DEPARTMENT OF CIVIL AVIATION
MINISTRY OF TRANSPORT AND COMMUNICATIONS
THE REPUBLIC OF THE UNION OF MYANMAR

PREPARATORY SURVEY ON HEHO AIRPORT DEVELOPMENT PROJECT (PPP INFRASTRUCTURE PROJECT) (FIRST PHASE) IN THE REPUBLIC OF THE UNION OF MYANMAR

FINAL REPORT

September 2019

JAPAN INTERNATIONAL COOPERATION AGENCY

TOYOTA TSUSHO CORPORATION

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JR(P)
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Summary

1. Outline of the Project

The Heho Airport is a domestic airport located in the western part of Shan State, which serves as its gateway. There are also areas around the airport that are famous as tourist destinations in the country.

With the economic growth of Myanmar in recent years, the number of passengers at the Heho Airport has increased, and the number of passengers in 2017 reached 540,000. In this regard, Heho Airport needs expansion of facilities.

However, the government budget for carrying out its expansion and maintenance has not been enough, and expansion of the airport is difficult without the use of external funding sources such as the official development assistance (ODA) and private funds.

The Department of Civil Aviation (DCA) and private airport operator including contractors have started contract negotiations for the concession business contract from February 2019.

The following procedure for signing of the concession agreement is expected:

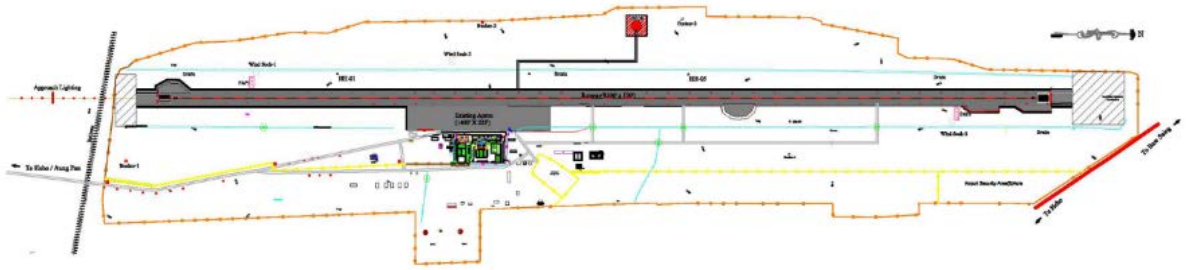
1. Contract negotiation meetings with DCA
2. Getting approval from MoTC about changes from RFP conditions to the negotiation result
3. Confirmation of the agreed Terms and Conditions of Heho Airport Agreement (HAA) including the above changes
4. Getting confirmation from Attorney General Office (AGO) and Myanmar Investment Committee (MIC) for the agreed HAA
5. Final confirmation of HAA which the comments from MoTC/AGO/MIC are reflected
6. Cabinet approval of the Agreed HAA
7. Signing of HAA

Currently, it is under "1. Contract negotiation meetings with DCA", and the conditions about tariff rate are mostly agreed mutually. Further contract conditions will be negotiated with DCA.

The purpose of this survey is to carry out the survey and analysis necessary for the examination and procedure of the Private Sector Investment Finance (PSIF) for project realization, towards airport operation by a private airport operator.

2. Examination of the Necessity and Validity of the Project

The runway at the Heho Airport has asphalt pavement with a length of 2,591 m and a width of 46 m. Since the apron is connected directly to the runway and taxiway is not installed, airport operation is not safe. Also, since there is no parallel taxiway, the runway occupancy time is long and this causes flight delay.



Source: The Study Team

Figure 1 Existing Airport Layout Plan

The total floor area of the departure and arrival passenger terminal building is only 2,000 m^2 while the annual passenger in 2017 exceeds the capacity of the passenger terminal building (500,000 per year). As a result, serious congestion occurs especially in the departure lobby and check-in area in the terminal building.

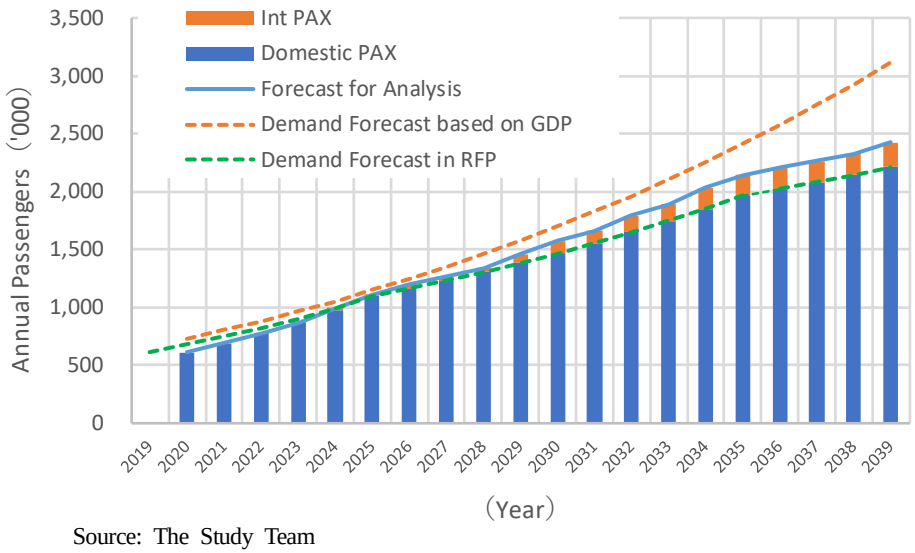
The operation of Heho Airport is currently being conducted by DCA, and the following are issues for the concession business contract:

- Demarcation of scope of work (role assignment) between DCA and the Special Purpose Company (SPC);
- Planning for smooth transfer of operations from DCA to the SPC (organization, personnel, and facilities);
- Constructing a management department for SPC (Transfer of business from DCA, Separation of accounting (secure independent profitability)); and
- Correspondence to international airport.

3. Project Plan

The forecast model using the gross domestic product (GDP) as an explanatory variable was adopted and the correlation equation between the number of domestic passengers at the Heho Airport and GDP up to 2017 was calculated.

As for the future GDP growth rate, the International Monetary Fund (IMF) forecast rate was adopted until 2022. The GDP growth rate from 2023 to 2025 was estimated to be 7.5%, and after 2026, the increase rate of GDP growth rate is decreased to 0.1% every year.



Source: The Study Team

Figure 2 Demand Forecast

The demand forecast calculated by the correlation equation with GDP is larger than the demand forecast shown in the Request for Proposal (RFP) of the concession business contract.

In this study, the number of domestic passengers is to be matched with the figure in the RFP, but the demand forecast shown in the RFP refers to the number of domestic passengers only and does not include international passengers. The interviews with airlines confirmed that they are willing to place their service at the Heho Airport, so the Study Team will use the schedule below and the number of international passengers will be added to the domestic passengers.

- International flight operation (turbo prop, ATR72) starts in 2024
- International flight operation (Jet, A320) starts in 2029

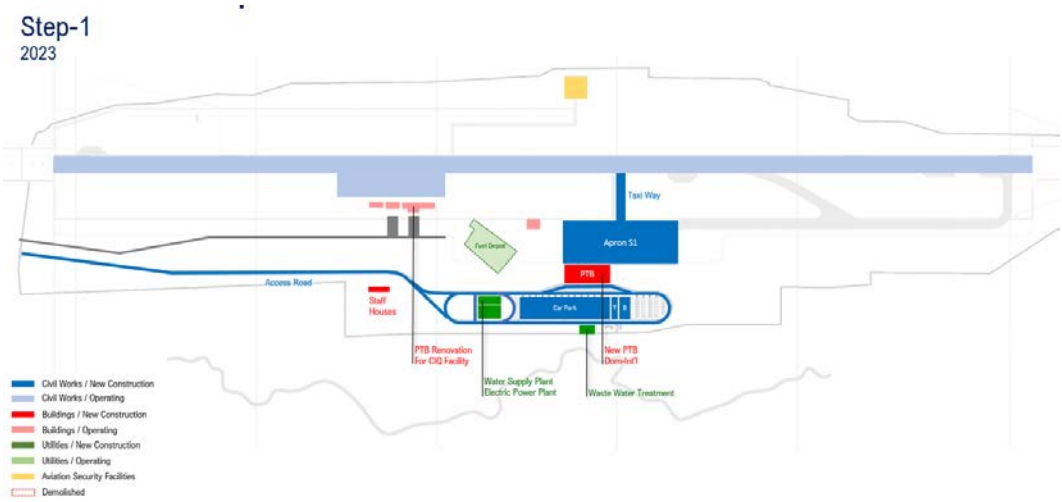
Regarding the stipulation in the concession agreement of Mandalay International Airport not allowing the airports within 150 km of Mandalay International Airport to operate any international scheduled flights, DCA have officially noticed to MJAS, which is the private airport operator of Mandalay International Airport, that DCA will remove the stipulation. According to DCA, they are currently under negotiation about the stipulation, and MoTC/DCA is going to settle this matter as soon as possible.

In addition, considering that the number of passengers in 2018 decreased from 2017, the demand forecast in this survey is smaller than that in the RFP from 2020 to 2024, and the same value as that in the RFP from 2025.

The scale of facilities to be maintained was set based on the future demand forecast results.

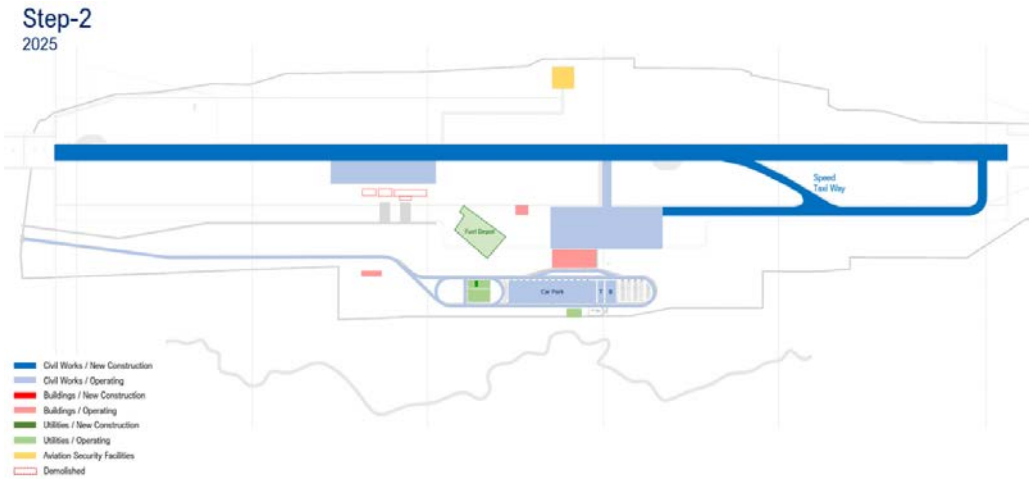
The construction of Step-1 will start in 2021, the new facilities will be put into service in 2023, and the following maintenance will be carried out according to the demand while in operation.

The maintenance plan of each step is shown in the figure below.



Source: The Study Team

Figure 3 Construction Plan（Step-1, 2023）



Source: The Study Team

Figure 4 Construction Plan（Step-2, 2025）

Table 1 shows the step construction schedule. Step-1 works will be done in 2021-22 while Step-2 works in 2023-24.

The total cost of Step-1 and Step-2 is USD 30 million.

Table 1 Step Construction Schedule

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	1	2	3	4	5	6	7	8	9	10	11	12
Contract Effective		○										
Construction (Step-1)			⟷	⟷								
Construction (Step-2)					⟷	⟷						

Source: The Study Team

4. Information for Environmental Impact Assessment

The possibility of involuntary resettlement has been confirmed by field inspection and satellite image confirmation, which have been conducted.

Table 3 Site Survey Result for Preliminary Environmental and Social Consideration Study

Item	Result of Site Survey	Summary of Situation
Current Status of Land Acquisition （DCA・Kalaw Township Administration Office Interview）	✈ The Ministry of Transport and Communications (MoTC) has issued a request letter to Shan State Regional Government to calculate the cost for land acquisition in February 2019. ✈ The total land acquisition area required for this project is assumed to be 60.61 acres. It consists of 56.52 acres of private agricultural land and 4.09 acres of government land. ✈ The Kalaw Township Administration Office, which is in charge of the Shan State government, calculated the cost of land acquisition. The calculated cost has been agreed by landowners.	Land acquisition process for project site has been proceeded without any problem by the Myanmar government side. The confirming of the land acquisition procedure is expected to be carried out as part of the due diligence survey of the land during the second phase survey.
Possibility of Involuntary Resettlement	✈ There is no residence except the residential area on the east side of the planned project area. ✈ There are 165 people in the residential area. It consists of 66 DCA officials staff including family members of staff, 90 government police responsible for airport security, 7 residents who operate the cafeteria and market with permission from DCA, and 2 private oil company employees.	Among the 165 people, seven residents who run the cafeteria and market are expected to be eligible for involuntary resettlement. There are markets operating only during the daytime. However, there are no residents in the airport area, therefore involuntary resettlement is not expected.

Source: The Study Team

As a preliminary environmental and social consideration study, the JICA's environmental checklist (Airport) was prepared.

The Preparatory Survey for Heho Airport Development Project in the Republic of the Union of Myanmar

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Source: The Study Team

Location Map of the Target Airports

Photo

Passenger Terminal Building

Departure Lounge

Apron

Runway

Arrival Lobby

Tourism Resources (Inle Lake)

Figure List

Table List

Abbreviations

MoTC	Ministry of Transport and Communications
DCA	Department of Civil Aviation
ODA	Official Development Assistance
IMF	International Monetary Fund
GDP	Gross Domestic Product
MoPF	Ministry of Planning and Finance
ICAO	International Civil Aviation Organization
PAPI	Precision Approach Path Indicator
SALS	Simple Approach Lighting System
REDL	Runway Edge Light
RTHL	Runway Threshold Light
WBAR	Wing Bar Light
AWOS	Automatic Weather Observation System
DVOR/DME	Doppler VHF Omnidirectional Range / Distance Measure Equipment
NEPAS	National Energy Puma Aviation Services
GSE	Ground Support Equipment
CIQ	Customs, Immigration, Quarantine
SPC	Special Purpose Company
CBR	California Bearing Ratio
WMO	World Meteorological Organization
DCPT	Dynamic Cone Penetration Test
MJAS	MC-Jalux Airport Services
PBB	Passenger Boarding Bridge
UMFCCI	Union of Myanmar Federation of Chambers of Commerce and Industry
MFVP	Myanmar Fruit, Flowers and Vegetable Producer and Exporter Association
SAI	State Agriculture Institute
PSL	Premium Sojitz Logistics Co., Ltd
NGO	Non-government Organizations
UMTA	Union Myanmar Travel Association
RFP	Request for Proposal
AAGR	Average Annual Growth Rate
FAA	Federal Aviation Administration
FIDS	Flight Information Display System
CNS	Communication, Navigation, Surveillance
ILS	Instrumental Landing System
PSC	Passenger Service Charge
UDF	User Development Fee
APSC	Additional Passenger Service Charge

Chapter 1 Outline of The Study

1.1 Background of the Study

The Heho Airport is a domestic airport located in western Shan State. The area around the airport is one of the famous tourist destinations in Myanmar. The distance between Heho Airport and Yangon International Airport is around 430 km. The distances between Heho Airport and the other two international airports, namely Mandalay International Airport and nay Pyi Taw International Airport are around 140 km.

With the economic growth of Myanmar in recent years, the annual number of passengers at the Heho Airport has increased. In 2017, it reached 540,000, exceeding the capacity of the existing passenger terminal buildings (500,000 annually). As a result, there is serious congestion, especially in the departure lobby and in the check-in area in the passenger terminal building.

The Heho Airport is currently operated by the Ministry of Transport and Communications, Department of Civil Aviation (DCA). While the number of passengers will continue to increase and its contribution to the economy of Myanmar is expected, there is not enough government budget to extend the Heho Airport. It is difficult to carry out the maintenance and expansion of the airport without the use of external funding sources, such as official development assistance (ODA) and private funds.

DCA and private airport operation planners, including contractors, have started contract negotiations for the concession business contract in February 2019.

The following procedure for signing of the concession agreement is expected:

1. Contract negotiation meetings with DCA
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Currently, it is under "1. Contract negotiation meetings with DCA", and the conditions about tariff rate are mostly agreed mutually. Further contract conditions will be negotiated with DCA.

The purpose of this project is to expand and repair the Heho Airport and to operate and maintain the airport by private operators properly, thereby contributing to the development of Myanmar.

1.2 Objectives of the Study

For project realization, this study conducts the survey and investigation needed for screening and processing of the PSIF loan.

1.3 Target Project Area and Counterpart

The Heho Airport handled about 540,000 passengers in 2017. It has the third largest annual passenger number after the Yangon and Mandalay airports. The annual passenger number and the annual aircraft movement had been increasing favorably after 2012, after the release of economic sanctions. The Heho Airport is the gateway of Shan State. Many foreign tourists go to the Inle Lake through the Heho Airport because of its proximity. The population of Shan State is about 5.8 million (11.4% of Myanmar population, 4th largest). The Heho Airport development project is needed for industry attraction in the future.

Source : The Study Team

Figure 1-1 Project Target Location

1.4 Contents and Schedule of the Study

The work schedule of this survey is as follows:

Table 1-1 Survey Schedule

	2019			
	May	June	July	August
1) Data Collecting				
2) Site Survey, Interview				
3) Natural Condition Survey				
4) Conceptual Plan				
5) Airport Operation Plan				
6) Cost Estimate				
7) Market Analysis				
8) Surrounding Area Development Survey				
9) Financial Plan				
10) Environmental Impact Assesment				
11) Survey Plan				▼
12) Reporting			DFR▼	FR▼

Source : The Study Team

Chapter 2 Project Background and Existing Situation

2.1 Background of the Project

(1) Land and Nature

The Republic of the Union of Myanmar is located in the northwest part of the Indochina Peninsula. The land of Myanmar spans 2,100 km from north to south and 900 km from east to west, and has a total area of around 678,500 km^2. The Ayeyarwady River flows from north to south and is located almost at the center of the land, forming an alluvial plain in a wide area. Myanmar has borders with China in the north, Laos and Thailand in the east, and India and Bangladesh in the west. The Andaman Sea and the Bay of Bengal are located south of the land.

Myanmar is a multiracial country, consisting of more than 130 races. Burmese, which represent 70% of total population in the country, live in the wide area at the center of the land along the Ayeyarwady River. Many minor races live in the mountainous areas in the east and west of the land.

The climate in Myanmar is of the tropical monsoon type. There are three seasons, namely, hot season (from April to May), rainy season (from June to October), and dry season (from November to March).

Shan State, the study area of the project, is located in the middle eastern part of Myanmar. Shan State is located within the mountainous area with relatively high elevation. Therefore, the temperature is cool throughout the year, compared with other regions in Myanmar.

Shan State has borders with China, Laos, and Thailand. There are some areas important for traffic and logistics in Shan State.

(2) Population and Economics

1) Population

According to the census in 2014, the total population in Myanmar is 51.41 million. The population is relatively concentrated in Yangon Region (14.3%), Ayeyarwady Region (12.0%), Mandalay Region (12.0%), and Shan State (11.3%). The population in Shan State is 5.81 million.

According to IMF, the actual population in 2015 was 51.85 million, and estimated population in 2018 was 52.83 million.

Source：The Study Team

Figure 2-1 Concentrated/Minimum Population Area

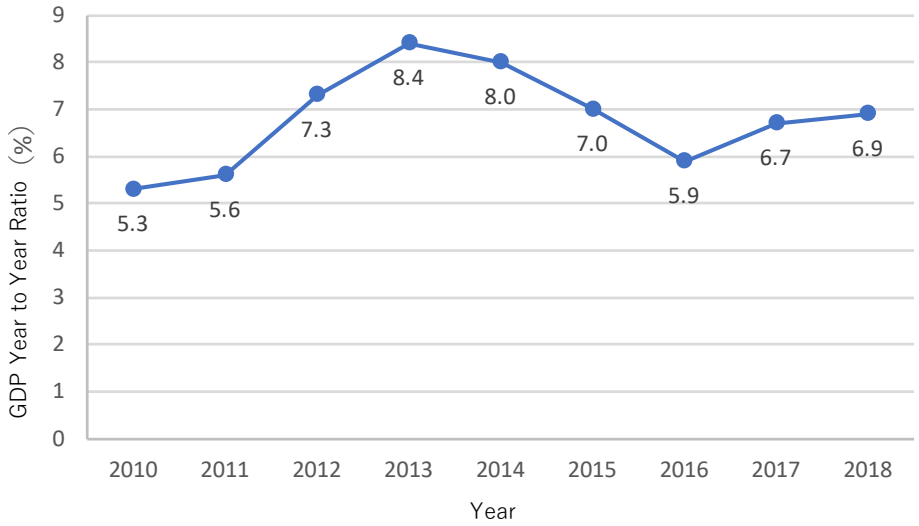
2) Economics

The military regime, which started in a coup d'etat in September 1988, abandoned a socialism policy and promoted an economic openness policy. However, because of unrealistic exchange rate, rigid economic structure, and economic sanctions by foreign countries due to the military regime's violation of human rights, like the house arrest of Mrs. Aung San Su Kyi, the economics in Myanmar was declining.

After that, because of the transition from a military government to a democratic government in March 2011, the economic sanctions were removed by countries in Europe due to economic reform such as the amendment of the Foreign Investment Law, liberalization of importation of used cars, standardization of exchange rate, phased market liberalization for banks and insurance companies, and development of the stock market. The current government that started in March 2016 and led by Mrs. Aung San Su Kyi, who is the State Councilor in Myanmar, is developing a framework for promotion of foreign investments.

The trend of economic growth rate is shown in Figure 2-2.

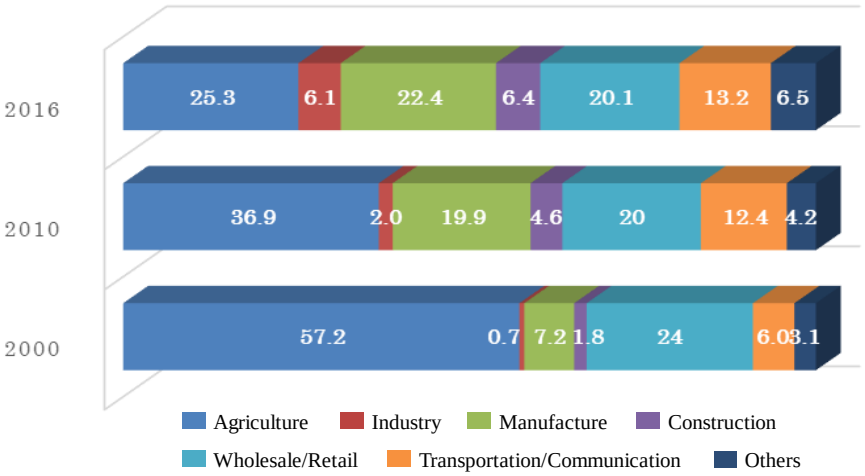
According to IMF, the GDP per capita in Myanmar is USD 1,307 in 2017.



Source：IMF, 2018 is the estimated value

Figure 2-2 Trend of Real GDP in Myanmar

After the transition from a military government to a democratic government in 2011, the structure of the industry has been changed. The trend of the ratio of industries is shown in Figure 2-3.



Source：Myanmar Central Statistical Organization

Figure 2-3 Trend of Ratio of Industries

Comparing 2010 and 2016, the ratio of agriculture decreased from 36.9% to 25.3%. However, the ratio of mining (from 2.0% to 6.1%), manufacturing (from 19.9% to 22.4%), construction (from 4.6% to 6.4%), and transport and communications (12.4% to 13.2%) increased. The increase of mining is caused by the development of the petroleum gas field. The increase of manufacturing is caused by foreign companies' advance into Myanmar for light industries, such as clothing. In this sector, companies from Japan, China, and Korea moved in because of low labor cost and exemption of custom duty.

Although natural gas, beans, jades, and rice have been major export items in Myanmar, clothing is currently the major export item because of the development of light industries. According to Myanmar Central Statics Department, the total amount of export and import is USD 12.5 billion and USD 16.6 billion, respectively.

Major industries in Shan State are agriculture and agricultural products, trading, mining, and tourism. The GDP ratios are 36.7% in agriculture, 24.4% in mining, and 38.9% in services. Half of the total population engage in agriculture.

Chapter 3 Necessity of the Project

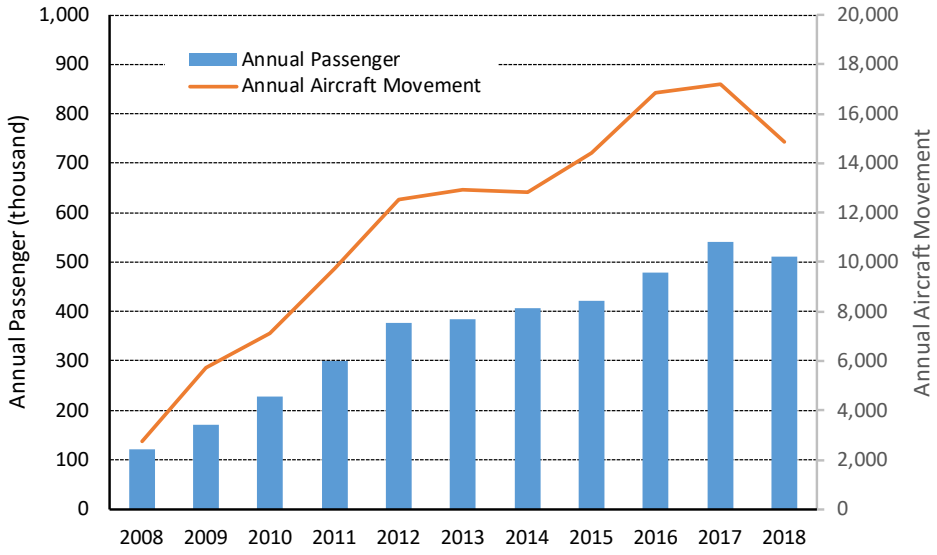
3.1 General

To consider the necessity of the Heho Airport Development Project, traffic demand, existing facility situation, operational situation, site surrounding conditions, and natural condition of the airport were confirmed. Market analysis and consideration of measures for the expansion of future demand were also conducted.

3.2 Traffic Demand

3.2.1 Current Situation of Traffic Demand

Figure 3-1 shows the trend of annual passenger volume and annual aircraft movement in the Heho Airport. The annual passenger volume has increased continuously since 2008. The rate of increase each year fluctuates considerably, increasing by about 13% in 2016 and 2017, but decreasing to 510,000 passengers in 2018. Recently, due to the political problem of Myanmar, there is a tendency that European tourists have decreased. In addition, one of the reasons of decreasing of passengers in 2018 is that the total flights decreased due to the decreasing of number of airlines. It is assumed that this decreasing is temporary.



Source：DCA

Figure 3-1 Annual Passenger and Takeoff and Landing Flights in the Heho Airport

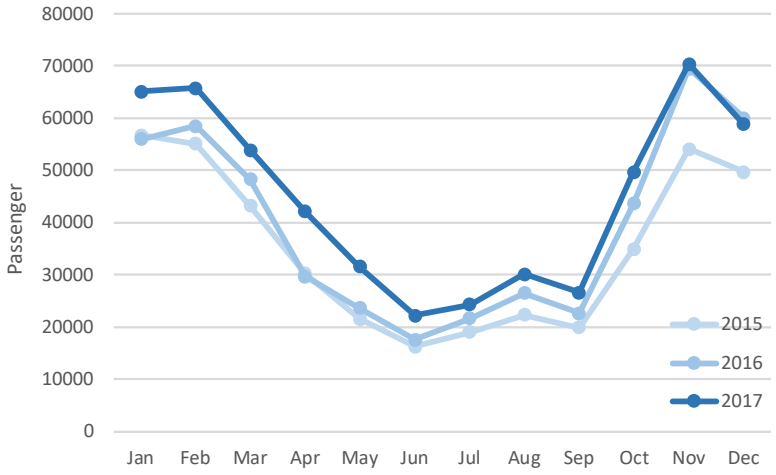
Table 3-1 Annual Passenger and Takeoff and Landing Flights in the Heho Airport

Year	Domestic Annual Passenger (,000)	Increase Rate (%)	Takeoff and Landing Numbers（times）	Increase Rate (%)
2008	121	-	2,769	-
2009	171	41.0%	5,738	107.2%
2010	227	32.9%	7,138	24.4%
2011	301	32.2%	9,726	36.3%
2012	378	25.7%	12,542	29.0%
2013	385	2.0%	12,928	3.1%
2014	408	5.8%	12,802	-1.0%
2015	423	3.7%	14,424	12.7%
2016	478	13.0%	16,841	16.8%
2017	540	13.1%	17,208	2.2%
2018	510	-5.6%	14,872	-13.6%

Source：DCA

The figure shows the monthly number of passengers from 2016 to 2018.

The peak season is from October to March, with the number of passengers rising from November to February.

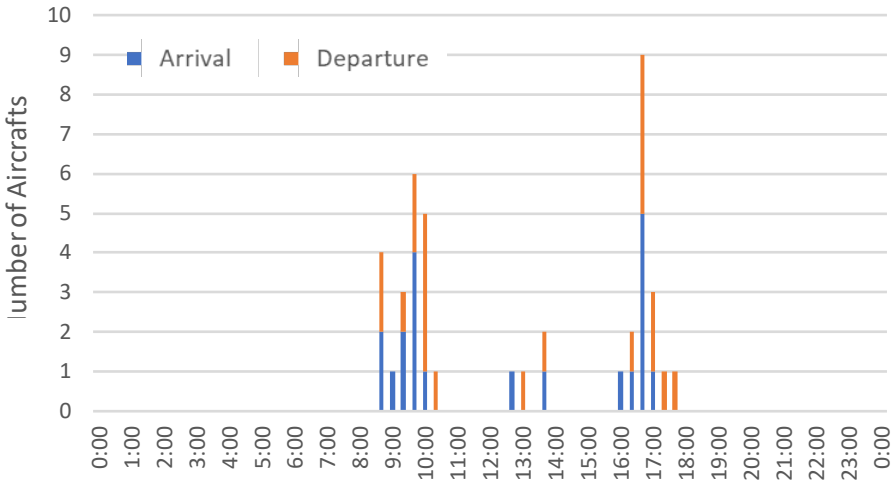


Source：DCA

Figure 3-2 Monthly Number of Passenger

The schedule of aircraft takeoff and landing during the low season (2018/5/15) of the Heho Airport is shown in Figure 3-3.

Aircrafts of Myanmar's domestic airlines depart from the Yangon Airport in the morning and return to Yangon in the evening via the regional airport, so flights arriving and departing at the Heho Airport in the morning and evening tend to be concentrated. The peak time is from 8:00 a.m. to 10:30 a.m., and from 9:00 a.m., there is a takeoff and landing flight every 5 to 10 minutes.



Source：The Study Team

Figure 3-3 Schedule of Aircraft Takeoff and Landing during the Low Season (July 15th 2018)

Regarding the number of takeoffs and landings per hour, there are 8 to 9 takeoffs during the low season and 15 to 16 takeoffs during the high season. (The maximum parking capacity of the apron is ATR-72 x 11 or ERJ 190 x 1 + ATR 72 x 8.)

Regarding the number of departures and arrivals per day, there are 18 to 20 aircrafts during the low season and 35 to 40 during the high season. The flight status of domestic airlines is shown in the table below.

Table 3-2 Number of Daily Aircraft Movements

Airline	Low Season		High Season	
	Flights (flight/day)	Aircraft Movements (nos./day)	Flights (flight/day)	Aircraft Movements (nos./day)
Myanmar National Airline	7-8	14-16	11-12	22-24
Air KBZ	7-8	14-16	9-11	18-22
Golden Myanmar Airline	3	6	4	8
Mann Yadanarpon Airline	3	6	4	8
Yangon Airways	2	4	2	4

Source : The Study Team based on Hearing Survey to Airlines

3.2.2 International Flight Situation

There is no scheduled international flight in the Heho Airport, and all international flights are ambulance flights. In case foreigners get injured or ill, ambulance flights come to the Heho Airport.

Ambulance flights are from Bangkok, Chiangmai, and Singapore. Most flights are from Bangkok. Ambulance flights happen mostly in the high season. The frequency is about 3 to 4 times per month during the high season. There was a total of 15 ambulance flights in 2016.

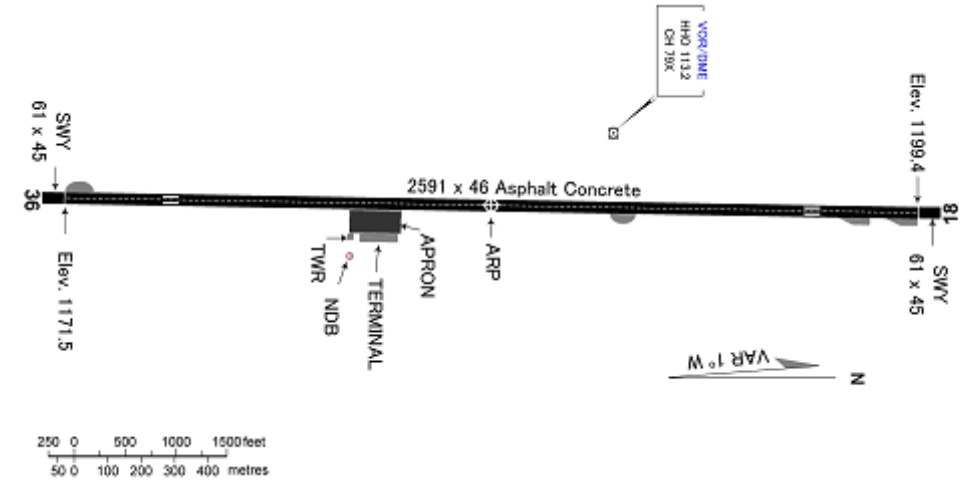
An ambulance flight may sometime stay overnight. Because of the occupancy in the apron, other flights can be delayed in case of overnight stay.

3.3 Existing Airport Facility Situation

3.3.1 Airside Facilities (Runway, Taxiway, and Apron)

(1) Runway and Runway Strip

The existing runway has the following specifications: length of 2,591 m (8,500 feet) and width of 46 m (150 feet). The pavement type is asphalt concrete. The parking apron is directly connected to the runway, and there is no connecting taxiway. Since there is no parallel taxiway, aircraft delay sometimes happens.



Source : AIP

Figure 3-4 Airside Facilities Layout

The direction of runway approach differs depending on the season, and Table x-x shows the direction of runway approach in each season.

Table 3-3 Runway Approach Direction

Season	Rate of Runway Approach Direction		Notes
	Runway 18	Runway 36	
Winter	50%	50%	North wind
Others	90%	10%	

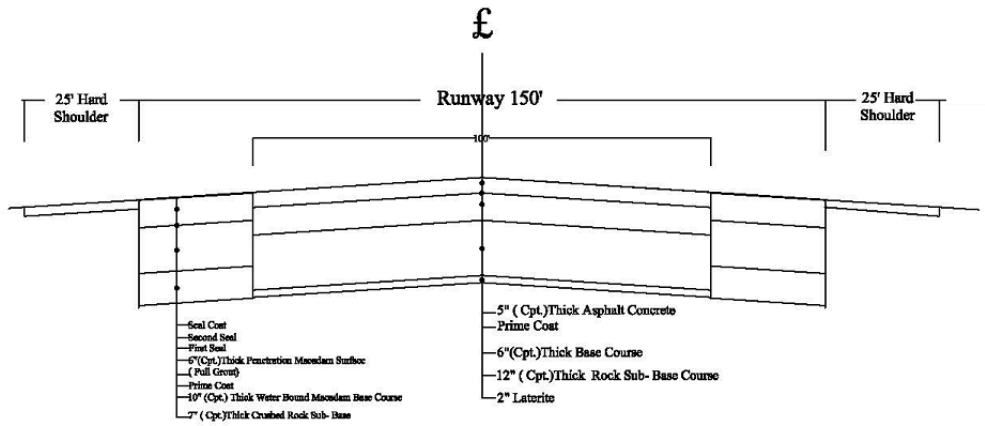
Source : The Study Team (Based on interview with DCA)

The runway is sometimes closed due to heavy rain, heavy fog (less than 1-mile visibility), strong wind (25 to 35 knot), etc. Smoke from the villages around the airport sometimes makes the runway less visible.

Heavy rain and strong wind occur in the rainy season, and heavy fog occurs in the dry season. Runway closure occurs three to four times a year, and closure time is usually 45 to 60 minutes.

AIP shows that pavement strength is 68,039 kg. The maximum takeoff weight of ATR-72 is 22,500 kg, and the maximum takeoff weight of A320 is 78,000 kg. Strengthening of runway pavement is needed for operation of A320.

The existing runway surface condition is good. Figure x-x shows the existing runway structure.



Source: DCA

Figure 3-5 Runway Pavement Structure

Photo 3-1 Runway (Middle)

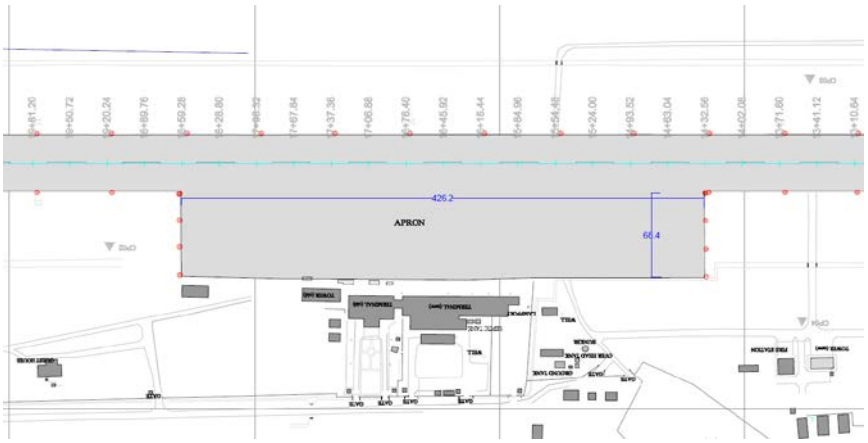
Photo 3-2 Runway (North End)

The size of the existing runway strip is 2,895 m x 150 m. The dimensions correspond to non-instrument landing operation.

(2) Apron

The apron size is 426 m x 68 m (1400 ft x 225 ft) and can accommodate a maximum of 10 ATR-72 aircrafts.

In 2016, DCA carried out the extension of the apron and added four aircraft parking spots. There are no apron markings, and parking is given priority from the north side.



Source: DCA

Figure 3-6 Apron Layout

The aircraft parking spot is near the runway, and operation is not safe.

In case of taking off from Runway 18, the distance from the apron to the runway end is far and may cause airport operation crowding.

Photo 3-3 Apron Parking Situation

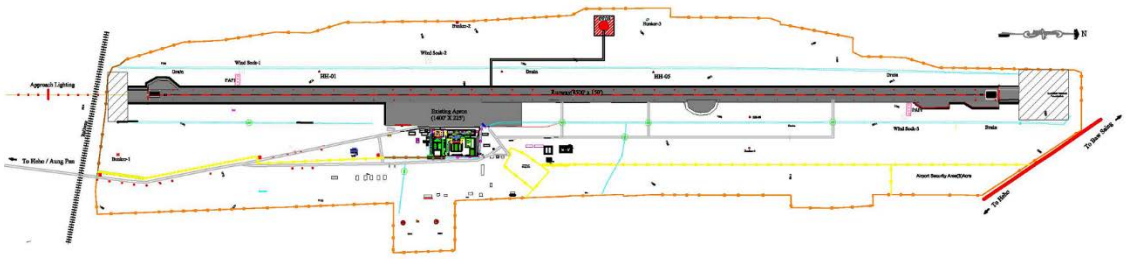
Photo 3-4 Bird's Eye View of Apron

Photo 3-5 Jet Aircraft Parking Situation (ERJ190)

The apron pavement structure is originally made of asphalt concrete and overlaid with asphalt bitumen mixed with sand. The existing apron surface is in good condition.

(3) Drainage Facilities

The main drainage open channel is constructed in the east and west side of the runway strip. The collected rain water flows from north to south. The open channel size is adequate for rain water drainage. Rain water flows outside the airport area and reaches the stream where flow is from the east side of the airport area.



Source：DCA

Figure 3-7 Drainage Facility Layout

Photo 3-6 Apron Drainage

Photo 3-7 Terminal Area Drainage

Photo 3-8 Runway Strip Drainage

Photo 3-9 Box Culvert to the Outside of Airport Area

3.3.2 Passenger Terminal Building

The passenger terminal building is divided into two for departure and arrival. The size of each building is shown in Table 3-4.

The arrival passenger terminal building was opened on 1 January 2015 for the settlement of the terminal building crowding. Before the opening of the arrival passenger terminal building, the present departure passenger terminal building handles departure and arrival passengers.

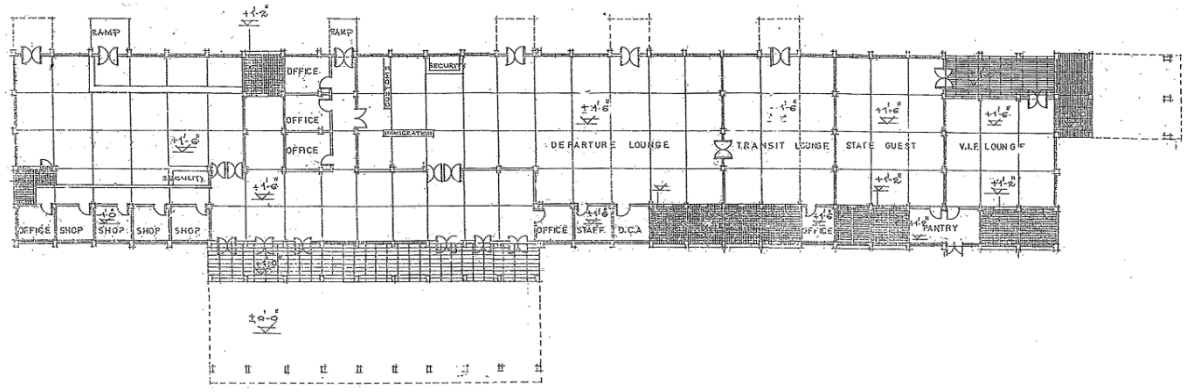
Table 3-4 Passenger Terminal Building Specification

Name	Width	Length	Area	Floor
Departure Passenger Terminal Building	91 m (300 ft)	15 m (50 ft)	1,365 m^2	1
Arrival Passenger Terminal Building	36 m (120 ft)	18 m (60 ft)	648 m^2	2

Source：The Study Team

(1) Departure Passenger Terminal Building

Passengers check-in at the departure lobby, proceed to immigration, where their name and nationality are recorded, and pass through the security check gate. Passengers wait for boarding at the departure lounge.



Source: DCA

Figure 3-8 Departure Passenger Terminal Building Layout

Five airlines can operate in the passenger terminal building, and many passengers crowd in the building at morning peak time. The second departure lounge is the former baggage handling area of arrival passengers. The second departure lounge is narrower than the first departure lounge. The second departure lounge can handle three airlines.

Immigration is found inside both the departure and arrival passenger terminal buildings. As instructed by the state, immigration controls not only passengers for charter flights, but also all domestic flight passengers entering the restricted area.

The VIP lounge is located at the northern tip of the departure passenger terminal building. After VIP passengers arrive at the Heho Airport, they can walk directly to the VIP lounge from the apron.

Some lighting fixtures of the terminal building have troubles, and the inside of the building looks dimly lit. Since power failure happens frequently, the terminal building is designed such that sunshine can enter through the windows of the room and can illuminate the room amidst power failure. The building is designed such that the room can take in fresh air from an opened window in case air conditioning stops due to power failure.

Photo 3-10 1st Departure Lounge

Photo 3-11 2nd Departure Lounge

Photo 3-12 VIP Lounge

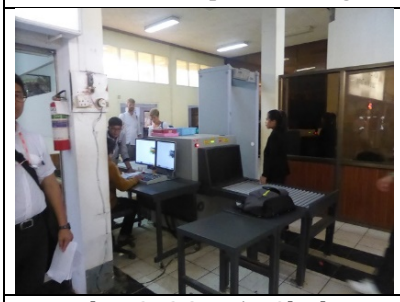


Photo 3-13 Security Check

Photo 3-14 Custom

Photo 3-15 Check in Counter

(2) Arrival Passenger Terminal Building

There is no Baggage Handling System (BHS). Located in the first floor are the passenger waiting space for check-in baggage, meeting space for arrival passengers, and the toilet. The second floor is the future space for the airline office.

Photo 3-16 Arrival Passenger Terminal Building

Photo 3-17 Check in Baggage Moving Cart

Photo 3-18 Arrival Area

(3) Security Equipment

The metal detector is broken and not in use.

The x-ray checking facility introduced through Japan ODA is not in use because of circuit troubles by frequent power failures. Airport staff have ordered to repair the machine, but the machine is not repaired yet.

(4) Other Equipment

The CCTV system (camera 13, 3 surface monitor) and the electrical clock system is installed in the passenger terminal building.

3.3.3 CNS/ATM and Airport Safety Equipment

(1) VOR/DME

The VOR/DME is installed in the opposite side of the passenger terminal building in 2014, and the expense was supported through Japan grant aid. The maintenance road for VOR/DME connects the center of the runway and the VOR/DME. If maintenance staff want to go to the VOR/DME from the passenger terminal building, they need to cross the runway and access must be approved by the air traffic controller.

The VOR/DME operates in good condition. In case of power failure, a generator works for emergency electricity.

Photo 3-19 DVOR/DME

Photo 3-20 DVOR/DME Machine Room

(2) NDB

The NDB is installed on the east side of the parking area, and it operates in good condition.

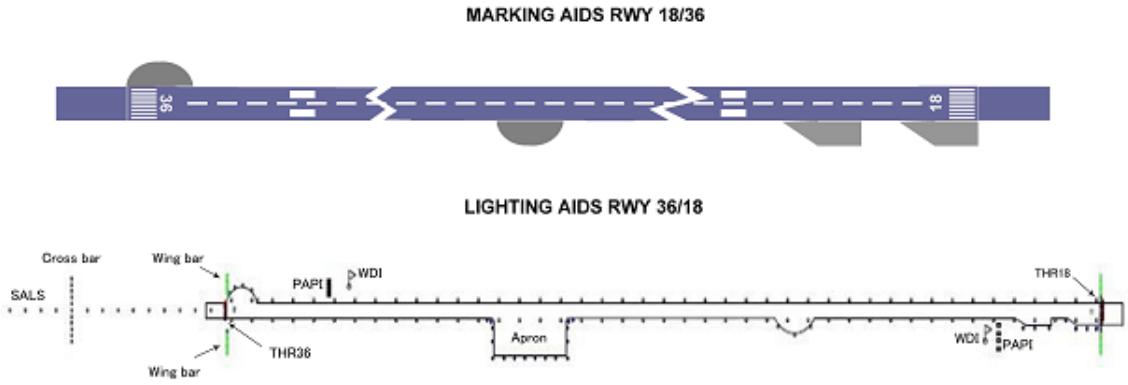
Photo 3-21 NDB(1)

Photo 3-22 NDB(2)

(3) Aeronautical Ground Light

The existing aeronautical ground lighting is composed of the Runway Edge Light, the Runway Threshold Light, PAPI, SALS (36 side), and so on. The number of each lighting is shown as follows:

- Simple Approach Lights (SALS): 24 lights
- Runway Edge Light (RWEL): 86 lights
- Runway Threshold Light: 28 lights
- Wing Bar Light: 20 lights
- Precision Approach Path Indicator (PAPI): 2 sets
- Rotating Beacon: 1 light



Source: AIP

Figure 3-9 Aeronautical Ground Light Layout

(4) Control Tower

The control tower was constructed in 2015 and is found in a new location, different from the former control tower located beside arrival passenger terminal building. The 4-storey control tower has a height of about 19 m aboveground.

The first floor of the control tower is allocated for the firefighting staff room and for ambulance parking.

	
Photo 3-23 Control Tower, Fire Fighting Station	**Photo 3-24 Control Room inside Control Tower**

(5) Firefighting Station

The new firefighting vehicle garage is constructed in the first floor of the control tower. There is one fire fighting vehicle and one rapid fighting vehicle introduced in 2014. The ambulance is old, and medical equipment inside the car cannot be used.

Training for the firefighting vehicle is conducted once per week.

The fire extinguisher is inspected regularly. Each airline installs a fire extinguisher in the apron.

		
Photo 3-25 Firefighting vehicle	**Photo 3-26 Ambulance**	**Photo 3-27 Firefighting Station**
		
Photo 3-28 Fire Extinguisher inside PTB	**Photo 3-29 Fire Extinguisher in Apron**	**Photo 3-30 Water Tank for FFV**

(6) AWOS

The AWOS is installed in 2014 and the expense was supported by Japan grant aid.

3.3.4 Utility Facilities

(1) Electrical Facilities

Power failure happens at least once every day for about 10 to 15 minutes once or twice daily on average in the rainy season and dry season. In the dry season, power failure time is relatively long.

1) Receiving Voltage, Supply Line

Electricity comes from the hydroelectric power plant of Laikaw via a 4,000-V line to the substation of Lay Low Town and flows to Heho Village via a 11-kV line and flows to the Heho Airport via a 11-kV line.

The electric line from Heho Village to the Heho airport is the same as the supply line of the Heho Village. DCA requested to separate the electric supply line of Heho Village and the Heho Airport; however, it is not yet realized.

2) Transformer

Table x,x shows the transformer installed in the Heho Airport.

Table 3-5 Existing Transformer

No	Capacity	Supply Destination
1	315 kVA	Water Supply Tank, Shop
2	160 kVA	Aeronautical Ground Light
3	50 kVA	Water Supply Tank

Source : The Study Team

In addition to the above, a 40-kVA transformer is installed near a deep well.

Photo 3-31 Main Transformer for Airport

Photo 3-32 Power Station

3) Generator

There are four generators in the Heho Airport, and the supply destination of each generator is shown in Table 3-6

Table 3-6 Existing Generator

No	Capacity	Supply Destination
1	100 kVA	Aeronautical Ground Light, NDB, Control Tower
2	32 kVA	Passenger Terminal Building
3	7.5 kVA	-
4	5 kVA	-

Source: The Study Team

If main electricity supply stops, the generator (100 kVA) for the aeronautical ground light starts driving automatically, and the generator (32 kVA) starts manually.

The generator for the VOR/DME is installed in the VOR/DME site.

Photo 3-33 Generator (100 kVA)

Photo 3-34 Generator (32 kVA)

(2) Telephone Facilities

There are two telephone lines. One line is connected in the airport manager's house and another line is connected in the control tower.

(3) Water Supply Facilities

The daily water consumption of the Heho Airport is about 4,000 to 5,000 gallons (about 15.1 to 18.9 m^3). At the peak time, the daily water consumption is 6,000 gallons (about 22.7 m^3).

The water used in the Heho Airport is taken from a deep well and a dam.

The deep well is near the airport access road and is 800 m from the airport. Water can be taken from the deep well 24 hours during the rainy season, which lasts for three months (July to October).

In the dry season (November to June), the deep well can be used only for 1 out of 4 hours. Since there is not enough water taken from the deep well, water is conveyed from the dam (Innkhaung Dam) using a water boxer with a capacity of 3,000 gallons (about 11.4 m^3). The frequency of water conveyance depends on the day, which is about three to four times per day, due to changes of water volume at the dam by weather.

The rain water tank with a capacity of 30,000 gallons (about 114 m^3) is used only for the supply of firefighting vehicles. Since the pump of water supply is broken down, the pump of the firefighting vehicle is used instead.

1) Deep Well

There are three deep wells near the airport access road, and the depth of the well is from 350 to 400 ft (about 105 to 120 m).

Two intake pumps convey water from the deep well to the water tank (10,000 gal (about 37.8m^3)) near the deep well, and one supply pump conveys water from the water tank near the deep well to the receiving water tank near the passenger terminal building.

Photo 3-35 Water Well

Photo 3-36 Pump for Water Well

Photo 3-37 Water Tank

2) Receiving Water Tank and Elevated Water Tank

There are two receiving water tanks of the underground type. One tank has a volume of 10,000 gallons and a total tank volume of 20,000 gallons (about 75.7 m^3). One tank is for the arrival passenger terminal building and the second departure lounge. Another tank is for the first departure lounge and the VIP lounge.

The pump is for water supply from the receiving water tank to the elevated water tank. Water is supplied by gravitation from the elevated water tank to the terminal building.

Photo 3-38 Elevated Water Tank (1)

Photo 3-39 Elevated Water tank (2)

Photo 3-40 Receiving Water Tank (1)

Photo 3-41 Pump House

Photo 3-42 Receiving Water Tank (2)

Photo 3-43 Water Well inside the Airport

(4) Sewage Treatment System

There are three septic tanks with the following dimensions: 4.5 m length x 3.0 m width x 3.6 m height (15 ft x 10 ft x12 ft). Cleaning of the septic tank is conducted by the Kalaw City Development Committee once per year. Sludge collected from septic tank is buried near the airport boundary fence.

(5) Garbage Disposal Area

There is no incinerator in the airport, and garbage is burned at the airport area every evening. In the rainy season, it is difficult to burn garbage at the site, so the garbage is buried in three disposal pits inside the airport area every year. The disposal pit size is 3 m x 3 m x 3 m.

Photo 3-44 Septic Tank

Photo 3-45 Garbage Disposal Area

3.3.5 Access Road and Parking

(1) Airport Access Road

The airport access road connects the terminal area to National Highway 4, which connects Meiktila to Tachileik. The airport access road has two lanes and is paved with asphalt concrete.

Photo 3-46 Airport Access Road(1)

Photo 3-47 Airport Access Road(2)

(2) Parking

Parking is on the landside of the passenger terminal building and is not paved. Since there are no markers for the parking lot, the capacity of car parking is unclear.

During arrivals, there are many taxis and tourist buses that stop in the car parking, and the parking capacity is not enough in high season.

Photo 3-48 Car Parking(1)

Photo 3-49 Car Parking(2)

3.3.6 Fuel Facilities

The National Energy Puma Aviation Services (NEPAS), which is in a joint venture with the Myanmar government and PUMA, operates the fuel facility of the Heho Airport. NEPAS operates the fueling business by direct contracts with the airlines. The Ministry of Electricity and Energy has operated before, while NEPAS has been operating since 2016 only. There are two refueling cars, with a capacity of 21,000 liters. The daily fueling volume is 7,200 to 12,000 liters in the low season and 20,000 liters more in the high season. The unit price of fuel changes every month, and airlines pay charge based on monthly usage. Fuel is transported from Yangon (Thilawa) to Mandalay by inland water transportation and to Heho by tank truck, or from Yangon to Heho by tank truck. DCA lend the land to NEPAS and do not own the fuel facilities.

Photo 3-50 Entrance of Fuel Station

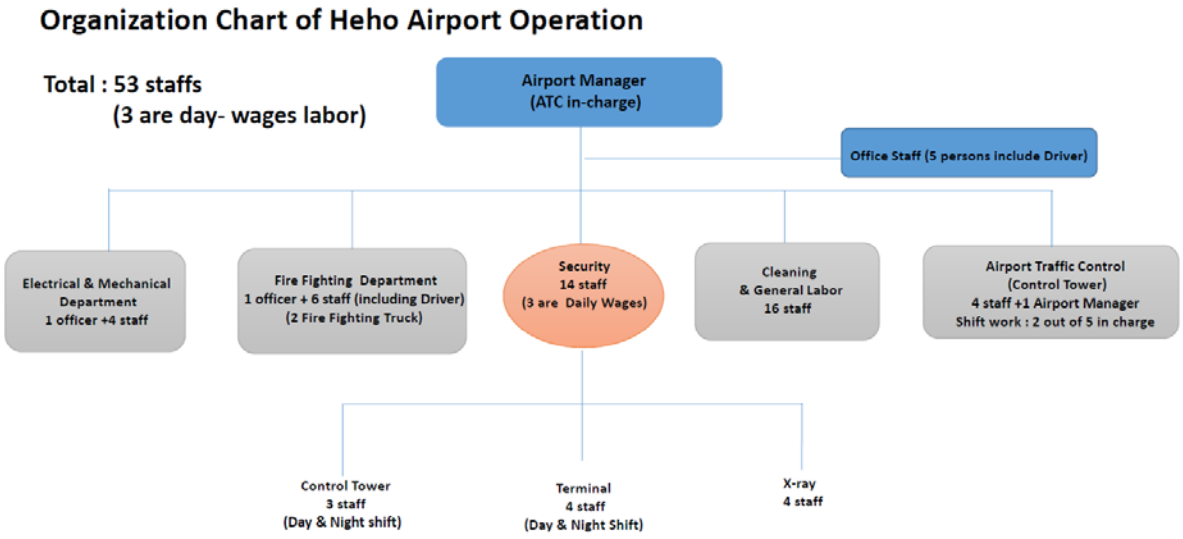
Photo 3-51 Fuel Station

Photo 3-52 Tank Truck

3.4 Airport Operation Situation

3.4.1 Airfield and Landside Operation by DCA

- The current organization of DCA at the Heho Airport is formulated based on a round-the-clock operation with acceptability of midnight or early morning flights.
- The total number of employees is 53, including three for a day-wage labor.
- In the current schedule, landing and take-off of regular flights are done between 5:30 a.m. and 6:30 p.m., but it may be changed according to weather conditions or so.
- Besides regular passenger flights, the airport accepts chartered flights and private flights even at midnight or early in the morning.
- Regular patrol to the airfield is conducted twice a day by three persons (one for firefighting and two for security).



Source: The Study Team (Based on interview with DCA)

Figure 3-10 Organization Chart in Heho Airport

The number of staff and details of works are shown below.

(1) Air Traffic Control (5 staff)

- One Airport Manager and four staff for two shifts a day with two staff each.
- Assuming responsibility to cover airspace, runway, apron, and parking spots.

(2) Cleaning and General Labor (16 staff)

(3) Security (14 staff - three staff for air control tower, four staff for passenger terminal building, and four staff for passengers and baggage inspection)

- Eleven full time employees and three daily wage labor.

- Daily duties for air control tower and passenger terminal building are covered by two shifts.
- Passengers and baggage inspection are conducted according to the flight schedule.

(4) Firefighting (7 staff)

- Two dedicated fire engines.
- One officer and six staff.

(5) Electrical and mechanical department (5 staff)

- One officer and four staff.
- Daily duties for maintenance are being conducted by local staff only.
- Other specific affairs are covered by DCA Head Office in Yangon.

3.4.2 Ground Handling by Airlines

- Currently, there is no involvement by DCA to ground handling affairs (ramp handling and passenger handling) at the Heho Airport. As no ground handlers are in business, each airline company takes care of their regular flights during their stay in "self-service".
- For departing passengers, airlines' local staff serve with confirmation of reservation and issue boarding pass using general laptop computers at their check-in counter.
- In the baggage handling process, under the condition of no conveyers or sorters, airlines' local staffs engage in loading/unloading and direct delivery with each passenger on the apron.
- As all aircraft stands are open without boarding bridges, all aircrafts can get out without support of towing cars (push-back). (Entire power-in and power-out operation)
- Due to the above situation, there is no dedicated ground support equipment (GSE) vehicle in the Heho Airport at the moment.

3.4.3 Aviation and General Security by National Police Office

- The National Police Office deploys 30 police officers for aviation security and another 50 officers for general security in the surrounding area of DCA's property for daily operation in two shifts by the agreement with DCA.
- Apart from the above assignment, Special Police (3), Investigation Police (3) and Army Intelligent (4) are assigned to regularly collect necessary information for airport security.

3.4.4 Custom, Immigration, and Quarantines

- Currently in Myanmar, three airports, i.e., Yangon, Mandalay, and Naypyidaw, are officially designated as "Port of Entries" that can directly accept international flights with resident CIQ officers on permanent basis. On the other hand, other airports, including the Heho Airport, are allowed to accept domestic flights only under the current system.
- It means that the Heho Airport does not have CIQ officers serving for international passengers as it concentrates on domestic service.
- On the other hand, the Immigration Office assigns officers to the Heho Airport to collect individual travel records from foreign passengers at declaration booths both for arrival and departure.
- Also, in the case of accepting international private aircrafts, CIQ officers are to be temporarily assigned to have passengers and baggage properly cleared. The information of frequency of these flights have not been acquired by the Study Team so far.

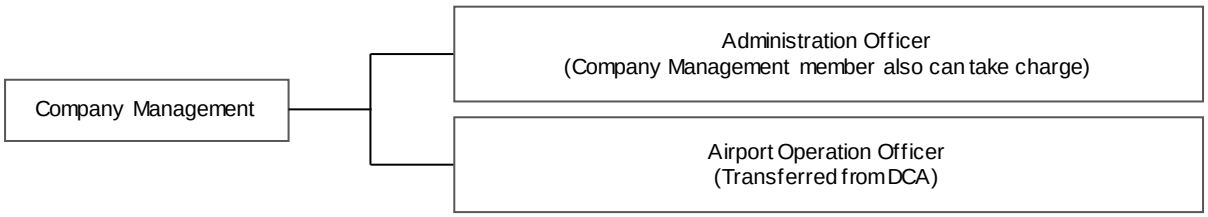
3.4.5 Overall Findings and Issues from Current Airport Operation

- Finalization of business scope for the new SPC to be taken over from the DCA Head Office.
- Elaboration of business transfer plan from the DCA Head Office to the new SPC.
- Establishment of the administration office of the new SPC that assumes business transfer plan and accounting measures independent from the national budget control.
- Preparation for internationalization in the future.

3.4.6 Individual Findings and Issues Picked Out from the Overall Points

- At the transition from DCA to the new SPC, airport operation is to be continuously assumed by the existing organization and staff of DCA who would then transfer from a public to a private entity.
- At the transition, the new SPC would confirm that air traffic control affairs remain under DCA's responsibility in consideration of the nature of duty.
- It is required to confirm whether aviation security can be continuously covered by the National Police Office in collaboration with local staff at the Heho Airport of the new SPC after the transition. In case the new SPC assumes aviation security entirely, a new organization with the right number of staff and related budgetary steps would be required.
- It is also required to confirm whether the Firefighting Office remains under the control of the new SPC.
- As the current Electrical and Mechanical Department is run by a small number of local staff of DCA with support from its head office in Yangon as needed, the new SPC inevitably needs to establish an independent maintenance team with the right number of staff and budget.

- As for the ground handling service, the new SPC needs to initiate the materialization of a local service provider to enhance operational capability to deal with the possible expansion of airport operations, upgrade of aircrafts from prop to jet, and internationalization in the future.
- As for fuel supply and refueling, the new SPC would enter into a feasibility study for introducing multiple service providers to deal with the demand increase in the future.
- As most of the back-office affairs are currently assumed by the DCA Head Office in Yangon with coverage of related overhead expense, the new SPC needs to establish an Administrative Division that covers labor control, revenue-expense control, and property management. In this regard, it is essential to realize the "sunk cost" that the DCA local office at the Heho Airport currently does not bear.



Source: The Study Team

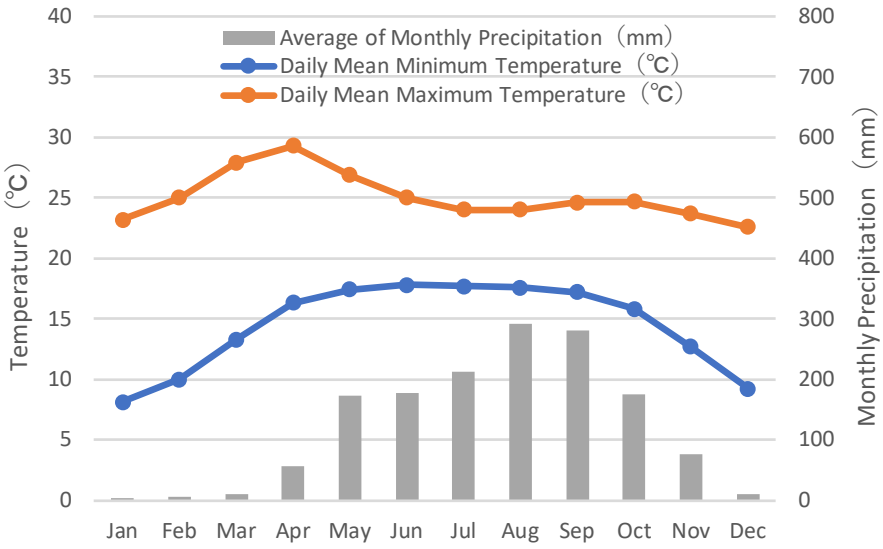
Figure 3-11 Suggested Organization Chart for Prospective Operating Company for Heho Airport

3.5 Condition of Project Site

3.5.1 Meteorological Data

Figure x-x shows the average of the daily maximum and minimum temperature and the average of monthly precipitation of Taunggyi. The Heho Airport is in the highlands where the climate is cooler as compared with other areas of Myanmar.

The average annual precipitation of Taunggyi is 1,471 mm, which is smaller than that of Yangon.

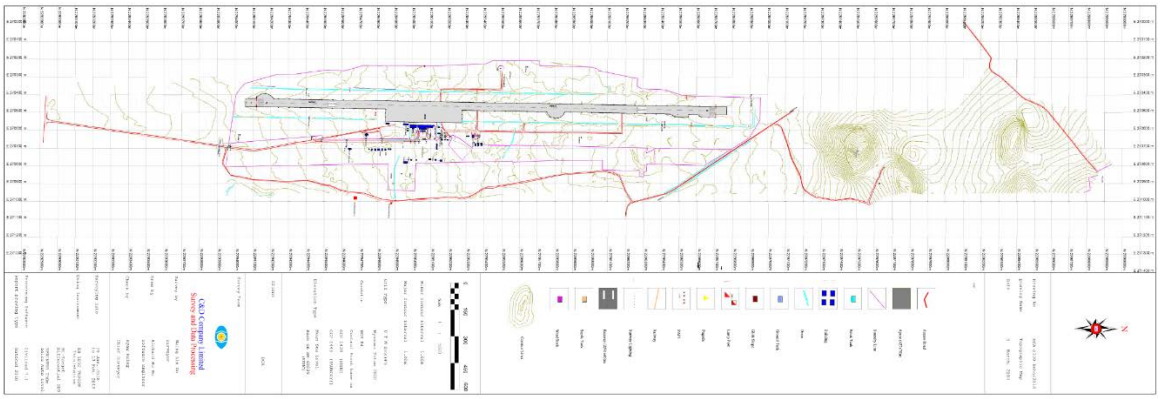


Source：World Meteorological Organization (WMO)

Figure 3-12 Daily Mean Temperature and Average of Monthly Precipitation in Taunggyi

3.5.2 Topography

DCA conducted the topographic survey of the entire Heho Airport area, including the new land acquisition area in 2018. Figure 3-13 shows the topographic map of the Heho Airport area.



Source: DCA

Figure 3-13 Topographic Map of the Heho Airport Area

The ground surface of the Heho Airport area is sloping from north to south. There are some steep hills on the north side of the airport. A stream flows along the east side of the airport. It may collect rainfall water from surrounding areas, including the Heho Airport, and discharge to downstream.

Photo Stream on the East Side of the Airport (1)

Photo Stream on the East Side of the Airport (2)

3.5.3 Geography

The geotechnical survey shown in Table 3-7 is conducted to check geographic conditions of the Heho Airport site.

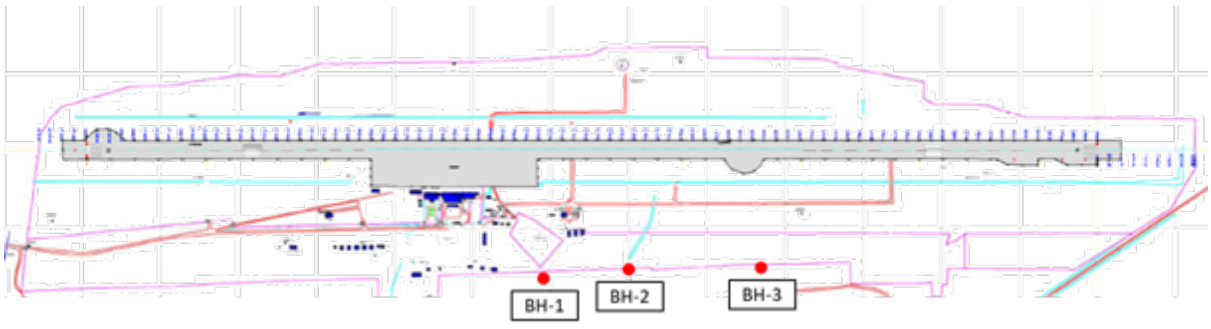
Table 3-7 Geographic Survey Contents

Survey Contents	Quantity	Objective
Boring (Standard Penetration Test (SPT) and Sampling)	3	Confirmation of geographic condition at the site of cargo terminal building, passenger terminal building, and control tower
Dynamic Cone Penetration Test (DCPT)	6	Confirmation of subgrade CBR for runway overlay thickness design
Plate Bearing Test	2	Confirmation of modulus of subgrade reaction (k-value) and CBR for apron pavement design
Laboratory CBR Test	6	Confirmation of subgrade CBR for parallel taxiway pavement design

Source: The Study Team

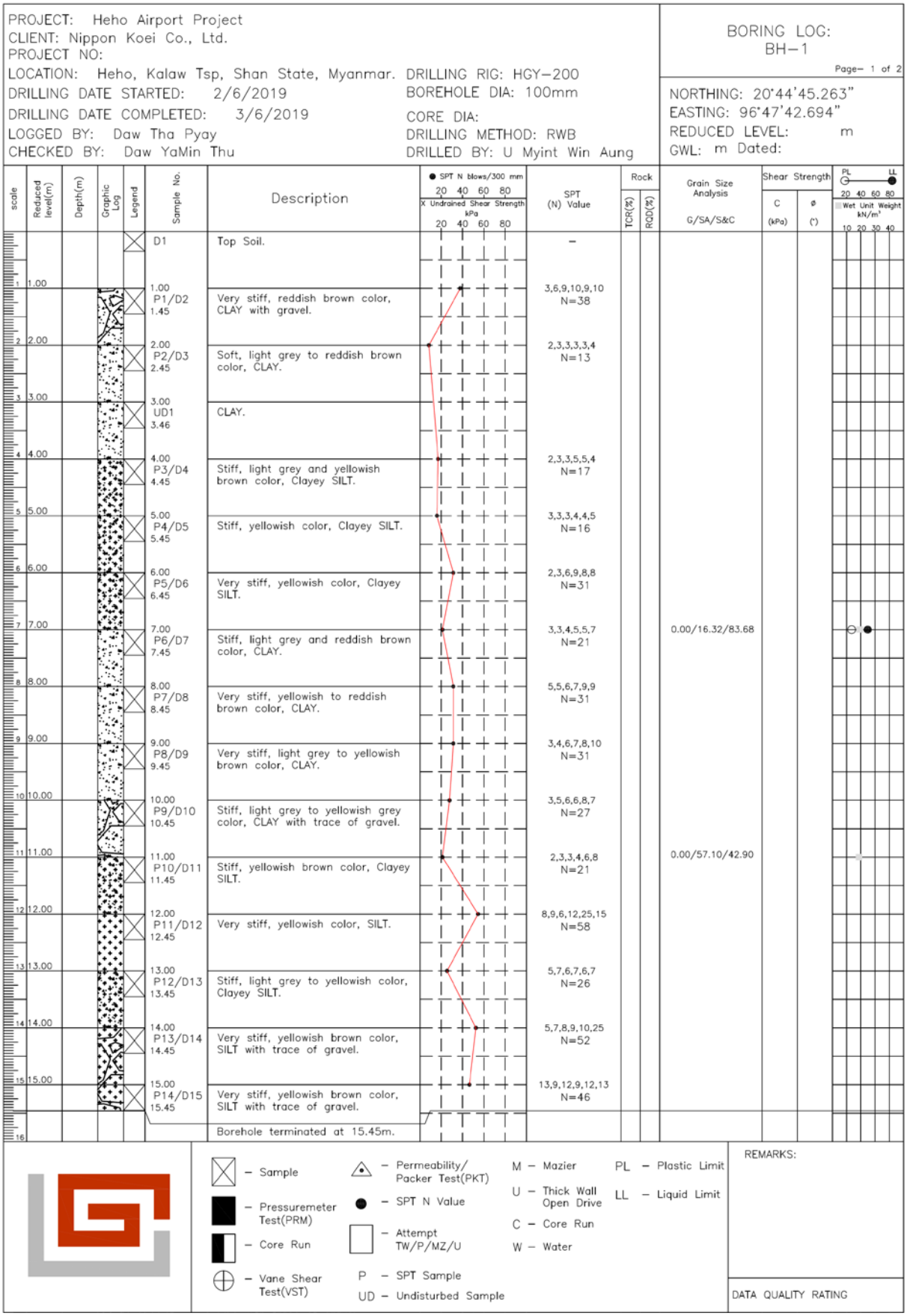
(1) Boring

Figure 3-14 shows the borehole location (3 points). BH-1 is placed in the cargo terminal building site. BH-2 is placed in the passenger terminal building site. BH-3 is placed in the control tower site. The borehole depth is 15 m (BH-1), 28 m (BH-2), and 20 m (BH-3). The Standard Penetration Test (SPT) and sampling were conducted at 1 m depth each. SPT was conducted based on ASTM D1587. SPT results (N-value) and soil distribution of each borehole location are shown in Figure 3-15. The type of soil in survey sites are mostly silt or clay. N-value is 15 or more at most all sampling layers. It can be said that the risk of soft ground is low at the survey site. N-value is over 30 from 20 to 23 m depth of BH-2, and soil type at that layer is clay or silt.



Source:The Study Team

Figure 3-14 Borehole Location


PROJECT: Heho Airport Project
CLIENT: Nippon Koei Co., Ltd.
PROJECT NO:
LOCATION: Heho, Kalaw Tsp, Shan State, Myanmar.
DRILLING DATE STARTED: 2/6/2019
DRILLING DATE COMPLETED: 3/6/2019
LOGGED BY: Daw Tha Pyay
CHECKED BY: Daw YaMin Thu
DRILLING RIG: HGY-200
BOREHOLE DIA: 100mm
CORE DIA:
DRILLING METHOD: RWB
DRILLED BY: U Myint Win Aung
BORING LOG: BH-1
Page- 1 of 2
NORTHING: 20°44'45.263"
EASTING: 96°47'42.694"
REDUCED LEVEL: m
GWL: m Dated:
scale
Reduced level(m)
Depth(m)
Graphic Log
Legend
Sample No.
Description
SPT N blows/300 mm
X Undrained Shear Strength kPa
SPT (N) Value
Rock
TCR(%)
RQD(%)
Grain Size Analysis
G/SA/S&C
Shear Strength
C (kPa)
ø (°)
PL LL
Wet Unit Weight kN/m³
D1 Top Soil. -
1.00 P1/D2 1.45 Very stiff, reddish brown color, CLAY with gravel. 3,6,9,10,9,10 N=38
2.00 P2/D3 2.45 Soft, light grey to reddish brown color, CLAY. 2,3,3,3,3,4 N=13
3.00 UD1 3.46 CLAY.
4.00 P3/D4 4.45 Stiff, light grey and yellowish brown color, Clayey SILT. 2,3,3,5,5,4 N=17
5.00 P4/D5 5.45 Stiff, yellowish color, Clayey SILT. 3,3,3,4,4,5 N=16
6.00 P5/D6 6.45 Very stiff, yellowish color, Clayey SILT. 2,3,6,9,8,8 N=31
7.00 P6/D7 7.45 Stiff, light grey and reddish brown color, CLAY. 3,3,4,5,5,7 N=21 0.00/16.32/83.68
8.00 P7/D8 8.45 Very stiff, yellowish to reddish brown color, CLAY. 5,5,6,7,9,9 N=31
9.00 P8/D9 9.45 Very stiff, light grey to yellowish brown color, CLAY. 3,4,6,7,8,10 N=31
10.00 P9/D10 10.45 Stiff, light grey to yellowish grey color, CLAY with trace of gravel. 3,5,6,6,8,7 N=27
11.00 P10/D11 11.45 Stiff, yellowish brown color, Clayey SILT. 2,3,3,4,6,8 N=21 0.00/57.10/42.90
12.00 P11/D12 12.45 Very stiff, yellowish color, SILT. 8,9,6,12,25,15 N=58
13.00 P12/D13 13.45 Stiff, light grey to yellowish color, Clayey SILT. 5,7,6,7,6,7 N=26
14.00 P13/D14 14.45 Very stiff, yellowish brown color, SILT with trace of gravel. 5,7,8,9,10,25 N=52
15.00 P14/D15 15.45 Very stiff, yellowish brown color, SILT with trace of gravel. 13,9,12,9,12,13 N=46
Borehole terminated at 15.45m.
Sample
Pressuremeter Test(PRM)
Core Run
Vane Shear Test(VST)
Permeability/ Packer Test(PKT)
SPT N Value
Attempt TW/P/MZ/U
P - SPT Sample
UD - Undisturbed Sample
M - Mazier
U - Thick Wall Open Drive
C - Core Run
W - Water
PL - Plastic Limit
LL - Liquid Limit
REMARKS:
DATA QUALITY RATING

a) BH-1

PROJECT: Heho Airport Project
CLIENT: Nippon Koei Co., Ltd.
PROJECT NO:
LOCATION: Heho, Kalaw Tsp, Shan State, Myanmar.
DRILLING DATE STARTED: 30/5/2019
DRILLING DATE COMPLETED: 1/6/2019
LOGGED BY: Daw Tha Pyay
CHECKED BY: Daw YaMin Thu
DRILLING RIG: HGY-200
BOREHOLE DIA: 100mm
CORE DIA:
DRILLING METHOD: RWB
DRILLED BY: U Myint Win Aung

BORING LOG:
BH-2

Page- 1 of 3

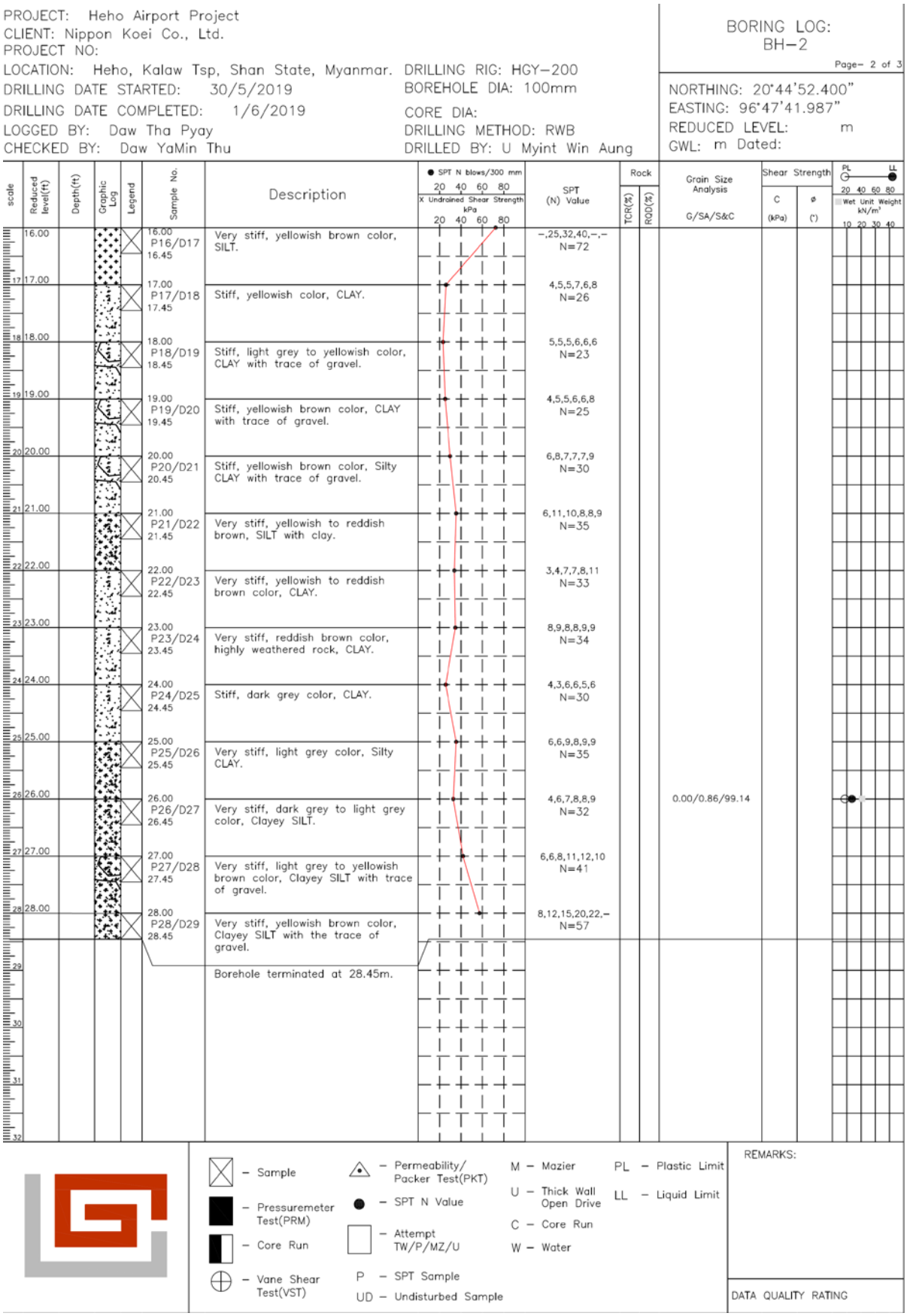
NORTHING: 20°44'52.400"
EASTING: 96°47'41.987"
REDUCED LEVEL: m
GWL: m Dated:

scale	Reduced level(m)	Depth(m)	Graphic Log	Legend	Sample No.	Description	SPT N blows/300 mm (20 40 60 80) / Undrained Shear Strength kPa (20 40 60 80)	SPT (N) Value	Rock TCR(%)	Rock RQD(%)	Grain Size Analysis G/SA/S&C	Shear Strength C (kPa)	Shear Strength ø (°)	PL LL (20 40 60 80) / Wet Unit Weight kN/m³ (10 20 30 40)
					D1	Top Soil.		-						
1	1.00				1.00 P1/D2 1.45	Firm, yellowish to reddish color, CLAY with trace of gravel.		2,2,3,3,4,5 N=15						
2	2.00				2.00 P2/D3 2.45	Stiff, yellowish to reddish color, Silty CLAY with trace of gravel.		2,3,5,6,7,7 N=25						
3	3.00				3.00 P3/D4 3.45	Stiff, yellowish to reddish color, CLAY.		1,2,3,5,5,7 N=23						
4	4.00				4.00 P4/D5 4.45	Firm, reddish color, CLAY.		2,1,4,3,4,4 N=15			0.00/1.66/98.34			
5	5.00				5.00 P5/D6 5.45	Stiff, reddish color, CLAY.		2,2,3,4,4,5 N=16						
6	6.00				6.00 P6/D7 6.45	Very stiff, light to yellowish brown color, CLAY with trace of gravel.		3,5,6,6,9,9 N=30						
7	7.00				7.00 P7/D8 7.45	Stiff, light grey to yellowish brown color, CLAY.		2,3,4,4,5,5 N=18						
8	8.00				8.00 P8/D9 8.45	Stiff, light grey to yellowish brown color, CLAY with trace of gravel.		3,3,3,4,4,6 N=17						
9	9.00				9.00 P9/D10 9.45	Stiff, yellowish to reddish brown color, CLAY with trace of gravel.		3,4,4,5,6,6 N=21						
10	10.00				10.00 P10/D11 10.45	Stiff, yellowish to brown color, CLAY.		3,3,3,5,6,6 N=20						
11	11.00				11.00 P11/D12 11.45	Stiff, yellowish brown color, Clayey SILT.		2,4,4,6,9,11 N=30						
12	12.00				12.00 P12/D13 12.45	Very stiff, yellowish brown color, SILT.		7,13,17,13,10,13 N=53			0.00/9.34/90.66			
13	13.00				13.00 P13/D14 13.45	Stiff, yellowish color, Clayey SILT.		6,5,6,5,6,5 N=22						
14	14.00				14.00 P14/D15 14.45	Very stiff, light grey to yellowish color, CLAY.		5,6,7,9,12,13 N=41						
15	15.00				15.00 P15/D16 15.45	Very stiff, light grey to yellowish grey color, CLAY with trace of gravel.		7,8,9,10,11,14 N=44						
16														

- Sample
- Pressuremeter Test(PRM)
- Core Run
- Vane Shear Test(VST)
- Permeability/ Packer Test(PKT)
- SPT N Value
- Attempt TW/P/MZ/U
- P – SPT Sample
- UD – Undisturbed Sample
- M – Mazier
- U – Thick Wall Open Drive
- C – Core Run
- W – Water
- PL – Plastic Limit
- LL – Liquid Limit

REMARKS:

DATA QUALITY RATING


PROJECT: Heho Airport Project
CLIENT: Nippon Koei Co., Ltd.
PROJECT NO:
LOCATION: Heho, Kalaw Tsp, Shan State, Myanmar.
DRILLING DATE STARTED: 30/5/2019
DRILLING DATE COMPLETED: 1/6/2019
LOGGED BY: Daw Tha Pyay
CHECKED BY: Daw YaMin Thu
DRILLING RIG: HGY-200
BOREHOLE DIA: 100mm
CORE DIA:
DRILLING METHOD: RWB
DRILLED BY: U Myint Win Aung
BORING LOG: BH-2
Page- 2 of 3
NORTHING: 20°44'52.400"
EASTING: 96°47'41.987"
REDUCED LEVEL: m
GWL: m Dated:
Description
SPT (N) Value
Rock
Grain Size Analysis
Shear Strength
Very stiff, yellowish brown color, SILT.
Stiff, yellowish color, CLAY.
Stiff, light grey to yellowish color, CLAY with trace of gravel.
Stiff, yellowish brown color, CLAY with trace of gravel.
Stiff, yellowish brown color, Silty CLAY with trace of gravel.
Very stiff, yellowish to reddish brown, SILT with clay.
Very stiff, yellowish to reddish brown color, CLAY.
Very stiff, reddish brown color, highly weathered rock, CLAY.
Stiff, dark grey color, CLAY.
Very stiff, light grey color, Silty CLAY.
Very stiff, dark grey to light grey color, Clayey SILT.
Very stiff, light grey to yellowish brown color, Clayey SILT with trace of gravel.
Very stiff, yellowish brown color, Clayey SILT with the trace of gravel.
Borehole terminated at 28.45m.
0.00/0.86/99.14
Sample
Pressuremeter Test(PRM)
Core Run
Vane Shear Test(VST)
Permeability/ Packer Test(PKT)
SPT N Value
Attempt TW/P/MZ/U
SPT Sample
UD – Undisturbed Sample
M – Mazier
U – Thick Wall Open Drive
C – Core Run
W – Water
PL – Plastic Limit
LL – Liquid Limit
REMARKS:
DATA QUALITY RATING

b) BH-2

PROJECT: Heho Airport Project
CLIENT: Nippon Koei Co., Ltd.
PROJECT NO:
LOCATION: Heho, Kalaw Tsp, Shan State, Myanmar.
DRILLING DATE STARTED: 4/6/2019
DRILLING DATE COMPLETED: 4/6/2019
LOGGED BY: Daw Tha Pyay
CHECKED BY: Daw YaMin Thu
DRILLING RIG: HGY-200
BOREHOLE DIA: 100mm
CORE DIA:
DRILLING METHOD: RWB
DRILLED BY: U Myint Win Aung

BORING LOG:
BH-3

Page- 1 of 2

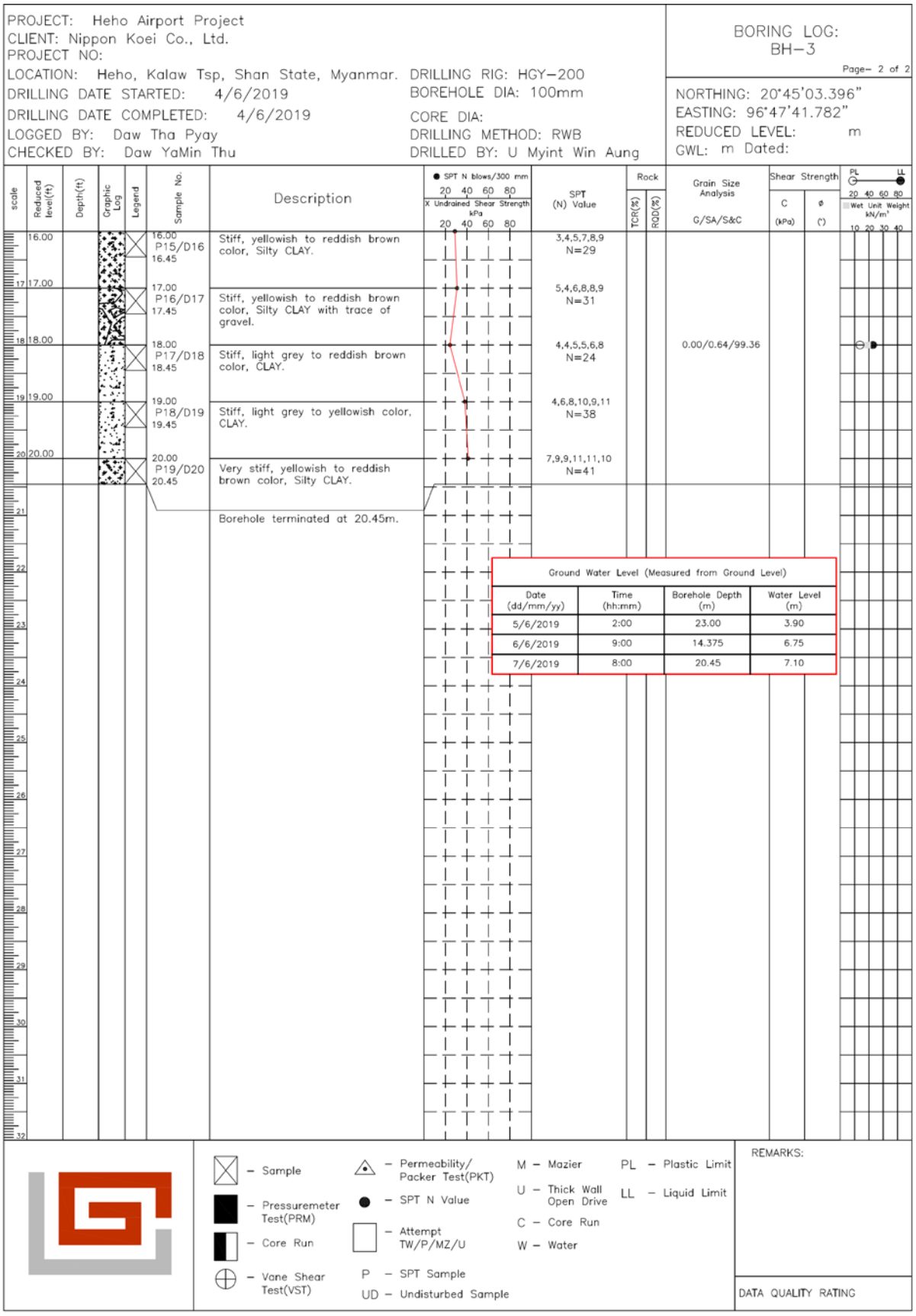
NORTHING: 20°45'03.396"
EASTING: 96°47'41.782"
REDUCED LEVEL: m
GWL: m Dated:

scale	Reduced level(m)	Depth(m)	Graphic Log	Legend	Sample No.	Description	SPT N blows/300 mm (20 40 60 80) / Undrained Shear Strength kPa (20 40 60 80)	SPT (N) Value	Rock TCR(%)	Rock RQD(%)	Grain Size Analysis G/SA/S&C	Shear Strength C (kPa)	Shear Strength ø (°)	PL LL (20 40 60 80) / Wet Unit Weight kN/m³ (10 20 30 40)
1	1.00				D1	Top Soil.		–						
					1.00 P1/D2 1.45	Firm, reddish brown color, CLAY with trace of gravel.		2,3,3,3,4,4 N=14						
2	2.00				2.00 P2/D3 2.45	Stiff, light grey and reddish brown color, CLAY.		2,3,4,5,5,6 N=20						
3	3.00				3.00 P3/D4 3.45	Stiff, light grey and reddish brown color, CLAY.		2,3,3,4,5,5 N=17						
4	4.00				4.00 UD1 4.45	UD1.								
5	5.00				5.00 P4/D5 5.45	Firm, light grey and yellowish brown color, CLAY.		3,3,3,4,4,4 N=15						
6	6.00				6.00 P5/D6 6.45	Stiff, yellowish to reddish brown color, CLAY.		3,3,4,6,5,6 N=21						
7	7.00				7.00 P6/D7 7.45	Stiff, light grey to yellowish color, CLAY.		3,3,5,5,6,7 N=23						
8	8.00				8.00 P7/D8 8.45	Stiff, light grey to reddish color, CLAY.		3,3,4,5,5,6 N=20						
9	9.00				9.00 P8/D9 9.45	Very stiff, light grey to yellowish brown color, CLAY with trace of gravel.		3,3,3,5,5,7 N=20						
10	10.00				10.00 P9/D10 10.45	Very stiff, yellowish to light grey color, SILT.		5,9,12,9,12,21 N=54						
11	11.00				11.00 P10/D11 11.45	Stiff, yellowish color, Clayey SILT with trace of gravel.		4,4,5,4,6,6 N=21						
12	12.00				12.00 P11/D12 12.45	Stiff, yellowish to reddish brown color, CLAY.		3,4,6,5,8,10 N=29						
13	13.00				13.00 P12/D13 13.45	Very stiff, yellowish brown color, Silty CLAY with trace of gravel.		4,4,5,7,7,15 N=34						
14	14.00				14.00 P13/D14 14.375	Very stiff, yellowish color, SILT.		6,14,12,17,25,– N=54			0.00/10.22/89.78			
15	15.00				15.00 P14/D15 15.45	Stiff, yellowish color, SILT.		9,9,6,5,7,7 N=25						
16														

– Sample
– Pressuremeter Test(PRM)
– Core Run
– Vane Shear Test(VST)
– Permeability/ Packer Test(PKT)
– SPT N Value
– Attempt TW/P/MZ/U
P – SPT Sample
UD – Undisturbed Sample
M – Mazier
U – Thick Wall Open Drive
C – Core Run
W – Water
PL – Plastic Limit
LL – Liquid Limit

REMARKS:

DATA QUALITY RATING



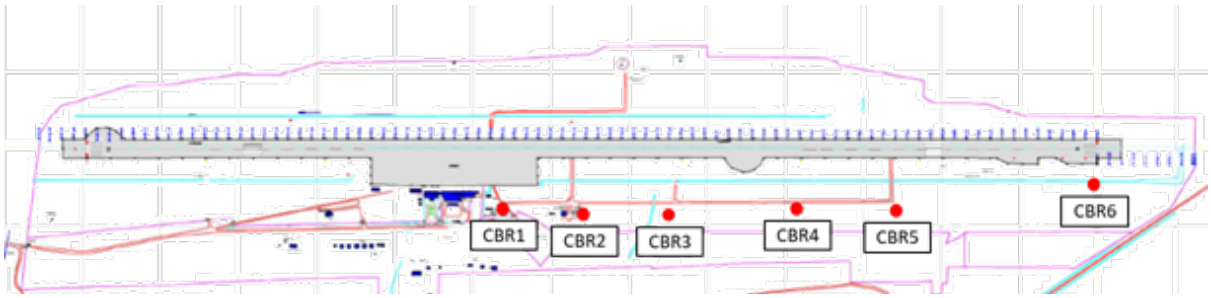
c) BH-3

Source: Geolab (Myanmar) Co., Ltd.

Figure 3-15 SPT Result (N-value) and Soil Distribution

(2) Laboratory CBR Test

CBR test samples were taken from six points on the east side of the runway. Figure 3-16 shows the sampling locations. Samples were taken from the northern side of the airport, which might become the cutting soil area of land preparation. Samples were taken below 50 cm depth from the ground surface since the surface layer might contain some impurities. The laboratory CBR test was conducted based on ASTM D1883. The water content of soil for the CBR test was adjusted to the optimum water content which was obtained from the Compaction Test (ASTM D698). Surcharge weight used for the test was 10 lb (4.54 kg). Laboratory CBR test results are shown in Table 3-8.



Source: The Study Team

Figure 3-16 Sampling Location for CBR Test

Table 3-8 CBR Test Results

Location	CBR(%)	Design CBR (%, embankment area)
CBR1	4.406	4.0
CBR2	5.711	
CBR3	4.242	
CBR4	4.161	
CBR5	3.998	
CBR6	5.058	

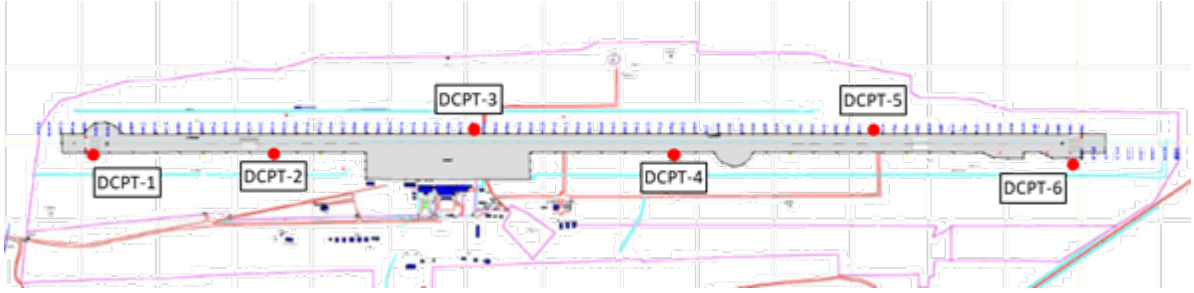
Source: The Study Team

From test results, the design CBR value of embankment soil taken from the northern side of the airport was calculated by using the formula (*), where CBR 2 is excluded for the design CBR calculation since the CBR value at the penetration piston depth of 0.1 inch was smaller than 0.2-inch depth.

$$\text{Subgrade Design CBR} = \text{Mean Value of CBR Test} - \text{Standard Deviation of CBR} \times 1.0 \quad (*)$$

(3) Dynamic Cone Penetration Test (DCPT)

The Dynamic Cone Penetration Test (DCPT) was conducted at six locations along the runway to determine the subgrade condition used for runway overlay design. Figure 3-17 shows the DCPT locations. DCPT was conducted from 110 cm excavated surface to consider runway pavement thickness. DCPT was conducted based on ASTM D6951.



Source: The Study Team

Figure 3-17 Dynamic Cone Penetration Test Location

From penetration depth records of every 5 blows (it may be less than 5 times when the lot is extended), cone penetration amount per blow, called DCP Index, are determined. DCP Index is converted into field CBR value by using the following formula:

$$\mathrm{CBR} = \frac{292}{DCP\ Index^{1.12}}$$

To determine the CBR value at each test location, the converted CBR value up to the 500 mm from the test surface was checked. The minimum converted CBR value from the range was adopted as the field CBR value of the location. The field CBR at each location is shown in Table 3-9.

Table 3-9 CBR Values Calculated from Test Results

Location	Field CBR	Design CBR
DCPT1	5	Southern Side 3.5%
DCPT2	3.7	
DCPT3	18	Northern Side 11%
DCPT4	11	
DCPT5	14	
DCPT6	20	

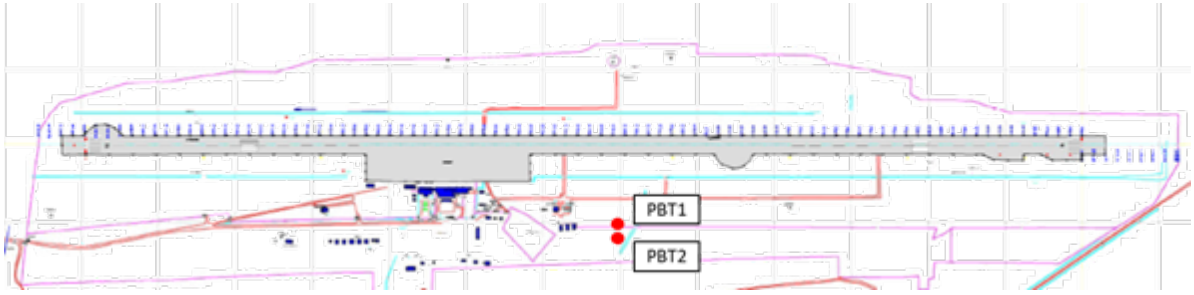
Source: The Study Team

From the test results, it can be seen that the CBR of the northern side of the airport (DCPT3~6) was more than 10% when the penetration depth of the lot was within 1,000 mm. On the other hand, the CBR value of the southern side of the airport (DCPT 1&2) is around 3% to 10%, except when part of the CBR value is extremely large. Therefore, it can be said that the subgrade strength of the northern area and the southern area is different. The design CBR value of each area was determined by using a minimum CBR value of each area. The design CBR value of the southern area is 3.5%, and the value in northern area is 11% (see Table 3-9).

(4) Plate Bearing Test

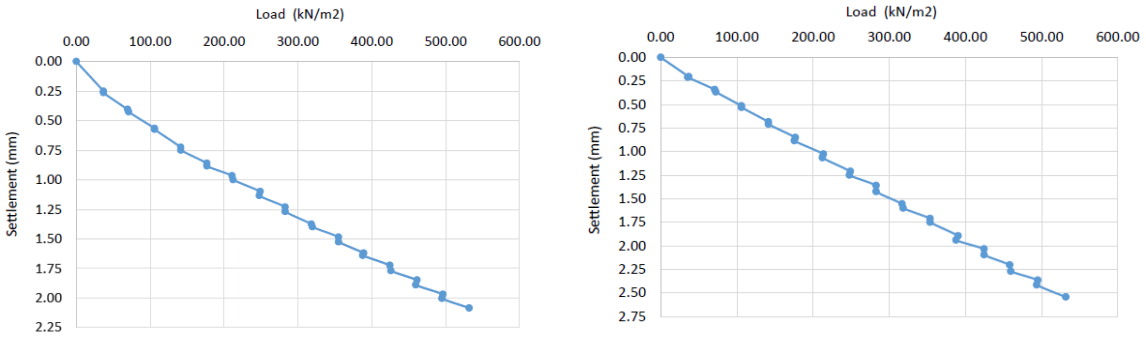
To determine the subgrade condition and to use the apron pavement design, the Plate Bearing Test was conducted (2 locations). Test locations are shown in Figure 3-18. The Plate Bearing Test was conducted based on ASTM D1194. The plate with 300 mm diameter was used for the test. The loading weight was increased to 0.25 ton-force (tonf) per 5 minutes. The maximum loading weight is 3.75 tonf. After reaching 3.75 tonf, the loading weight was decreased by 0.5 tonf each time. Each loading weight was kept for five minutes, and the settlement of ground at the start and end of loading time was recorded. Source: Geolab (Myanmar) Co., LTd.

Figure 3-19 shows the load–settlement curve for each testing location.



Source: The Study Team

Figure 3-18 Plate Bearing Test Location



a) PBT1 **b) PBT2**

Source: Geolab (Myanmar) Co., LTd.

Figure 3-19 Plate Bearing Test Result (Load – Settlement Curve)

The modulus of subgrade reaction k_{30}, obtained through the Plate Bearing Test with 30 cm diameter plate, is calculated using the following formula, considering applied load when settlement of ground was 1.25 mm.

$$k_{30} = \frac{Applied\ Load\ (\ kN/m^2)}{1.25(mm)}$$

For airport pavement design, subgrade reaction k_{75} obtained by the Plate Bearing Test with 75 cm diameter plate is used. Therefore, k_{30} is converted into k_{75} by using the following formula.

$$k_{75} = \frac{k_{30}}{2.5}$$

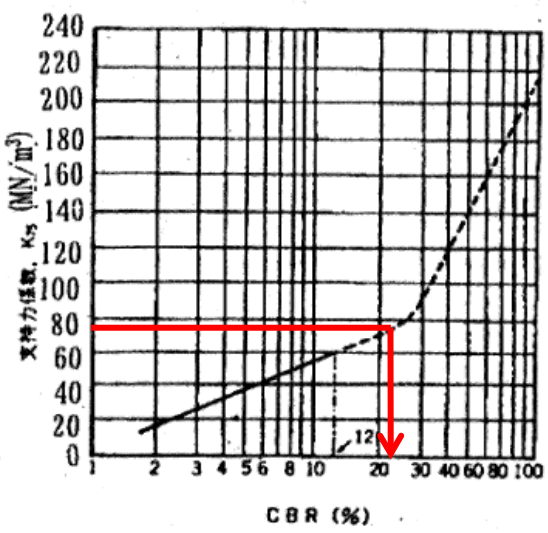
Subgrade reaction k_{75}, which is calculated for each test location, is shown in Table 3-10.

Table 3-10 Plate Bearing Test Result

Location	Subgrade Reaction K_{75}	Converted CBR Value
PBT1	89.6 MN/m^3	≧11%
PBT2	78.4 MN/m^3	

Source: The Study Team

Figure 3-20 shows the relationship between the CBR value and the subgrade reaction (k-value). From this relationship, it can be said that the CBR value at the Plate Bearing Test location should be over 11%.



Source: reference "Airport Pavement Design Manual and Design Examples"

Figure 3-20 Relationship between CBR and Subgrade Reaction (k-value)

3.6 Market Analysis

(1) Market Trend of Domestic Airlines

When the Survey Team visited Myanmar in May, interviews with Air KBZ, Myanmar Airways International, Myanmar National Airlines, and Golden Myanmar Airlines were conducted. Below are their market trends.

1) Air KBZ

- Owned airline by KBZ Group which is operating in the domestic route.
- They own eight ATR aircrafts. They are planning to purchase two ATR aircrafts and two Embraer aircrafts in the future.
- They intend to purchase ATR aircrafts because of the limited runway condition of domestic airports except Naypyidaw Airport, Yangon Airport, and Mandalay Airport.
- They currently have a total of ten departure flights per day during the high season (November ~ March) and six departure flights per day in the low season (April ~ October) at the Heho Airport.
- Air KBZ has a plan to expand domestic routes using Heho airport as a hub airport.

2) Myanmar Airways International

- Owned airline by KBZ Group which is operating in the international route from Yangon Airport and Mandalay Airport.
- They operate to Bangkok, Singapore, China (Guangzhou), Taiwan, Macao, and Kolkata.
- They own three A319 aircrafts and four A320 aircrafts.
- They currently do not operate at the Heho Airport. They will consider international flights in the future.
- Myanmar Airways International has a plan to expand international routes from Yangon Airport and Mandalay Airport at first stage. After Heho airport becoming international airport they will consider international route form Heho airport.

3) Myanmar National Airlines

- Myanmar National Airlines is the state–owned airline. They are operating domestic flights mainly from
- Yangon Airport as a hub. They are operating international flights partially.
- They own four B737 aircrafts, nine ATR aircrafts, and two Embraer aircrafts.
- Basically, they use Embraer aircrafts for international flights and ATR aircrafts for domestic flights.
- They currently have a total of six departure flights per day during the high season (November ~ March) and three departure flights per day in the low season (April ~ October) at the Heho Airport.

4) Golden Myanmar Airlines

- Owned airline by Co-operative Bank.
- They operate domestic flights from Yangon Airport as hub.
- They own two ATR aircrafts. They are planning to purchase one ATR in the future.
- They intend to purchase ATR aircrafts because of the limited runway condition of domestic airports except Naypyidaw Airport, Yangon Airport, and Mandalay Airport.
- They currently have a total of three departure flights per day during the high season (November ~ March) and three departure flights per day in the low season (April ~ October) at the Heho Airport.

(2) Market Analysis of Airlines and Travel Agencies

When the Survey Team visited Myanmar in May, interviews with the Myanmar Airlines and Myanmar travel agencies were conducted. Below is the market analysis. In addition, Bangkok Airways was also interviewed concerning their interest of international flight to the Heho Airport.

It can be said that the Heho Airport has high potential as an international airport because half of the passengers are foreigners in average (foreign passenger ratio will increase in high season) and especially because there is a large number of tourists from Europe.

Located at the center of Shan State, the catchment area of the Heho Airport is quite large. As widely known, there are many tourist spots in Shan State such as the Inle Lake and other historical spots. The trend of tourism in Myanmar is traveling around Bagan and Shan State together as a package tour. There were many expectations from airlines and travel agencies that tourist demand will further increase due to Bagan being named as a United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage Site.

As mentioned above, it is clear that many tourist passengers use the Heho Airport, but there are many business passengers using the Heho Airport as well. The passenger ratio is 70% tourists and 30% business in high season (November ~ March), but the passenger ratio will reach an average of 50% tourists and 50% business.

In addition, airlines indicated the cargo demand from the Heho Airport due to abundant agricultural products in Shan State, such as vegetables, fruits, and flowers. To carry cargoes from the Heho Airport, wide-body passenger aircrafts or cargo freighter service is necessary.

As mentioned above, the Heho Airport has both tourist demand and business demand, and there is a high possibility for international flights in the future. It is possible to fly from Thailand, China, and Laos to the Heho Airport aboard narrow body aircrafts due to the airport's location advantage.

When the Survey Team interviewed Bangkok Airways, they said that they were studying the feasibility of launching a new international service to the Heho Airport for a long time. They expressed their strong interest to start the new international operation at the Heho Airport.

The Department of Civil Aviation intends to make the Heho Airport an international airport, and they are under negotiation with MJAS to amend the concession agreement so that the Heho Airport can become an international airport.

(3) Request on Airport Facilities from Airlines and Travel Agency

When the Survey Team visited Myanmar in May, interviews with the Myanmar Airlines, Myanmar travel agencies, and Bangkok Airways were conducted. Below are their requests on airport facilities.

Flight delays and flight cancellations occur in the morning due to the influence of foggy weather during winter. Many airlines requested for an upgrade in airport lighting facilities and ILS to avoid flight delays and cancellations.

Airlines and travel agencies pointed out below their requests concerning the passenger terminal building and the airport access:

- Installation of VIP and airline lounge;
- Installation of agent booth for hotel and taxi arrangements;
- Installation of souvenir shop;
- Installation of PBB for international flight; and
- Improvement of airport access form downtown.

To accept international flights, improvement of ground handling service, catering services, and aircraft fuel supply service were requested by the Bangkok Airways.

3.7 Consideration of Measures for Future Demand Expansion

3.7.1 General

In this section, measures for the capacity expansion of the Heho Airport are being considered, taking into account the future demand due to the development of surrounding areas of the airport. The study area is mainly the South Shan area, where there is demand for utilization of the Heho Airport as passenger and cargo use. In particular, the survey covers the area from Kalaw and Aungpan in the western region of the South Shan area to Taunggyi and Hopong through National Road No. 4. The study area in South Shan area is shown in the following map.

Source: Myanmar Information Management Unit

Figure 3-21 Location Map of South Shan Area and Study Area (shown as red colored circle)

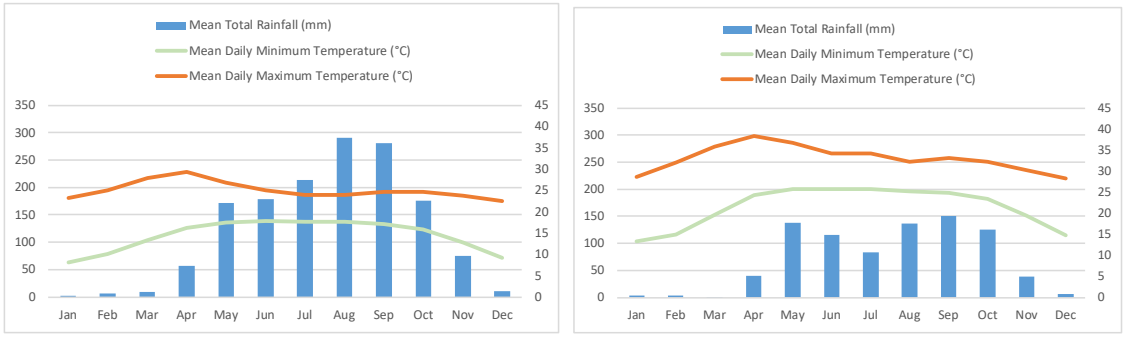
The total geographical area of the South Shan area is 21,653 square miles (approximately 560,000 km^2), and the population is 2.4 million (2015-16, Source: Shan State Government). The per capita gross domestic product (GDP) of the South Shan Region is about USD 524 (2015-16, Source: Shan State Government), which accounts for about 40% of the Shan State's total GDP. The major industries are agriculture, agro-processing, commerce, mining, and tourism. Looking at the GDP by industry, 36.7% is agriculture, 24.4% is industry, and 38.9% is service (2015-16, Source: Ministry of Planning and Finance). About 50% of the population is engaged in agriculture related industry (2012-13, Source: Department of Labor). The South Shan Region is good for agriculture as it has cooler climate compared to other regions in Myanmar. In addition, Shan State has good potential tourism resources, such as the Inle Lake. A large number of tourists, including foreigners, are attracted to Shan State.

Among the industries in the South Shan area, the Survey Team is focused on the agriculture and tourism sector, which contributes to the potential expansion and usage of the Heho Airport. In the following sections, the general condition of agriculture and tourism is confirmed.

3.7.2 General Conditions of Agriculture in the South Shan Area

(1) Climate Conditions of South Shan Area

The agro-climatic area in Myanmar is generally divided into four categories, namely 1) "Dry Zone" which includes the western part of Myanmar, 2) "Mountain Zone" which includes Shan State, 3) "Delta Zone" which includes the Ayeyarwady River mouth area, and 4) "Coastal Zone" which includes the southern area of Myanmar. Among the four categories, the "Mountain Zone", where Shan State is located, has an area with an annual rainfall of about 1,000 to 2,000 mm and a relatively high altitude. Because of this, the climate is cool and suitable for producing high value crops, such as vegetables, fruits, and flowers. In addition, there are several regions with different elevations in Shan State. Therefore, the harvesting time of crops can also be varied. The weather conditions of Mandalay (located in the "Dry Zone") and Taunggyi in Shan State (located in the "Mountain Zone") are shown below.



Source: World Meteorological Organization

Figure 3-22 Climate Conditions of Taunggyi (left) and Mandalay (right) in 30 years average

(2) Major Agricultural Products in South Shan Area

The cultivated area in the South Shan area is about 1.13 million acres (about 530,000 ha), according to Shan State Investment Opportunity Survey 2017. In Shan State, various crops are grown due to the diversity of climate conditions. Compared with other states and regions, fruit and vegetable cultivation is popular. In Shan State, avocado, cabbage, coffee, tomato, mango, tea, potato, ginger, garlic, etc., are cultivated. Shan State is the major production area of these crops in Myanmar. Around the Heho area, flower cultivation is also popular, including chrysanthemum, roses, and lilies. Strawberry is cultivated in areas such as Taunggyi and Hopong. These crops are also shipped to large cities in Myanmar, such as Yangon, and some are exported by land to China.

The cultivation areas of major crops in the South Shan area are as follows:

Table 3-11 Cultivation Areas of Major Crops in the South Shan Area (acre)

Name of Crops	Southern Shan
Rice	574,260
Wheat	21,224
Corn	3,371
Oil Crops	255,485
Ground Nut	66,251
Sesame	23,026
Sunflower	26,045
Mustard	3,487
Rubber	1,128
Potato	43,511
Maize	22,436
Mango	15,179
Pulses and Beans	226,436
Coffee	10,691
Mandarin Orange	11,060
Tea	58,146

Source: Shan State Investment Opportunity Survey 2017

According to the interview from the Shan State Office of Myanmar Fruit, Flower, and Vegetable Producer and Exporter Association (MFVP), which is a related organization of the Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI), MFVP recognizes that the following crops in Shan State have high potential for markets, namely potato, ginger cultivation around the Kalaw area, flower (chrysanthemum, rose, lily, etc.) cultivation in the Heho area, and tea and coffee production in Pindaya and Pinraung area. These crops are recognized in Myanmar as high-brand value and high-quality agriculture products.

(3) Present Conditions of Agriculture Production in South Shan Area

Based on the results of the field survey, the present conditions of agricultural production in the South Shan area are summarized as follows:

Table 3-12 Present Conditions of Agricultural Production in the South Shan Area

Field	Present Conditions
1) Agriculture support services	✈ Public agriculture extension services by "Extension Workers" of state agriculture office and human resource development by the State Agriculture Institute (SAI) are provided, but their technical level is not high, and there is a shortage of human resources. ✈ Private companies, including foreign-affiliated companies in Shan State, are often carrying out contract farming with farmers in Shan State and providing technical advices of cultivation and materials to farmers.
2) Farmers and agricultural production corporations	✈ There is not much collaboration among individual farmers, especially across ethnic groups. ✈ The technical level of cultivation management and pest control is not high, but there is a tendency of farmers to actively work on new agriculture products. ✈ Several companies, such as V-Fresh, start to employ foreign agricultural engineers and perform high-level facilities horticulture (cultivated items: mini tomatoes, cucumbers, melons, strawberries, lettuce, etc. See photos below). ✈ Flower cultivation (see photo below) is becoming popular around the Heho Airport area, and there is high demand from overseas countries, such as Thailand. Some flower producers bring their products by air to the border city in Myanmar, such as Tachileik, and sell them to Thai flower traders.
3) Agricultural input and equipment	✈ Several foreign seed companies (Thailand, Taiwan, the Netherlands, etc.) are operating in Shan State. Good quality varieties are becoming available. ✈ A certain long period is required for breed registration, and the large number of illegal breeds of varieties pose a problem for foreign seed companies. ✈ In recent years, materials for horticulture, such as poly-house materials and sprinklers, are more readily available.

Field	Present Conditions
4) Agricultural machinery	✈ Foreign agricultural machinery companies of China, India, Japan, etc., started to operate in Shan State. Agricultural machineries necessary for cultivation are currently available in Shan State.
5) Agriculture logistics and marketing	✈ In urban areas such as Yangon, there is an increasing number of health conscious customers, and high value-added crops such as organic vegetables have high prices. ✈ The main case is that individual farmers sell agricultural products through a middleman, but the number of contract farming with agricultural processing company is also increasing. ✈ A cold chain service is provided by Premium Sojitz Logistics Co., Ltd. (PSL), and it is possible to transport fresh agriculture products in a refrigerated or frozen status to large cities such as Yangon and Mandalay.
6) Value addition activities such as agro-processing	✈ Myanmar Belle Company operates a contract vegetable farming and a dehydrated vegetable factory using their products. The total number of agricultural processing industries in Shan State is not very large. ✈ Maw Shan Company operates a tea processing factory in Pindaya. The company purchases raw materials of tea from tea leaf farmers in the Pindaya area. The company also provides a technical assistant for cultivation and obtained organic certification. ✈ The local government and private companies in Pindaya area are planning to open a shop for the promotion of tea brand of Shan State, where customers can taste many tea varieties.

Source: Prepared by the Study Team based on the interview from related organizations in Shan State

Strawberry cultivation (after harvested)

Lettuce cultivation in poly house

Flower cultivation in the Heho area

Sorting process of tea leaves in the factory

(4) Analysis of Problem and Issues on Agriculture in South Shan Area

The development of the agricultural sector in Shan State in the short term has no direct effect to the increase in number of passenger and cargo demand for the Heho Airport. However, it has high agricultural potential, and exports of high value-added crops will lead to increase in demand for future international flights and cargo flights. For future demand expansion through the development of the agriculture sector, the problems and issues of the agriculture sector are analyzed as follows:

1) Continuous efforts to improve the technical level of individual farmers

In Shan State, the cultivation potential of high value-added crops, including vegetables, is high due to its geographical conditions. Flower, tea, and coffee produced in Shan State also has high brand value in Myanmar. Especially for flowers, it is considered as the high potential products for freight since some products are imported to the neighbor countries through the domestic flights until the border area.

In the agricultural sector, foreign companies related to agriculture have started operating in Shan State in recent years. Infrastructure for production, distribution, and processing of agricultural products is being developed, especially by the private companies. Foreign seed companies in the US, Europe, and Asia have entered into the market. Farmers can now purchase quality seeds easily compared before. Agricultural materials, such as agricultural chemicals, fertilizers, and houses, have become easier to obtain. Agricultural machinery is available from Japanese, Chinese, and Indian companies. Regarding logistics and marketing of agriculture, cold chain services in Shan State, although limited, have started to be provided.

However, in terms of individual farmers, due to a weak agricultural extension system by the public sector, the level of farming technology is low. The technical level of extension workers and agricultural school staff, who should give instructions on agricultural technology, would be also low. Although the quality of agricultural products seems to be improving through the technical assistance from individual agriculture related companies and non-government organizations (NGOs), it still does not satisfy the high value market, such as foreign market.

It is not common for farmers in the Shan area to cooperate in cultivation, so it is difficult for them to individually invest in facilities of horticulture, such as poly houses.

Improving the technical level of farmers is considered to be so important for maximizing the potential of agriculture in Shan State. Continuous efforts to support agriculture production and farmers are the main issues for future demand expansion of the airport.

2) Promotion of agricultural processing industry in South Shan area

Agro-processing is an option for adding value to agricultural products. Although Shan State already has agro-processing industries, such as dried vegetables and tea products, there are only a few industries. It is possible to increase the demand for use of airport cargo and business trips by promoting the agro-processing industry. These agro-processing industries also play important roles in agricultural technical support and in improving the technical level of farmers. In addition, agro-processing industries will possibly provide employment opportunities for farmers in the off-season.

3) Higher value addition and increased income opportunities for farmers by linking with tourism

By linking agriculture with the tourism sector, which is one of the major industries in Shan State, it could be possible to achieve high value addition to the agriculture sector, as well as increase income opportunities for farmers. Shan State already has high brand value in Myanmar in terms of both agricultural production and tourist destination. The linkage of agriculture and tourism, such as tourism farms, has high potential and could expand the number of tourists and increase farmers' income.

3.7.3 General Conditions of Tourism in South Shan Area

(1) Major Tourism Resources in South Shan Area

1) Inle Lake

The largest resource for tourism in the South Shan area is the Inle Lake. It is the largest tourist destination in Shan State, mainly for western tourists, and the number of hotels around Inle Lake has increased rapidly as described. In Inle Lake, local residents living on water, vegetable cultivation on the floating island, bird watching, and pagoda around the lake attract tourists. Nearly 100% of tourists visiting the South Shan area through the Heho Airport visit Inle Lake. On the other hand, water quality has deteriorated due to the rapid development of hotels and waste discharge of residents to the water. This could be a future problem of Inle Lake. The entrance fee (MMK 15,000/person) to the Inle Lake area is collected for conservation of the area, but the usage is not clearly disclosed in the entrance fee. According to the tourism association, Shan State collect the fee, however, the collecting works of the fee is subcontracted to private companies.

Water Floating Residence in Inle Lake

Traditional Fishery by Boat in Inle Lake

2) Trekking

A trekking route in the mountainous part of the South Shan area from Kalaw, which serves as a base town for a couple of days, is one of the popular tourist routes. Similar to Inle Lake, many American and European backpackers visit the area. In particular, the three-day route from Kalaw to Inle Lake is popular.

3) Buddhist ruins

Many ancient Buddhist ruins remain in the South Shan area. The cave pagodas in Pindaya and the Kaku Temple are especially popular with tourists. Due to the distance, not all tourists visit the Inle Lake, but its potential as a tourist destination is high.

4) Cultural diversity and minorities

Shan State is an area with 34 ethnic minorities, such as Pao, Danu, and Palaun. These ethnic groups have different cultural characteristics and have high ethnic and cultural diversity. These groups have high potential as tourism resources in Shan State.

5) Balloon Festival

Many tourists are interested in the Balloon Festival, which takes place every year on a full moon day in November in Taunggyi. It is a traditional Buddhism festival of the Shan. People fly many balloons and light fireworks.

(2) Number of Tourists and Hotels in Shan State

1) Tourists in Shan State

The table below shows the number of tourists from overseas countries in Myanmar.

Table 3-13 Number of Tourists from Overseas Countries in Myanmar (2017)

Region	Visitors	Percent (%)
Asia	953,801	69.98
West Europe	239,358	17.56
North America	87,153	6.39
Oceania	37,644	2.76
East Europe	20,069	1.48
Other Americas	12,592	0.92
Middle East	6,465	0.48
Africa	5,866	0.43

Source: Directorate of Hotel and Tourism

The table below shows the number of visitors in Shan State.

Table 3-14 Number of Visitors in Shan State (2016)

Regions	Domestic	International	Day Return Visitors
Southern Shan	400,051	252,750	0
Northern Shan	88,564	22,897	228,418
Eastern Shan	82,757	62,081	1,369,566
Total	571,372	337,728	1,597,984

Source: Directorate of Hotel and Tourism

In Shan State, approximately 650,000 people visit annually, where 250,000 of which are foreign tourists. Myanmar has many tourists from Asian countries, such as Thailand, China, and Japan, but according to the interview with the Union of Myanmar Travel Association (UMTA) of Shan State Office, about half of the tourists visiting Shan State are Americans and Europeans. However, in recent years, European and American tourists are declining especially due to political issues in Myanmar. According to the travel agencies, Thai tourists, which account for 20% of the tourists visiting Myanmar, often return home only for sightseeing around the Yangon area. However, the travel agencies predict that tourists to Heho Airport area will increase after starting operation of international airports at Heho Airport from Thailand.

On the other hand, according to the survey result at the check-in counters by KBZ Company, more than half of the annual domestic passengers in the Heho Airport are business passengers with business in Shan State. For this reason, the Heho Airport has a stable demand for business passengers.

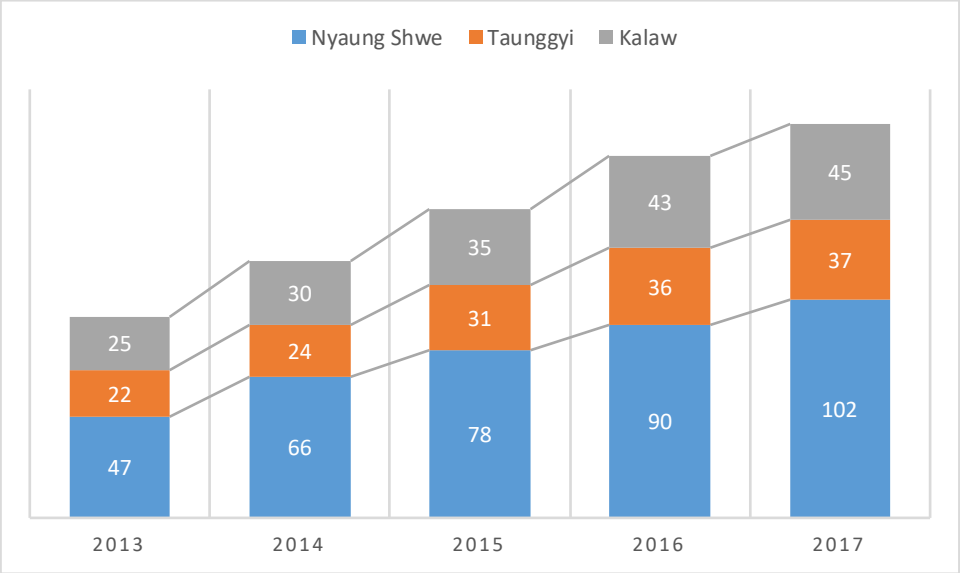
2) Number of Hotels in Shan State

The trend in the number of hotels in the major cities of the South Shan area (Kalaw, Nyaung Shwe, and Taunggyi) is as follows.

Table 3-15 Number of Hotels in Major Tourist Place in Shan State

	2013	2014	2015	2016	2017
Nyaung Shwe	47	66	78	90	102
Taunggyi	22	24	31	36	37
Kalaw	25	30	35	43	45
Whole Myanmar	923	1,106	1,279	1,432	1,590

Source: Directorate of Hotel and Tourism



Source: Directorate of Hotel and Tourism

Figure 3-23 Number of Hotels in Major Tourist Place in Shan State

In the last five years, the number of hotels has increased rapidly in the three major cities in the South Shan area. The number of hotels has increased significantly in five years, especially in Nyaung Shwe, where majority of the tourists visiting Inle Lake choose to stay. This is higher than the increase in number of hotels in Myanmar. Hotel development in the South Shan area could be rapidly advancing. However, according to interviews with the Shan Sta Tourism Association, hotel occupancy rates have been stagnant due to the recent decline in number of tourists caused by political problems, etc. The hotel occupancy rate around Nyaung Shwe last year was estimated at about 50%, and at present, hotels in the South Shan area are considered to be in an oversupply situation.

On the other hand, integrated development plans for hotels, golf courses, etc., by KBZ are in progress around the Heho Airport.

(3) Existing airport surrounding area development plan in the tourism sector

The KBZ Group, in a joint venture with several companies (24 Hours Group, MAI, ATR Agro Myanmar, Agro 24 Co., Ltd, etc.), plans to develop a resort complex that combines accommodation, residential area, commercial facilities, and golf courses near the Heho Airport. The project is called the “Heho Garden Villa Project”.

The total cost of the development project is estimated at USD 20 million. The development area is about 300 acres (about 120 ha), and according to interviews with KBZ staff, land acquisition has already been completed.

Currently, it is under the process of issuance of permit from the government. Construction works is scheduled to start in October 2019. Investment decision of this project was already done. Even though without the development project of Heho Airport, this project is scheduled. They expect multiplier effects caused by the airport development project. It is planned to build golf courses and hotels before the expansion of the Heho Airport. KBZ would decide whether to construct residential area and commercial facilities according to the increase in number of guests for the golf course and hotel. The hotel will have over 100 rooms. The expected guests are foreigners from Western countries.

In the South Shan area, there are several golf courses, such as Aye Thar Yar Gold Resort near Nyaung Shwe, Taunggyi Gold Club in Taunggyi, and Aungpan Gold Club near Aungpan. According to KBZ, these golf courses are owned by the Army and the quality of the courses is not at the international level. KBZ is planning to develop a golf course of international high-quality standard. The construction of a new golf course may lead to a new demand of tourists in the South Shan area. The development project could have a high synergistic effect with the launch of international flights, especially to Thailand by the Heho Airport development.

Source: The KBZ Group

Figure 3-24 General Layout of Heho Garden Villa Project

(4) Analysis of Problem and Issues on Tourism in the South Shan Area

The Heho Airport is used by both business travelers and tourists, which has a stable passenger demand. It is estimated that this demand will continuously grow in the future with the economic growth of Myanmar. For further expansion of the demand, it is necessary to develop new demand, especially for tourists in Shan State.

The following analysis was carried out on the issues for increasing the number of passengers and demand for the Heho Airport through tourism development in the South Shan area.

1) Maintenance of the tourism value of Inle Lake

Shan State has very rich tourism resources including Inle Lake, but at present, the tourism sector in the South Shan area highly depends on Inle Lake to attract tourists. Although there are other tourism resources such as trekking, the destination for nearly 100% of tourists visiting the South Shan area is Inle Lake. Therefore, it is important to maintain the value of Inle Lake as a tourism resource in the future.

However, the water quality of the area around Inle Lake is deteriorating due to the recent development of tourism, such as operation of more hotels. In addition, the types of birds that can be observed by bird watching are also decreasing. If development continues without any control, the attractiveness of Inle Lake as a tourism resource could decline, and there might be a reduction in the number of tourists visiting Shan State.

It will be an issue to maintain the environmental aspect of Inle Lake, which is a valuable tourism resource in the Shan area so that it can be expected to attract tourists continuously even in the future.

2) Implementation of activities attracting non-European tourist

According to the interview, in recent years, European and American tourists are decreasing due to political issues in Myanmar. Majority of tourists in Shan State are from Western countries; therefore, attracting non-Western tourists is also important to further increase the number of tourists visiting Shan State. Under the current situation, the hotel is considered to be in oversupply condition, so it is necessary to create new tourist demand other than the existing Western tourists. In particular, it is imperative to attract Asian tourists, who account for 70% of the tourists visiting Myanmar, to the South Shan area through marketing efforts targeted to new tourists. Especially, Thailand tourists are the highest priority for the target since the international flights are considered by the airlines. In addition, the tourists from Islamic countries such as Indonesia and Malaysia

can be also high priority for the target from the point of view of the tourism resources in Shan States. It is also assumed that the tourists from Europe are also main tourists continuously even in the future, and the key of demand expansion is to take Asian tourists into Heho Airport in parallel with European tourists. In the second phase survey, high potential countries and prioritization will be studied in detail as much as possible.

3) Attractive tourism development with the use of various tourism resources in the South Shan area

It is recognized that ethnic diversity and culture are other valuable resources in Shan State, but these are not fully utilized as tourism resources. It is considered that tourists are attracted to the cultural characteristics of an area, such as people living on the lake and vegetable cultivation on floating islands in Inle Lake, thus improving the attractiveness of this cultural diversity as a tourism resource is an important issue.

The branding of Shan State as a place with various tourist destinations is also a critical issue. Shan State has diverse tourism resources compared with other tourist destinations in Myanmar, such as Bagan. Maximum utilization of exiting tourism resources and development of new tourist destinations with utilization of both natural and cultural resources in Shan State are necessary to increase future demand of tourists.

In addition, it is important to enhance the attraction as a tourist destination by cooperating with agriculture, which is another major industry in Shan State.

3.7.4 Consideration of Measures for the Expansion of Future Demand of Heho Airport

As described so far, Shan State has unique geographical features compared to other states. The state is also rich in tourism resources. Because of this, differentiation from other regions and states in Myanmar is possible in terms of airport demand, which is competitively advantageous for the development of the Heho Airport. It can be said that there is a stable demand because the Heho Airport has passenger demand for both business and tourism purposes. Necessary measures to achieve further expansion of the Heho Airport are considered for potential future international and cargo flights.

Based on the current situation of the agriculture and tourism sector as described so far, the results of examining the measures for future demand expansion of the Heho Airport are shown below. In the agricultural sector, the Study Team recognized that it is important to revitalize the agriculture sector by attracting the investment of agriculture-related industries, including foreign capital to Shan State by taking full advantage of its agricultural potential. In the tourism sector, it is necessary to utilize the diverse tourism resources of Shan State and to increase the number of tourists from areas other than US and Europe. The attraction of Inle Lake as the backbone of Shan State tourism sector needs to be maintained.

Table 3-16 Problem and Issues on Agriculture/Measures for Expansion of Future Demand

Problem and Issues	Measures for Expansion of Future Demand
1) Continuous efforts to improve the technical level of individual farmers	1)-1 Strengthening agriculture extension services by public private partnership
	1)-2 Invitation of agriculture expert from foreign countries for technical cooperation of cultivation techniques for high export potential agriculture products (flowers, fruits, etc.)
	1)-3 Introduction of certification system of active farmers and introduction system of farmers to private companies
2) Promotion of agricultural processing industry in the South Shan area	2)-1 Introduction of preferential treatment system to companies which support farmers or use of agriculture products for processing from Shan State
	2)-2 Invitation of foreign agro-processing and agriculture related companies, especially to target countries of international flights for the Heho Airport such as Thailand
3) Higher value addition and increased income opportunities for farmers by linking with tourism	3)-1 Supporting activities for the establishment and management of tourism farm in Shan State
	3)-2 Development of tourist courses for tea production, winery, and other unique agro-processing in Shan State

Source: The Study Team

Table 3-17 Problem and Issues on Tourism /Measures for Expansion of Future Demand

Problem and Issues	Measures for Expansion of Future Demand
1) Maintenance of the tourism value of Inle Lake	1)-1 Maintenance of value of Inle Lake as tourist destination by environmental conservation including cooperation with JICA project for Inle Lake
	1)-2 Better utilization and disclosure of use of the entrance fee of Inle Lake
2) Implementation of attraction activities for non-European tourists	2)-1 Development of tourist routes and implementation of promotional activities in order to attract short-stayed Thai tourists to Shan State
	2)-2 Development of tourist routes, introduction of halal certification, and implementation of promotional activities for tourist attractions targeting people from Islamic areas, such as Indonesia
	2)-3 Tourism development targeting high-income classes from Myanmar and Asian countries, such as golf tourism
3) Attractive tourism development with the use of various tourism resources in the South Shan area	3)-1 Strengthening of tourism brand of Shan State with the integration of cultural resources, natural resources, and agriculture
	3)-2 Creation of new tourism resource utilizing the natural environment of Shan State, such as green tourism, eco-tourism, and adventure tourism

Source: The Study Team

It is necessary to consider the following points in the future survey on the abovementioned future demand expansion measures:

- Examine the details of the demand expansion measures through a detailed survey;
- Prioritize the demand expansion measures;
- Study the implementation organization, including both public and private participation on the demand expansion measures;
- Examine the implementation schedule; and
- Examine the fund securing the implementation of measures.

According to the result of hearing survey at the site, the efforts for the future demand increase by private sector are seen. However, it is possible to set up a public-private council, with the participation of the Shan State government and the Chamber of Commerce and industry-related organizations, and to examine the details through these councils since the measures for demand expansion will be important for each public-private sector. It is also an important factor for the expansion of airport demand so that organizations of relevant public and private sectors consider the expansion of the Heho Airport as an opportunity and unitedly aim for the growth of Shan State industry through the use of the airport.

Chapter 4 Project Implementation Plan

4.1 Objectives of the Project

The Heho Airport is the gateway to Shan State. The Inle Lake is located near the Heho Airport, where many foreign tourists visit.

The population of Shan State is about 5.8 million as of 2014, and the development of Heho Airport will be important in attracting industries.

4.2 Demand Forecast

Based on the demand forecast described in the RFP set by DCA, we examined the possibility of introducing an international flight and the timing of aircraft aircraft switching (introduction of jet aircraft).

The demand forecast values described in REP and their growth rates are shown in the table.

Table 4-1 Domestic Passenger Demand Forecast

Year	Domestic Passengers (,000)	Yearly Average Increase Rate
2008	121	-
2009	171	-
2010	227	-
2011	301	-
2012	378	-
2013	385	-
2014	408	-
2015	423	-
2020	681	10.0%
2025	1,096	10.0%
2030	1,466	6.0%
2035	1,963	6.0%

Source: RFP

In this project, considering 20 years as the operation period from the start of operation 2020, the demand after 2035 of the demand forecast value of RFP was calculated. Increase rate of domestic passenger after 2035 is 3.0%.

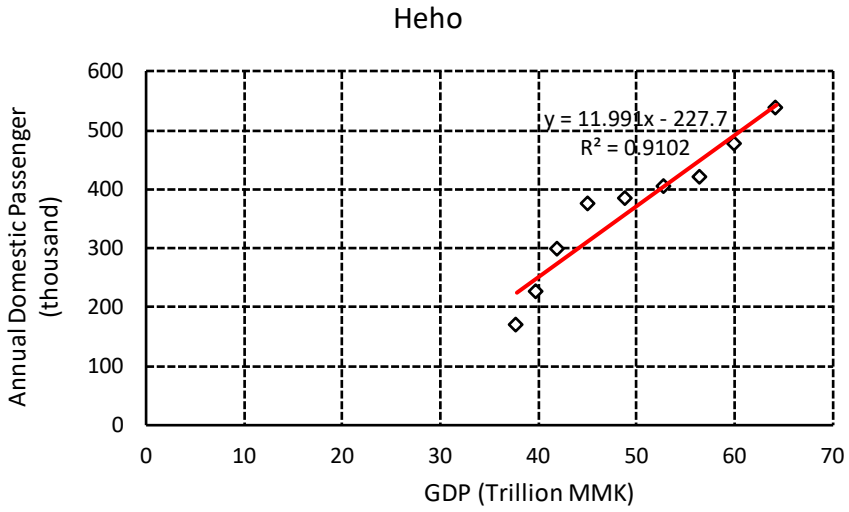
The table shows the demand forecast set additionally.

Table 4-2 Added Domestic Passenger Demand Forecast

Year	Domestic Passengers (,000)	Yearly Average Increase Rate
2008	121	-
2009	171	-
2010	227	-
2011	301	-
2012	378	-
2013	385	-
2014	408	-
2015	423	-
2020	681	10.0%
2025	1,096	10.0%
2030	1,466	6.0%
2035	1,963	6.0%
2040	2,276	3.0%
2045	2,638	3.0%
2049	2,969	3.0%

Source: The Study Team

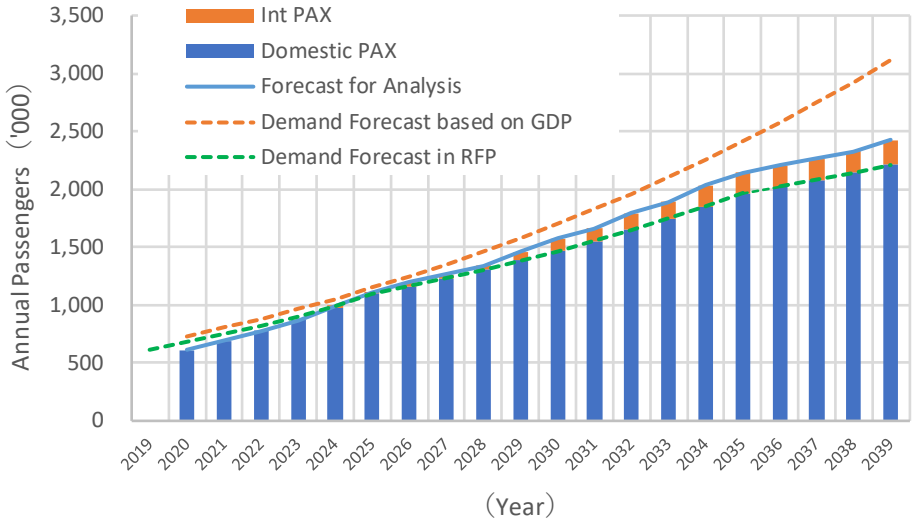
The demand forecast adopted the forecast model using GDP as an explanatory variable, and the correlation equation between the number of domestic passengers at the Heho Airport and GDP up to 2017 was calculated.



Source: The Study Team

Figure 4-1 Correlation Equation of Annual Domestic Passenger and GDP

The future GDP growth rate will use the IMF forecast rate until 2022, 7.5% from 2023 to 2025, and 0.1% decrease each year after 2026.



Source: The Study Team

Figure 4-2 Demand Forecast

The demand forecast calculated by the correlation equation with GDP is larger than the demand forecast shown in the Request for Proposal (RFP) of the concession business contract.

In this study, the number of domestic passengers is to be matched with the RFP, but the demand forecast shown in the RFP refers to the number of domestic passengers only and does not include international passengers. The interviews with airlines confirmed that they are willing to place their service at the Heho Airport, therefore the Study Team will use the schedule below and the number of international passengers will be added to the domestic passengers.

- International flight operation (turbo prop, ATR72) starts in 2024
- International flight operation (Jet, A320) starts in 2029

As for international flights, it was assumed that there was a demand for international flights from Southeast Asia (especially Thailand) and South China to Heho Airport as a result of interviews with travel companies and airlines.

It is necessary to develop CIQ facilities at the airport for international flights, and the service will be started after the completion of new passenger terminal building. Therefore, operation of CIQ facilities will be made in 2023 and international flight will start from round trip of ATR 72 in 2024.

In addition, considering that the number of passengers in 2018 decreased from 2017, the demand forecast in this survey is smaller than that in the RFP from 2020 to 2024, and the same value as that in the RFP from 2025.

The number of annual takeoffs and landings was calculated by dividing the annual passengers by the number of passengers per aircraft (60% load factor for domestic flights), taking the load factor into consideration.

Table 4-3 Demand Forecast of Takeoff and Landing Flight

No	Year	Prop（ATR72）		Jet（A320）		Total
		Int	Dom	Int	Dom	
1	2023	0	17,750		0	17,750
2	2024	300	19,120		0	19,420
3	2025	300	17,760		3,650	21,710
4	2026	700	18,820		3,870	23,390
5	2027	700	19,950		4,100	24,750
6	2028	700	21,150		4,350	26,200
7	2029	0	22,420	700	4,610	27,730
8	2030	700	16,970	700	8,140	26,510
9	2031	700	17,990	700	8,630	28,020
10	2032	0	19,060	1,400	9,150	29,610
11	2033	0	20,210	1,400	9,700	31,310
12	2034	700	21,420	1,400	10,280	33,800
13	2035	700	13,630	1,400	15,270	31,000
14	2036	700	14,040	1,400	15,730	31,870
15	2037	700	14,460	1,400	16,200	32,760
16	2038	700	14,900	1,400	16,680	33,680
17	2039	1,400	15,340	1,400	17,180	35,320
18	2040	1,400	15,800	1,400	17,700	36,300
19	2041	1,400	16,280	2,100	18,230	38,010
20	2042	1,400	16,770	2,100	18,780	39,050
Total		13,200	353,840	18,900	202,250	588,190

Source: The Study Team

According to the airlines, the main aircraft of the airlines for domestic flights is ATR-72 because the most domestic airports such as Heho Airport cannot accommodate jet aircrafts. They have a intention that they will introduce jet aircrafts if the domestic airport could accommodate jet aircrafts. Therefore, in the air-traffic demand forecast, jet aircrafts for domestic flights start to be operated in 2025 after the completion of the runway pavement overlay works.

It is assumed that it will be started to operate international flights from Bangkok at first. After that, flights from China and Southeast Asia will be expected. In Mandalay International Airport, international flights from Chiang Mai, Singapore, China have been increased even though the international flights were only from Bangkok and Kunming at first.

The aircraft movements in 2018 include round route flights like Mandalay – Heho – Tachileik. In case of the round flights, the flights include passengers not getting off at Heho Airport, and aircraft movements are high comparing with passenger number. On the other hand, in this study, the aircraft movements are calculated from the annual passenger number dividing by passenger number per an aircraft, and it doesn't reflect the current situation. However, it is considered that the method of the air traffic demand is reasonable since it is assumed that direct flights will increase because of increase of aircrafts owned by airlines in the future.

4.3 Outline of the Project

4.3.1 Requirement Performance of Airport facility

The facility size is calculated based on the demand in 2025 and 2035 by the air traffic demand forecast. The parameters used for the calculation are discussed as follows.

Peak Day Coefficient: Based on the monthly passenger data, the average daily passenger by month is calculated, and the month with the highest average daily passenger is the design peak month. The peak day coefficient (=1/220) is calculated by the annual passenger and the average daily passenger in the design peak month.

Based on the peak day coefficient, the design peak day passenger is calculated as follows:

Table 4-4 Design Peak Day Passenger

	Annual PAXs (000)	
	2025	2035
Domestic	1,096	1,963
International	15	182
Total	1,111	2,145

	Design Peak Day (DPD) PAXs	
	2025	2035
Domestic	4,980	8,920
International	70	830
Total	5,050	9,750

Note: Design Peak Day Coefficient: 1/220

Source: The Study Team

Passenger Ratio by Route: As for the domestic flights, the passenger ratio by route is calculated from the provided seats by route based on the weekly flight schedule of the Heho Airport. As for international flights, international passengers are expected in the air traffic demand forecast.

Table 4-5 Passenger Ratio by Route and Design Peak Day Passenger

		PAX Share	DPD PAXs by Route	
			2025	2035
International			70	830
Domestic	Yangon	58%	2,890	5,170
	Mandalay	21%	1,050	1,870
	Tachileik	9%	450	800
	Nyaung U	5%	250	450
	Kengtung	4%	200	360
	Lashio	2%	100	180
	Mongset	1%	50	90

Source: The Study Team

Seats by Aircraft: There are 150 seats in the jet aircraft A320, which is expected to be operated in the Heho Airport, and there are 72 seats in the propeller aircraft ATR-72, which is currently owned by the airlines in Myanmar.

Based on each parameter, the design peak day aircraft movement by route and aircrafts is calculated as shown in Table 4-6.

Table 4-6 Design Peak Day Aircraft Movements by Route and Aircrafts

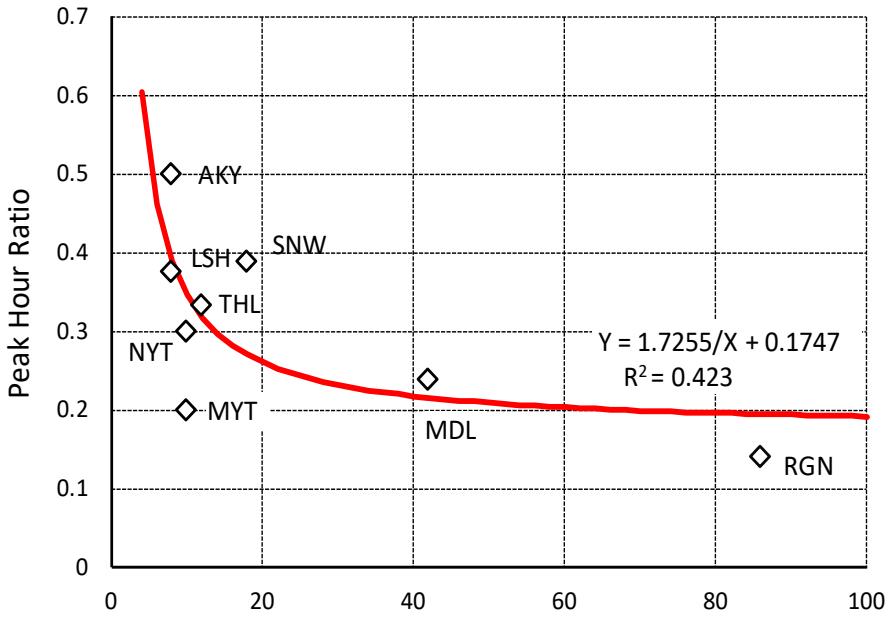
	Aircraft Type	DPD Aircraft Movements	
		2025	2035
International	Jet	2	8
Yangon	Jet	12	30
	Propeller	30	36
	Total	42	66
Mandalay	Propeller	20	38
Tachileik	Propeller	8	16
Nyaung U	Propeller	4	8
Kengtung	Propeller	4	8
Lashio	Propeller	2	4
Mongset	Propeller	2	2
Total Daily Movements		84	150

Note (1): seat capacity, Jet: 160 seats, Propeller: 72 seats
Note (2): Calculated based on the following assumptions:
- ✓ 6 airlines operate to/from Heho
- ✓ In 2025, 6 round trips by jet aircraft are operated daily (3 airlines operate 2 trips daily)
- ✓ In 2035, 15 round trips by jet aircraft are operated daily

Source: The Study Team

Peak Hour Coefficient: Based on the flight schedules of the main airports (eight airports) in Myanmar, the approximation formula for the peak hour coefficient is calculated as follows:

$\alpha = 1.7255 / X + 0.1747$: α Peak Hour Coefficient, X Daily Aircraft Movement



Source: The Study Team

Figure 4-3 Study of Approximation of Peak Hour Coefficient

In few years ago, there were total eleven domestic airlines in Myanmar, and each airline own around two aircrafts. Each airline had operated round route flights like Yangon – Nyaung U – Mandalay – Heho – Yangon. Because of that, aircraft movements were concentrated at morning, noon, and evening. Currently, the number of airlines has become five, and the aircrafts owned by the airlines have been increased. Therefore, it is assumed that the concentrated peak of traffic will be decreased in the future. Moreover, the peak hour ratio become small if total flight number increase. Therefore, it can be said that the assumption that the peak hour ratio will be small in the future is reasonable.

The required aircraft parking stands for apron are calculated from the peak hour aircraft landing, spot occupancy time, and allowance factor (=1.2), as shown in Table 4-7.

Table 4-7 Study of Required Aircraft Parking Stand by Aircraft

(2025)			
	Code C (B737/A320)	Code C (ATR72)	Total
Daily aircraft movements	14	70	
Peak hour coefficient	0.195		
Peak hour movements	2.7	13.7	
Peak hour arrivals	1.4	6.9	
Stand occupancy time (min)	35	30	
Stand requirements	1	5	
Extra stands	1		
Total requirements	2	5	7
(2035)			
	Code C (B737/A320)	Code C (ATR72)	Total
Daily aircraft movements	38	112	
Peak hour coefficient	0.186		
Peak hour movements	7.1	20.8	
Peak hour arrivals	3.6	10.4	
Stand occupancy time (min)	35	30	
Stand requirements	3	7	
Extra stands	1		
Total requirements	4	7	11

Source: The Study Team

Based on the above consideration, the required aircraft parking stands are shown in the table below.

Table 4-8 Required Aircraft Parking Stand

Year	2025	2035
Code C (A320)	2	4
Code C (ATR72)	5	7
Total	7	11

Source: The Study Team

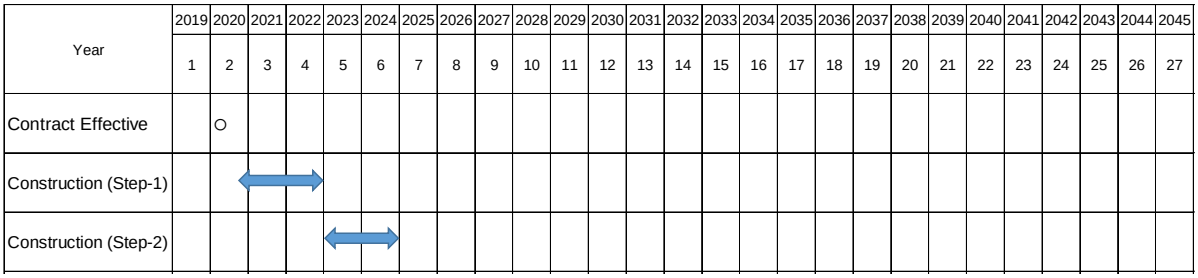
4.4 Outline Facility Design

Based on the result of the air traffic demand forecast, the development year and facility size to be developed are set.

Since the commencement of the concession is expected in 2020 in this project, the construction of Step-1, opening of the facilities, and next development according to actual demand will be implemented step by step.

The timing of phased development is shown in Figure 4-4.

The Step-1 and Step-2 developments are implemented in 2021 to 2023 and 2024 to 2025, respectively.



Source: The Study Team

Figure 4-4 Phased Development Schedule

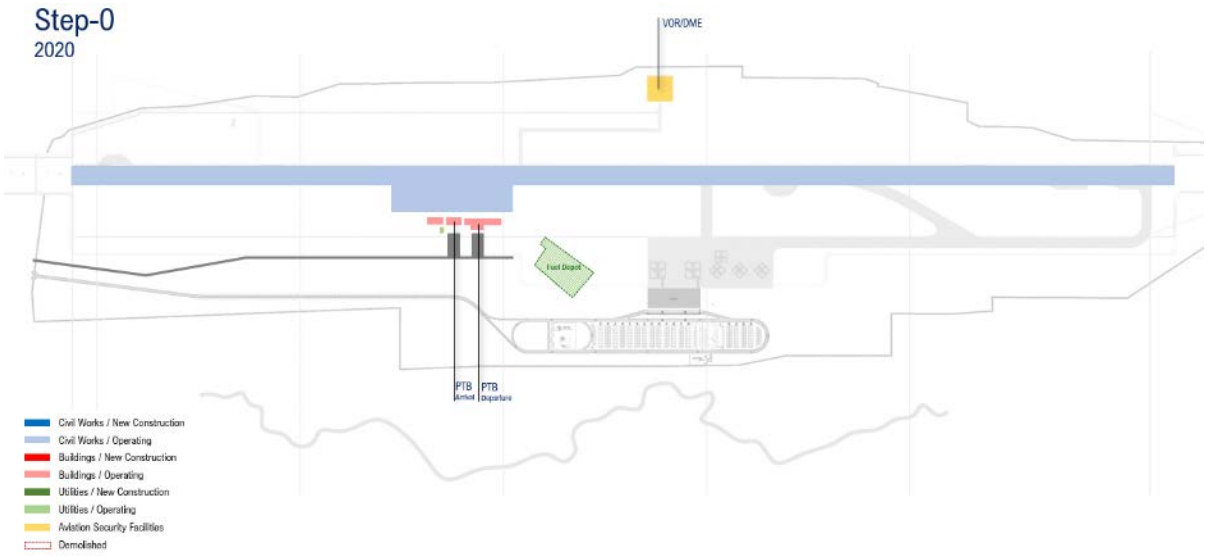
The development items in each step are summarized in Table 4-9.

Table 4-9 Phased Development Items

Development Timing	Step-0 (2020)	Step-1 (2023)	Step-2 (2025)
Development Item	Renovation of Existing Passenger Terminal Building	✈ Construction of New Passenger Terminal Building ✈ Construction of New Apron ✈ Construction of New Connection Taxiway ✈ Installation of Aeronautical Ground Lightings ✈ Development of Airside Service Road ✈ Construction of New Car Parking ✈ Development of Access Road ✈ New Construction of Utility Facilities (Water Supply, Wastewater Treatment, Power Supply) ✈ New Construction of Staff Quarters	✈ Runway Pavement Overlay ✈ Partial Development of Parallel Taxiway ✈ Development of Rapid Exit Taxiway ✈ Installation of Aeronautical Ground Lightings ✈ Expansion of Water Supply Facilities

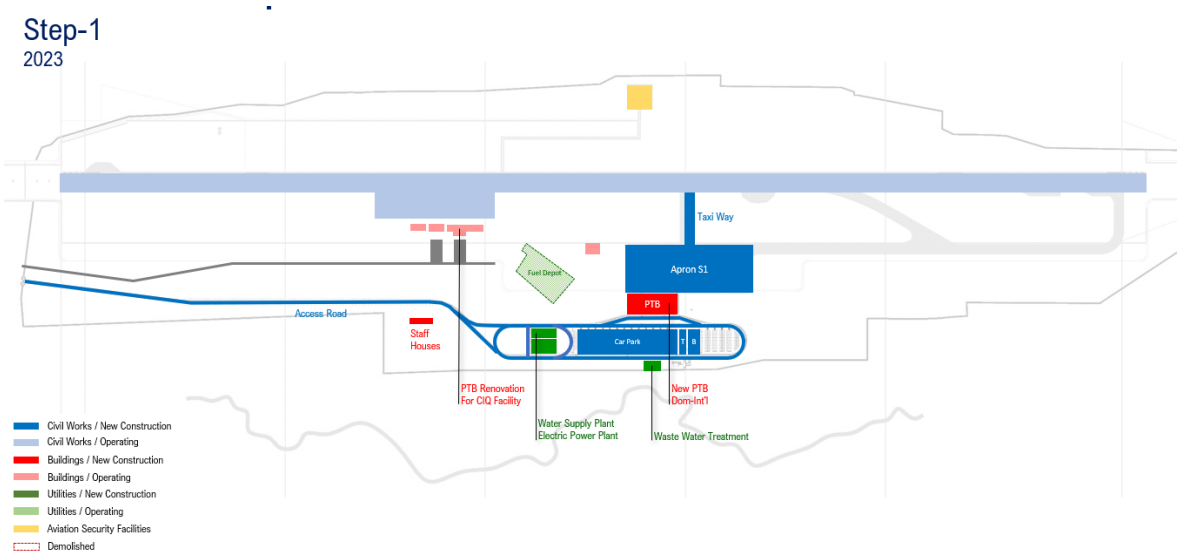
Source: The Study Team

The layout of development is planned as follows:



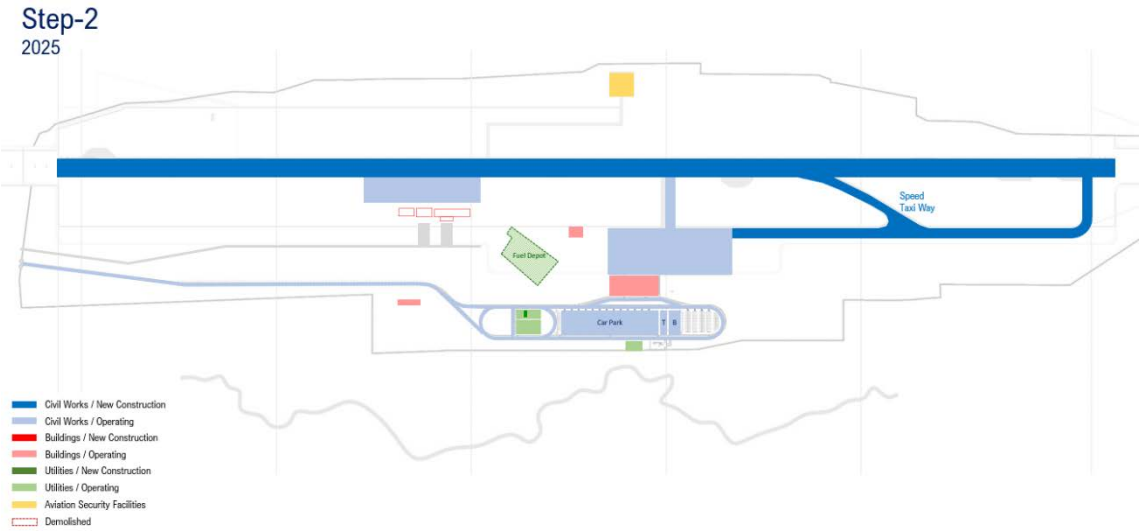
Source: The Study Team

Figure 4-5 Development Layout Plan (Step-0, 2020)



Source: The Study Team

Figure 4-6 Development Layout Plan (Step-1, 2023)



Source: The Study Team

Figure 4-7 Development Layout Plan (Step-2, 2025)

4.4.1 Airport Civil Facilities (Runway, Taxiway, and Apron)

(1) Land Preparation

Based on the topographic survey date conducted by DCA, earthwork volume associated with parallel taxiway and apron construction was calculated using Civil 3D (Autodesk). Target area of earth work volume calculation is not only the development area of this project, but also the whole airport site being taken into account the future plan. Source: The Study Team

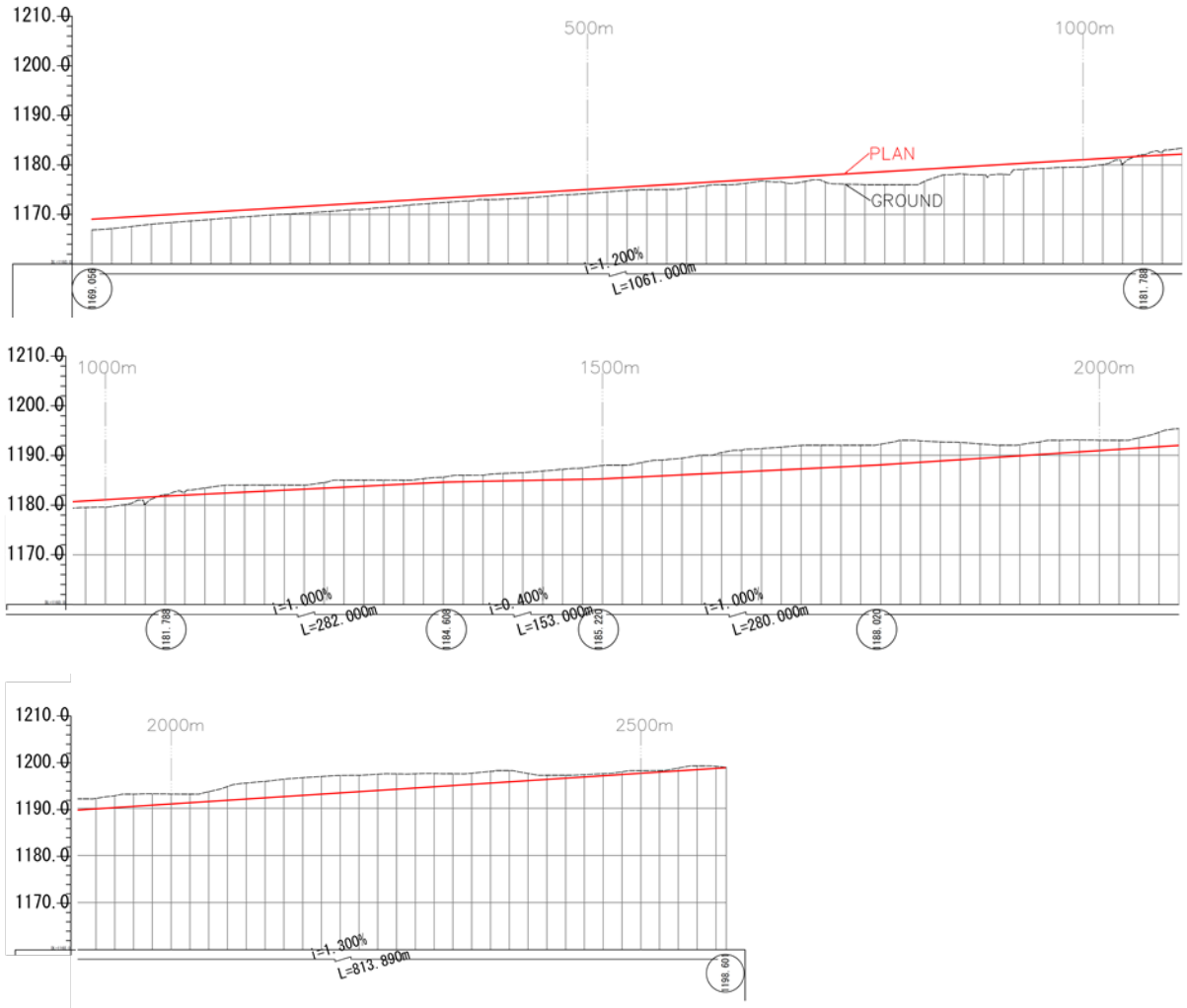
Figure 4-8 shows the cutting and filling area used for earthwork volume calculation. The orange area is the cutting area while the green area is the filling area. Mainly, southern side of the airport is filling area and northern side is cutting area. Source: The Study Team

Figure 4-9 shows the planned parallel taxiway center line and the present ground surface longitudinal section. Source: The Study Team

Figure 4-10 shows the typical plan and present ground cross-section.

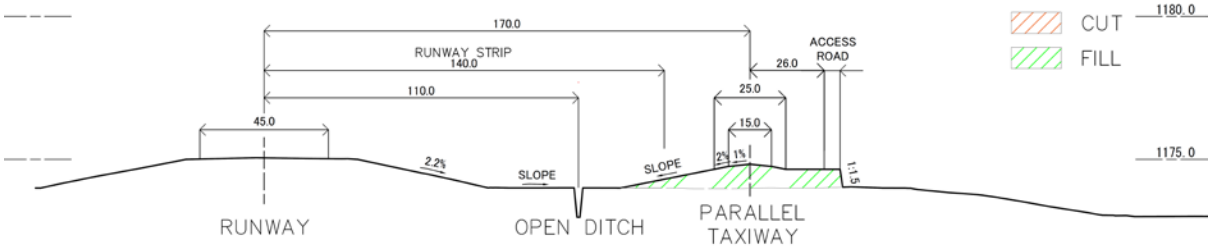
Source: The Study Team

Figure 4-8 Cutting and Filling Area

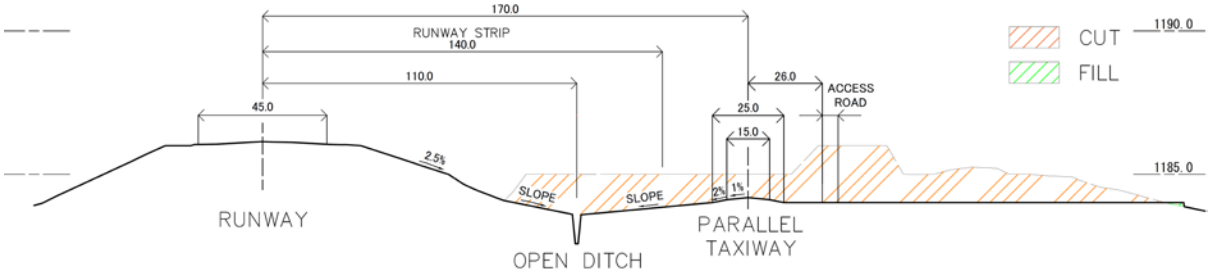


Source: The Study Team

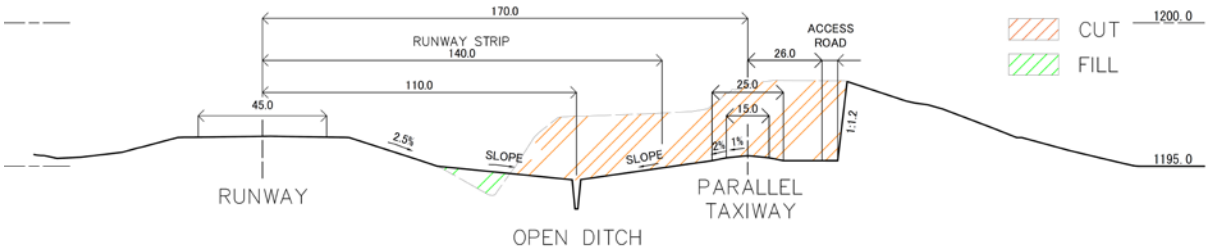
Figure 4-9 Planned Parallel Taxiway Center Line and Present Ground Surface Longitudinal Section



a) Around 500m from the Southern Side Runway Edge



b) Around 1500m from the Southern Side Runway Edge



c) Around 2500m from the Southern Side Runway Edge

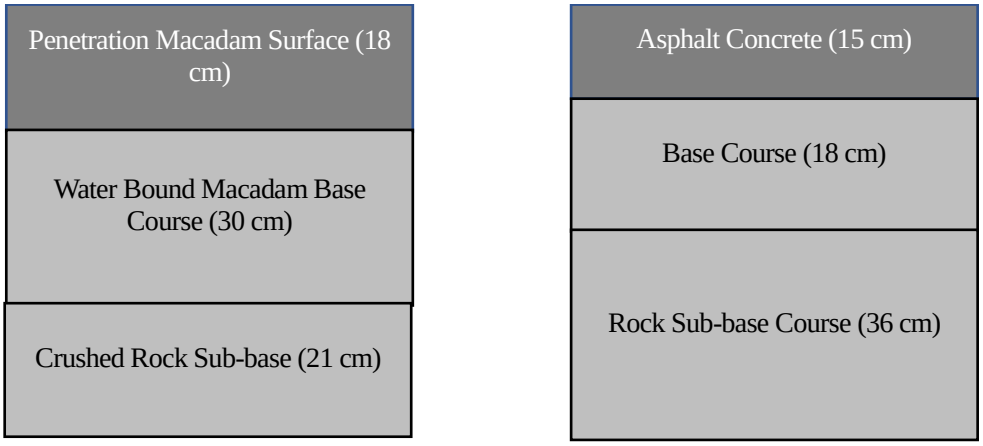
Source: The Study Team

Figure 4-10 Typical Plan and Present Ground Cross Section

(2) Runway Pavement

In this project, the extension and widening of the runway is not part of the project objectives. However, the overlay for the runway pavement is studied because the operation of larger aircrafts and the increase of aircraft movements are expected in the future.

According to the documents on the existing runway pavement structure received from DCA, there are different pavement structures at the center portion and edge portion which were widened recently by DCA. The pavement structures are as follows:



Edge Portion **Center Portion**

Source: Prepared by the Study Team based on DCA's documents

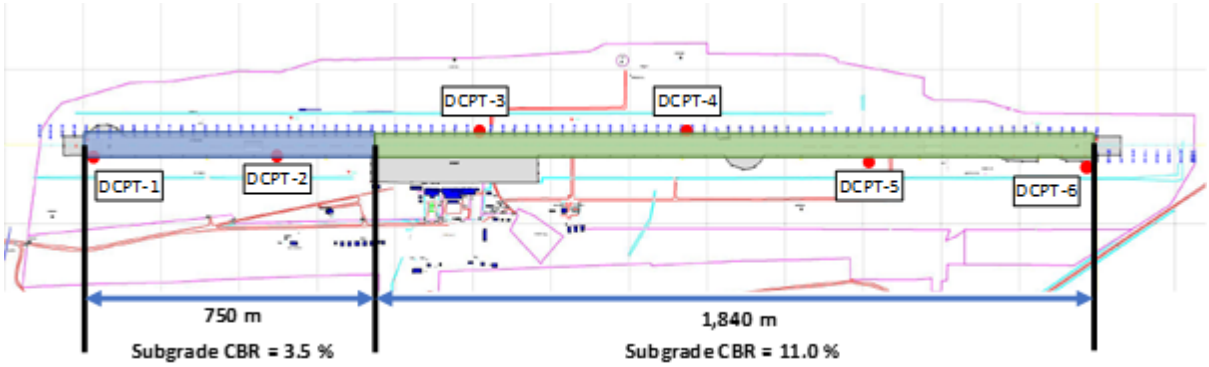
Figure 4-11 Existing Runway Pavement Structure

The CBR values obtained by the geotechnical investigation at subgrade are very different between the north side and the south side of the runway. Therefore, the different design CBR values set for the north side and the south side are shown in Table 4-10 and Figure 4-12.

Table 4-10 Design CBR Values for Runway Overlay

Location	CBR Value
North side	11.0%
South side	3.5%

Source: The Study Team



Source: The Study Team

Figure 4-12 Separation of Runway between the North Side and South Side

The design year for runway overlay is set to 20 years (from 2023 to 2042).

Based on the result of the air traffic demand forecast, the design traffic amount (number of departures for ten years) for overlay design is set as shown in Table 4-11.

Table 4-11 Design Traffic Amount (Unit: Nos.) (10 Years)

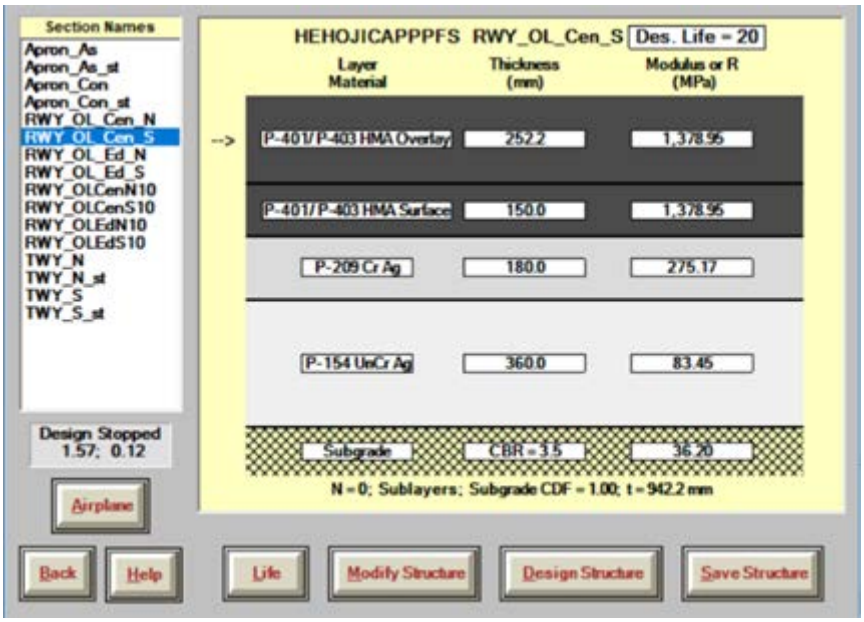
	Air Traffic Movement (Domestic)	Air Traffic Movement (International)	Air Traffic Movement (Total)	Number of Departure (Total)
ATR72	353,853	13,200	367,053	183,527
A320	202,271	18,900	221,171	110,585

Source: The Study Team

Based on the above conditions, the overlay thickness is calculated by "FAARFIELD", which is the pavement design program released by FAA.

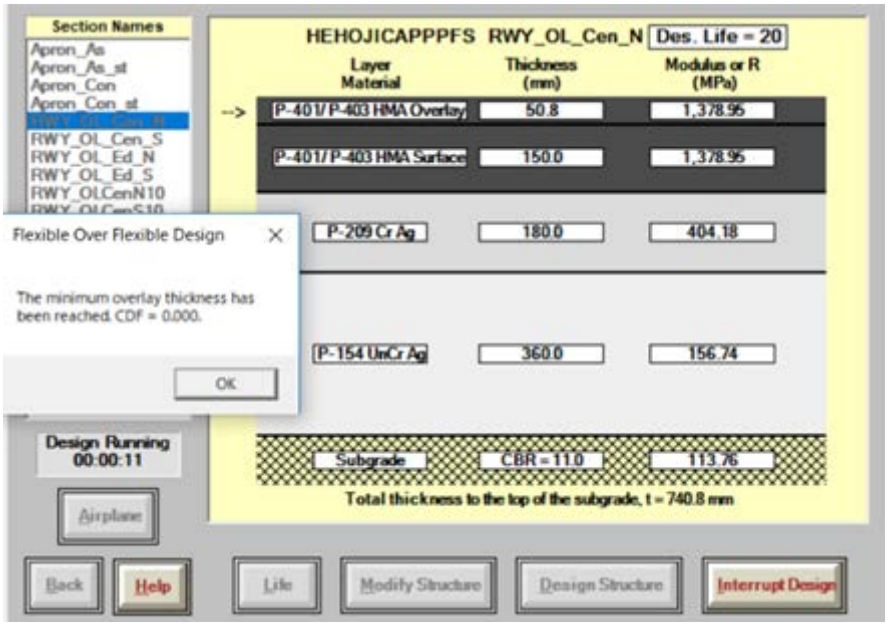
In addition, because the runway has different pavement structures at the center portion and edge portion as shown in Figure 4-11, the overlay thickness based on each pavement structure is calculated, and the result is compared.

The result of calculations by FAARFIELD is shown in Figure 4-13, Figure 4-14, Figure 4-15, and Figure 4-16.



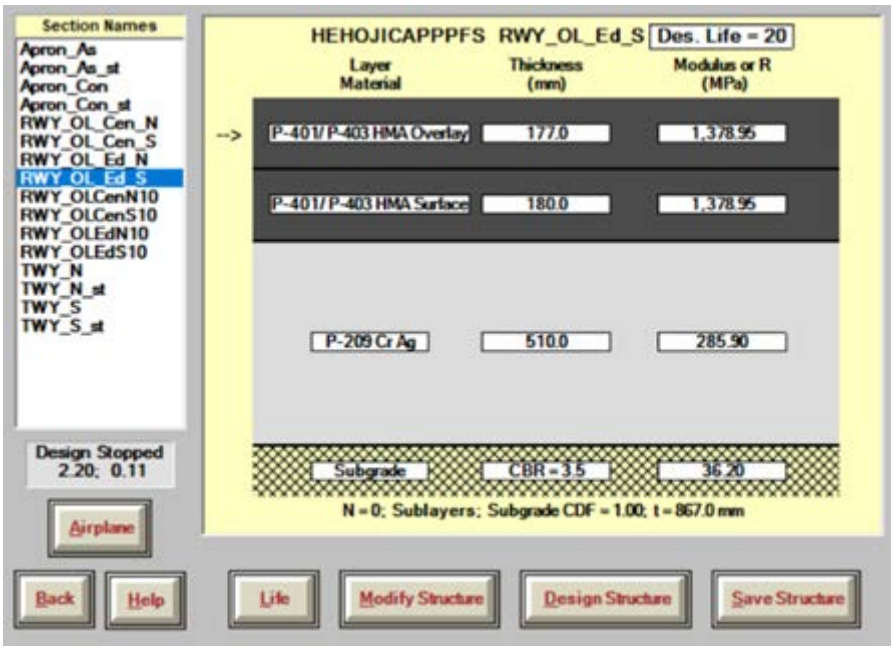
Source: The Study Team

Figure 4-13 Calculation of Overlay Thickness for Runway (Center Portion Structure, South Side)



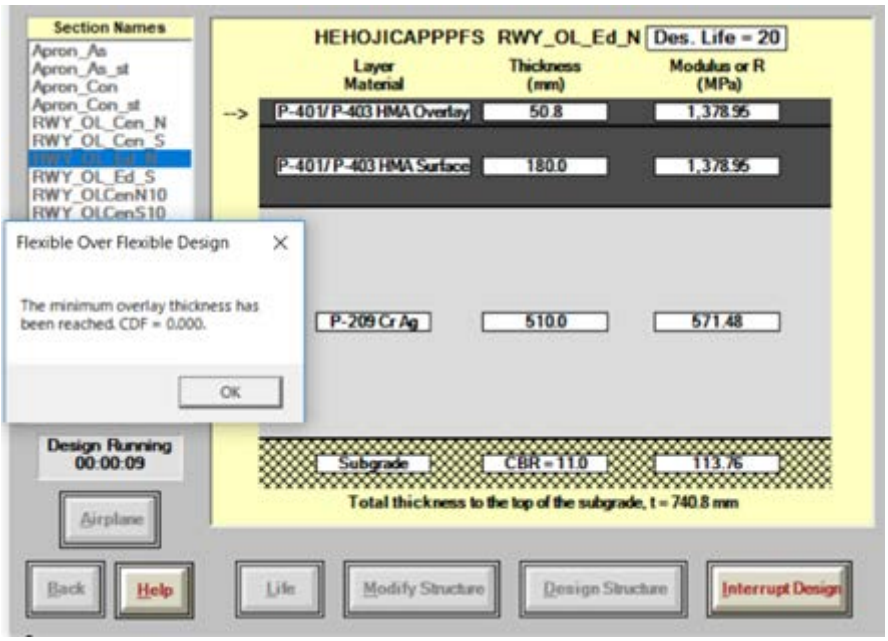
Source: The Study Team

Figure 4-14 Calculation of Overlay Thickness for Runway (Center Portion Structure, North Side)



Source: The Study Team

Figure 4-15 Calculation of Overlay Thickness for Runway (Edge Portion Structure, South Side)



Source: The Study Team

Figure 4-16 Calculation of Overlay Thickness for Runway (Edge Portion Structure, North Side)

The summary of results of the above calculation is shown in Table 4-12.

Table 4-12 Study Result of Runway Overlay

Study Case	Location	Study Result
Based on Center Part Structure	South Side	Overlay is necessary in 26 cm of thickness
	North Side	Overlay is not necessary
Based on Edge Part Structure	South Side	Overlay is necessary in 18 cm of thickness
	North Side	Overlay is not necessary

Source: The Study Team

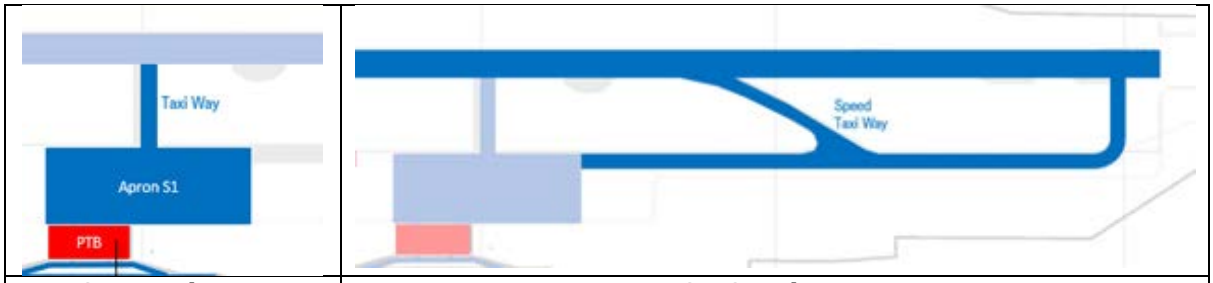
According to Table 4-12 the necessary overlay thickness based on the center part structure is bigger than that based on the edge part structure. Therefore, the result based on the center part structure is applied as the runway overlay design. The overlay work of 26 cm thickness is done on the south side of the runway, and no overlay work is done on the north side of the runway.

(3) Taxiway

1) Taxiway Layout Plan

The new connection taxiway between the existing runway and new apron is planned in Step-1 in this project. In Step-2, new parallel taxiway and rapid exit taxiway are planned at the northside.

The width of the taxiway is 15 m, referring to ICAO Annex 14, so that this taxiway width can accommodate the aircrafts operating in the Heho Airport.



Step-1 Development	Step-2 Development

Source: The Study Team

Figure 4-17 Layout Plan of Taxiway

2) Taxiway Pavement

The design year for taxiway pavement is set to 20 years, and the same design traffic amount as the runway overlay shown in Table 4-11is applied for the apron pavement design.

As for the parallel taxiway, it is divided into the filling part (south part) and the cutting part (north side). Therefore, based on the result of the geotechnical investigation, the design subgrade CBR values for the filling part and the cutting part are set as shown in Table 4-13.

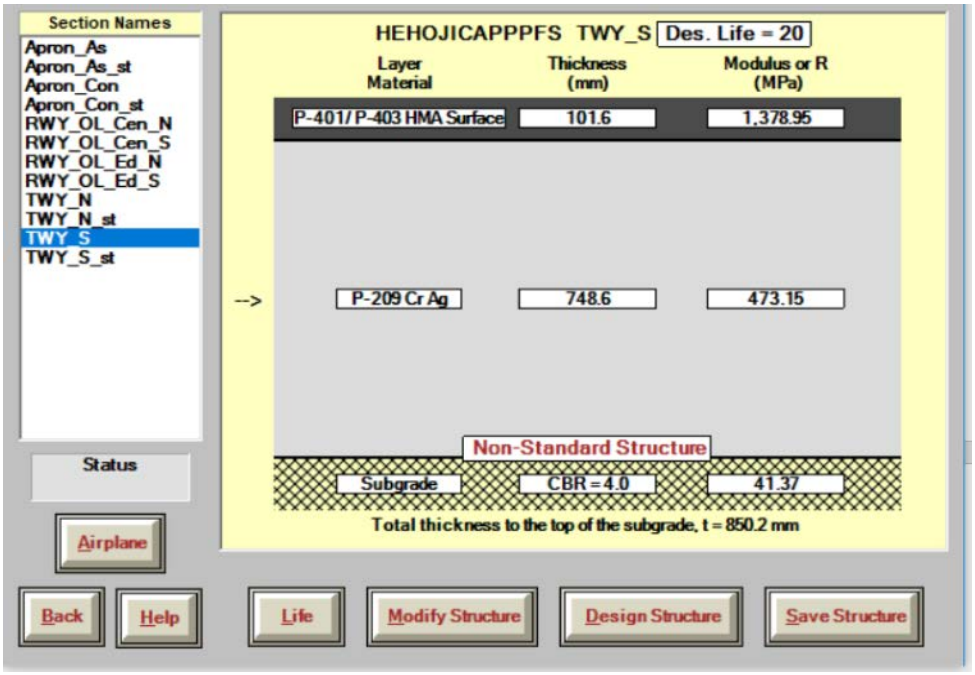
Table 4-13 Design CBR Value for Taxiway Pavement

Location	CBR Value
Filling Part (South Side)	4.0%
Cutting Part (North Side)	11.0%

Source: The Study Team

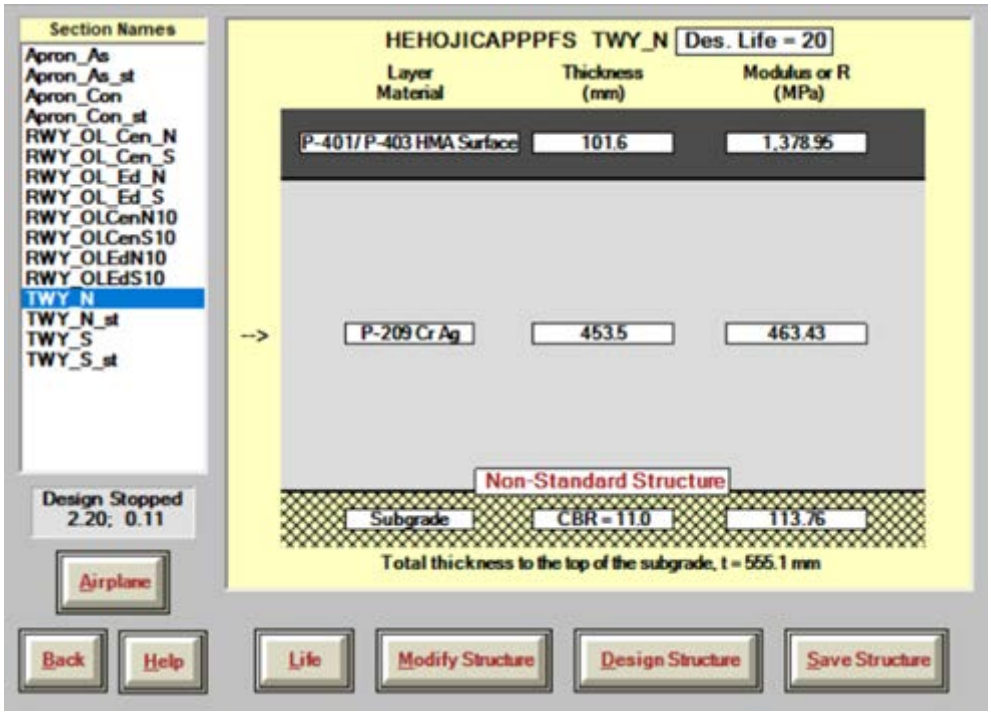
The asphalt pavement for the surface layer and the crushed aggregate for the base course are used as pavement structure.

The results of calculation by FAARFIELD is shown in Figure 4-18 and Figure 4-19.



Source: The Study Team

Figure 4-18 Calculation of Taxiway Pavement Structure (Filling Part)



Source: The Study Team

Figure 4-19 Calculation of Taxiway Pavement Structure (Cutting Part)

(4) Apron

1) Apron Layout Plan

In order to accommodate the aircrafts for the new passenger terminal building, new apron is planned in front of the new terminal building. The required aircraft parking stands (for A320 x 2, for ATR72 x 5) as shown in Table 4-8 are prepared.

In addition, road for GSE is installed between the aircraft parking stand and the terminal building.

2) Apron Pavement

The same design traffic amount as the taxiway shown in Table 4-14 is applied for the apron pavement design.

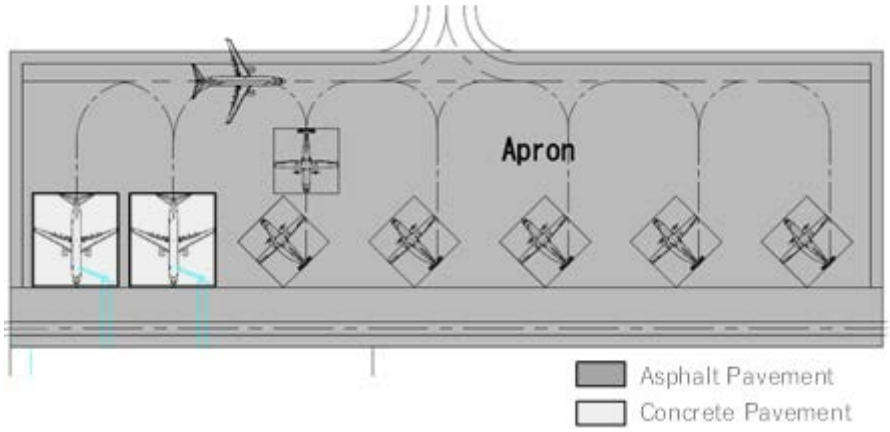
The concrete pavement is applied for the part where jet aircrafts (A320 or equivalent) park in the apron because the rigidness of the concrete pavement is more advantageous. Considering the economical pavement design, the asphalt pavement is applied for the other part of the apron.

Based on the result of the geotechnical investigation, design CBR values and K values for subgrade are set as shown in Table 4-14.

Table 4-14 Design CBR Value and K Value for Apron Pavement Design

Location	CBR value	K Value
Asphalt Pavement Part	11.0%	-
Concrete Pavement Part	-	78 MN/m^3

Source: The Study Team

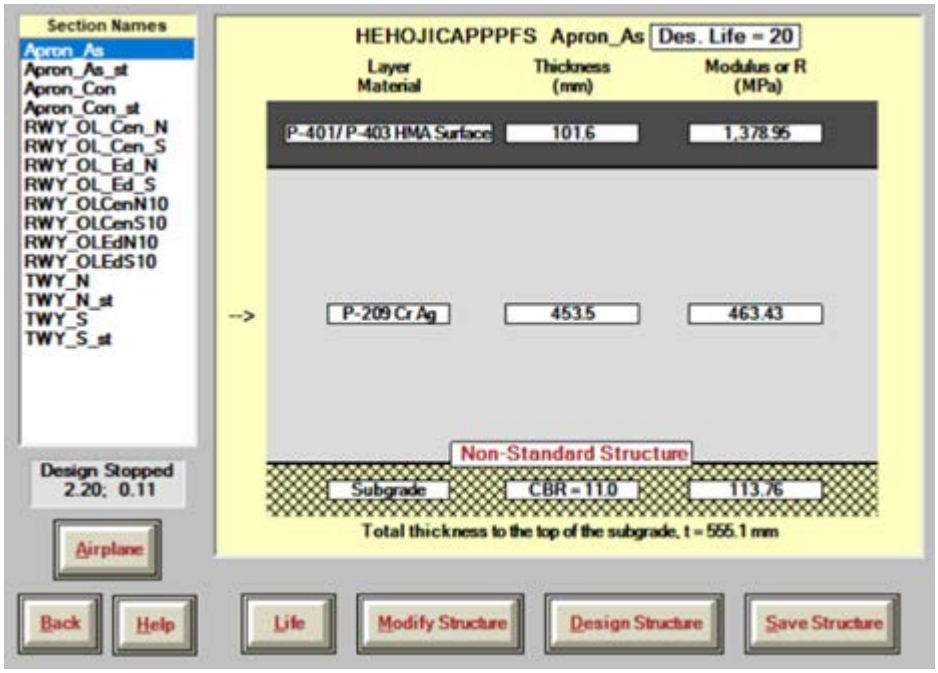


Source: The Study Team

Figure 4-20 Layout of Apron Pavement Type

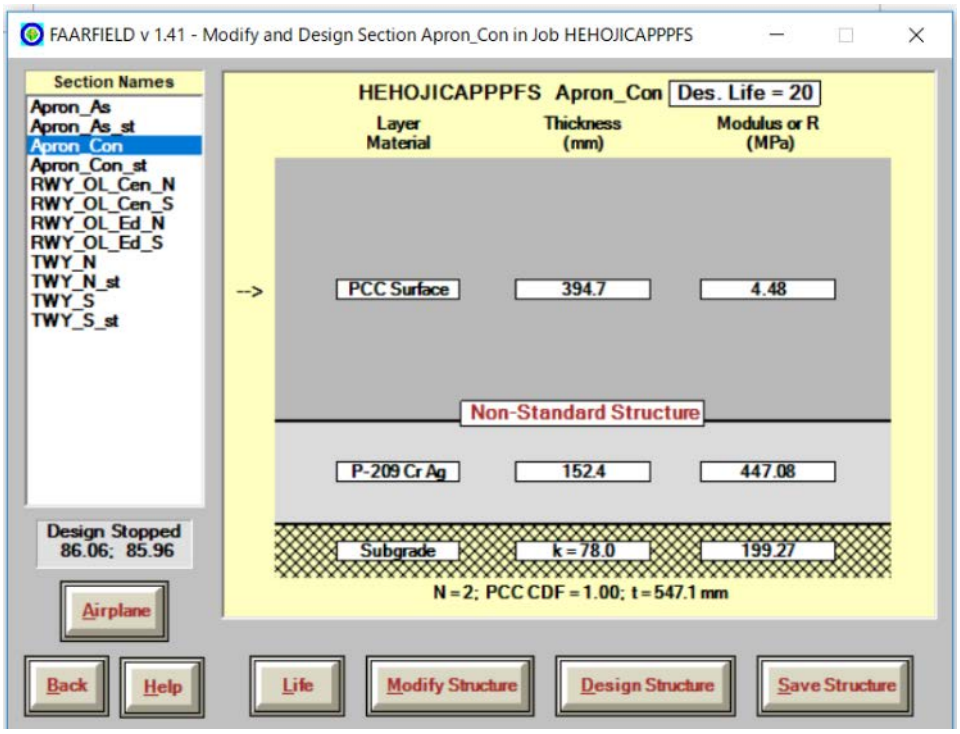
Asphalt pavement or concrete pavement for surface layer and crushed aggregate for base course are used as the pavement structure.

The results of calculation by FAARFIELD are shown in Figure 4-21 and Figure 4-22.



Source: The Study Team

Figure 4-21 Calculation of Apron Pavement Design (Asphalt Pavement Part)



Source: The Study Team

Figure 4-22 Calculation of Apron Pavement Design (Concrete Pavement Part)

4.4.2 Building Facilities

(1) Facility Plan

1) Renovation Plan of Existing Facilities

Until the new passenger terminal building is completed, it is required to make maximum use of the existing terminal building. Check-in counter and departure area of the existing terminal building are extremely crowded during peak hours. To solve the congestion during peak hours, the following renovation plan is proposed:

- Improvement of check-in counter
- Improvement of security check point
- Improvement of toilet facilities

Since all of the airport operations will be transferred to the new terminal building after its completion, the refurbishment of existing terminal building facilities will be limited to a minimum.

2) New Passenger Terminal Building

This plan aims to introduce CIQ facilities (customs, immigration, and quarantine) into the new passenger terminal building of the Heho Airport, which is the fourth largest airport in Myanmar. The Heho Airport is planning to introduce international flights around 2024 due to the increasing demand. The three main concepts of the new passenger terminal building are:

1) Rational traffic flow for passenger and luggage;

2) Environment-friendly building; and

3) Construction considering economic efficiency.

The location of the new passenger terminal building was decided following the overall airport layout plan. The building will be located at the center of the apron to ensure accessibility and visibility of the runway from the building.

The building will have a second floor, and the lengths are 128 m (north-south) and 52 m (east-west). The check-in counters, arrival lobby, and offices will be located on the first floor, and the departure lobby will be located on the upper floor. This zoning was determined considering compactness and rationality of the building.

The east side of the building, which is a curbside, will have a canopy roof whose length is as long as its approach. This roof creates a pleasant environment for the passenger by blocking the light and rain.

The main structure will be reinforced concrete, and the roof structure will be made of steel frame roof truss. The columns which support the second floor slab will be reinforced concrete with 8 m span considering economic efficiency. On the other hand, the columns for supporting the roof will have 16 m span to create large space to gain high visibility.

Other than the contents shown above, the plan will have flexibility to adapt to the increasing demand in the future. There will be 150 m wide open spaces each at the north and south sides of the building to allow the expansion when the passenger demand increases.

The main finishing of the building is shown below:

Roof:	Folded Galvalume Steel Sheet
External wall:	Precast concrete board, glass curtain wall
Internal Ceiling:	Rock wool decorative acoustic board
Internal Wall:	Wood, plasterboard + acrylic coating
Internal Floor:	Granite stone (passenger area), ceramic tile (service area)

Built-in furniture such as check-in counter, immigration booth, waiting seats, gate counter, and customs counter will be installed in the building.

For special equipment, BHS for check-in and arrival luggage and Flight Information Display System (FIDS) will be installed.

It is planned that there is a X ray inspection room for check in baggage at the area of check in counters so that interference by passengers after inspection is avoided.

A) Check-in Counter

The layout of the conveyor will be rational, and a linear counter will be introduced considering the future expansion. There will be 12 check-in counters each in the north and south side of the entrance hall.

B) Security Check (Screening)

The passenger will have to use escalator, elevator, or stairs to go to the security area on the second floor. The estimated number of x-ray belt will be three.

C) Departure Lounge (Common Use of International/Domestic)

The departure lounge is an area where all passengers will have to walk through and kill their time until their boarding time. Multiple retail and restaurant establishments will be installed to enable to use the passenger's waiting time more effectively. Also, there will be six boarding gates that are connected to the airside corridor or PBB.

D) Immigration

Immigration control is a facility that the passengers must pass through from the departure lounge (International/Domestic). There will be eight booths in total.

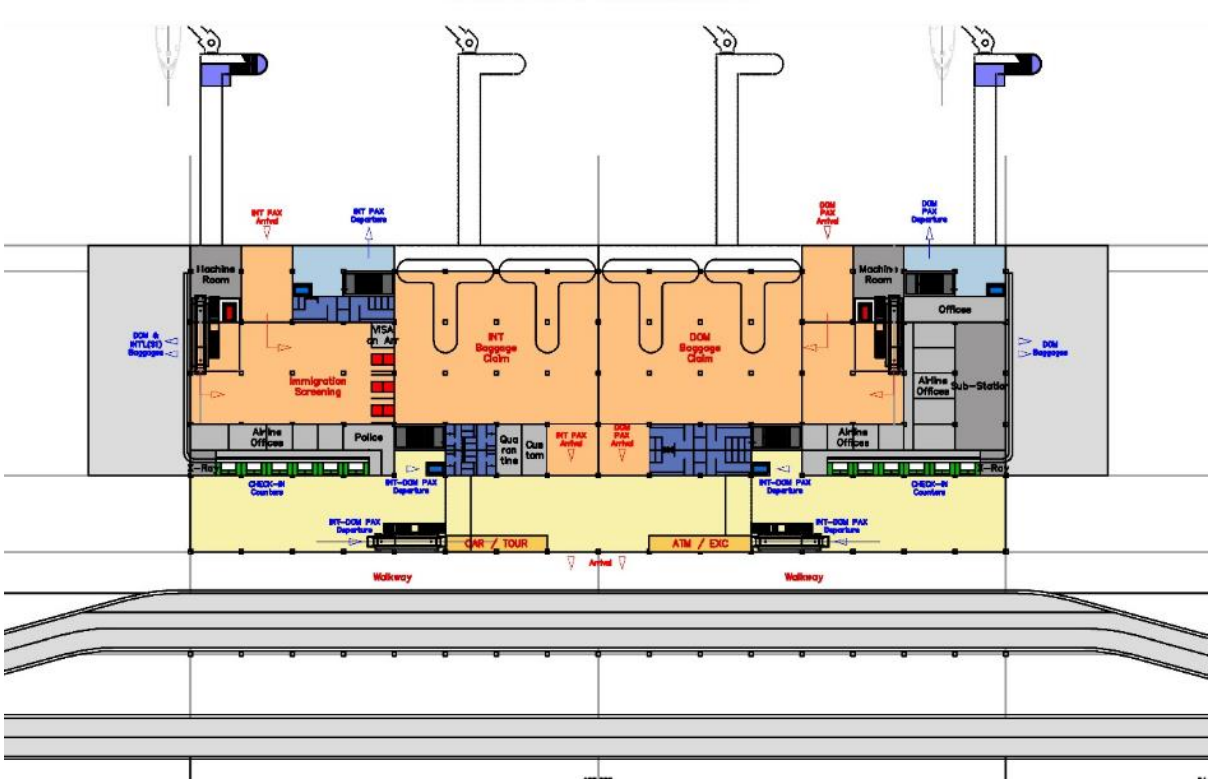
E) Departure Lounge

Departure lounge (International) will be an area only for passenger who pass through the immigration. The retail will be tax free.

F) Arrival BHS Area

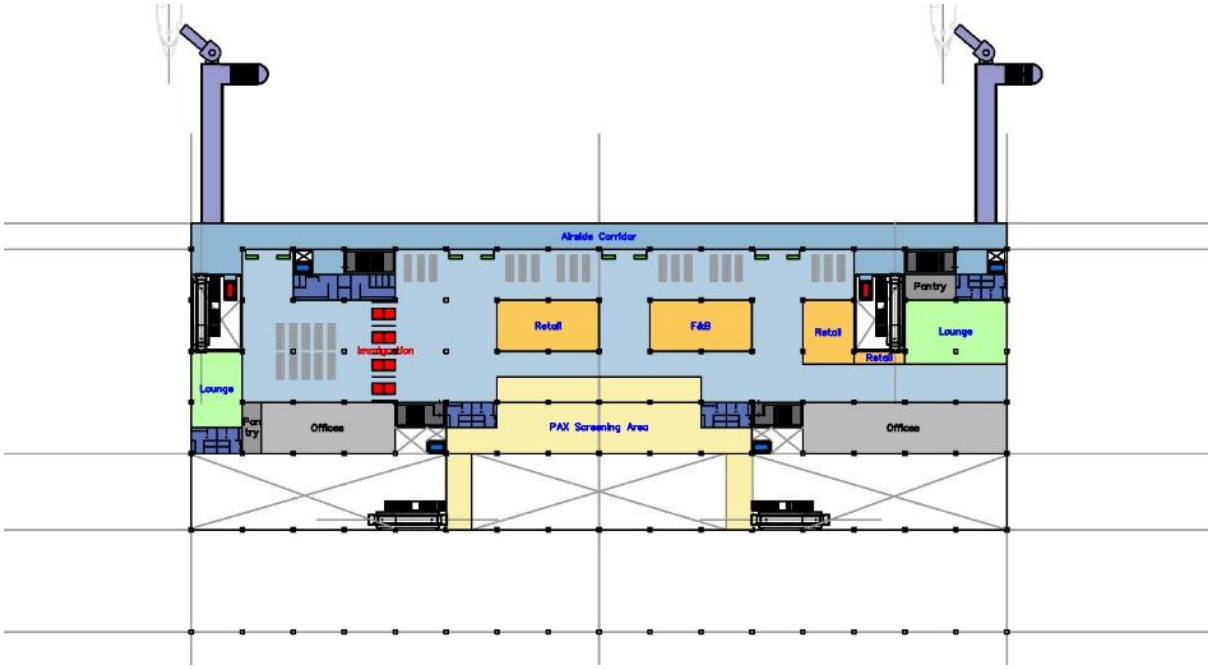
There will be separate arrival gate for international and domestic flight passengers to avoid intermingled traffic flow. CIQ facilities (customs, immigration and quarantine) and arrival visa booth will be installed in the international arrival area. There will be four BHSs in total that could change role depending on the ratio of international and domestic flights during peak hours.

Regarding the adjoining facilities, such as control tower, cargo terminal, and VVIP terminal building, these facilities will be constructed in stages depending on their demand. These facilities are not included in the plan.



Source: The Study Team

Figure 4-23 New International Passenger Terminal Building 1st Floor



Source: The Study Team

Figure 4-24 New International Passenger Terminal Building 2nd Floor

4.4.3 Air Navigation and Airport Safety Facilities

(1) CNS

Currently, VOR/DME is located in the Heho Airport. To improve aircraft movement, ILS will be installed. ILS category is CAT I. Localizer and glideslope will be installed. The time of installation depends on the future demand. All equipment of ILS will be imported from overseas and the approximate cost is USD 1.77 million.

(2) Airfield Ground Lighting System (AGL)

Taxiway light and apron light for newly constructed area are installed in Step-1 (2023). Taxiway lights for parallel taxiway and rapid exit taxiway are installed in Step-2 (2025). Precisions Approach Lighting System (PALS), necessary for the instrument landing, will be installed at the same time of ILS installation.

(3) Control Tower

The construction time of new control tower will be in the future later than Step-2. In the future plan, construction of the new traffic control tower is required in case of construction of the expanded apron and the parallel taxiway at south side since the area of these construction include the existing control tower area.

4.4.4 Utility Facilities

Water supply facilities, waste water treatment facilities, and power supply facilities are developed in line with the whole airport development.

(1) Water Supply

1) Development Plan

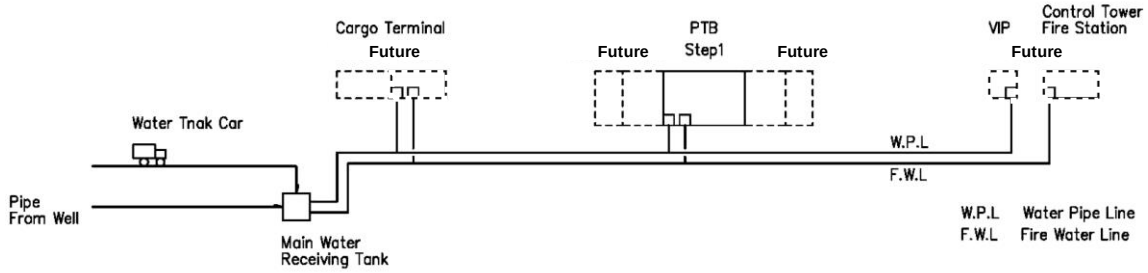
The pump house and water receiving tank are newly constructed in the south of the new car parking.

In Step-1, the existing water facilities are kept from the existing deep wells to the existing water receiving tank. The new tank and the existing tank are connected.

In Step-2, the existing facilities from the wells and the existing water receiving tanks are demolished. The connection facilities between the wells and the new tank are newly constructed. In addition, the new deep wells and the pump house are constructed.

Because sufficient amount of water is not secured in the dry season, water trucks are used even in Step-1 and Step-2 as the current situation. Water is carried from the water reserve dam in Innkhaung Village to the water receiving tanks at the airport by water trucks. In case water trucks with a capacity of 11 t, it takes a total of 1.5 hours for water intake, carrying, and supplying to the tanks.

The water supply system diagram is shown in Figure 4-25.



Source: The Study Team

Figure 4-25 Water Supply Diagram

2) Water Demand

Based on the result of the air traffic demand forecast, the necessary water amount according to the air traffic passenger demand is shown in Table 4-15 Water Demand Forecast.

Table 4-15 Water Demand Forecast

Item		Unit	Annual Passenger			
			2024	2029	2034	2040
Passengers	Annual Pax	pax	1,000,000	1,500,000	2,000,000	2,500,000
	Pax / Day	pax	2,740	4,110	5,479	6,849
	l / (day and pax)	l	55	55	55	55
	Stay time	hour	0.20	0.20	0.20	0.20
	l / d	l	30,140	45,210	60,269	75,339
Staff	Person	person	300	300	500	500
	l / (day and pax)	l	100	100	100	100
	l / d	l	30,000	30,000	50,000	50,000
Restaurant	Person	person	200	300	400	500
	l / (day and pax)	l	80	80	80	80
	l / d	l	16,000	24,000	32,000	40,000
Maintenance	l / d	l	10,000	10,000	15,000	15,000
Total		l	86,140	109,210	157,269	180,339

Source: The Study Team

According to the above table, water usage for a day in Step-1 is around 100,000 liters. Generally, the size of the water receiving tank at the airports is considered for half-day water usage. However, considering the water amount in the dry season, the capacity of the water receiving tank for Step-1 is set at 100 tons. The tank is made of concrete.

3) Facility Plan

The facilities to be developed are summarized in the following table:

Table 4-16 Water Supply Facility Plan for Step-1

Location	Items	Quantity
Existing Water Receiving Area	Multistage Centrifugal Pump (37 kW)	1 set
	Power Panel	1 set
Connection between Existing and New Water Receiving Tank	Pipe	550 m
New Pump House Area	Multistage Centrifugal Pump (37 kW)	3 sets (1 set is for standby)
	Power Panel	1 set
	Pump House	1 set

Source: The Study Team

Table 4-17 Water Supply Facility Plan for Step-2

Location	Items	Quantity
New Deep Well Area	Portable Water Reservoir	1set
	Multistage Centrifugal Pump (37 kW)	2 sets (1 set is re-use from Step-1)
	Generator (Re-use the one under usage at the airport)	set
	Pump House	1 set
Connection between New Deep Wells and Receiving Tank	Pipe	1,730 m

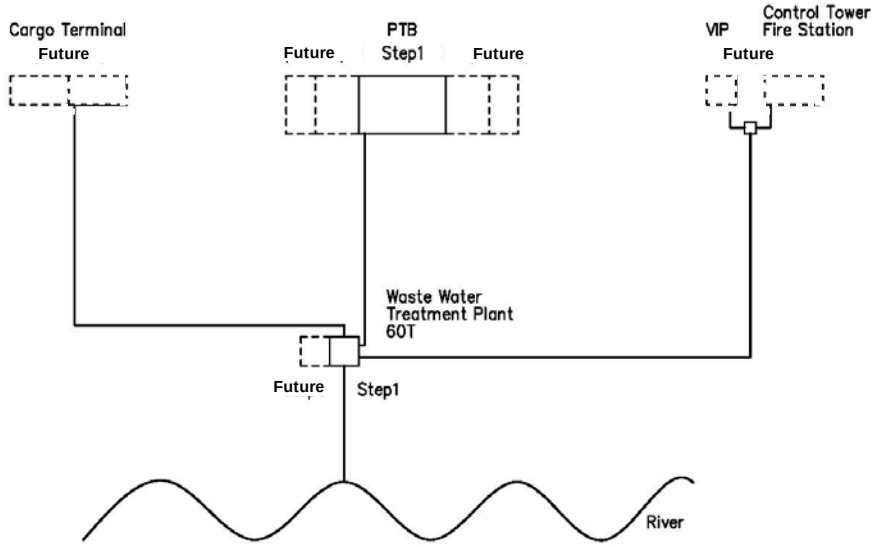
Source: The Study Team

(2) Sewage Water Treatment Facilities

1) Facility Layout

The sewage water treatment plant is developed on the east side of the new car parking, considering the prevention of stench damage to the passenger terminal building.

Sewage water from each building is carried to the sewage water treatment plant by pipes. Sewage water is kept in the raw water tank. Sewage water is treated through the septic tank and is then conveyed into the river on the east side of the airport area through an open channel. Therefore, the plant is planned at a location where the distance from the river is short. The type of septic tank used has the flow control function and the moving bed carrier filter process.



Source: The Study Team

Figure 4-26 Sewage Water Treatment System

2) Facility Plan

In case the annual passenger demand of the airport is 1,000,000, the amount of wastewater is 60 t for a day. The necessary facilities are summarized as follows:

Table 4-18 Wastewater Treatment Facility Plan for Step-1

Item	Quantity
Raw Water Tank	1 set
Large Merger Septic Tank	1 set
Discharge Pump	2 sets
Open Channel	1 set

Source: The Study Team

(3) Power Supply Facilities

1) Facility Layout

Power supply facilities are newly constructed on the south side of the new car parking.

The electric capacity of receiving power from the power supply company is 11 kVA. It is considered that the power intake line from outside the airport to the airport area is developed by the related government organizations, such as the ministries.

Power is supplied to each facility through the HV power receiving panels, the HV distribution panels, and the step-up transformer panels to be installed at the power house. Power is supplied from the power house to the passenger terminal building, the cargo building, and the control tower area, including the VIP terminal building and the firefighting station with high voltage (11 kV).

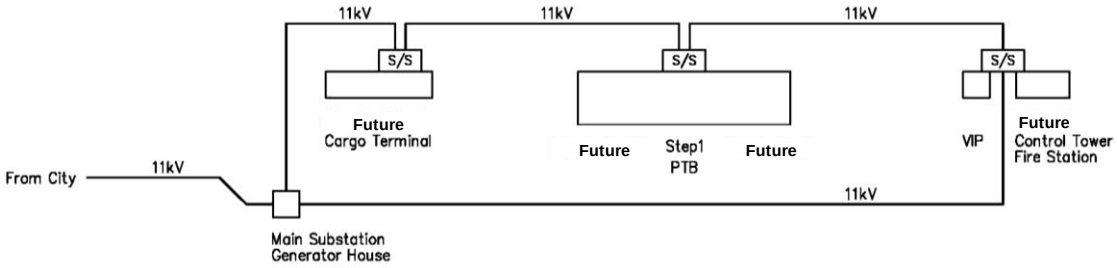
The power supplying facilities for the passenger terminal building and the cargo terminal building are developed in Step-1.

In the future, the ring-shaped high voltage distribution network in 11 kV is developed for the cargo terminal building, the passenger terminal building, and the control tower area.

The secondary distribution (from each facility to buildings) supplies power through the substations at each facility according to power usage at each facility.

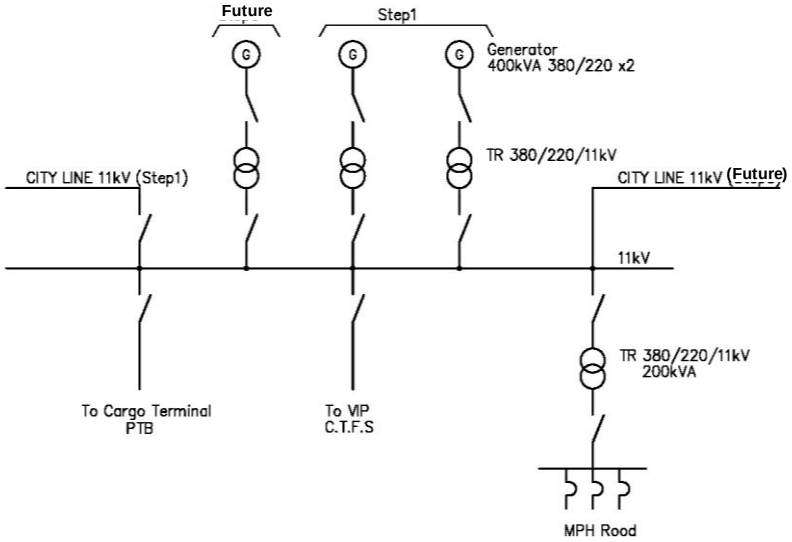
Power for other facilities, such as the water supply facilities, the sewage water treatment plant, the power house, and lightings for the load and the car parking, is supplied in low voltage (380/220 V) from the power house or each terminal building.

Power supply by installation of solar panels will be studied in the future based on the survey of amount of solar radiation.



Source: The Study Team

Figure 4-27 Power Supply System



Source: The Study Team

Figure 4-28 Power Supply Diagram

2) Back-up Generator

In the back-up generator system to be developed, the power is supplied by a UPS after power cut for 15 seconds. After that, it is automatically switched to power supply by generators. In Step-1 and Step-2, two sets of the three-phase low voltage (380/220 V) generator with 400 kVA capacity are installed. The total capacity is 800 kVA, and it is around 40% of load capacity of the whole airport.

In addition, a three-phase high voltage (11 kV) generator with 400 kVA capacity is installed in Step-3.

Fuel for these generators are kept at the fuel tank installed beside the power house. The capacity of the tank is for the fuel to operate the generators continuously for two days.

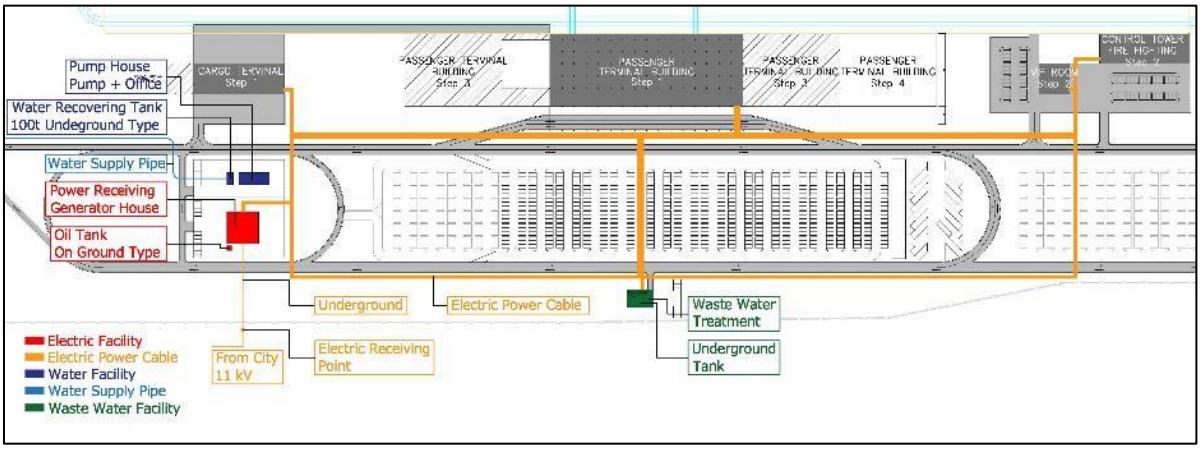
3) Main Power Line

It is mainly distributed through cables.

4) Lightning Protection Facilities

The lightning rods or facilities for internal lightning protection are installed.

The whole layout plan of the utility facilities is shown in Figure 4-29.



Source: The Study Team

Figure 4-29 Layout Plan of Utility Facilities

4.4.5 Access Road and Car Parking

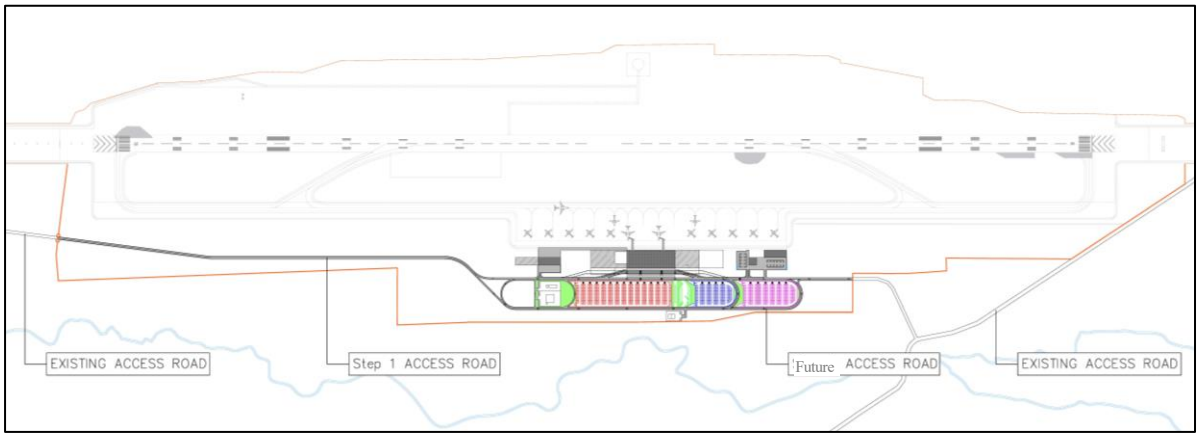
(1) Access Road

The access road is developed as shown in Figure XXX so that airport users can properly access the new passenger terminal building at the new location. The current access road is very near the airside restriction area after the Step-1 development. Therefore, the access road is planned in the new location from the point of view of aircraft safety.

Table 4-19 Access Road Development

	Item	Content
Step-1	Length	
	Width	3 m×2 = 6 m (1 lane for each direction)
Step-2	Length	
	Width	3 m×2 = 6 m (1 lane for each direction)

Source：The Study Team



Source：The Study Team

Figure 4-30 Layout of Access Road

(2) Car Parking

The target year for the car parking development in Step-1 is 2025, and the required number of car parking spots for passengers is calculated based on the following assumptions:

Table 4-20 Outline Calculation of Car Parking Spot for Passengers

	Annual Pax	Peak Day Pax (Annual Pax/220)	Peak Hour Pax (Peak Day Pax*0.196)	Parking Nos. (Peak Hour Pax*0.4)
2025	Around 1,000,000	4,545	891	356

Source：The Study Team

It is assumed that well-wishers and airport staff also use the car parking. Therefore, the required number of car parking spots for well-wishers and airport staff is calculated, applying each constant rate from parking spot for passengers.

Table 4-21 Outline Calculation of Car Parking Spot for Well-Wishers and Airport Staffs

	Peak Hour Well-Wisher	Staff Nos.	Total Nos.
2025	89	36	481

Source：The Study Team

Based on the above consideration, the size of the car parking is planned.

There are some unknown factors for airport car parking usage in Myanmar, wherein the car parking is not fully utilized even though there are a lot of car parking spaces in Myanmar airports like the Yangon International Airport and the Mandalay International Airport.

Therefore, the car parking for the Heho Airport is planned as shown in Table 4-22, considering flexible future expansion so that the car parking will be expanded easily according to actual usage.

Table 4-22 Planned Car Parking Size

	Development Nos. of Car Parking Spot	Total Nos. of Car Parking Spot
Step-1	502	502
For Future Expansion	440	942

Source: The Study Team

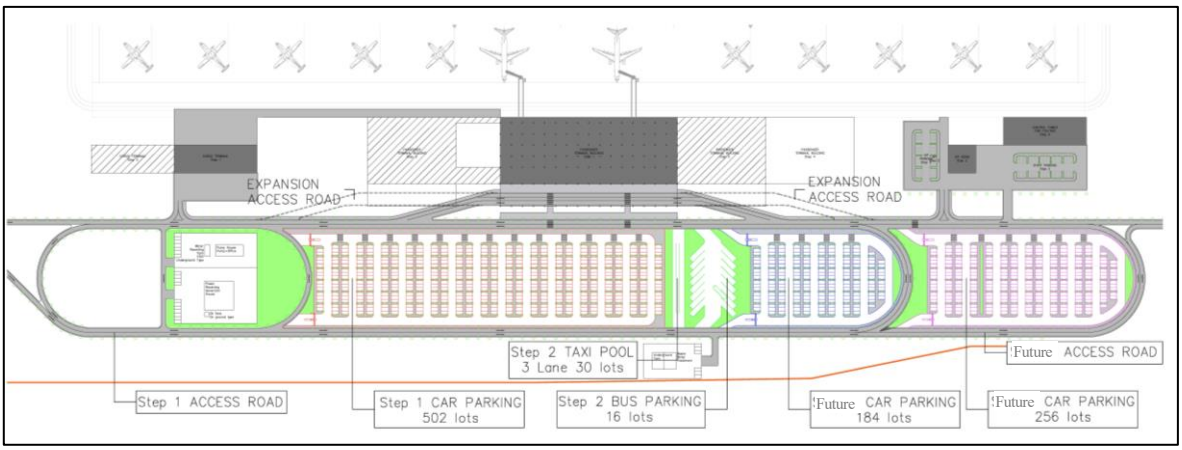
In addition, the bus parking and taxi pool are developed in Step-2 as shown in Table 4-23.

Table 4-23 Planned Size of Bus Parking and Taxi Pool

Item	Nos.
Bus Parking	16 nos.
Taxi Pool	30 nos. (3 lanes)

Source: The Study Team

Based on the above consideration, the layout of the car parking is shown in Figure 4-31.



Source: The Study Team

Figure 4-31 Car Parking Layout Plan

4.5 Construction Planning

In the Step-1 construction, it is necessary to carry out land preparation work before the construction of the passenger terminal building.

The passenger terminal building area is mainly the cut area, and the cut soil will be filled in the car parking area or in the future parallel taxiway area.

After the land preparation works, construction of the passenger terminal building and construction of taxiways and aprons will be carried out.

The connecting taxiway construction works inside the runway strip will be done at night, but the connecting taxiway outside the runway strip and apron can be constructed during daytime.

Land preparation works take six months, while the passenger terminal building works take about one year, and the finishing works take 2 to 3 months.

In the Step-2 construction, runway overlay and parallel taxiway on the north side construction will be conducted.

Runway overlay work will be done at night because aircrafts use the runway during daytime.

In the parallel taxiway construction, daytime construction is possible except at the runway strip area. Parallel taxiway construction should be carried out after land preparation work.

4.6 Preliminary Project Cost

Table 4-17 shows the preliminary project cost. The unit prices are set based on the hearing survey from construction companies in Myanmar and the construction price document "MYANMAR REPORT JUNE 2019 - CONSTRUCTION MARKET UPDATE, Rider Levett Bucknall". The unit prices will be examined in detail during the second phase survey.

Table 4-24 Preliminary Project Cost

1USD= JPY 113.27

Item			Step-1 (2023)				Step-2 (2025)			
			Quantity	Unit	Unit Price (USD)	Cost (000 USD)	Quantity	Unit	Unit Price (USD)	Cost (000 USD)
Civil Work						4,160				7,057
Earth Work			60,000	m^3	5	270	340,000	m^3	5	1,530
Pavement Work	Runway	Asphalt Overlay		m^2	32		123,893	m^2	32	4,001
	Taxiway	Asphalt Pavement	2,700	m^2	50	135	20,016	m^2	50	1,001
		Shoulder Asphalt Pavement	2,700	m^2	25	68	12,381	m^2	25	310
	Apron	Concrete Pavement	5,355	m^2	100	536	0	m^2	100	0
		Asphalt Pavement	28,201	m^2	50	1,410	0	m^2	50	0
		Shoulder Asphalt Pavement	517	m^2	25	13	0	m^2	25	0
		GSE road Asphalt Pavement	11,970	m^2	40	479	0	m^2	40	0
	Airside Service Road		11,913	m^2	25	298		m^2		
	Access Road		16,250	m^2	40	650		m^2		
	Parking		15,120	m^2	20	302		m^2		
	Roadside Planting			m^2			1,200	m^2	180	216
Building Work						13,538				0
Passenger Terminal Building		Existing PTB Renovation	1	lot	486,000	486		lot		
		New PTB	9,000	m^2	1,428	12,852		m^2		
Cargo Terminal Building			0	lot	600,000	0		lot		
Contro; Tower				lot			0	lot	441,431	0
Fire Fighting Station				lot			0	lot	88,286	0
Airport Staff House			1	lot	200,000	200	-			
Utility Work						1,669				588
Power Supply			1	lot	1,227,178	1,227		lot		
Water Supply			1	lot	208,355	208	1	lot	587,986	588
Sewage Treatment System			1	lot	233,076	233		lot		
CNS/ATM Facilities						795				765
CNS Equipment							0	lot	2,648,586	0
ILS							0	lot	1,765,724	0
AGL			1	lot	441,431	441	1	lot	765,147	765
Ambulance			1	台	353,145	353				
Subtotal of Construction Cost						20,161				8,410
Desgn and C/S Cost			5	%		1,008	5	%		420
Total						21,170				8,830

Source: The Study Team

4.7 Project Implementation Schedule

Table4-25 shows the project schedule.

The construction period of Step-1 is about two years, same with that of Step-2.

The constructed facilities in Step-1 start operation from 2023, while for Step-2 start from 2025.

Table4-25 Project Schedule

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	1	2	3	4	5	6	7	8	9	10	11	12
Contract Effective		○										
Construction (Step-1)			⟷	⟷								
Construction (Step-2)					⟷	⟷						

Source: The Study Team

Chapter 5 Environmental and Social Consideration

5.1 Myanmar Regulatory Framework

5.1.1 Fundamental Laws and Regulations Related to Environmental and Social Considerations

The fundamental laws and regulations related to environmental and social considerations and health in Myanmar are shown in Table 5-1. In addition, the major international agreements and treaties that the Myanmar government has ratified related to environmental and social considerations are shown in Table 5-2.

Table 5-1 Fundamental Laws and Regulations Related to Environmental and Social Considerations and Health in Myanmar

No.	Laws and Regulations
Environmental Framework	
1	The National Environment Policy (1994)
2	The Environmental Conservation Law (2012)
3	The Environmental Conservation Rule (2014)
Water Environment	
4	The Underground Water Act (1930)
5	The Law on Aquaculture (1989)
6	The Conservation of Water Resources and Rivers Law (2006)
7	The Conservation of Water Resources and River Rules (2013)
Forestry/Biodiversity	
8	The Forest Law (1992)
9	The Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994)
EIA/Environmental Standards	
10	EIA Procedures (December 2015)
11	National Environmental Quality (Emission) Guidelines (December 2015)
Land Use	
12	The Land Acquisition Act (1894)
13	The Farmland Law (2012)
14	The Farmland Rules (2012)
15	The Vacant, Fallow and Virgin Lands Management Law (2012)
16	The Vacant, Fallow and Virgin Lands Management Rules (2012)
Heritage	
17	The Protection of Preservation of Cultural Heritage Region Law (1994)
18	The Heritage Goods Protection Law (2015)
Public Health	
19	The Public Health Law (1972)
20	The Prevention and Control of Communicable Diseases Law (1995, revised in 2011)
Working Environment	
21	The Worker's Compensation Act (1923)
22	The Payment of Wages Act (1936)
23	The Leave and Holiday Act (1951, partially revised in 2014)
24	The Labour Organization Law (2011)
25	The Social Security Law (2012)
26	The Labour Organization Rule (2012)
27	The Labour Dispute Settlement Law (2012)
28	The Employment and Skill Development Law (2013)
29	The Minimum Wage Law/Rules (2013)
Infrastructure/Economic Development	
30	The Foreign Investment Law (2012)
31	The Export and Import Law (2012)
32	The Myanmar Citizen Investment Law (2013)

Source: The Study Team

Table 5-2 Major International Agreements and Treaties that the Myanmar Government has Ratified Related to Environmental and Social Considerations

	International Agreements and Treaties	Date Ratified
1	Ramsar Convention (Convention on Wetlands of International Importance Especially as Waterfowl Habitat), 1971	2005
2	Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, D.C., 1973; and this convention as amended in Bonn, Germany, 1979	1997
3	Vienna Convention for the Protection of the Ozone Layer, 1985	1993
4	Basel Convention, 1989	2015
5	Montreal Protocol on Substances that Deplete the Ozone Layer, 1989	1993
6	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990	1993
7	United Nations Framework Convention on Climate Change (UNFCCC), New York, 1992	1994
8	Convention on Biological Diversity, Rio de Janeiro, 1992	1994
9	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	2004 (Accession)

Source: The Study Team

The following are summaries of the key laws related to the natural and social environment in Myanmar that will likely be relevant to environmental and social considerations:

Environmental Framework

The Environmental Conservation Law (ECL) (2012) and Environmental Conservation Rules (ECR s) (2014)

The Environmental Conservation Law (ECL) was enacted in March 2012. This law is the fundamental law of environmental management and environmental conservation in Myanmar prepared by the Ministry of Environmental Conservation and Forestry (MOECAF). Subsequently, the Environmental Conservation Rules (ECRs) were enacted in June 2014 as the detailed enforcement regulations for ECL. ECL stipulates MOECAF's responsibility for environmental policy and administration, formulation of environmental management plan, implementation of environmental monitoring, setting of environmental standards, management of hazardous waste, and formulation and implementation of EIA, among others.

Water Environment

The Conservation of Water Resources and Rivers Law (2006)

The aims of this law are as follows: (a) to conserve and protect the water resources and river system for the beneficial utilization of the public; (b) to enable smooth and safe waterways navigation along rivers and creeks; (c) to contribute to the development of the state economy through improving water resources and river system; and (d) to protect environmental impact.

Forestry/Biodiversity

The Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994)

The objectives of this law are to implement the government policy for wildlife protection and natural areas conservation, to carry out in accordance with the relevant international conventions, to protect endangered species of wildlife and their natural habitats, to contribute for the development of research on natural science, and to protect wildlife by the establishment of zoological/botanical gardens.

EIA/Environmental Standards

The EIA Procedure (2015)

The EIA Procedure formulated by MOECAF in coordination with the Asian Development Bank (ADB) was enacted in December 2015. This EIA Procedure covers the following contents: screening of projects, qualification

for conducting the initial environmental examination (IEE)/EIA, categorization of projects for IEE/EIA/environmental management plan (EMP), preparation of IEE/EIA report and EMP, public involvement, procedure on how to get the approval of IEE/EIA report from the Environmental Conservation Department (ECD) under MOECAF, environmental compliance certificate (ECC), and monitoring process after getting the approval of the IEE/EIA report.

National Environmental Quality (Emission) Guidelines (2015)

The MOECAF formulated the National Environmental Quality (Emission) Guidelines (NEQG) in coordination with the ADB in December 2015. The NEQG determines the guideline values for general emissions, such as air emissions, wastewater, noise levels, odor, and those for sector-specific emissions such as emissions from forestry, agribusiness/food production, chemicals, oil and gas, infrastructure, general manufacturing, mining, and power.

Land Use

The Land Acquisition Act (1894)

The Land Acquisition Act (1894) serves as the fundamental law for land acquisition in Myanmar that sets out the procedure of land acquisition and compensation. The act further outlines relevant procedures, including notice periods, procedures for objections to acquisition (Article 5), method of valuation of land, process for taking possession of land (Articles 16 and 17), court processes and appeals (Articles 18 and 24), procedures for the temporary occupation of land (Article 35), and the acquisition of land for companies (Article 38). The act requires that compensation 'at market value' is provided to those from whom the land is acquired (Article 23).

The Farmland Law and Rules (2012)

The law determines the land use rights of farmland and the granting of land use rights to eligible farmers. It allows the right to sell, mortgage, lease, exchange, and give either whole or part of the right to use the farmland. The law determines the formation as well as the roles/responsibilities of farmland administrative bodies at various levels. The Farmland Law and Rules determine procedures such as the application for farmland registration and obtaining land use certificates, application of transfer of farmlands for other purposes, and indemnities and compensation.

Heritage

The Protection of Preservation of Cultural Heritage Region Law (1994)

This law prescribes the determination of cultural heritage regions for protection and preservation so as not to deteriorate due to natural disaster or man-made destruction.

Public Health

The Public Health Law (1972)

It is concerned with the protection of people's health by controlling the quality and cleanliness of food, drugs, environmental sanitation, epidemic diseases, and regulation of private clinics.

The Prevention and Control of Communicable Diseases Law (1995, Revised in 2011)

This law describes the functions and responsibilities of health personnel and citizens in relation to prevention and control of communicable diseases. It also describes measures to be taken in relation to environmental sanitation, reporting and control of outbreaks of epidemics and penalties for those failing to comply. The law also authorizes the Ministry of Health to issue rules and procedures when necessary with the approval of the government.

Working Environment

The Worker's Compensation Act (1923)

It stipulates that an employer is required to make payments to employees who become injured or who die in any accidents arising during and in consequence of their employment.

The Leave and Holidays Act (1951, partially revised in 2014)

This act has been used as the basic framework for leaves and holidays for workers with minor amendment in 2006 and 2014. This defines the public holidays when every employee shall be granted with full payment. It also defines the rules of leaves for workers including medical leave, earned leave, and maternity leave.

The Labor Organization Law (2011)

The Labor Organization Law replaced the Trade Union Act enacted in 1927 for protecting the rights of the workers, having good relations among the workers or between the employer and the worker, and for forming and carrying out the labor organizations systematically and independently. Under the law, the labor organization has the right to carry out freely in drawing up their constitution and rules. It has the right to negotiate and settle with the employer if the workers are unable to obtain the right of the workers contained in the labor laws. On the other hand, the employer shall recognize the labor organizations and assist as much as possible if the labor organizations request for help for the interest of his workers.

The Social Security Law (2012)

The Social Security Law, enacted in 2012, amended the Social Security Act in 1954. It stipulates the formation and implementation of social security systems.

The Minimum Wage Law (2013)

The Minimum Wage Law, passed in March 2013, replaced the 1949 Minimum Wage Act. The law provides a framework for minimum wage determination: the presidential office establishing a tripartite minimum wage committee shall decide the minimum wage with industrial variation based on a survey on living costs of workers possibly every two years. This also stipulates equal payment.

5.2 Preliminary Environmental and Social Consideration Study

The following studies were conducted to confirm the potential environmental and social impact of this project. In addition, JICA's "Environmental Checklist (Airport)" was prepared based on the confirmation of project plan and this first phase survey.

1) Confirmation of expected project plan and candidate project site by field inspection and satellite image (Google Earth)
2) Hearing survey with the Department of Civil Aviation (DCA)・Kalaw Township Administration Office

5.3 Result of Preliminary Environmental and Social Consideration Study

5.3.1 Current Status of Land Acquisition

The following information were obtained from the hearing survey with DCA and Kalaw Township Administration Office:

- The Ministry of Transport and Communications (MoTC) has issued a request letter to Shan State Regional Government to calculate the cost for land acquisition in February 2019.
- The total land acquisition area required for this project is assumed to be 60.61 acres. It consists of 56.52 acres of private agricultural land and 4.09 acres of government land.
- Kalaw Township Administration Office, which is in charge of the Shan State government, calculated the cost of land acquisition. The calculated cost has been agreed by landowners. The land owners are total 41. Currently, all the lands are utilized for agriculture.

From the above, the land acquisition process for the project site has proceeded without any problem by the Myanmar government side.

5.3.2 Possibility of Involuntary Resettlement

The possibility of involuntary resettlement has been confirmed by field inspection and satellite image confirmation, which have been conducted.

- There is no residence except the residential area on the east side of the planned project area.
- There is a total of 165 people in the residential area. It consists of 66 DCA officials staff including family members of staff, 90 government police responsible for airport security, 7 residents who operate the cafeteria and market with permission from DCA, and 2 private oil company employees.
- Among the 165 people mentioned above, seven residents who run the cafeteria and market are expected to be eligible for involuntary resettlement. The lands in the residential area is owned by DCA (MoTC). The people use the land with the approval from DCA.
- There are markets which operate only during the daytime. However, their operators are not residents in the airport area, therefore it is not expected that they will be subject to involuntary resettlement. The staffs from the markets come from outside of the project area.

Cafeteria and market with permission from DCA

Markets open only during the day

5.4 Environmental Checklist

As a preliminary environmental and social consideration study, JICA's environmental checklist (Airport) was prepared as shown in Table 5-3. Environmental Checklist (Airport).

Table 5-3 Environmental Checklist (Airport)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been officially completed?	N	EIA reports have not been prepared in accordance with the regulation in Myanmar, as of July 2019. EIA reports shall be prepared by the project proponent and submitted to MONREC during the second phase survey. Condition imposed on the approval of the EIA report is not confirmed yet, since EIA reports have not been submitted
		(b) Have EIA reports been approved by authorities of the host country's government?	N	
		(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	N	
		(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?	N	The necessity of approval other than EIA report is also confirmed during the second phase survey.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
	(2) Explanation to the Public	(a) Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public?	N	Stakeholder meetings including information disclosure in accordance with the EIA procedure in Myanmar will be held during the second phase survey. In addition, comments from stakeholder meeting and public disclosure are expected to be reflected in the final EIA report.
		(b) Are proper responses made to the comments from the public and regulatory authorities?	N	
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	N	The alternative study including the necessity of this project as zero option study will be carried out during the second phase survey
2 Mitigation Measures	(1) Air Quality	(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?	-	The number of aircraft using the Heho Airport is expected to increase due to this project. The impact on air quality with these points will be forecasted in the EIA study.
		(b) Where industrial areas already exist near the airport, is there a possibility that the project will make air pollution worse?	-	
	(2) Water Quality	(a) Do pollutants, such as BOD, COD, SS, oil and grease contained in effluents from various facilities, such as related facilities and ancillary facilities, comply with the country's effluent standards? Is there a possibility that the effluents from the project will cause areas that do not comply with the country's ambient water quality standards?	Y	The sewage of the project site will be treated by septic tank to meet the emission standards of Myanmar and it will be discharged to the water body outside.
	(3) Wastes	(a) Are wastes generated from the airport and ancillary facilities properly treated and disposed of in accordance with the country's standards?	-	Environmental management plan will be prepared in the EIA report to be considered in the methodology of monitoring for solid waste.
	(4) Soil Contamination	(a) Has the soil in the project site been contaminated in the past, and are adequate measures taken to prevent soil contamination by leaked materials, such as aviation fuels?	-	The apron shall be laid with a rigid pavement to correspond with the risk of oil and grease leakage.
	(5) Noise and Vibration	(a) Does noise from aircraft comply with the country's standards?	-	Although the number of aircraft arrival and departure will increase, average noise level is not expected to change significantly with the current situation. Therefore, a baseline survey will be conducted in the EIA study, and a detailed study including comparison with reference values will be conducted.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
		(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?	N	Increasing surface transport vehicle is expected to raise the overall noise along the access road corridors, but the impact is expected to be limited since there are no receptors along the access roads into the airport.
	(6) 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?	-	The groundwater usage is assumed as in the current situation. It is expected that the intake will increase according to the demand, however, since it is not a rapid increase, ground subsidence is not expected.
	(7) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	N	There is no factor to cause offensive odor.
3 Natural Environment	(1) Protected Areas	(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?	—	The project is not located in the protected areas. In addition, impact on the protected areas is not expected.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	—	There are no primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats) in and around the airport.
		(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	—	The site is expected to have no habitat for protected species. In addition, the related investigation and examination will be conducted during the EIA study.
		(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	—	The project site is located in the existing airport area and significant ecological impacts are not anticipated.
		(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?	—	Since the amount of water usage by this project might be limited, significant negative impact is not expected.
	(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?	—	Alteration of drainage system will not be caused by the project. The environmental effect should be studied in case of changing river stream near the project site.
		(b) Do the facilities affect adversely flow regimes, waves, tides, currents of rivers, etc., if the project facilities are constructed on/by the seas?	—	The project will not be executed on/by the seas.
	(4) Topography and Geology	(a) Does the project require the large-scale change of topographic/geographic features?	—	The project site is located on the land that has already been developed and there is no large-scale change of topographic/geographic features.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
		(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?	—	There is no slope whose stability should be considered in the project area.
		(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?	-	Countermeasures to prevent soil runoff will be considered.
		(d) In the case of offshore projects, is there any possibility that the project will erode natural beaches?	—	It is not applicable.
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?	—	The project will be implemented on the site acquired by the Government of Myanmar, and it is expected that the planned site will be leased after the implementation of land acquisition and involuntary resettlement.
		(b) Is adequate explanation on relocation and compensation given to affected persons prior to resettlement?	—	
		(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards, developed based on socioeconomic studies on resettlement?	—	
		(d) Is the compensation going to be paid prior to resettlement?	—	
		(e) Are the compensation policies prepared in document?	—	
		(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	—	
		(g) Are agreements with the affected people obtained prior to resettlement?	—	
		(h) Is the organizational framework established to properly implement the resettlement? Are the capacity and budget secured to implement the plan?	—	
		(i) Are any plans developed to monitor the impacts of resettlement?	—	
		(j) Is the grievance redress mechanism established?	—	
	(2) Living and Livelihood	(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?	—	The project will be implemented on the land acquired by the Government of Myanmar, and it is not expected to have significant negative impacts on the livelihoods of the residents.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
		(b) Is there any possibility that the project causes the change of land uses in the neighboring areas to affect adversely the livelihood of local people?	-	The project will be implemented on the area acquired by the Government of Myanmar, and it is expected that the direct impact on road traffic and land use by local residents and water use shall be minimal.
		(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?	-	By the extension of the terminal, aircraft movement will be changed; and workers will increase during construction. Therefore, adequate mitigation measures should be considered for the risk of diseases when the detailed plan is prepared.
		(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?	-	The project is the extension of the existing airport terminal; necessary infrastructure for the new terminal such as access road and water and sewage system have already been installed in the airport.
		(e) Is there any possibility that the airports and other project structures will cause sun shading and radio interference?	N	The possibility that the project structures will cause sun shading and radio interference is negligible.
	(3) 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?	—	There is no archeological, historical, cultural and religious heritage in and around the project area.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	—	The local landscape will not be adversely affected by the proposed structures.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	—	Since the project will be executed in the airport area without land acquisition, the project is not expected to have impacts on the culture and lifestyle of ethnic minorities and indigenous peoples.
		(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	—	
	(6) Working Conditions	(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?	-	DCA has managed the operation of the Heho Airport in accordance with the law of occupational safety and health in Myanmar. Even after the implementation of this project, continuous management by the project proponent shall be conducted.
		(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?	-	In the project, the acoustic design and building materials might be considered to shield occupants from aircraft noise levels.
		(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.?	--	Project proponent might develop elaborate plans to ensure safety and health of the workers and airport users that are guided by the local and international safeguards including International Civil Aviation Organization (ICAO).

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
		(d) Are appropriate measures taken to ensure that security guards involved in the project do not violate safety of other individuals involved or local residents?	–	Since the project is executed in the existing airport area, the project will have low safety risks for residents associated with security guards.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	Y	【Air quality】 Some negative impacts on air quality are expected in the short term because of exhaust gas, re-suspended soils and dust from construction machineries and vehicles. Toward the impact, some mitigation measures will be considered such as periodic maintenance of machineries and vehicles, regularly sprinkling water to the construction site and access road, and implementation of excavation in a state of wet soil. 【Noise and vibration】 Since the construction site is inside the airport area, few negative impacts for noise and vibration are expected around the airport. However, limited impact is assumed on the residences along the transportation route of vehicles for construction. To mitigate this impact, some measures like pre-notification to related people and setting of signboards will be considered. In addition, installation of fence around the construction site and limitation of the working hour during low operational time zone of the airport are considered. 【Solid waste】 Excavated soil, mowed grass, felled trees, and other construction waste are expected to be generated from the construction works. The proper waste management policy, which is the integrated management and recycling method in the site, will be prepared to deal with construction waste properly. 【Water quality】 As for domestic drainage from the construction site, several measures such as installment of receptacle for appropriate discharge and installment of mobile toilets at the construction work areas and construction camp sites will be considered.
		(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce these impacts?	N	It is expected that the working environment might be improved by reducing the exhaust gas and noise from the aircraft and reducing the aircraft noise by sound of the terminal building and building materials.
		(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce these impacts?	-	Since the construction work is to be conducted inside the airport area, impact on social environment is expected to be limited. Potential impacts may be impact on safety risk of airport users and employees by construction workers and construction vehicles and increase of risks on spreading of infectious diseases such as

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
				HIV/AIDS. Toward these potential risks, some measures will be considered such as to observe safety precautions at all times at the construction work by the contractors, to streamline people and vehicular movement in and out of the airport especially within the construction site, to provide appropriate alternative parking lots to the airport users, and to enhance awareness of the workers on HIV/AIDS and other social infections.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	-	Environmental management plan will be prepared in the EIA study that includes environmental monitoring, environmental performance and mechanism for evaluation. Environmental and social management plan will be prepared that sets the monitoring items for air quality, water quality, noise, drainage, waste management, biological environment, and occupational health and safety, and the responsible authority.
		(b) What are the items, methods, and frequencies of the monitoring program?	-	
		(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	-	Adequate measures will be considered and provided in the EIA report.
		(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?	-	Adequate measures will be considered and provided in the EIA report.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Roads, Railways, and Bridges checklist should also be checked (e.g., projects including roads, railways, bridges).	―	Since the project does not include any plans related to road, railway, and bridge, it is not applicable.
		(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 transmission lines and/or electric distribution facilities).	―	Since the project is not located on the sea, it is not applicable.
		(c) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation).	―	Since the project does not include large areas of deforestation, it is not applicable.
	Note on Using Environmental Checklist	(a) If necessary, the impacts on transboundary or global issues should be confirmed (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).	-	The impacts on transboundary or global issues will be considered and provided in the EIA report.

Source: The Study Team

5.5 Environmental and Social Consideration Study Required by Second Phase Survey

5.5.1 Requirement of EIA Procedure in Myanmar

According to the EIA procedure in Myanmar, it is assumed that this project will be categorized into EIA and approved by Environmental Compliance Certificate (ECC). Table 5-4 shows the categorization of economic activities for assessment purposes of the EIA procedure.

Table 5-4 Categorization of Economic Activities for Assessment Purposes of EIA Procedure

No.	Project	IEE	EIA
125	Airports and Runway Construction	Runway length < 2,100 m	Runway length ≥ 2,100 m

Source: Annex 1 Categorization of Economic Activities for Assessment Purposes of EIA Procedure in Myanmar (2015)

5.5.2 Requirement of EIA Study for JICA Environmental and Social Consideration Guideline

This project is rehabilitation and expansion of an existing airport, and the newly required land acquisition area is also limited. The land acquisition cost has already been agreed between the government and the private landowners. In addition, the number of targets for involuntary resettlement is limited. Therefore, Undesirable environmental and social impact is not expected. Then this project might be categorized as "Environmental Category B". Therefore, the Advisory Committee for environmental and social considerations will not be held.

In the environmental and social considerations studies, based on JICA's Guidelines for Environmental and Social Considerations, alternative plans will be analyzed, and a prediction / assessment of the items that have significant environmental impacts, mitigation measures, and monitoring plans will be prepared. The report is prepared based on "JICA Category B Report Outline".

In the survey on social considerations (land acquisition and resettlement), a Abbreviated Resettlement Action Plan (ARAP) will be prepared based on JICA's Guidelines for Environmental and Social Considerations and the World Bank Safeguard Policy. Refer to the World Bank "Involuntary Resettlement Source Book Planning and Implementation in Development Projects" for the contents that should be included in the ARAP, as well as specific preparation procedures, survey contents, and methods.

If there is land that has already been acquired or resettled for this project, the implemented land acquisition process, methodology for public consultation meeting and compensation policy for resettlement will be reviewed. In the process of resettlement, the consultation method and compensation policy will be confirmed. In case the result has a diremption from JICA's guidelines for environmental and social consideration, the solution for the diremption will be proposed.