

Democratic Republic of Timor Leste
Ministry of Transport and Communications
Airport Administration and Air Navigation of Timor-Leste

**PREPARATORY SURVEY
FOR
THE PROJECT FOR IMPROVEMENT
OF
PRESIDENTE NICOLAU LOBATO
INTERNATIONAL AIRPORT**

FINAL REPORT

MAY 2019

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

**JAPAN AIRPORT CONSULTANTS INC
ORIENTAL CONSULTANTS GLOBAL CO., LTD.**

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Summary

1. Country Overview

The Democratic Republic of Timor Leste (hereinafter referred to as “Timor-Leste”) is located in the east side of Timor Island, which lies to the eastern side of Indonesia, in the midway of Sulawesi, New Guinea islands and Australia. The country has one million sixteen hundred thousand population and is an island country. Generally speaking, the infrastructure in Timor-Leste is in poor condition due to the series of turmoil after the independence and maintenance capacity has not been accumulated.

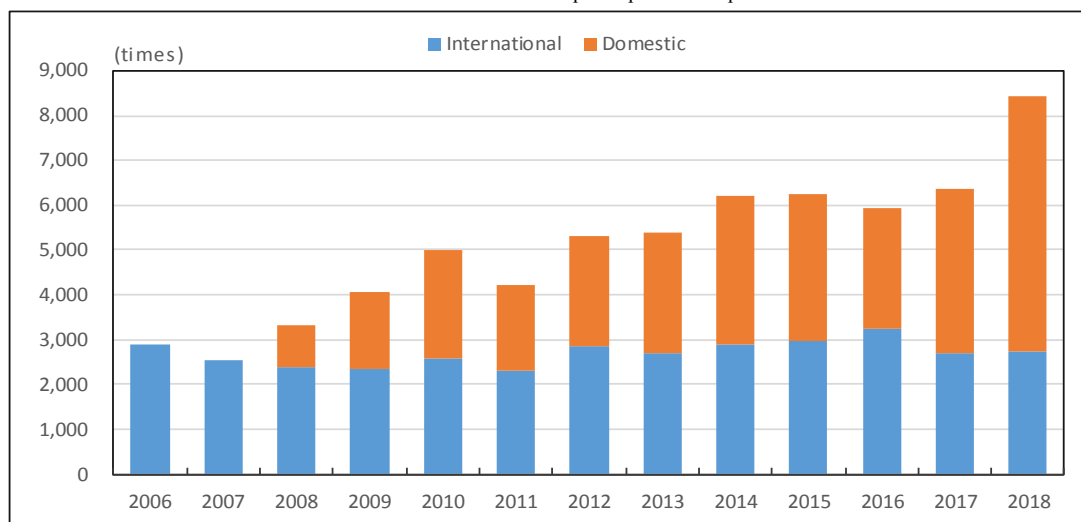
Presidente Nicolau Lobato International Airport (hereinafter referred to as “Dili International Airport”) is located in the capital city of Timor-Leste and has international regular flights to Indonesia, Australia and Singapore. The number of international passengers in 2017 was two hundred sixteen thousand. The airport also has domestic routes and regular flights to Oecussi and Suai.

Along with the regular flights, Dili International Airport has unscheduled flights with small aircrafts and helicopters. General aviation flights also are operated. The international and domestic airport traffic in Dili International Airport from 2006 to 2018 is as shown in the Table 1, which the statistics by Administration of Airports and Air Navigation of Timor-Leste, As seen from the table, the number of passengers has almost tripled in the past 10 years.

Table 1 Airport Traffic Record at Dili International Airport

CY	Aircraft Movements (times)						Passengers (thousand persons)						Cargoes (tons)	
	International		Domestic		Total		International		Domestic		Total		International	
	Number	Change	Number	Change	Number	Change	Number	Change	Number	Change	Number	Change	Number	Change
2006	2,902				2,902		62.7				62.7		276.4	
2007	2,538	-12.5%			2,538	-12.5%	76.5	22.2%			76.5	22.2%	267.2	-3.3%
2008	2,366	-6.8%	962		3,328	31.1%	91.5	19.5%	6.3		97.8	27.8%	326.4	22.1%
2009	2,356	-0.4%	1,700	76.7%	4,056	21.9%	113.3	23.8%	10.4	64.7%	123.7	26.5%	391.6	20.0%
2010	2,566	8.9%	2,414	42.0%	4,980	22.8%	133.2	17.6%	16.7	60.5%	150.0	21.2%	415.7	6.2%
2011	2,306	-10.1%	1,912	-20.8%	4,218	-15.3%	143.7	7.8%	7.8	-53.1%	151.5	1.0%	426.0	2.5%
2012	2,834	22.9%	2,460	28.7%	5,294	25.5%	168.7	17.4%	10.1	29.0%	178.8	18.0%	471.5	10.7%
2013	2,680	-5.4%	2,702	9.8%	5,382	1.7%	192.0	13.8%	12.9	27.2%	204.9	14.6%	239.6	-49.2%
2014	2,896	8.1%	3,302	22.2%	6,198	15.2%	189.5	-1.3%	17.4	35.0%	206.8	0.9%	171.0	-28.6%
2015	2,982	3.0%	3,266	-1.1%	6,248	0.8%	193.0	1.8%	19.0	9.4%	212.0	2.5%	246.6	44.2%
2016	3,232	8.4%	2,712	-17.0%	5,944	-4.9%	212.7	10.2%	16.4	-13.6%	229.2	8.1%	284.0	15.2%
2017	2,698	-16.5%	3,674	35.5%	6,372	7.2%	216.4	1.7%	30.3	84.7%	246.7	7.7%	326.1	14.8%
2018	2,754	2.1%	5,674	54.4%	8,428	32.3%	241.7	11.7%	33.5	10.4%	275.2	11.5%	241.7	-25.9%

Source: Airport Operation Department and General Directorate of Statistics



Source: Airport Operation Department and General Directorate of Statistics

Figure 1 International and Domestic Air Passenger Traffic at Dili

2. Project Background

Improvement of safety is the urgent issue to be addressed. In fact, the dimensions of the runway, taxiway and associated strips as well as the runway end safety area at Dili International Airport does not satisfy the international standards and recommendations stipulated in Annex 14 of International Civil Aviation Organization (hereinafter referred to as “ICAO”). In addition, the air traffic control tower is not high enough to satisfy the line-of-sight requirement for the controller to the eastern side of the runway. Furthermore, the inadequate runway length of 1,850m only necessitates some payload penalty for the flights to Singapore. Not only this, due to the breakdown of airfield ground lighting, the nighttime aircraft operation is also restricted.

Dili International Airport used to be one of the local airports in Indonesia. The passenger terminal building was designed for domestic purpose and the size is not large enough. The international passenger processing facilities such as the customs, immigration and quarantine (hereinafter referred to as “CIQ”), provided in the building are not functionally located and the number is not adequate to accommodate growing demands and the level of service level stays poor.

In 2026, the number of passengers in Dili International Airport is expected to reach four hundred thousand and the passenger service level would continue to deteriorate. The government of Timor –Leste has already started a series of study for extension of the runway from 1,850 to 2,150, and restoration/improvement of the airfield ground lighting. Regarding the terminal facilities, the Government of Timor-Leste requested Japanese Government to provide a grant assistance for development of the new international passenger terminal building and air traffic control tower as well as other associated facilities which need immediate improvement.

Table 2 Requested Project Components

	Component	Size
1	International Passenger Terminal Building	Total Floor Area7,000-8,000m2
2	International Cargo Terminal Building	Total Floor Area600m2
3	International Apron	B737/A320 Class: four parking stands
4	New Taxiway	-
5	Apron Flood Lighting and Airfield Ground Lighting	-
6	Access Road, Parking	Car parking: Approximately 300 parking spaces
7	Air Traffic Control Tower	Including Air traffic control equipment

Source: JICA Study team

3. Results of Survey and Contents of the Project

In response to the request, the Government of Japan decided to conduct a preparatory survey. The Japan International Cooperation Agency (JICA) dispatched a survey team to Timor-Leste between 31st March and 8th May 2018. The survey team held several meetings with the relevant authorities in Timor-Leste to discuss the contents of the request. The survey team also conducted field survey and examined capability of ANATL for the operation and maintenance, the conditions of existing facilities, and consequently prepared a preliminary design and rough cost estimate of the new international terminal facilities development and the construction/procurement plans.

After the first field survey, the survey team prepared a development plan, conducted outline design and estimated costs, which were summarized in the draft final report. The survey team

subsequently visited Dili and explained to relevant organizations on the contents of the Project and undertaking of Timor-Leste between 1st to 10th Feb 2019, upon which both sides agreed

Table 3. Outline of the Components

	Component	Outline	Remark
1	International Passenger Terminal Building	1-story steel structure, 6722m ² Security Equipment : 1 set	
2	International Cargo Terminal Building	1-story steel structure, 400m ²	Excluded from the scope of JICA Grant
3	International Apron	Concrete pavement : 10,890m ² Asphalt pavement: 5,476 m ²	3 small jet parking stands GSE area
4	Taxiway	Asphalt pavement : 9,527m ² Asphalt pavement : 3,002m ²	Taxiway Shoulder
5	Airfield Ground Lighting	Taxiway light Apron flood light Aerodrome beacon	Excluded from the scope of JICA Grant.
6	Car Park, Access Road	Roadway: one lane each, width 3.25 m Asphalt pavement : 12,876m ²	Car park is excluded from the scope of JICA Grant. (Earthwork is included for car park. Pavement work for car park is excluded.)
7	Air Traffic Control Tower and Air Traffic Control Equipment	ATC tower : 400m ² Office : 400m ² , one-story ATC equipment : 1 set	
8	Substation	Substation : 250m ² , one-story Emergency standby generator	

Source: JICA Study team

4. Project Implementation Schedule

The whole project period is 31 months including the detailed design stage for 9 months and construction period for 22 months.

5. Project Evaluation

(1) Relevance

The relevance of the Project was examined in terms of the number of beneficiaries, urgency, contribution to the development objectives of the recipient country and consistency with the aid policy of Japan. As a result of that, the relevance of the Project is evaluated as high.

1) Beneficiaries of the Project

The Project aims to improve the facilities of Dili International Airport, the gateway for Timor-Leste. The proposed terminal facilities development improves the capacity and safety of Dili International Airport, thus contributing to the enhancement of aviation safety and comfort of the entire Timor-Leste and brings benefits to the tourism industry and the national economy

of the country. Therefore, it is considered that the beneficiaries of the Project are not only the users of the airport but also the whole nationals of Timor-Leste.

2) Urgency

The existing passenger terminal building used to be utilized as a domestic passenger terminal in the era of Indonesia government. There is an inappropriate operation; for example, the departing passenger processing for domestic and international flights is mixed up. In addition to that, the size of the existing terminal building is 3,500m² only and not adequate to accommodate two hundred fifty thousand annual passengers. The inadequate size results in a long que in check-in and immigration areas during the peak-hours. The service level is considered to be low. There is an urgent need to improve Dili airport as an airport in the capital city and gateway for Timor-Leste.

3) Contribution to the development objectives of the recipient country

Development plan of Timor-Leste as “Strategic Development plan 2011-2030”, National Civil Aviation Policy, both recognize that Dili International Airport lacks capacity to handle aviation demands and basic facilities do not meet safety requirements set by ICAO and advocate the need to expand facilities. In particular, old and deteriorated passenger terminal building and lack of the passenger handling capacity are considered to be obstructive factors for economic growth and tourism development and it is recognized that those need to be improved. The Project is consistent with the development objectives of the recipient country.

4) Consistencies with Japanese Development Assistance Policies and Objectives

The Government of Japan addresses development of Timor-Leste by placing emphasis on assistance to sustainable development and improvement of infrastructure is one of the prioritized areas. The Project aims to improve convenience and safety of aviation and revitalize economy by constructing high quality infrastructure in the capital city of Timor-Leste. Therefore, the Project is considered to be consistent with Japanese development assistance policies and objectives of Timor-Leste.

(2) Effectiveness

The project aims at increasing the airport capacity for the growing aviation demands and contributing to improving the convenience and safety of aviation and economic growth of Timor-Leste. Qualitative indicator to evaluate the effects of the Project is the number of international passengers, the number of foreign visitors and passenger processing time.

1) Quantitative effects

For quantitative effects, the target figures are set for 2025, which is 3 years after the completion of the Project and the baseline year is set for 2017. The detailed figure is shown below.

Table 4

Indicator	Baseline (2017)	Target Figure (2025)
Number of International Passenger	216,400	330,000
Number of Foreign Visitor	65,642	100,000
Passenger processing time for one aircraft	30 minutes※1	20 minutes

Source: JICA Study team

※1: Processing time for inbound immigration check for passengers from one aircraft (150 seats with load factor of 75%) measured by the Survey Team.

2) Qualitative effects

The project is expected to have qualitative effects in the following..

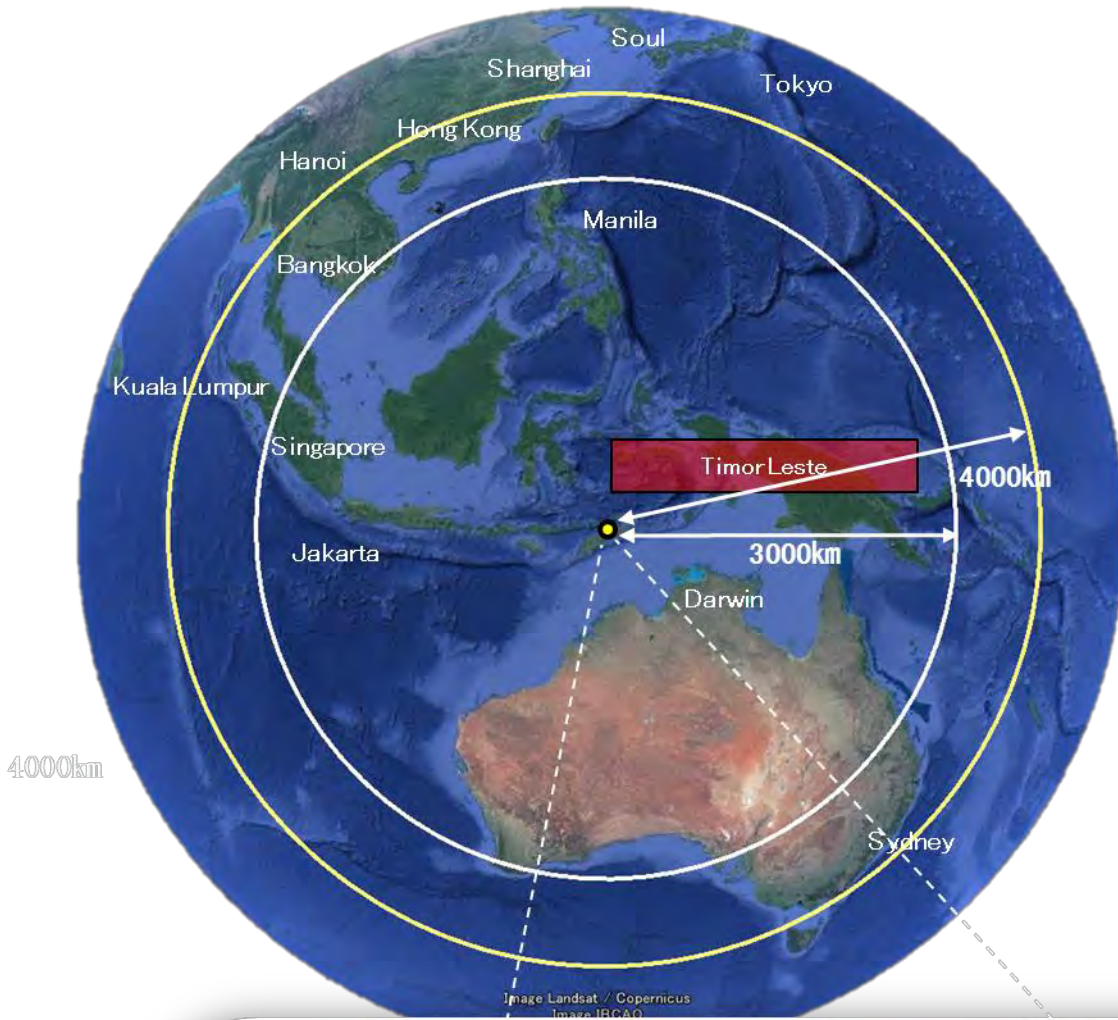
- Safety, convenience and comfort of air passengers are improved by the construction of new international passenger terminal building.
- Safety of aircraft operation is improved since parked aircraft on the apron does not infringe the obstacle limitation surface by the relocation of international terminal facilities.
- Improvement in safety, convenience, comfort of the airport facilities will contribute to promote tourism and generate economic development.

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Presidente Nicolau Lobato International Airport



Perspective





Long Term Perspective



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Abbreviations

AACTL	Civil Aviation Authority of Timor Leste
ABN	Aerodrome Beacon
ADB	Asian Development Bank
ANATL	Administration of Airports and Air Navigation of Timor-Leste
ASTM	American Society for Testing and Materials
ATC	Air Traffic Control
CAD	Civil Aviation Department
CIP	Commercially Important Passengers
CCR	Constant Current Regulator
CCTV	Closed Circuit Television
CIQ	Customs Immigration Quarantine
DME	Distance Measuring Equipment
EPS	Electrical Pipe Shaft
FRP	Fiber Reinforce Plastics
GDP	Gross Domestic Product
GSE	Ground Support Equipment
ICAO	International Civil Aviation Organization
LED	Light Emitting Diode
NDB	Non-Directional Radio Beacon
NOC	National Operation Centre
OAG	Ocean Airline Guide
PAPI	Precision Approach Path Indicator
RC	Reinforced Concrete
SOP	Standard Operation Procedure
SS	Sub Station
UHF	Ultra-High Frequency
UNMIT	United Nations Integrated Mission in Timor-Leste
VFR	Visual Flight Rule
VHF	Very High Frequency
VOR	VHF Omnidirectional Range
VVIP	Very Very Important Person

Chapter 1 Background of the Project

Chapter 1 Background of the Project

1.1 Current Status and Issues of the Aviation Sector

1.1.1 Current Status and Issues

(1) Current Status and Issues

Presidente Nicolau Lobato International Airport (hereinafter referred to as “Dili International Airport”) is the main gateway to the country located in the capital city of the Democratic Republic of Timor-Leste (hereinafter referred to as “Timor-Leste”). Timor-Leste consists of the eastern side of Timor island and an enclave, Oecussi.

Although playing its role as the gateway airport, Dili International Airport was designed and constructed as a local airport during the era of Indonesian administration. The passenger terminal building was designed for domestic use, but currently being operated for both international and domestic operations and the international facilities such as CIQ are provided in the building, resulting in narrow and congested terminal use and therefore the service level is very poor. The dimensions of the runway strip and the runway end safety area do not meet the requirements stipulated in relevant documents published by the International Civil Aviation Organization (ICAO) and there is an urgent need to improve.

The government of Timor-Leste also recognizes that lack of capacity to handle growing aviation demands harms economic development and development tourism and raises issues to be solved in plans in a higher layer such as National Strategic Development plan 2011-2030 and National Civil Aviation Policy

(2) Record of Air Transportation

Dili international Airport is connected with Darwin in Australia, Denpasar in Indonesia and Singapore by international flights. Frequency and types of aircraft used are show in the table below. Airline companies operating in Dili International Airport are Silk Air, Sriwijaya Air, Nam Air, Air North and Citi link. In addition, Aero Operator and Mission Aviation Fellowship provide charter flights and emergency transport service within the country. ZEEMS has domestic flights to Suai and Oecusse.

Table 1.1.1-1 Flight Status of Dili International Airport

Airport	City	Frequency/week	Airline	Aircraft
Ngurah Rai Int Airport	Denpasar	14	Nam Air	B737-500
Ngurah Rai Int Airport	Denpasar	7	Citilink	A320
Ngurah Rai Int Airport	Denpasar	7	Sriwijaya Air	B737-800
Darwin Int Airport	Darwin	8	Airnorth	E70
Changi Int Airport	Singapore	3	SilkAir	A320

Source: JICA Study team



Source: JICA Study team

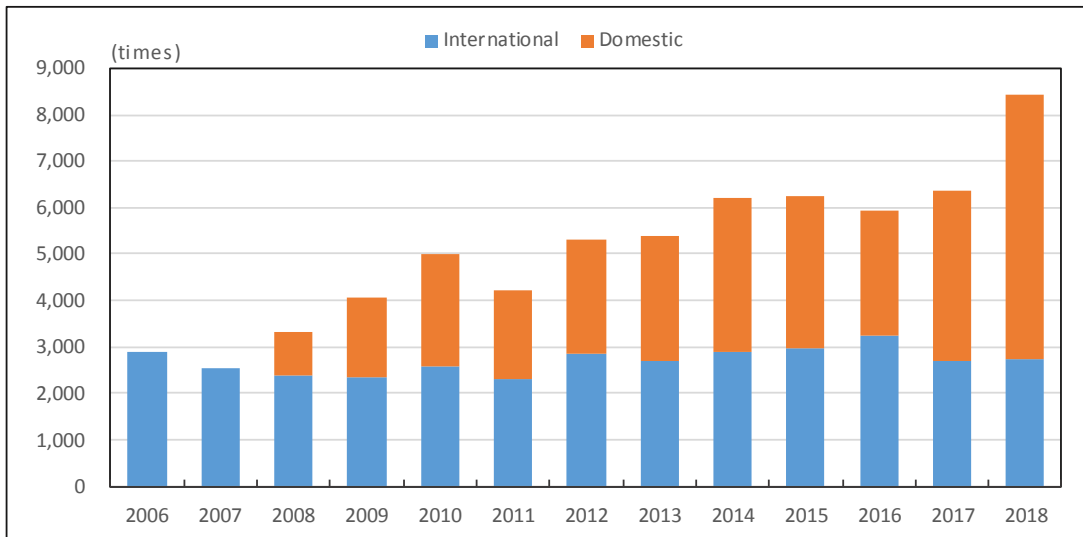
Figure 1.1.1-1 International Flight Routes of Dili Int Airport

Dili International Airport has unscheduled flights and general aviation flights by small aircraft and helicopters in addition to the international regular flights. Record of the transition of international and domestic aviation flights between 2006 and 2018 in Dili international airport, the latest date available at the time of 2019, is summarized in the table below. In the past 10 years, the number of passengers has almost tripled. With regard to the air cargo movement, the record of international cargo volume only is available.

Table 1.1.1-2 Airport Traffic Record at Dili International Airport

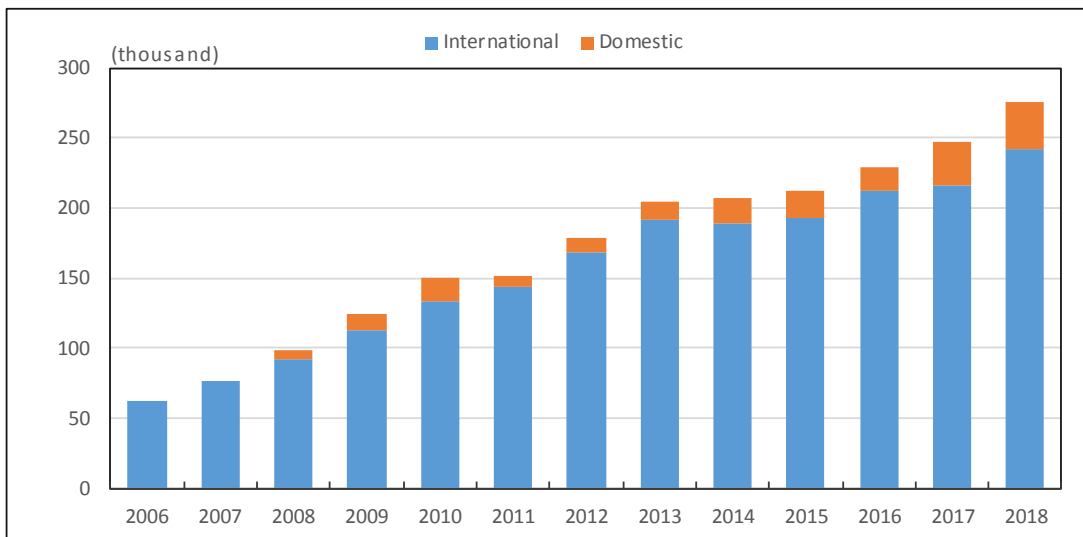
CY	Aircraft Movements (times)						Passengers (thousand persons)						Cargoes (tons)	
	International		Domestic		Total		International		Domestic		Total		International	
	Number	Change	Number	Change	Number	Change	Number	Change	Number	Change	Number	Change	Number	Change
2006	2,902				2,902		62.7				62.7		276.4	
2007	2,538	-12.5%			2,538	-12.5%	76.5	22.2%			76.5	22.2%	267.2	-3.3%
2008	2,366	-6.8%	962		3,328	31.1%	91.5	19.5%	6.3		97.8	27.8%	326.4	22.1%
2009	2,356	-0.4%	1,700	76.7%	4,056	21.9%	113.3	23.8%	10.4	64.7%	123.7	26.5%	391.6	20.0%
2010	2,566	8.9%	2,414	42.0%	4,980	22.8%	133.2	17.6%	16.7	60.5%	150.0	21.2%	415.7	6.2%
2011	2,306	-10.1%	1,912	-20.8%	4,218	-15.3%	143.7	7.8%	7.8	-53.1%	151.5	1.0%	426.0	2.5%
2012	2,834	22.9%	2,460	28.7%	5,294	25.5%	168.7	17.4%	10.1	29.0%	178.8	18.0%	471.5	10.7%
2013	2,680	-5.4%	2,702	9.8%	5,382	1.7%	192.0	13.8%	12.9	27.2%	204.9	14.6%	239.6	-49.2%
2014	2,896	8.1%	3,302	22.2%	6,198	15.2%	189.5	-1.3%	17.4	35.0%	206.8	0.9%	171.0	-28.6%
2015	2,982	3.0%	3,266	-1.1%	6,248	0.8%	193.0	1.8%	19.0	9.4%	212.0	2.5%	246.6	44.2%
2016	3,232	8.4%	2,712	-17.0%	5,944	-4.9%	212.7	10.2%	16.4	-13.6%	229.2	8.1%	284.0	15.2%
2017	2,698	-16.5%	3,674	35.5%	6,372	7.2%	216.4	1.7%	30.3	84.7%	246.7	7.7%	326.1	14.8%
2018	2,754	2.1%	5,674	54.4%	8,428	32.3%	241.7	11.7%	33.5	10.4%	275.2	11.5%	241.7	-25.9%

Source: Airport Operation Department and General Directorate of Statistics



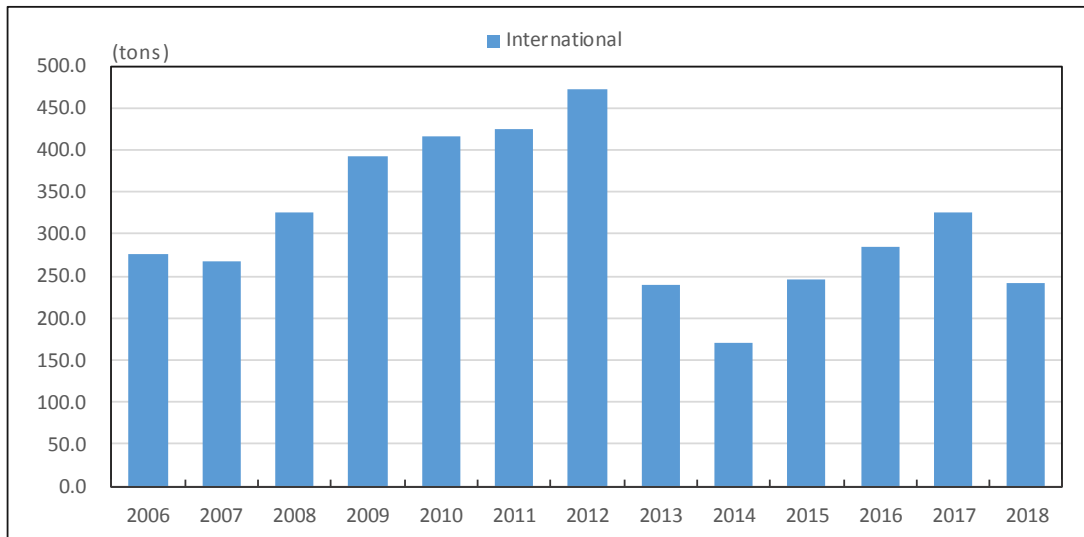
Source: Airport Operation Department and General Directorate of Statistics

Figure 1.1.1-2 Transition of Aviation Demand in Dili Int Airport (Aircraft Movements)



Source: Airport Operation Department and General Directorate of Statistics

Figure 1.1.1-3 Transition of Aviation Demand in Dili Int Airport (Passenger Number)



Source: Airport Operation Department and General Directorate of Statistics

Figure 1.1.1-4 Transition of Aviation Demand in Dili Int Airport (Cargo Volume)

The number of aircraft movements shows a growing trend and has reached 6,372 times in 2017. In terms of the international and domestic flights, both keep approximately 3,000 times, though a little fluctuation is observed.

The number of passengers is steadily growing with little fluctuation and has reached two hundred forty-six thousand in 2017 and the international passenger movements accounted for more than 90% of the total passengers.

After the volume of cargo significantly decreased after the peak of four hundred seventy tons in 2012, it is increasing after 2014 and reached three hundred twenty-six ton in 2017. The significant drop in 2013 is considered to be caused by the cease of UN Integrated Mission in Timor-Leste, UNMIT. In the recent five years, the volume of cargo for unloading accounted for larger volume over total handling volume of cargo.

Table 1.1.1-3 Transition of Cargo handling in the Past 5 Years

	Load		Unload		Total	
	tons	ratio	tons	ratio	tons	ratio
2013	30.2	12.6%	209.1	87.4%	239.3	100.0%
2014	64.1	37.5%	106.9	62.5%	171.0	100.0%
2015	21.7	8.8%	224.8	91.2%	246.6	100.0%
2016	31.1	11.0%	252.9	89.0%	284.0	100.0%
2017	144.3	44.3%	181.8	55.7%	326.1	100.0%

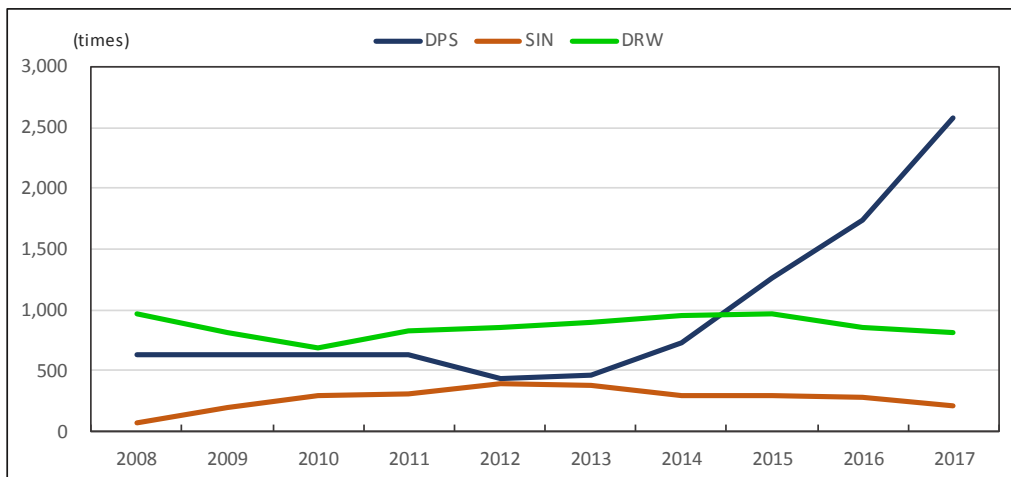
Source: General Directorate of Statistics

The transition of the number of international flights in the past 10 years is shown in the table below. Looking at the number by routes, the number of passengers on the Denpasar (DPS) route has been continually increasing after 2013, Singapore (SIN) and Drawing (DRW) are leveled or show slight decrease. In 2017, DPS is 2,583 time / year, SIN is 210 time / year and DRW is 814 time / year.

Table 1.1.1-4 Flight Status in the Past 10 Years by Routes

CY	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
South-Eastern Asia	696	830	922	936	835	854	1,024	1,563	2,020	2,793
CGK : Soekarno-Hatta					12	4				
DPS : Denpasar Bali	626	626	626	626	436	464	730	1,263	1,734	2,583
SIN : Singapore	70	204	296	310	387	386	294	300	286	210
Australia and New Zealand	962	821	682	834	857	904	952	966	856	814
DRW : Darwin	962	821	682	834	857	904	952	966	856	814
Total	1,658	1,651	1,604	1,770	1,692	1,758	1,976	2,529	2,876	3,607

Source: OAG Schedule Analyzer



Source: OAG Schedule Analyzer

Figure 1.1.1-5 Transition of International Regular Flight by Routes

Airline companies operating in Dili International Airport are shown in Table 1.1.1-5

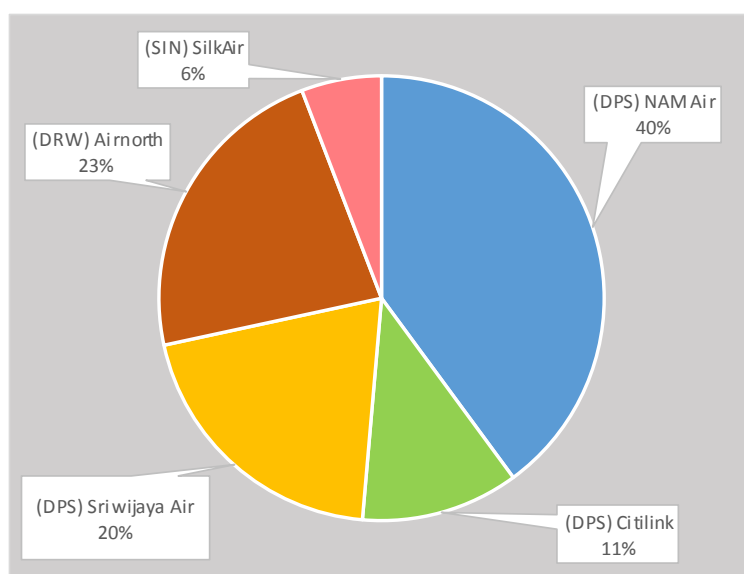
Singapore route used to be operated by Air Timor established by the travel agent in Timor-Leste and the aircraft was leased by Silk Air by Wet Lease. However, after 2015, Air Timor only deals with reservation and sale of tickets and operation is carried out by Silk Air. Practically, all flights in Dili International Airport are operated by foreign based airlines. In 2017 present, 5 airlines, NAM Air, Citilink, Indonesia, Sriwijaya Air, Silk Air (Air Timor) and Airnorth Regional, are operating in Dili International Airport and only Citilink Indonesia is categorized as Low Cost Carrier (LCC).

With regard to the number of aircraft movements by airline in 2017, NAM Air accounted for 40% (1,440 flights) of the total international flights, followed by Air north Regional 23% (814 flights) and Sriwijaya Air 20% (730 flights).

Table 1.1.1-5 Status of International Flight by Airlines

CY	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
CGK : Soekarno-Hatta					12	4				
Batavia Air					12	4				
DPS : Denpasar Bali	626	626	626	626	436	464	730	1,263	1,734	2,583
Batavia Air					72	26				
Garuda Indonesia								474		
NAM Air									370	1,440
Merpati Nusantara Airlines	626	626	626	626	364					
Citilink Indonesia								59	632	413
Sriwijaya Air						438	730	730	732	730
SIN : Singapore	70	204	296	310	387	386	294	300	286	210
SilkAir	70	204	208	310	306	272	294	300	286	210
Air Timor			88		81	114				
DRW : Darwin	962	821	682	834	857	904	952	966	856	814
Sky Air World		26								
Airnorth Regional	962	795	682	834	857	904	952	966	856	814
Total	1,658	1,651	1,604	1,770	1,692	1,758	1,976	2,529	2,876	3,607

Source: OAG Schedule Analyzer



Source: OAG Schedule Analyzer

Figure 1.1.1-6 Composition of International Flight by Airline (2017)

The types of aircraft for international regular flights are shown in the table below. Denpasar and Singapore routes are operated by small jet aircraft of B737 and A320, which has less than 200 seats. Darwin routes are operated by turbo prop or regional jet aircraft, which has less than 100 seats.

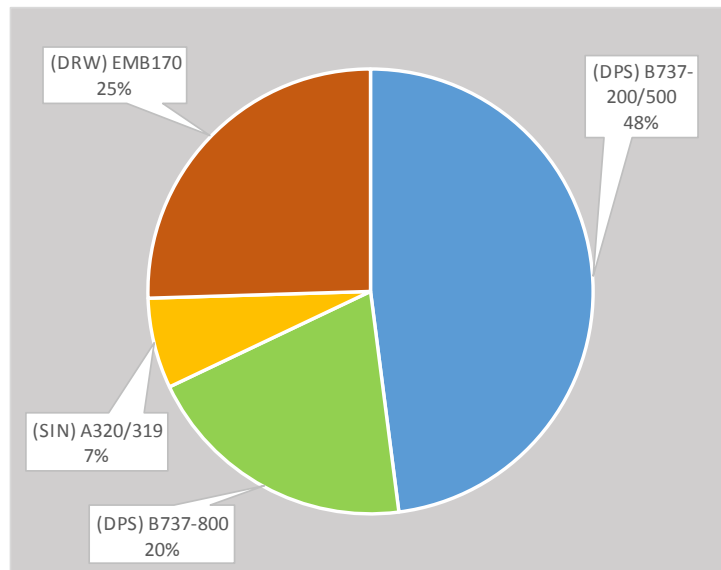
In 2017 present, Denpasar route is largely operated by B737-200 or 500, approximate seat number 199, accounting for 48% (1,532 flights). Darwin route is operated by EMB170, approximate seat number, 76, accounting for 25% (814 flight), Denpasar route by B737-800, approximate seat number 187, accounts for 20% (638 flight) and Singapore route by A320/319, approximate seat number 150/128, accounts for 7% (210 flight).

Table 1.1.1-6 Status of Type of Aircraft Operating in the Past 10 Years

CY	(times)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
CGK : Soekarno-Hatta					12	4					
B737 (122)					12	4					
DPS : Denpasar Bali	626	626	626	626	436	464	730	1,263	1,734	2,583	
A320 (180)								59	632	413	
B737-200/500 (119)	626	626	626	626	436	464	730	1,020	1,020	1,532	
B737-800 (187)									82	638	
CRJ1000 (96)								184			
SIN : Singapore	70	204	296	310	387	386	294	300	286	210	
A319 (128)	70	204	286	310	381	384	282	286	180	2	
A320 (150)			10		6	2	12	14	106	208	
DRW : Darwin	962	821	682	834	857	904	952	966	856	814	
EMB170 (76)		524	646	820	825	890	914	892	844	814	
EMB120 (30)	962	269	36	14	32	10	28	56	12		
ERJ135/145 (50)		26									
F70 (79)							10	6			
SA226/227 (19)		2				4		12			
Total	1,658	1,651	1,604	1,770	1,692	1,758	1,976	2,529	2,876	3,607	

note) (): Average number of available seats

Source: OAG Schedule Analyzer



Source: OAG Schedule Analyzer

Figure 1.1.1-7 Composition of International Flight by Type of Aircraft (2017)

Weekly flight schedule of international regular flight in March 2018 is shown in the figure below. All flights are inbound flights. The arrivals and departures are concentrated between 12:00 and 15:00 PM.

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Mon.							DRW	TL ERJ						SIN	MI A320		SIN								
												DPS	IN B735	DPS			DRW	TL ERJ							
												DPS	IN B735	DPS											
												DPS	QG A320	DPS											
Tue.												DPS	IN B735	DPS											
												DPS	IN B735	DPS											
												DPS	QG A320	DPS											
												DPS	SJ B738	DPS											
Wed.							DRW	TL ERJ					TL ERJ	DRW											
												DPS	IN B735	DPS											
												DPS	IN B735	DPS											
												DPS	QG A320	DPS											
Thu.							DRW	TL ERJ																	
												DPS	IN B735	DPS											
												DPS	IN B735	DPS											
												DPS	QG A320	DPS											
Fri.							DRW	TL ERJ																	
												DPS	IN B735	DPS											
												DPS	IN B735	DPS											
												DPS	QG A320	DPS											
Sat.							DRW	TL ERJ							SIN	MI A320		SIN							
												DPS	IN B735	DPS											
												DPS	IN B735	DPS											
												DPS	QG A320	DPS											
Sun.																									
												DPS	IN B735	DPS											
												DPS	IN B735	DPS											
												DPS	QG A320	DPS											

Source OAG

Figure 1.1.1-8 Weekly International Regular Flight by Day

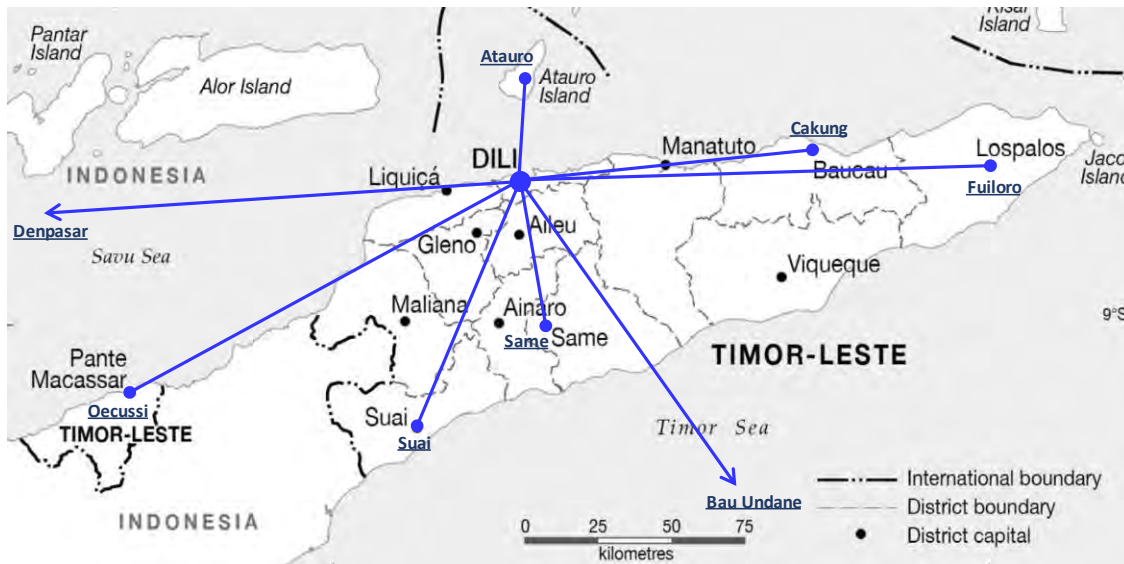
Flight status except international regular flight is shown in the table below.

As for the domestic routes, small aircraft such as DHC-6 are flying to Same, Atauro, Calung, Fuiloro, Oecussi, and Suai. In addition to that, helicopters are being operated to Bau Undane where oil field exists. There is chartered flight between Dili International Airport and Denpasar

Table 1.1.1-7 Flight Status of Dili International Airport Except Regular International Flight

Destination (IATA code)	Operator	Equipment	Number of Flights	Remarks
Same (WPSM)	MAF International	GippsAero GA8 Airvan	4	
Atauro (WPAT)	MAF International	GippsAero GA8 Airvan	3	
Cakung (WPEC)	MAF International	GippsAero GA8 Airvan	6	
Fuiloro (WPFL)	MAF International	GippsAero GA8 Airvan	6	
Oecussi (WPOC)	Kenn Borek Air	DHC-6 (Twin Otter)	8	
	MAF International	GippsAero GA8 Airvan	2	
		Subtotal	10	
Suai (WPDB)	MAF International	GippsAero GA8 Airvan	2	
Bau Undane (YBYU)	Babcock Offshore Services Australasia	Eurocopter	31	
		Sikorsky Helibus	13	
		Subtotal	44	
Dili (WPDL)	Babcock Offshore Services Australasia	Sikorsky Helibus	10	Local Flights
		Eurocopter	8	
	MAF International	GippsAero GA8 Airvan	2	
		Subtotal	20	
Denpasar (WADD)	Lankair Private	B737-500	10	Charter Flights
Total			105	

Source: Flightaware.com



Source: JICA Study team

Figure 1.1.1-9 Flight Status except International Regular Flight (April, 2018)

ZEEMS TL (Special Economic Zone for Social Market Economy of Timor-Leste) operates regular domestic flights to Oecussi and Suai with DHC-6, 6 round trips per week.

(3) Other Airports

In addition to Dili International Airport, there are eight local airports in Timor-Leste. Among them, development projects are ongoing in Oecussi and Suai airports. Baucau airport is operated as an international and alternative airport of Dili international airport. Other airports do not have facilities for jet aircraft operations. The location of each airport is shown in the figure below.

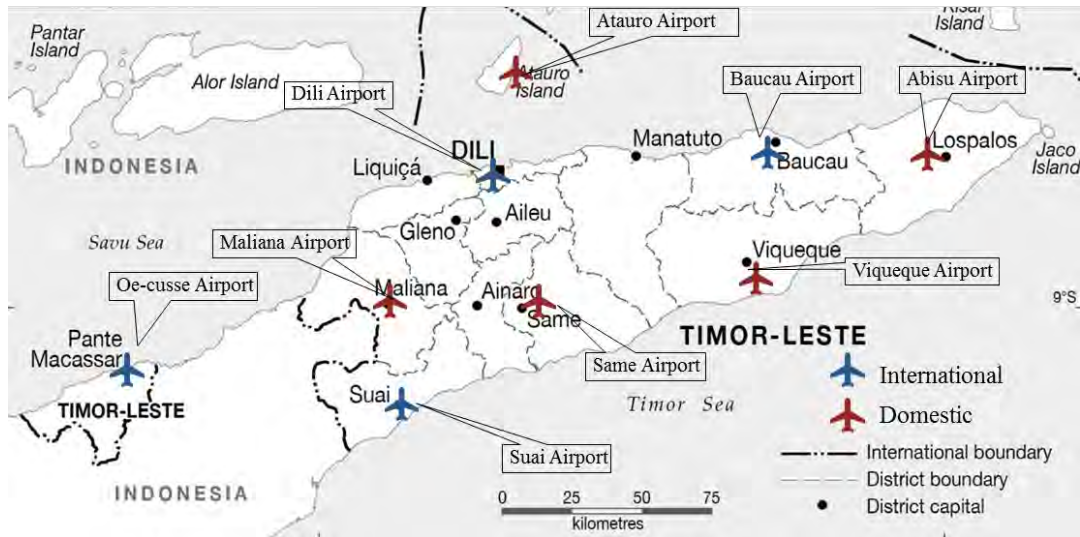


Figure 1.1.1-10 Location of Airport in Timor-Leste

Table 1.1.1-8 Description of Airport in Timor-Leste

No	Airport	Description
1	Dili International Airport	The facilities are aging and deteriorating. The capacity of passenger terminal building is not enough for growing demands. Some facilities do not meet international standards in terms of the service level and safety and need to be improved.
2	Baucau Airport	International airport and alternative airport of Dili International Airport, having 2500m long runway and airbase is located
3	Oe-cusse Ambeno Airport	Improvement of existing facilities is ongoing and will be completed by 2019. The airport has regular domestic flights and will be operated as an international airport upon completion of the Project.
4	Suai Airport	Improvement of existing facilities is completed in 2018 and will be operated as an international airport. The airport is a base for transportation to the oil field in the southern part of the country.
5	Maliana Airport	Local airports with less than 100m runway, no scheduled flights, only has charter and emergency transportation flights
6	Same Airport	
7	Atauro Airport	
8	Abisu Airport	
9	Viqueque Airport	

Source: JICA Study team

(4) Aviation Sector Authority

Relevant authorities of aviation sector in Timor-Leste are ANATL and Civil Aviation Authority of Timor Leste (AACTL). Both are independent authority and their supervisory authority is the Ministry of Transport and Communications (MTC). ANATL is responsible for airport operations and development as well as air traffic control. AACTL is a regulatory body of aviation sector responsible for aviation safety and security.

1.1.2 Development Plan of Timor Leste

(1) National Strategic Development Plan of Timor Leste 2011-2030

Chapter 3 of Timor Leste Strategic Development Plan 2011-2030 (SDP) emphasizes the importance of expansion of Dili international airport and describes that Timor Leste plans to develop air network by construction and improvement of local airports in the country.

The development plan notes that lack of capacity to handle passenger is regarded as issues in Dili International airport and that it will handle one million passengers by extension of runway and construction of new passenger terminal building. Runway extension is planned to accommodate large jet aircraft such as A330 by extending runway up to 2,500m across Comoro River and widening runway up to 45m. Modern passenger terminal operation is expected to be realized in order to promote tourism industry through the airport construction

(2) Dili Urban Master Plan Project

Dili urban master plan (October 2017 JICA) points out that Dili international airport does not meet an international standard because of the small passenger terminal building and shortage of runway length and it has issues to be solved in terms of security and safety. It says that improvement of capacity and safety of airport facilities is necessary. Development of Dili international airport will contribute to one of the pillars of Dili urban vision 2030, realizing hub for robust economy. It also sets making the airport see and conform as one of the development policies in order to meet ICAO standards and practices and satisfies an appropriate service level set by IATA manual. It recommends that the development is divided into two phases, the phase one is for short term and the phase two is for long term. The phase one is expected to be between 2019 and 2021 and its cost is estimated to be US\$ one hundred million-

(3) National Civil Aviation Policy

National Civil Aviation Policy approved in June 2017 advocates that the development of infrastructure is one of the important factors to promote civil aviation in Timor-Leste. In this policy, understanding that SDP identifies the level of Dili international airport is lower than the standard and needs to construct new passenger terminal building and extend runway in order to promote tourism, the provision of runway end safety area is given the highest priority. In addition to that, the policy also says that the government of Timor-Leste supports extension of runway, construction of taxiway, apron, cargo terminal building and navigation aids facilities according to the master plan.

(4) ANATL's Airport Development Plans

Above all, ANATL understands the followings shall be the higher priorities.

- 1) Extension of runway to 2,150m and development of runway light and runway end safety area;
- 2) Construction of the passenger terminal building and other terminal facilities.

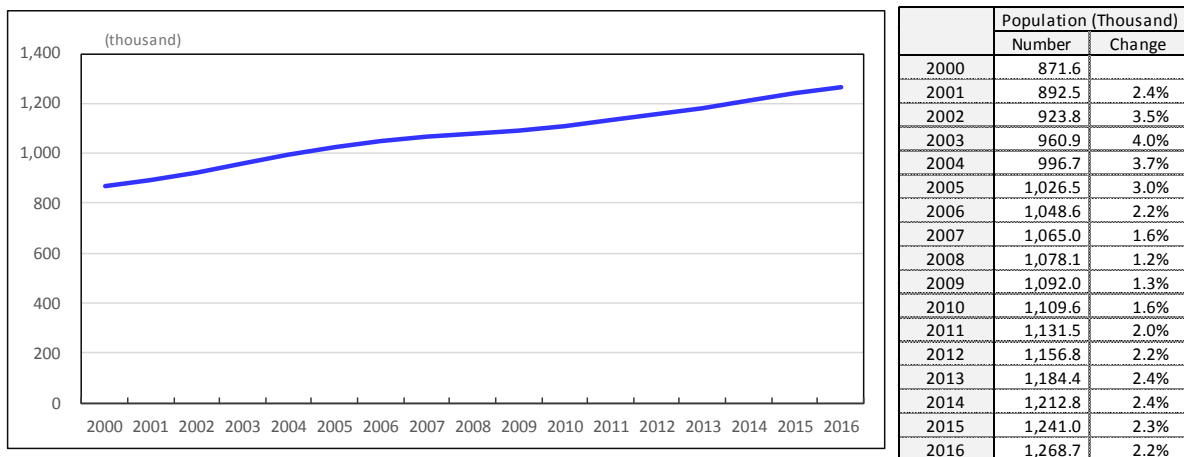
ANATL plans to implement the item 1 above with finance from the government of Timor-Leste and item 2 with Japanese grant aid. ANATL also understands the importance of master plan for the balanced development of the airport and requests assistance for preparation of the master plan in addition to the construction of facilities.

The government of Timor-Leste plans to extend the runway to 2,500m beyond Comoro River in order to accommodate large jet aircraft such as A330. However, details have not been studied on how to construct the runway and runway strip beyond the river. In addition, there are a lot of issues to be solved such as land acquisition and resettlement. Technical, economical, and social and environmental studies are required, and concrete plan has not been yet developed.

1.1.3 Social and Economical Situations

(1) Population

Transition of population between 2000 and 2016 in Timor-Leste is summarized in the table below. Between 2000 and 2016, the population steadily increases by 2.4% in each year and reached one million twenty-seven hundred thousand.



Source: General Directorate of Statistics

Figure 1.1.3-1 Transition of Population in Timor Leste

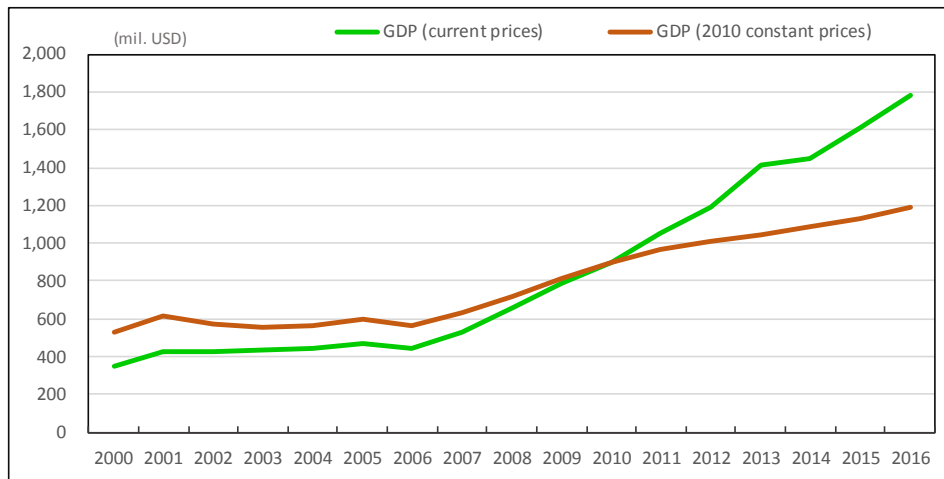
(2) GDP

GDP of Timor-Leste between 2000 and 2016 is summarized in the table below. GDP steadily increases by 5.2% in average and reached US\$ one thousand and ninety hundred million-. Per capita GDP also increases by 2.8% in average every year.

Table 1.1.3-1 Transition of GDP (Non-oil) in Timor Leste

	GDP (Million USD)				GDP per Capita (USD)			
	Current Price		2010 Constant Price		Current Price		2010 Constant Price	
	Value	Change	Value	Change	Value	Change	Value	Change
2000	350.4		525.5		402.0		603.0	
2001	429.6	22.6%	611.3	16.3%	481.3	19.7%	684.9	13.6%
2002	422.9	-1.5%	570.5	-6.7%	457.8	-4.9%	617.5	-9.8%
2003	430.5	1.8%	557.9	-2.2%	448.1	-2.1%	580.6	-6.0%
2004	442.9	2.9%	563.5	1.0%	444.3	-0.8%	565.3	-2.6%
2005	466.6	5.4%	600.0	6.5%	454.6	2.3%	584.5	3.4%
2006	440.0	-5.7%	564.9	-5.9%	419.6	-7.7%	538.7	-7.8%
2007	531.3	20.7%	629.5	11.4%	498.8	18.9%	591.1	9.7%
2008	659.6	24.2%	718.8	14.2%	611.8	22.6%	666.7	12.8%
2009	786.0	19.2%	812.2	13.0%	719.7	17.6%	743.8	11.6%
2010	894.4	13.8%	894.4	10.1%	806.1	12.0%	806.1	8.4%
2011	1,053.5	17.8%	965.4	7.9%	931.0	15.5%	853.2	5.8%
2012	1,188.9	12.9%	1,013.8	5.0%	1,027.8	10.4%	876.4	2.7%
2013	1,410.0	18.6%	1,040.5	2.6%	1,190.5	15.8%	878.6	0.2%
2014	1,450.6	2.9%	1,083.2	4.1%	1,196.1	0.5%	893.1	1.7%
2015	1,606.5	10.7%	1,126.5	4.0%	1,294.5	8.2%	907.8	1.6%
2016	1,783.0	11.0%	1,186.2	5.3%	1,405.4	8.6%	935.0	3.0%

Source: World Development Indicators (World Bank, Mar. 2018), Timor-Leste Economic Report (World Bank, Mar. 2018) and Global Economic Prospects (World Bank, Jan. 2018)



Source: World Development Indicators (World Bank, Mar. 2018), Timor-Leste Economic Report (World Bank, Mar. 2018) and Global Economic Prospects (World Bank, Jan. 2018)

Figure 1.1.3-2 Transition of GDP in Timor Leste (Non-oil)

In Timor-Leste, there are two statistics, one for GDP including Oil and the other for GDP excluding Oil, given that the main industry is development of oil and natural gas.

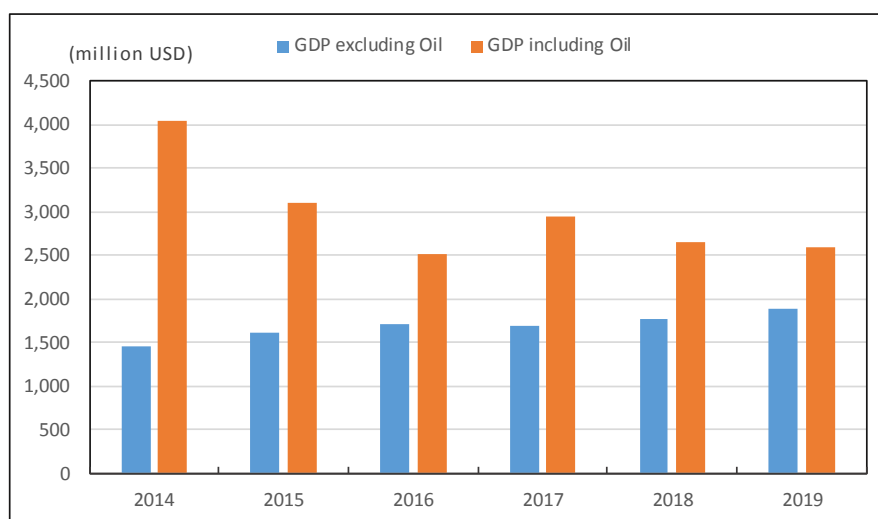
Looking at the statistics by the World Bank, while GDP excluding Oil shows relatively steady increase, GDP including Oil shows a large fluctuation. This is caused by the changes in oil price and volume of oil and gas excavated. It is predicted that the gap in proportion between GDP including Oil and GDP excluding Oil is reduced in the future. GDP excluding Oil is expected to grow. One the other hand, GDP including Oil will experience negative growth.

In this project, GDP excluding Oil is adopted because it is difficult to predict development trend of oil and gas industry and it is unlikely that aviation demands are affected by the decrease in recent GDP including Oil due to strong increase in aviation demands. GDP excluding Oil is adopted in the following aviation forecast study.

Table 1.1.3-2 Comparison between GDP including Oil and GDP excluding Oil

	Year	GDP excluding Oil (Million USD)		GDP including Oil (Million USD)	
		Value	Change	Value	Change
Actual	2014	1,454		4,045	
	2015	1,609	10.7%	3,104	-23.3%
	2016	1,702	5.8%	2,521	-18.8%
Projection	2017	1,688	-0.8%	2,955	17.2%
Forecast	2018	1,760	4.3%	2,660	-10.0%
	2019	1,888	7.3%	2,594	-2.5%

Source: Timor-Leste Economic Report (World Bank, Mar. 2018)



Source: Timor-Leste Economic Report (World Bank, Mar. 2018)

Figure 1.1.3-3 Transition between GDP including Oil and GDP excluding Oil

1.2 Need of the Project and Requested Project Components from Timor-Leste Side

The Democratic Republic of Timor Leste is in the east side of Timor Island, which lies in an east side of Indonesia, in the midway of Sulawesi, New Guinea islands and Australia. The country has one million sixteen hundred thousand population and is an island country. The infrastructure is poor due to the turmoil after the independent and maintenance capacity has not been accumulated.

Dili International Airport is in the capital of Timor-Leste and has airline routes and international regular flights to Indonesia, Australia and Singapore. The current number of annual passengers is two hundred thirty thousand per year. The airport also has domestic routes and regular flight to Oecussi and Suai.

Dili international airport does not meet the required standards set by ICAO in basic facilities of the airport such as runway end safety area and runway strip. Urgent need for improving safety is recognized. The airport also has restriction due to the short runway length of 1,850m. Depending on the types of aircraft, it cannot operate with its maximum take-off weight and due to malfunction of airfield ground lighting, night operation is also restricted.

Dili International Airport used to be one of the local airports in Indonesia. The design of passenger terminal building is for domestic purpose and its size is small. International flight

facilities such as customs, immigration and quarantine (hereinafter referred to as “CIQ”) are in a part of the building, the facilities are not able to handle growing demands and the service level stays low. Air traffic tower was built more than 35 years ago and is getting older. Height of the air traffic control tower is not high enough to observe the runway end at the east side by air traffic controllers. There is a safety issue to be solved.

Improvement of Dili international airport is proposed in Dili urban master plan project (June 2016) funded by JICA. The government of Timor-Leste also recognizes the need to significant improvement of the airport.

To deal with this situation, the government of Timor-Leste through ANATL requested the grant aid project to the government of Japan. The components requested are summarized in the table below.

Table 1.1.3 Requested Component

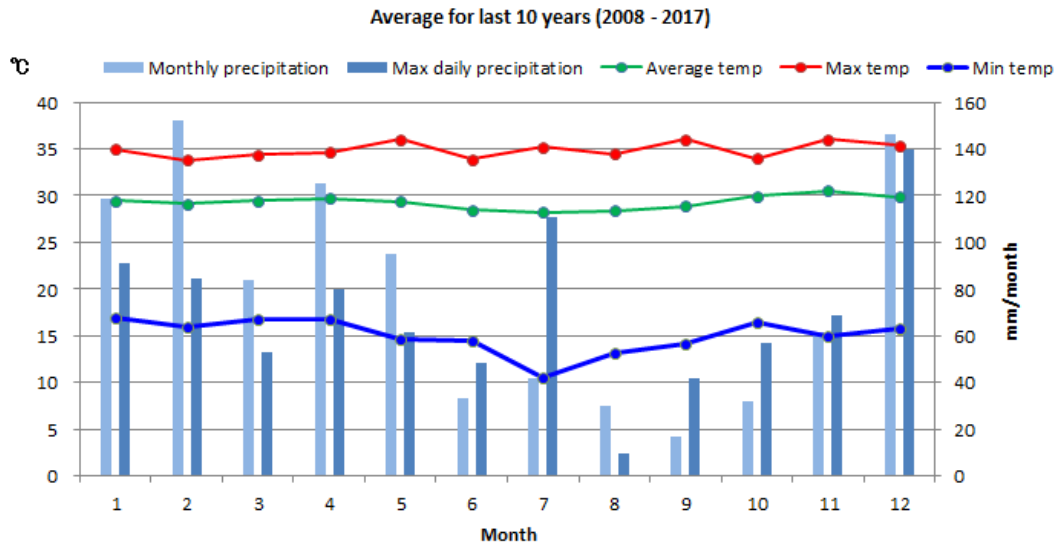
	Component	Size
1	International Passenger Terminal Building	Floor area: 7,000-8,000m2
2	International Cargo Terminal Building	Floor area: 600m2
3	Apron	B737/A320 class: 4 stands
4	Taxiway	-
5	Apron flood light, taxiway light	-
6	Access Road and Car Park	Approximately 300 parking spaces
7	Air traffic tower	Including air traffic control equipment

Source: JICA Study team

1.3 Natural Environments and Natural Condition Survey

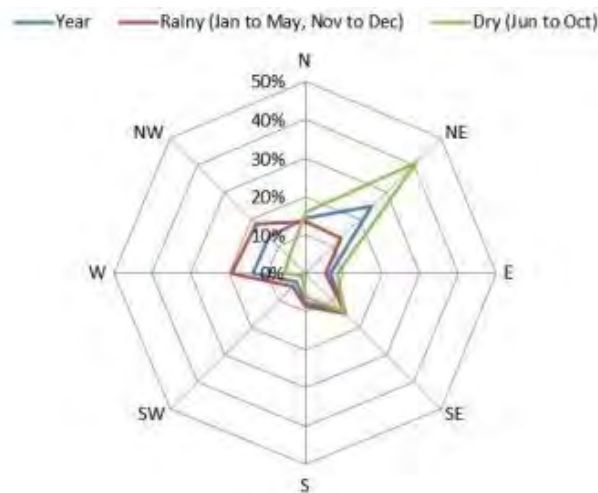
(1) Weather

Weather observation system is installed at the east side of the airport premise and observes temperature, humidity, pressure, amount of isolation, rainfalls, wind direction and velocity. The following figure shows the statistical results of the past 10 years, between 2008 and 2017. According to the result, the average annual temperature is almost flat and remains roughly around 30 degree Celsius. The highest temperature is around 35 degree Celsius and the lowest temperature is around 15 degree Celsius. The amount of rainfall increases from November to May which is regarded as rainy season. The rest of the year from June to October is dry season. About the wind direction, north east wind is prevailing throughout the year, and, during the dry season, the tendency reveals strongly.



Source: National Directorate of Meteorology

Figure 1.1.3-1 Weather data in the Past 10 Years (2008 - 2017)



Source: National Directorate of Meteorology

Figure 1.1.3-2 Wind Direction and Velocity in the Past 10 years (2008-2017)

(2) Topography and Soil Conditions

1) Topographic Survey

The area of topographic survey conducted during the preparatory survey period is shown in the following table and figure.

Table 1.1.3-1 Area of Topographic Survey

Item	Area	Quantity
Plane table survey	International terminal area, taxiway, apron, parking and access road	300,000m ²
Longitudinal traverse measurement	Taxiway	550m x 50m

Source: JICA Study team



Source: JICA Study team

Figure 1.1.3-3 Area of Topographic Survey

a) Method of Survey

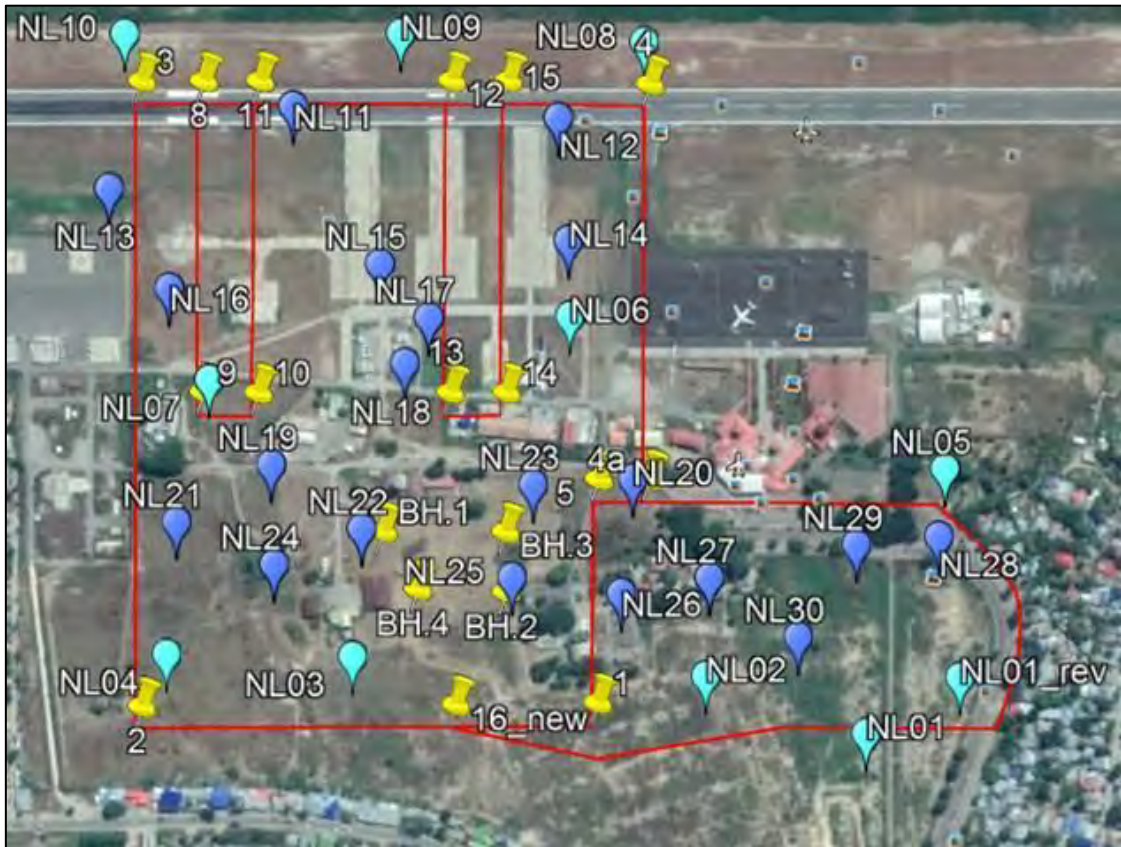
All geographic data outputs have the coordinates with elevations referred to the Height of DIL0202 obtained from Geodesy and Boundary Delimitation Department, Directorate of Land Property and Cadastral Services.

Moreover, benchmark control points for use in the project and future use were established.

i) Horizontal control point

Horizontal control survey was carried out for obtaining the horizontal coordinates of control points from the concomitant using Total station and Global Positioning System (GPS) Equipment. The control points were surveyed using dual frequency GPS receivers working on a static mode with at least 5 tracking satellites.

A closed-loop and double set-up method was used for the leveling survey to obtain the elevations of GCPs. All outputs have been mentioned in metric unit. All measuring of angles and distances have been done by double set-up method. Each Outputs data was observed by two times average.



Source: JICA Study team

Figure 1.1.3-4 The area of interest for the project is shown

ii) Installation of ground control points

All elevation data outputs have given referred to Optometric Height of DIL0202 existing in the airport. Closed traverse survey and leveling started from a benchmark (DIL0202), connected to benchmark (4-080504-00367) using double set-up method. Outputs data by double survey have been averaged out.

Ten (10) concrete monuments for Benchmark control points for use in the project and future use were established.

b) Topographic Survey Plan

The topographic survey was conducted using all points gathered with 0.1m supplementary contour interval, 0.5m minor contour interval and 1.0m major contour interval. Buildings and other features were digitized using the points measured from the fieldwork.

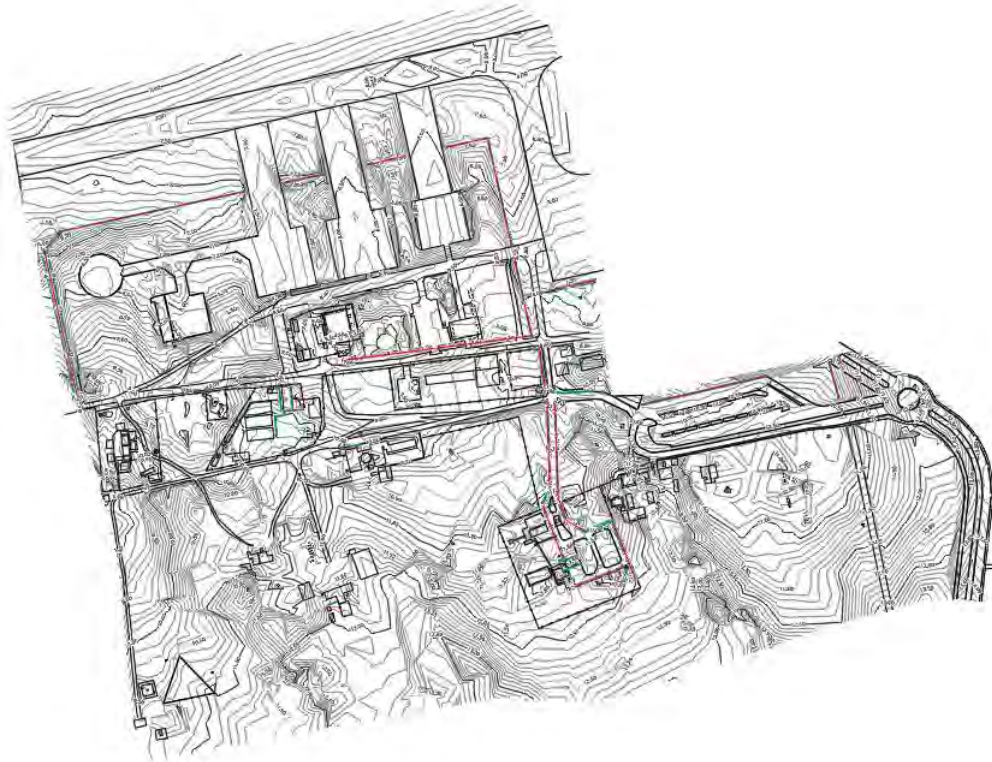
Existing drainages ditches and canals were also measured in terms of the existing drainage pattern and water flow on site. Since the stream were not visible due to dry season, the drainage pattern was examined using water flow command in AutoCAD. The layout of the existing drainage pattern is shown in Figure Figure2-2-2.3c The existing drainage ditches and canals are illustrated.

The Base line was set out in parallel with the existing runway.

c) Ground Survey (Contours)

- Contours drawings are included with following items
- Layout of Ground control points
- Elevations for existing buildings and objects in the project area

The existing drainages ditches and canals observed in terms of their drainage pattern and water flow in the CAD drawing.



Source: JICA Study team

Figure 1.1.3-5 Existing drainage ditches and canals

d) List of survey equipment

Survey equipment

- | | |
|--|---------|
| • Spectra Precision Focus8 Total Station | 2 units |
| • Leica Sprinter 250m Digital Level | 2 units |

e) Survey Result

i) Horizontal and Vertical Control Points

Reference Stations

Horizontal Control (GCP): DIL0202 and 4-080504-00367

Vertical Control (BM): DIL0202

Reference Stations are Dili Airport Horizontal and Vertical Control Reference Used

GCP Vertical & Horizontal DIL202 and 4-080504-00367

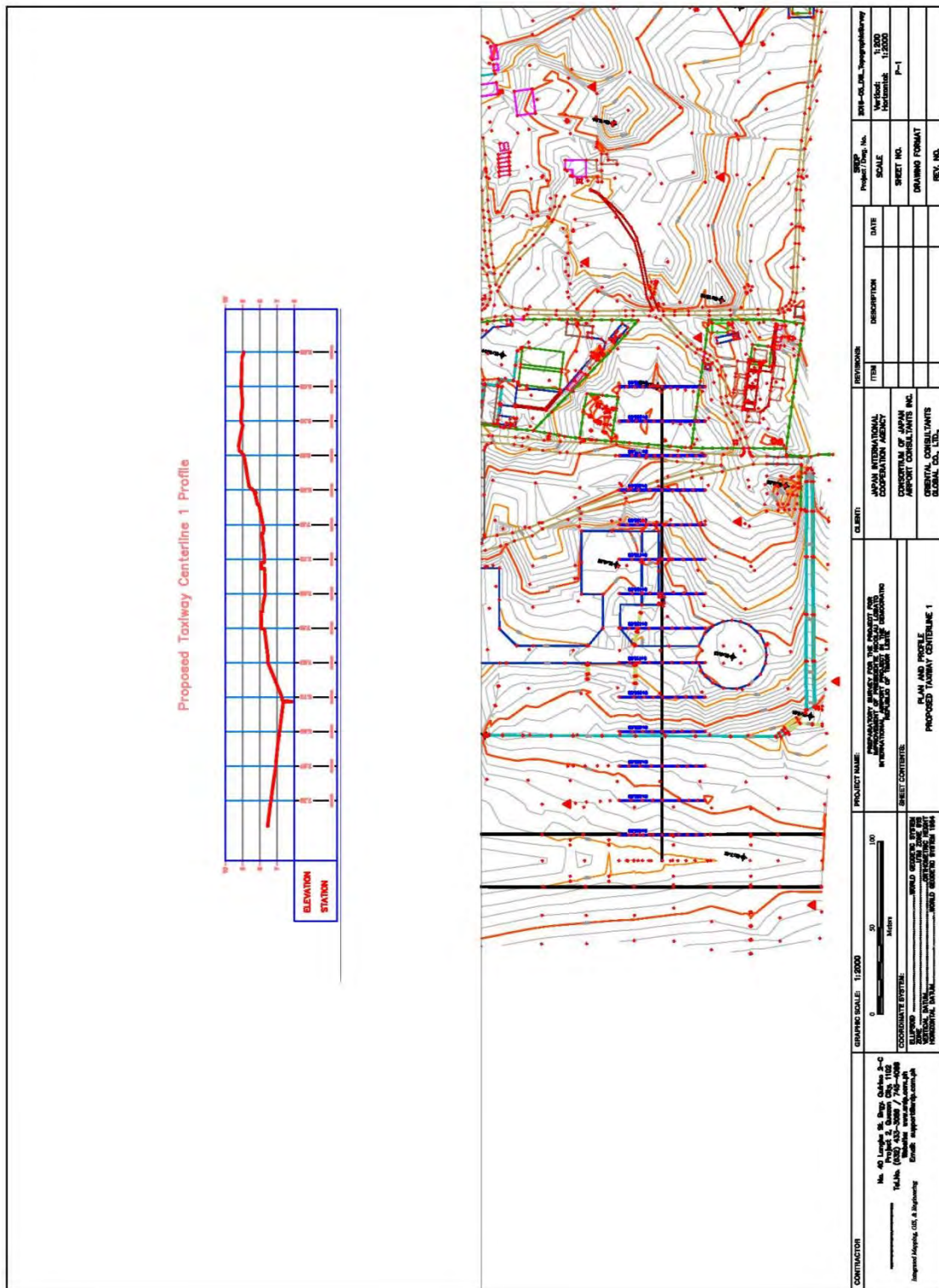
GCP Vertical DIL0202

Table-1-3.2 Dili Airport Horizontal and Vertical Control Reference Used

DIL10202	4-080504-00367
	
	
Northing: 9053154.573	Northing: 9053655.187
Easting: 776076.896	Easting: 778173.625
Ortho Height EL=4.620	

Source: JICA Study team

ii) Cross Section and Centerline Profile Survey of the Proposed Taxiways
 The proposed taxiway plan and cross section are shown in Figure 1.1.3-6.

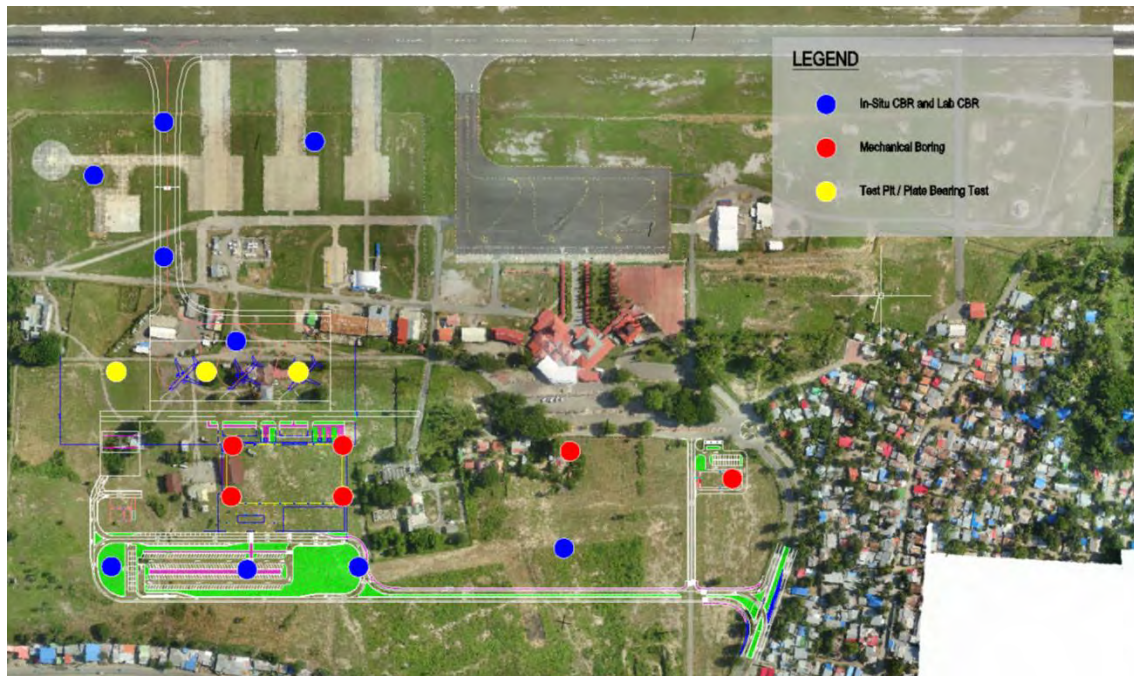


Source: JICA Study team

Figure 1.1.3-6 Plan and cross section for proposed taxiway

2) Soil Investigation

The overview of the soil investigation is shown by the figure below. During the preparatory survey, examinations are conducted for 6 borehole and In-Situ CBR and Labo CBR tests are conducted for taxiway, apron, parking and access road in 4 locations. Plate bearing tests are conducted in 3 locations for the apron area.



Source: JICA Study team

Figure 1.1.3-7 Location of Soil Investigation

The results of the soil investigation are included in the attachment of the report.

3) Disaster Situation

a) Flood

Dili international airport is located at the downstream of Comoro River and belongs to the area is subject to the risk of flood. Most part of the land in Timor-Leste is mountainous and Dili is located downside of steep terrain. Therefore, there are possibilities that the flood will occur during the rainy season. The following map shows the area where flood risks exist in Timor-Leste

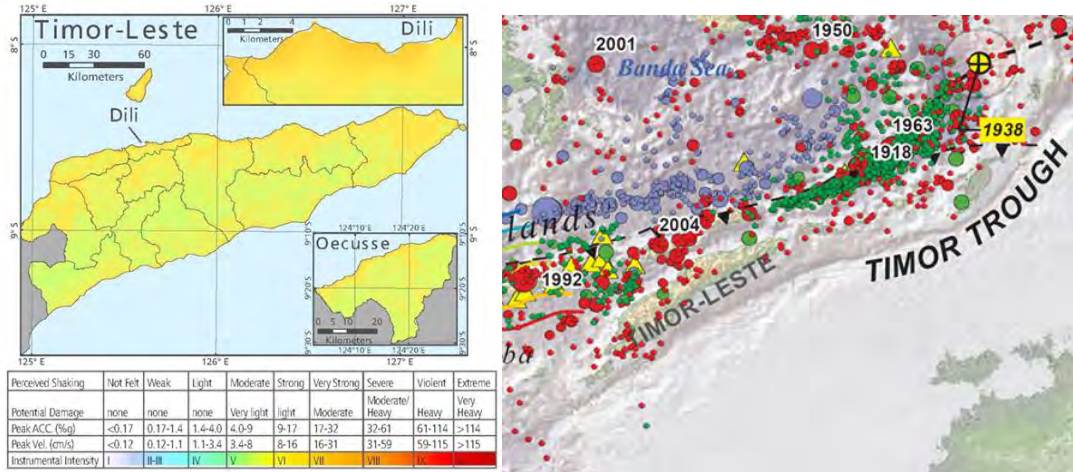


Source: UN Office for the Coordination of Humanitarian Affairs (OCHA)
 Figure 1.1.3-8 Flood Risk Map

b) Earthquake

Timor-Leste lies on the Pacific Ocean volcanic belt, where volcanic activities are active and there are risks of earthquake. According to the record, an earthquake with magnitude 6.9 occurred in 1995 and caused 11 casualties and in 2011 an earthquake with magnitude 5.6 occurred in the suburbs of Dili.

According to the study of the Pacific Islands Applied Geoscience Commission (SOPAC), it is predicted that an earthquake with magnitude between 5.0 and 5.9 will occur in the next 40 years with more than 40% probability.



Source: The Pacific Islands Applied Geoscience Commission (SOPAC)
 Figure 1.1.3-9 Earthquake Risk Map

1.4 Environment and Social Consideration

1.4.1 Environmental Impact Assessment

(1) Project Component

The project component is as below.

1) Common items

- Partial removal of concrete pavement on existing runway
- Complete removal of asphalt pavement on existing access road
- Removal of rainfall drainage across new runway
- Dismantle and removal of existing aviation control tower, attached building and electric power substation
- Installment and removal of temporary yard and road for the project construction

2) Construction of building facilities

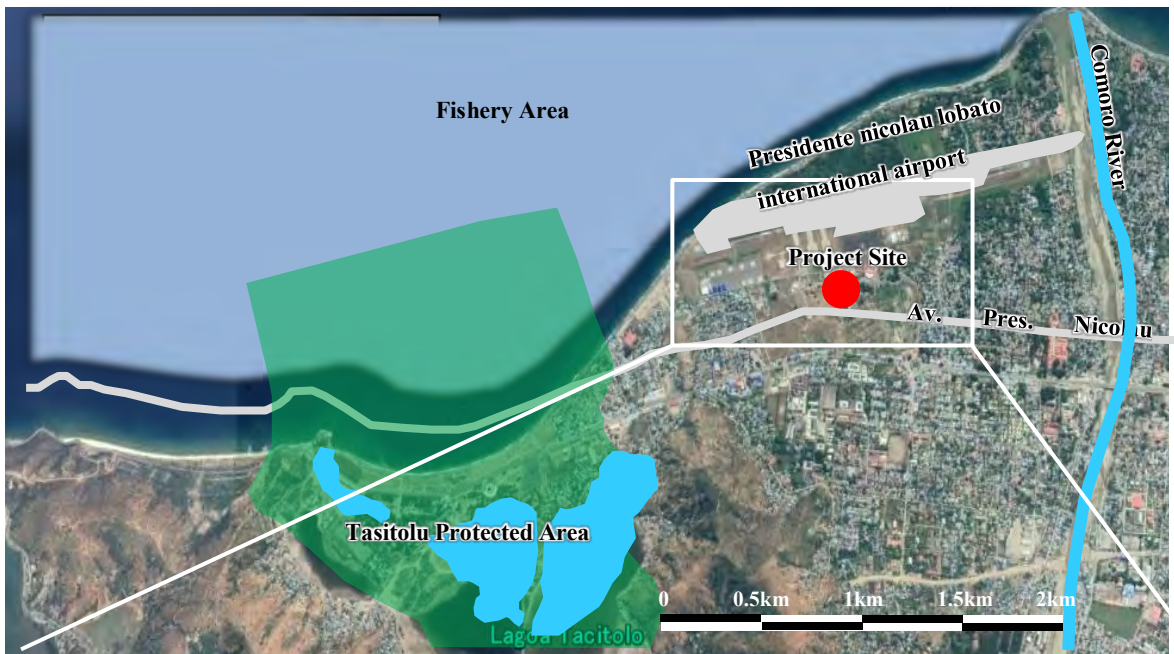
- New international passenger terminal
- New international cargo terminal
- Aviation Control Tower
- Electric power substation

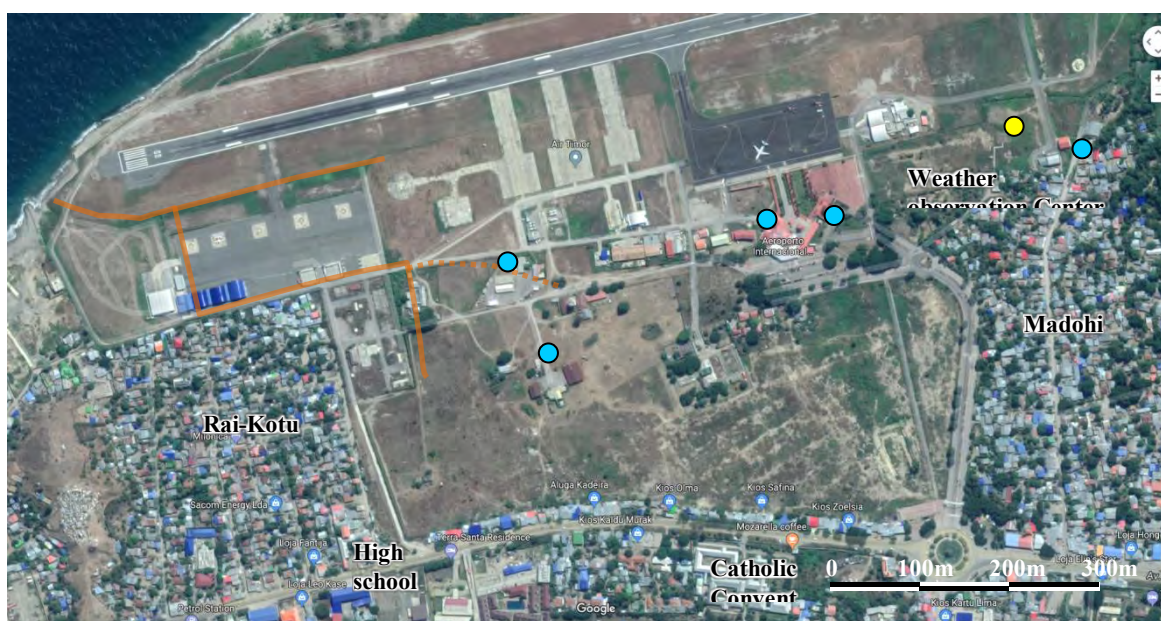
3) Construction of civil engineering facilities

- Runway
- Parking apron for international flight
- Access road and car parking area

(2) Baseline Environmental and Social Conditions

The Project site is on the ground of Presidente Nicolau Lobato International Airport owned by ANATL as below.





Source: JICA Study team

Figure 1.4.1-1 Overview of Construction Site

The project site is located between two communities; Madohi and Rai-Kotu in Dom Aleixo sub district as following, which are governed by Dili Municipality. According to the result of Census implemented in 2015, population around the project site is approximately 130,000 persons and population density is 5,017.9 persons /km². The international airport, located in the suburbs of Dili within 15 minutes by car, faces the sea on the north and residential area on the south.

Table 1.4.1-1 Social condition at Dom Aleixo sub district

Item	Unit	Figure
Population		
Male	Person	67,646
Female		62,449
Total		130,095
Sex ratio (for female)	%	108.3
Median age	Age	21.2
Broad Age groups (0 - 14)	Person	44,225
Broad Age groups (15 - 59)		82,575
Broad Age groups (60 -)		3,295
Dependency Ratio (15 - 59)	%	57.55
Land area	km ²	25.9
Population Density	person /km ²	5017.9
Orphan hood (Mother deceased)	%	1.3

Item	Unit	Figure
Orphan hood (Father deceased)		3.1
Orphan hood (Both deceased)		0.4
Childbirth certification	%	38.9
Private Households	House hold	20,579
Average Households size	Person	6.3
Labor Force		
Male		54.9
Female	%	33.3
Total		44.6
Employment		
Male		47.6
Female	%	29.4
Total		39.7
Gross Enrollment Rate (Primary School)		
Male		108.0
Female	%	107.3
Total		107.7
Gross Enrollment Rate (Primary School)		
Male		142.6
Female	%	131.9
Total		137.2
Literacy Rate		
Male		95.8
Female	%	95.8
Total		95.8
Persons Living with Disabilities		
Walking		0.4
Seeing		0.5
Hearing	%	0.2
Intellectual/ Mental		0.2
All		0.9
Main Source of Energy for Cooking for Private Households		

Item	Unit	Figure
Clean energy	%	41.6
Kerosene		19.7
Wood		36.4
Sanitation and Safe sources		
Households using improved sanitation facilities	%	85.5
Access of private households to improve or safe sources of drinking water		97.0
Use of improved sanitation facilities by private households		97.3
Crop and Livestock		
Private households engaged in crop production	%	18.9
Private households engaged in livestock rearing		50.2

Source: 2015 Timor-Leste Population and Housing census

The surrounding conditions of the construction site are summarized in the table below. Comoro River is running at the east side of the airport and the sea is in the north side. A national road runs in the south side of the airport and the residential area is located in the west side of the airport. Therefore there is little space to expand. There is a relatively large area in the south part of the airport premise and the area is suitable for the Project.

Table 1.4.1-2 Surrounding Condition of the Project Site

Item	Remarks
i. Watercourses and water bodies	
Watercourses	Comoro River at 1km distance to east from the project site
Water bodies	Tasitolu Protected Area at 1.5km distance to south west from the project site
ii. Linear and transport components	
Airport	Presidente Nicolau Lobato International Airport
Road	Av. Presidente. Nicolau Lobato
iii. Other features of existing or past land use	
Cultural or sacred site	No exist
Commercial development	No exist
Houses	There are some residential houses along Av. Nicolau Lobato which are located at out of the project site.
Residential Areas	Eastern area: Madohi village Western area: Rai-Kotu village

Item	Remarks
Industrial facilities	Not exist
Sensitive receptors	A high school at Rai-Kotu A Catholic convent at southern area. (See Table 3 as below) Hospital is not existed
iv. Community lands and nearby communities	Eastern area: Madohi village Western area: Rai-Kotu village
v. National parks, protected area etc. or other environmentally sensitive areas	National Parks: Not exist Protected Area assigned by United Nations: Tasitolu Protected Area at 1km distance to west from the project site Community managed reserves or grounds: Not exist Habitats of species that require special protection: Not exist Other environmentally sensitive areas: Not exist
vi. Fisheries and fishing areas	The offshore area from Beto Tasi to Tasitolu
vii. Hunting areas	No exist

Source: JICA Study team

(3) Regulations and Organizations related to Environmental and Social Considerations

1) Government agency related to Environmental and Social Considerations

National Directorate of Pollution Control and Environmental Impact (hereinafter referred to as the “NDPCEI”), Ministry of Development and Institutional Reform has a responsibility for Environmental and Social considerations in Timor-Leste, which is in charge of receiving of Project Document, implementation of Screening, Scoping and Environmental Impact Assessment, Revision of Environmental Management Plan (hereinafter referred to as the “EMP”), Issue of Environmental Certification etc. The table below explains the related agencies for Environmental and Social consideration and their roles.

Table 1.4.1-3 The roles of related agencies for Environmental and Social consideration

Implementation Body	Role
ANATL	<ul style="list-style-type: none"> To implement overall procedure related to Environmental and Social consideration as a Project Proponent. To prepare and submit Project Document, Simplified Environmental Impact Statement (SEIS) and Environmental Management Plan. To hold Stakeholder meeting and Public consultation as needed. To prepare and implement Environmental Monitoring Plan
NDPCEI	<ul style="list-style-type: none"> To classify Environmental category for the Project To review SEIS and EMP

Implementation Body	Role
	<ul style="list-style-type: none"> • To issue Environmental Certificate • To supervise and support Environmental Monitoring implemented by ANATL

Source: JICA Study team

2) Environmental and Social consideration system in Timor-Leste

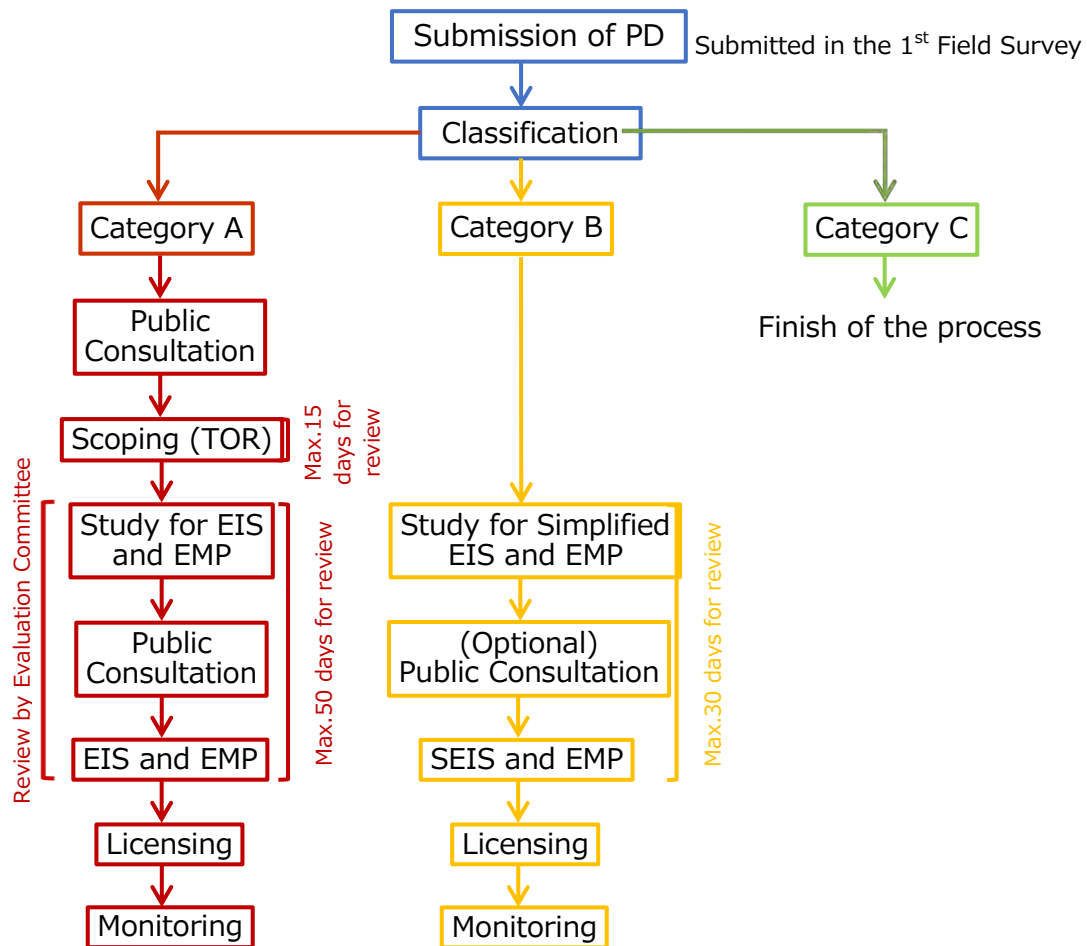
A table below indicates the Laws and regulations regarding Environmental and Social considerations in Timor-Leste. Environmental Licensing Law enacted in 2011 provides the EIA procedure in Timor-Leste and 8 regulations and guidelines as below also provide preparation of SEIS and EMP and holding of Public Consultation Meeting and Evaluation Committee.

Table 1.4.1-4 Law and Regulation regarding Environmental Impact Assessment in Timor-Leste

Constitution
Constitution of Timor-Leste
Law
Decree Law No.26/2012 “Environmental Basic Law”
Decree Law No.5/2011 “Environmental Licensing Law”
Regulation
Guidelines on the Detailed Requirements for the Terms of Reference, Environmental Impact Statements and Environmental Management Plans for Environmental Assessment
Regulation on the Detailed Requirements for the Terms of Reference, Environmental Impact Statements and Environmental Management Plan for Environmental Assessment
Regulation on the Public Consultation Procedures and Requirements During the Environmental Assessment Process
Guidelines on the Public Consultation Procedures and Requirements During the Environmental Assessment Process
Regulation on the status and rules of procedures for the Evaluation Committee for managing the environmental assessment procedure for Category A projects
Guidelines on the status and rules of Procedures for the Evaluation Committee for managing the environmental assessment procedure for Category A projects
Regulation on Impact and Benefits Agreements
Guidelines on Impacts and Benefits Agreements

Source: NDPCEI

Since NDPCEI which has responsibility for EIA procedure in Timor-Leste has stipulated the EIA flow, the project proponent must follow the procedure in order to acquire the Environmental Compliance Certificate (hereinafter referred to as the “ECC”). After submission of Project Document (hereinafter referred to as the “PD”) and Application form for ECC, NDPCEI evaluates them and classifies the EIA category for the project. The flow chart is shown as below.



Source: NDPCEI

Figure 1.4.1-2 Flow Diagram of the EIA process in Timor-Leste

The EIA process in Timor-Leste is classified into three categories as below;

Category A is the project which may potentially cause significant adverse impacts,

Category B is the project which may cause some adverse impacts,

Category C is the project which likely to cause negligible impacts.

According to the Decree Law No.5/2011 “Environmental Licensing”, the project is categorized as “B” from the following considerations:

The project is not considered to be “Construction and expansion of airports and airfields” in “Annex I: Category A Projects” but to be “Rehabilitation of airports and airfields or building a smaller facility at the airport” in “Annex II: Category B Projects”.

On 12th June of 2018, NDPCEI under the General Directorate of Environment has issued the official letter indicating classified as a category B with reference No. 177/DNCPIA/VI/2018.

(4) Comparative investigation for alternatives including the “without project” scenario

JST investigated the alternatives including zero-option. Regarding the proposed project site, since there are no other candidate places above advantage of the site described as below, only one site was proposed for the project.

- Additional land acquisition is not occurred due to the proposed site owned by ANATL.
- By planning new international terminal at the same site as the existing terminal, it will be easier to move for passengers between the two terminals.

JICA study team has already considered three options of layout plan for access road, aviation control tower and international terminal shown as below including “Without project option”.

i. Without project

“Without project” means to cancel the project and to maintain the current status. In this case, it is unnecessary to allocate the project budget, to level the land and to log the trees in the project site. As a result, the capacity of existing terminal would not meet the future aviation demand in Dili International Airport expected to grow as described in the Chapter 4. Additionally, the number of international passengers can be expected to increase quite smoothly for the future, which affects positive impact on the economy of Timor-Leste such as Tourism. By taking “Without project”, the benefit of the impact will be waived.

ii. Alternative 1

In this option, an access road to the new International Terminal will be branched off at south side of the existing road. Since the access road will be connected with gentle curve, it is easy for drivers to enter the road. In addition, the length of access road (Approx. 370m) was shortened compared to Alternative 1 (Approx. 400m), which means the construction cost can be reduced. However, some trees might be logged at the entrance. Additionally, existing some related facilities and trees might be affected by the construction of new control tower.



Source: JICA Study team

Figure 1.4.1-3 Layout Plan for Alternative 1

iii. Alternative 2

In this option, the access road to the new international terminal will be branched off from west side of the existing road with sharp curve in order to avoid traffic mixture between international airline

users and domestic airline users. Additionally, the negative impact for the existing related facilities and trees could be avoided by alteration of location for the tower from west to east.



Source: JICA Study team

Figure 1.4.1-4 Layout plan for Alternative 2

Table 1.4.1-5 Comparison between Alternatives

Item	Alternative 1	Alternative 2	Without project
Operational aspect	Higher aviation control tower should be needed because the tower location moved to the west side from the center of runway. Alternative 1 cannot meet the request from ANATL to expand their future commercial land at the south side of existing terminal.	Necessary height can be made lower than Alternative 1 because the tower location moves to the center of runway compared with Alternative 1. Larger commercial area can be secured due to the tower location, as an aviation control area, moved to east side of construction area. Less traffic congestion may be occurred than Alternative 1 because there will be two access roads that connect to new international terminal and existing terminal, can be separated at a closer point from the entrance of the airport.	The option cannot meet an increasing future aviation demand. Treatment capacity for passenger will be insufficient, and the comfortability will be decrease under existing terminal.
	+	++	-
Technical aspect	Pile foundation should be needed due to weak ground condition at the tower location. Rubble concrete foundation using shallow water pit can be available due to shallower	Pile foundation should be needed due to weak ground condition at the tower location same as Alternative 1. Rubble concrete foundation using deep well raises the cost due to	N/A

Item	Alternative 1	Alternative 2	Without project
	groundwater level (-5m) than support layer level (-7m).	shallower groundwater level (-5m) than support layer level (-10m). Therefore, Precast concrete pile foundation should be installed.	
	+	+	-
Cost aspect	Cost for foundation of the tower and paved road area would be lower than Alternative 2.	Cost for foundation of the tower and paved road area would be slightly higher than Alternative 2.	N/A
	++	+	-
Environmental and Social aspect	There are some impacts for existing buildings and trees and shrubs on the construction phase.	Compared with Alternative 1, there are fewer impacts for existing buildings and trees and shrubs on the construction phase.	N/A
	+	++	-

Source: JICA Study team

The above-mentioned result turned out that little difference is detected between Alternative 1 and 2 from the viewpoints of technic, cost and environment and social. Considering operational aspect, Alternative 2 should be selected as below reasons.

- ANATL strongly requested to expand their future commercial land at the south side of existing terminal.
- The tower location should be centered from the aspect of visual insurance for aviation controller.
- Possibility of traffic congestion on the access road.

(5) Scoping

Scoping result and Terms of Reference for Environmental and Social considerations are shown as below.

1) Environment

There is no obligation to implement scoping process for the project because of Category B classified by NDPCEI under the General Directorate of Environment on 12th June of 2018. However, JST implemented scoping process in accordance with “The writing guideline for Category B report of Environmental and Social considerations” in JICA guideline (2010). The result is as below.

Table 1.4.1-6 Scoping Matrix for EIA items

No	Item	Assessment Phase		Anticipated Impact
		Construction	Operation	
Natural Environment				
1	Topography and Geographical features	C	D	<p><u>Construction:</u> There are not any negative impacts because excavation and landfill works are not needed for flatland. However, it is probable that the project site is soft ground in case of high-level ground water.</p> <p><u>Operation:</u> There are hardly any impacts regarding Topography and Geographical features in this project.</p>
2	Ecosystem	C	D	<p><u>Construction:</u> There is little impact on the ecosystem around the project site because the space of the development area is quite limited, and the project site is an undeveloped field now. However, it is probable that cut down tree species are in the IUCN red list.</p> <p><u>Operation:</u> No impact because of any primary factors which hardly cause ecological destruction.</p>
3	Coastal and sea area	B-	B-	<p><u>Construction and Operation:</u> Negative impact to Coastal and sea area may be generated without any countermeasures because the Project site is close to the sea.</p>
4	Protected area	C	C	<p><u>Construction and Operation:</u> It is probable that some negative impacts are generated in and around the project site in the case that National parks or Protected area are located near the site.</p>
5	Global warming	D	C	<p><u>Construction:</u> There are hardly any impacts regarding global warming in this project because a large-scale logging and an increased emission amount of greenhouse gas by the constructed buildings which causes climate change will not be estimated.</p> <p><u>Operation:</u> The project will contribute to global warming if future flight number will increase rapidly.</p>
Pollution control				
6	Land subsidence	D	D	<p><u>Construction and Operation:</u> There is no primary factor which causes land subsidence because no activities which pump up a lot of ground water will be planned.</p>
7	Land degradation	D	D	<p><u>Construction and Operation:</u> The project site is an undeveloped field now and Construction works which have negative impact to land degradation are not scheduled in this project. Therefore, it can be said that there is no</p>

No	Item	Assessment Phase		Anticipated Impact
		Construction	Operation	
				impact.
8	Soil erosion	D	D	<p><u>Construction:</u> Construction works which have negative impact to soil erosion such as embankment are not scheduled in this project. Therefore, it can be said that there is no impact.</p> <p><u>Operation:</u> Although the project site is close to costal area, operation works which have negative impact to soil erosion are not scheduled in this project. Therefore, it can be said that there is no impact.</p>
9	Air Pollution	B-	B-	<p><u>Construction:</u> Emission gas (NOx, SOx) and dust (SPM) are caused by some machines and dump trucks.</p> <p><u>Operation:</u> It is estimated that atmospheric environment will be worse because of increasing number of flight number and airport transfer vehicles in the future.</p>
10	Water Quality	B-	B-	<p><u>Construction:</u> There are some impacts on surrounding river, sea area and its bottom sediment by discharged waste water and dust from the construction site, and oil leaks of heavy machine and dump trucks.</p> <p><u>Operation:</u> It is probable that waste water derived from kitchen and toilet will be generated in case of no mitigation measure on the operation phase.</p>
11	Noise and Vibration	B-	B-	<p><u>Construction:</u> Noise and vibration cause by construction heavy machineries and dump trucks.</p> <p><u>Operation:</u> There is a possibility that increased number of flights and airport transfer vehicles can make level of noise and vibration rise.</p>
12	Soil contamination	B-	D	<p><u>Construction:</u> Minor impact of soil contamination will be generated by oil leaks of heavy machine and dump track.</p> <p><u>Operation:</u> Operation activities which have negative impact to soil contamination are not scheduled in this project. Therefore, it can be said that there is no impact.</p>
13	Solid Waste	B-	B-	<p><u>Construction:</u> Excavated soil and debris will be generated.</p> <p><u>Operation:</u></p>

No	Item	Assessment Phase		Anticipated Impact
		Construction	Operation	
				It is probable that solid waste, which is derived from kitchen and toilet and disposed by visitors and workers in the new international terminal, will be generated.
14	Bottom Sediment	B-	B-	<u>Construction:</u> There are some impacts on surrounding river, sea area and its bottom sediment by discharged waste water and dust from the construction site, and oil leaks of heavy machine and dump trucks. <u>Operation:</u> It is probable that waste water derived from kitchen and toilet will be accumulated in case of no mitigation measure.
15	Underground water	B-	D	<u>Construction:</u> There are some impacts on surrounding underground water by excavation works on the construction phase. <u>Operation:</u> Operation activities which have negative impact to underground water are not scheduled in this project. Therefore, it can be said that there is no impact.
16	Offensive Odor	D	D	<u>Construction and Operation:</u> There is no primary factor which causes offensive odor.

Rating:

B : Some impact is expected.

C : Extent of impact is unknown (Examination is needed. Impacts may become clear as study progress.)

D : No impact is expected.

+: Positive, -: Negative

2) Social Environment

JST implemented the scoping for socio-economic items same as Environmental items. The result is shown in below table.

Table 1.4.1-7 Scoping Checklist for Socio-economic Items

No	Item	Assessment Phase		Anticipated Impact
		Construction	Operation	
Social Environment				
1	Land acquisition and Involuntary	D	D	<u>Construction and Operation:</u> Land acquisition and involuntary resettlement won't be generated because the entire project land owned by ANATL.

No	Item	Assessment Phase		Anticipated Impact
		Construction	Operation	
	resettlement			
2	Local economy such as employment and livelihood, etc.	A+	B+	<p><u>Construction:</u> It is possible that new employment is created with construction of a new terminal building and a control tower. And it is predicted that some stalls will be opened for workers around the project site.</p> <p><u>Operation:</u> It is possible that new employment is created with operation of a new terminal building</p>
3	Land use and utilization of local resources	D	D	<p><u>Construction and Operation:</u> The project site is assigned as unused ground in land use category because there is an undeveloped field now. Therefore, it can be said that there is no impact.</p>
4	Social institutions such as social infrastructure and local decision-making institutions	D	D	<p><u>Construction and Operation:</u> There is no possibility of dividing local administrative organization, local association, assembly and local business by the project because the entire project land owned by ANATL.</p>
5	Existing social infrastructure and services	D	B+	<p><u>Construction:</u> There is no negative impact in this project in terms of existing social infrastructure and services because entire construction site is in the airport area.</p> <p><u>Operation:</u> Although it can be predicted that traffic volume increase by vehicles for airport transfer, it can be improved the social infrastructure and services by construction of a new terminal building and a control tower compared with the current condition.</p>
6	Landscape	D	D	<p><u>Construction and Operation:</u> There are not any negative impacts such as reduction of field of view because a new terminal building is proposed as 1st story's structure. Although a new control tower is proposed with height of approx. 30m, there is no negative impact such as reduction of field of view because the proposed location is over 100m away from nearby community. There is also no negative impact for scenic spots such as Betotasi beach because the proposed location is over 1 km away from there.</p>
7	Poor classes	A+	B+	<p><u>Construction:</u> It is possible that new employment for poor classes is created with construction of a new terminal building and a control tower. And it</p>

No	Item	Assessment Phase		Anticipated Impact
		Construction	Operation	
				is predicted that some stalls will be opened for workers around the project site. <u>Operation:</u> It is possible that new employment for poor classes is created with operation of a new terminal building.
8	The indigenous and ethnic people	C	C	<u>Construction and Operation:</u> New employment for indigenous and ethnic people should be considered if existed around the project site.
9	Maldistribution of benefit and damage	D	D	<u>Construction and Operation:</u> The construction of a terminal building and a control tower will not bring out Maldistribution of benefit and damage in surrounding area because the proposed project site is in the airport area.
10	Local conflict of interest	B-	D	<u>Construction:</u> Negative impact regarding local conflict of interest may be generated without any consideration for employment of construction workers. <u>Operation:</u> Operation activities which have negative impact to Local conflict of interest are not scheduled in this project. Therefore, it can be said that there is no impact.
11	Water usage	B-	D	<u>Construction:</u> Turbid water will be generated by construction, which effects on some wells in and around the project site if existed. <u>Operation:</u> Operation activities which have negative impact to water use are not scheduled in this project. Therefore, it can be said that there is no impact.
12	Gender	C	C	<u>Construction and Operation:</u> It is possible that there is a sexual discrimination for new employment and wage.
13	Children's rights	B-	D	<u>Construction:</u> There is a possibility of child labor. <u>Operation:</u> There is no negative impact in this project in terms of children's rights.
14	Cultural heritage	C	D	<u>Construction and Operation:</u> The consideration for cultural heritage should be needed if existed in and around the project site.
1	Health	B-	D	<u>Construction:</u>

No	Item	Assessment Phase		Anticipated Impact
		Construction	Operation	
5	(Infectious diseases such as HIV/AIDS, etc.)			It is possible that any infectious diseases spread to local people by construction workers. <u>Operation:</u> Operation activities which have negative impact to Health are not scheduled in this project. Therefore, it can be said that there is no impact.
16	Labor environment	C	B+	<u>Construction:</u> The consideration for construction workers regarding labor environment and safety should be needed. <u>Operation:</u> The labor environment will be improved by installment of new equipment and facility compared with current situation.
17	Accident	B-	B-	<u>Construction:</u> There is a risk by heavy machines and dump trucks on the construction phase. <u>Operation:</u> There is a possibility that increased number of airport transfer vehicles make safety deteriorate.

Rating:

A : Significant impact is expected.

B : Some impact is expected.

C : Extent of impact is unknown (Examination is needed. Impacts may become clear as study progress.)

D : No impact is expected.

+: Positive, -: Negative

(6) Terms of Reference for EIA survey

Based on the above-mentioned result, JST prepared TOR for anticipated environmental items as below.

Table 1.4.1-8 Terms of Reference for EIA survey

No	Item	Survey item	Survey method
Natural Environment			
1	Topography and Geographical features	①Topography in and around the project site ②Geological features in the project site	①Topographic survey, confirmation of drainage route on the surface layer by field survey, Literature review ②Geological survey (Boring Survey)
2	Ecosystem	①Checking whether any rare species is existed in and around the project site. ②Checking whether there is any tree requiring felling down due to the project	①Interview survey for related agencies and Literature review ②Field survey
3	Coastal and sea area	Checking whether there is any impact due to the project.	Interview survey for related agencies
4	Conservation area	Checking whether there is any conservation area in and around the project site.	①Interview survey for related agencies and Literature review
5	Global warming	Checking current and future flight number	Interview survey for related agencies
Pollution Control			
6	Air Pollution	①Air quality standard and current and future flight number ②Checking whether there is any air pollution problem in and around the project site.	①Interview survey for related agencies and Literature review ②Interview survey for related agencies and neighborhood, Literature review
7	Water Quality	①Water quality standard ②Checking whether there is any water pollution problem in and around the project site.	①Interview survey for related agencies and Literature review ②Interview survey for related agencies and neighborhood, Simplified survey
8	Noise and Vibration	①Noise and vibration standard and current and future flight number ②Checking whether there is any noise and vibration problem in and around the project site.	①Interview survey for related agencies and Literature review ②Interview survey for related agencies and neighborhood, Literature review

No	Item	Survey item	Survey method
9	Soil contamination	①Soil contamination standard ②Checking whether there is any soil contamination problem in and around the project site.	①Interview survey for related agencies and Literature review ②Interview survey for related agencies and neighborhood
10	Solid Waste	Current situation of final disposal site	Field survey, Literature review
11	Bottom Sediment	①Bottom sediment standard ②Checking whether there is any bottom sediment problem in and around the project site.	①Interview survey for related agencies and Literature review ②Interview survey for neighborhood and Literature review
12	Underground water	①Underground water standard ②Checking whether there is any Underground water problem in and around the project site.	①Interview survey for related agencies and Literature review ②Interview survey for neighborhood and simplified survey
Social Environment			
13	Land acquisition and Involuntary resettlement	Checking whether Land acquisition and Involuntary resettlement is necessary due to the project.	Interview survey for related agencies
14	Local economy such as employment and livelihood, etc.	Current condition of local economy such as residential resources for livelihood and local industry in and around the project site	Interview survey for related agencies and neighborhood
15	Existing social infrastructure and services	Current situation of existing social infrastructure and services in and around the project site	①Interview survey for related agencies and neighborhood ②Literature review
16	Poor classes	Checking whether poor classes are existed in and around the project site.	Interview survey for related agencies and neighborhood
17	The indigenous and ethnic people	Checking whether indigenous and ethnic people are existed in and around the project site.	Interview survey for related agencies and neighborhood

No	Item	Survey item	Survey method
18	Maldistribution of benefit and damage	Checking any impact by the project	Interview survey for related agencies and neighborhood
19	Water Use change	Current situation of water uses in the project site	Field survey
20	Gender	Organization and female employment situation for ANATL	Interview survey for related agencies
21	Children's right	Checking actual condition of child labor	Interview survey for neighborhood
22	Cultural heritage	Checking whether there is any cultural heritage and its impact if existed in and around the project site	Interview survey for related agencies and neighborhood
23	Health (Infectious diseases such as HIV/AIDS, etc.)	Current situation and countermeasure	Literature review
24	Labor environment	Checking any impact by the project	Interview survey for related agencies
25	Accident	Checking any traffic accident in the project site	Interview survey for related agencies and neighborhood

(7) The result of Environmental socio-economic survey including prediction

1) Natural Environment

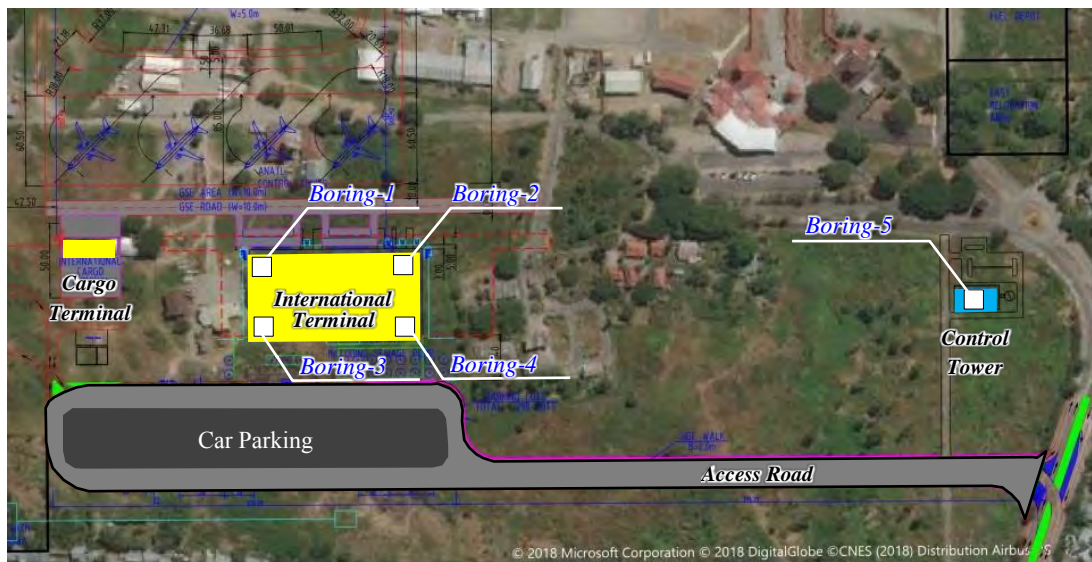
a) Topography and Geographical features

According to the survey result, the geology features in and around the project site are mainly comprised silt, sand and gravel especially silt on the surface layer. Clay layer and loam layer mainly overspread at northern side and at southern side of the project site respectively. The result of boring survey is shown in Table 2-2-3.6. According to the result, the shallowest level of underground is around -5 meters except Boring No.3 in which there is no observed water. And it can't be said that the geology is poor ground because there is no survey point where N value is over 10.



Source : Soils of Timor-Leste, 2015, Seeds of Life

Figure 1.4.1-5 Geographical Features in and around the Project Site



Source: JICA Study team

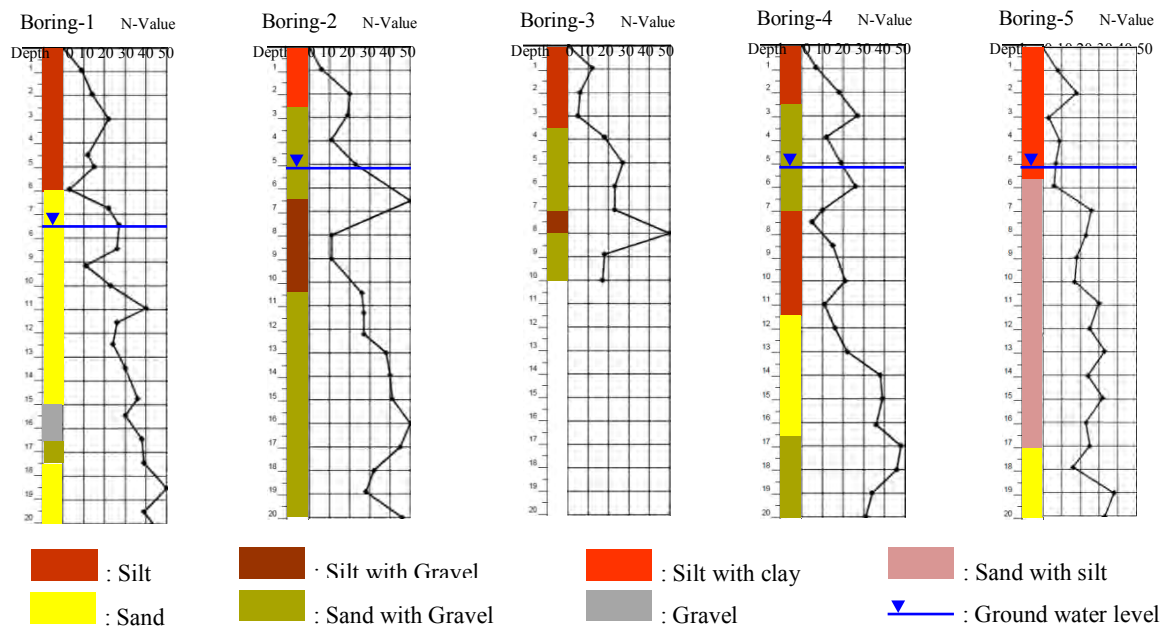


Figure 1.4.1-6 The Result of Boring Survey

b) Ecosystem

Threatened terrestrial plant and animal species in Timor-Leste are shown in following table. The total threatened terrestrial species are 13, distributed as follows: endangered (6), and vulnerable (7). According to the field survey conducted in April 2018, the endangered species were not observed or confirmed in and around the project site. And main vegetation in the project site is shown in the table, which is not categorized as threatened species.

Table 1.4.1-9 Summary of terrestrial plant and animal species in Timor-Leste

Taxa	Number	Threatened
Vertebrates		
Amphibians	10	-
Terrestrial birds	151	4
Terrestrial mammals	69	4
Terrestrial reptiles	47	-
Invertebrates		
Insects	488	1
Plants		
Terrestrial	807	4
Total	1,572	13

Sources: The National Biodiversity Strategy and Action Plan of Timor-Leste (2011 – 2020) Revised Edition 2015

Table 1.4.1-10 List of endangered terrestrial plant and animal species in Timor-Leste

Common Name	Scientific Name	IUCN Status	Threatening Process
Birds			
Timor green pigeon	<i>Treron psittaceus</i>	EN	Habitat loss, agriculture, hunting
Timor imperial pigeon	<i>Ducula cineracea</i>	EN	
Water ground dove	<i>Gallicolumba hoedtii</i>	EN	
Yellow-crested cockatoo	<i>Cacatua sulphurea</i>	EN	Habitat loss, harvest for pet trade, agriculture
Terrestrial Mammals			
Thin shrew	<i>Crocidura tenuis</i>	VU	Habitat loss, degradation, restricted range
Western naked-backed bat	<i>Dobsonia peronei</i>	VU	Habitat loss, extraction, restricted range
Mentawai palm civet	<i>Paradoxurus hermaphrodites</i>	VU	
Greater long-eared bat	<i>Nyctophilus timorensis</i>	VU	
Insects			
Timor yellow tiger	<i>Parantia timorica</i>	EN	Severely fragmented population with ongoing decline
Plants (Trees)			
Sandalwood	<i>Santalum album</i>	VU	Habitat loss, fires, agriculture, extraction
Borneo teak	<i>Intsia bijuga</i>	VU	Habitat loss, selective logging
Burmese rosewood	<i>Pterocarpus indicus</i>	VU	Habitat loss, agriculture, selective logging
	<i>Mangifera timorensis</i>	EN	

IUCN Status: EN: Endanger, VU: Vulnerable

Sources: The National Biodiversity Strategy and Action Plan of Timor-Leste (2011 – 2020) Revised Edition 2015



Hanek



Dila



Sukaer Malae



Hudi



Bak Moruk



Kaichoti

Picture 1.4.1-1 Main Vegetation in the Project Site

c) Coastal and sea area

Although there is Beto tasi beach at the north side of Dili International Airport, no mangrove or coral reef was observed. According to interview survey for fishermen, there is no concern of fish catch for them due to water quality degradation. As a reference, an quality survey of sea water was conducted for the previous project¹ at Dili port located at 5 km distance to east from the project site, the only value of Dissolved oxygen (DO) slightly exceeded Sea water quality standard in Indonesia which is the suzerain, which means minor water quality pollution. Therefore, discharged water and oil and grease from the project should be treated with appropriate methods. Additionally, environmental standard for sea water quality has not been yet stipulated in Timor-Leste.



Picture 1.4.1-2 Situation of Interview Survey for Fishermen at Beto Tasi Beach

Table 1.4.1-11 Survey result of sea water quality in the previous project

No.	Parameter	Unit	Result	Criteria in Indonesia	WHO criteria	Evaluation
1	Total Phosphate (T-P)	mg/L	0.01	-	2	Pass
2	Salinity	%	39	-	-	Pass
3	Oil and Grease	mg/L	<0.2	5	10	Pass
4	Turbidity	NTU	3	<5	-	Pass
5	Dissolved Oxygen (DO)	mg/L	4	>5	-	Excess
6	pH	-	8	6.5 – 8.5	6 - 9	Pass
7	Temperature	°C	29	-	-	Pass
8	Total Coliforms	MPN/100ml	3	1,000	400	Pass
9	Total Suspended Solids (TSS)	mg/L	<2	80	50	Pass
10	COD	mg/L	34	-	125	Pass
11	Total Nitrogen (T-N)	mg/L	2	-	10	Pass
12	Total Dissolved Solid (TDS)	mg/L	38,900	-	-	-

Description: Criteria Standard from Environmental Ministry Decree of Republic Indonesia No.51 of 2004 about Sea Water Quality Standard

Wastewater and ambient water quality, Environmental, Health, and Safety (EHS) Guidelines, IFC

¹ The Project for urgent shift of ferry terminal in Dili port, 2016, JICA

d) Conversation area

In Timor-Leste, 30 protected areas were assigned in the 4th National Report and in the National biodiversity strategy and Action plan for Timor-Leste. Especially, Tasitolu protected area is located near the International Airport show as below Figure. On the other hand, there is no national park around the project site.



Source: JICA Study team

Figure 1.4.1-7 Conversation Area

e) Grobal Warming

As a result of interview survey for ANATL, the current average flight number of arrivals and departures was 18 times per day and the number will be up to 23 times per day in 2027 considered as the target year. Since it means that only 2 regular flights will be increased per day, it can be said that it is a minor impact on Global warming.

2) Pollution Control

a) Air Pollution

According to the field survey and land use survey, no factory as air pollution source is located in and around the project site. As a reference, an air quality survey was conducted for the previous project² at Dili port, a similar coastal environment of the Project, to analyze sulfur dioxide (SO₂), carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), hydro carbon (HC), dust (TPS), PM₁₀, PM_{2.5} and lead (Pb), and those samples of each item were collected at the port. The analysis results show that all items were satisfied with WHO's and Indonesian reference criteria and no air pollution was found. Regarding deterioration of atmospheric ambient due to increasing flight number of arrivals and departures, it can be said that it is a minor impact on air pollution because only 2 regular flights will be increased per day.

² "The Project for urgent shift of ferry terminal in Dili port", 2016, JICA

Table 1.4.1-12 Survey result of air quality in the previous project

No.	Parameter	Duration of Test	Unit	Result	Criteria in Indonesia	WHO criteria	Evaluation
1	Sulphur Dioxide (SO ₂)	1hour	µg/Nm ³	25	900	-	Pass
		24hour		-	365	125 (interim target-1) 50 (interim target-2)	-
2	Carbon Monoxide (CO)	1hour	µg/Nm ³	3,357	30,000	-	Pass
		24hour	µg/Nm ³	-	10,000	-	-
3	Nitrogen Dioxide (NO ₂)	1hour	µg/Nm ³	23	400	200 (guideline)	Pass
		24hour	µg/Nm ³	-	150	-	-
4	Ozone (O ₃)	1hour	µg/Nm ³	35	235	-	Pass
5	Hydro carbon (HC)	3hour	µg/Nm ³	105	160	-	Pass
6	Dust (TSP)	24hour	µg/Nm ³	120	230	-	Pass
7	PM ₁₀	24hour	µg/Nm ³	50	150	150 (interim target-1) 100 (interim target-2) 75(interim target-3)	Pass
8	PM _{2.5}	24hour	µg/Nm ³	28	65	75 (interim target-1) 50 (interim target-2) 37.5(interim target-3)	Pass
9	Lead (Pb)	24hour	µg/Nm ³	0.1	2	-	Pass

Description: Criteria Standard from Government Regulation of Republic Indonesia No.41 of 1999 National Ambient Air Quality Standard and WHO Standard

b) Water Quality

Regarding surface waters around the project site, the Comoro River and the Tasitolu Lake are located. The river is at 1 km distance to east and the lake is at 1.5 km distance to south west from the project site. And there is Beto tasi beach along the north side of Dili International Airport at 0.6 km distance.

According to the results of Geotechnical investigation, ground water occupies around below 4.0 meter or 5.0 meter at the project site. Therefore, ANATL and neighborhood have their own deep well for daily life water at the ground depth below 10 meter. JICA study team has conducted Water quality survey. Regarding values of pH (Hydrogen ion concentration) and EC (Electric Conductivity), at two monitored wells in the project site and at one monitored well in the respective nearby community, are within the standard value of Indonesia. The standard value for EC has not yet been stipulated in IFC. From the above, it can be said that the water quality in and around the project site is appropriate for drinking.



Source: JICA Study team

Figure 1.4.1-8 Location and Result of Water Quality Survey

Table 1.4.1-13 Water Quality Standard

No.	Parameter	Unit	Criteria in Indonesia	IFC criteria	Evaluation
1	pH	-	6.5-8.5	6 - 9	Passed
2	Electrical conductivity (EC)	mS/cm	0-1	-	Passed

Source: Governor of DKI Jakarta Decree No. 582 of 1995 concerning Determination of River / Water Quality Standards and Liquid Waste Standard in the Prop. DKI Jakarta
Wastewater and ambient water quality, Environmental, Health, and Safety (EHS) Guidelines, IFC

c) Noise and Vibration

The result of noise survey is shown as below. The survey value can't be assessed whether it is over standard value or not because of no existence of the noise standard in Timor-Leste.

The result of Noise survey in and around the project site is shown as below. The result value cannot be compared with environmental standard for noise and vibration because of no standard in Timor-Leste. However, it is can be said that the value is within the range of Request Limits for Motor Vehicle Noise under the Noise Regulation Law, Japan even if the value for traffic noise of Avenue Presidente Nicolau Lobato exceeds the standard value in IFC guideline.

It is possible that noise and vibration will be generated by a plant operation, heavy machines and dump trucks during the construction. However, a relatively loud noise and vibration such as piling works will be generated during the construction of a new control tower and an aviation control tower, whose emitting sources will be about 100 meters from surrounding residential area, stores, public buildings etc. It can be said that the noise impact will get slight because it has about 40dB reduction with every 100m distance. It can be said that vibration level will be also decreased same as noise impact. Therefore, it can be judged that the impact of noise and vibration is not significant for surrounding area and people. Regarding a quarry located at 3km to south from the project site, the impact of noise and vibration is also slight because of no residential and commercial area around the quarry.



Source: JICA Study team

Figure 1.4.1-9 Result of Noise Level

Table 1.4.1-14 Noise Level Standard

No.	Parameter	Unit	Criteria in Indonesia ¹	Request Noise Limits in Japan ²	IFC Criteria ³	Evaluation
1	Noise level	dB	70	75	70	Passed

- Source:
1. Decree of Governor DKI Jakarta No. 551/2001, Indonesia
 2. Request Limits for Motor Vehicle Noise under the Noise Regulation Law, Japan
 3. Environmental, Health, and Safety (EHS) Guidelines, IFC



Picture 1.4.1-3 Site for Quarry at Beduku, Dili

Below figure shows the noise level by INM (Integrated Noise Model) in and around the International Airport. DNL (Day-Night Average Sound Level) has been accepted worldwide as Noise unit for airline operation and over 65 DNL has been recognized as unsuitable noise level for residential area. The flight number of departure and arrival is based on the survey result as of April, 2017 and 2027. Both of the prediction results suggest that there are not any residential area included in the zone over 65DNL and that there is no sensitive residential area due to aircraft noise even in 2027 because only 2 regular flights will be increased per day compared with 2017. Regarding the increasing number of airport transfer vehicles accompanied by the increase of future flight number, slight noise deterioration will occur because airport user will increase approximately 500 persons per day by 2027.



Noise level

Source: JICA Study team

DNL >65 : Significant
 DNL between 55 and 65 : Moderate
 DNL <55 : Least severe

Reference : JST and Integrated Noise Model, Federal Aviation Administration

Figure 1.4.1-10 Result of Noise Prediction

d) Soil Contamination

According to the survey result, there is a slight possibility of soil contamination because there is no factory, which deals with heavy metal and heavy oil, and concern of groundwater contamination such as arsenic has not yet been found according to a literature review and an interview survey for neighborhood. There is no environmental standard for soil contamination in Timor-Leste.

e) Solid Waste

JST visited a waste disposal site at Tibar, Liquiçá, located at 3.7km distance to south west from the project site, managed by Sanitation Department of Dili District Administration. According to the ADB report³, 120 tons/day waste is generated from service area and will be 250 tons/day in 2030. On the other hand, it can be said that the land still has a collection capacity at least for over 30 years. Since debris and soil generated by the project will be disposed as below table, the impact on the waste disposal site will be slight. The soil generated by the construction will be discharged to northern side of the airport area.

Table 1.4.1-15 Disposal method of Construction waste generated by the project

Waste type	Estimated amount	Disposal site
Asphalt concrete	Approx. 1,000 ft	Tibar disposal site
Concrete	Approx. 300 ft	
Soil	Approx.133,000tf	Northern side of the airport area

Reference: JICA Study team



Source: JICA Study team

Picture 1.4.1-4 Current Condition of Tibar Disposal Site

f) Bottom Sediment

Since a concern of groundwater contamination such as arsenic has not yet been found according to a literature review and an interview survey for neighborhood, there is no impact for bottom sediment. There is no environmental standard for bottom sediment in Timor-Leste.

³ TA-8750 TIM: Preparing the Urban Services Improvement Sector Project, 2015.3, ADB

g) Underground Water

As shown in the Table 2-2-3.8, the values of pH (Hydrogen ion concentration) and EC (Electric Conductivity), at two monitored wells in the project site and at one monitored well in the respective nearby community, are within the standard value of World Health Organization (WHO). Accordingly, the water quality in and around the project site is expected to be appropriate for drinking. There is no environmental standard for underground water in Timor-Leste.

3) Social Environment

a) Population

The table below shows the population in Dom Aleixo in which the project site is located. The average household size in Dom Aleixo is higher than the national average. An employment opportunity generated by the Project might be positive impact for the local people especially in Dom Aleixo sub district because the ratio for unemployment in the sub district is approx.2.0 % higher than the national average.

Table 1.4.1-16 Social condition at Dom Aleixo sub district and Whole country

Item	Unit	Figure	
		Dom Aleixo	Whole
Population			
Male	Person	67,646	601,112
Female		62,449	582,531
Total		130,095	1,183,643
Private Households	Household	20,579	204,597
Average Households size	Person	6.3	5.8
Labor Force			
Male	%	54.9	65.0
Female		33.3	45.7
Total		44.6	55.5
Employment			
Male	%	47.6	61.4
Female		29.4	43.7
Total		39.7	52.6

Source: 2015 Timor-Leste Population and Housing census

b) Land acquisition and involuntary resettlement

With regards to land acquisition and involuntary resettlement, any consultations are not necessary because the entire project site in which no resident lives is owned by ANATL according to the result of a literature review and an interview survey.

c) Local economy such as employment and livelihood, etc.

Although there is no agricultural land in and around the project site, some household engages in crop production and livestock rearing in Dom Aleixo sub district. However, the ratio is quite low compared to the national average. There is Fishery area along Beto tasi beach at the north side of Dili International Airport. There are no tourist sites in and around the project site.

Table 1.4.1-17 Agricultural condition at Dom Aleixo sub district and Whole country

Item	Unit	Figure	
		Dom Aleixo	Total
Private households engaged in crop production	%	18.9	79.6
Private households engaged in livestock rearing		50.2	87.2

Source : 2015 Timor-Leste Population and Housing census

d) Land use and utilization of local resources

Since the project site is on a plain and undeveloped field owned by ANATL at the present moment, there is no land for special and specific use. Regarding the surrounding area, at east and west side of the Project site, residential areas; Rai-Kotu and Madohi communities, are located. A main road, Av. Presidente Nicolau Lobato, is located at south side

e) Existing social infrastructure and services

The ratio for access of improved sanitation facilities and safe sources in Dom Aleixo is quite high relative to the national average, which means the water supply network and sewage treatment system etc. in the sub district have been installed with higher proportion than the other sub districts. There is a high school, Colegio São Miguel Arcanjo, in the Rai-Kotu village and a Catholic convent at south side of the project site.

Table 1.4.1-18 Sanitation condition at Dom Aleixo sub district and Whole country

Item	Unit	Figure	
		Dom Aleixo	Whole
Sanitation and Safe sources			
Households using improved sanitation facilities	%	85.5	49.5
Access of private households to improve or safe sources of drinking water		97.0	74.7

Source : 2015 Timor-Leste Population and Housing census

f) Poor Classes

Since most of the interviewees don't have own job, they are really interested in the project with large expectation for participation to the project as construction workers.

g) The indigenous ethnic people

There are not any indigenous and ethnic people around the project site and its surrounding.

h) Maldistribution of benefit and damage

It should be based on the equal employment in order to avoid a conflict between two communities; Madohi village and Rai-Kotu because JST in a former road project in Timor -Leste was requested by village mayors

i) Water use

According to the interview survey for neighborhood, it turned out that almost all of the households have own well and use their daily life water by pumping up from the well.

j) Gender

According to an interview survey for ANATL, ANATL keeps gender equality in employment because the number of female staff occupied more than 20% in total, which is composed of 112 regular staffs and 56 contract staffs.

k) Children’s right

According to the interview survey for neighborhood, there is no case of child labor. But the full dissemination to supervising agencies and contractors should be needed in order to avoid child labor in the project.

l) Cultural heritage

There is no cultural heritage in and around the project site according to the interview survey.

m) Infectious diseases such as HIV/AIDS, etc.

According to a literature review and an interview survey for neighborhood, it was confirmed that there were no infectious diseases such as HIV/AIDS in and around the project site. But Malaria and Dengue transmitted by mosquitos are occurred.

n) Labor environment

According to the construction plan and anticipated types of works, there is nothing to make labor environment worse. But the considerations of labor environment for construction workers and safety should be needed such as a roll call before and after the work, installment of rest room and first-aid office.

o) Accident

The traffic volume in the project site is comparatively light because of airport area, thus the accident frequency in the site is also low. On the other hand, the traffic volume of Av. Presidente Nicolau Lobato is quite high as main road in Dili

(8) Impact assessment and mitigation measure

Impact assessment for environmental items was implemented and their mitigation measures were suggested as below table.

Table 1.4.1-19 Impact assessment and mitigation measure

No	Item	Assessment phase		Assessment	Mitigation measure
		Construction	Operation		
Natural Environment					
1	Topography and Geographic	D	D	<u>Construction:</u> There are not any negative impacts	

No	Item	Assessment phase		Assessment	Mitigation measure
		Construction	Operation		
	al features			<p>because the project site is flatland and depth of excavation works is approximately 2 meters. And the geographical features were not identified as soft ground because the result of N value was over 10.</p> <p><u>Operation:</u> There is no primary factor which effects on Topography and Geographical features.</p>	
2	Ecosystem	D	D	<p><u>Construction:</u> There is limited impact on the ecosystem around the project site because the project site is an undeveloped field now and rare species were not identified.</p> <p><u>Operation:</u> There is no primary factor which causes Ecosystem.</p>	
3	Coastal and sea area	B-	B-	<p><u>Construction:</u> There are some impacts on surrounding hydrogeology by discharged waste water and dust from the construction site, and oil leaks of heavy machine and dump trucks.</p> <p><u>Operation:</u> Negative impact to Coastal and sea area may be generated without any countermeasures because the Project site is close to the sea.</p>	<p><u>Construction:</u> - Liquid waste from the construction workers will be processed at Portable Sewage Treatment Plants. - Used oil waste and other waste categorized as toxic hazardous materials to be submitted to the third party already obtained a permit from the government.</p> <p><u>Operation:</u> - Creating Sewage Treatment Plants to be used at operational stage which is then managed for the Liquid Waste Disposal</p>
4	Conservation Area	D	D	<p>Although the Tasitolu protected Area is located at south west area, there is little impact on the protected area because the distance from the project site is approx. 1.0km.</p>	
5	Global Warming	D	D	<p><u>Construction:</u> There are hardly any impacts in regard to global warming in this project because large scale of CO₂ emitted by heavy machines and dump trucks which causes climate change will not be estimated.</p> <p><u>Operation:</u> Since regular future flights will not be increased rapidly, it can be said that it is a minor impact on Global</p>	

No	Item	Assessment phase		Assessment	Mitigation measure
		Construction	Operation		
				warming.	
Pollution Control					
6	Land subsidence	D	D	There is no primary factor which effects on ground water, because no activities which pump up a lot of ground water will be planned.	
7	Land degradation	D	D	<u>Construction:</u> There is no primary factor which causes land degradation such as soil improvement material. <u>Operation:</u> There is no primary factor which causes land degradation.	
8	Soil erosion	D	D	<u>Construction:</u> There is no primary factor which causes soil erosion because the construction activity will be implemented on the ground and there is no river near the project site. <u>Operation:</u> There is no primary factor which causes soil erosion.	
9	Air Pollution	B-	D	<u>Construction:</u> There is some impact on air pollution surrounding the project site because heavy machines and dump trucks will operate <u>Operation:</u> Since the number of airport transfer vehicles accompanied by the future flight number will not be increased suddenly, Slight air pollution will be occurred.	<u>Construction:</u> - Introduction of low-emission heavy machine to reduce air pollution. - Around the work area is fenced as high as 2-2.5 m - Not piling basic/waste materials in the work area openly, and/or the excavated land pile must always be kept wet to prevent from pollution into the air. - The schedule arrangement and speed limit for project vehicle carrying materials by installing traffic signs and bumps - Sprinkle water on the road surface to prevent dust emission at the entrance of project site. <u>Operation:</u> - Planting and maintaining park/green space - Set and enforce speed limits on the access road for airport transfer vehicles by installing traffic signs and bumps
10	Water	B-	B-	<u>Construction:</u>	<u>Construction:</u>

No	Item	Assessment phase		Assessment	Mitigation measure
		Construction	Operation		
	Quality			<p>There are some impacts on surrounding river and sea area by discharged waste water and dust from the construction site, and oil leaks of heavy machine and dump trucks.</p> <p><u>Operation:</u> It is probable that waste water derived from new international airport will be generated in case of no mitigation measure.</p>	<ul style="list-style-type: none"> - Liquid waste from the construction workers will be processed at Portable Sewage Treatment Plants. - Used oil waste and other waste categorized as toxic hazardous materials to be submitted to the third party already obtained a permit from the government. <p><u>Operation:</u></p> <ul style="list-style-type: none"> - Creating Sewage Treatment Plants to be used at operational stage which is then managed for the Liquid Waste Disposal
11	Noise and Vibration	B-	B-	<p><u>Construction:</u> Noise and vibration cause by construction machineries.</p> <p><u>Operation:</u> Since the number of airport transfer vehicles accompanied by the future flight number will not be increased suddenly, slight deterioration of noise and vibration environment will be occurred.</p>	<p><u>Construction</u></p> <ul style="list-style-type: none"> - All construction vehicles/ equipment will have mufflers and they will be properly maintained. - Inform people of the possible vibration before using vibrating equipment used due the construction activity. - Around the work area is fenced as high as 2-2.5 m - The schedule arrangement and speed limit for project vehicle carrying materials by installing traffic signs and bumps <p><u>Operation</u></p> <ul style="list-style-type: none"> - Set and enforce speed limits on the access road for airport transfer vehicles by installing traffic signs and bumps
12	Soil contamination	B-	D	<p><u>Construction:</u> Minor impact of soil contamination will be generated by oil leaks of heavy machine and dump track.</p> <p><u>Operation:</u> There is no primary factor which causes soil contamination.</p>	<p><u>Construction:</u> To perform inspection and maintenance for heavy machines and dump trucks periodically. In case of being found defects or troubles, to fix them and exchange some parts without delay.</p>
13	Solid Waste	B-	B-	<p><u>Construction:</u> Excavated soil and debris will be generated.</p> <p><u>Operation:</u> It is probable that solid waste, which is derived from kitchen and toilet and disposed by visitors and workers in the new international terminal, will be generated.</p>	<p><u>Construction</u></p> <ul style="list-style-type: none"> - Residual and hazardous wastes shall be disposed in designated disposal sites. <p><u>Operation</u></p> <ul style="list-style-type: none"> - Segregation system of wastes shall be introduced. - Recyclables shall be recovered

No	Item	Assessment phase		Assessment	Mitigation measure
		Construction	Operation		
					and sold to recyclers. - Organic (biodegradables) shall be collected and disposed of on site by composting (no burning on site), if possible.
14	Bottom sediment	B-	B-	<p><u>Construction:</u> There are some impacts on surrounding river and bottom sediment of sea area by discharged waste water and dust from the construction site, and oil leaks of heavy machine and dump trucks.</p> <p><u>Operation:</u> It is probable that waste water derived from new international airport will be generated in case of no mitigation measure.</p>	<p><u>Construction:</u> - Liquid waste from the construction workers will be processed at Portable Sewage Treatment Plants. - Used oil waste and other waste categorized as toxic hazardous materials to be submitted to the third party already obtained a permit from the government.</p> <p><u>Operation:</u> - Creating Sewage Treatment Plants to be used at operational stage which is then managed for the Liquid Waste Disposal</p>
15	Under ground water	D	D	<p><u>Construction:</u> There is no primary factor which effects on ground water, because no activities which pump up a lot of ground water will be planned. Excavated gravel including water will be separated from water.</p> <p><u>Operation:</u> There is no primary factor which effects on ground water, because no activities which pump up a lot of ground water will be planned.</p>	
16	Offensive odor.	D	D	<p><u>Construction:</u> There is no primary factor which causes offensive odor.</p> <p><u>Operation:</u> It is probable that waste water derived from new international airport will generate offensive odor in case of no mitigation measure.</p>	<p><u>Operation:</u> Creating Sewage Treatment Plants to be used at operational stage which is then managed for the Liquid Waste Disposal</p>
Social Environment					
17	Land acquisition and Involuntary resettlement	D	D	Land acquisition and involuntary resettlement won't be generated because the entire project land owned by ANATL.	
18	Local economy such as employment	A+	B+	<u>Construction:</u> It is possible that new employment is created with construction of a new terminal building and a control tower. And	No need of mitigation measure because of positive impact on the both phases.

No	Item	Assessment phase		Assessment	Mitigation measure
		Construction	Operation		
	and livelihood, etc.			it is predicted that some stalls are opened for workers around the project site. <u>Operation:</u> It is possible that new employment is created with operation of a new terminal building	
19	Land use and utilization of local resources	D	D	The project site is assigned as unused ground in land use category because there is an undeveloped field now. Therefore, it can be said that there is no impact. There is no local resource in and around the project site.	
20	Social institutions such as social infrastructure and local decision-making institutions	D	D	There is no possibility of dividing local administrative organization, local association, assembly and local business by the project because the entire project land owned by ANATL.	
21	Existing social infrastructure and services	D	A+	<u>Construction:</u> There is no negative impact in this project in terms of existing social infrastructure and services because entire construction site is in the airport area. <u>Operation:</u> It can be improved the social infrastructure and services by construction of a new terminal building and a control tower compared with the current condition.	No need of mitigation measure because of positive impact on the both phases.
22	Landscape	D	D	<u>Construction:</u> There are not any negative impacts such as reduction of field of view because a new terminal building is proposed as 1st story's structure. <u>Operation:</u> Although a new control tower is proposed with height of approx. 30m, there is no negative impact such as reduction of field of view because the proposed location is over 100m away from nearby community.	
23	Poor classes	A+	B+	<u>Construction:</u> It is possible that new employment for poor classes is created with	No need of mitigation measure because of positive impact on the both phases.

No	Item	Assessment phase		Assessment	Mitigation measure
		Construction	Operation		
				<p>construction of a new terminal building and a control tower. And it is predicted that some stalls will be opened for workers around the project site.</p> <p><u>Operation:</u> It is possible that new employment for poor classes is created with operation of a new terminal building.</p>	
24	The indigenous and ethnic people	D	D	<p><u>Construction and Operation:</u> There are not any indigenous and ethnic people around the project site and its surrounding.</p>	
25	Maldistribution of benefit and damage	D	D	<p><u>Construction and Operation:</u> The construction of a terminal building and a control tower will not bring out Maldistribution of benefit and damage in surrounding area because the proposed project site is in the airport area.</p>	
26	Local conflict of interest	B-	D	<p><u>Construction:</u> Negative impact regarding local conflict of interest may be generated without any consideration for employment of construction workers.</p> <p><u>Operation:</u> There is no primary factor which causes local conflict of interest.</p>	<p><u>Construction:</u> Public consultation should be implemented for nearby communities gathered around their village mayor in order to avoid local conflict.</p>
27	Water use	D	D	<p><u>Construction:</u> There is no primary factor which effects on ground water, because no activities which pump up a lot of ground water will be planned. Excavated gravel including water will be separated from water.</p> <p><u>Operation:</u> There is no primary factor which effects on ground water, because no activities which pump up a lot of ground water will be planned.</p>	
28	Gender	B-	D	<p><u>Construction:</u> It is possible that there is a sexual discrimination for new employment and wage on the construction and operation phase.</p> <p><u>Operation:</u> There is no negative impact in this project in terms of gender because it can be said that ANATL keeps</p>	<p><u>Construction:</u> To set the percentage of female for employment of unskilled workers (Ex. 50%), and their equal salary.</p>

No	Item	Assessment phase		Assessment	Mitigation measure
		Construction	Operation		
				gender equality in employment.	
29	Children's rights	D	D	<u>Construction:</u> There is a possibility of child labor. <u>Operation:</u> There is no negative impact in this project in terms of children's rights.	<u>Construction:</u> The contract clause of FIDIC; "6.21 Child labor" should be obeyed by ANATL and contractors.
30	Cultural heritage	D	D	<u>Construction and Operation:</u> There are not any precious cultural heritages at the project site and its surrounding.	
31	Health (Infectious diseases such as HIV/AIDS, etc.)	B-	D	<u>Construction:</u> It is possible that any infectious diseases spread to local people by construction workers from other districts and foreign countries. <u>Operation:</u> There is no primary factor which effects on health	<u>Construction:</u> Necessary training will be imparted for the AIDs and HIV.
32	Labor environment	B-	B+	<u>Construction:</u> The considerations of labor environment and safety for construction workers should be needed. <u>Operation:</u> The labor environment will be improved by installment of new equipment and facility.	<u>Construction:</u> To educate and lecture safety driving for the workers. A roll call before and after the work, installment of rest room and first-aid office.
33	Accident	B-	B-	<u>Construction:</u> The considerations of safety for construction workers should be needed because heavy machines and dump trucks will be operated. <u>Operation:</u> There is a possibility that increased number of airport transfer vehicles make safety deteriorate.	<u>Construction:</u> To educate and lecture safety driving for the workers. A roll call before and after the work, installment of rest room and first-aid office. <u>Operation:</u> Set and enforce speed limits on the access road for airport transfer vehicles by installing traffic signs and bumps

Rating:

A : Significant impact is expected.

B : Some impact is expected.

C : Extent of impact is unknown (Examination is needed. Impacts may become clear as study progress.)

D : No impact is expected.

+: Positive, -: Negative

Table 1.4.1-20 Implementation plan for mitigation measure

No	Item	Mitigation measure	Location	Implementation phase	Implementation Body	Supervising Body	Cost
1	Coastal and sea area	Liquid waste from the construction workers will be processed at Portable Sewage Treatment Plants. Used oil waste and other waste categorized as toxic hazardous materials to be submitted to the third party already obtained a permit from the government.	Project site	Construction	Contractor	ANATL	Included in construction cost
		Creating Sewage Treatment Plants to be used at operational stage which is then managed for the Liquid Waste Disposal	Project site	Operation	Contractor	ANATL	Included in construction cost
2	Air Quality	Introduction of low-emission heavy machine to reduce air pollution	Project site	Construction	Contractor	ANATL	Included in construction cost
		Around the work area is fenced as high as 2-2.5 m	Project site	Construction	Contractor	ANATL	Included in construction cost
		Not piling basic/waste materials in the work area openly, and/or the excavated land pile must always be kept wet to prevent from pollution into the air.	Project site	Construction	Contractor	ANATL	Included in construction cost
		The schedule arrangement and speed limit for project vehicle carrying materials by installing traffic signs and bumps	Project site and transportation route	Construction	Contractor	ANATL	Included in construction cost
		Sprinkle water on the road surface to prevent dust emission at the entrance of project site	Project site and transportation route	Construction	Contractor	ANATL	Included in construction cost
Planting and maintaining park/green space	Project site	Construction	Contractor	ANATL	Included in construction cost		

No	Item	Mitigation measure	Location	Implementation phase	Implementation Body	Supervising Body	Cost
		Set and enforce speed limits on the access road for airport transfer vehicles by installing traffic signs and bumps	Project site	Operation	ANATL	MPWTC	Paid by ANATL
3	Water Quality Water Quality	Liquid waste from the construction workers will be processed at Portable Sewage Treatment Plants	Project site	Construction	Contractor	ANATL	Included in construction cost
		Used oil waste and other waste categorized as toxic hazardous materials to be submitted to the third party already obtained a permit from the government	Project site	Construction	Contractor	ANATL	Included in construction cost
		Creating Sewage Treatment Plants to be used at operational stage which is then managed for the Liquid Waste Disposal	Project site	Construction	Contractor	ANATL	Included in construction cost
4	Noise and Vibration	All construction vehicles/ equipment will have mufflers and they will be properly maintained	Project site	Construction	Contractor	ANATL	Included in construction cost
		Inform people of the possible vibration before using vibrating equipment used due the construction activity	Project site	Construction	Contractor	ANATL	Included in construction cost
		Around the work area is fenced as high as 2-2.5 m	Project site	Construction	Contractor	ANATL	Included in construction cost
		The schedule arrangement and speed limit for project vehicle carrying materials by installing traffic signs and bumps	Project site and transportation route	Construction	Contractor	ANATL	Included in construction cost
		Set and enforce speed limits on the access road for airport transfer vehicles by installing traffic signs and bumps	Project site	Operation	ANATL	MPWTC	Paid by ANATL

No	Item	Mitigation measure	Location	Implementation phase	Implementation Body	Supervising Body	Cost
5	Soil contamination	To perform inspection and maintenance for heavy machines and dump trucks periodically. In case of being found defects or troubles, to fix them and exchange some parts without delay	Project site	Construction	Contractor	ANATL	Included in construction cost
6	Solid Waste	Residual and hazardous wastes shall be disposed in designated disposal sites	Project site and Final disposal site	Construction	Contractor	ANATL	Included in construction cost
		Segregation system of wastes shall be introduced. Recyclables shall be recovered and sold to recyclers. Organic (biodegradables) shall be collected and disposed of on site by composting (no burning on site), if possible.	Project site	Operation	ANATL	MPWTC	Paid by ANATL
7	Bottom sediment	Liquid waste from the construction workers will be processed at Portable Sewage Treatment Plants	Project site	Construction	Contractor	ANATL	Included in construction cost
		Used oil waste and other waste categorized as toxic hazardous materials to be submitted to the third party already obtained a permit from the government	Project site	Construction	Contractor	ANATL	Included in construction cost
		Creating Sewage Treatment Plants to be used at operational stage which is then managed for the Liquid Waste Disposal	Project site	Construction	Contractor	ANATL	Included in construction cost
8	Offensive odor	Creating Sewage Treatment Plants to be used at operational stage which is then managed for the Liquid Waste	Project site	Construction	Contractor	ANATL	Included in construction cost

No	Item	Mitigation measure	Location	Implementation phase	Implementation Body	Supervising Body	Cost
		Disposal					
9	Local conflict of interest	Public consultation should be implemented for nearby communities gathered around their village mayor in order to avoid local conflict	Project site	Construction	Contractor	ANATL	Included in construction cost
10	Gender	To set the percentage of female for employment of unskilled workers (Ex. 50%), and their equal salary.	Project site	Construction	Contractor	ANATL	Included in construction cost
11	Children's rights	The contract clause of FIDIC; "6.21 Child labor" should be obeyed by ANATL and contractors.	Project site	Construction	Contractor	ANATL	—
12	Health (Infectious diseases such as HIV/AIDS, etc.)	Necessary training will be imparted for the AIDs and HIV	Project site	Construction	Contractor	ANATL	Included in construction cost
13	Labor environment	To educate and lecture safety driving for the workers. A roll call before and after the work, installment of rest room and first-aid office.	Project site	Construction	Contractor	ANATL	Included in construction cost
14	Accident	To educate and lecture safety driving for the workers. A roll call before and after the work, installment of rest room and first-aid office.	Project site	Construction	Contractor	ANATL	Included in construction cost
		Set and enforce speed limits on the access road for airport transfer vehicles by installing traffic signs and bumps	Project site	Operation	ANATL	MPWTC	Paid by ANATL

(9) Monitoring Plan

Monitoring plan is shown as below. In the construction phase, ANATL will become supervising body and a contractor will be implementation body for monitoring. In the operation phase, Ministry of Public Works, Transport and Communications (MPWTC) will be supervising body and ANATL will become implementation body for monitoring.

Table 1.4.1-21 Monitoring plan on the construction phase

Environmental item	Details	Monitoring method	Location	Period /Frequency	Supervisor/ Implementation body	Cost
Pollution Control						
Air Quality	Dust	Sampling and analysis	Project site	When construction commences, once a month during construction and when works completed.	ANATL/ Contractor	Included in construction cost
	Condition of air quality and dust regarding; -Water sprinkling -Seat covering -Dump truck	Visual observation		Daily		
Water Quality	Water quality ※(TSS, pH, T-N, T-P, COD, Oil and grease)	Sampling and laboratory analysis	Deep well in the project site	Monthly		
Noise and Vibration	Noise level : LA_{max} , L_{Aeq} Vibration: L_{10}	Measuring equipment	Boundary of the project site	Monthly (However daily during piling works)		
	Maintenance of heavy machines and dump trucks	Visual observation	Project site	Monthly		
Soil contamination	Oil leak	Visual observation	Project site	In refueling		
Solid Waste	Contents and amount of waste	Visual observation	Project site	Daily		
Social Environment						
Local conflict of interest	Monitoring for the	Monthly report	Project site	Monthly	ANATL/	Included in construction

Environmental item	Details	Monitoring method	Location	Period /Frequency	Supervisor/ Implementation body	Cost
	communities				Contractor	cost
Gender	Employment situation for workers	Monthly report	Project site	Monthly		
Children's rights	Confirmation of child labor	Roll call/ Monthly report	Project site	Daily		
Health (Infectious diseases such as HIV/AIDS, etc.)	Management for safety and sanitation	Monthly report	Project site	Monthly		
Labor Environment	Health condition/ gymnastic exercises	Roll call/ Monthly report	Project site	Daily		
	Safety education	Training		Every recruiting period		
Accident	Driving accident Traffic accident	Monthly report	Project site and its surroundings	Daily		

Table 1.4.1-22 Monitoring plan in the operation phase

Environmental item	Details	Monitoring method	Location	Period /Frequency	Supervisor/ Implementation body	Cost
Air Quality	Traffic condition	Visual observation	Project site and its surroundings	Daily	MPWTC /ANATL	Paid by ANATL
Noise and Vibration						
Accident						
Water quality	Water quality (TSS, pH, T-N, T-P, COD, Oil and grease)	Sampling and laboratory analysis	Deep well in the project site	Monthly		
Solid Waste	Contents and amount of waste	Visual observation	Project site	Daily		

Table 1.4.1-23 Implementation cost for monitoring in the construction phase

Item	Estimated cost (USD)	Remarks
Environmental specialist (International)	50,000	2 months intermittently
Environmental specialist (Local)	9,000	9 months intermittently
Environmental management capacity building program	10,000	training materials, daily subsistence allowance as required
Environmental monitoring	15,000	Sampling and analysis
Tree planting subject to confirmation	-	at detailed design

Source: JICA Study team

(10) Stakeholder meeting

1) Discussion with related agencies

During the 1st field survey implemented by JST, ANATL held a consultation meeting for socialization and publication of the airport project for related agencies and explained regarding the project components and schedule. Since most of their comments show their demand for the project, there were not any comment and question for Environment and Socio-economy.







Picture 1.4.1-5 State of the consultation meeting

2) Interview survey for neighborhood

JST executed a face-to-face interview survey for residents as a simple socio-economic survey at nearby communities; Madohi and Rai-Kotu. Their main concern was regarding aviation noise and employment generation by the project.

Table 1.4.1-24 List of stakeholders with photos

Madohi				Rai-Kotu			
							
Interviewee							
	Name	Sex	Age		Name	Sex	Age
1	Antonio Alfonso Dasilva	M	32	1	Manuela Paulo Lahato	F	56
2	Celestina da Silva	F	53	2	Celestino Carroso	M	34
3	Cecielia Monteino	F	37	3	Domingos Atay Sorres	M	36
4	Fernando S. Da. Silva	M	53	4	Veronica Amaral	F	25

(11) Draft monitoring form

A. Construction phase

a) Air Quality (Measured value for exhaust gas and surrounding atmospheric ambient)

Item	Average measured value	Max measured value	Local standard	International Standard	Remarks (Location, Frequency, Method etc.)
Dust			-	IFC	(Boundary of the project site, Monthly)

Monitoring item	Condition during reporting period
Condition of air quality and dust regarding: -Water sprinkling -Seat covering -Dump truck	

b) Water Quality (Measured value for exhaust gas and surrounding atmospheric ambient)

Item	Average measured value	Max measured value	Local standard	International Standard	Remarks (Location, Frequency, Method etc.)
TSS			-	IFC	(Deep well in the project site, Monthly, Sampling and analysis)
pH					
T-N					
T-P					
COD					
Oil and Grease					
Temperature			-	-	

c) Noise and vibration

Item	Average measured value	Max measured value	Local standard	International Standard	Remarks (Location, Frequency, Method etc.)
Noise level	Maximum noise level: L _{max}		-	Japan	(Boundary of the project site, Monthly (However daily during piling works))
	Equivalent noise level: L _{Aeq}				
Vibration level	Upper end value of 80% range: L ₁₀				

d) Soil contamination

Impacted item	Details	Condition during reporting period	Remarks (Location, Frequency, Method etc.)
Soil contamination	Leaked oil by machines		Oil leak, in refueling

e) Solid waste

Monitoring item	Condition during reporting period
Contents and amount of waste (Soil, debris etc.)	

f) Local conflict of interest

Monitoring item	Condition during reporting period
Communities	

g) Gender

Monitoring item	Condition during reporting period
Employment situation for workers	

h) Children's right

Monitoring item	Condition during reporting period
Confirmation of child labor	

i) Health (Infectious diseases such as HIV/AIDS, etc.)

Monitoring item	Condition during reporting period
Management for safety and sanitation	

j) Labor environment

Monitoring item	Condition during reporting period
Health condition/ gymnastic exercises Safety education	

k) Accident

Impacted item	Details	Condition during reporting period	Remarks (Location, Frequency, Method etc.)
Accident	Driving accident, Traffic accident		

B. Operation Phase

a) Air quality/ Noise and vibration/ Accident

Monitoring item	Condition during reporting period
Traffic condition	

b) Water quality

Item	Average measured value	Max measured value	Local standard	International Standard	Remarks (Location, Frequency, Method etc.)
TSS			-	IFC	(Deep well in the project site, Monthly, Sampling and analysis)
pH					
T-N					
T-P					
COD					
Oil and Grease					
Temperature			-	-	

c) Solid waste

Monitoring item	Condition during reporting period
Contents and amount of waste (Soil, debris etc.)	

(12) Environmental checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	<p>(a) Have EIA reports been already prepared in official process?</p> <p>(b) Have EIA reports been approved by authorities of the host country's government?</p> <p>(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?</p> <p>(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?</p>	<p>(a) N</p> <p>(b) N</p> <p>(c) Unknown</p> <p>(d)</p>	<p>(a) Under preparation</p> <p>(b) In the process</p> <p>(c) Under preparation</p> <p>(d) Unnecessary</p>
	(2) Explanation to the Local stakeholders	<p>(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?</p> <p>(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?</p>	<p>(a) Y</p> <p>(b) Y</p>	<p>(a) The project contents have already been informed by the interview survey for local residents. But Public consultation is going to be held for all community members.</p> <p>(b) As local people expect employment generation by the project, the employment should be implemented fairly.</p>
	(3) Examination of Alternatives	<p>(a) Have alternative plans of the project been examined with social and environmental considerations?</p>	<p>(a) Y</p>	<p>(a) Since the original plan has a possibility of impact on a store in the project site by the construction of aviation control tower, an alternative was considered in order to avoid the impact.</p>
2 Pollution Control	(1) Air Quality	<p>(a) Is there a possibility that air pollutants emitted from the project related sources, such as airplanes will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken?</p>	<p>(a) N</p> <p>(b) N</p>	<p>(a) As future flight number will not be increased rapidly on the operation phase, atmospheric ambient will not be deteriorated. There is no environmental standard for air quality in Timor-Leste.</p> <p>(b) During the construction, atmospheric ambient will be deteriorated periodically by operating heavy machines and dump trucks. Therefore,</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) Where industrial areas already exist near the airport, is there a possibility that the project will make air pollution worse?		some mitigation measures should be introduced such as implementation of maintenance for heavy machines and dump trucks, water sprinkling during crushing activity. On the other hand, any activities which cause air pollution will not be scheduled on the operation phase.
	(2)Water Quality	(a) Do pollutants, such as Suspended Solids (SS), and oils contained in effluents comply with the country's effluent standards (BOD, COD etc.)? Is there a possibility that the effluents from the project will cause areas not to comply with the country's ambient water quality standards?	(a) Unknown	(a) Although there is no standard for effluents in Timor-Leste, all of the measured values were satisfied with the Indonesian standard. But the waste water will be discharged after appropriate treatment such as installment of septic tank.
	(3)Wastes	(a) Are wastes generated from the airports and other project facilities properly treated and disposed of in accordance with the country's regulations?	(a) Y	(a) As most of generated soil by the project will be reused in the airport area, the waste amount will not be large. Additionally, generated waste by the project such as debris can be treated appropriately because Tibar landfill site still has an enough collection capacity.
	(4)Soil contamination	(a) Has the soil in the project site been contaminated in the past? Are adequate measures taken to prevent soil contamination by leakage of fuels?	(a) Y	(a) Because the project site has been an undeveloped field so far, there is no case of soil contamination in the field. And an appropriate countermeasure for oil leakage should be implemented.
	(5)Noise and vibration	(a) Does noise from aircraft comply with the country's standards? (b) Is there a possibility that noise and vibrations from various sources, such as airport users' vehicles and vehicles for airport operations will adversely affect ambient noise levels? If impacts are anticipated, are adequate noise mitigation measures considered?	(a) Unknown (b) N	(a) As future flight number will not be increased rapidly on the operation phase, noise ambient will not be deteriorated. There is no environmental standard for noise level in Timor-Leste. (b) Since the number of airport transfer vehicles accompanied by the future flight number will not be increased suddenly, slight deterioration of noise and vibration environment will be occurred.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(6) Ground subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) There is no primary factor which effects on ground water, because no activities which pump up a lot of ground water will be planned.
	(7) Offensive Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a) N	(a) There is no odor emission source by the project.
	(1) Conservation Area	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) Although the Tasitolu protected Area is located at south west area, there is little impact on the protected area because the distance from the project site is approx.1.0km.
	(2) Ecosystem	<p>(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?</p> <p>(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?</p> <p>(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?</p> <p>(d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?</p>	<p>(a) N</p> <p>(b) N</p> <p>(c) Y</p> <p>(d) N</p>	<p>(a) There is no sensitive area for ecosystem in and around the project site.</p> <p>(b) There is no sensitive area for rare species in and around the project site.</p> <p>(c) There is limited impact on the ecosystem around the project site because the project site is an undeveloped field now.</p> <p>(d) Although there is no hydrological environment such as river at downstream side of the project site, Impact on Coastal and sea area is concerned. Therefore, Installment of septic tank will be introduced as a countermeasure for discharged waste water. It can be said that it is a minor impact on Ecosystem.</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(3) Hydrology	(a) Is there any possibility that alteration of drainage system due to the constructions of airports and related facilities will adversely affect surface water and groundwater flows? (b) Do the facilities affect adversely flow regimes, waves, tides, currents of rivers and etc. if the project facilities are constructed on/by the seas?	(a) N (b) N	(a) Surface water and groundwater flows will not be affected because the project site is located at inland area. (b) Any buildings will not be constructed on/by the sea.
3 Natural Environment	(4) Topography and Geology	(a) Does the project require the large scale change of topographic/geographic features? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff? (d) In the case of offshore projects, is there any possibility that the project will erode natural beaches?	(a) N (b)N (c) Y (d) N	(a) Excavation and landfill works are not needed on a large scale because of flatland. (b) Although topographical alteration such as banking and cutting will be implemented, there is no construction activity on a large scale which impacts on the stabilization of natural ground. (c) There is no possibility of soil runoff because the project will be implemented on a small scale and at inland area even if topographical alteration such as banking and cutting will be executed. Additionally, construction generated soil will be treated in the project site appropriately. (d) Any buildings will not be constructed on/by the sea.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	(a) N (b)	(a) Involuntary resettlement won't be generated because the entire project land owned by ANATL. (b)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		<p>(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?</p> <p>(d) Are the compensations going to be paid prior to the resettlement?</p> <p>(e) Are the compensation policies prepared in document?</p> <p>(f) Does the resettlement plan pay attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?</p> <p>(g) Are agreements with the affected people obtained prior to resettlement?</p> <p>(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?</p> <p>(i) Are any plans developed to monitor the impacts of resettlement?</p> <p>(j) Is the grievance redress mechanism established?</p>	<p>(c)</p> <p>(d)</p> <p>(e)</p> <p>(f)</p> <p>(g)</p> <p>(h)</p> <p>(i)</p> <p>(j)</p>	<p>(c)</p> <p>(d)</p> <p>(e)</p> <p>(f)</p> <p>(g)</p> <p>(h)</p> <p>(i)</p> <p>(j)</p>
	(2) Living and Livelihood	<p>(a) Is there any possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?</p> <p>(b) Is there any possibility that the project causes the change of land uses in the neighboring areas to affect adversely livelihood</p>	<p>(a) N, Y</p> <p>(b) N</p>	<p>(a) An employment opportunity generated by the Project might be positive impact for the local people.</p> <p>(b) Since the project site is on a plain and undeveloped field owned by ANATL at the present moment, there is no land for special and</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		<p>of local people?</p> <p>(c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?</p> <p>(d) Is sufficient infrastructure (e.g., roads) available for the project implementation? If the existing infrastructure is insufficient, is a plan developed to construct new infrastructure or improve the existing infrastructure?</p> <p>(e) Is there any possibility that the airports and other project structures will cause a sun shading and radio interference?</p>	<p>(c) Y</p> <p>(d) Y</p> <p>(e) N</p>	<p>specific use. Additionally, as there is no residential house downstream side from the project site, there is no impact on water use for livelihood of local people.</p> <p>(c) It is possible that any infectious diseases spread to local people by construction workers. Therefore, Necessary training for construction workers will be imparted for the AIDs and HIV.</p> <p>(d) Since existing road will be utilized as access road for construction, the existing infrastructure will not be needed to improve.</p> <p>(e) Since the airports and other project structures will not cause a sun shading and radio interference because these structures are proposed as 1st story's structure except aviation control tower. Although the tower is proposed with height of approx. 30m, there is no negative impact such as a sun shading because there is no residential house at southern side from the tower.</p>
	(3) Cultural Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There is no cultural heritage in and around the project site.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) There is also no negative impact for scenic spots such as Betotasi beach because the proposed location is over 1 km away from there.
	(5) Ethnic	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	(a)	(a) There are not any indigenous and ethnic people around the project site and its surrounding.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	Minorities and Indigenous Peoples	(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(b)	(b)
4 Social Environment	(6) Working Conditions	<p>(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?</p> <p>(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?</p> <p>(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?</p> <p>(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?</p>	<p>(a) Y</p> <p>(b) Y</p> <p>(c) Y</p> <p>(d) Y</p>	<p>(a) Labor environment should conform to stipulated labor law in Timor-Leste; Law No. 4/2012 on Labor.</p> <p>(b) Appropriate measures should be taken as tangible safety considerations based on the Labor law in Timor-Leste.</p> <p>(c) Appropriate measures should be planned and implemented as intangible safety considerations based on the Labor law in Timor-Leste.</p> <p>(d) Appropriate measures should be planned and implemented not to infringe on the safety for local people and the person involved in the project by executing necessary training for security guards of the project.</p>
5 Others	(1) Impacts during construction	<p>(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?</p> <p>(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to</p>	<p>(a) Y</p> <p>(b) N</p>	<p>(a) Environmental Management Plan including mitigation measures should be prepared.</p> <p>(b) There is limited impact on the ecosystem around the project site because the project site is an undeveloped field now and rare species</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		<p>reduce impacts?</p> <p>(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?</p>	(c) N	<p>were not identified.</p> <p>(c) An employment opportunity generated by the Project might be positive impact for the local people</p>
	(2) Monitoring	<p>(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?</p> <p>(b) What are the items, methods and frequencies of the monitoring program?</p> <p>(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</p> <p>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?</p>	<p>(a) Y</p> <p>(b)</p> <p>(c) Y</p> <p>(d) Unknown</p>	<p>(a) Monitoring program for the environmental items should be developed because there is some impact on environmental pollution surrounding the project site due to heavy machines and dump trucks etc.</p> <p>(b) The monitoring program should be determined throughout detailed discussions with related authorities considering technical level and development status for environmental equipment in Timor-Leste.</p> <p>(c) The personnel for preparing an adequate monitoring framework should be required for implementation body.</p> <p>(d) Regulatory requirements will be stipulated for each environmental item.</p>
6 Note	Reference to Checklist of Other Sectors	<p>(a) Where necessary, pertinent items described in the Roads, Railways, and Bridges checklist should also be checked (e.g., projects including large areas of deforestation).</p> <p>(b) If the airport is constructed on the sea, pertinent items described in the Ports and Harbors checklist should also be checked (e.g., projects including installation of power</p>	<p>(a) N</p> <p>(b) N</p>	<p>(a) Not applicable</p> <p>(b) Any airport facilities will not be constructed on/by the sea.</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		transmission lines and/or electric distribution facilities). (c) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation).	(c) N	(c) The project does not include large areas of deforestation but cutting g some trees in the project site by expansion of new terminal.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) There are hardly any impacts in regards to global warming in this project because large scale of CO2 emission by heavy machines and dump trucks which causes climate change will not be estimated.

1) Regarding the term “Country's Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.

In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Chapter 2 Basic Concept of the Project

Chapter 2 Basic Concept of the Project

2.1 Basic Concept of the Project

2.1.1 Project Purpose

(1) Overall Goal and Project Purpose

The new international passenger terminal building and other facilities to be developed under the Project will be capable of accommodating the increasing airport traffic with enhanced passenger safety, convenience and comfort. As a result, more foreign visitors are encouraged to come to Timor-Leste, contributing to the tourism sector promotion and the country's economic development. The overall goal and project purpose have been identified as follows:

Overall Goal:	The increase of the airport traffic at Dili International Airport contributes to the economic development of East Timor.
Project Purpose:	The new international passenger terminal building and other facilities at Dili International Airport will be so developed that the increasing air traffic will be accommodated with enhanced passenger safety, convenience and comfort.

2.1.2 Outline Design of the Japanese Assistance

(1) Outline Design of the Japanese Assistance

Minutes of Discussion (M/D) was agreed upon between Japanese and Timor-Leste sides and signed by the Leader of JICA Survey Team and the President of ANATL on 16 April 2018. The Minutes of Discussion identified following eight components of the Project as the request of the Timor-Leste side:

1. Construction of a new international passenger terminal building including equipment;
2. Construction of a new international cargo terminal building including equipment;
3. Construction of a new aircraft parking apron (four stands for A320/B737 class aircraft);
4. Construction of new taxiways;
5. Installation of apron flood lights and taxiway lights;
6. Construction of a road and car park for the new terminal facilities;
7. Construction of a new air traffic control tower including ATC equipment; and
8. Construction of a new electric power substation including emergency standby generators.

It should be noted that M/D states “JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.”

(2) Finalized Project Components

After the first site survey, the outline design was conducted for the eight project components listed in item (1) above, and it has been found out that the cost of the Project for the eight components would significantly exceed the budget allocated to the Project. Consequently, several optional project components have been examined to obtain a group of project

components and their sizes which ensure a minimum acceptable terminal function at a least project cost. As a result, it has been decided that the international cargo terminal and the pavement of the car park as well as the airfield lights are excluded and that the scope of the Project should consist of six project components shown in Table 2.1.2-1 below. It should be noted that the outline design was done for the international cargo terminal, car park and the apron flood lights/taxiway lights and the design materials are attached to this report for reference purpose only.

Table 2.1.2-1 Summary of Finalized Major Project Components

	Facilities	Summary	Remarks
1	International Passenger Terminal Building	One level, steel structure, floor space: 6722 m ² , Security equipment	
2	International Aircraft Parking Apron	Cement concrete pavement for apron: 10,890 m ² Asphalt concrete pavement for GSE area: 5,476 m ²	3 parking stands for small jet
3	Taxiway	Asphalt concrete pavement for Taxiway: 9,527 m ² Asphalt concrete pavement for shoulder: 3,002 m ²	
4	Car Park, Access Road	JICA Grant includes the earthwork only for the car park. Pavement and marking, etc. to be done by ANATL.	
5	Control Tower and ATC Equipment	Tower floor space: 400 m ² , six-story Office: 400 m ² , one level ATC equipment	-
6	Electrical Power Substation	Substation floor space: 250 m ² , one-story Emergency standby generator	-

Source: JICA Study team

2.2 Outline Design of Project Components

2.2.1 Design Policy

(1) Basic Policy

[Target Year]

As the new facilities to be developed under the Project will be opened in 2022, the new facilities are in principle to be able to accommodate the forecast traffic of 2027; five years after the opening day. However, the project cost needs to be reduced because of the limited amount of the budget, and the taxiway, apron and the car park in front of the new passenger terminal building, which can easily be expanded by Timor-Leste side, are to be able to accommodate the forecast traffic of the opening day (2022).

[Design Policy]

Planning and design of the facilities and equipment mainly comply with relevant international standards and recommendations of ICAO while complemented by other internationally accepted technical standards as well as local or Japanese fire/disaster prevention and protection regulations as appropriate. Relevant requirements about the universal design and the gender mainstreaming have also been carefully taken into account so that thus components and plans of the project will be math the concept for a Japanese Grant project.

(2) Natural Conditions

The project area should be taken into account in terms of protection from impacts of flood. Therefore, the level of the first floor for the control tower and power substation was fixed at 500 mm higher above the ground level. Also, the first-floor level of the international passenger terminal building is fixed to be the same level as the ground level from universal design view point.

When designing the storm water drainage facilities such as the gutters and drainpipes, a rainfall intensity of 140 mm/h, almost equivalent to a daily rainfall, has been employed as the design rainfall intensity, because the rainfall in Dili is normally very intensive during a short time period.

An electrical roll screen will be provided to the windows of eastern and western sides of the international passenger terminal building to prevent direct sunshine. As the culmination altitude of the sun is high and impact of sunshine is not significant, a blind is not provided to the southern side of the terminal.

(3) Social Conditions

In Timor Leste, in addition to its local language of Tetum (Tetun) and official language of Portuguese, Bahasa Indonesia and English and other languages are commonly used. These languages are to be indicated on the guidance plates and sign boards as appropriate.

(4) Building and Fire Codes

In Timor Leste, technical standards for construction such as the building code and fire code are yet to be developed. During meetings with the officials of the Department of Projects and Fire Brigade, it has been confirmed that relevant Building Codes and Fire Codes may be applied to the design of the facilities to be developed under JICA Grant, and the design has been carried out in accordance with relevant codes and regulation of Japan.

The taxiway and apron design have been carried out based on relevant FAA design standards as is the case in Timor Leste.

(5) Utilization of Local Contractors, Equipment and Materials

1) Local Contractors and Engineering Consultants

There are medium-sized local contractors who possess cement concrete plants and asphalt plants. Most of the large-scale construction projects in Timor Leste are undertaken by foreign contractors and several local contractors participated in such projects as subcontractors who have adequate capability and quality assurance knowledge for the Project, under appropriate supervision by Japanese contractor.

Neither local engineering consultant nor building design company has been identified because most of the engineering works are conducted by foreign companies. In fact, an Indonesian engineering company was employed by ANATL for planning and design of the proposed runway extension at Dili Airport.

2) Local Equipment and Materials

Fresh cement concrete and asphalt premix are available at its domestic markets as there are several local companies who possess necessary equipment for such production. Cement and steel bars are imported mainly from Indonesia and China. However, some of the locally available materials are very expensive, and in such case import from Japan and other foreign countries has been examined. Local contractors possess general construction equipment and they are to be utilized in the Project.

(6) Works by Timor Leste Side

The following architectural works are out of the scope of the Japanese Grant and will be undertaken by Timor Leste Side:

- Interior and utility works in areas exclusive for tenants in the new international passenger terminal building.
- Furniture and household goods to be provided in the new international passenger terminal building.
- Landscaping works.

(7) Grade of Materials

Locally available materials with standard grade are to be procured under the Project, paying more attention to the running cost than initial cost. Example is use of high-grade Low-E glass to the windows from energy saving viewpoint. Products with following energy saving performance have been chosen considering balance of cost and performance.

- Thermal transmittance: less than 1.6
- Solar heat gain coefficient: less than 0.4

(8) Construction Period

There are the existing control tower and power substation in the project site where the new apron and new terminal facilities are to be developed. As the airport needs to continue to be operational during the construction period, these existing facilities should be kept operation until the new control tower and power substation become operational, and the new apron pavement work may only be completed after the existing control tower has been demolished. The new international passenger terminal building works will require a long period to complete and therefore should be started immediately after the commencement of the construction works on site.

The new control tower and power substation works are followed by demolition of the existing tower and substation and then further followed by the new apron pavement work are to be carried out in parallel with the new passenger terminal building works and both are to be completed in the shortest period possible so that the Project is completed in a timely manner at a minimum cost.

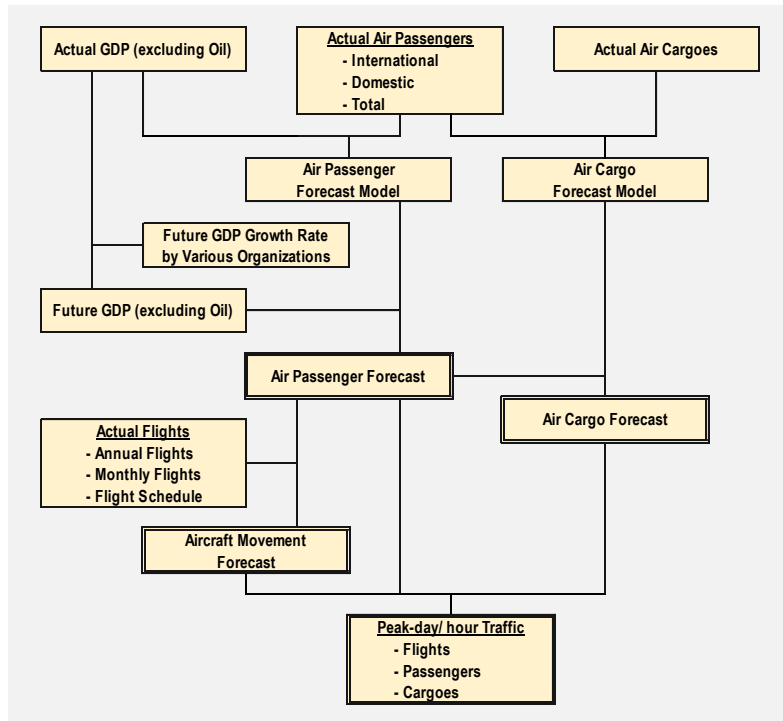
After a series of the technical examinations it has been found out that the parallel works can be completed in 22 months.

2.2.2 Basic Plan (Facilities Plan and Equipment Plan)

(1) Overall Plan

1) Air Traffic Demand Forecast

Based on the passenger and cargo movement records at Dili International Airport (sources: Airport Operation department, General Directorate of Statistics) and past GDP record of East Timor (source: IMF World Economic Data Base, October 2017), air traffic forecast has been examined. The workflow of the forecast is shown in Figure 2.2.2-1.



Source: JICA Study team

Figure 2.2.2-1 Work Flow of Air Traffic Demand Forecast at Dili International Airport

a) Forecast Models

Forecasting model of international passengers has been examined through regression analyses based on the passenger traffic and GDP (excluding Oil; see Chapter 1-1-3 (2)) records for ten years from 2008 to 2017. The forecasting model thus obtained is as follows:

Forecasting Model of International Passengers

$$\text{Pax} = 0.2536 \times \text{GDP} - 79.0 \quad (r^2 = 0.9767)$$

where Pax: International Passenger movements at Dili (thousands)

GDP: Million USD at 2010 constant prices

As for domestic passenger demand, the forecast was calculated as difference between the forecast of international passengers estimated by above mentioned model and the total passengers forecasted by following model, because actual records of domestic passenger are insufficient to analyze statistically.

Forecasting Model of Total Passengers

$$\text{Pax} = 0.2878 \times \text{GDP} - 88.5 \quad (r^2 = 0.9725)$$

where Pax: Total of Passenger movements at Dili (thousands)
 GDP: Million USD at 2010 constant prices

Forecasting model of international cargoes has been examined through regression analyses based on the passenger traffic and cargo traffic records as below.

Forecasting Model of International Cargoes

$$\text{Cargo} = 2.1520 \times \text{Pax} - 139.6 \quad (r^2 = 0.9072)$$

where Cargo: International Cargo movements at Dili (tons)
 Pax: International Passenger movements at Dili (thousands)

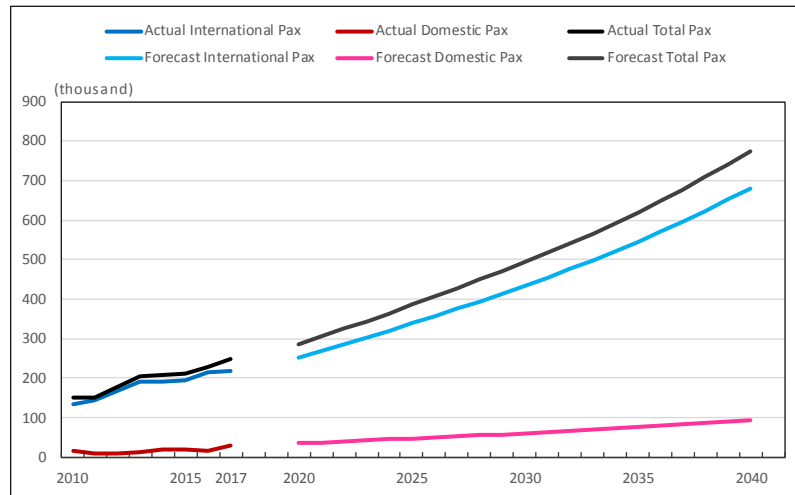
As for domestic cargo demand, it was considered that it is unnecessary to forecast because all of fleets operated in domestic air service are small turboprops that have few capacities to load air cargoes. Therefore, the forecast of domestic cargoes was excluded in this study.

Future growth rates of GDP were assumed taking into account of the IMF estimate as summarized below:

- i) IMF assumed that GDP of East Timor would grow at 6.0 % in 2018 and 2019, 5.5 % in 2020 and 2021 followed by 5.2 % in 2022.
- ii) It has been assumed that the GDP growth rate would also be 5.2 % in 2023, and would decrease by 0.2 % every two years and would remain steady at 4.0 % from 2034.

b) Air Traffic Demand Forecast at Dili

Based on above mentioned, air traffic demand forecast at Dili were estimated as shown in Figure and Table 2.2.2-1.



Source: JICA Study team

Figure 2.2.2-2 Air Traffic Demand Forecast at Dili

Table 2.2.2-1 Annual Air Traffic Demand Forecast at Dili

	CY	GDP (million USD) (2010 constant prices)		Air Passengers (thousand persons)						Air Cargoes (tons)	
		Value	Change	International		Domestic		Total		International	
				Number	Change	Number	Change	Number	Change	Volume	Change
Actual	2010	894	10.1%	133.2	17.6%	16.7	60.5%	150.0	21.2%	415.7	6.2%
	2011	965	7.9%	143.7	7.8%	7.8	-53.1%	151.5	1.0%	426.0	2.5%
	2012	1,014	5.0%	168.7	17.4%	10.1	29.0%	178.8	18.0%	471.5	10.7%
	2013	1,041	2.6%	192.0	13.8%	12.9	27.2%	204.9	14.6%	239.6	-49.2%
	2014	1,083	4.1%	189.5	-1.3%	17.4	35.0%	206.8	0.9%	171.0	-28.6%
	2015	1,127	4.0%	193.0	1.8%	19.0	9.4%	212.0	2.5%	246.6	44.2%
	2016	1,186	5.3%	212.7	10.2%	16.4	-13.6%	229.2	8.1%	284.0	15.2%
Forecast	2017	1,165	-1.8%	216.4	1.7%	30.3	84.7%	246.7	7.7%	326.1	14.8%
	2018	1,191	2.2%	222.9	3.0%	31.2	2.9%	254.1	3.0%	340.1	4.3%
	2019	1,241	4.2%	235.6	5.7%	32.9	5.5%	268.5	5.7%	367.4	8.0%
	2020	1,303	5.0%	251.3	6.7%	35.0	6.4%	286.3	6.6%	401.2	9.2%
	2021	1,368	5.0%	267.8	6.6%	37.3	6.3%	305.1	6.5%	436.8	8.9%
	2022	1,433	4.8%	284.5	6.2%	39.5	6.0%	324.0	6.2%	472.6	8.2%
	2023	1,502	4.8%	301.9	6.1%	41.8	5.9%	343.8	6.1%	510.2	7.9%
	2024	1,571	4.6%	319.5	5.8%	44.2	5.6%	363.7	5.8%	547.9	7.4%
	2025	1,643	4.6%	337.8	5.7%	46.7	5.6%	384.5	5.7%	587.3	7.2%
	2026	1,716	4.4%	356.1	5.4%	49.1	5.3%	405.3	5.4%	626.8	6.7%
	2027	1,791	4.4%	375.3	5.4%	51.7	5.2%	427.0	5.4%	668.0	6.6%
	2028	1,867	4.2%	394.4	5.1%	54.3	5.0%	448.6	5.1%	709.1	6.1%
	2029	1,945	4.2%	414.2	5.0%	57.0	4.9%	471.2	5.0%	751.8	6.0%
	2030	2,023	4.0%	434.0	4.8%	59.6	4.7%	493.6	4.8%	794.3	5.6%
	2031	2,104	4.0%	454.5	4.7%	62.4	4.6%	516.9	4.7%	838.5	5.6%
	2032	2,188	4.0%	475.8	4.7%	65.3	4.6%	541.1	4.7%	884.4	5.5%
	2033	2,275	4.0%	498.0	4.7%	68.3	4.6%	566.3	4.7%	932.2	5.4%
2034	2,366	4.0%	521.1	4.6%	71.4	4.6%	592.5	4.6%	981.8	5.3%	
2035	2,461	4.0%	545.1	4.6%	74.6	4.5%	619.7	4.6%	1,033.5	5.3%	
2036	2,559	4.0%	570.1	4.6%	78.0	4.5%	648.0	4.6%	1,087.2	5.2%	
2037	2,662	4.0%	596.0	4.6%	81.5	4.5%	677.5	4.5%	1,143.1	5.1%	
2038	2,768	4.0%	623.0	4.5%	85.1	4.5%	708.1	4.5%	1,201.2	5.1%	
2039	2,879	4.0%	651.1	4.5%	88.9	4.4%	740.0	4.5%	1,261.6	5.0%	
2040	2,994	4.0%	680.3	4.5%	92.8	4.4%	773.1	4.5%	1,324.5	5.0%	

Source: JICA Study team

c) Estimation of Air Traffic Demand by Route

As for international service, the existing three routes that consists of Denpasar (DPS), Singapore (SIN) and Darwin (DRW) are assumed to be operated continuously, and international passengers by route were estimated based on the actual flight schedule (frequency and operating fleet by route) with assumption that small jets (ICAO code C) will be operated continuously. However, for Denpasar route, large jet (ICAO code E) is expected to be operated along with increase of air passengers.

As for domestic service, new air routes such as Same and Atauro in addition to the existing two routes (Oecussi and Suai) will be operated in the future based on projection of AACTL (Civil Aviation Authority of Timor-Leste). Therefore, the forecasts by route were not estimated and it was assumed that turboprop (ICAO code B) will be operated continuously.

Fleet components in the future are summarized as below. Peak-day ratio was assumed as 1/324 based on actual monthly flight schedule from 2015 to 2017, and average load factor was assumed as 70.0%.

Fleet Components in International Flights

Denpasar (DPS): Small Jet (ICAO code C; 150 seats/ flight),
Large Jet (ICAO code E; 270 seats/ flight)

Notes) It was assumed that small jets will be operated to reach 14 times in peak-day, and, after that, large jets will be operated additionally.

Singapore (SIN): Small Jet (ICAO code C; 150 seats/ flight)

Darwin (DRW): Small Jet (ICAO code C; 76 seats/ flight)

Fleet Component in Domestic Flights: Turboprop (ICAO code B; 19 seats/ flight)

The forecasts of passengers and aircraft movements are summarized as shown in Table 2.1.2-1 and Table 2.2.2-3.

Table 2.2.2-2 Summary of Air Passenger/ Cargo Demand Forecast at Dili

CY	Air Passengers (thousand persons/annum)						Air Cargoes (tons/annum)			
	International				Domestic	Total	International			
	DPS	SIN	DRW	Sub total			DPS	SIN	DRW	Total
2020	164.6	21.9	64.9	251.3	35.0	286.3	263	35	104	401
2025	229.7	27.7	80.4	337.8	46.7	384.5	399	48	140	587
2030	305.9	33.4	94.6	434.0	59.6	493.6	560	61	173	794
2035	397.9	39.2	108.0	545.1	74.6	619.7	754	74	205	1,033
2040	513.6	45.6	121.2	680.3	92.8	773.1	1,000	89	236	1,324

Source: JICA Study team

Table 2.2.2-3 Summary of Aircraft Movement Forecast at Dili

(Aircraft movements/annum)

CY	International Flights						Domestic Flights (Code B)
	DPS			SIN (Code C)	DRW (Code C)	Total	
	Code E	Code C	Sub total				
2020		1,568	1,568	208	1,220	2,996	2,634
2025		2,188	2,188	264	1,512	3,964	3,510
2030		2,914	2,914	318	1,778	5,010	4,484
2035		3,790	3,790	374	2,030	6,194	5,608
2040	558	3,888	4,446	434	2,278	7,158	6,978

Source: JICA Study team

d) Adoption of Facility Planning Parameters

The commencement year of operation of Phase 1 facility was decided in 2022 and therefore the target year of facility planning of Phase 1 project decided to be 2027 and the target year of Phase 2 project will be around 10 years later Phase 1.

Air traffic demand forecasts in each target year are summarized as shown in Table 2.2.2-4.

Table 2.2.2-4 Air Traffic Demand Forecast in Target Years

		Phase 1 (CY 2027)	Phase 2 (Roughly 10 years later after target year of Phase 1 Project)
Air Passengers (thousands)	International	375	596
	DPS	259	441
	SIN	30	42
	DRW	86	113
	Domestic	52	81
	Total	427	677
Air Cargoes (tons)	International	668	1,143
Aircraft Movements (times)	International	code E aircraft	code E aircraft 174
		code C aircraft 4,376	code C aircraft 6,416
		total 4,376	total 6,590
	DPS	Large Jet (code E)	Large Jet (code E) 174
		Small Jet (code C) 2,466	Small Jet (code C) 3,888
		SIN	Small Jet (code C) 286
	DRW	Regional Jet (code C) 1,624	Regional Jet (code C) 2,130
	Domestic	Turboprop (code B) 3,890	Turboprop (code B) 6,124
	Total	code E aircraft	code E aircraft 174
		code C aircraft 4,376	code C aircraft 6,416
		code B aircraft 3,890	code B aircraft 6,124
		8,266	12,714

Source: JICA Study team

According to the actual international flight schedule at Dili, although the total of daily frequency is not high, the slots in specific hours are congested because the origin airports of all international flights are not Dili (all international flights are operated from other airport and turned back). According to the condition, facility planning parameter such as peak-hour flight and passengers were adopted based on assumed peak-day flight diagram in target year as follows and summarized as shown in Table 2.2.2-5.

Number of Passengers and Flights at Peak-hour (Parameter for PTB Planning)

- Phase 1 (CY 2027) : 340 persons/ peak-hour (6 flights = 3 arrivals and 3 departures)
- Phase 2 (about 10 years later of Phase 2) :
540 persons/ peak-hour (8 flights = 4 arrivals and 4 departures)

Number of Parking Spot at Peak-hour (Parameter for Aircraft Stand Planning)

- Phase 1 (CY 2027) : Small Jet (ICAO code C) × 4 / peak-hour (including occasional spot)
- Phase 2 (about 10 years later of Phase 2) :
Large Jet (ICAO code E) × 2 / peak-hour (including occasional spot)
Small Jet (ICAO code C) × 3 / peak-hour

Table 2.2.2-5 Summary of Facility Planning Parameters

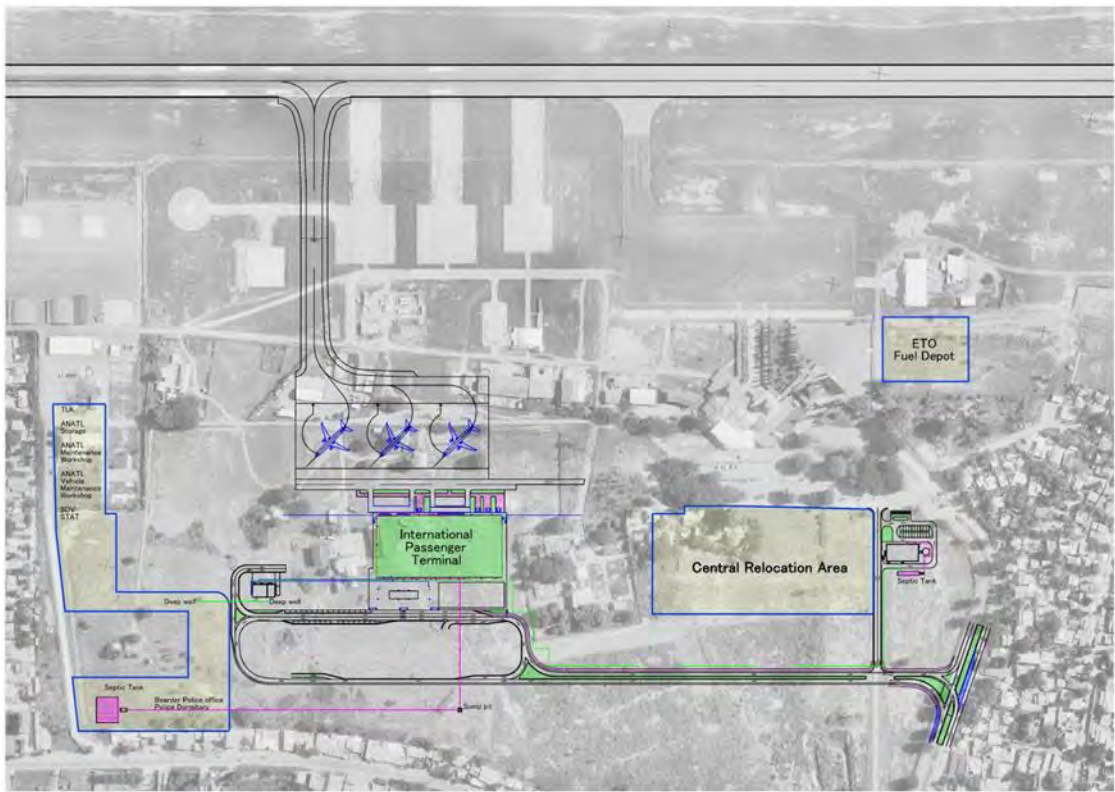
	Phase 1 (CY 2027)	Phase 2 (Roughly 10 years later after commencement of Phase 1 operation)
Passenger Terminal Building	340 persons/peak-hour (for each of arrival & departure)	540 persons/peak-hour (for each of arrival & departure)
Cargo Terminal Building	2.5 tons/ peak-day (total of loading & unloading)	4.3 tons/ peak-days (total of loading & unloading)
Aircraft Parking Stands	S-J (code C) x 4 (including occasional spot)	L-J (code E) x 2 S-J (code C) x 3 (including occasional spot)

Source: JICA Study team

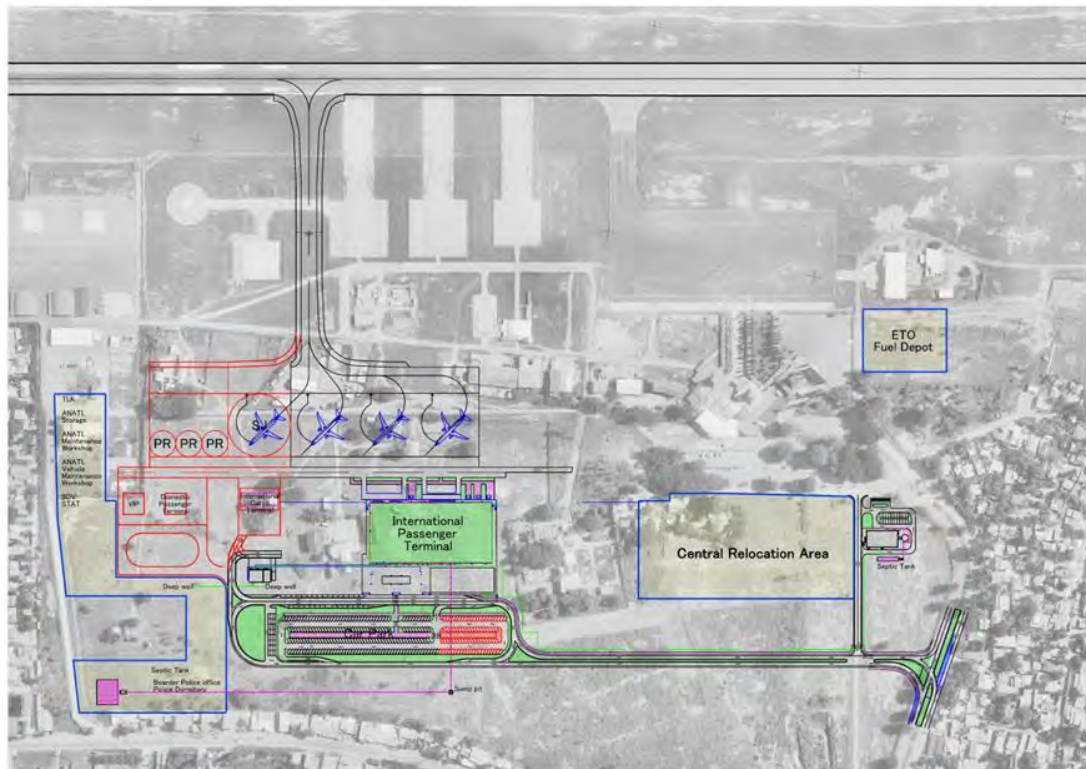
2) Terminal Facility Expansion Plan

For reference purpose, preliminary phased terminal facilities development plans up to around 2040 are presented hereunder. Assumed project target and major components are described as follows:

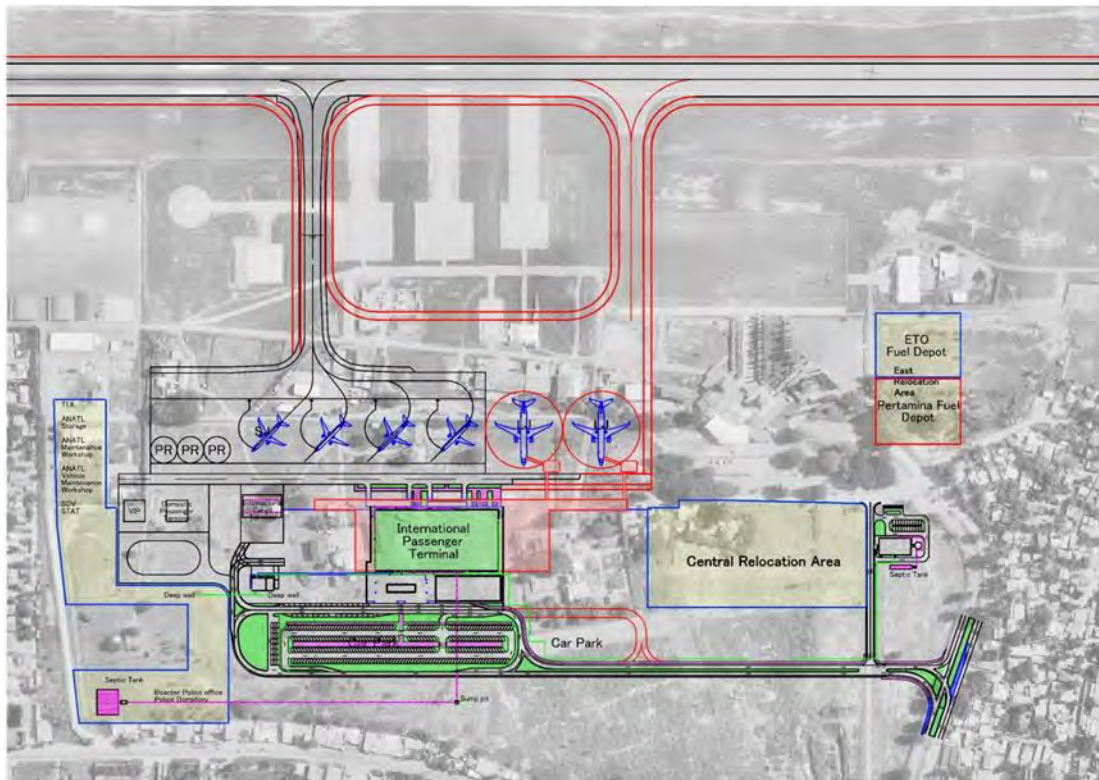
- Phase 0; preparatory works for smooth implementation of the Japanese Grant, consisting of the new power substations and relocation of the existing facilities by Timor-Leste side.
- Phase 1; development of the new international passenger terminal facilities, consisting of the construction of the international passenger terminal building, the aircraft parking apron, the taxiway as well as the new control tower and the power substation, etc. under Japanese Grant.
- Phase 1.5; relocation of the domestic passenger terminal building, the domestic apron and the cargo terminal building as well as the VIP terminal to the western side of the new terminal area. The international aircraft parking apron will need to be expanded but the runway length could be as is.
- Phase 2; Extension of the runway to approximately 2,150m to accommodate operations of the medium class jet aircraft (B787, A330 class) on Dili-Denpasar route. Expansion of the international passenger terminal building including two-level departure building with passenger boarding bridges will be implemented. The aircraft parking apron should also be expanded. The existing taxiway should be widened, and additional taxiway should be provided.



Phase 1: Development under the Japanese Grant



Phase 1.5 Relocation of the domestic passenger terminal building



Phase 2: Extension of the runway to accommodate operations of the medium class jet aircraft
 Source: JICA Study team

Figure 2.2.2-3 Preliminary Phased Terminal Facilities Development Plans

ANATL has a plan to extend the runway to initially 2,150m, 90m toward southwest and 210m toward northeast, by the Phase 2 above. The plan describes that the new terminal facilities are initially located closer to the existing RWY 08 threshold (the western runway end) and will be expanded to the northeast toward RWY 26 threshold (the eastern runway end). Therefore, the new terminal building location ensures that the new terminal facilities will remain nearly equidistant as much as possible from both runway thresholds for smooth airport operation and expansion while avoiding an adverse effect to the surrounding area. The location and eyelevel height of the new control tower have been designed to ensure that the line-of-sight requirement of the air traffic controller will meet with the internationally accepted requirement of US Federal Aviation Administration even in case the runway is extended in the long-term to the total length of 3,000m mainly to the northeast.

Therefore it is recommendable that when examining the Dili International Airport Master Plan including the runway extension plan, ANATL should carefully take into account the proposed terminal expansion plan so that a comprehensive airport master development plan for both the airside and landside is formulated.

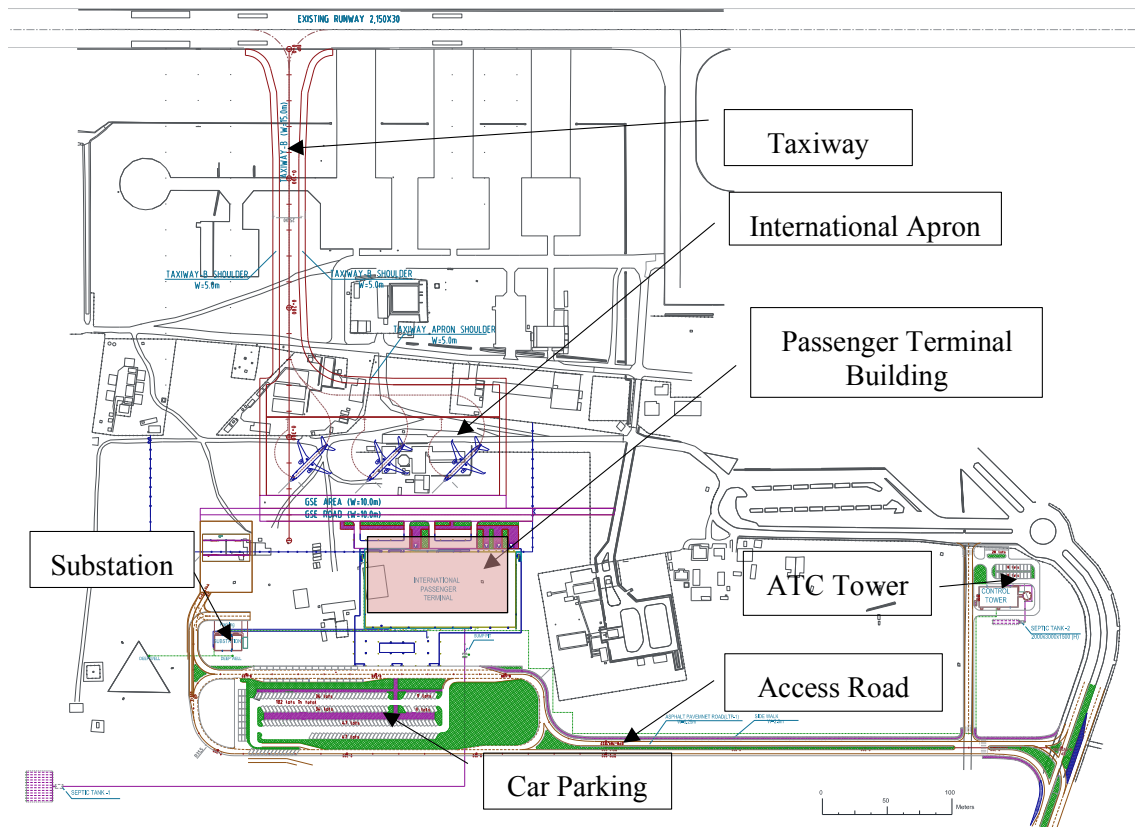
3) Facility Location Plan

The new terminal area is designed in the west side of the existing terminal area within the boundary of the airport property. The main component of the new passenger terminal building is planned in the area. The new international apron is located at the airside of the passenger terminal building. For the location of aircraft apron, the aircraft parked in the

apron does not infringe obstruction surface when ANATL operates with 150m runway strip after runway extension. The land is secured in the east side in order to expand the terminal building and apron in the future.

As a result of discussion with AATCL, 30m separation is secured between the terminal building and curbside of the access road based on the ICAO security manual. ANATL requests that the east side of the new terminal area is secured for development of commercial area in the future. The access road to the terminal building is located at the south side of the terminal building and designed straight from the south side of the parking area to the existing access road. The existing road is used for transfer between the existing terminal building and new terminal building.

Location of the ATC tower is planned as it locates in the centre between east and west end of the runway after extension in consideration to the view of the ATC controllers. The height of the ATC tower does not infringe obstruction surface. The location plan is shown in the figure below.



Source: JICA Study team

Figure 2.2.2-4 Facility Location

4) Plan for Each Facility

a) New International Passenger Terminal Building

As indicated in the aviation demands, the aircraft code will be Code C (small jet: B737 and A320) in the target year of 2027 and 2032. Code E (large jet) aircraft is expected to be operated after 2037.

For Code C aircraft operation, the aircraft park will be economically advantageous with self-maneuvering with one-story for passenger terminal building. For Code E (large jet aircraft), the passenger terminal building should be designed for two-story with passenger boarding bridge for securing safety and efficiency for passenger boarding.

The above concept taken into consideration, the new passenger terminal building is planned with one-story and potential to expand into the two-story building when Code E (large jet aircrafts) is operated in the future.

b) International Cargo Terminal Building

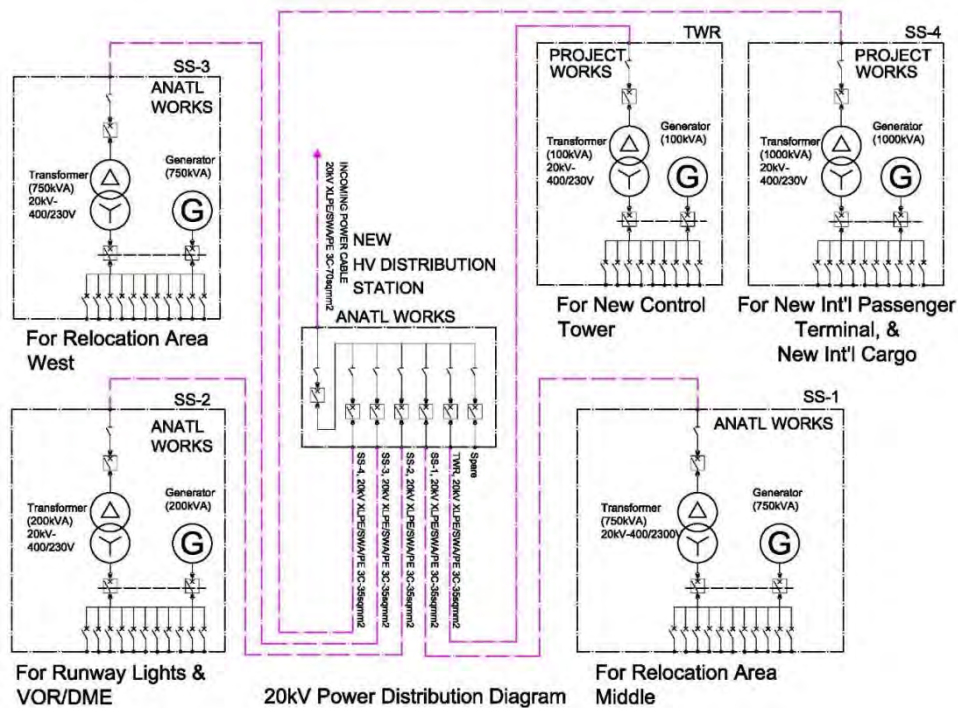
The size of the new cargo building has been assumed twice as large as the existing cargo building. Due to the constraints on the project budget, this component is excluded from the project.

c) ATC tower

The height of the ATC tower and the eye level of ATC controllers were planned to ensure adequate eyesight in the case that ANATL extends the runway to the east to 3000m crossing Comoro River.

d) Substation

It has been agreed upon between JICA and ANATL that ANATL should construct a 20kV HV Distribution Station to supply power to the new control tower (shown "TWR" in figure below) and the new power substation ("SS-4") to be developed under JICA Grant as well as the facilities to be relocated by ANATL etc. The new 20 kV HV Distribution Station will be constructed by the tender announcement scheduled in September 2019 according to the agreement by both Parties. From SS-4, the power will be supplied to the new international passenger terminal building.



Source: JICA Study team

Figure 2.2.2-5 Figure 2.2.2-4-1 Substation

e) Apron

At the preliminary stage of the Project, four spots for small jets were planned in order to meet aviation demands in 2027. However, through the discussion with ANATL, the number of the spots was decreased to three to meet the aviation demands of 2022, commencement of the passenger terminal building operation constructed by the Project.

f) Taxiway

At the early stage, two taxiways were planned in both the end of apron in order to flexible operate. However, taking into account the constraints for the project budget, one taxiway is designed at the west end of apron.

g) Parking and access road

The car parking to accommodate 260 cars was based on the aviation demands of three small jet aircraft in 2027. Taking into account the available project budget, the parking is divided two portions, one of which is earthwork, which was included in the Project and the other is pavement, which is to be undertaken by Timor Leste side. A Street light is only provided in the new ATC tower area.

h) Aeronautical ground lighting

At the beginning of the survey, aeronautical ground lighting required for the taxiway and apron was included in the Project. However, due to the constraints of the project budget, scope of the project has changed and excluded the ground lighting. Instead of

being undertaken by the Project, they will be installed when ANATL extends the runway and install the runway lights in future.

(2) Basic Plan (Facilities Plan)

1) New International Passenger Terminal Building (PTB)

a) Building Layout

Building location follows civil master plan. PTB south side (curbside) is provided with a 30-m long buffer area up to the road shoulder. This aims to meet ICAO requirements for counter terrorism. North side (airside) retains 10 m long vacant area, which will be used for future building extension. Both parts are covered with shading roof. The 30-m long buffer area and 10-m wide vacant space are covered with shading roof to protect the passengers and airport staff for luggage handling from rain and sunshine.

The new international passenger terminal building exclusively accommodates the international passengers. The existing terminal building will be converted to domestic one after completion of the new terminal building. With regard to the architectural design, the existing terminal reflects a local traditional style. Currently the architectural design of new international passenger terminal adopts a simple and modern feature based on the counterpart's opinion obtained at the initial stage of the Survey. However, the Survey Team received several requests from the current counterpart to consider vernacular style. This input will be fully taken into account at the detail design stage.

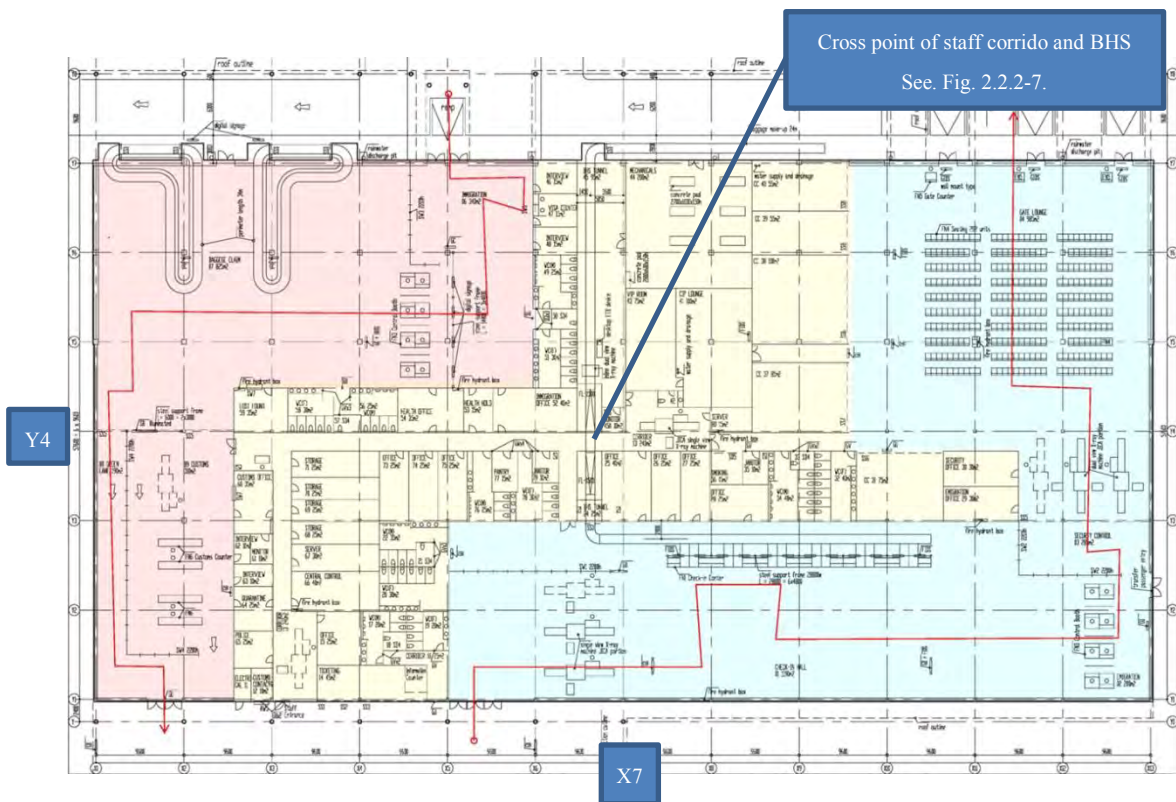
With regard to the structural grid of the new international passenger terminal building, a 9.6-m span has been adopted considering the stability and economy of the reinforced concrete structure. It spreads 12 bays in east-west, and 7 bays in north-south direction. It is flat building, and 2nd floor includes exterior space only.

A series of air conditioning outdoor units occupies one bay on the 2nd-floor rooftop. The next one bay is used as rooftop view deck because ANATL requested adding this usage. Due to the existing facility that has the same function attracting non-passenger visitors. This view deck is fully covered with mesh fence to separate airside apron for security.

Entire 1F area size is 6,720 m². It divided into three blocks, which are Departure Block (blue), Arrival Block (red) and Service Block (yellow). Arrival Block is located on the west side and Departure Block on the east side. The east-west arrangement here matches the direction of future building expansion. Service Block is located in the center and includes mechanical and functional rooms. This is aims at avoiding re-location of functional facilities in future building expansion.

Following locally available finish materials have been selected mainly because they are cost-effective in terms of the repair and maintenance after the project completion and still satisfy technical and quality requirements.

- Roof: aluminum - zinc alloy corrugated sheet 0.8t
- Exterior Wall: blockwork 200t +mortar20t +acrylic paint
- Interior ceiling:
LGS support system +Gypsum board 9t +rockwool acoustic board 12t
- Interior wall: blockwork 200t +mortar20t +acrylic paint
- Passenger area interior floor: granite stone 600 x600 x30t



Source: JICA Study team

Figure 2.2.2-7 PTB 1F Plan

i) Departure Block

Figure 2.2.2-6 presents departure block with blue hatched area. Entrance exists at (X5-6, Y1). Inside the terminal building, the departing passengers are firstly subjected to the general luggage inspection at the entrance, and proceed to the check-in counters, emigration counters for passport control, security check points for carry-on baggage and metal items, and gate hold area to wait for the boarding time (see red line in blue area on right side of Figure 2.2.2-6). This simple flow can help passengers understand their location in the buildings and way to go. Passengers always can see outside through the window opening by the right hand of move direction. This also will help passengers recognize the space. The ceiling height is determined as 4.5 m, which is spatial enough for public space, and designed to operate air conditioning efficiently.

General luggage inspection area in (X6-7, Y2) has space for two pairs of Single View X-ray machine and metal detectors, and a single space for future installation. Carry-on baggage inspection area in (X12, Y3-4) holds two pairs of Dual View X-ray machine and metal detectors and a single space for future installation. The checked baggage is inspected in BHS inline. Dual View X-ray machine and ETD inspection machine are installed on <BHS Tunnel 45>.

1. Departure Passenger Terminal Facilities		Planned Figure
1-b	Check-in Hall (check-in counters) Position of units Area	12 units 1,190 m ²
1-c	Emigration (Passport Control Counters) Number of desks Area	8 units 200 m ²
1-d	Security Control Number of security units Area	2 units 255 m ²
1-e	Gate Lounge Area	985 m ²
Sub-total (A)		2,630 m ²

Source: JICA Study team

Table 2.2.2-6 PTB Departure Block Room List

ii) Arrival Block

The arrival passengers enter the terminal building through arrival entrances located on the north side of the building (X5, Y7), and proceed to the visa purchase counters and the passenger quarantine as well as the immigration interview as required. Then they pick up their checked baggage at the baggage claim area and proceed to the customs check area (see red line in red area on left side of Figure 2.2.2-6).

Passengers get through window openings on the right-hand side in moving direction. On the left side (east side), several CIQ functions line up on X3 wall. The counterpart of CIQ personnel requested it at a direct meeting with related public sectors.

Airport quarantine monitors arriving passengers at (X5, Y6) beside immigration inspection gate. The suspected passengers are retained in <Health Hold 53>. A quarantine personnel attends the patient to transport to medical facilities in downtown. In the existing terminal, customs office currently conducts 100% total X - ray inspection. In the new PTB it will modernize the method to increase inspection process capacity. Inspector at (X2, Y4) separates passengers into two groups <Green Lane 08> on X1 side, and <Customs 09> on X2 side. The latter group is processed with necessary inspection. This includes animal and plant quarantine facilities.

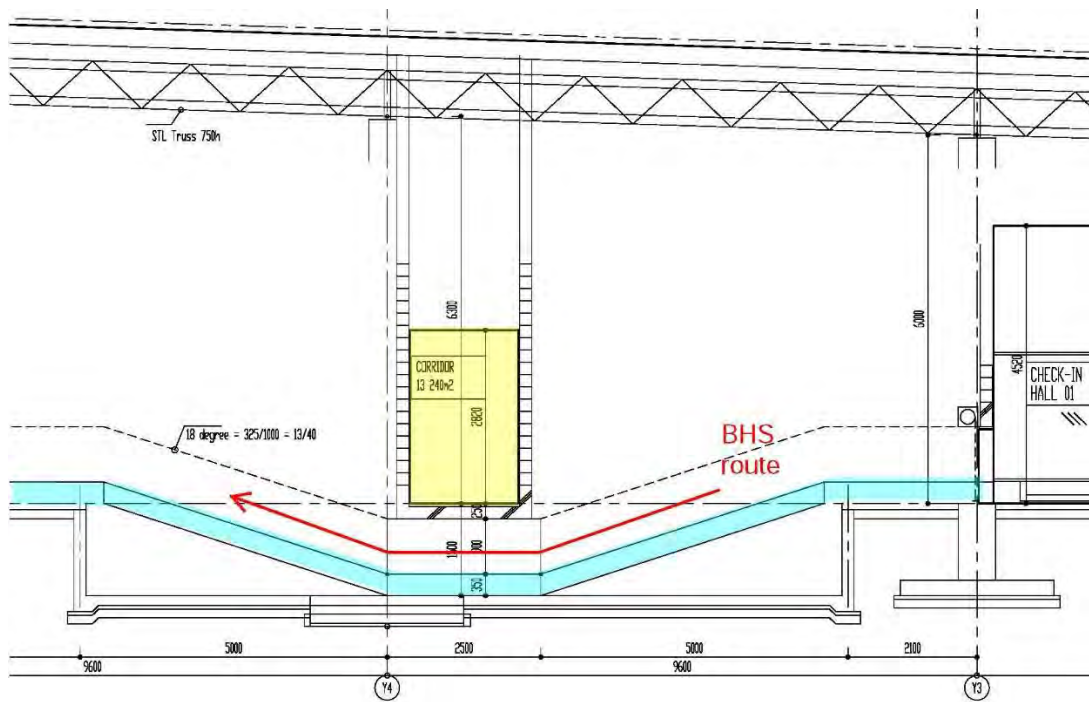
2. Arrival Passenger Terminal Facilities		
2-a	Immigration (Arrival Passport Control units)	
	Number of units	8 units
	Area	340 m ²
2-b	Baggage Claim	
	Number of device	2 units
	Area	825 m ²
2-c	Customs	
	(1) Custom X-ray Control for Non-declare	
	Number of units	1 units
	Area	190 m ²
	(2) Custom Control Area for Declare	
	Number of units	4 units
	Area	310 m ²
Sub-total (B)		1,665 m ²

Source: JICA Study team

Table 2.2.2-7 PTB Arrival Block Room List

iii) Service Block

The service block comprises several support facilities such as BHS tunnel, mechanical rooms, offices and WC. A staff entrance/exit of the terminal building and a staff corridor as well as an entrance to/exit from the gate lounge with security check point are also provided in the service block. This improves operational efficiency and security safety. <Central Control 66> and <Server 67> are located adjacent to staff entrance. These rooms work in a disaster control. This staff entrance serves for goods loading and garbage removal. For building smaller than 7,000m² of floor size, “co-use” of staff entrance and service loading is rational.



Source: JICA Study team

Figure 2.2.2-8 Cross Section at Staff Corridor (X7, Y4)

As per Figure 2.2.2-7, staff corridor and BHS tunnel intersect at (X7, Y4). BHS tunnel bottom is lowered down to 1FL – 1500. This eliminates staff corridor floor gap to ease goods handling and universal accessibility.

X-ray inspection machine and metal detector at the staff entrance/exit of the terminal building are to be procured by ANATL. The other X-ray machine and metal detector at the entrance to/exit from the gate lounge (X8, Y4) for inspection of the personnel and delivered goods are included in the scope of JICA Grant.

As ANATL tenant revenue heavily depends on Concessions and CIP lounge area, they need sufficient floor size. Tenant interior work of both Concessions and CIP lounge will be covered by ANATL. The building works provide minimum interior finish such as mortar finished wall, rockwool board ceiling, and MEP items to meet technical and regulatory requirements. VIP room is added behind CIP lounge to respond to ANATL's request.

All 5 passenger toilets are designed to meet universal design and gender freedom concept. Therefore, they have a separated handicap WC for wheelchair usage and furnished with a baby bed.

3. Other Terminal Facilities		
3-a	CIP Lounge (WC, VIP Room included)	200 m ²
3-b	Concessions	370 m ²
3-c	Airline and Other Office	290 m ²
3-d	CIQ Office	215 m ²
3-e	Central Control (Server Room included)	40 m ²
3-f	WC in 6 locations	370 m ²
3-g	BHS Room	105 m ²
3-h	Mechanical / Electrical Room	250 m ²
3-j	Storage	100 m ²
3-k	Other (corridor, the other technical premises)	487 m ²
Sub-total (C)		2,427 m²
Grand total (A+B+C)		6,722 m²

Source: JICA Study team

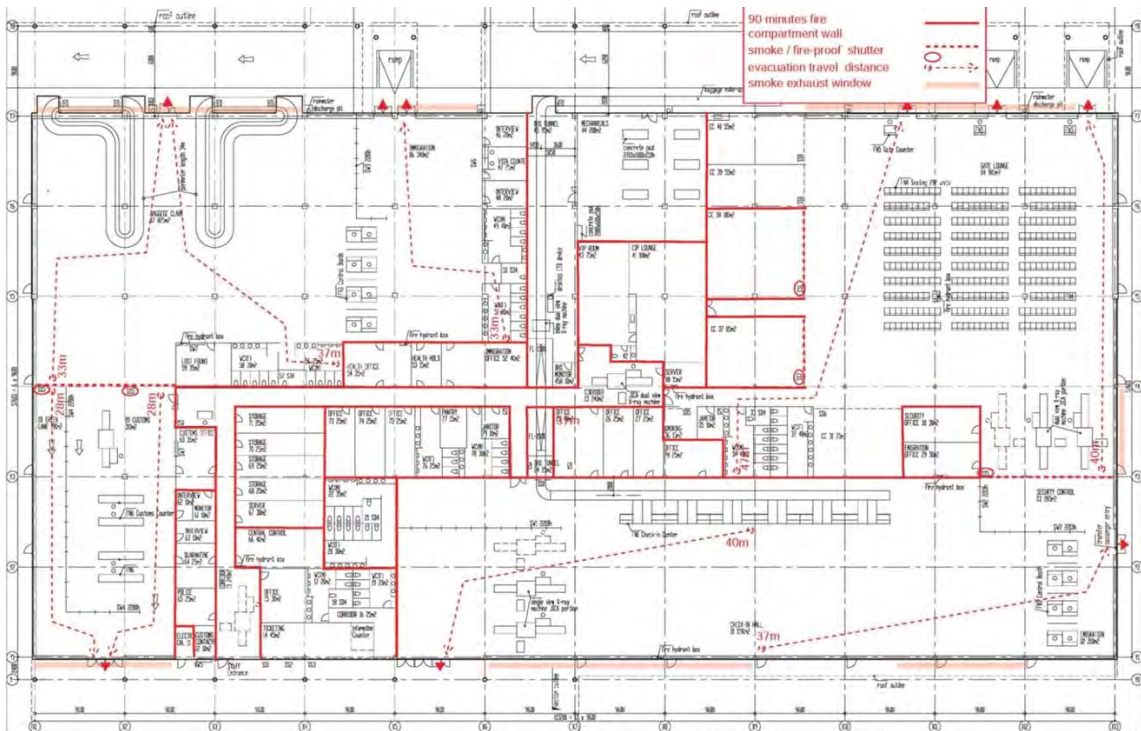
Table 2.2.2-8 PTB Service Block Room List

b) Disaster Prevention

It has been decided that Japanese Building Codes are to be used as referred regulatory. This is because local related regulatory system underdeveloped in East Timor and they agreed using Japanese building codes. In fact, we interviewed Building Directorate and Fire Departments for legal compliance in building codes to reveal it. Also, Disaster prevention plan is relatively simple as it is flat building. Complicated mechanical equipment is eliminated from the viewpoints of cost efficiency and usability. This also simplifies after-maintenance.

i) Fire Compartment

Japanese Building Codes requirements stipulate that all of the fire compartment area sizes remain under 1,500 m². In addition, storages, electric machinery rooms, which fire load is large, are isolated. All these fire compartments are separated by fire rated block wall. All openings are covered by either fire shutter or fire doors. Fire dampers are installed at penetrations of ducts for air-conditioning. Any automatic fire extinguishing system including a water sprinkler has not been adopted for easy maintenance work.



Source: JICA Study team

Figure 2.2.2-9 PTB Fire Fighting Plan

ii) Smoke Exhaust Compartment

Japanese Building Codes provide that passenger area is divided by hanging smoke barrier into smoke exhaust compartments under 500m² of floor size. Each compartment is provided with smoke exhaust window. It has opening size, which is over 1/50 of compartment floor size, and retain maximum the horizontal distance 30 m. Each exhaust window is operated with manual handle. 240 m² <Corridor 13> in Service Block is divided into under 100m² compartment from safety viewpoint in evacuation. Any other rooms such as office and concession remain less than 100m² in floor size. The PTB does not use any mechanical smoke exhaust system. This saves initial cost and makes after-maintenance easier.

iii) Evaluation Distance

Japanese Building Codes Clause stance 125 limits evacuation distance from any part of room to fire exits as 100m. In Departure Block and Arrival Block, walking distance is limited as 50 m to consider passenger usage. All passenger areas directly face exterior wall. This is advantageous in disaster evacuation planning.

c) Structural Plan

The single-story international passenger terminal building structurally consists of the following two parts:

- i) Reinforce concrete structure part where the roof-top mechanical system and the view deck are to be provided; and
- ii) Simple truss steel structure part for the other portion of the building.

Slab-on-grade ground floor is to be constructed on an independent foundation. The design bearing capacity of 100 KN/m² needs to be confirmed based on the plate bearing test on the site. In addition, the soil up to 50cm under the surface of the slab on grade is to be compacted to achieve 95 % of the maximum dry density based on the filed density test.

d) Electrical and Mechanical Facilities

i) Electrical Facilities Plan

a) Main Feeder and Low Voltage Power Distribution System

SS-4 substation is constructed to supply the electricity to the PTB by low voltage power distribution system of three phases four wire 380/220V, 50Hz.

Power circuit is three phase 380V, and lighting and receptacle circuit is single phase 220V

The cable size of main feeder between SS-4 substation and the PTB should take into consideration the voltage drop of 6% or less at the far end of the PTB from SS-4 substation.

b) Lights and Receptacles

Final distribution board with electric watt-hour meter is planned for each room basically so that electricity charges can be collected per room. Therefore, lights and receptacles circuits should be designed per room.

Considering energy saving, LED is adopted for reducing the maintenance cost.

To avoid blackout by interruption of power supply before starting the standby engine generator, self-contained battery-operated emergency lights are installed.

Self-contained battery operated "EXIT" lights are also installed at each escape door and corridor required.

The design average illuminance (lux) at each area and room is set as follows:

- Concourse, check-in hall, and toilets: 250 lux
- Departure hall, arrival hall, baggage claim area, VIP/CIP lounge, and shops: 300 lux
- Airline offices, airport management offices, and CIQ offices: 400 lux
- Storage and mechanical room: 150lux

Spotlights should be installed at the check-in area to achieve sufficient illuminance (minimum 400 lux) on the counters.

At least one receptacle will be installed per 100m² for cleaning equipment. For computers, individual receptacle is installed at each counter such as immigration booth and check-in counters. Unfortunately, all receptacles in the PTB are backed up by standby engine generator, but it is not Uninterruptible Power System (UPS). Therefore, user should prepare the UPS for computers.

Individual receptacle is also planned for advertisement displays and hand dryers.

c) Telephone System

In order to clarify the inquiry counter from outside, the project plans an IP phone for airline offices, airport management offices, CIQ offices, etc.

IP-PBX should have at least 12 trunk lines and 80 extension lines.

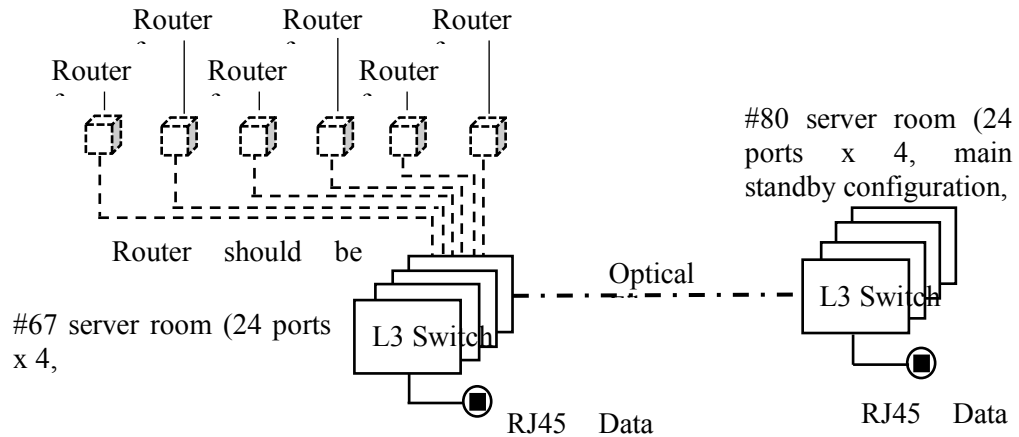
d) Data Network System

Data network system is planned to access the servers of each airline check-in/booking system, management/data system of CIQ department and airport authority, and access to Internet.

However, the equipment necessary for interface with each server through ISP such as modem/router, fire wall, and contract with ISP are not included in the project.

The security between each network in the PTB is designed based on V-LAN, and physical separation is not planned.

Figure 2.2.2-9 shows a conceptual diagram of the data network.



The data network switches will be shared by the following groups with Virtual Local Area Network (VLAN)

- 22 data ports for airlines office network
- 17 data ports for immigration office network
- 2 data ports for health office network
- 4 data ports for customs office network

Source: JICA Study team

Figure 2.2.2-10 Conceptual Diagram of Data Network.

e) Public Address System

The public address system is planned for announcing general information, boarding call for passengers, passenger call, and emergency notices. In addition to central announcement, individual announcement from check-in counter and boarding gate are available.

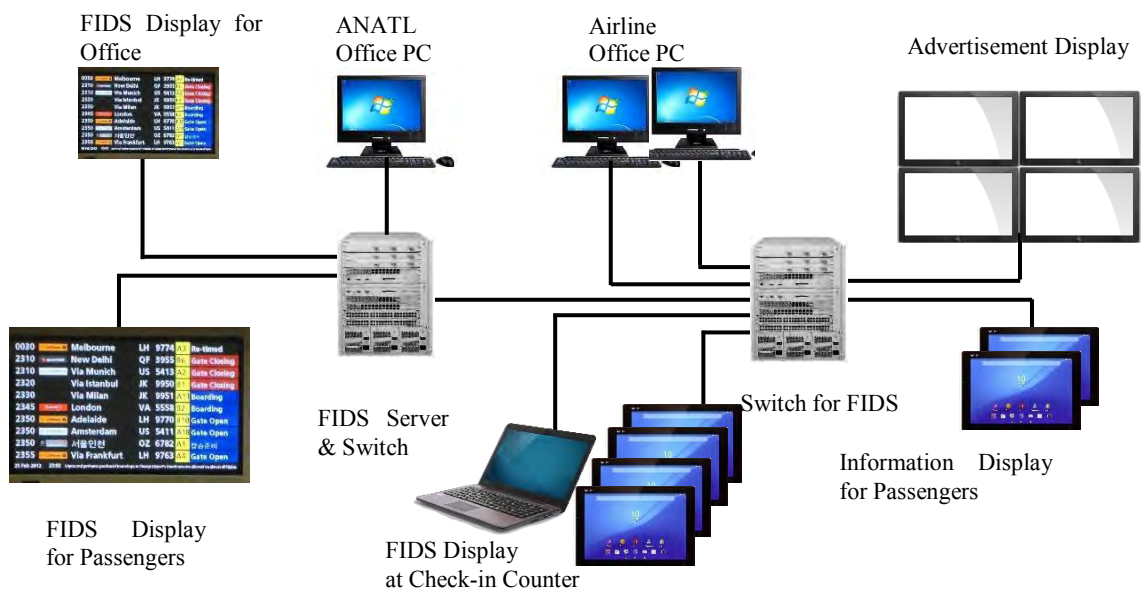
The output groups will be as follows:

- Management/General announcement: zone 11
- Public area in front of arrival/departure hall: zone 9
- Check-in hall, and emigration counter: zone 1
- Departure hall, shops, and CIP & VIP lounge: zone 2, 6, 7, & 8
- Arrival hall, immigration counter, baggage claim area, and customs: zone 4, 3, & 5
- Spare circuits: zone 12, & 13
- Emergency notices: all zones

f) Flight Information System (FIDS)

The flight information system is planned to display in real time flight information to departing passengers and welcoming peoples. The advertisement displays are planned as an option of FIDS to distribute charm of Timor-Leste country to tourists.

Figure 2.2.2-10 shows a conceptual diagram of FIDS.



Source: JICA Study team

Figure 2.2.2-11 Conceptual Diagram of FIDS

g) CCTV Camera System

The CCTV camera system is planned at new international passenger terminal building for airport security to monitor suspicious objects, and suspicious persons around PTB.

But the monitoring area is only inside the international terminal building and circumference of the building.

h) Building Management System (BMS)

By the monitoring and control a multitude of air conditioning equipment in a unified manner, the building management system is planned so that building operator obtains the maximum air conditioning effect with minimum energy.

BMS conveys the signals and status such as ON and OFF, and Alarms of switchgear, standby engine generator, and pumps for effective maintenance.

ON and OFF of lights of passengers' area and corridor in the PTB, road and car parking lights, and apron flood lights will also be controlled from the BMS individually.

i) Fire Alarm System

The fire alarm system is designed in accordance with Japanese fire cord.

j) Lightning Protection System

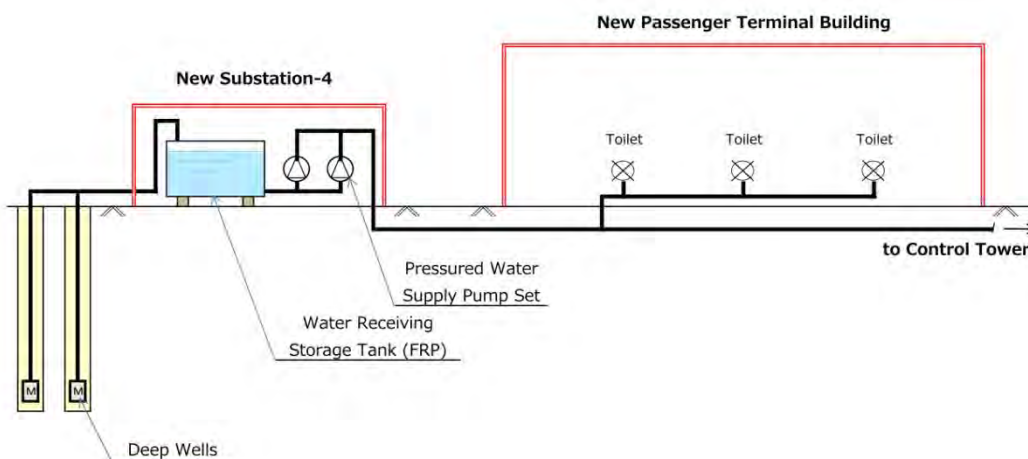
Protection level IV is applied based on the type of building and location. The external lightning protection system is planned by the mesh method of 20m pitch. The building structure steel will be used for the down conductor instead of copper wire.

SPDs are planned on the main distribution boards for an internal lightning protection system.

ii) Mechanical Works

a) Water Supply System

In order to supply potable water to the new passenger terminal building, the new deep wells will be provided on the side of sub-station-4, because the water capacity of the existing deep wells is not enough. The new water receiving storage tank will be installed in a mechanical room inside sub-station-4 and the capacity of water storage tank will be at least a half-day usage. The water will be provided to the new passenger terminal building and the new control tower.

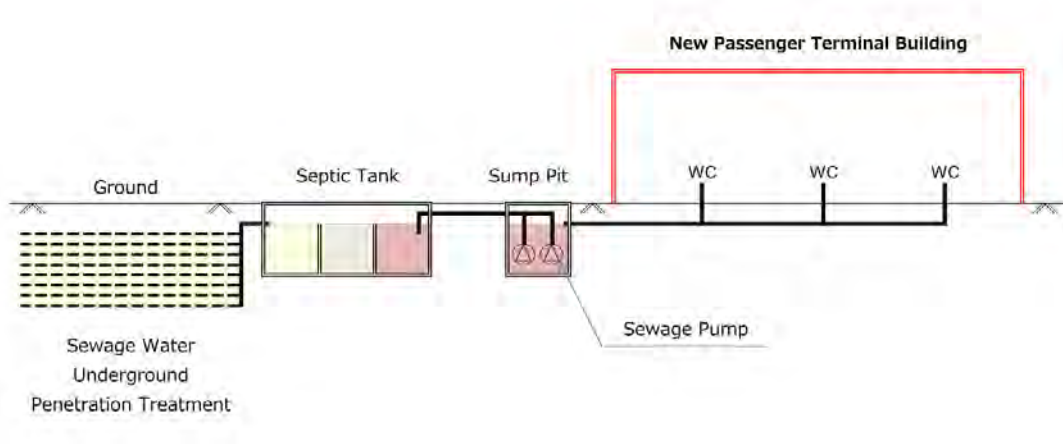


Source: JICA Study team

Figure 2.2.2-12 Outline of Water Supply System

b) Sewage Drainage Treatment System

A new simple septic tank treatment system with underground penetration treatment pipes will be used for the new passenger terminal building. In order to prevent pollution of underground water, the septic tanks with penetration treatment pipes will be installed at 330m to the southwest from the new passenger terminal building. The sewage water will be conveyed via a sump pit with a sewage pump on its way.



Source: JICA Study team

Figure 2.2.2-13 Outline of Sewage Drainage Treatment System

c) Fire Protection System

Since there are no local fire regulations, the Japan's fire defense law was applied and therefore an internal fire hydrant system is planned. The fire water storage tank is used as water receiving storage tank. The internal fire hydrant water supply pump will be located in mechanical room inside sub-station-4. In addition, in the passenger terminal building the fire extinguishers is supposed to be placed in accordance with fire law and regulations.

d) Air Conditioning and Ventilation System

To facilitate maintenance in normal operation and in trouble, and to reduce the costs for air conditioning equipment maintenance, the air conditioning system adopts use air cooled packaged air conditioner (PAC), with cooling only split type, multi & individual system.

For the area of check-in hall, gate lounge, baggage claim, immigration, and custom, ceiling duct type or ceiling cassette type's air conditioner will be used. For the other areas such as offices, VIP room, CIP lounge, and center control room, ceiling cassette type air conditioner will be used. Also, the wall mounted type's temperature controller will be installed in each room and area.

The fresh air will be provided to each room and the direct expansion coil type's floor mounted air conditioner will be used as outside fresh air unit (OU-OA).

The design air condition for external temperature is 34.9 °C, for relative humidity is 69.5%. The design internal temperature shall be 24~26°C (refer to the following Table 2.2.2-9table 3-2-2.9).

Table 2.2.2-9 Internal Condition of Air Conditioning Design

Room Name	Dry-bulb temperature DB (°C)	Relative Humidity RH (%)
Check in Hall Emigration/Immigration Security Control Arrival Bus Station Gate Lounge Baggage Claim Customs CIP/VIP Lounge Concession/Tenant Areas (CC)	25°C (± 2 °C DB)	50% (result)
Corridor	28 °C (± 2 °C DB)	50% (result)
Offices Smoking (Room)	26 °C (± 2 °C DB)	50% (result)
Central Control Server	24 °C (± 2 °C DB)	50% (result)

Source: JICA Study team

The mechanical ventilation system will be used for toilets, machine rooms, electrical rooms, pantry, smoke room and storages to exhaust the bad smell, heat generation and dust from these rooms.

e) Airport Special Equipment

The BHS (Baggage Handling system) will be installed in Departure Block and in Arrival Block. There is no backup system on the Departure Block. This will be settled by improving the maintenance operating activities up to the same level as in Japan. For fire protection purpose, all BHS tunnels are separated by fire ratted wall and fire-smoke shutter.

2) International Cargo Building

The international cargo terminal building has been excluded from the scope of the Project. However, the outline design itself has been carried out and the result is attached hereto for reference purpose.

3) International Aircraft Parking Apron

a) Design Criteria

i) Size of Facilities Required

- Small jet aircraft (Code C) x 3 spots, Self-maneuvering

ii) Design Aircraft

Table 2.2.2-10 Design Aircraft

Type of aircraft	Wingspan	Length	Height	Remarks
Small jet (ICAO Code C)				
B737-900ER winglet	35.79 m	42.11 m	12.55 m	Sriwijaya
B737-800 winglet	35.79 m	39.47 m	12.55 m	Sriwijaya
B737MAX-8	35.8 m	39.5 m	12.5 m	Silk Air (Future plan)
B737-500	28.88 m	31.01 m	11.15 m	737-500
A320-200	34.1 m	37.57 m	11.76 m	Citilink, Silk Air
A319-100	34.1 m	33.84 m	11.76 m	Silk Air
E170	26.00 m	29.90 m	9.67 m	Airnorth Regional
Large jet (ICAO Code E)				
B777-200	60.93 m	63.73 m	18.51 m	
B787-8	60.12 m	56.72 m	16.92 m	
A330-300	60.30 m	63.69 m	16.74 m	neo equivalent size
A330-200	60.30 m	59.00 m	17.89 m	neo equivalent size

Source : Aircraft Characteristics for Airport Planning

b) Geometric plan and design

The plane geometric plan of the apron is designed so that it will be compliant to the new standards of ICAO-Annex 14 shown in the table below and so that the large jet aircraft can be in service with parallel taxiway while ensuring a necessary separation from the runway center line and the parallel taxiway. The concept for parking design is based on the current operation and therefore designed so that aircrafts can maneuver with its own power and park the angle of 45 degrees. In addition, the parking is designed so that the tail wing of the design aircraft parked in the apron with nose-in and push-out method will not infringe transitional surface.

Table 2.2.2-11 New ICAO Standards for Basic Facilities of Airport

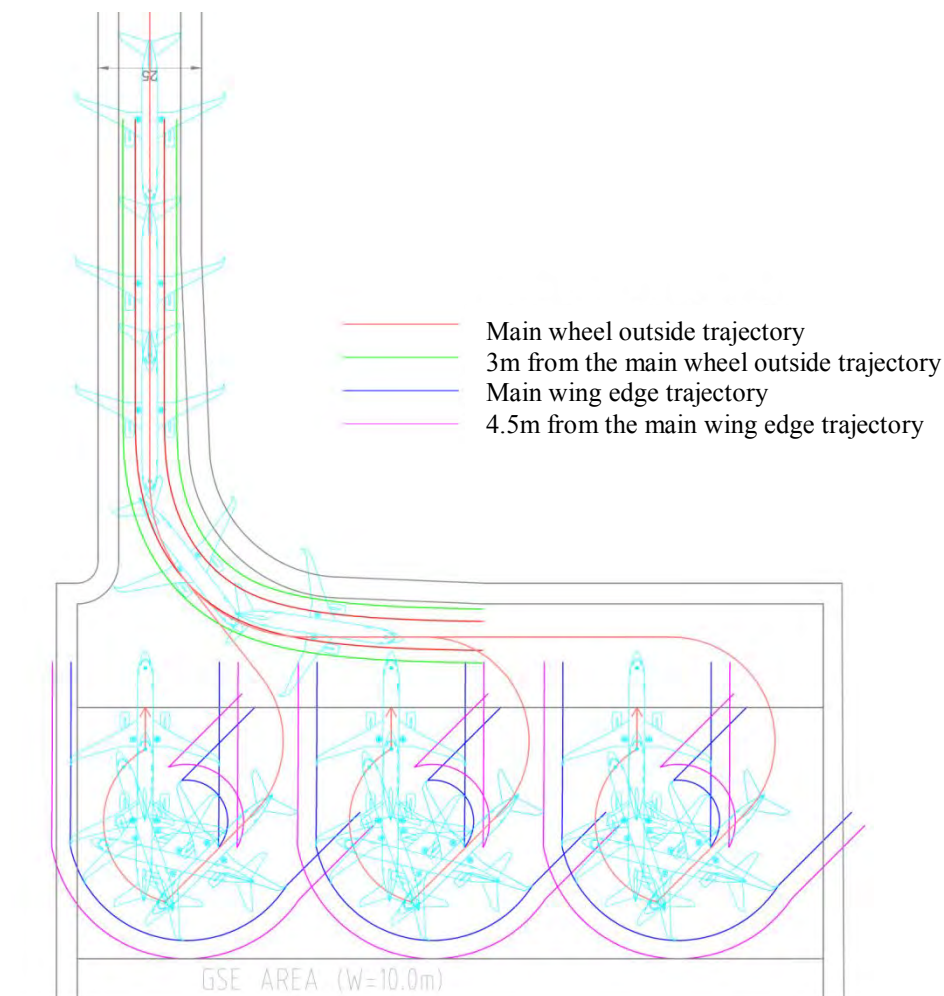
Width and Separation Distance	Minimum	Remarks
Width of runways	45 m	Future Code Number 4 or more
Runway strips (One side)	140 m	Future Precision approach
Runway centre line and parallel taxiway centre line	172.5 m	Future expansion (Code E)
Taxiway centre line to taxiway centre line	76 m	Future expansion (Code E)
Taxiway centre line to object	43.5 m	Future expansion (Code E)
	26 m	The Project (Code C)
Aircraft parked in the apron to object	7.5 m	Future expansion (Code E)
	4.5 m	The Project (Code C)

Width and Separation Distance	Minimum	Remarks
Width of taxiways	23 m	Future expansion (Code E)
	15 m	The Project (Code C)
Width of taxiway including shoulders	44 m	Future expansion (Code E)
	25 m	The Project (Code C)

Source: ICAO Doc (Annex 14 and Proposal for the amendment of Annex 14, Volume I and PANS Aerodromes, 19th April 2017)

In addition, it is confirmed that necessary separation distances are secured for the largest design aircraft, B737-900ER winglet (Code-C), with drawing the trajectory of the aircraft in the apron and taxiway.

- Separation between the outer edge of main wheels and the edge of taxiway in straight and curb portion of taxiway: 3.0m or more (Code-C)
- Separation between aircrafts parked in the apron and aircraft moving or object: 4.5m or more (Code-C)



Source: JICA Study team

Figure 2.2.2-14 Aircraft Parking in Apron

GSE area is designed as 10m width (5m x 2 lanes) between the apron and the international passenger terminal building. 5m width for conduits space is designed between GSE roads and international passenger terminal buildings. In addition, GSE road connecting the new apron and the existing terminal area is planned.

c) Pavement

Rigid pavement is used for the apron area. Design of pavement is conducted by the reference to the design standards of U.S. Department of Transportation, Federal Aviation Administration, Airport Design and Evaluation, AC150/5320-6F. Design aircraft for international flight was determined as B737-900ER, A320-200, Embraer ERJ170, and domestic flight for DHC6. Based on the traffic forecast, the annual growth rate was calculated and the total number of aircraft movements for pavement structural life of 20 years was used for design of apron pavement. The composition of apron pavement is shown in the table below.

Table 2.2.2-12 Composition of Apron Pavement

Composition of Apron Pavement	Thickness of Pavement
Concrete Pavement	38cm
Base course (Cement stabilized course)	13cm
Subbase course (Crushed aggregate)	20cm
Design CBR for Subgrade (After subgrade improvement)	8%

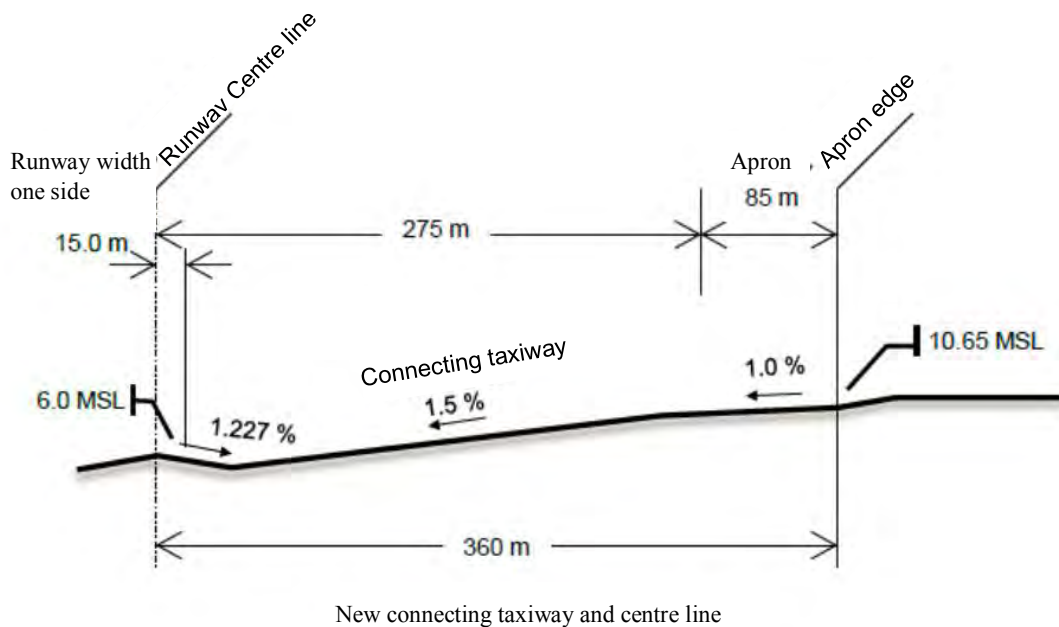
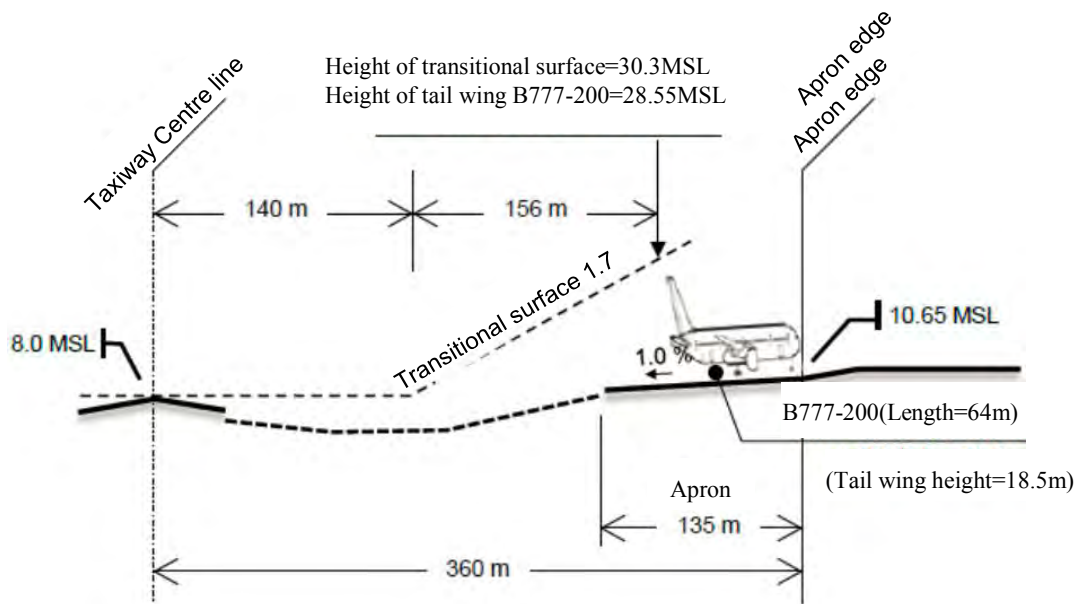
Source: JICA Study team

Improvement of subgrade is planned because CBR of the existing soil was as low as 0% according to the field survey. Thickness of subgrade for concrete pavement is designed as 1.0m and the economically effective thickness for improvement was calculated for 75cm. CBR after improvement of subgrade is 8%. For GSE road, 60cm subgrade improvement is planned.

4) Taxiway

a) Design Criteria

The width of the taxiway is determined as 15m to accommodate B737/A320. The width of shoulder is designed for the use of the new ICAO Standards for Basic Facilities of Airport shown in Table 3-2-2.12. The taxiway edge lights are to be installed at the taxiway shoulders in future.

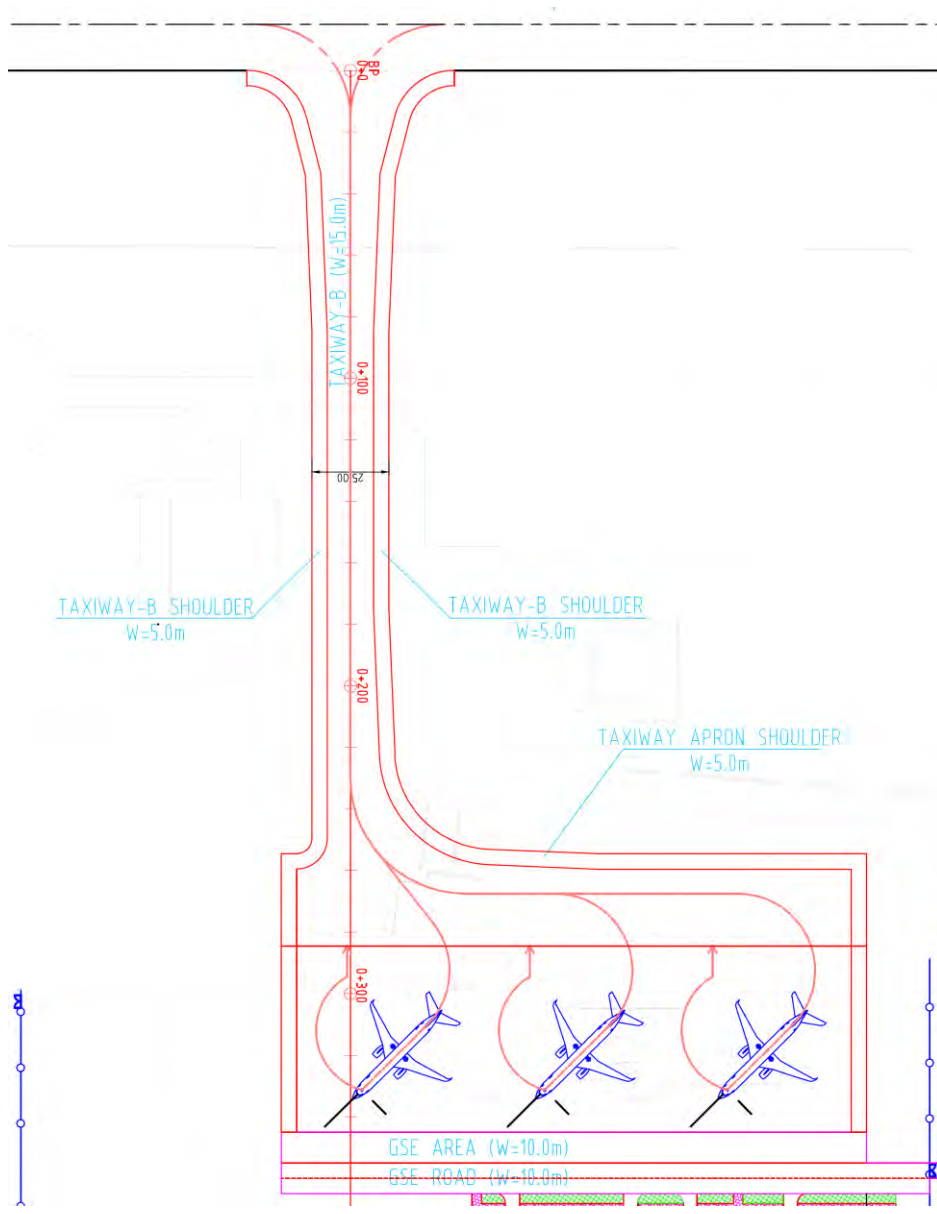


Source: JICA Study team

Figure 2.2.2-15 Cross section of Airside for New Terminal Area

b) Geometric Plan and Design

Taxiway that will be constructed in the Project connects the new international parking apron and the runway. Therefore, the design aircraft is used for design criteria corresponding to the apron. Ideally two connecting taxiways are to be provided to enable flexible aircraft operations on the runway, taxiway and apron. However, one connecting taxiway is planned in order to reduce the initial investment cost. The location of the connecting taxiway is shown in the figure below.



Source: JICA Study team

Figure 2.2.2-16 Geometric Design of Taxiway

c) Pavement Design

Asphalt pavement is equipped for taxiway and shoulder and its composition is designed in accordance with the same design criteria with the apron pavement. The determined composition of pavement is shown in table below.

Table 2.2.2-13 Composition of Taxiway and Shoulder Pavement

Pavement Composition	Taxiway	Pavement Composition	Shoulder
HMA surface	6cm	HMA surface	5cm
Surface course	6cm	Surface course	5cm
Base course (cement stabilization)	13cm		

Pavement Composition	Taxiway	Pavement Composition	Shoulder
Base course (Stabilized crushed aggregate)	15cm	Base course (Stabilized crushed aggregate)	15cm
Subbase course (crushed aggregate)	25cm	Subbase course (crushed aggregate)	17cm
Design CBR for Subgrade (After subgrade improvement)	8%	Design CBR for Subgrade (After subgrade improvement)	8%

Source: JICA Study team

Improvement of subgrade is planned because the survey found out that the CBR value of the existing soil is as low as 1%. Thickness of subgrade for concrete pavement is designed as 1.5m and the economically effective thickness that needs improvement was calculated for 90cm. CBR after improvement of subgrade is expected to be 8%.

5) Airfield Lighting System (AFL)

The Taxiway Edge Lights (TEDL), the Taxiway Guidance signs (TXGS), the Aerodrome Beacon (ABN) and the Apron Flood Lights (FLO) will be installed for the newly constructed facilities intended for use at night. However, the construction cost had exceeded the budget and AFL installation work had been approved to be transferred to the ANATL work.

The AFL installation works might be done by ANATL after completion of the Project under JICA Grant and some measures necessary for smooth ANATL AFL works are to be included in the civil and architectural design of the Project. Such measures include provision of spaces for future equipment installation and underground duct crossing the new taxiway. Outline design for AFL work has been carried out in the Survey and the design drawings and calculations, etc. are attached in the Annex.

a) Cable Ducts for Cross Taxiway

There were AFL cables and other cables laid around the existing runway and taxiway, and a lot of cables should have been buried underneath the new taxiway.

A cable duct for the existing cables and future cables should be provided at the cross area of taxiway.

Cable ducts crossing the new taxiway and associated manholes are to be constructed in parallel with the taxiway construction work, because cable ducts at cross taxiway have to be coordinated with taxiway construction work.

The manholes for the cable ducts should be installed more than 75m away from the runway center so that the maintenance work is to be carried out during airport operational hours.

As any detail design of AFL installation by the ANATL was yet to be started, required number and size of the cable ducts have not been specified. However, according to an Indonesian consultant employed by ANATL for examination of the future runway extension, six inches of size and six in number should suffice the future requirement, and our outline design has been carried out based on this assumption.

Expected future ANATL cables are estimated as follows:

i) Runway Lighting Cables

The existing runway edge light circuits were not functioned, because CCR was defected and a lot of lights were damaged. Therefore, the existing REDL cables were not used. The ANATL was planning to renew the runway lighting. Therefore, new cables will be laid in cable ducts.

Wind direction indicators were installed in this aerodrome, but they were not illuminated. After renewal of runway lighting, runway will be intended for use at night. Cables for wind direction indicators might be laid.

ii) Approach Lighting Cables

Cables for existing PAPI will be laid from the SS-2.

The ANATL was planning to install the new approach lighting when the runway is extended. Therefore, the new cables for approach lighting will be laid.

Cables for approach lighting might be Precision Approach Lights, Sequence Flashing Lights and the PAPI.

iii) Other Facilities

AFL facilities, navigation and communication facilities, meteorological facilities will be installed in the runway extension work. Cables for their facilities will be laid in taxiway cross ducts.

b) Existing PAPI

Existing PAPI system is functioning and it is important system for landing aircraft.

Power was supplied by the CCR installed in existing substation and controlled by the AFL control desk in the VFR room of the existing control tower.

The SS-2 will be constructed before demolishment of the existing substation and existing control tower.

A new AFL control desk will be installed in the VFR room for the new AFL system, but detail is not known because the design work has not started at the timing of the site survey. Future coordination with ANATL is required.

c) Coordination between AFL and this work

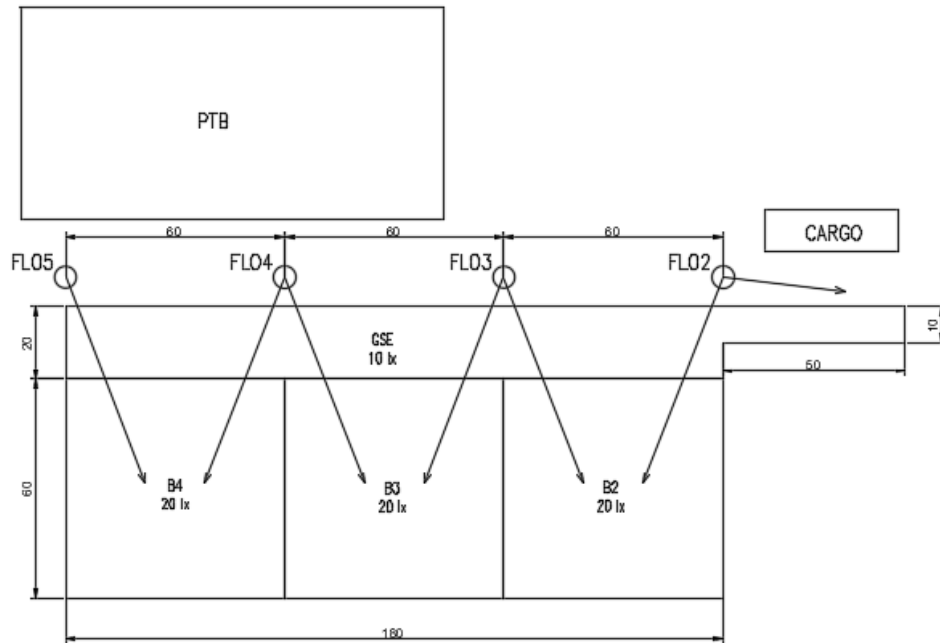
The AFL will be installed after completion of the civil and building works and following condition are required:

- i) TEDL will be installed on the taxiway shoulder pavement because location of lights are at 1.5m from the edge of taxiway. Part of the shoulder pavement should be removed and repaired by the installation work of pipes and light bases. Patch work will be remained on the surface of shoulder pavement.

- ii) The ABN will be installed after start of the use of the control tower. The new AFL control desk will also be installed after start of the use of the control tower. The following items should be coordinated in this work,
- Foundation for the ABN shall be prepared on top of the control tower.
 - Installation space for the ABN control panel (Power supply and On/Off control in the manual operation) should be prepared in the EPS in the control tower.
 - Cable installation route from a panel to the ABN at a top of tower should be prepared.
 - Installation space for the AFL control desk in the VFR room should be prepared.
 - Installation space for AFL control system (Interface for control desk and MET) should be prepared.
 - Electrical power which will be backed up by standby generator should be prepared.
 - The ANATL will lay AFL control cables between the SS-2, the PTB and the control tower building. Pipes for the ANATL cables will be prepared in cable ducts which are installed in this work.
- iii) Apron flood lights (FLO) will be installed after the new apron is completed. The expected location of FLO masts is shown in Fig3-2-2-1. There will be drainages and electrical ducts installed around the apron. Some preparations will be required for the FLO installation works. Electric power will be supplied from the mechanical room in the PTB. Pipes for the FLO will be prepared in cable ducts around the apron area.

The following items should be coordinated in this work because the FLO will be installed after the apron is completed.

- Preparation for installation space of lighting masts.
- Pipes for cables of the FLO should be prepared in cable ducts installed in this work.
- Space for panel installation in the mechanical room in the PTB.
- Preparation of electric power for the FLO (3P 4W 380-220V 11kVA, generator back up) should be prepared.
- Interface for the monitoring and control functions in a BMS.



Source: JICA Study team

Figure 2.2.2-17 Layout of Apron Floodlight Masts and Illuminance

6) Access Road and Car Parking

a) Conditions for design (Required facility scale)

This Project (in 2027):

Predicted demand volume will be 1,361 persons per day at peak time

Predicted demand volume will be 450 persons per peak hours (departure and arrival)

Note 1: 4 flights (2 arrivals and 2 departures) of 150 seats type aircraft within 1 hour.

Note 2: 50 persons per flight x 4 flights x 76% = 450 person

In field observation the number of entering cars from existing access road to car parking, 426 cars in total were observed in the afternoon. (11:45~16:05 on May 2nd, 2018. motorcycles not included.) The incoming and outgoing passengers were 513 persons in this period. Therefore, the predicted volume of traffic in 2017 will be around 1,100 cars per day (as a result of the following calculation: $426 \div 513 \times 1,361 =$). Also, motorcycles will be around 700 units per day.

This amount is lower than the design traffic volume for one lane indicated in Japanese Road Structure Ordinance. Therefore, the access road will be one lane with 1.5m stopping lane for broken-down vehicle to avoid traffic jam.

The existing car parking for 80 cars were observed as full occupation at a peak hour. At this time, there were 209 passengers at a peak time. (Observed time: 13:59~14:41 on May 2nd, 2018)

Figuring out the required parking space for ordinary vehicles

- i) Number of airport users (incoming and outgoing 4 flights at once) 450 persons / peak hours
- ii) Number of cars per one passenger in peak hours 0.38 unit / persons
(observed 80 units ÷ 209 passengers = 0.38 units / person)
- iii) Required car parking spaces in peak hours 171 units
- iv) Spare car parking space 11 units around

As shown above, the predicted total required car parking space is 182 spaces (③+④). In addition, taxi, bus and handicap-accessible parking spaces will be placed in another location.

b) Land arrangement plan (Route and intersection)

The Nicolau Lobato round-about is the symbol of Avenue Pres. Nicolau Lobato, which is located in the south side of airport. The access to Dili international airport branches off north way toward the airport of the round-about going through the promenade road reaching the terminal area. We have taken counsel with ANATL on the following 2 alternative plans for reaching the new terminal area from road promenade.

Table 2.2.2-14 Comparison plans for access road and car parking

Items	Alternative 1	Alternative 2
Outline	Using the existing 2nd Roundabout, branching off turning left of the round-about to reach International and domestic terminal. Turn right in addition to reach Domestic terminal.	Construct new T-shaped intersection in promenade road. Left turn for International terminal, straight ahead for Domestic terminal and VIP area.
Merits	There is a unity in traffic between the new and the existing terminal.	Able to reach the new terminal in shorter distance and less time compared to Alternative 1, enhancing convenience and economic potential. Moreover, the straight road can ensure maximum commercial area.
Judgement	Not Adopted	Adopted

Per our consultation, the plan Alternative 2 has been adopted

Source: JICA Study team



Access Road & Carpark (Alternative 1)



Access Road & Carpark (Alternative 2)

Source: JICA Study team

Figure 2.2.2-18 Design plan (Alternative1 and 2)

The access road has been designed based on relevant Japanese road standard as one-lane road (two-way use), with 3.25-m wide of a car lane, 0.5m of the right shoulder and 1.5m of stopping lane (5.25m width in total).

The one lane reaching to the passenger terminal is enough to accommodate the estimated incoming car amount according to the scale of the terminal facility. Therefore, this area will be arranged with one driving lane and one slow driving lane. Moreover, the driveway apron in front of terminal building will be arranged in four lanes total, one lane is for incoming and outgoing nearby terminal apron, one lane is for approaching and one for passing.

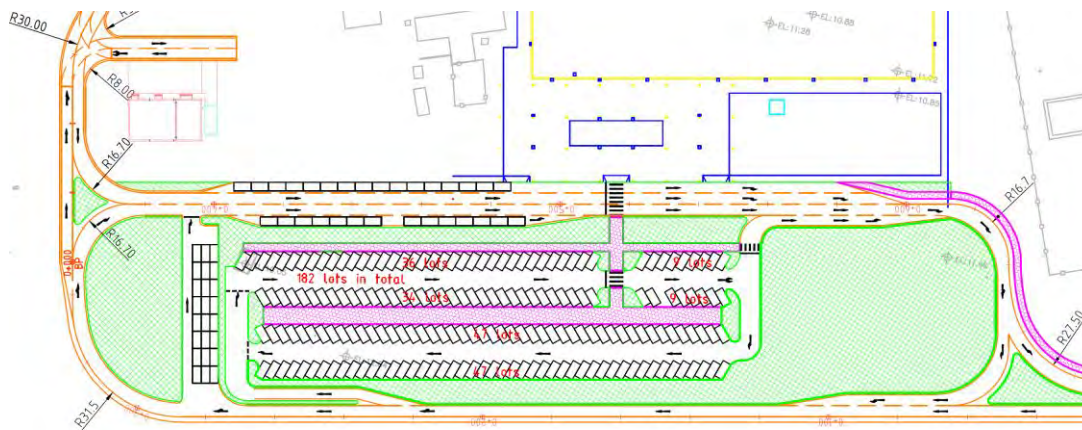
The number of parking spaces has been determined based on the estimated car amount according to the scale of the terminal facility. The entrance and exit will be narrowed in order to collect toll fee easily. Circulation path in the car parking will be placed.

Additionally, space for toll ticket vending machine and toll gate will be secured. Cars will park by 60 degrees angle. One parking space will be 2.5m wide and 5.0m long.

Street lighting for the new control tower area only is to be installed under the Project as the traffic controllers may need to stay in the tower during the nighttime. Cable ducts for the street lighting which cross the access road are also provided underneath the pavement as a provision for future installation of the street lighting by ANATL.

The space for buried infrastructure piping under car parking area will be considered. Moreover, the installing streetlights in the future project will be considered.

Figure 2.2.2-20 shows layout plan of car park for Phase 1. It should be noted that due to the budget limitation, it has been agreed upon by both Governments that the car park pavement and marking works, etc. are to be undertaken by Timor-Leste side.



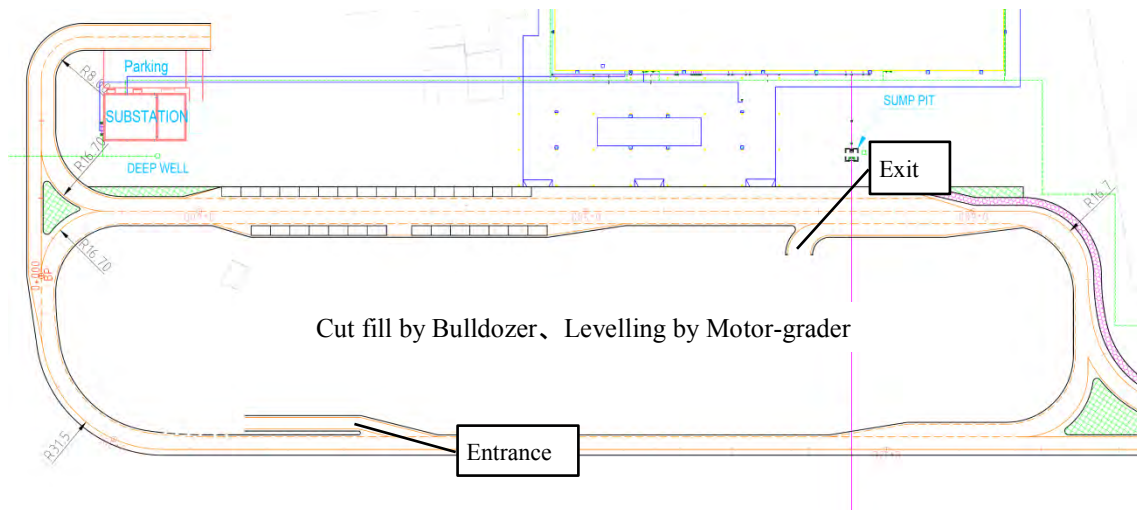
Source: JICA Study team

Figure 2.2.2-19 Layout Plan of Car Park for Phase 1

Ground levelling and installation of temporary open ditch works as well as the exit and entrance to the car park are to be executed under the JICA Grant, street light is excluded from the JICA Grant and thereafter the car park area will be transferred to ANATL for execution of the pavement work and other works by ANATL.

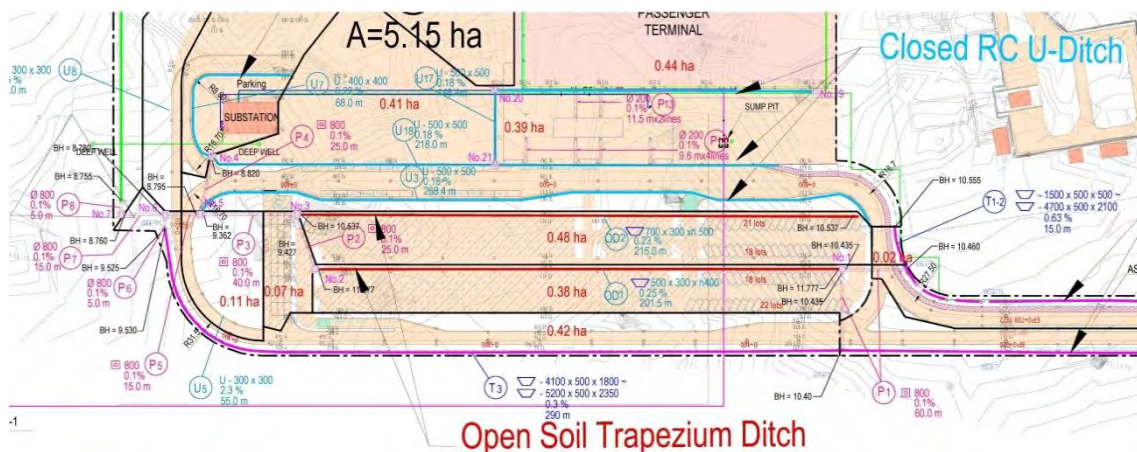
Step of works mentioned below for future parking area will be included in this project;

- i) Original ground fill be cut filled by Bulldozer and levelled by motor-grader
- ii) Construction of the entrance and exit paths
- iii) Provision of two lines of temporary soil open ditch (around 50cm width) for evacuation of surface water in this area.



Source: JICA Study team

Figure 2.2.2-20 Finishing Plan of Car Parking Area by JICA Grant



Source: JICA Study team

Figure 2.2.2-21 Open soil ditch in the Car Parking area (This project)

c) Pavement Design

Pavement structure has been designed based on the AASHTO (American Association of State Highway and Transportation Officials). Pavement structure is composed of four layers, such as a Surface Course, a Base Course and a Sub-Base Course. Thickness of each layer has been designed according to the Predicted traffic volume. Flexible pavement structural number (SN) will be 2.5 for access road.

Table 2.2.2-15 Pavement Structure of Access Road

Layer Description	Access Road
Surface Course	5cm
Base Course (Crushed Aggregate)	18cm
Sub-Base Course (Aggregate)	18cm
Subgrade Design CBR	8%

Source: JICA Study team

Pavement structure is composed of four layers which are a Surface Course, a Base Course and a Sub-Base Course for the reference.

The pavement structure for the car parking at the control tower is as shown below.

Table 2.2.2-16 Pavement Structure of Parking

Layer Description	Parking
Surface Course	5cm
Base Course (Crushed Aggregate)	12cm
Sub-Base Corse (Aggregate)	15cm
Subgrade Design CBR	8%

Source: JICA Study team

7) Air Traffic Control Tower and ATC Equipment

a) Location Plan and Required Eyeheight of New Control Tower

The location of the ATC tower is selected with referring to the FAA and JCAB regulations and standards. It was selected to be able to see the runway and taxiway of airport surface and air control area surrounding the airport without obstructions. The followings are considered for the selection.

- Consider extension of the runway to 3000m in the future.
- Locate as much as possible equidistant from the east and west runway ends.
- Height of the tower will not infringe the obstacle limitation surfaces after the runway is upgraded to an instrument and precision runway.
- Not to be affected by the expansion of the passenger terminal building and other terminal facilities.
- Height of the tower meets the requirement stipulated in FAA regulation, being able to see the end of the runway with depression angle of more than 0.8 degrees.
- Access road and basic infrastructures are prepared with low costs.

The location of ATC tower is shown in the figure below.

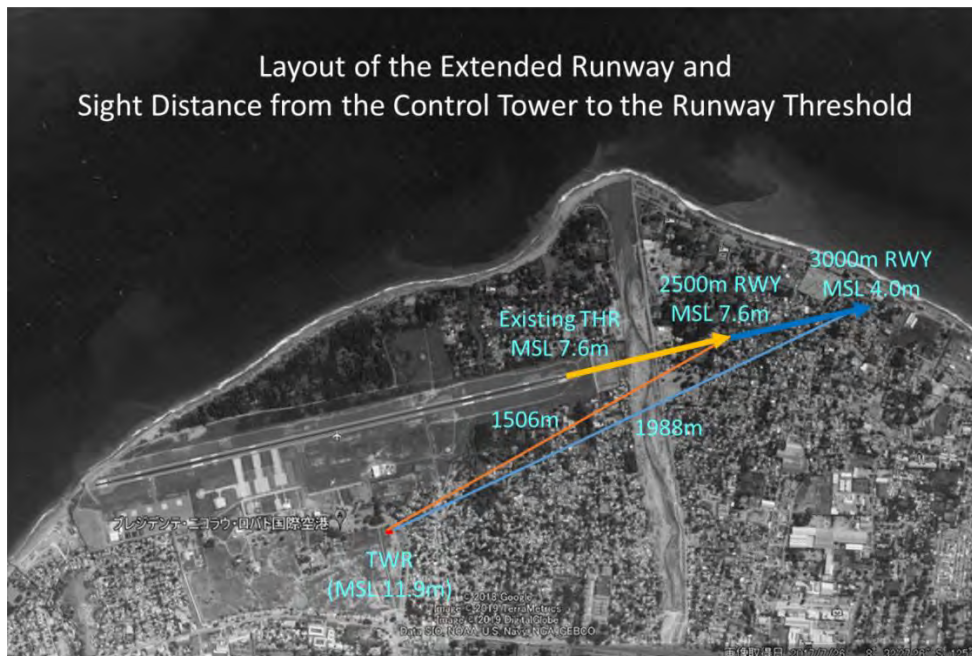
For the first choice, ANATL requested that the location of the new ATC tower should be moved to the east, taking the runway extension into consideration. ANATL also requested that the east side of the new passenger terminal should be kept vacant for the future use for commercial area. With those reasons, the second choice has been selected.



Source: JICA Study team

Figure 2.2.2-22-1 Alternative Locations of ATC tower

The distance between the selected locations (the second choice) to the center of the runway is approximately 400m. Height of obstruction surface is 37m with the width of the runway strip for one side, 140m. Mean sea level of the new ATC tower location is 12m and the level of the east ends of the runway (above MSL) when extended to 2500 m and 3000 m are assumed to be 7.6m and 4.0 m respectively considering their current ground elevations. Relative locations of the new control tower and the eastern edges of the extended runway are shown below.



Profile of the Extended Runway and Sight Angle of the Runway Threshold

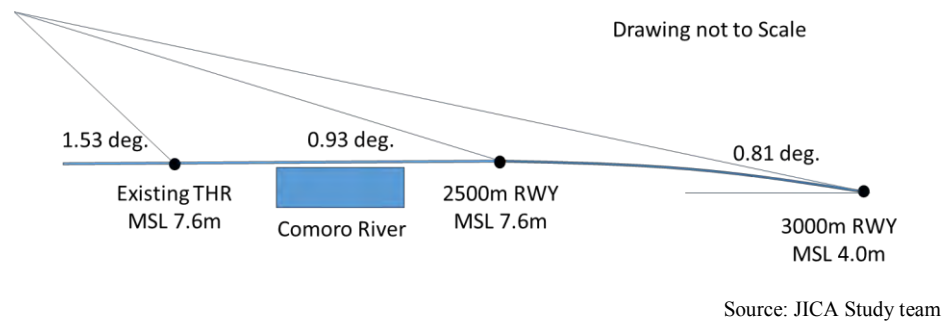


Figure 2.2.2-23-2 Height analysis of ATC tower

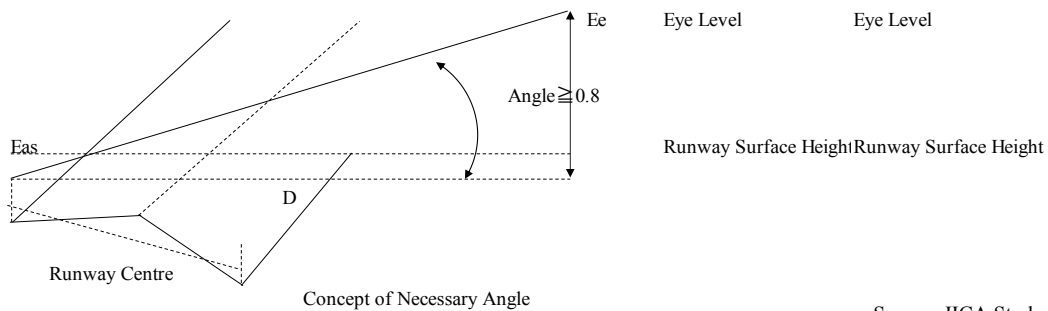
Based on the data listed below, the air traffic controllers' eyelevel/height has been estimated:

- i) Height of the surface of the runway (MSL) extended to 2500 m; 7.4 m.
- ii) Height of the surface of the runway (MSL) extended to 3000 m; 4.0 m.
- iii) Distance from the new ATC tower to the runway end extended to 2500 m; 1506 m.
- iv) Distance from the new ATC tower to the runway end extended to 3000 m; 1988 m.
- v) Minimum depression angle from controllers' eyelevel to the runway surface; 0.8 degree.

It has been found out that the minimum eye height of the new ATC in case of 3000-m long runway is 19.86 m above ground (ground elevation is 11.9 m). Based on the result of this examination, the new ATC tower has been designed with the controllers' eye height of 20.1 m (above the ground). The new ATC tower thus designed does not infringe the transitional surface.

Item		Runway East Side Northern Part RWY 2500 m	Runway East Side Northern Part RWY 3000 m
The Height of Ruwany Surface (MSL)	Eas	7.6 m	4.0 m
Distance with New Traffic Control Tower (m)	D	1506 m	1988 m
The Minimum Angle Necessary for Controller (Degree)	θ	0.8	0.8
	$\tan\theta$	0.0139635	0.0139635
Necessary Eye Level (MSL)	Ee	28.629031 m	31.759438 m
Eye Level above Ground=Necessary Height above Ground (Ee-11.9m (MSL at Tower location))	Ed	16.73 m	19.86 m
VFR Room Floor Height (Ed-1.2m)	Ef	15.53 m	18.66 m
ATC Toewr Height (Ef+4.0m)	Er	19.53 m	22.66 m
Lightning rod and Antennas (Er+3m)	Ea	22.53 m	25.66 m
(Reference) Horizontal Surface		45 m	45 m
(Reference) Transitional Surface ((400-140)/7)		37 m	37 m

Note) MSL is from AIP East side of Runway 25ft (7.6m)
 Airport Reference Point 25ft (7.6m)



Source: JICA Study team

Figure 2.2.2-24 Calculation of the Height of ATC tower

The following photos are views from the selected tower location to the east end of runway. It should be noted that the line of sight is not secured by the trees outside the boundary of the airport. ANATL should negotiate and coordinate as appropriate so that these trees will be cut and the line of sight of the new ATC tower will be secured.



West end of runway from ATC tower (16m) East end of runway from ATC tower (16m)



West end of runway from ATC tower (18m)

East end of runway from ATC tower (18m)



West end of runway from ATC tower (20m)

East end of runway from ATC tower (20m)

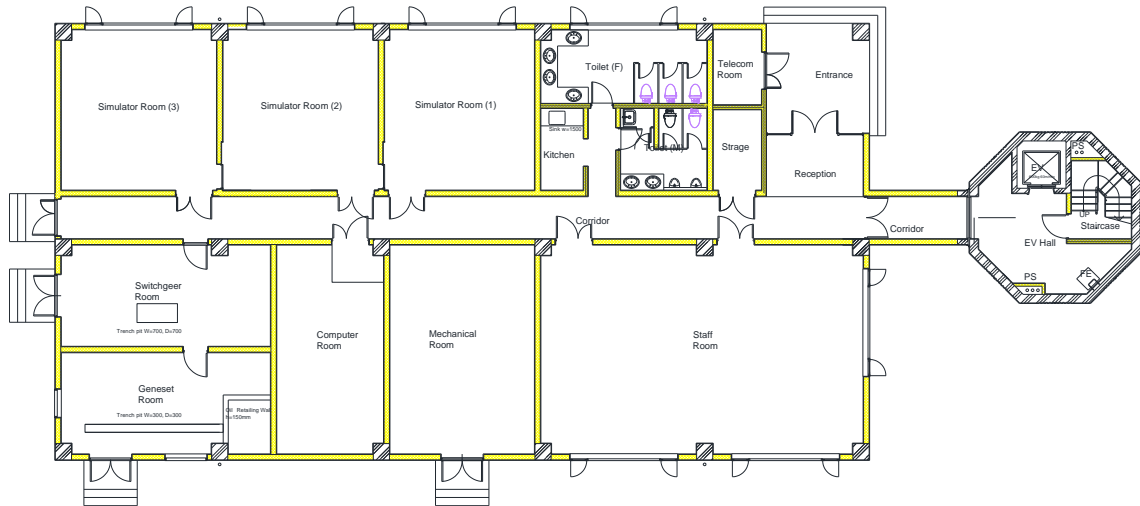
Note : Height is the relative height from the drone take-off point

Picture 2.2.2-1 Views from ATC tower height

ATC tower consists of 6 stories tower with 3.6m floor height each and office building with one story building. The eye level of air traffic controller in the VFR room is approximately 20.1 m above ground, which enables to view the east end of the runway after extension to 3000 m. The floor area of VFR is 50m² and the ladder is equipped to the rooftop.

VFR room is designed as free access floor with equipment wiring and piping into consideration. The elevator is planned up to the 5th floor. The area of the office floor is 400m with staff room, mechanical room, computer room and ATC simulator room, and generator room. The existing ATC simulators are transferred to this room by ANATL.

Outer wall of RC is planned with mortar and paint finish. Aluminum panel exterior is adopted in the steel part of the fourth floor.



Source: JICA Study team

Figure 2.2.2-25 Plan of first floor of ATC tower

b) Structural Plan

The control tower building consists of the six-story control tower and single-level office building.

The control tower is of the reinforced concrete structure with the tower cab of steel structure on the top thereof. The foundation of the tower should be of RC pile type for which the supporting soil layer should of GL-10m or deeper.

Office building is of a single-story and RC structure. This building is of a single-story and RC structure. The design bearing capacity of 100 KN/m² needs to be confirmed based on the plate bearing test on the site. In addition, the soil up to 50cm under the surface of the slab on grade is to be compacted to achieve 95 % of the maximum dry density based on the filed density test. The same specification applies to the embankment below the office building.

c) Electrical and Mechanical Facilities Plan

i) Electrical Facilities Plan

a) 20kV Power Receiving System

According to the Figure 2-2-1-2, electricity for the control tower is supplied from 20kV power distribution station which will be constructed by the government of East Timor. The planned loads of control tower building are estimated as follows:

Detail of Load	Plan	Demand	Design
- Lights and receptacles		36kVA	(75%) 27kVA

-	Air-conditioners	23kVA	(100%)	23kVA
-	Elevator and pumps	17kVA	(35%)	6kVA
-	Control Tower Equipment and VHF TX&RX radios	20kVA	(100%)	20kVA
	<u>Total</u>	95kVA	(80%)	76kVA

The demand factor of the electricity for control tower will apply 80% because control tower is one of the important facilities for the airport and the tower equipment are working continuously whole a day. As a result, the design electrical load is 76kVA. The final design electrical load becomes 100kVA including future load to be increased.

b) Standby Engine Generator

Standby engine generator is planned as backup in case of commercial power failure. The capacity of the generator will be 100kVA so as to back up 100% of the design load. However, continuous operation hours are 48 hours (2 days) as well as substation's generator.

c) Other Electrical Facilities

Main feeder/power, lighting and receptacles, telephone system, data network system, fire alarm system, and lightning protection system are planned in accordance with the design concept of the new international passenger terminal building.

ii) Mechanical Works

a) Water Supply System

Moreover, the additional booster water supply pump unit shall be used for control tower water supply. The pump unit with necessary components shall be installed in 1F machine room.

b) Sewage Drainage Treatment System

Also, a new simple septic tank treatment system with underground penetration treatment pipes shall be used for new control tower. In order to prevent the pollution of underground water as much as possible, the septic tank shall be located on the side of control tower.

c) Fire Protection System

Since there are no local fire regulations, to comply with the Japan's fire defense law, the fire extinguishers shall be installed in necessary location.

d) Air Conditioning and Ventilation System

The split type packaged air conditioner shall be used for control tower. According to different location, ceiling cassette type or wall mounted type shall be selectively used. The fresh air shall be provided to the room used air conditioning by fan. The mechanical ventilation fans shall be installed for toilets and machine rooms.

The design air condition for external temperature is 34.9 °C, for relative humidity is 69.5%. The design internal temperature shall be 24~26°C (refer to the following Table 2.2.2-17).

Table 2.2.2-17 Internal Condition of Air Conditioning Design

Room Name	Dry-bulb temperature DB (°C)	Relative Humidity RH (%)
VFR Simulator Rooms Computer Rooms Telecom Room	24°C (± 2 °C DB)	50% (result)
Offices Other Rooms	26 °C (± 2 °C DB)	50% (result)

Source: JICA Study team

The mechanical ventilation system shall be used for toilets, machine rooms, electrical rooms, pantry, smoke room and storages to exhaust the bad smell, heat and dust from these rooms.

Table 2.2.2-18 Design Condition of Ventilation

No.	Area / Room	Method of Ventilation			Ventilation Rate (time/h)
		Type-1 Supply & Exhaust	Type-2 Supply Only	Type-3 Exhaust only	
1	Toilet (Public)			○	10
2	Kitchen			○	15
3	Mechanical Room	○		○	5
4	Electrical room			○	5
5	Generator Room			○	5
6	Storage			○	5

Source: JICA Study team

d) Air Traffic Control Equipment

Air traffic control equipment is planned based on the current air traffic control operation. There is no plan to introduce radar system. The volume of traffic to be controlled is 30 times in the peak hour in 2027 of the target years, which is enough to be processed with the current level of operation.

The scope of the Project for ATC equipment is for aerodrome traffic control and approach control. The equipment is planned to operate those services in the new ATC tower. Dili international airport has three repeater stations. However, the Project excludes the equipment in the repeater stations.

The existing ATC tower and tower equipment need to be functioning until the new ATC tower is completed and the equipment is installed and operated in order to continue to provide air traffic control services. The equipment in the new ATC tower is procured in

the Project and the equipment in the exiting ATC tower is kept for spares after the completion of the new ATC tower.

The flowing table shows the list of ATC equipment

Table 2.2.2-19 Air Traffic Control Equipment

No.	Item	Qty	Major specifications or components	Summary
1	Air traffic control equipment			
1.1	Console	1 set	Air traffic controller consoles: 3 sets 1,200(W) x 1,050mm (H) x 1,000mm (L) Air traffic controller chair: 3 sets	The equipment is placed in VFR air traffic control room and enables air traffic controller to communicate with aircrafts and display flight information necessary for air traffic control. The equipment has three positions of aerodrome control, approach control and flight information
1.2	VCS	1 set	Headset, microphone, handmic, speaker, footswitch, timer, fight strip holder, touch panel, plug-in panel BBS function Voice Recorder	The equipment provides functions to control air traffic control communications between air traffic controllers and aircrafts and with air traffic control authorities of other countries, and monitor communication lines and record air traffic control communications
1.3	VHF communications system	1 set	Transceiver x 2 for approach control Transceiver x 2 for aerodrome control Transceiver x 1 for emergency	The equipment enables air traffic controller to communication with aircraft with specified VHF frequencies, connected with and controlled by VCS
1.4	VHF transceiver	1 set	Frequency (118.000-136.975MHz) VHF antenna UPS	The equipment is procured to provide backup function in case VHF Ground to Air communication system was failed. This enables air traffic controllers to communicate with aircrafts with this

No.	Item	Qty	Major specifications or components	Summary
				stand-alone transceiver
1.5	Clash alarm system	1 set	Alarm bel Direct speech system Modem (500m or more)	In case of emergency, the equipment provides alarming sound in the vicinity of the airport and enables to directly communicate with the fire station.
1.6	Air traffic information terminal	1 set	Computer Display Printer	The equipment is to provide flight information, weather information, those that are necessary for air traffic control.
1.7	Light gun	1 set	Reachable distance: 3.0 NM or more Color: Red, Green and white Source, LED or tungsten/halogen	In case that radio communication systems are failed, the equipment enables for air traffic controller to give instructions to aircrafts in the vicinity of the airport
1.8	Power supply system (Equipment room)	1 set	More than 15 munities Bypass function	The equipment provides back up power to the air traffic control equipment installed in the equipment room of the office building next to the ATC tower

Source: JICA Study team

8) SubStation

a) Plane Plan

One-story substation is planned for supplying power to the passenger terminal building and water supply. Power receiving and transformer, back-up generator, water supply system is installed in the substation. By planning an independent substation, it is possible to minimize noise caused by generators and influence on the passenger movements. Above facilities and equipment do not require daily maintenance. Therefore, staff members do not stay in the substation. Accordingly, facilities such as sitting room or toilets for staff members to stay are not planned.

Flood is occurring these days due to the climate change and its influence in Dili, according to the hearing, the water level during the flood happened in 2010 (Rainfall in the three days between 7th and 9th July was 252mm, Meteorological office) just below

knee. Therefore, floor level is designed GL+500mm in order to avoid the equipment to be flooded.

Exterior wall is planned with mortar and paint finish. Usual materials are used in order to save costs.

b) Structural Plan

This building is of a single-story and RC structure. The design bearing capacity of 100 KN/m² needs to be confirmed based on the plate bearing test on the site. In addition, the soil up to 50cm under the surface of the slab on grade is to be compacted to achieve 95 % of the maximum dry density based on the filed density test.

c) Facilities Plan

i) Electrical Facilities Plan

① 20kV Power Receiving System

According to the Figure 2-2-1-2, 20kV power distribution station will provide electricity to the substation SS-4. The transformer, switchgear and standby generator are installed in the SS-4 to supply the electricity to the new international passenger terminal building.

The planned electrical loads of the substation SS-4 are estimated as follows:

Detail of Load	Plan	Demand	Design
- PTB lights, apron lights, & receptacles	290kVA	(50%)	145kVA
- PTB Air conditioner	360kVA	(100%)	360kVA
- PTB Airport equipment & pumps	41kVA	(60%)	24kVA
- Int. cargo terminal lights & receptacles	5kVA	(60%)	3kVA
- Substation lights, receptacles & pumps	21kVA	(30%)	6kVA
Total	717kVA	(75%)	538kVA

From the above electrical load summary table, air conditioners occupy about half of the load. Therefore, the summer season when the cooling load becomes maximum peaks the electric load.

The inverter type air conditioners adopted in this project operate with its full capability at the time of starting and the power consumption also becomes maximum. When the room temperature reaches the set temperature, the capacity of the air conditioner drops and becomes an energy saving operation, and the power consumption also decreases. Since increasing the electricity at the time of starting of air conditioners should be taken into consideration, the average demand factor of the electric load at the substation will be 75%. As a result, the design electrical load is 538kVA. The final design electrical load will be planned 750kVA including future load to be increased.

② Standby Engine Generator

Standby engine generator is planned as backup in case of commercial power failure. The capacity of the generator will be 750kVA so as to back up 100% of the design load.

However, continues operation hours are 48 hours (2 days).

③ Other Electrical Facilities

Main feeder/power, lights and receptacles, telephone system, fire alarm system, and lightning protection system are planned in accordance with the design concept of the new international passenger terminal building.

ii) Mechanical Works

a) Water Supply System

The new deep wells shall be installed on the side of sub-station-4. The capacity of water storage tank shall be at least a half-day or daily usage. The new water receiving storage tank shall be installed in mechanical room inside sub-station-4, the water shall be provided to new passenger terminal building and new control tower.

b) Ventilation System

In order to exhaust the bad smell, heat generation and dust, the mechanical ventilation fans shall be installed for storage & pump room, electrical room and emergency generator room.

c) Fire Protection System

Since there are no local fire regulations, to comply with the Japan's fire defense law, the fire extinguishers shall be installed in necessary location

9) Rainfall Water Drainage Design

a) Setting of Design Condition

Hydrological Examination Conditions shall be in accordance with "Sewer Facility Plan / Design Guidelines and Commentary Japan Sewerage Association" and "Airport Civil Engineering Structure Design Guide and Design Example Partial Revision in April/2017.

i) Setting of Probable rainfall period

- Probable rainfall period : 10 years

ii) Setting of Rainfall intensity formula

Since there is no Data for more than 20 years in Timor-Leste, the Data are organized by partial duration series method.

The setting procedure of Rainfall intensity formula is shown below.

a. Daily rainfall data at Dali International Airport (1/3 / 2008-12 / 31/2017)



b. Estimate the daily rainfall of the 10-years probable rainfall period with the partial duration Series method of the Thomas plot method.



c. Estimate one-hour rainfall from daily rainfall in the 10-years probable rainfall period (considered to rainfall duration for 2 hours a day).



d. Estimate rainfall intensity formula from daily rainfall and 1-hour rainfall.

ii)-1 Daily rainfall data at Dali International Airport (1/3 / 2008-12 / 31/2017)

Data is extract 30 data, in order of the maximum value within the statistical period

Take Statistical years and make Statistical universe

Table 2.2.2-20-1 Rainfall data for the past 10 years

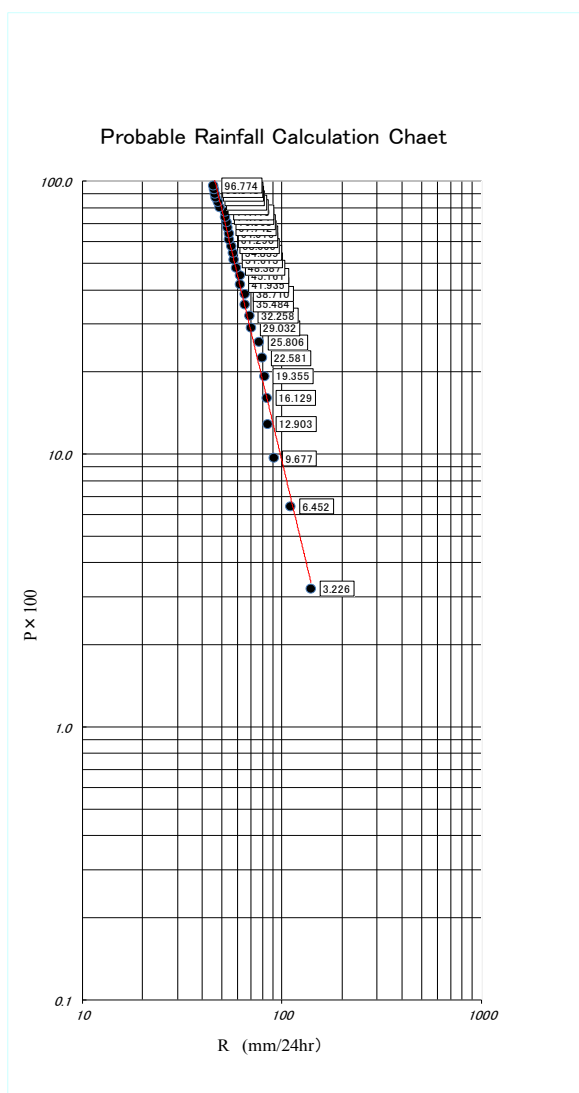
Rank	Date	Rain_24h (mm/24hr)
1	12/3/2010	140
2	7/8/2010	110.6
3	1/5/2013	91
4	2/5/2011	84.6
5	2/16/2013	84.2
6	2/20/2008	81.6
7	4/15/2014	79.6
8	7/9/2010	76.8
9	4/5/2008	70.2
10	11/5/2010	68.8
11	11/28/2017	65
12	7/7/2010	65
13	5/22/2010	61.6
14	2/11/2015	61.4
15	12/7/2008	59
16	10/28/2010	57.2
17	5/23/2008	57
18	4/26/2012	55.5
19	11/13/2017	54.4
20	5/5/2012	54.4
21	4/1/2011	53.1
22	3/23/2015	53
23	5/16/2013	52
24	5/1/2010	51.9
25	6/22/2013	48.5
26	12/31/2011	47.7
27	3/27/2016	46.6
28	1/2/2010	46.1
29	12/13/2016	45.6
30	5/22/2008	45.1

Source: JICA Study team

ii)-2 Setting of Daily rainfall and 1-hour rainfall

Estimate the daily rainfall and 1 hour rainfall of the 10-years probable rainfall period with the partial duration series method of the Thomas plot method.

Table 2.2.2-20-2 Rainfall data analysis



Thomas plot value and Rainfall intensity (mm/24 hr)

J	P	R: Rainfall intensity (mm/24hr)
1	3.226	140.0
2	6.452	110.6
3	9.677	91.0
4	12.903	84.6
5	16.129	84.2
6	19.355	81.6
7	22.581	79.6
8	25.806	76.8
9	29.032	70.2
10	32.258	68.8
11	35.484	65.0
12	38.710	65.0
13	41.935	61.6
14	45.161	61.4
15	48.387	59.0
16	51.613	57.2
17	54.839	57.0
18	58.065	55.5
19	61.290	54.4
20	64.516	54.4
21	67.742	53.1
22	70.968	53.0
23	74.194	52.0
24	77.419	51.9
25	80.645	48.5
26	83.871	47.7
27	87.097	46.6
28	90.323	46.1
29	93.548	45.6
30	96.774	45.1

a. Daily rainfall of 10-years probable rainfall period

$$P = 1/10 = 0.10 (0.1 \times 100 = 10)$$

$$R^{24} = 90 \text{ mm/24hr}$$

b. 1 hour rainfall of 10-years probable rainfall period

1 hour rainfall of 10-years probable rainfall period is considered to rainfall duration for 2 hours a day. (The application rainfall duration of the Talbot type is about 2 hours.)

$$R^1 = 90 \div 2 \text{ hr} = 45 \text{ mm/hr}$$

ii)-3 Creation of Rainfall intensity formula

The Talbot type rainfall intensity formula is created by the following calculation formula.

$$\begin{aligned} \textcircled{1} I^1 &= R^1 \times (24 / t) & \textcircled{5} B &= \frac{a}{T + b} \quad T : \text{hr} \\ \textcircled{2} B^1 &= I^1 / R^{24} & \textcircled{6} I^{24} &= R^{24} \times B \\ \textcircled{3} b &= (24 - B^1 \times t) / (B^1 - 1) \\ \textcircled{4} a &= b + 24 \end{aligned}$$

Item	Figure
R^1	45
R^{24}	90
t	2
I^1	540
B^1	6
b	2.400
a	26.40
B	$\frac{26.40}{T + 2.400}$
I^{24} (mm/24h)	$\frac{2376}{T + 2.400}$
I^1 (mm/h)	$\frac{99}{T + 2.400}$

ii)-4 Rainfall intensity formula

$$I_{10} = 99 / (T + 2.4)$$

I_{10} : Rainfall intensity (mm/hr) , t : Concentration time (hr)

iii) **Calculation of runoff**

$$Q = 1/360 \times C \times I \times A$$

C : Overall runoff coefficient , I : Rainfall intensity (mm/hr) , A : Drainage area(ha)

iv) **Runoff coefficient**

- Building area : 0.90
- Paved area : 0.95
- Lawn area : 0.30

v) Concentration time

a. Inlet time

- $t_1 = 7$ minutes

The inflow time in the digging side groove is calculated by the following equation.

$$t_1 = 6.92 (n \times L \div \sqrt{S})^{0.6} \times i^{-0.4}$$

n: Manning roughness coefficient (Pavement: 0.013, turf: 0.15)

L: Flow length(m),

S: gradient(%), i: Rainfall intensity (mm/h)

b. Flow time

- $t_2 = L \div 60 \times V$

L: Flow length (m), V: Flow velocity (m/sec)

c. Concentration time

- $t = t_1 + t_2$

t: Concentration time(min), t_1 : Inlet time(min) , t_2 : Flow time(min)

vi) Flow velocity

$$V = 1/n \times R^{2/3} \times I^{1/2} \text{ (Manning formula)}$$

R : hydraulic radius (m) = A/P (A: Sectional area, P: Wetted perimeter)

I : hydraulic gradient,

n : Roughness coefficient

The flow velocity shall be in the range of minimum 0.8 m / sec and maximum 3.0 m / sec according to "Sewer Facility Plan / Design Guidelines and Commentary Japan Sewerage Association"

vii) Roughness coefficient

- Cast-in-place concrete(U-ditch and C-BOX): 0.015
- Concrete pipe: 0.013
- Drilling side groove: 0.030
- Precast Concrete : 0.013
- Earth-Ditch: 0.025

viii) Design runoff

$$Q = A \times V$$

Q : Maximum runoff (m³/sec)

A : Sectional area (m²)

V : Flow velocity (m/sec)

ix) Section margin ratio

- The section margin ratio of the pipe and the digging side groove shall be 100%.
- The section margin ratio of the c-Box and Earth-Ditch(including U-Ditch) shall be 90%.

x) Minimum cross section and sediment trap

The minimum cross section of the U-Ditch shall be U-300, taking maintenance management into consideration. In addition, the sediment trap of the catch basin about 15 cm depth.

The minimum pipe diameter in the case of the lateral pipe is ϕ 150. Furthermore, the minimum pipe diameter in the case of drainage pipe crossing a road etc. in U-Ditch is set to ϕ 250 or more.

b) Drainage Plan

i) Setting of drainage Basin

The drainage catchment area at this airport has total area = 24.67 ha, Shown in the Figure 2.2.2-25 below. Types of drainage are; ①Trapezium shaped open ditch for along the access road and south side of parking area, ②Covered U-shaped ditch for around the Passenger terminal building, ③U-shaped open ditch for other area (airside). The end of ditch will be connected to ④existing RC ditch at west side of project area.



Source: JICA Study team

Figure 2.2.2-26 Drainage Catchment Area

ii) Calculation method of Overall runoff coefficient

The overall runoff coefficient is calculated from the runoff coefficient for each area. Runoff coefficient for each area s is shown in Table 2.2.2-20.

Table 2.2.2-20 Runoff coefficient for each area

Item	Runoff coefficient	Area(ha)	Runoff coefficient × Area (ha)
Pavement Area	0.95	7.98	7.58
Building Area	0.90	1.05	0.95
Grasses Area	0.30	15.64	4.69
Total		24.67	13.22

Source: JICA Study team

*Overall runoff coefficient : **C=0.60**

c) Flow Calculation

The drainage system in the airport is carried out in Trapezoidal waterway, a U-ditch and Concrete pipe.

Also, the flow rate calculation result is calculated based on the drainage system of the drainage plan.

2.2.3 Preliminary Design Drawings

Drawing Number	Drawing Name
Building Works	
Figure 2.2.3-1	PTB Site Plan
Figure 2.2.3-2	PTB Roof Plan
Figure 2.2.3-3	PTB 1F Plan
2-65Figure 2.2.3-4	PTB Elevation
Figure 2.2.3-5	PTB Cross Section
Figure 2.2.3-6	PTB Longitudinal Section
Figure 2.2.3-7	Power Station Plan, Oil Tank
Figure 2.2.3-8	Power Station Elevation & Section
Figure 2.2.3-9	ATC Tower & Office Plan & Oil Tank
Figure 2.2.3-10	ATC Tower & Office Elevation
Figure 2.2.3-11	Substation Power Distribution System Diagram
Figure 2.2.3-12	Substation Power Distribution System Diagram
Figure 2.2.3-13	Data Port Layout
Figure 2.2.3-14	PA system Layout
Figure 2.2.3-15	FIDS Equipment Layout
Figure 2.2.3-16	CCTV Camera Layout
Figure 2.2.3-17	Air Traffic Control Equipment Diagram
Civil Works	
Figure 2.2.3-18	Layout Plan Drawing
Figure 2.2.3-19	Demolition Plan
Figure 2.2.3-20	Temporary Facility Yard
Figure 2.2.3-21	Detailed Layout Plan (Taxiway)
Figure 2.2.3-22	Access Road Layout Plan
Figure 2.2.3-23	Airside Pavement Layout
Figure 2.2.3-24	Taxiway-B Profile
Figure 2.2.3-25	Typical Cross Section
Figure 2.2.3-26	Access Road Profile
Figure 2.2.3-27	Drainage System Plan
Figure 2.2.3-28	Traffic Sig

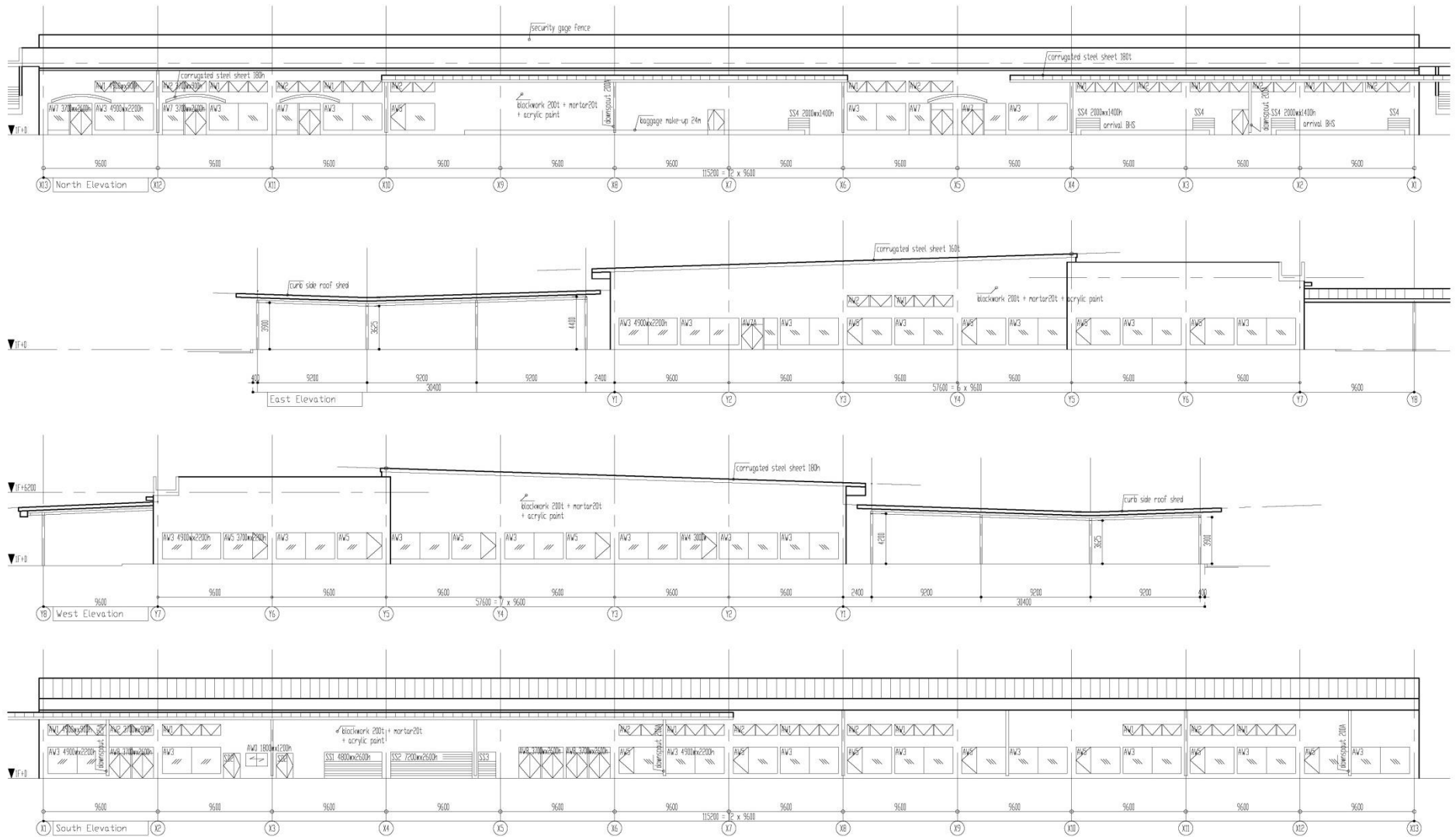


Figure 2.2.3-4 PTB Elevation

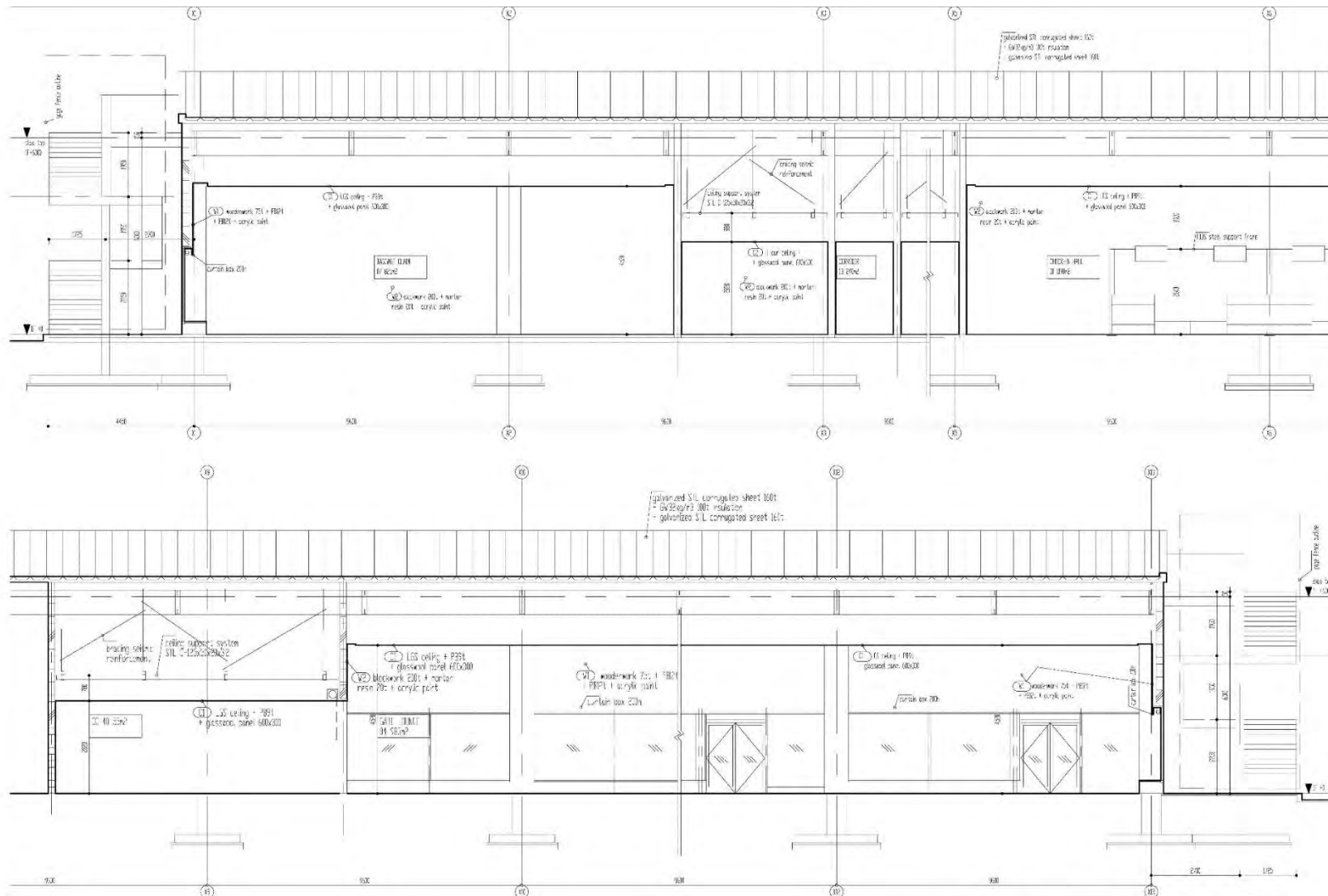


Figure 2.2.3-6 PTB Longitudinal Section

Finishing Schedule

Item No.	Particulars	Quantity	Unit	Remarks
1	Plaster	1.00	m ²	Plaster on wall
2	Paint	1.00	litre	Paint on wall
3	Carpet	1.00	m ²	Carpet on floor
4	External Floor	1.00	m ²	Concrete floor
5	Internal Ceiling	1.00	m ²	Concrete ceiling
6	Door	1.00	nos	Door
7	Window	1.00	nos	Window
8	Light	1.00	nos	Light
9	Handrail	1.00	m	Handrail

Item No.	Particulars	Quantity	Unit	Remarks
1	Plaster	1.00	m ²	Plaster on wall
2	Paint	1.00	litre	Paint on wall
3	Carpet	1.00	m ²	Carpet on floor
4	External Floor	1.00	m ²	Concrete floor
5	Internal Ceiling	1.00	m ²	Concrete ceiling
6	Door	1.00	nos	Door
7	Window	1.00	nos	Window
8	Light	1.00	nos	Light
9	Handrail	1.00	m	Handrail

Doors & Windows Schedule

Name	Location	Number	Size	Material	Glazing	Finishing	Lock	Remarks
SD-1	Storage	1	1800 x 2000	1800 x 2000	1800 x 2000	Acrylic resin based painting	Stainless	Door check
SD-2	Run-up Generator	1	1800 x 2000	1800 x 2000	1800 x 2000	Acrylic resin based painting	Stainless	Door check
SD-3	Filtering Facility	1	1800 x 2000	1800 x 2000	1800 x 2000	Acrylic resin based painting	Stainless	Door check
SD-4	Electrical Room	1	1800 x 2000	1800 x 2000	1800 x 2000	Acrylic resin based painting	Stainless	Door check
AL-1	Run-up Generator	1	1800 x 2000	1800 x 2000	1800 x 2000	Acrylic resin based painting	Stainless	Door check
AL-2	Run-up Generator	1	1800 x 2000	1800 x 2000	1800 x 2000	Acrylic resin based painting	Stainless	Door check

Fuel Storage Tank

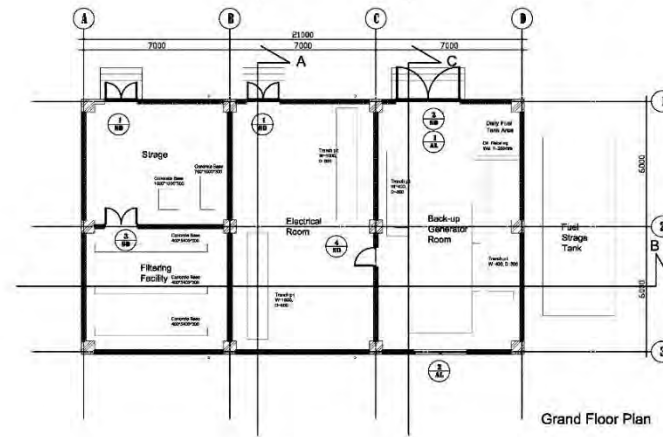
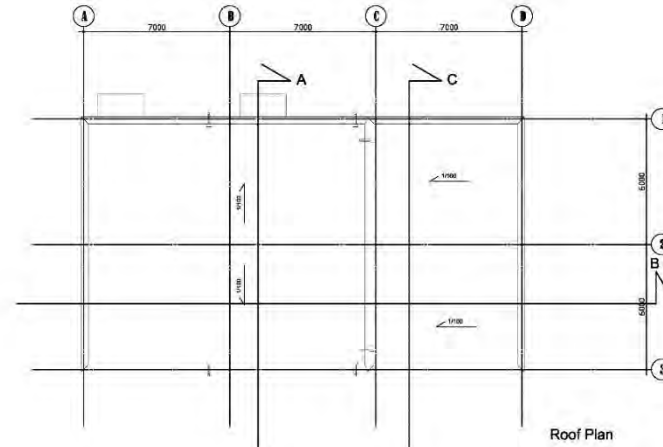
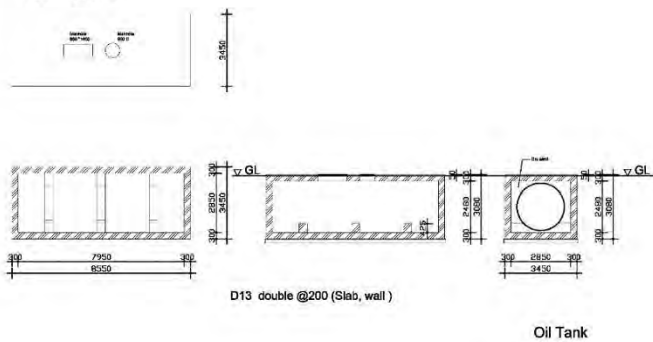


Figure 2.2.3-7 Power Station Plan, Oil Tank

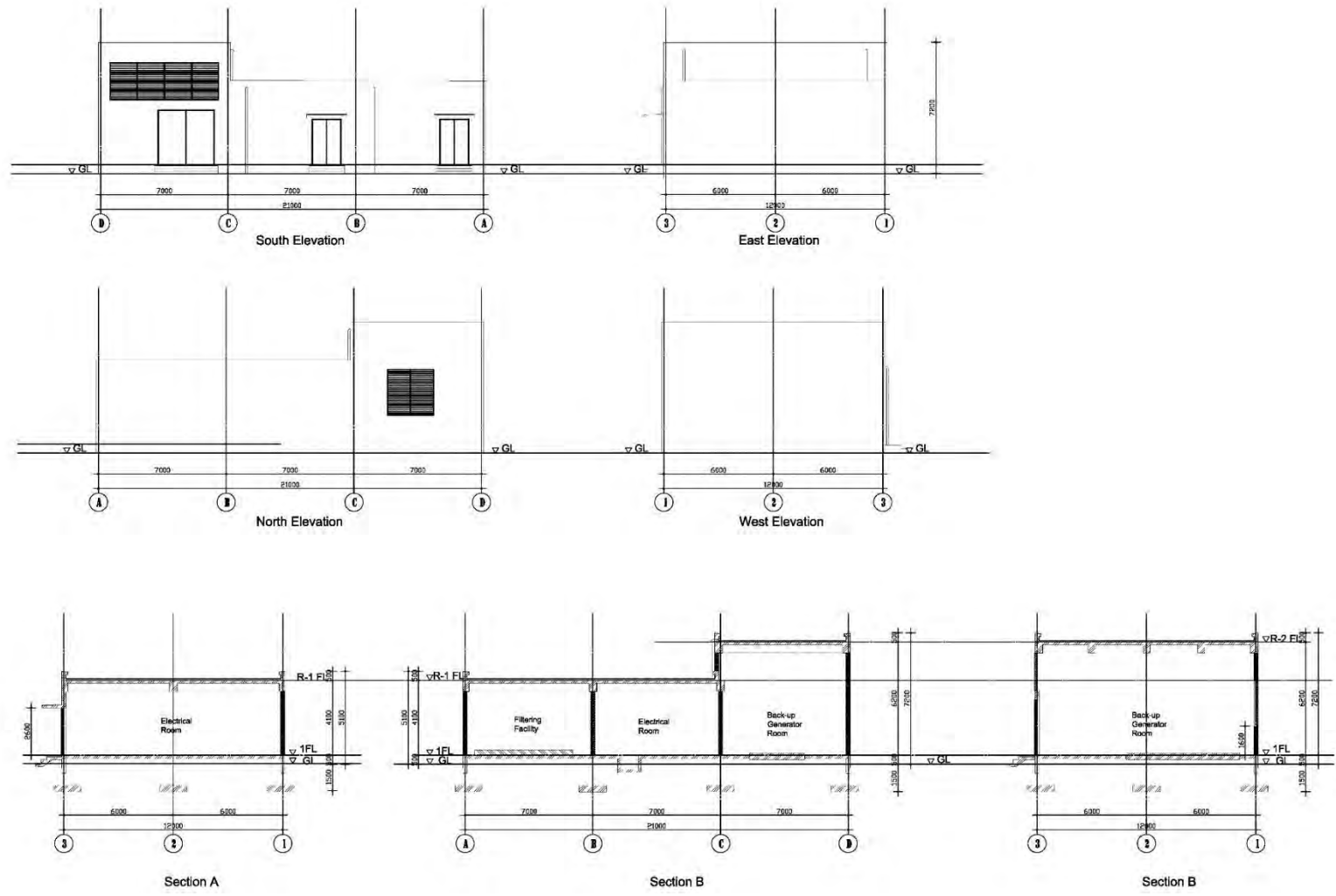


Figure 2.2.3-8 Power Station Elevation & Section

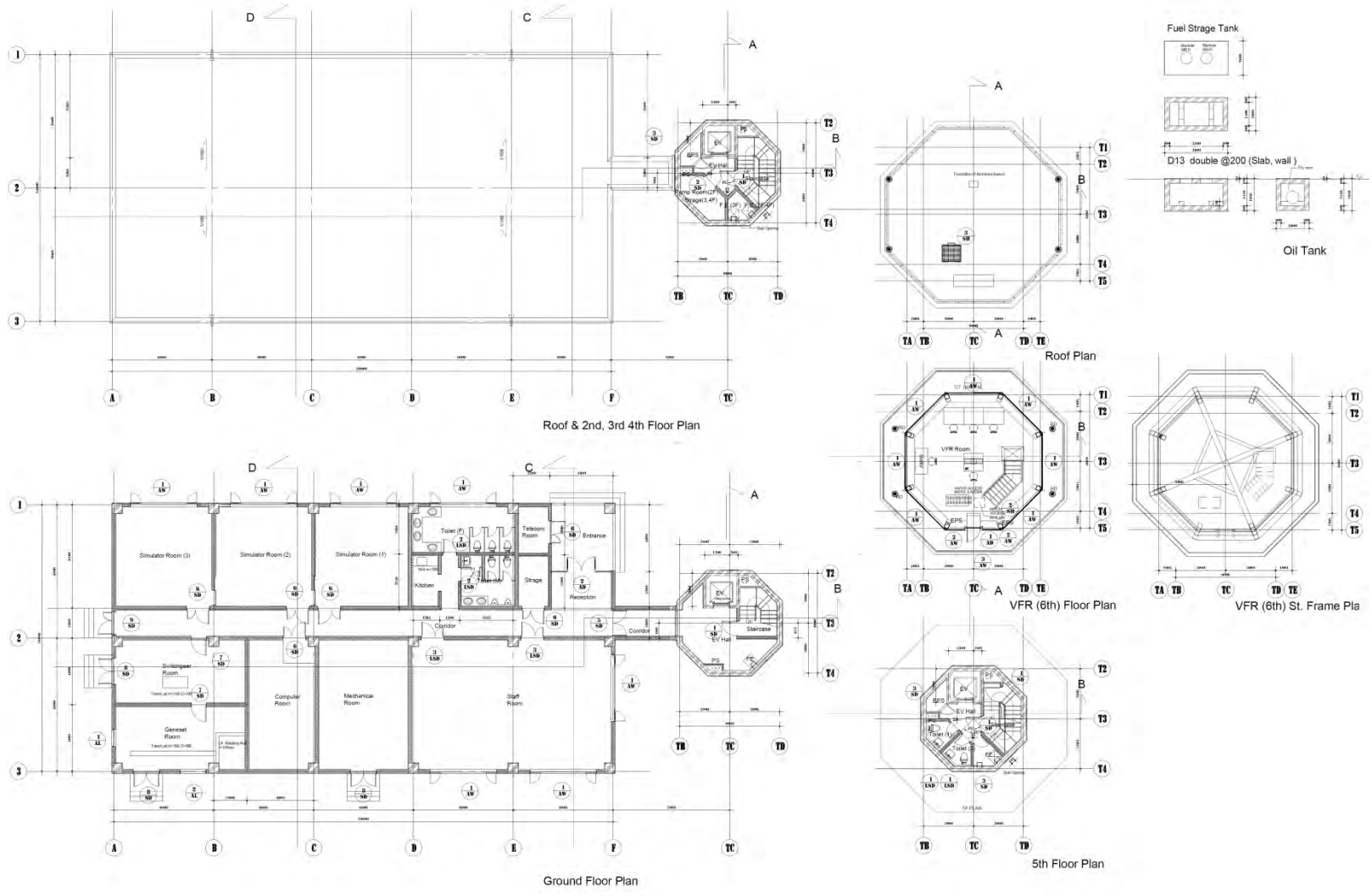
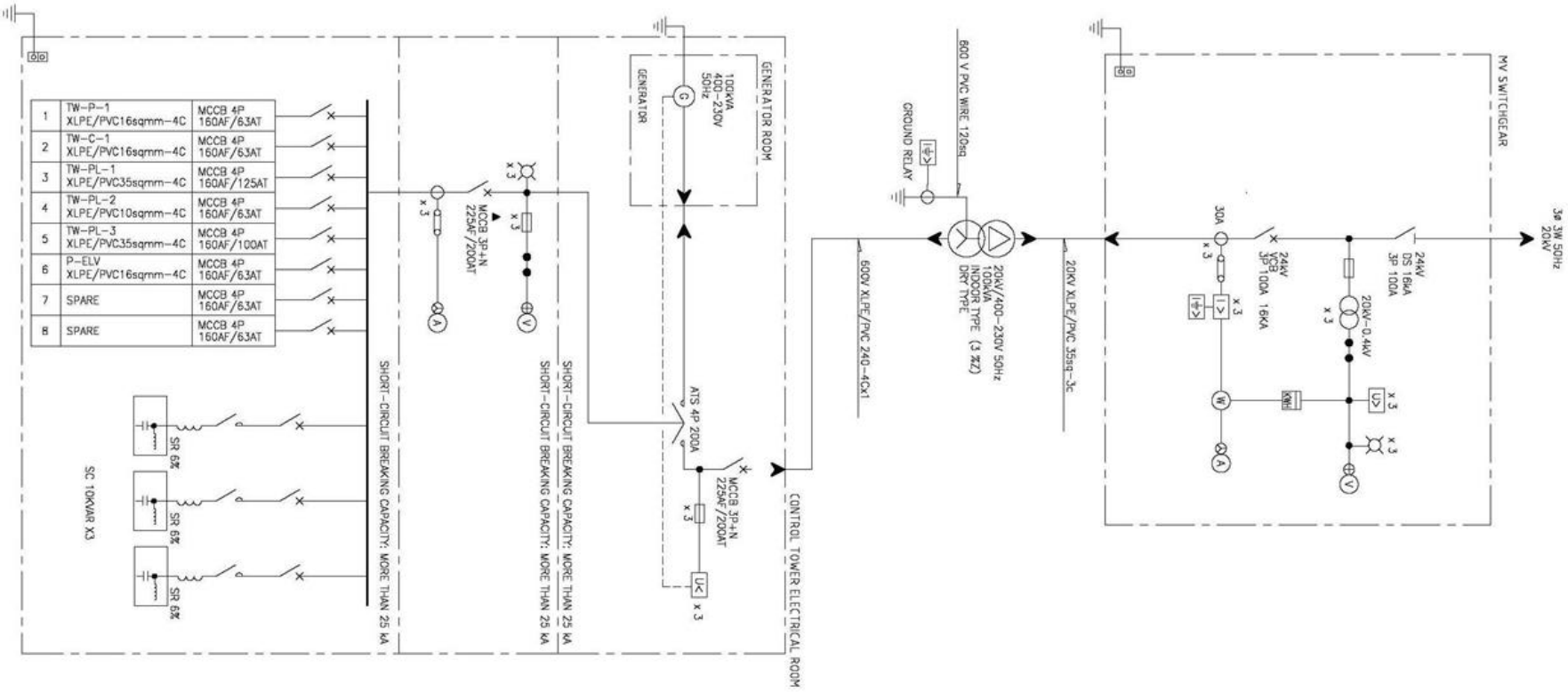


Figure 2.2.3-9 ATC Tower & Office Plan & Oil Tank



LEGEND

SYMBOL	DESCRIPTION
	POWER TRANSFORMER
	VACUUM CIRCUIT BREAKER
	DISCONNECTING SWITCH
	AIR CIRCUIT BREAKER
	POWER FUSE
	CURRENT TRANSFORMER
	REACTOR
	STATIC CAPACITOR
	INSTRUMENT TRANSFORMER
	CABLE HEAD
	TEST TERMINAL (CURRENT)
	TEST TERMINAL (VOLTAGE)
	VOLTMETER
	AMMETER
	WATT METER
	WATT-HOUR METER
	POWER FACTOR METER
	CHANGE OVER SWITCH (VOLTMETER)
	CHANGE OVER SWITCH (AMMETER)
	MOLDED CASE CIRCUIT BREAKER
	MAGNET CONTACTOR
	VOLTAGE RELAY(94)
	UNDER VOLTAGE RELAY(27)
	OVER VOLTAGE RELAY(59)
	OVER CURRENT RELAY (51)
	GROUND OVER CURRENT RELAY (51G)
	GENERATOR
	ALARM
	ATS

Figure 2.2.3-12 Substation Power Distribution System Diagram 2

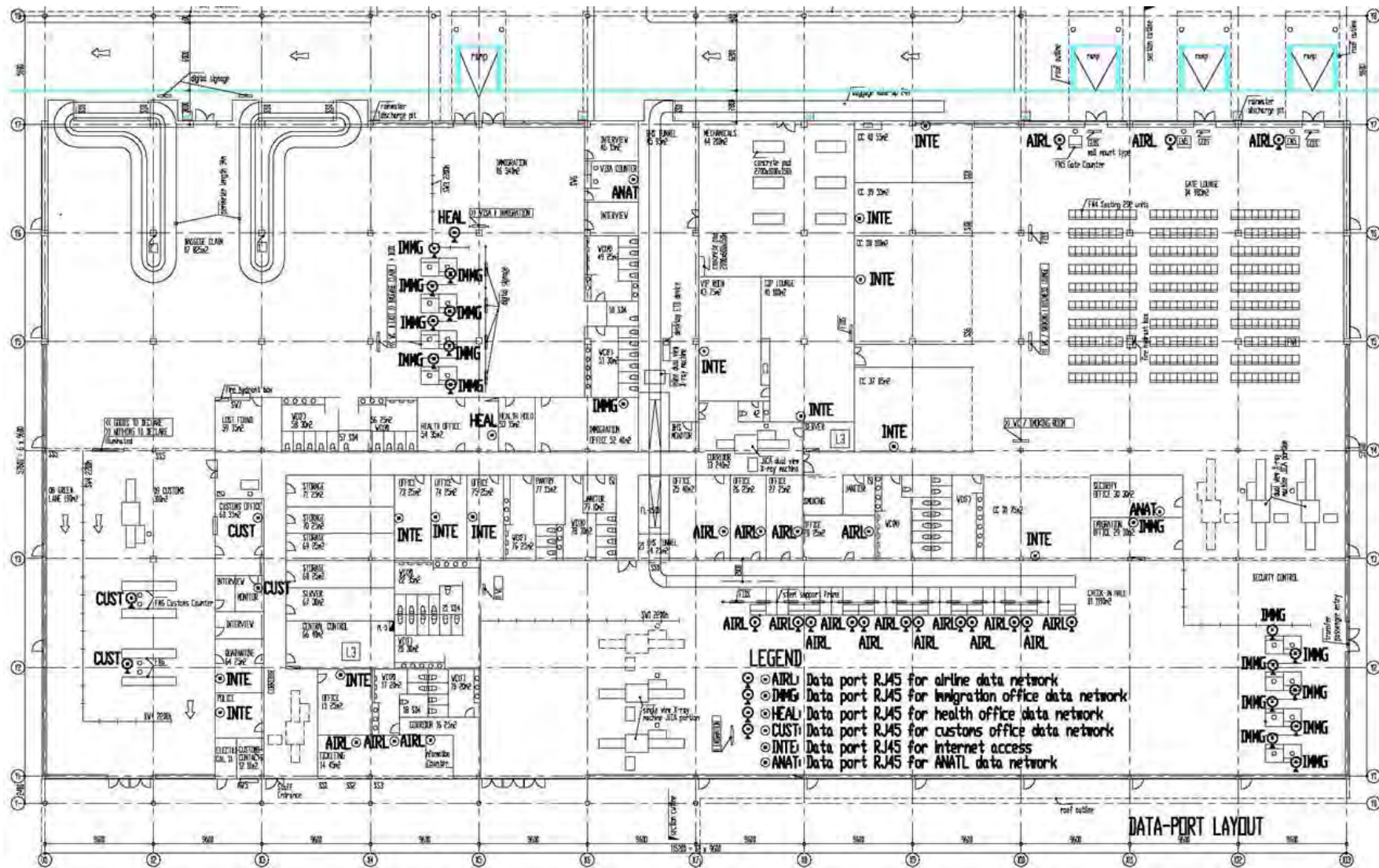


Figure 2.2.3-13 Data Port Layout

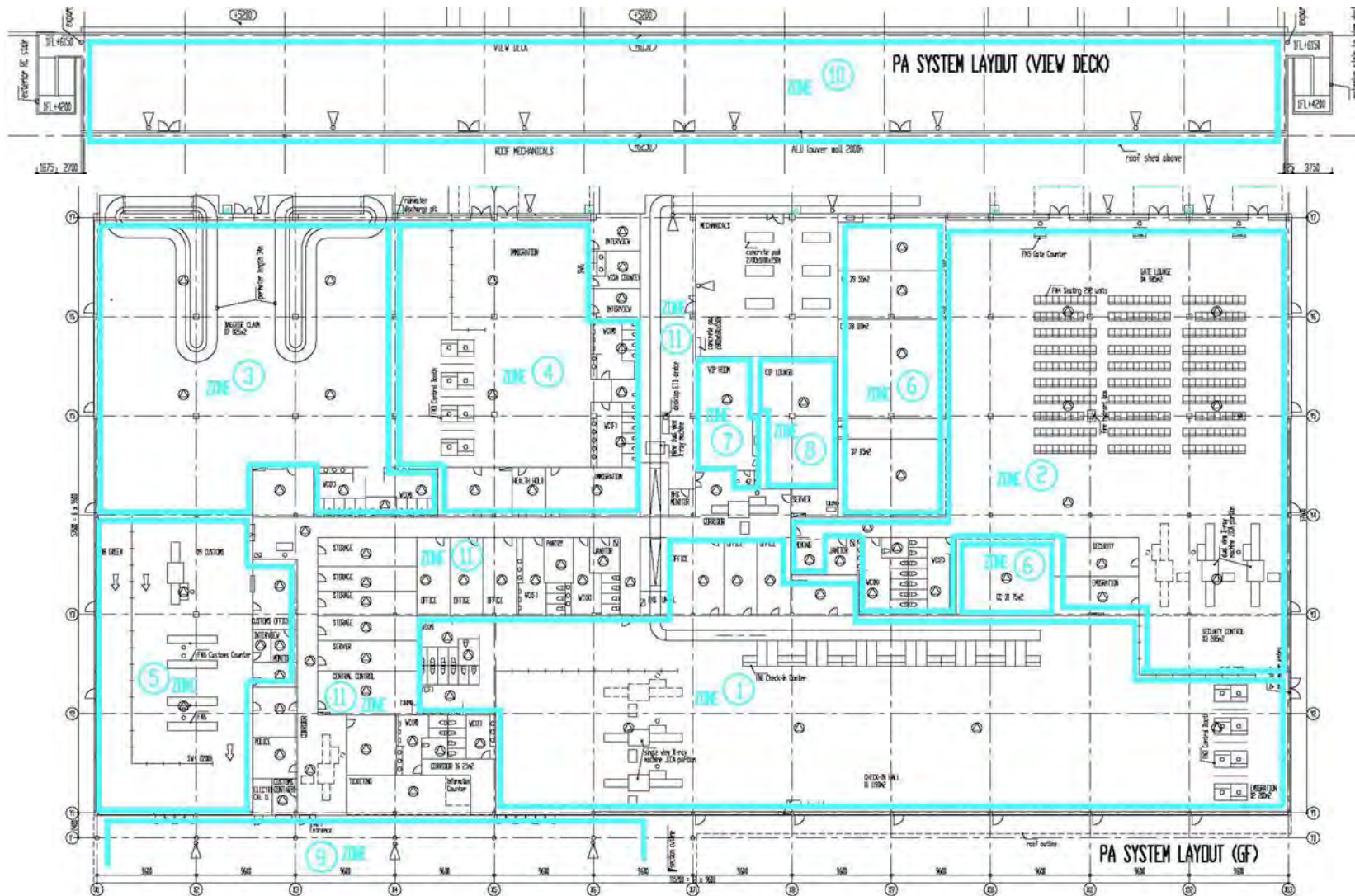


Figure 2.2.3-14 PA system Layout

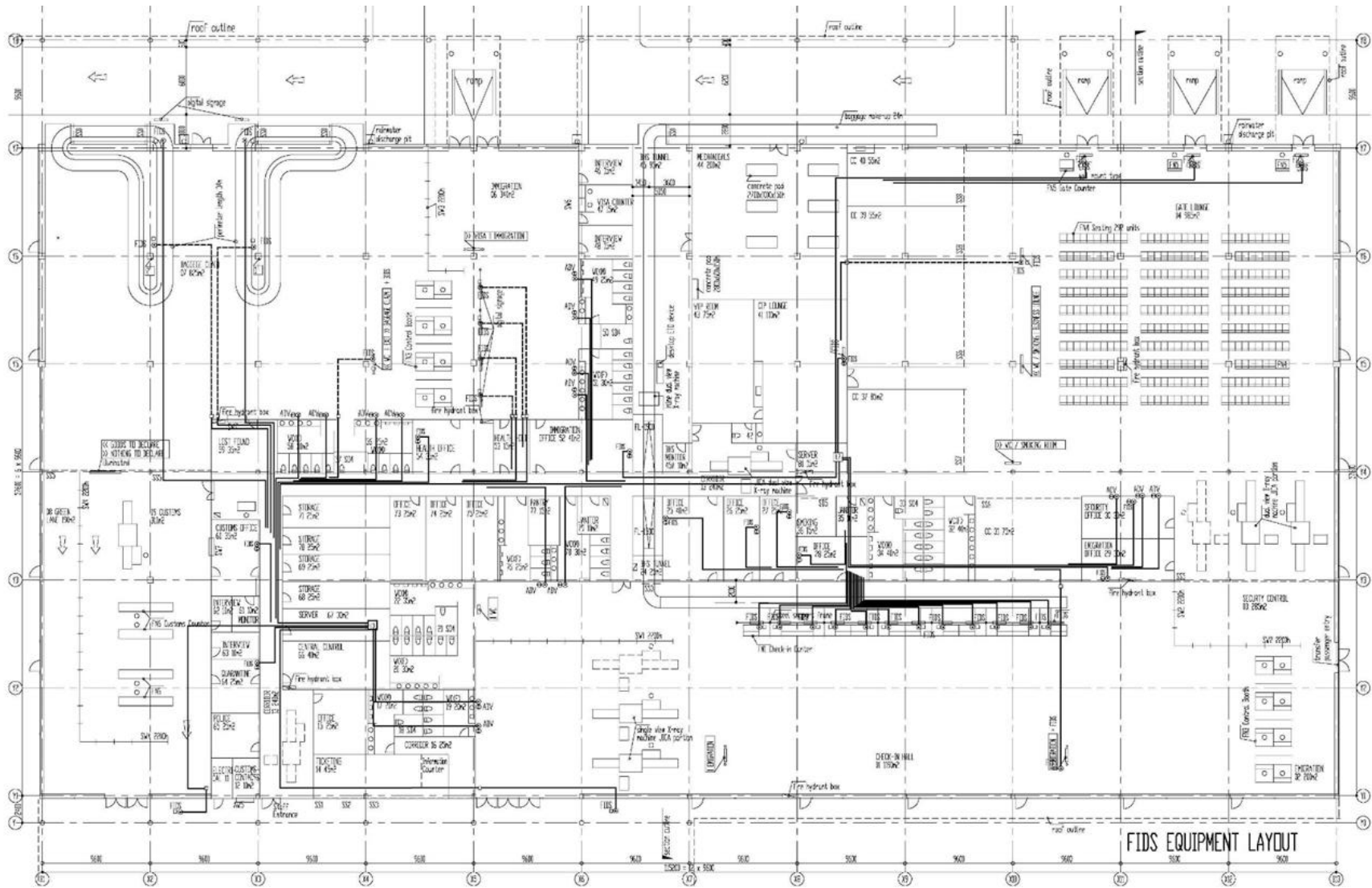


Figure 2.2.3-15 FIDS Equipment Layout

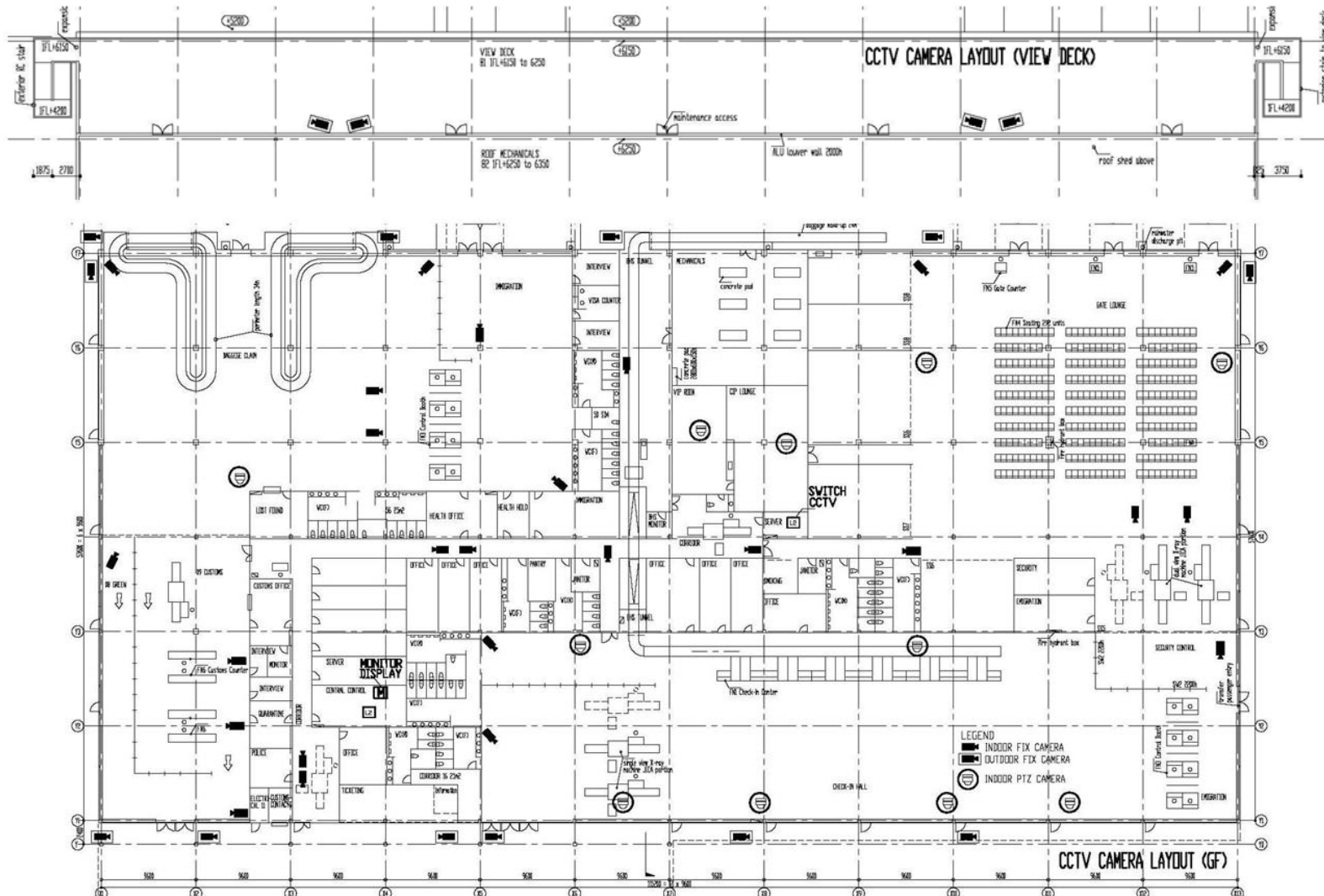


Figure 2.2.3-16 CCTV Camera Layout

Improvement of Nicolau Lobato International Airport Project in the Democratic Republic of Timor Leste

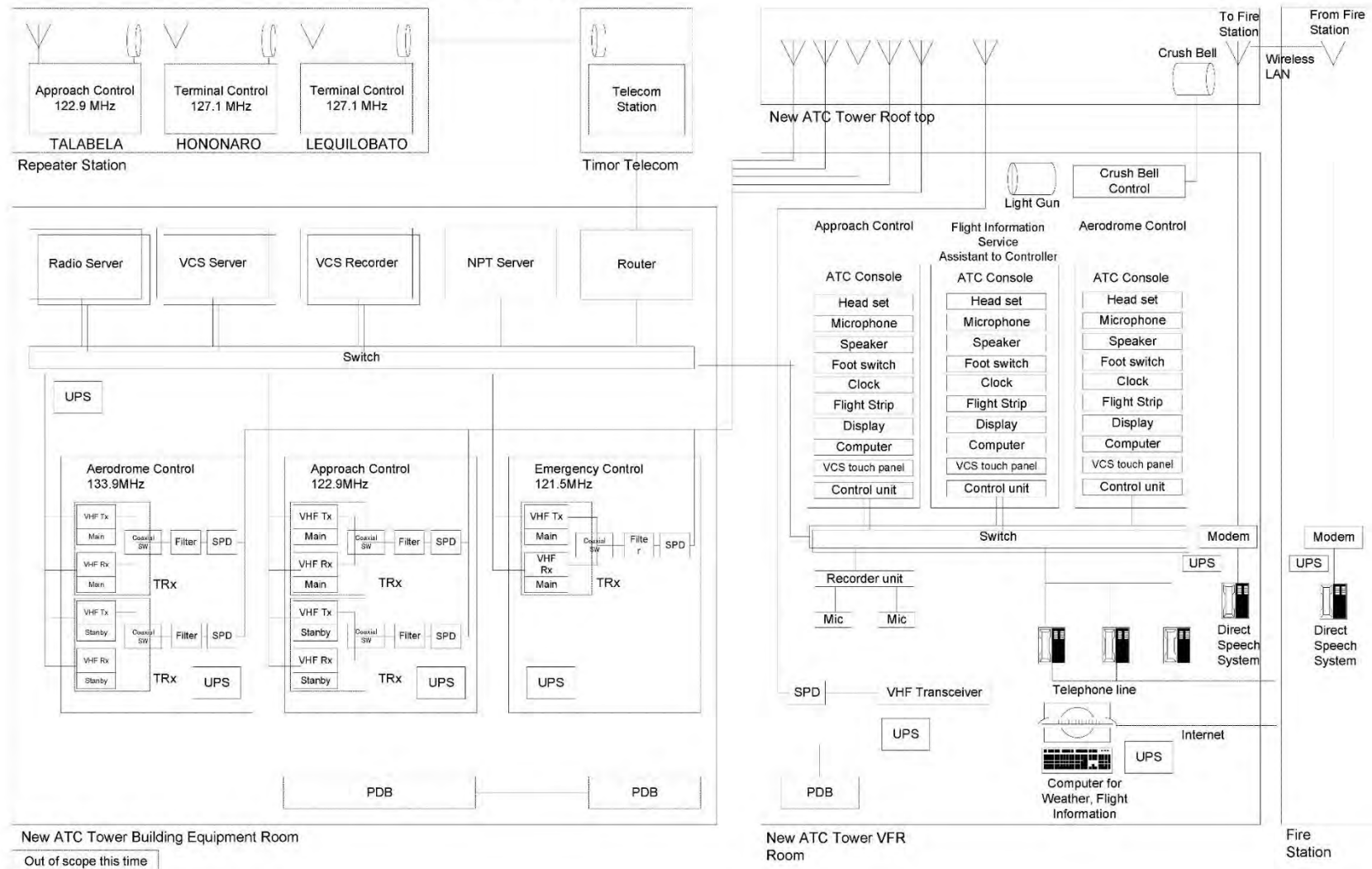


Figure 2.2.3-17 Air Traffic Control Equipment Diagram

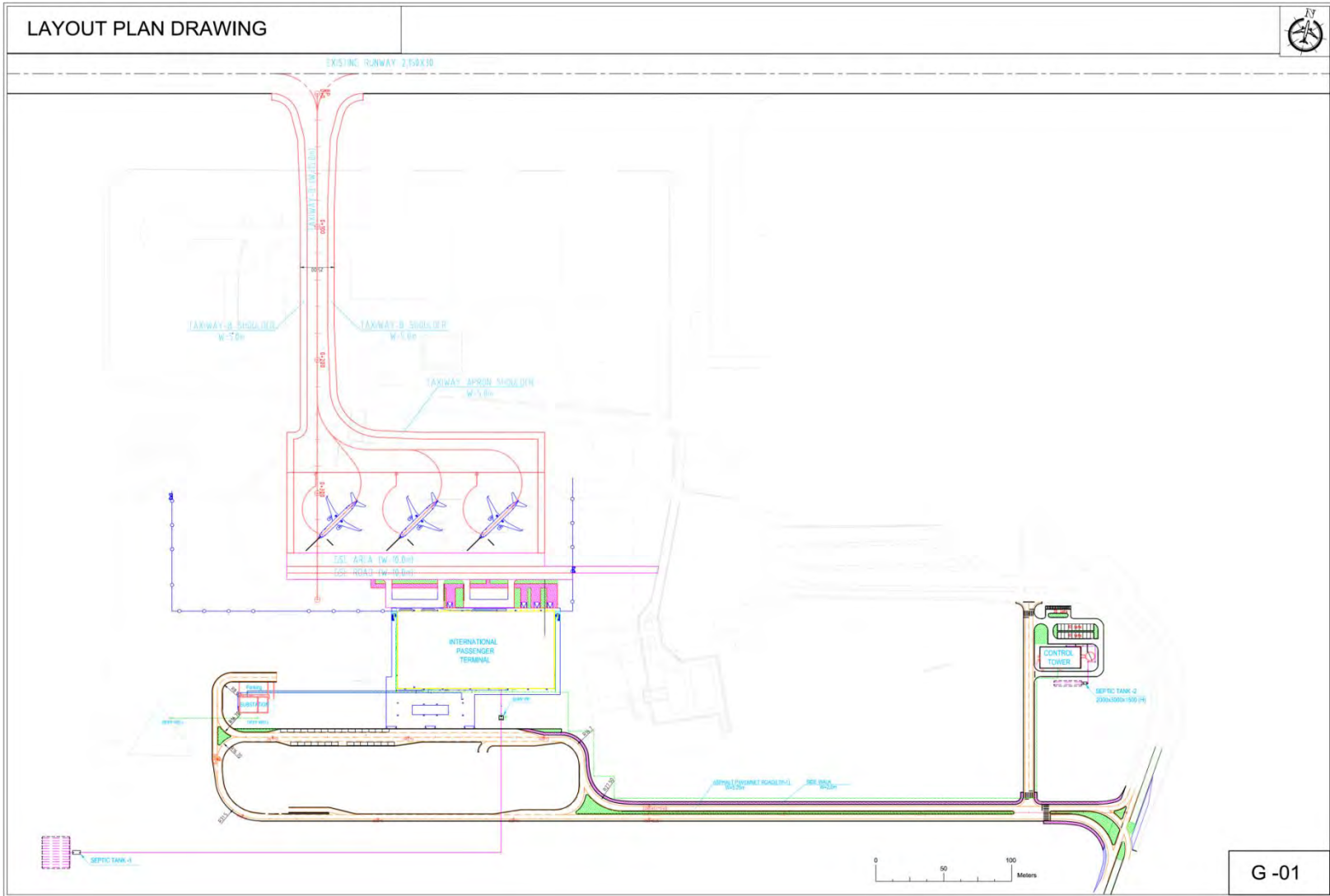


Figure 2.2.3-18 Layout Plan Drawing

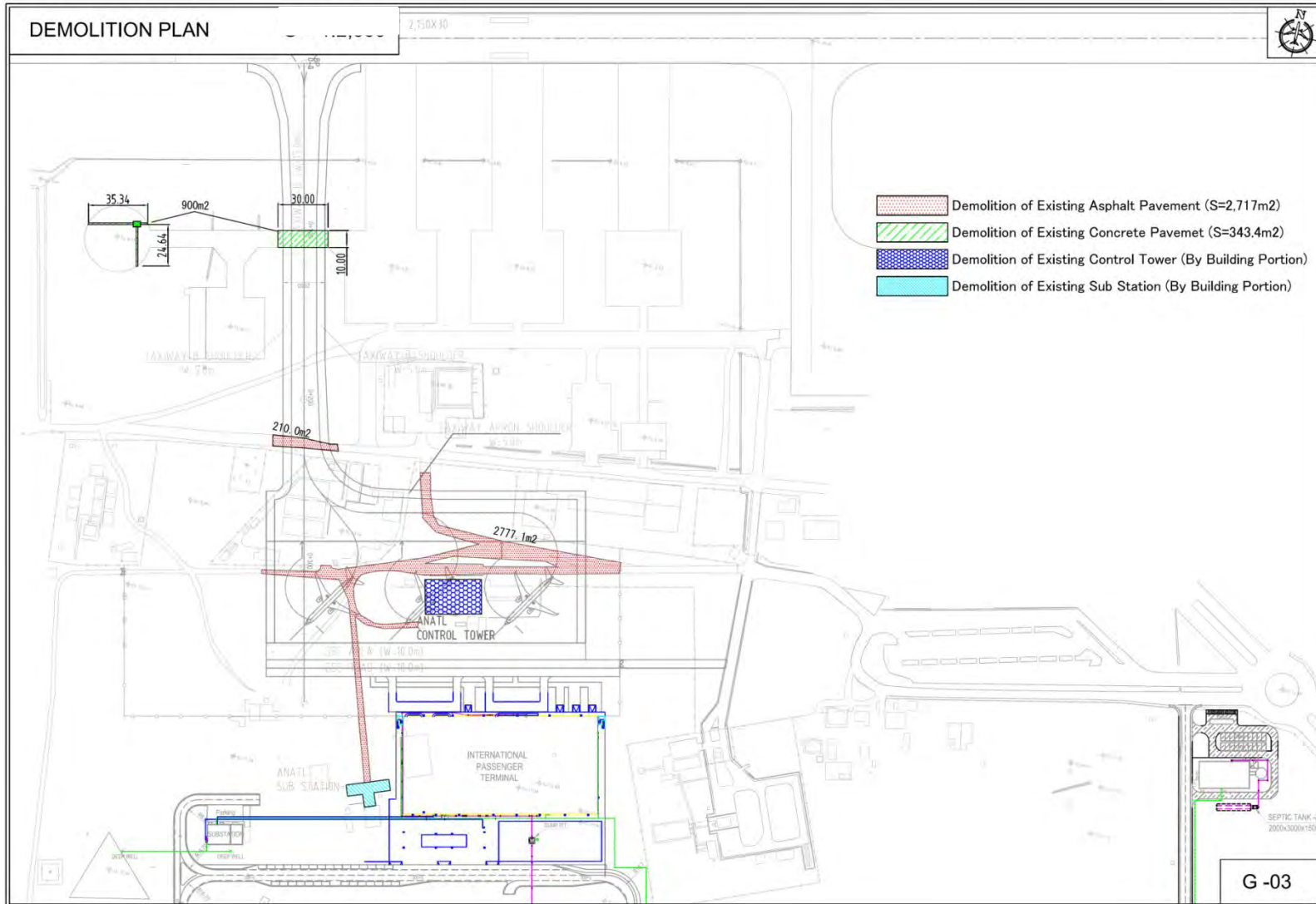
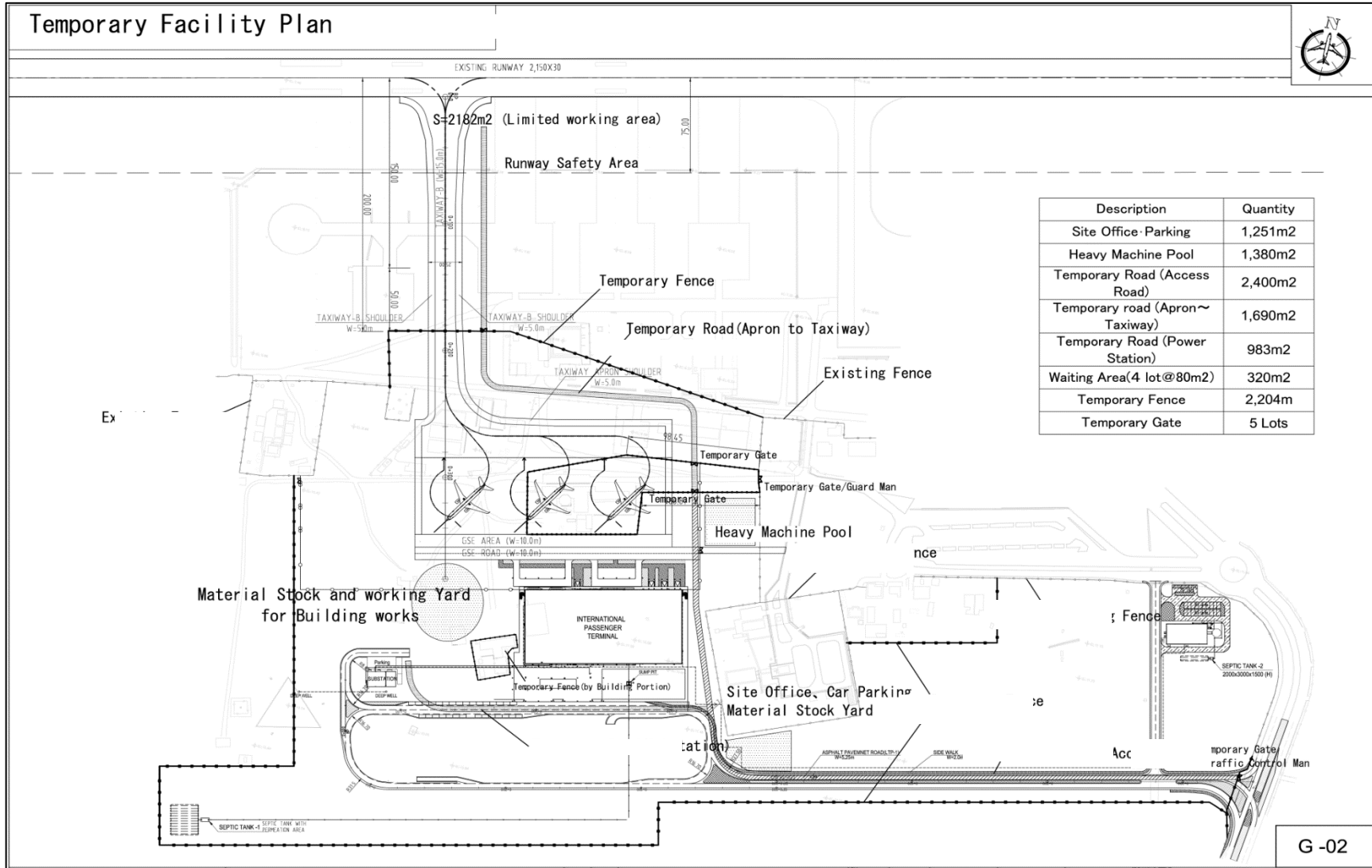


Figure 2.2.3-19 Demolition Plan

Temporary Facility Plan



G-02

Figure 2.2.3-20 Temporary Facility Yard

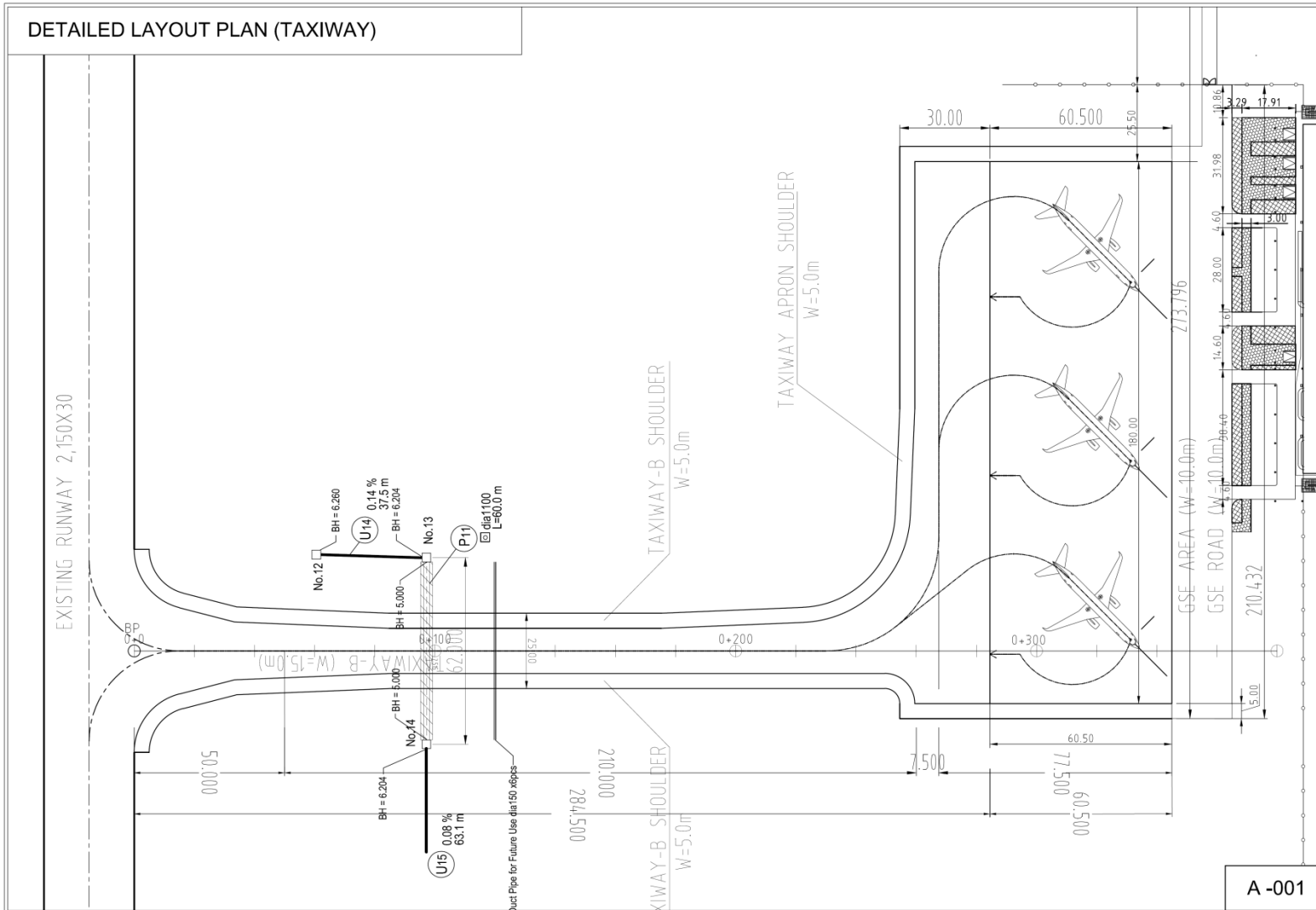


Figure 2.2.3-21 Detailed Layout Plan (Taxiway)

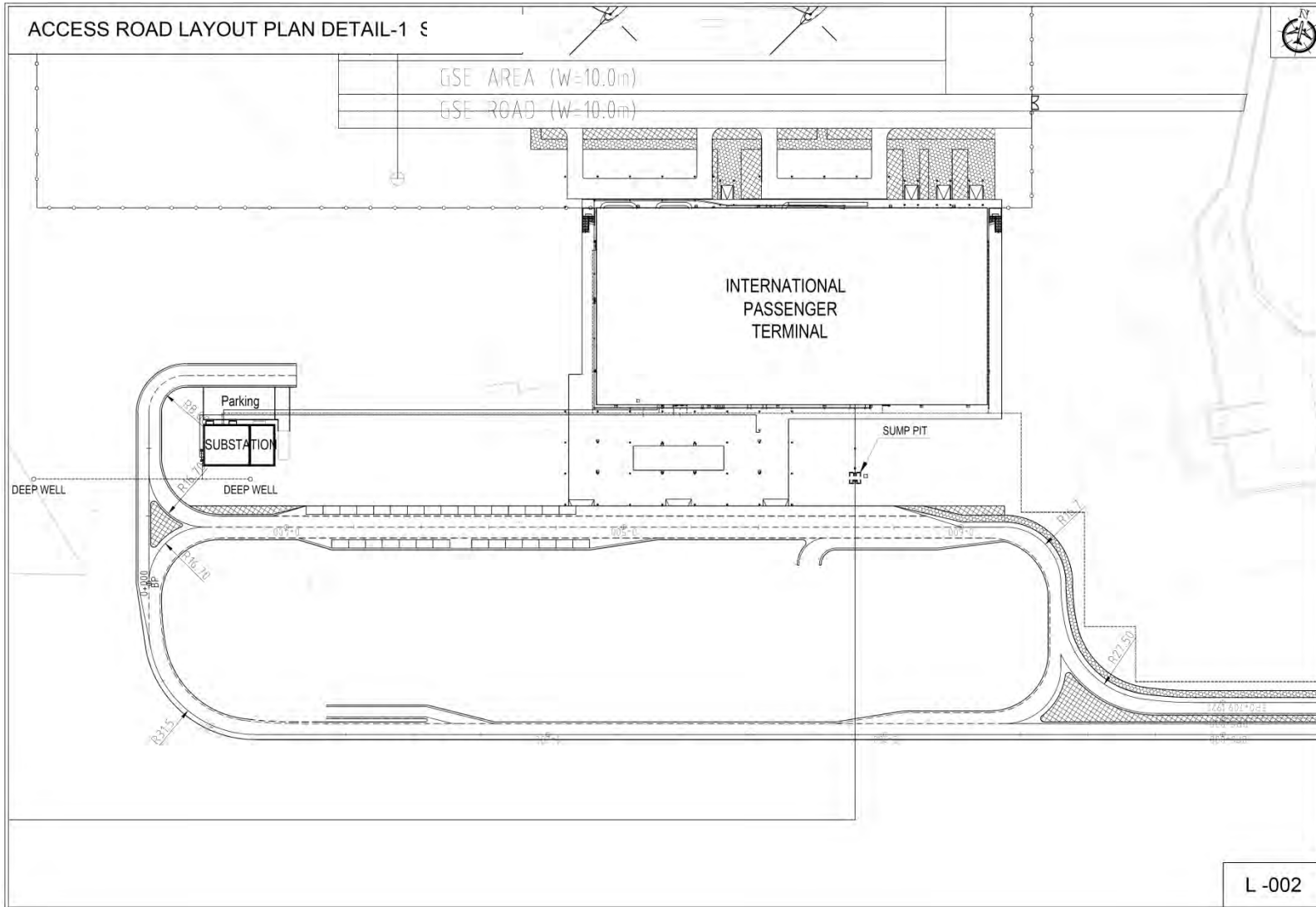


Figure 2.2.3-22 Access Road Layout Plan

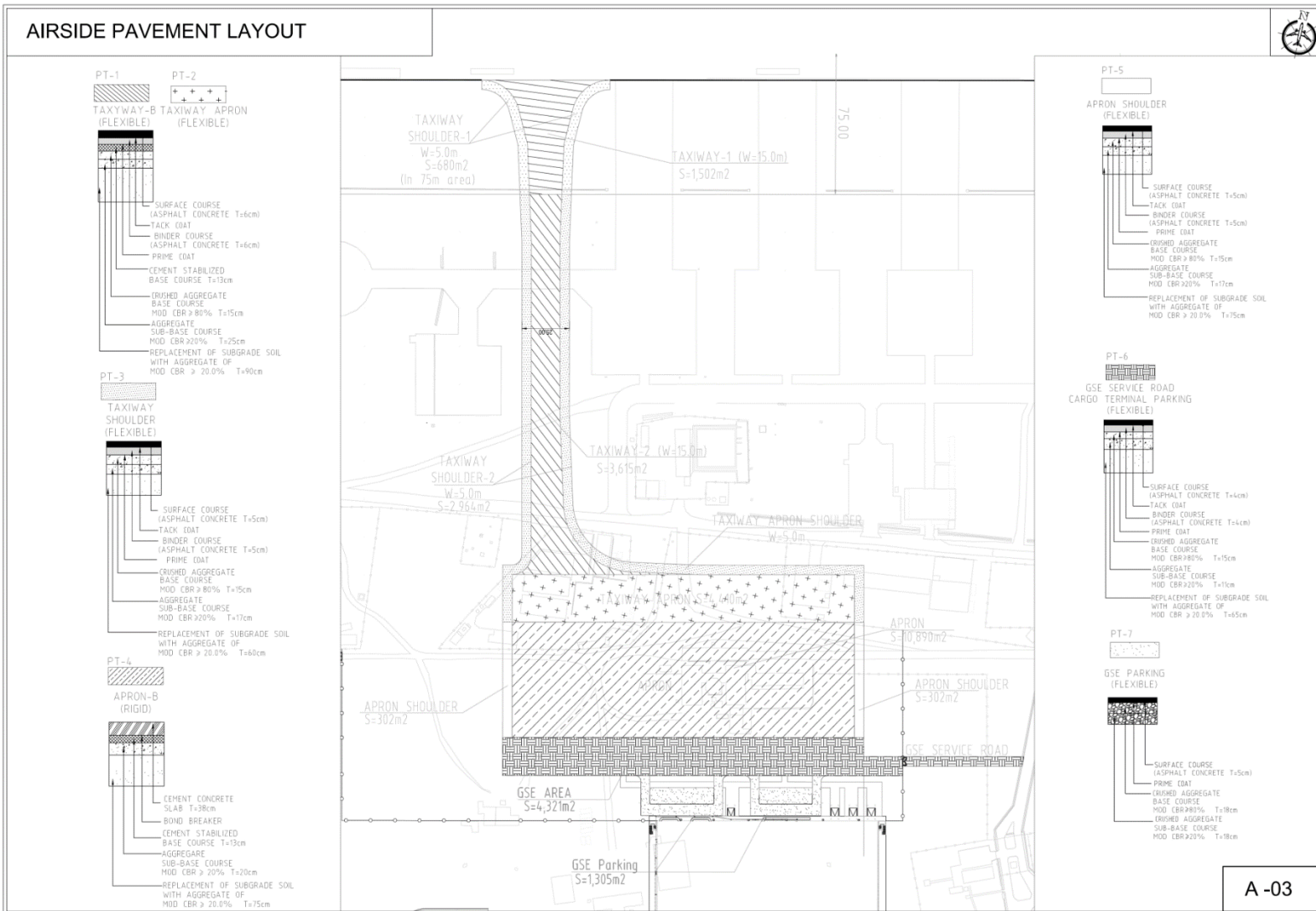


Figure 2.2.3-23 Airside Pavement Layout

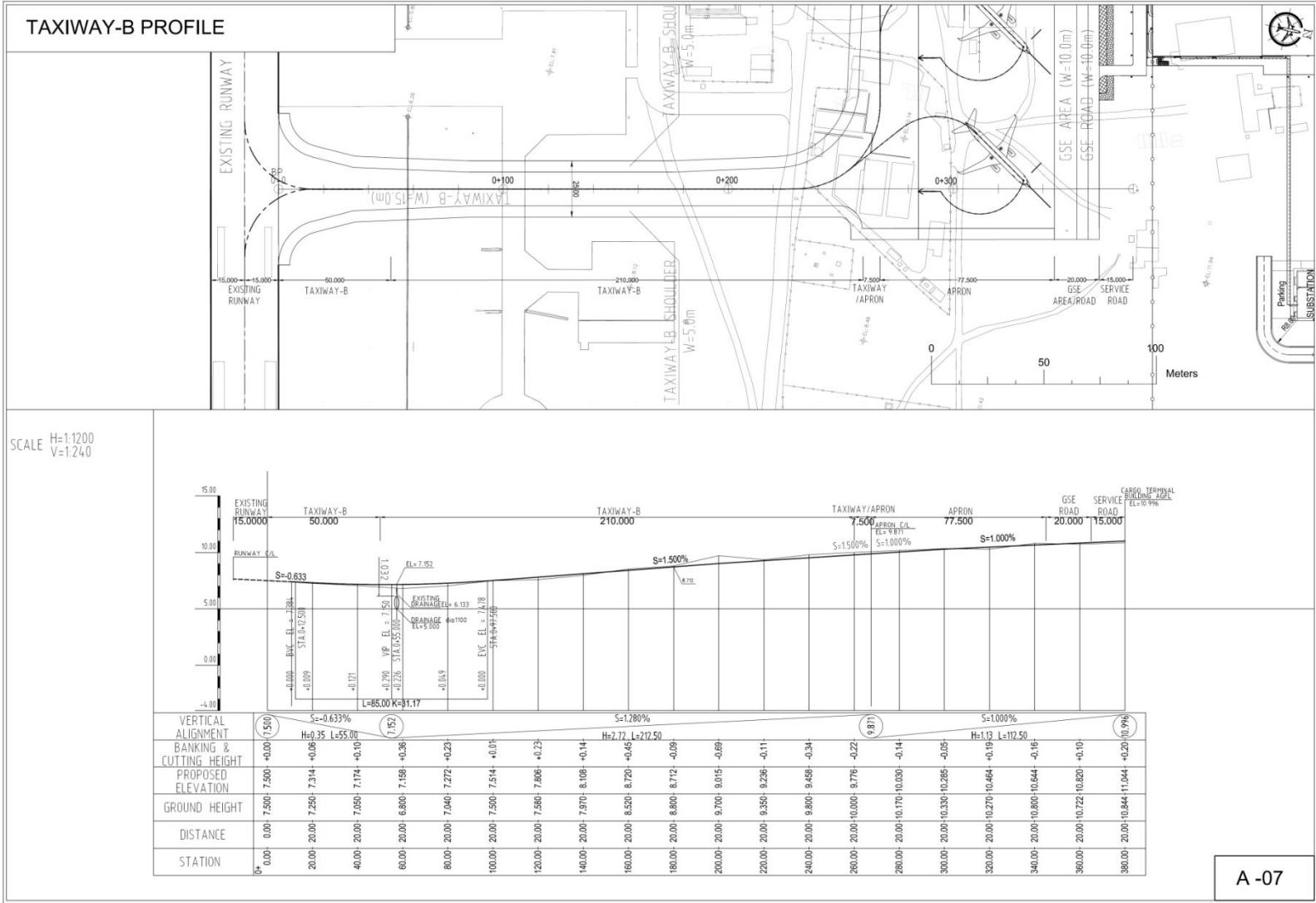


Figure 2.2.3-24 Taxiway-B Profile

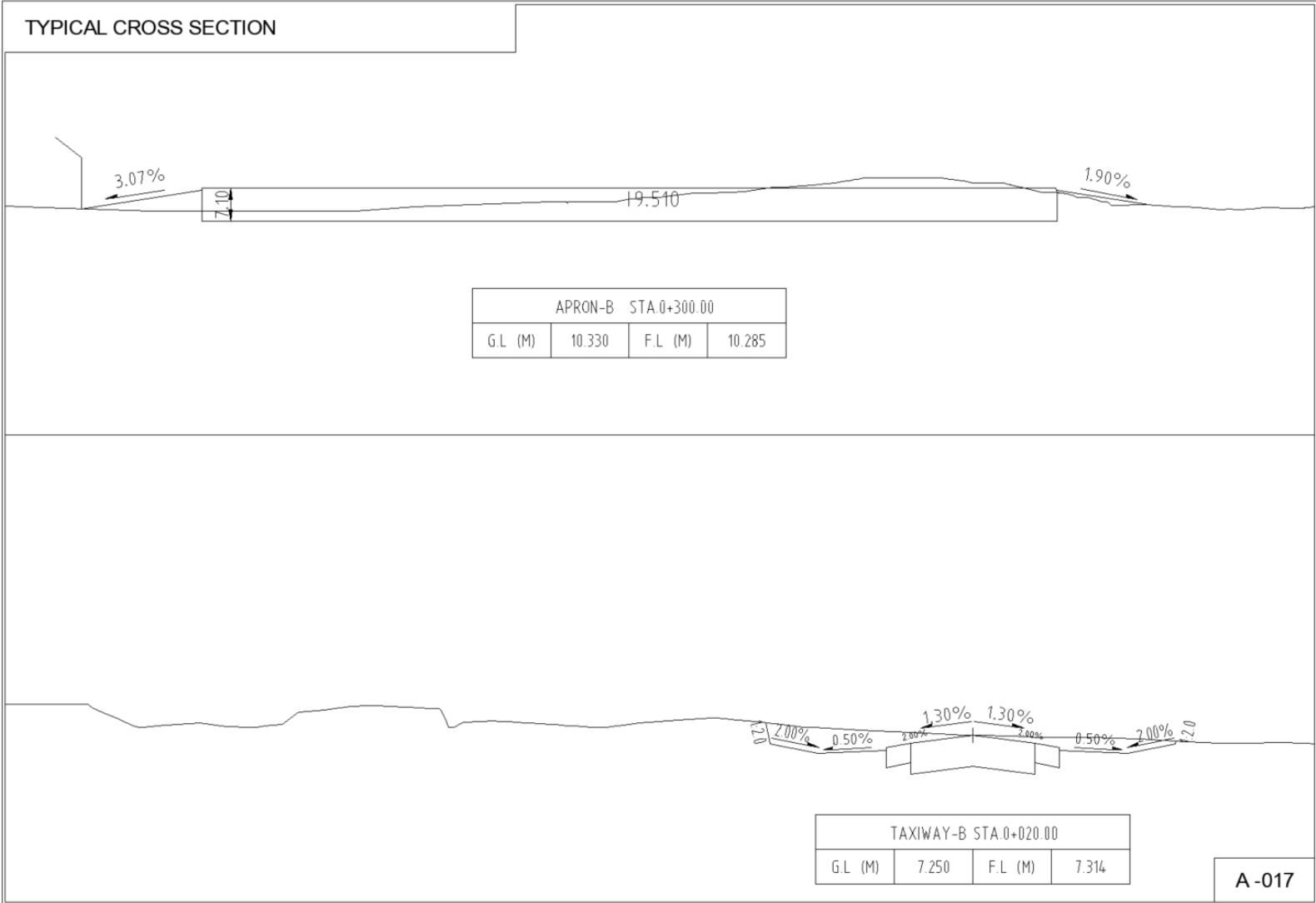


Figure 2.2.3-25 Typical Cross Section

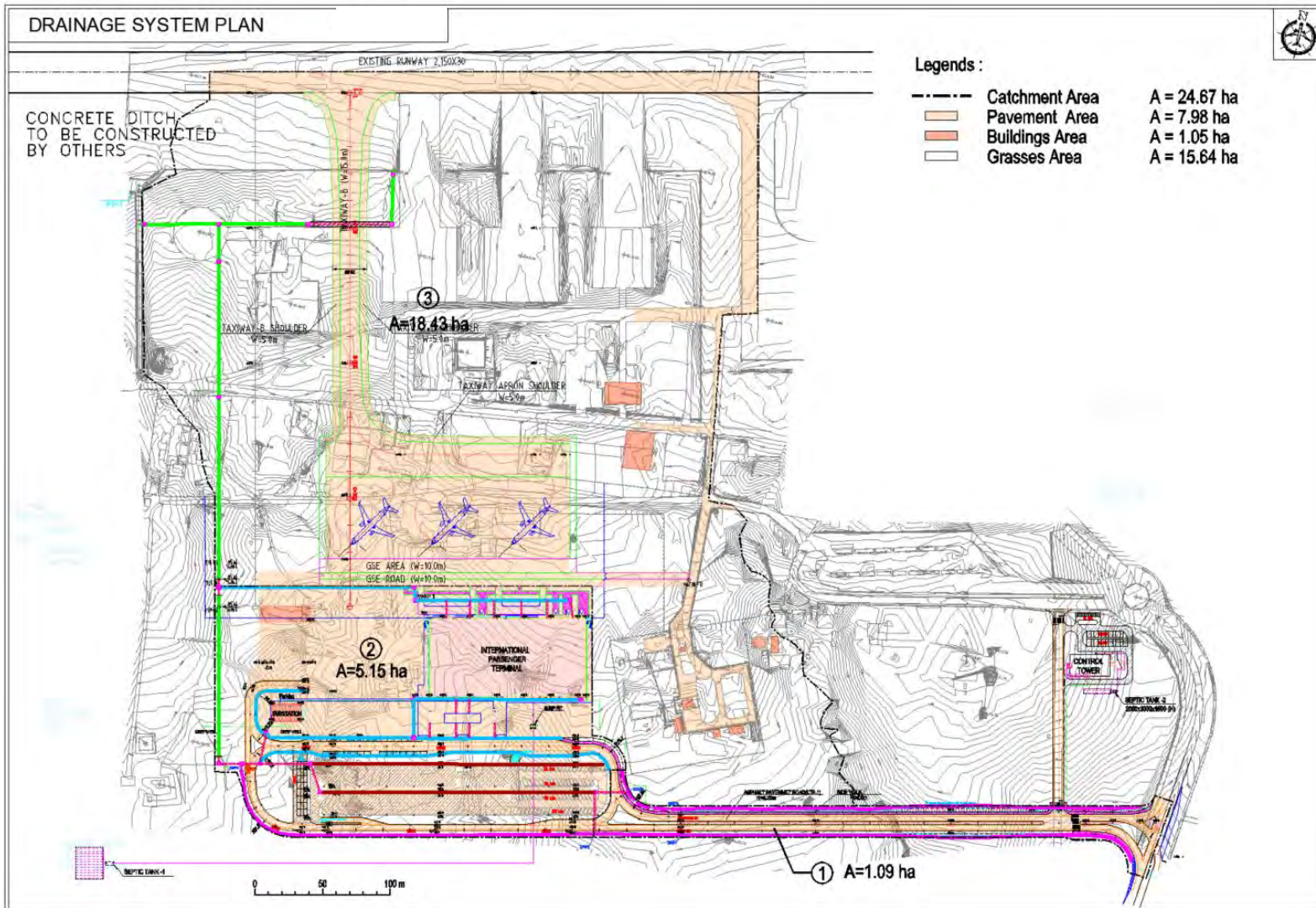


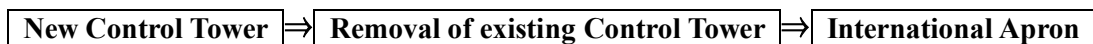
Figure 2.2.3-27 Drainage System Plan

2.2.4 Installation Plan / Procurement Plan

(1) Implementation Policy

Since this project construction will start at the existing airport, it will be important to make sure that airport operations will be affected minimally and no third-party disasters may occur.

In the project, the apron for international aircrafts is planned to be constructed right after the removal of the existing control tower, which will be removed after the new control tower is established. Therefore, the following work process is critical for the project.



Along with the construction process above, a new substation is to be constructed, then the removal of the existing substations will commence after switching the power supply from the existing substation to the newly built substation, but this process will not be a critical path because it will not affect other construction works.

As mentioned above, the architectural construction work of the project will begin with the critical construction of the control tower, and the international passenger terminal building with long-period construction, followed by commencement of the construction of the substation. Regarding civil work, pavement work of the taxiways and access roads comes first and apron pavement follows after removing the existing control tower. The landing area including the runway shoulder part (within 75m from the runway center line) is included within the taxiway pavement work. In the landing area, although it is necessary to do the pavement work outside the flight time of aircrafts, those works should be done during daytime, because the pavement area is small and construction during nighttime is not necessary.

Take full precaution to the following matters during construction period.

- Prioritize the passage of aircraft and related vehicles.
- Permission is required to access the airside.
- Inform the construction details to airport manager in advance, and if there is any change, it should be conveyed promptly.
- Construction participants should wear high-visibility clothing such as reflective vests, and construction equipment should be attached with warning lights and flags.
- Constant communication with the control tower by wireless radio when working on the airside.
- During an emergency, and evacuate immediately to safe areas, and perform necessary drills.

Regarding material procurement, locally available items will be procured as much as possible. Items and materials that are not available or too expensive at the domestic market, or will be procured from the third country after considering the price and materials that prioritize the quality should be procured from Japan.

(2) Implementation Conditions

As mentioned above, the period of removing the existing control tower, which is critical in this construction, may greatly affect the entire progress of the project and therefore time management should be significant. Also, the base of the new control tower construction site is found so loose that ready-made concrete pile will be used. There are construction records of ready-made concrete pile in the past, which needed to be supervised properly.

Since there are concrete plants, asphalt plants and subcontractors in Timor Leste, commodity materials can be easily procured. However the roofing materials and windows (aluminum sash) need to be procured from Japan from the aspect of the quality control. In addition, other specified equipment (BHS, FIDS, etc.) and steel doors will be procured from the third country because they can be available at a lower price than the local market.

(3) Scope of Works

The scope of Japanese Grant and Timor Leste side is shown below.

Table 2.2.4-1 Works of Japanese Grant and Timor Leste side

No	Items	Scope		Remarks
		Japanese Grant	Timor Leste side	
Before the tender				
1	To approve IEE/EIA		○	
2	(1) To secure the land necessary for the project including land for site office, plant yards (asphalt, concrete, crusher etc.), material storage yard, motor pool, temporary construction yard, and waste disposal site with good access to the project sites.		○	
	(2) To relocate existing utilities and buildings within the project sites.		○	
	(3) To obtain or arrange for license, permission and other necessary procedures for the project.		○	
3	To open a bank account (Banking Arrangement B/A)		○	
4	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant.		○	
5	To submit project monitoring report (with the result of detail design)		○	
6	To relocate the following existing facilities to new sites, to demolish the existing structures and to clear and level the sites for new construction works. a) ANATL Head Office Building b) ANATL Procurement Department Office Building c) ANATL Maintenance Workshop Building d) ANATL Vehicle Maintenance Workshop Building e) ANATL Storage f) TLK Office g) ETO Aviation Fuel Facility		○	

No	Items	Scope		Remarks
		Japanese Grant	Timor Leste side	
	h) Boarder Police Office Building			
7	To construct the following facilities: a) New High Voltage Distribution Station b) Electric Power Substations with Emergency Generators -Substation for existing terminal facilities and central relocated facilities -Substation for Aeronautical Ground lights and VOR/DME -Substations for west relocated facilities c) Electric power cables for existing facilities connected with new substations		○	
8	Clearing of obstructing		○	
During the Project Implementation				
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the supplier(s).		○	
2	To settle the following commissions to a bank of Japan for the banking services based upon the B/A a) Advising commission of A/P b) Payment commission of A/P		○	
3	To issue working visa for workers		○	
4	To enable provision of electric power supply for the equipment		○	
5	To take necessary safety measures during construction and installation		○	
6	Transportation and Customs clearance			
	(1) transportation to unloading port	○		
	(2) tax exemption and customs clearance procedures		○	
	(3) Inland transportation from port to site	○		
7	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services of such facilities may be necessary for their entry into the country of the recipient and stay therein for the performance of their work.		○	
8	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed by the country of the Recipient with respect to the purchase of the products and/or the services be borne by ANATL without using the grant.		○	
9	Expense burden except Japan's Grant Aid		○	
10	1) submission of monitoring report 2) submission of project completion report		○	
11	Submission of project completion report		○	
12	Construction of the following facilities			
	a) VIP terminal building		○	
	b) VIP road of airside c) VIP road of landside			
13	Procurement of special equipment	○		

No	Items	Scope		Remarks
		Japanese Grant	Timor Leste side	
14	Relocation of air traffic equipment below: 1) VOR/DME monitoring equipment 2) NDB monitoring device 3) Relocation of connection router with remote communication site		○	
15	Installation, adjustment, and testing of equipment	○		
16	Operation Guidance	○		
17	Communication test		○	
After the Project Implementation				
1	Maintenance and effective utilization of facilities and equipment 1) Allocate maintenance costs 2) Establishment of maintenance system 3) Periodic inspection		○	
2	Implementation of EMP and EMoP		○	
3	Submission of environmental monitoring results to JICA		○	

(4) Construction / Procurement Supervision

Scope of work for the Consultant during construction and procurement stage is divided into 1) Detailed design and 2) Construction / Procurement stages. Consultants assigned for each stage are shown in the followings. The tender will be held in one package including architectural, civil and equipment parts of the Project.

1) Detailed Design

a) Confirmation of the final project plan (Field Work)

For the final confirmation of the Project and site conditions the following consultants are engaged with the field work. The chief consultant, architect, structural architect, probing engineer, electrical engineer, cost estimator (architect work), civil engineer 1 and 2, and cost estimator (civil work). In addition, equipment planner will be dispatched for final confirmation.

b) Detailed Design and Review of Equipment Specification (Home Work)

In addition to the engineers dispatched to the above-mentioned field work, architect 2, structural architect 2, electrical engineer 2, probing engineer 2, civil engineer 3, equipment planner 2 will be engaged with the detailed design work.

c) Preparation of Tender Document (Home Work)

For preparation of tender documents, the following engineers will engage with the work. The Chief engineer, architect 1, structural architect 1, electrical engineer, tender

document (architect), civil engineer 1 and 2, tender document (civil), equipment planner, procurement planner.

d) Approval of Tender Document (Field Work)

For approval of tender documents of building, civil and equipment procurement, the following engineers will be dispatched to Timor-Lest, the chief consultant, architect 1, civil engineer 1, and equipment planner.

e) Tender Announcement, Explanation of Tender Document (Home Work)

For tender announcement and explanation of tender document, the following engineers will be engaged, the chief consultant, tender document (architect), civil engineer 1, tender document (civil), equipment planner, tender document (equipment).

f) Tender and Tender Evaluation (Field Work)

For tender evaluation, the following engineers will be dispatched, the chief consultant, civil engineer 1, equipment planner.

2) Construction and Procurement Supervision

a) Construction Supervision

The main components of the Project are construction of the passenger terminal building and taxiway and apron. For construction supervision, architect and civil engineer will stay in the field and engage with construction supervision.

- Management of schedule, quality and budget for construction work
- Meeting with ANATL, coordination with other relevant organizations
- Monthly report to ANATL, JICA and embassy of Japan
- Safety measure during construction

Building construction includes passenger terminal building which requires electrical, probing and special terminal equipment, ATC tower which require construction work in a higher area, and substation. Supervision for those works need considerable experience and knowledge. Experienced architect will be dispatched for supervision work. In addition, at the beginning of construction, beginning of structural construction and middle of structural construction and at the end of construction, architect and structural architect will be dispatched for inspection. Probing and electrical engineers will be dispatched at the beginning and middle and end of construction for inspection. For warranty period of one year after completion of the Project, architect will be dispatched for inspection.

Civil work includes complicated work of connection between runway and taxiway and pavement which require hot weather concrete. In addition, those pavement works need

to be started after removal of existing ATC tower and civil work needs to be completed within a limited period of work with quality, schedule and costs ensured. Under those circumstances, experienced civil engineer will be dispatched for supervision work. In addition, access road pavement, and taxiway and apron pavement, additional civil engineer will be dispatched for inspection. For warranty period of one year after completion of the Project, civil engineer will be dispatched for inspection.

The chief consultant mainly has a meeting with the government of Timor-Leste, airline and attends ceremony and important meeting. During the construction period, the chief consultant will be dispatched for three times for at the beginning, middle and end of the construction period.

In addition, for assistance of Japanese engineer, the following engineer will be employed for the Project, architect, electrical engineer, probing engineer, civil engineer x 2. To support those works, the following assistants are also employed, officer, driver, office boy.

b) Procurement Supervision

Procurement supervisor will be dispatched at the timing of installation of ATC tower equipment and airport security equipment. In addition, for approval of manufacturing drawings and inspection before shipment and one-year warranty period, equipment inspector will be dispatched.

(5) Quality Control Plan

Items and frequents of test for quality control shall be managed by the Standard Specification for Airport Civil Works.

(6) Procurement Plan

1) Construction Materials

a) Concrete

There are several companies with concrete manufacturing facilities around the construction site. All of them have quality testing facilities and meet the quality control level required in this construction. Furthermore, production capacity also meets the level required in this case. Therefore, concrete should be procured locally.

b) Cement

There is no production of cement in Timor Leste, but cement made in Indonesia or China is widely distributed, and has no problem in circulation volume. Therefore, cement is planned to procure locally.

c) Rebar

Rebar made in Malaysia, Indonesia and China is widely distributed and will be procured locally. But detailed attention is needed for the kind of standards because many are in circulation that is different from the ASTM standards.

d) Asphalt (Mixture)

There are several companies with asphalt manufacturing facilities around the construction site, and their quality management system and production capacity meet the requirements in this construction. Therefore, Asphalt should be procured locally.

e) Aggregate

There are several mining companies that own quarries in Timor Leste, but the lands are owned by the government. The company must get a license from the Department of Environment to conduct mining. In the previous JICA project, contractors directly negotiated with mining companies to obtain aggregate.

f) Other Materials

Most of the general construction materials are possible to procure locally, but the homogeneity and quality of the product materials must be ensured since those materials are made by neighboring third countries. Procurement from Japan and third country for high-quality materials will be considered, even for locally procurable materials. Steel doors, special equipment, and etc. can't be procured locally; therefore these will be procured from the third country. The procurement categories of the local, Japan and third country are shown in the table below.

Table 2.2.4-2 Procurement Classification of Materials and Equipment

Materials	Procurement classification			Remarks
	Local	Japan	Third Country	
Construction Materials				
Sand	○			Local Procurement
Aggregate	○			Local Procurement
Cement	○			Distributed in the local market
Asphalt	○			Distributed in the local market
Formwork	○			Local Procurement
Rebar	○			Distributed in the local market
Steel Frame	○			Distributed in the local market
Concrete Block	○			Local Procurement
Waterproof Materials	○			Distributed in the local market
Stones, Tiles	○			Distributed in the local

Materials	Procurement classification			Remarks
	Local	Japan	Third Country	
				market
Gypsum Board	○			Distributed in the local market
Light Gauge Steel	○			Distributed in the local market
Folded Plate		○		
Steel Joinery			○	Vietnam, Indonesia
Aluminum Fittings		○		
Glass	○			Distributed in the local market
Paints	○			Distributed in the local market
Interior Materials	○			Distributed in the local market
Elevators			○	
Electrical and Machinery Equipment	○	○	○	Distributed in the local market (Special Equipment are procured from third country)
Air Traffic Equipment		○	○	
Airport Security Equipment			○	

Source: JICA Study team

2) Construction Equipment

The local construction companies own general equipment such as a backhoe and crawler crane of 800 to 900ton class, construction equipment is planned to procure locally. There are several leasing companies of construction equipment, but they only handle general equipment, the backhoe is relatively expensive for \$ 150 / h (no operator).

3) Labor

a) Labor Supply/Skill Lever

In the example investigation at the site of the Japanese Grand Aid Project, about 60% of the laborers were locals, and 40% were Indonesian. Furthermore, the skill level of local workers was low that they can only accomplish very simple works that is why skilled workers and supervisors were all Indonesian. Therefore, even in the project, the general labor will be locals, but skilled workers, supervisors and leaders are expected to be Third Country people or Japanese. However, Indonesian skilled workers and supervisors are basically belonging to the local general contractors, and it plans to hire those local staying skilled workers and supervisors also in this project. Therefore, it is

not necessary to bring skilled workers and supervisors from Third Country only for this project.

b) Standard Working Hours, Overtime Workd, Holidays

i) Standard Working Hours

According to the local labor law, the standard working hours should not exceed 8 h/day or 44 h/week. As a result of an interview, general working hours at the site are shown in the table below.

Table 2.2.4-3 Standard Working Hours

Weekday	8:00 - 17:30 (Lunch Break 12:00 - 13:30、 8hours working)
Saturday	8:00 - 12:00
Sunday, Public Holiday	Holiday

Source: JICA Study team

ii) Premium Wage

The premium wage when the standard working time is exceeded by the Labor Law and the premium wage during nighttime (21:00 – 6:00) are stipulated in the table below.

Table 2.2.4-4 Premium Wage

Standard overtime	1.5 times
Holiday	2.0 times
Nighttime (21:00 - 6:00)	1.25 times

Source: Labour law of Timor-Leste

iii) Public Holidays

The local public holidays are shown in the table below. The total number of public holidays is 17days, which is equivalent to the number of Japanese Holidays (16days).

Table 2.2.4-5 Public Holidays of Timor Leste

Date	Name of Holiday
Jan 1	New Year's Day
Mar 3	Veterans Day
Mar 30	Holy Friday (variable date)
May 1	World Labor Day
May 20	Restoration of Independence Day
May 31	Corpus Christi (variable date)
Jun 15	Idul Fitri (variable date)
Aug 21	Idul Adha (variable date)
Aug 30	Popular Consultation Day
Nov 1	All Saints Day
Nov 2	All Souls Day
Nov 12	National Youth Day

Date	Name of Holiday
Nov 28	Proclamation of Independence Day
Dec 7	Memorial Day
Dec 8	Day of Our Lady of Immaculate Conception and Timor-Leste Patroness
Dec 25	Christmas Day
Dec 31	National Heroes Day

Source: JICA Study team

4) Transportation Method

i) Shipping route

Dili Port, located 5.8km from the airport, is currently used for unloading equipment and materials. There are plans to rebuild the Tibar Port, located 20km west from the airport, to replace the Dili Port as a cargo transportation port. However, the construction of the road to Tibar Port is currently ongoing, and the construction of port itself has not started yet. Therefore, it is assumed that even in this project's construction, shipment will be transported from Dili Port. There is still no direct shipment between Dili Port and Japan, so it is necessary to pass through Singapore or Surabaya when transporting materials from Japan.

ii) Transportation Road, Traffic Regulation

The road from Dili Port to the airport has two lanes on one side and no large traffic congestion could affect the transportation of materials even during the daytime peak hours. The way to the airport includes a bridge that crosses the Comoro River, and it has a sufficient strength structure that allows large transportation trucks to pass through, and no traffic regulation for large vehicles is being implemented. There is no problem with the passage of self-loading container trailers exclusively used for transportation.



Transportation Road



Trailer

Figure 2.2.4-1 Transportation Road in Timor Leste

(7) Initial Operation and Operational Training

1) Initial Operation Trainig

Air traffic control service department in ANATL operates and maintains air traffic control equipment and provide ATC services. In the Project, ATC equipment will be procured,

which are different from the existing one. In order for the staff members of ANATL to operate the equipment smoothly, it is necessary to provide initial operation training.

With regard to the airport security equipment, security department of ANATL operate existing equipment. However use of equipment is different from existing one. It is also necessary to conduct initial operation training for smooth operation.

Item to be provided, contents and target engineers are shown in Table 2.2.2-6.

Table 2.2.4-6 Initial Operation Training

Equipment	Contents	Duration	Target
Air traffic control equipment	<ul style="list-style-type: none"> ▪ System instruction ▪ Points of attention for operation ▪ Operation methods ▪ Measures against Emergency 	2 days	10 controllers (ANATL Air traffic control department)
Airport security equipment	<ul style="list-style-type: none"> ▪ System instruction ▪ Points of attention for operation ▪ Operation methods ▪ Measures against Emergency 	1 day	5 engineers (ANATL Airport security department)

2) Operation Training

Following the initial operation training above, the contractor provides operation training including methods of regular checks, methods of diagnostic, procedures to request repairs in case of failures and daily maintenance know-how. With regard to ATC equipment, operational procedures such as communication with aircrafts will be instructed. With regard to security equipment, concrete methods to check luggage are provided.

The contractor will submit report upon completion of initial operation and operational training. If the report was confirmed by ANATL and the Consultant, the Consultant will issue the completion certificate based on approval by ANATL.

Table 2.2.4-7 Operation Training

Equipment	Contents	Duration	Target
Air traffic control equipment	<ul style="list-style-type: none"> ▪ Ground to air communication ▪ Functions of ATC consoles ▪ Settings of VCS ▪ Settings of clash alarm 	1 day	10 controllers (ANATL Air traffic control department)
Airport security equipment	<ul style="list-style-type: none"> ▪ Method of luggage check by X ray system ▪ ETD usage method 	1 day	5 engineers (ANATL Airport security department)

(8) Soft Component

1) Soft Component

During the first field survey, ANATL requested the following technical cooperation services: Airport operation, maintenance of airport facilities, improvement of business operation, airport security, air traffic control services and firefighting. In addition, for the smooth commencement of new passenger terminal building operation, it will be necessary to provide support for coordination with immigration, customs and airline companies.

However, due to the various limitations on soft component, it is difficult to address those by soft component. Possibility to support by technical cooperation project is studied.

2) Technical Cooperation

Maintenance and operation of the existing airport facilities and its capacity of ANATL does not reach an international standard. It is necessary to improve safety, security, user services and maintenance capability. Therefore, in parallel to the development of new airport facilities, it is a must to improve the capacity of ANATL. For that purpose, technical cooperation project needs to be examined.

With following table of analysis of the issues, the fields that are required to provide assistance are the followings, 1) Development of airport operational capacity, 2) Improvement of business capacity, 3) Improvement of security, 4) transfer of terminal function to the new terminal.

Table 2.2.4-8 Optional Assistances for ANATL related to Capacity Building

	Assistance	Issues to be Addressed and Required Assistance
1	Airport Operation Capability Enhancement including Organizational Strengthening	<p>Number of ANATL staff will need to be increased to operate and maintain the airport facilities after the project implementation. Assistance is considered necessary for formulation of business plan to systematically recruit and employ appropriate staff force.</p> <p>ANATL has its airport operation manual, but it has not been updated since 2005. A complete operation manual needs to be prepared and ANATL staff should be trained based thereon for them to upgrade their services to an international standard, to be provided in the new international passenger terminal and other facilities.</p> <p>Currently ground handling services are provided by private companies such as STAT and SDV. Once the new terminal facilities are developed, the ground handling procedures will need to be changed, and ANATL, as the airport operator, should set down necessary rules/regulations and enforce the service providers to follow.</p>
2	Business Capability Enhancement	<p>As a private company, ANATL needs to strengthen its profitability. Currently, the tasks of ANATL's Department of Commercial are collection of fees and charges from the duty-free shops, airlines and other tenants. Limited resource only is currently available to</p>

	Assistance	Issues to be Addressed and Required Assistance
		generate more income for ANATL and hence improve its profitability. Wide range of commercial areas will be developed in the new international passenger terminal building, such as the concession areas, business lounge, rooftop viewer's deck and advertising spaces, etc. Appropriate ANATL staff should be so trained that they become capable of promoting these business resources, properly setting the fees and charges to be paid by concessionaires and properly managing relevant agreements therewith.
3	Airport Security	Up-to-date security manual should be prepared in accordance with relevant international standards and regulations, and ANATL staff should be so trained the requirements stipulated in the manuals are properly met.
4	Transfer of Terminal Operations	Once the new international passenger terminal is ready for operation, ANATL needs to transfer relevant terminal operation from the existing terminal to new one. Operation readiness and airport transfer training in close cooperation with the airlines, government offices such as CIQ, aviation security, tenants, etc. is required.

Source: JICA Study team

3) Examination of technical cooperation

JICA offers two schemes for provision of training and dispatch of experts, etc.; one is soft component and the other is the technical cooperation projects. According to JICA Guideline for the soft component, total staff-months of a soft component is generally five to ten staff-months, and it is not practicable to implement the above-mentioned assistance within the general upper limit of the input. Therefore, assistance under the technical cooperation project is considered desirable. Table below shows summary content of the technical cooperation project for ANATL.

Table 2.2.4-9 Summary Content of Technical Cooperation Project for ANATL

No	Item	Contents
1	Project Name	Project for Capacity Enhancement of ANATL for Airport Operation, Maintenance and Management (Technical Cooperation Project)
2	Overall Goal	Airport is to be developed according to a master plan, and to be properly administered/managed/maintained, contributing to development of the national economy and tourism.
3	Project Purpose	Capability of ANATL staff for the airport operation/maintenance/management will be strengthened and ANATL will be well organized.
4	Output	1. Capability of ANATL for airport operation, maintenance and management is enhanced (organizational strengthening included). 2. Business capability of ANATL is improved. 3. ANATL's capability for the aviation security is enhanced. 4. Planning and implementation for transfer of the facilities to the new terminal area.

No	Item	Contents
5	Major Activities	<ol style="list-style-type: none"> 1. Related to Output 1 above <ol style="list-style-type: none"> 1-1 Establishment of a working group for operation, maintenance and management 1-2 Review of organization, maintenance and management as well as operations 1-3 Formulation of terminal operation, maintenance and management plans 1-4 Formulation of airport pavement maintenance and management plans 1-5 Plan training in Japan and dispatch appropriate staff 2. Related to Output 2 above <ol style="list-style-type: none"> 2-1 Establishment of working group for enhancement of business management capability 2-2 Formulation of business plan of ANATL commercial department 2-3 Formulation and implementation of business promotion plan regarding enticement of tenants, rate setting and management 2-4 Formulation and implementation of action plans for improvement of customer satisfaction 2-5 Plan training in Japan and dispatch appropriate staff 3. Related to Output 3 above <ol style="list-style-type: none"> 3-1 Establishment of working group for airport and aviation security 3-2 Preparation and formulation of manuals for security check of international passengers and their baggage 3-3 Plan training in Japan and dispatch appropriate staff 3-4 Continuous organization development for airport and aviation security through planning and implementation of ANATL's own training 4. Related to Output 4 above <ol style="list-style-type: none"> 4-1 Establishment of working group for transfer of terminal facilities 4-2 Confirmation on acceptability of relocation/extension sites 4-3 Formulation of transfer/extension plan 4-4 Relocation of the domestic terminal facilities based on the transfer plan
6	Executing Agency	ANATL
7	Inputs from Japan	<ol style="list-style-type: none"> i) Experts <ol style="list-style-type: none"> 1. Team Leader/Airport Business Planner 2. Airport operation and safety 3. Operation/Maintenance/Management Specialist for Airside Facilities 4. Operation/Maintenance/Management Specialist for Terminal Facilities 5. Tenant operation 6. Tenant management Relocation Planning (ORAT) 7. Customer service 8. Airport security 9. Terminal transfer plan ii) Equipment Subject to further examination. iii) Training in Japan Subject to further examination.
8	Implementation Period	Two years

(9) Implementation Schedule

For the Grand Aid Project by the government of Japan to start, it is necessary to perform the following processes.

- Exchange of Notes between the governments are signed, Grant agreement is signed between the government of Timor-Leste and JICA
- ANATL, implementation agency and the Japanese Consultant recommended by JICA sign on the consultant agreement for detailed design and construction supervision works.
- Detailed design, preparation of tenderer document, assistance to tender and contact with the contractor will take place before commencement of construction

The whole project period 31 months including 9 months detailed design period and 22 months construction period. Implementation schedule is shown in Figure 2.2.4-2.

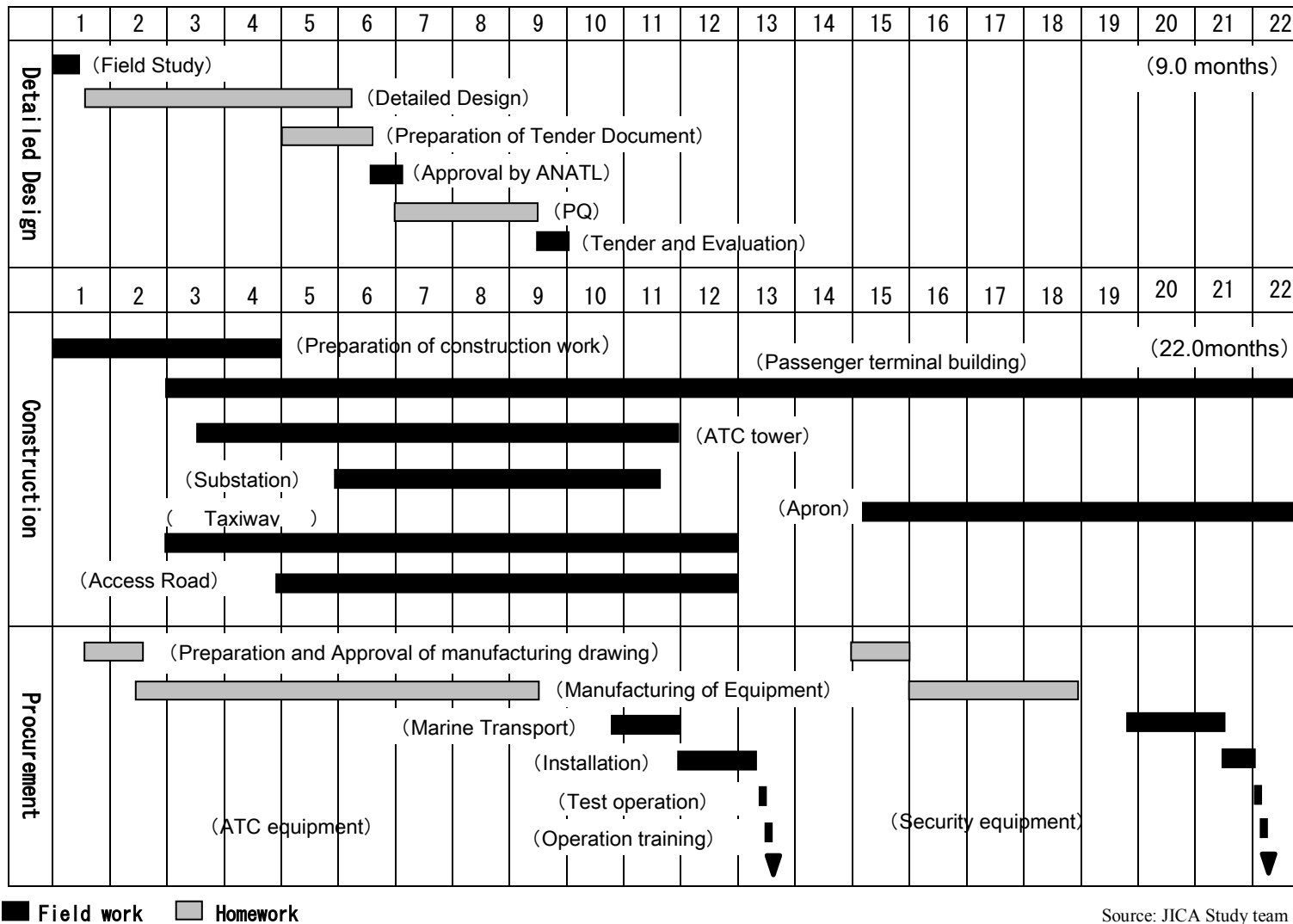


Figure 2.2.4-2 Implementation Schedule

2.3 Obligation of the Recipient Country

(1) Obligation of the Recipient Country

The Government of Timor-Leste is responsible to undertake the following items which are relevant for the implementation of the Project. ANATL has been transformed to a public company and has its own budgets. However, for a large scale of projects such as construction of terminal buildings and basic facilities of airports, state budgets are prepared. For this project, it is infeasible for ANATL to undertake by their budgets. It is required that ANATL requests budgets to the Ministry.

Table 2.2.4-1 Obligations by the Recipient Country 1

Construction undertaken by ANATL before the tender announcement
<p>(1) Relocation of existing facilities (Remove existing facilities and clear land for construction)</p> <ul style="list-style-type: none"> - ANATL office (Transfer to the temporary office in the existing police dormitory) - ANATL procurement office (Transfer to the temporary office in the existing police dormitory) - ANATL maintenance workshop (Transfer to the temporary office in the existing police dormitory) - ANATL car maintenance workshop (Transfer to the west relocation area) - ANATL warehouse (Transfer to the west relocation area) - TLK office (Transfer to the west relocation area) - ETO aviation fuel facility (Transfer to the east relocation area) - Border police office (Transfer to the west relocation area)
<p>(2) Construction of new power supply system</p> <ul style="list-style-type: none"> - High voltage distribution station (SS-0) - Following substations (including emergency generators) <ul style="list-style-type: none"> • Existing passenger terminal building and central relocation area (SS-1) • Aeronautical ground lightings and VOR/DME (SS-2) • West relocation area (SS-3) - Power cable between existing facilities and new substations
<p>(3) Logging and land clearance inside the Project site</p>

Source: JICA Study team

In addition to the Japanese grant aid project, the following facilities are prepared by the Timor-Leste by their budgets.

(2) Other obligation of the Recipient Country

Items undertaken by the Government of Timor-Leste is show in the Table below.

Table 2.2.4-2 Before the Start of the Project

No	Items	Remarks
1	IEE/EIA approval	ANATL needs to obtain environmental approval for the Project. Environmental category for the Project is B. ANATL needs to obtain approval before the cabinet meeting takes place in Japan, April 2019. During the Project period, ANATL apply extension of environment approval.
2	Secure necessary land (including temporary yard for construction)	-
3	Obtain necessary permission for building construction	-
4	Submission of Project monitoring reports	-
5	Logging of the trees and site clearance	There are containers and aircraft engines that are not used in the site, also firefighting car and electrical poles. ANATL needs to remove those which become obstacles for construction.

Table 2.2.4-3 During the Project Period

No	Items	Remarks
1	Banking Arrangement (B/A)	-
2	Issue Authorization to Pay (A/P)	-
3	Commissions for the followings a) A/P notification b) A/Payment	-
4	Necessary means for the aviation safety such as issuing of NOTAM during construction and installation.	-
5	Issuing of necessary access permission for construction workers	-
6	Coordination with relevant	-

No	Items	Remarks
	organizations and agents regarding airport operations	
7	Obtain necessary approvals for building constructions.	-
8	Provide necessary support and documents for Customs procedures	At the port of unload
9	Provide support for issuing VISA for Japanese consultants and contractors and third country engineers for construction and installation of equipment	According to the hearing from Japanese contractor, there was a case that due to the delay of the VISA issuance, start of construction was also delayed.
10	Tariffs and tax exemption measures	Tariffs are borne by the implementation agency in Timor-Leste.
11	Costs incurred by other than Japanese grant aid project	Costs such as preparation of basic infrastructure, power, communications
12	Relocation of existing ATC simulators	It is necessary to relocate ATC simulators to the ATC tower office building
13	Relocation of the following ATC equipment 1) VOR/DME monitoring device 2) NDB monitoring device 3) Routes connected with remote sites and relevant equipment	Relocation of the left mentioned equipment to the new ATC tower and their installation
14	Relocation of necessary antennas in the existing ATC tower	Coordinate with mobile companies to relocate mobile phone antennas and provide alternate sites for those.
15	Perform communication test	Communication test with aircrafts with new ATC equipment
16	Cutting of trees to secure necessary views for ATC controllers	According to the drone survey, due to the trees between the new ATC tower and east end of runway, the ATC controllers cannot see the end of runway no matter how high the new ATC tower was constructed. In order to secure necessary line of sight for ATC controllers, ANATL needs to coordinate to cut those trees.

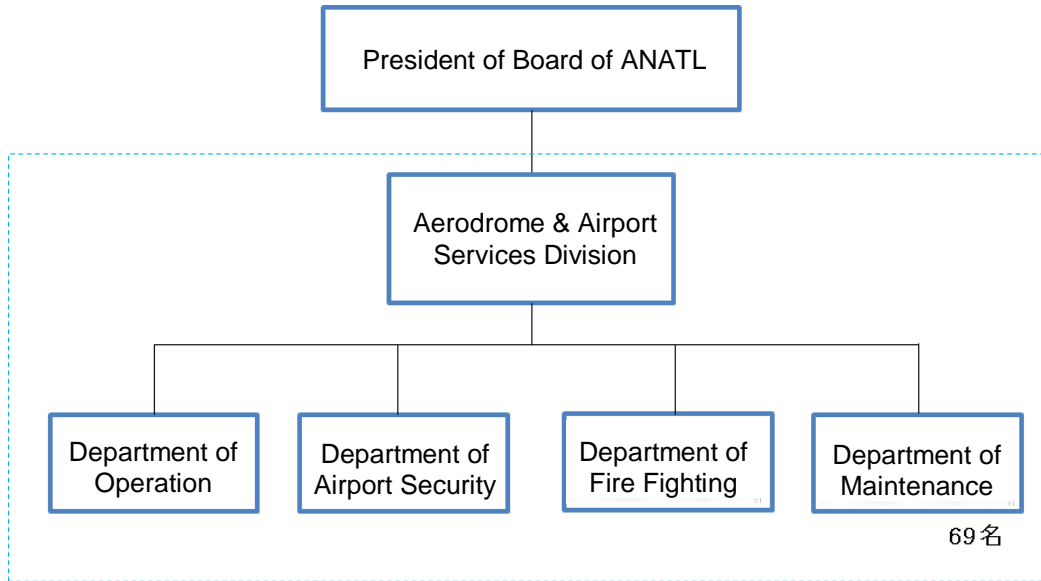
No	Items	Remarks
17	Submission of project monitoring report, completion report.	-

Table 2.2.4-4 After the Project Completion

No	Items	Remarks
1	<p>Operation and maintenance of facilities and equipment constructed and procured by the Japanese grant aid Project</p> <p>1) allocate necessary budgets for maintenance</p> <p>2) Establish operation and management system</p> <p>3) Perform regular inspections</p>	
2	Perform EMP and EMOp	
3	Submission of environmental monitoring results to JICA	

2.4 Operation and Maintenance of the Project

(1) Organization



Source: ANATL

Figure 2.2.4-1 ANATL Airport Operation

1) Department of Operation

8 staffs are assigned.

Maintenance of the basic facility “runway, taxiway and apron” and passenger terminal, cargo terminal and tenants’ control.

2) Department of Airport Security

20 staffs are assigned.

The border control between public area and restricted area.

Watching and inspection of human and articles by X-ray machine and Metal detector.

3) Department of Fire Fighting

20 staffs are assigned.

Respond to aircraft accident in the airport and fire.

4) Department of Maintenance

18 staffs are assigned.

Respond to bad condition and malfunction of all facility and equipment.

Mainly pavement area, no pavement area, building, airport electricity and drainage system.

In consideration of future organization, it will be important that defending space is increased by additional building and facility ex. new terminal, new parking and new apron.

Following this, it should be considered that number of staff is also increased for Department of Operation, Security and Maintenance. So it should be considered the recruiting and training schedule.

At first, the manuals regarding to airport operation revision should be done, then consider the manning schedule for each job shift, and education and training curriculum should be considered as soon as possible.

Furthermore, instructor training should be planned and finally, the recruiting number will be decided.

And strengthen of commercial field also become important.

Now, in the job description of Department of Operation, control of commercial field is mentioned. But it will be better for separated from Operation and should be newly established as Department of Commercial.

For example, selection of commercial tenant, selection of goods, forecasting of amount of sold, and fee of tenant should be considered at different structure.

Anyway, ANATL should be recognized the new structure's job volume will be increased by the revenue control, daily control work and so on.

(2) Number of staff and Skill Level

As mentioned above, number of staff of Airport Service should be increased.

Considering of ATC controller's present job volume, it seems no need to increase.

Assumed number of staff of "Airport Operation", "Airport Security" and "Maintenance" should be increased as follows.

- Airport Operation 8 staff → 16 staff (include commercial staff)
- Airport Security 20 staff → 30 staff
- Maintenance 18 staff → 25 staff

Present staff job skill does not seem to be good, but consciousness for compliance, education and training skill as a company does not seem to be so high.

Therefore, it will be better to get some support and assistance from overseas experienced airport operator. Then review the all manuals and system of training including management staff is strongly recommendable.

2.5 Project Cost Estimation

2.5.1 Cost Estimation for the Project

In this preparatory survey, the total project cost required for implementing this project was estimated based on the condition shown below.

Basis of Cost Estimation

- Cost estimate timing : May, 2018
- Exchange Rate : 1USD = 108.13Yen
- Construction period
: Period for detailed design and construction are shown in the Implementation schedule.

(1) Cost to be Borne by the Government of Japan

Costs to be borne by the Japanese grant aid is estimated as follows.

Table 2.5.1-1 Project cost borne by the Grant aid

(Confidential until verification of the Construction Contract)	
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(2) Cost to be Borne by the Government of Timor Leste

The estimated cost that will be borne by the Government of Timor-Leste is described in the following table. ANATL is a public company and has their budgets. A large scale of project was conducted by the state budgets. For this Project, it is difficult for ANATL to undertake by their budgets. It is necessary for ANATL to apply budgets to the Ministry.

Table 2.5.1-2 Costs borne by the government of Timor-Leste

Item	Costs (Thousands of US dollars)
Removal and site clearance	267 thousand US\$
Preparation of new power distribution system	1,457 thousand US\$
Construction of parking	1,110 thousand US\$
Customs duties and other fiscal levies to be borne by ANATL	116 thousand US \$
Banking commissions	232 thousand US \$
Total	3,112 thousand US\$

2.5.2 Operation and Maintenance

Based on the expenses of 2017, necessary costs for operation and maintenance are calculated. The cost is estimated as 74 million Japanese yen, about 30% increase from the current budgets. ANATL has surplus for more than one hundred million Japanese yen in 2015 and 2016 after made to a public company. The cost is considered to be borne given the increase of income by the construction of new passenger terminal building.

Table 2.5.2-1 Operation and Maintenance Costs

	Item	Annual maintenance costs	Remarks
1	Personnel expenses	US\$138,000-	15% increase against the expenses of 2017
2	Building and equipment annual maintenance costs	US\$350,000-	Calculated by area ratio of existing and new buildings based on 2017 expenses.
3	Airside pavement maintenance costs	US\$185,000-	2% of pavement costs
	Total	US\$673,000-	

Chapter 3 Project Evaluation

Chapter 3 Project Evaluation

3.1 Preconditions

To facilitate the Project, the Government of Timor-Leste needs to fulfill the following undertakings in addition to the items presented in Chapter 2 Roles of the Governments of Timor-Leste and Japan.

1. Secure temporary yards and area for removal of surplus soil within the premise of the airport
2. Renewal of power house and facilities
3. Removal of obstacles and land levelling in the construction site
4. Transfer of air traffic control simulators
5. Transfer of equipment in the buildings to be removed
6. Coordinate transfer of communication antennas installed with communications companies
7. Obtain environment approval
8. Application for necessary approval such as construction permit
9. Take appropriate measures so that taxes be exempted for grant aid project

The items 2,3,7 and 8 above shall be completed before the tender call for the construction works.

3.2 Necessary Inputs by the Government of Timor Leste

The following undertakings need to be fulfilled by the Government of Timor-Leste for the project to be effectively implemented.

(1) Secure Necessary Budget and Employees for Operation and Maintenance of the Facilities

The size of the passenger terminal building constructed in the Project is approximately two times as large as the existing passenger terminal building. In addition to that, civil facilities that need proper maintenance such as car park and access road at the land side and taxiway and apron will increase. In order to maintain these facilities so that they properly function, it is necessary to conduct regular check and maintenance periodically. ANATL needs to employ necessary engineers and secure budgets for that purpose.

(2) Continuous and Phased Construction of Facilities

The construction works of the JICA Grant will be completed in 2022 (the opening day) with adequate capacity in principle to accommodate the forecast demand of the year 2027. The scope of the Project includes construction of the international terminal facilities including the taxiway, apron, international passenger terminal building and the control tower. The new cargo terminal building and the car park pavement works will be carried out by ANATL. By enabling

small class jet aircraft to operate safely and effectively, the Project aims to contribute to promotion of tourism as well as economic and social development of Timor-Leste.

The current runway length is 1,850m only and weight limit is imposed for Singapore flight due to the short length of runway. In order to achieve aforementioned objectives, it is necessary for the Government of Timor-Leste to extend the runway initially to 2,150m and install aeronautical ground lighting system.

For the long-term development, it is estimated that the medium-class jet aircraft (Code E) will be introduced on the Denpasar route due to the increasing passenger demand. To accommodate Code E aircraft operation, the runway needs to be extended to 2150m and widened from current 30m to 45m as well as new taxiway to be constructed and the apron expanded. The international passenger terminal building will need to be expanded and modified based on the two-level passenger processing concept to allow Code E aircraft to make nose-in/push-out parking stand operation. Procurement of towing tractor is necessary. These development needs to be planned according to demand forecast and implemented in a timely manner. ANATL needs to be prepared technically and financially in order to implement these developments while paying due attention to social and environmental aspects.

It is desirable that the Government of Timor-Leste also relocate the domestic passenger terminal building and VVIP facilities to the new terminal area so that the layout of the terminal facilities fully complies with relevant ICAO requirements.

3.3 Important Assumptions

The following assumptions are raised in order to achieve project objectives.

(1) Security of Timor-Leste will not deteriorate

In order to achieve project objectives, it is necessary that forecast demand will be realized and the national economy and security of Timor-Leste will not deteriorate and continue to grow as predicted.

(2) The Government of Timor-Leste continues to put priority on tourism

The Government of Timor-Leste promotes tourism as a mean to promote the industry. In order to increase the number of air passengers, inbound demand is one of the important factors. Therefore it is necessary that Timor-Leste continues to promote tourism and regard it as one of the pillars to promote industry.

(3) Dili International Airport continues to be operated by ANATL

In order for this project to be implemented as planned and achieve project objectives, it is necessary that the airport continues to be operated by ANATL, which needs to achieve a proper organization structure and improve operation and maintenance capacity.

3.4 Project Evaluation

3.4.1 Relevance

The relevance of the Project was examined in terms of the number of beneficiaries, urgency, contribution to the development objectives of the recipient country and consistency with the assistance policy of Japan. As a result of the study, the relevance of the Project is evaluated high as described below:

(1) Beneficiaries of the Project

The Project aims to improve the facilities of Dili International Airport, which is the gateway for Timor-Leste. Mitigation of congestion and improvement of capacity and safety will benefit aviation safety and comfort of Timor-Leste and brings benefits to the tourism industry and the whole economy of the country. Therefore, the beneficiaries of the Project will be not only the users of the airport but also the whole nations of Timor-Leste

(2) Urgency

The existing passenger terminal building used to be utilized as the domestic passenger terminal in the Indonesian era. Currently it is used as the international and domestic passenger terminal building and the international and domestic passenger processing flows are often mixed up, causing security and safety concern in addition to the passenger inconvenience and discomfort. In addition, the size of the existing terminal building is about 3,500m², which is not large enough to accommodate forecast passenger demand of 270 thousand in 2027. As a result, in a peak hour, passengers have to wait in a long que for check-in and immigration. Therefore, the service level is considered to be low. There is an urgent need to improve Dili airport as an airport in the capital city and gateway for Timor-Leste.

(3) Contribution to the development objectives of the recipient country

Timor-Leste has developed two types of relevant development plans, which are Development plan of Timor-Leste as “Strategic Development plan 2011-2030” and “National Civil Aviation Policy”. Both of them recognize that Dili International Airport lacks capacity to handle aviation demands and basic facilities do not meet safety requirements set by ICAO and advocate the need to expand facilities. Obsolete passenger terminal building and lack of capacity to handle passengers are obstructive factors for economic growth and tourism development, which need to be improved. The Project is consistent with the development objectives of the recipient country.

(4) Consistencies with Japanese Development Assistance Policies and Objectives

The Project is consistent with Japanese development assistance policies and objectives of Timor-Leste. The Government of Japan addresses development of Timor-Leste by placing emphasis on assistance to sustainable development and improvement of infrastructure. The Project aims to improve convenience and safety of aviation and revitalize economy by constructing high quality infrastructure in the capital city of Timor-Leste. The project is consistent with the development assistance policy of Japan.

3.4.2 Effectiveness

The project aims to increase capacity of the airport in response to the growing aviation demands and contributes to improving the convenience and safety of aviation and economic growth of Timor-Leste. As quantitative effects of the Project, the number of international passengers, number of foreign visitors, and passenger processing time are proposed. In addition, direct and indirect effects for the Project are proposed.

(1) Quantitative effects

For quantitative effects, the target figures for 2025 which is 3 years after the completion of the Project is shown in the table below.

Table 3.4.2-1 Quantitative effects evaluation Indicators

Indicator	Baseline (2017)	Target Figure (2025)
Number of International Passengers	216,400	330,000
Number of Foreign Visitors	65,642	100,000
Passenger processing time for one aircraft	30 minutes※1	20 minutes

Source: JICA Study team

※1: Processing time for inbound immigration check for passengers from one aircraft (150 seats with load factor of 75%) measured by the Survey Team.

(2) Qualitative effects

It is expected that the following qualitative effects will realized by the Project.

- Safety, convenience and comfort of air passengers are improved by the construction of new international passenger terminal building.
- Safety of aircraft operation is improved since parked aircraft on the apron does not infringe the obstacle limitation surface by the relocation of international terminal facilities.
- Improvement in safety, convenience, comfort of the airport facilities will contribute to promote tourism and generate economic development.