Republic of the Philippines
Department of Transportation and Communication

Republic of the Philippines
Preparatory Survey
for
New Bohol Airport Construction and Sustainable Environment Protection Project

Final Report
Volume 1: Airport

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Japan International Cooperation Agency (JICA)

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Joint Venture


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BOHOL
Rajah Sikatuna National Park
Existing Airport
TAGBILARAN
PANGLAO
BOHOL SEA
DAUIS
PANGLAO
Proposed New Bohol Airport
PANGLAO
PANGLAO MAP

Executive Summary

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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%.

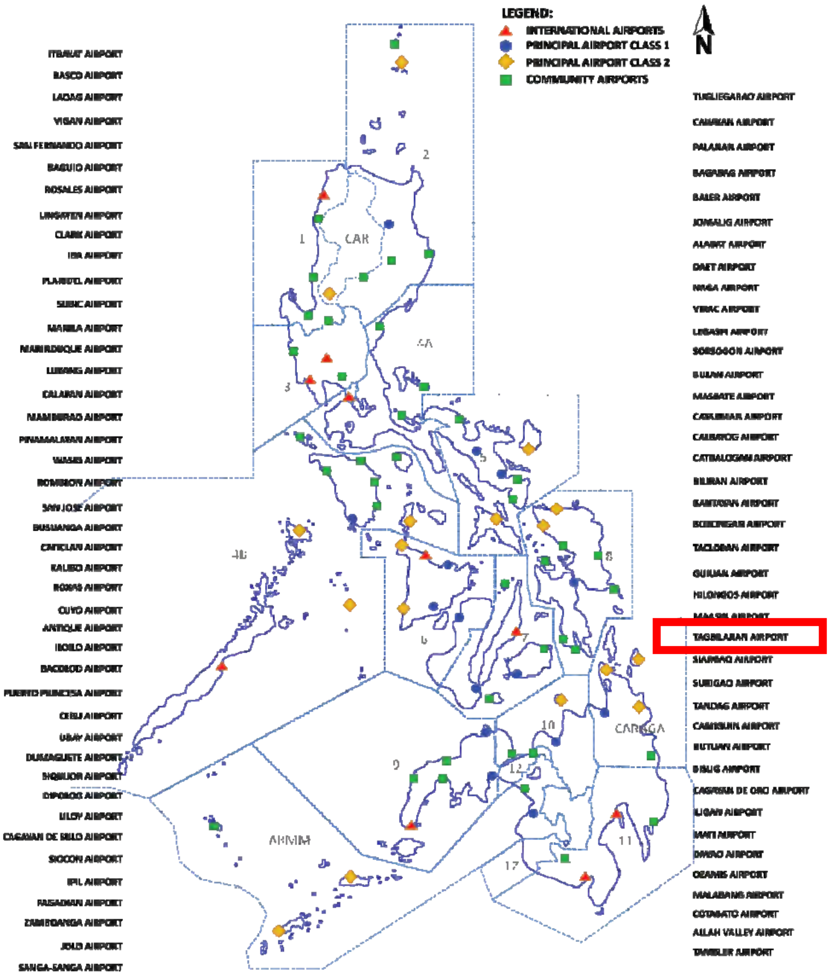
1.3. Current Situation of Air Transportation

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.

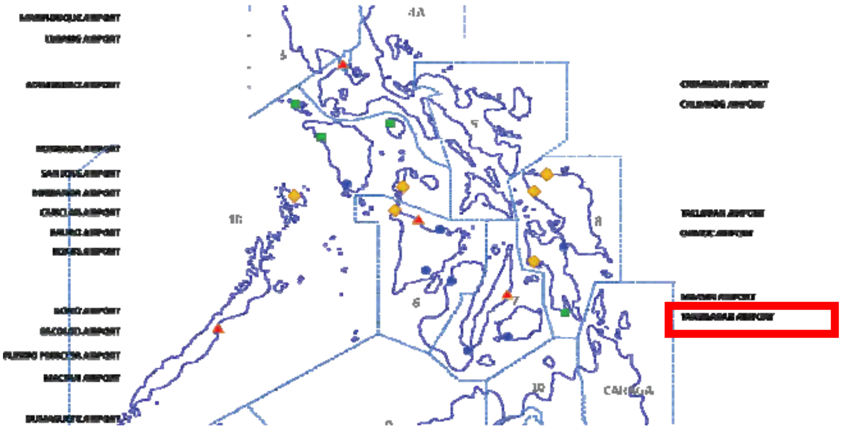


Source: JICA Study Team

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

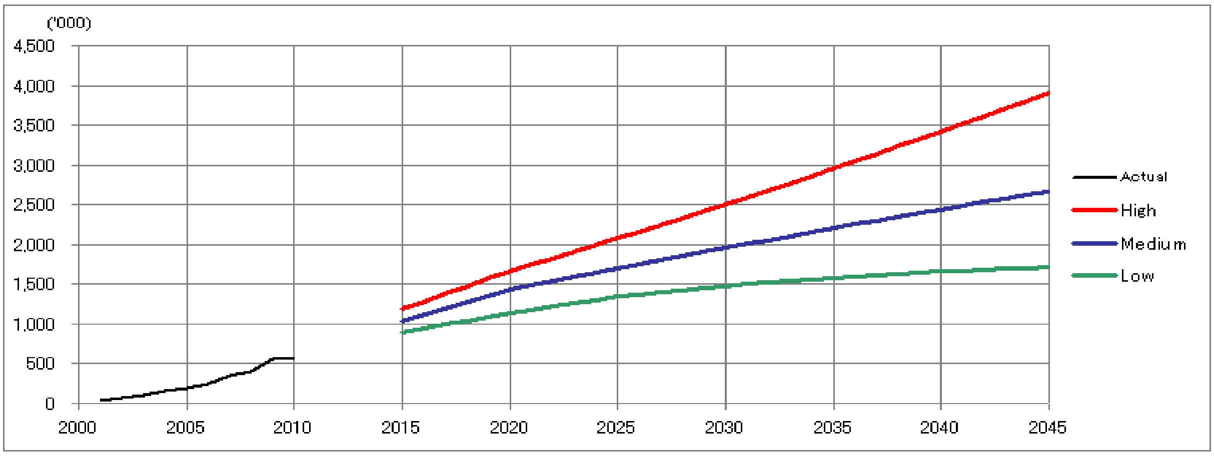
Source: JICA Study Team

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



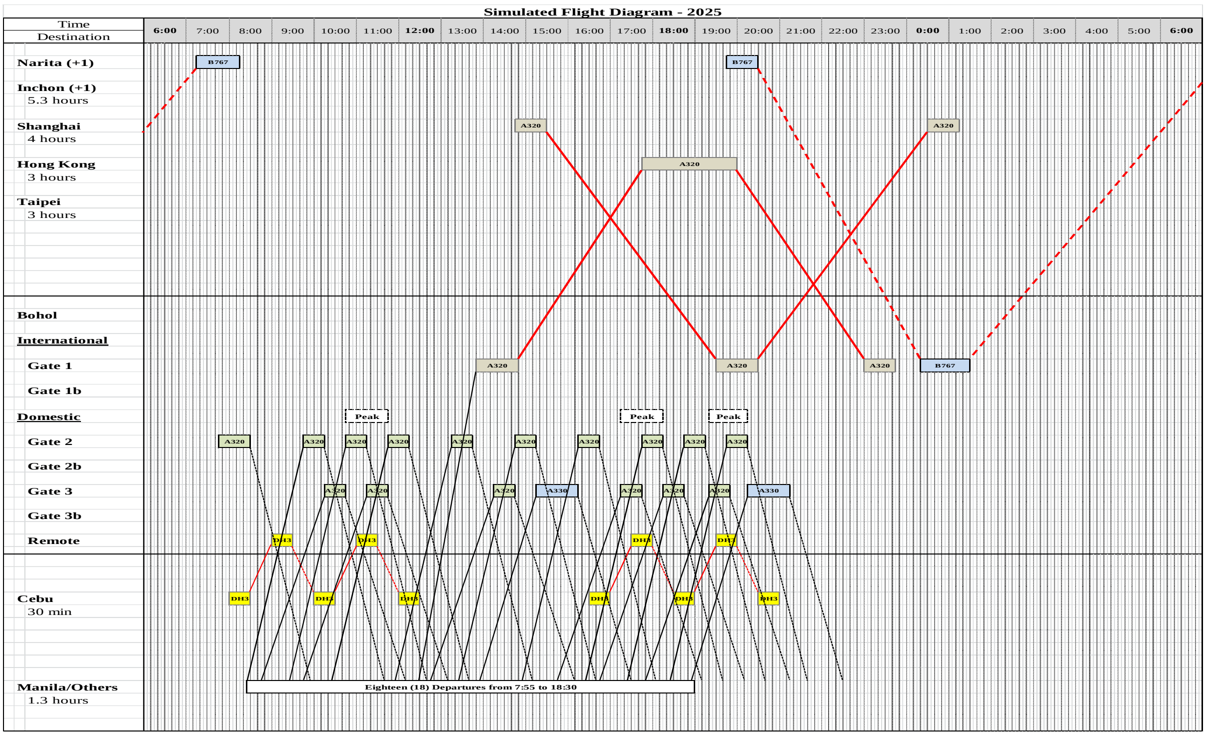
Source: JICA Study Team

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
2001	Actual Record											
	39,268	-	-	39,268								
2006	Forecast					Actual Record						
	96,000	64,000	57,000	217,000		240,176	-	240,176				
						Froecast						
2010						403,000		413,400		Actual Record		
	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		
2015						519,000		534,000	Low	898,000	2,000	900,000
	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
2020						627,000		658,200	Low	1,125,000	6,000	1,131,000
	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
2025						716,000		793,400	Low	1,295,000	50,000	1,345,000
	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
2030	n/a				n/a	782,000		963,400	Low	1,343,000	137,000	1,480,000
						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
2035						828,000		1,209,400	Low	1,414,000	164,000	1,578,000
						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
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 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:

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.

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 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.

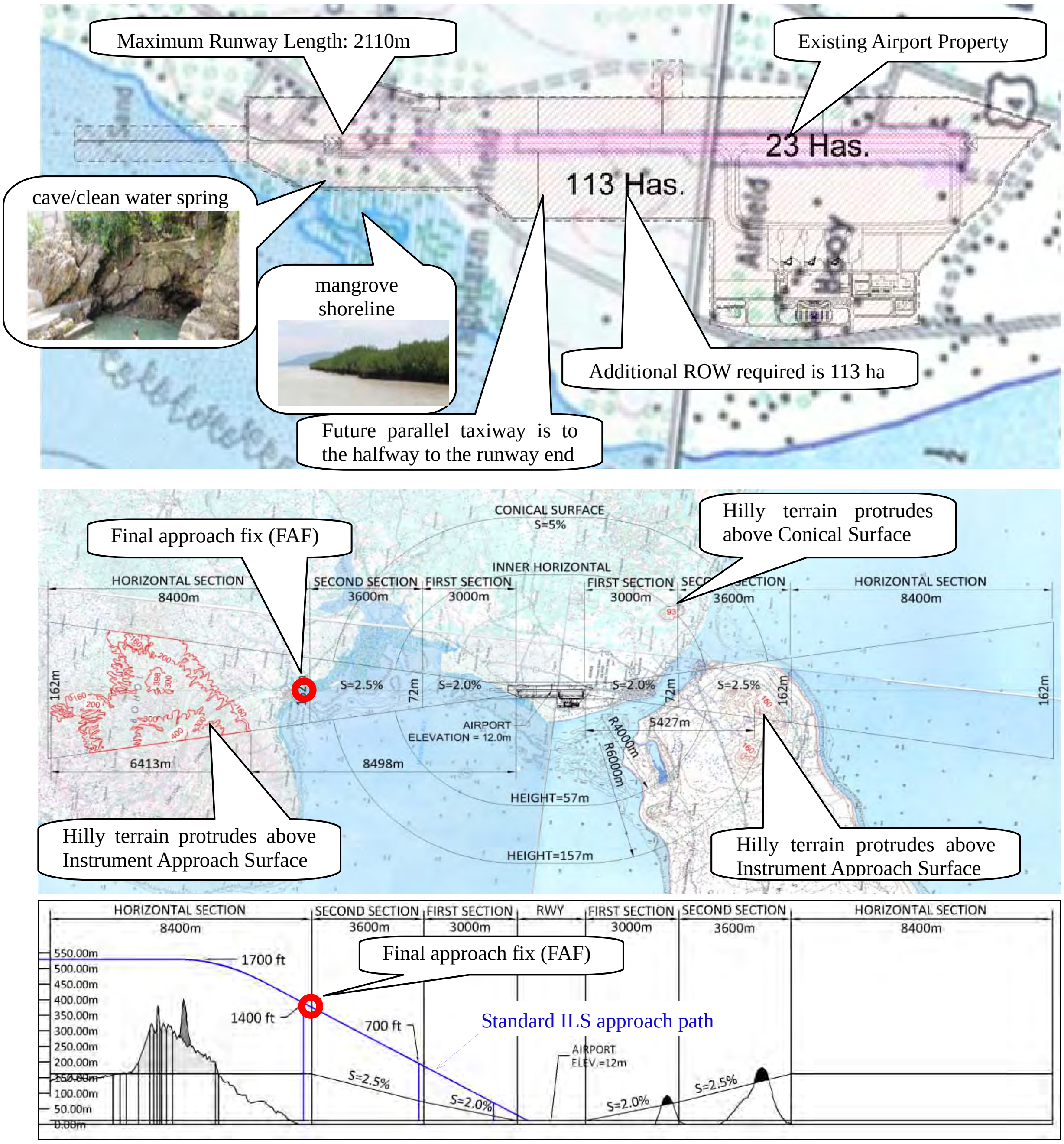
Description	Layout on Google Earth
Existing Tagbilaran Airport Non-instrument approach Runway: 30m x 1779 m Runway Strip: 100 m	
Option Original Scenario "Phase-1" Instrument Approach Runway: 45m x 2110 m Runway Strip: 300 m	

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.

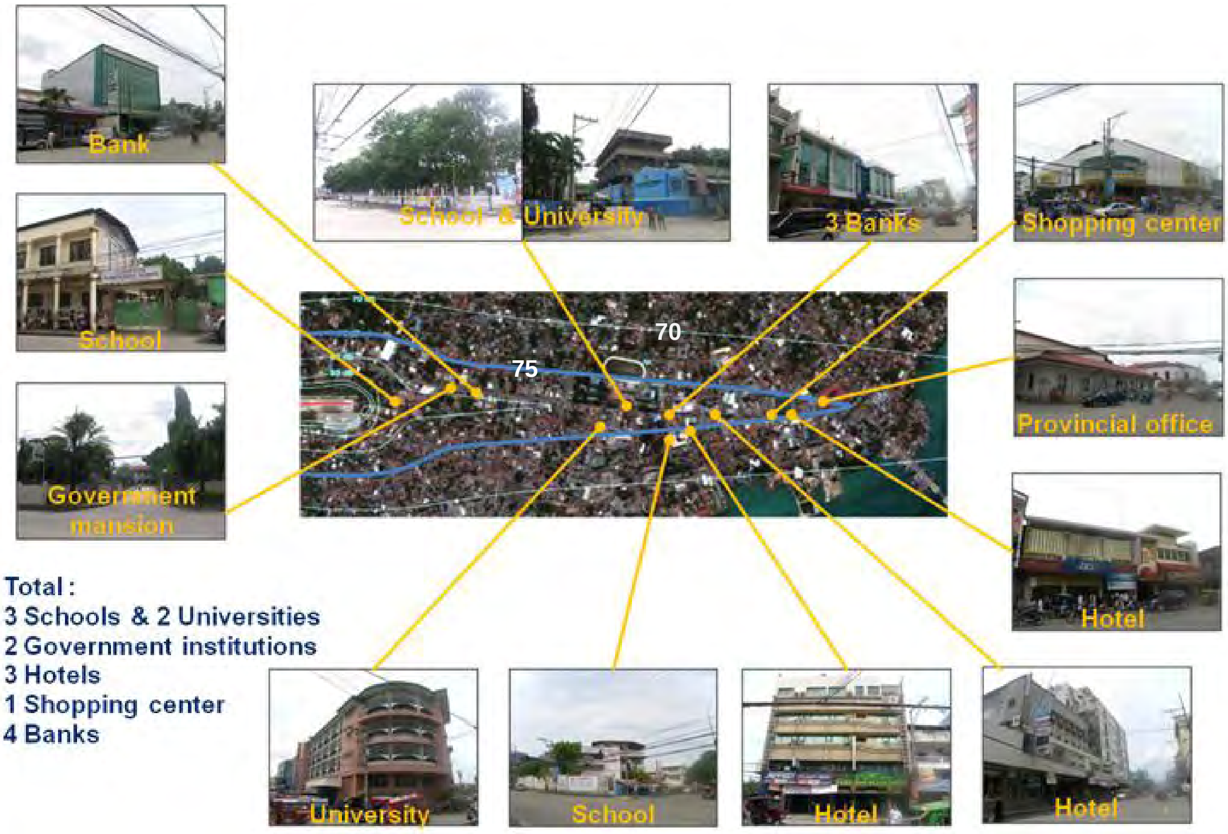
5) Areas affected by Noise Polution

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

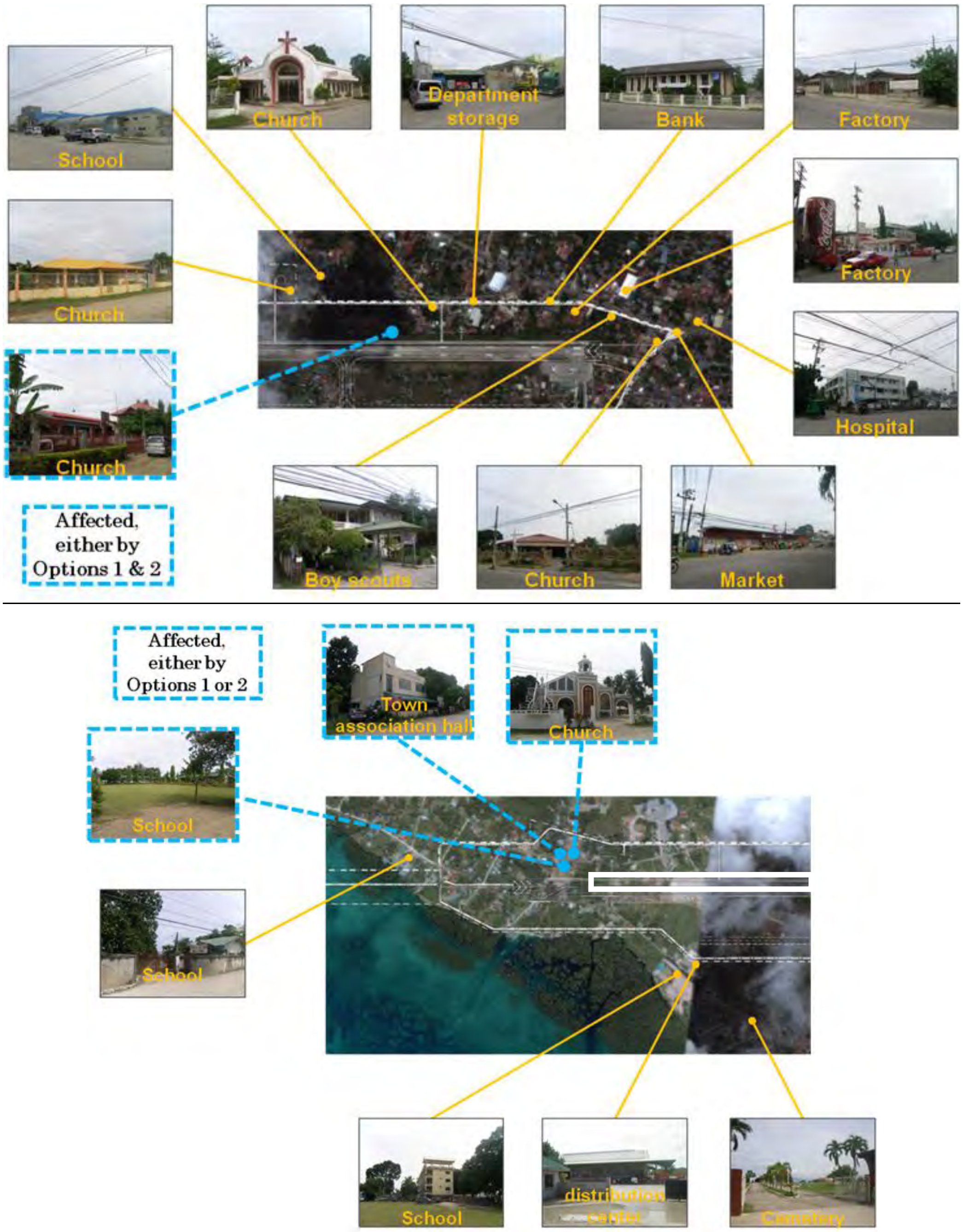
Figure 3-4 Areas possibly affected by noise in excess of WECPNL75 at Tagbilaran Downtown

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

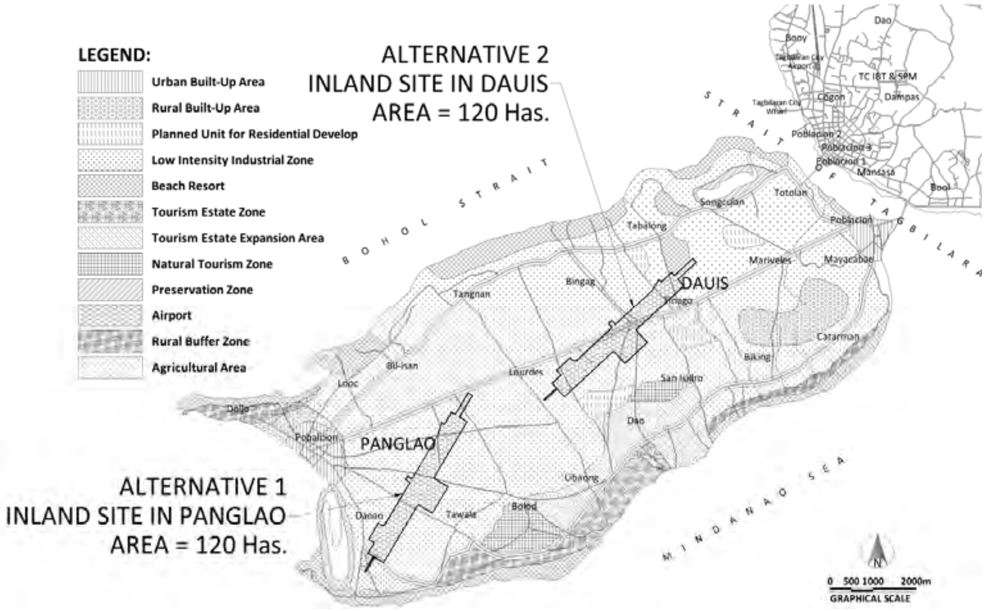
Figure 3-5 Properties affected by Tagbilaran Airport development

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

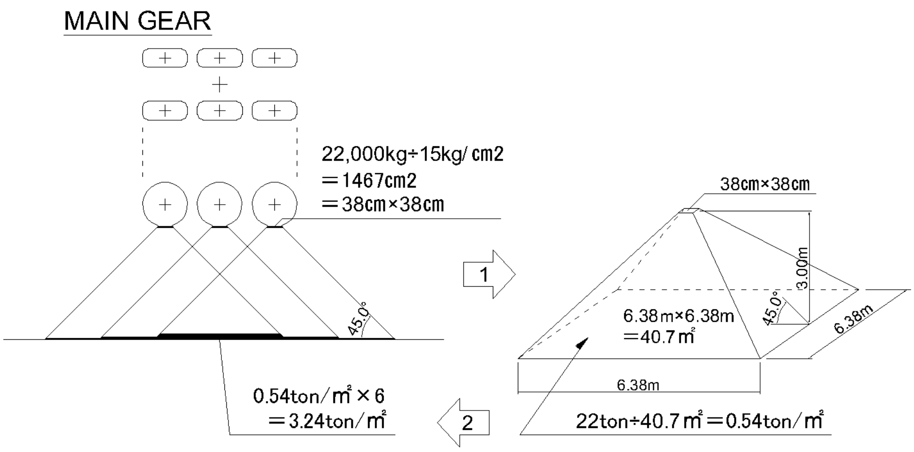
The project site is situated at 6 to 8 m above MSL, and underlain by Late Oligocene to Middle Miocene sediments and volcanic, mainly marine sandstone, shale and reef limestone; with some conglomerate, coal measure and marine and elastic-basaltic pyroclastic and lavas. A thick layer of coralline limestone 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) <u>Airport Layout</u>

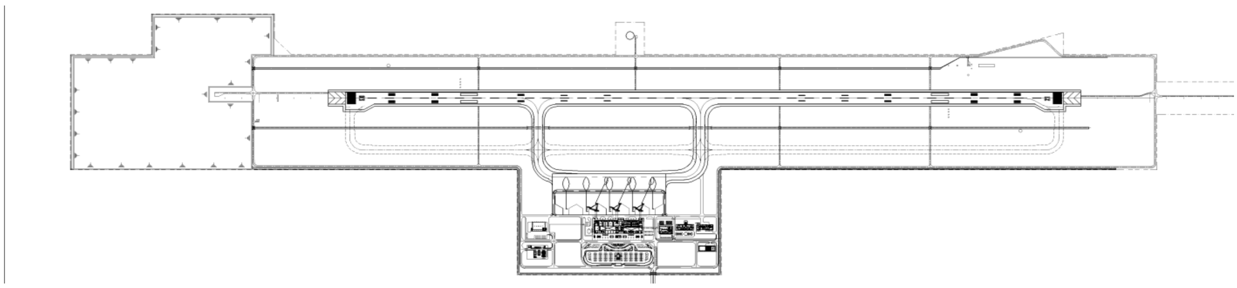
As mentioned above, the eventual runway length is 2,500 m which is designated as Phase-2 requirement for the Original Scenario.

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.

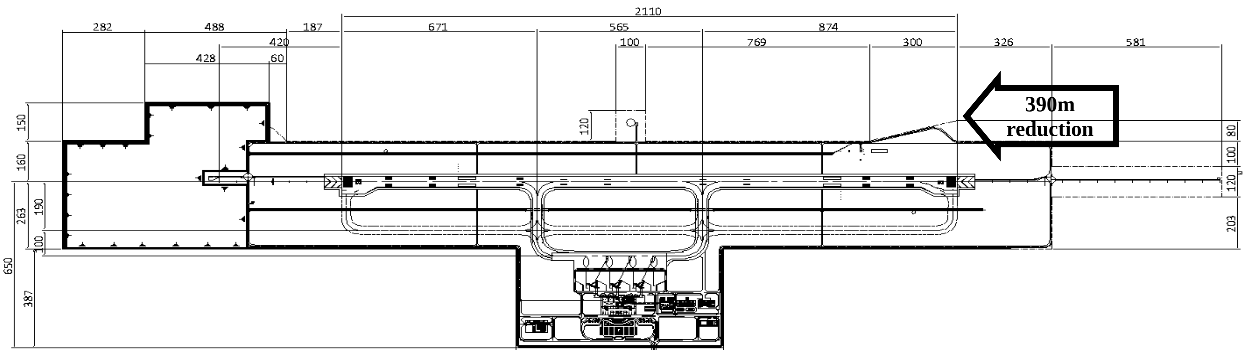
The Phase-1 runway length requirement for the Cost Saving Scenario is 2,000 m which can accommodate small jet mainly for domestic operations. This provision is not for an ILS precision approach runway but VOR/DME non-precision approach runway.

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.

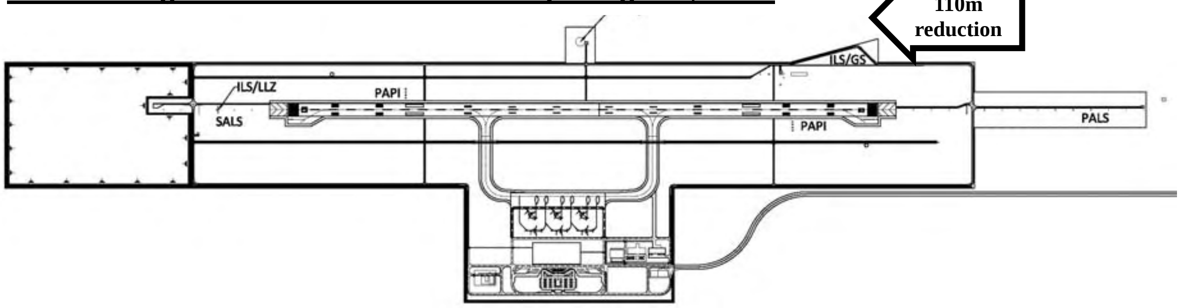
<u>Original Scenario Phase 2: Runway Length 2,500m</u>



<u>Original Scenario Phase 1: Runway Length 2,110m</u>



<u>Cost Saving Scenario Phase 1: Runway Length 2,000m</u>



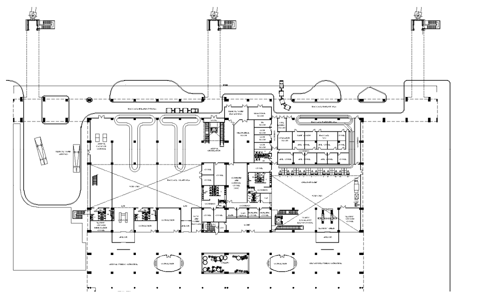
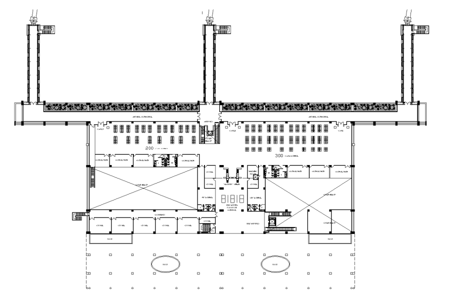
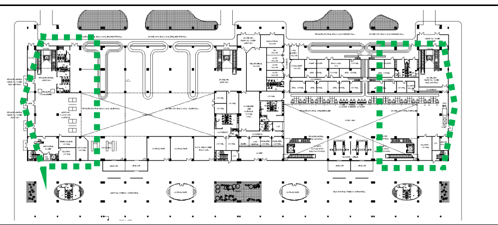
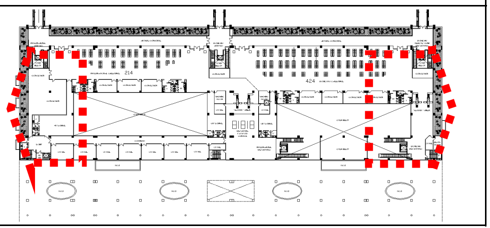
Source: JICA Study Team

Figure 4-3 Airport Layout Plan

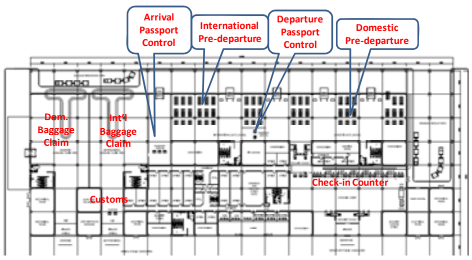
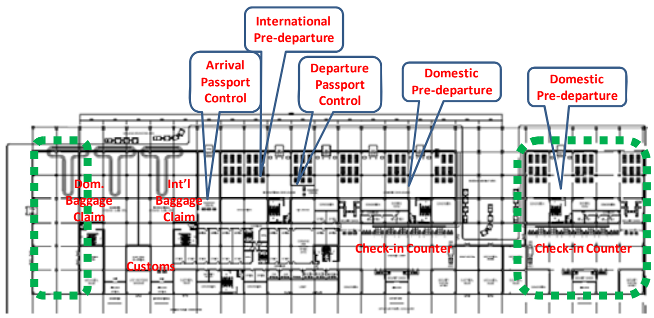
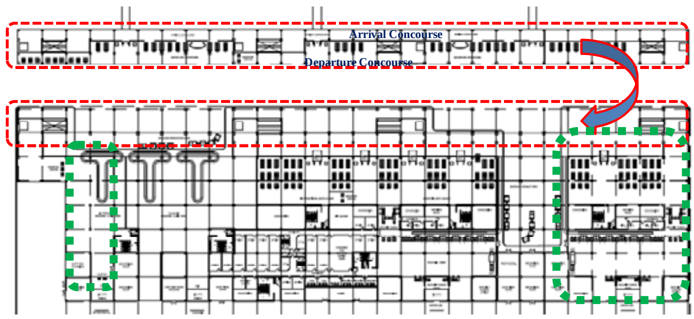
2) Passenger Terminal Building (PTB)

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

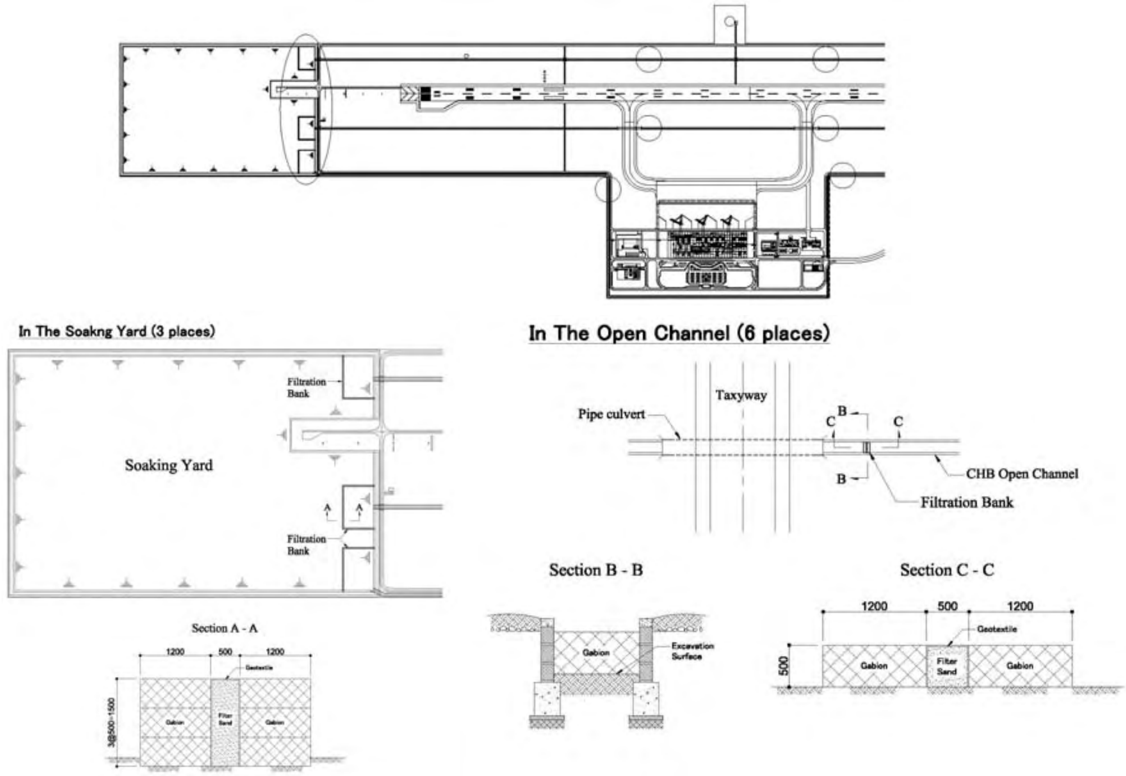
Solar Power Generation is adopted in the Cost Saving Scenario to save O&M cost.

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.

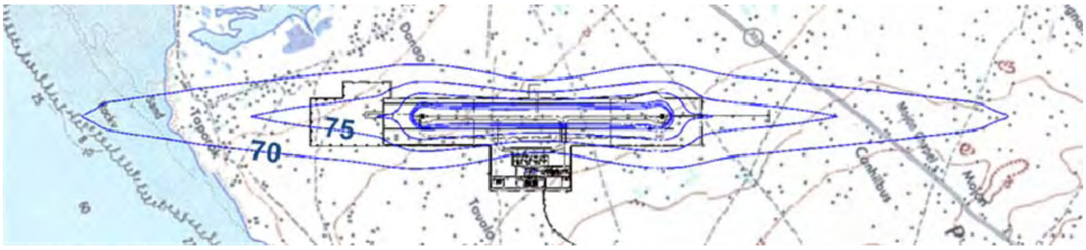
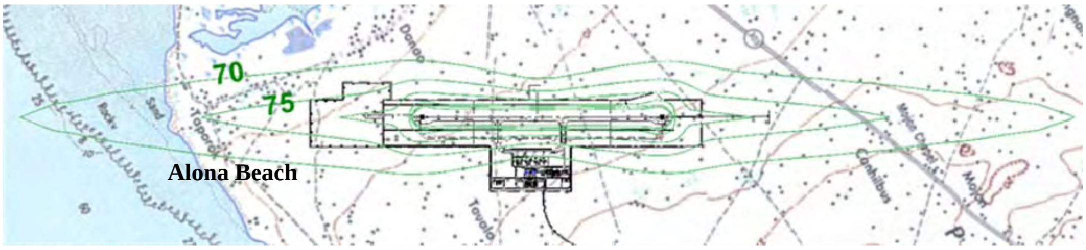


Source: JICA Study Team

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	

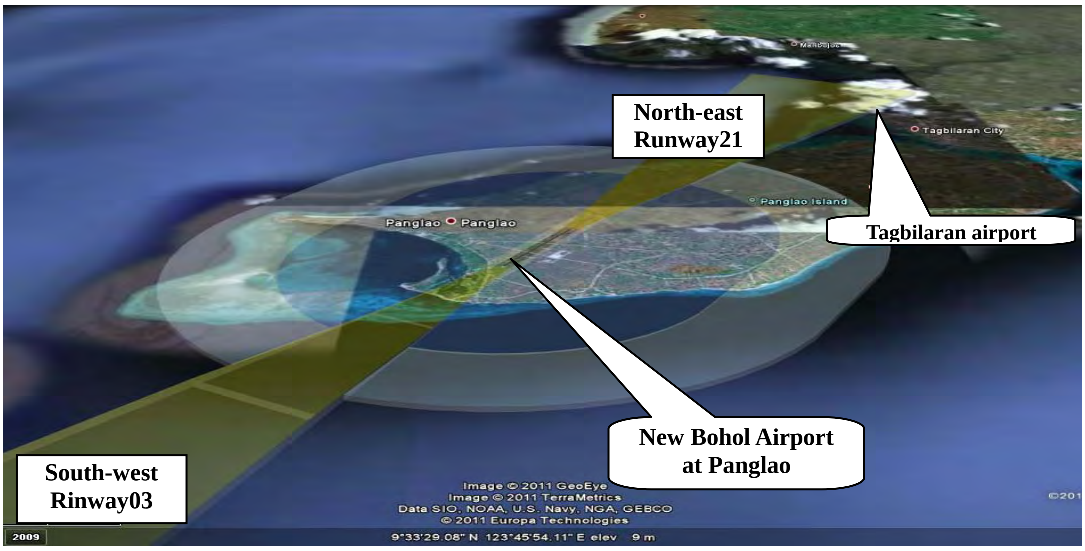
Source: JICA Study Team

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)

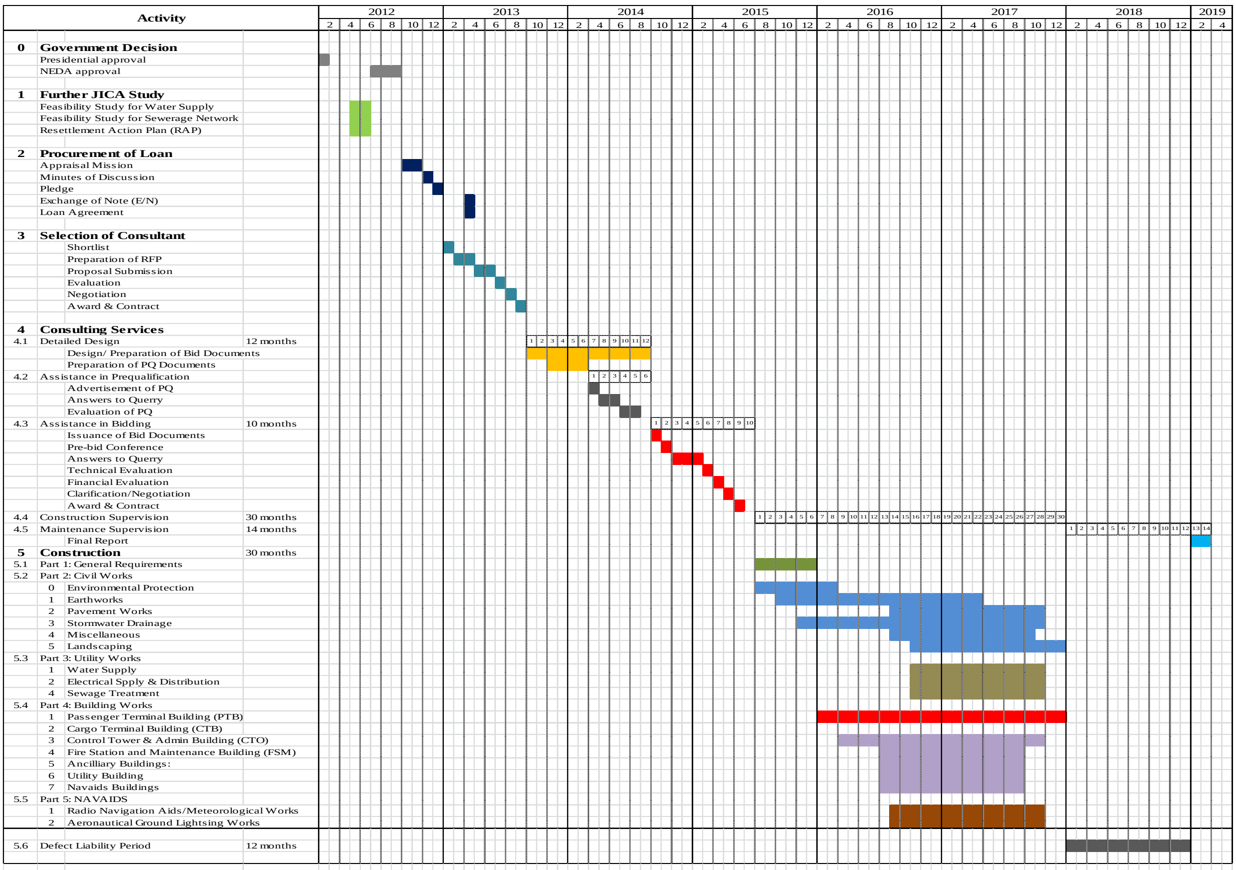
Description		Original Scenario		Cost Saving Scenario
		Phase 2	Phase 1	Phase 1
Base Cost	Base Construction Cost	5,828,184	4,977,566	4,164,553
	Contingency: 5 %	291409	248,878	208,228
	subtotal	6,119,593	5,226,444	4,372,780
	Consultancy	887,341	757,834	714,335
	Total	7,006,934	5,984,278	5,087,115
	Equivalent 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.

9. Modalities of Public Private Partnership (PPP)

9.1. General Assumption for Analysis of Possible PPP Scheme

General Assumptions for the Financial Analysis on the possible PPP scheme are shown below.

Table 9-1 PSC, Traffic Growth, and other Terms for Financial Analysis

Terms for Financial Analysis	
Base Year	2013
Commencement of Construction	2015
Completion of Construction	2017
Construction Period	3years
Start of Concession (upon of Operation)	2018
End of Concession Period	2047
Concession Period	30years
Annual Discount Rate	15%

Source: JICA Study Team

Table 9-2 Assumed Terms for Commercial Bank Loan Source: JICA Study Team

Terms of Loan	Asumption	Remarks
Interest Rate	8.9%	10-yerar Government Bond + spread
Grace Period	3 years	
Amortization Period	10 Years	
Start of Repayment	2018	
End of Repayment	2027	

Table 9-3 Type of Japanese ODA Loan Source: JICA website

Type of Loan		General Untied ODA	STEP ODA
Interest Rate	Construction	1.4 %	0.2 %
	Consulting Services	0.01 %	0.01 %
Grace Period		7 years	10 years
Amortization		25 years	40 years
Japanese technologies and products		N/A	More than 30 % of construction cost

9.2. Classification of Candidate PPP Scheme

Financial viability of possible PPP scheme has been studied as to six (6) candidate cases shown in Table 9-4. Analysis has been made for the both Original Cost Scenario and Cost Saving Scenario, and based on the two (2) cases of air traffic demand forecast, namely for Medium Traffic Demand Case and Low Traffic Demand Case.

Table 9-4 Classification of Candidate Case Source: JICA Study Team

Case		Construction	Operation & Maintenance	Type of Japanese ODA for Public Sector
1	Public-build & operate	All facilities by Public	All facilities by Public	General Untied
2		All facilities by Public	All facilities by Public	STEP
3	Public-build; and Private-operate	All facilities by Public	All facilities by Private	General Untied
4		All facilities by Public	All facilities by Private	STEP
5	Hybrid PPP	PTB by Private; and Runway & others by Public	PTB by Private; and Runway & others by Public	for Runway & others; General Untied
6		PTB by Public; and Runway & others by Private	PTB by Public; and Runway & others by Private	for PTB only; STEP

9.3. Result of the Case Study

Results of the financial analysis for Original Cost Scenario (OR) and Cost Saving Scenario (CS), respectively, are shown in Table 9-5.

Table 9-5 Financial Analysis for PPP Scheme for the Project

Case	PPP Scheme	Type of Japanese ODA for public construction	Conditions of financial arrangement for Private Sector (SPV)	Demand Forecast	Results of Financial Analysis for Private Sector (SPV)		ODA Repayment (Php mil.)	Net Income of Concession Fee (Php mil.)	Net Cash-flow of SPV (Php mil.)	Net Government Expenditure (Php mil.) (Note 3)
					IRR for SPV	Equity IRR	PV (Note 4)	PV (Note 4)	PV (Note 4)	PV (Note 4)
Original Cost Scenario (OR)										
OR-1	Public-build & operate	for all; General Untied		Medium	n.a.	n.a.	1,136	n.a.	n.a.	479
				Low	n.a.	n.a.	1,136	n.a.	n.a.	775
OR-2	Public-build & operate	for all; STEP		Medium	n.a.	n.a.	411	n.a.	n.a.	-247
				Low	n.a.	n.a.	411	n.a.	n.a.	50
OR-3	Public-build; and Private-operate (Concession)	for all; General Untied	Concession Profit Rate: 0% (Note 1) Gov't Subsidy: 0	Medium	not able to calculate IRR since there is no initial investment by SPV.		1,136	650	0	479
				Low			1,136	366	0	775
OR-4	Public-build; and Private operate (Concession)	for all; STEP	Concession Profit Rate: 2% (Note 1) Gov't Subsidy: 0	Medium			411	621	25	-221
				Low			411	366	0	50
OR-5	Private-build & operate PTB; and Public-build & operate Runway and others	for Runway and others; General Untied	D/E ratio: 50%	Medium	13.99%	15.55%	912	n.a.	301	1,153
			100% Equity	Low	11.71%	11.73%	912	n.a.	322	1,280
OR-6	Public-build & operate PTB; and Private build& operate Runway and others	for PTB only; STEP	Gov't subsidy: 50% (note 2) 100% Equity	Medium	-3.42%	-3.30%	81	n.a.	69	1,180
				Low	-12.38%	-11.24%	81	n.a.	2	1,393
Cost Saving Scenario CS)										
CS-1	Public-build & operate	for all; General Untied		Medium	n.a.	n.a.	962	n.a.	n.a.	177
				Low	n.a.	n.a.	962	n.a.	n.a.	473
CS-2	Public-build & operate	for all; STEP		Medium	n.a.	n.a.	349	n.a.	n.a.	-437
				Low	n.a.	n.a.	349	n.a.	n.a.	-140
CS-3	Public-build; and Private-operate (Concession)	for all; General Untied	Concession Profit Rate: 12% (Note 1) Gov't Subsidy: 0	Medium	not able to calculate IRR since there is no initial investment by SPV.		962	615	147	324
				Low			962	494	0	473
CS-4	Public-build; and Private operate (Concession)	for all; STEP	Concession Profit Rate: 15% (Note 1) Gov't Subsidy: 0	Medium			349	571	183	-254
				Low			349	494	0	-140
CS-5	Private-build & operate PTB; and Public-build & operate Runway and others	for Runway and others; General Untied	D/E ratio: 50%	Medium	18.10%	21.17%	849	n.a.	421	656
				Low	13.62%	15.22%	849	n.a.	260	791
CS-6	Public-build & operate PTB; and Private build& operate Runway and others	for PTB only; STEP	Gov't subsidy: 50% (note 2) 100% Equity	Medium	-3.10%	-2.98%	41	n.a.	70	903
				Low	-11.89%	-10.80%	41	n.a.	2	1,115

Note;

(*1) In the above financial analysis, ODA repayment is assumed to be covered by the Concession Fee to be paid by the Concessionaire. Profit of the Concessionaire is computed at [Total Operating Revenue – Total Operating Expenditure – ODA Repayment], provided that maximum profit of the Concessionaire is [Net Operating Income x Concession Profit Rate], surplus over and above which would be retained by the Government.

(*2) Government Subsidy: Maximum of 50 % as allowed in BOT Law

(*3) Net Government Expenditure = ODA Repayment + O & M Cost of the Government + Government Subsidy - Airport Revenue of the Government - Concession Fee - Income tax revenue.

(*4) Present value (PV) is based on the discount rate of 15 % [currently adopted by NEDA].

(*5) Operation cost for air traffic control is included in the O & M Cost of the Government.

1) Original Cost Scenario (OR)

In comparison between Cases OR-1 and OR-2 (both of Public-build & operate), amount of the Net Government Expenditure of the Case OR-2 (with STEP Loan) is smaller than that of the Case OR-1 (with General Untied Loan).

When comparing the Cases OR-3 and OR-4 (both of Public-build & Private-operate), amounts of Net Government Expenditure are similar to those of Cases OR-1 and OR-2 (both of Public-build & operate). This is because Value for Money (VFM) when operations are tasked by the private sector is not accounted for. Only in case of medium demand forecast of the Case OR-4 (Public-build by using STEP loan & Private-operate), the net Government Expenditure indicates negative figures, meaning that the Government would eventually earn surplus although the rate is minimal, e.g. 2% only. In this particular financial analysis, ODA repayment is assumed to be covered by the Concession Fee to be paid by the Concessionaire (i.e. SPV), and profit of the SPV might be very few (or, nearly zero). Unless the ODA repayment is shared by the public sector, no private sector is expected to undertake the Concession.

In the both cases of Hybrid PPP (Cases OR-5 and OR-6), the Net Government Expenditures are considerably higher amount.

In the Case OR-5 (Private build & operate PTB), IRRs for Private Sector (both IRR for SPV and Equity IRR) are computed at profitable levels (i.e. around 15%), despite Public would be in huge deficit. This is because the Private Sector undertake to build and operate the low-cost/high-return facilities (i.e. PTB) while the Public Sector would undertake the high-cost/low-return facilities (i.e. airside).

In the Case OR-6 (Private build & operate Runway and others), due to the negative IRR values (both IRR for SPV and Equity IRR), Private sector is most probably not interested in participating the Project. Also, because of the considerable amount of Government subsidy (50% of the construction cost for runway and others is to be granted to the Private sector without obligation of repayment) that would culminate the highest amount of Net Government Expenditure among the cases, the Case OR-6 is not appropriate scenario for the Project implementation both for public and private sectors.

2) Cost Saving Scenario (CS)

In Case CS-2 (Public-build & operate by using STEP Loan), the Net Government Expenditure indicates negative figure, meaning that the Government would eventually earn surplus, which however does not meet the Government policy to avail PPP scheme.

When medium or low demand forecast is applied in Case CS-4 (Public-build by using STEP loan & Private-operate), the Net Government Expenditure indicates negative figure, meaning that the Government would eventually earn surplus. When medium demand forecast is applied, Concession can gain profit (15% of Net Operating Income) without Government subsidy. However when low demand forecast is applied, the ODA repayment cannot be covered by the Concession Fee nor the Concession cannot gain any profit.

Similar to the Original Cost Scenario (OR) mentioned above, in the both cases of Hybrid PPP (Cases CS-5 and CS-6), the Net Government Expenditures are high amount.

In the Case CS-5 (Private build & operate PTB), IRRs for Private Sector are computed at profitable levels (IRR for SPV is 13.62% to 18.10%, and Equity IRR is 15.22% to 21.17%), despite Public would be in deficit. This is because the Private Sector would build PTB which is merely 18% of the Total construction cost, and gain the PTB revenue which is 71% of the total airport revenue, while the Public Sector would undertake the high-cost/low-return facilities (i.e. airside).

In the Case CS-6 (Private build & operate Runway and others), IRRs for Private Sector are computed at negative values (IRR for SPV is -3.1% to 111.89%, and Equity IRR is -2.98% to -10.8%)due to the negative IRR values (both IRR for SPV and Equity IRR), Private sector is most probably not interested in participating the Project. Also, because of the considerable amount of Government subsidy, the Net Government Expenditure is the highest among the cases, the Case CS-6 is not appropriate scenario for the Project implementation both for public and private sectors.

3) Conclusion

In view of the foregoing discussion, the Cost Saving Scenario Case CS-4 (Public-build by using STEP loan & Private-operate) is concluded as the most feasible PPP scheme among those cases, wherein, when medium demand forecast is applied, both the Government and the Concession can gain profit. It should however be noted that when low demand forecast is applied, the ODA repayment cannot be covered in whole by the Concession Fee nor the Concession can gain any profit.

Although the DOTC desires that the repayment of ODA loan is covered in whole by the Concession Fee, the above case study has resulted in the reality that it is hard for the Concessionaire to shoulder the demand risk (e.g. to overcome the occurrence of low demand forecast case). Consequently, the content of the Bid Documents and draft Concession Agreement should incorporate certain risk sharing structure and conditions of Concession Profit Rate, so as to encourage the private sector to bid in the Project implementation. Hence, it is recommended that a competent transaction advisor should be appointed to formulate the sustainable contractual arrangement for the “Private-operate” stage and to allocate the demand risks for the foreseeable future.

10. Project Implementation Program

Described hereunder is to further conduct basic design, to update the project implementation schedule, project cost, operation and maintenance costs, and to compute FIRR and EIRR, which are required by NEDA to come up with viable Implementation Program.

10.1. Summary of the Selected Construction Scheme

Specifications of the selected construction scheme are generally summarized as given in Table 10-1.

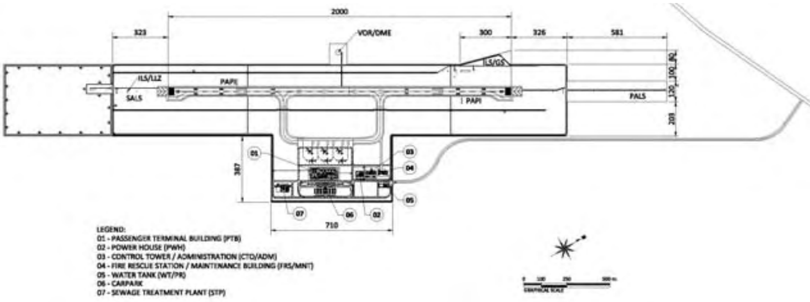
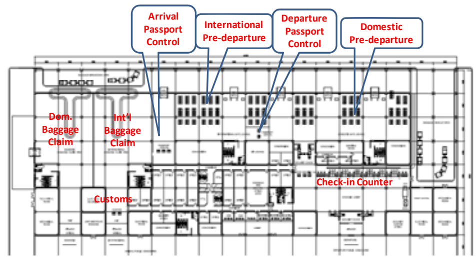
Table 10-1 Particulars of the Selected Construction Scenarios - Specifications

Description		Cost Saving Scenario (CS)		
		Phase 1	Horizontal Expansion	Vertical Expansion
Passenger Terminal (PTB)	Area	8,271 m^2	11,903 m^2	16,318 m^2
	PBB	without passenger boarding bridge (PBB)		with PBB
Other Buildings	26 buildings	4,570 m^2		
Utilities	Function	Water/ Power/Sewerage		
Runway	Length	2,000 m	2,500 m	
	Function	DHC3/A320/321	A330/B777	
Apron	Area	48,000 m^2	59,250 m^2	
	Function	6 A321	1 A330, 4 A321, 1 DHC3	
Car Park	Lots	18 buses/ 145 cars	18 buses/ 229 cars	
Fire Fighting Vehicle (FFV)	Function	Utilize the existing two 2.5-ton FFVs and 3-ton tank car (8 tons in total) to meet Category 6	Purchase three FFV (24.3 tons in total) to meet Category 9	
Navaids	Function	Precision CAT-1 ILS & VOR/DME		

Source: JICA Study Team

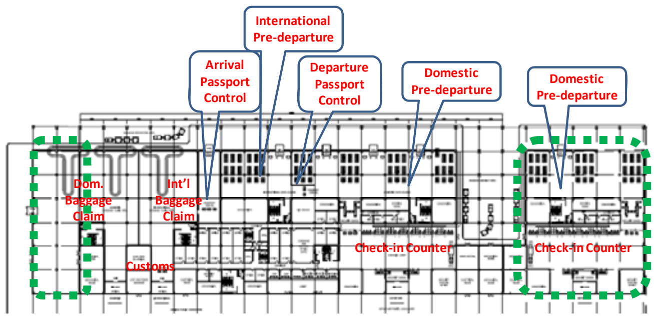
General layout plan of the selected construction scheme, namely for Cost Saving Scenario, is shown in Table 10-2.

Table 10-2 Particulars of the Selected Scheme - Plans for Airport Layout and PTB

<table>
<tr><td colspan="2"><u>Cost Saving Scenario (CS) Phase 1</u>:
Runway: 2,000 m x 45 m
with ILS & PALS</td><td>
</td></tr>
<tr><td>PTB
Phase 1</td><td>single-story
8,271m²
without PBB</td><td>
</td></tr>
<tr><td rowspan="2">PTB
Phase 2

Ground Floor Expansio

2nd Floor Expansio</td><td>Stage 1
Horizontal Expansion

single-story
11,903m²
without PBB</td><td>
</td></tr>
<tr><td>Stage 2
Vertical Expansion

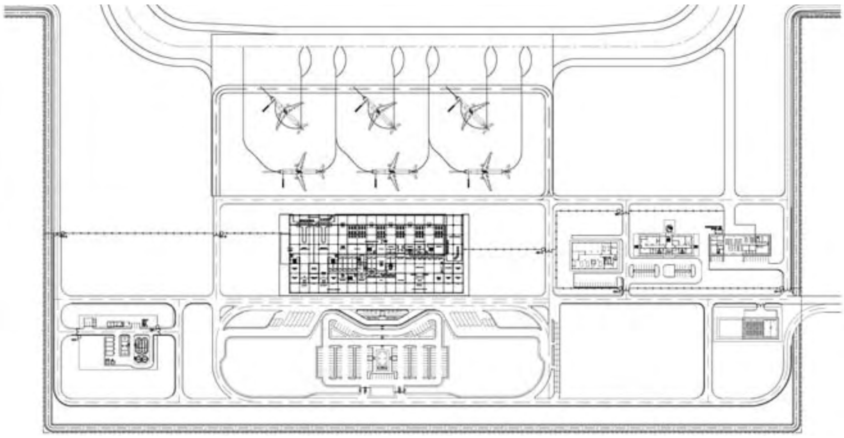
two-story
16,318m²
with PBB</td><td>
</td></tr>
</table>

Source: JICA Study Team

10.2. Basic Design of the Cost Saving Scenario

1) Terminal Area Layout

The Proposed PTB is of a single story building with self maneuvering aircraft stands, the terminal area layout is proposed as shown in Figure 10-1.



Source: JICA Study Team

Figure 10-1 Terminal Area Layout Plan

2) Main Facility Requirements

Main facilities of passenger terminal building are as shown in Table 10-3.

Table 10-3 Main Facilities to be provided for Phase-1 PTB (for 2020)

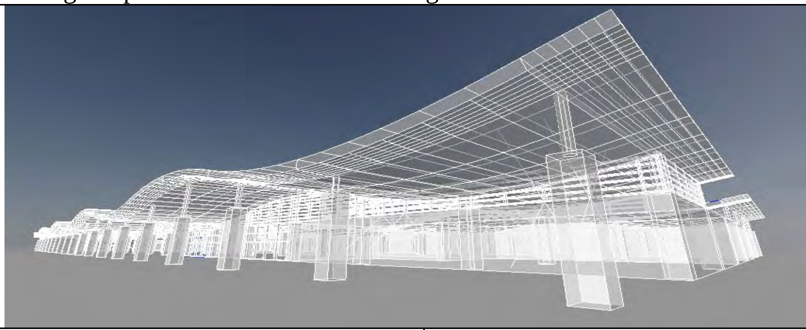
Main PTB Facilities		Initial Functions to be provided
A	PTB floor area 8,271 m²	The total floor would be commonly used for domestic and international operations. At pre-departure lobby and baggage claim areas, international and domestic functions are segregated by temporary partitions.
B	Check-in Counter 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 provided 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 international departure passport control; and 6 desks for arrival passport control are to be provided.
G	Customs Desks 4 desks	4 customs desks (bench) are provided.

Source: JICA Study Team

3) Passenger Terminal Concept

The design concept and main drawings of passenger terminal building are shown in the following figures.

The multi curved roof is inspired by the profiles of "Chocolate Hills" and "Rolling Dolphins on Waves" surrounding the islands of Bohol.



Chocolate Hills	Rolling Dolphins on Waves
	

The undulated roof structures are visible to the public emphasizing the new Bohol Airport as a "Green Airport".

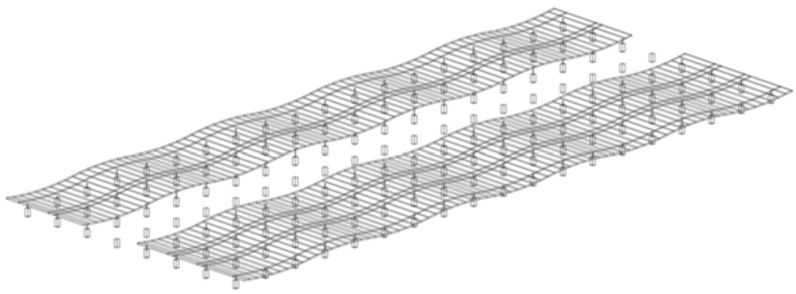
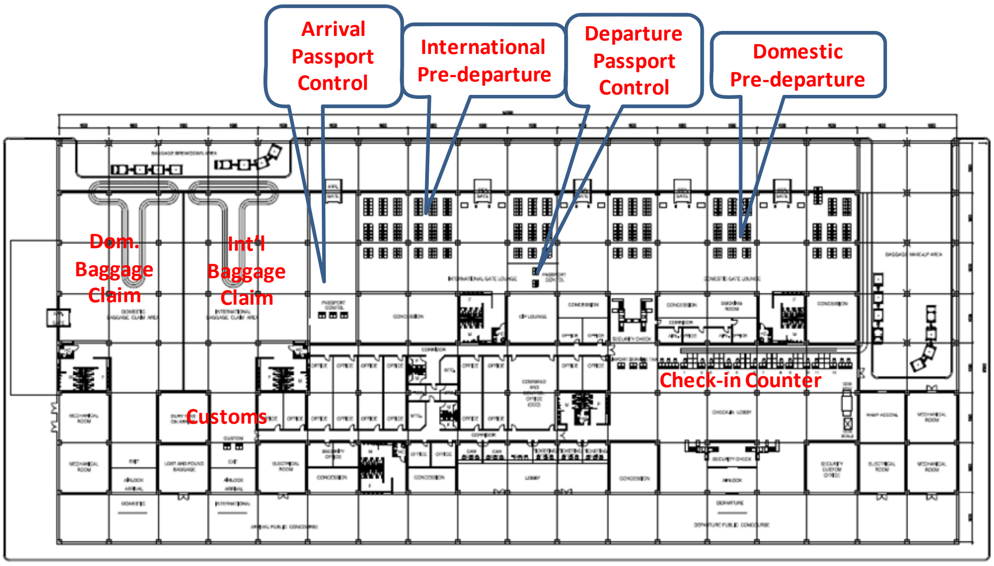
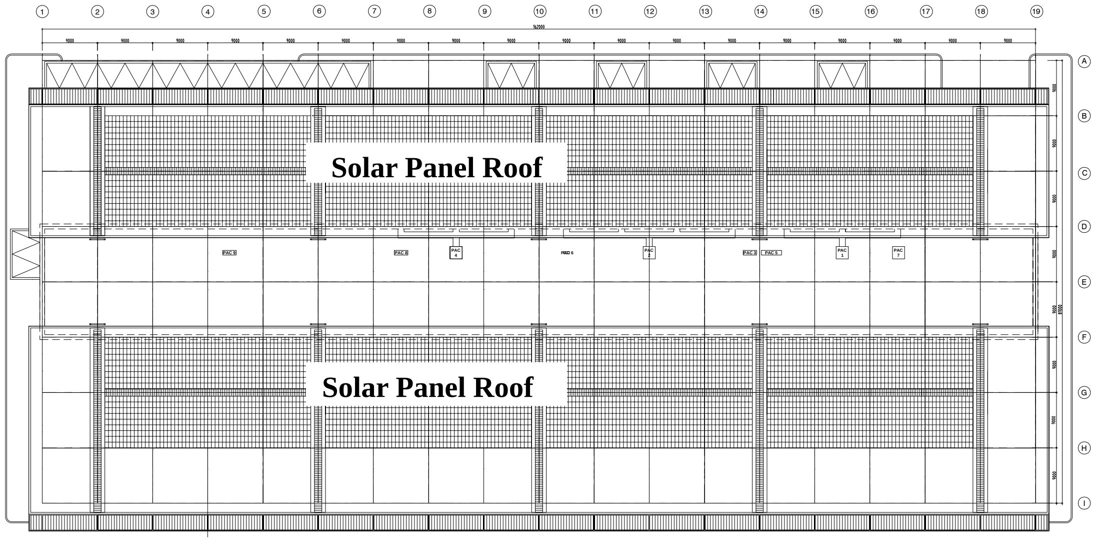


Figure 10-2 Proposed Architectural Concept



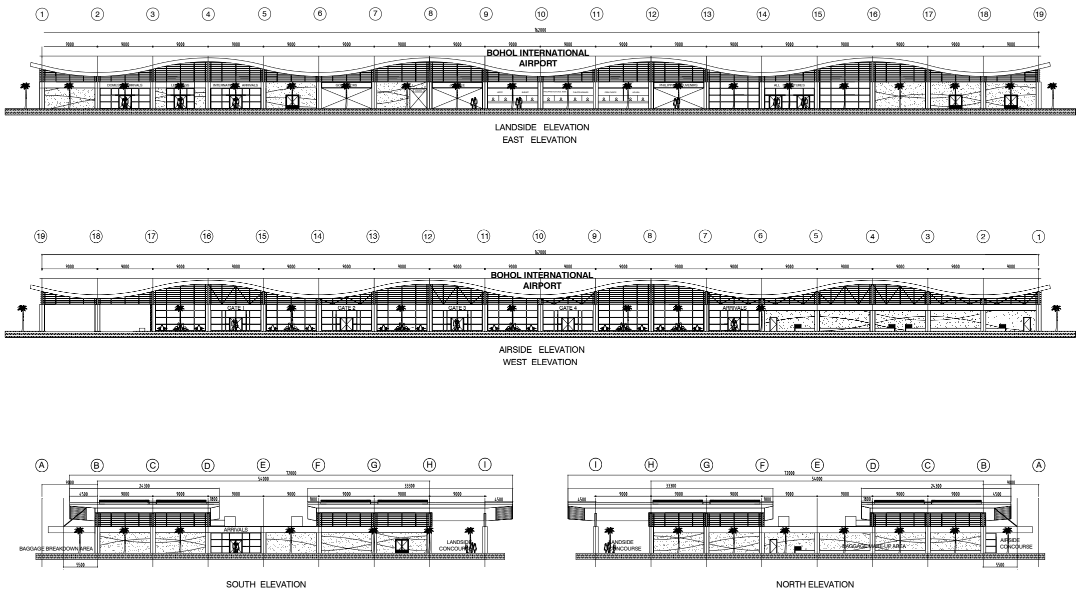
Source: JICA Study Team

Figure 10-3 Passenger Terminal Building (PTB) - Ground Floor Layout Plan



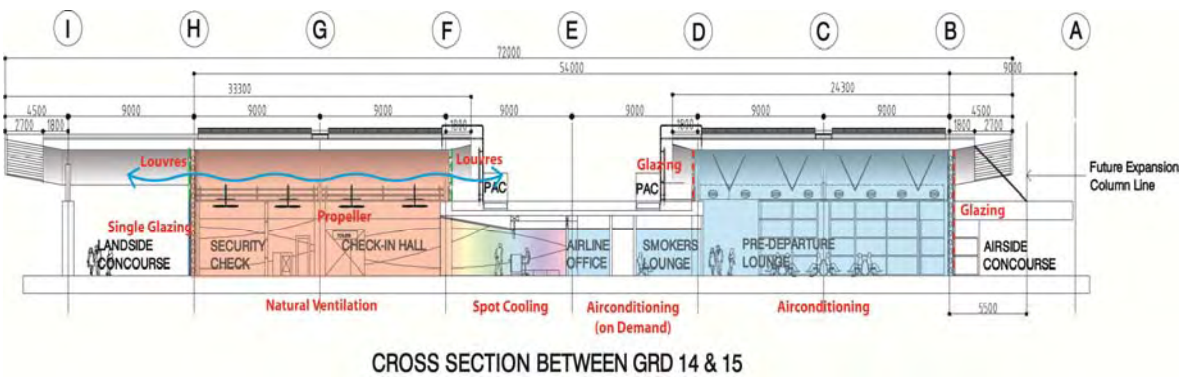
Source: JICA Study Team

Figure 10-4 Passenger Terminal Building (PTB) - Roof Plan



Source: JICA Study Team

Figure 10-5 Passenger Terminal Building (PTB) - Elevations and Sections



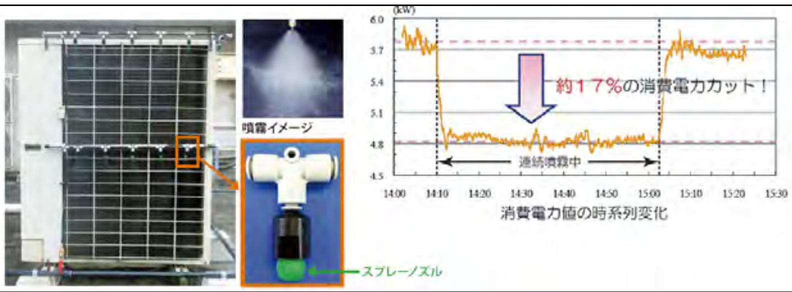
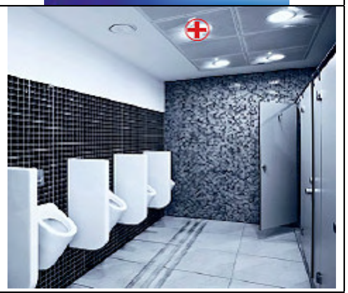
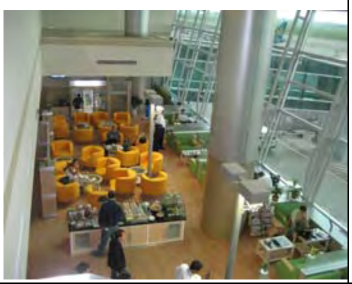
Source: JICA Study Team

Figure 10-6 Section of Air-conditioning and Ventilation

4) Energy Saving Aspect for Eco-airport functions

Various energy saving systems are studied so that operation and maintenance cost can be saved, in view of the functions given in Table 10-4.

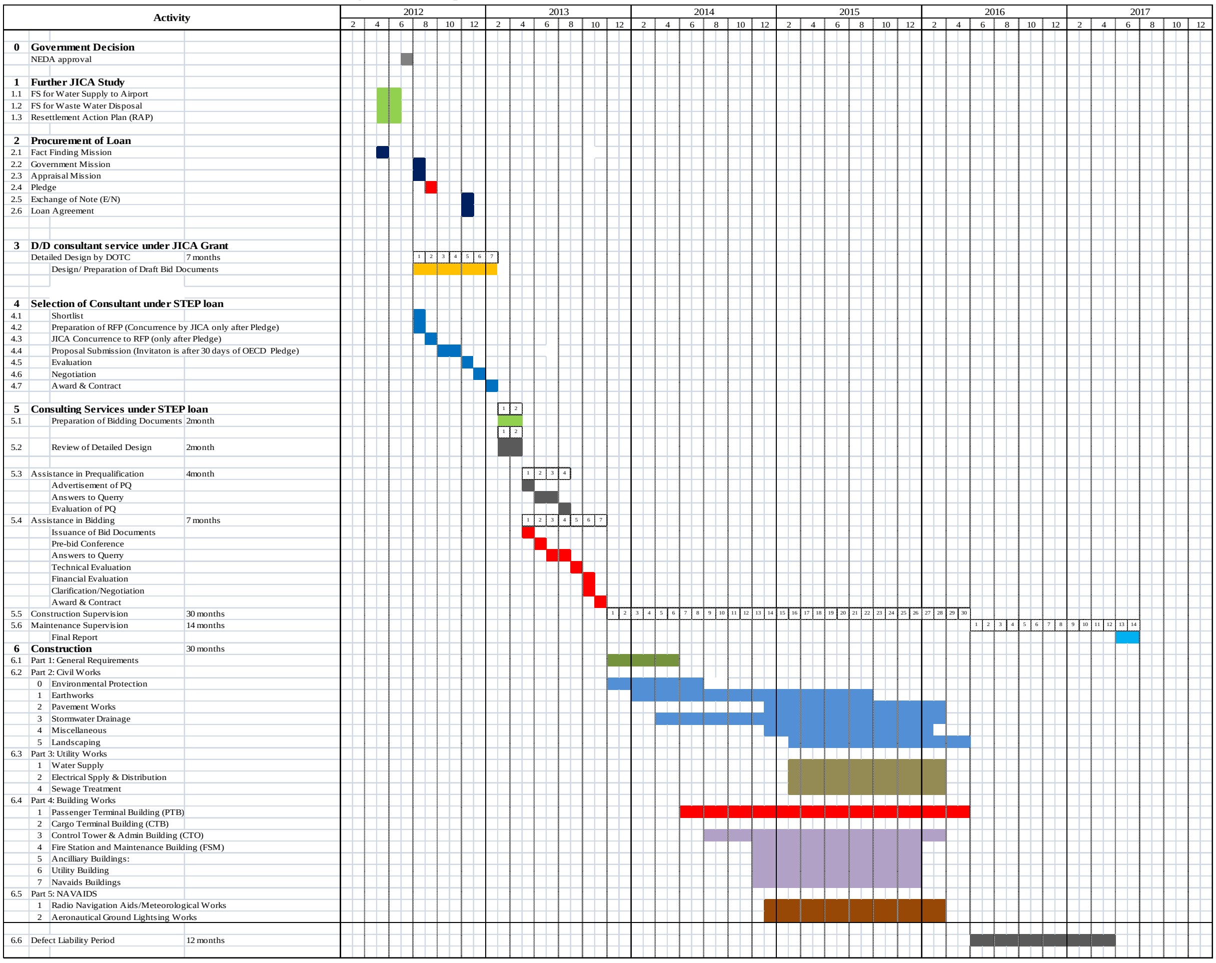
Table 10-4 Energy Saving Aspect for Eco-airport functions

 		 
Energy conservation type air conditioning system		Motion Detectors for Toilets
		 
Haneda International Airport	Fukuoka Airport	
Solar Power Generation Panel		Sensor-operated flush valves
		
LED Lights	Day Light Sensor for Lounge and Lobby	Solar Hot Water Supply System

10.3. Project Implementation Schedule

Based on the discussion between DOTC and JICA at April 2012, it is assumed that the Government would request JICA STEP Loan for Project implementation, the Project is assumed to be implemented to follow the schedule shown in Table 10-5.

Table 10-5 Project Implementation Schedule Source: JICA Study Team



10.4. Project Cost Estimate

Based on the Basic Design of his chapter, the construction cost on the 2012 price was amended as shown in Table 10-6 (without VAT), and was submitted to NEDA.

Table 10-6 Project Cost Estimate based on 2012 Basic Design without VAT ('000)

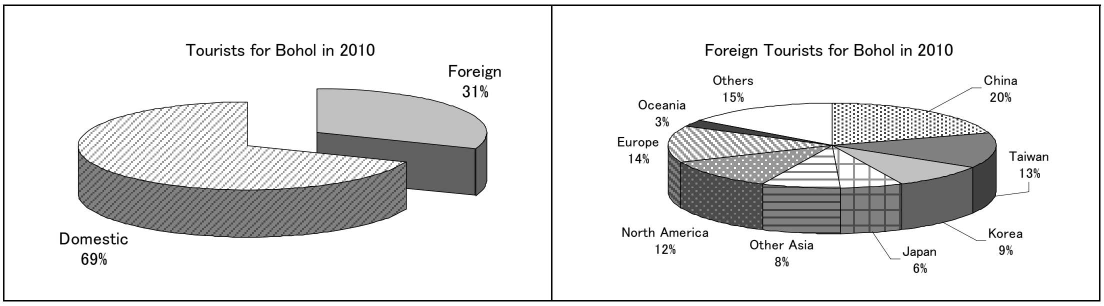
Description		Local (Php)	Foreign (Yen)	Total (Php)
Construction	Base Cost	1,688,164	5,557,406	4,627,663
	escalation	191,084	249,870	323,248
	escalated Cost	1,879,248	5,807,276	4,950,911
	contingency: 5 %	93,962	290,364	247,546
	Total Cost	1,973,210	6,097,640	5,198,457
Consultancy	Detailed Design	135,666		135,666
	ODA financed	137,017	995,561	663,603
Land Acquisition		206,850		206,850
DOTC Administration Cost		217,160		217,160
Grand Total		2,669,903	7,093,201	6,421,736

Source: JICA Study Team
Exchange Rates: US$ 1.0 = Yen 82.43 = Php 43.6 (or Php 1.0=Yen 1.8)
Escalation rates for the coming years: Philippine Peso =4%, Japanese Yen =1.6%

11. Suggested Direction and Programs toward Sustainable Tourism Development

11.1. Current Tourism Situation

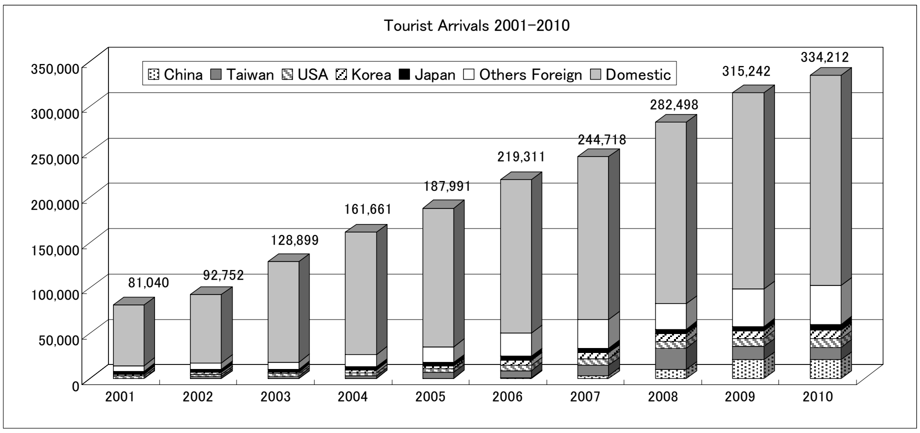
The annual volume of tourist arrivals in 2010 was approximately 330,000, 69 % of which were domestic tourists and 31 % were foreign tourists.　Regarding the foreign tourist volume by country, the largest one is China with a 20% share of the total amount of foreign tourists, followed by Taiwan (13%), USA (12%), South Korea (9%) and Japan (6%).



Source: JICA Study Team (Data source from DOT)

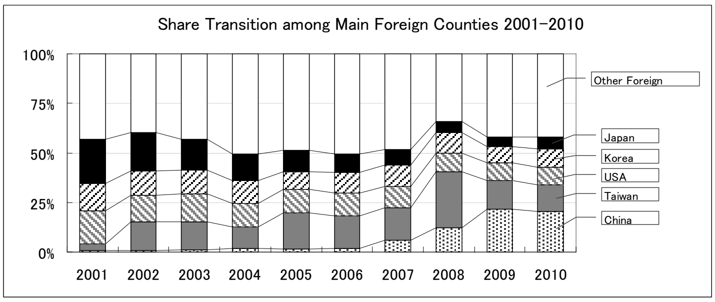
Figure 11-1 Tourist Arrivals by County in 2010

The annual tourist arrival growth rate in the last decade is approximately 15% based on the 80,000 arrivals in 2001. It should be noted that the annual growth rate of foreign arrivals in the same period is 22% which is a larger growth than the domestic tourist arrivals.



Source: JICA Study Team (Data source from DOT)

Figure 11-2 Tourist Arrivals Transition 2001-2010



Source: JICA Study Team (Data source from DOT)

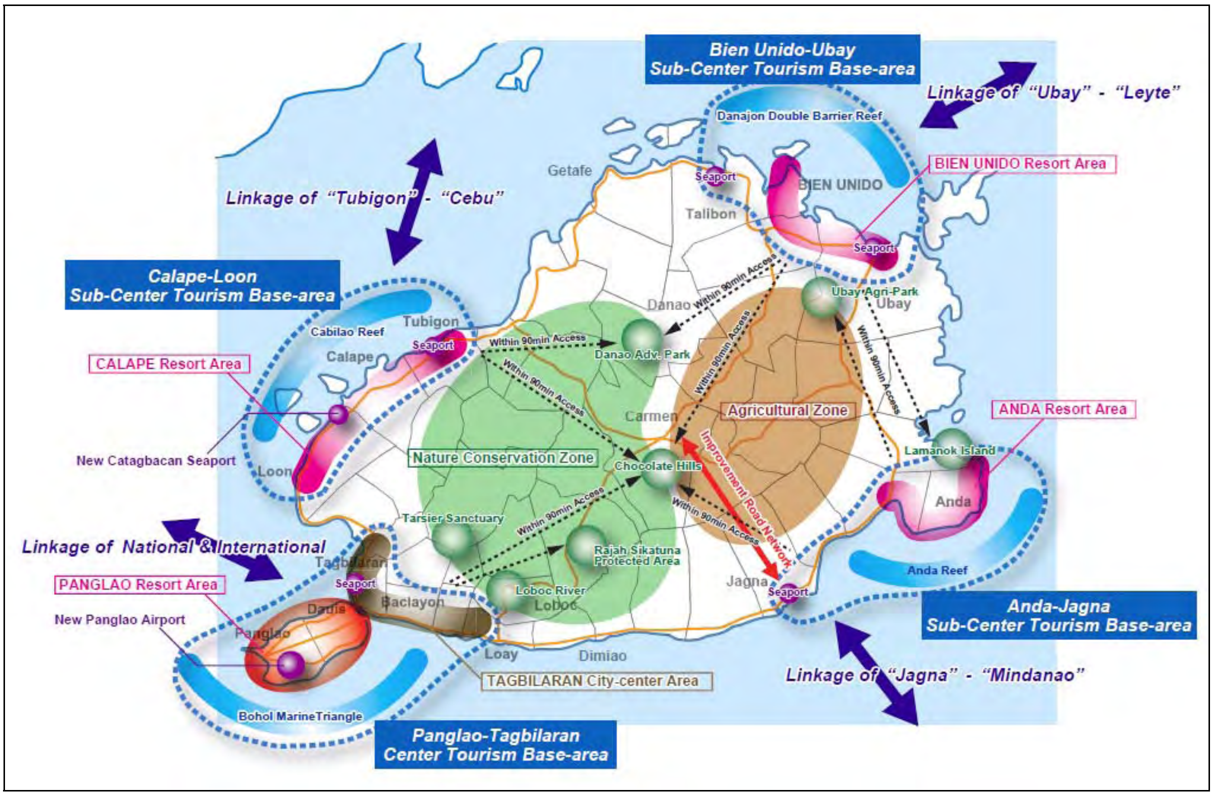
Figure 11-3 Tourist Arrivals Share among Main Foreign Countries 2001-2010

11.2. Proposal of Tourism Development Visions and Directions

The Bohol province established “Green Bohol!” for a future vision in the Provincial Development and Physical Framework Plan (PDPFP) and emphasized “Bohol has it all!” which means they can correspond to any tourist needs’ in the “Tourism Master Plan on the Tourism Clusters of Bohol Province.”

In this study, it proposes a “High-Quality Comfortably Eco-Tourism” as a tourism development vision, based on the planning issues and Bohol Eco-tourism Vision mentioned above.

Bohol still has good nature and atmosphere tourists can enjoy and be relax, on the other hand local people are getting realize environmental change caused by tourists increase rapidly. Therefore, it can be said that now is a good opportunity to establish Bohol’s Eco-tourism. To respond to tourists increase tendency it is important to establish a system or a mechanism to implement the vision, “High-Quality Comfortably Eco-Tourism” by means of conducting tourism development programs as followings. This must achieve tourism development with good balance even if the new Bohol Airport will be constructed.



Source: JICA Study Team

Figure 11-4 Proposed Bohol Tourism Development Direction Image

11.3. Proposal of Tourism Development Programs

Based on the tourism development visions and directions, some programs should be carried out and a priority package program is proposed as below.

1) Tourism Use Control in Conjunction with Spatial Management System

Bohol Province formulated the “Provincial Development & Physical Framework Plan (2010-2015)” to set a framework of a future land use plan for the whole Bohol. Based on the provincial framework, each municipality formulates a “Comprehensive Land Use Plan (CLUP)” on local level. Normally these land use plans indicate comprehensive directions of land use, such as urban use (residential, industrial and commercial), agricultural use, forestry use and so on. For the achievement of sustainable tourism development, tourism use control, both its volume and method, should work with spatial management system regulated by CLUP, to take a balance between tourism development and nature conservation. This spatial management system for tourism use control will have tourism use zoning which will correspond to rules and regulations of tourism use as shown in Table 2.3-2. The system should consider nature conditions, characteristics and methods of how tourists use the zones and how nature should be conserved and managed.

2) Examination of Appropriate Carrying Capacity

Definition of “Carrying Capacity” in this study: the maximum number of people and/or the tourism use method (high-quality tourism such as eco-tourism and agri-tourism) that may visit a tourist destination at the same time, without causing destruction of the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction.

It should be considered to keep a proper maximum carrying capacity of Bohol with the current growing volumes of both tourists and population. Especially on Panglao Island, tourism use may continue to excessively expand and new hotels and buildings may also construct due to its attractive white beach resorts and its easy accessibility. For avoiding and mitigating excessive concentration of use, it is necessary to introduce a “Usage Control Management” system based on a concept of “Maximum Carrying Capacity” especially on Panglao Island. What is especially important in the immediate future is to control the marine area of Panglao Island where over-use problems are appearing, such as at Balicasag Isand and Alona Beach. Additionally, it is recommended to examine and introduce a similar concept of “Sanctuary Fee” for entry into the island or a regulation of limited hotel rooms for construction hotel on the island in order to avoid and mitigate over concentration of tourists’ number in Panglao Island.

3) Adaptive Management based on a Monitoring System

For aiming sustainable usage of tourism resources, it is necessary to apply an “Adaptive Management” concept which means managing the natural environment flexibly with carefully observing change of nature conditions based on results of a monitoring process. It is important to understand and show clearly a change of tourism resource quantitatively through the monitoring process. At first, monitoring sites will be set up in some areas where over-use problems are appearing, the monitoring should be conducted continuously. As noted above, the adaptive management should be conducted to understand the change of tourism resources through continuous and periodical monitoring.

4) Enforcement of Guide System in Corresponding with Regulations

The current “Tour Guide” system in Philippines has already been established with submitting required documents, undertaking training course and passing examination by DOT. It is necessary to renew the current guide system by adding requirements of environmental conservation knowledge and to establish a new system which has corresponding regulations between usage control zoning and an accompanied guide system. Also it is recommended to establish a further marine guide system in addition to the current terrestrial guide system. It is reasonable that concerned people such as diving trainers and boat owners take a training course and an examination at minimum level in order to improve manner of snorkelers and other tourists.

A Priority Package Program for Sustainable Tourism Development

<table>
<tr><td>Goal</td><td colspan="2">To establish an improved framework for the conservation and appropriate use of tourism resources under the concept of “carrying capacity”, targeting on Panglao Island.</td></tr>
<tr><td>Contents</td><td colspan="2">1) Establishment of Bohol’s Implementation Organizations
i. To review and analyze current conditions of stakeholders
ii. To establish “Regional Liaison Committee (tentative name)”, which has roles to consider and decide directions of management and to promote liaison and coordination
iii. To establish “Scientific Council (tentative name)”, which has roles to provide necessary advices from viewpoints of scientific knowledge
2) Commencement and Continuance of a Monitoring System
i. To commence monitoring surveys in cooperation with relevant organizations to grasp environmental conditions and the number of tourists, and to examine the maximum carrying capacity
ii. To operate monitoring system which consists mainly of collecting survey results and analyzing those results
3) Set of Goals and Policies for Sustainable Tourism Development and Establishment of Adaptive Management System
i. To set goals and policies for sustainable tourism development by Bohol’s implementation organizations
ii. To formulate tourism usage control methods in conjunction with existing CLUPs
iii. To operate PDCA cycle, namely “Adaptive Management System” based on the results and analysis of monitoring to be conducted
4) Pilot Trials of Usage Control based on a Maximum Carrying Capacity
i. To set study areas and initial figures of carrying capacity in each study area
ii. To conduct pilot trials to control the maximum number of tourists in study areas, and to review and modify proper figures of carrying capacity by feedbacks based on the monitoring results
5) Enforcement of Guide System for Tourism Usage Control
i. Improve the training course for the current guide system
ii. Introduce a new guide system in marine areas as well as the current system in terrestrial areas
6) Capacity Development for Officials and Relevant Players
i. Formulate and conduct training programs for officials and relevant players
ii. Prepare administrative guidelines for officials’ use</td></tr>
<tr><td rowspan="3">Implementation Organizations</td><td>Management Bodies</td><td>Administrative agencies that conduct the management. It may consist of Province of Bohol DOT (Department of Tourism), etc.</td></tr>
<tr><td>Regional Liaison Committee (tentative name)</td><td>It has roles to consider and decide directions of management and to promote liaison and coordination. It may consist of members of existing committees, such as tourism, hotel, fishery, tour guide, diving shop, restaurant and commercial with management bodies.</td></tr>
<tr><td>Scientific Council (tentative name)</td><td>It has roles to provide necessary advices from viewpoints of scientific knowledge. It may consist of members of researchers from university and institution, relevant NGO representatives, tour guides and other persons who have special knowledge.</td></tr>
<tr><td>Schedule</td><td colspan="2">Two Years</td></tr>
</table>

Items	Period (2 Years)					
1) Establishment of Bohol’s Implementation Organizations	■					
2) Commencement and Continuance of a Monitoring System		■	■	■	■	■
3) Set of Goals and Policies for Sustainable Tourism Development and Establishment of Adaptive Management Syste		■	■			
4) Pilot Trials of Usage Control based on a Maximum Carrying Capacity			■	■	■	■
5) Enforcement of Guide System for Tourism Usage Control				■	■	■
6) Capacity Development for Officials and Relevant Players				■	■	■

Source: JICA Study Team

12. Design of Water Supply Facilities at New Bohol Airport

12.1. Water Supply Situation in the Target Areas

1) Tagbilaran City

The population of Tagbilaran City is 92,297 (Census 2007) and the increase rate of population is 3.6%. Water supply in Tagbilaran City is managed by Bohol Water Utilities, Inc. (BWUI) and Tagbilaran City Waterworks System (TCWS).

- BWUI supplies water to 59,300 water supply population in the area in charge in 2011. The population served is 86%. The water consumption per capita is 268L/cap/day. It also supplies water for production to Dauis of Panglao Island.
- TCWS supplies water to 24,000 water supply population in the area in 2010. The population served is 75%. The water consumption rate per capita is 140L/cap/day. The water supply amount is 4,632m^3/day.

2) Panglao Island

- DAUIS: Total population in water supply area of Dauis in March 2012 is 45,735. The population served is 49% and the water consumption per capita is 70L/cap/day. The water supply amount in March 2012 is 2,728m3/day. The yield of the well in barangay is limited to 396m3/day and 2,500m3/day is supplied from the BWUI network.
- PANGLAO: Total population in water supply area of Panglao in 2010 is 27,241. The population served is 68% and the water consumption per capita is 70L/cap/day. The water source in the coastal area in Panglao is slightly salty and is not used for drinking. Therefore it is difficult to develop the new water sources in the Panglao Island.

3) Water Supply Conditions for New Airport

The water demand for the new airport is 420m3/day and this is about 2% of 21,000m3/day, the total maximum water supply amount by BWUI in 2012. The total water supply capacity by BWUI in March (the summer season) in 2012 is 23,487m3/day and the water supply amount is 20,753m3/day. The margin of daily supply is 13%, which is 3,000m3/day.

The existing water supply facilities of BWUI for the new airport are shown in below table. A stable water supply for all water users becomes possible.

Sources of Six Wells in Collera: Amount of Water Source: 8,700m^3/day (pump capacity). There is a margin of 1,800m^3/day for the transportation to Dauis.
1) Capacity of R6 Tank (reservoir): 2,000m^3: Retention time of the R6 tank is 6.2hours which is enough.
2) Transmission Pump (Dampas): The capacity is more than 2,400m^3/day (alternately one pump operation). Simultaneous operation will allow supply of sufficient amount of water to the airport with functional operation.
3) Transmission Pipe: Transmission pipe pumped up at Dampas, supplying water to Dauis. Current flow rate to Dauis is 2,100m^3/day.

12.2. Condition of Water Supply Facilities in the Area

Water supply per person by BWUI in Tagbilaran is 268L/cap/day (cf. Tokyo: 240L/cap/day), which is rather large, an immediate water shortage is unlikely to occur. There is an expansion of 10,000m3 by BWUI, the increase of water supply for Dauis is expected. The expansion work will be completed since 2013 to 2014 and then it is possible to supply water up to 2025.

12.3. Water Supply Plan for New Airport

According to the new Panglao Airport, the maximum amount of demand for the airport is estimated to be 383m3/day. Daily maximum water supply amount is 420m3/day (including leakage rate, 10%). Water facility plan for new airport is as follows.

- Receiving tank, GL29m: 1 tank in the site of BWUI, with water pump: 1 pumping station
- Relay tank, GL65m: 1 tank (in the private site, agreed)
- Transmission pipes: through Central Highway between Dauis to New Airport (D150-D150mm, L=14km)

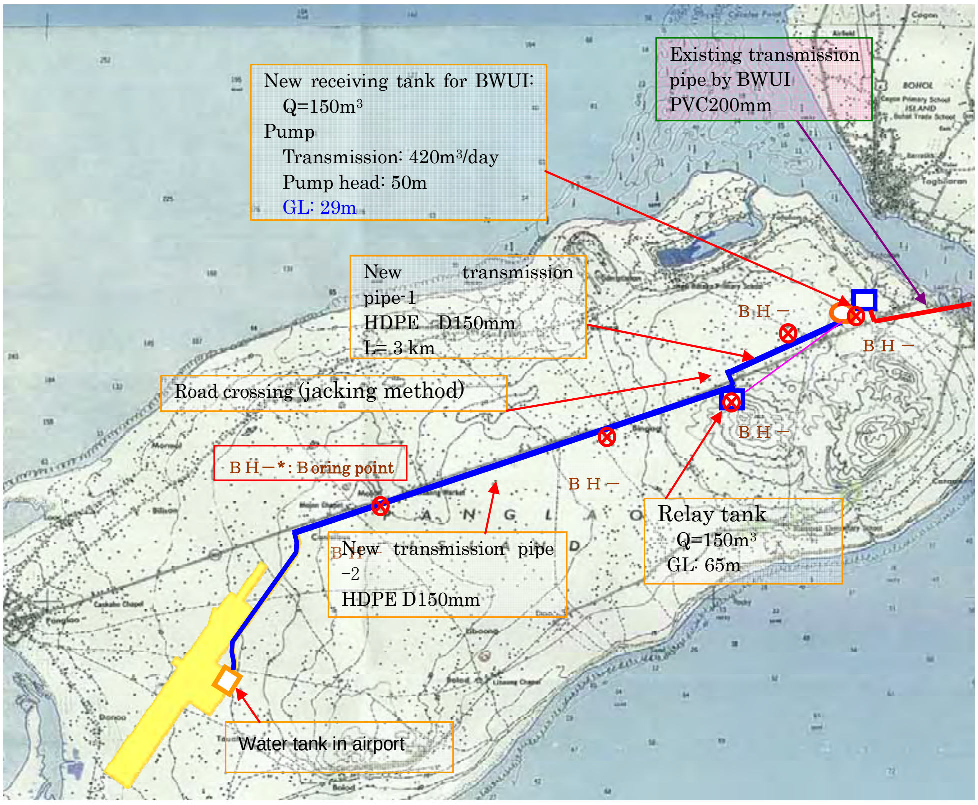


Figure 12-1 New Panglao Airport Water Supply Facilities

12.4. Maintenance Plan

1) Maintenance System

The provincial government has no water supply engineer in their organization. Therefore, they rely on BWUI in terms of technical subjects or related matters for water supply. For the Bohol provincial government to remain as a major shareholder of BWUI, its public nature and reliability are to be assured through authorized governmental guidance and achievements attained. However, the ownership of facilities still belongs to the new airport. DOTC is necessary to discuss the receiving water fees and maintenance fees with BWUI for implementation in the future.

2) Receiving Water Fees・Operation and Maintenance Fees

BWUI proposed water fees as follows:

- The amount of receiving water at the point of receiving tank: 420 m^3/day (Dauis, Mareveles in the site of Brng. BWUI)
- Water fees include the general operation and maintenance of BWUI after transferring the water supply facilities (General operation and repair of receiving tanks, transmission pipes, pump station and water pump): 30PhP/m^3 , Total: 12,600PhP/day
- Electricity fees (cost for transmission pump, instrumentation equipment)
- Major repairs (Crack or bursting caused by earthquake or accident)

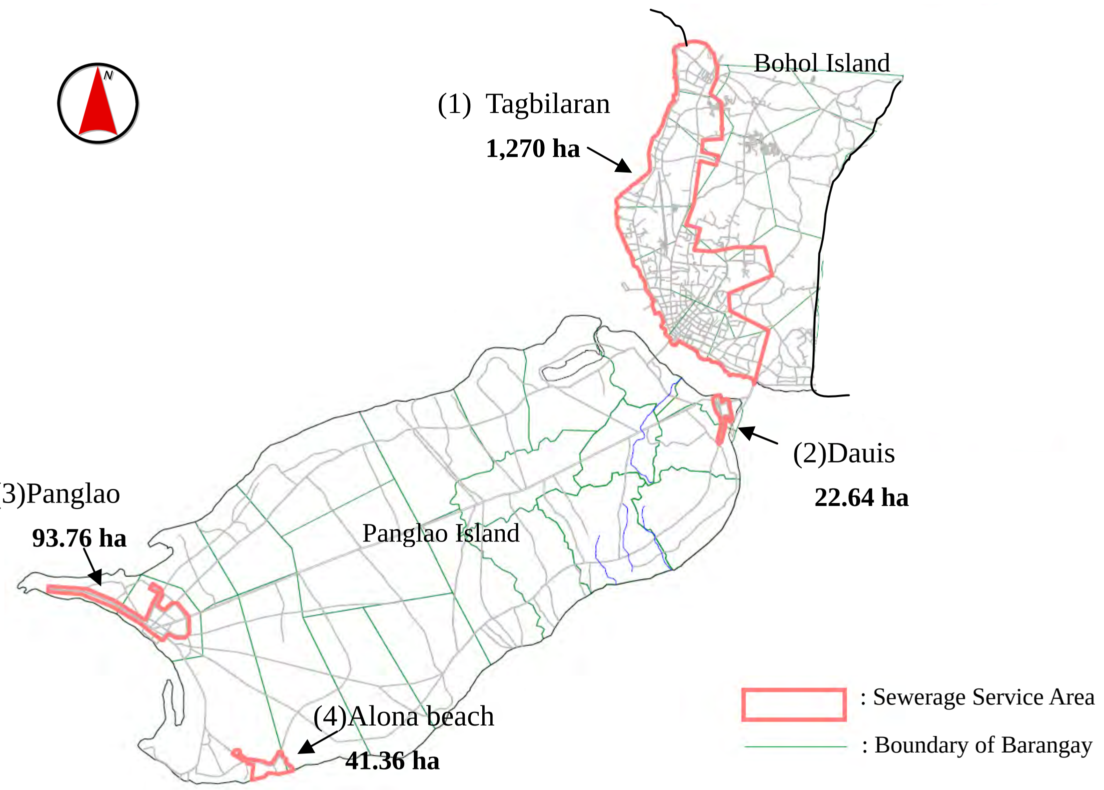
  Total: 1,800PhP/day

13. Sewerage Development Plan

13.1. Study Area and Sewerage Development Area

The study area for sewerage development plan covers three LGUs; namely Tagbilaran City, Dauis Municipality and Panglao Municipality. The following four areas shown in Figure 13-1 were selected as the sewerage service area by considering population density, density of hotel and candidate site of wastewater treatment plant.

1) Tagbilaran system: center of city and surrounding of Wastewater Treatment Plant (WWTP),
2) Dauis system: part of Poblacion,
3) Panglao system: part of Poblacion and Barangay Doljo and,
4) Alona beach.



Source: JICA Study Team

Figure 13-1 Proposed Sewerage Service Area

13.2. Planning Fundamentals

Year 2035 is set as the target year of the design period for the sewerage development plan. The planning fundamentals by sewerage system is sown in Table 13-1. Since the service area of Tagbilaran system is quite large, two-staged implementation of the sewerage development for Tagbilaran system is recommended.

Table 13-1 Planning fundamentals by Sewerage System

Sewerage System		Present Population (LGU Total)	Projected Population (LGU Total)	Planned Service Area(ha)	Planned Sewered population	Design Flowrate (Daily Max. m3/d)
		2010 (projcted by Province)	2035			
	(1)Tagbilaran	98,145	146,640	1,270.00	69,578	20,500
	(2)Dauis	40,387	74,130	22.64	1,400	252
Panglao		27,241	40,540	–	–	–
	(3)Panglao (Poblacion+Doljo)	–	–	93.76	8,017	1,440

Source: JICA Study Team

13.3. Features of Proposed facilities

The features of proposed facilities by sewerage system are shown in Table 13-2.

Table 13-2 Features of Proposed Facilities by Sewerage System

Sewerage System		Contents
Tagbilaran	(Phase 1)	Gravity sewer Ø200〜Ø900mm, L=58.3 Km Force main pipe Ø100〜Ø400 mm, L=1 Km Pumping Station, N= 1 Wet Pit Pumping Station N=6 House Connections; 6,397 WWTP (Q=10,250 m^3/d)
	(Phase 2)	Gravity sewer Ø200〜Ø500 mm, L=35.8 Km Force main pipe Ø100〜Ø250 mm, L=1.6 Km Pumping Station, N= 1 Wet Pit Pumping Station N=13 House Connections; 7,519 WWTP (Q=10,250 m^3/d)
Dauis		Gravity sewer Ø200 mm, L=2.6 Km House connections; 280 WWTP (Q=252 m^3/d)
Panglao	Poblacion & Doljo	Gravity sewer Ø200〜Ø300 mm, L=7.6 Km Force main pipe Ø100 mm, L=5 m Wet Pit Pumping Station N=1 House Connections; 1,678 WWTP (Q=1,440m^3/d)
	Alona	Gravity sewer Ø200〜Ø250 mm, L=3.1 Km Force main pipe Ø100 mm, L=0.3 Km Wet Pit Pumping Station N=2 House Connections; 289 WWTP (Q=660 m^3/d)

Source: JICA Study Team

13.4. Construction Cost

Approximate Construction Cost by sewerage Project is shown in Table 13-3.

Table 13-3 Construction Cost by Sewerage System Unit: million Peso

Sewerage Project	**Phase 1**	**Phase 2**	**Total**
Tagbilaran	1,297.9	850.6	2,158.9
Dauis			39.7
Alona Beach	71.2	-	71.2
Panglao（Poblacion & Doljo）	-	177.1	177.1

Source: JICA Study Team

13.5. Project Evaluation

As a rule of thumb, the FIRR should at least be equal to the weighted average cost of capital for the project. However, required sewerage tariff to make FIRR positive is 3.3 - 6.3 times as high as the existing tariff of water supply without any subsidy/grant. Likewise, the projects are not financially viable since the corresponding sewerage tariff to be collected in the project area is too high. However, the cash flow analyses conducted for the sewerage projects show revenues attributable to the projects can cover the O&M costs. Therefore, if the sewerage systems are granted to the local government agencies like the city or the municipality, they could operate the sewerage systems continuously.

Furthermore, the economic benefits of the sewerage projects seem to be very large considering the contributions to tourism industry and conservation of the water environments. Hence, the sewerage projects should be executed from an economic and ecological points of view.

14. Studies for Individual Sewage Treatment Facilities

14.1. Aim of the Study

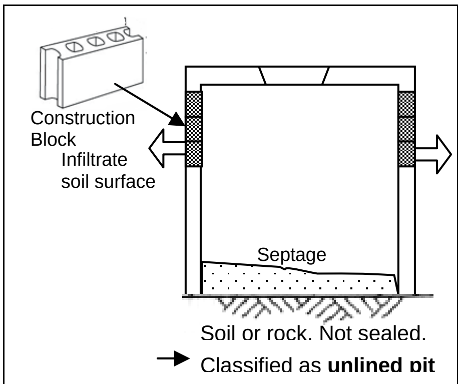
The aim of this study is to propose short term countermeasures for domestic wastewater management in Panglao Island (Dauis Municipality and Panglao Municipality). Investigation of existing individual sewage treatment facilities, related administrative agencies and private companies, technical and systematic tasks for domestic wastewater management are conducted in this survey.

14.2. Study Results of Existing Individual Sewage Treatment Facility

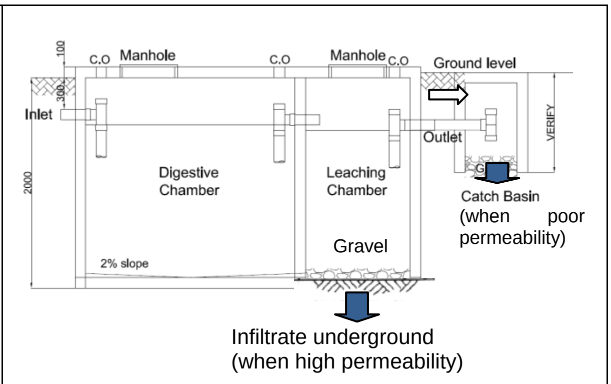
1) Households

The results show that human excreta from households seep underground after treated by Septic Tanks (STs) or unlined pits. Grey water (wastewater from kitchen and bath room) is normally discharged to soil surface directly in old houses. On other hand, in relatively new houses, various treatment methods such as connected to STs or the 2nd chamber of the ST or directly discharged without treatment etc. are used for grey water. Generally, periodic desludging of STs is not conducted in the households.

Typical drawings of existing individual sewage treatment facilities are shown below.



Old Type, One chamber ST



Two chambers ST

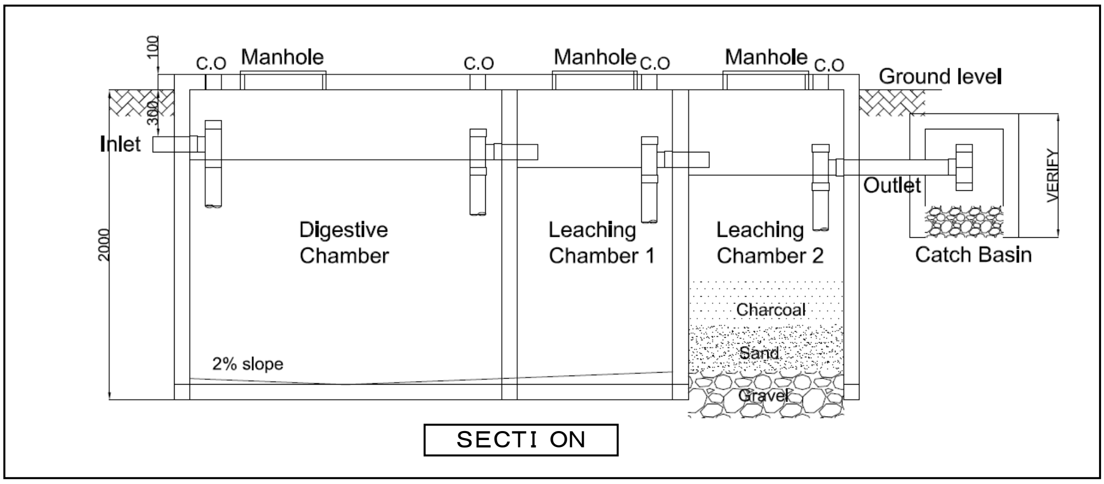
Figure 14-1 Typical Drawings of Existing STs

2) Tourist Accommodation Facilities

Tourist accommodation facilities of Panglao Island are obligated to install STs with 3 or more chambers since 2005 by the ordinance. All investigated hotels had at least one ST with 3 or more chambers.

14.3. Identification of Problems in Existing Individual Sewage Treatment Facility

Figure 14-2 shows the typical drawing of a 3 chambers ST which is recommended in Dauis and Panglao municipalities. The problem of the current typical drawings used in Panglao Island is that in the area where the percolation of soil at the bottom of the tank is poor, effluents of ST seep underground through the catch basin from the outlet at the upper part of the ST. Therefore, a filtration process through charcoals, sands, and gravels at the bottom of the final chamber cannot be benefited before seeped underground. As an alternative, introduction of an up-flow filter type ST (Figure 14-3) is recommended in this study.



Source: Panglao municipality building office

Figure 14-2 Standard Drawing of 3 chambers ST

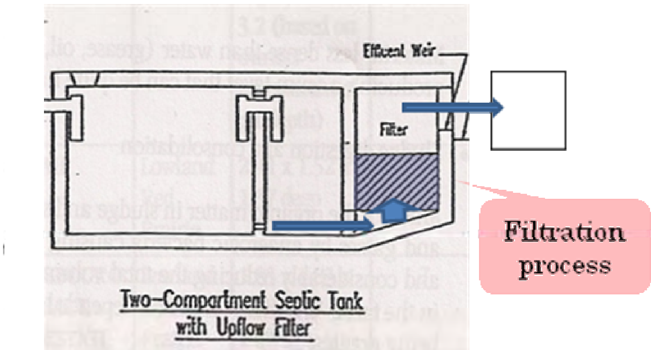


Figure 14-3 Up-filter ST

14.4. Proposals of Technical Assistance Program by JICA

JICA technical assistance program for following two items is proposed to be implemented with Panglao and Dauis municipalities in years to come.

- **Support 1: Establishment of a New Organization for Individual Treatment Facility Management**

At present, acquisition of Building Permit is necessary to construct new buildings. In addition, commercial facilities require Sanitary Permit. Upon the application of these permits, Municipal Building Office (MBO)'s Engineer and/or Sanitation Inspector give guidance about required facility and conduct a final inspection. However, there are cases even in the recently constructed buildings or houses installed unlined-pit type toilets or improper ST which is different from the drawings. Only two engineers and one engineer are working in Dauis and Panglao MBO respectively. Vulnerability of the organizations is considered to be one of the reasons for the current situation.

Thus it is proposed to establish a new organization to manage individual treatment facilities for the all Panglao Island area (Dauis and Panglao Municipalities) separated from existing Municipal Health Offices and MBOs, and the technical assistance is aiming on capacity development of new organization and human resources.

- **Support 2: Pilot Project for Improving Individual Sewage Treatment Facilities**

The introduction of the Up-flow filter type ST is proposed to improve ST effluents quality in this study. The final tank of the Up-flow filter ST serve as an upflow filtration tank, and the quality of treated water improves since it is thoroughly filtered before discharged. However, introduction of Up-flow filter type ST requires appropriate maintenance including periodical cleaning or replacement of the filter material. Therefore, it is necessary to carry out a pilot project for households and small/medium sized accommodation facilities to select the suitable filtering materials and confirm the facility structure, and to establish the operation and maintenance methods. Preparation of Up-flow filter STs introduction plans shall be the final object for the technical assistance.

14.5. Consideration of Public Septage Treatment Facilities and its Construction Funding Sources

1) Consideration of Septage Treatment Facility

Currently, there are no public septage treatment facilities in Bohol Province, and the septage generated from Panglao Island is mainly collected and disposed by 2 private companies which are in Tagbilaran city. According to the interview to the desludging companies, collected septage are disposed in their own land. However, the actual status of the septage treatment/disposal is not known. Therefore, required septage treatment facility for Panglao Island is considered as the near-to-mid term countermeasure in this study. The implementation body of the facility is assumed to be the new organization proposed to set up in the JICA technical assistance program. A vacant land own by DOTC near the new airport is proposed as septage treatment facility construction site.

2) Financing for Septage Treatment Facility Construction

According to the interview to the related authorities, Tourism Infrastructure and Enterprise Zone Authority (TIEZA) has most possibilities of financing for septage treatment facility construction at the present. As a prerequisite to construct the septage treatment facility, it is important to set up the new organization that is expected to be the implementation body of the project.

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Chapter 9. Modalities of Public Private Partnership (PPP)

Chapter 10. Project Implementation Program

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**

<u>G</u>

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**

<u>H</u>

HF	**High Frequency**

<u>I</u>

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

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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.

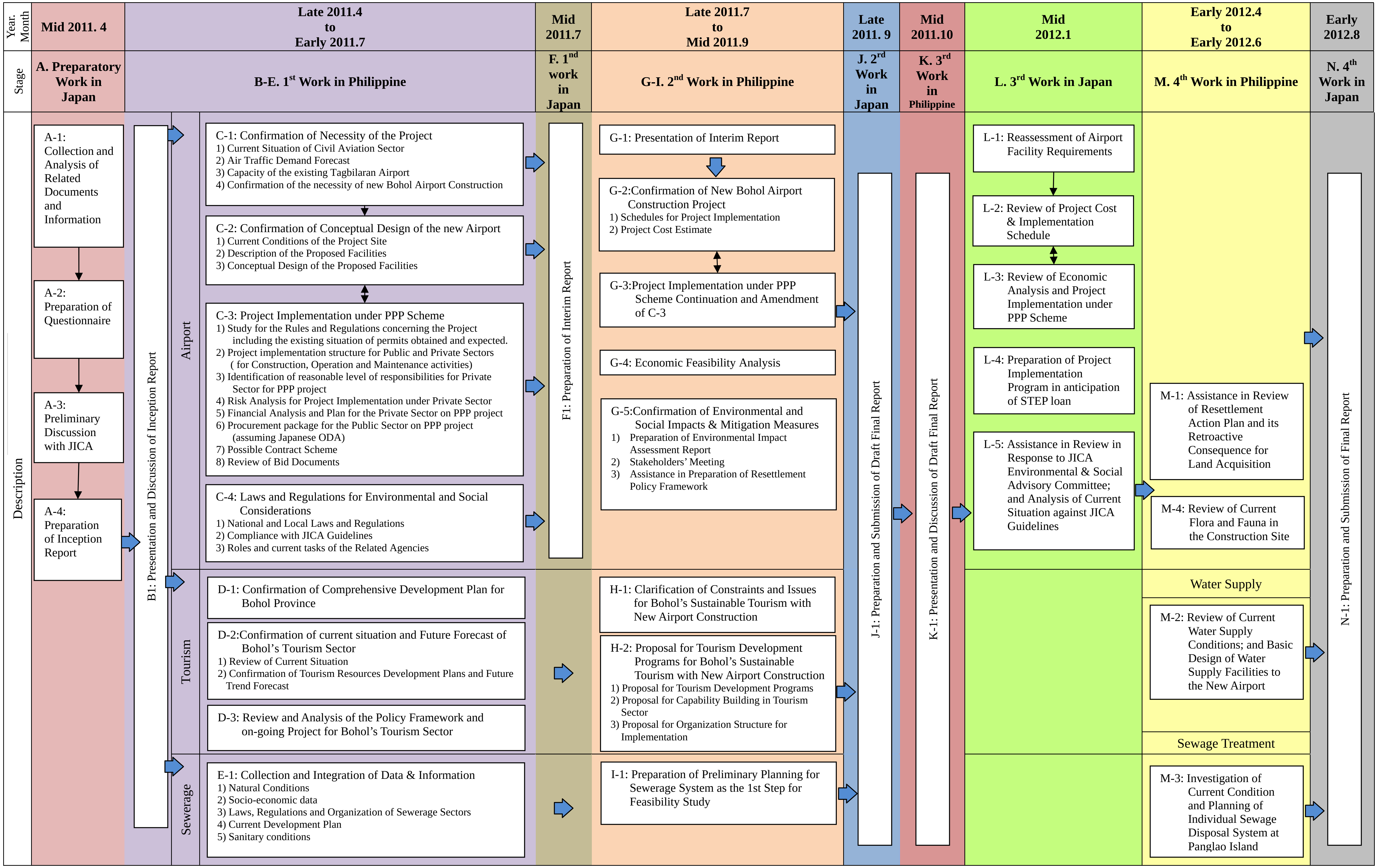

Figure 1.3-1 Flowchart of the Study

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.

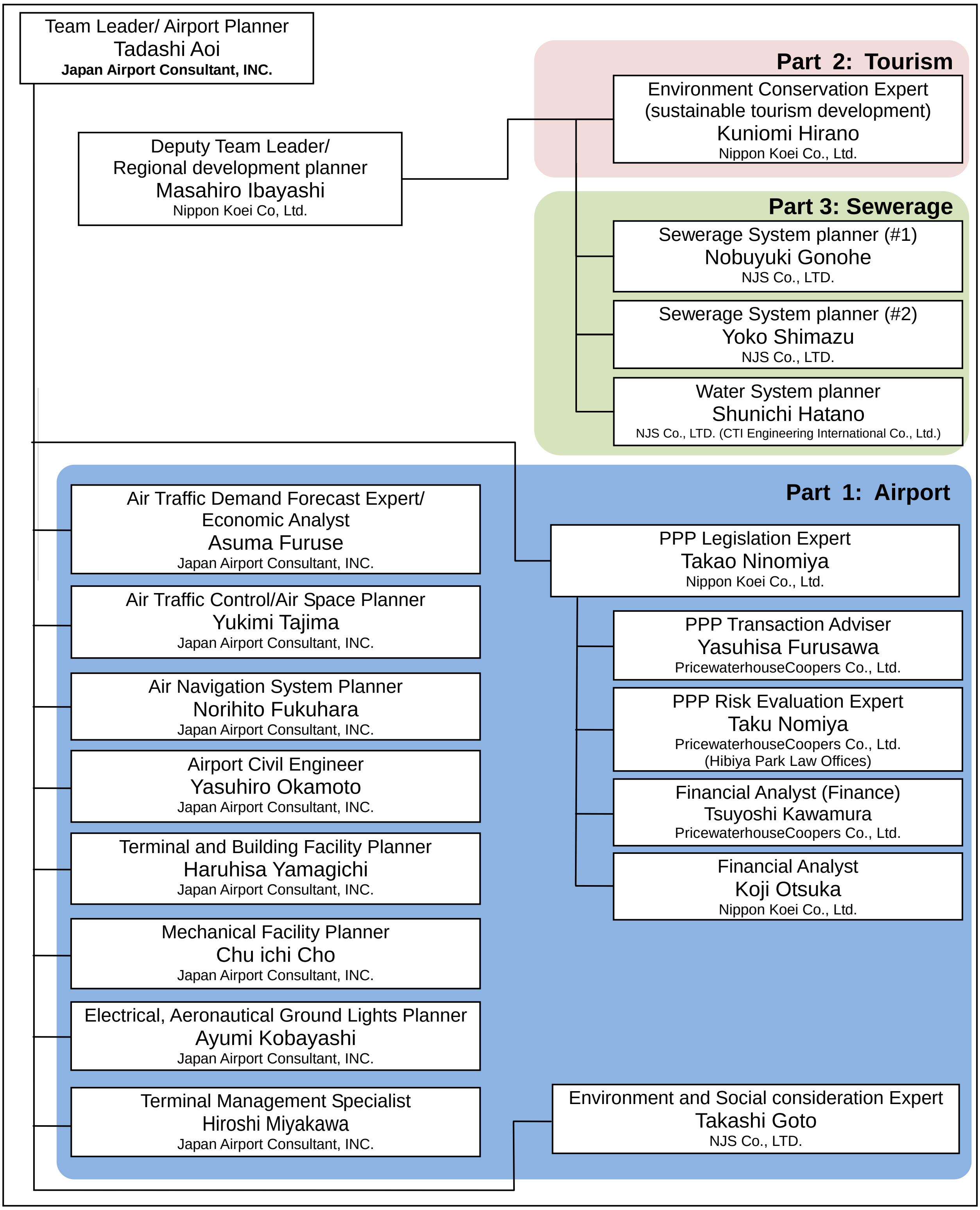

Figure 1.5-1 Study Team Organization

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

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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		2000		2009		Average Growth Rate (%)		
	GRDP	share (%)	GRDP	share (%)	GRDP	share (%)	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		2000		2009		Average Growth Rate (%)		
	GRDP	share (%)	GRDP	share (%)	GRDP	share (%)	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)

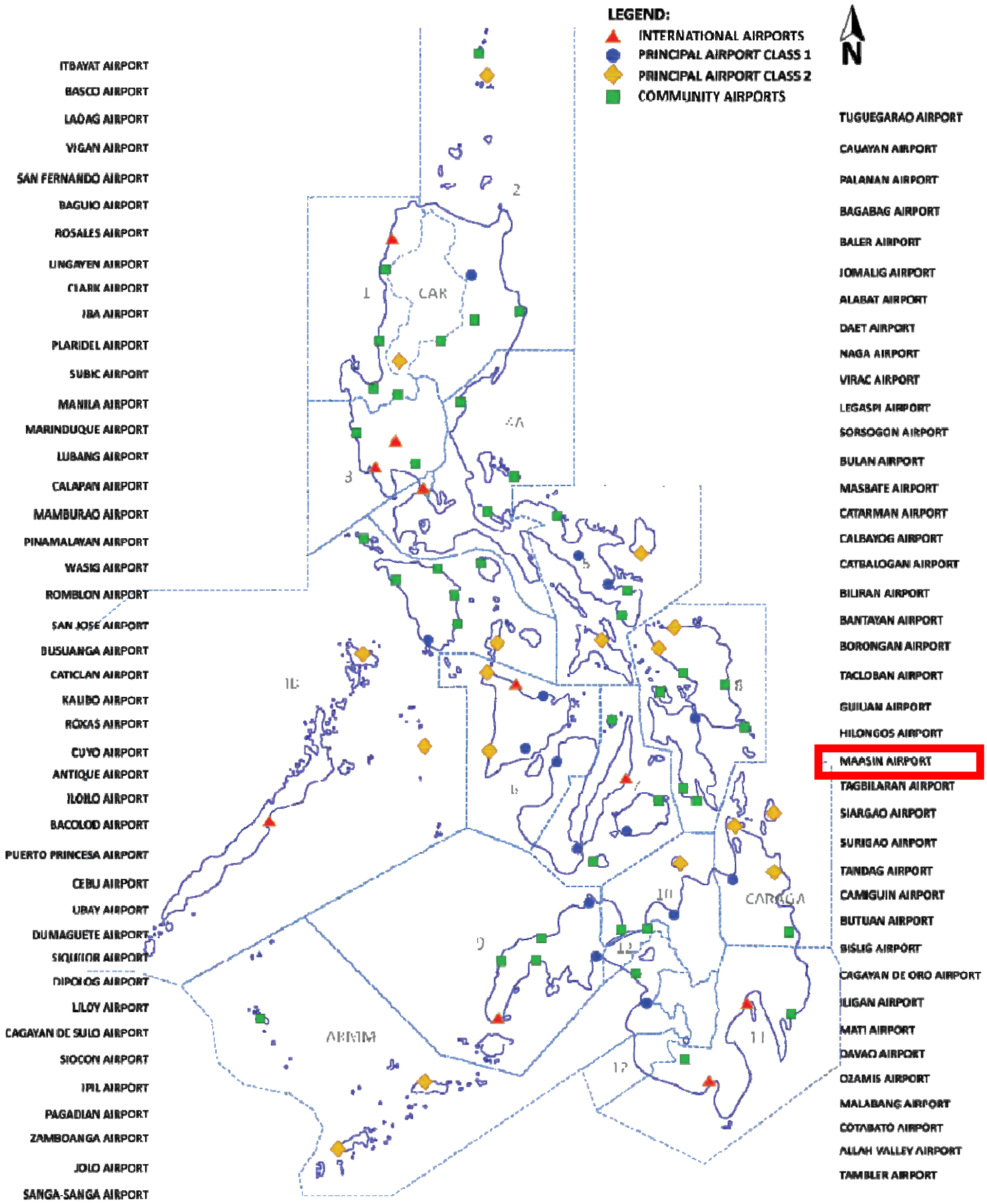
Industry	(a) Philippines		(b) Region VII		Share of Region-VII [(b)/(a)]
	GDP (bil. Php)	share (%)	GRDP (bil. Php)	share (%)	
AGRICULTURE SECTOR	944	14.20	36	7.86	3.85%
INDUSTRY SECTOR	2,099	31.57	144	31.28	6.88%
Mining and Quarrying	108	1.63	2	0.37	1.57%
Manufacturing	1,459	21.95	99	21.51	6.81%
Construction	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.

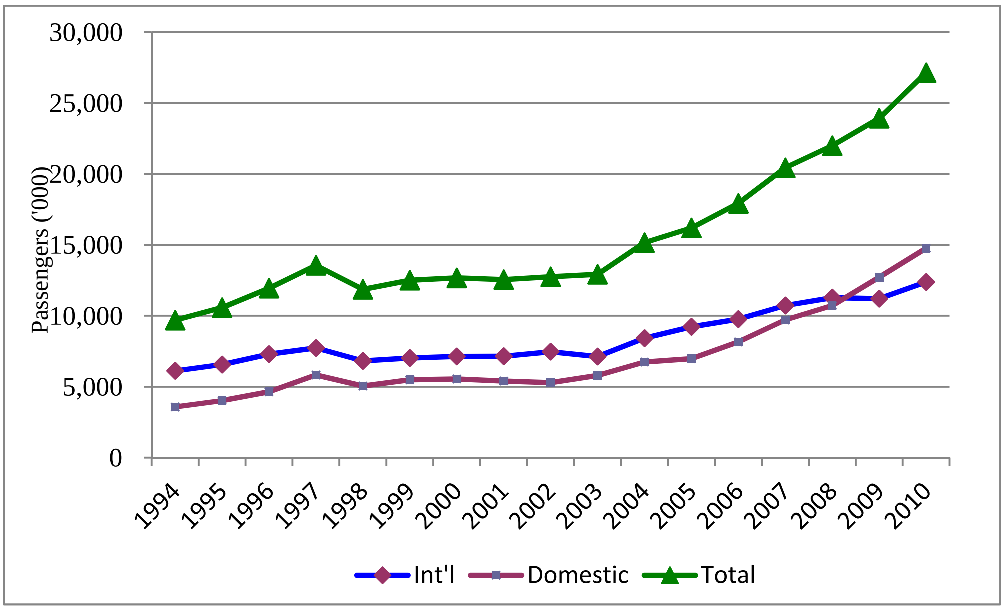
Table 2.2-2 Statistics of Air Passengers and Cargo at NAIA

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

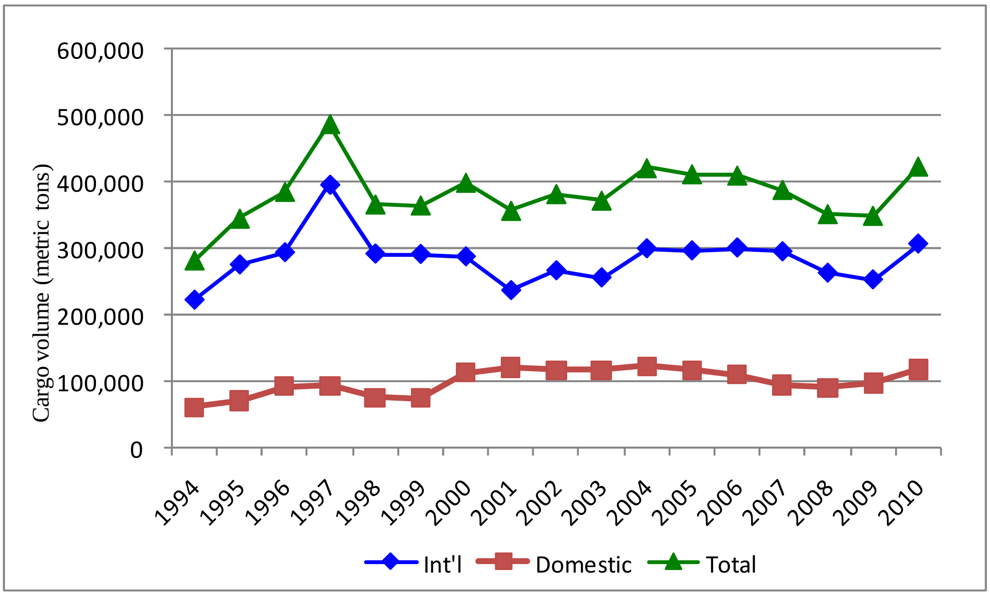
The above table particularly shows that the number of domestic passengers at NAIA more than doubled during the past 5 years, i.e. from 7 million in 2005 to 14.8 million in 2010. This trend is attributed to the recent emerging business model of the LCC's.

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

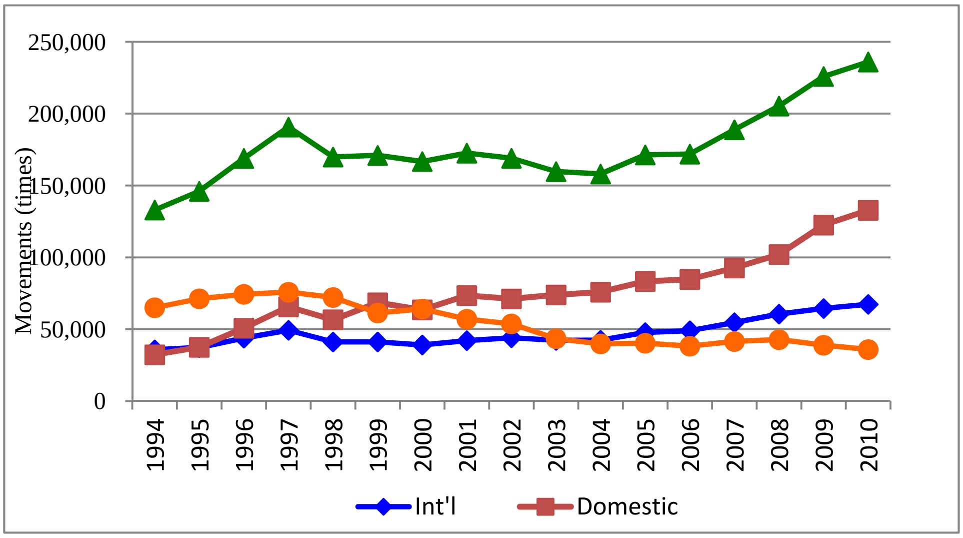
Figure 2.2-3 Chronological Change in Air Cargo Traffic at NAIA

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

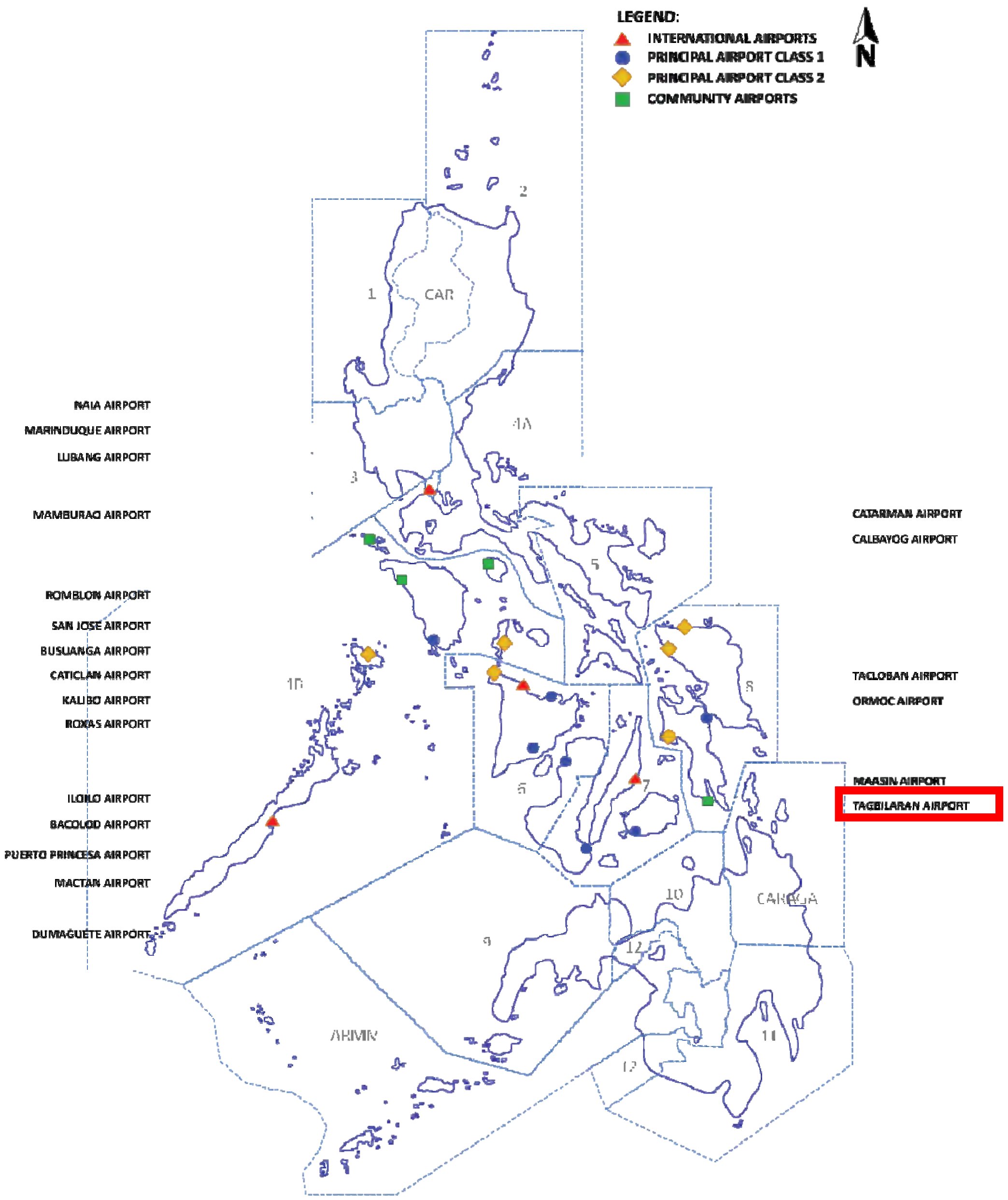
Table 2.2-4 shows the annual aircraft movements at NAIA for the past 16 years. Aircraft movements at NAIA have rapidly increased during the past decade. In 2010, NAIA handled approximately 67 thousand international, 133 thousand domestic, and 36 thousand aircraft movements for general aviation.

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.

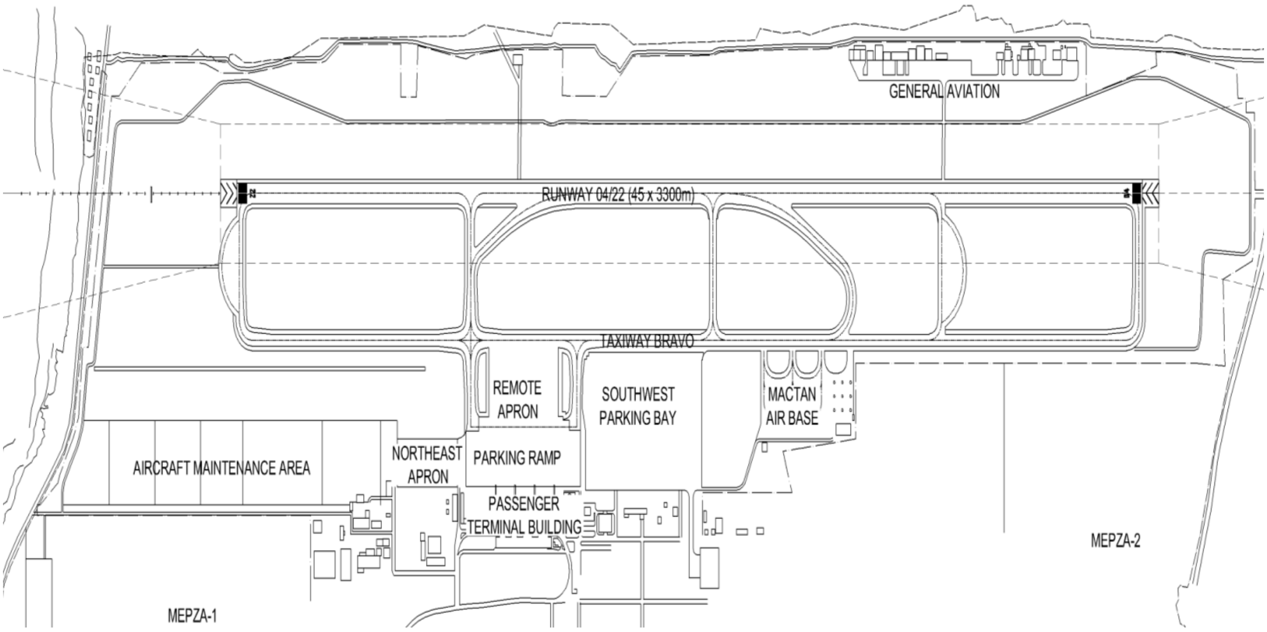
Similarly, at Tagbilaran Airport, the annual passengers grew by 290% during the past 5years, and yearly a total of 572 thousand passengers were transported via 4,664 movements of A320/A319's, thus on a yearly average a total 123 passengers are onboard each flight, an occupancy of nearly 80%.

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

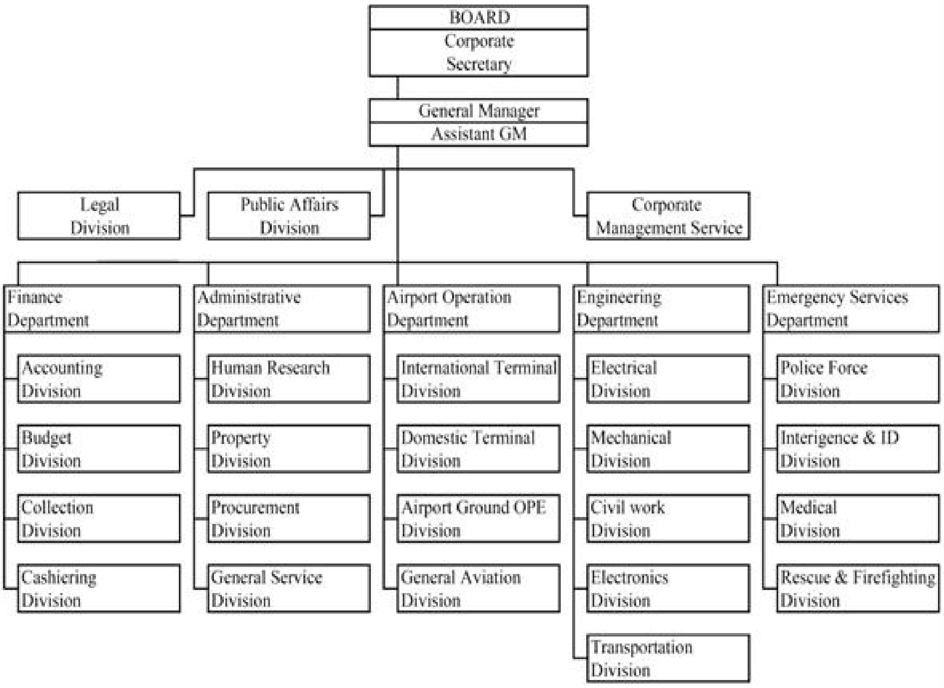
Figure 2.2-6 Mactan International Airport Layout

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**

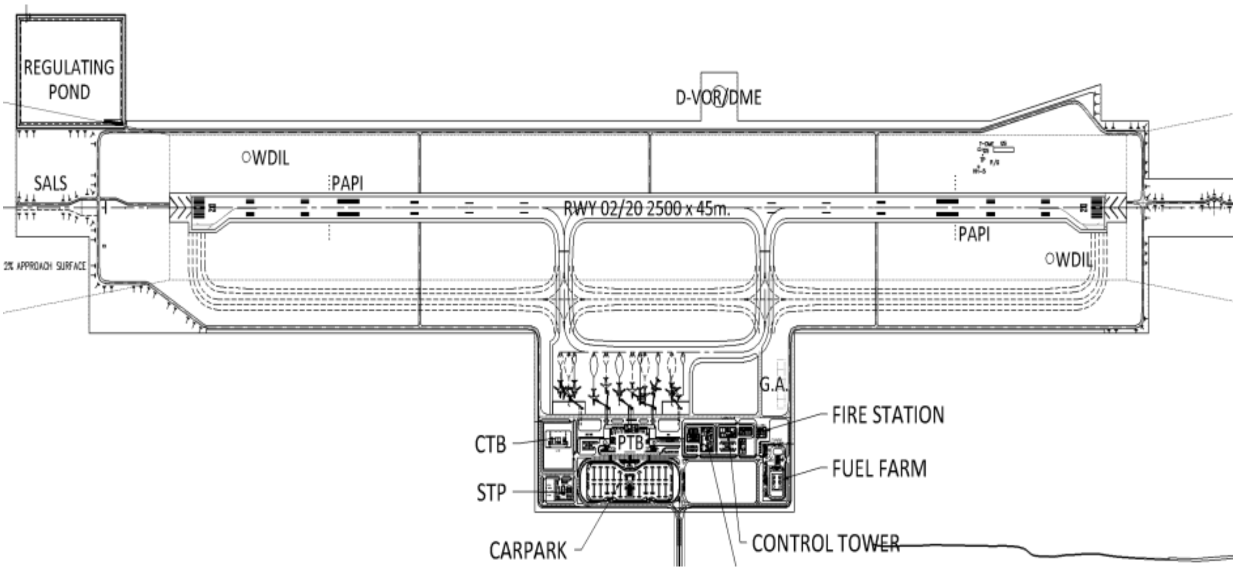
Through a hearing and information collected from the airport officials, the approximate average of annual operation and maintenance costs for the past years are estimated as follows:

- 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).



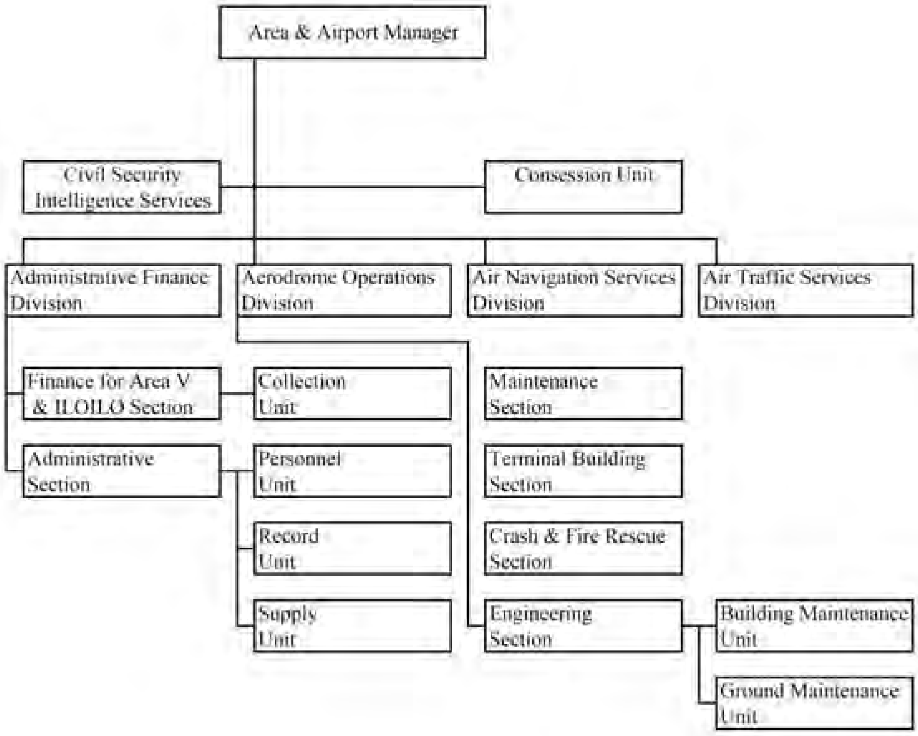
Source: JICA Study Team

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

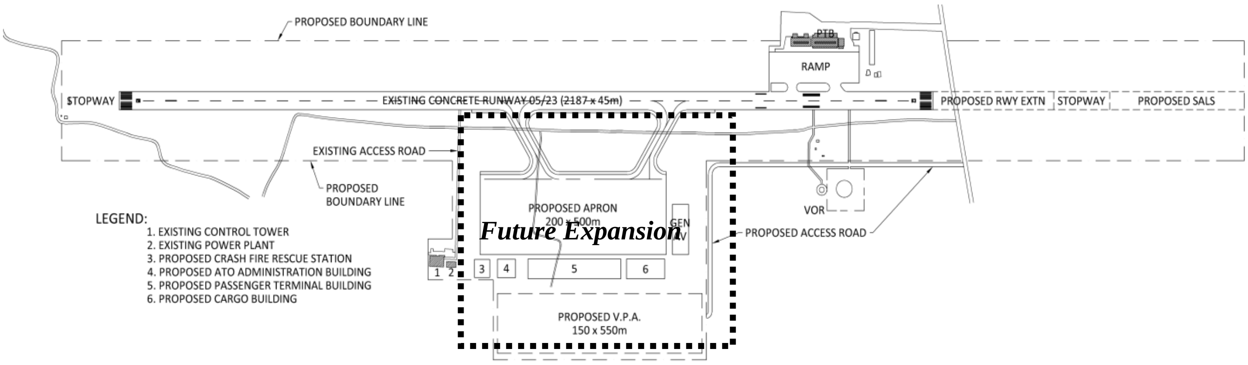
c) Kalibo International Airport

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.

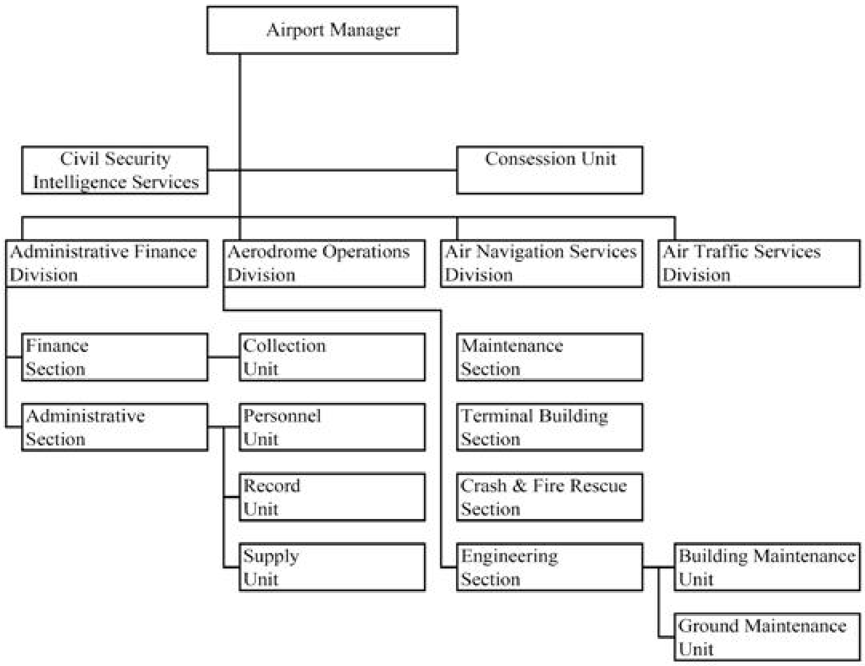
The most international passengers carried at Kalibo in 2010 were by Zest Airways, which now defines Kalibo as its hub and operates scheduled shuttle flights at Kalibo to and from Inchon (daily), Pusan (twice a week), and Shanghai (4 times a week). Those international traffic demands are considered to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

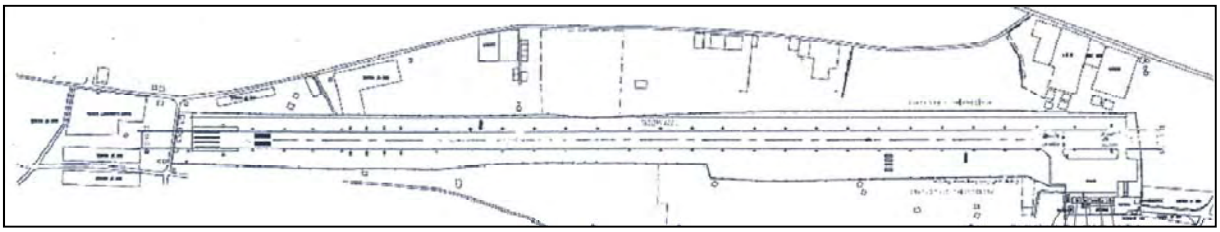
Table 2.3-1 General Information of Tagbilaran airport

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.

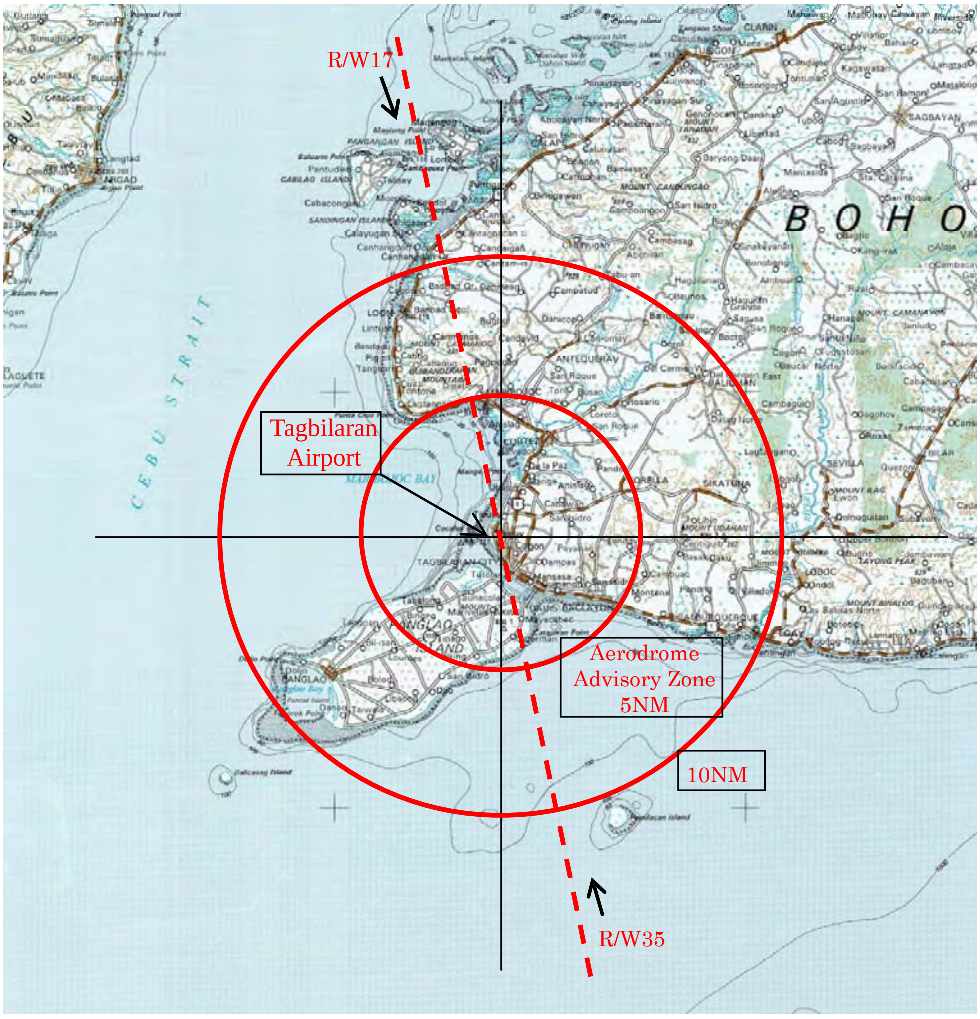
FSS Tower in Tagbilaran Airport

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.

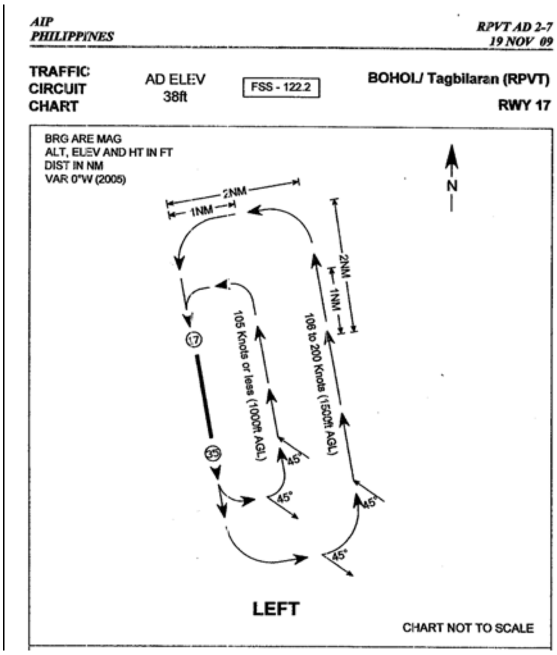
R/W17Approach direction

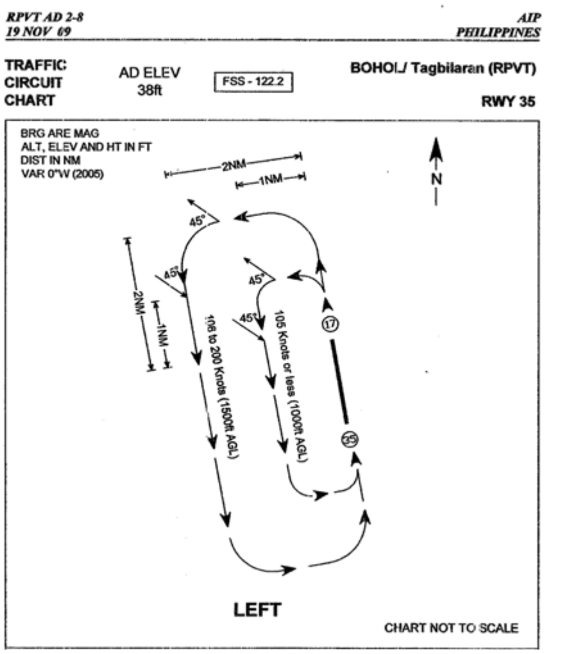
R/W35Approach direction

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.

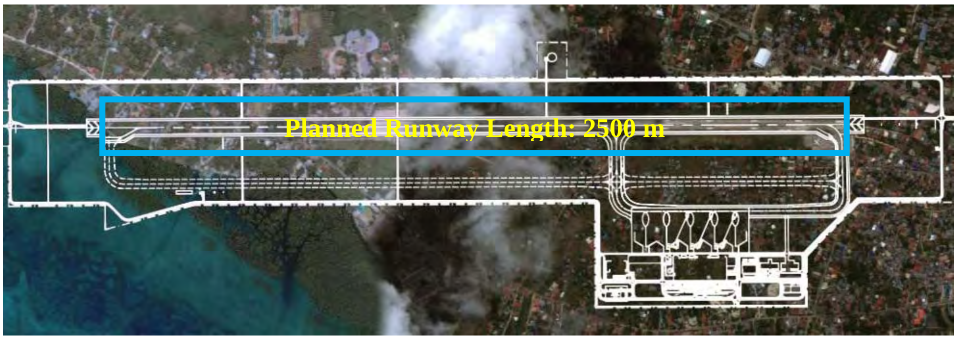
Description	Layout on Google Earth
Existing Tagbilaran Airport Non-instrument approach Runway: 30m x 1779 m Runway Strip: 100 m	
"Phase-2" Development; as discussed in Chapter 6 superimposed on Tagbilaran Runway Instrument landing Runway: 45m x 2500 m Runway Strip: 300 m	

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,

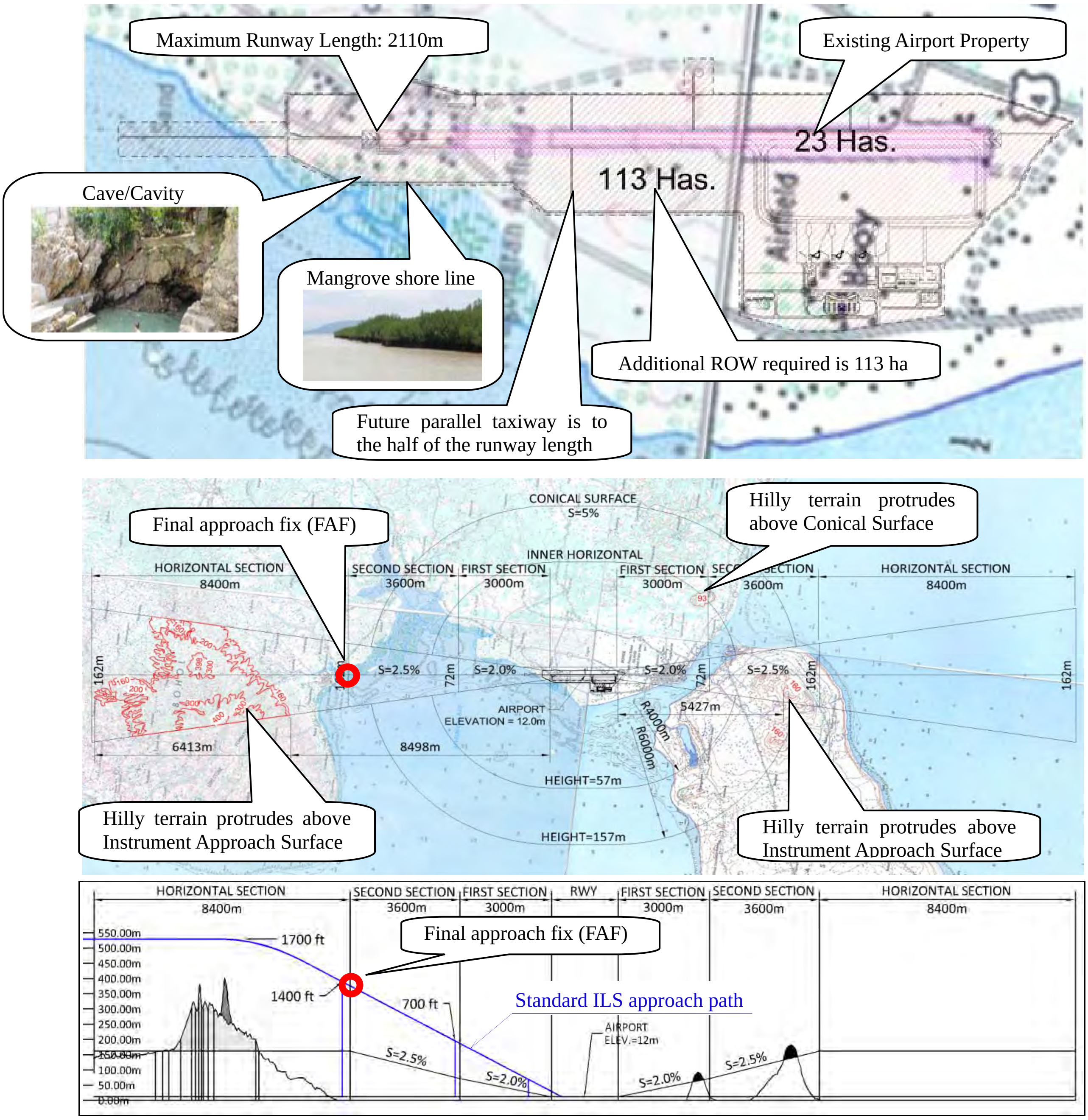
For the purpose of this Draft Final Report, the following two (2) Options are considered for the simulation of Tagbilaran airport development scenarios.

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.



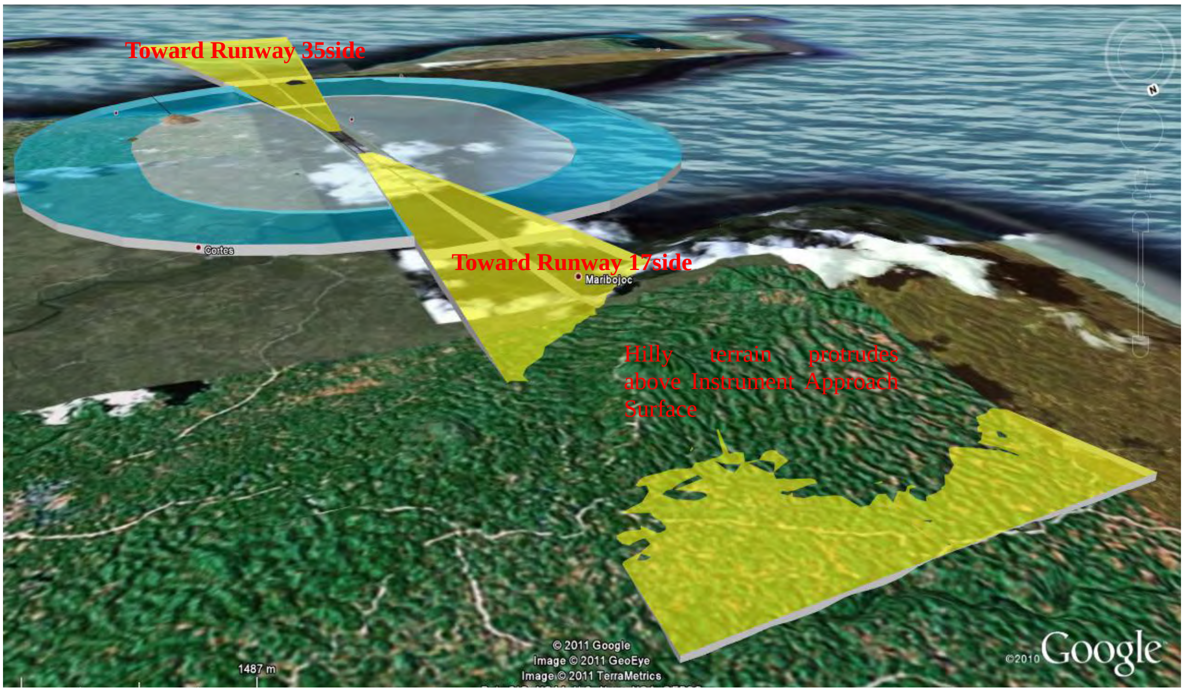
Source: JICA Study Team

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

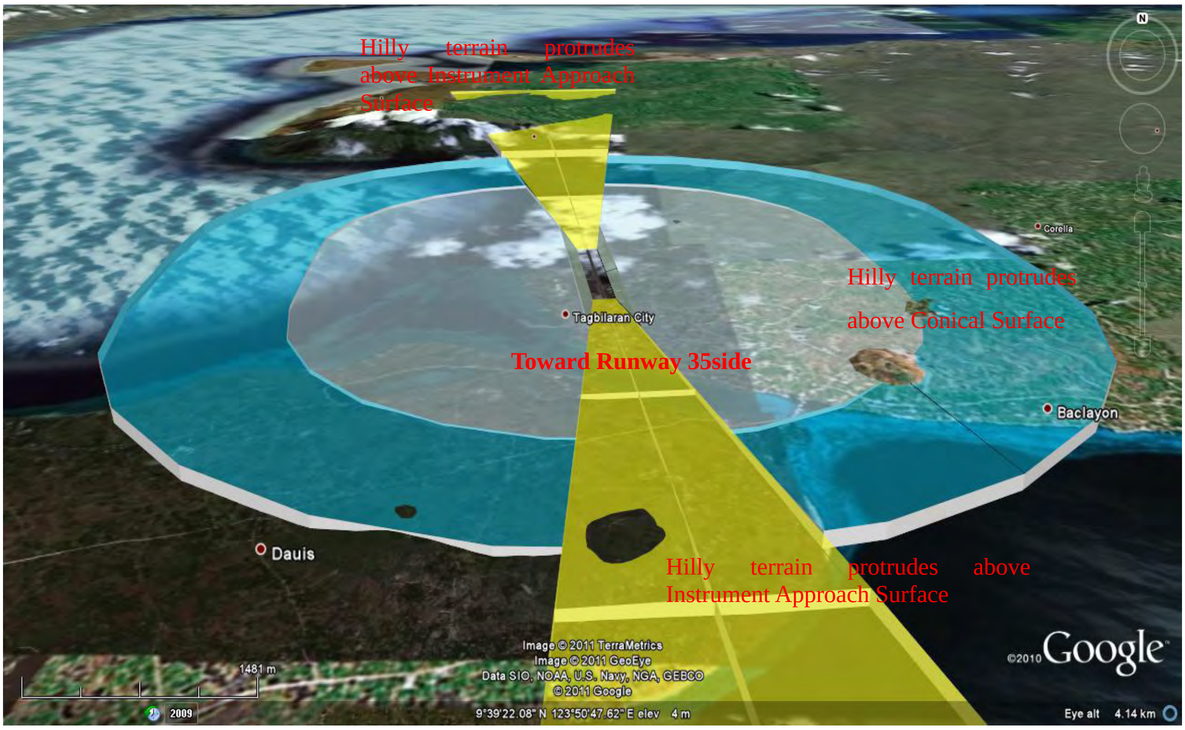
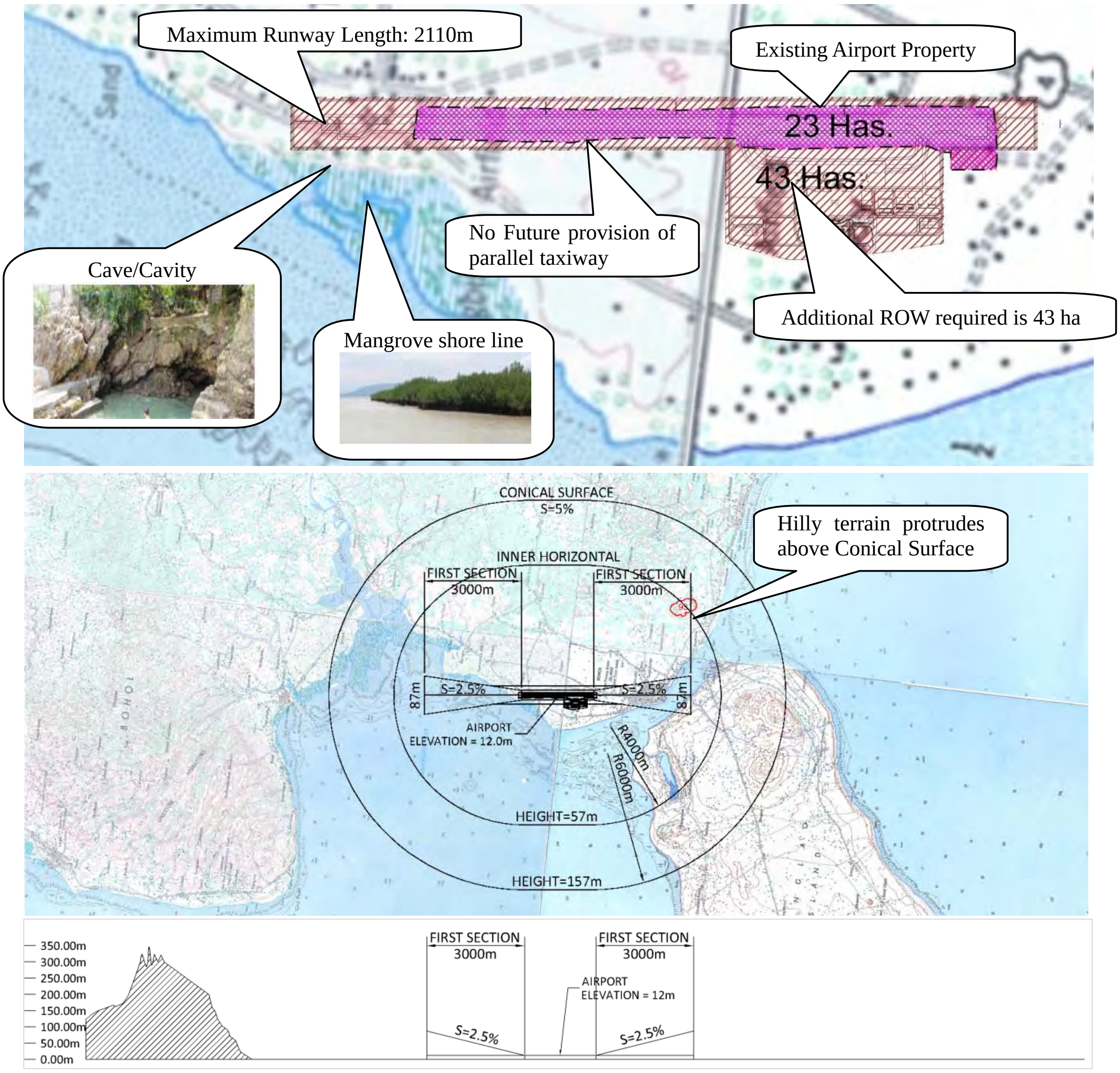


Figure 2.3-10 Obstacle Limitation Surface (Virtual Image) at Tagbilaran Airport In case of Instrument Approach Runway

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.

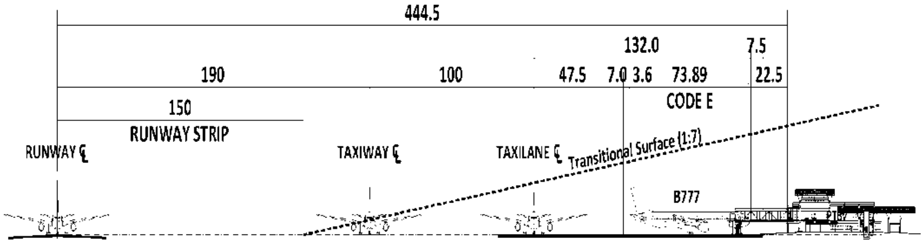
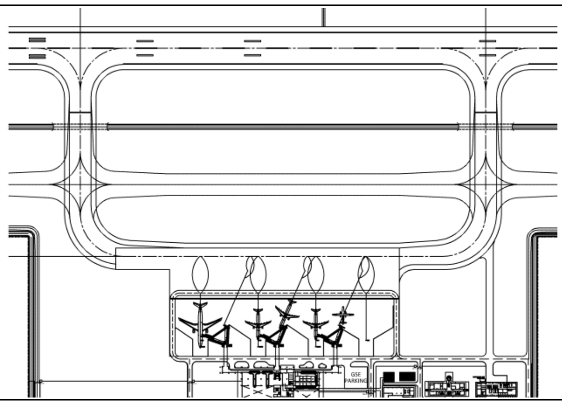
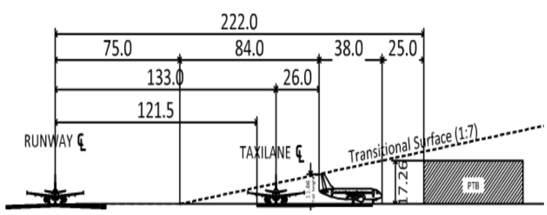
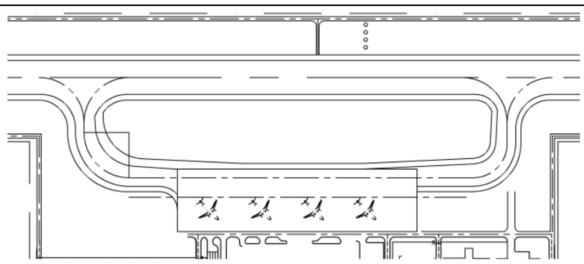


Source: JICA Study Team

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

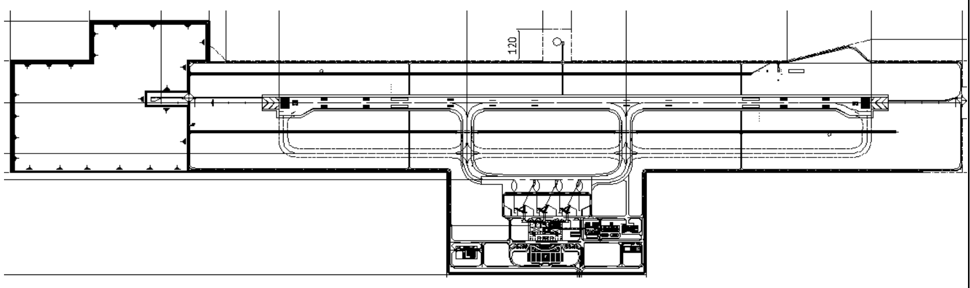
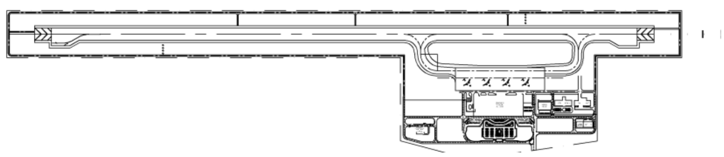
- A hilly terrain exists at eastern conical surface, which is protruding above the obstacle limitation surfaces for the non-instrument runway in accordance with ICAO Annex 14.
- Terminal area is only to accommodate domestic airlines' operations of the currently-used aircraft, A320.
- PTB is purely for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

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

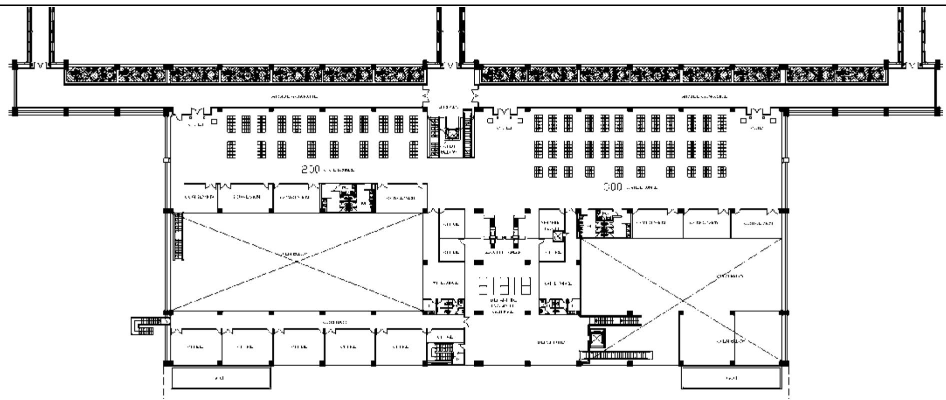
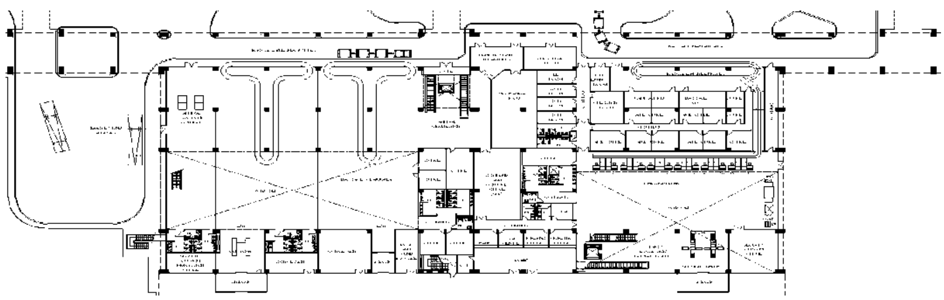
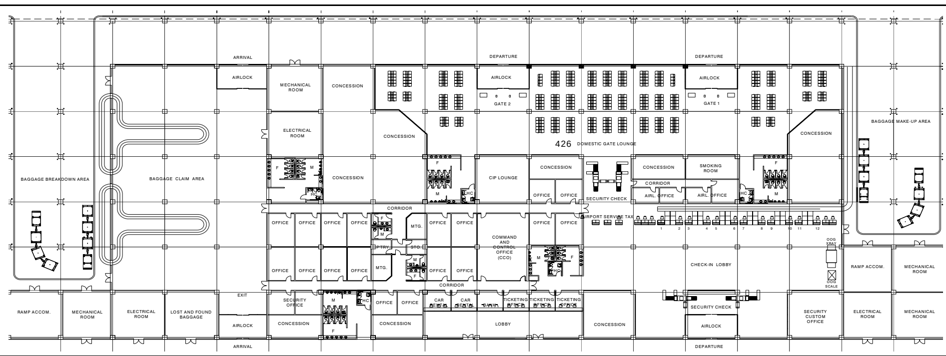
Source: JICA Study Team

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

<u>Option 1</u> **“Phase-1”Basic Development Scenario**	
<u>Option 2:</u> **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)

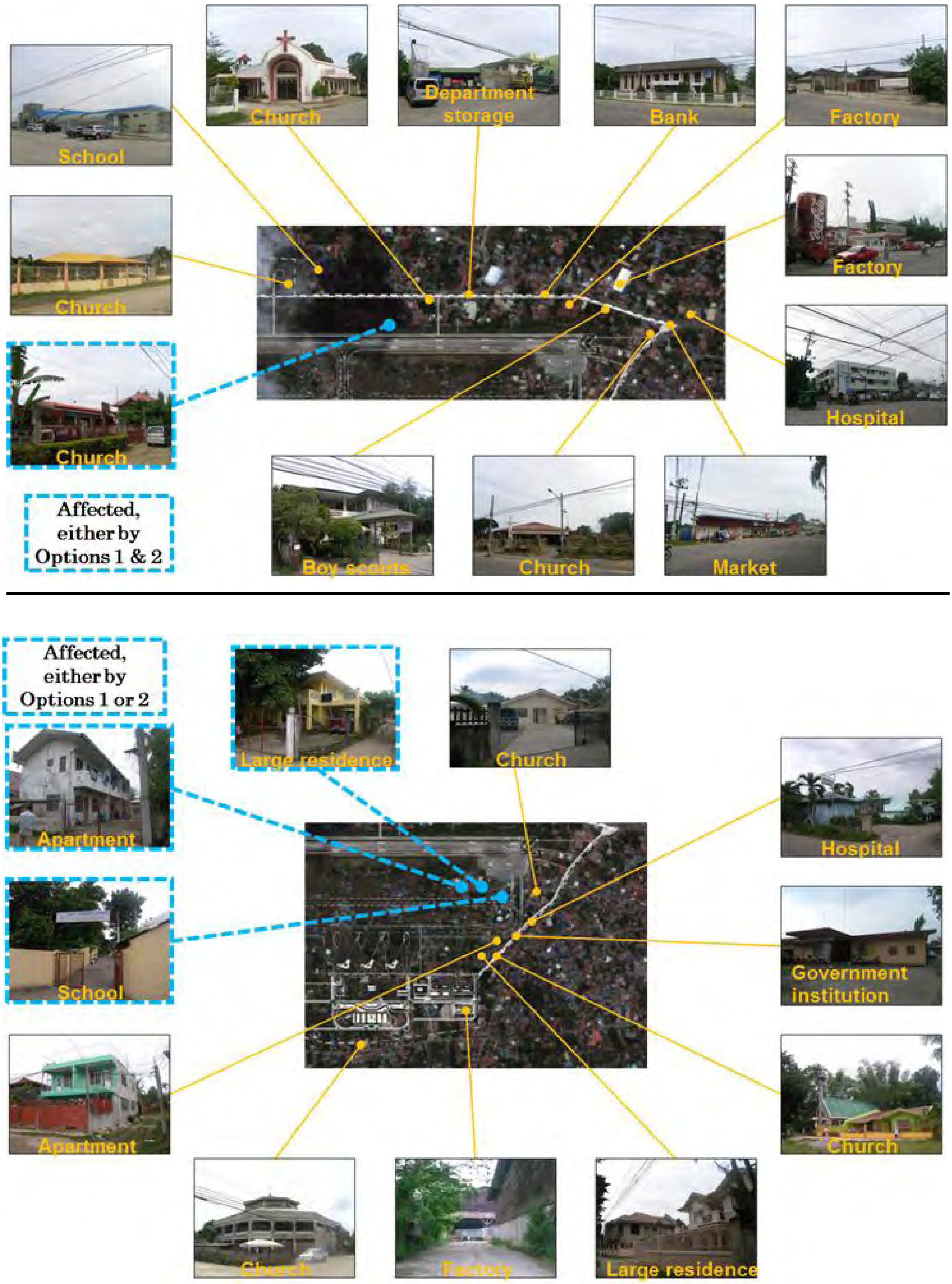
<u>Option 1</u> **“Phase-1”Basic Development Scenario** **2nd Floor: 4,557 m²** **and** **Ground Floor: 5,204 m²**	 
<u>Option 2:</u> **Bare Minimum Development Scenario** **Ground Floor: 7,550 m²** **Only**	

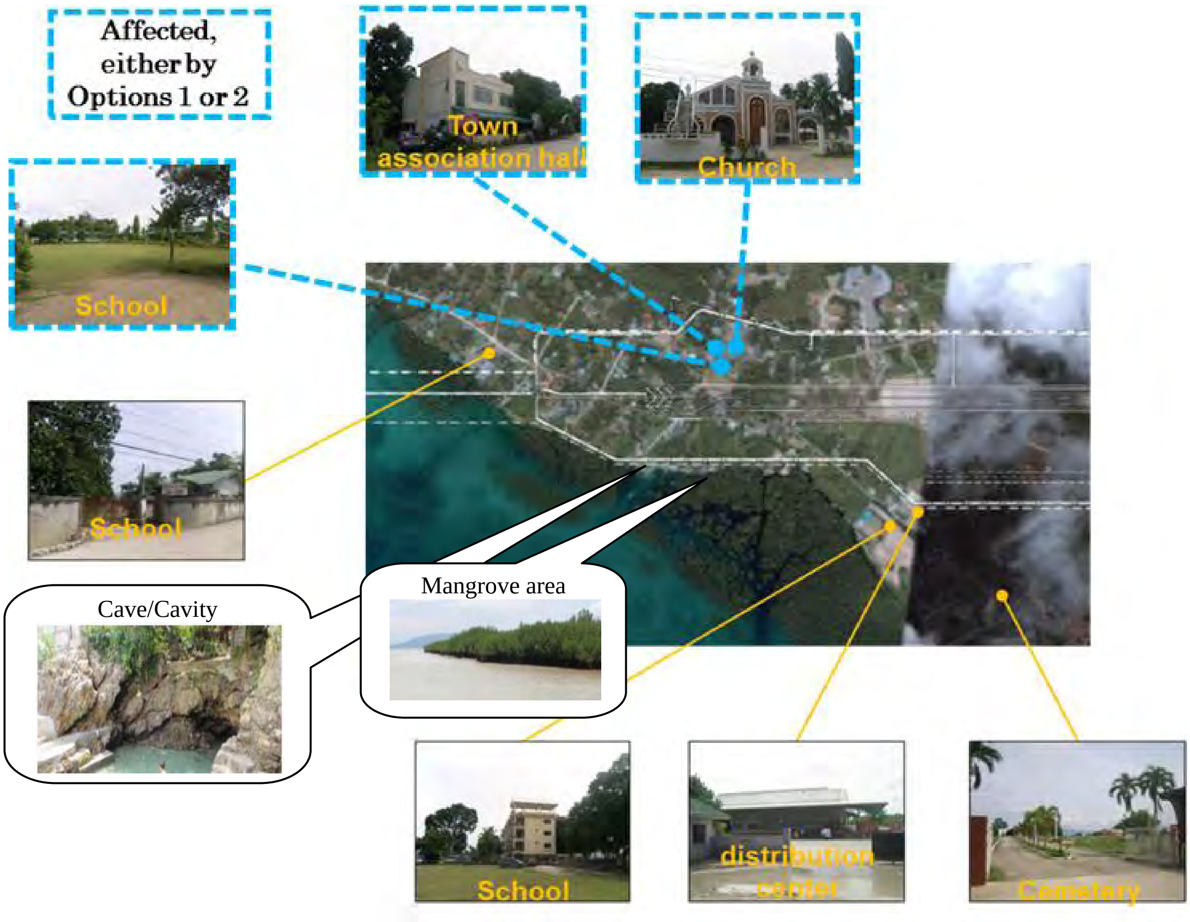
Source: JICA Study Team

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.

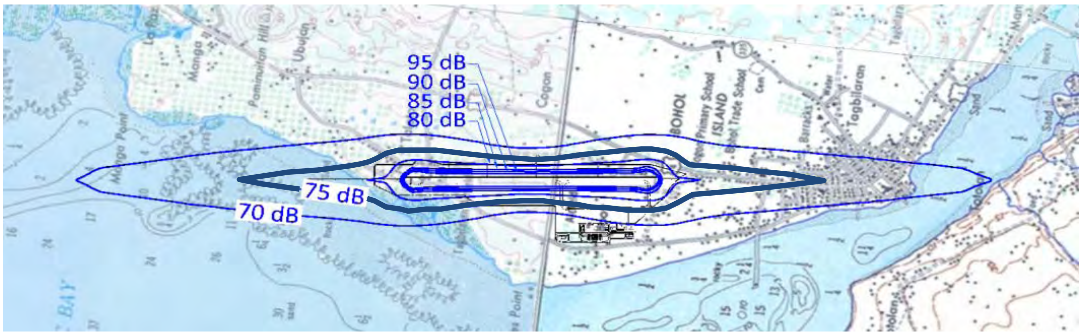
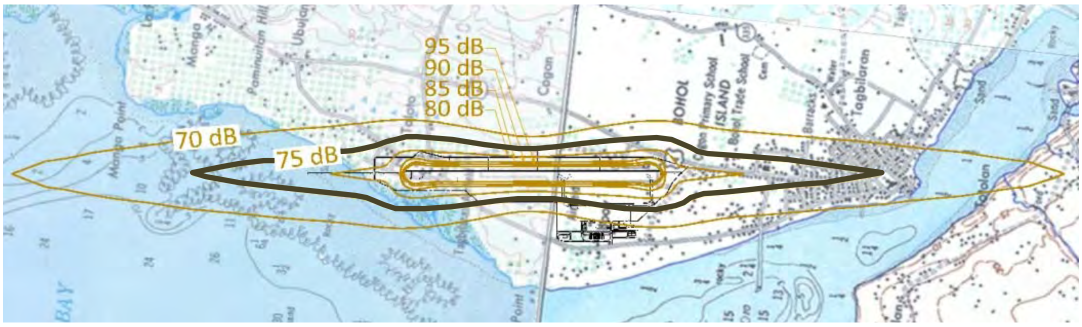
3) Properties affected by Possible Noise Pollution

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.

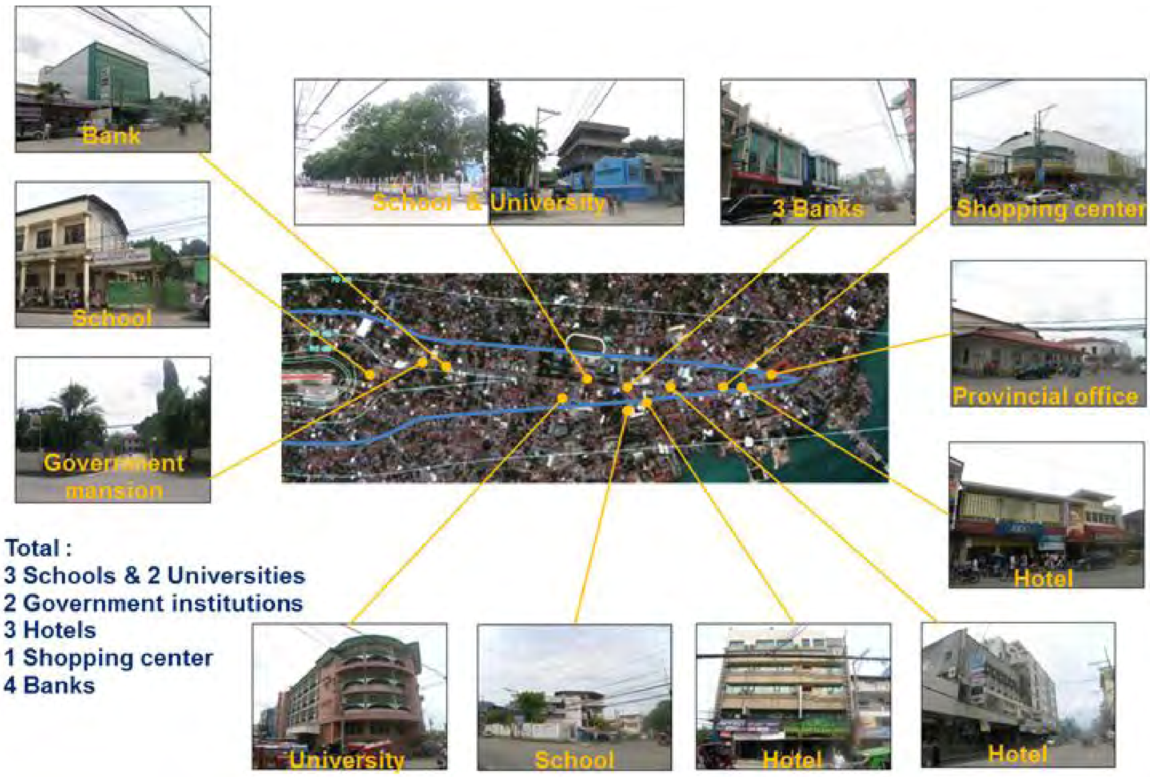
In Japan, properties affected by more than 75 WECPNL are subject to compensation of noise preventive measures, e.g. provision of sound proof windows, walls, roofs and/or air-conditioning.

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="2">Demolition/ Replacement</td><td>Residence
School
Church
Government institution
hospital
market
bank
factory & storage</td><td>870
5
8
2
2
1
1
5</td><td>Residence
School
Church
Government institution
hospital
market
bank
factory & storage</td><td>430
1
2
0
0
0
0
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

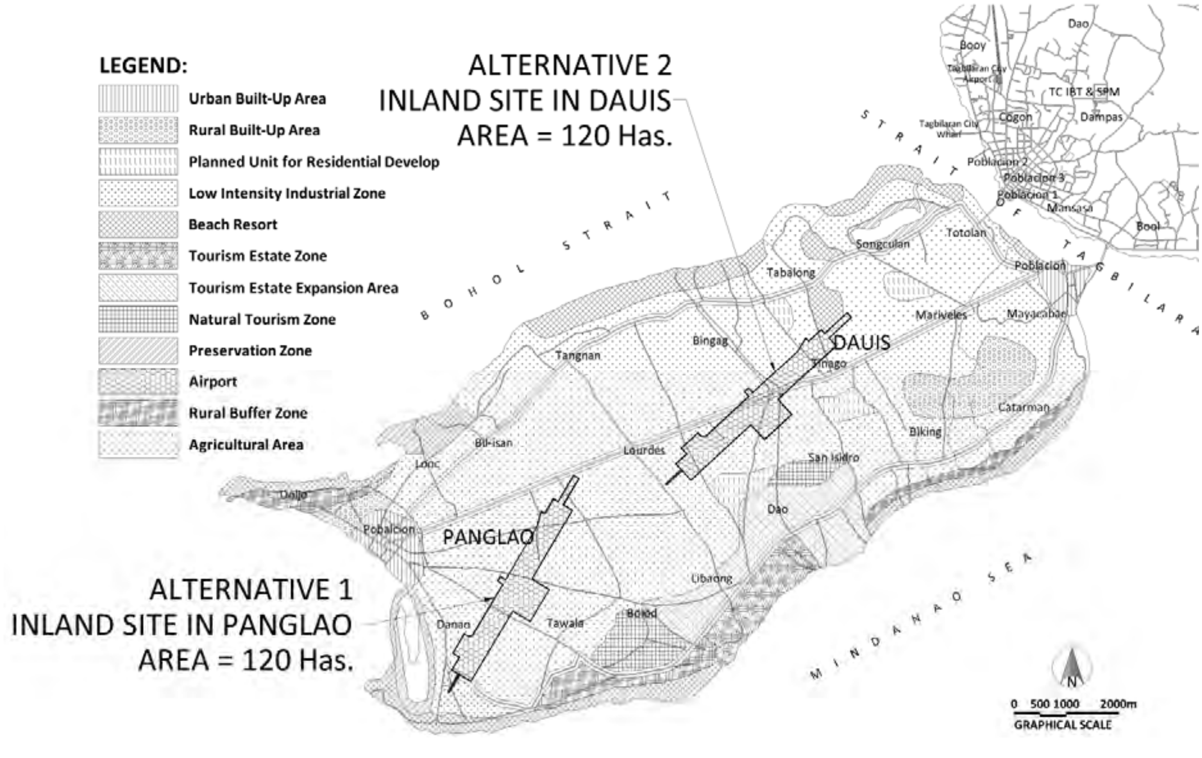
The New Bohol Airport location on Panglao Island was earlier decided during the year 2000 Feasibility Study, for the main reason that mainland Bohol is mountainous and has very few flat areas, where if an airport would be developed, natural topography would project into obstacle limitation surface of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

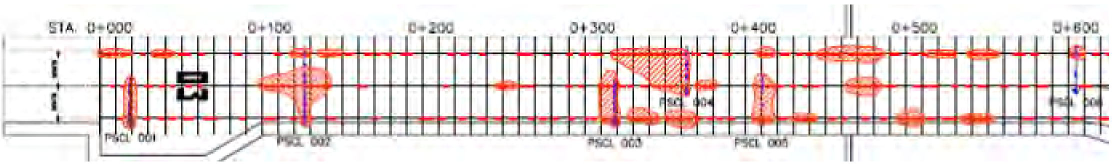
2.4.2. Geological Conditions

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.

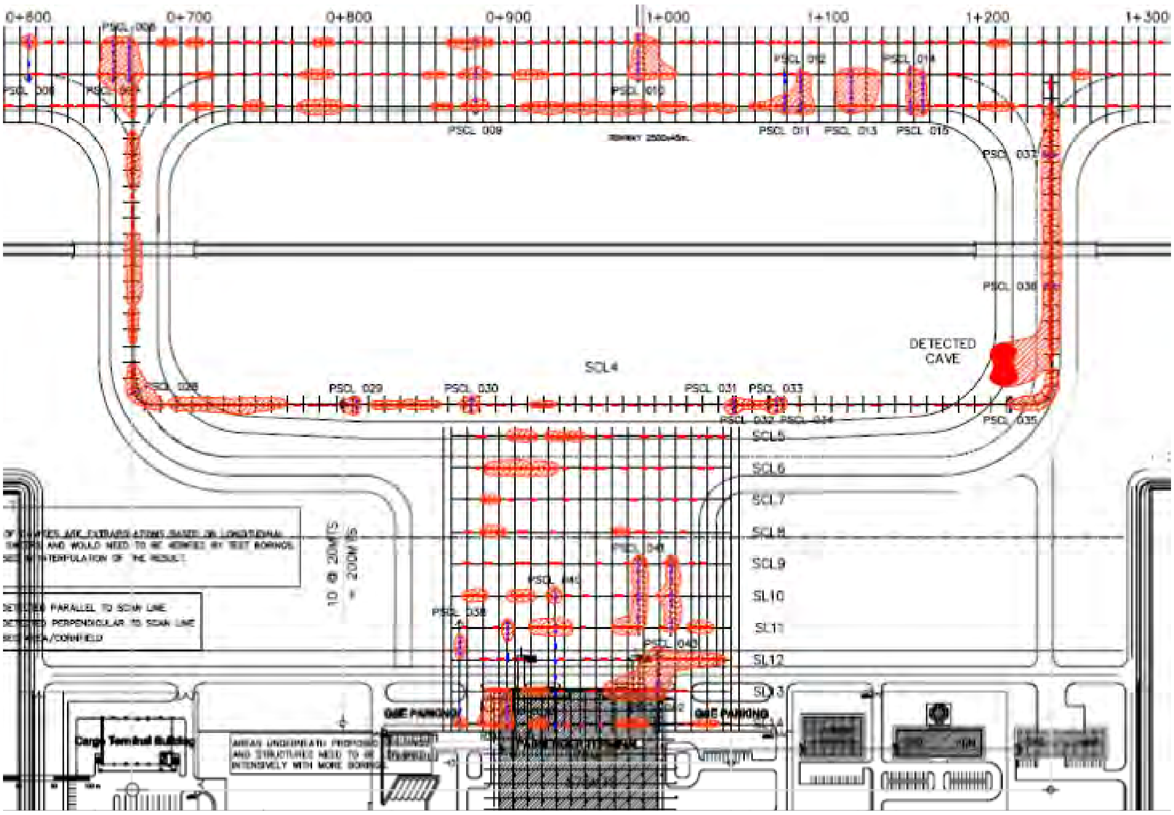
1) Geological Survey and Investigation

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.

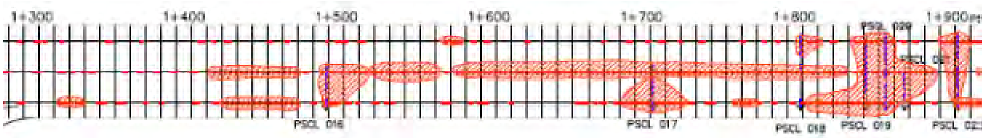
Runway STA 0-60 to STA 0+600



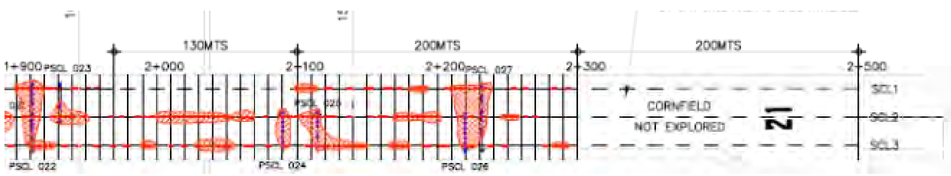
Runway STA + 600 to STA 1+300



Runway STA 1+300 to STA 1+900



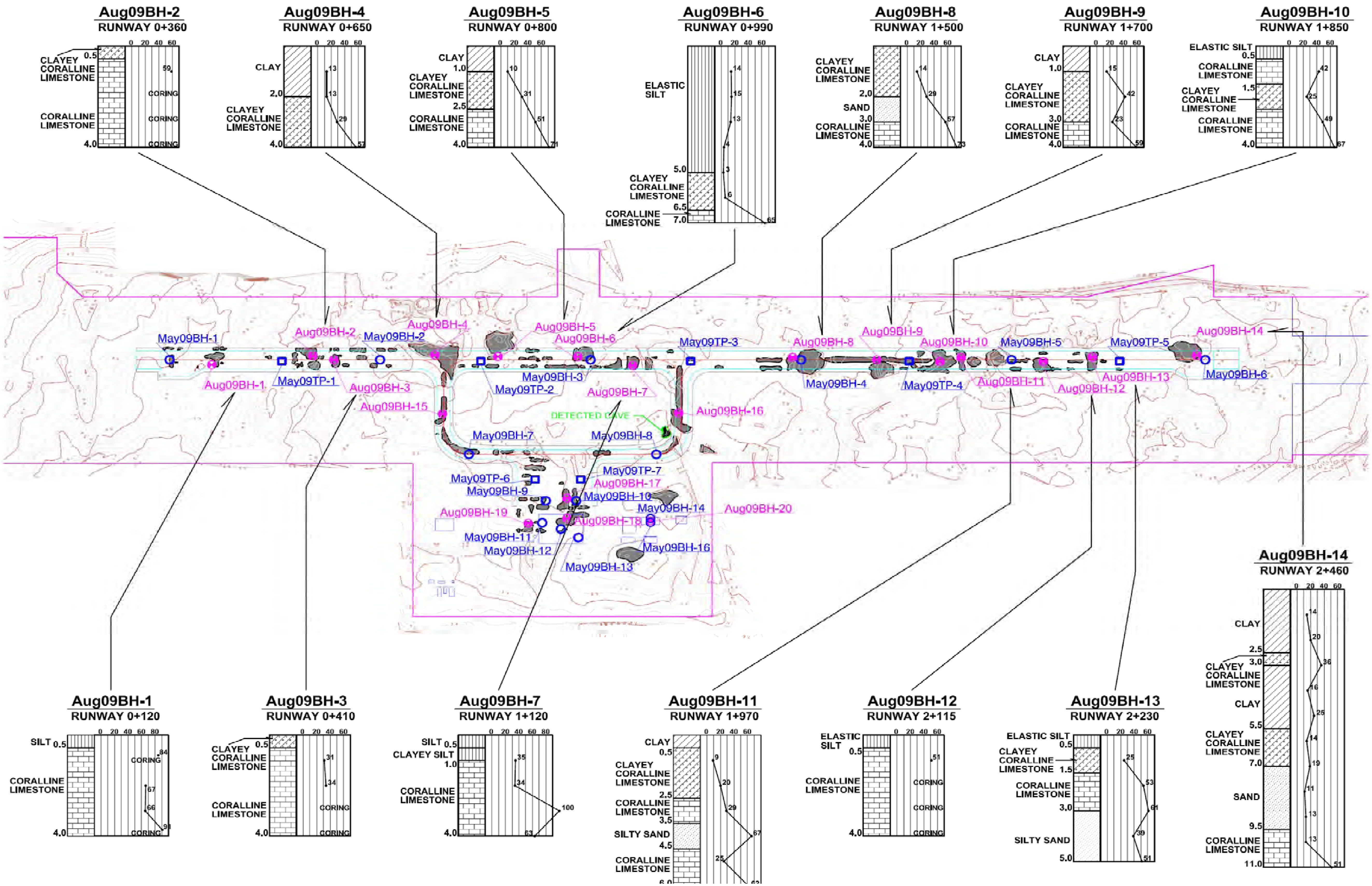
Runway STA 1+900 to STA 2+560



Source: JICA Study Team

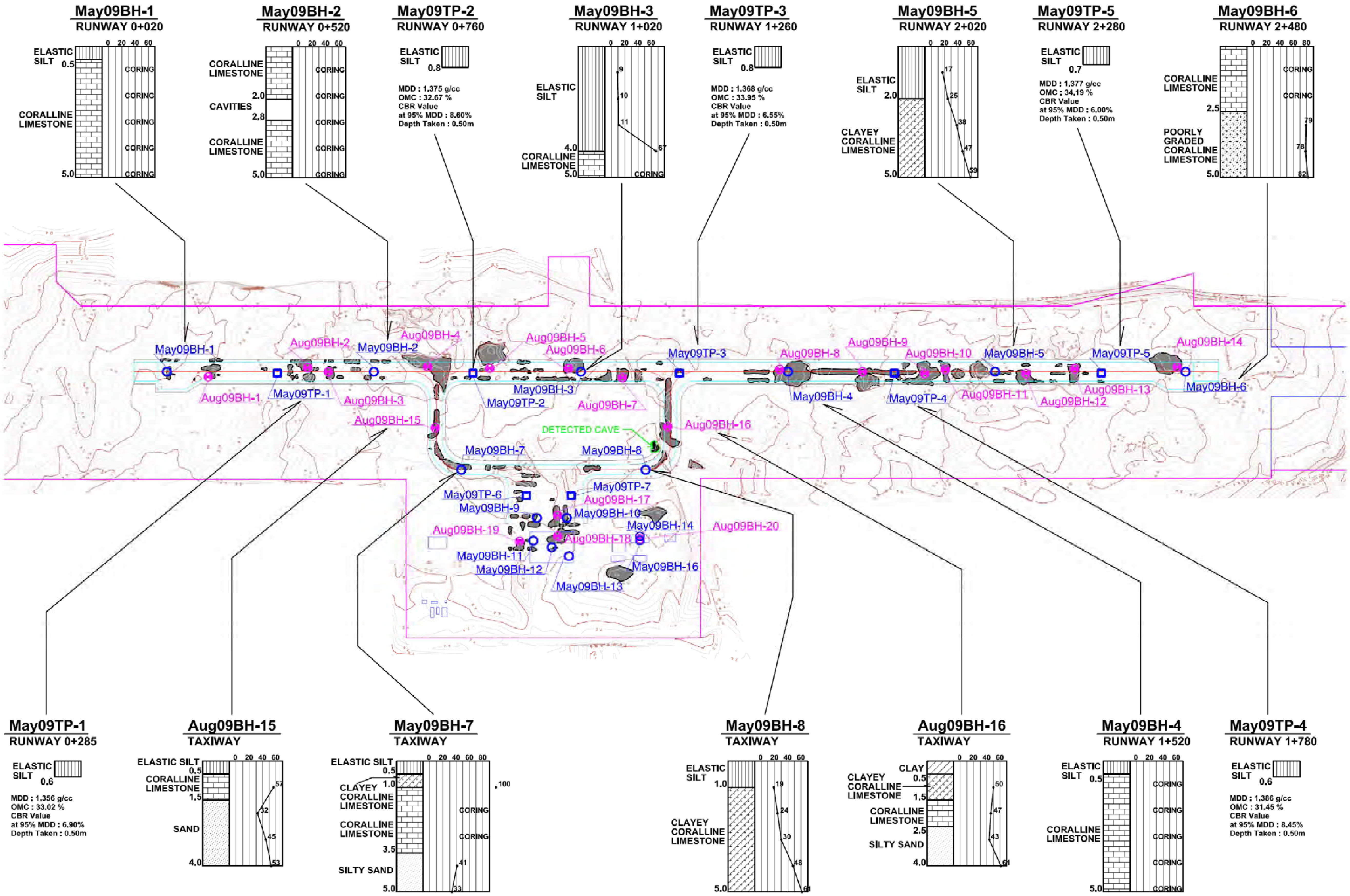
Figure 2.4-2 Potential Cavity suspected through GPR Survey

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).



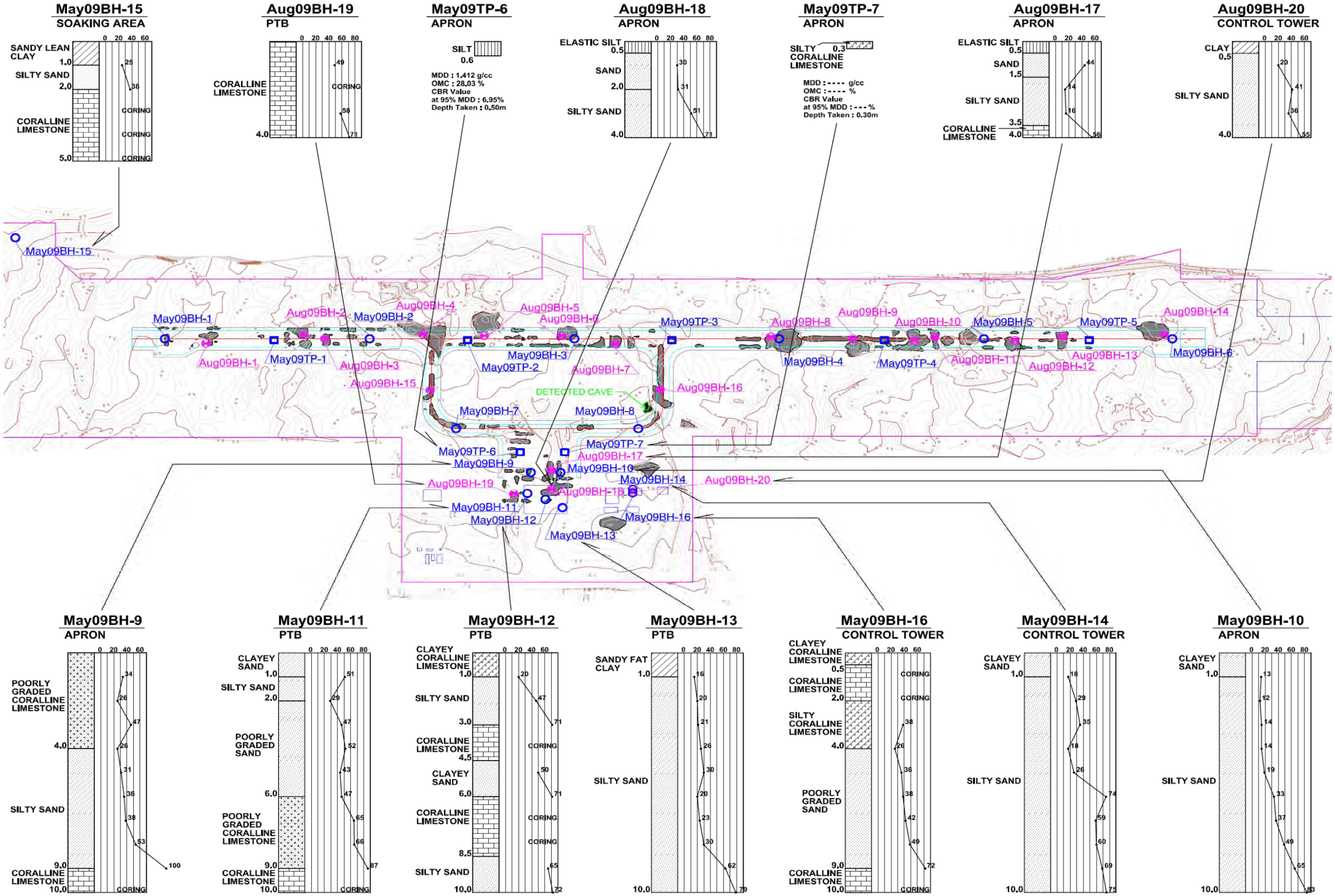
Source: JICA Study Team

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



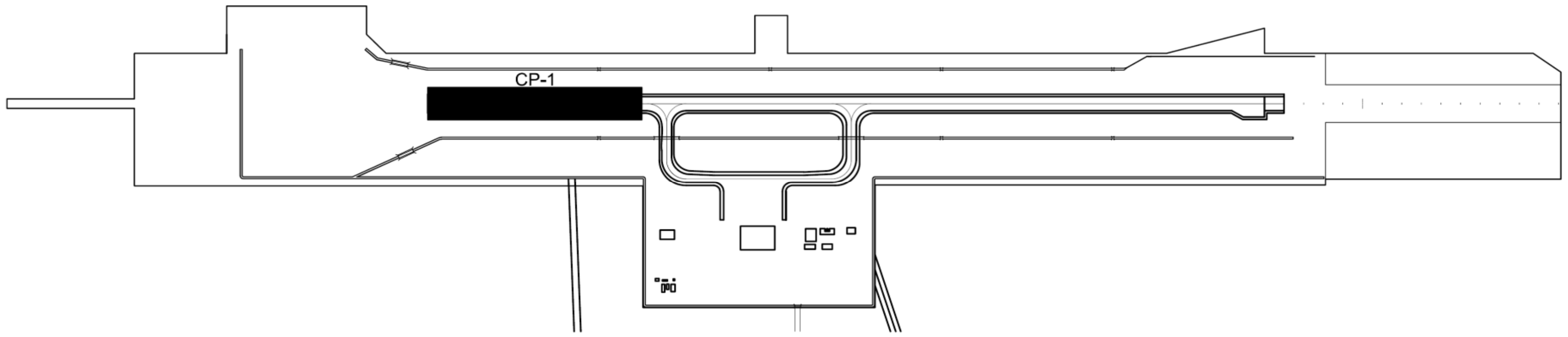
Source: JICA Study Team

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

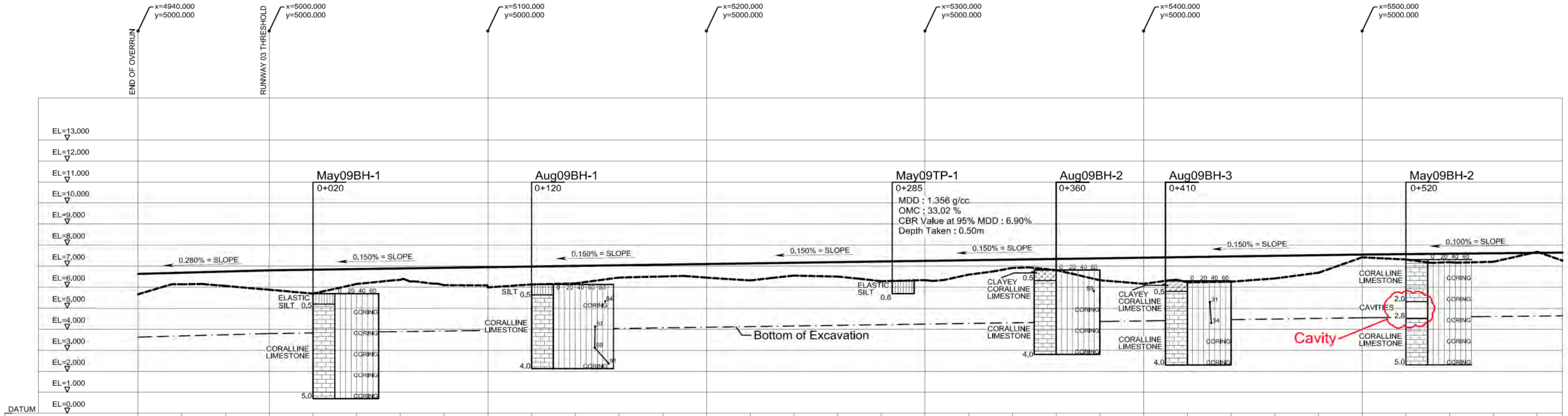


Source: JICA Study Team

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



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

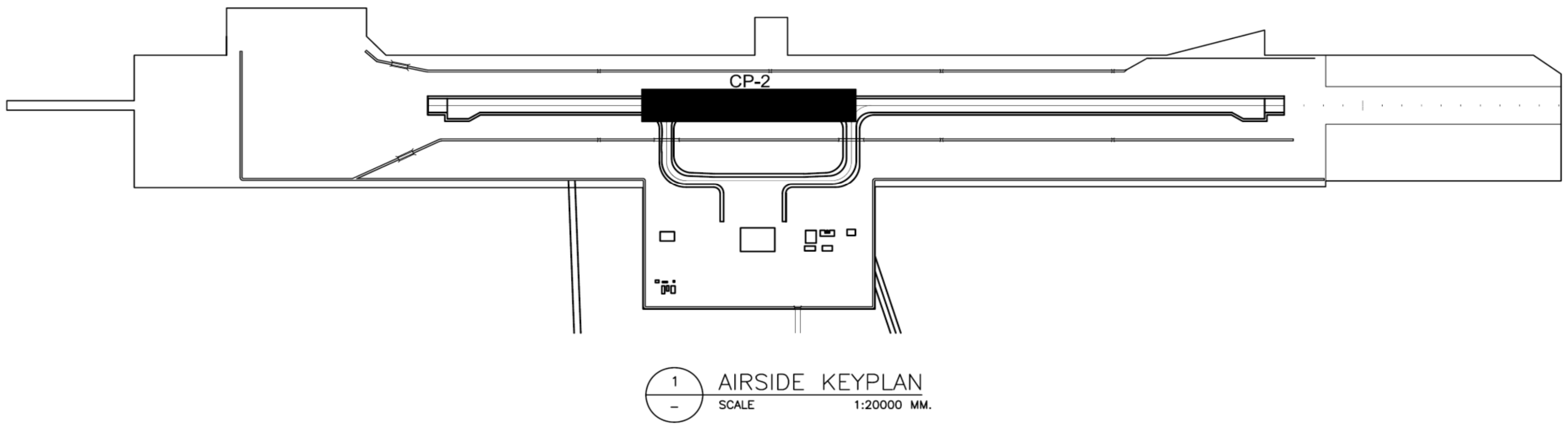
STATION	0+280.000	0+300.000	0+320.000	0+340.000	0+360.000	0+380.000	0+400.000	0+420.000	0+440.000	0+460.000	0+480.000	0+500.000	0+520.000	0+540.000	0+560.000	0+580.000
DESIGN CENTERLINE ELEVATION	7.220	7.250	7.280	7.310	7.340	7.370	7.400	7.430	7.460	7.490	7.520	7.550	7.570	7.590	7.610	7.630
ORIGINAL 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

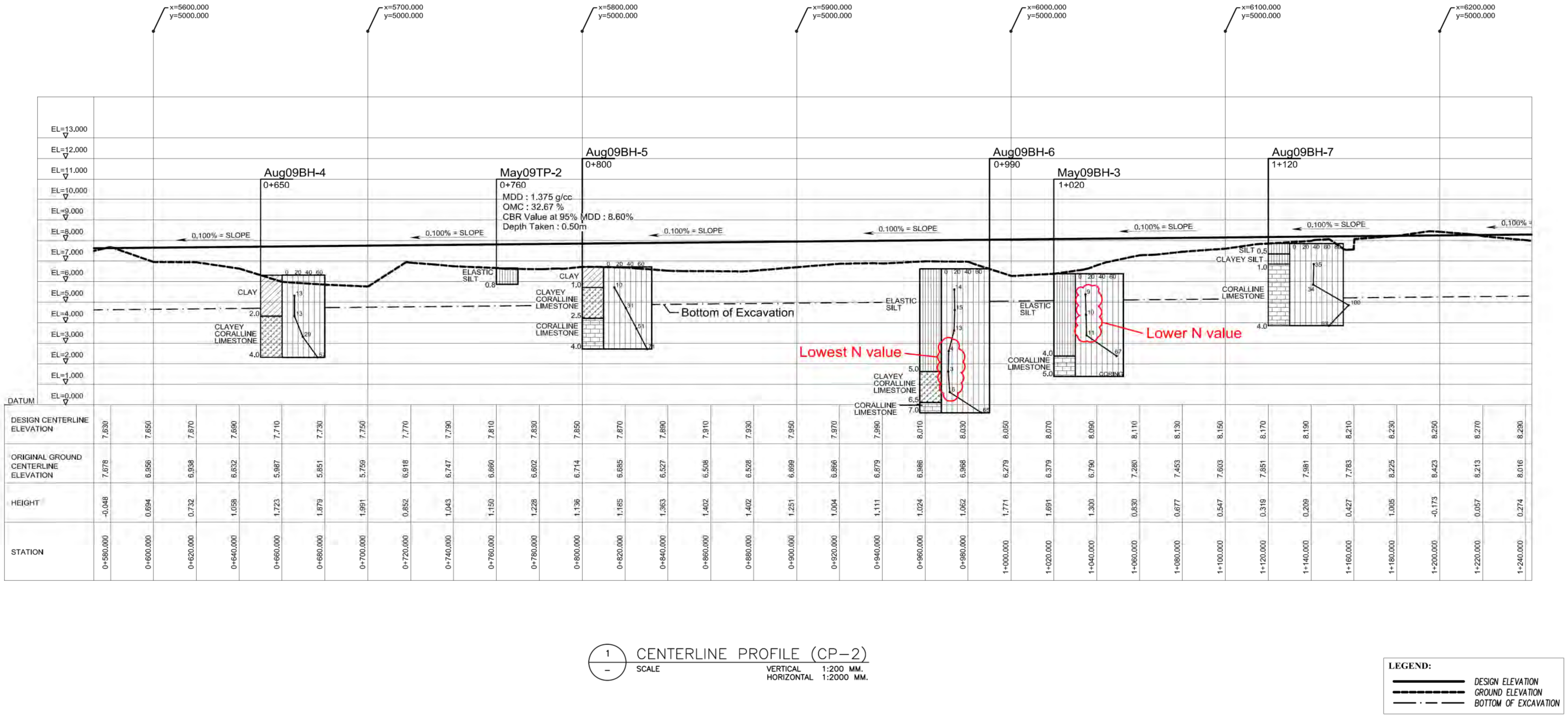
CENTERLINE PROFILE (CP-1)
SCALE VERTICAL 1:200 MM. HORIZONTAL 1:2000 MM.

LEGEND:
DESIGN ELEVATION
GROUND ELEVATION
BOTTOM OF EXCAVATION

Source: JICA Study Team

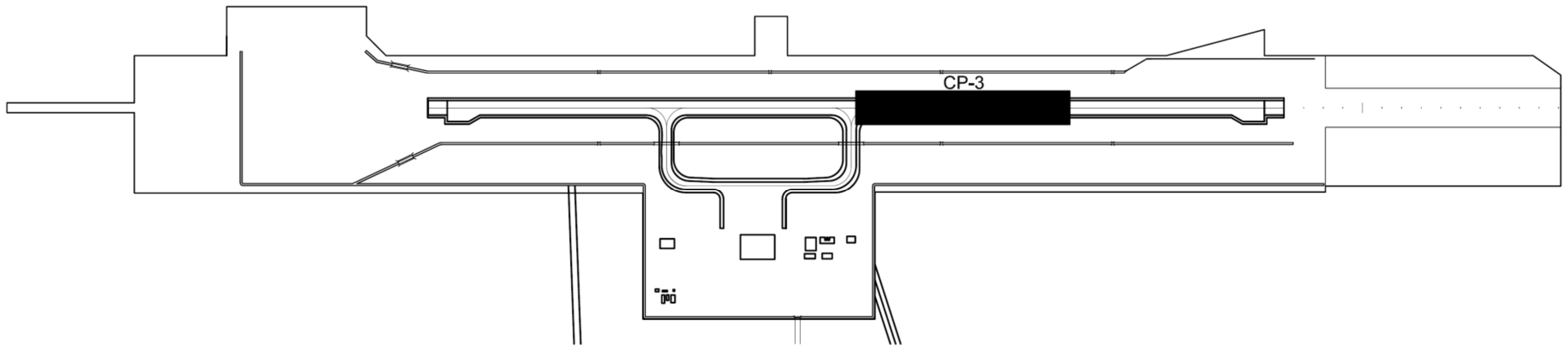
Figure 2.4-4 (1) Runway Centerline Profile with Borehole and Test Pit logs – 1st quarter (sta. –60 m - 600 m)



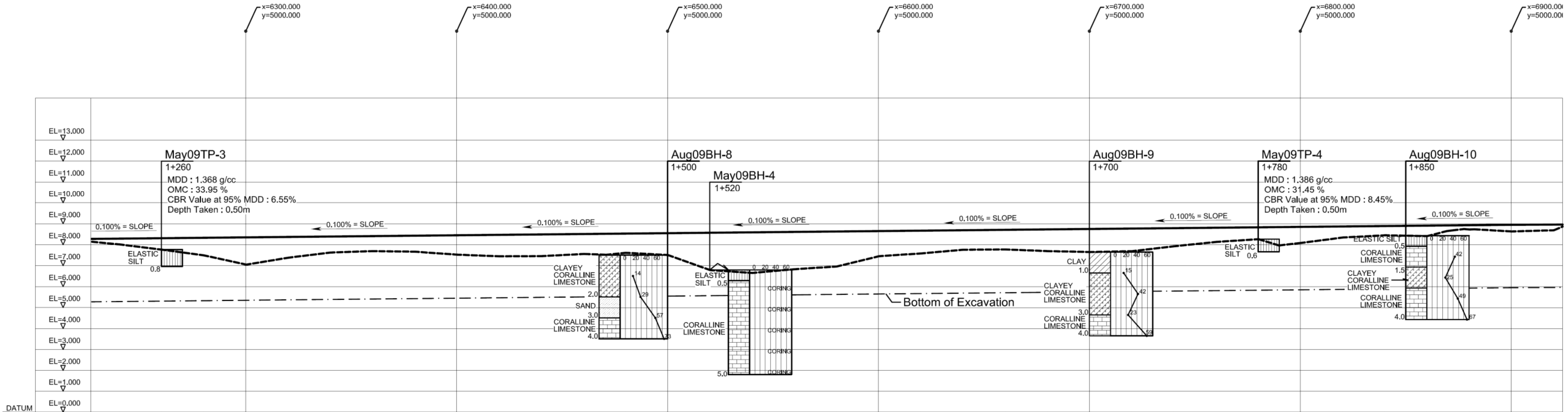


Source: JICA Study Team

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.



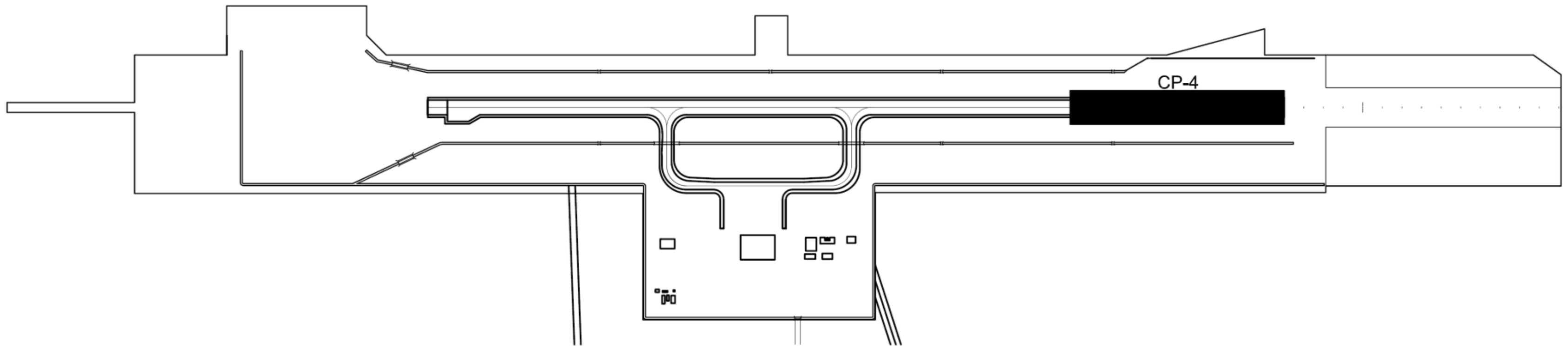
DESIGN CENTERLINE ELEVATION	ORIGINAL GROUND CENTERLINE ELEVATION	HEIGHT	STATION
8.290	8.016	0.274	1+240.000
8.310	7.768	0.542	1+260.000
8.330	7.497	0.833	1+280.000
8.350	7.057	1.293	1+300.000
8.370	7.379	0.991	1+320.000
8.390	7.626	0.764	1+340.000
8.410	7.694	0.716	1+360.000
8.430	7.668	0.762	1+380.000
8.450	7.528	0.922	1+400.000
8.470	7.450	1.020	1+420.000
8.490	7.457	1.033	1+440.000
8.510	7.557	0.953	1+460.000
8.530	7.614	0.916	1+480.000
8.550	7.510	1.040	1+500.000
8.570	6.795	1.775	1+520.000
8.590	6.655	1.935	1+540.000
8.610	6.831	1.779	1+560.000
8.630	6.961	1.669	1+580.000
8.650	7.446	1.204	1+600.000
8.670	7.585	1.085	1+620.000
8.690	7.759	0.931	1+640.000
8.710	7.776	0.934	1+660.000
8.730	7.697	1.033	1+680.000
8.750	7.652	1.098	1+700.000
8.770	7.692	1.078	1+720.000
8.790	7.924	0.866	1+740.000
8.810	8.132	0.678	1+760.000
8.830	8.265	0.565	1+780.000
8.850	8.082	0.768	1+800.000
8.870	8.342	0.528	1+820.000
8.890	8.450	0.440	1+840.000
8.910	8.412	0.498	1+860.000
8.930	8.729	0.201	1+880.000
8.950	8.635	0.315	1+900.000
8.960	8.690	0.270	1+920.000

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

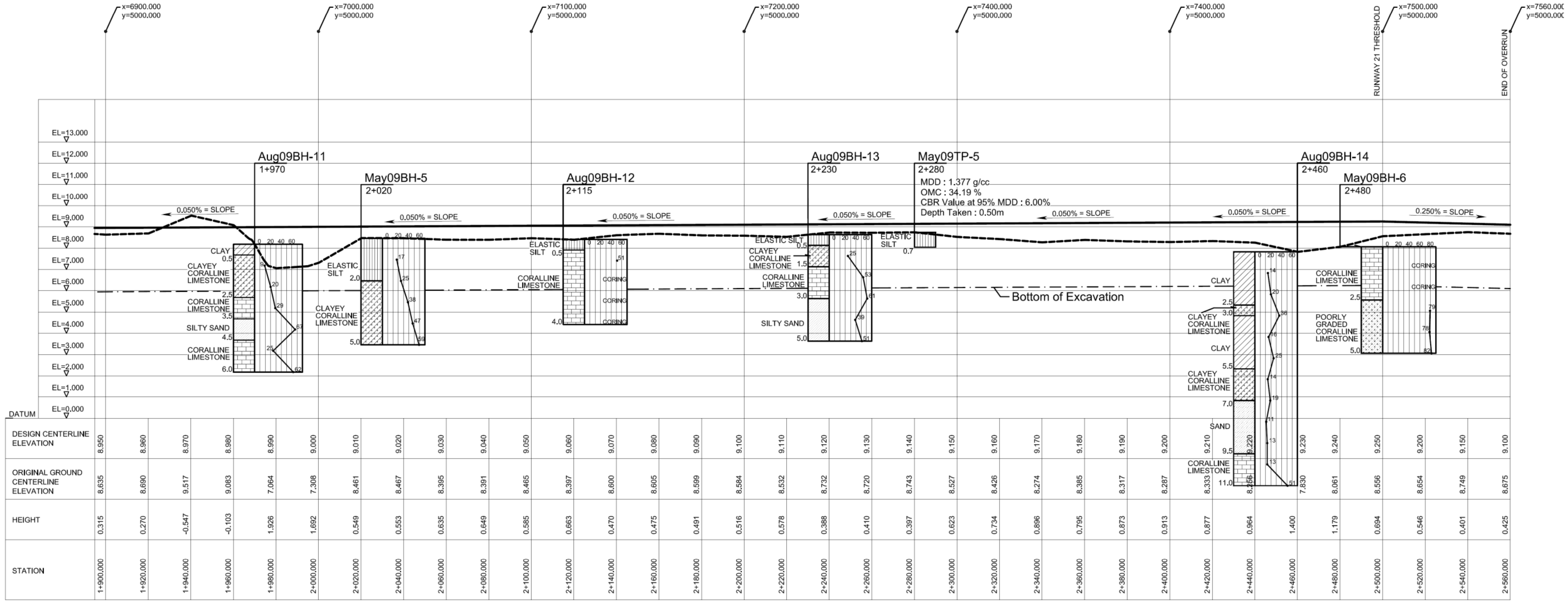
LEGEND:
DESIGN ELEVATION
GROUND ELEVATION
BOTTOM OF EXCAVATION

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)



1 AIRSIDE KEYPLAN
SCALE 1:20000 MM.



	1+900.000	1+920.000	1+940.000	1+960.000	1+980.000	2+000.000	2+020.000	2+040.000	2+060.000	2+080.000	2+100.000	2+120.000
DESIGN CENTERLINE ELEVATION	8.950	8.960	8.970	8.980	8.990	9.000	9.010	9.020	9.030	9.040	9.050	9.060
ORIGINAL GROUND CENTERLINE ELEVATION	8.635	8.690	9.517	9.083	7.064	7.308	8.461	8.467	8.395	8.391	8.465	8.397
HEIGHT	0.315	0.270	-0.547	-0.103	1.926	1.692	0.549	0.553	0.635	0.649	0.585	0.663

	2+140.000	2+160.000	2+180.000	2+200.000	2+220.000	2+240.000	2+260.000	2+280.000	2+300.000	2+320.000	2+340.000
DESIGN CENTERLINE ELEVATION	9.070	9.080	9.090	9.100	9.110	9.120	9.130	9.140	9.150	9.160	9.170
ORIGINAL GROUND CENTERLINE ELEVATION	8.600	8.605	8.599	8.584	8.532	8.732	8.720	8.743	8.527	8.426	8.274
HEIGHT	0.470	0.475	0.491	0.516	0.578	0.388	0.410	0.397	0.623	0.734	0.896

	2+360.000	2+380.000	2+400.000	2+420.000	2+440.000	2+460.000	2+480.000	2+500.000	2+520.000	2+540.000	2+560.000
DESIGN CENTERLINE ELEVATION	9.180	9.190	9.200	9.210	9.220	9.230	9.240	9.250	9.200	9.150	9.100
ORIGINAL GROUND CENTERLINE ELEVATION	8.385	8.317	8.287	8.333	8.256	7.830	8.061	8.556	8.654	8.749	8.675
HEIGHT	0.795	0.873	0.913	0.877	0.964	1.400	1.179	0.694	0.546	0.401	0.425

1 CENTERLINE PROFILE (CP-4)
SCALE VERTICAL 1200 MM. HORIZONTAL 1:2000 MM.

LEGEND:
DESIGN ELEVATION
GROUND ELEVATION
BOTTOM OF EXCAVATION

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

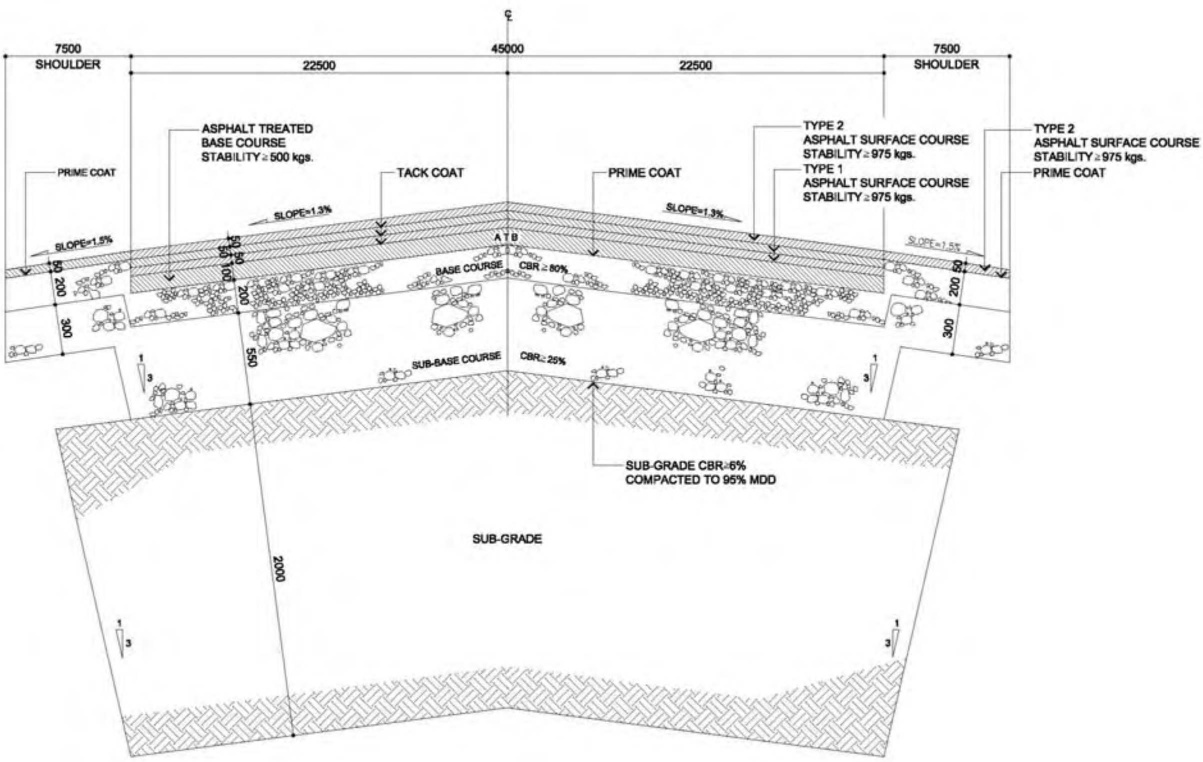
Classification of Soil		Bearing Strength (t/m2)	N value
Sand	dense	30	30～50
	medium	20	20～30
		10	10～20
	loose	5	5～10
Clay	dense	10	8～15
	medium	5	4～ 8
	loose	3	2～ 4

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).

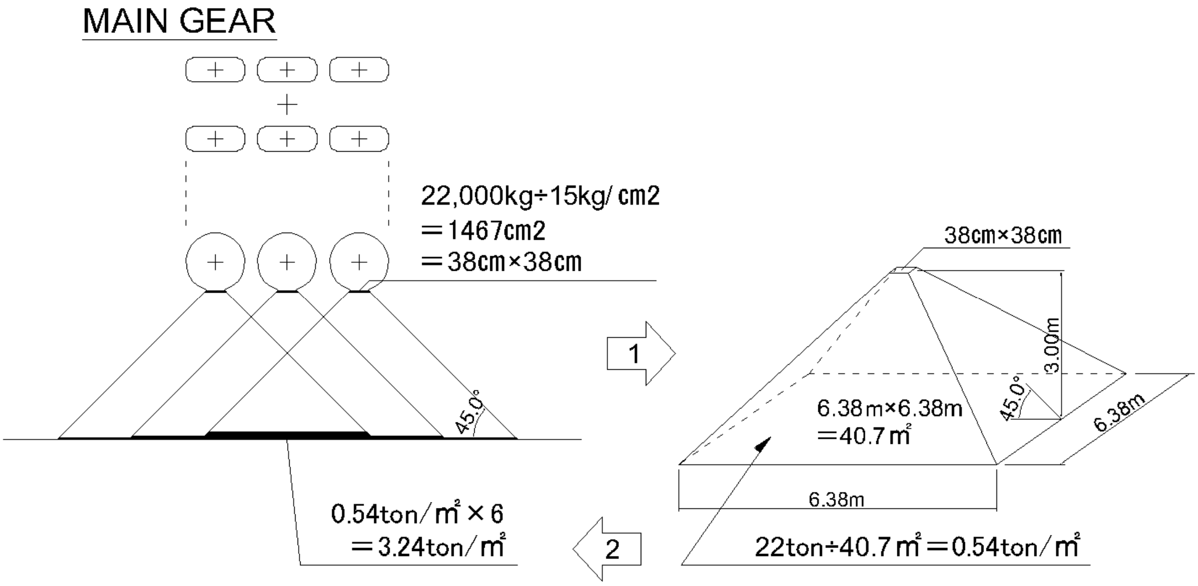
The designed thickness of the runway pavement is 1 m (refer to Chapter 5). Below the pavement structure, a compacted subgrade is necessary. Required thickness of the compacted subggrade is between 1.5 m (FAA standard in case of non-cohesive soil when 90 % compaction degree is achieved) and 2 m (Japanese 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.cm^2 which requires 38 cm square (1,467 cm^2) 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 m^2). The load of a main gear at pavement surface is 22 tons (loaded at the surface area of 1,467 cm^2) and the same load measured at the bottom of the pavement is 0.54 tons/m^2 (equally loaded at the area of 40.7 m^2). The center of the main gear is affected by the same load of 6 accumulated tires, which is 3.24 tons/m^2 (i.e. 0.54 tons/m^2 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

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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)

	(1) Sea Passengers		(2) Air Passengers			(3) Total	
CY	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.

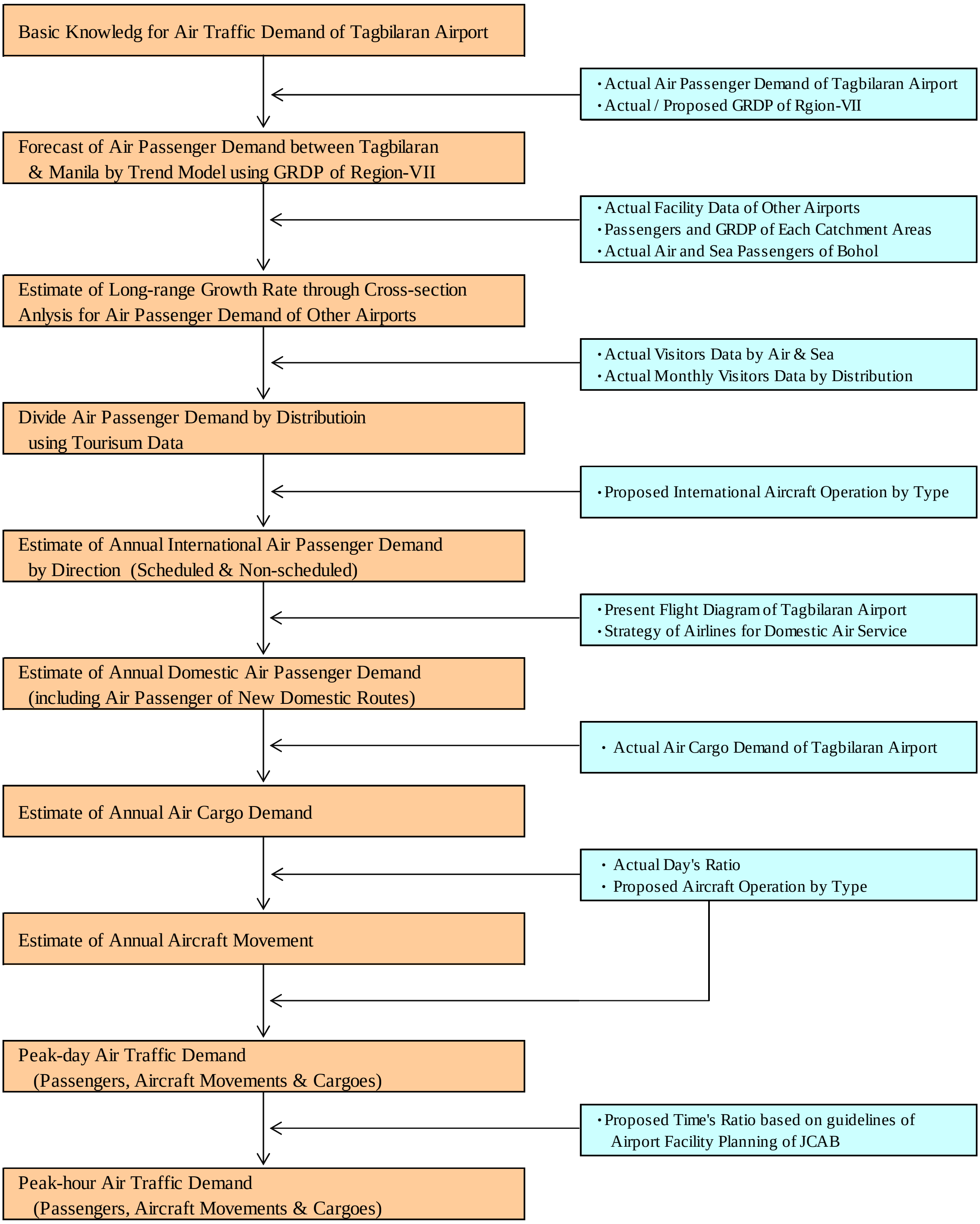
As mentioned in the foregoing Chapter 2, upon opening to international traffic in 2009 at Kalibo Airport, international flights bound for Seoul, Pusan, Shanghai, Taipei, Hong Kong were launched and the number of international passengers quickly reached 230 thousand in 2010.

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.

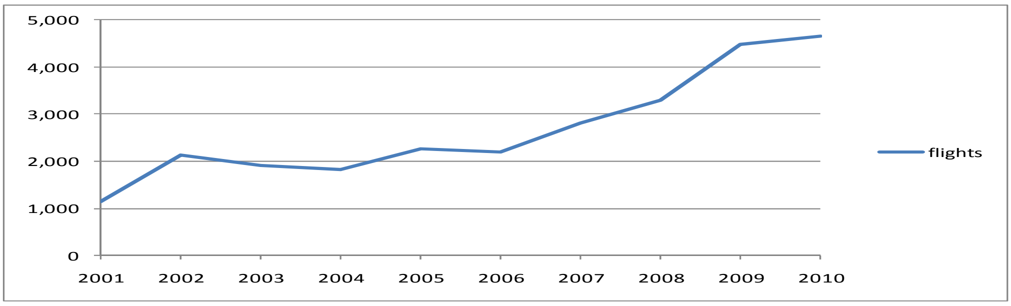
Table 3.4-1 Past Air Traffic Records at Tagbilaran Airport In comparison with GRDP in Region-VII

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

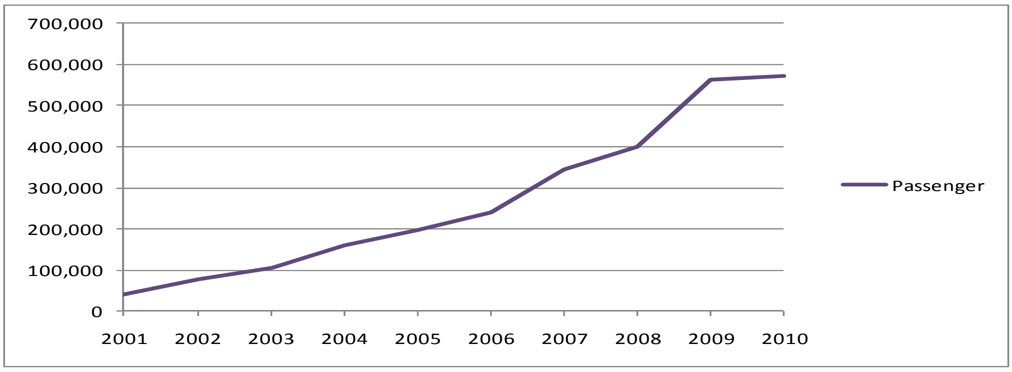
70,326 mil. in 2001 to Php 108,311 mil. in 2011); the GRDP elasticity is calculated at 3.43 (= 16.8 / 4.9).



Source: JICA Study Team

Figure 3.4-1 Past Aircraft Movements at Tagbilaran Airport

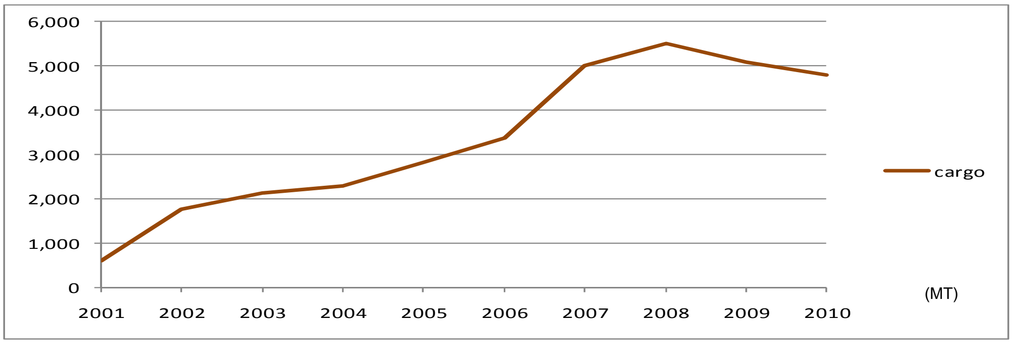
The number of air passengers at Tagbilaran Airport has increased at an average annual growth rate of 34.7 % (increased from 39.268 in 2000 to 572.476 in 2011); the GRDP elasticity is calculated at 7.08 (= 34.7 / 4.9).



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) Forecast of Air Passenger between Bohol and Manila

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:

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

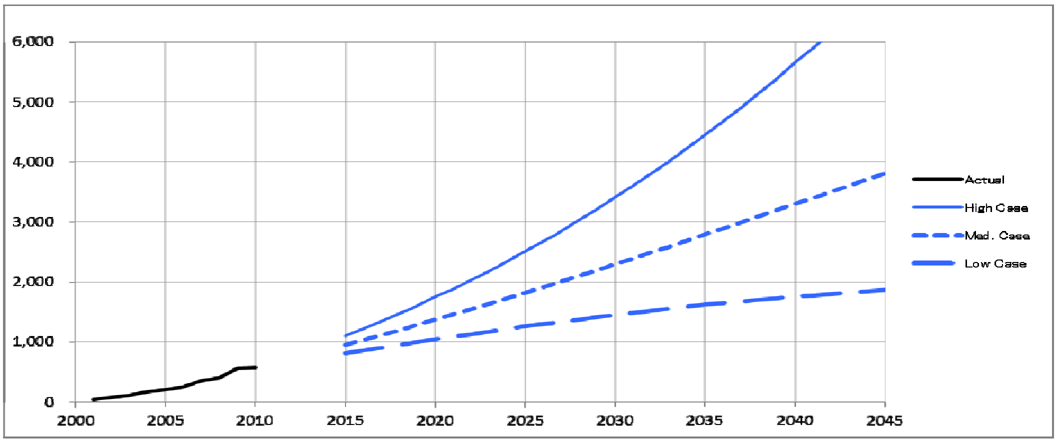
Where PAX_{TM} : Annual Air Passenger Demand of Bohol-Manila
GRDP : GRDP of Region VII (mil. PhP at constant price in ‘85)

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]) (Latent Air Passengers/Actual Air Passengers)	771,205 (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

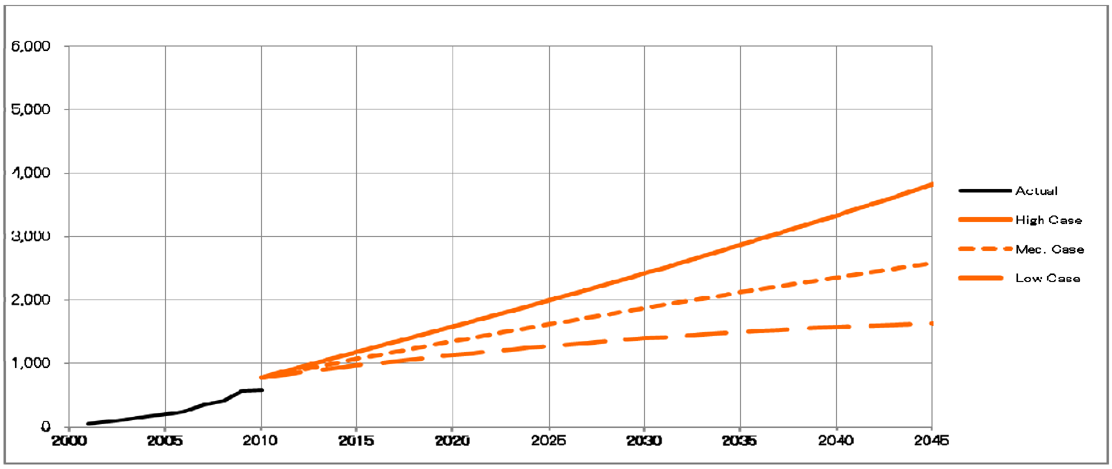
Source: JICA Study Team

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).

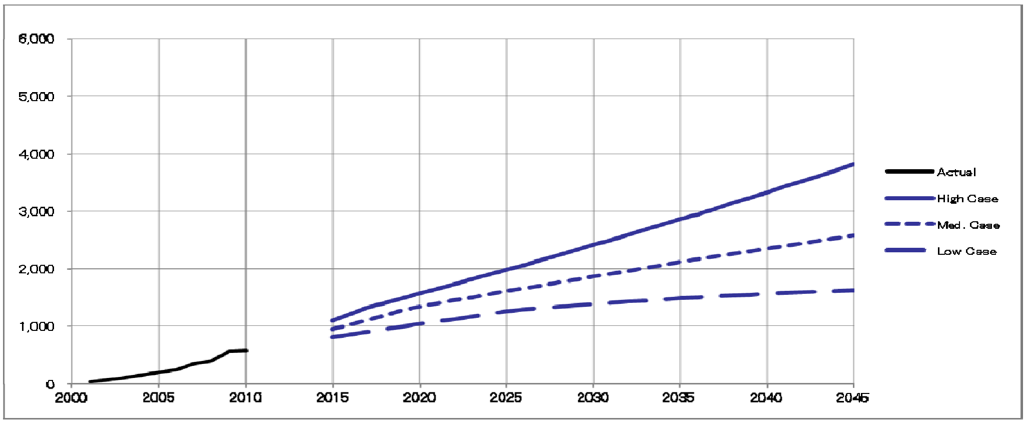
Consequently, the forecast by the trend model has been adopted before the point of intersection of the demand curve for forecast by the trend model and the demand curve for the latent demand, and the latent demand has been adopted after the point.

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
	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
2006	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
	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
2007	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
	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
2008	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
	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
2009	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

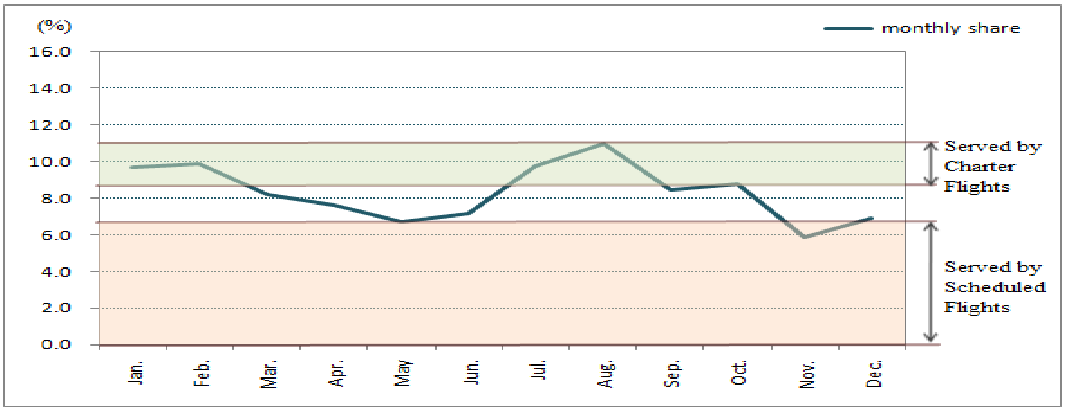
3) Forecast of International Air Passengers

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%

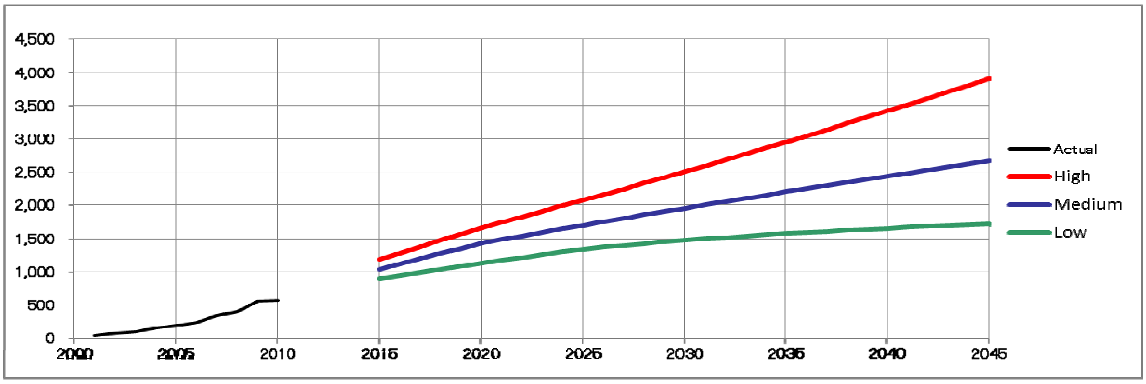
Source: JICA Study Team

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 x PAX + 1569609.0 $r^2 = 0.7987$

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.

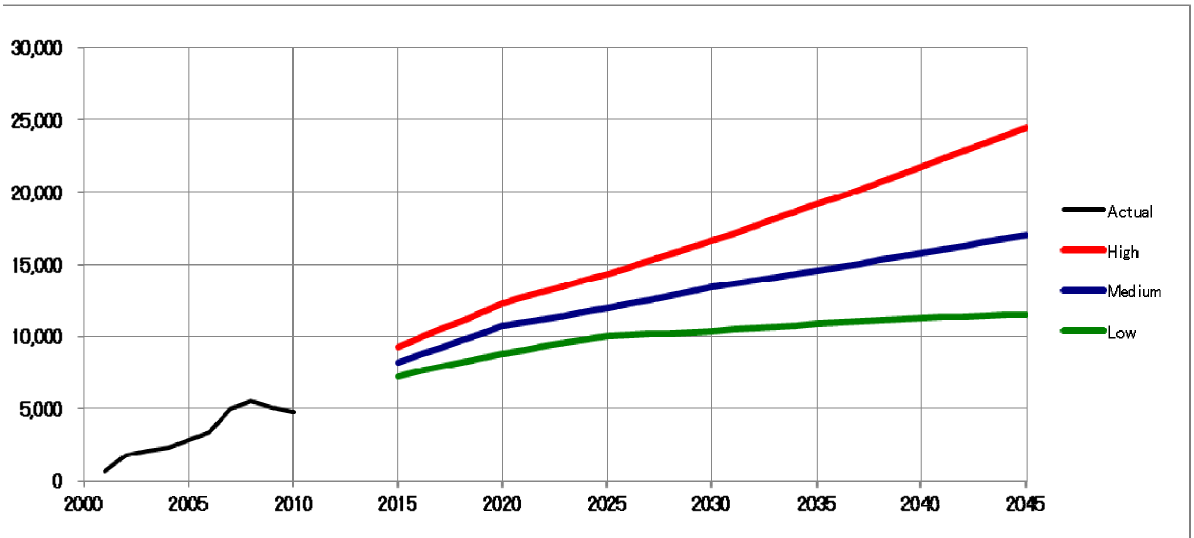
Accordingly, annual future air cargo demand has been forecasted as follows:

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)

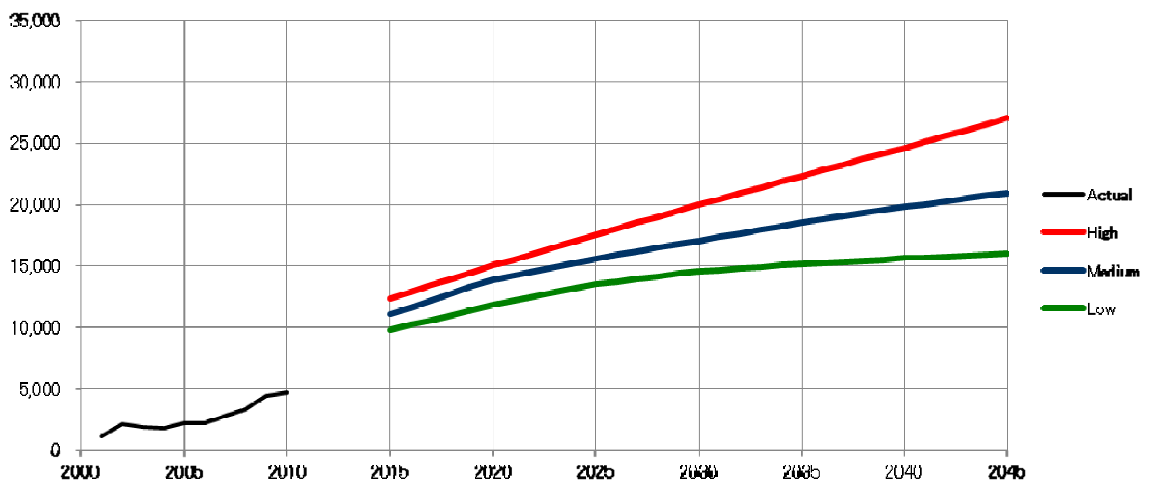
	Domestic		International Flights						Grand Total	
CY	Flights	G/R (%)	Scheduled	G/R (%)	Non-Sche.	G/R (%)	Total	G/R (%)	Flights	G/R (%)
2010	4,664								4,664	
2015	11,022	18.8			16		16		11,038	18.8
2020	13,548	4.2			40	20.1	370	87.4	13,918	4.7
2025	14,370	1.2	812		58	7.7	1,254	27.6	15,624	2.3
2030	15,358	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
	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
1-way Peak-day Traffic	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
	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
2-way Annual Traffic	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%	
	aircract	Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
1-way Peak-hour Traffic	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
		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
1-way Peak-day Traffic	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
		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
2-way Annual Traffic	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	
		Seat	L/F	Pax	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger	flights	passenger
1-way Peak-hour Traffic	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

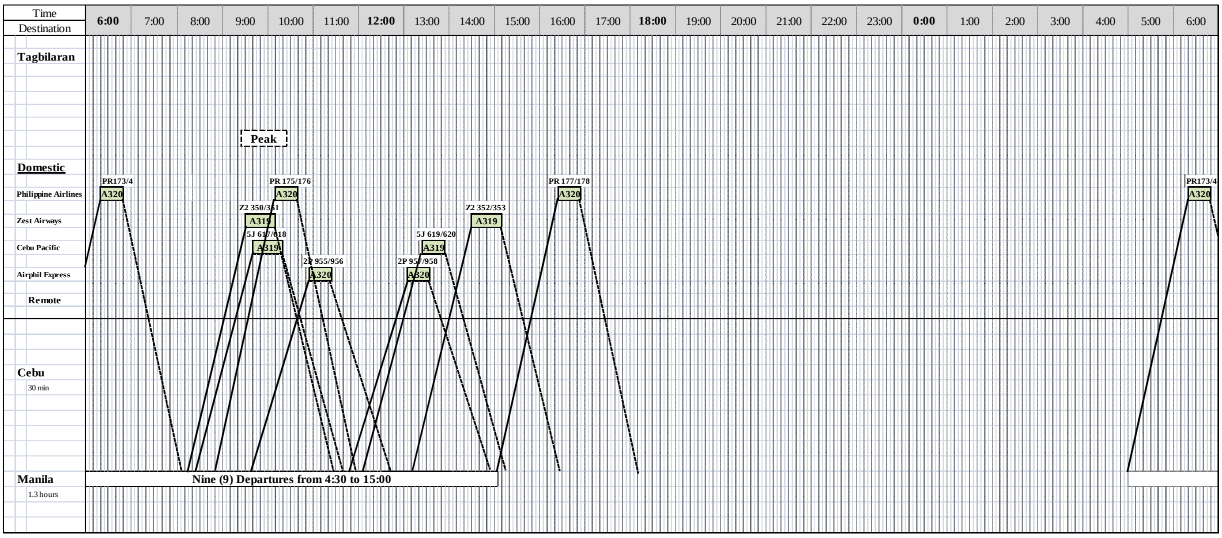
Table 3.6-1 (3) Peak Hour Air Traffic Demand at New Bohol Airport (High Case)

				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
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	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
	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
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	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
	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%	
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	0.62	25	0.59	24	0.58	23	0.57	23	0.56	22	0.55	22	0.54	22
	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
	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
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			0.69	72	2.53	263	3.58	372	3.80	396	4.00	416	4.00	416
	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							0.40	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
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			386	40,144	1,472	153,088	2,266	235,664	2,612	271,648	2,754	286,416	2,884	299,936
	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
	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	
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								
	B767charter	260	80%	208														
	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

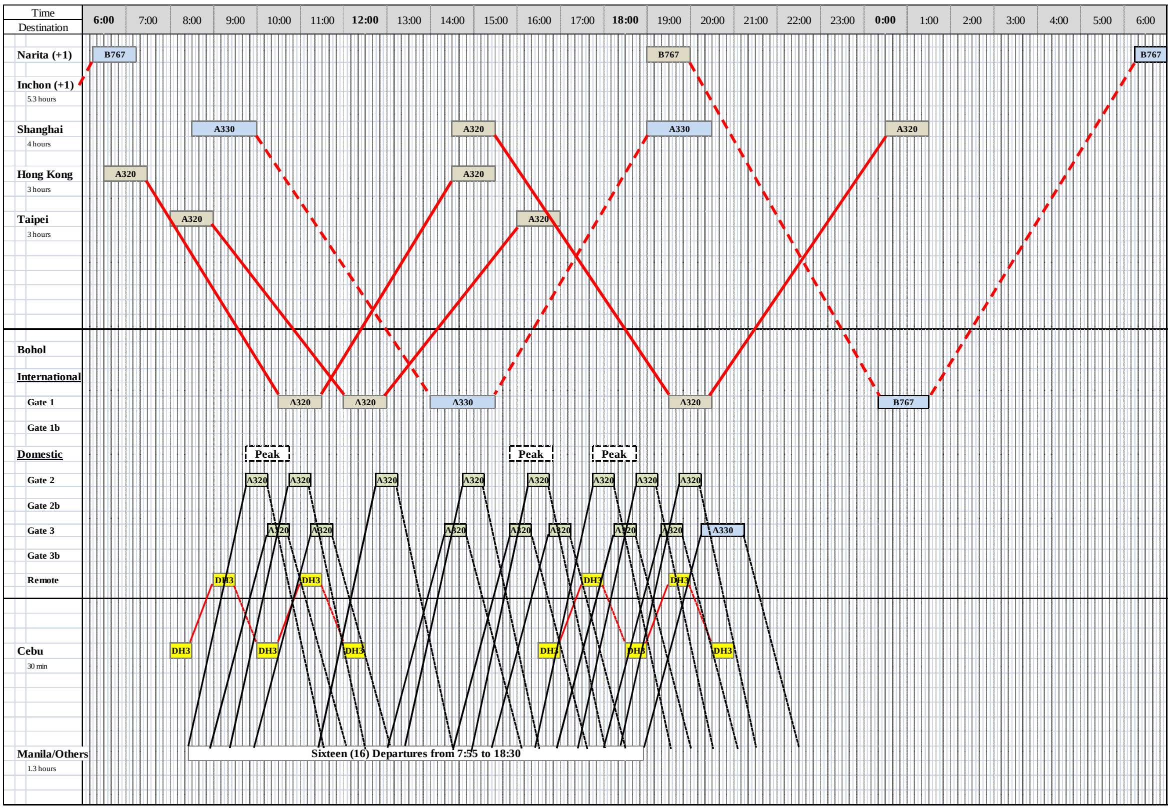
Current flight schedule at the existing Tagbilaran Airport is shown in Figure 3.6-1.



Source: JICA Study Team

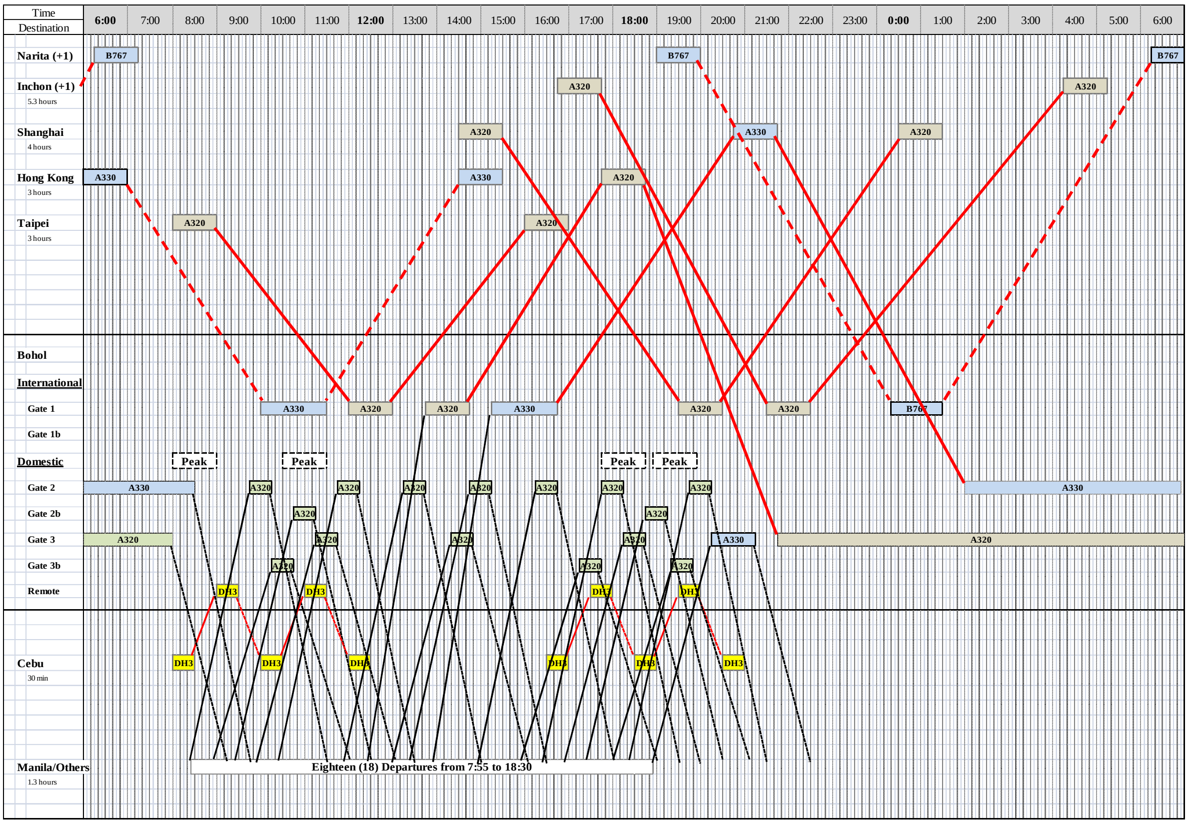
Figure 3.6-1 Present Flight Schedule at Tagbilaran Airport [2011]

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:



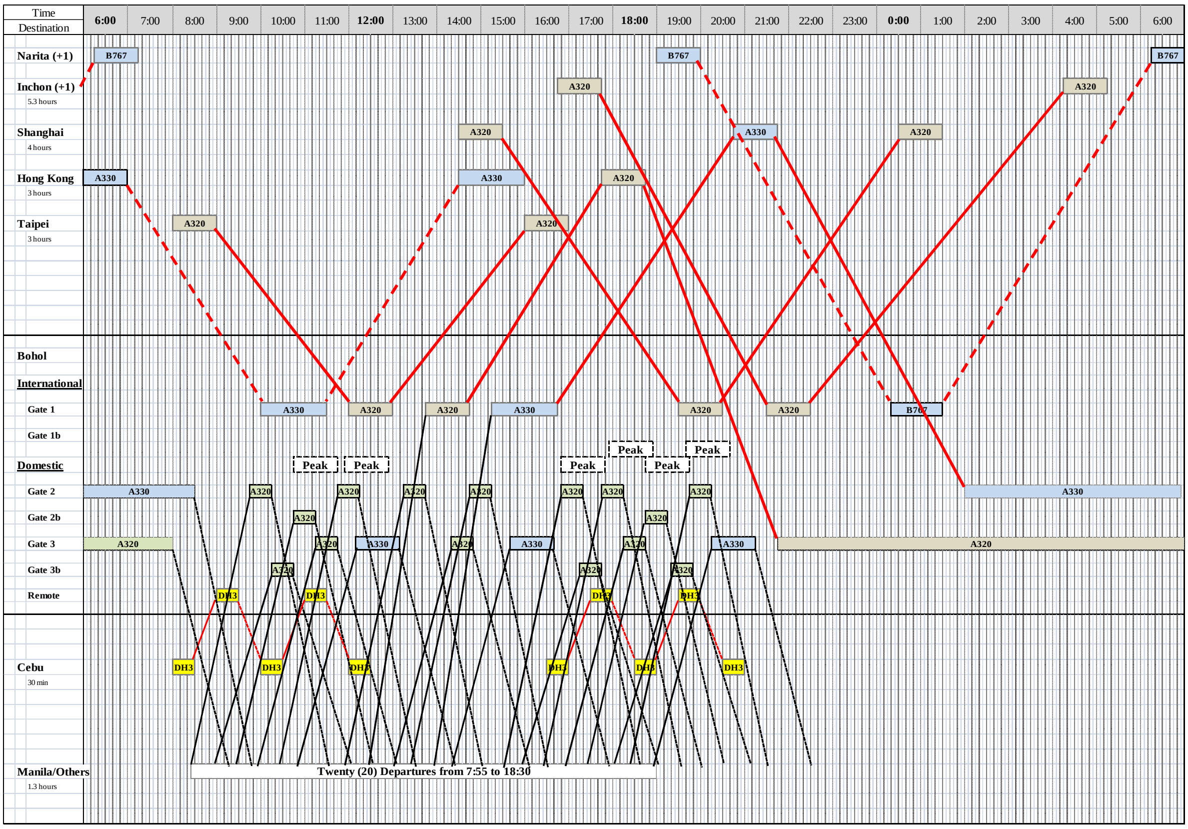
Source: JICA Study Team

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



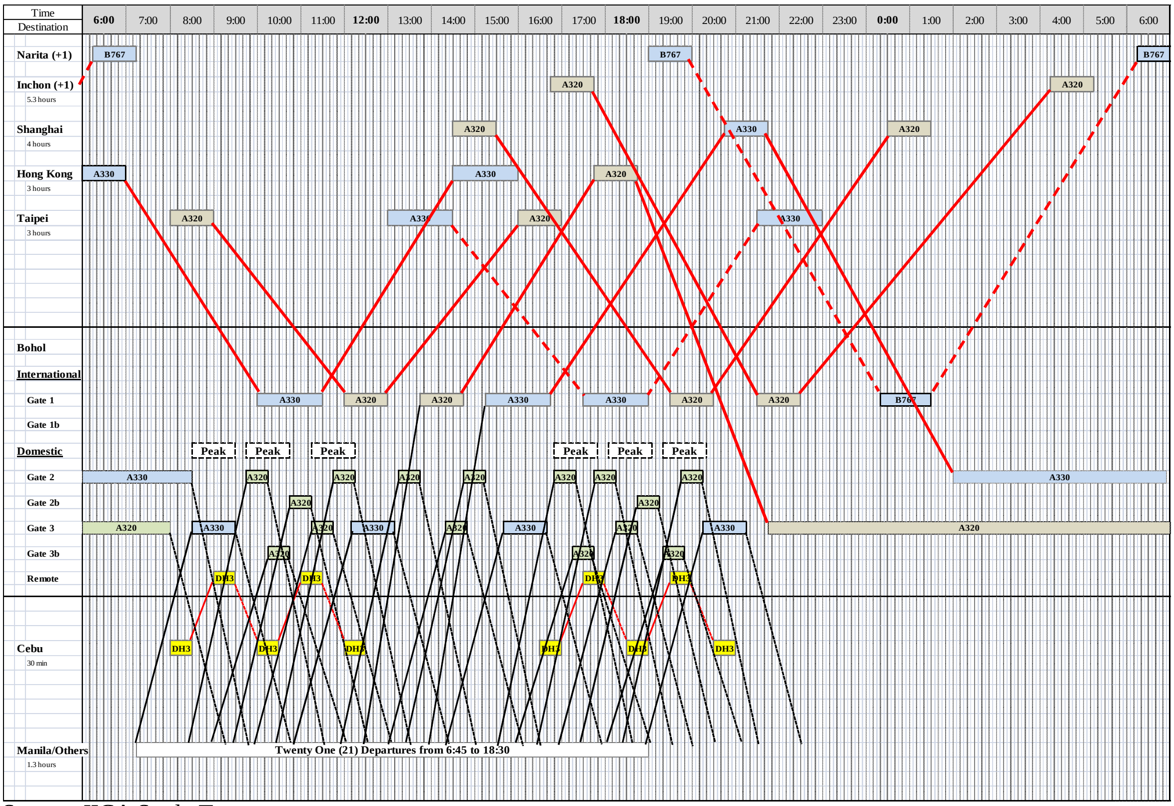
Source: JICA Study Team

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



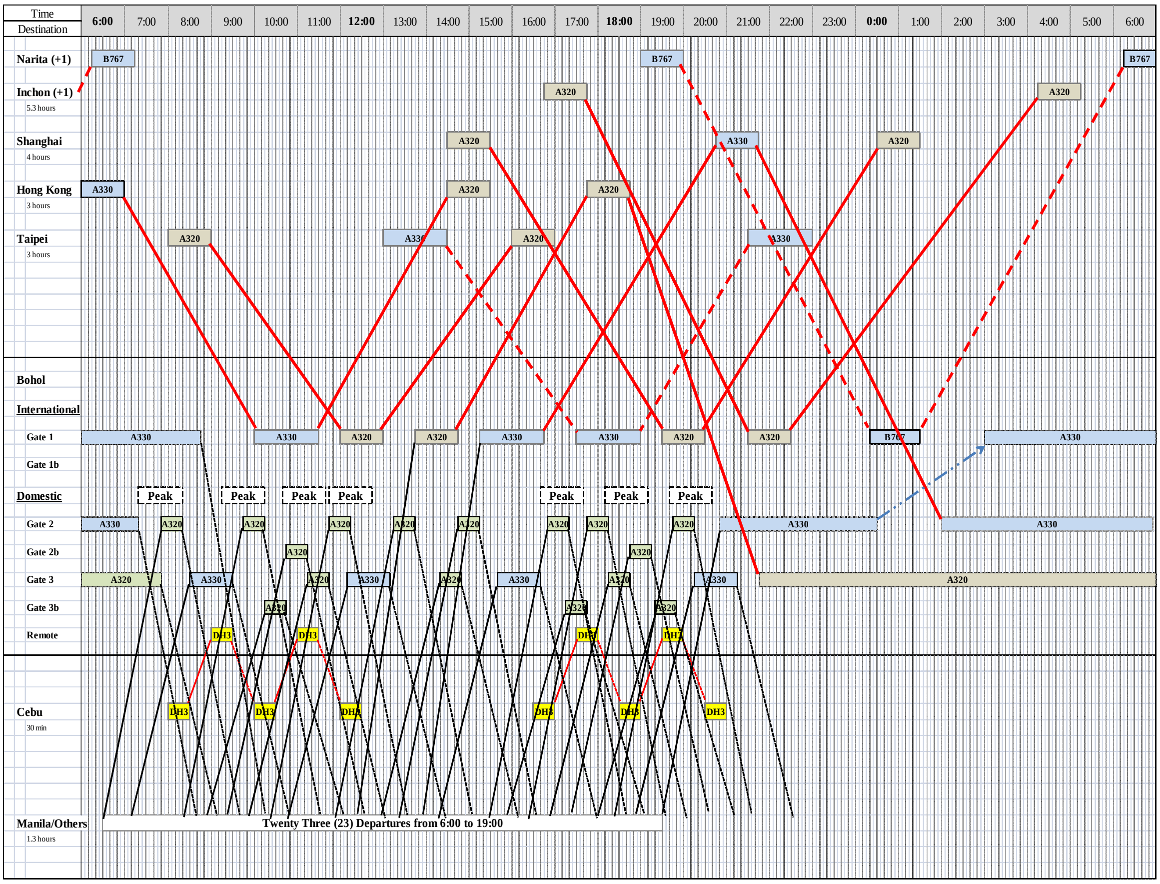
Source: JICA Study Team

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

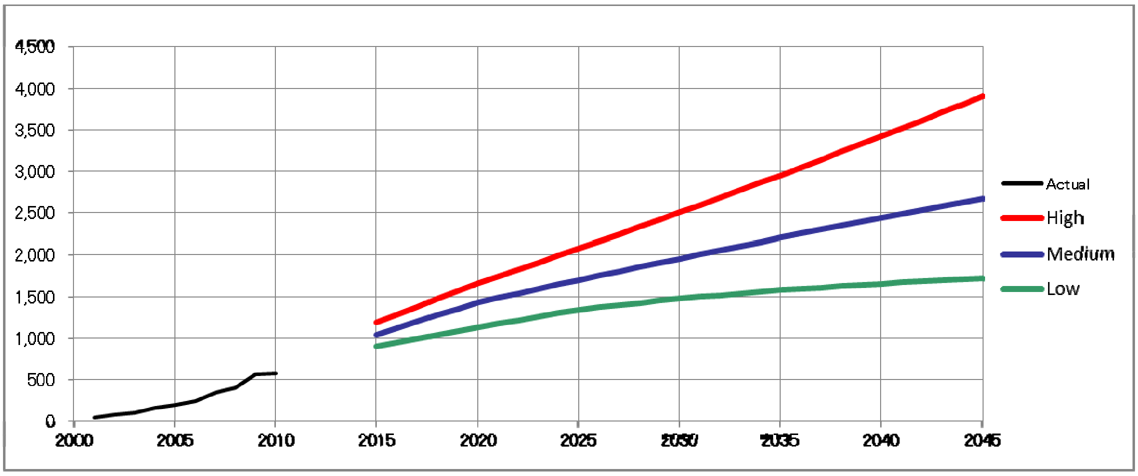
Source: JICA Study Team

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

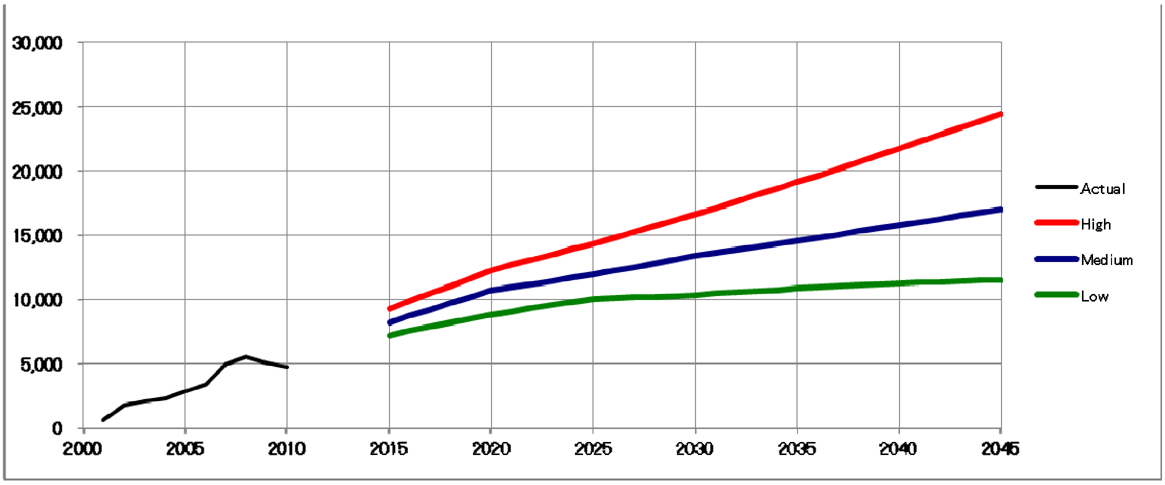
notes : (*1) including some new route between Bohol and other islands
(*2) 4 new routes (BHL-SHA, BHL-HKG, BHL-TPE & BHL-SEL) and charter flights to/from many asian countries

Source: JICA Study Team



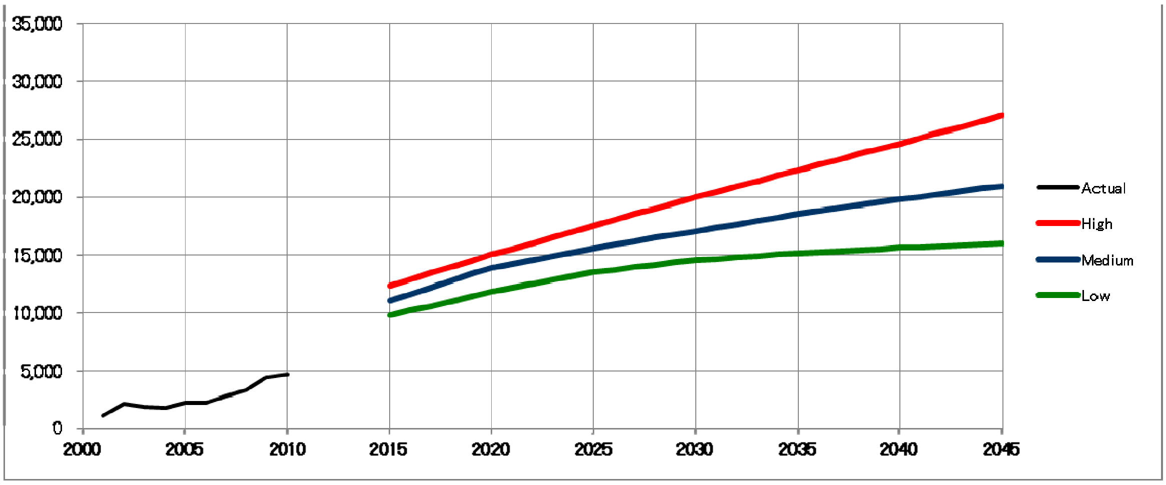
Source: JICA Study Team

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						403,000		413,400				
	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		
2015						519,000		534,000	Low	898,000	2,000	900,000
	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
2020						627,000		658,200	Low	1,125,000	6,000	1,131,000
	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
2025						716,000		793,400	Low	1,295,000	50,000	1,345,000
	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
2030						782,000		963,400	Low	1,343,000	137,000	1,480,000
						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
2035						828,000		1,209,400	Low	1,414,000	164,000	1,578,000
	n/a				n/a	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
2040									Low	1,469,000	189,000	1,658,000
									Midium	2,117,000	324,000	2,441,000
						n/a			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.