Vilnius International Airport

Master Plan

Executive Summary

Reference BI6468-NAC-AP-VN-RP-YA-05(02) - Summary VNO
Date 04/12/2023
Version Final / version 02

a company of Royal HaskoningDHV

Master Plan VNO
Executive Summary

Reference
BI6468-NAC-AP-VN-RP-YA-05(02) - Summary VNO
Status
Final / version 02

Date
04/12/2023

Project Name
Preparation of Master Plans for Lithuanian Airports VNO KUN and PLQ

Project Number
BI6468

Authors
Alisa Silven
Asmeeta Das Sharma
Graeme Odendaal
Jan Koelink
Kimeshni Naicker
Lise Gascard
Mary Panagopoulou
Michael Doughty
Priscila Coghlan Jonas
Quincy Tjaden
Remco Troquete
Tendayi Chiureki

Checked by
Jan Koelink
Steven Wanders
Date 04/12/2023

Approved by
Tessel Severs
Date 04/12/2023

Classification
Confidential

NACO
a company of Royal HaskoningDHV

NACO, Netherlands Airport Consultants
Schenkkade 49
2595 AR The Hague, The Netherlands
(+31) 88 348 1300
www.naco.nl

Contents

List of figures

List of tables

1. Introduction

A comprehensive master plan of the airport should endeavour to adopt a balanced approach that considers economic, environmental and cultural aspects whereby present needs are met without compromising the ability of future generations to fulfil their own needs.

State Enterprise Lithuanian Airports (LA) is the owner and operator of the airports of Vilnius International Airport (VNO), Kaunas International Airport (KUN) and Palanga International Airport (PLQ) in Lithuania.

To be able to sustain the anticipated further growth of aviation traffic and to bring the world closer to Lithuania in the coming 30 years (until 2052), LA has initiated a project to develop master plans for the Lithuanian airports VNO, KUN and PLQ. These master plans provide guidelines for the necessary developments required to strengthen the positions of the respective airports and turn a new page in the history of Lithuanian Airports.

In November 2022, LA has engaged HaskoningDHV Nederland B.V. operating as NACO Netherlands Airport Consultants (NACO), as their airport master planner.

This Executive Summary presents the key takeaways of the final master plan report per below topics:

- **Traffic Forecast**: Mapping the trajectory of aviation activity;
- **Passenger Terminal Building**: Enhancing the journey for travellers while accommodating growth;
- **Master Plan**: Guiding airport facilities' growth efficiently;
- **Phasing Strategy**: Sequencing development for optimal outcomes;
- **Environmental Aspects**: Embracing sustainability in expansion;
- **Financial Analysis**: Balancing investments for long-term viability.

For details on the topics in the Executive Summary, reference is made to the final master plan report.

2. Traffic Forecast

Traffic forecast approach

The general forecasting approach is illustrated in the chart on the right. The forecasts for VNO were generated using a combination of:

- **bottom-up** route-by-route forecasts for the initial years of study and over the COVID recovery period, and;
- **top-down long-term forecasts** based on a macro-economic modelling approach. As such, our forecast methodology blends a top-down macro-econometric modelling approach with a bottom-up analysis of short-term route opportunities.

To address the uncertainty related to the future air traffic development at the airport, three separate scenarios, Low, Base and High were developed.

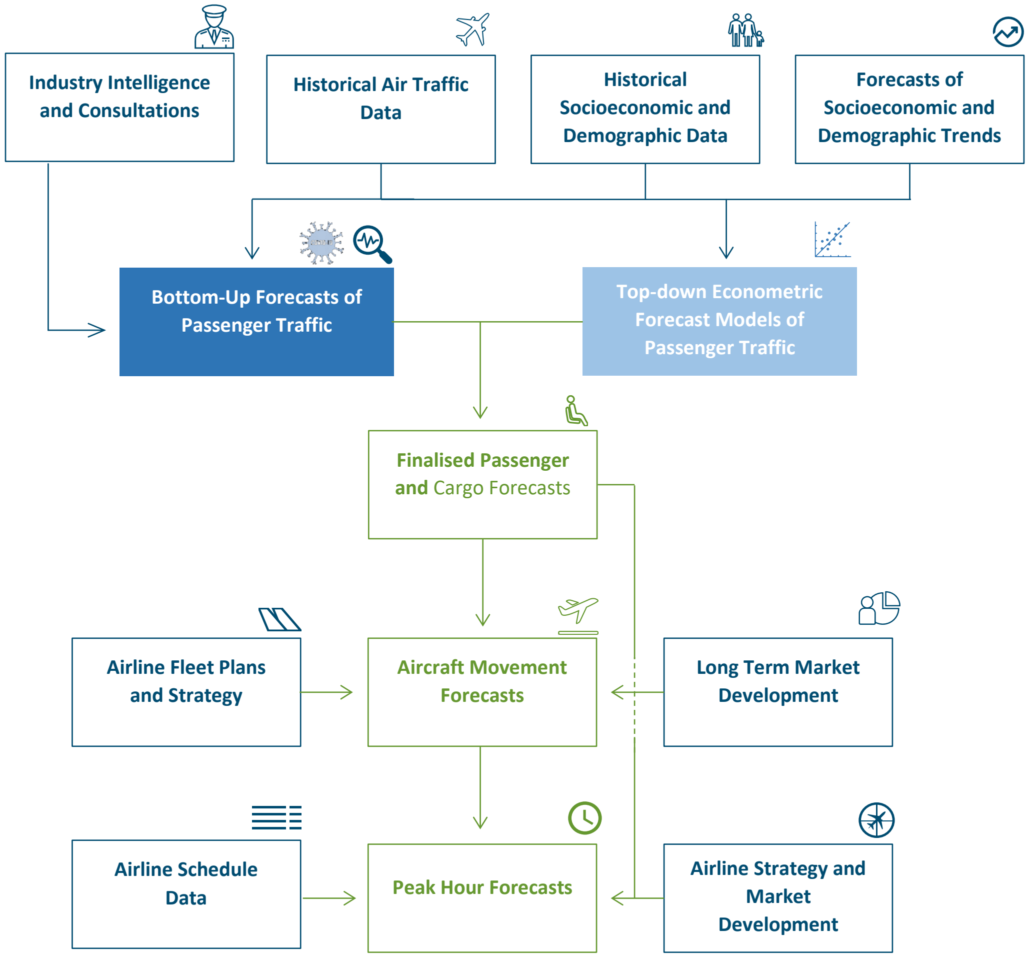

FIGURE 1 NACO FORECAST PHILOSOPHY

Commercial passenger and ATM forecast

Commercial passenger traffic at VNO is expected to increase from 3.9 million annual passengers in 2022 to the following passenger volumes in 2052:

- Low: 8.8 million, equivalent to a CAGR of 2.7%;
- Base: 10.8 million, equivalent to a CAGR of 3.4%;
- High: 13.1 million, equivalent to a CAGR of 4.1%.

Commercial passenger ATM at VNO is expected to increase from 42.2 thousand in 2022 to the following number of movements in 2052:

- Low: 61.4 thousand, equivalent to a CAGR of 2.2%
- Base: 71.5 thousand, equivalent to a CAGR of 2.7%
- High: 82.3 thousand, equivalent to a CAGR of 3.2%

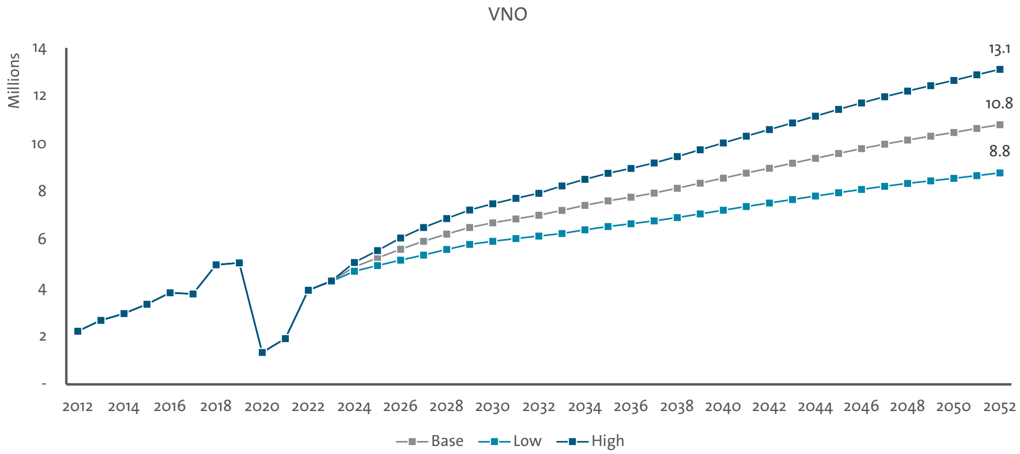

FIGURE 2 LONG-TERM PASSENGER TRAFFIC PROJECTIONS

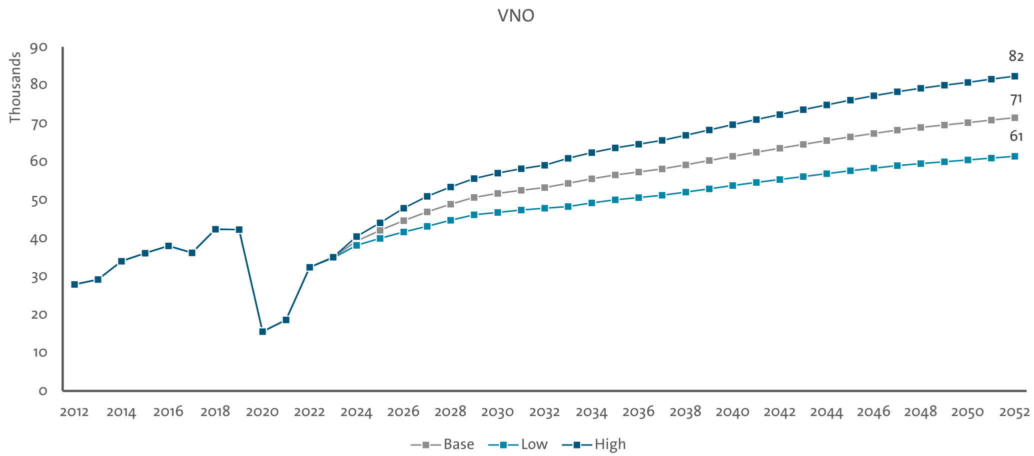

FIGURE 3 LONG-TERM COMMERCIAL ATM PROJECTIONS

Peak hour forecast

Based on the peak hour benchmark, depending on the scenario, VNO will serve the following 30th peak hour volumes for passenger flows as well as the absolute peak for ATMs.

Low Scenario

- 3,770 total two-way passengers and 28 ATMs;

Base Scenario

- 4,320 total two-way passengers and 30 ATMs;

High Scenario

- 4,920 total two-way passengers and 33 ATMs.

Table 1 VNO 30th passenger peak hour forecast (rounded to closest 10 passengers)

	VNO	2019	2022	2032	2042	2052	2022 - 2052	2022 - 2032	2032 - 2042	2042 - 2052
Low	2-way	2,024	1,914	2,860	3,330	3,770	2.3%	4.1%	1.5%	1.2%
	Arr	1,361	1,411	1,990	2,180	2,310	1.7%	3.5%	0.9%	0.6%
	Dep	1,509	1,378	1,970	2,210	2,390	1.9%	3.6%	1.2%	0.8%
Base	2-way	2,024	1,914	3,120	3,750	4,320	2.8%	5.0%	1.9%	1.4%
	Arr	1,361	1,411	2,170	2,450	2,650	2.1%	4.4%	1.2%	0.8%
	Dep	1,509	1,378	2,150	2,480	2,740	2.3%	4.5%	1.4%	1.0%
High	2-way	2,024	1,914	3,380	4,180	4,920	3.2%	5.9%	2.1%	1.6%
	Arr	1,361	1,411	2,350	2,730	3,010	2.6%	5.2%	1.5%	1.0%
	Dep	1,509	1,378	2,340	2,770	3,110	2.8%	5.4%	1.7%	1.2%

Table 2 VNO absolute ATM peak hour forecast

	VNO	2019	2022	2032	2042	2052	2022 - 2052	2022 - 2032	2032 - 2042	2042 - 2052
Low	2-way	20	16	24	26	28	1.8%	4.0%	0.9%	0.6%
	Arr	12	13	18	19	19	1.3%	3.5%	0.4%	0.1%
	Dep	13	12	17	18	18	1.3%	3.5%	0.4%	0.1%
Base	2-way	20	16	25	28	30	2.1%	4.7%	1.1%	0.7%
	Arr	12	13	20	21	21	1.6%	4.2%	0.6%	0.2%
	Dep	13	12	18	19	20	1.7%	4.2%	0.6%	0.2%
High	2-way	20	16	27	30	33	2.4%	5.3%	1.2%	0.8%
	Arr	12	13	21	22	23	1.9%	4.9%	0.7%	0.3%
	Dep	13	12	19	21	21	2.0%	4.9%	0.8%	0.3%

Cargo forecast

Air cargo at VNO is forecast to increase from 15,987 tons in 2022 to:

- Low: 27.3 thousand tons in 2052, equivalent to a CAGR of 1.8%;
- Base: 39.1 thousand tons in 2052, equivalent to a CAGR of 3.0%;
- High: 52.8 thousand tons in 2052, equivalent to a CAGR of 4.1%.

The share of full-freighter cargo will be (78.2% in 2022):

- Low: 65.0% in 2052;
- Base: 72.5% in 2052;
- High: 80.0% in 2052.

Full freighter ATMs will increase from 739 in 2022 to:

- Low: 1,050 in 2052;
- Base: 1,400 in 2052;
- High: 1,800 in 2052.

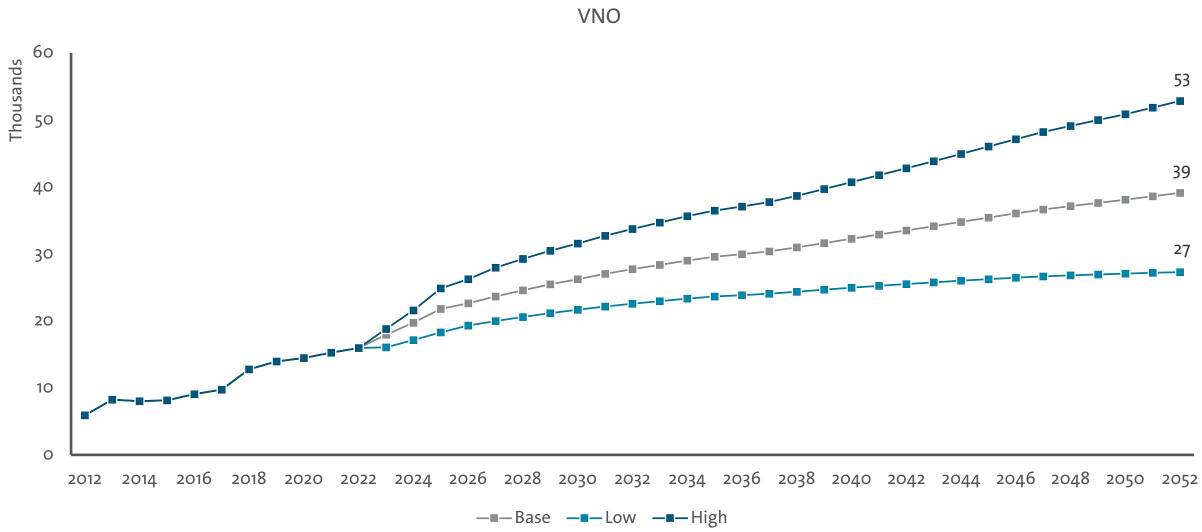

Figure 4 VNO cargo forecast (in metric tons)

General Aviation forecast

GA ATMs at VNO is forecast to increase from 3 thousand in 2022 to:

- Low: 4.1 thousand in 2052, equivalent to a CAGR of 1.1%
- Base: 6 thousand in 2052, equivalent to a CAGR of 2.4%
- Base: 8 thousand in 2052, equivalent to a CAGR of 3.4%

The drop in GA volumes in the period between 2025 and 2027 is explained by anticipated decrease in military flights at the airport.

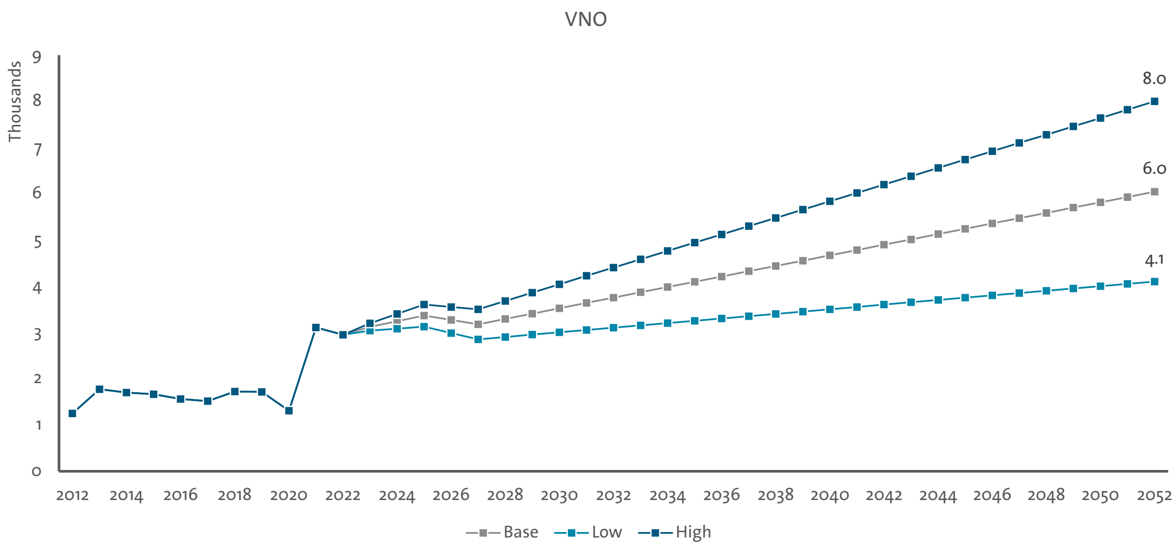

FIGURE 5 VNO GA FORECAST

3. Passenger Terminal Building

This section presents the final design proposition for the terminal building area. It outlines the facility requirements for the years 2037 and 2052 and the consequent developments required to fulfil the demand has been presented.

During the exploration phases, the gap analysis highlighted existing bottlenecks and the need for short term expansion to relieve the congestion. Baggage reclaim, and non-Schengen gate waiting areas were noted to be the major congestion points in the existing passenger journey. Further expansion is required for the landside commercial, border control and security. The expansions have been presented in functional layouts for the end phase.

FIGURE 6 AERIAL VIEW ON THE FUTURE TERMINAL AREA

Facility Requirements

The facility sizing takes into consideration the annual and peak hour figures. Based on this, the facility requirements and related waiting areas are calculated for the year 2037 and 2052. The results are presented in Table 3. The data is used to calculate the number of required equipment and floor area of the passenger processes of the airport terminal which need to be incorporated in the terminal layout to accommodate the anticipated future demand.

Short term terminal expansion

The proposed expansions for the short term are envisioned to be completed within the next 5 years.

TABLE 3 FACILITY REQUIREMENTS

2037			2052		
Check-in	Facilities (#)	Queueing (m²)	**Check-in**	Facilities (#)	Queueing (m²)
Conventional counters	14	270	Conventional counters	18	330
Drop-off counters	11	0	Drop-off counters	13	0
Kiosks	13	0	Kiosks	16	0
Security	Facilities (#)	Queueing (m²)	**Security**	Facilities (#)	Queueing (m²)
Boarding card control	3	70	Boarding card control	3	90
Standard security lanes	8	320	Security lanes	10	380
Priority security lanes	1				
Border control outbound	Facilities (#)	Queueing (m²)	**Border control outbound**	Facilities (#)	Queueing (m²)
Manual counters	11	170	Manual counters	15	180
ABC readers	4	0	ABC readers	4	0
Border control inbound	Facilities (#)	Queueing (m²)	**Border control inbound**	Facilities (#)	Queueing (m²)
Manual counters	14	50	Manual counters	18	210
ABC readers	4		ABC readers	5	0
European Entry System (EES)	Facilities (#)	Queueing (m²)	**European Entry System (EES)**	Facilities (#)	Queueing (m²)
EES kiosks	10	50	EES kiosks	12	70
Baggage reclaim	Facilities (#)	Queueing (m²)	**Baggage reclaim**	Facilities (#)	Queueing (m²)
Reclaim belt length	211	750	Reclaim belt length	250	930
Min. no. of belts	2		Min. no. of belts	4	
Customs	Facilities (#)	Queueing (m²)	**Customs**	Facilities (#)	Queueing (m²)
Green channel	1	80	Green channel	2	100
Red channel	1		Red channel	1	
Inspection positions	1		Inspection positions	1	
Gate waiting	Facilities (#)	Queueing (m²)	**Gate waiting**	Facilities (#)	Queueing (m²)
Schengen	12	1,526	Schengen	12	1,526
Non-Schengen	11	2,119	Non-Schengen	11	2,119
Combined	23	3,645	Combined	23	2,400
Commercial		Area (m²)	**Commercial**		Area (m²)
Landside		1,450	Landside		2,050
Schengen		3,600	Schengen		6,150
Non-Schengen		2,150	Non-Schengen		3,350

Terminal 5

Terminal 4 is expected to provide sufficient departure capacity; however arrivals capacity is lacking. Even with the proposed extension of the belts, the reclaim will already get saturated around 2027. Therefore, the development of T5 should start as soon as possible.

Gate waiting area non-Schengen

It is proposed on the short term to build a non-Schengen pier, which provides 4 additional contact gates and a bus lounge with 4 additional gates. Together with the existing bus lounges this caters for short term and long-term demand.

Non-Schengen arrivals

The introduction of a non-Schengen pier requires a long-term vision on reorganising the arrivals route. Through an iterative process it was decided to incorporate non-Schengen arrivals facilities on Level 1 (Figure 7). To be aligned with the development of the pier, these facilities must be realised according to the same time schedule.

Rail Baltica integration

Although the underground rail station might not be realised on the short term, it is recommended to incorporate the necessary provisions to smoothly connect rail and air traffic. Proposed links in

Landside commercial - The Passage

The gap analysis shows a shortage of landside commercial space. The refurbishment of T1, together with commercial facilities around the

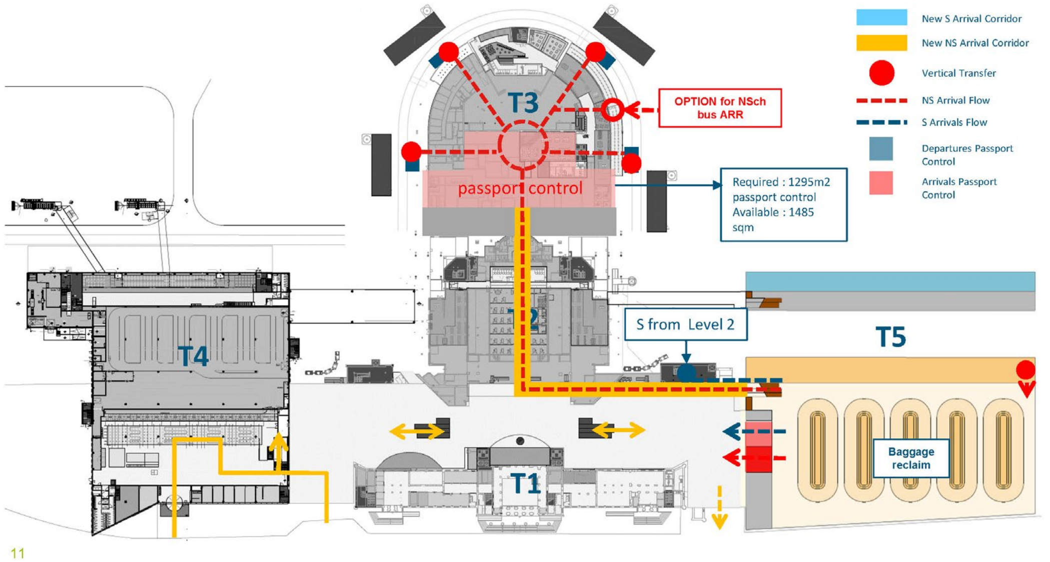

FIGURE 7 PRINCIPLE OF LINKING THE PROPOSED ARRIVALS FLOW IN THE FIXED LINKS

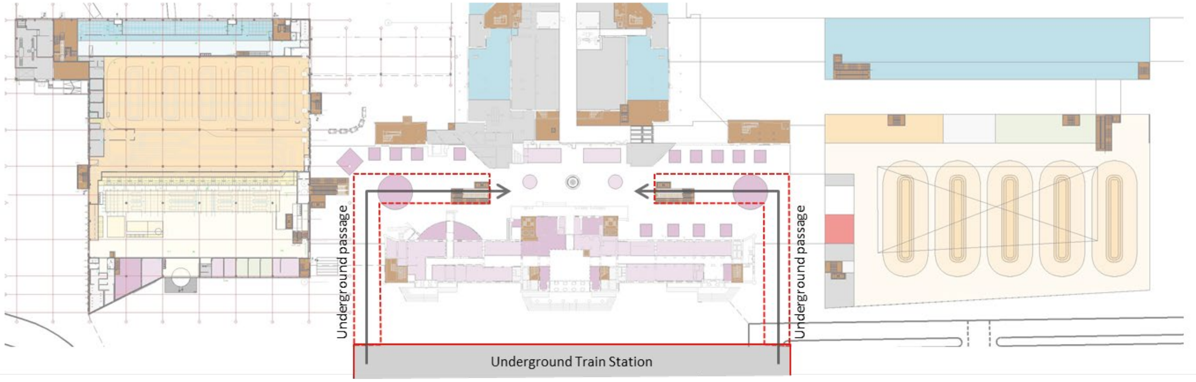

FIGURE 8 RAIL BALTICA INTEGRATION THROUGH THE LANDSIDE PASSAGE AREA

public space between T1, T4 and T5 provide sufficient spaces with a unique character and commercial potential.

Airport offices

To develop T5, the existing ON office building must be dismantled on the short term. On the long term, landside developments require dismantling of other office buildings, which are in use by Lithuanian Airports. To compensate this, landside offices are proposed on the top level of terminal 5 (approx. 4000 m²) which can be used for administrative support and operational centres. Alternately, additional entries from the landside could be provided, to rent out space to third parties.

Air Traffic Control Tower (ATCT)

In the short term, the demand can be met with 4 baggage reclaim belts. However, 5 belts might be required to fulfil the 2052 demand. Hence, there are 2 options to retain the ATCT in the short term. The tower can have its independent landside entry from the Passage area or can use the common access area provided for the offices and technical areas on L2 and L3. For the latter, the ATCT will be accessed on L2. Office spaces on L3 can also be used for the ATCT or remote tower office functions.

Functional Zoning Plan 2052

In response to Lithuanian Airports (LA) ambitions and the demand for expansions of dynamic and static process capacity functional plans are developed to cater for the demand up to 2052 (13 MAP).

Level 1 (Ground floor)

The following proposed interventions will require a complete reconfiguration of T2-T3 ground floor:

1. 2 Swing bus gates between T2 and T3.
2. NS arrival hall to receive passengers from the new NS bus lounge and contact gates.
3. Additional bus lounge in T5 and a walk-in walk-out lounge in a pier with 9 gates. This development is optional, however improves the passenger experience significantly.

FIGURE 9 IMPRESSION OF THE PASSAGE

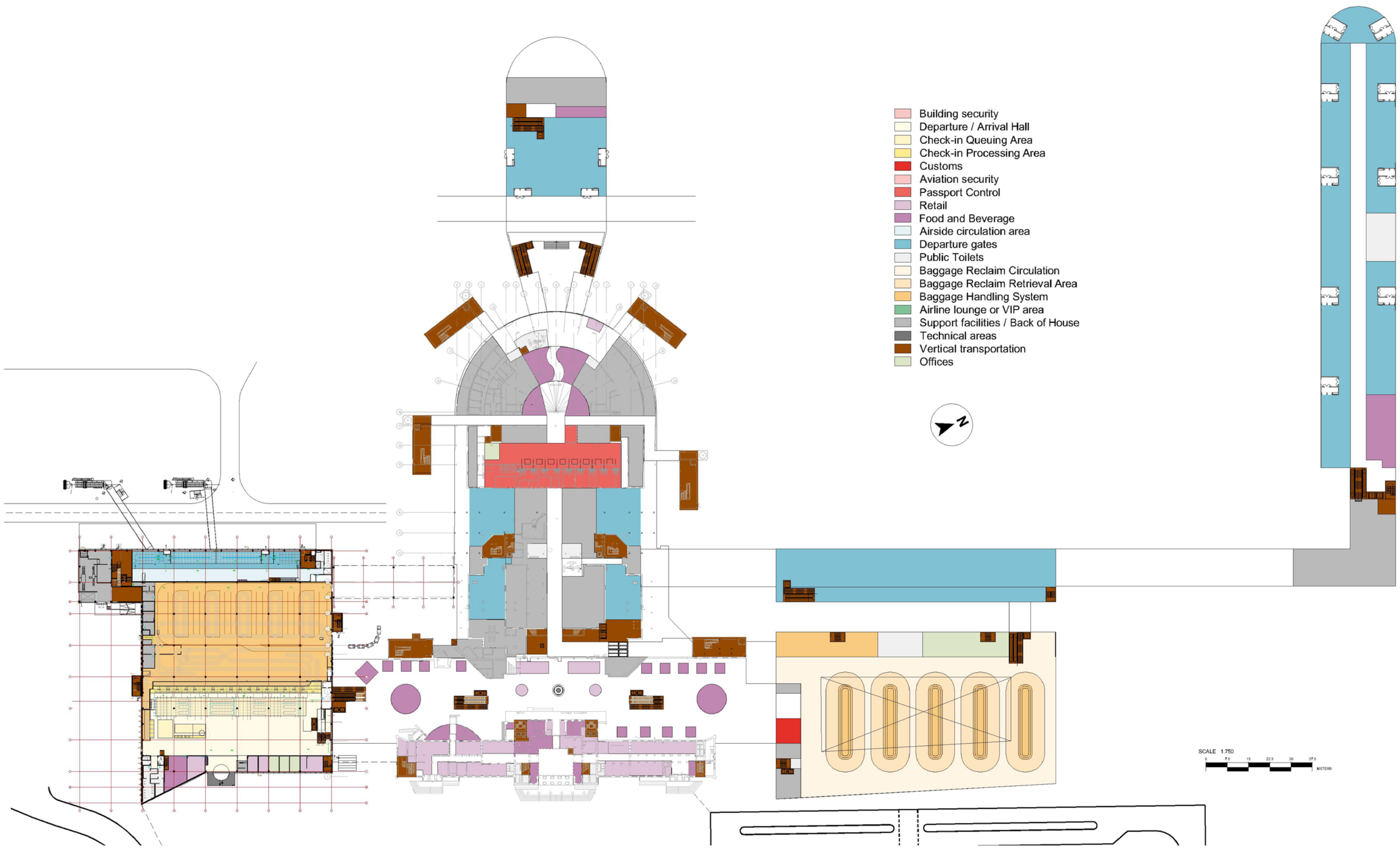

FIGURE 10 FUNCTIONAL LAYOUT 2052 LEVEL 1

Level 2 (First Floor)

Figure 12 presents the proposed functional layout for Level 2 for 2052.

The key additions are the Schengen and Non-Schengen Piers. The NS pier is connected at the tip of T3 to the building. To establish an aesthetic connection, it is recommended that the VT currently located at the intersection of the building and pier is demolished. Further, the outbound passport control has been reorganised to accommodate the 2052 demand.

For the Schengen pier, 15m wide connecting corridor has been provided to access the T5 Schengen bus lounge and the pier. This corridor will also inject the arrival passengers directly into T5.

FIGURE 11 IMPRESSION OF THE PIERS

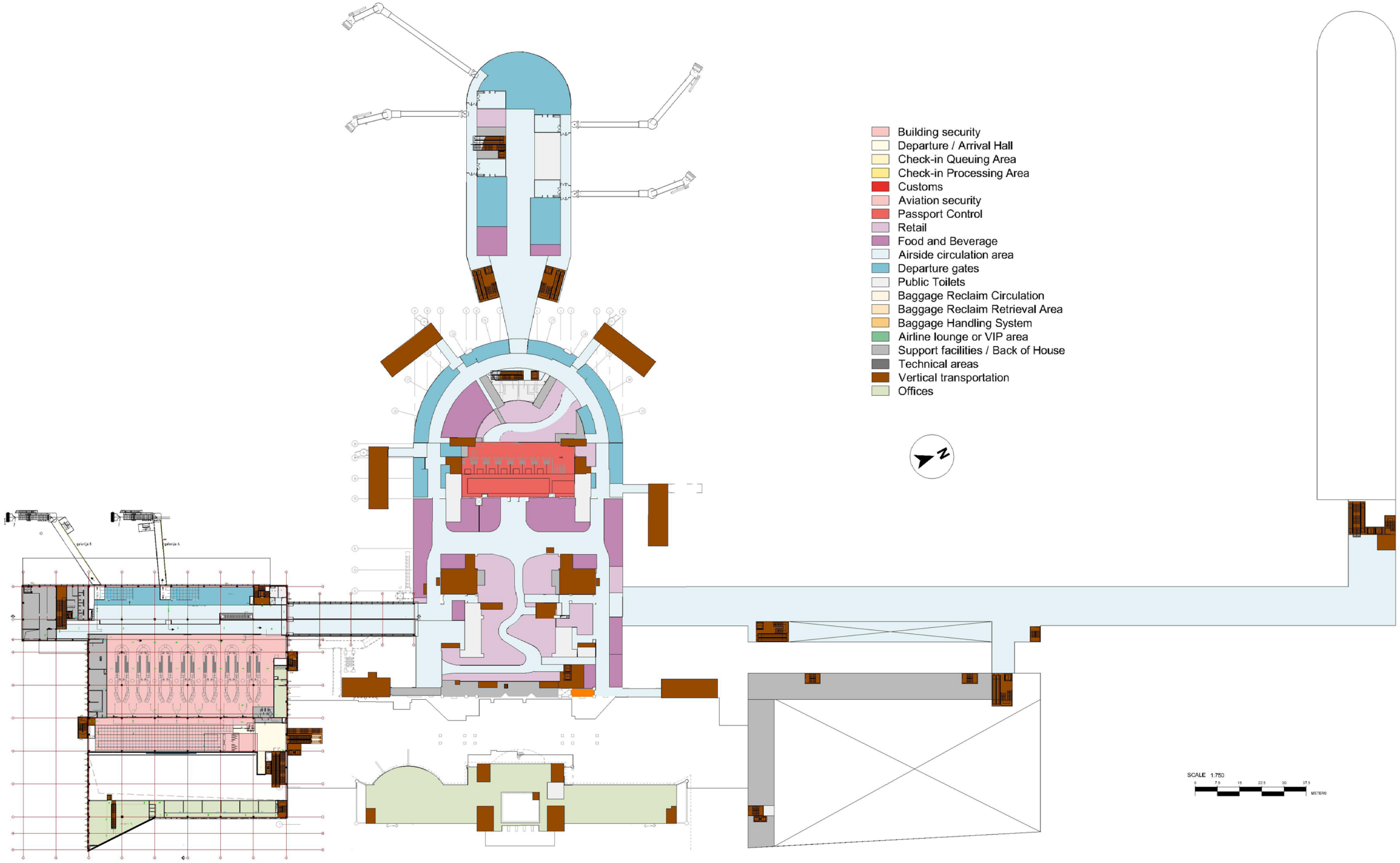

FIGURE 12 FUNCTIONAL LAYOUT 2052 LEVEL 2

Level 3 (Second floor)

Figure 14 presents the functional layout for Level 3 for 2052.

The relocation of the arrival flow allows for the entire flow to be used for commercial functions.

The space currently used for NS arrivals can be converted into a premium restaurant with a direct view of the airside. Inbound passport control could be converted into NS lounges while the S-NS transfer zone could be converted into a Schengen or VIP lounge.

There is large potential in developing this floor for niche F&B and lounges to generate higher commercial revenues.

Figure 13 Impression of the Schengen pier seen from landside

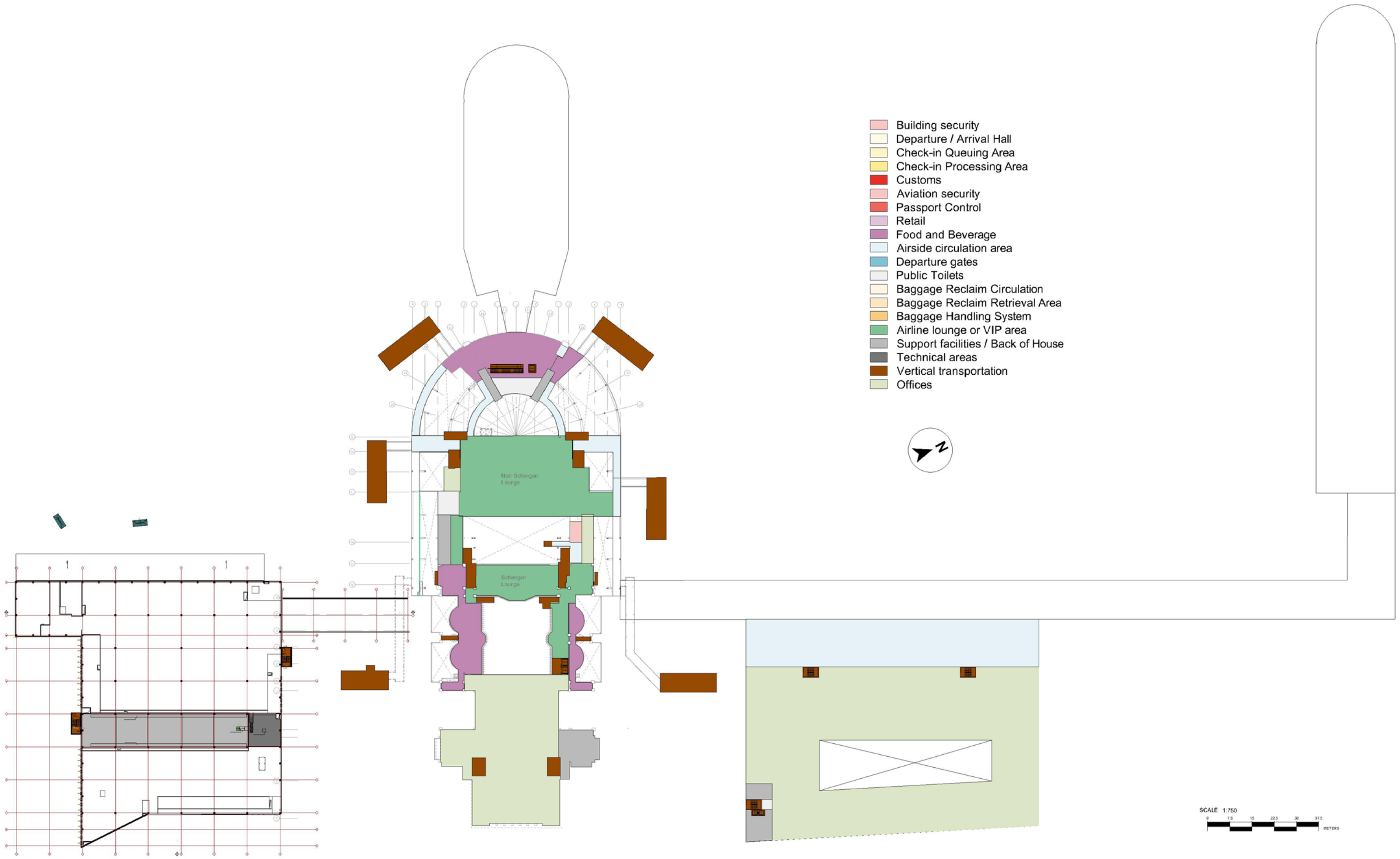

FIGURE 14 FUNCTIONAL LAYOUT 2052 LEVEL 3

4. Master Plan

This section outlines the strategic and required developments for the airport. First the critical airside infrastructure (runway, taxiways, aprons) is discussed, followed by the support facilities at the airport. In the end, the landside accessibility of the airport is discussed. The sizing of all infrastructure and facilities is based on the high scenario from the traffic forecast.

Airside

The existing runway at VNO (01-19) has a total length of 2,515 metres. The runway has sufficient length and capacity for the forecasted traffic growth. Hence, no changes are foreseen for the runway, nor for the navigational aids. The air traffic control tower is planned to be replaced by a digital (camera) tower for remote control.

The taxiway system will efficiently be expanded and adjusted to provide adequate access to the respective aprons for different sizes of aircraft (See Figure 15). The expansion includes a partial parallel taxiway on the East side of the runway, providing access to the dual use military apron.

As a result, the passenger apron is compliant for unrestricted ICAO Code C, and a route for Code E operations. The expanded general aviation apron is provided with an extension of its Code A compliant taxiway.

In the master plan, the following aircraft parking stands are provided:

- Commercial passenger apron: 35 Code C aircraft or 33 Code C and 2 Code E aircraft
- General aviation apron: 15 Code A aircraft
- Military apron: 12 Code C or 3 Code E
- De-icing: 5 Code C

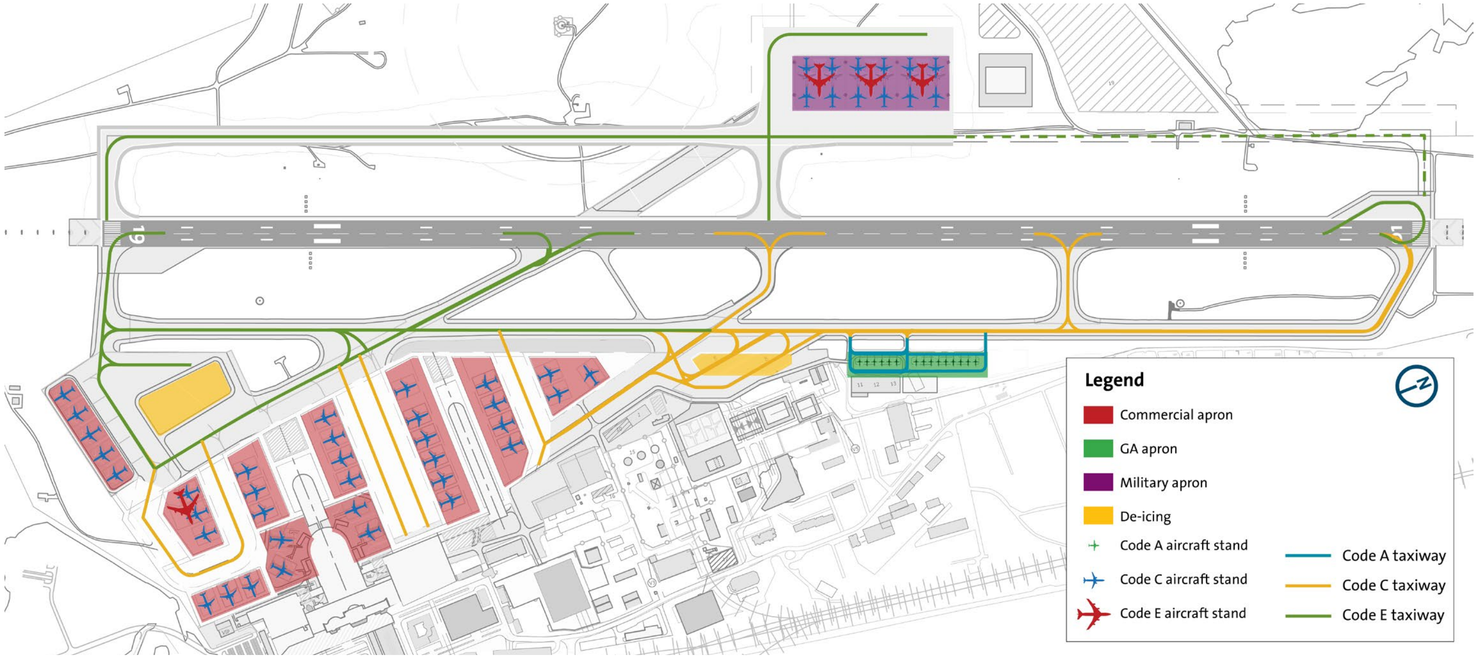

FIGURE 15 TAXIWAYS AND APRONS

Cargo facilities

The two existing cargo facilities have a total combined floor area of approximately 5,325 square metres. According to the functional requirements, it is expected that the general cargo facilities do not require any expansions within the master plan horizon to cater for the increase in cargo volumes.

Regarding express freight facilities, within the master plan, a land area reservation of 10,000 square metres is included to ensure preparedness for the potential expansion of express cargo freight handling at VNO.

Aircraft Maintenance (MRO) facilities

The existing MRO hangars and facilities are envisioned to remain unchanged. To anticipate future developments, the master plan includes a strategic area reservation, situated in the southwestern part of the airport premises. The area is accessible from the landside and has a direct connection with the airside. The area reservation enables an MRO facility able to perform maintenance activities on two narrow body aircraft simultaneously.

Military, General Aviation, and VIP facilities

To facilitate the military mobility project at VNO, the master plan includes an area for military developments of approximately 8 hectares, located on the East side of the runway. This airside area can flexibly be used to accommodate the parking of three widebody aircraft or six to 12 narrowbody aircraft. The apron is anticipated to be for dual use, accommodating both commercial and military air traffic. A taxiway system is in place to grand access to the runway. From the landside, access is provided by means of a secondary landside/airside gate located in the eastern part of the airport premises.

The master plan includes the expansion of general aviation facilities towards the south, with the primary objective of creating a consolidated cluster of these facilities. Approximately 2,000 square meters of footprint area can be allocated to accommodate small hangars or offices tailored for general aviation operations.

In the master plan, it is envisioned that the VIP/conference centre facility will remain unchanged.

Figure 16 View on the airside

Airport support facilities

The airport has several facilities that support the operations.

EMERGENCY FACILITIES

Taking the developments on the airfield into account, the ability to meet the required response times is reassessed and it's concluded that the current location of the ARFF station is still able to meet the ICAO requirements for ARFF services. Furthermore, the current RFF station already provides enough bays to accommodate an increase in the number of RFF vehicles which is needed when the need for upgrading the aerodrome category arises.

GSE FACILITIES

The Ground Support Equipment (GSE) fleet requires sufficient parking space. Several central parking areas are reserved in the passenger terminal area (see Figure 17). Within the staging areas, also charging facilities for electrified GSE (eGSE) is available. No modifications or changes are anticipated in the GSE maintenance facilities as part of the master plan. The existing facilities are considered sufficient to accommodate the projected needs and demands for GSE maintenance in the foreseeable future.

AIRPORT MAINTENANCE FACILITIES

The maintenance facilities owned and operated by LA are relocated to the Eastern section of the airport grounds, in proximity to the military mobility land plot. The maintenance facilities can cater to various needs, including the upkeep of snow removal equipment. As a component of the master plan, a land plot of approximately 1.8 hectares (consistent with the current size) has been designated to the East of the military mobility project for this purpose.

AIRSIDE/LANDSIDE GATES

The main airside/landside gate is relocated to provide more queueing space on both landside and airside. A secondary airside/landside gate is planned to provide efficient access to the eastern area of the airport and the military dual use apron.

IN-FLIGHT CATERING

As requested by the client, the master plan assumes that in-flight catering facilities in the future will be located entirely off airport. This is why the master plan does not include a dedicated land plot reservation for in-flight catering facilities.

CONSOLIDATION CENTRE

The main purpose of a consolidation centre is to facilitate the efficient flow of goods from suppliers to airside restricted commercial areas for use within the passenger terminal building, and waste flows out of the airport. The master plan includes a spatial reservation for a 1,300 square metres consolidation. The location of this consolidation centre has access to the airside service road system for the most efficient operations between the passenger terminal building and the consolidation centre.

COMMERCIAL FACILITIES

Southwest in front of the passenger terminal buildings, the AirInn Vilnius Hotel is located. Within the overall plans for the reconfiguration of the landside area, the master plan includes a provision for an additional commercial area. The plot covers an area of approximately 3,500 square metres and can be effectively utilised for various commercial purposes. To determine the optimal commercial development for the plot in front of the passenger terminal building at Vilnius International Airport, it is advisable to conduct a comprehensive market study to provide insights into the local and regional market dynamics, customer preferences and emerging trends that can guide the decision-making process.

Positioned in the southern section of the airport, adjacent to the planned consolidation centre, an available plot offers strategic commercial potential. With both landside and airside access, this site is well-suited for functions like fixed base operators, in-flight catering providers, and other users seeking a facility on the landside/airside boundary.

On the eastern side of the airport, the master plan includes the reservation of two substantial land plots, each spanning 80,000 square metres, earmarked for landside commercial developments. These areas are intended to accommodate various possibilities, including warehouses and administration facilities tailored for logistics operations.

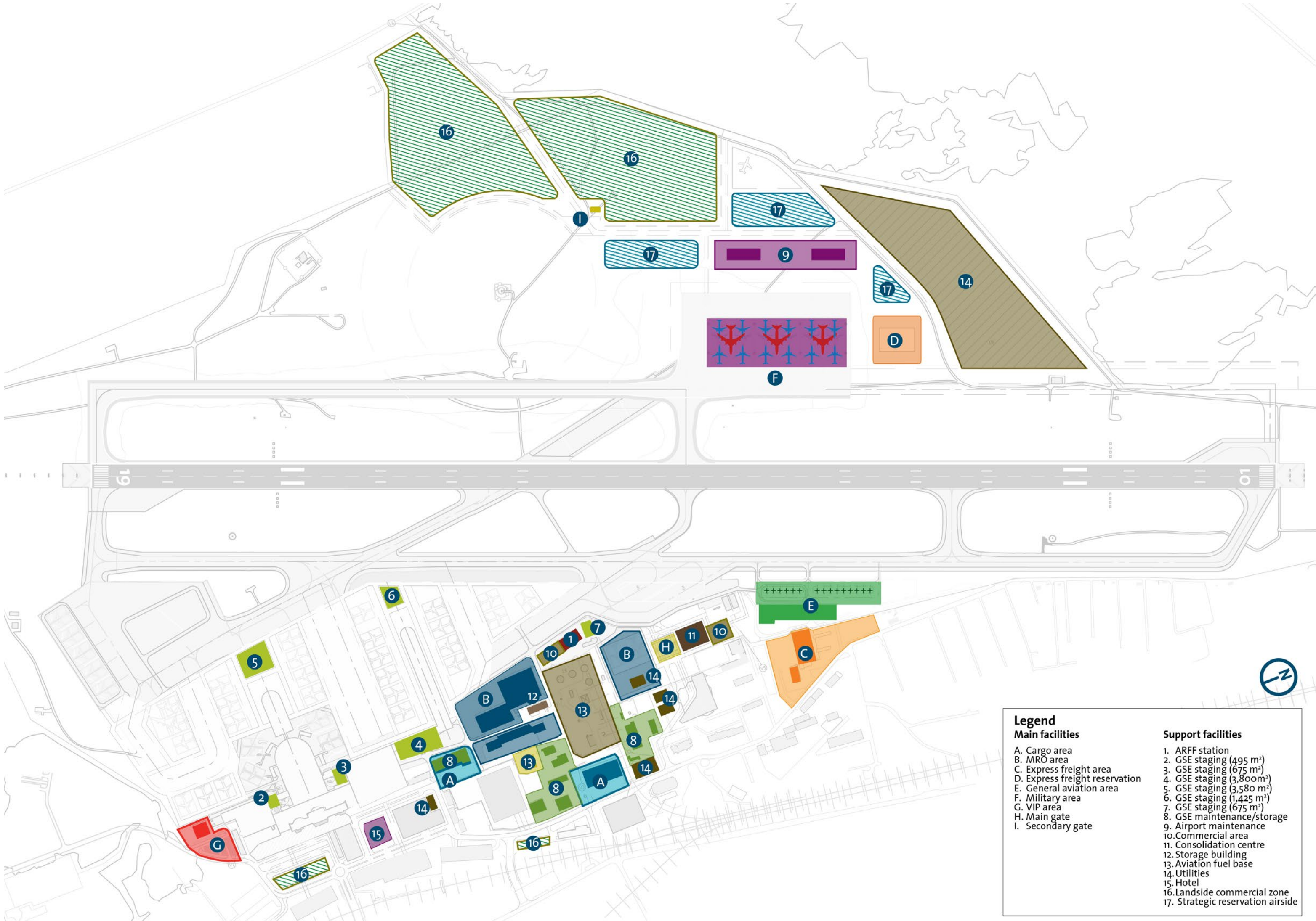

FIGURE 17 MAIN AND SUPPORT FACILITIES IN THE MASTER PLAN

Landside accessibility

The master plan prepares the landside area for the future development of the new municipality road and optimizes the kerb system. It prioritizes streamlined access to the airport support zone and introduces a secondary access road through a proposed viaduct to do so. In a dotted red line, the municipality viaduct alternatives are indicated, one for heavy traffic in the south and one for regular traffic in the north. The brown dotted line indicates an alternative municipality road in the north.

The redevelopment of the passenger terminal area will impact several at-grade parking zones (PC, P2, P3, P5, P87, P8, P15), while preserving existing structures (P1, P4, ADC) and at-grade employee parking (P6). Car rental services will continue to grow in the current P4 area due to established infrastructure and convenience. This will lead to new multi-storey parking structures to compensate for passenger parking space.

The master plan includes three new multi-storey parking facilities. The first, located south of the hotel, will offer five levels and space for e-hailing services. The second, spanning five levels, replaces the existing employee parking and serves both employees and passengers. The third, with six levels, meets passenger parking demand in the Western area. Adjustments to landside/airside boundaries will ensure proper placement.

Additionally, the plan designates a taxi buffer area and a 2,560 m² bus station for improved transportation. This comprehensive strategy sets the stage for efficient landside operations, enhanced connectivity, and optimized passenger services.

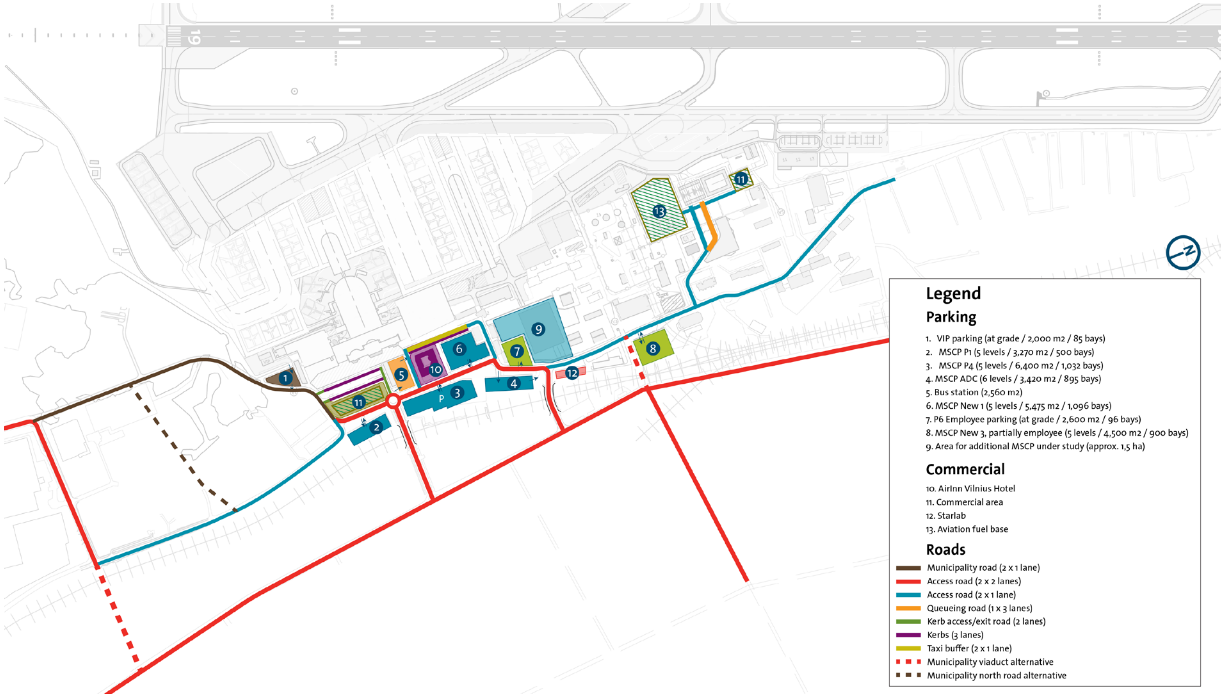

FIGURE 18 LANDSIDE ACCESSIBILITY IN THE MASTER PLAN

Utilities

POTABLE WATER

Potable water is supplied directly to VNO by the water utility company, UAB Vinniaus Vandenys. Currently, all water-consuming activities at the airport make use of potable water. Fresh water is becoming increasingly scarce, and therefore, it should be used sparingly. To reduce the overall potable water demand, non-potable water-consuming activities should be separated from activities in which the use of potable water is essential. Previously, borehole water was used for all essential potable water activities; however, due to strict water quality and monitoring requirements, VNO management decided to switch over to potable water supplied by UAB Vinniaus Vandenys. The current source of supply should be maintained; however, potable water storage tanks are to be added to increase resilience, and the existing potable water booster pump station would need to be upgraded to meet future potable water demands. In addition, the existing pipe network is to be expanded to allow connections to future airport facilities. Spatial reservations have been made in the master plan to allow for the tanks and upgrading of the pump station in the future.

WASTEWATER

Wastewater is generated at various facilities at VNO. This wastewater flows down to a central wastewater lift station before being pumped away to the Vilnius wastewater treatment plant, located a few kilometres away. This wastewater treatment plant will be upgraded in the future by the local municipality, and therefore, the current conveyance and treatment strategy should be maintained. The existing lift station will need to be upgraded to cater to future demands, and the existing pipework also needs to be expanded to allow for connections to future facilities. Spatial reservation for the upgrading of the lift station has been reserved in the master plan.

NON-POTABLE WATER

Fresh water is becoming increasingly scarce, and therefore, only essential potable water consumption activities should make use of potable water. All other water-consuming activities at VNO should make use of non-potable water where practically possible. Activities that can make use of non-potable water have been listed in the master plan. The non-potable water for these activities will be sourced primarily through rainwater harvesting and from the existing well, which has been sealed for future non-potable water-consuming activities. For this to be implemented, new infrastructure will be required, which includes rainwater harvesting tanks, groundwater storage tanks, and booster pumps. Rainwater harvesting tanks are generally small and would be located near the source of generation; as such, reservations have not been made for these in the master plan. However, depending on the number of activities that could use non-potable water, the sizes of the groundwater reservoir and booster pump could be significant, and therefore, special reservations have been allocated for these in the master plan. Furthermore, a new non-potable water network will be required, which connects the groundwater tank to the non-potable water-consuming activities.

FIREWATER

Potable water is currently used for the fire suppression systems at VNO. Presently, potable water and firewater are combined into one pipe network. The fire hydrants are connected to the potable water network, which is used to fight fires from the exterior of the airport facilities. In some of the buildings, fire sprinkler systems and hoses are employed to suppress fires, and they too are connected to the potable water network. The water used by fire hydrants and sprinklers does not require potable water; instead, non-potable water can be utilised. Rainwater harvesting systems can be implemented for the facilities that require sprinkler systems and hoses (Terminal building). For the hydrants, non-potable water from the future groundwater tank, supplied via a non-potable water pipe network, could be utilised. As mentioned in the non-potable water section, special reservations have been made for the groundwater storage tank and booster pumps, but not for the rainwater harvesting systems in the master plan.

AVIATION FUEL

VNO has an existing fuel farm, primarily supplied by a dedicated railway line that terminates within the fuel farm. The fuel farm has two large storage tanks used for storing Jet A-1 kerosene. To accommodate future demands, additional storage tanks will need to be constructed. It is expected that in the future, sustainable aviation fuel (SAF) will gradually replace the traditional Jet A-1 kerosene currently used at VNO. These two fuel types share similar chemical properties and can be mixed within the same tanks. Therefore, special fuel infrastructure is not required to store SAF. Additional fuel storage tanks are necessary at the VNO fuel farm to meet the anticipated future fuel demands. Spatial reservations have been made in the master plan to accommodate the new fuel storage tanks. Fuel is supplied from the fuel farm to the aircraft via fuel bowers, and the same supply and storage philosophy should be maintained for VNO.

DRAINAGE

Approximately 19.5% of the airport is covered with impermeable surfaces such as runways, taxiways, parking areas, service roads, and buildings. The runoff generated on these surfaces is collected by an extensive runoff collection system located on both the airside and landside. Additional impermeable areas will be added on both the airside and the landside in the future. The existing collection system is to be expanded in the future to allow for drainage connections to these areas. The northern apron was recently upgraded and now includes two dedicated de-icing runoff collection systems. This system allows runoff contaminated with de-icing fluids to be collected and directed to the future de-icing recycling plant located on the landside. The future de-icing recycling plant will recycle the contaminated runoff so that it can be reused. Runoff contaminated with de-icing fluids at Kaunas and Palanga will also be collected and transported to the new facility for recycling in the future.

HEATING

The facilities at VNO are primarily heated using hot water supplied by a local district heating company. The hot water supplied to these facilities comes from district heating plants located a few kilometres away. These plants use both sustainable and non-sustainable methods to heat the water. Some of the smaller facilities at the airport make use of heating pumps to provide heat. The district heating water network will need to be expanded in the future to allow for connections to the new facilities. Heat pumps can be added to future facilities that are small and not located near the existing district heating water pipe network.

SOLID WASTE

Waste streams generated at VNO are managed and handled in accordance with EU and national waste management legislation. Currently, VNO collects and transports all MSW to a central point located near the main parking lot in front of the terminal building. The solid waste is then transported to the processing centre JSC VAATC (EN-Vilnius Region Waste Processing Centre). Secondary waste is separated into raw materials, which are then used to generate power and heating at a local cogeneration plant. All remaining waste is disposed of in landfills. In the future, solid waste handling will be carried out at the future consolidation centre. Handling the solid waste at the future consolidation centre will ensure that the waste is efficiently, and sustainably managed, environmental impacts are minimized, valuable resources can be recovered, and public health and the environment are better protected.

ELECTRICAL SUPPLY

VNO has a dual redundant power supply that originates from two distinct power stations: Vilnius Power Plant 2 and Vilnius Cogeneration Power Plant 3. High voltage power is directly supplied from these power plants to the main power intake substation, located on the landside at VNO. This substation then distributes medium voltage power through an underground looped ring feed to various distribution substations scattered throughout the airport. These substations subsequently provide low-voltage power to the various electrical consumers at VNO. The distribution substation will need to be expanded to ensure sufficient capacity to meet future power demands. Additional distribution substations may also be required depending on load distribution. The cable network will also need to be expanded in the future to allow for connections to the future planned facilities.

SOLAR FARM

A solar plant has also been planned on the southeast side of the airport. This solar plant will help reduce peak loads during the summer months. Furthermore, VNO is taking steps to reduce its overall carbon emissions. As such, it is in the process of replacing all combustion powered GSE equipment with equivalent electrically powered GSE equipment. To facilitate this transition, charging stations have been planned at various locations at the airport.

TELECOMMUNICATIONS

The existing VNO telecom infrastructure comprises Passive IT infrastructure, Active IT infrastructure, server rooms, and mobile telecommunications. VNO possesses an extensive underground telecommunication ducting system known as outside plant, which interconnects the various facilities and equipment within the broader airport precinct. The outside plant and cables will need to be extended to establish connections with the future VNO facilities. Depending on the capacity of the existing duct network, new ducts may be necessary. The area within the existing server room may also need expansion to accommodate additional racks for storing critical data associated with new airport systems.

5. Phasing Strategy

The main objective of the VNO master plan is to reserve space. Space is required to safeguard future development flexibility and expansion in the short and in the long term. The purpose of the phasing strategy is to guide these developments in the most efficient way. This phasing strategy prevents that short-term developments will obstruct long term developments and at the same time reduces the risk of over-investment and over-capacity by a stepwise approach. The phasing strategy is divided in the following four phases:

- Phase 1 2023-2027 (6.5 MAP)
- Phase 2 2028-2032 (7.9 MAP)
- Phase 3 2033-2042 (10.6 MAP)
- Phase 4 2043-2052 (13.1 MAP)

FIGURE 19 AERIAL IMPRESSION OF THE MASTER PLAN

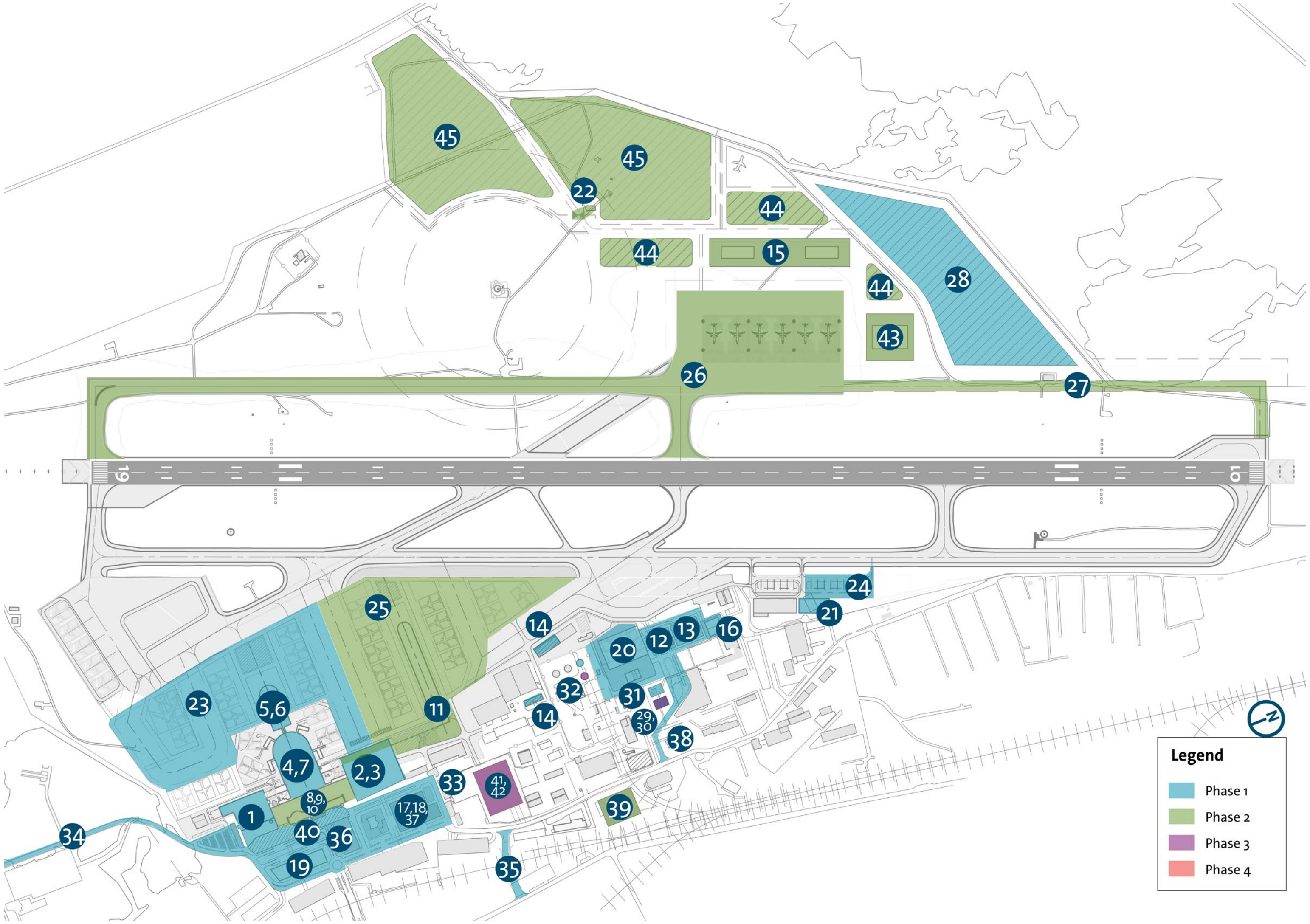

Figure 20 Phasing strategy

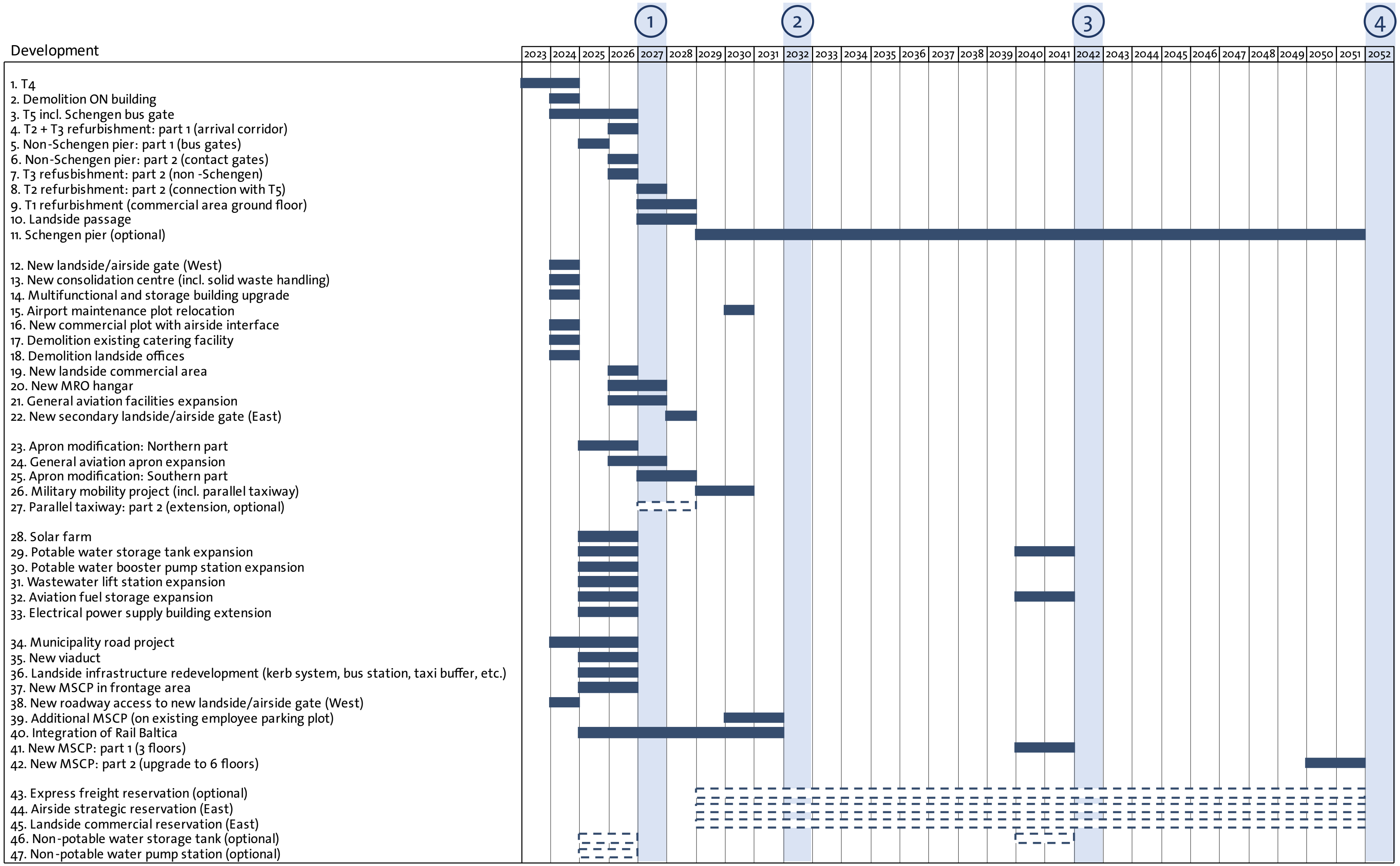

FIGURE 21 PHASING TIMELINE

6. Environmental Aspects

The environmental aspects analyses has been performed in accordance with the Directive 2001/42/EC of the European Parliament and of the Council of the European Union of 27 June 2001 on the assessment of the effects of certain plans and programs on the environment, transposed in the Environmental Law of Lithuania.

The current and general environmental impact has been assessed as moderate, with particular attention points on noise, de-icing and carbon emissions. The de-icing process is changing with the collection of de-icing fluids. This will significantly reduce its environmental impact.

In scoping this environmental assessment, three key issues (noise and its impact on residential areas, CO2 emissions and how to reach Net Zero Carbon and air quality and its impact on human health) have been particularly assessed, following the topics developed by the EU in their major vision (Zero Pollution Act) and policy initiatives (European Green Deal).

Noise impact

By 2052, it is expected that the maximum number of annual movements will be around 90.000, against 47.000 in 2019. This increase in number of movements will have an impact on the noise regulations as well as the noise footprint and its impact on residential areas.

Two EU regulations will newly applied (Environmental Noise Directive (END) (EC) 2002/49 and (EC) 2014/598 – Balanced Approach) requiring the airport to follow European guidance and approach with regards to noise management. VNO is already following or currently implementing most of the elements within these regulations (strategic noise maps, noise management action plan following the 4 pillars of the balanced approach, introduction of insulation program, optimisation of the procedure…). Moreover, the noise protection zone, that are currently pending approval, will allow development while complying with the national Hygiene Law and its maximum permissible noise limits. This will also monitor the development of the traffic and the local inhabitants exposed to aircraft noise.

While evaluating what will be the impact, a noise Modelisation using tool compliant with ECAC Doc 29 has been performed, comparing 2019 and 2052 scenarios. For 2052 scenarios, multiple sub-scenarios has been developed, in alignment with trends observed within the development of night flights when airports are increasing traffic. Therefore, the 2 sub-scenarios of 2052, are evaluating an increase in traffic forecast while maintaining night flights at the same level as 2019, these extra flights being moved respectively during the day or during the evening.

A focus on Lden 65dB(A) and Lnight 55dB(A) have been done, two thresholds of the hygiene law.

When the flights remain in the night, Lnight 55 dB(A) will be 86% larger in 2052, compared to 2019. However, when new flights are scheduled during the day or evening instead of the night, the Lnight 55 dB(A) contours will only increase slightly, namely 1%.

Focusing on the impact on population, people exposed to 55dB Lden or higher will increase from 19.500 inhabitants up to 33.000 inhabitants with 2052 standard scenario and up to 26.000 people (if extra night flights are moved to the day), 30.000 (moved to the evening). Therefore, more local inhabitants will be exposed to 55dB Lden or higher with traffic growing.

This exposition compared to other European airports remain moderate and is even lower when the development of night flight is performed in a balanced environment. Detailed measures to limit the impact are described in the main document as

TABLE 4 SURFACES OF NOISE CONTOURS FOR BEFORE AND AFTER MITIGATION MEASURES

Scenario	Lden 65 dB(A)		Lden 55 dB(A)	
	Surface (m²)	Impact	Surface (m²)	Impact
2019	3,167,260		5,583,400	
2052	6,267,267	+ 97%	10,420,055	+ 86%
2019 (night to day)	4,567,057	+ 44%	5,638,378	+ 1% *
2052 (night to evening)	5,356,037	+ 69%	5,638,378	+ 1% *

examples of measures to go further in limiting noise impact.

Impact on CO2 and air quality

The impact on CO2 and air quality is directly correlated to the increase in traffic, the local emissions coming in majority from the LTO (landing and take-off) cycle.

While a set of regulations are being taken with regards to CO2 emissions, at the European level, there are various legislation regarding air quality (e.g. 2008/50/EC, 2008/1/EC, 2001/81/EC) but none of them are specifically targeted to airport-related emissions. In the future, with the science evolving on this topic, this could change and to prepare for more stringent legislation and to pioneer in working conditions for ground staff, there are measures that VNO can already implement.

First, it is recommended that VNO monitors its emissions impacting air quality (CO, NOx, VOS, SO2, PM10, PM2.5) using sensors. These sensors should be placed strategically around the airport as to measure the concentration of these emissions, both at the runway thresholds and at places under the flight paths. Furthermore, as to limit the impact of temporary meteorological and therefore to get exploitable results, it is advised to conduct this study at different times of the year.

There are two specific points worth mentioning related to the development at LA airports:

- Increase in nitrogen emissions by latest/newest generation aircraft
- Health impact of UFP for ground staff

These points are being developed in the main report.

Becoming 'zero-emissions'

In 2021, European airports have committed to reach Net Zero carbon emissions by 2050 as well as the full aviation sector. To prepare for this objective, the European Union put forward the Green Deal, the backbone of the European decarbonisation strategy. For the transport sector, a milestone is to be reached in 2030 where emissions must have reduced of 55% against a 1990 baseline. Table 5 summarises the legislation that VNO will be impacted by, as of now, when it comes to its sustainability policy.

VNO, should therefore prepare its infrastructure, in alignment with this set of regulation (GPU at stands, access to airport by rail mode…).

Moreover, LA has committed to Net Zero by 2050 for its 3 airports: Vilnius, Kaunas and Palanga and should provide their roadmap to ACI Europe by May 2024 at the latest, including an intermediate step of being carbon neutral by 2030.

Being Net Zero Carbon, in the ACA program and for ACI, means reducing its own emissions (i.e. Scope 1 and scope 2 emissions) as much as possible[1].

TABLE 5 IMPACTING LEGISLATION

Legislation	Emission targeted	Vilnius
Energy efficiency **Energy building performance** Expected to be adopted Q3 2023 **dates are yet to be set by the European legislator*	New building Net Zero emissions	2030
	Solar panels on roof of new/existing buildings*	~ 2030
AFIR Expected to be adopted Q3 2023	GPU at contact stands	2025
	GPU at remote stands	2030
	EV chargers (along TEN-T network)	2025 +
Refuel EU Expected to be adopted Q4 2023	All measures	2025
TEN-T Provisional agreement expected by the end of 2023	PCA at contact stand	2030
	Access to airport by rail mode	2040

[1] According to the European Commission mobility plan, Net Zero emission means a reduction of 90% of Carbon emissions against a 1990 baseline (resource.html (europa.eu))

Three main sources of (scope 1 and scope 2) emission are present at VNO:

- Electricity: to achieve the European Net Zero ambitions and the Lithuanian airports ambition to produce, on site, 100% green electricity for its consumption, it is necessary to foresee local electricity supply. The installation of a solar farm on the airport facilities and investing in power purchase agreements with wind farms is among the preferred solution.
- Transport: progressively replacing light vehicles with electric vehicles and purchase HVO100 for heavy vehicles before the introduction of a more mature solution seems to be most suitable at this stage
- thermal energy: VNO is connected to the grid and Vilnius city has as ambition to become Net Zero by 2050 and therefore is transitioning to biofuel. Emission reduction potential may vary depending on the feedstock used, the energy (green or grey) used for the production pathway (from raw material to biofuel). VNO will need to declare the emission reduction provided by the heat supplier.

VNO is ACA Level 3. Therefore some of the scope 3 emissions are calculated and a stakeholder engagement plan is already being developed. Moreover, airport have a role of guiding and influencing its stakeholders to reduce scope 3 emissions. This influence might impact the infrastructure in the future and especially with the introduction of fossil-fuel free aircraft.

Future aircraft

Radical changes to aircraft are required to meet sustainability targets. There are multiple sustainable aviation technologies in development, which all have their own specific relevance in terms of aircraft size and range. Airports should prepare for these new technologies. The Alliance for Zero-Emission Aviation (AZEA) is currently developing guidelines for airports how to prepare infrastructure for future aircraft. The table below identifies the benefits and concerns of the new technologies.

Some of the first highlighted infrastructure requirements are developed in the core document. This topic being currently in constant development, it is strongly advised to follow the latest developments in the near future.

Other aspects

The other aspects of the environment and in particular water, waste, biodiversity have been evaluated and the impact will remain low with the foreseen developments. Some examples to lower the impact as developing waste management strategy to reduce waste under circular economy principles, install a pond for non-potable water use are detailed and could be explored further.

TABLE 6 BENEFITS AND CONCERNS OF NEW AIRCRAFT TECHNOLOGIES

	Electric flight	Hydrogen	SAF
Benefits	• 100% emissions reduction (when using green energy) • Commercially available • Small adjustments to infrastructure	• 100% emissions reduction • No limit on capacity and range	• No infrastructural adjustments required • Commercially available • No limit on capacity and range
Concerns	• Limited capacity and range • High electricity demand • Medium-term solution • Medium TRL	• high energy demand • Long-term solution • Low TRL • Safety	• Not fully eliminating emissions • Availability is limited • High price • Land use impacts

7. Financial Analysis

CAPEX

The total airport cost consists of the direct cost and 30% of indirect cost. The presented cost is for the master plan proposed developments based on the high forecast scenario. Some facilities are excluded from the Capex as they are considered third party investments. These are:

- Military mobility related infrastructure
- Commercial developments such as hotels
- MRO, GA and cargo hangars
- Digital towers
- Fuel storage tanks.

In VNO, the terminal development is the biggest cost driver. The cost for the airside and landside developments (parking) is also considerable.

The capital expenditure is an order of magnitude cost estimate with an accuracy variance of minus 50% to plus 50% for the master plan phase of the project.

Table 7 Key projects and major costs per phase

Key projects	Cost
Phase 1 (2023-2027)	178 million EUR
Terminal T5	50 million EUR
Non-Schengen pier	18 million EUR
Bus parking, MSCP near hotel	19 million EUR
Solar farm	16 million EUR
Apron refurbishment	26 million EUR
Taxiway refurbishment	13 million EUR
Miscellaneous	26 million EUR
Phase 2(2028-2032)	74 million EUR
Apron refurbishment	10 million EUR
Terminal passage, T1 refurbishment & train connections (part of costs, approx. 10 million already in phase 1)	30 million EUR
MSCP near new viaduct	14 million EUR
Electric substations	14 million EUR
Miscellaneous	13 million EUR
Phase 3 (2033-2042)	46 million EUR
Schengen pier	32 million EUR
MSCP in the west	14 million EUR
Phase 4 (2043-2052)	14 million EUR
MSCP in the west (expansion)	14 million EUR

Table 8 Capital expenditure for VNO per category and total

Description		Cost	
Enabling works		EUR	1,814000
	Demolition work	EUR	1,057,000
	Land preparation	EUR	126,000
	Earth works	EUR	631,000
Airside infrastructure		EUR	60,519,000
	Taxiways	EUR	15,568,000
	Aprons	EUR	39,093,000
	Airside ground vehicle infrastructure	EUR	5,858,000
Main terminal building		EUR	131,095,000
Airport support facilities		EUR	5,002,000
	Support facilities	EUR	4,689,000
	Airport security and fences	EUR	313,000
Landside infrastructure		EUR	69,974,000
	Road infrastructure	EUR	9,355,000
	Parking	EUR	59,760,000
	Other landside developments	EUR	859,000
Utility systems		EUR	27,027,000
	Power supply	EUR	18,256,000
	Water supply and discharge	EUR	7,590,000
	Solid waste handling	EUR	480,000
	Special systems and communication	EUR	701,000
Commercial developments		EUR	16,140,000
Total direct cost		EUR	311,571,000
Indirect cost	30%	EUR	93,471,000
Total cost		EUR	405,042,000

Operational cash flow projections

As part of the master planning exercise, a financial analysis has been carried out as well, including the development of operational cash flow projections.

By combining these operational cash flows with the estimated capital expenditures associated with the master plan, insight is provided into the overall profitability of the master plan project as well as any funding requirements. The added value of extending the forecasting and planning work into a financial model is that through this the financial impact of the capacity development scenario is made transparent.

Projections have been prepared for the main operational cash flows, i.e. aeronautical revenues, non-aeronautical, or commercial revenues, and operating expenditures. The approach to project operating revenues and expenses consists of the following two steps:

1. Reconcile and analyse historic data: based on the collected data and to the extent data has been made available, an overview has been made of the historic development of revenue and cost items.
2. Projection of operational cash flows: After creating the basis for the cash flow projection as described above, the second step is the actual projecting of the cash flows based on projected changes in key drivers. For each main operating revenue and cost item, the governing drivers are selected and weighted to the extent that these drivers affect revenues and cost items.

Aeronautical revenues

For the use of the airport infrastructure as well as for certain on-demand services, airports typically levy a set of airport charges and fees to its main users, i.e. the airlines and passengers. In order to avoid airport operators abusing their monopoly position, airport charges are typically regulated. At the Lithuanian airports, a light-handed regulatory regime is in place, where adjustments to the system of charges are proposed by the airport and subsequently reviewed and approved by the governing authorities.

Historical aeronautical revenues increased from EUR 12.9 million in 2015 to EUR 27.1 million in 2019, equivalent to a compound annual growth rate of 20.4%. Factors driving the growth in aeronautical revenues achieved during this period include a strong, double-digit growth in passenger traffic, an increase in passenger service charge in 2018 as well as a reduction in the overall discount provided based on the incentive scheme.

Like elsewhere, the onset of COVID-19 and subsequently introduced travel restrictions had a significant impact on passenger volumes at VNO as well. Aeronautical revenues consequently suffered a dramatic decline as well, decreasing by almost two-thirds from Eur 27.2 million in 2019 to 9.7 million in 2020. In line with a gradual recovery of traffic, aeronautical revenues started to rebound as well, although revenues in 2022 were still almost 20% below 2019-levels.

Forecasts of aeronautical revenues are primarily a function of (i) air traffic activity levels, particularly in terms of passengers, aircraft movements, and fleet mix driving maximum take-off weight, (ii) the development of the published aeronautical fees and charges, and (iii) the discounts and incentives offered to the airlines serving both airports.

Without strict regulatory oversight and guidance, the airport charges have been evaluated from a market point of view. While airlines are currently enjoying a strong financial year, indicating potential scope for an increase in the airport charges, this has to be considered in the context of VNO's competitive position in the region as well as airline profitability at the airport.

Both factors do not show overwhelming evidence that airport charges can be increased without a potential capacity response from particularly the low-cost carriers. However, similar to the recent increase in the passenger service charge, a one-time increase of 10% in passenger service charge is assumed in 2028 to compensate for the investment cost as well as higher operating cost associated with the envisaged terminal expansion. In return, airlines can benefit from increased capacity and improved service levels.

An otherwise conservative indexation assumption has been adopted that enables VNO to further grow its airline portfolio and network.

Total aeronautical revenues are predicted to recover to Euro 25.2 million by 2023, which is still 7.2% below the Euro 27.2 million achieved in 2019. Beyond 2023, aeronautical revenues are expected to have doubled by 2030 compared to 2023, totalling Euro 52.3 million, while at the end of the planning period, total aeronautical revenues are expected to reach Euro 111.1 million, equivalent to a compound annual growth rate of 5.2%. For comparison, passenger traffic is expected to increase by 3.2% over the same period. Adjusting for inflation, real aeronautical yield, i.e. aeronautical revenue on a per-passenger basis, gradually improves from Euro 5.7 per passenger in 2023 to Euro 7.8 in 2052.

Non-aeronautical revenues

In addition to the aeronautical activities described in the previous section, Vilnius Airport also generates revenues from the various non-aeronautical, commercial activities. This includes operations in the fields of retail (both duty free and specialty retail), food & beverage and advertising activities as well as car rental, car parking, VIP lounges and rents. Except for advertising and car parking, the airport has currently outsourced the primary non-aeronautical commercial activities, such as F&B, retail, and car rental, to third-party concessionaires. As of 2024, the operations of the car parking facilities will be outsourced as well.

Total non-aeronautical revenues increased from Euro 7.4 million in 2015 to Euro 13.6 million in 2019, equivalent to a compound annual growth rate of 16.2%; during the same period passenger traffic increased at an average annual rate of 11.0%. As a result of the COVID-19 pandemic impacting passenger traffic in 2019 and 2020, commercial revenues dramatically decreased as well. Despite traffic volumes not fully recovered yet, commercial revenues in 2022 were approaching the same level as in 2019.

The commercial yield, i.e. the commercial revenue on a per-passenger basis adjusted for inflation, has historically hovered around Euro 3.5 per passenger, with the exception of 2020 and 2021, when yield was significantly higher. While the airport handled a dramatically lower traffic base in both years, the airport still generated a significant amount of revenues that were relatively independent of passengers, such as the rental payments. As a result of the lower traffic base, revenues on a unit basis consequently were higher.

Non-aeronautical revenues (yields) generally increase as traffic volume increases. Vilnius Airport receives a share of the revenue from its concessionaires operating within retail, F&B and from 2024 also car parking, through concession fee agreements.

For the financial projections of Vilnius Airport, the concept of weighted average CF% was utilised in order obtain a single value. It was calculated based on the income generated in 2019, being the last normal year before COVID, from the different duty free and retail categories according to their sales volume and respective CF%'s. The EU vs. non-EU passenger mix is based on provided year-to-date traffic figures through mid-July 2023 to the current, most accurate reflection of the traffic composition vs. the post-COVID revenue potential.

Regarding the income generated from duty free sales, there is deemed to be potential for higher CF% on products in the categories of spirits and tobacco sold to non-EU passengers, as well as for P&C products sold to both EU and non-EU passengers. Traditional retail CF% (non-core categories) ought to remain around 20% to make it attractive for local operators and alternative business models. Special attention should be paid to total retail portfolio when adding new units to commercial areas – in order to prevent cannibalisation amongst concessionaires.

Weighted average CF for retail (duty free and traditional retail combined) is currently 21,7%. Increases in CF% on specific categories within five years, in connection with contract re-negotiations or new tender, would drive weighted average CF% to 23.5% - with a potential further increase to 25% driven by a second contract re-negotiation or new tender.

For F&B, there is potential for CF% in the span of 17-27%, with an average of 22% due to the standardised operations and offerings in airport F&B units. Margins on products in the coffee and bakery categories, which usually make up the most sold F&B products, can be up to 80% or more which underlines the potential for a higher average CF% imposed.

The management of the advertising services at Vilnius Airport are currently kept in house - decision should be revisited in advance of the year 2029 when new investments are needed in the current digital infrastructure from 2019, as an international OOH partner is deemed to enable Vilnius Airport to boost average revenue per passenger, versus current performance.

The car parking administration has recently been outsourced for a 10-year period. LA should continuously evaluate the managerial set-up regarding the parking services to understand whether the operational synergies of administering three airports would generate more revenue than applying a third-part operator. The topic should be revisited in 2029, after the first five year of the contract, and again well in advance of the contract expiry in 2034.

Operating expenditures

For the day-to-day operations and maintenance of the airport, the airport incurs operating expenses (OPEX). The total OPEX increased from Euro 11.6 million in 2015 to Euro 20.1 million in 2022, equivalent to a CAGR of 8.1%. While the revenues were substantially impacted by the COVID-19, OPEX decreased by 29.1% in 2020. This demonstrates relatively strong fixed nature of most of the OPEX categories.

In 2022, the share of staff OPEX comprised 50.9% and it was the largest single OPEX item. Staff expenses increased by 33% in 2022 compared to the prior year which was driven by the growth of the employee numbers (fulltime equivalents) as well as variable remuneration compensation which did not take place since 2021 due to COVID-19. Projections of future staff cost at VNO are generated by making assumptions on the number of FTEs required to handle future traffic volumes in conjunction with forecasts of the salary and other staff-related cost. FTEs are forecast to double from 380 in 2022 to 777 employees by 2052.

Operational costs are the second largest OPEX item and the major non-staff OPEX component. Between 2021 and 2022, operational expenses increased by more than 60% which was due to sharp increase in energy and utilities expense (+104%), transport cost (+41.9%, driven by increase in fuel prices) and property maintenance (+60%). Projections of future non-staff cost at VNO are generated by making assumptions on respective cost drivers and elasticity factors.

Total OPEX is forecast to increase from Euro 20.1 million in 2022 to Euro 74.7 million in 2052, equivalent to a CAGR of 3.8%. In real terms, the costs are expected to reach Euro 43.6 million, or a CAGR of 2.3%, which is lower than passenger traffic CAGR of 3.4%, indicating economies of scale occurring as a result of a fixed-based nature of certain OPEX items. This is also evident from the real OPEX per passenger evolution throughout the forecast period. It is forecast to decrease from Euro 5.7 per passenger in 2022 to Euro 4.0 in 2052.

CAPEX

Certain elements of the initial capital expenditures plan have been intentionally neglected in the financial analysis. Specific investments funded by third parties (e.g., MRO developments) do not relate to capacity needs, and as a consequence, they necessitate the development of distinct business cases to analyse their feasibility. On the other hand, maintenance costs have been incorporated to the financial analysis. The resulting cumulative CAPEX over the forecast period for the base scenario is Euro 595 million in nominal terms.

EBITDA and Funding Requirements

Combining the forecasts of operating revenues with the operating expenditures provides insight into the airport's operational profit, i.e. EBITDA. Long-term EBITDA margin is expected to be around 61% which is near the upper range of the benchmark

Combining the forecasts of EBITDA with the capital expenditures illustrates to what extent the cash flow from operations can finance the investments or if there are additional funding requirements. Total funding requirements amount to Euro 99 million associated with the capital expenditure program of Euro 595 million envisaged over the entire planning period.