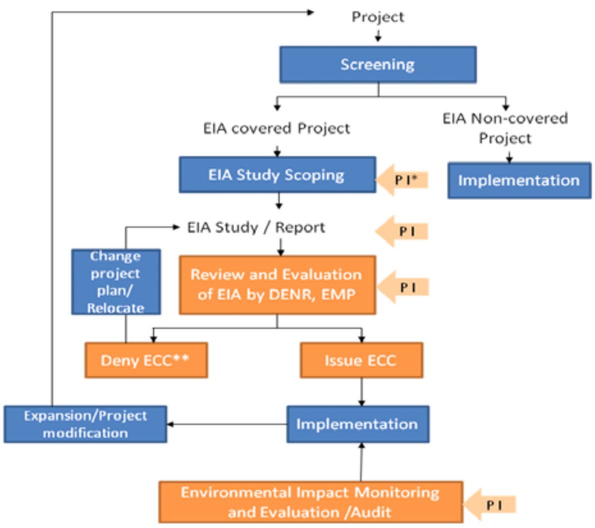


Figure 8.2-1 Flowchart of EIA

8.2.4. ECC Conditions of the Project

The Environmental Management Bureau (EMB) of Department of Environment and Natural Resources, Region VII issued Environmental Compliance Certificate (ECC) in 4th, June 2003. The ECC is in compliance to the requirements of presidential Decree No.1586, in accordance to Department Administrative Order No.2003-30. The ECC is valid for five years, DOTC submitted the documents to EMB to extent the ECC in 2008. EMB issued again new ECC in 3rd, June 2008. The reissued ECC is valid until 2nd, June 2013. The number of ECC is R07-0804-0133-25.

The ECC shows the major conditions as follows;

<u>A. Environmental Management and Monitoring Plan (EMMoP)</u>

- to ensure all commitments, appropriate mitigating/enhancement measures and monitoring requirements,

- to establish 200,000 seeding within 6 months after project implementation,

- to establish and deposit Environmental Guarantee Fund (EGF), an EGF is required to be established for all co-located or single projects that have been determined by DENR to pose a significant public risk or where the project requires rehabilitation or restoration,

- to create Multi-partite Monitoring Team (MMT) and establish Environmental Monitoring Fund (EMF), the EMF is a fund that a proponent establishes in support of the activities of the MMT.

- to continue Information, Education and Communication (IEC) Program to explain to all stakeholders the condition of ECC,

- to submit an updated Project Environmental Risk Categorization and

- Submit an Abandonment Plan to EMB.

<u>B. General Conditions</u>

- to conform with applicable provisions of RA 6969, RA 8749, RA 9003 and RA 9275 in operation stage,

- to monitor actual project impact

- to submit semi-annually an ECC Compliance Report

- to prepare billboard

8.2.5. The Gaps between PEISS and JICA Guideline

The major Gaps between PEISS and JICA Guideline are as follows;

(1) Disclosure System of EIS Report

PEISS prescribes haw to prepare public consultations, stakeholder meetings to gather opinions from residents and stakeholders widely. However, disclosure system of scoping result and final EIA report does not regulated.

(2) Evaluation system of Scoping Result and Final EIS

Evaluation of scoping result and final EIS is carried out by internal committee usually. Evaluation by third party is special case in the Philippines.

(3) Development in National Parks

It is possible that the development project can be implemented in National Parks follow official procedure prepared by EMB.

8.3. Study Results

8.3.1. Outline of the Study Area

1) Location

Panglao Island is located in the southwestern portion of Bohol Province in Central Visayas in the Philippines. It is particularly located at 123’48’21 east longitude and 9’32.871’ north latitude. The travel time from Tagbilaran City is just 30 minutes away from the mainland Bohol.

(Source: Eco-Tourism development Plan for Panglao Island, 2008, Provincial Government of Bohol)

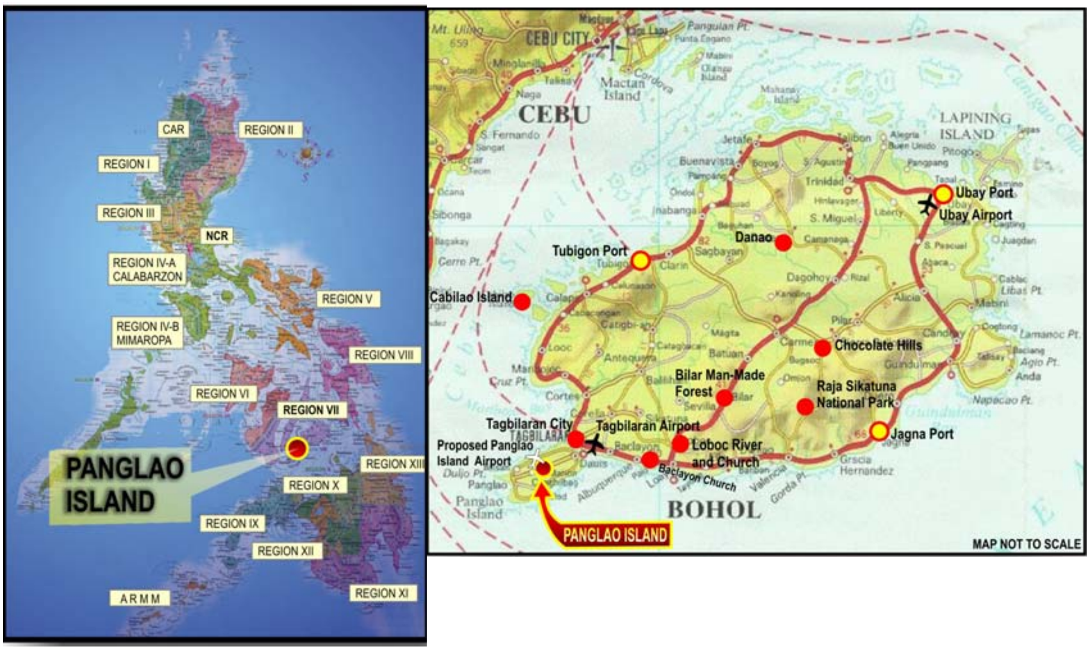


Figure 8.3-1 Location Map of Panglao Island

Project Area is located in south-west area of Panglao Island, the island is connected to Bohol Island by two course ways. Site area for new airport is 229.18 hectares. The site is selected from three alternatives by the EIS Study in 2000.

Figure 8.3-2 Project Area

2) <u>Outline of Panglao Island</u>

Panglao Island is consist of two (2) municipalities, Municipality of Panglao and Dauis, quick facts of tow municipalities are shown in Table 8.3-1.

Table 8.3-1 Outline of Panglao and Dauis Municipality

Quick Facts on the Municipality of Panglao:

Land Area: 5,049.48 hectares
Ethymology: originated from a fishing deviccalled "Panggaw" which is later known as Panglao
Coastline: 28.17 kilometers
Soil Cover: Bolinao Clay
Population (2007 Census): 25,558
Population Density: 5.06 persons per hectare
Number of Households: 3,890
Annual Growth Rate: 2.52%
Literacy Rate: 92%
Political Subdivision: 1st District, 10 Barangays, only one inland barangay
Economy: Fishing, Low Intensity Farming, Tourism
Tourism Values:
Total Tourist Visitation in the Municipality(2008): 1,837,585
Number of Resorts: 53 establishments (85% resorts, 4% hotel & resorts, 10% lodging houses, 2% cottages, 2% inns)
Tourist Attractions and Establishments:

Alona Beach	Bohol Beach Club
Bolod Beach	Eskaya Beach Resort
Doljo Beach	Ananyana Beach Resort and Spa
Libaong Beach	Balicasag Island Marine Sanctuary
Panglao Watchtower	

Distance from Tagbilaran City: 18 kilometers (from easternmost barangay)
Infrastructure:
Road Network: 96.136 kilometers
Potable Water Demand:
2,693 cubic meters per day (cum/d), CY 1998
7,474 cum/d (Projected CY 2030)
Main Potable Water Source: Groundwater

Quick Facts on the Municipality of Dauis:

Land Area: 4,457 hectares
Etymology: originated from "Daui", the sound produced by the fisherman and "weese" the sound produced by the line and bobber
Coastline: 21 kilometers
Soil Cover: Bolinao Clay
Population (2007 Census): 36,525
Population Density: 8.2 persons per hectare
Number of Households: 2,669
Annual Growth Rate: 4.74%
Literacy Rate: 93%
Political Subdivision: 12 Barangays, two inland barangays

Tourism Values:
Number of Resorts: 10 establishments
Tourist Attractions and Establishments:

Bikini Beach	Bohol Plaza View Deck
Dauis Museum	Panglao Island Nature Resort
Mount Biking	Riverside Boating
Bee Farm	Hinagdanan Caves

Distance from Tagbilaran City: 3 kilometers

Infrastructure:
Road Network: 92.514 kilometers
Potable Water Demand:
3,107 cum/d, CY 1998
7,670 cum/d (Projected CY 2030)
Main Potable Water Source: Groundwater

3) Topics in the Area

a) Coral Triangle Initiative (CTI)

The Philippines entire country serves as the apex of "Coral Triangle" (CT), which is known as the world's center of marine biodiversity. The CT region is located along equator at the confluence of the Western Pacific and Indian Oceans. Using coral and reef fish diversity as the two major criteria, the boundaries of this region are defined by scientists as covering all or part of the exclusive economic zones of six countries: Indonesia, Malaysia, Papua New Guinea, the Philippines, the Solomon islands and Timor-Lest. Covering only 1.6% of the planet's oceanic area, there is board scientific consensus that the CT represents the global epicenter of marine life abundance and diversity – with 76% of all known coral species, 37% of all known coral reef fish species, 33% of the world coral reefs, the greatest extent of mangrove forests in the world, and spawning and juvenile growth areas for the world's largest tuna fishery. Moreover, the biogeographically conditions within the CT may also enable the region to maintain its exceptional productivity in the face of future impacts of climate change, marking it potentially the world's most important "refuge" for marine life (CTI RPOA 2008).

In 2009, DENR-PAWB (Department of environment and Natural Resources- Protected Area and wildlife Bureau) prepared National Plan of action for Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security. The target year of the plan is 2020, and the plan includes action plan of Philippine Government to achieve the national collaborate goals. Philippines Government organized NCCC (the National CTI Coordination Committee) to implement the action plan. The members of NCCC are consist of DFA (Department of Foreign Affaires), DOF (Department of Finance), NEDA (National Economic and Development Authority), two representatives of NGOs, two representatives of Academic Institutions, representative of Business sector. However, it is not clear budget allocation to do some activities.

b) Bohol Marine Triangle

Background of Bohol Marine Triangle (BMT)

The National Biodiversity Strategy and Action Plan (NBSAP) was endorsed by the Philippine Council for Sustainable Development and eventually approved by the President in 1997. The NBSAP recommended a "Grand Strategy" for conserving marine biodiversity, comprising: (1) users not exceeding carrying capacities, (2) harvest not exceeding sustainable yields, (3) reconfiguring institutions to sustain living systems, (3) learning more about interactions among natural and human systems, and (4) valuing biodiversity as the source of national wealth and sustenance. This was taken into account when designing the BMTP.

In early 1998, the Philippine Congress passed Republic Act 8550, also known as the Philippine Fisheries Code of 1998. This national legislation, among others, defined the extent of municipal waters as 15 kilometers from the coastline, set rules for declaring fish sanctuaries, and mandated their governance through the local Fisheries and Aquatic Resources Management Councils (FARMCs). The RA 8550 provides a policy basis on which effective local governance for coastal and marine biodiversity conservation and sustainable development could spin off. Moreover, the Local Government Code of 1991 provides also some guidance for marine resource conversation. It was noted during the preparatory phase of the BMT Project, though, that the immediate institutional threats to biodiversity were exacerbated by: gaps in local ordinances, guidelines and enforcement; lack of awareness of environmental and natural resources principles and values, due to lack of information and education; limited opportunities or resources for sustainable livelihoods; as well as institutional weaknesses – such as among barangay and municipal FARMCS – combined with lack of coordination among government agencies. Before the project commenced, two fish sanctuaries have been successfully maintained by the local communities in Barangay Pamilacan in Baclayon and Sitio Balicasag (Barangay Poblacion) in Panglao Municipality. Several other marine protected areas (MPAs) have been set up by municipal ordinances, but these were not operational as of 1999 and were called as "paper parks". Thus, when the BMT Project was being conceived, the local implementation of RA 8550 in the 12 coastal barangays of Baclayon, Dauis and Panglao municipalities was still very weak and uneven. Issues that have been threatening the BMT region are complicated by limited livelihood opportunities, low level of awareness of stakeholders, and national and local legislations and policies that have not yet been translated into a locally coherent and effective system of governance for coastal management. Originally, the BMTP was planned as a five-year initiative to devise and set up an effective system for governing and managing the rich marine and coastal resources within the triumvirate of three islands: Panglao, Balicasag and Pamilacan. The system was envisioned not to be part of the National Integrated Protected Areas System (NIPAS), and is, therefore, intended to be managed by a body consisting of local communities, non-government organizations and local government representatives using the Local Government Code of 1991 (RA 7160) and the Philippine Fisheries Code of 1998 (RA 8550) as basic legal framework. There are originally seven strategic outputs for which the project is responsible. A more effective, equitable and sustainable planning, implementation, monitoring and enforcement of biodiversity conservation is established in the project through these outputs:

- strengthened government and community institutions to facilitate application of a coastal management framework, with the establishment and maintenance on marine reserves as a major component;
- development and application of policies and guidelines that will facilitate the elimination of destructive activities
- relevant and reliable information for monitoring and inventory as basis to establish sustainable harvesting
- compliance with environmental guidelines improved through a programme of education and awareness building
- alternative conservation–enabling livelihood activities are sustained through established benefit sharing and revolving fund schemes

- targeted ecosystem rehabilitation will improve overall ecosystem health and contribute to improve well-being of local communities
- an integrated Master Plan for BMT is established and operationalized

The project was designed and executed by a national non-government organization (NGO), the Foundation for Philippine Environment (FPE), in partnership with the Bohol Alliance of NGOs (BANGON). Other key stakeholders were the provincial government of Bohol and the municipal governments of Baclayon, Dauis and Panglao. According to the project document, project management was to be done through a Project Management Office (PMO) at the field level to ensure that the activities agreed upon are implemented as scheduled by the responsible parties. Recognizing that the FPE is a funding and not an implementing institution, the latter launched a search for the appropriate NGO to be the main implementing agent. After a year-long search, it was decided that BANGON would be the NGO that was most suited for the job.

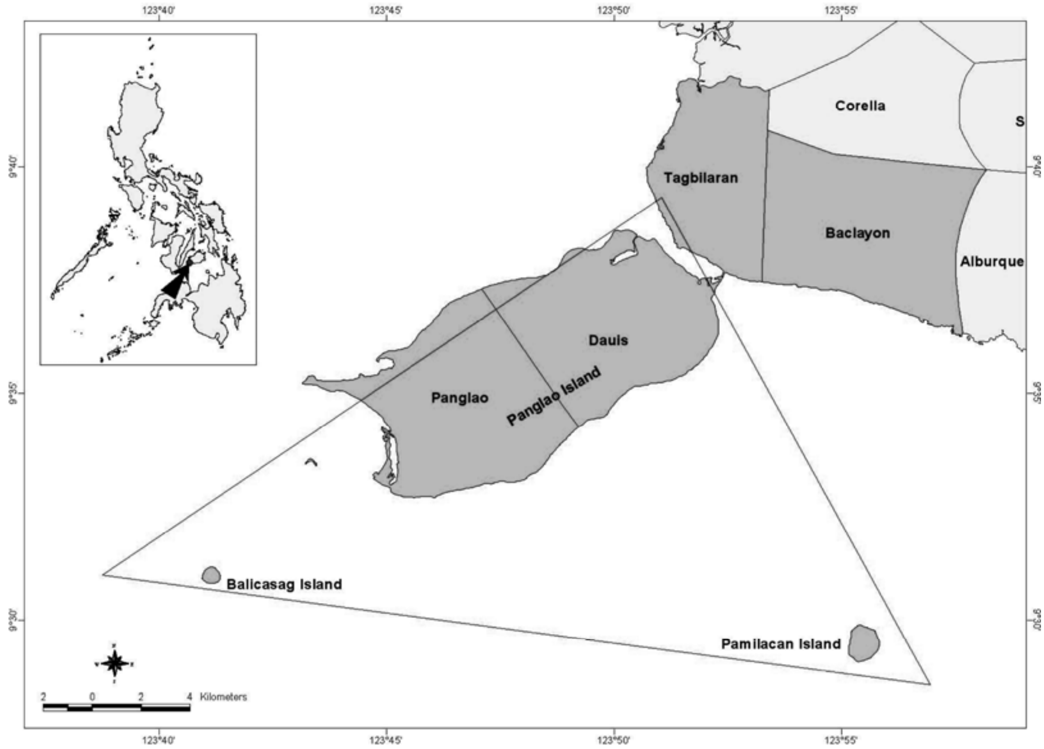
BANGON is a consortium of 16 developmental NGOs that are based in Bohol. Six of them are focused on coastal resource management and possess various expertise that, when put together, offer huge potential for project success. Thus, BANGON was contracted by the FPE in April 2002 to be the implementing arm of the project, along with other NGOs and institutions. Project activities were divided by BANGON among its six member NGOs, with the former also doing secretariat works. When the contract between BANGON and FPE concluded in 2005, the same was not renewed. Instead, project implementation was transferred to the newly-formed PADAYON, which is now the platform for the sustained management of BMT.

In May 2004, a Mid-Term Evaluation (MTE) was commissioned by UNDP to assess the progress of project implementation. The MTE, among others, made comprehensive comments on the project design, and recommended that the project be extended for another year. Thus, instead of ending in 2006, the project ended in June 2007.

(Source: Biodiversity Conservation and Management of the Bohol Islands Marine Triangle Project (UNDP/GEF ATLAS ID 00014471))

Area of BMT

The Bohol Marine Triangle (BMT) spans over 112,000 ha and includes the three islands of Panglao (9,000 ha), Pamilacan (200 ha) and Balicasag (25 ha) in three municipalities of Baclayon, Dauis, and Panglao. The BMT area is significant in terms of biodiversity including: eleven of the 22 species of marine mammals in the Philippines; three of the world's eight species of sea turtles; rare and endangered species of pelagic fishes (whale sharks, mantas and stingrays), seahorses and giant clams; rare shells such as Cones Gloria-maris, Cypraea guttata and Cypraea valentia and several migratory birds. In addition, the coastal ecosystems of the BMT are productive and provide economic opportunities to coastal communities. Although key interventions1 by the local government units and non-government organizations have been initiated to conserve biodiversity resources, the net benefits generated from the rich and diverse coastal ecosystems of the BMT have not been considered in decision-making. In addition, environmental and socioeconomic issues have recently been identified by the local stakeholders, 2 thus motivating the need for the economic valuation as a basis for understanding and developing appropriate economic instruments for sustaining the use of the BMT resources. Putting monetary value is one way of enhancing the knowledge of stakeholders in recognizing the importance of coastal and marine resources to economic development on a sustainable and ecologically sound basis.



Source: Profile of the BMT, 2004

Figure 8.3-3 Bohol Marine Triangle, Bohol Province, Philippines

Coastal and Marine Resources

The four ecosystems identified included coral reefs and their associated habitats (sea grass, Sargassum, etc.), mangroves, beaches or intertidal areas, and marine waters. The BMT has 554 ha of coral reef area with 263 hard coral species. Hard coral cover ranged from 9.5–21% in 1984 and increased to 20.4–68.3% in 2003 (Calumpong, 2004; White, et al., 2003). The increase in hard coral cover can be attributed to the conservation efforts of the local government units and non-government organizations (NGOs) such as the establishment of marine protected areas (MPAs). All reef fishes and target fishes inside the reserves are also predominantly stable and showed an increase in density. Mean fish density of all reef fish species in the reserve and non-reserve areas was 2,777 individuals/500 m2 and 2,578 individuals/500 m2, respectively (Calumpong, 2004). Mean fish density of all target species was 232 individuals/500 m2 in reserve areas and 157 individuals/500 m2 in non-reserve areas (Calumpong, 2004). Of the 35 recorded mangrove species in the Philippines, 30 species covering 253 ha are found in the BMT area. The BMT has 2556 ha of sea-grass beds with 9 species of the 16 species of sea grasses identified in Philippine waters. The BMT area has 131 species of algae covering 408 ha. The BMT area spans over 112,000 ha, 92% of which is deep-sea or marine water. This area, which ranges from 32 to 357 meters deep, provides a migratory route for whales and dolphins as well as habitat of these species and other marine life (Foundation for Philippine Environment, 2000). Threatened species and Endangered species in BMT is shown in Table 8.3-2.

Table 8.3-2 Threatened Species and Endangered Species in BMT

Threatened Species	Endangered Species
Charonia tritonis (trumpet triton)	Rhincodon typus (whale shark; butanding)
Cassis cornuta (horned helmet)	Tursiops truncates (bottle-nose dolphin)
Turbo marmoratas (green snail, bulato)	Stenella longirostris (spinner dolphin)
Trochus niloticus (smooth top shell, samong)	Grampus griseus (Risso's dolphin)
Birgus latro (coconut crab; tatus)	Blainville's beaked whale
Millepora sp. (branching fire coral)	False killer whale
Acropora valensiennesi	Short finned pilot whale
Subergorgia mollis (Gorgonian fan)	Bryde's whale
Hippocampus comes (common seahorse)	Blue Whale
Note: (Source : Biodiversity Conservation and Management of the Bohol Islands Marine Triangle Project (UNDP/GEF ATLAS ID 00014471) Final Evaluation Report GEF August) Definition of Terms: RA9147 (An Act Providing for the Conservation of Wildlife Resources and Their Habitats, Appropriating Funds Therfor and for Other Purposes) ・Endangered species: *refers to species or subspeacies that is not critically endangered but whose survival in the world is unlikely if the caual factors continue operating.* ・Threatened species: *a general term to denote species or subspeacies considered as critically endangered, endangered, vulnerable or other accepted categories of wildlife whose population is at risk of extinction.*	Pigmy killer whale
	Melon-headed whale
	Dwarf sperm whale
	Sperm whale
	Chelonia mvdas (Green sea turtle)
	Eretmochelvs imbricate (Hawksbill turtle)
	Lepidochelys olivacea (Olive ridley turtle)
	Caretta caretta (Logger head turtle)
	Cervochelvs coriasea (Leatherback turtle)
	Pelagic Fishes: whale sharks, devil manta , stingrays
	Clams: Tridacna gigas (true giant clam, taklobo)
	Tridacna derasa (taklobo, smooth giant clam
	Tridacna squamosa (fluted/ scaly giant clam)
	Hippopus hippopus (straw berry/ horse hoof clam/ kukong kabayo)
	Hippopu porcellanus (China/ porcelain clam)

<u>Fishery and Tourism</u>

Fishery and tourism at BMT Area are evaluated in the Report (Economic Valuation of coastal and marine Resources: Bohol marine triangle, Philippine, Coastal management, 35:319-338, 2007). The Report shows the income from fishery is average 6,600 peso/month/person in 2004. The income from tourism is over than fishery. In the near future, fisherman has opportunity to engage in tourism, i.e. pick- up divers, boat driver, dolphin and wheel watching. The tourism business will improve the income of fishermen.

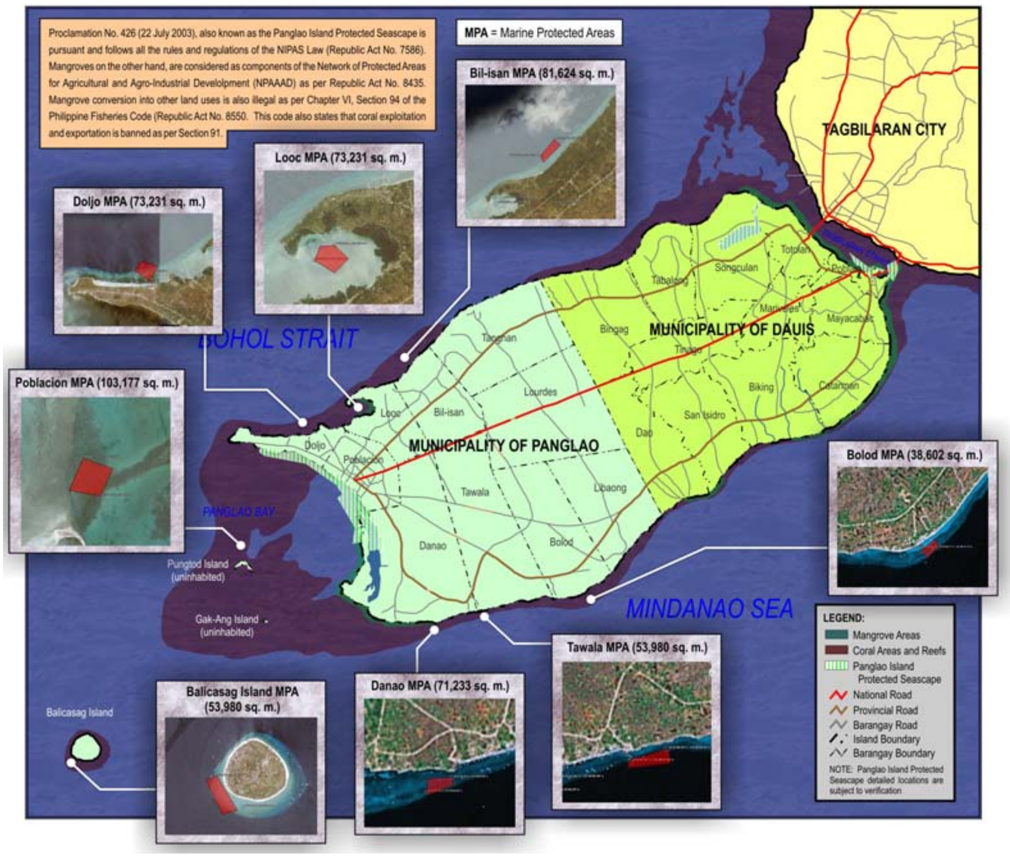
c) Protected Area

In order to ensure the sustainable use of resources and to maintain the natural condition of Panglao's natural beauty, Panglao Municipality has formulated an ordinance classifying all the designated protected areas to maintain the essential ecological processes and life support system in order to preserve the biological diversity of Panglao Island. One such example is an officially declared 271 hectare protected area proclaimed under the NIPAS in July 22, 2003 that covers coastal barangays in Panglao such as Barangay Doljo, Poblacion and Danao.

The conservation of coastal and fishery resources to ensure sustainable and equitable utilization of coastal areas in conformance with Philippine Fisheries Code of 1998 is taken into account as stated in the municipal ordinance of Dauis. In addition, promotion of sustainable fisheries is needed to support the local fishermen making a living in the island.

As stated in the general prohibitions of Municipal Ordinance 02 of Panglao, establishing and putting up fish coral or “bungsod” with 200 meters from buffer zone is strictly prohibited in the marine protected areas. Marine protected areas should not serve as docking area for boats as well. Likewise, dropping of boat anchors will devastate the corals underneath the sea. Gathering, collecting, catching fish and other marine resource using distractive and extractive methods such as cyanide fishing dynamite fishing, and the like is prohibited. Furthermore, the core zone of the marine protected areas is fragile, therefore it should be free from any and all human activities including scuba diving, swimming, snorkeling, and other forms of recreational activities.

The duly authorized personnel of the Municipal Government, particularly the Municipal Agriculture offices as well as the deputized fish-wardens and Bantay Dagat members are responsible for monitoring marine areas. Monitoring and patrolling activities in and around the area of the marine protected areas. Furthermore, the committee on patrol conducts the arrest and seizure against the violators of these ordinances. Penalties shall be given to those who violated the policies imposed by the municipalities in the island. There is a Php 1,000 fee per offender for every offence done by any group of individual caught violating.



Source: Eco-tourism Development Plan for Panglao Island

Figure 8.3-4 Protected Areas in Panglao Island

4) Natural Conditions

a) Topography and Land Forms

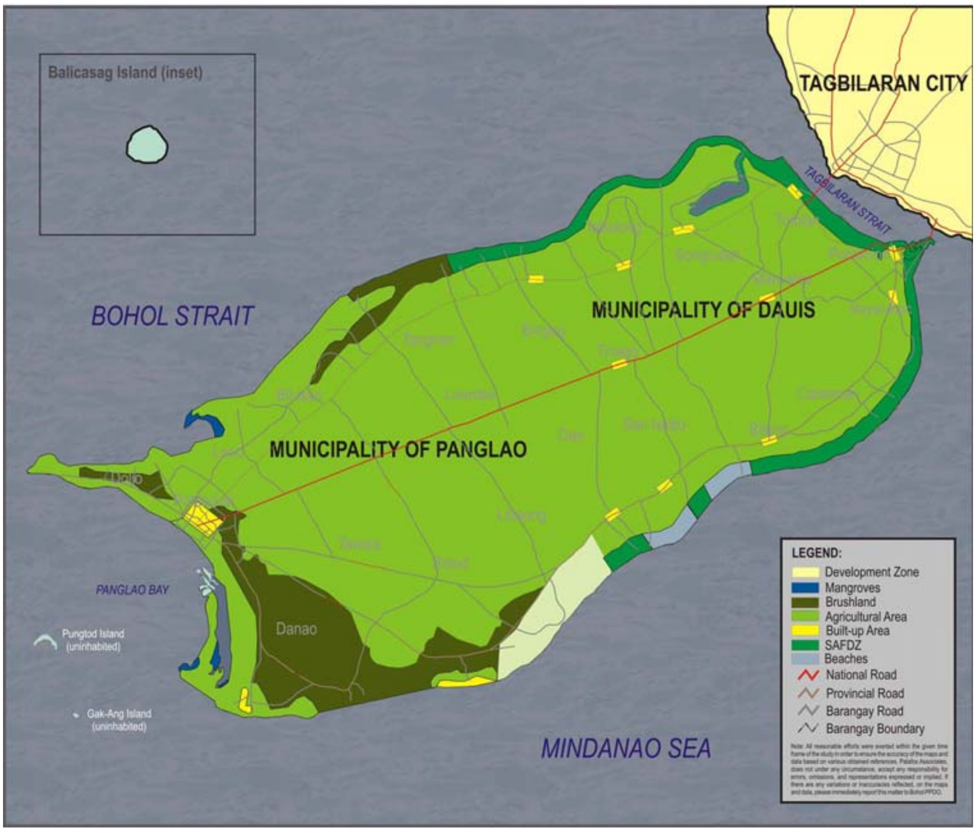
Panglao Island has flat to hilly landforms with a rocky and characteristic but flat in general with mountain ranges located in the southeastern part. It is elevation gradually rises from five meters to about 30 meters above sea level. Particularly, the geological features and classifications within the island are coastal plains, limestone plains, limestone hills, limestone terraces and sinkholes.

b) Land-use

Panglao municipality has retained a predominantly agricultural and rural character. A sizable portion of island's total land area of about 9,500 hectares is allocated to marginal agriculture and coconut plantation. Detailed land-used is described in Table 8.3-3 and shown in Figure 8.3-5. Major land-use are introduced by following pictures.

Table 8.3-3 Detailed description of land-use

Land-use	Hectares	Percent	Notes
Development Zone	210	2.2	The part of south coastal area is specified as development area.
Mangroves	84	0.9	Mangrove grow the around of the island without coastal zone.Big tracts of coconut plantations occupy the north and northwestern section of the island primarily in the localities of Deljo, Pangnan, Bilisan and Danao, all in the municipality. Coconut plantations on the island are not normally inter-cropped. The undergrowth is mostly grass and shrub, which are used occasionally for pasture.
Brush land	911	9.6	Brush land comprise a mixture of shrub, brushwood and sparse stands of trees and coconuts. A wide swath of brush lands cover the southern section of the island in Panglao municipality and extends northward along the coast to Dauis just across Bicag Hills.
Agricultural land	7,606	80.0	Big tracts of coconut plantations occupy the north and northwestern section of the island primarily in the localities of Deljo, Pangnan, Bilisan and Danao, all in the municipality. Coconut plantations on the island are not normally inter-cropped. The undergrowth is mostly grass and shrub, which are used occasionally for pasture.
Built up Area	209	2.2	There are two built-up areas corresponding to the two town centers of Panglao and dauis. Situated at opposite ends of the island, the two built-up areas are connected by a road spine that traverses the island in the concentration of residential hall, church, health center and schools. The built-up areas do not attain an urban character despite intense land using activities.
SAFDZ	428	4.5	A sand and gravel quarry is also being operated in the municipality of Panglao as source of local requirements for construction materials.
Coastal Area	60	0.6	White sand beach
Total	9,508	100	



Source: Eco-tourism Development Plan for Panglao Island

Figure 8.3-5 Land-use Map

	
Picture.8.3.1 Coconuts Plantation	**Picture.8.3.2 Bananas Plantation**

	
Picture.8.3.3 Mango Plantation	**Picture.8.3.4 Corn Field**
	
Picture.8.3.5 Grassland and Open Areas	**Picture.8.3.6 Brush Land**
	
Picture.8.3.7 Residential area	**Picture.8.3.8 Mangrove area**

	
Picture.8.3.9 Under Developing	**Piturec.8.3.10 Fishing**
	
Picture.8.3.11 Aloha Resort	**Picture.8.3.12 White sand resort**
	
Picture.8.3.13 Church and Park in Panglao	**Picture.8.3.14 Church and Park in Panglao**

c) Climate and Rainfall

The climate type of the province of Bohol is identified as Type IV. Type IV climate is distinguished by an even rainfall distribution throughout the year and minimal rainfall recorded at 1,400 millimeters to 1,600 millimeters per year. The average temperature is at 27.3 degrees Centigrade. February to April are the months with the least number of rainy days. This is a good indication that Panglao Island as compared to other province in the Philippines is hardly visited by typhoons and rainfalls. The summer season from May to July brings higher temperatures and very humid days. The hottest month is during August with a temperature reaching 28.2 degrees Centigrade. Moreover, the months of February to May have the least number of rainy days. The southwest monsoon, also known as the habagat is from November to April while the northeast monsoon also known as the amihan prevails during the months of May to October. Daytime temperature during amihan is 26 degrees Centigrade on average, cooling down at night to 25 degree Celsius. The coldest time of the year is January with a temperature of 26 centigrade. Dominant wind comes from northeast quadrant during months of November to March. Bohol only experiences 7% of the typhoon and cyclones passing the archipelago every year. (Source: Eco-tourism Development Plan for Panglao Island)

d) Hydrogeology and Water Resources

The island has a small surface water resource and a lot of the surface drainage has intermittent flows. The source of ground water in the town is present regardless of the minimal vegetation cover of the island. Dauis is served by 75 of deep wells and 156 dug wells as the primary source of water. Due to the relatively small surface water resource in the island, it is noticeable that the municipality is encountering problems with regard to accessing water for residential and commercial use. Water is provided to households by means of electric pumping units and reservoir. The municipality Panglao has a total of 122 deep wells and 44 shallow dug wells situated in different barangays.

Panglao island is covered by Maribojec Limestone. Maribojec Limestone is distinguished as highly coralline, soft, chalky, non-compacted and marly. To add, it is composed of coralline leaf and reef sands which makes is highly porous and forms the main water table aquifer in Panglao Municipality. Limestone has a very high permeability and run off is practically non-extent in this formation as indicated by the good natural drainage of the island. (Source: Eco-tourism Development Plan for Panglao Island)

e) Plant Communities

Floral results yielded a total of 167 species of plants belonging to 136 genera under 41 families in the project site. The most represented families were Fabaceae, Poaceae, and Euphorbiaceae with more than 10 species and genera. Out of 167 plant species, 76 were trees species; 28 shrubs; 24 herbs; 18 grasses; 14 vines; 6 sedges and 1 strangling fig species. The shrub-layer contained 90 species of plants under 77 genera and 33 families while the undergrowth had 92 plants, belonging to 78 genera and 31 families. Threatened species include Vitex parviflora and Diospyros pilosanthera. Buchanania arborescens was found to be the most common in the shrub layer. This was followed by Glochidion lutescens and Myrsine philippinensis, all are indicators of a karst environment including Vitex parviflora. Chromolaena odorata and Imperata cylindrica were the common undergrowth species. Bambusa blumeana (kawayan-tinik) dominated based on its cumulative basal diameter. Imperata cylindrica dominated the undergrowth. The diversity and dominance values in the shrub-layer showed a moderate to high species diversity. Its species dominance was very low. The undergrowth had very high species diversity values and consequently a low species dominance.

For the weeds, some 51 species belonging to 42 genera under 16 families were identified. Family Poaceae (grass family) was the most represented group. Chrysopogon aciculatus (amorseko) was the most dominant weed followed by Imperata cylindrica. The mean diversity value for weeds in the entire project site is moderate while evenness was high. On agricultural crops, a total number of 23 agricultural crop species belonging to 21 genera under 19 families were identified. The major agricultural crop species under cultivation were coconuts and bananas. Coconuts, through copra sales, yielded the most family income among the crops grown. The species diversity of the agricultural crops in the project site was very low due to a few species that dominated in the count. (Source: Field Survey Report 2012)

f) Wildlife

Faunal survey results revealed a total of 26 avifauna species, 4 bats species and 6 anurans. It was very remarkable that out of the 26 birds, 20 were endemics. Distribution status was mostly Common. The most commonly bird species observed were Lonchura jagori and Aplonis panayensis. The Lanius nasutus (Long-tailed Shrike) birds made an adaptation to the degraded environment by like building their nests on the ground grasses due to the absence of higher vegetation. The bats were the only conspicuous wildlife mammals in the area. The degraded vegetation and habitat conditions could not support the presence of other mammals like monkeys, tarsiers, civet cats, flying lemurs and squirrels. All the six anuran species identified were under the status of Least Concern based on the IUCN status list. Two were endemics. A land crab under family Gecarcinidae was encountered during the search for anurans in Barangay Bolod.

The arthropods survey yielded the following data: a total of 84 insect species belonging o 14 Orders and 49 families; 6 arachnids belonging to 1 order (Araneae) and 6 families; and 1 Diplopod were positively identified. Identification is still to be made with 17 insects and 3 arachnids. The diversity, evenness and dominance varied with different sites from very low to low. However, for nocturnal arthropods, 3 of the 4 sites had high diversity. The dominant species in all sites were the Hymenopterous insects which include the ants, wasps and the bees which mostly useful as pollinators, predators, decomposers, parasites and predators of insect pests. (Source: Field Survey Report 2012)

The study came up with the following conclusions: On the overall, species diversity of both flora and fauna is moderately high in the impact areas. Although vast floral and faunal populations will be lost or wiped in the mega construction, it is believed that no species will be locally extinct as there are still be residual populations in the rest of the island. And there are not Threatened Species and Endangered Species in the area.

g) Water Quality

Between Panglao island and Bohol Island lies a narrow channel which receives a significant amount of pollution loading which appears to be sourced from both sewerage discharges from Tagbilaran City and Dauis Municipality. Increasing development and expected population increase in the future inevitably increase nutrient loading to levels that may affect use of the marine resources around Panglao island. Assessments of water quality around the island indicate significant levels of nutrient content specially ammonia in some coastal parts of Panglao Island. Possible sources of these nutrients can be derived from resort effluents. With continuous uncontrolled discharge of this effluents to the coastal waters will result to the destruction of marine life along the coast.

5) Social Conditions

a) Sanitary and Toilet Facilities

Majority of households in Panglao Island use personal septic tanks, which total to 5,998. other common toilet facility types are other depositories used exclusively by households, and a common sewer or septic tank that are shared by other households as well. Open pit and other systems, as listed in Table 8.3-4. are still commonly used, which without regulation and careful maintenance, night cause contamination of the local water supply and the island's water table. Consequently, there is still high number of households that do not have toilet facilities, more than those using open pit or other system combined. This problem should therefore be addressed to avoid contamination and for the enhancement of sanitary conditions and welfare of the island's residents. Crucial to this as well is to avoid contaminants reaching the open waters and seas surrounding the island. (Source: Eco-tourism Development Plan for Panglao Island)

Table 8.3-4 Toilet Facility (2000)

Municipality	Water-sealed				Closed Pit	Open Pit	Others (Pail System, etc.)	None
	Sewer/Septic Tank, Used Exclusively by Households	Sewer/Septic Tank, Shared with Other Households	Other Depository, Used Exclusively by Households	Other Depository, Shared with Other Households				
Panglao	2,550	242	695	47	70	71	8	207
Dauis	3,448	640	422	78	172	21	91	173
TOTAL	5,998	882	1117	125	242	92	99	380

Source: National Statistics Office

b) Solid Waste Management

In the island, the most common method of disposing solid waste is through siga or burning of collected organic and inorganic garbage. More than 50% of households burn their garbage. Second after burning wastes is reuse of waste particularly organic wastes, for animal feeds. A total of 1905 households, or 21% of the household population practice this form of garbage disposal. This is perhaps the most common form of recycling wastes for other purposes. Reusing as fertilizer or composting is also an identified method, but is not commonly used compared to other ways.

In Panglao reusing waste as animal feed is the second most common practice for garbage disposal at a total 1455 households. In Dauis on the other hand, dumping in individual pits and dumps is the second most common waste disposal method with 666 practicing households, after burning, which registered with 3,167 counted households. (Source: Eco-tourism Development Plan for Panglao Island)

Table 8.3-5 Method of Waste Disposal (2000)

Municipality	Garbage Truck Pickup	Dumping in Individual Pit (Not Burned)	Burning	Composting (Later Used as Fertilizer)	Burying	Reused as Animal Feed	Others	TOTAL
Panglao	74	196	1,688	27	450	1,455	0	3,890
Dauis	253	666	3,167	422	87	450	0	5,045
TOTAL	327	862	4,855	449	537	1,905	0	8,935

Source: National Statistics Office

Picture.8.3.15 Existing Landfill (Panglao)

c) Economy

Majority of the agricultural produce in the island are corn, upland rice, legumes, vegetables, bananas, coconut and root crops such as yam. However, it is understandable that production is only at a sustainable level due to the limited rainfall and poor soil condition unsuitable for large scale major production. Poultry and livestock in the island however are for small scale business and dedicated only for backyard raising. Livestock raised in both municipalities are carabao, cattle, swine, goat and chicken. The Municipality of Dauis, in comparison to the Municipality of Panglao, has a higher output of livestock because it is relatively near Tagbilaran market. Panglao, surrounded by coastal waters manifest that fishing is the major source of livelihood. Aside from the livelihood that the coastal resources offers, it also serves as the major supply of food for residents living in the coastal barangays. There are 2,500 fisher folk in the island that make living from the bounties of the sea. The fish frequently caught are tamarong, tuna, limbahon, syganids, snappers, grouper, flying fish, bawo, surgeon fish, mackerel and others. The annual fish catch and consumption in the Municipality of Panglao and Dauis (2000) is 686,565 and 1,240,750 respectively. (Source: Eco-tourism Development Plan for Panglao Island)

(1) Agriculture

Panglao and Dauis have a combined area of 5,758.16 hectares of land devoted to agricultural use, where 4,180.16 hectares are located in Dauis, while over a quarter at 1,578 hectares of land are found in Panglao. Majority of the crops produced in the island are corn, upland rice, legumes, vegetables, fruits, coconut and root crops such as yam. Corn is the island’s main crop with a total yield of 1,767 metric tons, due to its characteristic of being more adaptable to Panglao Island’s climate and soil. Despite the vast area to produce crops, production is only at a sustainable level. This is due to the limited rainfall and poor soil condition unsuitable for large scale major production.

Another concern is that agricultural lands being covered to commercial and residential uses are often incompatible and deviate from the zoning ordinance of the area. This is a common occurrence in many island communities that often see tourism as a more lucrative industry compared to agriculture. The tendency of landowners consequently is to convert farm, grazing, productive land into resorts and hotel properties. Land productivity might also become a crisis, which often leads to food importation from the main land and from farther areas. (Source: Eco-tourism Development Plan for Panglao Island)

(2) Fishery

In terms of fishery resources, Panglao and Dauis’ coastal location is a blessing. Majority of its barangays are coastal, which provides immediate proximity to the sea as an economic resource and source of food of the local. Fishing is major source of income on the land with over 2,500 fisherfolk as mentioned in Panglao and Dauis’ Comprehensive land Use Plan. Table 8.3-6 shows the annual fish catch in 2000 and the consumption requirement as well. (Source: Eco-tourism Development Plan for Panglao Island)

Table 8.3-6 Annual Fish Catch and Consumption

	Non-Motorized Pumpboats	Motorized Pumpboats	Commercial Fishing Vessels	Total Annual Fish Catch (kg)	Total Annual Consumption
Panglao					
No. of Operators	738	135	None		
No. of Pumpboats	777	150	None		
Annual Catch (kg)	538,740	147,825	None	686,565	768,132
Dauis					
No. of Operators	309	574	17		
No. of Pumpboats	309	574	17		
Annual Catch (kg)	46,350	344,400	850,000	1,240,750	792,450

Source: 2001 to 2010 CLUP of Dauis, 2001 to 2010 Draft CLUP of Panglao

(3) Tourism

Panglao island has been one of the top visited destinations in Central Visayas and in the whole Philippines. The island is known for its white sand beaches found in Libaong, Bolod, dao, and san Isidro. Other attractions include balicasag island, which is known for snorkeling and diving. Pnaglao island is equipped with its tourism infrasturacture such as hotels and resorts of varying ratings and numerous restaurants. The combined bed capacity of the island is well over 1,000.

In 2008, the municipality of Panglao alone had approximately 459,396 tourists staying over 24 hours while walk-in excursionists amounted to 1,378,189, which total to 1,837,585 according to the Bonol provincial Government's project of population and Turists. This is based on the average room occupancy during peak and lean seasons, while walk-in excrusionists ase estimated to be three times the number of tourists. Over half of the tourists who visit Panglao came from different countries around the world. The Department of Tourism tallied the tourist volume from the month of January to February 2010/2009. Based from the assessment, East Asia has the highest tourist visitations in Bohol having a total of 12,874. next is Europe with a total of 5,428 and lastly is North America which has a total tourists visitations of 2,133. (Source: Eco-tourism Development Plan for Panglao Island)

8.3.2. Environmental Standard

1) <u>Air Quality Standard</u>

Environmental Air Quality Standard is shown in Table 8.3-7. which is the NAAQS specified by DENR.

Table 8.3-7 DENR National Ambient Air Quality Standards (NAAQS)

Pollutant	Concentration		Method of Measurement (b)
	ug/Ncm	Ave. Time	
Sulfur Dioxide (SO^2)	340	1 hr	Kimoto Gas Bubbler Sampler & Pararosaniline
Nitrogen Dioxide (NO^2)	260	1 hr	Kimoto Gas Bubbler Sampler & Griess Saltzman
Total Suspended Particulate (TSP)	300	1 hr	High Volume and Gravimetric
Lead (Pb)	20	1 hr	High Volume and AAS

2) Water Quality Standard

The following standards of water quality can be applied in this area.

Table 8.3-8 Environmental Standard DAO 34 Class SB 1) RWC I

Parameter	Unit	(2) For Coastal and Marine Waters (as amended by DAO 97-23)			
		Class SA	Class SB	Class SC	Class SD
Color	PCU	(c)	(c)	(c)	(c)
Temperature (d) (max. rise in deg. Celcius)	0C rise	3	3	3	3
pH		6.5-8.5	6.5-8.5	6.5-8.5	6.0-9.0
Dissolved Oxygen (e)	mg/L	5.0	5.0	5.0	2.0
BOD5	mg/L	3	5	7(10)	-
Total Suspended Solids	mg/L	(f)	(g)	(g)	(h)
Total Dissolved Solids	mg/L				
Surfactants (MBAS)	mg/L	0.2	0.3	0.5	-
Oil/Grease	mg/L	1	2	3	5
Nitrate as Nitrogen	mg/L				
Phosphate as Phosphorus	mg/L				
Phenolic Substances	mg/L	nil	0.01	(l)	-
Total Coliforms	MPN/ 100mL	70 (m)	1,000 (m)	5,000 (m)	-
Or Fecal Coliforms	MPN/ 100mL	nil	200 (p)	-	-
Chloride as Cl	mg/L	-	-	-	-
Copper	mg/L	-	0.02 (n) (o)	0.05 (o)	-

Water Quality Parameter	Units	(4) For Coastal and Marine Waters			
		Class SA	Class SB	Class SC	Class SD
Arsenic (i)	mg/L	0.05	0.05	0.05	-
Cadmium (i)	mg/L	0.01	0.01	0.01	-
Chromium (hexavalent) (i)	mg/L	0.05	0.1	0.1	-
Cyanide	mg/L	0.05	0.05	0.05	-
Lead (i)	mg/L	0.05	0.05	0.05	-
Total Mercury (i)	mg/L	0.002	0.002	0.002	-
Organophosphate	mg/L	nil	nil	nil	-

Table 8.3-9 Effluent Standard DAO No.35 Table 2A, Category II

Parameter	unit	Value
Color	PCU	100
Temperature	-	3
pH	-	6-9
COD	mg/l	60
Settlement Solids (1-hour)	mg/l	0.3
5-day 20C, BOD	mg/l	30
Total Suspended Solid	mg/l	50
Total Dissolved Solids	mg/l	1000
Surfactants (MBAS)	mg/l	2
Oil/Grease	mg/l	5
Phenolie Substances as Phenols	mg/l	0.05
Total Coliforms	MPN/100ml	3,000

Class SB 1) Tourist zones and marine reserves primarily used for recreational activities such as bathing, swimming, skin diving, etc., established under existing laws and/or declared as such by the appropriate government agency.

3) Noise level Standard

With regards to noise the values are within the environmental quality standard in general areas as specified by DENR shown on Table 8.3-10.

Table 8.3-10 Environmental Quality Standards for Noise in General Areas

Category of areas	Daytime dB(A) 9:00a.m.-6:00p.m.	Morning & Evening dB(A) 6:00 a.m.-9:00 p.m. 6:00 p.m.-10:00 p.m.	Nighttime dB(A) 10:00p.m.- 6:00 a.m.
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65

Note:

Class AA – A section or contiguous area which requires quietness such as Area within 100 meters from school sites, nursery schools, hospitals and special homes for the aged.

Class A – A section or contiguous area which is primarily used for residential purposes.

Class B – A section or contiguous area which is primarily a commercial area.

Class C – A section or contiguous area which is primarily reserved as a light industrial area.

Class D – A section or contiguous area which is primarily reserved as a heavy industrial area.

Noise Standard by Aircraft

There is not a standard of noise level from aircraft in Philippines, the table shows the standard in Japan is based on international standard, the value is one of the target when the evaluation of noise level.

Table 8.3-11 Noise Standard by Aircraft

Area Category	Standard (WECPNL)	Standard (Lden)
I	70	57
II	75	62

I: residential area, II: out of I area, the standard was modified from WECPNL to Lden in June, 2007 (Japan).

8.4. EIA Study

8.4.1. Scoping

Scooping result is shown in Table 8.4-1. The table reflects suggestions and opinions of JICA advisory committees.

Table 8.4-1 Scooping Results of New Airport Project

Items			Note			
			Total	Plan/Construction	Operation	Note
Social Environment	1	Resettlement	Negative - A	Negative - A	Negative - A	There are 66 houses (about 200 peoples) in project area. The Compensation of resettlement has been finished already. They will move substitution area when construction works start.
	2	Economic Activities (employment)	Positive - A	Positive - A	Positive - A	Good effective after operation, the employees of the airport will be appointed local peoples.
		Economic Activities (Business)	Positive - A	Positive -A	Positive -A	
	3	Land-use	Positive - B	Positive - B		Agriculture and bush land will be changed to airport area.
	4	Cutting of area relation	Negative - D	Negative - D		Barangay roads have to replace.
	5	Transportation and lively facilities	Negative - C	Negative - B	Negative - D	New access road will be prepared before the construction works.
	6	Poor, aborigines	Positive - B	Positive - B	Positive - B	There is not residential area for poor and aborigines.
	7	Inequality of profit	Negative - D	Negative - D	Negative - D	It is possible unfair employment will be happened.
	8	Remains, cultural assets	–	–	–	There is not Remains, cultural assets in the project area.
	9	Profit Opposition	–	–	–	There is not profit opposition.
	10	Water right, common right	–	–	–	There is not surface water and common area.
	11	Preservation of health	Negative - C Positive- A	Negative - C	Positive - A	It is possible to increase diseases by increasing of population.
	12	Disaster Risk	Negative - D	Negative - D	Negative - D	It is possible rainfall water from pavement area will occur flood.
Natural Environment	13	Topography/Geology	Negative - C	Negative - C	Negative - C	Land reclamation work will change topographical condition.
	14	Soil erosion	Negative - C	Negative - C	Negative - C	Rainfall water will occur soil erosion of development area.
	15	Ground water	Negative - D	Negative - D	Negative - D	Ground water level will be down, when pumping up and use the water for construction/operation phase
	16	Lakes and marshes	–	–	–	There is not lakes and marshes in the project area.
	17	Coast/sea area	Negative - C	Negative - C	Negative - C	Project site does not include coast/sea area.
	18	Species/Wildlife	Negative - C	Negative - C	Negative - D	Development activities change original species and circumstance for wildlife.
	19	Weather	–	–	–	There is no risk.

Items			Note			
			Total	Plan/Construction	Operation	Note
	20	Geography	Negative - D Positive - A	Negative - D	Positive - B	Land reclamation work will be lose original geography.
	21	Global Worming	Negative - D	Negative - D	Negative - D	Heavy machines activities in construction stage and departure and arrival of airplane will exhaust global worming gas.
Pollutions	22	Air pollution (construction)	Negative - A	Negative - A	–	Heavy machines activities in construction stage and departure and arrival of airplane will exhaust global worming gas.
			Negative - D	Negative - D		
		(Operation)	Negative - D	–	Negative - D	Small impact from exhaust gas.
	23	Water pollution	Negative - B	Negative - B	Negative - B	Untreated waste water of buildings and oil for maintenance will impact to ground water.
	24	Soil pollution	Negative - D	Negative - D	Negative - D	Untreated waste water of buildings and oil for maintenance will impact to ground soil.
	25	Solid waste	Negative - B	Negative - B	Negative - B	Solid waste will be generated in construction and operation phase.
	26	Noise/vibration	Negative - B	Negative - B	Negative - C	Heavy machines activities in construction stage and departure and arrival of airplane will generate noise and vibration.
	27	Ground sinkage	Negative - D	Negative - D	–	It is possible runway ground will be sunk by heavy load.
	28	Offensive odor	–	–	–	There is risk from sewerage sludge.
	29	Sediment soil	–	–	–	There is risk from sewerage sludge.
	30	Traffic accident	Negative - C	Negative - C	Negative - D	It is possible to increase traffic accidents.

Note: Evaluation criteria：

A: Significant Impact

B: Moderately Impact (Impact can be decreased by mitigation.)

C: Minimal Impact (Impact can be minimal by mitigation.)

D: Insignificant

– : Non

It is difficult to evaluate the impact of single project for global warming, therefore policy and total program is discussed in Philippines Government.

8.4.2. Surrounding Conditions of the Project

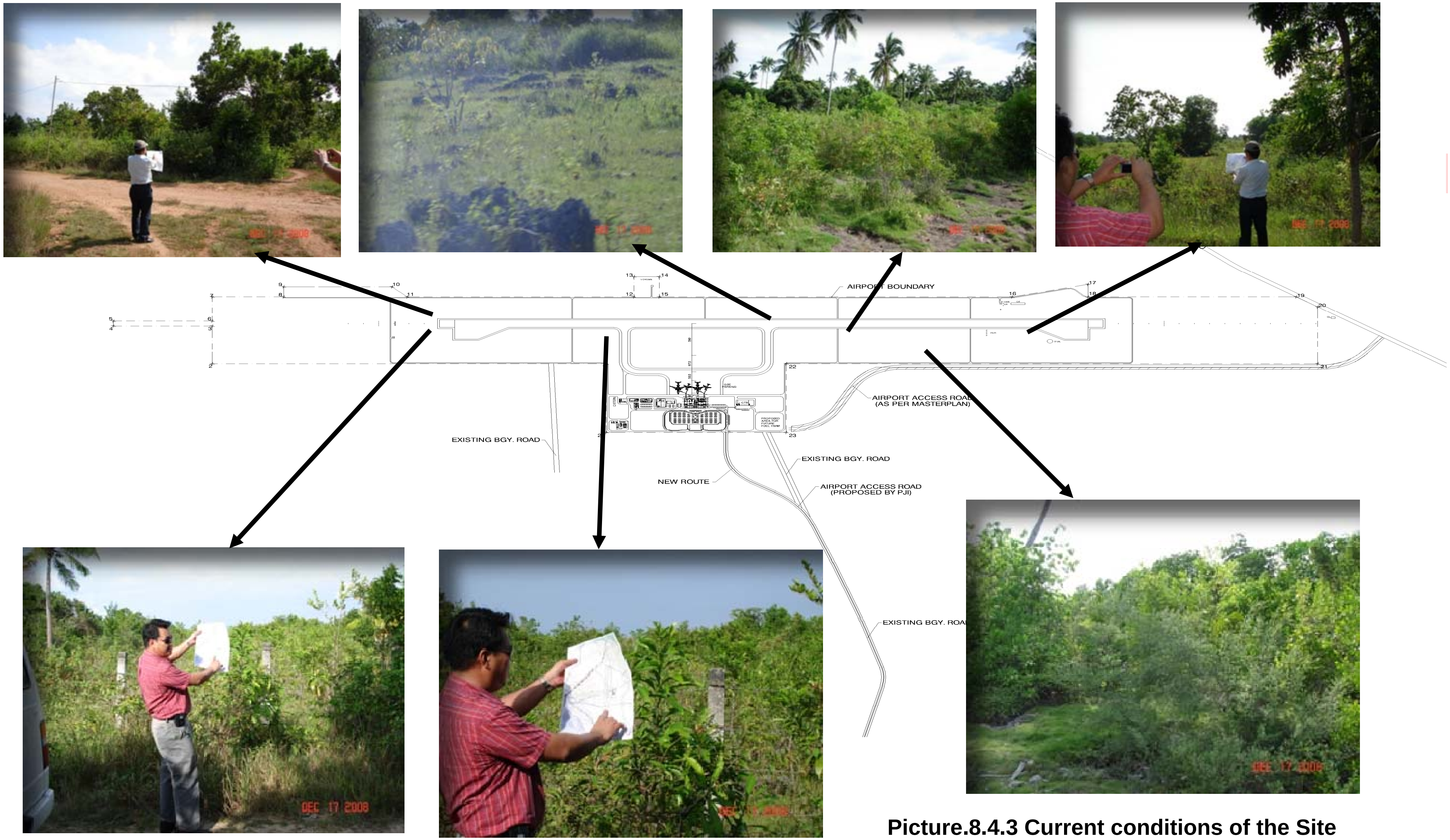
1) Surrounding Natural Conditions

The proposed site for the airport is basically an open area dominated by residential and agricultural lands with occasional patches of fruit trees and bamboo thickets. About 30% of the sites are regulated with native shrubs and bamboo thickets. About 30% of the sites are regulated with native shrubs and grasses, which have low economic value and furthermore fire-prone. (EIA Report, 2000)

However, large agriculture area can not be identified on field inspection. Some agriculture area may be given up cultivation after purchase by the government. Current surrounding conditions are shown in Picture 8.4.1 to 8.4.6.

Picture.8.4.1 Central Area of the Project Site

Picture.8.4.2 Runway Area



Picture.8.4.3 Current conditions of the Site

Picture.8.4.4 Runway Area

Picture.8.4.5 Geological Investigation

Picture.8.4.6 Coastal Area near the Site (south-west)

2) Discussions about the Project

Necessity of the airport is discussing from 1990s by Government officers and local residents. The construction work close at hand in 2010, some professors of University of Philippines send letter to the President to express environmental negative impact to nature of the island by the airport construction/operation. However, they discussed with DOTC and Bohol provincial Government closely, then they understood the critical situation of existing airport and needs of new airport. They send a letter to the President in February, 2011 and October, 2011 to support the airport construction work by academic points of view. The member of professors is shown in Table 8.4-2.

Table 8.4-2 Member of the Professors

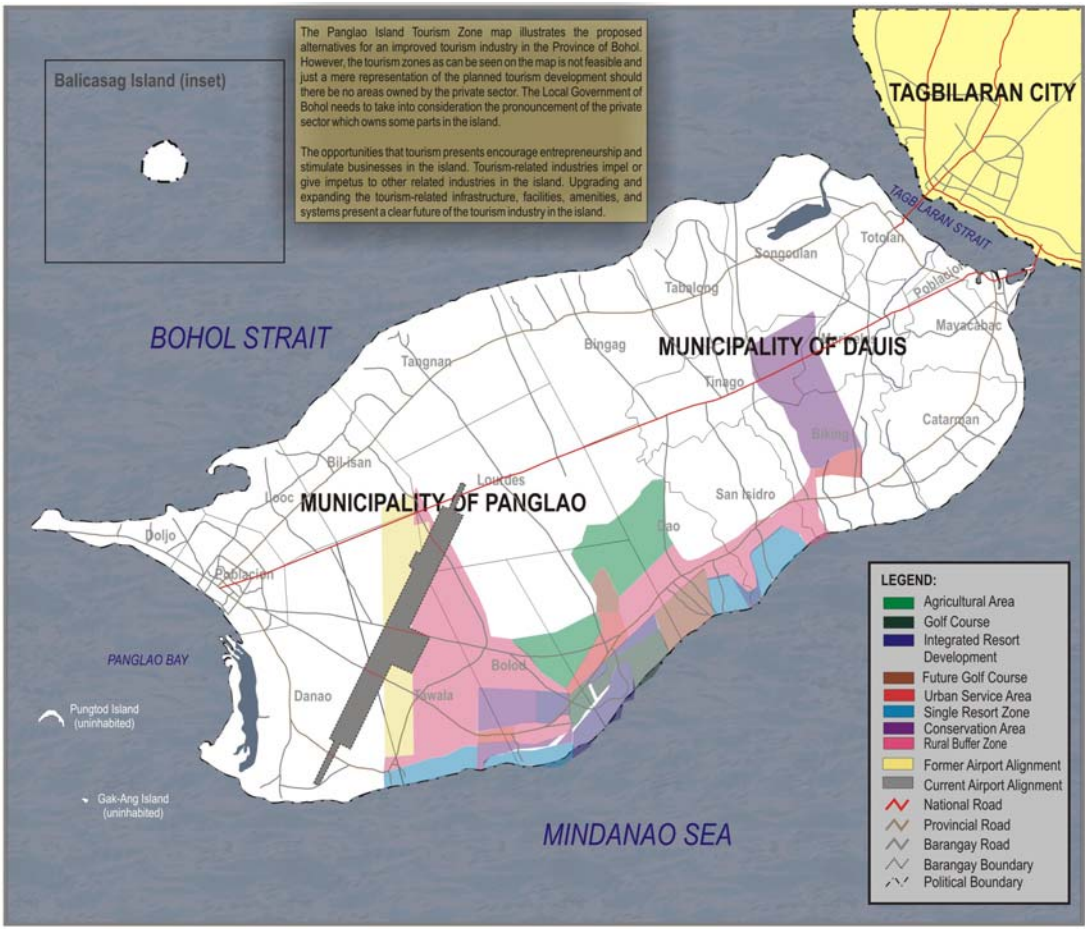
No.	Name	Position
1	Ernesto M.Pernia, PhD	Former professor, currently Professorial lecture, UP School of Economics, and Former lead Economist, currently Consultant , ADB
2	Caesor A, Saloma, PhD	Chancellor of Physics, UP, and Academician, NAST
3	Jose V. Abueva, PhD	Professor Emeritus and Former President, UP
4	Paul V. Fabella, PhD	Professor, UP School of Economics National Scientist, NAST
5	Carlo Arcilla, PhD	Director, National Institute of Geological Sciences, UP College of Science
6	Ramon L. Clarete, PhD	Professor, UP School of Economics Consultant, ADB
7	Rene Rollon, PhD	Dirctor, Institute of Environmental Science and Meteorology UP College of Sience
8	Atty. Herman Cimafranca	Assistance Solicitor General Office of Solicitor General
9	Eduardo C. tadem, PhD	Professor, UP Asian Center

3) Development Plan of Panglao Island

Major developing area in Panglao island is south coastal area, according to the development plan. The plan is shown in Figure 8.4-1. Bohol provincial government formulated “Panglao Tourism development Guideline” to check destructive development in 2009. REDCOM (Review and Development Committee) was organized under the guideline. REDCOM will check the tourism project which is over two million development cost. The committee is authorized to issue the construction permission and business permission.

The tourism development needs basic infrastructure i.e. water supply and sewerage system. Water supply system had been studied by the consultant. The output of the study is “Integrated Water Supply System Master Plan (BHL-1)”, which include water supply system for Panglao Island. The plan will supply the tourist water demand about 3,100 persons/day (1,127,000 persons/year). Water resource is Loboc River in Bohol Island. The project will start in 2015.

The sewerage system is studied in this JICA Study, the study recommend the area shall be adopted individual treatment system in the view of economical point.



Source: Eco-tourism Development Plan for Panglao Island

Figure 8.4-1 Development Plan of Panglao Island

4) Geological Conditions

The new site is located on the flat land of 6-8 m height from sea level, the area is consist of sandstone, shale, coral limestone, basalt and lava. Thick coral lime stone is confirmed under surface soil by geological investigation. There is a discussion that some coral caves disturbed in new airport construction at Panglao Island, however the investigation result make a clear that there are not exist coral caves at new site.

The strength of the base ground is evaluated as same as New International Tokyo Airport. The load calculation of designed aircraft proves safety of the basement. According to the design, the total thickness of pavement is 3 m.

5) Water Quality, Air Quality and Noise level

a) Water Quality

Water quality sampling/monitoring was conducted in the study area on 13 and 14 July 2011. Grab samples were taken from two (2) groundwater and two (2) seawater stations. The groundwater sampling stations were located in Barangay Danao and Barangay Tawala, both in Panglao, Bohol while the seawater sampling stations were located 100 meters away from the shoreline of Alona Key Beach in Barangay Tawala, Panglao, Bohol and the other one inside the mangrove area facing Panglao Bay in Barangay Danao, Panglao, Bohol Figure 8.4-2 shows the location of the sampling stations.

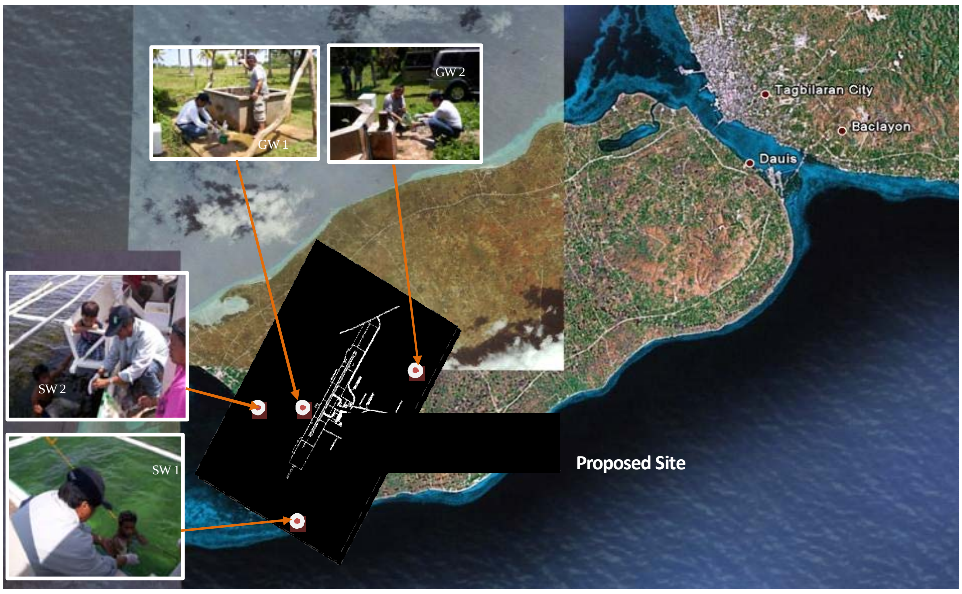


Figure 8.4-2 Location Map of Sampling Points

The results of water quality laboratory analyses of groundwater and seawater samples are tabulated in Tables 8.4-3 and 8.4-4, respectively. These were compared to the results of the previous EIA study conducted in year 2000.

Table 8.4-3 Comparison of Groundwater Quality Results

Parameters	Previous Study (01 August 2000)		Updated Study (13, 2011)		DENR Limit
	GW-1	GW-2	GW-1	GW-2	
Iron, mg/L	ND	ND	<0.08	<0.08	1.0
Total Coliforms, MPN/100 ml	>16.0	>16.0	>23.0	>23.0	<1.1
Escherichia Coli	Negative	Negative	Negative	Negative	Negative
Heterotrophic Plate Count, CFU/mL	1,100	730	20,000	8,500	<500
pH	6.99	7.05	6.78	6.91	6.50 – 8.50
Temperature, ^{o}C			23	23	-
Color, TCU			<4	<4	5
Settleable Solids, mg/L			<0.10	<0.10	-
Dissolved Oxygen, mg/L			8.0	7.9	-
Biological Oxygen Demand, mg/L			<2	<2	-
Chemical Oxygen Demand, mg/L			29	19	-
Total Dissolved Solids, mg/L	484	956	502	495	500
MBAS (Surfactants), mg/L			<0.10	<0.10	-

Phenols, mg/L			<0.002	<0.002	-
Total Suspended Solids, mg/L			<2.0	<2.0	-
Oil & Grease, mg/L			1.0	1.2	-
Calcium, mg/L	81.70	88.92	97	98	100
Magnesium, mg/L	11.56	18.07	9.6	7.9	30 – 50
Chloride, mg/L	164	386	112	97	250
Silica, mg/L	7.67	8.42	4.4	3.2	-
Sulfite, mg/L	7	35	<0.50	<0.50	-
Total Hardness, mg/L	252	296	282	277	300

Based on the results, the metal parameter (iron) has little value which is less than 0.08 mg/L while e-coli is negative both in the previous and current studies. All samples indicated that the total coliform has high value (23 MPN/100ml) which is above the Philippine Standard Limit (<1.1 MPN/100ml) while heterotrophic plate count also have a very high values caused by the bacteria found in the samples. The samples were taken in an open source (dug well). The results of the other parameters such as pH, temperature, color, settleable solids, dissolved oxygen, biological oxygen demand, chemical oxygen demand, total dissolved solids, surfactants, phenols, total suspended solids, oil and grease, calcium, magnesium, chloride, silica, sulfite and total hardness are mostly within the standard limit.

Table 8.4-4 Comparison of Seawater Quality Results

Parameters	Previous Study (01 August 2000)	Updated Study (July 14, 2011)		DENR Limit (Class SB)
	SW-1	SW-1	SW-2	
Copper, mg/L		<0.04	<0.04	0.02
Total Coliforms, MPN/100 ml	<2	<1.8	<1.8	1,000
Fecal Coliforms, MPN/100 ml	<2	<1.8	<1.8	200
pH	7.48	7.95	8.40	6.5-8.5
Temperature, ^{o}C		23	23	-
Color, PCU		5	10	3
Dissolved Oxygen, mg/L		5.7	8.8	5.0
Biological Oxygen Demand, mg/L	19	2	<2	2
MBAS (Surfactants), mg/L		<0.10	<0.10	0.30
Phenols, mg/L		<0.002	<0.002	0.01
Total Suspended Solids, mg/L	29	20	4.0	<30
Oil & Grease, mg/L	ND	1.1	1.2	2.0

The parameters of the current samples which have the good quality compared to the standard limit are copper, total coliforms, fecal coliforms, pH, temperature, biological oxygen demand, surfactants and phenols. But the parameters such as color, dissolved oxygen, total suspended solids and oil & grease have high values and exceed the standard limit. This only emphasized that the samples taken contained organic wastes which consisted of anything that was once part of a living plant or animal, including food, leaves, feces, etc.

b) Air Quality/Noise Quality

In order to determine the present state or condition of atmospheric air in the area where the New Bohol Airport will be constructed, actual on-site air samplings were conducted on July 12 and 13, 2011 at five (5) sampling points which were in the same locations as in the previous study. Sampling was done using Gas Bubbler for SO2 and NO2, Staplex High Volume Air Sampler for TSP and Pb.

Figure 8.4-3 shows the locations of the air and noise sampling stations.

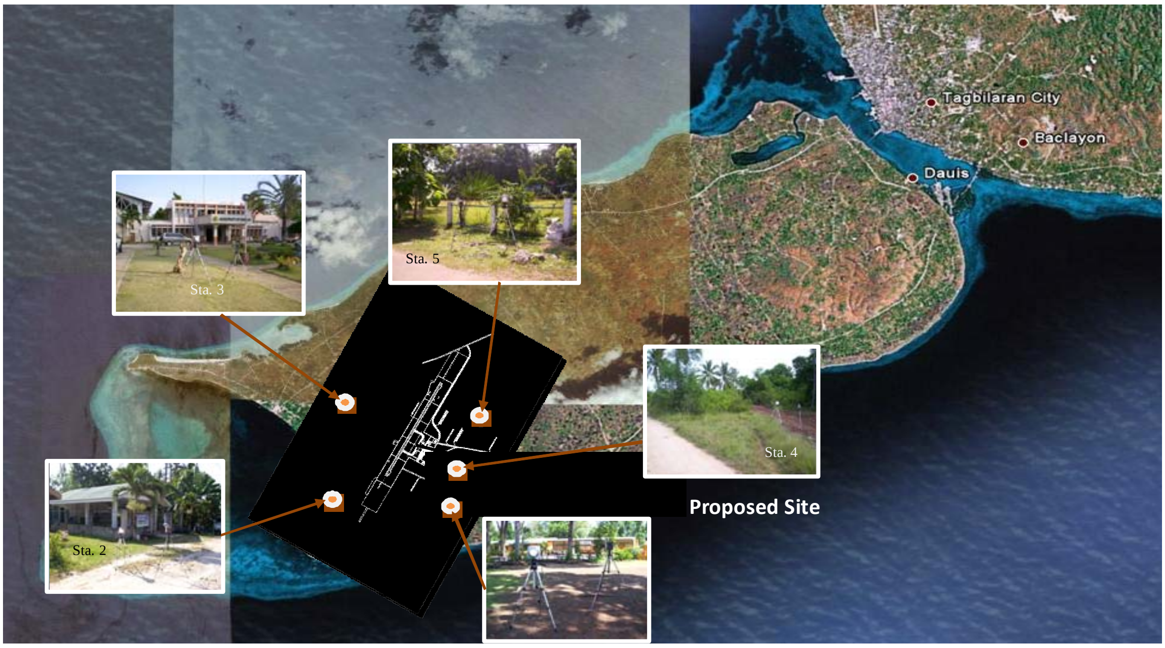


Figure 8.4-3 Location Points of Stations (Air & Noise)

Air Quality

The results of the chemical analyses of the air samples are given in Table 8.4-5 for sulfur dioxide (SO2), nitrogen dioxide (NO2), total suspended particulates (TSP) and lead (Pb). The results were compared to the results of the samples conducted in the previous study but same location of sampling stations.

Table 8.4-5 Comparison of Air Quality Results

Location	Previous Study (31 July & 01 August 2000)				Updated Study (July 12&13, 2011)			
	SO_2 (ug/Nm^3)	NO_2 (ug/Nm^3)	Pb (ug/Nm^3)	TSP (ug/Nm^3)	SO_2 (ug/Nm^3)	NO_2 (ug/Nm^3)	Pb (ug/Nm^3)	TSP (ug/Nm^3)
Sta. 1 – Tawala Elementary School	ND	32.2	ND	4.9	24.9	3.9	ND	13.8
Sta. 2 - Danao Barangay Hall	ND	22.7	ND	429.7	ND	9.4	ND	114.6
Sta. 3 - Panglao Municipal Hall	ND	9.4	ND	32.3	51.5	2.8	ND	22.4
Sta. 4 - Access Road to Airport	ND	22.8	ND	5.1	ND	ND	ND	13.6
Sta. 5 - Bolod Elementary School	ND	28.3	ND	10.3	ND	7.2	ND	115.38
DENR Standard	340	260	20	300	340	260	20	300

Noise level

Table 8.4-6 presents the values of the respective noise levels at each sampling station as compared with the results of the previous study. Gaging from these noise observations, the site of the New Bohol Airport can be considered within the normal range of noise levels as specified in the DENR's NAAQS.

Table 8.4-6 Comparison of Noise Level Results

Location	Results of Previous Study		Results of the Updated Study	
	Noise Level, db(A)	Source of Noise Monitored	Noise Level, db(A)	Source of Noise Monitored
Sta. 1 – Tawala Elementary School	51.3	Noise from passing vehicles	55	Children shouting inside classroom Car passing by
Sta. 2 - Danao Barangay Hall	50.3	Noise from passing vehicles	52	Car passing by Motor cycle passing by
Sta. 3 - Panglao Municipal Hall	50.5	Noise from passing vehicles	55	Cockcrow Birds sound
Sta. 4 - Access Road to Airport	51.9	Noise from passing vehicles	52	Wind noise People Talking Birds sound
Sta. 5 - Bolod Elementary School	52.7	Noise from car body building and repair shop	55	Wind noise People talking Motor cycle passing by

Table 8.4-7 Environmental Quality Standards For Noise In General Areas

Category of areas	Daytime dB(A) 9:00a.m.-6:00p.m.	Morning & Evening dB(A) 6:00 a.m.-9:00 p.m. 6:00 p.m.-10:00 p.m.	Nighttime dB(A) 10:00p.m.- 6:00 a.m.
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65

Note: Class AA – A section or contiguous area which requires quietness such as Area within 100 meters from school sites, nursery schools,hospitals and special homes for the aged.
Class A – A section or contiguous area which is primarily used for residential purposes.
Class B – A section or contiguous area which is primarily a commercial area.
Class C – A section or contiguous area which is primarily reserved as a light industrial area.
Class D – A section or contiguous area which is primarily reserved as a heavy industrial area.

8.4.3. The Study on Resettlement

1) Objective and Background

The objectives of the study are as follows:

1) To grasp the current status of land acquisition and resettlement for the New Bohol Airport Construction Project.

2) To identify and analyze the gaps between the 1) above and JICA' "Guidelines for Environmental and Social Considerations (2010)".

3) To propose an additional study and an action plan for filling the above gaps, if any.

Under the New Bohol Airport Construction Project, there are two phases of land acquisition; namely in 1990s and after 2006. After conducting a survey of the affected structures, including a more detailed assessment of obstacle limitations in Alternative Site I, a pre-final orientation was established by the Project Task Force in coordination with Air Transportation Office (ATO), the present Civil Aviation Authority of the Philippines (CAAP), which necessitated a re-orientation of the original alignment to a new orientation bearing North 30 degrees East. The new alignment was later subjected to a new topographic and inventory survey under the Feasibility Study (F/S) in 2007.

The detailed information is described in Resettlement Action Plan prepared in 2012 (Volume III).

2) Land Acquisition before the Change of Alignment

Before discussing the change of the original alignment, the land acquisition of the Right of Way (ROW) for the new project already commenced as early as 1990s. In those days, the Central Government agencies, namely Department of Transportation and Communication (DOTC), Department of Tourism (DOT) and CAAP, had been planning to establish, develop and operate a new airport in the Municipality of Panglao. Provincial Government of Bohol had been engaged by the Central Government to conduct the acquisition of the ROW for the said project by virtue of a Memorandum of Agreement dated 23rd January 1994. Before the change of alignment, the total area of 62.48 ha was acquired. However, due to the realignment, 32.60 ha had become outside of the project area (See Table 8.4-8). Those lands were later bartered with the land of newly identified project affected persons.

Table 8.4-8 Scale of Land Acquisition Before Realignment

No. of Lots	Total Area (sq. m.)	Area Within Project Site after realignment (sq. m.)	Area Outside Project Site after realignment (sq. m)
50	624,786	298,639	326,147

Source: Memorandum of Agreement between Central Government and Provincial Government of Bohol, dated on November 10th 2009

3) Land Acquisition After the Change of Alignment

On 22nd July 2006, the DOTC and the Bohol Provincial Government executed a Memorandum of Agreement which enabled the Provincial Government to resume land acquisition and conduct related activities for the airport project. Since then, land acquisition has been implemented based on the land acquisition law (Republic Act 8974), and rules and regulations set by Provincial Government. Hereinafter, land acquisition and resettlement after the change of alignment will be described and analyzed.

As of November 2011, all the lands in the ROW of the new alignment were already acquired or under acquisition procedure. As shown in Table 8.4-9. Out of 425 lots in the ROW, 252 lots, equivalent to 75.5 % of the total, are already acquired. Out of the acquired 173 lots, 93 lots are bartered with the previously acquired lands which had become outside of the ROW after realignment.

Table 8.4-9 Current Status of land Acquisition as of November 2011

Status		No. of Lots	No. of Owners	Area (sq. m)	Lot-wise Ratio (%)
a)	Acquired through cash compensation	220	167	1,431,615	62.5
b)	Previously acquired before realignment	32	18	298,639	13.0
a)+b)	Already acquired	252	185	1,730,254	75.5
c)	Acquired through Barter Exchange	93	104	289,849	12.6
d)	Under Expropriation	8	5	40,348	1.76
e)	Under negotiation/ identification	67	58	212,718	9.3
f)	Owned by Government (Road)	5	-	18,635	0.8
c)+d)+e)+f)	Under Acquisition	173	167	560,370	24.5
Total		425	352	2,291,804	100.0

Source: Summary of Lots and Owners for the New Bohol Airport Project' obtained from the Provincial Government. The name of an owner is converted to a numbers for protecting their privacy.

Out of the remaining 80 lots, 67 lots are still under negotiation with owners or identification of owners. According to a provincial officer, some of the owners under negotiation prefer to barter exchange than cash compensation, and wait for necessary procedure. Another 8 lots are under expropriation, which means that the court will decide the final compensation amount for those lots. Out of 352 total land owners, only 5 owners proceeded to complaint to the court. One of the reasons for such small number of owners under expropriation could be the alternatives for land acquisition: i.e., cash compensation or barter exchange (land to land compensation).

4) Scale and Status of Resettlement

According to the record obtained from Bohol Provincial Government, 64 households were affected with their houses and had to resettle outside of the ROW. Among those 64 households, there was one (1) household without land ownership (rent-free occupant), and one non-eligible household who settled after cut-off date, February 20th 2008 (See Table 8.4-10).

Table 8.4-10 Scale of Resettlement

No of households whose houses are affected	No. of population whose houses are affected	No. of areas affected	No. of households by Land Tenure/ Eligibility	
			Owners	Rent-free occupant
64	347	270,798 sq.m.	63	1

Source: 64 Households Affected with Their Houses

As shown in Table 8.4-10, out of the 64 households above, 61 households were already paid their eligible compensation. Out of remaining 3 households, 2 are under expropriation and waiting for the final decision on compensation amount by the court. The other household is not eligible for any types of compensation, since the family had settled before the cut-off date.

Out of the 64 households affected with their houses, 32 households had been already resettled outside of the ROW, mostly to nearby areas in Panglao or Bohol Island, except for one who resettled to Batangas Province. There are still 32 households remaining in the project site, since they were allowed, by the Provincial Government, to remain until the commencement of the construction of the new airport. And after cut-off date, 11 households move in the site from outside, then there are 43 household in May, 2012.

5) Relocation

At the relocation site, 54 lots with 250 sq.m were made available for households affected with their houses. As of the present, occupancy allocation had been completed and, therefore, lots were fully allocated. The lots were awarded through barter or purchase. The records of Bohol Province Government shows that 36 lots were bartered and 16 lots were acquired through purchase. The two (2) remaining lots were allocated to one (1) informal dweller (rent-free occupant) in the project site and to the cooperative composed of affected lot owners, namely Panglao Landowners Multi-purpose Cooperative.

Since displacement is unavoidable, the project holder (DOTC) decided to ensure that displaced persons be provided with:

- Economically feasible options for resettlement based on consultations with them and assessment of resettlement alternatives.
- Te project holder will re-provide the relocation lots for 38 families that are Interested to Avail in the Relocation Site in 43 families in avoidable displacement.
- 21 families except 17 families who have been owners of the lots shall pay the land cost (15,000 Php) that is same price of 2008.
- The project holder accept the loan payment, the period is 10-15 years.
- Where physical relocation is necessary, assistance to transportation, dismantling of their structures, meal allowances for a week, special assistance and health care for vulnerable groups such as children, elderly, disabled persons and mothers.
- Development assistance in addition to compensation for lost assets such as land preparation, agricultural inputs and credit facilities and training and livelihood opportunities. In this situation the existing cooperative is the ideal mechanism to provide this assistance.
- Children in school that will be disrupted due to relocation should be assisted in transferring to other schools near the relocation site. Coordination should be done with the Dept. of Education to ensure their acceptance of the transferee.

From the past study, there have been efforts in preparing the affected people for livelihood opportunities once project construction starts. Skills training on cooking, welding and automotive were conducted, unfortunately, only the landowners attended the training because the intended beneficiaries were too busy working for their daily needs.

Based from the latest socio-economic survey conducted last April 2012, almost 50% of the affected people were unemployed.

Since provision of livelihood opportunities is mandated by law to involuntary resettlement, it means that skills training be conducted again but this time intended for the affected families and training can be program now while they are waiting for the completion of the resettlement site. Training now is advantageous so that they can begin their livelihood project or augmenting their income. Training should be along the field of services which are in demand in the area such as lifeguarding, bar-tendering, resort or room servicing, massage therapy, sewing or handicraft making, beauty care. etc. Since Bohol is booming in its tourism industry, the stated skills needed could easily be employable.

To facilitate the transfer of the affected families, it is decided that the Provincial government and DOTC includes the construction of core houses for the affected families and recover the cost by amortizing the house to them payable within 10 to 15 years either thru Pag-ibig or other financing institution. This is similar to the housing program being implemented by the

National Housing Authority. If they request demolish and re-construction of existing houses to resettlement area, PMO will assist re-movement activities. The assistance for affected families in avoidable displacement can reduce the loan payment. If the families will pay back only land acquired cost only by 10 years loan, the payment is around 200 - 300 peso/month.

Picture.8.4.7 Developed Resettlement Area

Table 8.4-11 Current Status of resettlement as of 2011

No. of households whose houses are affected	No. of households who had been paid their compensation for land and/ or structure	No. of households who have already resettled outside of ROW	No. of households who still live in the project site	No of households who have land lots in resettlement site
64	61	32	32	17

Source: 64 Households Affected with Their Houses

5) Legal and Policy Frameworks for Land Acquisition and Resettlement

On 22nd July 2006, the DOTC and the Bohol Provincial Government executed a Memorandum of Agreement which enabled the Provincial Government to resume land acquisition and conduct related activities for the airport project. Since then, land acquisition has been implemented based on the land acquisition law (Republic Act 8974), and rules and regulations set by Bohol Provincial Government and the Central Government. Major legal framework and policy of the government are as follows;

- Republic Act No.8974 (An Act to facilitate the acquisition of right-of-way, site or location for National Government Infrastructure projects and for Other Purposes) approved in November 2000, and its Implementing Rules and Regulations (IRR)

- Executive Order No.14, series of 2006 (Establishing the Implementing Guidelines for land acquisition and relocation activities for Panglao airport development project) of provincial Government of Bohol issued on 29th August 2006.

- Resolution No.0-55-2005 Series of 2005 (A Resolution Setting the Appraisal of lands and other Improvements Affected by the proposed Panglao Airport Development Project) approved by November 3rd 2005. (Annex F)

- Memorandum of Agreement (MOA) between Central Government (DOTC, DOT and CAAP) and Provincial Government of Bohol, dated on November 10th 2009.

Table 8.4-12 summarizes the compensation / entitlement package based on the above mentioned legal and policy framework. In addition, livelihood programs are planned for the affected persons through the Panglao Landowners Multi-purpose Cooperative established and officially registered on October 30, 2007.

Table 8.4-12 Compensation and Entitlement Matrix

Type of Loss	Compensation/ Entitlement
Land with title	1) Cash compensation of 60 PhP/ sq. m. OR 2) Barter with previously acquired land
Land without title	None, but a lot for resettlement site is prepared for an informal settler for free.
Structure	Market value for buildings and other structures shall be based on the data of the Schedule of Market Values from the Office of Provincial Assessor with a plus factor f of 10% of the basic rate. Also lots at a resettlement site can be obtained through purchase or barter.
Plants and trees	Compensation is paid for different types of trees and plants

Note: Other assistance such as transportation allowance is not known.

6) Public Consultation

Public consultation between project affected peoples and Bohol provincial Government (BPG) were hold in 2009 to discuss about relocation conditions. BPG assisted to establish organization of owners coop. However, PAPs refused to demolish their structures, because the project implementation is uncertain in that time.

In April 2012, DOTC held public consultation at project office in Panglao Municipality to explain the relocation schedule and public assistances. BPG invited women to keep a gender balance. 54 numbers of PAPs (including 34 women) joined the meeting. They requested BPG to prepare livelihood program (See RAP Report).

7) Gaps between JICA Guidelines and the Actual Practice

There are mainly three gaps between the JICA guidelines on involuntary resettlement and the land acquisition and resettlement activities actually practiced for the project. Those points are summarized in Table 8.4-13.

Table 8.4-13 Gaps between JICA Guidelines and Actual Practice

No.	JICA Guidelines	Actual Practice for the Project
1.	Compensation must be based on <u>the full replacement cost.</u>	Based on the Provincial Resolution in 2005, land price was unanimously set as PhP 60 per sq.m. On the other hand, affected structures were paid the market values with a plus factor of 10% of basic rate. (Necessary actions) It is necessary to further investigate if the above compensation scheme is in line with the JICA's definition of the full replacement cost.
2	Appropriate and accessible grievance mechanisms must be established.	There is no 'systematic' grievance redress mechanism existing in the project, except for informal complaints brought to the relevant officers.
3	Resettlement action plans (RAP) must be prepared and made available to the public.	Due to uncertainty of materialization of the project, no comprehensive RAP was prepared, and made to the public. (Necessary actions) Now that the project is going to be implemented soon, it is especially important to prepare the plan on: 1) Development of a resettlement site 2) Schedule of resettlement of 44 households still living in the project site 3) Follow-up activities after resettlement 4) Expediting the land acquisition of remaining 53 lots

8) Future Program

Most important issue is that the re-movement of remaining 43 families will be done smoothly without problems, DOTC shall consider following actions, more detailed future program and information is described in RAP Report (Volume III)

(1) Development of Resettlement Site

If affected families are still plan to move to the resettlement site, development needs to be done prior to the relocation. Then, it is necessary to discuss who are responsible for the development of resettlement site, and what kind of measures (such as water supply) are need to be taken.

(2) Establishment of Systematic Grievance Redress Mechanism

Through discussions with government stakeholders and project affected persons, it is necessary to establish a systematic grievance redress mechanisms, so that affected persons' complaints and anxiety are registered and solutions or answers are given back to them.

8.4.4. Stakeholder Meetings

1) Related Agencies and Local Stakeholder

The related agencies of the new airport construction project are shown in Table 8.4-14 and local stakeholders are shown in Table 8.4-15. In this study, two (2) times of local stakeholder meeting was held in Panglao and Dauis Municipality, and one (1) related agencies meeting was held in Manila. The major contents of discussions are as follows;

Table 8.4-14 Related Agencies

Name of Related Agencies	Role
Department of Transportation and Communication(DOTC）	Executed agency
Department of Tourism (DOT)	Executed agency
Philippines Tourism Authority(PTA)	Executed agency
Provincial Government of Bohol Provincial, Planning & Development Office	Executed agency
City of Tagbilaran	Executed agency
Municipality of Panglao	Executed agency
Tagbilaran Airport Office	Executed agency
Tourism Infrastructure & Enterprise Zone Authority (TIEZA)	Executed agency
Civil Aviation Authority of the Philippines	Executed agency
National Economic & Development Authority(NEDA)	Coordinator
Department of Environment & Natural Resources (DENR) and Environment Management Bureau (EMB)	EIA

Table 8.4-15 Local Stakeholder

Name	Role
Provincial Government of Bohol Provincial, Planning & Development Office	Assistance
Municipality of Panglao	Assistance
Barangay officials and residents of the affected barangays.	Residents

2) 1st Local Stakeholder Meeting

The Stakeholders' Meeting started at 2:00 in the afternoon. Introduction was made by Mr. Abelio Arbilo from the Mayor's Office of Municipality of Panglao. Presentation of the proposed project and purpose of the meeting was delivered by the Project Consultant, Engr. Danilo J. Castillon.

The meeting was attended by fifty three (53) participants, including sixteen (16) women. The participants were composed of the municipal officials/staff, barangay officials and residents of the affected barangays. See attached attendance sheet.

Table 8.4-16 1st Local Stakeholder Meeting

Q/R	Note
Mr. Alfredo Estopito (Councilor from Barangay Lourdes)	
Question	Is the bidding for the airport project is already confirmed?
Response	It is not yet confirmed. That is the reason why Philippines Government is considering PPP scheme for the project and asked the Government of Japan to carry out F/S of the project. But before JICA shall be considered realization of the scheme, JICA need the recent environmental and social status and other aspects of the project area as basis of their review for approval or not. The Project Consultants were hired to conduct the study and will not be involved in the construction.
Mr. Antonio Arbitanio (Purok Leader from Barangay Danao)	
Question	Are you a contractor or investor? Where will be the funds come from? There is unfair cost of land acquisition.
Response	We are consultants hired by JICA. JICA will carry out F/S of the new airport project and consider total management system including finance. JICA need update all necessary documents for their review before making a decision whether to financial assistance or not. In terms of cost for land acquisition, the zonal value is being followed by the government.
Question	We would like to express our appreciation on the airport and the effort being done by the Project Consultant particularly to the Japanese to pursue this project.
Response	Mr. Takashi Goto thanked the people who came to the meeting and also expressed his gratitude to the help given by the Philippine Government to Japan during the last dilemma they had.
Mr. Moises Nioda (Councilor from Barangay Lourdes)	
Question	What are the conditions to the possible financial assistance from Japan?
Response	At this early stage, we cannot say those conditions. Agreement between the Philippine and Japan Governments will be discussed deeply and depends on the terms and conditions of the funding agency which is JICA.
Mr. Danny Reyes (Resident from Barangay Lourdes)	
Question	What are the data needed for the study? If you still need to get our perception as to date about the project through household survey, why we need to hold this meeting now?
Response	We need to update the environmental/social situation such as water quality, air quality, noise quality, corals and mangroves descriptions of the island and also the opinion of the people about the project wherein a standard survey form from DENR will be used. Also, this meeting is required not only by the DENR but as well as JICA to know and witness personally by the JICA Study Team through Mr. Takashi Goto if you really in favor for the establishment of New Bohol Airport here in your municipality.
Mr. Faustino Mila (Resident from Barangay Tawala)	
Question	When will be the target date for the implementation of the airport project? With regards to job hiring, local workers should be prioritized?
Response	We cannot answer now exactly the timeline for the construction of the airport. As what said earlier, there are several stages to be considered. We still need to update the previous environmental impact study conducted on year 2000. Then prepare the report for submission to JICA for their review and approval. If approve, an agreement should be discussed and be finalized by our government and JICA and that is the only time that we can proceed for the construction phase of the airport. With regards to local hiring, there is a provision in our labor law that the local workers should be hired provided that they are qualified with the description of the job needed.

All the participants are very much willing and in favor for the construction of the new airport.

3) 2nd Local Stakeholder Meeting

The 2nd Second Stakeholders' Meeting started at 2:00 in the afternoon on 22th, July. Opening remarks was done by the Honorable Vice-Mayor Evangeline B. Lazaro of the Municipality of Panglao. The result of the updated Environmental Impact Assessment (EIA) study was discussed by Engr. Danilo J. Castillon, Senior Engineer from Test Consultants, Inc. Open forum was followed after the presentation.

The meeting was attended by fifty four (54) participants, including twenty (20) women. Local consultant invited residents from not only Pnaglao barangay and Dauis barangay, and made arrangement the gender balance. The participants were composed of the provincial and municipal officials/staff, barangay officials and staff, lot owners and residents of the affected barangays.   See attached attendance sheet.

Table 8.4-17 2nd Local Stakeholder Meeting

Q/R	Note
Hon. Walter P. Sultan (Member, Sangguniang Bayan of Panglao)	
Question	What will be the volume of people that will come in the municipality? This is pertaining to the in-migration of people to the area.
Response	Response: The priority in hiring of qualified workers will be local residents but the influx of people cannot be controlled if most of the workers will be from other municipalities.
Ms. Leonila Lafuente (OIC-BEMO from the Provincial Government)	
Question	We just want to suggest that the wastewater treatment facility of this airport should be constructed during the construction phase of the project, unlike with the previous projects in Bohol wherein the structures already existed before the wastewater treatment facility was constructed.
Response	This is usually included in the conditions stated in the ECC and the project team will include in the design. JICA is presently conducting separate study on water supply and sewerage systems in Panglao Island and Bohol.
Hon. Walter P. Sultan (Member, Sangguniang Bayan of Panglao)	
Question	One of several problems in Panglao are the water supply and sewerage systems, may we know the extent of your study in accordance with the Terms of Reference?
Response	The study of the water supply and sewerage components is part of the study of the JICA Survey Team but scheduled to be conducted by next year.
Ms. Jovencia S. Asilo (Municipal Planning and Development Officer of Panglao)	
Question	This project had been proposed since 1992 and the ECC was approved in 2000 and the latest re-issuance was in 2008, when will be the exact date of implementation?
Response	The decision is done by Philippines Government. JICA will assist the implementation by the request of your government.
Hon. Walter P. Sultan (Member, Sangguniang Bayan of Panglao)	
Question	The issue now is the source of funds and not the study anymore.
Response	JICA is interested to assist in funding this project and that is the main reason why we are conducting this meeting and updating all baseline data that are necessary in processing the required documents for approval.
Hon. Evangeline B. Lazaro (Vice-Mayor of Panglao)	
Question	There are big hotels within Panglao municipality but sad to say they did not hire local workers but

	mostly from Manila, what would be the assurance that it will not happen again?
Response	We are not contractor but under the ECC conditions, preference in hiring will be given to workers the locals provided that they are qualified.
Mr. Nick Loremey (Purok Leader, Barangay Danao, Panglao, Bohol)	
Question	The water supply in Panglao is not sufficient, can we suggest funding for water system since there are abundant water sources found in Barangay Doljo, Panglao. Also, there are many tourists in the area and sometimes experienced problem in accommodations.
Response	The suggestion is noted.
Mr. Patricio Arkay (Resident from Barangay Danao, Panglao, Bohol)	
Question	We just want to inform you that the purchase of our lot was very cheap. As we knew, the market price is between PhP 500-600 per sq.m but they paid us PhP 40 per sq.m.
Response	The price of land acquisition was based on the zonal value set by the Bureau of Internal Revenue depending on the assessment of land in the particular area.
Mr. Alfredo Estopito (Member, Sangguniang Barangay of Barangay Lourdes, Panglao, Bohol)	
Question	What is the result of the assessment of the study? Who will finance the project?
Response	The preparation of the project report is now on-going and there are no activities yet being implemented.
Ms. Antonina P. Fuego (Member, Sangguniang Barangay of Barangay Lourdes, Panglao, Bohol)	
Question	What are the reasons why the project took so long and till now is not being implemented? There was an instance that a certain lot owner was not paid for his property which was included in the acquired lot.
Response	About this matter, the Provincial Administrator of Bohol answered the query. Payment of the lot for the person she was referring is not yet complete because he did not processed properly his documents. The Provincial Government of Bohol wants to assure that the communities are well notified on all activities to be done in the area. The province did not have enough funds to sustain for the project and that is the reason why we asked for the financial assistance from JICA. Another reason for the delay was the change of the orientation of the project alignment and the sinkholes within Panglao Island but the project site is not located within any of the sink hole areas. Just try to understand that the process is not that easy for us to have enough funds.

4) The Government Stakeholders' Meeting

The Government Stakeholders' Meeting started at 2:00 in the afternoon on 29th,July. The purposes of the meeting are: a) in order to take into consideration the environmental and social factors in a way of that is most suitable to local situations, and in order to reach an appropriate consensus; and b) disclosure of information at an early stage, the outcome must be incorporated into the contents of project plans.

The program of the meeting consisted of the presentation of the project by Mr. Tadashi Aoi, Team Leader of the JICA Project Team; outline of the Panglao Island presented by Mr. Takashi Goto, JICA Project Team; updating of the EIA Study by Engr. Danilo Castillon, Senior Engineer of Test Consultants, Inc.; and open discussion.

The meeting was attended by fourteen (14) participants, composed of the different representatives from various government agencies. See attached attendance sheet for the list of participants.

Table 8.4-18 The Government Stakeholders' Meeting

Q/A	Note
Mr. Felicisimo C. Pangilinan, Jr., Planning Officer from DOTC	
Question	Can the lot area already acquired enough to accommodate the revised master plan?
Response	Yes, the Provincial Government of Bohol bought additional lot area required for the revised master plan.
Question	Who conducted the geotechnical study? Are the 40 boreholes and 20 test pits enough to determine the safeness of the structures to be built in the area?
Response	PhilJAC conducted the geotechnical study of the area and that the number of the boreholes and test pits are enough to determine the suitability of the soil and appropriate depth of the structure's foundation. But if you think we need to have additional boreholes and test pits, we note your suggestion and propose to implementation agency.
Question	If the corals will break up, are there possibilities that cavities will be created and spread out? We just want an assurance that the structures to be constructed are safe from the cavities. Also, we are trying to avoid the difference of soil classifications during the pre-construction stage and the actual soil investigation to be conducted during the construction phase. We already experienced that in some of our projects.
Response	If you think that it is really necessary to have additional boreholes and test pits, we will propose to implementation agency.
Question	So the baseline study conducted in year 2000 is being updated now by the Consultants?
Response	Yes, as per Terms of Reference. All sampling station locations for the field investigation surveys in year 2000 are the same sampling station locations being considered in the update, except for one sampling station located in mangrove area for sea water.
Question	What is Heterotrophic Plate Count? The value of result being presented is really alarming.
Response	It is the density of aerobic and facultative anaerobic heterotrophic bacteria in water. The heterotrophic plate count is a good measure of water treatment plant efficiency, after growth in transmission line, and the general bacterial composition of source water.
Engr. Nicanor Mendoza, Engineer IV from EMB-WQMS	
Question	Is it possible for us to require you to have additional water sampling site? Artesian well is possible? We are officially requiring you to take sample in a new source wherein the water is potable in the area.
Response	It is not possible for us to have another location of sampling points because as our TOR states that we need to take samples on the same sites as in of the previous study and we are only required to update the current situation in the area. We are not in the position to decide to take other samples or to change the sampling sites. If you want, we will note and propose to implementation agency. The DOTC as the proponent, can prepare communications to address that request but reiterated that this suggestions be recorded in the Minutes of the Meeting.
Mr. Raul T. Jardin, Representative from NSWMC	
Question	What is the source of acceptable limits you used in comparing the results?
Response	It is the Philippine National Standard for Drinking Water (PNSDW) known as the DENR Administrative Order (DAO) 34.
Engr. Nicanor Mendoza, Engineer IV from EMB-WQMS	
Question	Where is the discharge point of wastewater in the area? You should also have taken a sample from that area.
Response	As what we said earlier, we only update the data of the previous study and we never decide on the location of the sampling points. Your recommendations will be recorded accordingly and to be submitted to implementation agency.

Engr. Petra Aguilar, Engineer IV from EMB-AQMS	
Question	The causes or reasons of high recorded value should be indicated and the sampling points be incorporated in a map. I am also recommending that the samples should be taken during two seasons, the wet and dry seasons, which is more appropriate for comparison of the results.
Response	The remarks, causes or reasons, and location map with regards to sampling stations will be part of the report. The suggestion will be noted and proposed to implementation agency.
Mr. Felicisimo C. Pangilinan, Jr., Planning Officer from DOTC	
Question	Is the stakeholders' meeting really required by JICA?
Response	Yes.
Question	What are the purposes of the stakeholders' meeting and the conduct of the perception survey? How many had been interviewed and what are the questions indicated in the form being used?
Response	The stakeholders' meeting is a requirement from JICA while the perception survey is being undertaken to gather the opinion of the residents towards the project. The number of respondents was determined by getting the total household population of the area to be surveyed and get the 10% of the household population as the representative samples and surveyed in random locations. The form being used was the approved questionnaire by EMB in our various EIS reports.
Question	Was the stakeholders' meeting conducted in a public place? How are you assured that the participants in the first meeting also attended in the second local stakeholders' meeting?
Response	The local stakeholders' meetings were conducted twice and represented by different sectors such as from the provincial, municipal and barangay LGUs and also lot owners and local residents of the affected areas. The first meeting was held in Panglao Cultural Center on May 21, 2011 and the recent one was held in the Municipal Session Hall on July 22, 2011. The participants were invited through letters.
Ms. Juvy P. Serafin, Representative from NSWMC	
Question	Have you done geo-hazard study and if MGB was involved?
Response	This is not included in our study, but the query is noted and for verification.
Mr. Joel G. Polintan, Technical Staff from EIAMD	
Question	Is this for another ECC application? If not, what is really the purpose of this meeting?
Response	This will not be for another ECC application. The concerns that we gathered from this meeting will be the basis if we need to amend the design of the new airport.
Mr. Virgilio S. Victorino, ACANS, ANPPDD from CAAP	
Comment	Due to short notice of the invitation for this meeting, I don't have advance information about the status of this project but all that had been discussed in this meeting are well understood and noted.
Mr. Felicisimo C. Pangilinan, Jr., Planning Officer from DOTC	
Question	Based on the projected passengers, will there be any significant change that will result to the amendment of the existing ECC?
Response	Response: If EMB-Region VII will accept the amendment plan and found no significant changes, then we can use the existing ECC. We will revise the new EIA report for DOTC and if necessary, it will also be submitted to EMB-Region VII.
Question	Maybe EMB-Region VII will be asked only for the amendment of the conditions in the ECC. Is the contract of the local consultant requires a full-blown EIS?
Response	Response: We hope that it will just be an amendment to ECC conditions. As per contract of the local consultant, no need to conduct a full blown EIS but rather to update only the baseline conditions of the area. The local consultant will submit a revised EIS report based on DAO 03-30.
Ms. Patricia Dumpit-Daet, Technical Staff from EIAMD	

Question	Have you been coordinating with EMB-Region VII?
Response	Not yet, it will be done after we finished the report.
Ms. Juvy P. Serafin, Representative from NSWMC	
Question	There is no discussion about solid waste management plan for the project.
Response	It will be incorporated in the EIA report.

8.4.5. Prediction and Assessment of Impact

1) Future Environmental Conditions without the Project

Comparing the future conditions without the project against those conditions where the project is implemented is essential for weighing the project's benefits against its impacts. Hence, the future environmental conditions without the project are presented in this section.

Table 8.4-19 Future Environmental Conditions without the Project

Items	Impact
1) Resettlement	Without project, any resettlement will be not required.
2) Economic Activities	Without the project, population growth will be brought by natural increase and net-mitigation. Fishing despite its potential as a significant source of livelihood and income, has been and its likely to remain subsistence and small scale without intervention or assistance. Unemployment rate is expected to be same if no employment generating facilities will be established in Bohol or in the island.
3) Land Use	Agriculture can not be good business due to poor soil and water. The investment in agriculture will not longer be attractive and some owners may now give up their lands for other purposes. It is possible to reduce agricultural area.
4) Cutting of Area Relation	Without project, existing relationship of residents will be continued.
5) Transportation and lively facilities	Community infrastructures and social services availability will tend to remain as in the existing condition.
6) Poor peoples and Indigenous Peoples	Same as the present time.
7) Inequality of beneficiary	Same as the present time.
8) Heritage	Non
9) Opposition	Same as the present time.
10) Water Right, Common Right	There are not small rivers and ponds. There is not common property of the barangays and municipalities.
11) Preservation of Health	Same as the present time.
12) Disaster Risk	If global warming will raise sea level, disaster risk of tsunami is higher.
13) Topography/Geology	The topography/geology of the project site will remain unchanged.
14) Soil Erosion	Non.
15) Ground Water	Without any major development in the area, the demand for water is likely to increase slightly from its present level. This increase will be due to the natural population growth. Use of fertilizers and pesticides in agriculture is the potential cause of ground water contamination.

16) Lake, River	Non.
17) Coast/Sea area	With or without the project, oceanography characteristics in the area will remain the same.
18) Species/wildlife	Without the project, the composition and pattern of distribution of existing plant species will remain practically the same in the area. There may be some small scale clearing of some vegetative cover associated with the building of some residential houses and business establishments. Panglao Island is classified as a low diversity land. With or without project, fish and wildlife characteristics in the area will not change.
19) Geography	Without any major development in the area, the geography of the project site will remain unchanged.
20) Topography and Geology	Same as the present time.
21) Global Warming/Weather	Considering the available data, no sudden changes in the microclimate could be expected in the project are for the near future. Without significant changes in the environment, changes in temperature, wind direction and speed, rainfall, relative humidity, etc. are also not expected.
22) -30) Air, Water and Soil Pollutions, Noise and Vibration problems	The air, water and soil quality in the area is likely to remain practically unchanged since no significant source of air pollutants is expected to be generated in the project vicinity in the future. Noise and vibration levels along the major way will increase slightly due to the slight increase in traffic volume associated the natural increase in population.

2) Preconstruction/Construction Impacts

Potential impacts during pre-construction phase and the operational phase of the proposed airport project are identified and assessed. The two major development activities during the construction of the project are the construction of access road and airport facilities. Construction activities are expected to disturb the physical, biological and socio-economic environment of the impact zone.

Table 8.4-20 Preconstruction/Construction Impacts

Items	Impact
1) Resettlement	There were 64 houses in the project area. The compensation of resettlement has been finished already. They will move substitution area prepared by the provincial government, when the construction work will start.
2) Economic Activities	The project can employ local residents during the construction phase. It can provide enough work to substantially reduce the unemployment in Bohol particularly in Panglao Island. Business opportunities like sari-sari stores are expected to crop up in the island due to influx of construction workers in the site.
3) Land use	It will not make unwarranted accelerated use of scarce resources in favor of short-term over long-term economic needs. The project site is not considered a prime agricultural land or primary forestland. Its use as an airport site that will generate benefits to the immediate and bigger community than its present land uses which are characterized as marginal/subsistence and unproductive grassland/shrub land. Clearing and other required civil works to be undertaken in the project area during construction stage will result to vegetation loss. However, the impact is only minimal since is mostly covered shrubs and grasses.

4) Cutting of Area Relation	Barangay roads to access to the neighborhood shall be replaced if necessary.
5) Transportation and lively facilities	Congestion in narrow barangay roads and at the entrance to the site will slightly increase due to the hauling of construction materials. However, the average daily trips will not be significant since the construction schedule will be spread over a long period. Construction workers will add up to the existing number of commuters in the area. However, this will only occur during the early phase of construction. The workers will create temporary residence in the construction site that would minimize average daily trips. Road accidents are expected to be moderately significant due to increase in the movement of delivery trucks coming to the project site. Community infrastructures and social services availability will not change as the existing condition in this stage.
6) Poor peoples and Indigenous Peoples	Poor peoples have opportunities to get new job.
7) Inequality of beneficiary	There is no impact.
8) Heritage	Non.
9) Opposition	Non.
10) Water Right, Common Right	Non.
11) Preservation of Health	It is possible construction workers will be source of infection.
12) Disaster Risk	It is possible that the construction activities will obstruct the natural drainage pattern in the area. During construction phase especially in times of heavy down pours, the prevention of flooding in the proposed project area is necessary. Construction of drainage structures around the project site would allow efficient flow of surface runoff to natural drainage system.
13) Topography/Geology	Land reclamation work will change topographical condition in the area. However, the work will be planned to minimize, the balance of cutting and embanking is planned as equal. The topography/geology of the project site will not changed the feature of original land form.
14) Potential Soil erosion	Any horizontal construction activities especially for site development will definitely cause some soil erosion. Without any mitigation measures, the amount of eroded soil will be significant during rainy periods on large exposed areas. Runoff water will transport soil particles that will result to siltation of water bodies in the project area.
15) Ground Water	There is no pavement of runway area until final phase, therefore water balance between evaporation and permeation will not change. However, it will be possible water quality of shallow wells become worse.
16) Lake, River	Non.
17) Coast/Sea area	The project will not direct impact coast and sea area.
18) Species/wildlife	It will not result in unwarranted hazards to endangered species. The project site and areas proximate to it have no recorded endangered species, which could be affected by the construction and operation phases of the project.
19) Geography	Land reclamation work will be planned to minimize, therefore geographical condition is almost same as original land.
20) Topography and Geology	The civil work will change topography of the area.

21) -22) Air Pollution/Global Warming	Expected air emission sources are from delivery trucks during hauling of construction materials and from the construction equipment used. However, magnitudes of these emissions are relatively small and could easily be dispersed by the wide air space in the site. Hence the expected impact would be minimal. A moderate dust generation is expected during the dry season due to ground preparation and earthwork activities.
23) Water Pollution	During construction stage, about several hundred skilled and unskilled workers are to be hired. They will generate waste water in their life. Water quality of the surrounding water bodies may be impaired due to the direct discharge of sanitary waste water. Likewise, when the effluent from the specific system is discharged directly into the soil subsurface, it could migrate downward especially in areas intensive ground water pumping and declining discharge of this wastewater may cause short-term impact on water quality.
24) Soil Pollution	Waste oil and grease from heavy equipment and fuel has potential impact to soil pollution.
25) Solid Waste	Solid waste will be generated from the followings: (1) construction site, (2) construction office, (3) and temporary residence of workers. The wastes shall be collected and disposed to new sanitary landfill site in Bohol Island, the site is under construction. Without any mitigation measures the solid waste generation could become one of the major log term environmental problems.
26) Noise Pollution	Operation of various construction equipment will be major source of noise generation during construction. The expected sound levels in dB(A) at various distance from these and other construction equipment are shown in Table 8.4-21. The DENR standards for noise in general areas are shown in Table 8.4-22. From this Table, it can be seen that noise levels from most of the equipment attenuate to typical ambient levels at a distance of 240 meters and should pose no problem to nearby communities. It is therefore expected that these noise levels will not be nuisance to the public since there is a reasonable distance between the present residential areas and the proposed construction site.
27) -29) Ground sinkage, odor, sludge quality	Non.
30) Traffic Accident	Traffic accidents will be increased by construction and commuter' vehicles near the site.

Table 8.4-21 Noise Level (Heavy equipment)

Source	Distance from Source , dB(A)				
	15	30	60	120	240
Front Loader	75	69	63	57	51
Backhoe	85	79	73	67	61
Grader	88	83	78	72	66
Track	91	85	79	73	67
Concrete Mixer	82	76	70	64	58
Crane	83	77	71	65	59
Generator	78	72	66	60	54

Compressor	81	75	69	63	57
Pump	76	70	64	58	52
Pile Driver	101	95	89	83	77
Jackhammer	88	82	76	70	64

Table 8.4-22 Maximum allowable noise level

Area	Maximum allowable noise level, dB(A)		
	Daytime	Morning/early Evening	Nighttime
School, Hospitals	50	45	40
Residential	55	50	45
Commercial	65	60	55
Light Industrial	70	65	60
Heavy Industrial	75	70	65

3) Operation Phase

Potential impacts from the operation of the proposed airport will arise from the numerous activities related to airport operations. Normal activities such as aircraft takeoff and landing, movements of passenger and cargo vehicles to and from the airport complex, would affect the physical and biological environment around the site. More importantly, the development of the site would transform the land use in the area that could become a nucleus of growth and development.

Table 8.4-23 Operation Phase

Items	Note
1) Resettlement	It is same as construction phase.
2) Economic Activities	Good effective after new airport operation, the employees of the airport will be appointed local people due to the Conditions of ECC. The project will create both a permanent and transient population in the island. The increasing of population will impact regional economic activities.
3) Land use	It is expected that the values of the nearby areas will rise. In the near future, the domino effect of economic development that can be catalyzed by the proposed airport and other development projects in the project area may even felt not only in the immediate area of the project site but also in the nearby towns of Panglao.
4) Cutting of Area Relation	Barangay roads to access to the neighborhood shall be replaced if necessary.
5) Transportation and lively facilities	The basic services demand for road network will greatly increase during the operation phase of the project. The stretch between Tagbilaran city and the airport will the heaviest toll. With the improvement on lifestyle that can catalyzed by the airport project, and the urbanization of the project area in general, the health and safety of the residents may subsequently improve. Because of development and

	economic capability of the residents, improvement on the basic utilities such as sanitaized pipe drinking water, water-sealed septic tank and other basic health and sanitation facilities are expected to be effected in the project areas.
6) Poor peoples and Indigenous Peoples	Poor peoples have a chance to get new job.
7) Inequality of beneficiary	There is no impact.
8) Heritage	Non.
9) Opposition	Non.
10) Water Right, Common Right	Non.
11) Preservation of Health	It is possible airport workers, tourists and passengers will be source of infection.
12) Disaster Risk	The following probable environmental hazards that could be encountered in this project are as follows: accident disposal of extremely hazardous substance, accidental fuel spills/leaks, fire, accident due to Seismic Activity, crash.
13) Topography/Geology	Non.
14) Soil Erosion	Soil erosion during the lifetime of the project is expected to decrease and much lower than the present rate due to a shift of land use from agricultural. Implementation of the project would mean more covered areas and less soil to be exposed directly to rainfall. Erosion by overland flows will also be less since the entire development will be proved with lined canals and more paved areas.
15) Ground water	Increase in water demand is expected to be insignificant during the operation phase of the airport.
16) Lake, river	Non.
17) Coast/Sea area	The project will not direct impact coast and sea area.
18) Wild life	Every plant is felled down by land development work, original plants and wild life will be missing.
19) -20) Topography and Geography	Geography will be changed, because new terminal building will be build at the project site.
21) -22) Air Pollution/Global warming	The exhaust fumes from aircrafts and transportation vehicles will be increased. However, magnitudes of these emissions are relatively small and could easily be dispersed by the wide air space in the site.
23) Water Pollution	There is pollution threat to the water quality of the nearby coastal waters and ground water from the liquid and solid wastes generated from the proposed project. The examination is as below.
24) Soil pollution	There is possibility of pollution or contamination from the routine use of the fuel storage tanks and fuel pipeline.
25) Solid waste	Solid waste will normally be generated from the followings: (1) restaurant in the airport, (2) material packaging , (3) office operations, and (4) routine maintenance. Waste from restaurant is biodegradable wastes, packaging wastes are cardboard boxes and plastic wrappings. Waste office papers are usually mixed waste paper and computer paper. Routine maintenance will

	generate rags used in cleaning and maintaining equipment. Improperly managed solid wastes are health and environmental hazards. Rats, flies, and other disease vectors breed in open dumps. Improper management many also cause air and water pollution. The persisting bad odor may constitute a major environmental nuisance. Burning of solid wastes in the open will generate some gaseous and particulate matter causing air pollution problems. Leachates could contaminate the groundwater, while runoffs from open dumps will pollute surface water. Without any mitigation measures the solid waste generation could become one of the major log term environmental problems.
26) Air-Noise Pollution	The examination is as below.
27) Ground sinkage	It is possible runway ground will be sunk by heavy load.
28) Odor	Non.
29) Sludge quality	Non.
30) Traffic accident	Traffic accidents will be increased by passengers vehicles near the airport.

Air-Noise Pollution

Aircraft takeoff and landing, and movements of passenger and cargo vehicles to and from the airport complex, would affect the air quality and noise around the site. There would be a slight increase in ambient concentration of air pollutants in the area.

The project, with its attendant pollution control measures, will generate noise pollution at moderately significant levels only during takeoff and landing of planes. This noise impact could only be experienced by residents living within 300 meters away from airport.

The most probable sources of air pollutant are cars and aircraft. From the point of view of regulation, these sources of air pollution are very difficult to control and regulate. The control is already beyond the authority of the airport management or the proponent.

In case of aircraft, the advents of new aircraft models whose efficiency of fuel burning is much better than the old one could help minimize the generation of air pollutants.

In the case of cars, emissions are very much dependent on the type of vehicle and the type of fuel they are using. With the government efforts to ban leaded gasoline, the emissions of lead particulate will surely minimize. However, the emissions of sulphur oxides, nitrogen oxides and particulate from cars/vehicles using diesel as fuel may not really help in minimizing the generation of air pollutants. The best that the proponent can do is to coordinate with the concerned authority on how to effectively and strictly implement the anti-smoke belching campaign of the government. The assistance of the local government officers will surely help in the implementation of such a program.

In case the airport project will install equipment or facilities, which are possible sources of air pollutants (i.e. boiler, incinerator, etc.), all these facilities with emission sources will comply with the air quality standards (DENR Administrative Order No.14: Revised Air Quality Standards of 1992). Air pollution control devices will be installed. In case of boilers, for instance, the facilities will use a fuel with low sulphur content and install a smoke stack with the appropriate height and dimensions that could reduce the expected ground level concentrations to acceptable levels. A properly designed stack will surely comply with the requirements. In addition, all oil-burning equipment will be provided with heaters capable of heating oil to a temperature appropriate for the oil and burner.

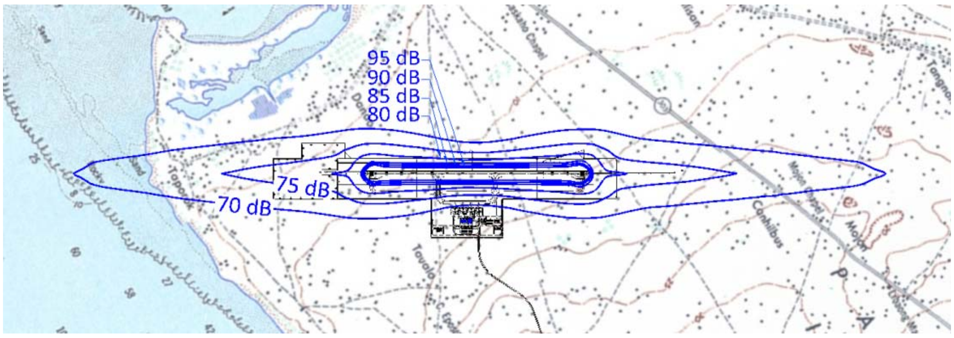
A Noise Abatement Line or open space could be established and a green zone could be created surrounding the airport and shielding the adjacent residential areas. Residential land use and their expansion could be planned outside of the delineated airport zone to minimize accidents and prevent noise pollution in the residential areas.

Noise contour at the proposed New Bohol Airport site in Panglao for the years 2020 and 2030 are computed as shown below.

Figure 8.4-4 Noise Contour by Aircraft

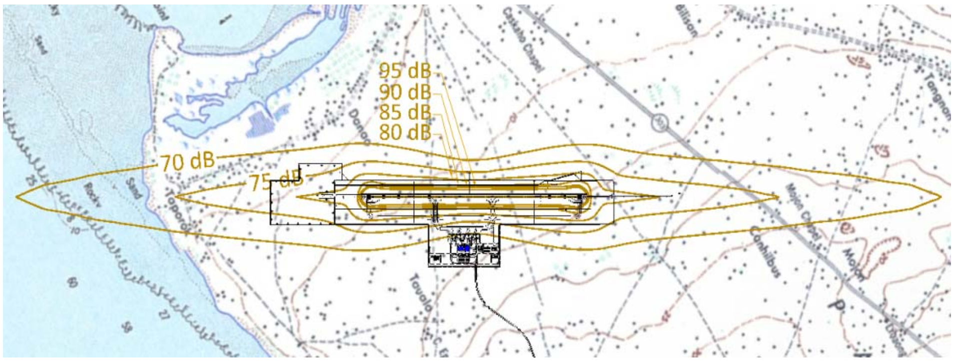
WECPNL

for 2020



WECPNL

for 2030



Source: JICA Study Team

There are only a few, or possibly no residents affected by the noise level of more than 75 WECPNL since ROW for the 1-km long Precision Approach Lighting System in the north-east, and wide areas for a Storm-water Soaking Yard in the south-west have already been acquired.

The new Bohol Airport will have no topographical obstruction that protrude above the obstacle limitation surfaces for instrument approach runway, thus fully complying with ICAO standard.

Rainfall Water and Waste Water Management

From Liquid Waste

Sewage treatment plant (STP) is discharged into the drainage systems that contain nitrate, metals, bacteria and viruses. These materials may have deleterious effects on the ground water quality. The greatest concentrations of dissolved nitrates in deep groundwater zones are usually located beneath the densely populated urban areas. The effluent migrate downward especially in areas of intensive groundwater pumping and declining ground water levels.

Without any mitigating measures, effluents from the STP will cause a long-term negative impact on the groundwater quality of the groundwater resources beneath the proposed residential areas. Without any mitigating measures STP effluent will cause a long-term accumulation of nitrates in groundwater.

Another source of waste water is the floor-drain wastes include routine floor washings and the occasional cleaning of spills. Normally, operating a mechanical equipment will generate some typical waste, which are petroleum based lubricants and fluids.

Fuel Storage Tank/Pipelines

Pollution or contamination from the routine use of the fuel storage tanks and fuel pipeline are not expected during routine operations since these systems are designed not to release their contents to the ground. However, the possibility of leakage should not be discounted. Hence, these aspects are discussed in the section for mitigation measures.

Rainfall Water

Pavement area is limited only runway area, rainfall water from the pavement area and airport area flow into and seepage in the effluent ditch without concrete bottom, and minimized rainfall water reach to seepage pond.

Recorded maximum daily rainfall quantity is 94 mm/day in Oct., 2010. Assumed generated rainfall based on the record, maximum rainfall water amount is 94,000 ton /day (200ha x 50% x 94mm).

Waste Water from Main Building

The waste water quantity from main building is designed as 420 ton/day. The waste water is generated from toilet, restaurant, cleaning of the floor. The waste water is treated in-side treatment plant in main building.

Water Management

The capacity of seepage pond is 200,000 ton designed as based on the rainfall water and business water quantity.

8.5. Mitigating Measures

Environmental and social impacts from new airport construction and operation shall be mitigated by countermeasures. The countermeasures shall be considered in design stage, the plan shall be carried out in construction and operation stage. The countermeasure will mitigate the impacts from the new airport project.

8.5.1. Pre-construction / Construction phase

Mitigation Measures on Pre-construction/Construction phase is shown in Table 8.5-1.

Table 8.5-1 Mitigation Measures on Pre-construction/Construction phase

Items	Note
1) Resettlement	Resettlement activities shall be completed before construction work. The monitoring of the activities shall be carried out.
2) Economic Activities	**<u>Local labor employment</u>** Prioritization of local labor for employment will maximize the positive impact of the project. Priority in employment may be given to those households whose properties will be negatively affected by the project. The employment of any of their household members can be part of the compensation package. The required consideration is as follows; 1) If affected peoples have not qualified school background, PMO shall prepared training for new job and give priority. 2) Documents required for new job shall be prepared by PMO. 3) Recruitment of employment shall be rejected an influential person.
3) Land Use/Compensation of Crop Damage	Before and/or during construction phase, crops, which may be affected by the activities, will be assessed and appropriately valued. Crop valuation may be based on prevailing market rates or as prescribed by the Assessor’s office. This process will be jointly undertaken by Bohol Provincial Government and respective LGU’s, the farm owners, and a third party.
4) Cutting of Area Relation	Barangay roads to access to the neighborhood shall be replaced by requests of residents.
5) Transportation and lively facilities/Traffic plan	Rerouting of the national highway and the creation of a new road become necessary. The national highway should be realigned with a safety spatial margin from the runway to avoid any untoward accidents, particularly runway overrun by aircraft. Immediate opening of alternate routes, the creation of temporary roads to ease the traffic burden airport construction, and completing construction of the rerouted national road at the soonest time possible.
6) Poor peoples and Indigenous Peoples	Lively food program for affected peoples.
7) Inequality of beneficiary	Non
8) Heritage	Non
9) Opposition	Non
10) Water Right, Common Right	Non

11) Preservation of health	Education and IEC campaign for local labor and employment of construction shall be carried out to keep public sanitary conditions and protect the diesis.
12) Disaster Risk/Soil Erosion	Soil Erosion during rainy days of the construction periods is unavoidable. However, this can be controlled by the use of structural erosion prevention and sediment control practices, which will divert the storm sewer flows away from the exposed areas, prevent sediments from moving offsite, and reduce the erosive forces of runoff waters. These may include the following: (1) interceptor dikes, (2) pipe slope drains, (3) straw bale barrier, (4) sediment trap, and (5) temporary sediment basin. Interceptor dikes are generally built around the perimeter of a construction site before any major soil disturbing activity takes place. Pipe slope drains reduce the risk of erosion by discharging runoff to stabilized areas. This is effective before a slope has been stabilized or before permanent drainage, structures are ready for slope use. A straw bale can be used as a temporary sediment barrier by placing them end-to-end in a shallow excavated trench. The sediment trap is appropriate for sites with short time schedules. It is formed by excavating a pond or by placing an earthen embankment across a low area or drainage. A temporary sediment basin is a setting pond with a controlled water release structure used to collect and store sediment produced by construction activities.
13) Topography Geology	Original ground is almost flat land, the development plan will make arrangement the balance of cut and fill amount. The plan has to suggest in specification contractor shall bring fill materials from out of Bohol Island.
14) Soil erosion	See 12)
15) Groundwater	Water for construction work shall be brought from Bohol Island.
16) Lake, river	Non.
17) Coast/Sea area	The project will not direct impact coast and sea area.
18) Wildlife/plants	Greening plan shall be prepared at planning phase.
19) Weather	Non
20) Geography	Temporary Fence will be constructed toobstruct the construction work, if necessary.
21)-22) Air pollution/Global worming	Common to most construction is dust generation, which persists only during the first few months of site development. It can easily be controlled by regular sprinkling the exposed areas with water. Strict implementation of dust control is necessary since the wide unobstructed air space of flat landscape is favorable for dust transport. Spraying with used oil for dust control should not be allowed since it will contaminate the ground.
23) Water Pollution	Temporary toilets have to set up for construction workers in construction site and temporary houses. Sediment ponds for rainfall water in construction site have to be prepared.
24) Soil Pollution	<u>Fuel Storage Tank/Pipelines</u> Pollution or contamination from the routine use of the fuel storage tanks and fuel pipeline are not expected during routine operations since these systems are designed not to release their contents to the ground. However, the possibility of leakage should not be discounted. Hence, these aspects are discussed in the section for mitigation measures.
25) Solid Waste	Sanitary landfill site which is under construction in Bohol Island has to be completed before starting of construction work.
26) Control of Noise	Noise generating construction activities should be scheduled during daytime.

Generation	Heavy equipment used should be maintained regularly. Movement of vehicles and equipment should be controlled within the project site.
27) Ground Sinkage	The special construction work shall be considered for sink holes under ground, due to more detailed geological investigation.
28) Odor	Non.
29) Sludge quality	Non.
30) Traffic Accident	Training for employee for construction drivers.

8.5.2. Operation Phase

Table 8.5-2 Mitigation Measures on Operation phase

Items	Note
1) Resettlement	Resettlement activities shall be completed before construction work. The monitoring of the activities shall be carried out.
2) Economic Activities	Residents have a job and will improve income.
3) Land – use	Agricultural land will be decreased, but farmers can get new job.
4) Cutting of Area Relation	Barangay roads to access to the neighborhood shall be replaced by requests of residents.
5) Transportation and lively facilities/Traffic plan	Rerouting of the national highway and the creation of a new road become necessary. The national highway should be realigned with a safety spatial margin from the runway to avoid any untoward accidents, particularly runway overrun by aircraft. Immediate opening of alternate routes, the creation of temporary roads to ease the traffic burden airport construction, and completing construction of the rerouted national road at the soonest time possible.
6) Poor peoples and Indigenous Peoples	Lively food program for affected peoples.
7) Inequality of beneficiary	Non
8) Heritage	Non
9) Opposition	Non
10) Water Right, Common Right	Non
11) Preservation of health	The source of infection will be increased by workers, passengers and tourists from unknown places. Public organization has to carry out IEC Campaign to improve their awareness for public health and sanitation. Proper number of medical offices and hospitals also have to prepared due to increased population.
12) Disaster Risk	Establish the rainfall water control system in the site.
13) Topography Geology	Original ground is almost flat land, the development plan will make arrangement the balance of cut and fill amount. The plan has to suggest in specification contractor shall bring fill materials from out of Bohol Island.
14) Soil erosion	See 12).
15) Extraction of Ground Water	Extraction of ground water according to its rate of recharge and tapping other sources of water to supply the airport's requirement should be regulated. Piped water from Tagbilaran is feasible solution to this problem. There is Master

	Plan (Bohol Integrated Water Supply System Master Plan, 2008) prepared by Australian Aid. The implementation of the plan will break off the water shortage problems.
16) Lake, river	Non.
17) Coast/Sea area	The project will not direct impact coast and sea area.
18) Wildlife/plants	Greening plan shall be prepared at planning phase.
19) Weather	Non
20) Geography	Temporary Fence will be constructed toobstruct the construction work, if necessary.
21)-22) Control of Air pollution/Grovel worming	The most probable sources of air pollutant are cars and aircraft. From the point of view of regulation, these sources of air pollution are very difficult to control and regulate. The control is already beyond the authority of the airport management or the proponent. In case of air craft, the advents of new aircraft models whose efficiency of fuel burning is much better than the old one could help minimize the generation of air pollutants. In the case of cars, emissions are very much dependent on the type of vehicle and the type of fuel they are using. With the government efforts to ban leaded gasoline, the emissions of lead particulate will surely minimize. However, the emissions of sulfur oxides, nitrogen oxides and particulate from cars/vehicles using diesel as fuel may not really help in minimizing the generation of air pollutants. The best that the proponent can do is to coordinate with the concerned authority on how to effectively and strictly implement the anti-smoke belching campaign of the government. The assistance of the local government officers will surely help in the implementation of such a program.
23) Water pollution	In operation of new airport facility, operation/management of waste water treatment facility is very important. Management agency shall prepared the manual and carry out periodical inspection. Oil and other non-miscible compounds in the runoffs can be removed efficiently using oil-water separators.
24) Soil pollution	<u>Fuel Storage Tank/Pipelines</u> Pollution or contamination from the routine use of the fuel storage tanks and fuel pipeline are not expected during routine operations since these systems are designed not to release their contents to the ground. However, the possibility of leakage should not be discounted. Hence, these aspects are discussed in the section for mitigation measures.
25) Solid waste	The airport management will employ the integrated solid waste management system by setting its solid waste management goals and objectives and then selecting and applying the suitable techniques, technologies and management programs to achieve those goals and objectives. The airport management may practice zero-waste management. Solid waste shall be sorted. Biodegradable waste shall be composts, recoverable materials will be recoverable materials will be recovered for recycling and reuse. Those materials that are non-biodegradable and non-recyclable shall be collected by a collection vehicle and will be disposed of in a landfill. Collection shall be done on a regular daily basis. Wastes collected will be landfill is recommended once it is operational. The landfill shall comply with the proper design and specifications.

	 Operation body of the airport shall make an agreement with Bohol Provincial Government to use sanitary landfill located in Municipality of Alburquerque.
26) Control of Noise Pollution	A Noise abatement Line or open space could be established and green zone could be created surrounding the airport and shielding the adjacent residential areas. Residential land use and their expansion could be planned out side of the declined airport zone to minimize accidents and prevent noise pollution in the resident areas.
27) Ground Sinkage	The special construction work shall be considered for sink holes under ground, due to more detailed geological investigation.
28) Odor	Non.
29) Sludge quality	Non.
30) Traffic Accident	Traffic conducting system shall be considered to formulate proper new road net wark.

8.6. Environmental Monitoring Plan

Environmental monitoring shall be carried out by project implementation agency and MMT. The monitoring results shall be reported to EMB periodically. The original environmental monitoring plan was formulated by EIS report in 2000. The plan is complied with international standard and JICA guideline.

8.6.1. Pre-construction / construction phase

Usually, construction phase impacts are short-term in nature. For this reason, monitoring plan during this phase of the project implementation may be carried out by checking the adherence of the contractor to fundamental engineering construction protocol. Likewise, an on the spot inspection of the contractors/constructor adherence to the mitigating measures indicated in this EIS can be checked. The monitoring items are shown in Table 8.6-1.

8.6.2. Operation Phase

Ground water quality, air quality and noise level shall be monitored periodically. The purpose of the monitoring is inspection of mitigation measures indicated in this EIS can be checked. The monitoring items are shown in Table 8.6-1.

Table 8.6-1 Monitoring Plan (in EIA Report 2000, revised version)

parameter	Station	Frequency	Procedure	Applicable standard
Pre-construction/Construction Stage				
Dust deposition	Closest homes	Weekly	Visual inspection	Presence of heavy dust deposits
	4 stations, 50m from site	Monthly during dry season	Gravimetric	DAO 14
Noise	Closest homes	Monthly	Noise meter	DAO14
	Closet homes	Weekly	Hearing	Disturbance
Color	Alona Kew Beach Resort	Monthly	Visual comparison	DAO 34
TSS	Sampling stations	Monthly	Gravimetaric	DAO 34
Oil &Grease	Sampling stations	Monthly	Gravimetric Petroleum ether extraction	DAO 34
Phenols	Sampling stations	Monthly	Chloroform extraction or stannous chliride	DAO 34
COD	Sampling Stations	Monthly	Azide modification	DAO 34
BOD	Sampling stations	Monthly	Azide modification	DAO 34
PH	Sampling stations	Monthly	PH meter	DAO 34
Siltation	Sampling stations/Adjoining waters	Monthly	Visual inspection	
Solid and liquid waste	Construction site	Monthly	Visual inspection	
Operation Phase				
TSP	Sampling stations	Quarterly	Gravimetric	DAO 14
Noise	Survey of people within the critical noise zones	Quarterly	Noise meter	DAO 14
PH	Sampling Stations	Monthly	PH meter	DAO 34
BOD	Sampling stations	Monthly	Azide modification (dilution technique)	DAO 34
Oil & grease	Sampling stations	Monthly	Gravimetric petroleum either extraction	DAO 34
DO	Sampling Stations	Monthly	DO meter	DAO 34
SS	Sampling stations	Monthly		DAO 34
COD	Sampling stations	Monthly		DAO 34
N	Sampling Stations	Monthly		DAO 34
P	Sampling stations	Monthly		DAO 34
Solid waste	Sampling stations	Monthly	Visual inspection	