DEPARTMENT OF CIVIL AVIATION,
MINISTRY OF PUBLIC WORKS AND TRANSPORT
LAO PEOPLE' S DEMOCRATIC REPBULIC

FINAL REPORT ON THE PROJECT FOR TECHNICAL SUPPORT ON CONTINUOUS IMPROVEMENT OF VIENTIANE INTERNATIONAL AIRPORT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

MAY 2022

JAPAN INTERNATIONAL COOPERATION AGENCY

GYROS CORPORATION
PACIFIC CONSULTANTS CO., LTD.

IM
JR
22-077

Location Map

Summary

1. Background of the Project

1.1. Background

In the Lao People's Democratic Republic (herein Lao PDR), which is the only landlocked country in the Association of Southeast Asian Nations (ASEAN) with a mountainous area that occupies 80% of the land, air transport is an essential means of transportation for the development of the country. It is necessary for the smooth movement of people and goods and connectivity with neighboring countries.

Vientiane International Airport, located in Vientiane, the capital of Loa PDR, plays an essential role as a gateway to the country. It is a base for economic activities such as tourism and trade. According to the Department of Civil Aviation (DCA), Ministry of Public Works and Transport (MPWT), the number of passengers increased at an annual rate of about 16% between 2009 and 2019, and approximately 1.76 million international passengers and 580 thousand domestic passengers used Vientiane International Airport in 2019.

To cope with growing demand, the international passenger terminal building was expanded, and construction of a new domestic passenger terminal building was conducted by a 9 million yen loan entitled "Vientiane International Airport Terminal Expansion Project" (2014). Although both terminal buildings began operating in August 2018, the air transport demand has outgrown the original demand forecast.

Vientiane International Airport must be improved, and the development effects of the past project must be maintained. The DCA's capacity building needs to be enhanced by forming a long-term improvement plan that includes improving the appropriate airport facilities and operations along with system development.

1.2. Project Outline

1.2.1. Overall Goal

The usability, efficiency, and safety of Vientiane International Airport have been improved to meet growing air traffic demand.

1.2.2. Project Purpose

The DCA's capacities relevant to continuous improvement of Vientiane International Airport have been developed.

1.2.3. Output

Output 1: The current situation of Vientiane International Airport has been understood.

Output 2: The air traffic demand forecasts for Vientiane International Airport up to the year 2050 have been conducted.

Output 3: Current facilities and services at Vientiane International Airport have been evaluated.

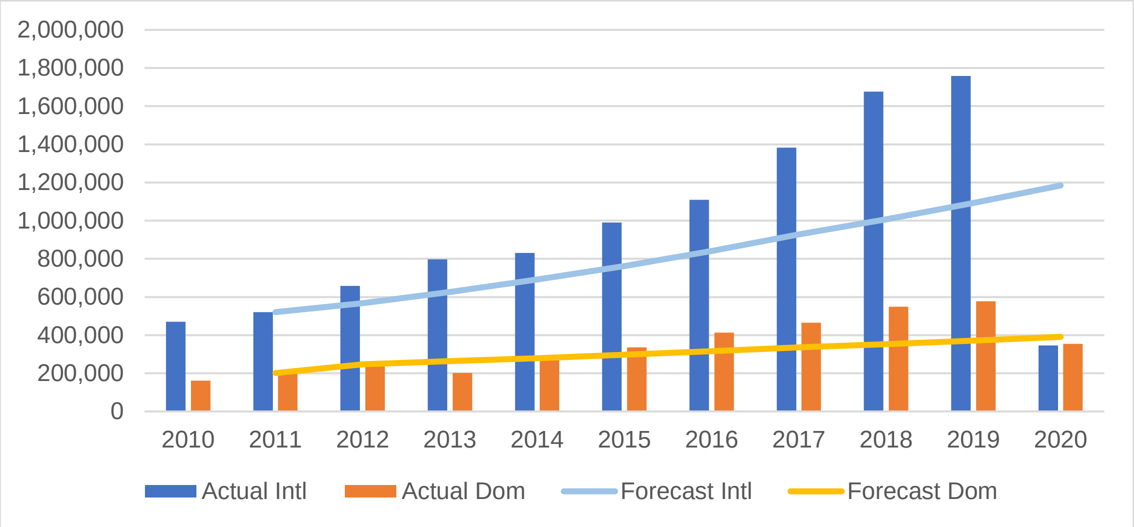
Output 4: Immediate improvement needs of Vientiane International Airport have been identified.

Output 5: Development of a long-term improvement plan for Vientiane International Airport in consideration of the social and environmental impacts on the surrounding areas.

Output 6: Economic and financial analyses of the long-term improvement plan for Vientiane International Airport have been conducted.

2. Current Situation

Figure 1 summarizes passenger and aircraft movements at Vientiane International Airport from 2010 to 2020, also showing the demand forecast results of the Vientiane International Airport Terminal Expansion Project Preparation Survey (hereinafter referred to as the Terminal Expansion Project) conducted in 2013. In 2019, there were 1.76 million international passengers and 578,000 domestic passengers. As result of demand forecast for Terminal Expansion Project, the number of international passengers in 2019 estimated to be about 1.1 million, and domestic passengers estimated to be about 350,000, so the number of passengers increased at a much higher level than this forecast. The number of international and domestic passengers increased at an average annual rate of 15%–16% in 2010–2019 until the global pandemic of COVID-19 hit the air traffic in 2020.



Source*: DCA ,L-JATS and Terminal Expansion Project Report.*

Figure 1. The trend of Passenger Movement at VTE

3. Air traffic demand forecast

Annual air traffic passengers were forecasted based on the correlation between past air passengers and GDP in Lao PDR. The future GDP was estimated considering the national economic growth and also the impact of COVID-19 on the economy. Figure 2 shows the result of the air traffic demand forecast.

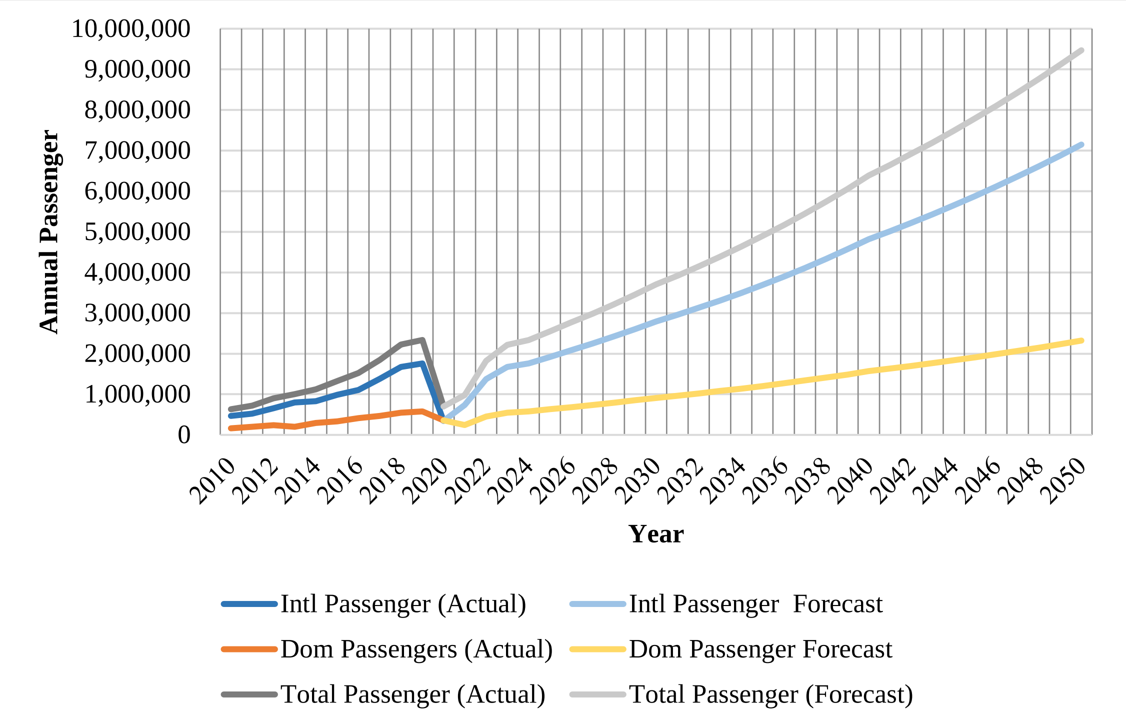


Figure 2 Results of Air Traffic Demand Forecast

The international passenger will be 2.8 million in 2030 and 7.1 million in 2050. The domestic passenger will be 0.9 million in 2030 and 2.3 million in 2050.

4. Evaluation of Current Facilities and Services

JICA TC Team evaluated the existing facility by comparing it with current capacity and future demand while considering safety issues.

4.1. Runway, Taxiways and Aprons

JICA TC Team calculated the runway length requirements for current and future aircraft types, and the result was that the current runway length of 3,000 m is sufficient. The runway capacity has been calculated based on the current operating procedures. The runway's estimated current peak hour capacity is 21 movements per hour, and these movements will be reached by 2035. Some cracks appear on the runway's surface, and the pavement surface conditions has become rough.

The dimensions and separation of taxiways satisfy international standards. However, pavement conditions have deteriorated in some areas, and the pavement was overlaid more than 15 years ago. It may need to be overlaid within ten years. There are severe cracks on Taxiway B and Taxiway T.

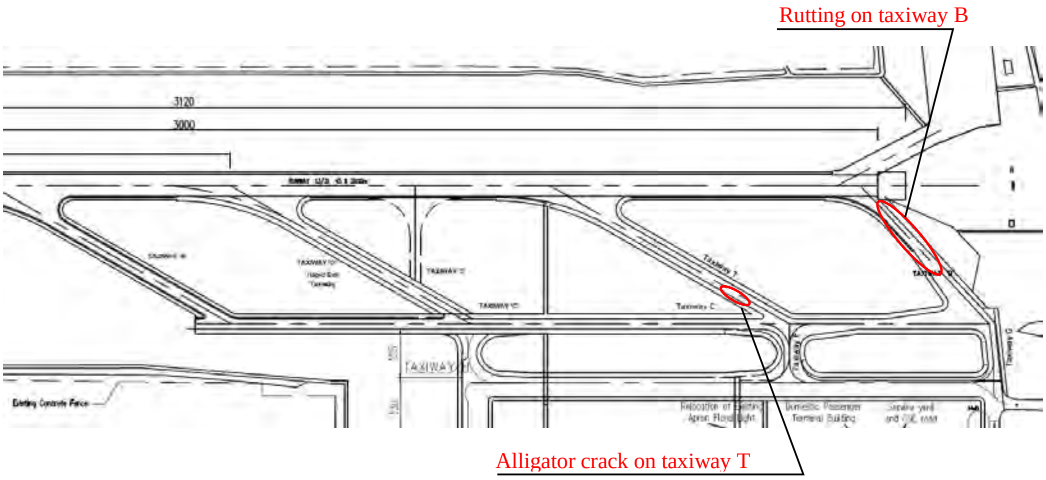


Figure 3 Severe Cracks on Taxiway B and Taxiway T

The current capacity of the apron is 20 parking spots. The peak hour aircraft parking will be more than 20 by 2035. There are severe cracks on the apron concrete slabs, and these slabs need to be replaced by new concrete slabs.

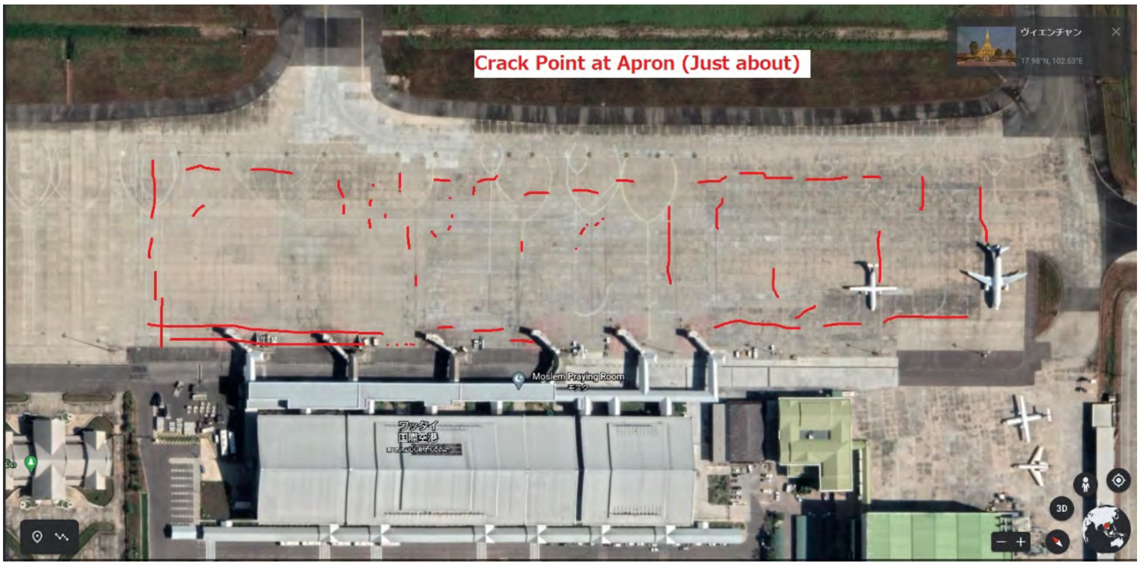


Figure 4 Severe Cracks in Apron

4.2. Passenger Terminal Buildings

The capacity of passenger terminal buildings was estimated by comparing current facility size and future facility requirements based on the peak hour passengers. The result was that capacity of both international and domestic passenger terminal buildings would be reached by 2030.

4.3. Other Facilities

The existing access road from the national highway to the terminal area is very congested during peak hours.

Most of the airfield lighting system was installed in 1997, and the condition has deteriorated.

There are many obstacles in the vicinity of the airport, which infringe the obstacle limitation surface.

5. Immediate Improvement Needs at Vientiane International Airport

The following facilities need to be developed to ease the congestion and improve service to the passengers.

- International Passenger Terminal Building
- Domestic Passenger Terminal Building
- Access Road

The following facilities need immediate rehabilitation.

- Taxiways
- Apron
- Airfield Lighting Systems

5.1. International Passenger Terminal Building

The Departure Lounge in the international passenger terminal building is 1,200 m2 and will run out of space if many passengers recover after the COVID-19 pandemic. Therefore, the JICA TC Team proposes to create a new departure lounge space between the departure concourse and the main building, as shown in Figure 5.

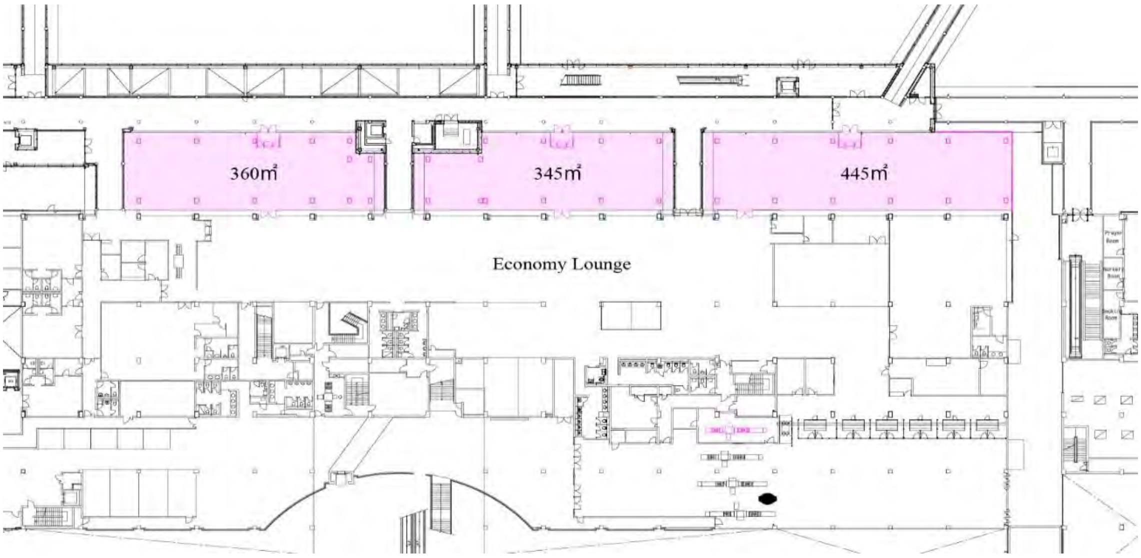


Figure 5 Improvement Plan of Departure Lounge in International Passenger Terminal

5.2. Domestic Passenger Terminal Building

Before COVD-19, congestions occured at the baggage claim area in the domestic passenger terminal building. There is a baggage claim belt, but sometimes more than two flights arrive simultaneously. To solve the congestion, the JICA TC Team proposes to install a new baggage belt. Since there is enough space to install the other belt, it is not challenging to install the equipment, as shown in Figure 6.

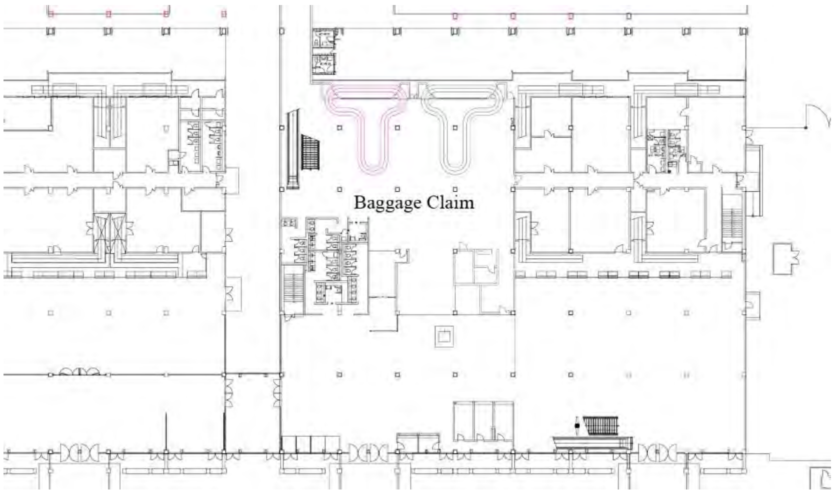


Figure 6 Additional Baggage Claim Belt in Domestic Passenger Terminal Building

5.3. Expansion of the Access Road

The JICA TC Team planned to add a lane in the entry part of the access road from the intersection of national road 13 to the terminal area, with the lane assignment shown in the figure below.

This lane widening will enable smooth travel from the national road to the terminal area and is expected to reduce traffic congestion on the entry lane. In addition, the exit lane will be widened to three lanes for smooth traffic flow.

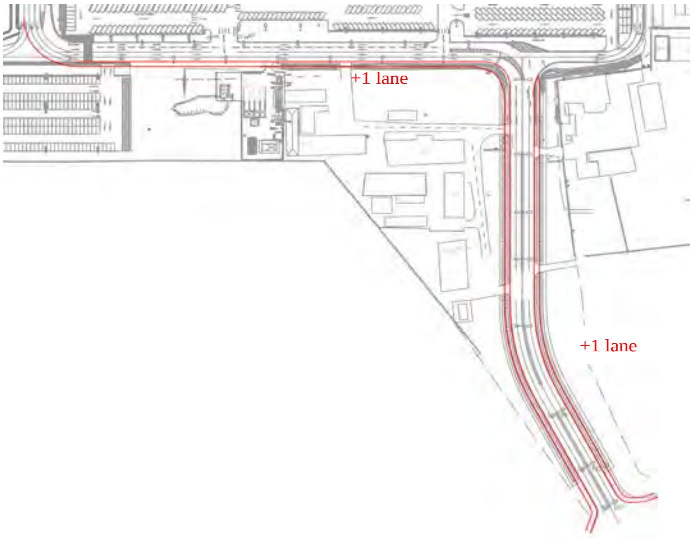


Figure 7 Access Road Expansion Plan

5.4. *Rehabilitation of Taxiways*

The priority of rehabilitation of taxiways is Taxiway B and Taxiway T. The area of rutting and cracks should be repaired to avoid further damage to the pavement and overlay of the entire area. The overlay area of Taxiway B is 13,242 m2, and that of Taxiway T is 15,972 m2.

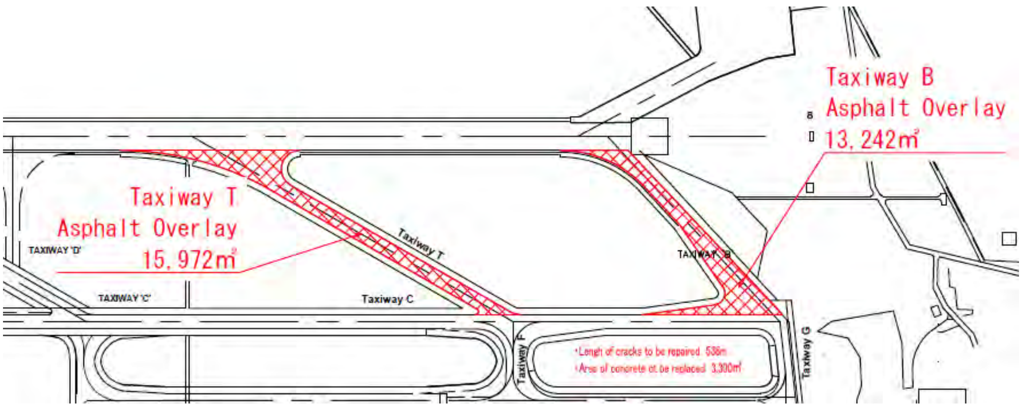
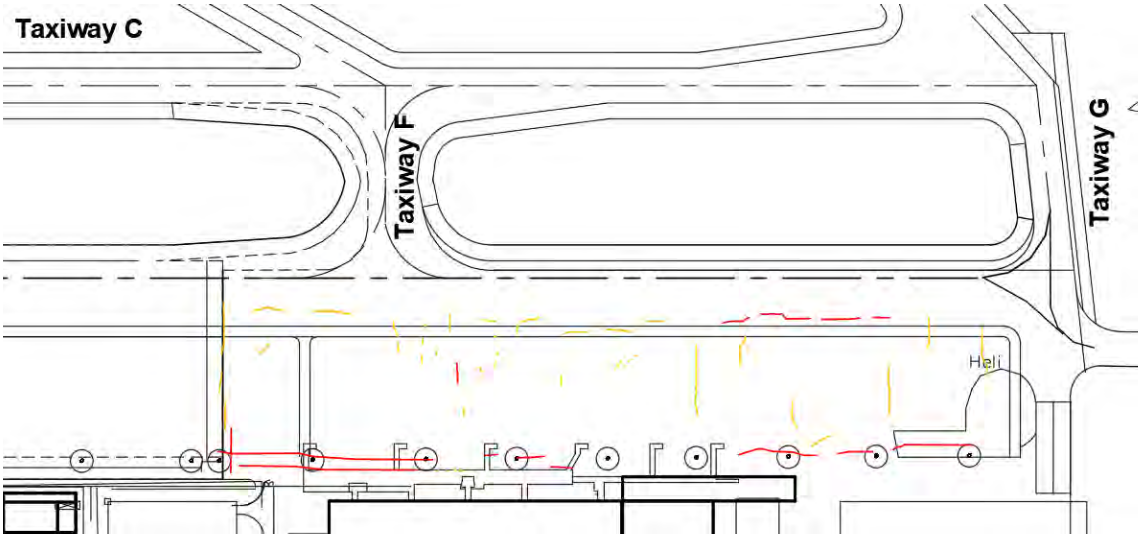


Figure 8 Rehabilitation of Taxiway B and Taxiway T

5.5. *Rehabilitation of Aprons*

The size of the apron pavement cracks is large and in a wide area. It was reported that water went into the cracks. These cracks are severe and require the replacement of the whole slab as the cracks appear to penetrate the pavement's entire thickness. The cracks appear on the edge line and the second line of slabs. Replacement of these slabs with a new concrete slab is recommended. In addition to the edge, cracks on the No. 14 spot should be replaced because the crack shows it is structural damage.



—: Cracks considered desirable to be repaired
—: Cracks that should be considered for observation and maintenance.

Figure 9 Sketch of the location of cracks in the apron

5.6. Rehabilitation of Air Field Lighting System

Replacement of lightings on Taxiway B and Taxiway T is planned. The power cables around the taxiways are old and buried without pipe. It is necessary to replace all power cables in this area. In addition to the wires for Taxiway B and Taxiway T, the replacement of lines to PAPI close to the Runway 13 Threshold is planned because there are common cable routes with the taxiway light cables. Some of the CCRs are old, and no spare parts are available. These CCRs should be replaced due to age and instability.

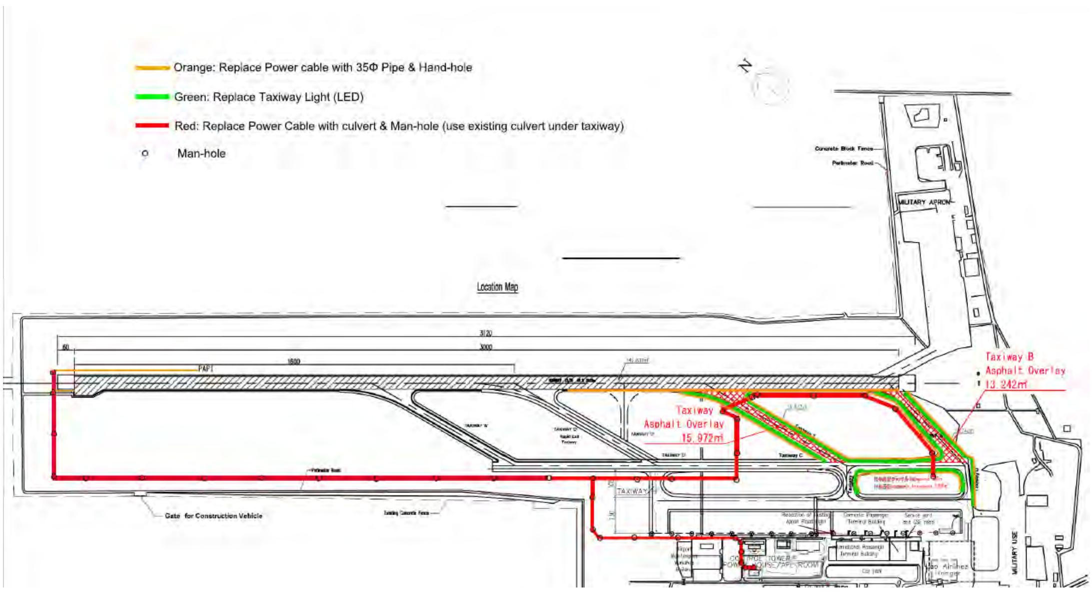


Figure 10 Rehabilitation of Airfield Lighting System in Immediate Improvement Plan

5.7. Cost Estimate

The total cost of the Immediate Improvement Plan is estimated as LAK 229,240 million (JPY 2,353 million).

6. Long-term Improvement Plan of Vientiane International Airport

6.1. Phasing of Development Plan

The phased development plan is prepared for a long term improvement plan. Phase 1 is the immediate development plan explained above. Five-year development plans from 2030 to 2040 are planned. Each plan is prepared considering that the facility will not require significant development after five years of completion. The scope of work in each phase are summarized in Table 1.

Table 1 Scope of Work of Each Phase

Phases	Completion Year	Target Demand Year	Scope of Works
Phase 1 (Immediate Improvement)	2025	2035	International Passenger Terminal Building Domestic passenger Terminal Building Expansion of Access Road Rehabilitation of Taxiway B and T Rehabilitation of Aprons Rehabilitation of Air Field Lighting System
Phase 2	2030	2035	Expansion of Aprons Extension of Parallel Taxiway New Access Road from Western Side Additional Car Parks Rehabilitation of Runway Pavement Rehabilitation of Taxiway Pavement Repair of Air Field Lighting System New Power House
Phase 3	2035	2040	New Cargo Terminal Building New VVIP Building Construction of International Departure Passenger Building Renovation of International Passenger Building Renovation of Domestic Passenger Building
Phase 4	2040	2045	Expansion of Aprons Extension of Parallel Taxiway Renovation of Passenger Terminal Building Rehabilitation of Air Field Lighting System

6.2. Phase 2 Development Plan

6.2.1. Expansion of Apron

The parking spots will be insufficient before 2035. It is necessary to expand the apron to meet future demand. The parking spot marking will be changed to accommodate required aircraft in the existing and extended apron, as shown in Figure 11.

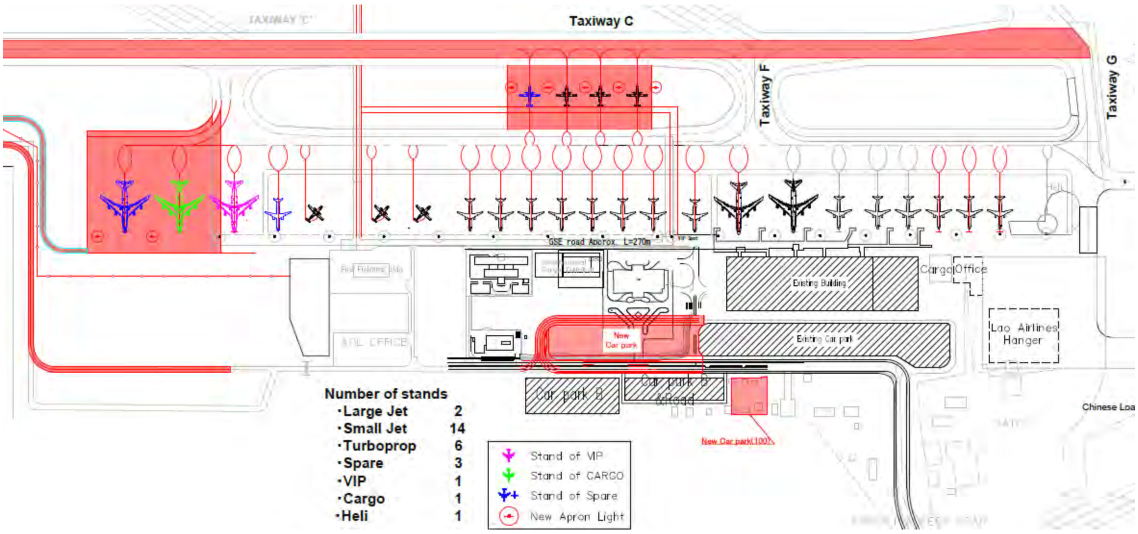


Figure 11 Expansion of Apron in Phase 2

6.2.2. Extension of Parallel Taxiway

To improve the runway throughput, some turboprop aircraft and small jet aircraft must depart Runway 13. The extension of the parallel taxiway to secure 2,500 m takeoff length is planned.

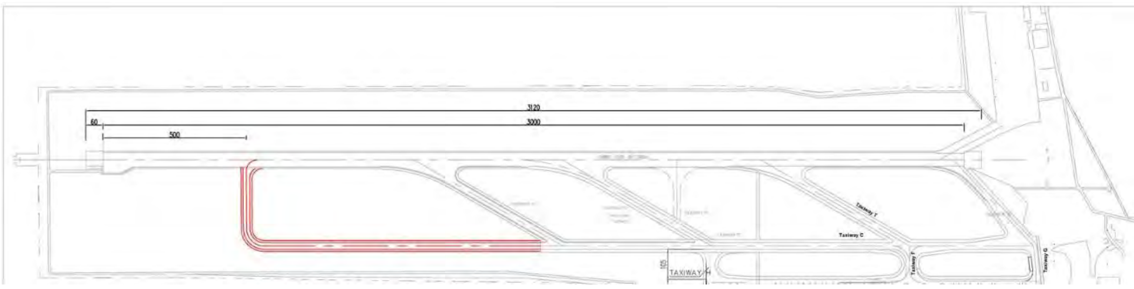


Figure 12 Development Plan of Expansion of Parallel Taxiway

6.2.3. Rehabilitation of Runway and Taxiway Pavement

The whole area of the runway and taxiways other than Taxiway B, Taxiway T, and Taxiway D were overlaid in 2006. Since that time, there have been no significant rehabilitation works. It is planned to conduct the overlay work in this phase, and at the same time, the airfield lighting system on the runway and the taxiway will be replaced.

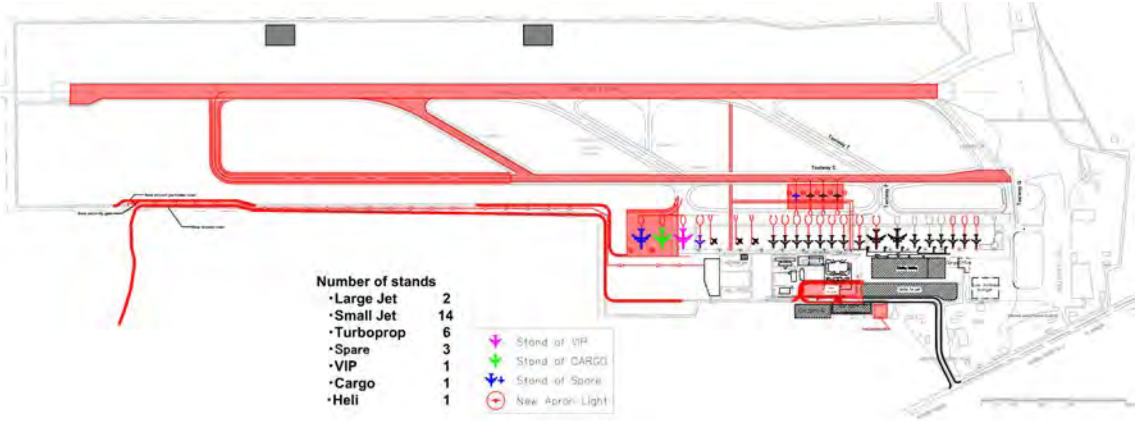


Figure 13 Pavement Rehabilitation Plan in Phase 2

*6.2.4. Air Field Li*ghting System

Major rehabilitation of airfield lighting system is planned. All the runway lights and taxiway lights will be replaced with LED type, and power cables will be replaced with new wires cast in pipes. The rehabilitation has to be conducted while keeping the existing lighting. A new powerhouse is planned next to the current powerhouse. CCRs for associated lighting will also be replaced. The scope of the work is shown below:

- Taxiway edge lights
- Runway edge lights
- Turn pad lights
- CCRs (Runway A, Runway B, Threshold 13, PAPI 13, PAPI31, Threshold 31, Approach Lights, Taxiway A, and Taxiway B)
- Power cables
- New powerhouse
- Backup generators

The layout plan of airfield lighting system rehabilitation is shown in Figure 13.

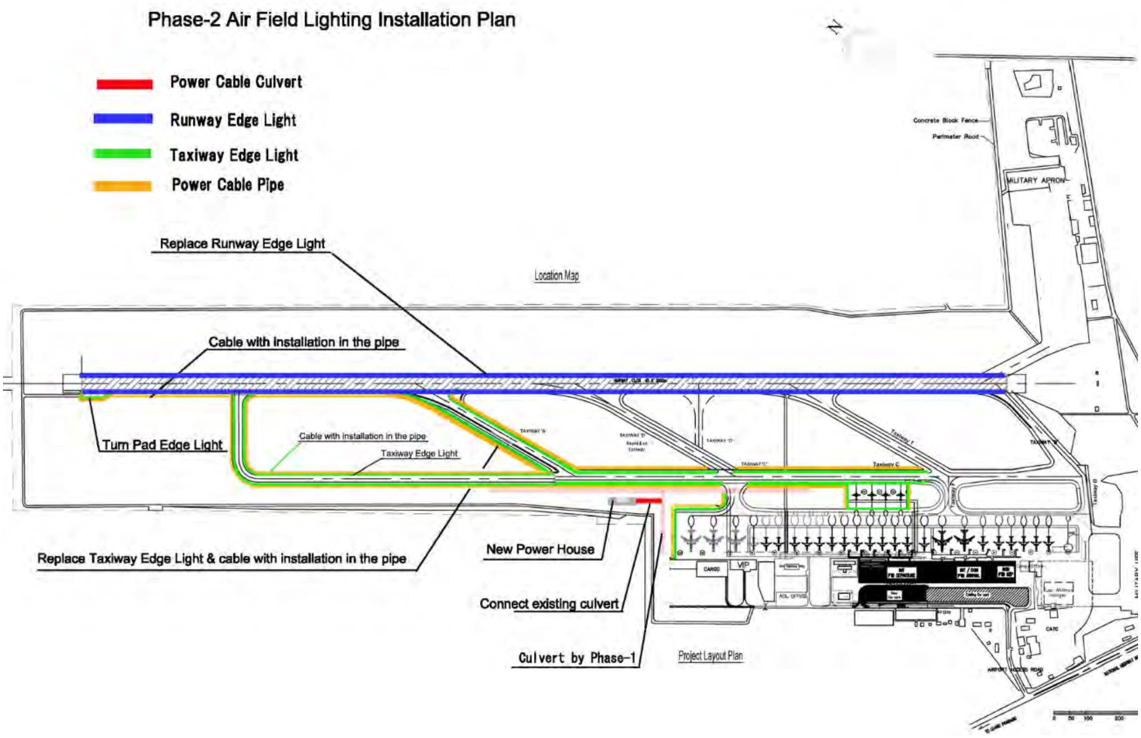


Figure 14 Air Field Lighting System Rehabilitation Plan in Phase 2

6.2.5. The new access road from the West Side

A new access route from national road 13 to the existing gate at the western side of the airport is planned as the access route from the northwest. The way will be connected to the terminal area by utilizing part of the existing airport service road.

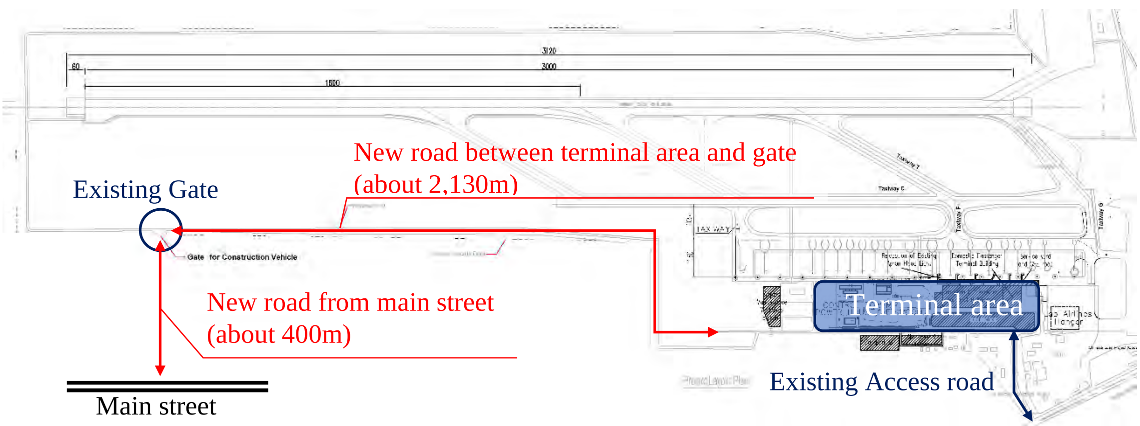


Figure 15 Outline of the New Access Road

6.2.6. Cost Estimate

The total project cost for Phase 2 is estimated as LAK 399,930 million (JPY 4,105 million).

6.3. Phase 3 Development Plan

6.3.1. New Cargo Terminal Buildings and VVIP Building

Before constructing the new international departure passenger building, the existing cargo terminal building and VVIP building will be relocated to the open space in the west part of the airport.

6.3.2. Passenger Terminal Buildings

The construction of a new international departure passenger building is planned. The existing international passenger building will be converted to a dedicated arrival passenger terminal for international and domestic passengers. The current domestic passenger terminal building will be converted to a domestic departure passenger building. Figure 16 shows floor layout of the new international departure passenger building and the existing international and domestic building.

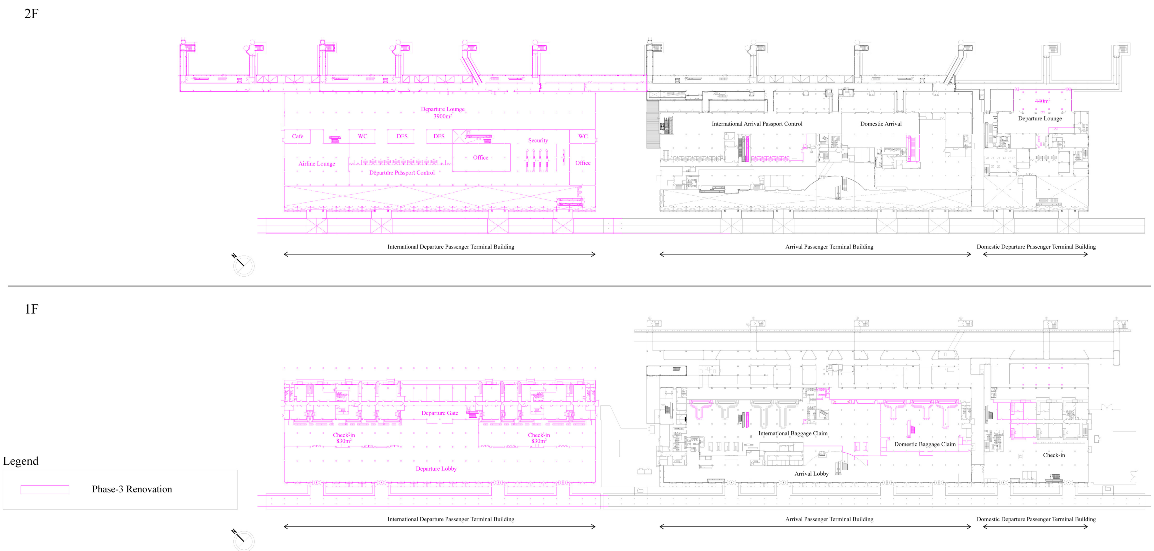


Figure 16 Floor Layout of New Passenger Termina Buildings in Phase 3

Figure 15 and Figure 16 shows the renovation plan of existing buildings in Phase 3.

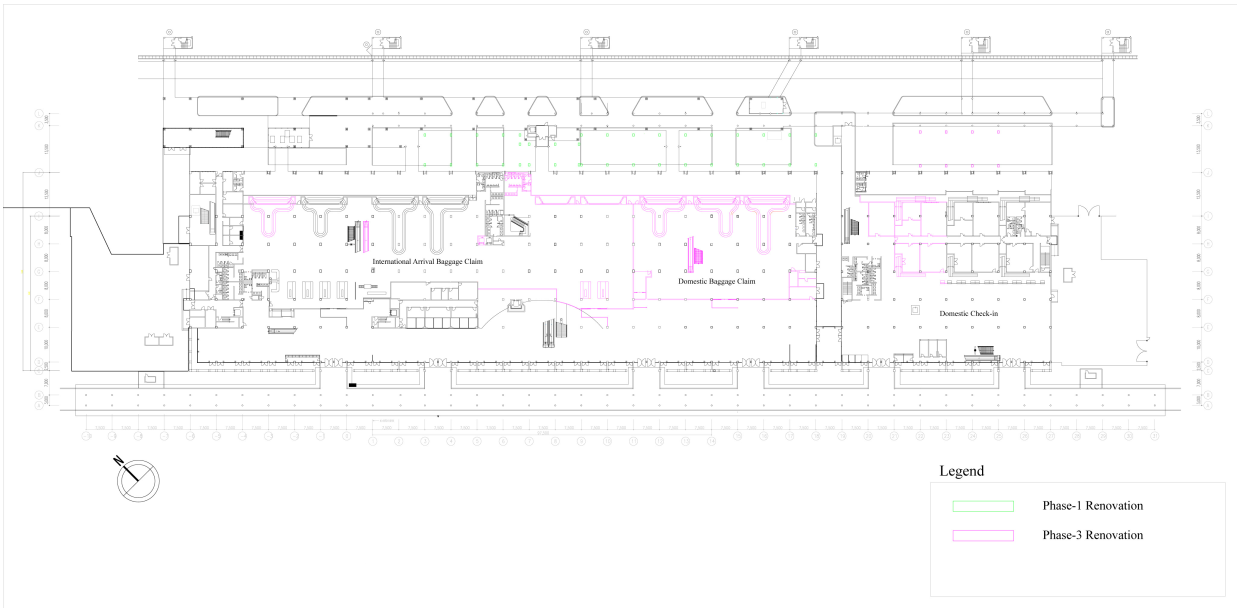


Figure 17 Phase-3 Renovation Plan of Passenger Terminal Building (1st Floor)

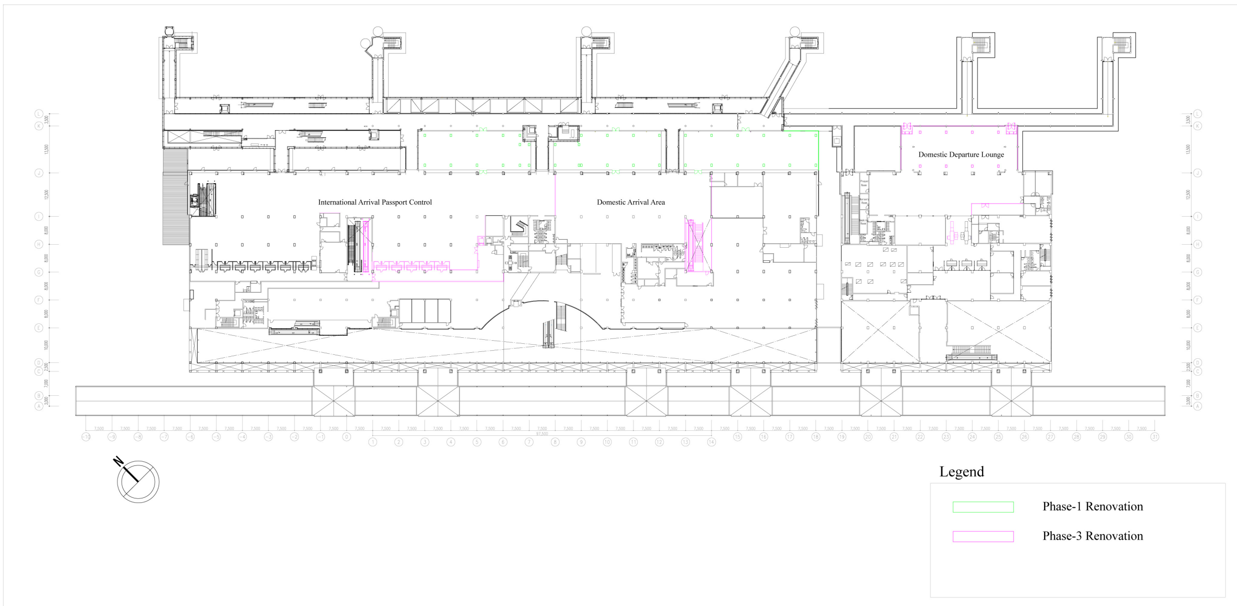


Figure 18 Phase-3 Renovation Plan of Passenger Terminal Building (2nd Floor)

6.3.3. Special Equipment

It is expected that the current security X-ray system for screening hold baggage and cabin baggage will be replaced with CT type X-ray equipment in future. This phase plans to replace the existing X-ray system with CT type X-ray equipment.

6.3.4. Cost Estimate

The total project cost for Phase 3 is estimated as LAK 1,975,410 million (JPY 20,289 million).

6.4. Phase 4 Development Plan

The scope of the Phase 4 development plan is to expand the apron, extend the parallel taxiway, and renovate the passenger terminal buildings.

6.4.1. Expansion of Apron

To meet the demand in 2045, the apron between Taxiway C and the existing apron is extended to the western side. Because all the turboprop aircraft will be parked in the extended area and change of parking configurations in the frontal apron, expansion of the frontal apron to the western side will not be required.

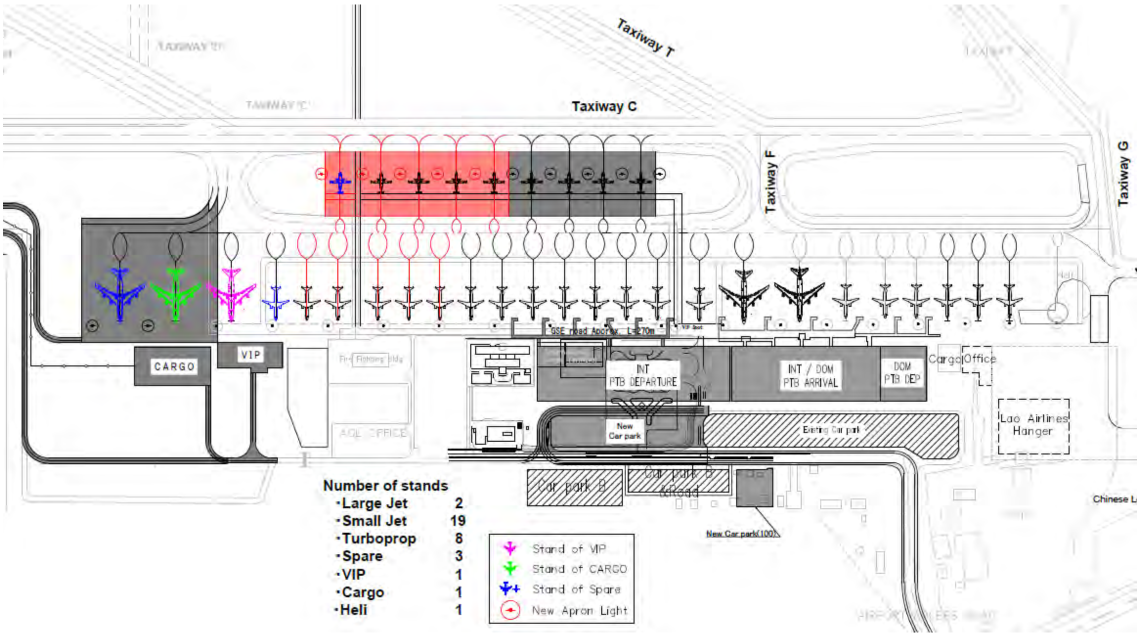


Figure 19 Expansion of Apron in Phase 4

6.4.1. Extension of Parallel Taxiway

Extension of the parallel taxiway to the Runway Threshold 13 is planned in this phase.

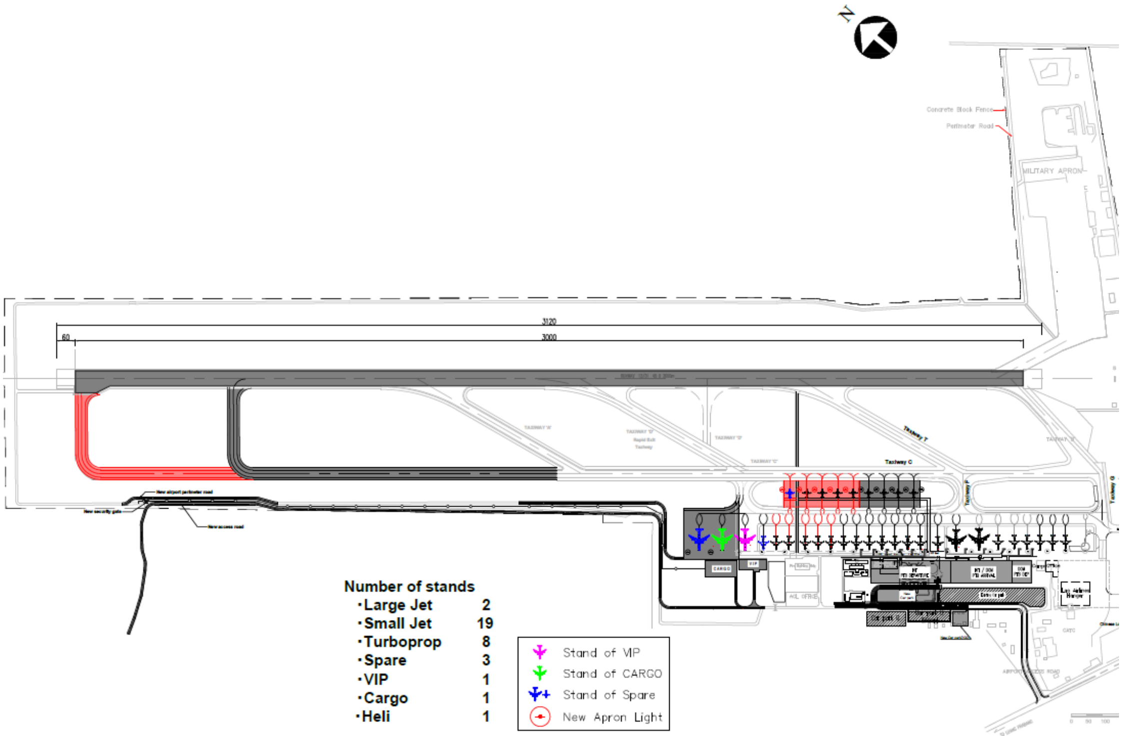


Figure 20 Extension of Parallel Taxiway

6.4.2. Renovation of Passenger Terminal Buildings

The renovation of the passenger terminal building in this phase will not require major structural expansion. Additional baggage claim belts will be installed in the domestic arrival area on the First Floor. Other counters of the international arrival immigration will be installed on the Second Floor of the arrival building.

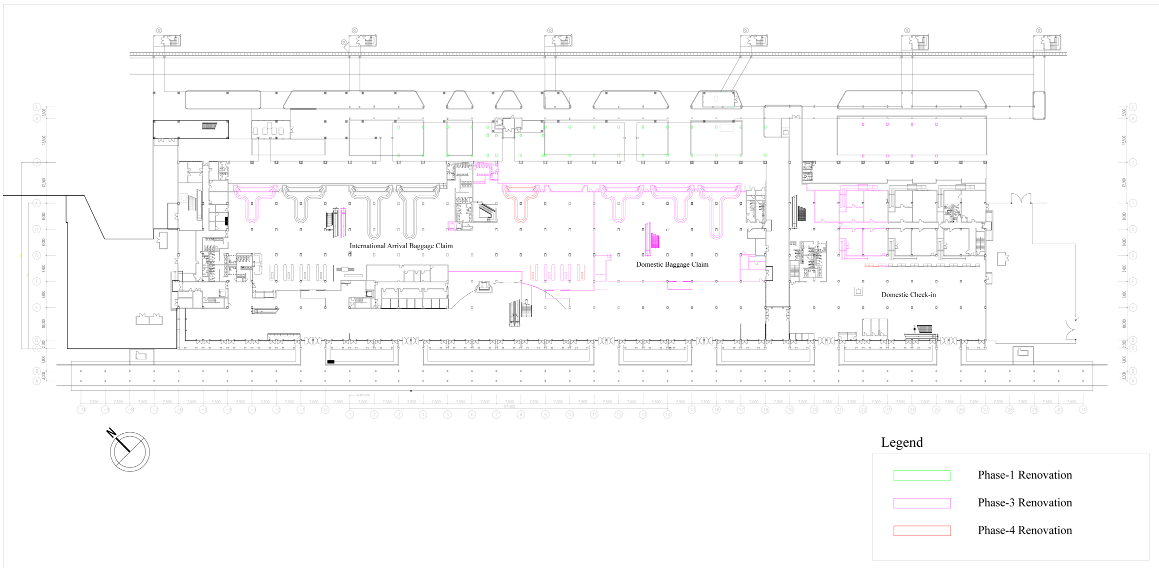


Figure 21 Phase-4 Renovation Plan of Passenger Terminal Building (1st Floor)

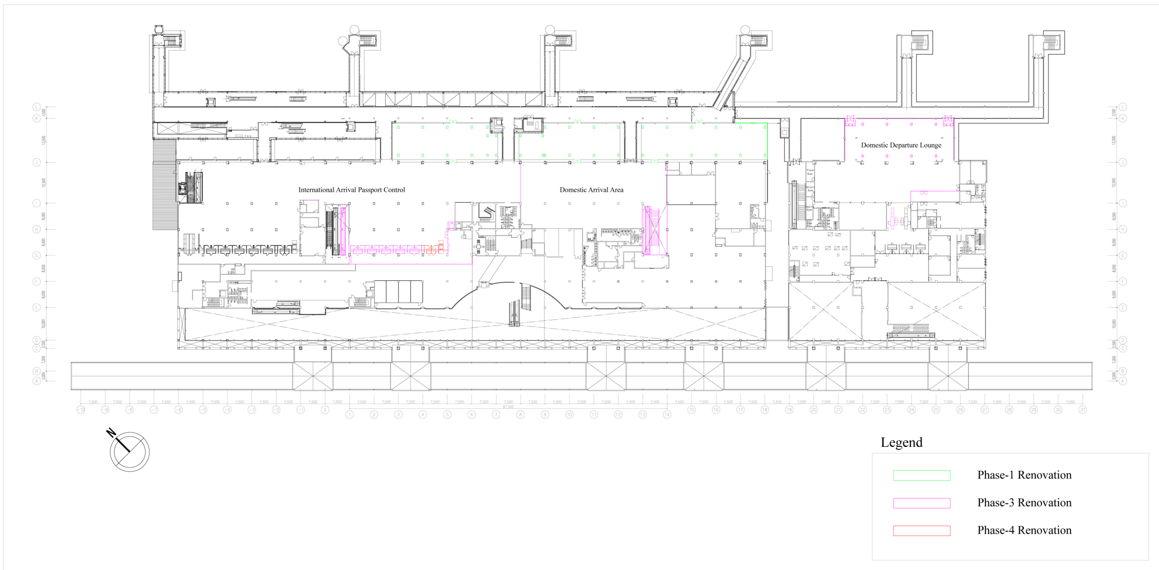


Figure 22 Phase-4 Renovation Plan of Passenger Terminal Building (2nd Floor)

6.4.3. Air Field Lighting System

Because the apron is expanded and the parallel taxiway is extended, installation of new apron floodlights and taxiway edge lights are planned. The PAPI will be replaced on both sides. Threshold lights on both sides are approach lights for 13 approaches. Stop bars will be installed in all six taxiways. The layout plan of the airfield lighting system rehabilitation is shown in Figure 21.

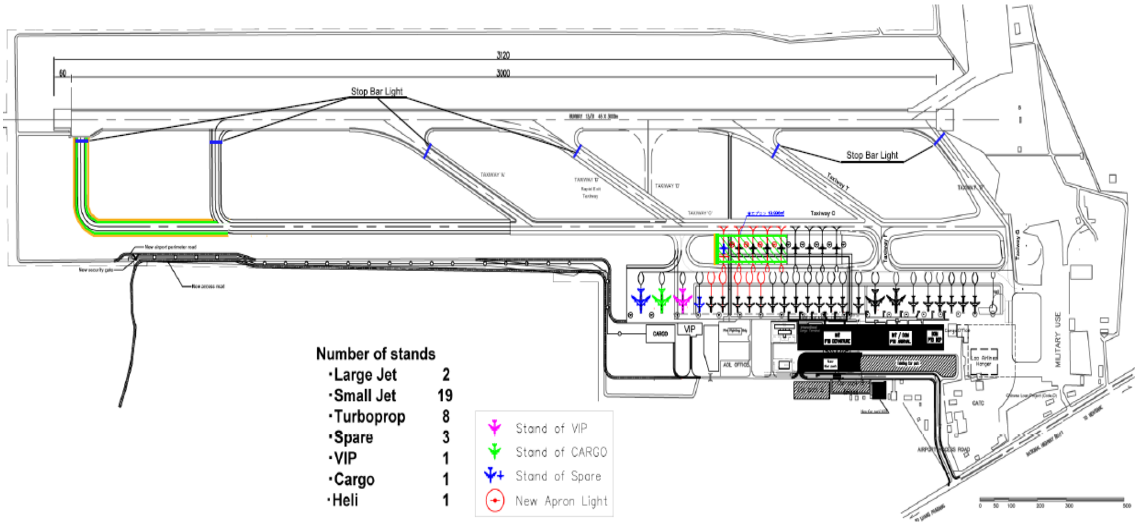


Figure 23 Air Field Lighting System in Phase 4

6.4.4. Cost Estimate

The total project cost for Phase 3 is estimated as LAK 250,550 million (JPY 2,572 million).

6.4.5. Summary

Figure 24 shows the airport layout after completing all phases development plan. After extending the parallel taxiway to the runway 13 threshold side, the runway capacity will be 30 movements per hour. The ability to handle international passengers will be 5.9 million passengers per annum, and that for the domestic passenger will be 1.9 million. Thus, the total handling capacity will be 7.8 million passengers per annum. To maintain Vientiane International Airport to the capacity of the year 2045, the total investment will be approximately LAK 2,885,130 million (JPY 29,308 million).

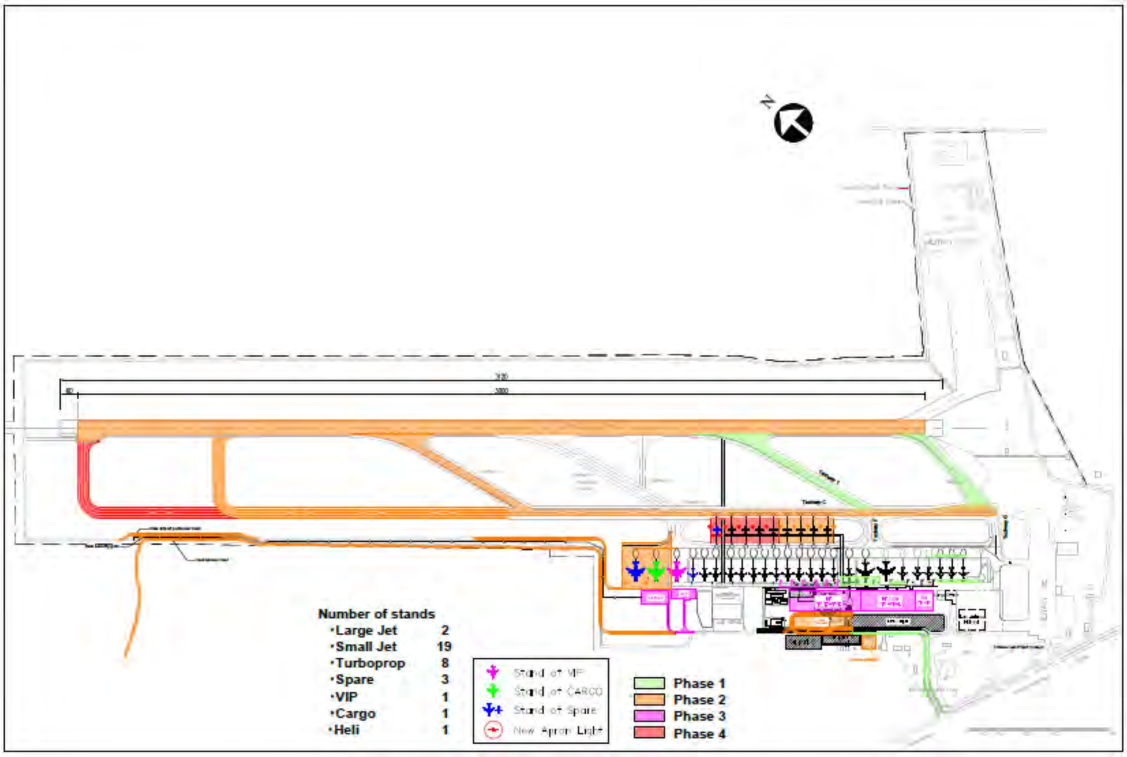


Figure 24 Final Airport Layout Plan

7. Financial and Economic Analyses

The Project FIRR is calculated at 6.1%. If financed at a lower cost than 6.1%, the project will be financially feasible. EIRR is 22.0%, above the target of 12%. The project's economic net present value (ENPV) is calculated LAK 1,286,130 million at a 12% discount rate. It could be concluded that the current project is economically feasible and should be implemented as it is expected to generate sufficient economic benefits to the country.

Location Map

Summary

Table of Contents

Abbreviations

Table of Contents

List of Tables

List of Figures

Abbreviations

ACC	Area Control Center
ADB	Asian Development Bank
ADRM	Airport Development Reference Manual
AEC	ASEAN Economic Community
AFTN	Aeronautical Fixed Telecommunication Network
AIM	Aeronautical Information Management
AIP	Aeronautical Information Publication
AMHS	ATS Message Handling Services
AOL	Airport of Laos
ASEAN	Association of Southeast Asian Nations
ASEM	Asia Europe Meeting
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Airport Terminal Service
ATS	Air Traffic Service
AWOS	Automatic Weather Observation System
CAA	Civil Aviation Authority
CAGR	Compound Average Growth Rate
CBR	California Bearing Ratio
CCR	Constant Current Regulator
CDP	United Nations Committee for Development Programs
CNS	Communication Navigation and Surveillance
CTR	Control Area
CUPPS	Common Use Passenger Processing System
DCA	Department of Civil Aviation
DFR	Draft Final Report
DME	Distance Measuring Equipment
DNRP	Department of Natural Resources and Policy
Dom DPTB	Domestic Departure Passenger Terminal Building
DPTB	Domestic Passenger Terminal Building
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMMP	Environmental Management and Monitoring Plans
ENPV	Economic Net Present Value
ESIA	Environmental and Social Impact Assessment
FAA	Federal Aviation Administration
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GPS	Global Positioning System
GSE	Ground Support Equipment
HHL	Hung Huang Logistics Co., Ltd:
IAP	Instrument Approach
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IEE	Initial Environmental Examination
IFR	Instrumental Flight Rules
ILS	Instrument Landing System
Int’l/Dom APTB	International and Domestic Arrival Passenger Terminal Building
Int'l DPTB	International Departure Passenger Terminal Building
IPTB	International Passenger Terminal Building
ISA	International Standard Atmosphere
JCAB	Japan Civil Aviation Bureau

JICA	Japan International Cooperation Agency
JICA TC Team	JICA Technical Cooperation Team
JPY	Japanese Yen
LAK	Lao Kip
LANS	Lao Air Navigation Services
LATM	Lao Air Traffic Management
LDC	Least Developed Country
LED	Light Emitting Diode
LED	Light Emitting Diode
L-JATS	Lao-Japan Airport Terminal Service
LPLAAF	Lao People's Liberation Army Air Force
LSB	Lao Statistics Bureau
LSFC	Lao State Fuel Company
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MONRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
MPWT	Ministry of Public Works and Transport
MSSR	Mono-pulse Secondary Surveillance Radar
MTOW	Maximum Takeoff Weight
NM	Nautical Mile
NSEDP	National Socio-Economic Development Plan
OAG	Official Airline Guide
OAS	Obstacle Assessment Surface
OCHA	UN Office for the Coordination of Humanitarian Affairs
OECD	Organization for Economic Co-operation and Development
OEW	Operating Empty Weight
OLS	Obstacle Limitation Surface
OPEC	Organization of the Petroleum Exporting Countries
PAPI	Precision Approach Path Indicator
PBB	Passenger Boarding Bridge
PBN	Performance Based Navigation
PCN	Pavement Classification Number
PCR	Polymerase Chain Reaction
PDR	People's Democratic Republic
PONRE	Provincial/ Capital Department of Natural Resources and Environment
PR	Progress Report
PRS	Preferential Runway System
PSF	Passenger Service Fee
PSR	Primary Surveillance Radar
RCAG	Remote Control Air to Ground
RPK	Revenue Passenger Kilometers
RVR	Runway Visual Range
RWY	Runway
SDGs	Sustainable Development Goals
SID	Standard Instrument Departure
SMMP	Social Management and Monitoring Plans
STAR	Standard Instrument Arrival
TMA	Terminal Area
TTM	Telegraphic Transfer Middle Rate
TWY	Taxiway
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
USD	United States Dollar
VAT	Value Added Tax
VHF	Very High Frequency

VIP	Very Important People
VMC	Visual Meteorological Condition
VOR	VHF Omni Directional Range
VSAT	Very Small Aperture Terminal
VTE	IATA Code for Vientiane International Airport
WOP	Without Project
WP	With Project
WPT	Waypoint
WTO	World Trade Organization

1. Background of the Project

1.1. *Background of the Project*

In the Lao People's Democratic Republic (herein Lao PDR), which is the only landlocked country in the Association of Southeast Asian Nations (ASEAN) with a mountainous area that occupies 80% of the land, air transport is an important means of transportation for the development of the country. It is necessary for the smooth movement of people and goods and for connectivity with neighboring countries.

Vientiane International Airport, located in Vientiane, the capital of Loa PDR, plays an important role as a gateway to the country. It is a base for economic activities such as tourism and trade. According to the Department of Civil Aviation (DCA), Ministry of Public Works and Transport, the number of passengers increased at an annual rate of about 16% between 2009 and 2019, and approximately 1.79 million international passengers and 570,000 domestic passengers used Vientiane International Airport in 2019.

In order to cope with growing demand, expansion of the international passenger terminal building and construction of a new domestic passenger terminal building was conducted by a 9 million yen loan entitled "Vientiane International Airport Terminal Expansion Project" (2014). Although both terminal buildings began operating in August 2018, the air transport demand has outgrown the original demand forecast.

Vientiane International Airport must be improved, and the development effects of the past project must be maintained. The DCA's capacity building needs to be enhanced by forming a long-term improvement plan that includes the improvement of the appropriate airport facilities and operations along with system development.

1.2. *Project Outline*

1.2.1. *Overall Goal*

The usability, efficiency, and safety of Vientiane International Airport have been improved to meet growing air traffic demand.

1.2.2. *Project Purpose*

The DCA's capacities relevant to continuous improvement of Vientiane International Airport have been developed.

1.2.3. *Outputs*

There are six outputs from this project as follows:

Output 1: The current situation of Vientiane International Airport has been understood.

Output 2: The air traffic demand forecasts for Vientiane International Airport up to the year 2050 have been conducted.

Output 3: Current facilities and services at Vientiane International Airport have been evaluated.

Output 4: Immediate improvement needs of Vientiane International Airport have been identified.

Output 5: Development of a long-term improvement plan for Vientiane International Airport in consideration of the social and environmental impacts on the surrounding areas.

Output 6: Economic and financial analyses of the long-term improvement plan for Vientiane International Airport have been conducted.

1.2.4. *Activities*

Activities of this project are as follows:

1. To understand the current situation of Vientiane International Airport
   - 1-1 Socioeconomic conditions
   - 1-2 Air traffic demand growth trend
   - 1-3 Related organizations–government, airport operators, airlines, and others
   - 1-4 Government policy on airport development
   - 1-5 Facilities at Vientiane International Airport
   - 1-6 Airport access to Vientiane International Airport
   - 1-7 Past studies on the development of Vientiane International Airport
   - 1-8 Environmental laws and regulations

2. To conduct air traffic demand forecasts for Vientiane International Airport up to the year 2050
   - 2-1 Projection of future socioeconomic framework
   - 2-2 Forecast of annual passengers, aircraft movement, and cargos
   - 2-3 Peak hour forecasts
   - 2-4 Airport access traffic forecast

3. To evaluate current facilities and services of Vientiane International Airport with respect to current and future requirements
   - 3-1 Runway, instrument flight methods, and ATC procedures
   - 3-2 Taxiways and aircraft stands
   - 3-3 Passenger terminal facilities
   - 3-4 Cargo terminal facilities
   - 3-5 Rescue and firefighting facilities
   - 3-6 Aeronautical ground lighting systems
   - 3-7 Air navigation and meteorological systems
   - 3-8 Fuel supply facilities
   - 3-9 Airport access
   - 3-10 Airport utility systems
   - 3-11 Drainage
   - 3-12 Others

4. To identify immediate improvement needs at Vientiane International Airport
   - 4-1 Improvement of facilities
   - 4-2 Improvement of services

5. To develop a long-term improvement plan for Vientiane International Airport in consideration of social and environmental impacts on the surrounding areas
   - 5-1 To conduct alternative study to enhance runway capacity
   - 5-2 To formulate long-term improvement plans for airport facilities, including descriptions of each improvement, general layout plan, implementing organization, etc.
   - 5-3 To estimate a project implementation schedule and costs

6. To conduct economic and financial analyses of the long-term improvement plan for Vientiane International Airport
   - 6-1 To conduct an economic analysis of the long-term improvement plan
   - 6-2 To conduct a financial analysis of the long-term improvement plan
   - 6-3 To examine the funding plan for the long-term improvement plan

1.2.5. *Project Period*

The project period is from February 2021 to April 2022.

1.2.6. *Project Site*

The project site is Vientiane International Airport (VTE)

1.2.7. *Implementing Agency*

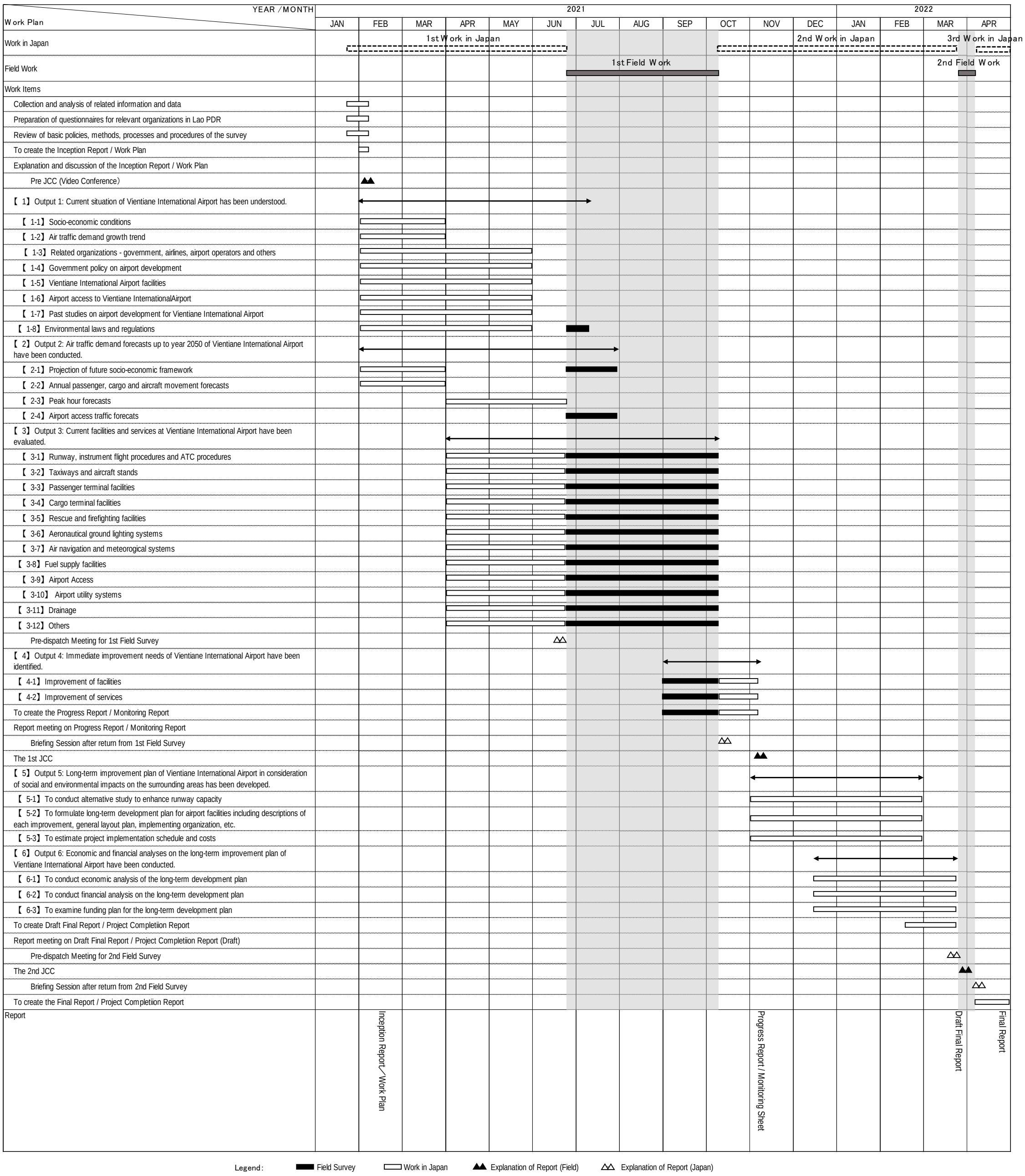
The implementing agency is the Department of Civil Aviation, Ministry of Public Works and Transport.

1.3. ***Project methods***

1.3.1. *Project Schedule*

The project implementation schedule and work flow chart are shown in Table 1.1 and Figure 1.1, respectively.

Table 1.1 Work Plan



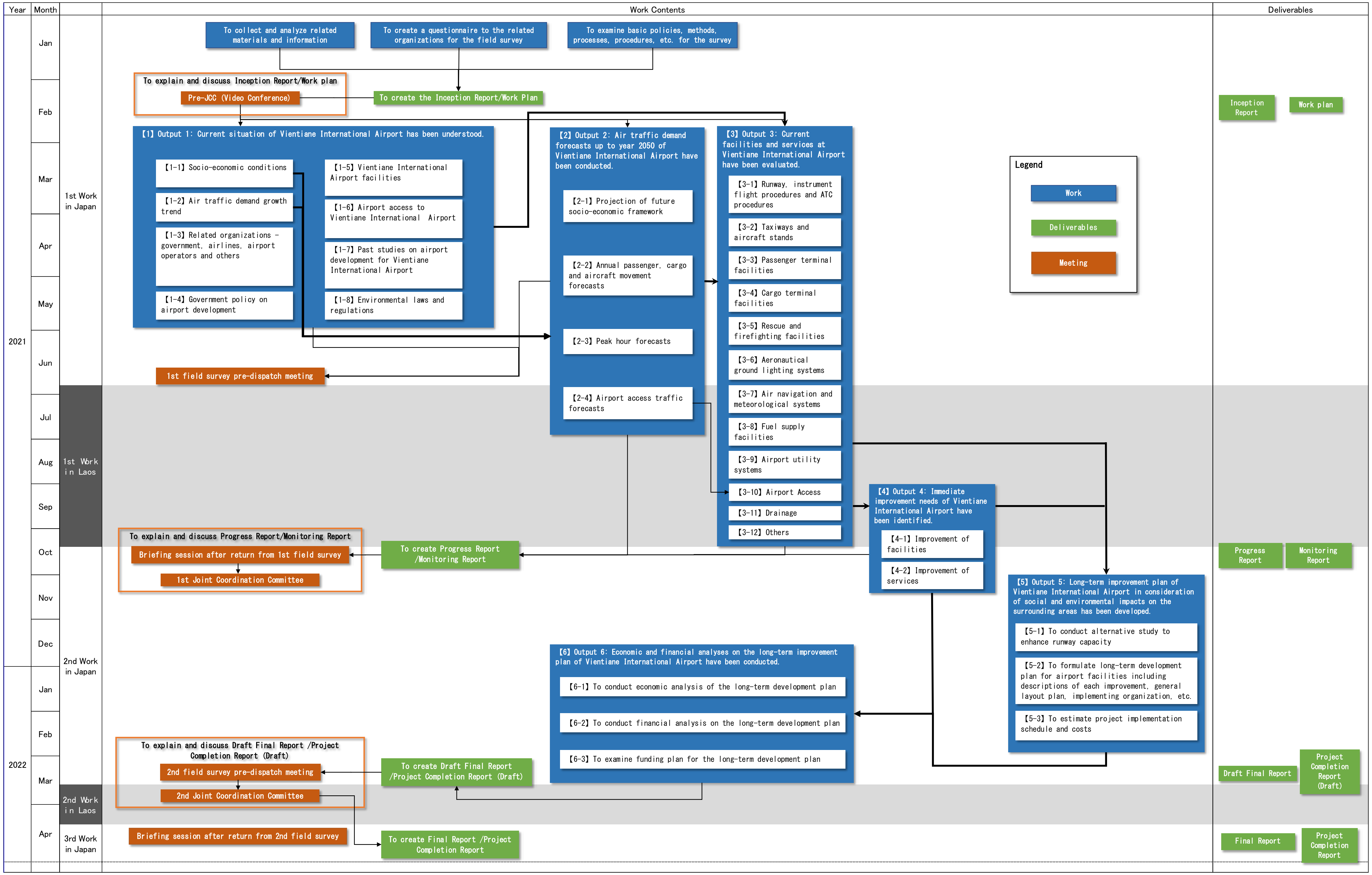


Figure 1.1 Work Flow of the Project.

1.3.2. *JICA Technical Cooperation Team Member*

Members of JICA Technical Cooperation (TC) Team from the Japanese side is shown in Table 1.2.

Table 1.2 JICA TC Team Members

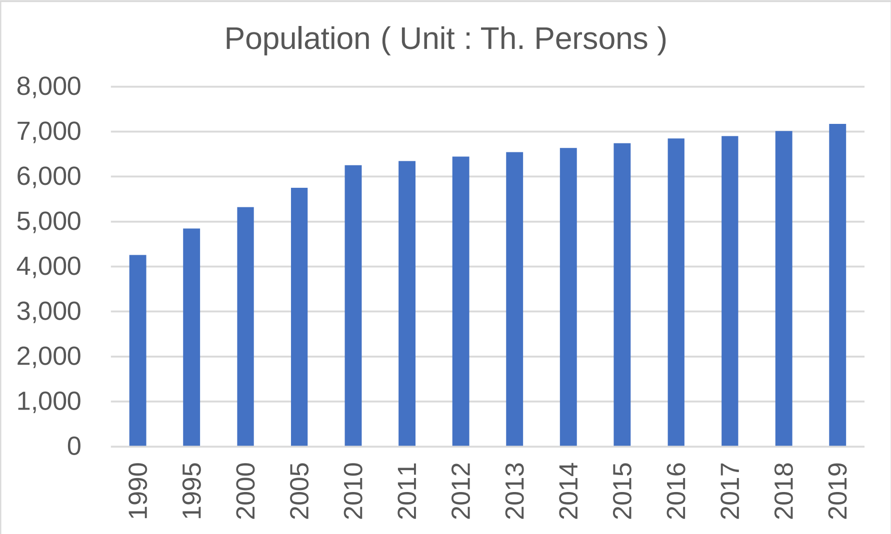
Position	Name	Company
Chief Advisor/Airport Planner/Runway/ATC Capacity Analysis Expert (2)	Mr. Takao Yamaguchi	Gyros Corporation
Air Traffic Demand Forecast Expert	Mr. Hideo Arikawa	Ars System Corporation
Runway/ATC Capacity Analysis Expert (1)	Mr. Atsushi Miwa	Pacific Consultants Co., Ltd.
Airspace and Flight Procedure Planner	Mr. Shinji Hara	Pacific Consultants Co., Ltd.
Airport Civil Engineering Facility Planner	Mr. Keisuke Mizukami	Pacific Consultants Co., Ltd.
Airport Terminal Facility Planner	Mr. Kimihiko Ogihara	Gyros Corporation
Air Navigation System Planner	Mr. Hiroshi Mizumasa	Gyros Corporation
Environmental Impact Expert	Mr. Norikazu Yamazaki	Yachiyo Engineering Co., Ltd.
Project Cost Estimation Expert	Ms. Marie Iokawa	Gyros Corporation
Economic/Financial Analysis Expert	Ms. Kinuyo Fukuda	Gyros Corporation
Local Consultant	Mr. Khamlek Chintavong	Gyros Corporation

2. Understanding the Current Situation

2.1. *Socio Economic Situation*

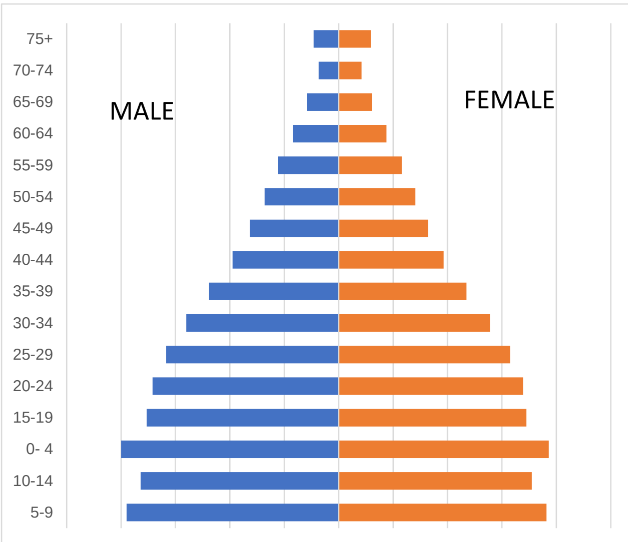
2.1.1. *Population and GDP*

The population of Lao PDR reached 7.17 million in 2019 (see Figure 2.1). The population is steadily increasing, and the pyramid-type age-gender composition suggests a continuous future increase (see Figure 2.2).



Source: *Lao Statistics Bureau, Ministry of Planning and Investment*

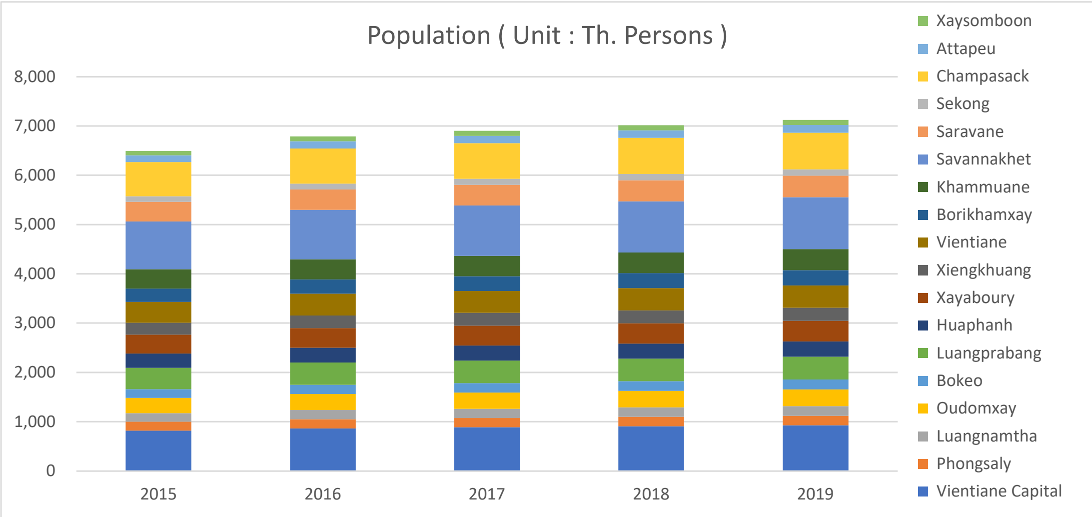
Figure 2.1 Population of Lao PDR



Source: Estimated from the "Population and Housing Census 2015" LSB, MPI.

Figure 2.2 Population by Sex and Age Category

Figure 2.3 shows the regional population of Lao PDR.

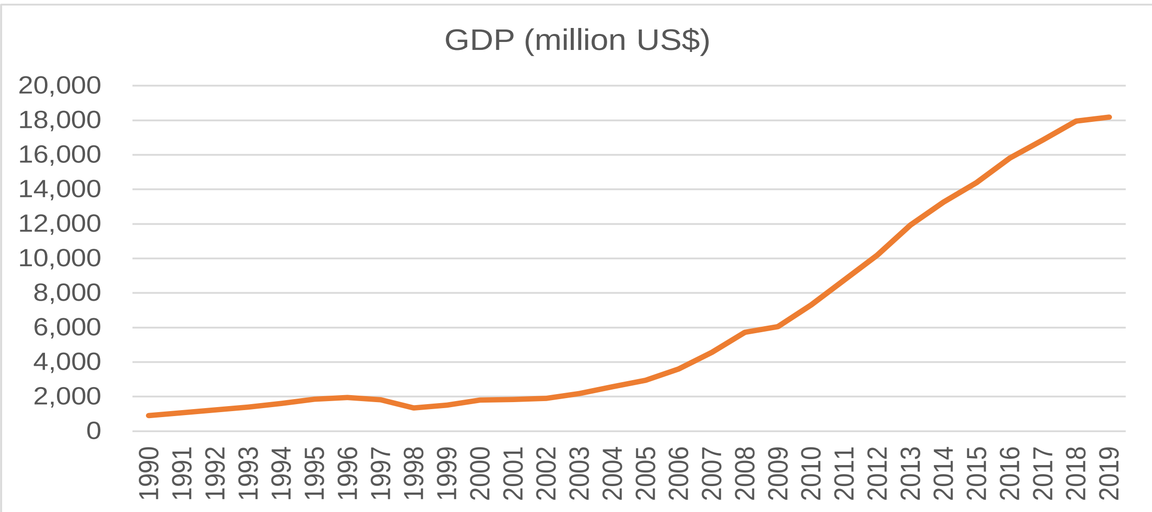


Source: Lao Statistics Bureau.

Figure 2.3 Lao PDR Population by Region

The United Nations Committee for Development Programs (CDP) classifies Lao PDR as a least developed country (LDC). Nominal GDP was U.S. $18.174 billion in 2019. The country's real GDP growth rate has been 7%–8% since 2006. It fell below 7% in 2016 and dropped to 4.7% in 2019 (see Figure 2.4).

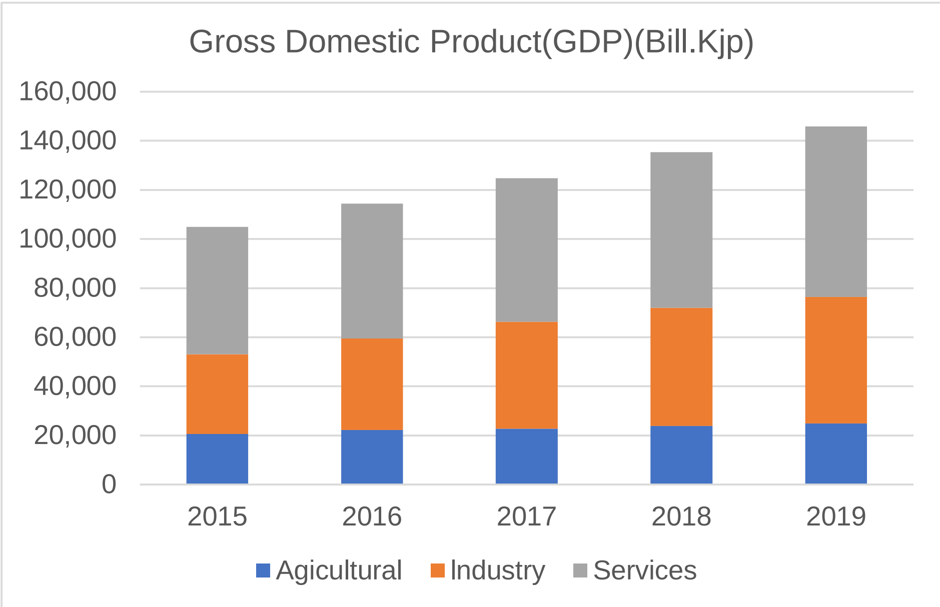
Since the beginning of 2020, the global spread of COVID-19 has had a major impact on the country's domestic economy because tourism, industry, trade, investment, prices, exchange rates, and remittances from abroad seriously declined. According to the World Bank, the country's economic growth was projected to range between −1.8% and −1% in 2020, the lowest since 1990. It also estimates that poverty will increase by 1.4% to 3.1% in 2020.



Source: UN, Global Note

Figure 2.4 National GDP of Lao DRP

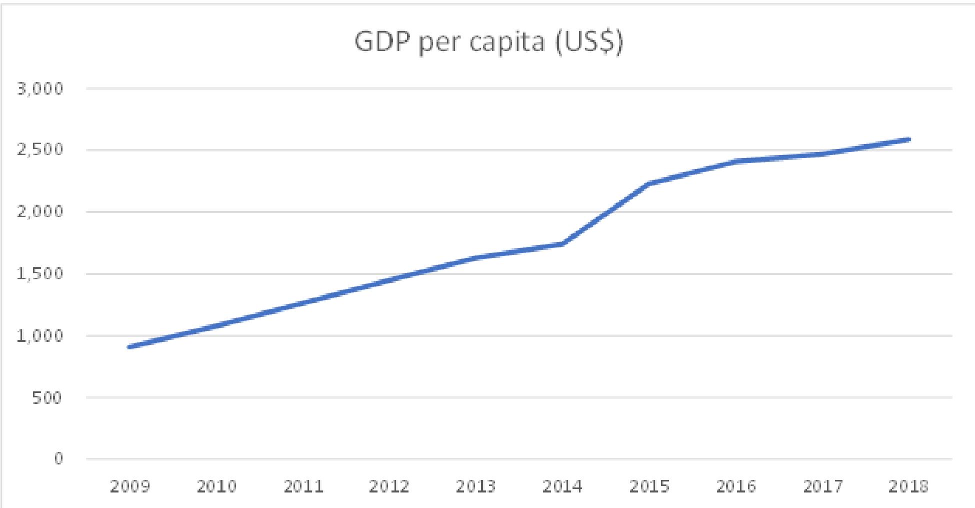
As Figure 2.5 shows, the industrial and service sectors outgrew the agricultural sector in 2015–2019. With the launch of the ASEAN Economic Community (AEC), signed in 2015, direct investment from neighboring countries in the industrial and service sectors of Lao PDR has increased.



Source: *Department of Economic Statistics, LSB, MPI.*

Figure 2.5 GDP by Sector

The trend of GDP per capital of the country is shown in Figure 2.6.

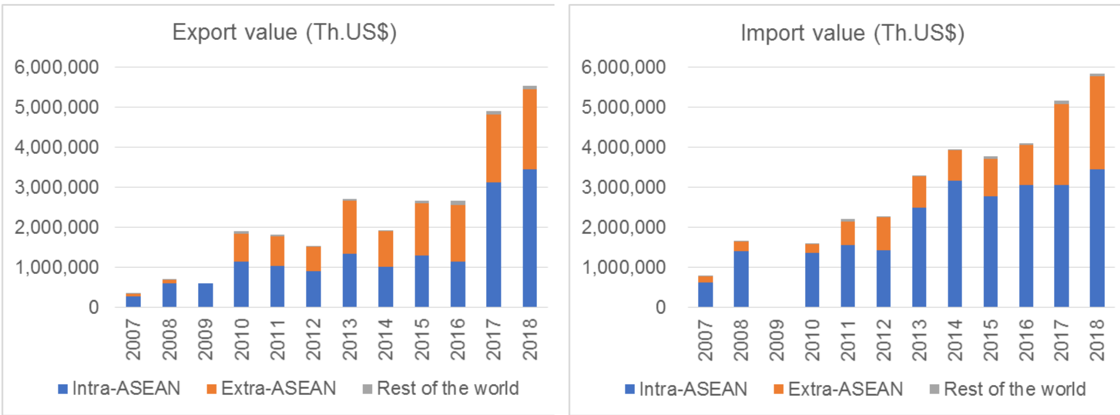


Source: Statistics Book by Lao PDR.

Figure 2.6 GDP per Capita

2.1.2. *Trade and freight transportation.*

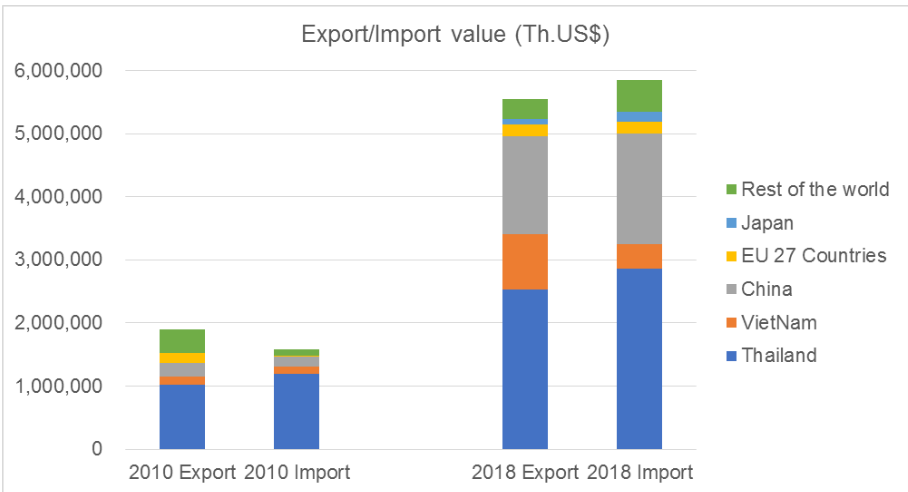
The trade value (exports and imports) of Lao PDR has increased as the result of tariff reduction following accession to the World Trade Organization (WTO) in 2012 and liberalization of regional trade as a member of the ASEAN Economic Community in 2015. In 2019, it was approximately U.S. $12 billion, ten times that in 2007. As Figure 2.7 shows, imports have increased constantly while exports expanded rapidly after 2016, assisted by industrial sector development.



Source: Department of Economic Statistics, LSB, MPI.

Figure 2.7 Exports and Imports of Lao PDR

Lao PDR's major trading partners are Thailand, Vietnam, and China. Thailand remains the single largest trading partner, assisted by increased direct investment from Thailand to Lao PDR. In recent years, however, trade with Vietnam and China have increased rapidly. Trade with the other bordering countries, Cambodia and Myanmar, is still limited. (See Figure 2.8 for Lao PDR imports and exports.)

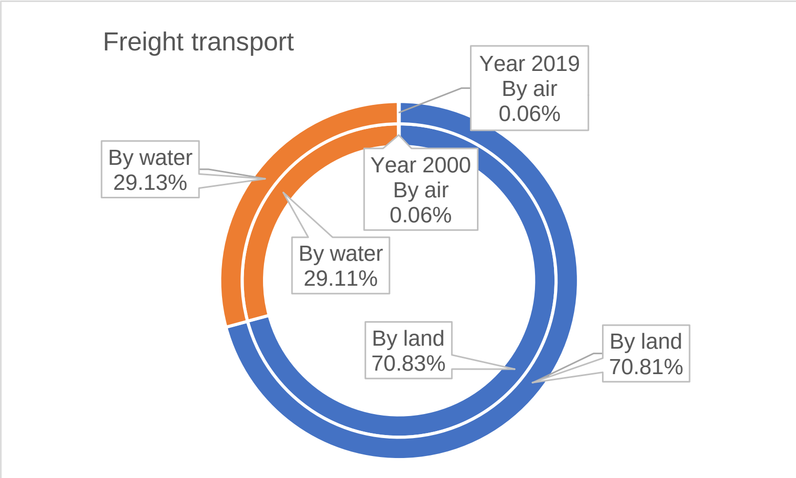


Source: Department of Economic Statistics, LSB, MPI.

Figure 2.8 Loa PDR import/Export Trade by Country

In 2019, air freight accounted for a negligible 0.06% of total freight transportation in the country, while land and water were 70.8% and 29.1%, respectively, as shown in Figure 2.9.

.



Source: Ministry of Industry and Commerce, Ministry of Energy and Mines, Ministry of Public Works and Transport.

Figure 2.9 Freight by Mode of Transport in Lao PDR

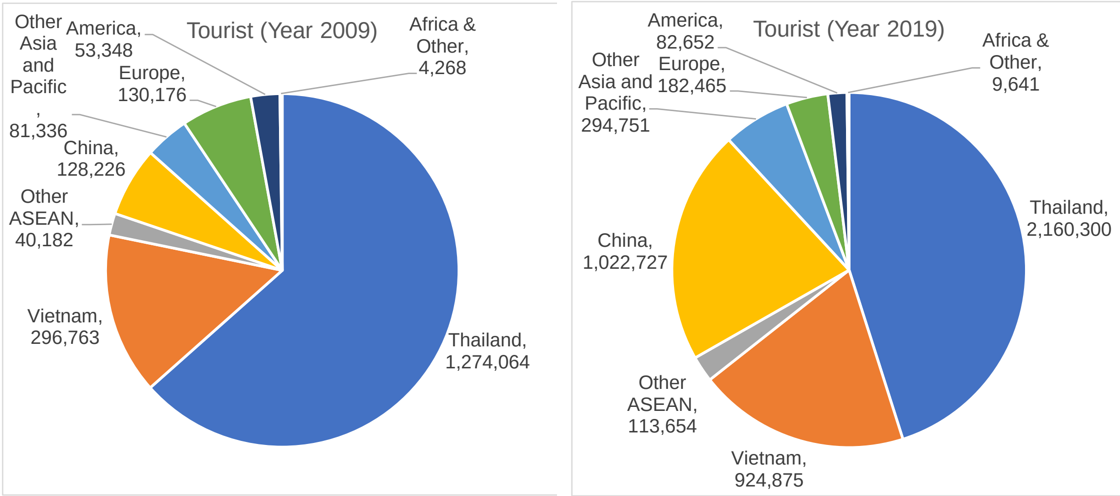
2.1.3. *Tourism*

Lao PDR has many tourism resources, such as Buddhist temples and UNESCO-registered World Cultural Heritage sites (Town of Luang Prabang, Vat Phou, and associated ancient settlements within the Champasak Cultural Landscape, Plain of Jars). In 2019, these sites attracted approximately 4.8 million foreign tourists, which makes tourism the country's major industry in terms of earning foreign currency. The country also has many domestic tourists, as shown in Figure 2.10.

Source: Ministry of Information, Culture and Tourism.

Figure 2.10 Tourist Trends in Lao PDR

Tourists from Thailand accounted for 44% of total foreign tourists in 2019, followed by China (21%) and Vietnam (19%). As can be seen in Figure 2.11, tourism from China and Vietnam increased in 2009–2019.



Source: Ministry of Information, Culture and Tourism.

Figure 2.11 Foreign Tourists by Country in 2009 and 2019

2.2. ***Historical Air Traffic Movement at VTE***

2.2.1. *Passenger Movement*

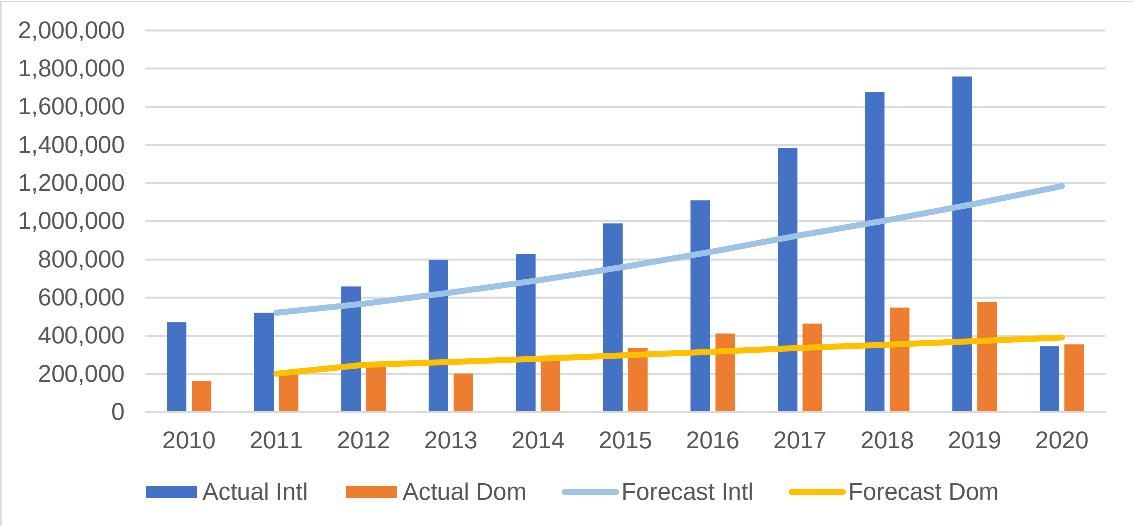
Table 2.1 andSource: DCA , L-JATS and Terminal Expansion Project Report.

Figure 2.12 summarize passenger and aircraft movements at VTE, also showing the demand forecast results of the Vientiane International Airport Terminal Expansion Project Preparation Survey (hereinafter referred to as the Terminal Expansion Project) conducted in 2013. In 2019, there were 1.76 million international passengers and 578,000 domestic passengers. As result of demand forecast for Terminal Expansion Project, the number of international passengers in 2019 estimated to be about 1.1 million, and domestic passengers was estimated to be about 350,000, so the number of passengers increased at a much higher level than this forecast. The number of both international and domestic passengers increased at an average annual rate of 15%–16% in 2010–2019 until the global pandemic of COVID-19 hit the air traffic in 2020.

Table 2.1 Historical Passenger and Aircraft Movements to/from VTE

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
International Passengers	469,747	520,500	658,482	797,383	830,222	989,575	1,108,837	1,382,848	1,676,990	1,758,728	345,137
Domestic Passengers	161,973	201,142	242,153	202,166	293,927	336,627	412,592	464,211	548,151	577,893	354,987
Total	631,720	721,642	900,635	999,549	1,124,149	1,326,202	1,521,429	1,847,059	2,225,141	2,336,621	700,124
International Aircraft Movements	-	-	7,940	10,312	9,914	10,795	11,359	13,311	15,646	16,244	7,539
Domestic Aircraft Movements	-	-	6,014	7,832	6,857	7,846	8,364	10,178	11,966	12,189	8,382
Total Aircraft Movements	-	-	13,954	18,144	16,771	18,641	19,723	23,489	27,612	28,433	15,921

Source: DCA, AOL and L-JATS.



***Source**: DCA , L-JATS and Terminal Expansion Project Report.*

Figure 2.12 Trend of Passenger Movement at VTE

2.2.2. *International Flight Routes*

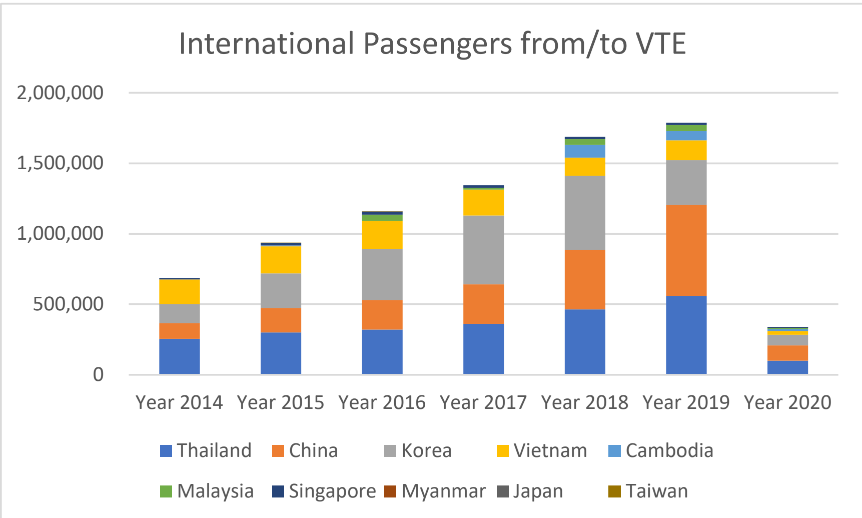
As summarized in Table 2.2, as of 2019 there were 19 international flight routes between VTE and international airports in such countries as Cambodia, China, Singapore, South Korea, Malaysia, Thailand, and Vietnam. International passengers tend to increase as the economic ties deepen between two countries. Therefore, it is likely that the number of passengers to and from the neighboring countries, i.e., China, Thailand and Vietnam, will continue to grow.

Table 2.2 International Passengers to/from VTE by Route

	2014	2015	2016	2017	2018	2019	2020
Total	687,415	935,616	1,160,675	1,343,514	1,687,484	1,788,359	338,345
Suvarnabhumi, Thailand	255,831	299,420	302,159	337,521	372,470	463,077	81,354
Kunming Chansui, China	89,922	83,335	78,552	70,668	211,520	311,190	72,331

Incheon, Korea	73,831	222,579	233,334	329,164	408,053	231,322	64,016
Hanoi, Vietnam	176,249	133,842	145,499	127,108	128,357	140,646	26,402
Shenzhen, Baoan, China					3,622	132,736	
Donmueang, Thailand			17,695	23,301	91,067	96,697	19,743
Gimhae, Busan, Korea	61,429	21,741	127,129	159,252	116,282	84,311	11,225
Guangzhou Baiyun, China	14,128	39,109	32,776	44,403	72,498	72,535	15,603
Phnompenh, Cambodia		4,967			61,805	66,254	12,271
Kuala lumpur, Malaysia			45,126	11,722	39,698	43,184	10,385
Haikun, Meilan, China			12,698		34,915	31,177	2,941
Chengdu, Shuangliu, China					16,408	29,838	3,524
Changsha, Huanghua, China			17,488	21,615	22,780	24,835	4,785
Singapore	10,751	18,139	23,306	18,380	16,671	16,238	3,885
Nanning, Wuxu, China						15,561	
Changzhou Benniu, China		3,818	4,309		7,657	14,608	1,203
Shanghai, Pudong, China						7,417	
Hangzhou, Xiaoshan, China						6,304	1,197
Chongqing, Jiangbei, China						429	5,926
Yangon, Myanmar							934
Narita, Japan							620
Beijing, China	5,274	49,156	63,783	144,386	53,429		
Hochiminh, Vietnam		55,914	54,353	55,994			
Muan, Korea					1,389		
Siem Reap, Cambodia					28,863		
Vinh, Vietnam		3,373					
Danang, Vietnam			1,218				
Qingquangang, Taiwan			1,250				
Taoyuan, Taiwan		223					

Source: DCA.



Source: OAG

Figure 2.13 VTE International Passengers by Route

Figure 2.14 shows the international route distances to and from Vientiane International Airport. The longest scheduled flight route is Gimhae, Korea, and the distance is 3,713 km (2,005 nautical miles). Because the maximum range of a small jet aircraft such as a B737 or an A320 is approximately 4,000 km, most of the international routes to Korea and China are within the range of small jet aircraft. Also, the southern parts of China and Indochina are within the range of turboprop aircraft such as the ATR-72, the range of which is 1,300 km.

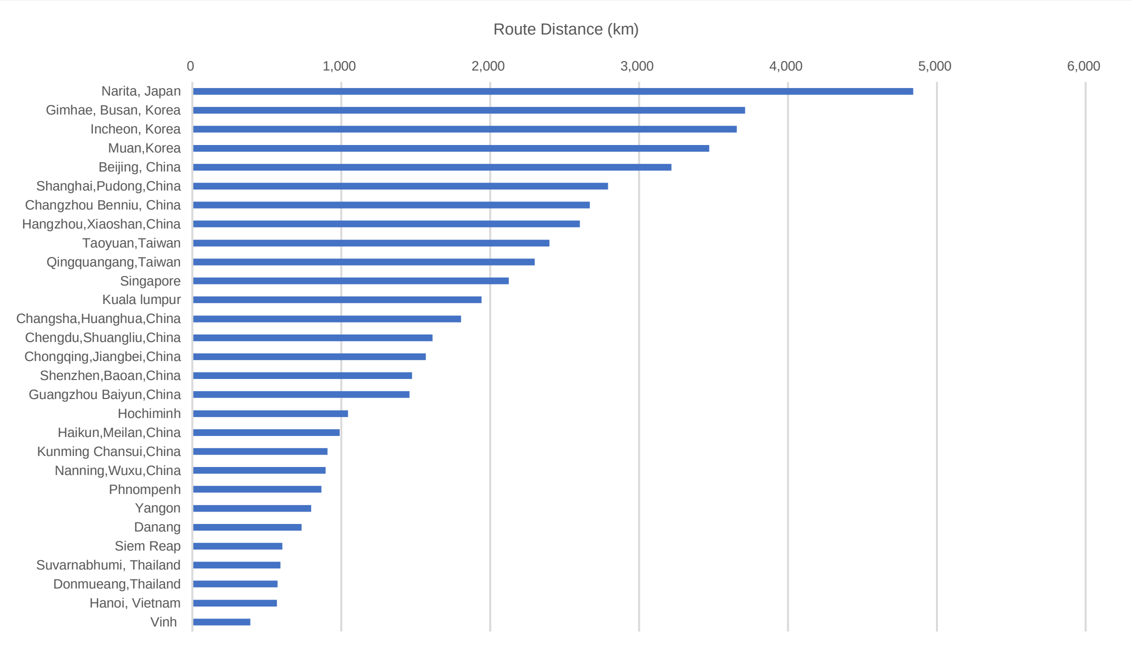


Figure 2.14 International Route Distances to/from the Vientiane International Airport

2.2.3. *Domestic Flight Routes*

Table 2.3 summarizes the domestic passenger data at VTE by route. The busiest routes to and from Vientiane International Airport are Luang Prabang, and the second and third routes are Luang Namtha and Pakse. Pakse has the longest domestic routes to and from Vientiane as shown in Figure 2.15.

Table 2.3 Domestic Passengers to/from VTE by Route

	2014	2015	2016	2017	2018	2019
Total	290,487	292,660	405,409	450,625	498,783	552,383
Luang Prabang	142,747	169,367	184,550	229,959	224,679	229,232
Luang Namtha	27,593	23,308	28,544	48,713	48,276	100,830
Pakse	43,442	43,693	42,768	73,610	97,849	100,722
Oudomsay	21,745	20,366	103,065	28,443	45,970	55,329
Xieng Khouang	18,009	21,170	31,290	29,318	30,383	34,872
Savannakhet	15,162	14,756	8,430	519	6,746	22,809
Samneua	3,820		861	5,314	5,182	5,096
Phongsaly	2,115		548	2,946	3,007	3,462
Houeisay	15,854		5,353	31,803	36,691	31

Source: DCA.

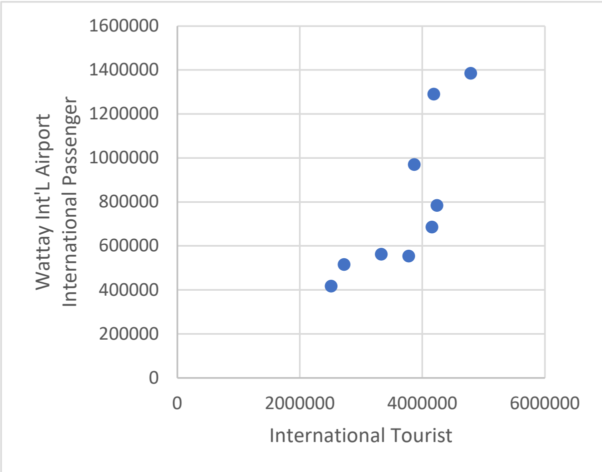
Figure 2.15 Domestic Route Distances to/from Vientiane International Airport

.

2.2.4. *Tourism*

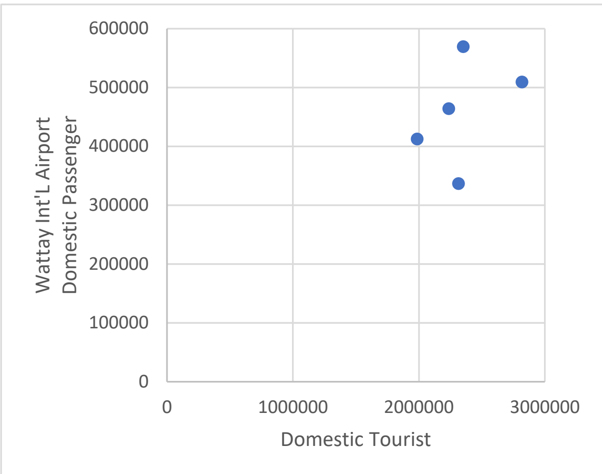
Foreign tourists visiting Lao PDR do not necessarily use VTE. Some enter and leave the country by land or river from bordering countries, or some use other international airports such as Luang Prabang International Airport. In 2019, the number of foreign tourists entering from VTE was 12% of the total and from Luang Prabang Airport was 4.2%. The remaining 83.8% used land routes and rivers.

As Figure 2.16 shows, there is a rather strong positive correlation between VTE international passengers and foreign tourists visiting the country. On the other hand, the correlation between VTE domestic passengers and the country's domestic tourists is not as strong (Figure 2.17).



Source: Ministry of Information, Ministry of Public Works, DCA.

Figure 2.16 Correlation between VTE International Passengers and Foreign Tourists Visiting Lao PDR



Source: Ministry of Information, Ministry of Public Works, DCA.

Figure 2.17 Correlation between VTE Domestic Passengers and Domestic Tourists in Lao PDR

2.2.5. *Airport Access Facilities*

In February 2021, the study team conducted an interview survey with approximately 400 passengers departing on domestic flights. The survey with international flight passengers were not conducted as international flights were suspended due to COVID-19. The survey content included the airport access mode, use of the parking lot, and how many people were seeing off the departing passenger. The results of the interview survey are summarized below.

As Figure 2.18 shows, 78% of the interviewees took a private car to VTE, while use of public transportation was very small (buses (7%) and taxis (3%)). The absence of international flight passengers may be a reason for the small proportion of taxi users because foreigners are likely to take a taxi.

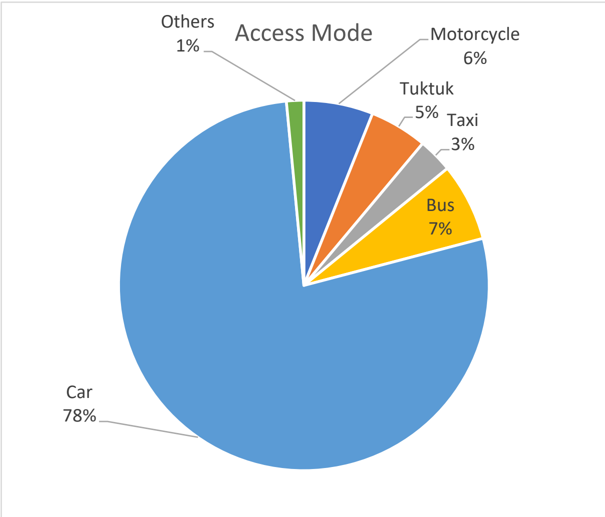
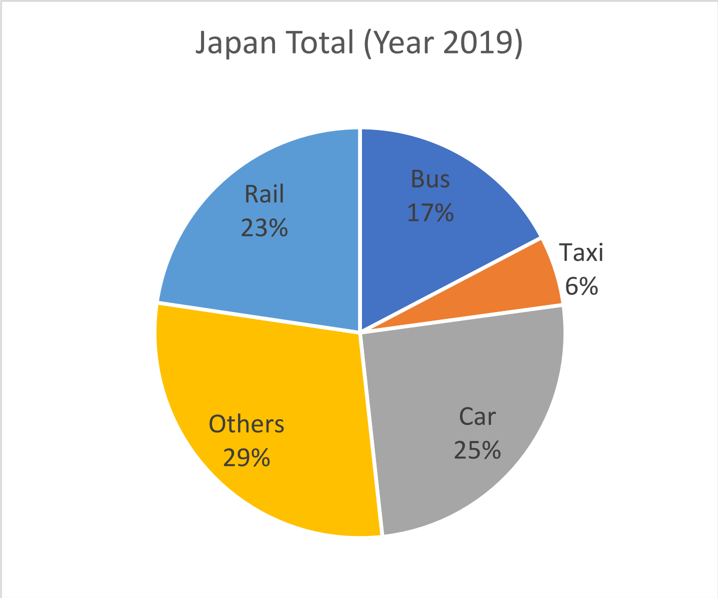


Figure 2.18 Access Mode to VTE (2021 February)

In Japan, the Ministry of Land, Infrastructure, Transport and Tourism makes an annual survey on passengers' access modes to all airports in Japan. As presented in Figure 2.19, public transportation (railways, buses, and taxies) accounts for 46% of the total. According to a similar survey conducted at Soekarno-Hatta International Airport, Jakarta, in 2010, the use of public transportation is even higher at 63% (taxis 38% and buses 25%). (The share of public transportation should be higher now because a train and MRT started operation after the survey was carried out.)



Source: *MLIT, Japan.*

Figure 2.19 Final Access/Egress Mode for Airports in Japan

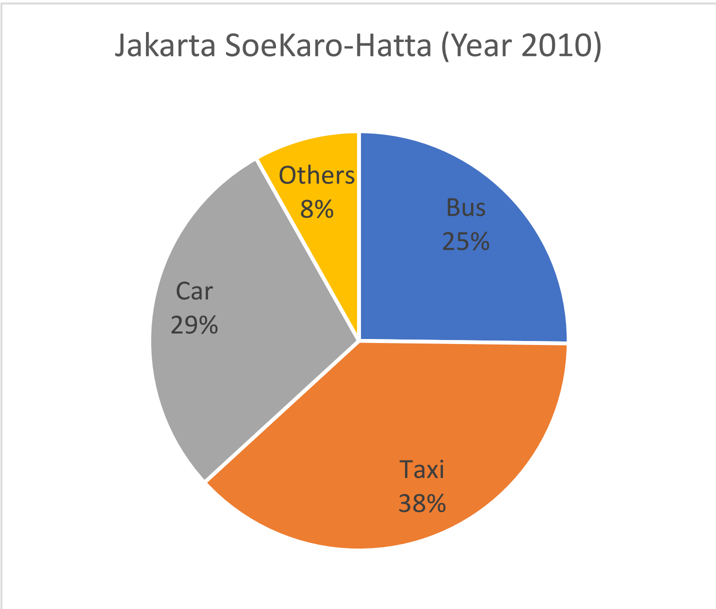


Figure 2.20 Final Access/Egress Mode for Soekarno-Hatta International Airport

To estimate the capacity of access facilities, the number of people seeing off a passenger at VTE is needed. According to the interview survey made by the study team, the average was 1.083 per departing passenger. It is 0.5 in Japan, based on the annual Japanese survey.

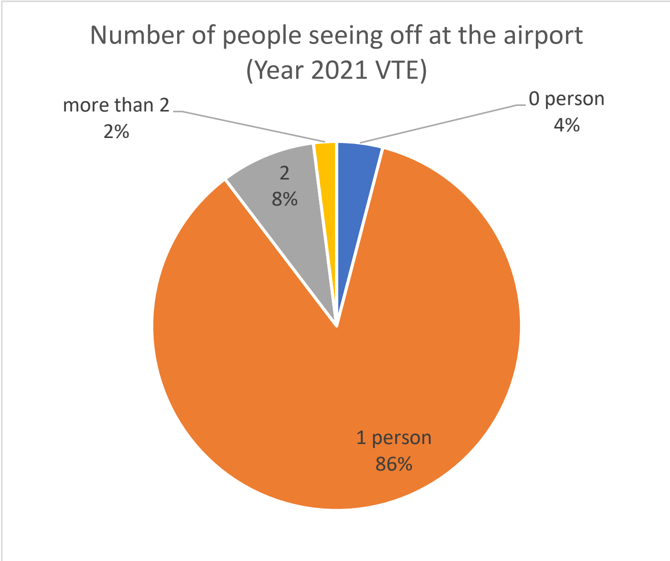
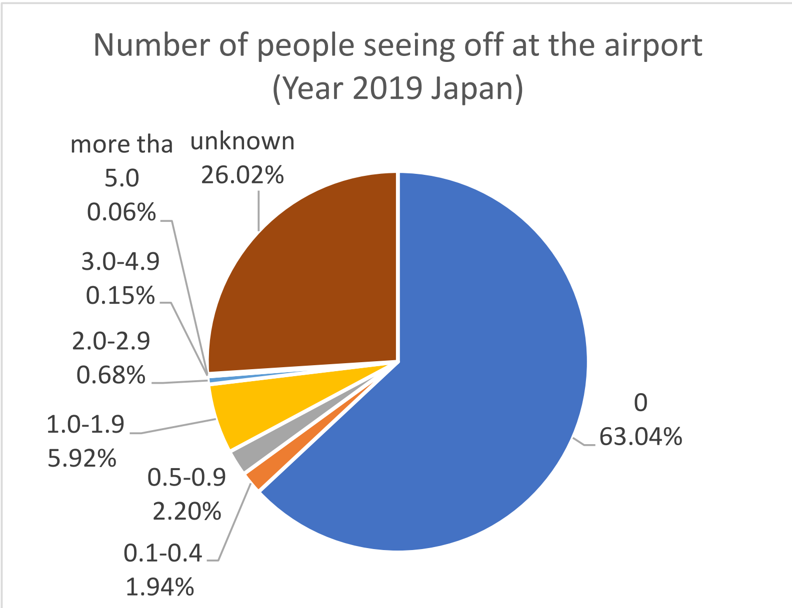


Figure 2.21 Number of People Seeing off a Domestic Flight Departing Passenger at VTE



Source: *MLIT, Japan.*

Figure 2.22 Number of People Seeing off a Departing Air Passenger in Japan

As Figure 2.23 shows, only 9% of the private car users parked in the VTE airport parking lot. The figure might have been higher if the interview survey had included domestic and international flight arriving passengers. People picking up passengers (both domestic and international) tend to stay longer at the airport than those seeing off domestic flight departing passengers.

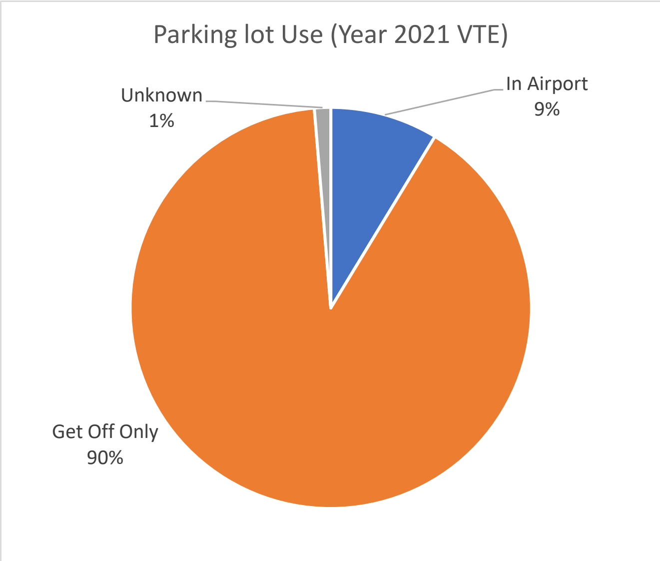
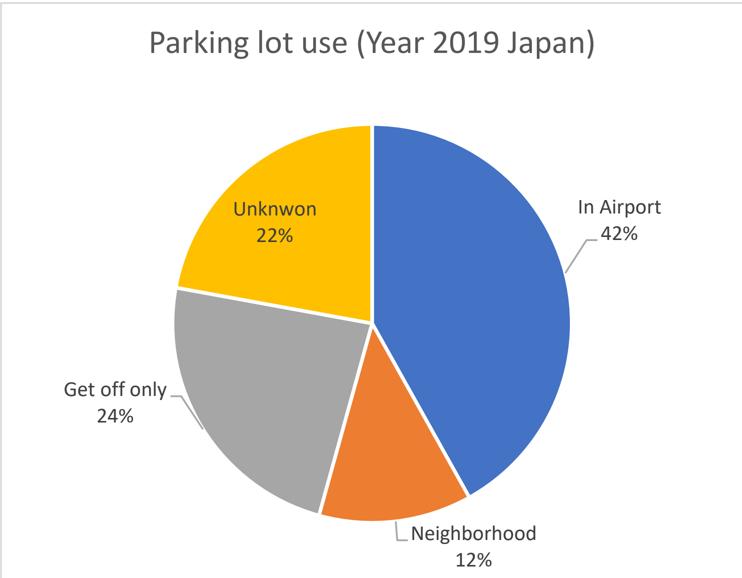


Figure 2.23 Parking Lot Users at VTE (2021 February)

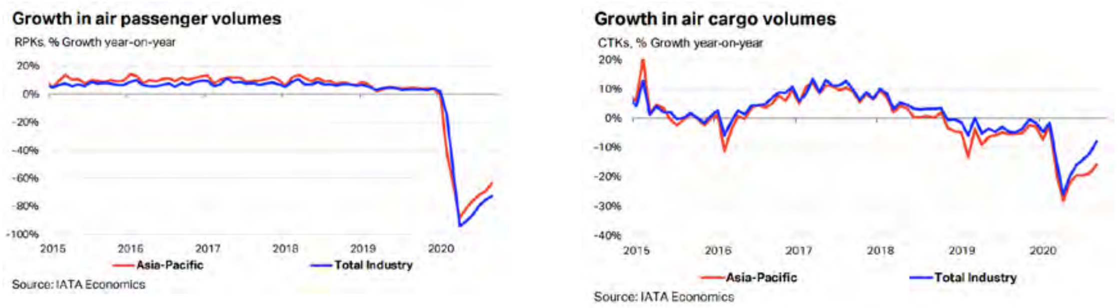


Source: *Year 2019 MLIT, Japan.*

Figure 2.24 Parking Lot Users at Airports in Japan

2.2.6. *COVID-19 Impact*

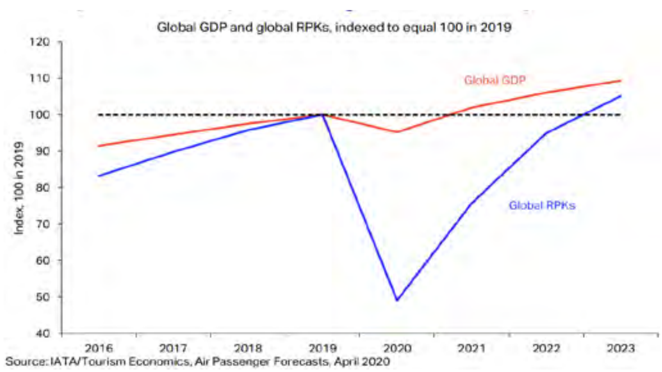
COVID-19 has seriously dampened global aviation demand and has devastated airlines. As shown in Figure 2.25, globally, air passengers have been more affected than air cargos.



Source: IATA.

Figure 2.25 Global Trend of Air Passengers and Air Cargos

The International Air Transport Association (IATA) announced in July 2020 that global passenger traffic (revenue passenger kilometers or RPKs) will not return to pre-COVID-19 levels by 2024. It should be noted that recovery in air travel tends to lag behind economic activity as shown in Figure 2.26.



Source: IATA.

Figure 2.26 Trend of Economic Activity and Air Travel

Aviation demand should pick up if the COVID vaccine becomes available globally. Considering the slow pace of vaccination, the study team also expects the demand will not return to pre–COVID-19 levels before 2024.

Table 2.4 Impact of COVID-19 on Air Traffic Demand.

2021			2022			2023			2024		
Vaccine Production for COVID-19											
Vaccination in Developed Countries											
		Vaccination in All Countries									
		Temporary air route opening									
					Air route opening step by step						
				Reduction of immigration restrictions							
								Revival of aviation demand			

2.3. ***Related Organizations***

2.3.1. *Ministry of Public Works and Transport*

The Ministry of Public Works and Transport (MPWT) is the government organization that administers road, rail, and air transport and public works. Organization chart of MPWT is shown in Figure 2.27.

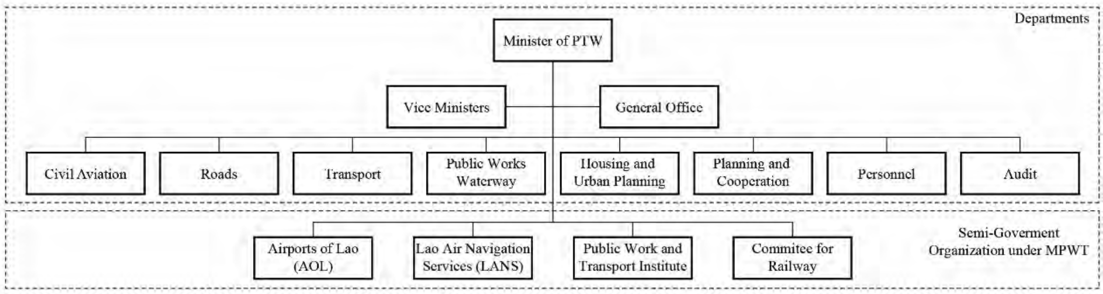
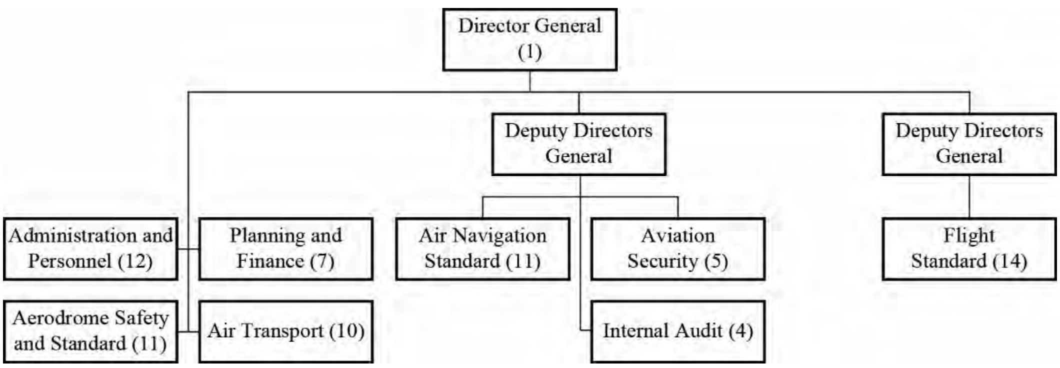


Figure 2.27 Organization Chart of MPWT

2.3.2. *Department of Civil Aviation*

The Department of Civil Aviation (DCA) is responsible for policy and planning in civil aviation and for regulatory oversight of technical and safety matters pertaining to aviation. There are eight divisions: Administration and Personnel, Division, Planning and Finance Division, Air Transport Division, Aerodrome Safety and Standard Division, Air Navigation Standard Division, Aviation Security Division, Internal Audit Division, and Flight Standard Division. The department has a staff of 77. An organization chart of DCA is shown in Figure 2.28.

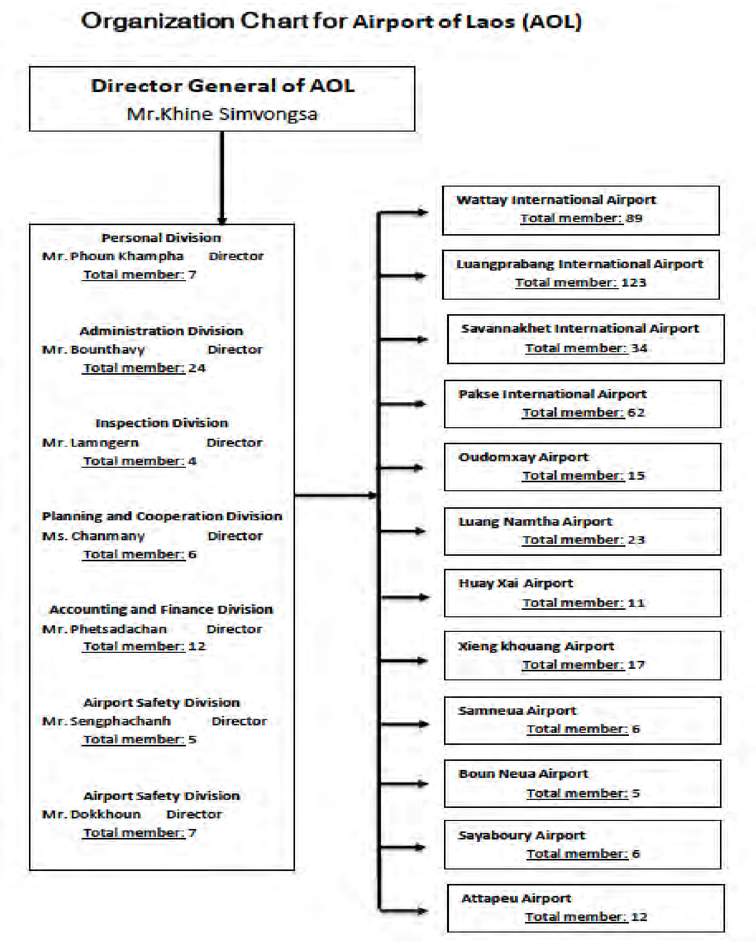


Source: DCA

Figure 2.28 DCA Organization Chart

2.3.3. *Airport of Laos (AOL)*

The Airport of Laos (AOL) provided airport operation and air navigation services but air navigation service was separated from AOL in 2008. AOL operates four international airports and eight domestic airports. Organization chart of AOL is shown in Figure 2.29.



Source: AOL.

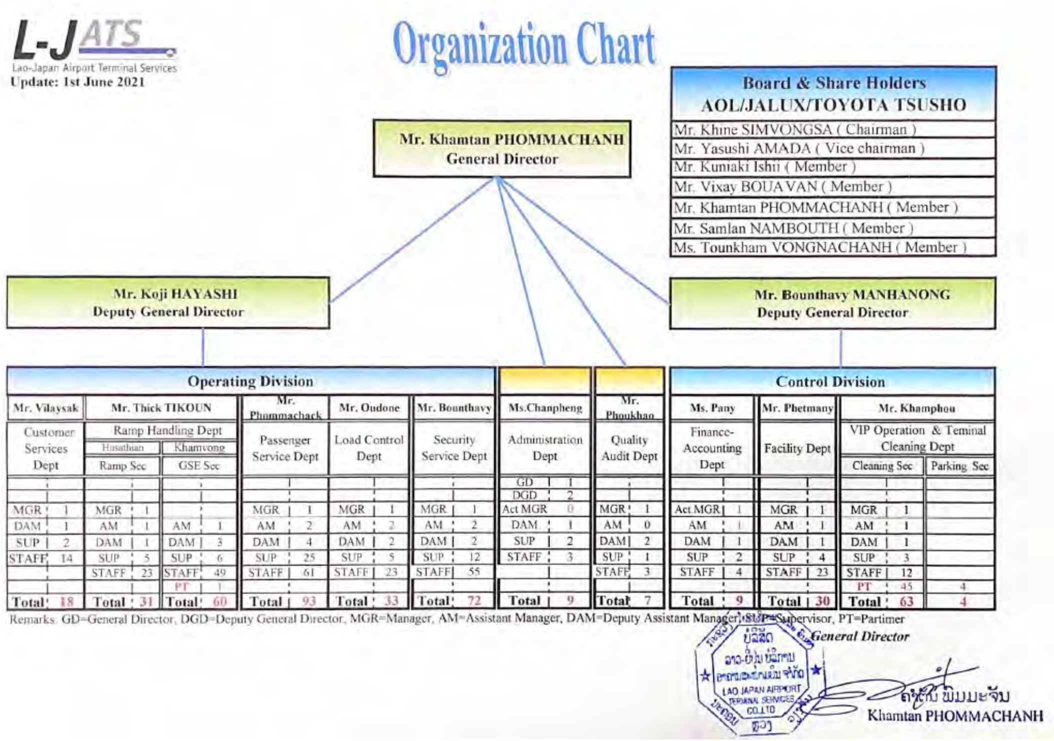
Figure 2.29 AOL Organization Chart

2.3.4. *Lao Air Navigation Services*

Lao Air Traffic Management (LATM) was established as the air navigation service provider in 2008. The name was changed to Lao Air Navigation Services (LANS), and it provides all air navigation services in Lao PDR.

2.3.5. *Lao-Japan Airport Terminal Service*

Lao-Japan Airport Terminal Service (L-JATS) is a company that manages and operates the International Passenger Terminal and provides passenger services, ramp services, and security services by a concession agreement with the Ministry of Public Works and Transport (MPWT). The company consists of JALUX and Toyota Tsusho, in partnership with the Airports of Lao (AOL) as a public-private partnership. It was established in April 1999 when the international passenger terminal building was completed. An organization chart of L-JATS is shown in Figure 2.30.

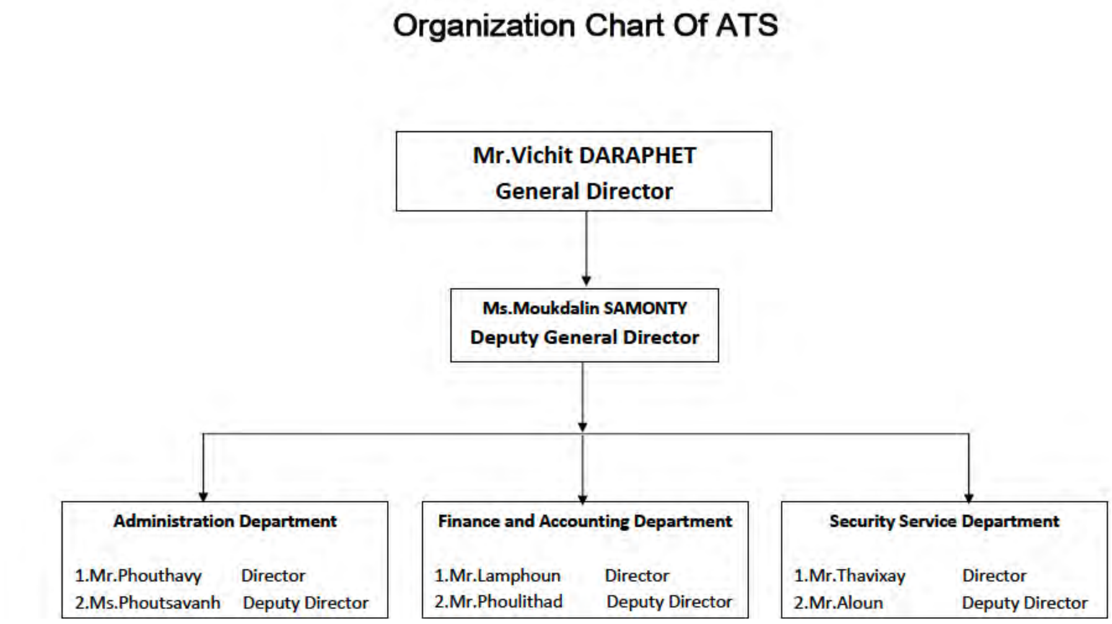


Source: L-JATS.

Figure 2.30 L-JATS Organization Chart

2.3.6. *Airport Terminal Service*

Airport Terminal Service Co., Ltd. (ATS), is a company to operate and manage the Domestic Passenger Terminal. Airport Terminal Service consists of AOL and Buathip Company as a public –private partnership established in 2013. An organization chart of ATS is shown in Figure 2.31.



Source: ATS.

Figure 2.31 ATS Organization Chart

2.3.7. *Lao Airlines*

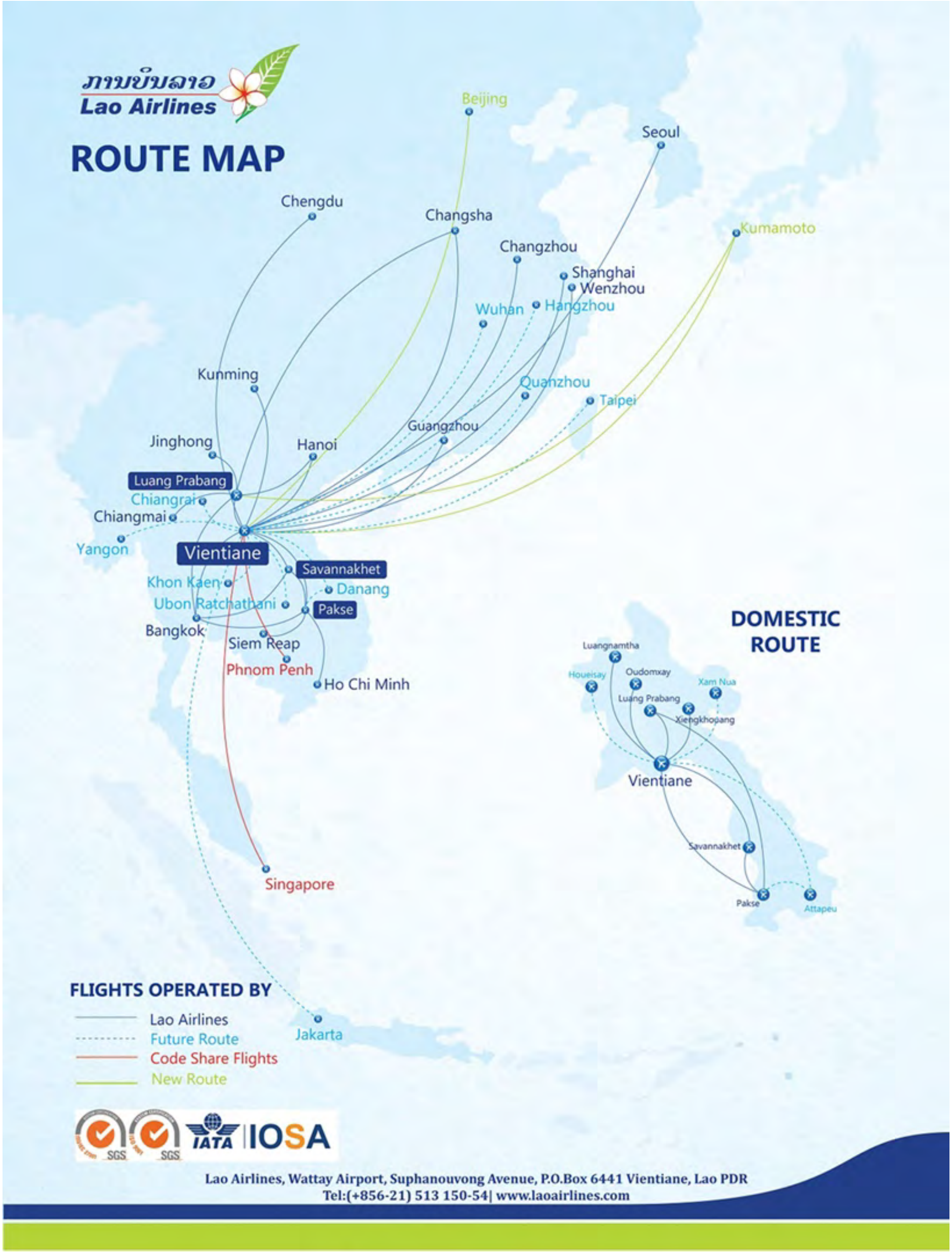
Lao Airlines is a state-owned airline in Lao PDR and established in 1976. Lao Airlines fleet consists of 11 aircraft as shown in Table 2.5.

Table 2.5 Lao Airlines Fleet

Aircraft	Seats	Number
A320-214	Business 8/Economy 150: Total 158 Business 16/Economy 126: Total 142	4
ATR72-600	Economy 70	3
ATR72-500	Economy 70	4
Total		11

Source: Lao Airlines

According to the 2021 to 2025 five-year plan of Lao Airlines, there is no plan to add more fleet. The plan is to increase the frequency of the routes to cope with the increased demand. Lao Airlines operates in seven domestic airports, Vientiane, Luangamtha, Oudomxay, Luang Prabang, Xiengkhouang, Savanhakhet, and Pakse. There is a plan to operate in Houeisay and Xam Nua in future. Lao Airlines operates international flights to China, Korea, Vietnam, Cambodia, and Thailand. The current and future routes are shown in Figure 2.32.



Source: Lao Airlines.

Figure 2.32 Lao Airlines Route Map

2.3.8. *Lao Skyway*

Lao Skyway is a private airline that operates scheduled and nonscheduled flights. The company was established in 2002. Lao Skyway started as a helicopter charter company and now operates both helicopter and fixed wing aircraft. Lao Skyway operates in nine airports, Vientiane, Luang Prabang, Luangnamtha, Oudomxay, Bokeo, Phongsaly, Huaphan, Xiengkhoang, and Pakse. Fleet of La Skyway is shown in Table 2.6.

Table 2.6 Lao Skyway Fleet

Aircraft	Seats	Number
MA-60	Economy 56	3
Cessna 208 Grand Caravan	Economy 11	2
MI-17V1 (Helicopter)	Economy 22	4
AS 350 B2 (Helicopter)	Economy 5	1
Total		10

Source: *Lao Skyway.*

2.4. *Policy on Airport Development*

2.4.1. *National Development Plan*

Vision 2030 is the Lao PDR long-term national development plan, which is a 10-year socio-economic development strategy from 2016 to 2025. Vision 2030 aims to transform Lao PDR into an upper-middle income developing country with innovative, green, and sustainable economic growth.

The 9th National Socio-Economic Development Plan (NSEDP) is a 5-year national development plan. The objective of the 9th NESDP is "to fully focus on socioeconomic development based on the existing potentials in order to help the country effectively achieve the LDC's criteria through quality, inclusive and green growth and achieve the SDGs by 2030." Airport development is in Outcome 5: Connectivity and Integration.

2.5. *Airports in Lao PDR*

There are 13 airports in Lao PDR. Among the airports, there are four international airports, Vientiane International Airport, Luang Prabang International Airport, Pakse International Airport, and Savannakhet International Airport. The longest runway is in Vientiane International Airport. Its length is 3,000 m. The second longest is in Luang Prabang International Airport with a length of 2,900 m. These two airports can accommodate large jet aircraft with adequate pavement strength. The list of the airports is in Table 2.7. The airport locations are shown in Figure 2.33.

Table 2.7 Airports in Lao PDR

No.	Airport Name	Nearby city	IATA Code	ICAO Code	Elevation	Runway Orientation	Runway Length	Runway Pavement
1	Phongsaly	Phongsaly	PCQ	VLFL	1334 m	RWY02/20	890 m	Gravel
2	Oudomsay	Muang Xay	ODY	VLOS	550 m	RWY02/20	1600 m × 30 m	Concrete
3	Luangnamtha	Luang Namtha	LXG	VLLN	549 m	RWY18/36	1600 m × 30 m	PCN 14 F/B/Y/T
4	Sam Neua	Houaphan	NEU	VLSN	1000 m	RWY08/26	1132 m	Gravel
5	Houei Say	Ban Houayxay	HOE	VLHS	421 m	RWY16/34	1472 m × 30 m	Asphalt
6	Luang Phabang	Luang Phabang	LPQ	VLLB	293.6 m	RWY05/23	2900 m × 45 m	PCN 60/R/B/W/T
7	Sayabouly	Sainyabuli	ZBY	VLSB	380 m	RWY15/34	990 m	Gravel
8	Xiengkhuang	Xiengkhuang	XKH	VLXK	1093 m	RWY07/25	2600 m × 38 m	PCN 32/F/C/X/U
9	Vientiane	Vientiane	VTE	VLVT	170.7 m	RWY13/31	3000 m × 45 m	PCN 62/F/B/W/T
10	Sepon	Sepon	N/A	VLSP	214 m	RWY05/23	1257 m × 18 m	PCN 45/R/B/Y/U
11	Savannakhet	Savannakhet	ZVK	VLSK	155 m	RWY04/22	1638 m × 38 m	PCN 31/R/B/W/T
12	Pakse	Pakse	PKZ	VLPS	103.9 m	RWY15/33	2400 m × 45 m	PCN 49/F/C/X/T
13	Attapeu	Saysetha	AOU	VLAP	105 m	RWY11/29	1850 m × 30 m	Asphalt

Source: *AIP Lao PDR.*

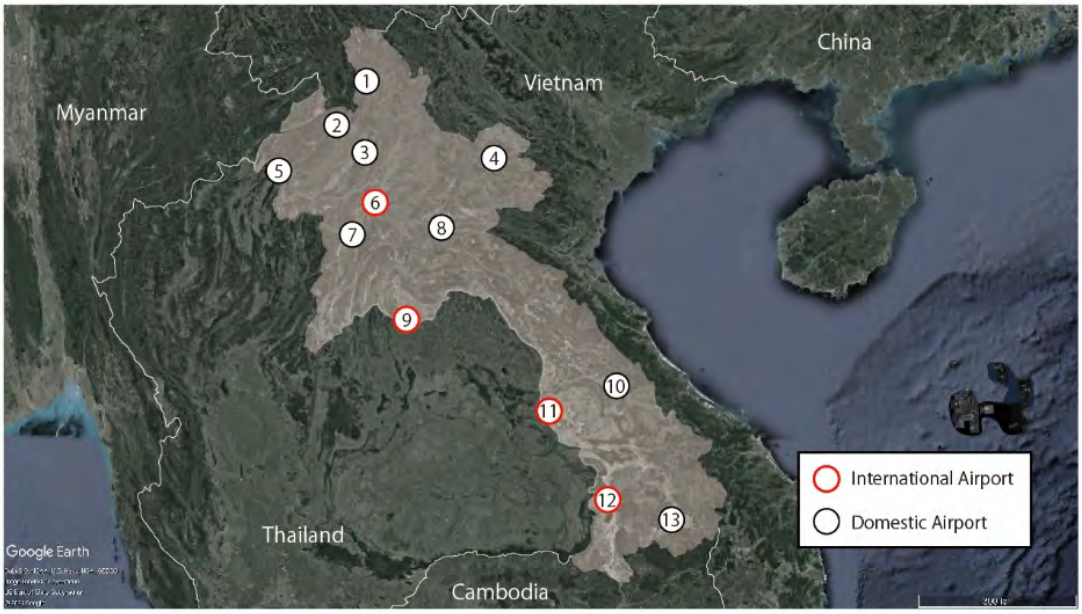
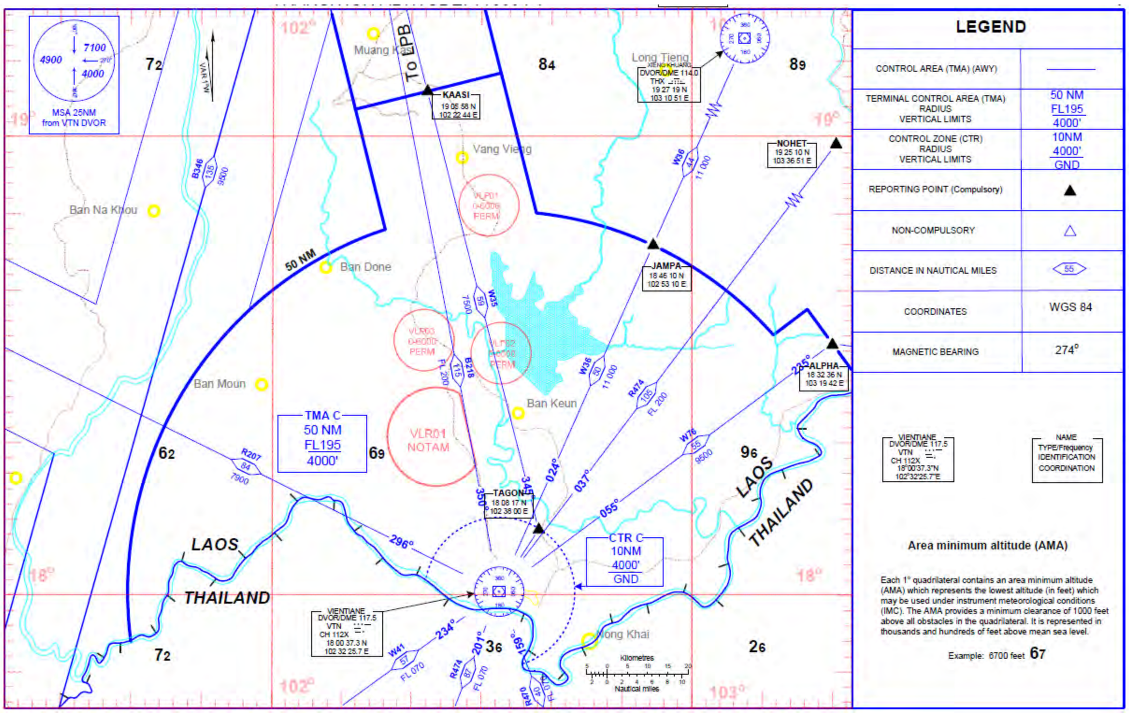


Figure 2.33 Airports in Lao PDR

2.6. *Airspace*

2.6.1. *Vientiane Terminal Area and Control Zone*

Figure 2.34 shows the Vientiane Terminal Area (TMA). It is shaped approximately like a half-circle on the north side. Its south side is adjacent to the Bangkok Flight Information Region (FIR), which is under the control of Thai ATC, on the border with Thailand. It is physically bordered by the Mekong River. The Vientiane TMA covers an area with an approximate 50 Nautical Mile (NM) radius centered on VTN DVOR/DME with some 5 to 15 NM long additional area along with route W35 with 20 NM width to KAASI at the north and route W76 with 10 NM width to ALPHA on the northeast.



Source: AIP Lao PDR.

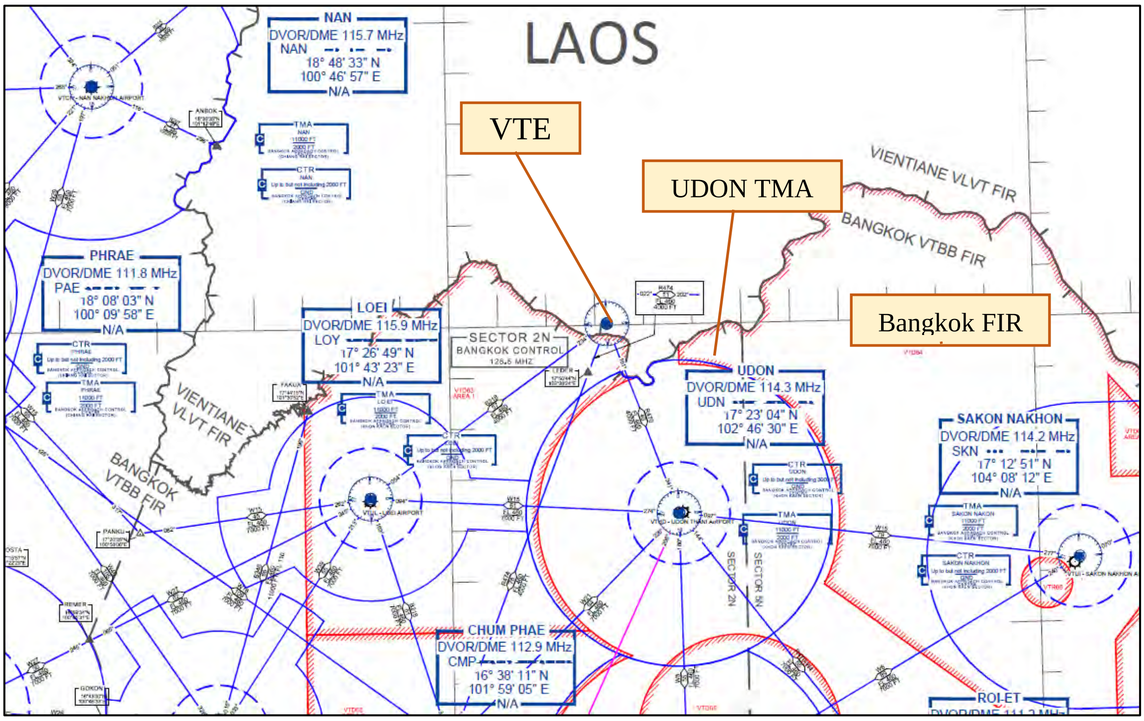
Figure 2.34 Vientiane Terminal Area (TMA) and Control Zone (CTR)

The primary route is R474 to and from Hanoi, Vietnam, from the north and to and from Bangkok, Thailand, from the south. Other routes are B218 to and from China and R470 to and from Cambodia and Ho Chi Minh, Vietnam, through Thai airspace. Other routes starting with "W," such as W35, W36, W76, and W41 are more likely regional routes, mainly to and from domestic or nearby airports.

The Vientiane Control Area (CTR) is set within a circle with a 10-NM radius centered on VTN DVOR/DME, limited by the FIR boundary the same as Vientiane TMA.

2.6.2. *Adjacent Airspace: Bangkok FIR*

Because Vientiane International Airport is located very close to the Thai border, the adjacent airspace at its south, Bangkok FIR, is quite influential in its operation. Figure 2.35 shows a part of Bangkok FIR, which is the adjacent airspace of Vientiane TMA. It is observed that UDON TMA also faces Vientiane TMA on its south with the height from 2,000′ to 11,000′, and this situation requires more complicated ATC coordination with the Thai side. This would necessitate communication with not only Thai area control but also with the UDON approach in case some aircraft operations may affect those airspaces, such as the approach to RWY 31 from the south or departure from Runway 13 to the south.



Source: AIP Lao PDR.

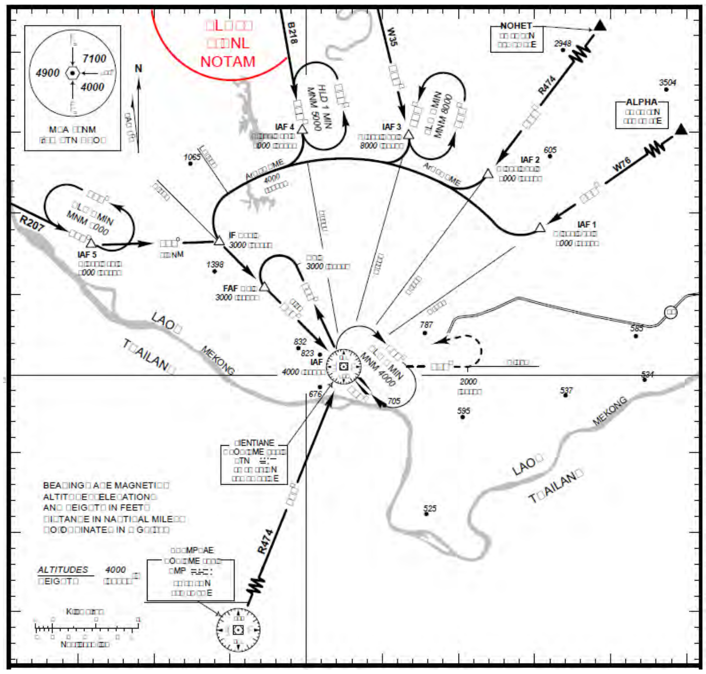
Figure 2.35 Adjacent Area of Bangkok FIR at the South

2.6.3. *Route Structure*

With the limited airspace on the northern side, aircraft as well as air traffic control operations are also limited because the route structure is affected. Figure 2.36 to Figure 2.42 show the route structures of Instrumental Flight Procedures (IFPs), namely Standard Instrument Arrival (STAR), Standard Instrument Departure (SID), and Instrument Approach Procedure (IAP):

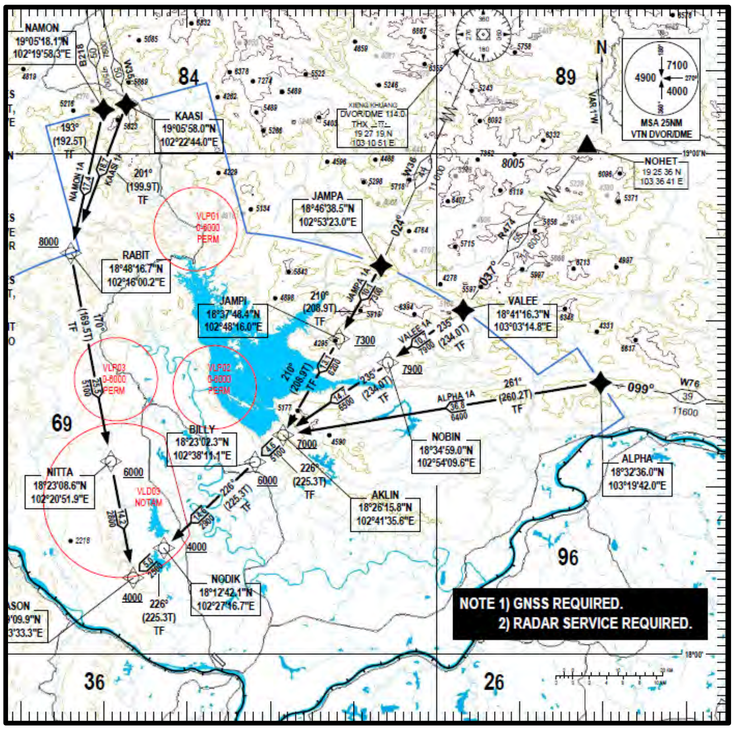
- Figure 2.36: STAR (Conventional)
- Figure 2.37: STAR (Performance-based Navigation (PBN))
- Figure 2.38: SID (Conventional)
- Figure 2.39: SID (Conventional to south) *not used unless coordination is made
- Figure 2.40: SID (PBN)
- Figure 2.41: IAP: ILS approach (Conventional)
- Figure 2.42: IAP: RNP APCH (PBN)

Note: Conventional IFPs utilize navigational information based on ground navigational aids while PBN IFPs apply information from the Global Positioning System (GPS).



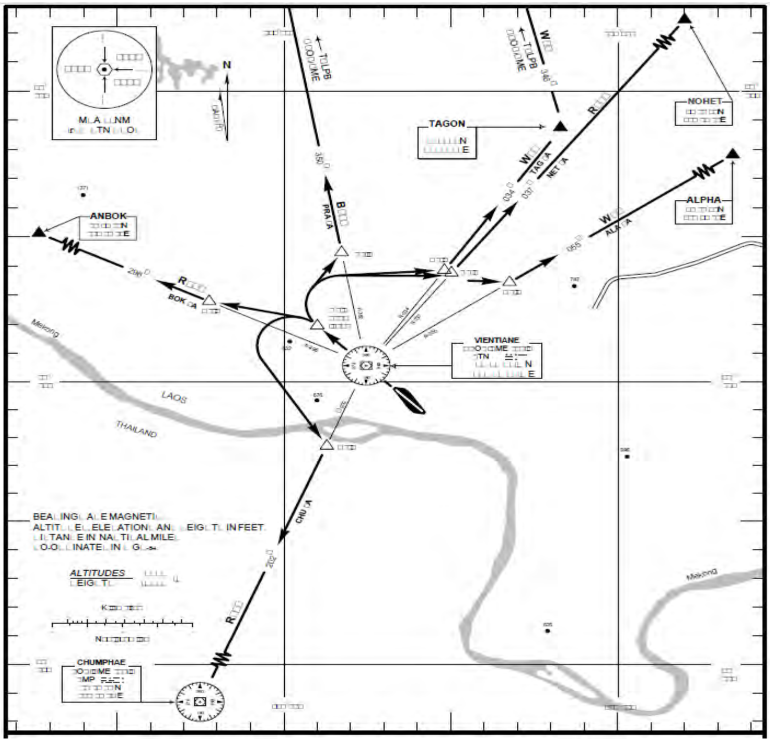
Source: AIP Lao PDR.

Figure 2.36 STAR (Conventional)



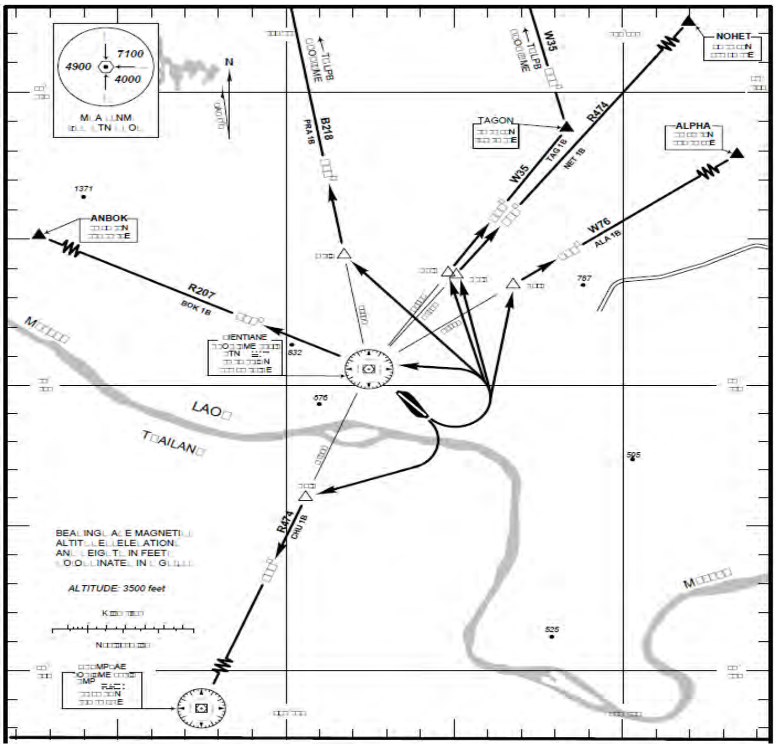
Source: AIP Lao PDR.

Figure 2.37 STAR (PBN)



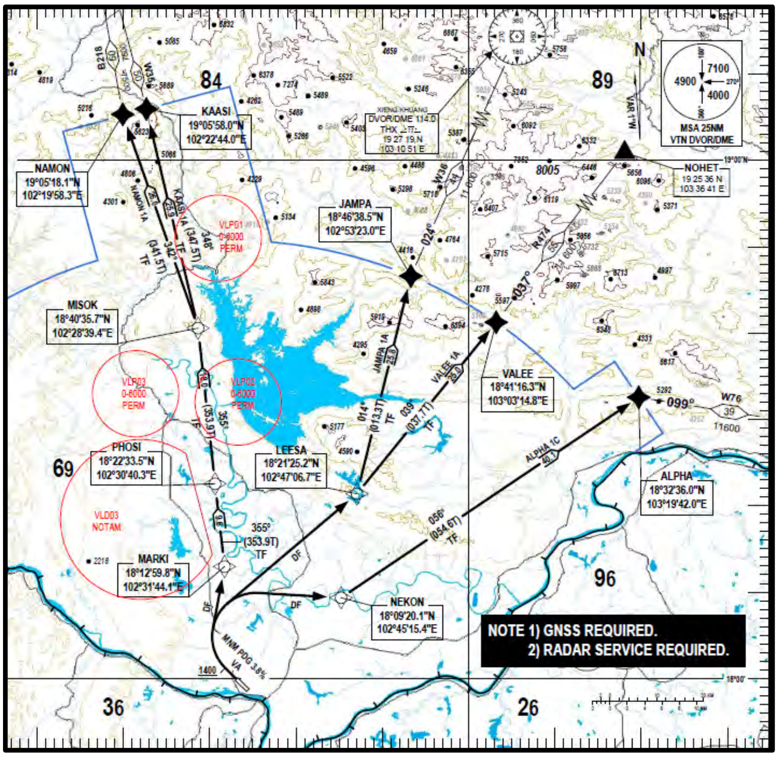
Source: AIP Lao PDR.

Figure 2.38 SID (Conventional)



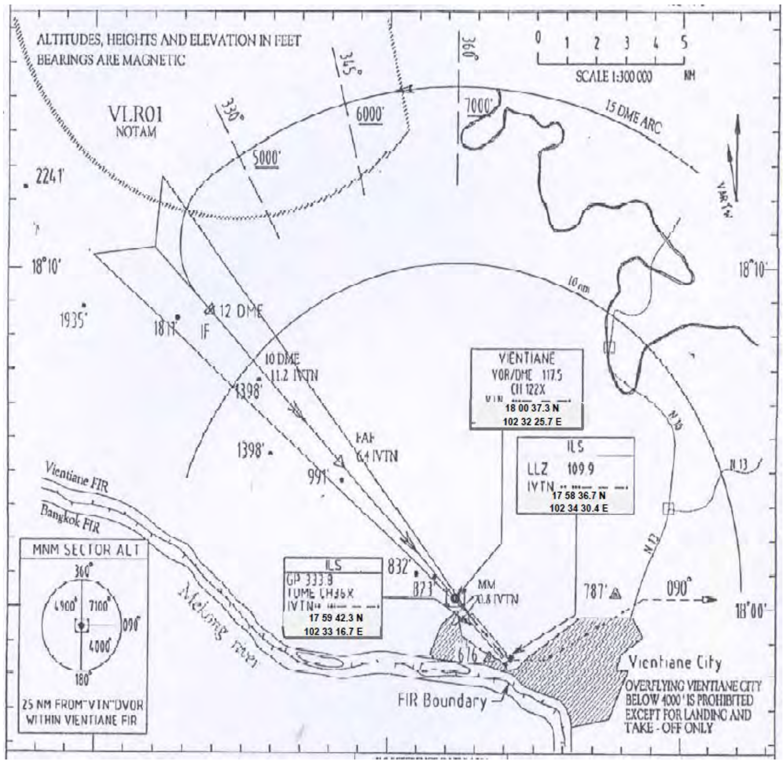
Source: *AIP Lao PDR*
**not used unless coordination is made..*

Figure 2.39 SID (Conventional to south) *not used unless coordination is made



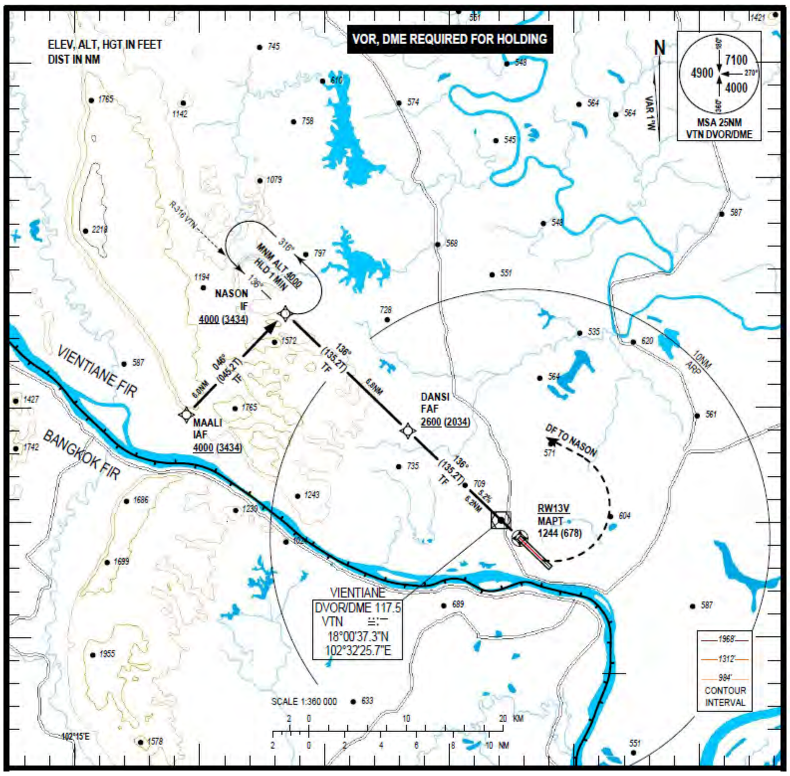
Source: *AIP Lao PDR.*

Figure 2.40 SID (PBN)



Source: AIP Lao PDR.

Figure 2.41 IAP: ILS Approach to RWY13 (Conventional)



Source: AIP Lao PDR.

Figure 2.42 IAP: RNP APCH to RWY13 (PBN)

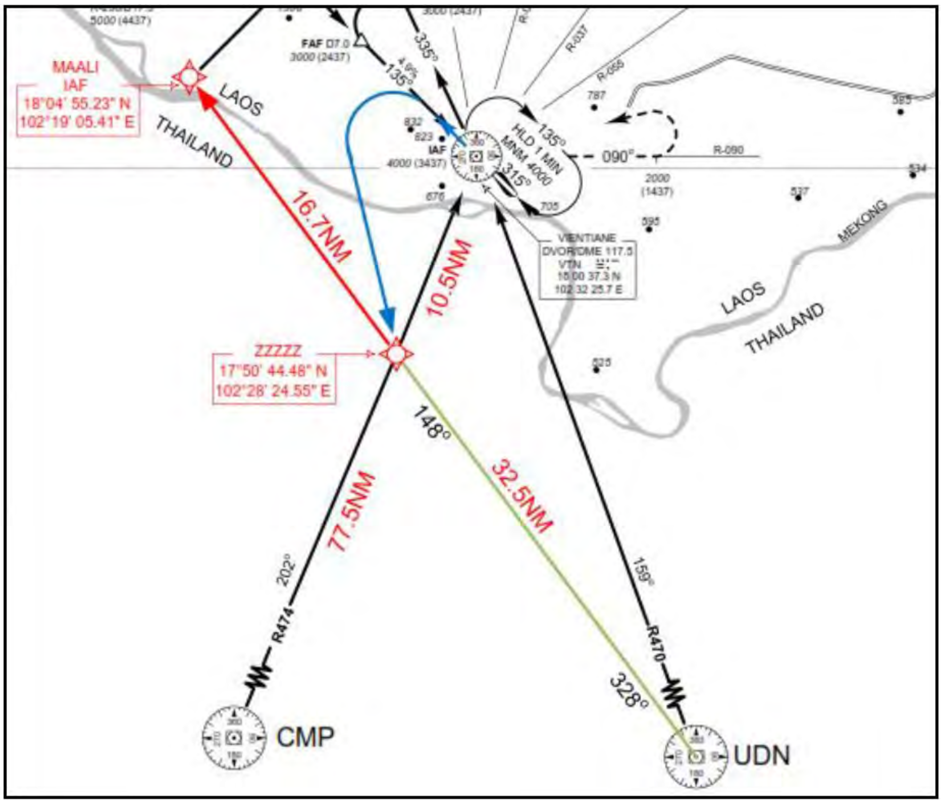
2.6.4. *Progress in Setting-up New Routes*

Performance-based navigation IFPs at Vientiane International Airport are developed under the JICA Technical Cooperation Project, "The Project for the Capacity Development for Transition to the New CNS/ATM Systems in Cambodia, Lao PDR, and Vietnam." The project, which was called "EMCA (East Mekong New CNS/ATM)," was conducted from January 2011 to January 2016, and those PBN IFPs have been effective since July 2014. Because most current aircraft are capable of using navigational information from satellites, those PBN IFPs are primarily used at VTE along with only precision approach of Instrument Landing System (ILS) to the Runway 13.

There were extensive discussions during EMCA about how Vientiane airspace can be utilized more effectively. One typical example is the connection to Required Navigation Performance (RNP) approach to the runway 13 at MAALI (see Figure 2.39). This waypoint (WPT) is intended to accommodate air traffic from the south, and it was therefore recommended to coordinate with the Thai side to set up new routes directly connecting to this WPT in order to shorten the arriving distance to VTE from Thailand, particularly from Bangkok.

This issue has been raised in the Mekong ATM Coordination Group (MK-ATM/CG), and eventually it was basically agreed with both ATC service providers, LANS on the Lao side and

AERO Thai on the Thai side. The meeting discussed the operating procedure for flights departing/arriving at Vientiane International Airport to/from Bangkok FIR using the new intermediate waypoint "ZZZZZ (to be named by AERO Thai)" to facilitate better traffic sequencing into/out of Vientiane International Airport to/from routes R474 and R470 at UDN. Table 2.43 shows the connection to MAALI (shown by the red arrow) along with a new departure route (shown by the blue arrow) to/from the intermediate waypoint of "ZZZZZ" together with an additional connection between "ZZZZZ" and UDN.



Source: *MK-ATM/CG/8 - WP/02 (Dec. 2019).*

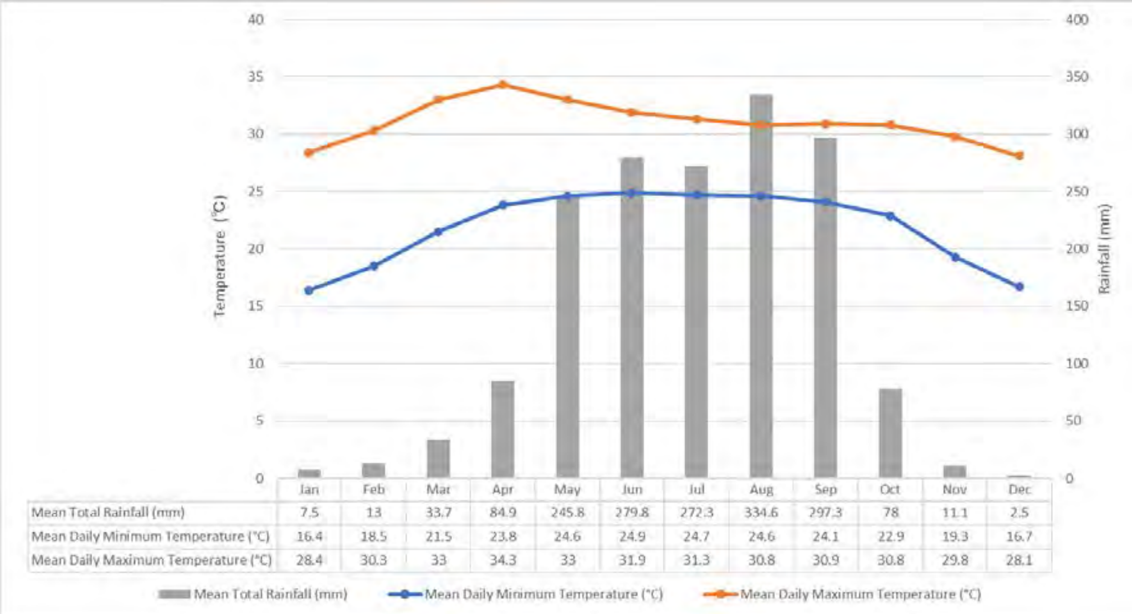
Figure 2.43 Proposed New Routes and Procedures for Vientiane International Airport

Unfortunately, the process to implement the above routes has been immobilized due to COVID-19. However, according to AERO Thai, the Royal Thai Air Force has approved the procedure, provided that each flight be coordinated ahead of time. It took a number of years to reach the agreement, but it shows the possibility of further utilization of the airspace in the south.

2.7. ***Natural Conditions***

2.7.1. *Meteorological Conditions*

Lao PDR is in the tropical monsoon area, and the rainy season is from May to October. Figure 2.44 shows the monthly average maximum temperature, minimum temperature, and rainfall over 50 years from 1950 to 2000 (*https://worldweather.wmo.int/*). The hottest month is April, and the temperature is approximately 34°. In December and January mean daily minimum temperature goes down to 16°C.



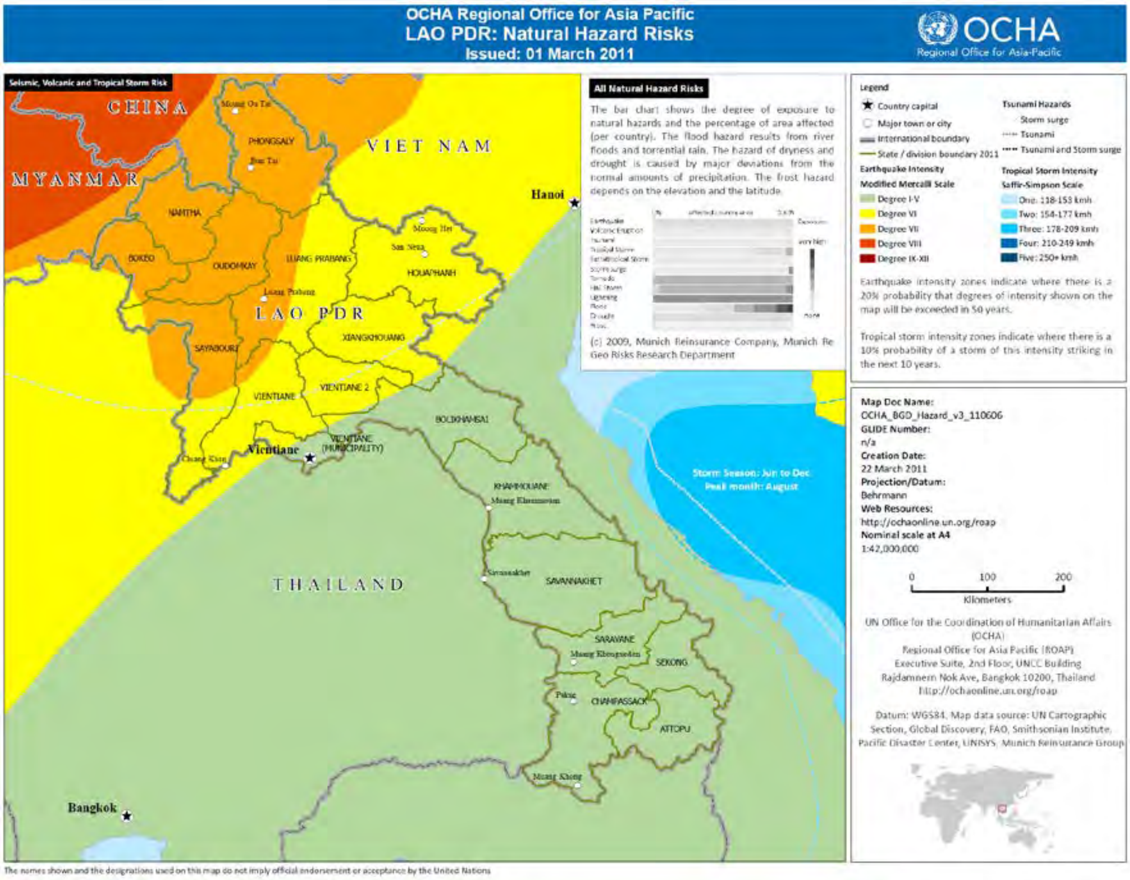
Source: https://worldweather.wmo.int/.

Figure 2.44 Temperature and Rainfall in Vientiane

2.7.2. *Natural Hazards*

Source: OCHA.

Figure 2.45 shows the map of Natural Hazard Risks in Lao PDR prepared by the UN Office for the Coordination of Humanitarian Affairs:OCHA. The risks of earthquakes are higher in the northern part of the country, but the risk is low in the Vientiane area.



Source: OCHA.

Figure 2.45 Natural Hazard Risk Map

2.7.3. *Wind Conditions*

Wind analysis was conducted by the previous JICA project in 2013. According to the result of the analysis, the wind velocity in the airport is not strong, and wind coverage for 10 kt cross wind is 99.72%. From this analysis, the effect of wind on aircraft operation is minimal.

2.7.4. *Geotechnical Conditions*

There have been many pavement constructions and improvement projects in the airport in the past, and there are many soil records. In the airside, the subgrade is sandy clay and the water level is high. Design CBR value used in the pavement design was 4% to 5%.

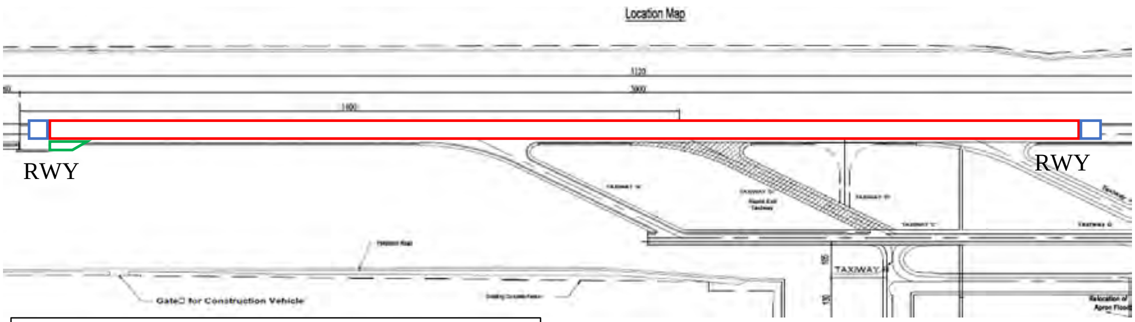
Table 2.8 Design CBR and K Values

Design Location	Design Year	Design CBR (%)	Design K Value (kg/cm^2)
Runway extension	1969	4.0	3.5
Taxiway A & T, Apron 1A	1971	4.0	3.5
Taxiway D	2013	5.0	N/A

2.8. *Facilities at Vientiane International Airport*

2.8.1. *Runway*

The dimension of the current runway is 3,000 m (9,842.5 feet) in length and 45 m (147.6 feet) in width. The pavement type is asphalt concrete. The runway direction is 13-31. The turning pad is located on the RWY13 side of the runway. The overruns are located at both ends of the runway and are 60 m long and 45 m wide. Figure 2.46 shows the layout plan of the current runway.



Legend : Runway Overrun Turning pad

Source : *AS BUILT DRAWING.*

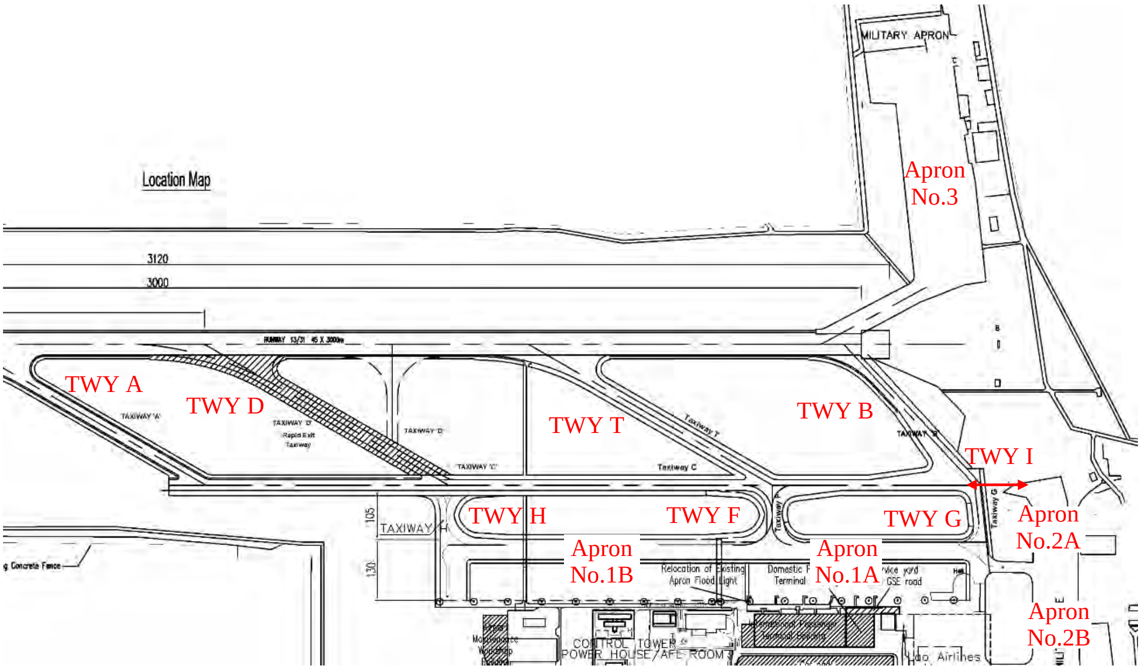
Figure 2.46 Current Runway Plan View

2.8.2. *Taxiways and Aprons*

2.8.2.1. Taxiways

The layout of the taxiways is shown in Figure 2.47.

.



Source *: AS BUILT DRAWING.*

Figure 2.47. Taxiway and Apron Layout.

According to the AIP, the width of each taxiway and the PCN (international standard markings for pavement strength) are shown in Table 2.9.

Table 2.9 Taxiway width and PCN

Taxiway	Width(m)	PCN
A	23	PCN 62/F/B/W/T
B	23	PCN 62/F/B/W/T
C	23	PCN 62/F/B/W/T
D	23	PCN 49/F/C/W/T
F	37	PCN 90/F/D/W/T
G	23	PCN 90/F/D/W/U
H	23	PCN 90/F/D/W/U
I	18	PCN 58/R/B/W/T
T	23	PCN 62/F/B/W/T

2.8.2.2. Aprons

The spot layout of the front of the terminal building for Apron No. 1A is shown in Figure 2.47. The Stands from #12 to #17 are located in front of the terminal building. The Stand sizes #12 and #14 are for code E, #13 and #15 through #17 are code C, and #18 and #19 are ATR-72 self-powered spots.

The stands #13 and #15 have a spot width of at least 49 m, which is necessary for the ATR-72 to be able to operate on its own.

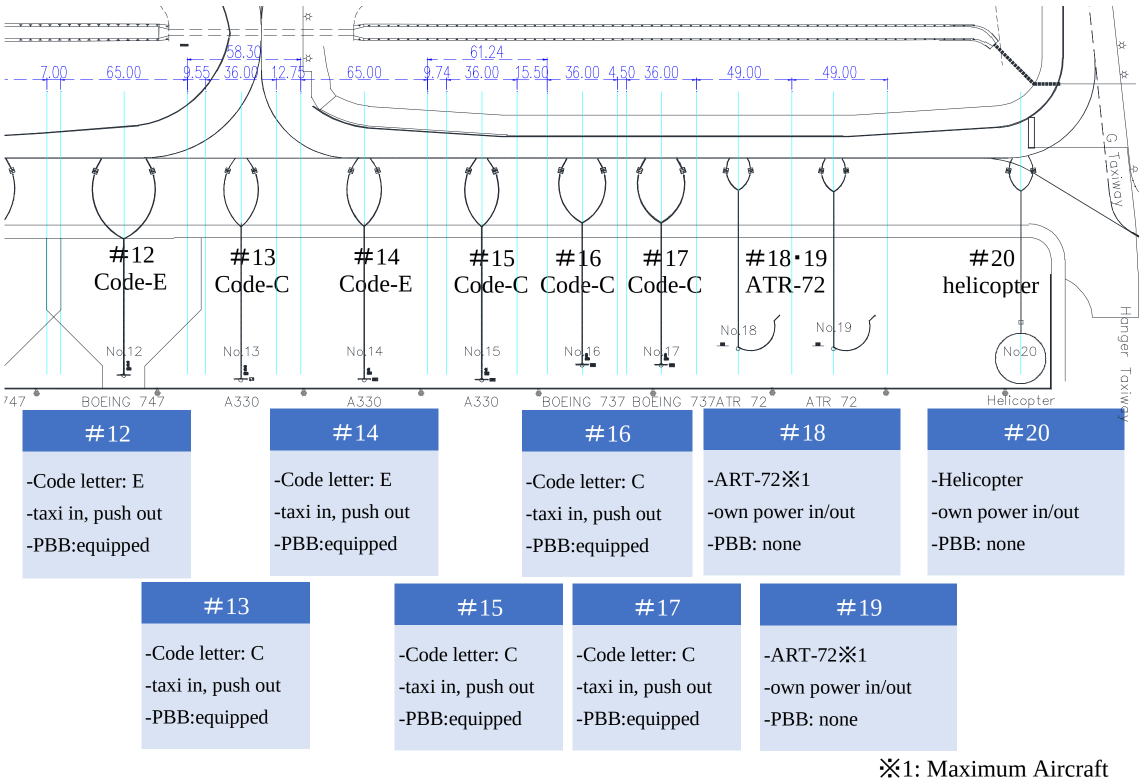


Figure 2.47 Spot layout of Apron 1A

The spot layout diagram for Apron No. 1B is shown in Figure 2.48. Stands #4 through #10 do not have a clearance of 4.5 m, which is the prescribed separation for Code C.

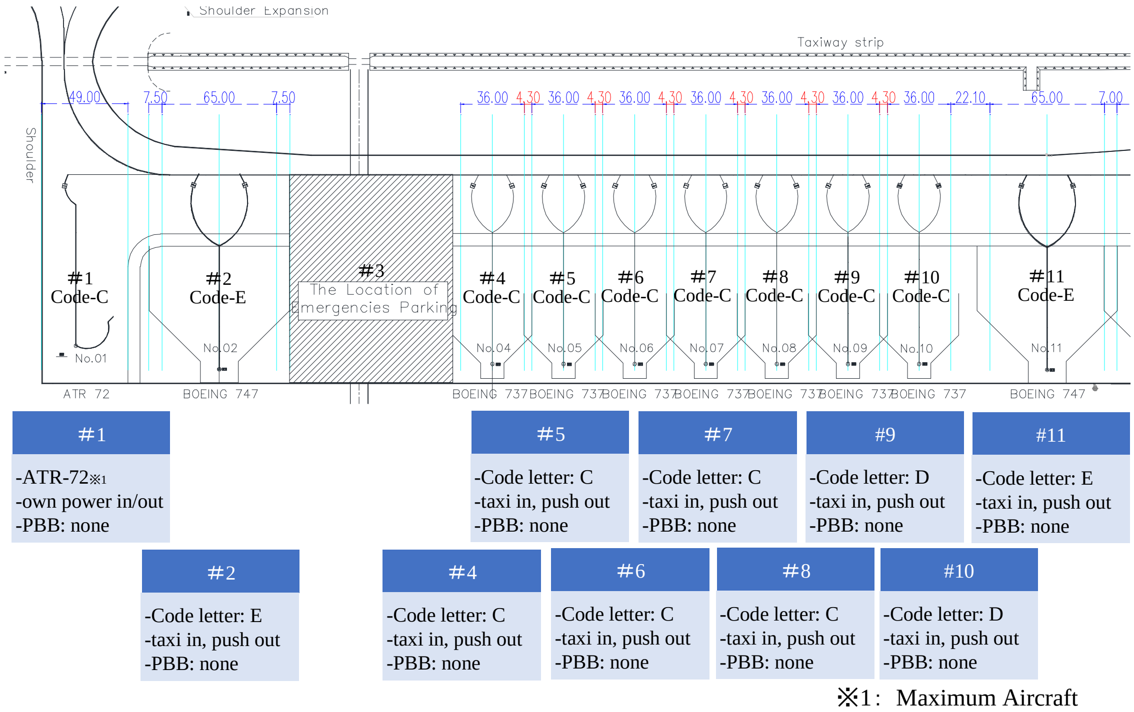


Figure 2.48 Spot Layout of Apron 1B

2.8.3. *Pavement Structure*

Various types of pavement structure exist at VTE. The following sections summarizes those pavement structures and their layouts.

2.8.3.1. Runway Pavement

The original runway was 2,500 m in length. It was extended to 3,000 m in 1971. The pavement structure is different in the first 500 m section from Runway Threshold 13 and in 500 m to Threshold 31. The northern side of the runway was a 28 cm concrete slab, 30 cm base course and 120 cm subbase course. The original 2,500 m was 28 cm concrete slab and 28 cm base course. Intersections between the runway and Taxiway A and Taxiway T were replaced by asphalt pavement in 1995. Another part of the runway was overlaid twice in 1995 and 2006. The pavement structure of the runway is summarized in Table 2.10.

Table 2.10 Runway Pavement Structure

Location	Pavement Structure (Year of Construction)
From runway threshold 13 to 995 m	Asphalt pavement: 20 cm (2006) Asphalt pavement: 10 cm (1995) Crack relief layer: 10–15 cm (1995) Concrete slab: 28 cm (1969–1971) Base course: 30 cm (1969–1971) Sub base 120c m (1969–1971)
995 m to 1,150 m	Asphalt pavement: 20 cm (2006) Asphalt pavement: 20 cm (1995) Cement treated base course: 25 cm (1995) Stabilized base course: 30 cm (1995) Sub base 15 cm (1995)
1,150 m to 2,400 m	Asphalt pavement: 10 cm (2006) Asphalt pavement: 10cm (1995) Crack relief layer: 10–15 cm (1995) Concrete slab: 28 cm (1962) Base course: 28 cm (1962)
2,400 m to 2,650 m	Asphalt pavement: 20 cm (2006) Asphalt pavement: 20 cm (1995) Cement treated base course: 25 cm (1995) Stabilized base course: 30 cm (1995) Sub base 15 cm (1995)
2,650 m to 3,000 m	Asphalt pavement: 10 cm (2006) Asphalt pavement: 10 cm (1995) Crack relief layer: 10–15 cm (1995) Concrete slab: 28 cm (1962) Base course: 28 cm (1962)

2.8.3.2. Taxiway Pavement

Taxiway A was constructed in 1971 with concrete pavement. Intersection with the runway was replaced with asphalt pavement in 1995. All area was overlaid with 10 cm thick asphalt pavement in 2006. The pavement structure is as shown in Table 2.11.

Table 2.11 Taxiway A Pavement Structure

Location	Pavement Structure (Year of construction)
Intersection between Taxiway A and the runway	Asphalt pavement: 10 cm (2006) Asphalt pavement: 20 cm (1995) Cement treated base course: 25 cm (1995) Stabilized base course: 30 cm (1995) Sub base 15 cm (1995)
Taxiway A	Asphalt pavement: 10 cm (2006) Concrete slab: 28 cm (1969–1971) Base course: 30 cm (1969–1971) Sub base 120 cm (1969–1971)

The original Taxiway D was constructed in 1962, and the taxiway was not rehabilitated for a long time. A new rapid exit taxiway D was constructed in 2018. The pavement structure is as shown in Table 2.12.

Table 2.12 Taxiway D Pavement Structure

Location	Pavement Structure (Year of Construction)
Taxiway D	Asphalt pavement: 13 cm (2018) Stabilized base course: 19 cm (2018) Sub base 38 cm (2018)

Taxiway T was constructed in 1971 with concrete pavement. The intersection with the runway was replaced with asphalt pavement in 1995. All area was overlaid with 15 cm thick asphalt pavement in 2006. The pavement structure is as shown in Table 2.13.

Table 2.13 Taxiway T Pavement Structure

Location	Pavement Structure (Year of construction)
Intersection between Taxiway T and the runway	Asphalt pavement: 10 cm (2006) Asphalt pavement: 20 cm (1995) Cement treated base course: 25 cm (1995) Stabilized base course: 30 cm (1995) Sub base 15 cm (1995)
Taxiway T	Asphalt pavement: 15 cm (2006) Concrete slab: 28 cm (1969–1971) Base course: 30 cm (1969–1971) Sub base 120 cm (1969–1971)

Taxiway B was constructed in 1962. Intersection with the runway was replaced with asphalt pavement in 1995. A major portion of the taxiway was overlaid by 10 cm of thick asphalt pavement in 1995. The area was overlaid again in 2006. There is a holding bay on the east side of the taxiway, which was constructed in 1962. The holding position area was not overlaid because it has not been used. The pavement structure is as shown in Table 2.14.

Table 2.14 Taxiway B Pavement Structure

Location	Pavement Structure (Year of Construction)
Intersection between Taxiway B and the runway	Asphalt pavement: 10 cm (2006) Concrete slab: 28 cm (1969–1971) Base course: 30 cm (1969–1971) Sub base 120 cm (1969–1971)
Taxiway B	Asphalt pavement: 10 cm (2006) Asphalt pavement: 10 cm (1995) Crack relief layer: 10–15 cm (1995) Concrete slab: 28 cm (1962) Base course: 28 cm (1962)

Taxiway C is a partial parallel taxiway. The southern part of Taxiway C between Taxiway D and Taxiway B is the original concrete pavement laid in 1962, and the area between Taxiway A and Taxiway D was extended area in 1971. The pavement structure in these areas is different. The southern part of the taxiway was overlaid with 10 cm asphalt in 1995 but the northern part was not overlaid that time. The whole area was overlaid with 10 cm asphalt in 2006. The pavement structure is as shown in Table 2.15.

Table 2.15 Taxiway C Pavement Structure

Location	Pavement Structure (Year of construction)
Between Taxiway A and Taxiway C	Asphalt pavement: 10 cm (2006) Asphalt pavement: 20 cm (1995) Cement treated base course: 25 cm (1995) Stabilized base course: 30 cm (1995) Sub base 15 cm (1995)
Between Taxiway C and Taxiway B	Asphalt pavement: 10 cm (2006) Asphalt pavement: 10 cm (1995) Crack relief layer: 10–15 cm (1995) Concrete slab: 28 cm (1962) Base course: 28 cm (1962)

Taxiways F and G was constructed in 1962. The taxiway was overlaid with 10 cm asphalt in 1995 and 10 cm asphalt in 2006. The pavement structure is as shown in Table 2.16.

Table 2.16 Taxiway F Pavement Structure

Location	Pavement Structure (Year of Construction)
Taxiway F	Asphalt pavement: 10 cm (2006) Asphalt pavement: 10 cm (1995) Crack relief layer: 10–15 cm (1995) Concrete slab: 28 cm (1962) Base course: 28 cm (1962)
Taxiway G	Asphalt pavement: 10 cm (2006) Asphalt pavement: 10 cm (1995) Crack relief layer: 10–15 cm (1995) Concrete slab: 28 cm (1962) Base course: 28 cm (1962)

Taxiway H was constructed in 2013. The surface is asphalt. The pavement structure is as shown in Table 2.17.

Table 2.17 Taxiway H Pavement Structure

Location	Pavement Structure (Year of Construction)
Taxiway H	Asphalt pavement: 10 cm (2013) Base course: 26 cm (2013) Sub base 81 cm (2013)

There is no detailed information on pavement structure for Taxiway K and Taxiway I.

Apron No. 1A was originally constructed with concrete pavement in 1962. The western part of the apron was expanded in 1971. The central section of the concrete slabs was replaced in 1995. The apron was overlaid with 20 cm of concrete in 2006. The northeast part of the area between taxiway F and G was expanded in 2013. The pavement structure is as shown in Table 2.18.

Table 2.18 Apron 1A Pavement Structure

Location	Pavement Structure (Year of construction)
Apron 1A	Concrete Slab: 20 cm (2006) Concrete slab: 28 cm (1962) Base course: 28 cm (1962)
Apron 1A Central parts	Concrete Slab: 20 cm (2006) Concrete slab: 30 cm (1995) Cement Treated Base course: 15 cm (1995) Sand fill: 20 cm (1995)
Apron 1A expansion area	Concrete Slab: 36 cm (2013) Base course: 21 cm (2013) Sub base course: 15 cm (2013)

Apron No. 1B was constructed in 2013 with concrete pavement. The pavement structure is as shown in Table 2.19.

Table 2.19 Apron 1B Pavement Structure

Location	Pavement Structure (Year of construction)
Apron 1B	Concrete Slab: 36 cm (2013) Base course: 21 cm (2013) Sub base course: 15 cm (2013)

The pavement structure of the airport is shown in Figure 2.49

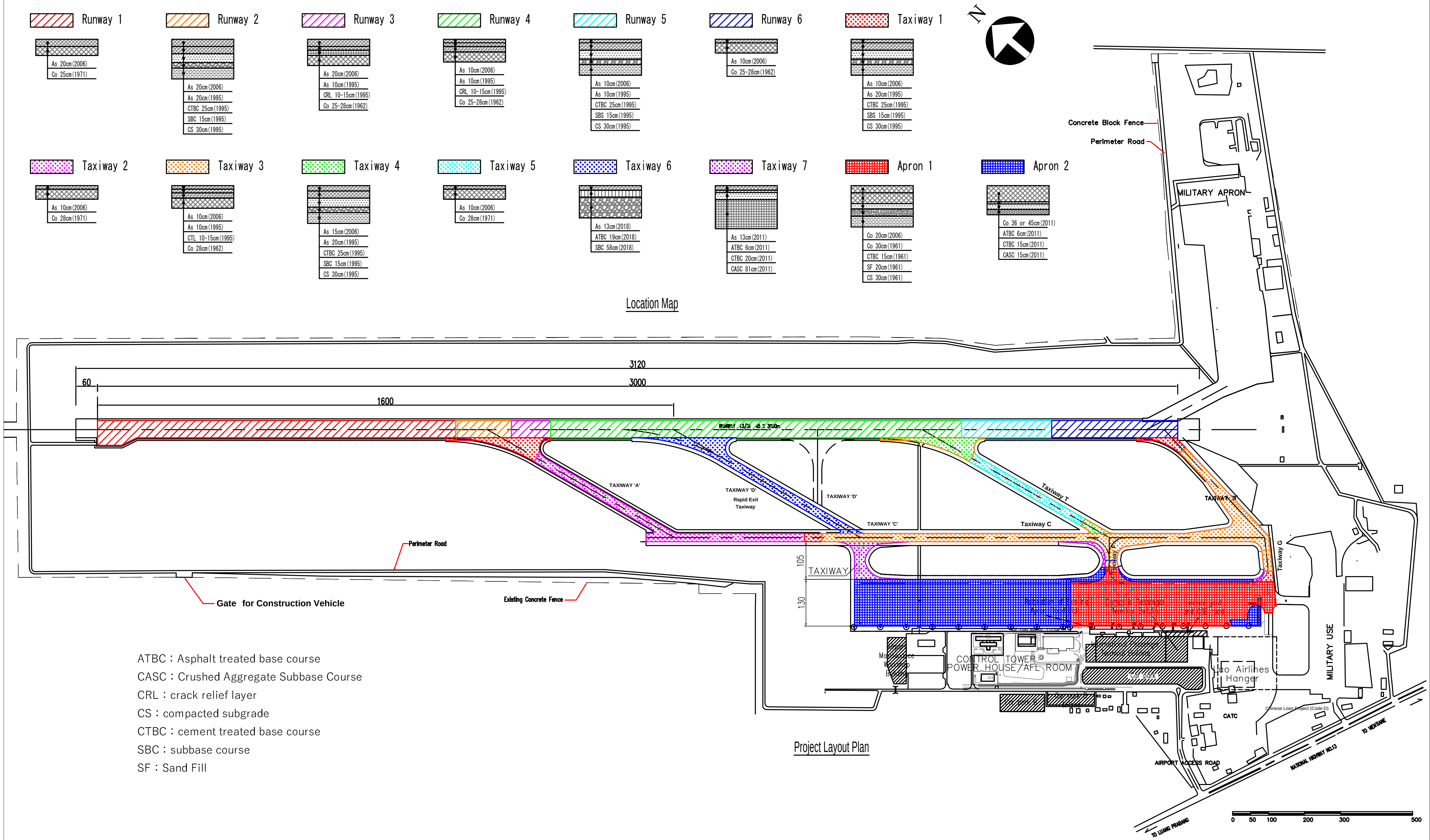


Figure 2.49 Pavement Structure Layout

Source: JICA TC Team

2.8.4. *Terminal Area*

The terminal area of the airport is located in the southwest part of the airport. The layout of buildings in the terminal area is shown in Figure 2.50. A Lao Airline hangar and office are located at the eastern side of the terminal area. The domestic passenger building is located next to the Lao Airline office, and the international passenger terminal is at the western side of the domestic building. There is a VVIP building at the western side of the international passenger building. A cargo terminal is located on the western side of the VVIP building. There is an area for air traffic control facilities such as a control tower and operation building, LANS office, and power supply substation. A fire station and a small aircraft hangar is located at the western end of the terminal area.

Figure 2.50 Terminal Area Layout

2.8.5. *Passenger Terminal Facilities*

This chapter addresses the current conditions of the existing terminal facilities. Existing terminal facilities means the International Passenger Terminal Building, the Domestic Passenger Terminal Building, the VVIP Terminal Building, and the related equipment.

2.8.5.1. International Passenger Terminal Building (IPTB)

The international passenger terminal building (IPTB) was built by the Japanese Grant Aid Project in 1998 and was expanded by a Japanese Soft-Loan Project in 2018. The building is a three-story RC structure and is designed with a total floor area of 25,000 m^2. The IPTB is estimated to handle 2,274,703 passengers annually and the number of passengers (one way) at the design peak hour is 677 according to the final report of the Preparatory Survey for the Project for Expansion of Vientiane International Airport in 2013. The building facilities has been operated by L-JATS since 1999. Figure 2.51 shows a view from the airside to the passenger terminal buildings.

Figure 2.51 International and Domestic Passenger Terminal Building from Airside

The passenger flow and area list of the IPTB are shown in Figure 2.52

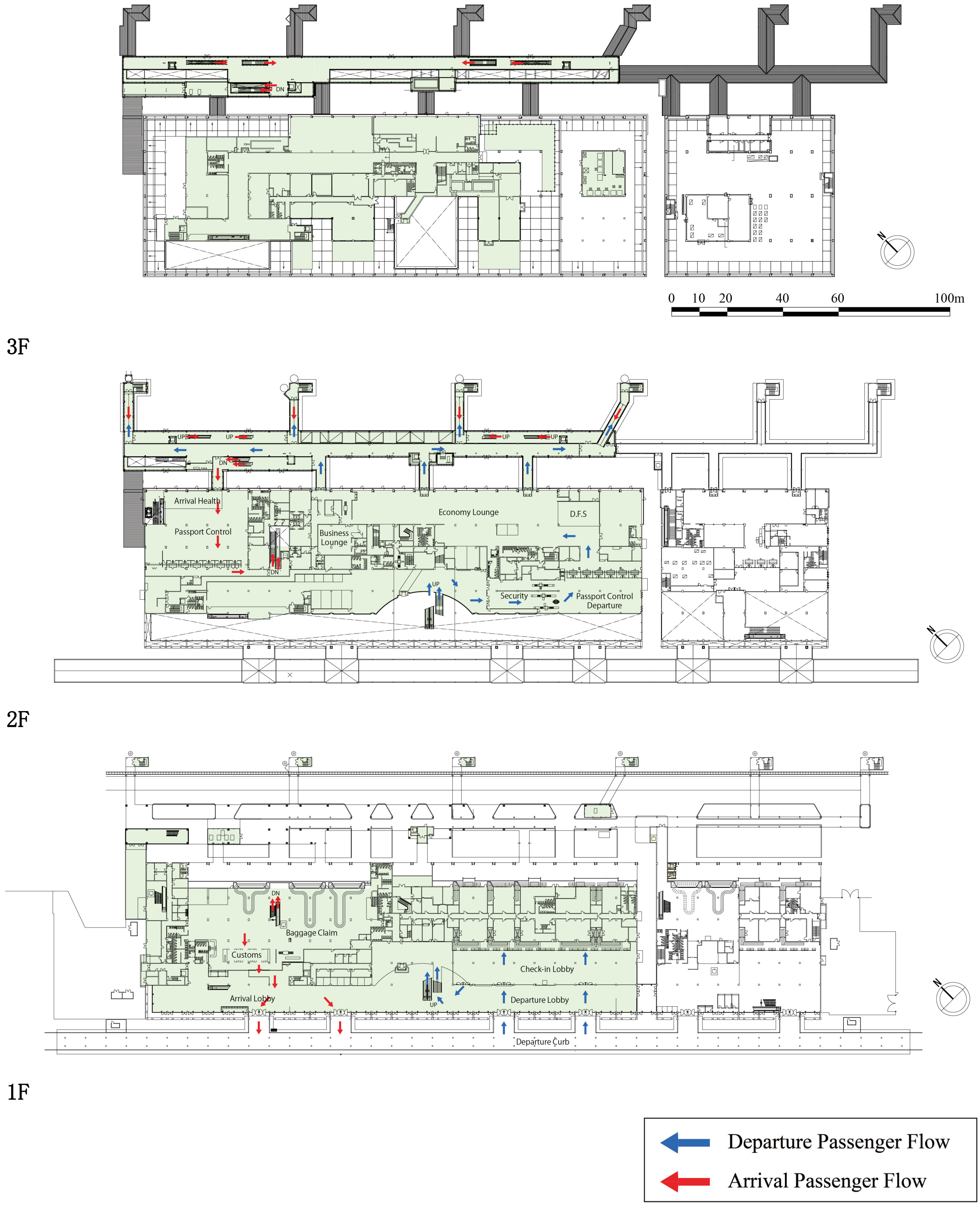


Figure 2.52 Passenger Flow of the International Passenger Terminal Building

(1) Departure Curb

The Departure Curb is a drop-off space in front of the building, which is about half the length of the terminal building.

Figure 2.53 International Departure Curb

(2) Departure Lobby (First Floor)

The Departure Lobby is a public space on the first floor of the building. Passengers who check in at the counter use the stairs and escalators in the central atrium to go to security on the second floor. There is also an elevator that takes the passengers to the second and third floors.

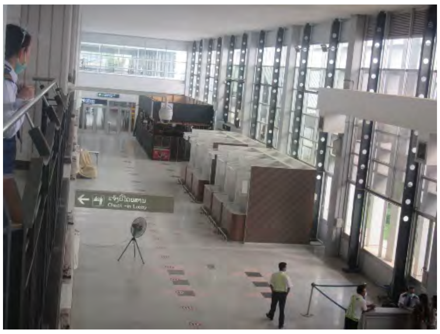



Figure 2.54 Departure Lobby (left) and Hall (right) in the IPTB

(3) Check-in Counter (First Floor)

The check-in area is separated from the departure lobby by a fixed stanchion and covers approximately 800 m^2. There are 33 check-in counters of conventional type. There is no Self-Service Kiosks nor Fast Bag Drops. As a common use passenger processing system (CUPPS), vMUSE is being used by each airline and maintained by AOL to keep passengers moving.

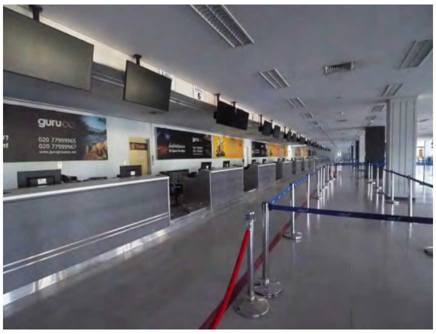
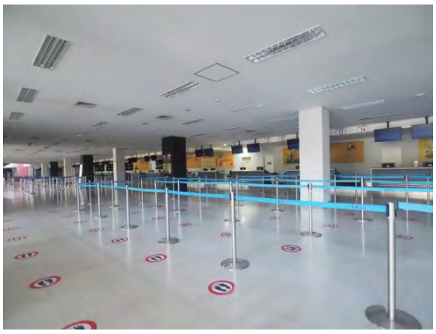



Figure 2.55 Check-in Hall for International Passenger

(4) Security (Second Floor)

There are two X-ray machines, two walk-through metal detectors, and one full-body scanner in the security area. There is one X-Ray machine and one walk-through metal detector for airport staff entering the airside in the same area.

After the COVID-19 pandemic, a booth was set up to check passengers' negative COVID-19 certificates before proceeding to the security check point.


Figure 2.56 Desk for checking the Covid Certificate before Security (left) and Departure Security (right) in IPTB

(5) Passport Control Departure (Second Floor)

Thirteen counters are available for passport control departures. One of the counters is an automated gate. This departure immigration area is approximately 390 m^2, and it was congested during peak hour.

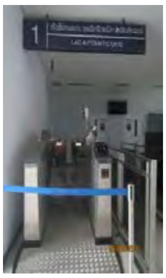



Figure 2.57 Automatic Gate (left) and Passport Control Counters (right) in IPTB

(6) Departure Lounge (Second Floor)

The departure lounge is approximately 1,300 m². Congestion has occurred before the COVID-19 pandemic.

Figure 2.58 Departure Lounge (left) and Baoding Gate (right) in IPTB

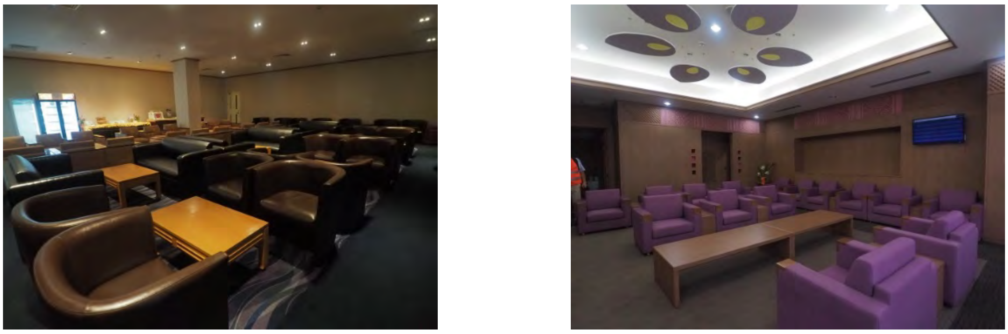


Figure 2.59 Business Lounge (left) and VIP Room (right) in IPTB

(7) Arrival Health Check (Second Floor)

The arrival health check is currently set up as a temporary booth in the immigration area. Here documents are checked for COVID-19 negativity. There are five seats, and the PCR test is conducted in this area. It takes more than an hour to handle an international arrival passenger on a single flight because this test is conducted carefully. There is a big queue in the corridor in front of this area.

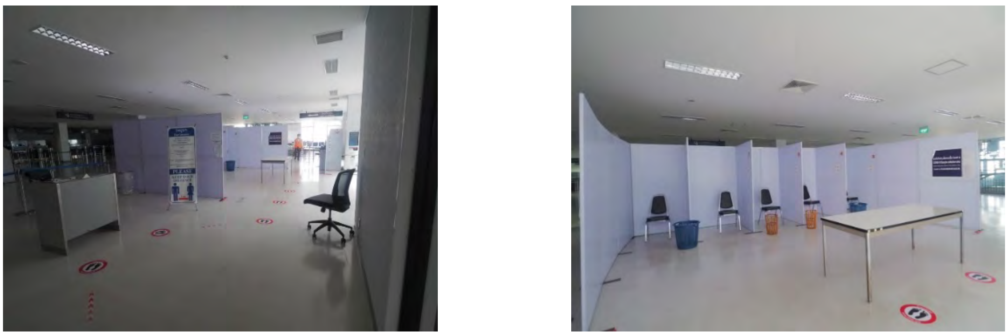


Figure 2.60 Temporary COVID-19 Test Booth in IPTB

(8) Passport Control Arrival (Second Floor)

There are fifteen counters in passport control arrival.

Figure 2.61 Arrival Passport Control Area in IPTB

(9) Baggage Claim (First Floor)

Three baggage claim belt conveyors are operated in the baggage claim area. This number of baggage claim conveyors was enough during peak hours before the COVID-19 pandemic. There is a space prepared for one more baggage claim in the area in the future.

Figure 2.62 Baggage Claim Area in IPTB

(10) Arrival Customs (First Floor)

There are seven customs counters. The rate of passengers with nothing to declare is relatively high. There is a sufficient number of counters even during peak hours. There is one set of x-ray machines for customs checks in this area.


Figure 2.63 Customs Area in IPTB

(11) Arrival Lobby (First Floor)

The Arrival Lobby is a public space on the first floor of the building. There are many booths for banks, travel agent and COVID-19 monitoring booths have been currently added.

Figure 2.64 Arrival Lobby (left) and COVID-19 Monitoring Unit in the Lobby (right)

The floor areas of each room in the International Passenger Terminal Building are shown in Table 2.20.

Table 2.20 Floor Area of the International Passenger Terminal Building

Name of Room	Measured Value	Unit	Remarks
International Departure			
Departure Curb	86.0	m	
Departure Lobby (First Floor)	504.8	m^2	
Check-in Counter (First Floor)	804.8	m^2	
	33	N	Number of Check-in Counter
Security (Second Floor)	210.0	m^2	
	2	N	Number of X-ray Inspection Machine
Departure Passport Control (Second Floor)	380.0	m^2	
	13	N	Number of Counter
Departure Lounge (Second Floor)	1,200	m^2	
International Arrival			
Arrival Health Check (Second Floor)	5	N	Number of Chair for COVID-19 Test
Arrival Passport Control (Second Floor)	15	N	Number of Counter
Baggage Claim (First Floor)	1,190	m^2	
	3	N	Number of Baggage Belt
Arrival Customs (First Floor)	145.0	m^2	
	7	N	Number of Counter
Arrival Lobby	734.0	m^2	

(12) Security Equipment

There are nine x-ray machines, six Walkthrough Metal Detectors, and a Full Body Scanner in the departure security area. Six medium-size x-ray machines are used for passenger and staff entering airside and three large-size x-ray machines used for inspection of baggage in the baggage make-up area behind the check-in counter. All x-ray equipment is inspected by L-JATS once every three months. A list of security equipment is shown in Table 2.21 and Table 2.22.

Figure 2.65 X-Ray Inspection Equipment in IPTB

Figure 2.66 Walkthrough Metal Detector (left) and Full Body Scanner (right)

Table 2.21 X-Ray Inspection Equipment in IPTB

Location	Specification	Manufacture/Model	Installation year	Condition
IPTB, Baggage Make-Up 1F	X-Ray Hold Baggage	Smiths detection/100100V-2is	2017	Good
IPTB, Baggage Make-Up 1F	X-Ray Hold Baggage	Smiths Heimann/HS 9075	2012	Good
IPTB, Baggage Make-Up 1F	X-Ray Hold Baggage	Smiths Heimann/HS 9075	2012	Good
IPTB, Security 2F	X-Ray for Carry On	Smiths detection/HI-SCAN 6040-2is	2017	Good
IPTB, Security 2F	X-Ray for Carry On	Smiths detection/HI-SCAN 6040-2is	2017	Good
IPTB, Security 2F	X-Ray for Staff	Smiths Heimann/HS7555i	2012	Good
IPTB, Departure Lounge 2F	X-Ray Carry On for Transit	Heimann System/HS 7555A	1998	Good
IPTB, Gate to VIP Room 2F	X-Ray Carry On	Smiths Heimann/HS7555i	2012	Good
IPTB, 1F	X-Ray Carry On	XIS 6545 ASTRC 160ss3286	2018	Good

Table 2.22 Walkthrough Metal Detector in IPTB

Location	Specification	Model/Name manufacture	Installation year	Condition
IPTB, Gate to VIP Room 2F	Metal Detector (HI-PE Multi Zone)	Model: HIPE/PZ, Serial No 21106047034	2012	Good
IPTB, Check point for staff	Metal detector (PMD2)	Model: PMD2/PTZ, Serial No 20306043014	2003	Good
IPTB, QS Check point 1F	Metal Detector (HI-PE Multi Zone Plus)	Model: HIPEPLUS/PZ, Serial No 21506012081	2018	Good
IPTB, VIP Area Gate 2F	Metal Detector (HI-PE Multi Zone)	Model: HIPE/PZ, Serial No 21106047035	2012	Good
IPTB, QS Check point 2F	Metal Detector (HI-PE Multi Zone)	Model: HIPE/PN-TR600BH, Serial No 9664129	2012	Good
IPTB, QS Check point 2F	Metal Detector (HI-PE Multi Zone Plus)	Model: HIPE PLUS/PZ, Serial No 21606044102	2017	Good

Table 2.23 Body Scanner in IPTB

Location	Specification	Model/Name manufacture	Installation year	Condition
IPTB, Security 2F	Metal Detector	L3/Pro version 2	2017	Good

(13) Passenger Boarding Bridge (PBB)

There are two brands of Passenger Boarding Bridge (PBB), two units of Shinmaywa and four unites of Bukaka. The Shinmaywa PBB has been used since 1998, and the Bukaka PBB has been used since 2018, at the time of the expansion of the terminal building.

Figure 2.67 Passenger Boarding Bridge (left: Shinmaywa, right: Bukaka)

2.8.5.2. Domestic Passenger Terminal Building (DPTB)

The domestic passenger terminal building was built at the same time the international passenger terminal building was expanded in 2018. The total floor area of the building is approximately 7,000 m^2, and the capacity for passengers (one way) at the peak hour is 227. The building facilities have been operated by ATS since 2013.

The passenger flow and layout plan of the DPTB are shown in Figure 2.68.

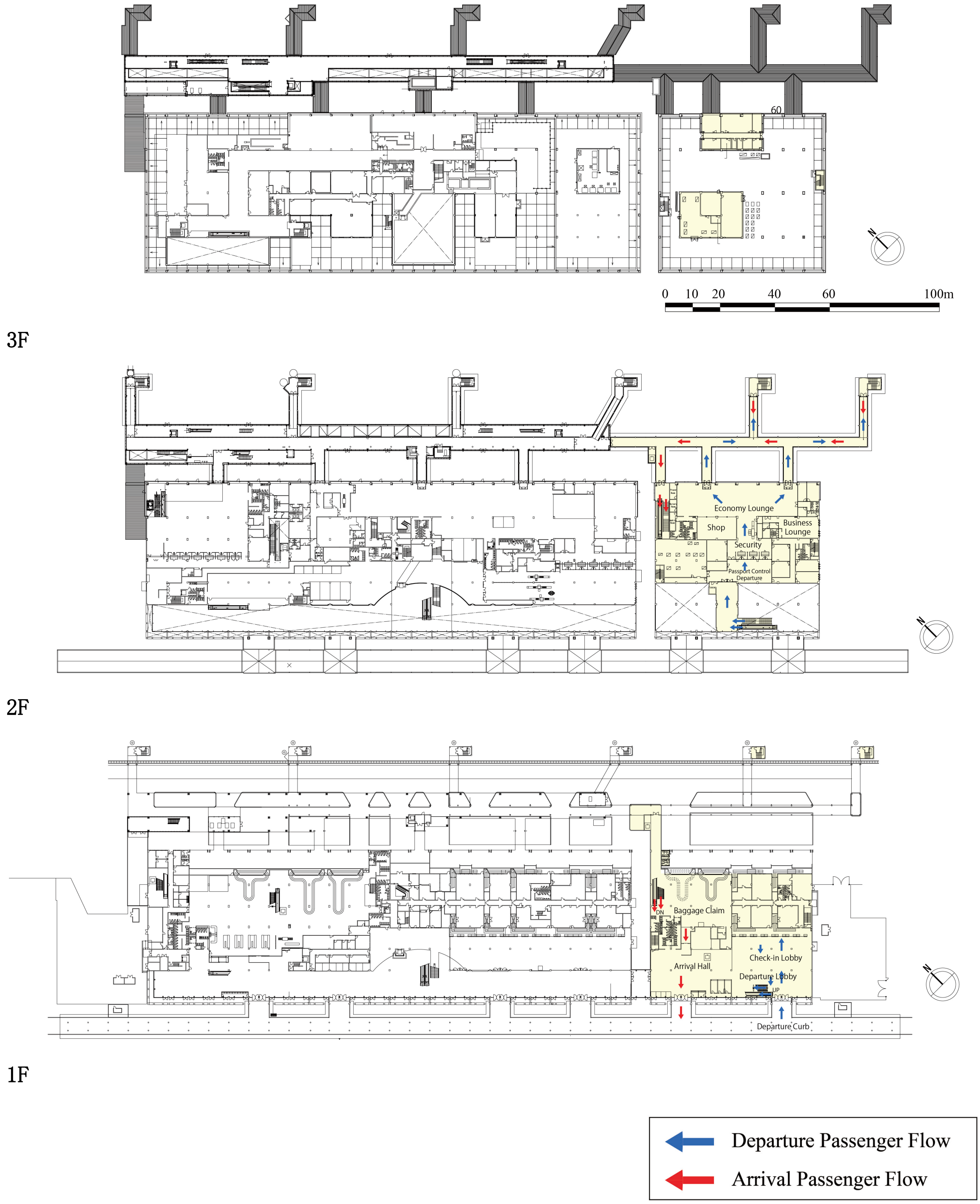


Figure 2.68 Passenger flow of the Domestic Passenger Terminal Building

(1) Domestic Departure Curb

The Departure Curb is a drop-off space in front of the building and is the same as the one at the international departure curb.

Figure 2.69 Domestic Departure Curb

(2) Departure Lobby (First Floor)

The Departure Lobby is a public space on the first floor of the building. There is no clear boundary between the departure lobby and the check-in area. As in the international passenger terminal building, after check-in passengers use the stairs and escalators to reach the security area on the second floor.

Figure 2.70 Departure Lobby (left) and Lobby Atrium (right) in DTPB

(3) Check-in Counter (First Floor)

There are fourteen counters in the domestic terminal. Mainly, two airlines—Lao Airlines and Laos Skyway—use these counters. For Lao Airlines, they use vMUSE as the CUPPS. Lao Skyway uses Amelia RES Commercial Systems for passenger check-in. The system is being operated and maintained by each airline.

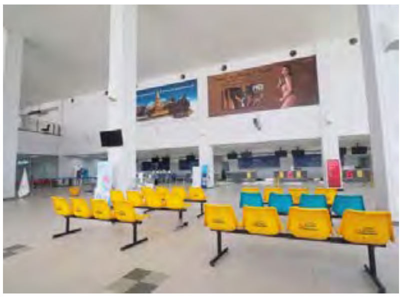



Figure 2.71 Check-in Hall for Domestic Passenger

(4) Passport Control Departure (Second Floor)

There is a passport control counter although the building is for a domestic flight. Passengers are requested to show their IDs at this counter.

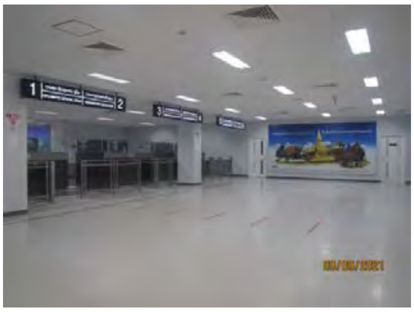



Figure 2.72 Passport Control Area (left) and Passport Control Counters (right)

(5) Security (Second Floor)

There is one x-ray equipment and one walk-through metal detector in the security area for the passengers and the staff. The list of security equipment is shown in Table 2.24.

Figure 2.73 Departure Security Area (left) and Equipment (right)

Table 2.24 Security Inspection Equipment in DPTB

Location	Specification	Model/Name manufacture	Installation year	Condition
DPTB, Security Area 2F	X-Ray for Carry On	Smiths detection HI-SCAN 6040-2is	2017	Good
DPTB, Make-Up Area 1F	X-Ray for Hold Baggage	Smiths detection/100100v-2is	2017	Good
DPTB, Make-Up Area 1F	X-Ray for Hold Baggage	Smiths detection/100100v-2is	2017	Good
DPTB, Security Area 2F	Metal Detector (HI-PE Multi Zone Plus)	Model: HIPE PLUS/PZ, Serial No 21606044102	2017	Good

(6) Departure Lounge (Second Floor)

The domestic departure lounge is approximately 540 m². It is large enough for passenger seating and waiting for boarding; there are two boarding gates in the domestic passenger lounge. On the same floor there are an airline lounge and a VIP Room.


Figure 2.74 Domestic Passenger Departure Lounge (left) and VIP Room (right)

(7) Baggage Claim (First Floor)

There is a baggage claim belt conveyor in the baggage claim area. During peak hours, one belt is not enough. There is space to install one more baggage claim belt in the future.


Figure 2.75 Baggage Claim Area in DPTB

(8) Arrival Lobby (First Floor)

The arrival lobby is a public space on the first floor of the building.


Figure 2.76 Arrival Lobby in DPTB

The floor area of each room in the Domestic Passenger Terminal Building is shown in the Table 2.25.

Table 2.25 Floor Area of Domestic Passenger Terminal Building

Name of Room	Measured Value	Unit	Remarks
Domestic Departure			
Departure Curb	60.0	m	
Departure Lobby (First Floor)	310.0	m^2	
Check-in Counter (First Floor)	280.0	m^2	
	14	N	Number of Check-in Counter
Passport Control Departure (Second Floor)	140.0	m^2	
	6	N	Number of Counter
Security (Second Floor)	140.0	m^2	
	1	N	Number of X-ray Inspection Machine
Departure Lounge (Second Floor)	540.0	m^2	
Domestic Arrival			
Baggage Claim (First Floor)	457.0	m^2	
	1	N	Number of Baggage Belt
Arrival Lobby	363.0	m^2	

2.8.5.3. VVIP building

VVIP building was constructed in 2012 by Non-project grants from the government of Japan to host the 9th Asia-Europe Meeting (ASEM 9). The building was designed and built by Lao construction companies, and constructed for a year. This single-story Lao traditional building is operated by L-JATS. There is a set of single view X-ray equipment and walk-through metal detector.

Figure 2.77 VVIP Terminal (left: from Airside, right: from landside)

2.8.5.4. Ground Support Equipment (GSE)

Ground support equipment (GSE) is owned and managed by L-JATS, Lao Airlines, and Lao Skyway. Ground support equipment is parked in an empty space near the terminal building. There is no covered workshop, so maintenance is carried out outdoors. The list of GSE is shown in Table 2.26, Table 2.27, and

Table 2.28.

Table 2.26 Ground Support Equipment owned by L-JATS

No	Name of GSE	Model	From	Arrival Date	Tire size front/rear	Capacity
1	Aircraft Tow Tractor	FMC	USA	20-Oct-99	12,00–20	below A321
2				10-Jan-02	385/65R22-5	below A321
3				24-Nov-05	16,00–25	B747
4	Container Pallet Loader	SHINKO	Japan	1-Jun-02	8.25–20	6,5 tons
5		FMC/com-der	USA	4-Dec-03		6,8 tons
6		FMC/com-der15i		1-Jul-08		7 tons
7	Main Deck Loader (MDL)	TLD	China	19-Jun-19	355/50–20	14 tons
8	Conveyor Belt	TLD	HKG	22-Jul-02	7.00–16	240 kg
9		Wollard	USA	26-Mar-03	7.00–16	240 kg
10		TLD	HKG	25-May-04	7.00–16	240 kg
11				25-Oct-12	7.00–16	240 kg
12	Cargo Tractor	TOYOTA	Japan	22-Sep-01	6.00–9/7.00–15	2500 kg
13				25-Oct-01	6.00–9/7.00–15	2500 kg
14				6-Feb-04	6.00–9/7.00–15	2500 kg
15				6-Feb-04	6.00–9/7.00–15	2500 kg
16				10-Apr-07	6.00–9/7.00–15	2500 kg
17		TLD	China	19-Jun-19	185–14/28*9–15	2500 kg
18				19-Jun-19	185–14/28*9–15	2500 kg
19	Passenger step vehicle	TLD/isuzu	HKG	22-Jul-02	7.00-16-10RIB	5.590 mm
20				25-May-04	7.00-16-10RIB	5.590 mm
21		TLD/4HF1-II		21-Aug-08	7.00-16-10RIB	5.620 mm
22		TLD		10-Sep-12	215/7.5–17.5	5900 mm
23				10-Sep-12	215/7.5–17.5	5900 mm
24	Ground Power Unit	Trilecton	USA	1-Dec-00	6.90–9	115–120 V,1200 KVA, 400 Hz
25		Wollard		3-Sep-04	4.80–8	28,5 VDC
26		Hobart		8-Sep-04	4.80–8	28,5 VDC
27		TLD	China	21-Oct-05	20.5–8	115–120 V, 140 KVA,400 Hz
28				19-Jun-19	20.5*8–10	115-120 V,180 KVA, 400 Hz
29	Air Condition Unit			22-Oct-03	7.50–10	50 tons
30				17-Feb-06	7.50–10	50 tons
31	Air Starting Unit	Trilecton	USA	1-Dec-00	7.50–10	
32		TLD	HKG	5-Jan-06	7.50–10	
33	Forklift	TMC	Japan	29-Jul-02	300–15/700-12	5 tons
34				18-Oct-05	300–15/700–12	5 tons
35	Toilet Services	MISUBISHI		2-Nov-00	8.25–16	3.500 liters
36		TLD	HKG	31-Jul-07	215–17.5	2.300 liters

37		TLD/LC100		23-Aug-12		129/257 L
38	Water services	NISSON	Japan	10-Feb-04	7.5–16	3.000 liters
39	Ramp Bus	TLD	TAIWAN	17-Dec-13	445/65R22.5	over 100 pax
40			China	26-Jun-20		over 100 pax
41	Minibus	TOYOTA	Japan	15-Jul-05	195–15	9 Seats
42				9-Sep-11	195–15	15 Seats
43				11-Oct-13	195–15	15 Seats
44	Tow Bar	Wasp	Germany		7.0–8	B 737
45		Aero specialties	USA	28-Oct-16		B 737
46		Wasp	Germany	2-Feb-05		B747
47		Aero specialties	USA	28-Oct-16		B747
48		TLD	HKG	23-Aug-12		
49		Aero specialties	USA	18-Dec-15		A318-A321
50				27-Oct-19		A318-A322
51	Baggage Cart	Local market	Lao	15-Jul-99	5.00–10	400 kg
52		-		3-Feb-03	5.00–10	400 kg
53		-		5-Feb-04	5.00–10	400 kg
54		-		19-Oct-05	5.00–10	400 kg
55				17-Jan-19		600 kg
56	Container Dolly	TLD	HKG	22-Jan-03		
57				9-Feb-06		
58	Pallet Dolly			9-Feb-06		
59				9-Oct-12		
60	Electric car	CARIO	Thailand	20-Oct-12		3 seats
61				20-Oct-12		5 seats
62	Ladder for AC techn	Local market	Lao			1,5 m; 2 m
63	Pax step manual					B737
64						B737
65						B737
66						MD11
67	Cart for chock, cone			3-Jan-19		
68	PBB	SHINMAYWA	Japan	1-Jun-99		
69		BUKAKA	Indonesia	25-Aug-18		
70	Pressure pump machine	PUMA	Thailand			
71	Washing pump machine		Thailand			

Table 2.27 Ground Support Equipment owned by Lao Airline

No	Name of GSE	No	Model	Arrival Date	Unit	Remark
1	Aircraft Tow Tractor	1	NISSAN	31-Dec-06	1	4 Units
2	Aircraft Tow Tractor	2	NISSAN	31-Dec-07	1	
3	Aircraft Tow Tractor	3	NISSAN	31-Jan-08	1	
4	Aircraft Tow Tractor	4	NISSAN	31-Dec-12	1	
5	Push Back GUANTAI	1	GUANTAI	31-Jul-13	1	3 Units

6	Push Back GUANTAI	2	GUANTAI	31-Oct-10	1	
7	Push Back Towing	3	TLD	31-Jul-12	1	
8	Conveyor Belt Truck	1	GUANGTAI	31-Dec-07	1	3 Units
9	Conveyor Belt Loader	2	TLD	31-Jan-19	1	
10	Conveyor Belt Loader	3	TLD	31-Jan-19	1	
11	Cargo Tractor	1	TLD	31-Jul-12	1	2 Units
12	Cargo Tractor	2	NISSAN	31-Dec-07	1	
13	ACU Machine	1		31-Dec-07	1	1 Units
14	GPU ISUZU WEIHUIR	1	ISUZU	31-Dec-04	1	1 Units
15	Catering Car	1	ISUZU	31-Dec-12	1	2 Units
16	Catering Car	2	ISUZU	31-Dec-12	1	
17	Toilet Services	1	HINO	31-Dec-04	1	2 Units
18	Toilet Services Truck	2	JMC	31-Dec-07	1	
19	Water services Truck	1	JMC	31-Dec-07	1	1 Units
20	Pickup	1	Toyota	31-Dec-04	1	2 Units
21	Pickup	2	Toyota	31-Dec-04	1	
22	Bus	1	JXT	15-Jul-05	1	2 Units
23	Bus	2	HINO	31-May-14	1	
24	Minibus	1		30-Jun-11	1	2 Units
25	Minibus	2	HYUNDAI	30-Jun-11	1	

Table 2.28 Ground Support Equipment owned by Lao Skyway

No	Name of GSE	No	Brand	From	Unit	Weight	Capacity	Remark
1	ACT/CGT	1	Toyota	Japan	1	4.500 T	25.000 T	VTE
2	ACT/CGT	2	Toyota	Japan	1	4.500 T	25.000 T	VTE
3	ACT/CGT	3	Toyota	Japan	1	4.500 T	25.000 T	VTE
4	GPU	1	Guinault	France	1	2.500 T	28DC/115AC	VTE
5	GPU	2	Guinault	France	1	1 T	28DC/115AC	VTE
6	GPU	3		Thailand	1		28DC	VTE
7	Baggage Cart	1		Laos	8		1.500 T	VTE
8	Baggage Cart	2		Laos	4		1.500 T	LPQ
9	Baggage Cart	3		Laos	4		1.500 T	PKZ
10	Baggage Cart	4		Laos	2		1.500 T	ODY
11	Baggage Cart	5		Laos	2		1.500 T	LXG

2.8.6. *Cargo Terminal Buildings*

There are three cargo terminals in Vientiane International Airport. One is dedicated to international cargo and is operated by Lao’s courier company (Hung Huang Logistics Co., Ltd: HHL). The other two terminals are operated by domestic airlines (Lao Airlines and Lao Skyway).

2.8.6.1. International Cargo Terminal Building

The International Cargo Terminal Building, which consists of Terminals 1 and 2, and functions as one terminal, is located to the west of the IPTB. The buildings are operated by HHL, who contracts the operation of Terminal 1 with L-JATS and the operation of Terminal 2 with AOL, respectively.

Terminal 1 was built in 1998 and expanded in 2015. The building includes the storage area and a two-story cargo agent office. The storage area has floor space of 1,650 m^2 and is divided by a metal fence into two areas for import and export cargos. The x-ray room is located in the center of the building, and the x-ray machine is used for scanning the export goods. The details of the x-ray equipment is shown in Table 2.29.The weighing scale for export goods can measure up to one ton. The import section has racks for storing goods. The imported cargo is handled within three days.

Table 2.29 X-Ray Equipment in International Cargo Terminal Building

Specification	Model/Name manufacture	Installation year	Condition
X-Ray for export goods	Smiths Detection 145180 TS	2011	Good

Terminal 2 was built in 2018 by HHL. The building has 1,600 m^2 total floor area and is used mainly for export cargo storage. There are cool room and dangerous goods storage in the building.

Figure 2.78 Cargo Terminal Building (left: Exterior, right: Interior)

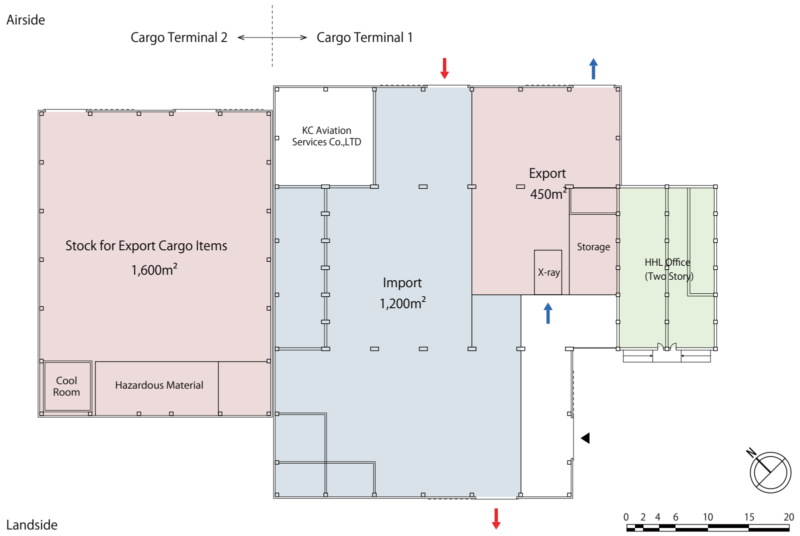


Figure 2.79 Current Layout of the International Cargo Terminal

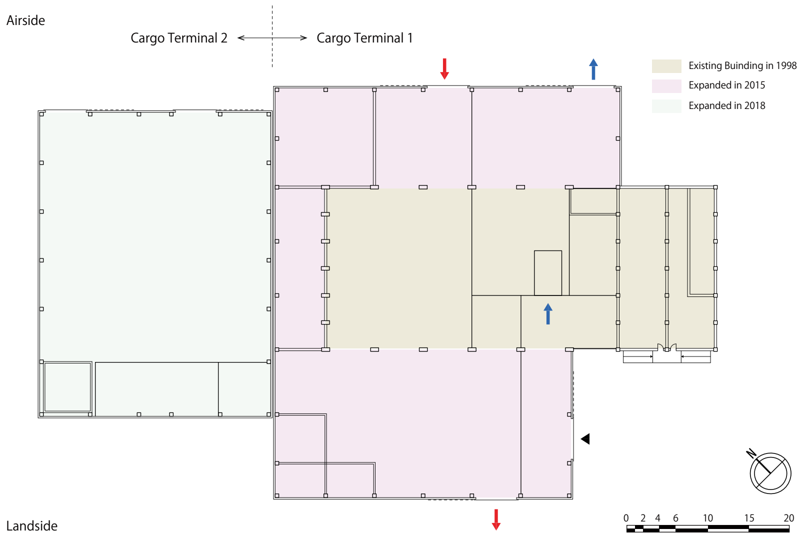


Figure 2.80 Development History of the International Cargo Terminal

2.8.6.2. Airline's Cargo Terminal Building

Lao Airlines and Lao Skyway operate their own cargo terminals.

(1) Lao Airlines Cargo Terminal

Lao Airlines handles international and domestic cargo. The cargo building was a former domestic passenger terminal, and the cargo area is on the first floor. The area is approximately 840 m^2 and there is one x-ray inspection machine. The building was built around 1970, and it is aging; however, no noticeable flaws have been seen.

Figure 2.81 Lao Airlines Cargo Terminal (left: from Airside, right : from Landside)

(2) Lao Skyway Cargo Terminal

The Lao Skyway cargo terminal handles only domestic cargo. The one-story building is 216 m^2 and has one x-ray inspection machine. Since the terminal is located on the landside without access to the airside, the cargo is transported from the cargo terminal to the domestic terminal building through the land side road. X-ray cargo inspections are conducted at the passenger terminal area again before loading to the aircraft.

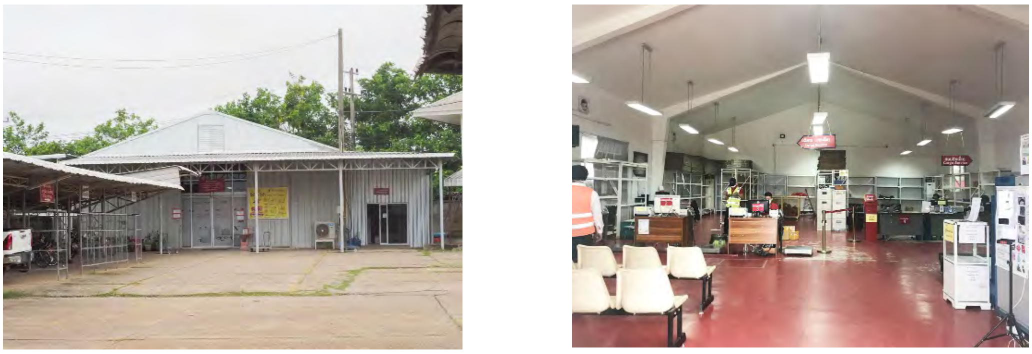


Figure 2.82 Lao Skyway Cargo Terminal (left : Exterior, right : Interior)

Table 2.30 X-Ray Equipment of Airline's Cargo Terminal

Specification	Model/Name manufacture	Installation year	Condition
X-Ray for export goods (Lao Airlines Cargo)	Smiths Heimann/HS 9075	2012	Good
X-Ray for export goods (Lao Skyway Cargo)	Astrophysics/XIS 100XD	2019	Good

2.8.7. *Hangar*

There are two hangars in Vientiane International Airport, one is for Lao Airlines and another is for Lao Skyway. Both hangars are located on the eastside of the Airport.

2.8.7.1. Lao Airlines Hangar

Lao Airlines hangar was built in 2011 by China. The hangar area is 4,536 m^2.

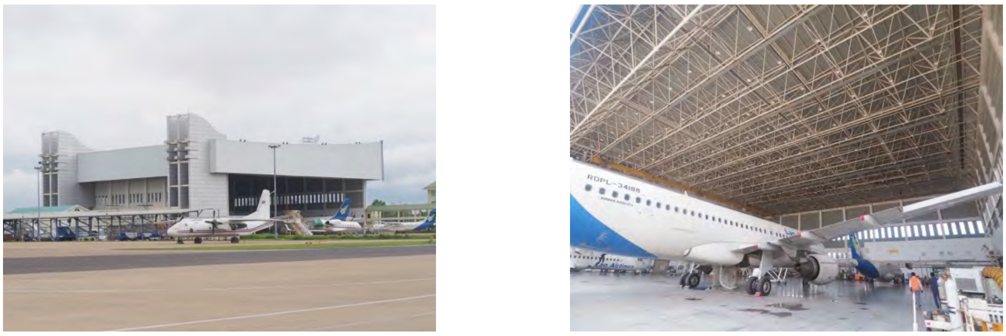


Figure 2.83 Lao Airlines Hangar (left: Exterior, right: Interior)

2.8.7.2. Lao Skyway Hangar

The Lao Skyway hangar was built in 1964 by the United States Army, and it was used by the U.S. military service beginning in 1965 as a logistics house. From 2002 to the present time, it has been used as a Lao Skyway Hangar. The hangar area is 2,189 m^2.

Figure 2.84 Lao Skyway Hangar

2.8.8. *Rescue and Fire Fighting Facilities*

2.8.8.1. Fire Station

The fire station was originally built in 1997 by the Japanese Grant Aid Project as a single-story building with five bays for fire fighting vehicles. In 2019, two-bays were extended by AOL for accommodating the three new fire-fighting vehicles procured by the Japanese Grant Aid Project in 2018.

2.8.8.2. Fire-Fighting Vehicles

There are seven fire-fighting vehicles at Fire Fighting Station in Vientiane International Airport. Three fire-fighting vehicles were provided in 2018 by the Japanese Grant Aid Project to meet ICAO RFF Category 9 standards. A list of the fire-fighting vehicles is shown in Table 2.31.

Figure 2.85 Fire-Fighting Station (left) and Fire-Fighting Vehicles (right)

Table 2.31 List of Fire-Fighting Vehicles

Equipment	Qt	Specification	Model Name/Manufacture	Installation Year	Condition
IVECO MAGIRUS DRAGONx6	1	Water: 13,000 L Foam: 1,800 L Monitor Throw: 90 m Main Monitor Discharge Rate: 6,000 L/min Dry Powder: 250 kg Dry Powder Discharge rate: 1.5 kg/s	IVECO/Italy	2013	Unavailable Requires heavy maintenance
IVECO MAGIRUS DRAGONx6	1	Water: 13,000 L Foam: 1,800 L Monitor Throw: 90 m Main Monitor Discharge Rate: 6,000 L/min Dry Powder: 250 kg Dry Powder Discharge rate: 1.5 kg/s	IVECO/Italy	2013	
IVECO MAGIRUS DRAGONx6	1	Water: 13,000 L Foam: 1,800 L Monitor Throw: 90 m Main Monitor Discharge Rate: 6,000 L/min Dry Powder: 250 kg Dry Powder Discharge rate: 1.5 kg/s	IVECO/Italy	2013	Available Requires slight maintenance

MJ-12	1	Water: 12,000 L Foam: 1,200 L Monitor Throw: 75 m Main Monitor Discharge Rate: 4,545 L/min	MITSUBISHI (MORITA) /JAPAN	1997	Unavailable Requires replace a tire and slight maintenance
KANGLIM TATA DAEWOO 6 × 6	1	Water: 8,000 L Foam: 160 L Monitor Throw: 50 m Main Monitor Discharge Rate: 1,100 L/min	KANGLIM	2011	Available Requires slight maintenance
IVECO MAGIRUS 4 × 4	1		IVECO/Italy	2013	Available Requires slight maintenance
Fire Command Vehicle	1		Revo/Japan	2012	Available Requires slight maintenance

In addition to the fire-fighting vehicles, there is one ambulance at the Fire Fghting Station (see Table 2.32).

Table 2.32 List of Ambulance

Equipment	Qty	Specification	Model Name/Manufacture	Installation Year	Condition
Hyundai Minivan	1		Hyundai	2016	70%

2.8.9. *Control Tower*

The existing control tower and operations building were constructed in 1998. The operation building is a two-story building, and the control tower is a 7-story building. The height of the roof of the control tower is 33.2 m. The controller's eye position is 31.2 m from the ground. There is no obstruction from the control cabin to the runways, taxiways, and aprons.

Figure 2.86 Control Tower and Operation Building (left: Airside, right: Landside)

2.8.10. *Fuel Supply Facility*

The fuel supply facility is located on the southwest side of the road opposite the control tower and administration area. The fuel is transported by a tanker from this area to the apron. There are three tanks, two of the tanks have a capacity of 600,00 liters and one tank has a capacity of 750,000 liters. Total capacity of the fuel tank is 1,950,000 liters. The fuel facility was constructed in 1997. Daily consumption of fuel before the COVID-19 pandemic was 100,000 to 150,000 liters. After the COVID-19 pandemic, it decreased to 10,000 to 20,00 liters. The fuel is transported from Thailand by a special tanker. The fuel facility is operated by Lao State Fuel Company (LSFC), a 100% state-owned company that was established in 1976.

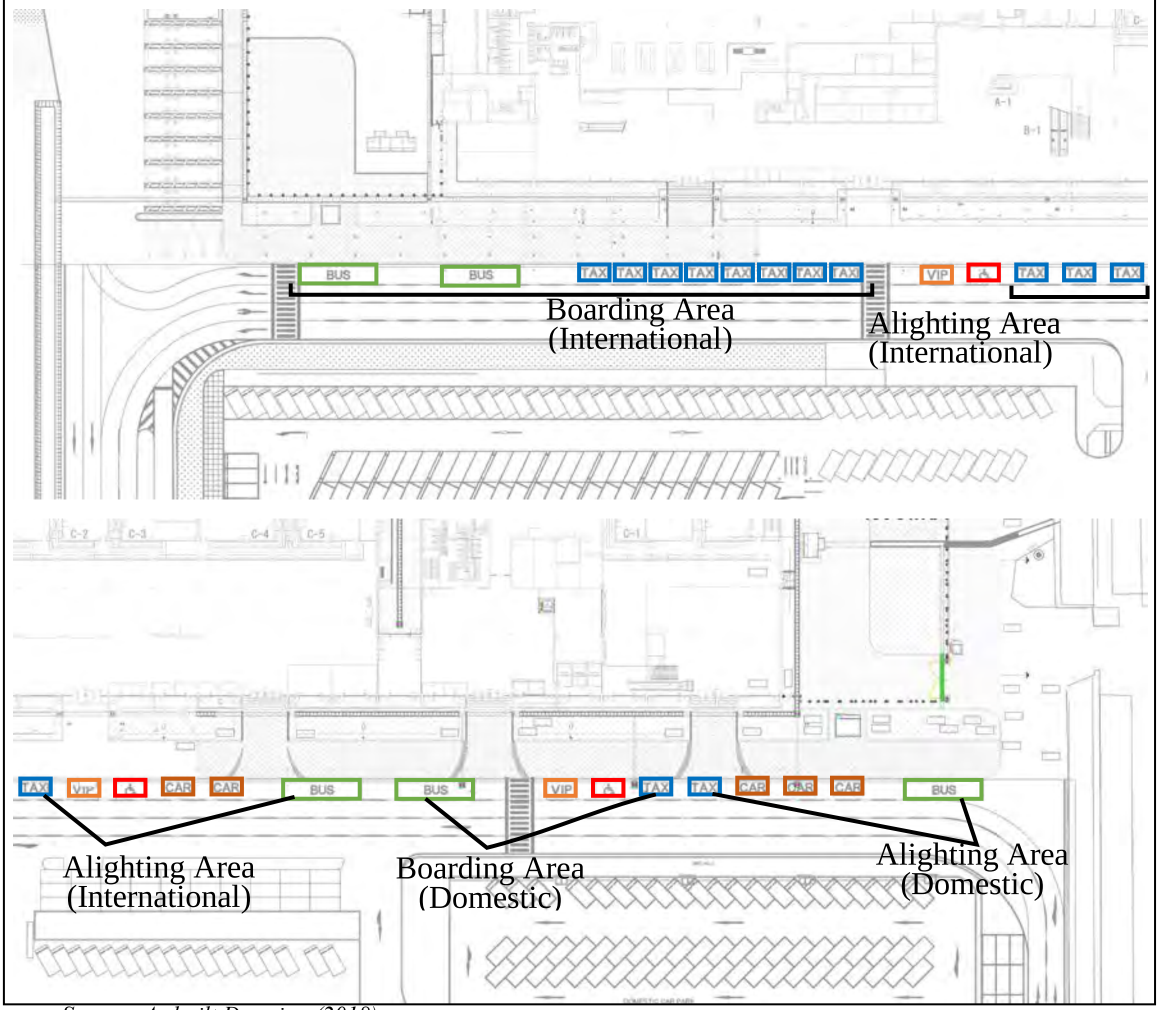
Figure 2.87 Fuel Farm

2.8.11. *Airport Access and Car Park*

2.8.11.1. Existing Curbside

The existing curbside of Vientiane International Airport is shown in Figure 2.88.

		International		Domestic		Size
		takeing point	getting off point	takeing point	getting off point	
BUS		2	1	1	1	13m × 3.3m
TAXI		8	4	1	1	5m × 2.5m
Handicapped		1		1		5m × 3.3m
VIP		1		1		5m × 3.3m
Private Car		2		3		5m × 2.5m



Source: As built Drawing (2018)

Figure 2.88 Existing Curbside

According to the as built drawing (2018), getting on and off locations for all modes of transportation are located in front of both the international and domestic terminal buildings.

2.8.11.2. Actual Condition of Operation

The real use of the curbside is different from what shows in the as built drawings. We found that there were only dedicated spaces for the handicapped and for VIPs, and there were no spaces for buses, taxies, and private cars. Therefore, the length of the curbside area that can be used by buses, taxis, and private cars is about 264 m, as shown in Figure 2.89.

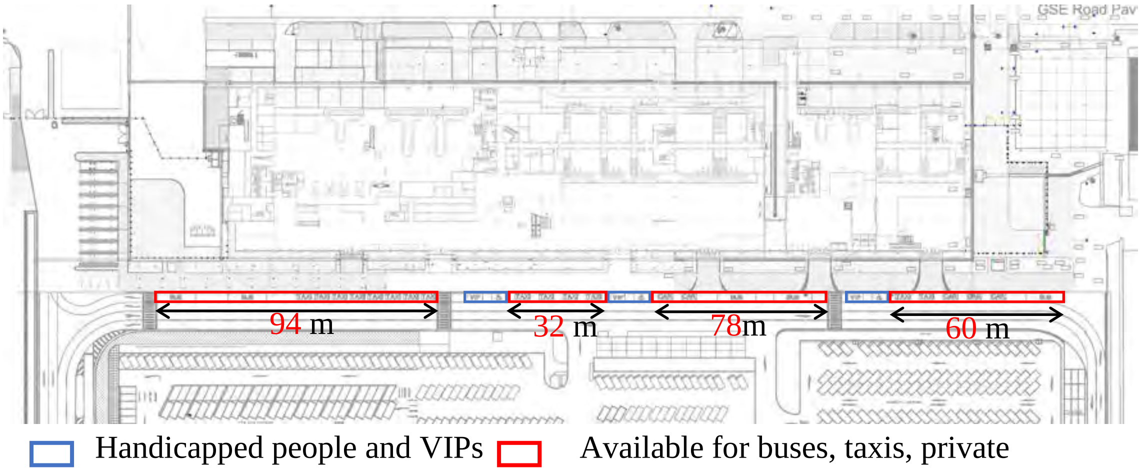


Figure 2.89 Actual Curbside Operation

2.8.11.3. Car Parking

Car parking is located in front of the terminal buildings. In 2018, parking was expanded through a Japanese soft-loan project in which the project—new parking and extension of the existing parking—were constructed. The capacity of each parking area is officially shown in Table 2.33. In the existing parking for international passengers, there is a solar power system that was installed by the Japanese Grant Aid Project in 2014.

Table 2.33 Parking Capacity

Name of Parking	Number of Parking	Year of construction	Year of extension
Existing Parking for International Passenger	214	N/A	2018
Existing Parking for Domestic Passenger	132	N/A	2018
Expanded Parking	535 with 6 parking spots for Bus and 120 parking spots for Motorbike	2018	-

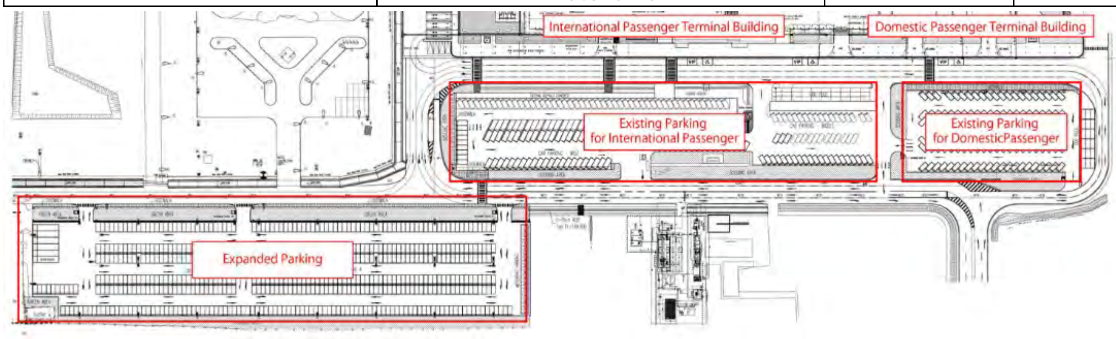


Figure 2.90 Current Car Parking Layout

Figure 2.91 International car parking

Figure 2.92 Solar System (left) and Domestic Car Parking (right)

2.8.11.4. Access Road

There are two-lane road from National Road 13 to the terminal area as an access road to the airport. Because this is the only entrance and exit to the airport, this road is very congested during noon time from 11:00 to 13:00.

2.8.12. *Airfield Lighting System*

2.8.12.1. Airfield Lighting Equipment

Airfield lighting equipment in the airports consists of both Finnish and Chinese equipment. Because of the mixture of manufactures, maintenance is challenging. Therefore, maintenance technician training is important.

Runway Lights and Taxiway Lights were installed in 1997 (lights for new high-speed taxiway and new apron areas were installed in 2013 - 2018). However, the lighting fixtures are kept in good condition with minor repairments, and spare parts are available in the market.

High voltage power cables around the runway between each runway light was replaced by Lao's Government fund in 2013, partial cable disconnections have not occurred after the replacement. The list of airfield lighting equipment is shown in Table 2.34.

Table 2.34 List of Airfield Lighting System

No.	Items	Type/Code	Number of lights under operation	Spare parts
1	Taxiway Halogen Lamp 45 Watts	OSRAM 64320 45 W GZ9.5 NAED 58846	175	50
2	Runway Halogen Lamp 105 Watts	OSRAM 64339 B 105 W 6.6 A NAED58961	30	20
3	Runway Halogen Lamp 150 Watts	OSRAM HLX64361 Z 150 W 6.6 A PK30d	92	30
4	Runway Halogen Lamp 200 Watts	OSRAM HLX64382 200 W 6.6 A PK30d	225	30
5	Approach Hight Intensity Halogen 200 Watts	PAR46 200 W 6.6 A	166	100
6	Isolating Transformers 45 Watts	ENSTO 45 W	450	85
7	Isolating Transformers 150 Watts	ENSTO 150 W	100	70
8	Isolating Transformers 200 Watts	ENSTO 200 W	250	50
9	Isolating Transformers 250 Watts	ENSTO 250 W	5	3
10	Isolating Transformers 300 Watts	ENSTO 300 W	5	3
11	Primary Connector Kit for KD500 Filled with grease for screened (shield cable)	EFLA KD500 Conductor Size 6 mm2	700	70
12	Electrical Breakable Coupling (Secondary Connector Plug)	36-3KDC 501	850	150

2.8.12.2. Generators

As shown in Table 2.35, some of the generators in the powerhouse are old and were installed more than 20 years ago. Major rehabilitation is needed.

Table 2.35 List of Generators

System	Qty	Location	Specification	Model Name/Manufacture	Installation year	Condition
Generator Set 3 Ph. 350 kVA 380 V inc;	1	DPTB	Oil tank 1 m3 Chimney D200 Oil piping Installation, T& C, and training Distribution panel DB-GEN (380 V) inc; Metal enclosure MCCB 630 A -50 kA MCCB 400 A – 36 kA MCCB 200 A – 36 kA	Model: KH02100T04N	2018	good

YANMAR Generator	3	Powerhouse	Type: Vertical, Water-cooled, four-cycle diesel engine Continuous rate output: 1500 ps/1800 rpm Combustion system: Direct injection Starting system: Starting motor or Air starter Power takeoff position: Flywheel	6NHL/YANMAR Diesel Engine	1997	Heavy maintenance is necessary
Generator	2	Control Tower				

2.8.12.3. Constant Current Regulator (CCR) System

The electricity supply from CCR to airfield lighting equipment occasionally experienced failures, especially during rainfall. This was caused by frequent electric leaks due to aging and deterioration of electric power transmission cables. This is because cables are buried directly into the ground without proper casing. This condition makes it difficult to find the location of the errors and the reconnection of the cables.

Some of CCRs were installed more than 20 years ago, and it is difficult to obtain spare parts. Table 2.36 shows details of CCRs.

Table 2.36 List of Constant Current Regulator Systems

System	Location	Equipment	Specification	Model Name/Manufacture	Installation year	Condition
CCR-01	Powerhouse	RUNWAY A	Product code: CCR 15 KVA Input: 380 VAC 51.7 A 50 Hz Output: 15k VA 6.6 A 2272 V Remote control telecom: 24 VDC Options: LFD + EFD	ATTECH/ Vietnam	2016	good
CCR-02	Powerhouse	RUNWAY B	Product code: CCR 15 KVA Input: 380 VAC 51.7 A 50 Hz Output: 15 kVA 6.6 A 2272 V Remote control telecom: 24 VDC Options: LFD + EFD	ATTECH/ Vietnam	2012	good
CCR-03	Powerhouse	THRESHOLD 13	Product code: CCR 4 KVA Input: 380 VAC 13.8 A 50 Hz Output: 4 kVA 6.6 A 606 V Remote control telecom: 24 VDC Options: LFD + EFD	ATTECH/ Vietnam	2012	good
CCR-04	Powerhouses	THRESHOLD 13	Product code: CCR 4 KVA Input: 380 VAC 13.8 A 50 Hz Output: 4 kVA 6.6 A 606 V Remote control telecom: 24 VDC Options: LFD + EFD	ATTECH/ Vietnam	2012	good

CCR-05	Powerhouse	THRESHOLD 31	IDM 7000 Input: 230 VAC 20 A 50 Hz Output: 4.0 kW/kVA 6.6 A 606 V Control: 24/48/60 V-DC FAA class. L-829/1/2 Type: IDM 7000-P5-FE/4.0	IDMAN/ Finland	2013	good
CCR-06	Powerhouse	THRESHOLD 31	IDM 7000 Input: 230 VAC 20 A 50 Hz Output: 4.0 kW/kVA 6.6 A 606 V Control: 24/48/60 V-DC FAA class. L-829/1/2 Type: IDM 7000-P5-FE/4.0	IDMAN/ Finland	1997	good
CCR-07	Powerhouse	APPROACH HIGHT	Type: CCR-95E Input: 2P 380 V 50 Hz Output Current: 6.6 A Weight: 3229 kg Rating: 30KVA	CCR-95E/ China	2013	good
CCR-08	Powerhouse	APPROACH HIGHT	Type: CCR-95E Input: 2P 380 V 50 Hz Output Current: 6.6 A Weight: 3229 kg Rating: 30 KVA	CCR-95E/ China	2013	good
CCR-09	Powerhouse	Spare	IDM 7000 Input: 230 V 25 A 50 Hz Output: 4.0 kW/kVA 6.6 A 757 V Control: 24/48/60 V-DC FAA class. L-829/1/2 Type: IDM 7000-P5-FE/4.0	IDMAN/ Finland	1997	good
CCR-10	Powerhouse	APPROACH LOW 31	IDM 7000 Input: 230 VAC 20 A 50 Hz Output: 4.0 kW/kVA 6.6 A 606 V Control: 24/48/60 V-DC FAA class. L-829/1/2 Type: IDM 7000-P5-FE/4.0	IDMAN/ Finland	1997	good
CCR-11	Powerhouse	PAPI 13	Product code: CCR 4 KVA Input: 380 VAC 13.8 A 50 Hz Output: 4 kVA 6.6 A 606 V Remote control telecom: 24 VDC Options: LFD + EFD	ATTECH/ Vietnam	2012	good
CCR-12	Powerhouse	PAPI 13	Product code: CCR 4 KVA Input: 380 VAC 13.8 A 50 Hz Output: 4 kVA 6.6 A 606 V Remote control telecom: 24 VDC Options: LFD + EFD	ATTECH/ Vietnam	2012	good
CCR-13	Powerhouse	PAPI 31	IDM 7000 Input: 230 VAC 20 A 50 Hz Output: 4.0 kW/kVA 6.6 A 606 V Control: 24/48/60 V-DC FAA class. L-829/1/2 Type: IDM 7000-P5-FE/4.0	IDMAN/ Finland	1997	good

CCR-14	Powerhouse	PAPI 31	IDM 7000 Input: 230 VAC 20 A 50 Hz Output: 4.0 kW/kVA 6.6 A 606 V Control: 24/48/60 V-DC FAA class. L-829/1/2 Type: IDM 7000-P5-FE/4.0	IDMAN/ Finland	1997	good
CCR-15	Powerhouse	TAXIWAY	IEC 61822 ICAO Aerodrome Design Manual, Part 5, electrical system Type: IDM 8000-ES-PB/400 STEPS 7: IEC Style 3/FAA type L-829 Input: 400 V 45 A 50 Hz Output: 15 kW/kVA 6.6 A 2273 V Control: 24/48/60 V-DC	IDM 8000	2018	good
CCR-16	Powerhouse	TAXIWAY	IEC 61822 ICAO Aerodrome Design Manual, Part 5, electrical system Type: IDM 8000-ES-PB/400 STEPS 7: IEC Style 3/FAA type L-829 Input: 400 V 45 A 50 Hz Output: 15 kW/kVA 6.6 A 2273 V Control: 24/48/60 V-DC	IDM 8000	2013	good

2.8.13. *Air-Navigation and Communication System, and Meteorological System*

2.8.13.1. Air Navigations Equipment

Most of the air navigation equipment is less than 10 years old and is functioning properly. The main unit of VOR equipment shelters and cables were installed more than 20 years ago and are still used today. PSR, which was installed 20 years ago, was decommissioned due to aging, and the MSSR that was installed in 2018 is functioning properly. The layout of air navigation equipment is shown in Figure 2.93 and Table 2.37 shows list of air navigation equipment.

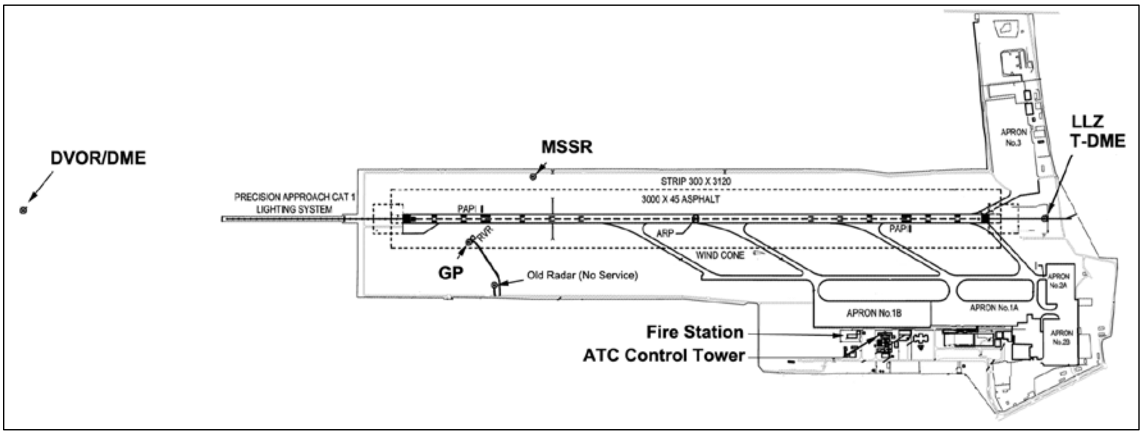


Figure 2.93 Layout of Air Navigation Equipment

Table 2.37 List of Air Navigation Equipment

Equipment	Specification	Type/ Manufacture	Installation year	Condition of Equipment/Spare parts/etc.
VOR	VTN (117.50 MHz	DVOR (THALES) 100 W	2011	Operational (DVOR Electronics part was replaced with the new one in 2011 but Antennas, shelter, cables used existing ones since 1994), a limited number of spare parts and unsustainable of Antenna/cables.
DME	CH122X	DME 1 KW type (THALES)	2011	Operational (DVOR Electronics and Antenna/cables part was replaced with the new one in 2011) limited number of spare parts
NDB	VE 205 KHz	Telerad	1985	**Withdrawal**
ILS	109.90 MHz 333.89 MHz	NEC	2014	Operational (good condition), measuring equipment like Oscilloscope was broken and uncalibrated PIR,
T-DME	36X	NEC	2014	Operational (good condition)
RADAR	PSR	THALES	2000	**Stop operation**
SSR	MSSR	THALES	2018	Operational, limited number of spare parts

2.8.13.2. ATC VHF Radio Communications

All VHF radio equipment for ATC is operating properly. However, the available spare parts are very limited as shown in Table 2.38.

Table 2.38 List of Radio Communication Equipment

Equipment	Specification	Type/ Manufacture	Installation year	Condition of Equipment/Spare parts/etc.
APP (main)	119.70 MHz	NEC (R&S)	2015	Operation (filter not good) (no spare parts)
TWR (main)	118.10 MHz	NEC (R&S)	2015	Operation (filter not good) (no spare parts)
ATIS (main)	127.80 Mhz	Telerad	2014	Operation (good condition) (no spare part)
VHF emergency	121,5 MHz	NEC (R&S)	2015	Operation (good condition) (no spare part)
ACC VTE	124,1 MHz	NEC (R&S)	2015	Operation (good condition) (no spare part)
ACC VTE	128,3 MHz	NEC (R&S)	2015	Operation (good condition) (no spare part)

2.8.13.3. Aeronautical Information Management (AIM) Equipment

The equipment for AIM is new and operating properly. However, there are no spare parts. Details of AIM equipment is shown in Table 2.39.

Table 2.39 List of AIM Equipment

Equipment	Specification	Type/ Manufacture	Installation year	Condition of Equipment/Spare parts/etc.
AFTN/AMHS	AERMAC	Thales	2014	Operation (good condition) (no spare part)
AIM	AIXM 5.1	Thales	2018	Operation (good condition) (no spare part)

2.8.13.4. Network System/Equipment

Aeronautical Network Systems within domestic airports in Laos is as follows:

1. Between Vientiane airport to VLXK airport used a VSAT and Leased Line
2. Between Vientiane airport to VLSK airport used a VSAT and Leased Line
3. Between Vientiane airport to VLPS airport used a VSAT and Leased Line
4. Between Vientiane airport to VLLB and other domestic airports used the Leased Line.

Each communication line keeps a dual-route such as VSAT and Leased Line as a backup.

Communication lines between Vientiane to each RCAG (Remote Control Air to Ground) are connected with direct cable or Leased Line and VSAT. Air Traffic Control (ATC) has voice communication lines for Remote Control Air to Ground (RCAG) between Vientiane to Savannakhet, Paksong, Attaque, Oudomsay, Luang Nam Tha, Luangphabang, Xiengkhouang, and Samnue.

2.8.13.5. Meteorological Equipment

The meteorological equipment is operating properly. However, the spare parts are in short supply. The list of meteorological equipment is shown in Table 2.40.

Table 2.40 List of Meteorological Equipment

Equipment	Specification	Type/ Manufacturer	Installation year	Condition of Equipment/Spare parts/etc.
AWOS	Xaria 300	Degreane	2014	Operation (good condition) (no spare part)
RVR	DF320	Degreane	2014	Not good condition, (no spare part)
Ceilometer	TL320	Degreane	2014	Operation (good condition) (no spare part)

2.8.14. *Airport Utility Systems*

2.8.14.1. Water Supply System

The water used at the airport is supplied by the city water. The water supply facility at Vientiane International Airport was upgraded in 2018.

The original water supply facility was distributed to each facility from an elevated water tower. The new water supply facility built in 2018 uses a water tank (200 m^3) and pumps to supply water to the international and domestic passenger terminal buildings.

The water tower is still in use today, supplying water to both passenger terminal buildings as well as to the VVIP and cargo terminals. Outline of the water supply system is shown in Figure 2.94 and layout of water supply system is shown in Figure 2.95 and Figure 2.96.

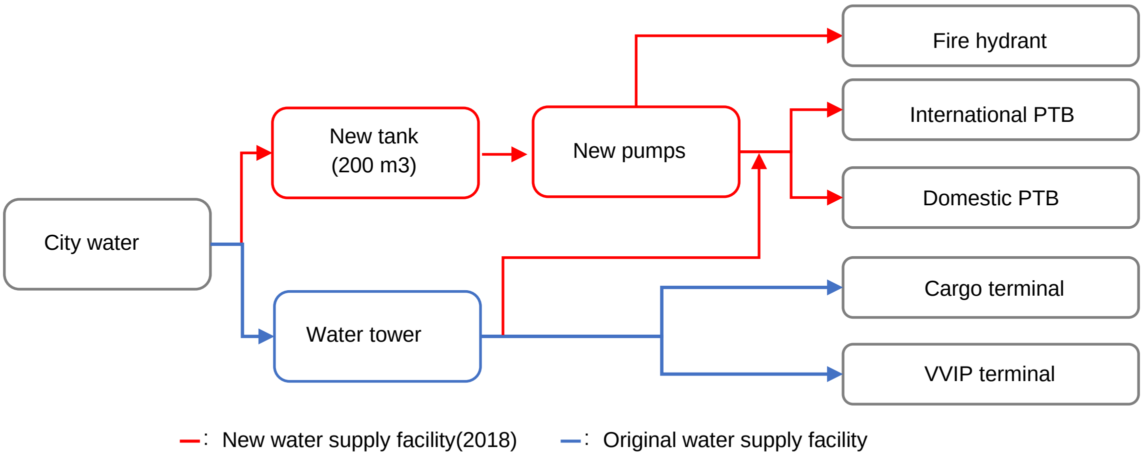


Figure 2.94 Outline of Water Supply System

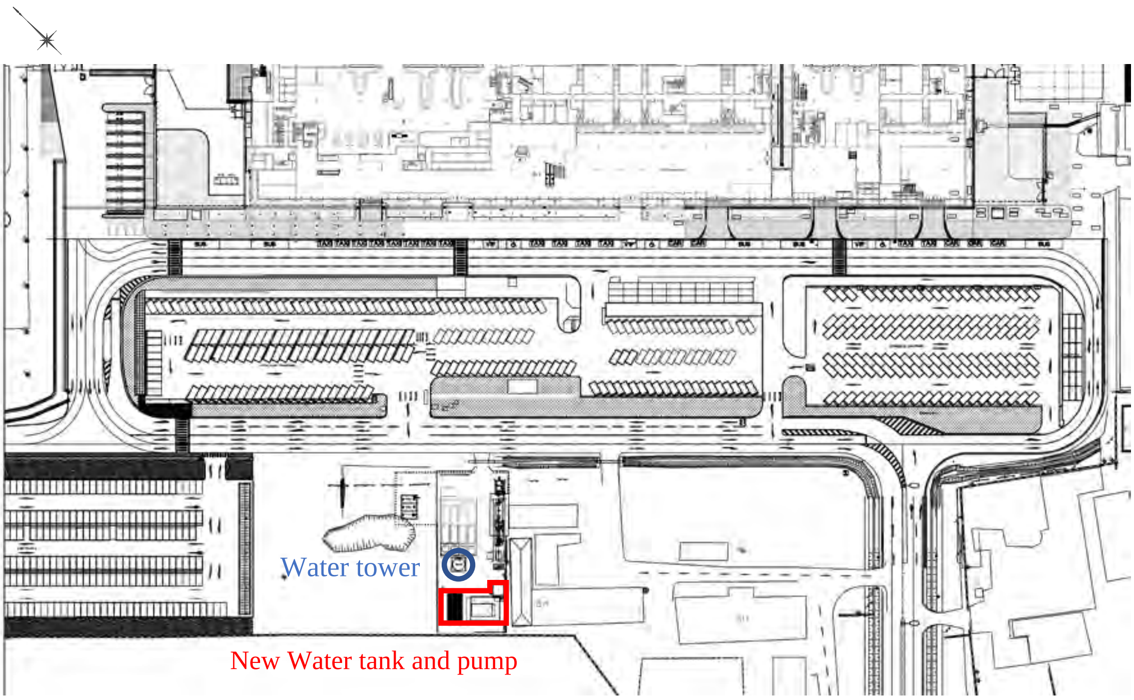


Figure 2.95 Location of the Water Supply Pump House

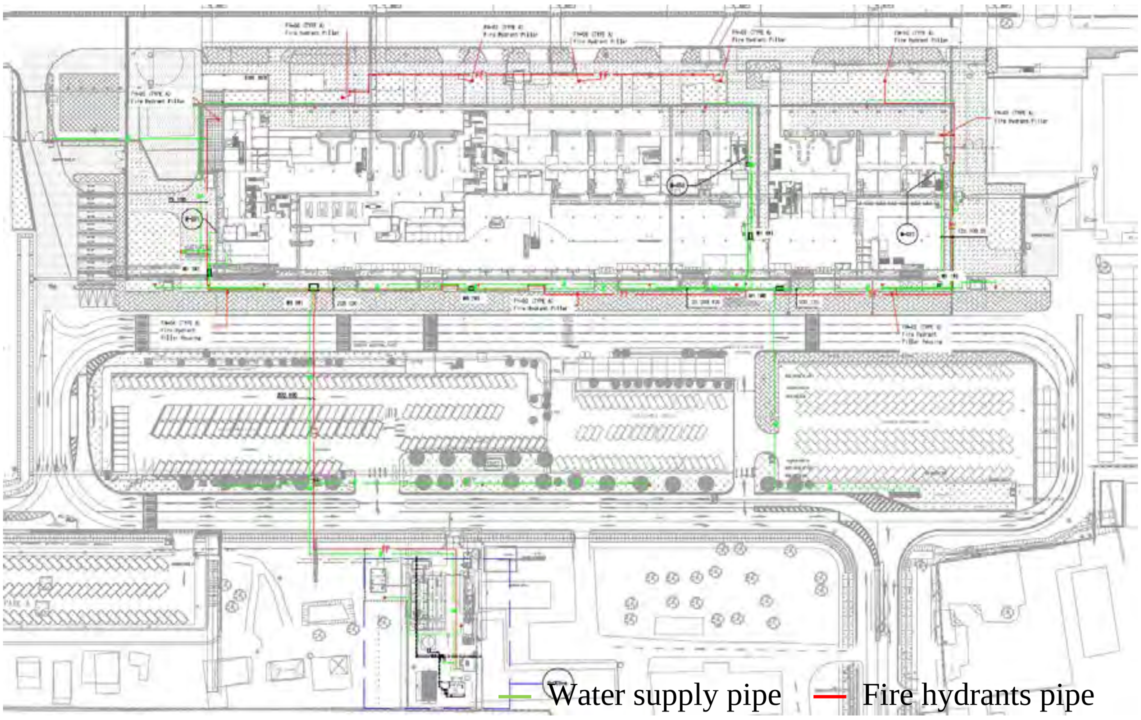


Figure 2.96 Location of the Water Supply Pipe and Fire Hydrants Pipe

2.8.14.2. Sewage Water Treatment System

At Vientiane International Airport, the sewage water flows into waste water tanks.

The waste water treatment tank for the drainage from the international passenger terminal building is 200 m^3. The waste water tank for the domestic passenger terminal building is 50 m^3. The location of sewage water system is shown in Figure 2.97.

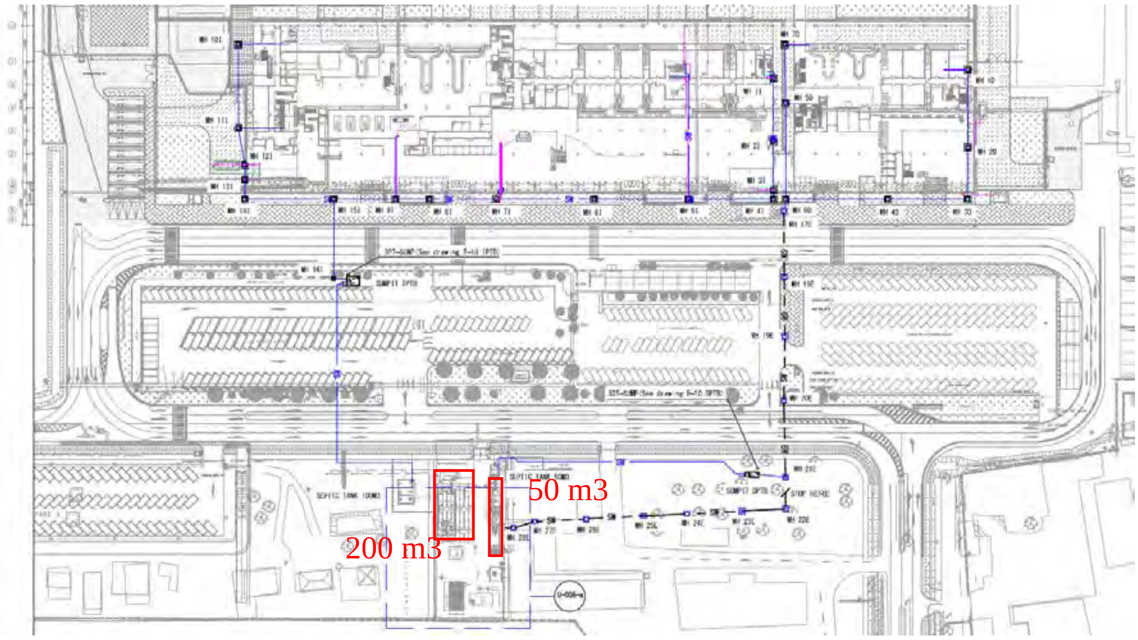


Figure 2.97 Location of Sewage Water System

2.8.15. *Drainage System*

The drainage system is shown in Figure 2.98. Rain water in the airport is discharged to the northeast side of the airport by open channels and culverts.

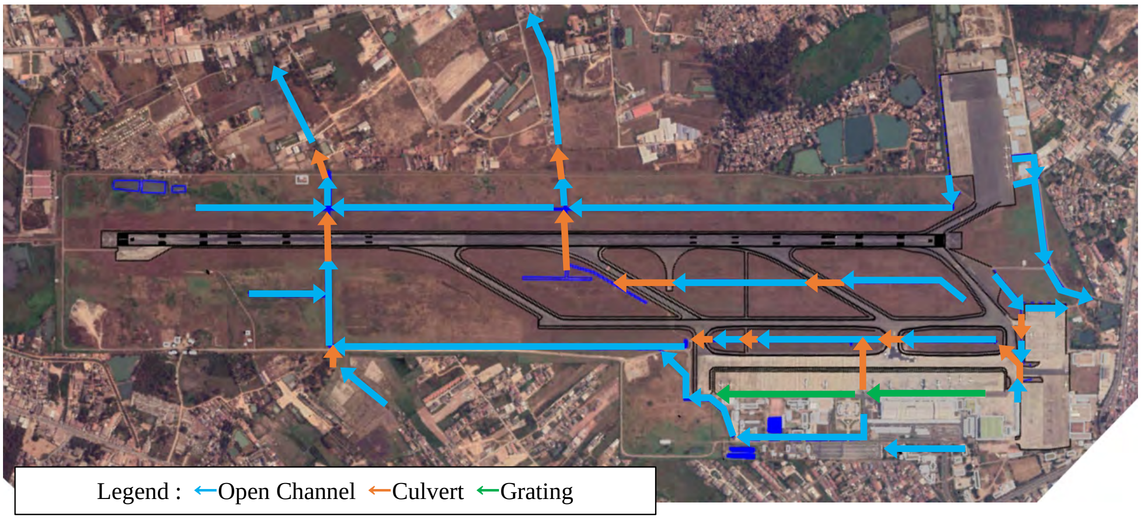


Figure 2.98 Drainage System Layout

2.9. ***Past Studies on Development of Vientiane International Airport***

2.9.1. *Airport History*

The runway, taxiway, and apron were originally constructed by the French. During World War II, the airport was used by the Japanese military, and after that the United States constructed the airport from 1958 to 1963. There were two runways in the airport, one was 04/22 and another was 13/31. The airport was officially opened in 1962. The original passenger terminal building was constructed by French in 1962. Runway 13/31 was extended from 2,000 m to 3,000 m from 1969 to 1971 by a Japanese Grant Aid Project. Rapid exit taxiways (Taxiway A and Taxiway T) were constructed at the same time as the apron expansion in 1972. The existing control tower and operation building, fire station, and powerhouse were constructed in 1998. The international passenger terminal building, the car park, and the maintenance workshop were constructed in 1999 by the Japanese Grant Aid Project. The apron was expanded in 2013 by the Japanese Grant Aid Project and the international passenger terminal was expanded, the new domestic passenger terminal building was constructed, and the rapid exit Taxiway D was constructed in 2018 by the Japanese Soft Loan Project.

2.9.2. *Past Studies and Projects*

There were several projects and studies on the development of the Vientiane International Airport since its opening. Table 2.41 summarizes the past studies and projects.

Table 2.41 List of Past Studies and Projects

Project Name	Implementation Year	Donner	Budget	Contents
Vientiane Airport Construction Project	1958–1962	USA	N/A	Construction of original 2,000 m × 45 m runway Construction of taxiway C, D and B Construction of apron 1
Vientiane Airport Passenger Terminal Construction Project	1965	France	N/A	Construction of the passenger terminal buildings
Vientiane (Wattay) Airport Runway Extension Project	1969–1971	JICA Grant Aid	430 million JPY	Extension of the runway n from 2,000 m to 3,000 m
Vientiane (Wattay) Airport Runway Extension Project	1971–1972	JICA Grant Aid	360 million JPY	Expansion of the Apron 1 Construction of new taxiway A and T
Civil Aviation Master Plan	1990	ICAO		Prepare Master Plan for 1991–2000
Installation of D-VOR/DME	1993–1995	France	7.36 million USD	Installation of D-VOR/DME Installation of NDB Installation of a new Enroute VHF
Vientiane Airport Improvement Project	1993–2001	ADB	14.35 million	Improvement of runway, taxiways and apron pavements

			USD	Installation of Approach Lighting System Renovation of international passenger building to domestic passenger building
Airfield Lighting System and Meteorological System Improvement	1997–2000	Nordic Fund	6.35 million USD	Improvement of Airfield Lighting System Installation of meteorological system
Major Airport Improvement Project	1997–2001	OPEC	N/A	Improvement of Apron pavements
The Project for Rehabilitation of Vientiane International Airport	1995–1998	JICA Grant Aid	4464 million JPY	Construction of a new international passenger terminal building Construction of a new control tower and operation building Construction of maintenance work shop Construction of storm water drainage Construction of a new fire station Installation of fire fighting vehicles Installation of Instrument Landing System
Northern Airport Improvement Project	2003	ADB		Updating CAMP Feasibility study for 6 small airports
Vientiane International Airport Pavement Improvement project	2005–2006	Thailand	9.8 million USD	Overlay of pavements of runway, taxiways and apron Construction of a new runway shoulders Construction of a new taxiway shoulders Installation of Approach Lighting System Installation of Airfield Lighting System
Vientiane International Airport Improvement Project	2011–2012	China	25 million USD	Construction of new turning pad Construction of overrun Installation of airfield lighting system Expansion of apron 2 and 3 Improvement of airport perimeter road
Construction of VVIP Terminal Building	2011–2012	Japan Embassy Grant Aid		Construction of a new VVIP building
Wattay International Airport Expansion Project	2011–2013	JICA Grant Aid	1985 million JPY	Expansion of Apron 1 Installation of security equipment Installation of fire fighting vehicles
The Modernization of Equipment for Transition to new CNS/ATM Systems	2013–2015	JICA TC	532 million JPY	Installation of AIS Automation system Installation of Remote Center Air to Ground for Enroute Installation of VHF Air to Ground Installation of ILS Installation of flight procedure design system
Vientiane International Airport Terminal Expansion Project	2013–2019	JICA ODA Loan	9017 million JPY	Expansion of the international passenger terminal building Construction of a new domestic passenger terminal building Construction of taxiway T Installation of taxiway light at taxiway T

2.9.3. *Pavement History*

The airport pavement has been expanded and rehabilitated by various projects in the past. The major pavement rehabilitation and expansion works are summarized in Figure 2.99. The original pavement was concrete pavements constructed by the United States in 1962. There were only two taxiways connecting between the runway and the apron, Taxiway D and Taxiway B. There were partial parallel Taxiway C and Taxiway F and Taxiway G to connect the parallel taxiway and the apron. There was only Apron No. 1A at that time.

A major expansion was conducted from 1969 to 1971 to extend the runway to 3,000 m and to construct of the rapid exit taxiways, Taxiway A and Taxiway T. Apron 1A was expanded to the northwest side. Concrete pavement was used to construct these pavements.

The next major rehabilitation was in 1995 by the ADB project. Most of the pavement area was rehabilitated by either overlay or reconstruction. The rehabilitation work on the runway and the taxiway was by asphalt pavement and that on the apron was by concrete pavement. Taxiways A, D, and T were not overlaid by that time.

In 2006, the pavements were rehabilitated by Thailand. Runway, Taxiway A, T, D, C, F, and G were overlaid with asphalt, and Apron 1A was overlaid with concrete pavement. Apron No. 3 was also overlaid with asphalt pavement. Taxiway D was not included in the scope.

Apron expansion to the northwest side of Apron 1A and rehabilitation of Apron 1A were conducted by JICA in 2013. Apron 1B was constructed with concrete pavement.

A new rapid exit taxiway was constructed in 2018 by the JICA soft loan project. The pavement was constructed using asphalt pavement.

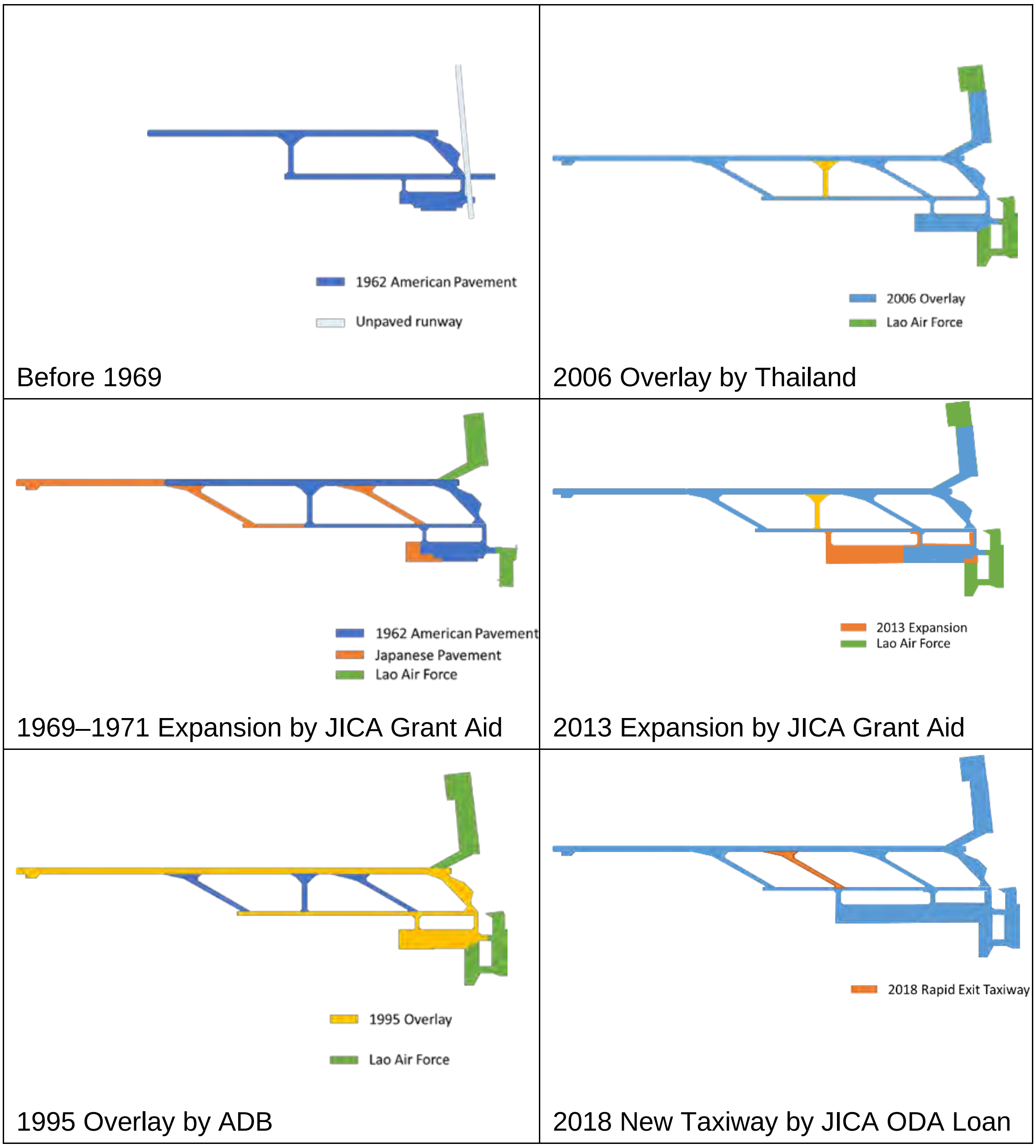


Figure 2.99 Pavement Rehabilitation and Expansion History

2.10. *Environmental Laws*

There are several laws and regulations related to environmental and social considerations in Laos.

2.10.1. *Legal Basis for EIA*

[**Law on Environmental Protection, No. 29/NA (2012)**]

This law provides a legal basis for environmental impact assessments (EIAs) and was promulgated on January 17, 2013. This law defines principles, regulations, and measures related to environmental management and monitoring to mitigate the impacts of development projects. This law aims to sustain and protect natural resources and public health by observing related regulations and standards such as Pollution Control Standard and the National Environmental Quality Standard.

2.10.2. *Law on Environmental Impact Assessment System*

[Government Regulation on EIA, No. 21/GOL (revised January 31, 2019)]

This decree is the principal environmental legislation regarding EIA. The Ministry of Natural Resources and Environment (MONRE) is the central authority to coordinate with the local agencies and administration to disseminate and enforce this decree. The decree was enacted to implement Article 22 of the Law on Environmental Protection in relation to environmental impact assessment. This decree provides rules, regulations, and measures on management and monitoring implementation of environmental impact assessment activities.

2.10.3. *Prime Minister's Decree on Environmental Impact Assessment*

[Decree on Environmental Impact Assessment, No 112/PM (February 18, 2010)]

This decree has is designed to disseminate and implement Article 8 of the Law on Environmental Protection, concerning Environmental Impact Assessment; to lay down principles and rules, and to adopt measures on establishment, functions, management, and monitoring of the concerned agencies in environmental impact assessment. The decree ensures that all investment projects of the state and private sector, both domestic and foreign, operating in Lao PDR that create or will create adverse environmental and social impacts, are designed with the right and appropriate environmental and social impact prevention and mitigation measures or environmental management and monitoring plans (EMMP) and social management and monitoring plans (SMMP). It intends to effectively prevent, minimize, and resolve adverse environmental and social impacts derived from investment projects and to contribute to national socioeconomic development, and to make it sustainable.

2.10.4. *Classification of Projects Regarding EIA*

[No. 8056/MONRE Ministerial Agreement on the Endorsement and Promulgation of the List of Investment Projects and Activities Required for Conducting the Initial Environmental Examination or Environmental and Social Impact Assessment (December 2013)]

This agreement stipulates that projects and activities are categorized into two groups: Group 1 shall prepare Initial Environmental Examination (IEE) and Group 2 shall prepare environmental and social impact assessments (ESIA). Airport construction falls into Group 2, which requires EIA. At present, the JICA project is in the study phase, and the outcome is unknown. The recommended results could only be a renovation of the terminal buildings within the existing VTE boundary and changes of air control operation. However, if resettlement is necessary due to the expansion of the VTE's periphery, the project will require EIA. Table 2.42 shows the relevant section of the list in the Ministerial Agreement No. 8056/MONRE also states that "If any investment projects and activities will cause on the impact that would require the compensation and resettlement of the people as specified in the provision of the Decree on Compensation and Resettlement of People Affected by Development Projects No. 192/PM, dated July 7, 2005[1], or any superseded legislation, these investment projects and activities is always required to prepare ESIA report according to the conditions set in the Ministerial Instructions and relevant technical guidelines, regardless of whether these projects and activities are categorized into Group1 or Group 2 or not falling to this list at all."

Table 2.42 Excerpt from the Table in No. 8056/MONRE

Type of Investment Projects and Activities		Group 1 Shall prepare IEE	Group 2 Shall prepare EIA
4.13	Airport construction	-	all

2.10.5. *Ministerial Instruction on IEE*

[No. 8029/MONRE Ministerial Instruction on the Process of Initial Environmental Examination of the Investment Projects and Activities (December 2013)]

This instruction is for implementing and extending the provisions prescribed under Article 21 of the Law on Environmental Protection (Amended) No. 29/NA, dated December 18, 2012. This instruction aims to ensure the uniform conduct of the Initial Environmental Examination by all investment projects and activities of public and private enterprises (both domestic and foreign) that operate business in Lao PDR that cause or are likely to cause environmental and social

[1] No.192/PM is now replaced by Decree on Compensation and Resettlement Management in Development Projects No.84 (April 5, 2016).

impacts. Those investment projects and activities shall conduct the efficient Initial Environmental Examination process, contribute to the sustainable socioeconomic development of the country, and shall mitigate and enhance global warming adaptation.

2.10.6. *Ministerial Instruction on ESIA*

[No. 8030/MONRE Ministerial Instruction on Environmental and Social Impact Assessment Process of the Investment Projects and Activities (December 2013)]

This instruction implements and extends the provisions prescribed under Article 22 of the Law on Environmental Protection (Amended) No. 29/NA, dated December 18, 2012. This instruction aims to ensure the uniform conduct of the Environmental and Social Impact Assessment by all investment projects and activities of public and private enterprises operating in Lao PDR that causes or is likely to cause environmental and social impacts. Those investment projects and activities shall conduct the efficient environmental and social impact assessment, contribute to the sustainable socioeconomic development of the country, and shall mitigate as well as enhance global warming adaptation.

2.10.7. *Compensation and Resettlement Management*

[No. 84 Decree on Compensation and Resettlement Management in Development Projects (April 5, 2016)]

This decree provides principles, regulations, and standards on the management, monitoring of compensation of losses, and the management of resettlement activities in order to effectively and adequately implement development projects that aim to ensure that the affected people are compensated, resettled, and assisted with permanent livelihood alternatives, leading to improvement of their living conditions or to be at the same level as they were before, as well as to ensure that the projects can contribute to the socioeconomic development of the nation in a sustainable manner.

2.10.8. *Divergence between Decree of Lao PDR and International Standards*

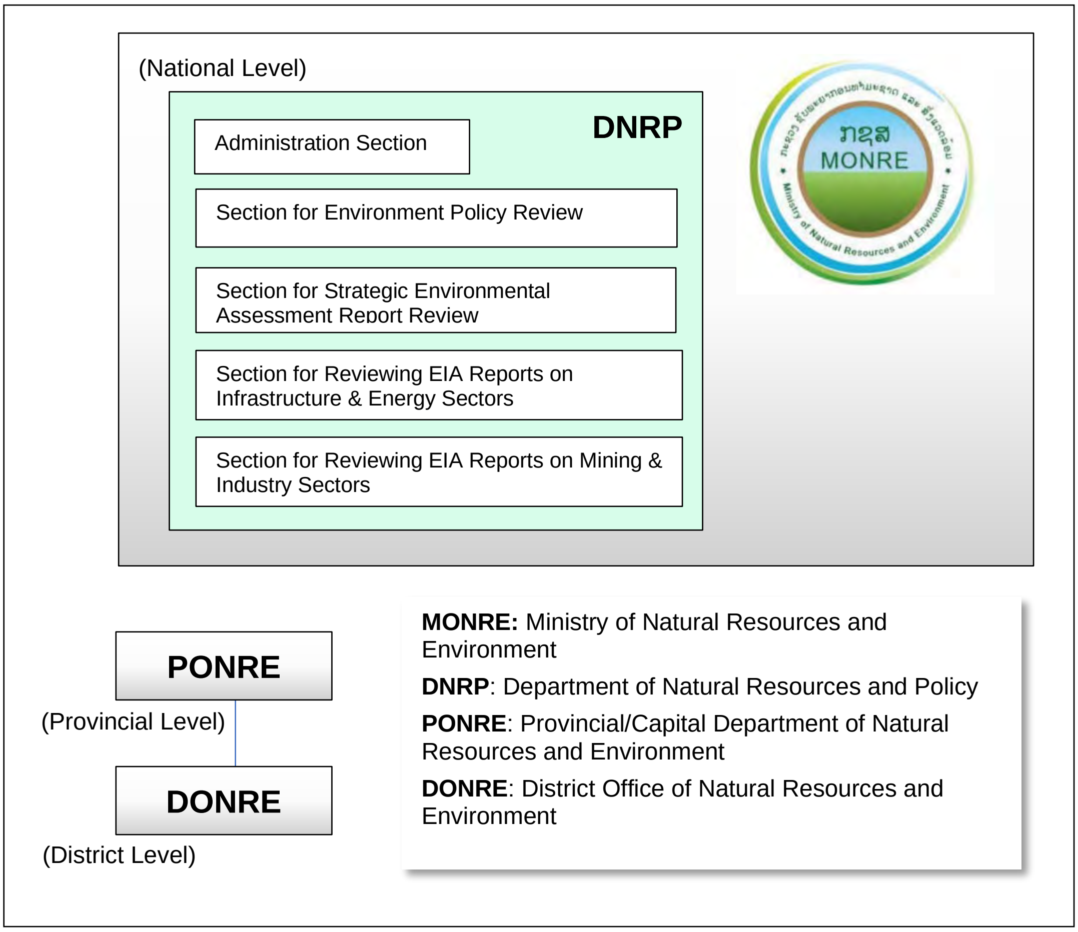
There are some divergences in compensation practices between Lao PDR and International implementation. As for a project assisted by JICA, the discrepancies must be filled for the basis of future official loan agreements between the two governments. Table 2.43 summarizes the divergences.

Table 2.43 Itemized Divergence between Lao PDR and World Bank

Items	Decree on Compensation and Resettlement Management in Development Projects (2016) Lao PDR	World Bank Environmental and Social Framework (5. Land Acquisition, Restrictions on Land Use and Involuntary Resettlement)
Completion date of compensation plan	The project owner shall complete the implementation of the compensation plan within 24 months from the date the compensation plan is officially adopted. (Article 8 Implementation of compensation)	- Compensation must be completed before construction begins. - Affected residents are provided with multiple options of compensation to choose from. - In the case of relocation, the new relocation site must be verified by the residents before the residents approve it. - The borrower will be able to acquire ownership of the land and related assets only after the compensation is done in accordance with the respective ESS.
Amount of compensation	Implemented based on the price applied by the government, the market price, and the average price applied during the compensation period. The price applied by the State (intermediate price) is the price set by the Ministry of Natural Resources and Environment. (Article 9 Evaluation and estimation of compensation amount)	- The compensation cost should be based on the reacquisition price, and the amount must include other expenses such as transaction cost. - The basis for calculating the amount of compensation and dialogue between project-affected people and the government must be documented and transparent.

2.10.9. *Implementation of EIA*

This Department of Natural Resources and Policy (DNRP) of MONRE will be the central authority to coordinate with other local agencies to facilitate EIA Projects while the Provincial/Capital Department of Natural Resources and Environment (PONRE) will be the central authority for IEE projects. The configuration of the divisions and branches of MONRE is shown in Figure 2.100.



Source: MONRE

Figure 2.100 Organization Chart of MONRE

2.10.10. *Procedure of EIA*

The procedures for EIA are presented in the Environmental Impact Assessment Guidelines (2012). The EIA guidelines are applicable for all Category 2 projects as defined in the Decree on Environmental Impact Assessment (No. 112/PM, February 16, 2010). Sections of the EIA Guidelines consist of three main parts as shown in Figure 2.101.

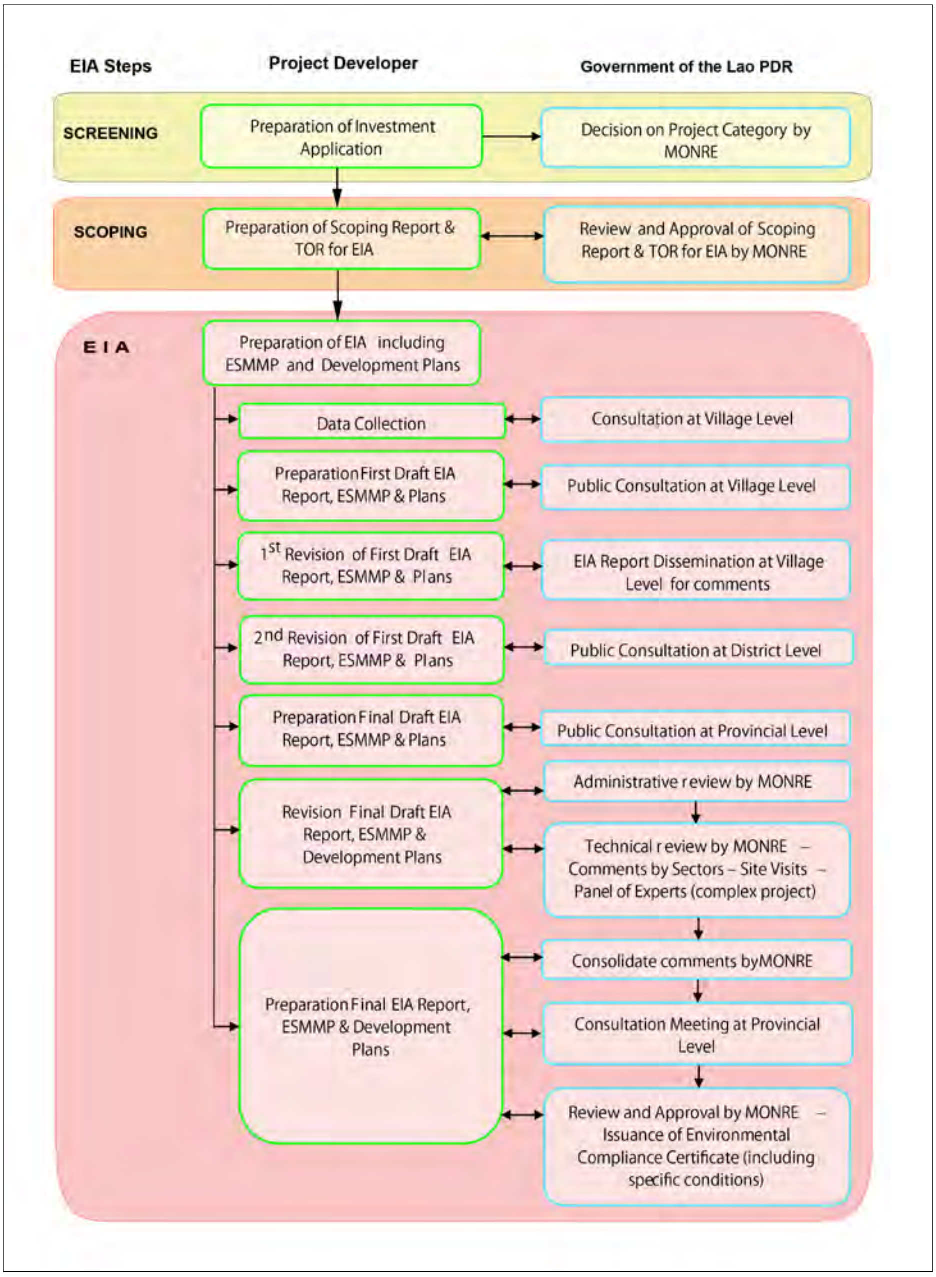


Figure 2.101 Responsibilities during Preparation of EIA Report for a Project of Category2

3. Air Traffic Demand Forecast

3.1. *Air Passenger Forecast*

3.1.1. *Forecast Flow*

The flow of the passenger forecast is presented in Figure 3.1.

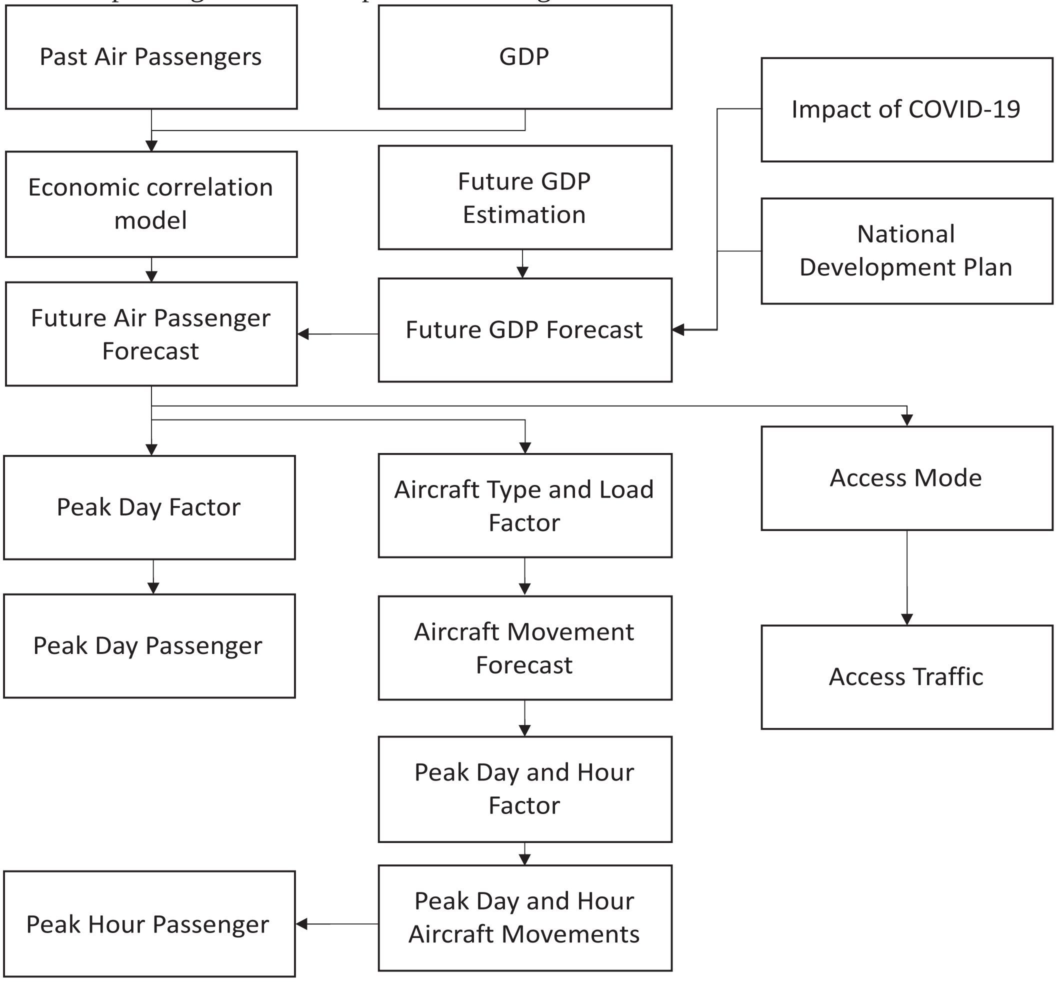
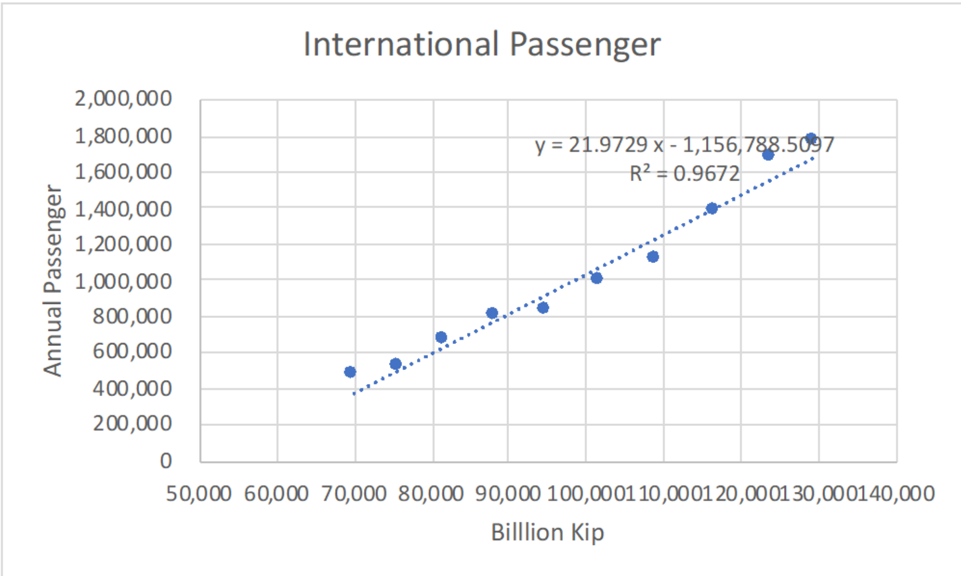


Figure 3.1 Flow of Air Passengers Demand Forecast

3.1.2. *Air Passenger Forecast Models*

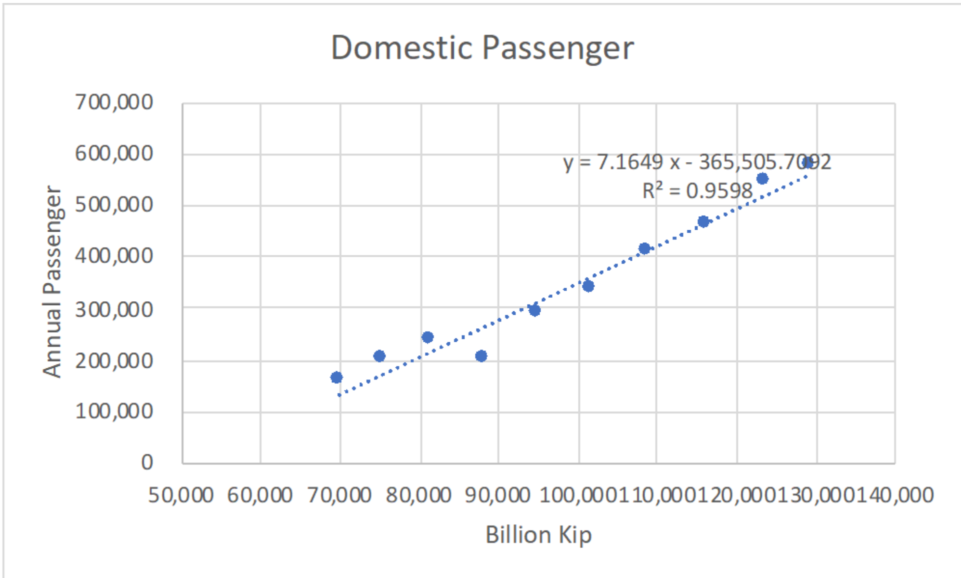
Figures below shows relation between GDP[2] and annual passengers in Vientiane International Airport for last 10 years. As shown in the figures, there is linear correlation between GDP and passengers. The linear regression model, which is suitable for a 30-year long-term prediction is used for the forecast.

[2] https://data.worldbank.org/indicator/NY.GDP.MKTP.KN?locations=LA



Source: DCA, World Bank

Figure 3.2 GDP vs. International Passengers



Source: DCA, World Bank

Figure 3.3 GDP vs. Domestic Passengers

The linear regression models of international passengers and domestic passengers are below:

The linear model applied between GDP and International passengers is:

$y = 21.9729x - 1156788.51$ (Equation-1)

Where, y : International annual passengers and x: GDP (Billion Kip at 2012 constant price)

The linear model applied between GDP and domestic passengers is:

$y = 7.1649x - 3605.70$ (Equation-2)

Where, y : Domestic annual passengers and x: GDP (Billion Kip at 2012 constant price)

3.1.3. GDP Forecast

The IMF projects the GDP of Lao PDR until 2026 as shown in Table 3.1.

Table 3.1 IMF GDP Forecast

Year	Growth Rate
2020	−0.40%
2021	4.60%
2022	5.60%
2023	5.80%
2024	5.80%
2025	6.10%
2026	6.00%

Source: IMF[3] as of April 2021

These values are used for the forecast of GDP up to 2027. GDP forecasts after 2027 refer to forecast by the OECD. OECD published a long-term GDP projections of OECD countries and other non-OECD countries[4]. Indonesia is the only countries among ASEAN countries included in the forecast. The average annual growth rate of GDP in the World is summarized in Table 3.2. There is trend to decrease the future growth rate of GDP in future.

Table 3.2 OECD GDP Forecast Growth Rate

Year	Average Annual Growth Rate			
	World	OECD Countries	Non-OECD Countries	Indonesia
2000–2010	4.1%	1.8%	4.0%	6.7%
2010–2020	4.2%	2.3%	1.9%	6.8%
2020–2030	3.4%	2.0%	3.8%	5.3%
2030–2040	2.7%	2.0%	2.7%	4.5%
2040–2050	2.4%	2.1%	2.4%	3.8%
2050–2060	2.3%	2.1%	2.3%	3.1%

Source: OECD

It is presumed that future growth rate trend of Lao PDR will be similar to that of Indonesia. The average annual growth rate of GDP of Lao PDR used in the GDP forecast is shown in Table 3.3.

Table 3.3 Lao PDR GDP Forecast Growth Rate

Lao PDR GDP Growth Ratio	
2027–2030	5.5%
2031–2035	4.5%
2036–2040	4.5%
2041–2045	3.5%
2046–2050	3.5%

[3] https://www.imf.org/en/Countries/LAO
[4] The OECD Economic Outlook No. 103
https://www.oecd-ilibrary.org/economics/data/oecd-economic-outlook-statistics-and-projections/long-term-baseline-projections-no-103_68465614-en

GDP forecast up to 2050 is shown in Figure 3.4.

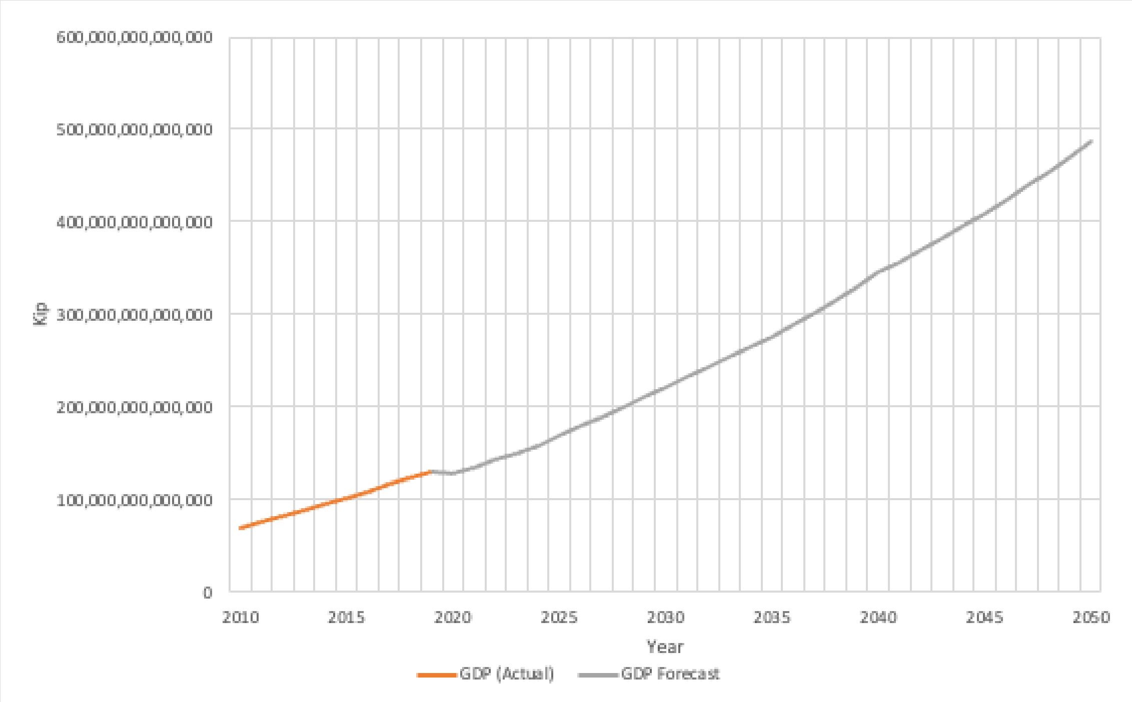


Figure 3.4 Forecast of GDP

3.1.4. *Air Passenger Forecast*

The influence of COVID-19 was considered in the forecast of air passengers. Travel restrictions to prevent spreading COVID-19 have influenced the world aviation market since March 2020. In Lao PDR, the percentage change in passenger demand in 2020 was down 51% as compared with in 2019.[5] According to IATA document, "COVID-19 An almost full recovery of air travel in prospect, May 201"[6], the air passenger demand will be same level of 2019 in 2024 as shown in Figure 3.5, and this perspective is applied in the forecast. However, this scenario is applied with large domestic market regions and as the domestic market in Lao PDR is not on a large scale, the recovery will be slower as compared to other countries.

[5] *https://www.iata.org/en/pressroom/pr/2020-04-24-01/*

[6] *https://www.iata.org/en/iata-repository/publications/economic-reports/an-almost-full-recovery-of-air-travel-in-prospect/*

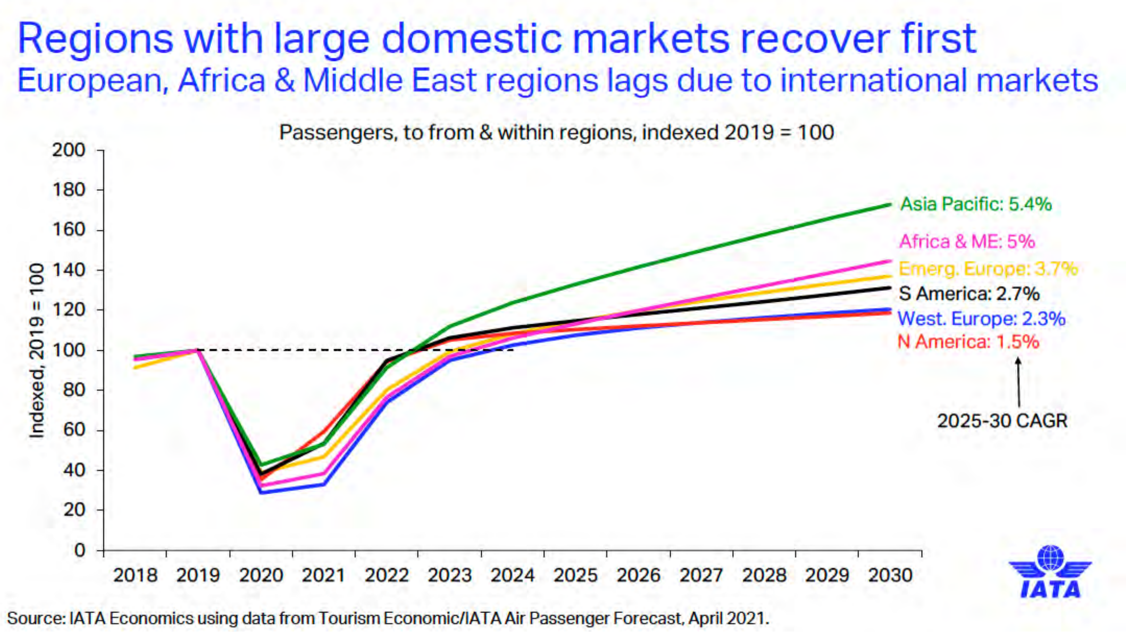


Figure 3.5 IATA Recovery Forecast-1

In the same document, IATA forecasts that there will be a strong rebound when border travel barriers are removed, but there will not be a full recovery in the future as shown in Figure 3.6.

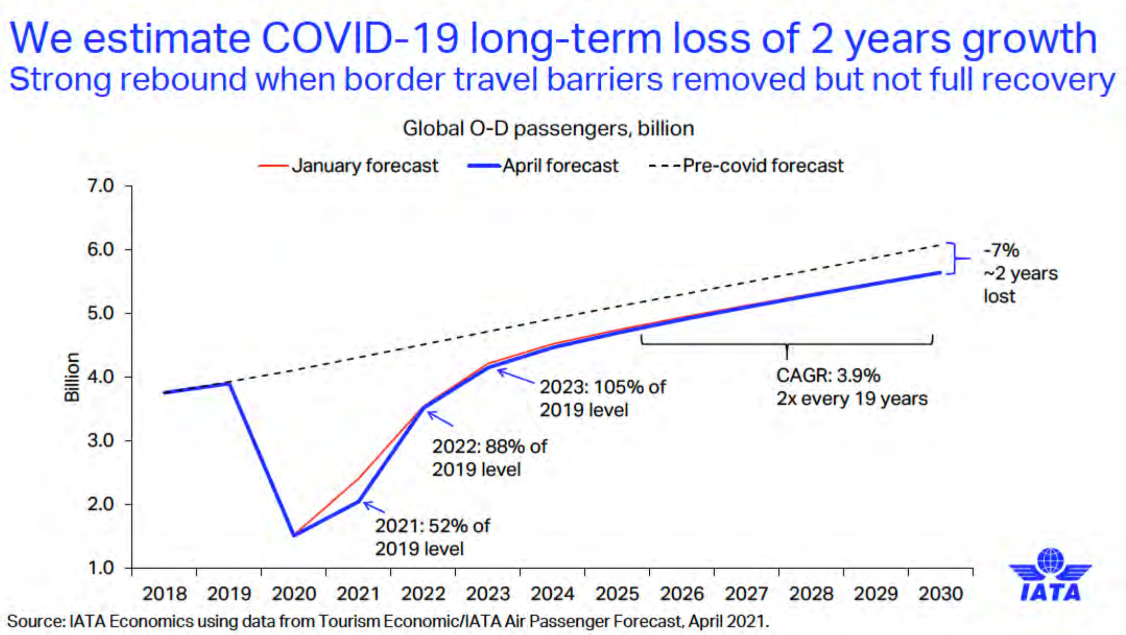


Figure 3.6 IATA Recovery Forecast-2

It is presumed that recovery of air passenger in Lao PDR will be slower than in other countries because the domestic market is relatively small. The following recovery scenario is used in the forecast from 2021 to 2024.

Table 3.4 Lao PDR Air Passenger Forecast 2021–2024

Year	Comparison with 2019	Passenger Forecast	
		International	Domestic
2019 (Actual)	100%	1,758,728	577,893
2020 (Actual)	19.6% (International) 61.4% (Domestic)	345,137	354,987
2021	42%	738,666	242,715
2022	78%	1,371,808	450,757
2023	95%	1,670,792	548,998
2024 (Same as 2019)	100%	1,758,728	577,893

The air passengers forecast in 2024 was calculated using Equation-1 and Equation-2, which is a correlation between GDP and air passengers and the forecast is compared with the above number of passengers in 2019.

Table 3.5 Comparison of Forecast by Equations in 2024 and 2019 Value

Item	Forecast GDP in 2024 (Billion Kip)	Forecast by equation (Equation 1 and 2)	Forecast (2019 value)	Ratio
International Passengers	159,415	2,346,025	1,758,728	75.0%
Domestic Passengers	159,415	776,692	577,893	74.4%

As shown in Table 3.5, the forecast in Table 3.4 is lower than the forecast by correlation equations. The equation is a correlation between GDP and air passengers before the influence of COVID, and it is necessary to the equation considering the future effect of COVID. To assess the impact of COVID, the future air passengers calculated from the equation is reduced 25.0% for international passengers and 25.6% for domestic passengers.

Results of the future air passenger forecast are shown in Table 3.6 and Figure 3.7.

Table 3.6 Results of Air Passenger Forecast

	2019 (Actual)	2025	2030	2035	2040	2045	2050
International Passengers	1,758,728	1,919,000	2,791,000	3,692,000	4,814,000	5,881,000	7,147,000
Domestic Passengers	577,893	630,000	912,000	1,204,000	1,567,000	1,912,000	2,322,000
Total Passengers	2,336,621	2,549,000	3,703,000	4,896,000	6,381,000	7,793,000	9,469,000

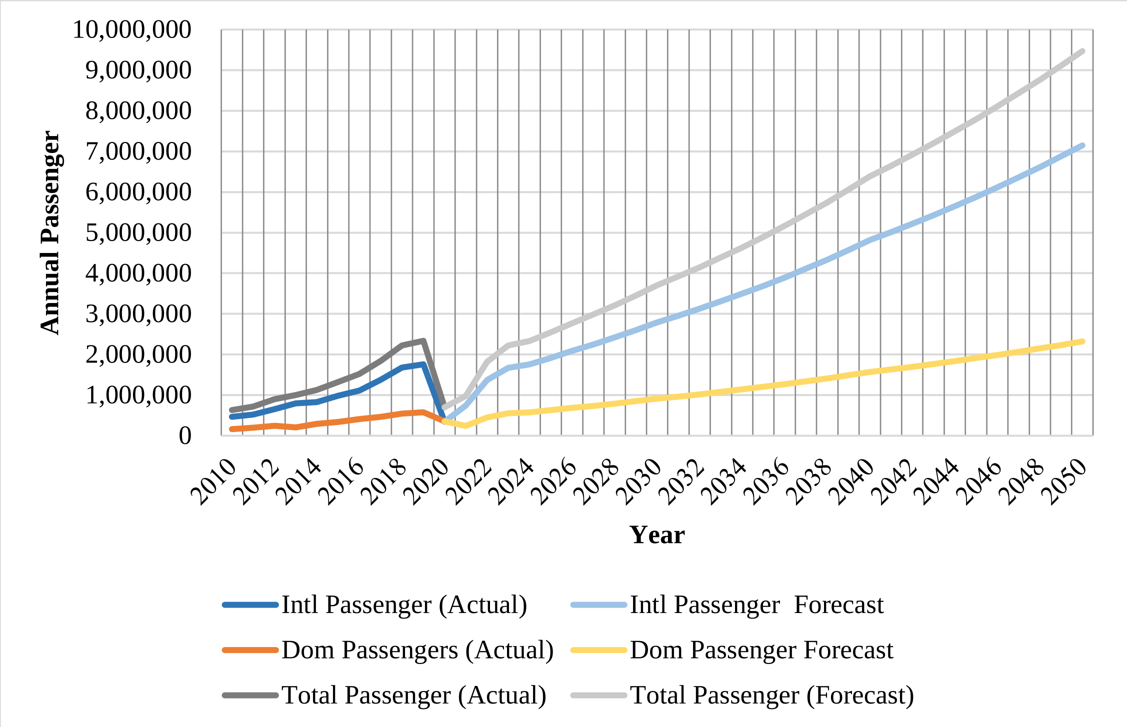


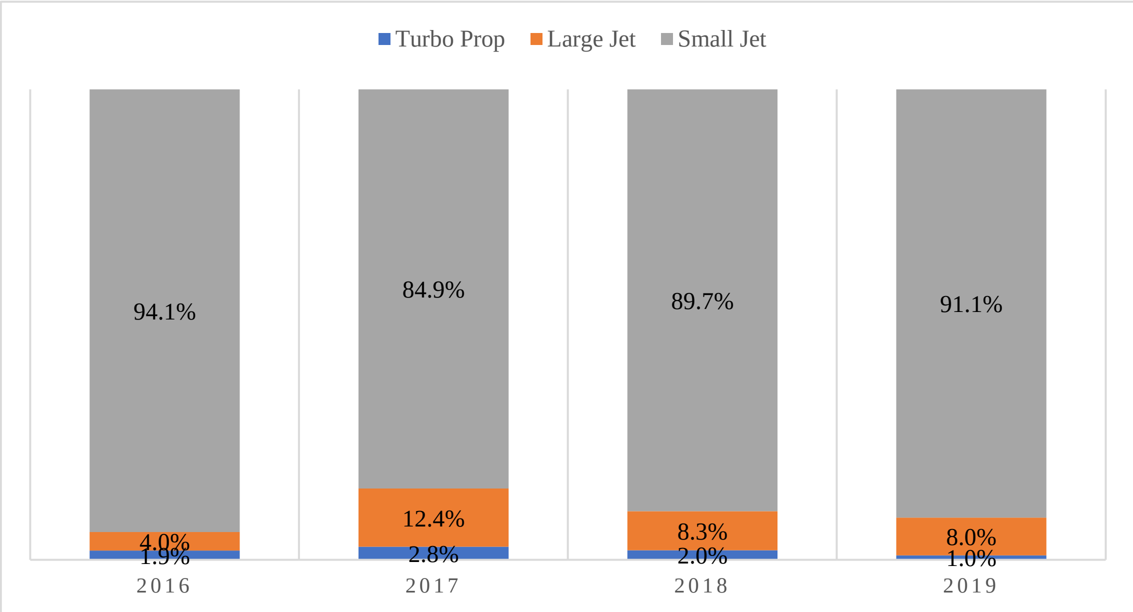
Figure 3.7 Air Passenger Forecast

3.2. ***Aircraft Movement Forecast***

3.2.1. *International Aircraft Movement*

Large jet aircraft, small jet aircraft, and turboprop aircraft were operated on international routes. Large jet aircraft include A330 and B787, small jet aircraft include A319, A320, and A321, turboprop aircraft include ATR 72 and Xian Yunshuji Ma-60. Large jet aircraft were only operated on the Bangkok, Phnom Penh, Kunming, and Guangzhou routes.

Figure 3.8 shows the ratio of available seats on international routes from 2016 to 2019. The majority of the routes were operated by small jets, which account for 85% to 95% of the aircraft. The large jet share was 4% to 12% and the turboprop share was 1.0% to 2.8%. The average shares over 4 years were adopted for the future aircraft ratio, which is 90% of small jets, 8% of large jets, and 2% of turboprops.



Source: OAG

Figure 3.8 Aircraft Share in International Routes

Because the number of passengers by routes was not available, the average load factors for the last four years were estimated from time table data from OAG. Table 3.7 shows available seats, annual passengers, and calculated load factors from 2016 to 2019.

Table 3.7 Available Seats, Annual Passengers and Load Factor

	2016	2017	2018	2019
Total Available Seats	1,786,032	2,216,065	2,623,043	2,734,811
Annual passengers	1,108,837	1,382,848	1,676,990	1,758,728
Load Factor	62.1%	62.4%	63.9%	64.3%

Source: OAG and L-JATS

The load factor has been increased year by year, and it is presumed to reach 70% in 2030. In this forecast, a 65% load factor is used from 2020 to 2029 and after 2030, 70% of the load factor is applied. Annual aircraft movement is calculated from the equation:

$$(Future\ aircraft\ movements\ by\ aircraft\ type) \\ = (Annual\ passner\ by\ aircraft\ type) \\ /\ (Number\ of\ seats) \times (Load\ Factor)$$

The results of the calculation of the annual aircraft movements of each type of aircraft is shown in Table 3.8, Table 3.9, and Table 3.10.

Table 3.8 Annual Aircraft Movements of Large Jet in International Route

Year	Annual Passenger	Share of Large Jet	Annual passengers by Large Jet	Available Seats	Load Factor	Annual Movements of Large Jet
2025	1,918,910	8%	153,513	294	65%	803
2030	2,791,392	8%	223,311	294	70%	1,085
2035	3,692,072	8%	295,366	294	70%	1,435
2040	4,814,482	8%	385,159	294	70%	1,872
2045	5,880,856	8%	470,469	294	70%	2,286
2050	7,147,374	8%	571,790	294	70%	2,778

Table 3.9 Annual Aircraft Movements of Small Jet in International Route

Year	Annual Passenger	Share of Small Jet	Annual Passengers by Small Jet	Available Seats	Load Factor	Annual Movements of Small Jet
2025	1,918,910	90%	1,727,019	160	65%	16,606
2030	2,791,392	90%	2,512,253	160	70%	22,431
2035	3,692,072	90%	3,322,864	160	70%	29,668
2040	4,814,482	90%	4,333,034	160	70%	38,688
2045	5,880,856	90%	5,292,771	160	70%	47,257
2050	7,147,374	90%	6,432,637	160	70%	57,434

Table 3.10 Annual Aircraft Movements of Turboprop in International Route

Year	Annual Passenger	Share of Turboprop	Annual Passengers by Turboprop	Available Seats	Load Factor	Annual Movements of Turboprop
2025	1,918,910	2%	38,378	70	65%	843
2030	2,791,392	2%	55,828	70	70%	1,139
2035	3,692,072	2%	73,841	70	70%	1,507
2040	4,814,482	2%	96,290	70	70%	1,965
2045	5,880,856	2%	117,617	70	70%	2,400
2050	7,147,374	2%	142,947	70	70%	2,917

Summary of the annual aircraft movements in the international route is shown in Table 3.11.

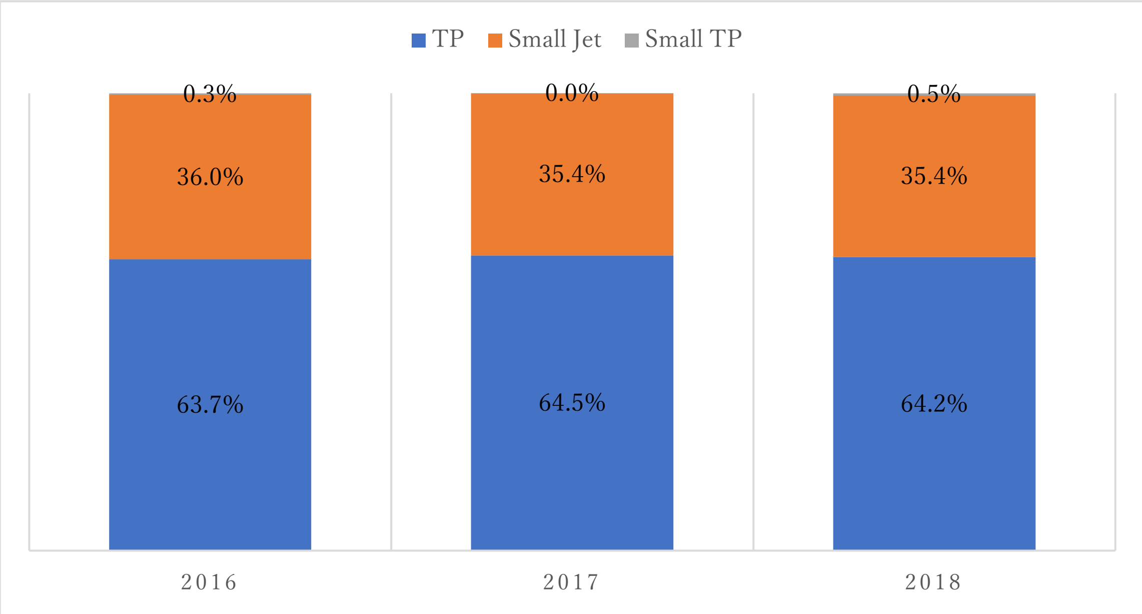
Table 3.11 Annual Aircraft Movements in International Route

Year	Large Jet	Small Jet	Turboprop	Total
2025	803	16,606	843	18,253
2030	1,085	22,431	1,139	24,655
2035	1,435	29,668	1,507	32,611
2040	1,872	38,688	1,965	42,524
2045	2,286	47,257	2,400	51,943
2050	2,778	57,434	2,917	63,130

3.2.2. *Domestic Aircraft Movement*

Small jet aircraft, turboprop aircraft, and small turboprop aircraft were operated in domestic routes. Small jet aircraft include A319, A320, and A321; turboprop aircraft include ATR 72 and Xian Yunshuji Ma-60; and small turboprop aircraft include Cessna 208b Caravan. Small jet aircraft are operated in Luang Prabang, Pakse, and Savannaket routes.

Figure 3.9 shows the ratio of available seats in domestic routes from 2016 to 2018. The ratio of a turboprop was 64%, of a small jet was 35%, and of a small turboprop was less than 1%. This ratio is used to estimate the number of aircraft movements in future.



Source: OAG

Figure 3.9 Aircraft Ratio in Domestic Routes

Table 3.12 shows selected traffic routes, which operate by A320 aircraft. The A320 was operated on the Luang Prabang, Pakse, and Savannaket routes. The traffic volume of Luang Prabang in 2019 was almost half of that in 2018. This is because more ATR 72 flights were operated on this route in 2019 instead of A320 aircraft. The load factor of the A320 on a domestic route was low, from 30% to 63%. The average load factor of these routes was 47.9%.

Table 3.12 Selected Route Traffic (A320)

	Annual Passenger	Annual Aircraft Movement	Passenger/ Aircraft	Aircraft Type	Available Seat	Load Factor
2018 Luang Prabang	198,696	2,477	80.2	A320	140	57.3%
2018 Pakse	53,790	1,082	49.7	A320	140	35.5%
2018 Savannakhet	3,344	82	40.8	A320	140	29.1%
2019 Luang Prabang	87,585	1,138	77.0	A320	140	55.0%
2019 Pakse	7,347	84	87.5	A320	140	62.5%
					Average	47.9%

Source: AOL

Table 3.13 shows selected route traffic, which is operated by ATR 72 and MA60 aircraft. These 56- and 70-seat aircraft are mainly operated in most domestic routes. The load factor of domestic routes in 2018 and in 2019 was from 61.9% to 65.2%, and the average was 63.8%.

Table 3.13 Selected Route Traffic (ATR 72 and MA60)

	Annual Passenger	Annual Aircraft Movement	Passenger/ Aircraft	Aircraft Type	Available Seat	Load Factor
2018 Luang Prabang	38,608	1,035	37.3	MA60	56	66.6%
2018 Louang Namtha	31,332	724	43.3	ATR72	70	61.8%
2018 Louang Namtha	21,252	592	35.9	MA60	56	64.1%
2018 Oudomsay	27,113	659	41.1	ATR72	70	58.8%
2018 Oudomsay	20,809	492	42.3	MA60	56	75.5%
2018 Pakse	36,432	846	43.1	ATR72	70	61.5%
2018 Pakse	16,510	608	27.2	MA60	56	48.5%
2018 Xieng Khouang	28,295	692	40.9	ATR72	70	58.4%
2019 Luang Prabang	85,280	1,778	48.0	ATR72	70	68.5%
2019 Luang Prabang	48,505	1,322	36.7	MA60	56	65.5%
2019 Pakse	76,899	1,861	41.3	ATR72	70	59.0%
2019 Pakse	18,796	636	29.6	MA60	56	52.8%
2019 Louang Namtha	36,346	713	51.0	ATR72	70	72.8%
2019 Louang Namtha	41,583	1,027	40.5	MA60	56	72.3%
2019 Oudomsay	28,656	644	44.5	ATR72	70	63.6%
2019 Oudomsay	21,065	550	38.3	MA60	56	68.4%
2019 Xieng Khouang	34,203	724	47.2	ATR72	70	67.5%
2019 Savannakhet	20,112	463	43.4	ATR72	70	62.1%
					Average	61.8%

Source: AOL

In general, airlines target a load factor from 70% to 80% to produce profit in the route so that it is reasonable to assume that the load factor of a domestic route will be increased from the current 50%–65% to 70% in the future. In this forecast, the future load factor is assumed as shown in Table 3.14.

Table 3.14 Future Load Factor

	Small Jet	Turboprop
2020–2025	50%	65%
2026–2030	60%	65%
2031–2035	65%	70%
2036–2050	70%	70%

Future aircraft movements on domestic routes were estimated from the share of aircraft type and load factors.

$$(Future\ aircraft\ movements\ by\ aircraft\ ype)$$
$$= (Annual\ passener\ in\ route)\ /\ (Number\ of\ seats) \times (Load\ Factor)$$

The annual aircraft movements of each aircraft type are shown in Table 3.15 and Table 3.16.

Table 3.15 Annual Aircraft Movements of Small Jets in Domestic Routes

Year	Annual Passenger	Share of Small Jet	Annual passengers by Small Jet	Available Seats	Load Factor	Annual Movements of Small Jet
2025	629,734	35%	220,407	160	50%	2,755
2030	912,100	35%	319,235	160	60%	3,325
2035	1,203,593	35%	421,257	160	65%	4,051
2040	1,566,845	35%	548,396	160	70%	4,896
2045	1,911,962	35%	669,187	160	70%	5,975
2050	2,321,853	35%	812,649	160	70%	7,256

Table 3.16 Annual Aircraft Movements of Turboprop in International Route

Year	Annual Passenger	Share of Turboprop	Annual passengers by Turboprop	Available Seats	Load Factor	Annual Movements of Turboprop
2025	629,734	65%	409,327	63	65%	9,996
2030	912,100	65%	592,865	63	65%	14,478
2035	1,203,593	65%	782,335	63	70%	17,740
2040	1,566,845	65%	1,018,449	63	70%	23,094
2045	1,911,962	65%	1,242,775	63	70%	28,181
2050	2,321,853	65%	1,509,205	63	70%	34,222

The annual aircraft movement forecast in domestic routes is summarized in Table 3.17.

Table 3.17 Annual Aircraft Movements in Domestic Route

	Small Jet	Turboprop	Total
2025	2,755	9,996	12,751
2030	3,325	14,478	17,803
2035	4,051	17,740	21,791
2040	4,896	23,094	27,990
2045	5,975	28,181	34,156
2050	7,256	34,222	41,478

3.3. ***Peak Period Forecast***

3.3.1. *Peak Period Aircraft Movements*

Because there is no daily traffic record available, the busy day ratio by the Japan Civil Aviation Bureau (JCAB) is used to calculate busy day traffic.

Table 3.18 Busy Day Ratio

	Apron, GSE and Fuel Supply	Passenger Terminal Building
Busy Day Ratio	1/330	1/300

Source: JCAB

Busy day aircraft movements are calculated from annual aircraft movements by the following formula:.

$$(Busy\ day\ aircrat\ movements) = (Busy\ day\ ratio) \times (Annual\ aircraft\ movements)$$

Busy day aircraft movements are shown in Table 3.19 and Table 3.20

Table 3.19 Busy Day Aircraft Movements in International Route

	Annual Aircraft Movements			Busy Day Aircraft Movements		
Year	Large Jet	Small Jet	Turboprop	Large Jet	Small Jet	Turboprop
2025	803	16,606	843	2	50	3
2030	1,085	22,431	1,139	3	68	3
2035	1,435	29,668	1,507	4	90	5
2040	1,872	38,688	1,965	6	117	6
2045	2,286	47,257	2,400	7	143	7
2050	2,778	57,434	2,917	8	174	9

Table 3.20 Busy Day Aircraft Movements in Domestic Route

		Annual Aircraft Movements		Busy Day Aircraft Movements	
Year		Small Jet	Turboprop	Small Jet	Turboprop
2025		2,755	9,996	8	30
2030		3,325	14,478	10	44
2035		4,051	17,740	12	54
2040		4,896	23,094	15	70
2045		5,975	28,181	18	85
2050		7,256	34,222	22	104

Source: Study Team

To calculate a busy hour ratio, the formulas in Table 3.21 are used.

Table 3.21 Busy Hour Ratio

	Busy Hour Ratio (d)
International	d = 1.05/(aircraft movements) + 0.114 (Where, not more than 100 movements per day)
Domestic	d = 1.51/(aircraft movements) + 0.115 (Where, not more than 100 movements per day) d = 6.61/(aircraft movements) + 0.064 (Where, more than 100 movements per day)

Source: JCAB

Busy hour aircraft movements are shown in Table 3.22 and Table 3.23.

Table 3.22 Busy Hour Aircraft Movements in International Route

Year	Busy Day Aircraft Movements			Busy Hour Aircraft Movements			
	Large Jet	Small Jet	Turboprop	Large Jet	Small Jet	Turboprop	Total
2025	2	50	3	1	7	1	9
2030	3	68	3	1	9	1	12
2035	4	90	5	2	11	2	14
2040	6	117	6	2	14	2	18
2045	7	143	7	2	17	2	21
2050	8	174	9	2	21	2	25

Table 3.23 Busy Hour Aircraft Movements in Domestic Route

	Busy Day Aircraft Movements		Busy Hour Aircraft Movements		
Year	Small Jet	Turboprop	Small Jet	Turboprop	Total
2025	8	33	2	5	7
2030	10	44	3	7	9
2035	12	54	3	8	11
2040	15	70	3	10	13
2045	18	85	4	12	16
2050	22	104	4	13	17

Peak periods of international flights and of domestic flights are not always the same period. A busy month of international flight was December 2019 and that of domestic flight was April 2019 as shown in Table 3.24.

Table 3.24 Busy Month of International and Domestic Flight

Month	Domestic		International		Total	
	Movements	Rank	Movements	Rank	Movements	Rank
Jan	1,226	3	1,443	3	2,669	2
Feb	1,048	12	1,324	7	2,372	11
Mar	1,209	5	1,454	2	2,663	3
Apr	1,235	1	1,293	10	2,528	8
May	1,233	2	1,319	9	2,552	4
Jun	1,084	11	1,285	11	2,369	12
Jul	1,143	10	1,322	8	2,465	9

Aug	1,216	4	1,330	6	2,546	5
Sep	1,146	9	1,276	12	2,422	10
Oct	1,192	7	1,347	5	2,539	7
Nov	1,168	8	1,373	4	2,541	6
Dec	1,207	6	1,478	1	2,685	1
Total	14,107		16,244		30,351	

Source: OAG

A combined busy month was December so that a busy hour on the busy day in December is analyzed further. Figure 3.10 shows a flight schedule on December 2019, which was the second busiest day during the average week of the peak month in 2019. The busy hour was 12 o'clock; however, the number of international flights in this period is 3 flights and this does not represent the busy hour movements of international flight, which was 5 movements. In this regard, 14 o'clock reasonably represents the combination of international and domestic flight. To estimate future busy hour aircraft movements, the sum of 63% (5/8) of domestic flights and 100% of international flight is used.

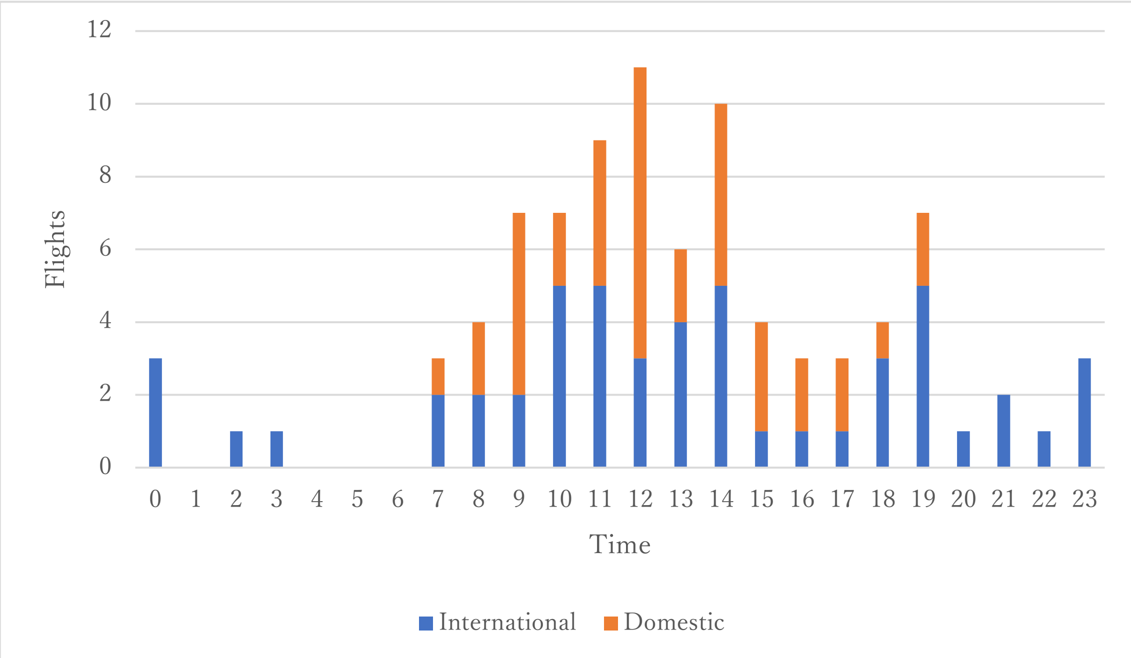


Figure 3.10 Peak Day Aircraft Movements

Table 3.25 Combined Busy Hour Movements

Year	International	Domestic	Total
2025	9	5	14
2030	12	6	18
2035	14	7	21
2040	18	8	26
2045	21	10	31
2050	25	11	36

3.3.2. *Peak Period Passenger Movements*

The number of busy day passengers (total of arrivals and departures) is calculated from annual passengers multiplied by the busy day ratio (1/300). A busy hour passenger is calculated from the following formula.

$$(Busy\ hour\ passengers) = (Bus\ hour\ aircraft\ movements) \times (Load\ Factor) \times (Available\ seats)$$

Each busy hour passengers carried by each aircraft type are calculated and the sum of each passenger by aircraft type is a busy hour passenger.

Table 3.26 Busy Day and Hour Passengers (Arrival and Departure)

	Busy Day Passenger		Busy Hour Passenger	
Year	International	Domestic	International	Domestic
2025	6,396	2,099	1,021	402
2030	9,305	3,040	1,349	525
2035	12,307	4,012	1,661	643
2040	16,048	5,223	2,048	782
2045	19,603	6,373	2,417	935
2050	23,825	7,740	2,854	1,037

3.4. ***Forecast of Air Cargos***

The flow demonstrated in Figure 3.11 is used to forecast the cargo demand once the basic data becomes available.

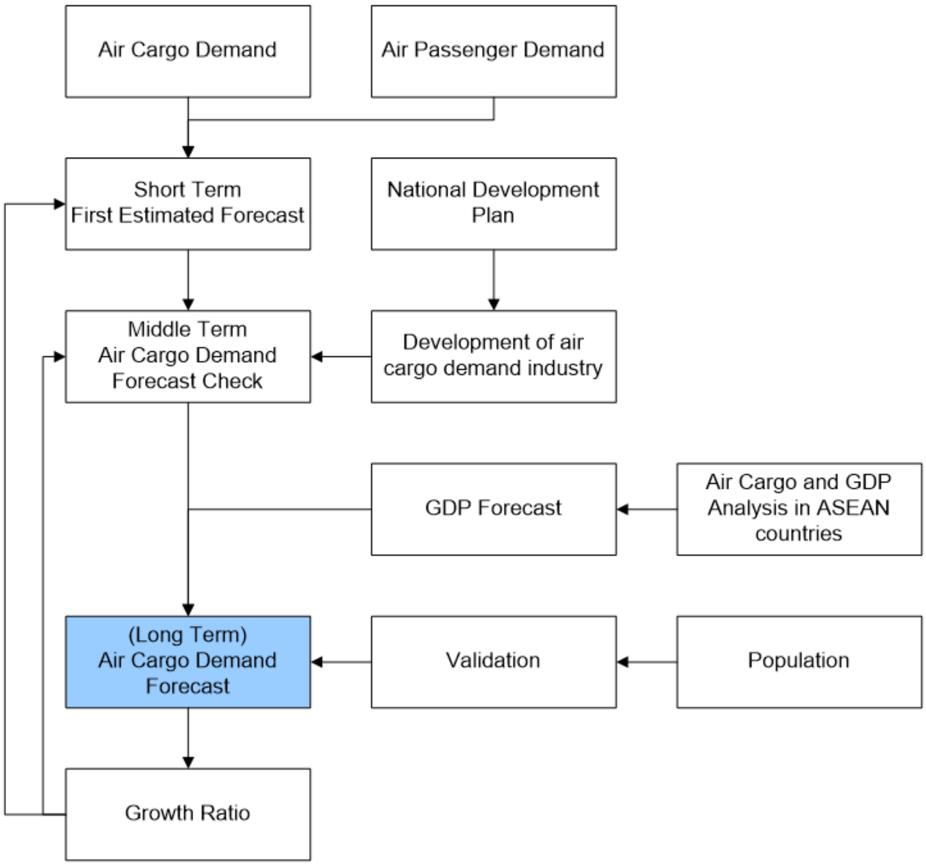


Figure 3.11 Flow of Air Cargo Demand Forecast

Air cargo at VTE is increasing slightly each year. However, compared to other ASEAN countries, the air cargo in Lao PDR is about 1/20 of that of Cambodia, which is very small. This low air cargo volume is probably because land routes are convenient for trade with neighboring countries such as Thailand and China. If the industry in Lao PDR changes, air cargo will increase sharply. Still, changes in the industrial structure are unpredictable, so current trends are used to forecast future values.

Table 3.27 Air Cargo Statistics

	Year	2015	2016	2017	2018	2019	2020
Cargo	International	2,703,952	3,308,810	3,347,652	3,730,695	3,513,679	1,439,006
	Domestic	443,113	416,329	520,762	630,023	688,809	435,195
Mail	International	160,300	212,027	254,758	283,814	304,972	65,667

Source: DCA

There is international airmail, but it accounts for about 8% of the international cargo, which depends more on the activities of people than on economic conditions. The data suggests that there is no domestic airmail (See Table 3.27). Hence, only air cargo is forecast.

Table 3.28 show that for international air cargo, Thailand is significant, and for domestic flights, Luang Prabang is large.

Table 3.28 Air Cargo by Direction

		Cargo (kg)		Mail (kg)	
		2018	2019	2018	2019
International	Cambodia	266,704	223,935	17,154	47,700
	China	103,482	87,690	6,244	5,952
	Korea	459,321	188,002	78,252	65,818
	Malaysia	133,399	173,493		
	Singapore	95,351	93,921		
	Thailand	2,536,463	2,416,686	177,204	181,521
	Vietnam	135,975	329,952	4,960	3,981
Domestic	Luang Prabang	195,392	195,663		
	Pakse	144,747	127,089		
	Savannakhet	10,695	35,416		
	Luang Namtha	89,748	71,897		
	Oudomsay	96,657	102,921		
	Xieng Khouang	92,784	155,823		

Source DCA

The air cargo volume has a linear correlation with GDP. The air cargo volume for international and domestic flights is forecast from the future forecast of GDP predicted above. However, if the number of import/export products that require shortening of transportation time increases in the future, or if an international production base is established, a significant change may occur. Figure 3.12 and Figure 3.13 shows a correlation between domestic and international air cargo and GDP.

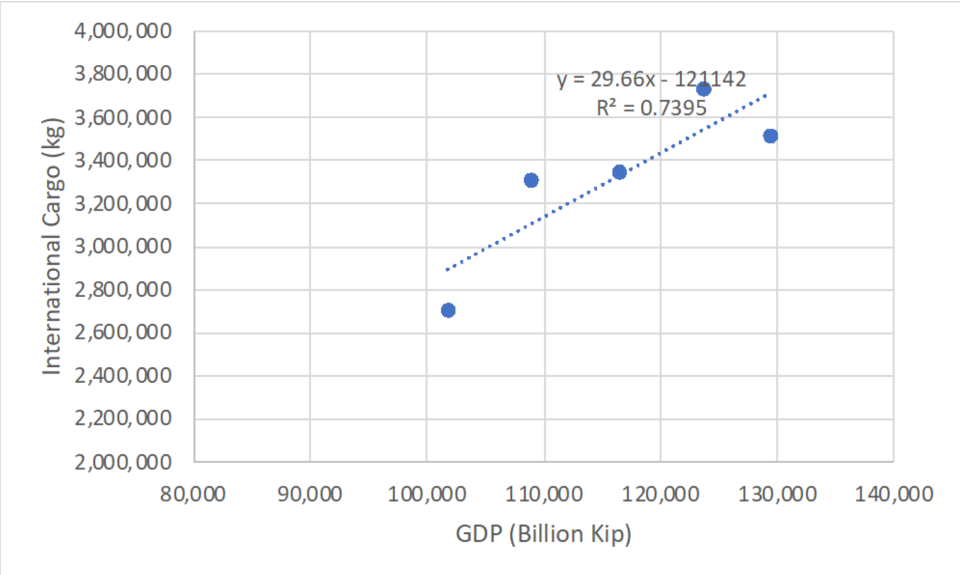


Figure 3.12 International Air Cargo and GDP

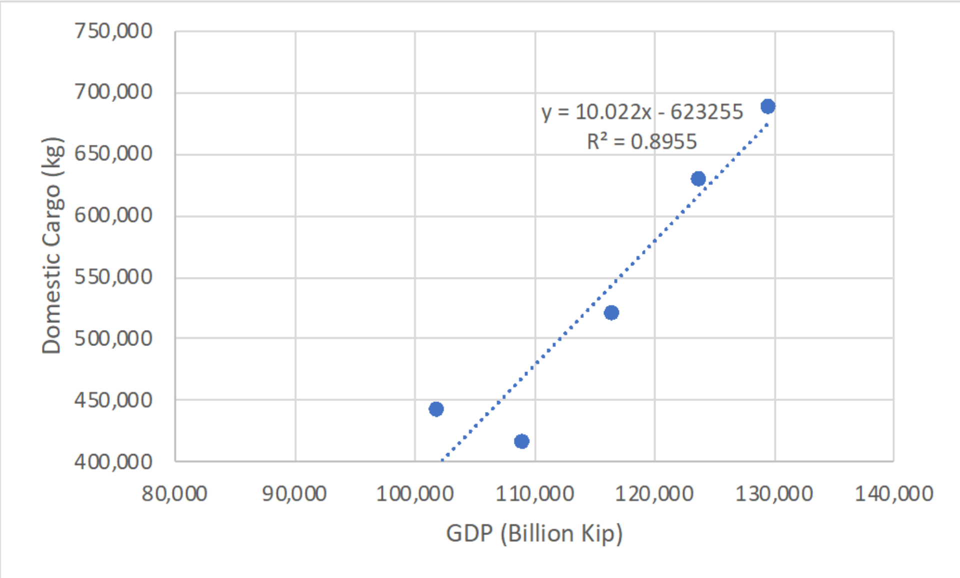


Figure 3.13 Domestic Air Cargo and GDP

The linear model applied between GDP and international air cargo is:

$$y = 29.660x - 121{,}141.52$$

Where, y is international air cargo (kg) and x is GDP (billion kip)

The linear model applied between GDP and domestic air cargo is:

$$y = 10.221x - 63{,}254$$

Where, y is domestic air cargo (kg) and x is GDP (billion kip)

These models are used to forecast future air cargo, and the results are shown in the table below:

Table 3.29 Results of Air Cargo Forecast

	2019	2025	2030	2035	2040	2045	2050
International Air Cargo (ton)	3,514	4,900	6,500	8,100	10,100	12,000	14,300
Domestic Air Cargo (ton)	689	1,100	1,600	2,200	2,800	3,500	4,300

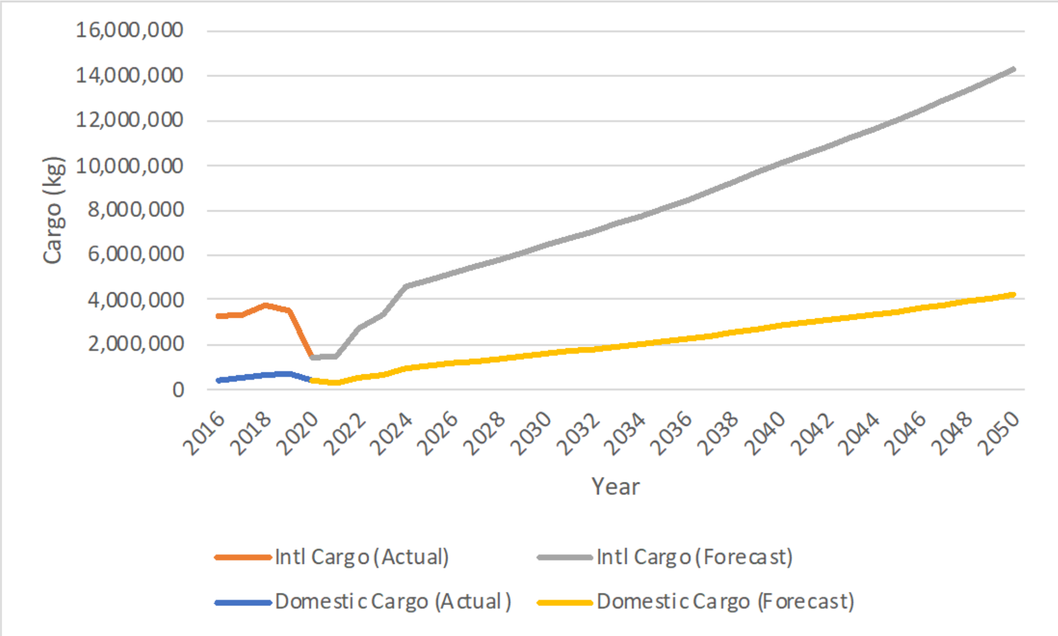


Figure 3.14 Results of Air Cargo Forecast

3.5. *Forecast of Airport Access Traffic*

Airport access/egress traffic is tentatively calculated in this section based on the interview survey conducted by the study team in February 2021.

The calculation is based on the following assumptions.

- Taxis, motorbikes and tuk tuks (small three wheel vehicle) transport one person to VTE and another from VTE (round trip).
- Buses transport 10 people to VTE and 10 from VTE (round trip).
- Private cars carry a departing air passenger, transport one person to VTE and none from VTE (one way trip).
- Private cars carrying an arriving air passenger, transport one person from VTE and none to VTE (one way trip).
- Cabin crews use airline buses.
- No assumption for airport staff, this data was not provided to the study team.

The result of the airport access/egress traffic calculation is summarized in Table 3.30 and illustrated in Figure 3.15. It is estimated at 43,514 Passenger Car Unit (PCU) in 2050, which can be comfortably served by a two-lane road capacity. The traffic would increase by only 10% if taxis, motorbikes, tuk tuks, and buses transport passengers one way instead of two ways.

Table 3.30 Forecast of Access/Egress Traffic on Peak Day

	2025	2030	2035	2040	2045	2050	
Motorcycles	550	930	1,090	1,250	1,410	1,560	Round trip
Tuk tuks	460	770	910	1,040	1,170	1,300	Round trip
Taxis	280	460	550	630	700	780	Round trip
Buses	60	100	120	140	160	180	Round Trip of 10 Persons
Private Cars	14,190	23,750	27,980	32,110	36,130	40,040	One way Trip
Air Line Staff Buses	64	88	95	109	115	127	Round trip
Airport Staff							No data
PCU (Total)	15,453	25,821	30,415	34,903	39,225	43,514	
Car Park Requirement per day	710	1,190	1,400	1,610	1,810	2,000	10% of Car Users

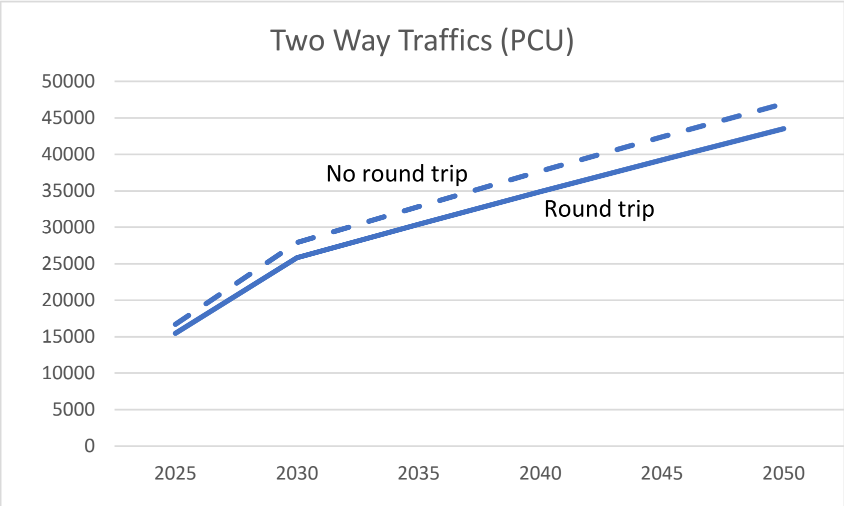


Figure 3.15 Forecast of Access/Egress Traffic at VTE