EXECUTIVE SUMMARY

CURITIBA INTERNATIONAL AIRPORT
AFONSO PENA
SBCT/CWB

November/2020

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INTRODUCTION

The Infrastructure Ministry published, in the Union Official Journal, in the Edition Number 52, on March 18th, 2019, the Public Call Notice 2/2019, with the main goal to select projects, surveys, investigation and technical studies to subsidize the modelling of the concessions for the expansion, exploitation, and maintenance of the following airports:

South Cluster

Curitiba/PR – Afonso Pena;
Foz do Iguaçu/PR – Cataratas;
Navegantes/SC – Ministro Victor Konder;
Londrina/PR – Governador José Richa;
Joinville/SC – Lauro Carneiro de Loyola;
Bacacheri/PR;
Pelotas/RS;
Uruguaiana/RS – Rubem Berta;
Bagé/RS Comandante Gustavo Kraemer.

North Cluster

Manaus/AM – Eduardo Gomes;
Porto Velho/RO – Governador Jorge Teixeira de Oliveira;
Rio Branco/AC – Plácido de Castro;
Cruzeiro do Sul/AC;
Tabatinga/AM;
Tefé/AM;
Boa Vista/RR – Atlas Brasil Cantanhede.

Central Cluster

Goiânia/GO – Santa Genoveva;
São Luís/MA – Marechal Cunha Machado;
Teresina/PI – Senador Petrônio Portella;
Palmas/TO – Brigadeiro Lysias Rodrigues;
Petrolina/PE – Senador Nilo Coelho;
Imperatriz/MA – Prefeito Renato Moreira.

According to the Public Call Notice 2/2019, the Grupo de Consultores em Aeroportos (GCA) presented the following reports for each airport: **Market Reports, Engineering Studies, Environmental Studies and Economic and Financial Evaluation**. Furthermore, it presented a complementary Economic Financial and Evaluation Report, for each Cluster, which aimed the economic financial feasibility assessment of the airports that form the Cluster.

The purpose of the Executive Summary is to present the main arguments, information and conclusions of each one of the Curitiba International Airport/PR Afonso Pena – SBCT/CWB report. For a better understanding of the studies, it is recommended the reading of the reports.

1 MARKET REPORT

This section presents a Summary of the Market Report for the **Curitiba – PR Airport – Afonso Pena** (IATA CWB or ICAO SBCT), the 12th busiest airport in Brazil, having processed 6.3 million passengers in 64 thousand operations, in addition to 29 thousand tons of cargo in 2018[1]. Currently, only two airports not under concession operate more passengers than SBCT: São Paulo/Congonhas (SBSP) and Rio de Janeiro/Santos Dumont (SBRJ).

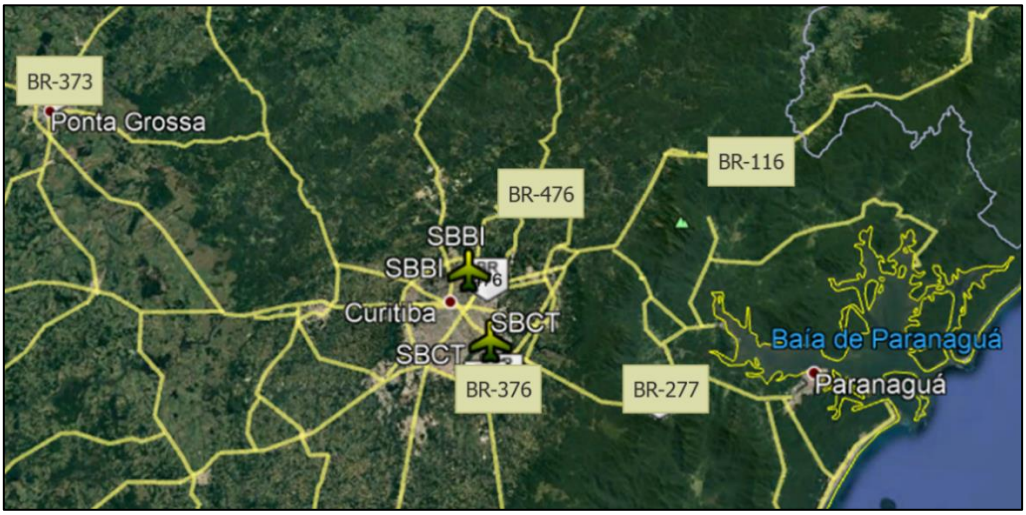
1.1 Overview

The Afonso Pena International Airport lies in the municipality of São José dos Pinhais, in the Metropolitan Curitiba Region, and conurbates with the Paraná state capital. Curitiba is the eighth most populous city in Brazil[2] and its Metropolitan Region includes developed industrial facilities, with particular emphasis on the automotive industry. The city also has an advanced services industry and tourist attractions like the Civic Center and the Botanical Garden.

As Figure 1-1 shows, the Airport lies close to the Ports of Paranaguá (75 km), the seaport with the third largest handling volume in Brazil, and Antonina (78 km). Paranaguá has facilities for large agribusiness operations, in addition to facilities dedicated to general cargo, both in containers and bulk, and liquid bulk operations.

SBCT also lies 130 km distant from the city of Ponta Grossa, which is relevant in terms of both population and the economy, with particular emphasis on the slaughtering business and soybean milling.

Figure 1-1: Curitiba, surroundings and highways



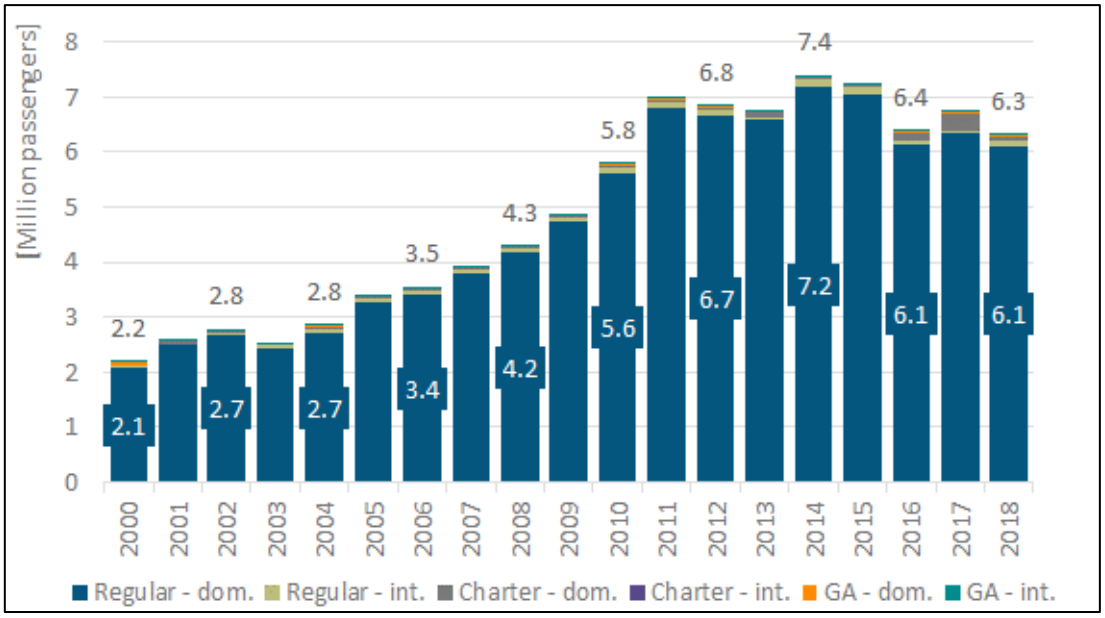
Source: Google Earth.

Therefore, Metropolitan Curitiba is a strong source of demand for SBCT, whose number of passengers handled more tripled from 2000 to 2011, when 7.0 million passengers went through it. From 2011 to

[1] Sources: ANAC and INFRAERO statistics.
[2] Source: https://cidades.ibge.gov.br/brasil/pr/curitiba/panorama. Estimated population in 2019.

2018, total passengers oscillated, peaking at 7.4 million in 2014, and then decreasing to 6.3 million in 2018 (6.1% average annual growth rate from 2000 to 2018).

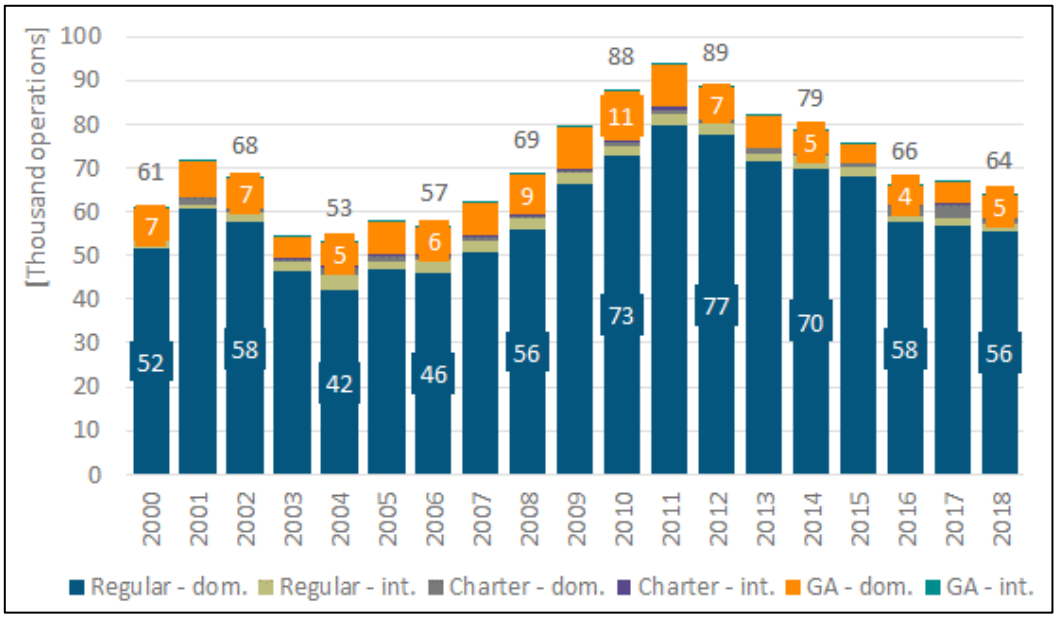
Figure1-2: Passenger history (origin, destination and connections) for the Airport



Source: INFRAERO.

The Airport had 64 thousand operations in 2018, of which 86% were regular domestic flights, 8% were domestic general aviation, and 3% were regular international (Figure1-3). The drop seen in 2011-2018 is mostly the result of the pattern seen in the Figure1-3 and of increased average aircraft size.

Figure1-3: Annual operations history (landings and take-offs) at the Airport



Source: INFRAERO.

In 2018, the Airport had 18 regular domestic routes[3] to every Brazilian Region, except the North, as Figure1-4 shows (line thickness reflects relative route frequency)

Figure1-4: Map of the Airport's domestic routes in 2018

Source: OAG and ANAC.

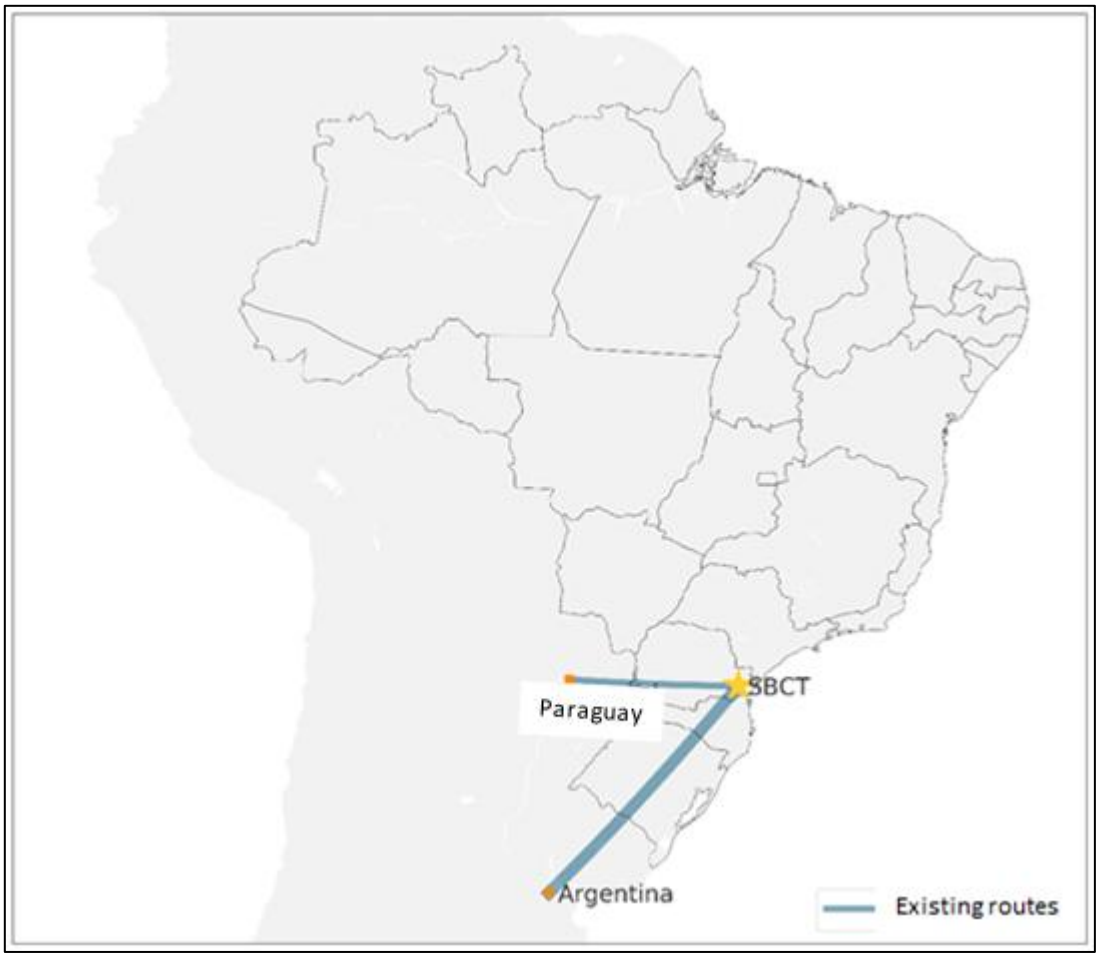
In 2018, 21% of all domestic passengers at SBCT had their origin/destination at Congonhas (SBSP), 13% at Guarulhos (SBGR), and 10% at the Porto Alegre Airport (SBPA). In addition, an estimated 78% of domestic passengers at SBCT flew on direct flights, while 22% had stops.

Concerning international routes, SBCT currently has flights to Paraguay (SGAS) and Argentina (SABE and SAEZ).Figure1-5 shows SBCT's international routes in 2018 (line thickness reflects relative route frequency).

[3] Only considers routes with twice-weekly or greater frequency (SBBR, SBCA, SBCF, SBCG, SBCY, SBFI, SBFL, SBFZ, SBGL, SBGR, SBKP, SBLO, SBMG, SBPA, SBRF, SBRJ, SBSP and SBSV).

BACCO CPEA INFRAWAY ENGENHARIA MP Moysés & Pires Sociedade de advogados Proficenter TERRAFIRMA

Figure1-5: Map of the Airport's international routes in 2018



Source: OAG and ANAC.

The main final destinations for SBCT's international passengers are Buenos Aires (Argentina), Santiago (Chile), and Miami (USA). Because of the currently small number of international routes, 92% of international passengers with origin or destination at SBCT must connect elsewhere, mostly at the Guarulhos Airport.

Regarding the pandemic impacts, it stands out that the airport continued to receive flights from the essential airline network and, therefore, never had its operations completely interrupted. However, the demand in March and April 2020 were, respectively, 59% and 4% of the previous year.

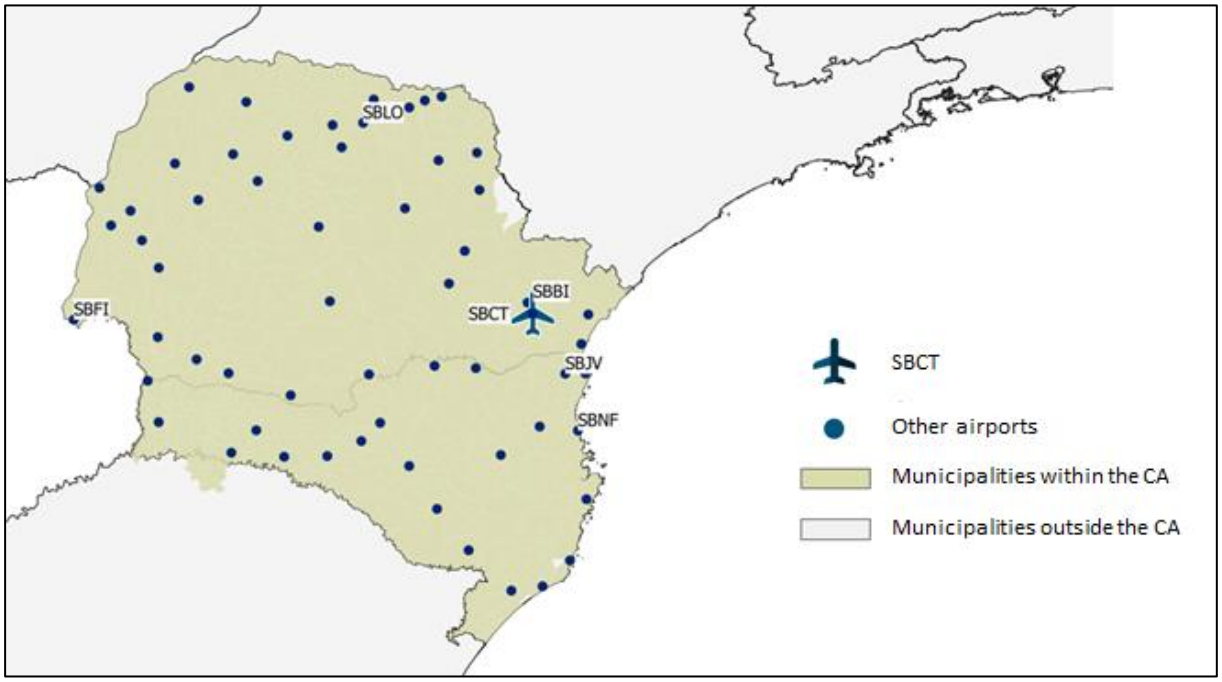
Concerning cargo handling, the airport handled 29 thousand tons in 2018, of which 16 thousand in the holds of commercial passenger flights and 13 thousand on freight aircraft (of which 3 thousand was postal cargo). The airport recorded 894 freighter operations in 2018, of which 592 were domestic and 302 international.

Catchment area

SBCT's Catchment Area (CA) is defined based on the "City Catchment Areas" ("Regiões de Influência das Cidades" – REGIC)[4] study, by the Brazilian Geography and Statistics Institute (IBGE), which comprehensively covers a range of economic and socio-cultural aspects of the population.

According to the REGIC, Curitiba is a Metropolis that influences Florianópolis and several important cities of the Paraná State interior, such as Londrina, Maringá and Foz do Iguaçu, and in the Santa Catarina State interior, like Joinville and Navegantes. Overall, the Curitiba CA, which Figure1-6 shows, covers more than 650 municipalities and 295 thousand square kilometers in total area.

Figure1-6: Airport CA according to the REGIC



Source: REGIC, ANAC and GCA Consortium.

To forecast the Airport's volumes and demand profile, the CA was adjusted to compatibility with the effective passenger catchment area according to the origins and destinations survey published in the study Brasil Que Voa (BQV), which EPL[5] conducted in 2014.

The BQV reveals that the airport is a departure site for passengers from Paraná and neighboring states, particularly nearby regions in northern Santa Catarina, like Joinville, São Bento do Sul and Mafra. Although Joinville and the more important cities in western Paraná State (Londrina, Maringá and Cascavel) are equipped with airports flying commercial operations, a significant percentage of SBCT's passengers come from these cities.

[4] Source: IBGE. *Regiões de Influência das Cidades 2007*, IBGE, Rio de Janeiro, 2008. The IBGE has published other and more current Urban-Territorial Division studies, but they reference the same hierarchical review of municipalities as produced for the 2007 study, that is, their hierarchy is simplified, but consistent with the one in the 2007 study.
[5] EPL is a Federal-government agency focused on country-wide transportation & logistics planning.

1.2 Demand forecasts

The Airport's demand has been forecast based on multivariate regression analyses whose parameters have been selected by means of tests with several potential independent variables for each flow analyzed.

1.2.1 Passengers

Domestic passengers

To forecast domestic passengers with origin or destination in the Catchment Area[6], the study ran regressions using Brazil's GDP and the CA's average fares, adjusting GDP elasticity in the long term based on the passengers-to-per-capita GDP ratio of large countries to reflect the reduction of the marginal propensity to fly as average income increases.

Once domestic demand had been forecast for the CA, the study distributed it across competing airports based on their historic market shares, among other factors. Finally, compatibility adjustments were made between forecast demand and 2019 volumes; additional consistency adjustments were made with international passenger forecasts[7] and adjustments regarding the COVID-19 pandemic.

Connecting and layover[8] passengers were forecast as function of the Airport's increased airline-network capillarity and domestic connections rate benchmarks.

International passengers

All international airports in Brazil compete for this passenger flow. Therefore, Brazilian demand is initially forecast based on Brazil GDP, World GDP, average airline fare in Brazil and international QAV[9] price, also adjusting for long-term GDP elasticity and considering the effects of the demand reduction due to the COVID-19 pandemic.

Then the method forecasts SBCT's total passengers with international origins or destinations, regardless of whether on international (direct) or domestic (indirect) flights. Then the study estimates the evolution of the percentage demand from direct international flights departures, both in existing routes and in routes to be created over the duration of the concession. This phase of the forecast is integrated with the aircraft routes and operations forecast described ahead.

For SBCT, the international passenger projection also took into account the runway system's range constraints, as will be discussed.

General aviation passengers

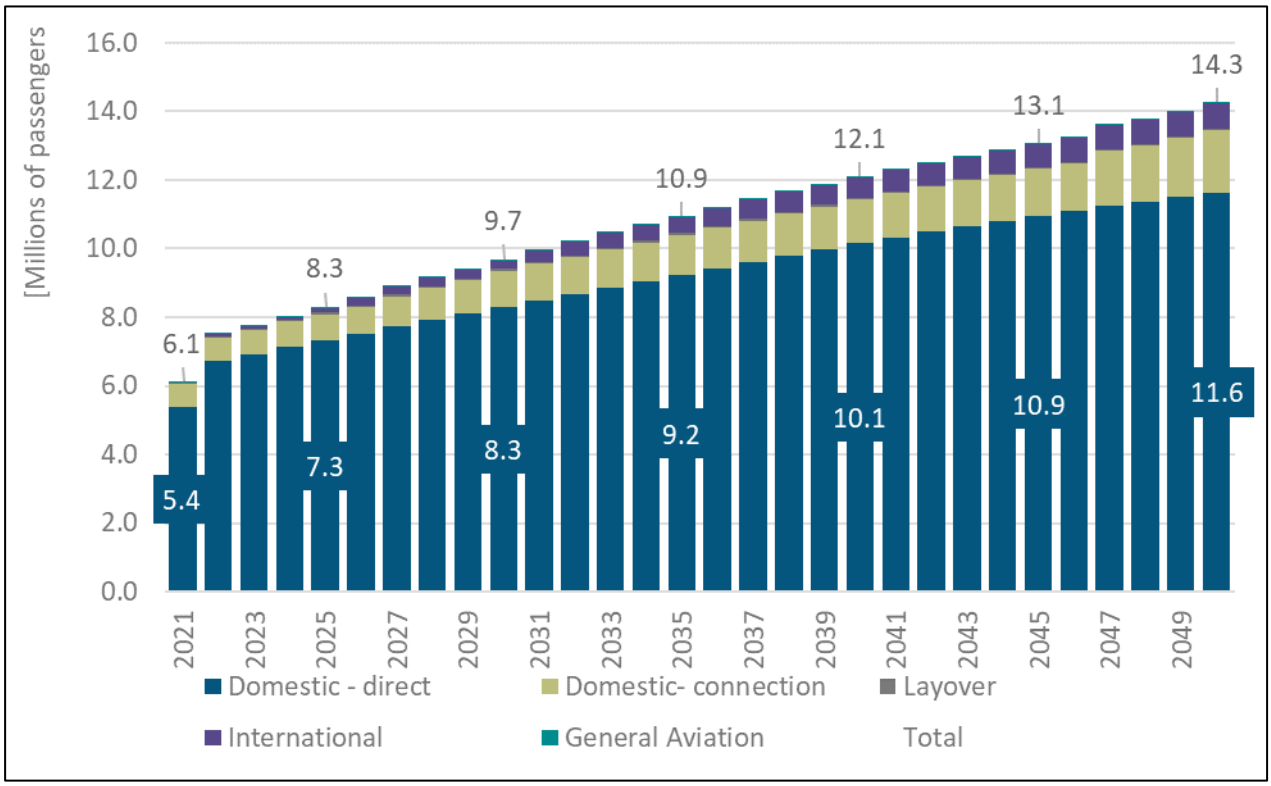
For general aviation passengers, the report first forecasts total aircraft operations based on several independent variables, such as Industrial GDP and Brazilian fleet (taking into account the effects of the pandemic). Then total passengers are estimated based on usual pax/operation parameters.

[6] Includes the Joinville and Ponta Grossa Airports.
[7] Because a share of domestic passengers have international origins or destinations, the creation of international routes at the Airport over time requires domestic forecast adjustments, with the replacement of domestic passengers with international ones associated with the routes created, and the addition of domestic passengers for international connections.
[8] Passengers who do not deplane at the Airport and therefore generate no fee revenues.
[9] Jet fuel.

Total passengers

Figure1-7 shows the consolidated results of the above forecasts. Total passengers at SBCT will grow 3% p.a. from 2021, the first year of the concession, and 2050, the final year of the concession, at which time 14.3 million passengers are expected.

Figure1-7: Total passengers forecast at the Airport by flow type



Source: GCA Consortium.

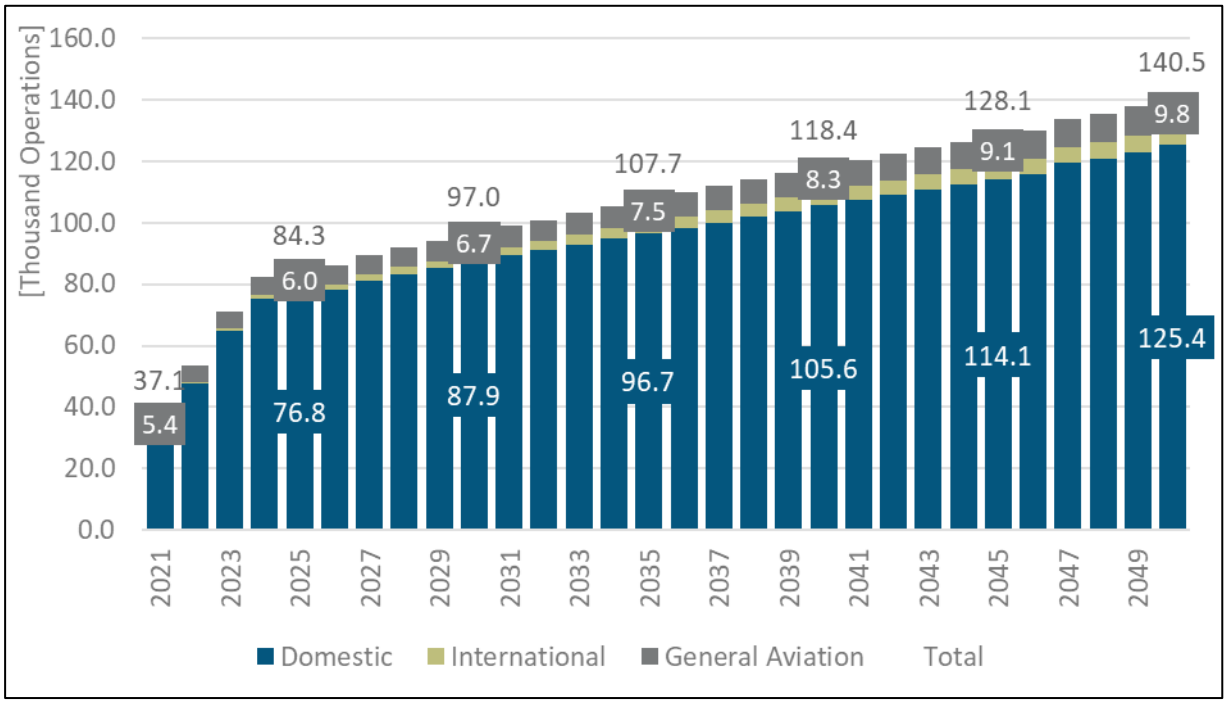
1.2.2 Aircraft operations and airline network

Domestic and international aircraft operations

Commercial aircraft operations were forecast based on passenger flows by origin-destination (OD) pairs, load factor, and aircraft mix, and are related with the evolution of the Airport's airline network. As demand increases, routes that existed before the pandemic are restored and new routes become feasible (the triggers for route creation vary according to the distance and allocated aircraft type) – therefore, the mix and number of aircraft evolves in harmony with the forecast airline network.

The study forecasts that in 2050, the final year of the concession, the Airport will record 125 thousand domestic and 5.3 thousand international commercial aviation operations with annual average growth rates of 4.9% and 8.0%, respectively. For general aviation, 9.8 thousand operations are forecast in 2050, a growth of 2.1% p.a.

Figure1-8: Total annual Airport operations forecast



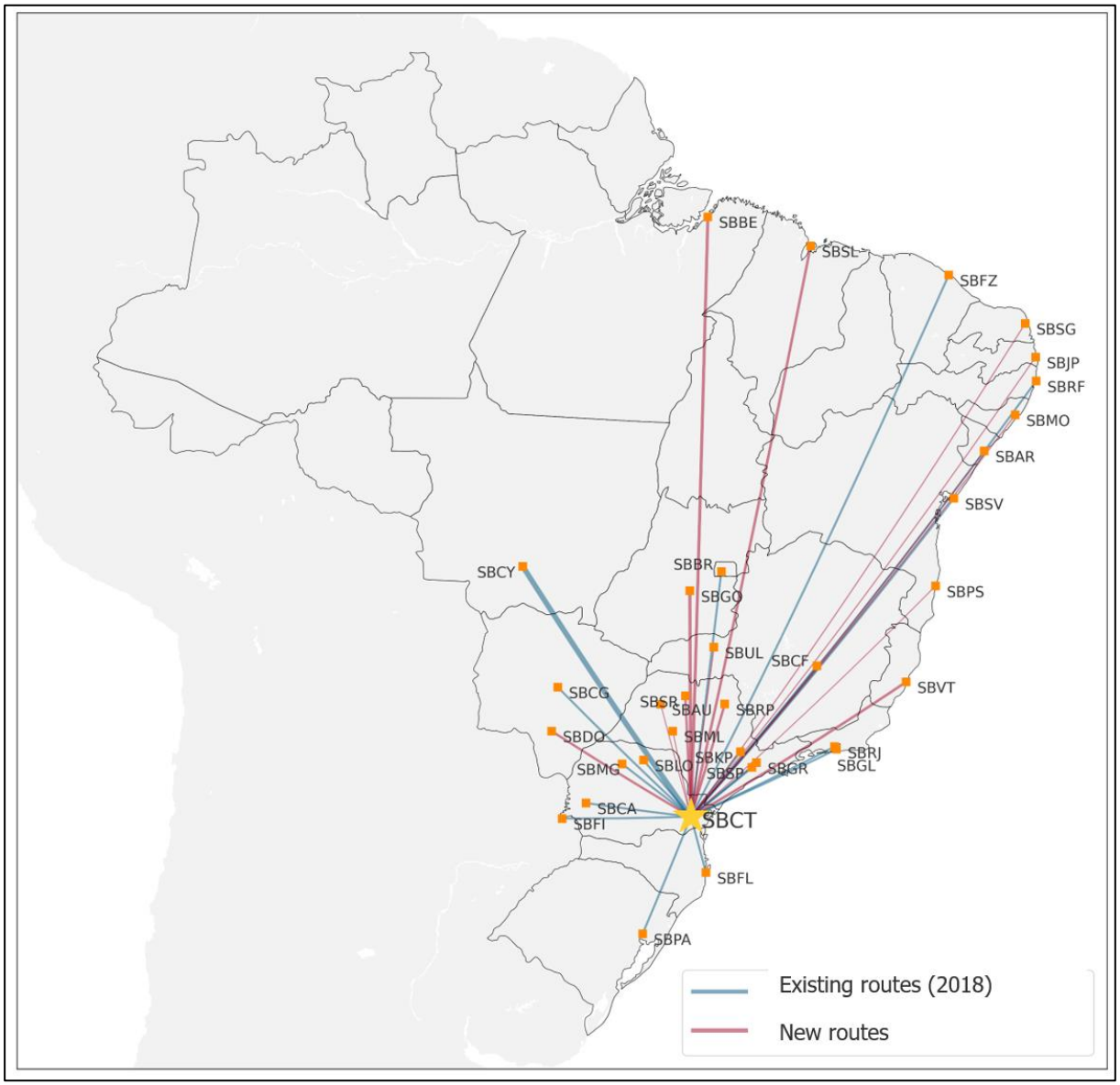
Source: GCA Consortium.

Airport insertion in the airlines network

A privileged location and a diversity of sources of demand enable SBCT to serve as a regional hub with high domestic connectivity, linking the Paraná State capital with the main domestic economic and demand-generating hubs, as well as with cities in the Paraná state interior.

During the concession, new connections between SBCT and as-yet unserved state capitals are expected as well as with regions with tourist attractions or significant farming activities such as Paraná State itself. As Figure1-9, shows, the number of connected domestic destinations from SBCT in Brazil is expected to almost double from 2018 to 2050, from 18 to 34.

Figure1-9: Domestic commercial routes in 2050



Source: GCA Consortium.

As for the international network, it is expected that routes to Argentina and Paraguai will be restored. In addition, new routes to Chile, Uruguai, North America and Europe will arise between 2018 and 2050, as displayed in Figure1-10.

Figure1-10: International commercial routes in 2050

Source: GCA Consortium.

1.2.3 Peak demand and restrictions

The Airport's main systems have been sized to meet demands at more intense flow times, so that users will receive appropriate service levels according to previously established criteria and, no severe operational and economic impacts will take place.

For Passenger Terminal (PT) areas and processors at airports flying more than one million passengers per year, like SBCT, the applicable service level criterion is based on the 30th busiest hour of the year. The results have been calculated for 2018 based on INFRAERO records and forecast according to domestic peak-factor benchmarks (peak demand/annual demand).

Table 1-1: 1-hour peak demand (30th event) at the Airport – Baseline year, concession start and concession end

Nature	Flow	2018	2021	2050
Domestic	Departure	1,141	775	1,540
	Arrival	1,048	712	1,415
	Connecting	176	119	238
	Simultaneous	1,921	1,304	2,593
International	Departure	121	64	439
	Arrival	121	64	439
	Connecting	0	0	0
	Simultaneous	154	82	559
Simultaneous	Departure	1,142	772	1,578
	Arrival	1,052	711	1,454
	Connecting	176	119	243
	Simultaneous	1,922	1,300	2,656

Source: INFRAERO and GCA Consortium.

For the runway system, the report considers maximum commercial aircraft operations per hour over a period of one year. As with passengers, the forecast embraces peak-factor benchmarks. It has been forecast that the Airport will have a peak of 28 commercial aircraft runway operations per hour in 2050.

General Aviation flows on the runway are also monitored, and operations are accommodated in the same peak hour or at times of lower demand, if necessary.

Dimensioning also considers peak usage of apron positions based on 2018 maximum usage records and peak factor benchmarks. According to the forecasts, a minimum 32 apron positions will be required by the end of the concession period.

Given the various systems' capacities (see Engineering Report), the study assesses potential restrictions on forecast demand. For the PT and apron systems, no restrictions on growth are expected in the light of the Airport's forecast improvement and expansion works.

Given the various systems' capacities (see Engineering Report), the study assesses potential restrictions on forecast demand. No restrictions on growth are expected in the light of the Airport's forecast improvement and expansion works.

1.2.4 Cargo

Concerning international cargo and based on regression analyses and INFRAERO, ANAC and Comexstat data, forecasts show export and import flows reaching 11 thousand (1.5% p.a. growth) and 24 thousand tons in 2050, respectively. For the same year, 3 thousand freighter aircraft operations are expected.

Domestic freight and postal flows are estimated based on the Airport's market share[10] of volumes forecast for Brazil. By the end of the concession period, 30 thousand tons of domestic freight and 5 thousand tons of postal volumes are forecast.

Both cargo traffic projections, international and domestic, consider the impact of the pandemic due to the restriction on people movement, to the economic downturn and to the changes in consumption behaviors.

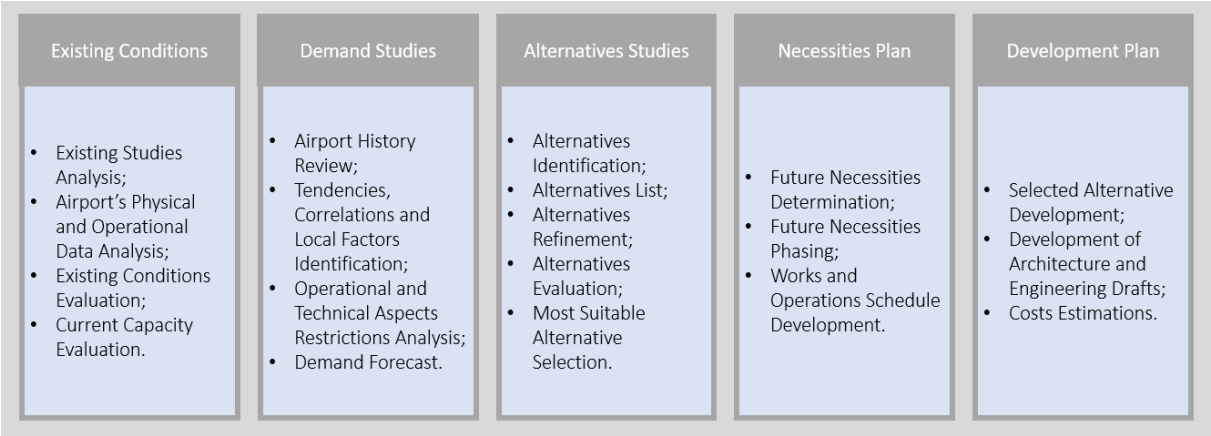
[10] Based on ANAC data.

2 ENGINEERING STUDIES

This section presents the Executive Summary of the Engineering Studies for the concession of the Curitiba International Airport/Afonso Pena – SBCT/CWB.

The Engineering Studies Report has been developed according to the methodology presented in Figure 2-1.

Figure 2-1: Study Methodology



Source: GCA Consortium.

Below, in brief explanations, the results and premises of each phase of the studies are presented. For further details, please check the complete studies report.

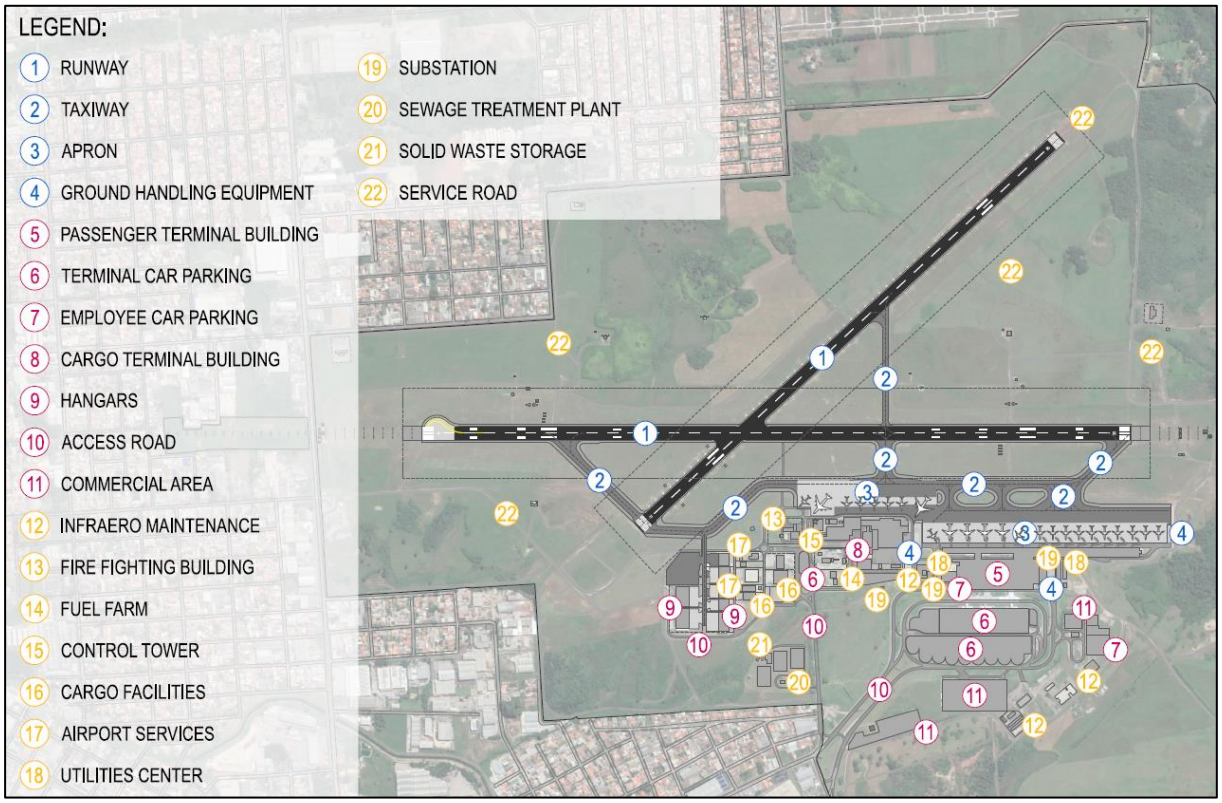
2.1 Existing Conditions

2.1.1 Current Situation

The current situation characterization is extremely important for an appropriate development of the Airport Site. Through it, it's possible to have an accurate understanding of the existing restrictions and opportunities for the expansion of the Airport complex. Among other aspects, the comprehension of the current situation involves operational, security, legal and social-environmental matters.

In order to characterize the present situation, it has also been evaluated the current operation and it has been done the identification of the existing infrastructures, by on-site visits, and of the main development plans and available studies. The Figure 2-2 illustrates the identification of the main existing facilities.

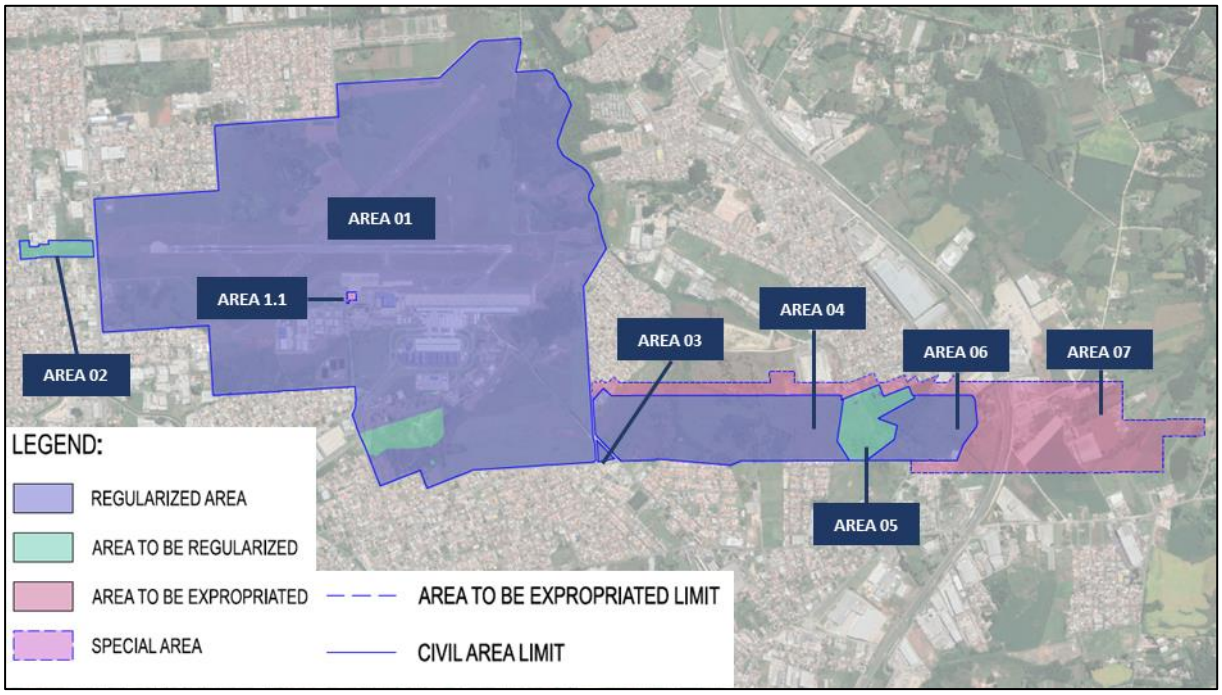
Figure 2-2: Current Facilities Situation



Source: GCA Consortium.

Furthermore, regarding the present patrimonial situation, it should be noted that the airport under study is in a patrimonial area divided in regularized area, area to be regularized and area to be expropriated. The regularized estates belong to the Federal Union in possession of INFRAERO. Now the estates to be regularized are properties of the Paraná State and third parties, going through the transference process, and the areas to be expropriated are under private third parties possession. The Figure 2-3 presents the patrimonial situation of the Airport.

Figure 2-3: Patrimonial Limits of the Airport Site



Source: Google Earth, GCA Consortium.

Currently, there are works in progress at the Airport, whose projects have been approved by INFRAERO. The most important goal of these works is the implementation of the mandatory signs, besides the infrastructure adaptations in the existent runways, patrimonial limit's walls and maintenance on the runway pavement. According to the SAC/MI guidance until the start of the concession period, the ongoing works must proceed. From this date on, the remaining services must be completed by the concessionaire and the remaining costs considered in the financial modeling of this study. Since the works in the Airport are expected to be completed until this date, there won't be residual costs related to these works to be considered by CAPEX.

2.1.2 Installed Capacity Evaluation

The analysis of the installed capacity is one of the phases in the existing conditions evaluation process. In this stage are evaluated the capacity conditions according to the appropriate levels of service. Thus, it has been developed the capacity assessment for all airport systems. The installed capacities of the main systems are presented below.

2.1.2.1 Runway, Taxiway and Apron System

Table 2-1 and Table 2-2 summarize the results obtained from the installed capacity analysis and the existing demand for the runaways, taxiways and aprons systems. The taxiways were assessed based on geometric width and code of the aircraft design restrictions.

Table 2-1: Runway Capacity

Component	Current Capacity	Demand	Situation
Runway (mov/h)	30,2	20	Suitable

Source: GCA Consortium.

Table 2-2: Taxiways Capacity

Taxiway	Width (m)	Width Without Shoulders (m)	RBAC154 Code	Critical Aircraft	Situation
Taxiway A	44	23	F	A332	Suitable
Taxiway B	45	24	F	A332	Suitable
Taxiway C	44	23	F	A332	Suitable
Taxiway D	15.5	15.5	B	CRJ2	Suitable
Taxiway E	44	23	F	A332	Suitable
Taxiway F	44	23	F	A332	Suitable
Taxiway G	46	25	F	A332	Suitable
Taxiway H	46	25	F	A332	Suitable
Taxiway M	57	36	F	A332	Suitable
Taxiway N	78	57	F	A332	Suitable

Source: AIP, GCA Consortium.

In order to measure the current capacity of the main aircraft aprons, the static and dynamic capacities were analyzed for five different scenarios. Each scenario prioritizes the maximum use of the most restrictive aircrafts, or rather, the occupying positions F, E, D and C in descending order of priority. The Table 2-3 shows the static capacity for the five scenarios evaluated.

- Scenario 1: Aircrafts code F, E, D, and C operating simultaneously, in descending order of priority;
- Scenario 2: Aircrafts code E, D and C operating simultaneously, in descending order of priority;
- Scenario 3: Aircrafts codes E and C operating simultaneously, in descending order of priority;
- Scenario 4: Aircrafts Codes D and C operating simultaneously, in descending order of priority;
- Scenario 5: Only aircrafts code C operating.

Table 2-3: Aprons Static Capacity

Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Boarding Bridge Positions	F/E/D/C	E/D/C	E/C	D/C	C
A	0	0	0	0	0
B	0	0	0	0	0
C	10	10	14	10	14
D	4	4	0	4	0
E	0	0	0	0	0
F	0	0	0	0	0

Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Remote Stands	F/E/D/C	E/D/C	E/C	D/C	C
A	0	0	0	0	0
B	0	0	0	0	0
C	8	8	10	8	12
D	1	1	0	2	0
E	0	1	1	0	0
F	1	0	0	0	0
Positions (Remotes + Boarding Bridges)	F/E/D/C	E/D/C	E/C	D/C	C
A	0	0	0	0	0
B	0	0	0	0	0
C	18	18	24	18	26
D	5	5	0	6	0
E	0	1	1	0	0
F	1	0	0	0	0
Total Boarding Bridges	14	14	14	14	14
Total Remote Stands	10	10	11	10	12
Total Number of Stands	24	24	25	24	26

Source: PDC Chart, GCA Consortium.

In order to evaluating the hourly dynamic capacity of the main apron, the static capacity obtained by the average occupation time of each aircraft code for the same scenarios was considered, obtaining the total dynamic capacity, as shown in Table 2-4.

Table 2-4: Aprons Dynamic Capacity

Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Average turning time (min)	F/E/D/C	E/D/C	E/C	D/C	C
A	15	15	15	15	15
B	25	25	25	25	25
C	45	45	45	45	45
D	75	75	75	75	75
E	85	85	85	85	85
F	130	130	130	130	130

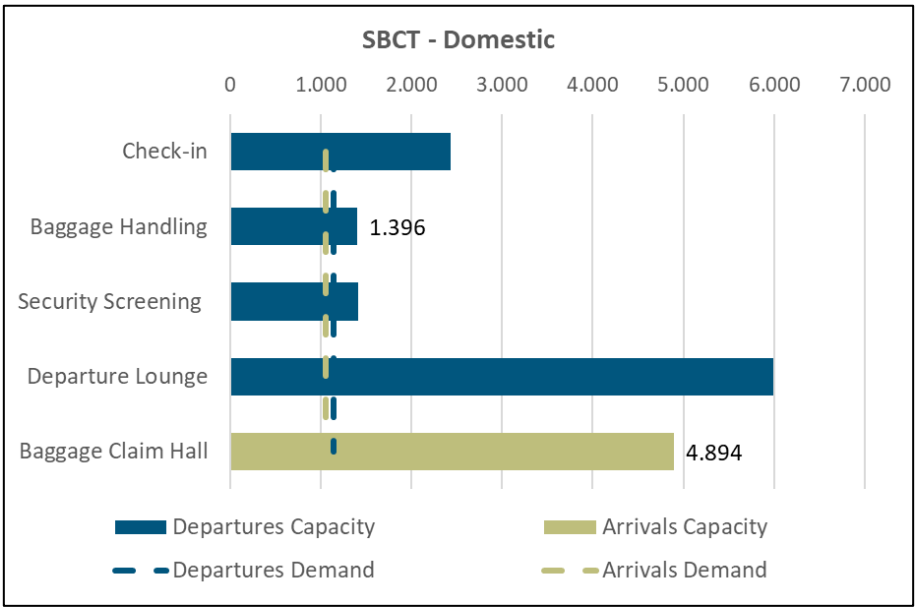
Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Capacity	F/E/D/C	E/D/C	E/C	D/C	C
A	0	0	0	0	0
B	0	0	0	0	0
C	24	24	32	24	35
D	4	4	0	5	0
E	0	1	1	0	0
F	0	0	0	0	0
Total	28	29	33	29	35

Source: GCA Consortium.

2.1.2.2 Passenger Terminal System

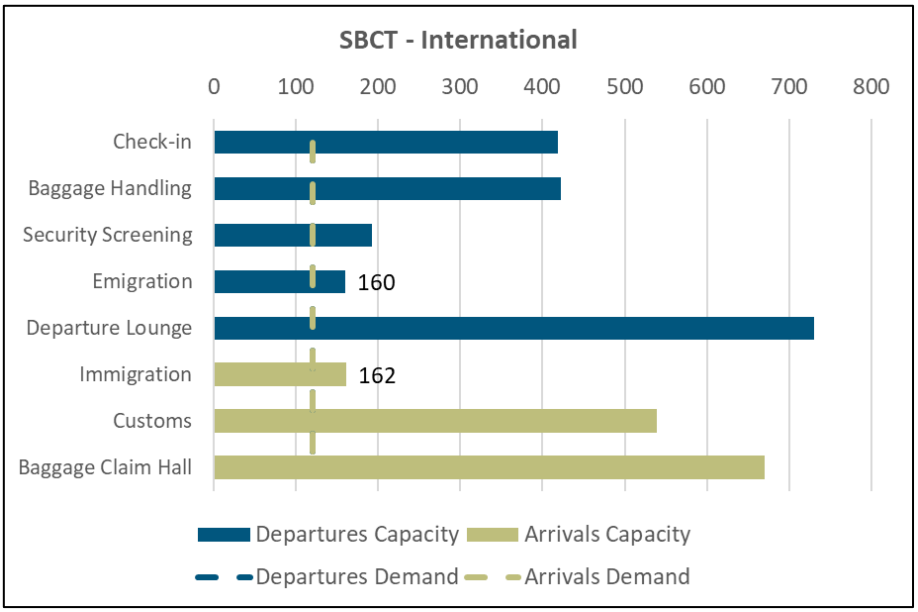
Figure 2-4, Figure 2-5 and Figure 2-6 summarize the results obtained from the installed capacity and the existing demands of the departures and arrivals flows. The components of the terminal were evaluated considering the international and domestic segments.

Figure 2-4: Terminal's Components Capacity – Domestic



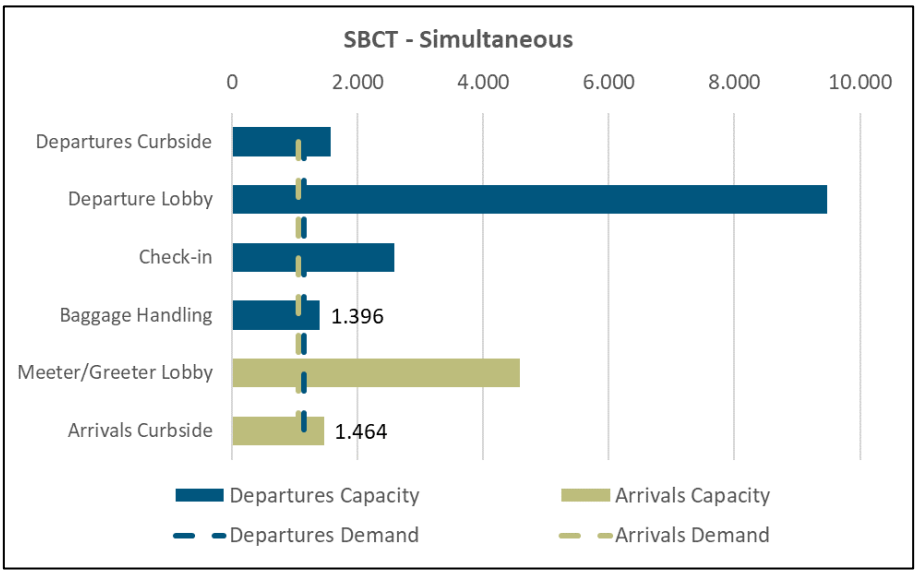
Source: GCA Consortium.

Figure 2-5: Terminal's Components Capacity – International



Source: GCA Consortium.

Figure 2-6: Terminal's Components Capacity – Simultaneous



Source: GCA Consortium.

2.1.2.3 Other Facilities

Regarding the current condition of other systems, the following observations can be noticed, about the present situation described on Table 2-5.

Table 2-5: Other Components Capacity Summary

Component	Facilities Description
Aeronautical Infrastructure	• **Operation:** presents technical capability for day/night non-precision VFR/IFR operation for both threshold at the auxiliary runway (11/29), day/night IFR accuracy CAT II for threshold 15 (main runway) and IFR day/night accuracy CAT I for threshold 33 (main runway). With PAPI system at Runway 15/33, one at each threshold, and an AVASIS system at threshold 11, the Runway is capable of landing jet aircraft by both thresholds.
Cargo Terminal System	• **Cargo Terminal Building:** suitable to current demand. • **Airside Aprons:** not suitable to current demand. • **Landside Aprons:** suitable to current demand. • **Cargo Terminal Parking:** suitable to current demand.
General Aviation System	• **General Aviation Terminal:** there is no General Aviation Terminal currently and as the demand is less than 25,000, the sector is suitable to current needs. • **General Aviation Aprons:** suitable to current demand. • **General Aviation Hangars and Aprons:** suitable to current demand. • **General Aviation Terminal Parking:** suitable to current demand.
Administration and Maintenance System	• **Administration:** suitable to current demand. • **Maintenance:** suitable to current demand.
Operation Support System	• **Fuel Farm:** suitable to current demand. • **Fire Fighting Installations:** suitable to current demand.
Airlines Support System	• **Cargo Processing:** suitable to current demand. • **Airlines Support Maintenance:** not suitable to current demand. • **Maintenance and Hangars:** not suitable to current demand.
Industrial Support System	• **Mail:** not suitable to current demand. • **Catering:** does not apply, there is no specific area at the airport. • **Airport Services:** not suitable to current demand.
Basic Infrastructure System	• **Electric Power:** suitable to current demand. • **Water Consumption:** suitable to current demand. • **Sewage Treatment:** not suitable to current demand. • **Solid Waste:** suitable to current demand.

Source: GCA Consortium.

2.2 Demand Studies

In order to evaluate the current capacity to accommodate the forecast demand and the investments needs over the concession period, market reports and forecasts of passenger demands, aircrafts

operations and freight have been developed. The Figure 2-7 shows the results of the studies of demand.

Figure 2-7: Demand Forecast Summary

Source: Market Reports.

2.3 Necessities Plan

Given the demand projections and the installed capacity, the infrastructures required to meet the expected demand were evaluated for all airport systems. The following Figure 2-8, shows a summary of infrastructure needs for the airport throughout the development stages considered for the period of analysis. The requirements of each stage are based on the existing infrastructure in face of the projected demand. Thus, the installed infrastructures have been kept, reallocated or expanded according to the anticipated needs.

Figure 2-8: Necessities Plan

SBCT	Phase 1	Phase 2	Phase 3
Airside System			
Runway	Intervention	Suitable	Suitable
Taxiways	Intervention	Intervention	Intervention
Aprons	Intervention	Intervention	Intervention
Ground Handling Equipments	Intervention	Intervention	Intervention
Passenger Terminal System			
Passenger Terminal Building	Intervention	Intervention	Intervention
Car Parking	Suitable	Suitable	Suitable
Access Roads	Intervention	Suitable	Suitable
Aeronautical Infrastructure			
Navigation Aids	Intervention	Suitable	Suitable
Air Cargo Terminal System			
Air Cargo Terminal Building	Suitable	Suitable	Suitable
Car Parking	Suitable	Suitable	Suitable
Access Roads	Suitable	Suitable	Suitable
General Aviation System			
General Aviation Terminal Building	Suitable	Suitable	Suitable
Aprons and Taxiways	Suitable	Suitable	Suitable
Car Parking	Suitable	Suitable	Suitable
Access Roads	Suitable	Suitable	Suitable
Administration and Maintenance System			
Administration	Suitable	Suitable	Suitable
Maintenance	Intervention	Intervention	Suitable
Operations Support System			
Fuel Farm	Suitable	Intervention	Intervention
Firefighting Building	Intervention	Suitable	Suitable
Airlines Support System			
Air Cargo and Maintenance Facilities	Intervention	Intervention	Intervention
Maintenance and Hangars	Suitable	Suitable	Suitable
Industrial Support System			
Mail	Intervention	Suitable	Suitable
Catering	Intervention	Intervention	Intervention
Airport Services	Intervention	Intervention	Intervention
Basic Infrastructure System			
Eletric Power	Intervention	Suitable	Suitable
Water Consumption	Intervention	Intervention	Intervention
Sewage Treatment	Intervention	Intervention	Intervention
Solid Waste	Suitable	Suitable	Suitable

Source: GCA Consortium.

Furthermore, an infrastructure needs summary for the airport with its main information and components over the 30 years considered for the analysis period is presented in Table 2-6.

Table 2-6: Main Components Necessity Summary

SBCT	Current	Phase 01	Phase 02	Phase 03
DEMAND	**2018**	**10 Years**	**20 Years**	**30 Years**
Annual Passengers Movements				
Regular Aviation	6,270,945	8,178,054	10,139,036	12,009,448
General Aviation	21,888	24,833	30,764	36,121
Total	20,518	27,473	35,203	41,212
Cargo (tons)				
Total	20,518	27,473	35,203	41,212
Aircraft Movements				
Passengers	58,005	90,262	110,082	130,693
Air Cargo	1,804	2,122	2,475	2,796
General Aviation	5,781	6,719	8,319	9,764
Total	65,590	99,103	120,875	143,253
RUNWAY SYSTEM				
Design Aircraft Code	E	E	E	E
Number of Runways	2	2	2	2
Runway Length (m) [1]	PPD 1: 2.218 PPD 2: 1.798	PPD 1: 2.218 PPD 2: 1.798 PPD 3: 3.000	PPD 1: 2.218 PPD 2: 1.798 PPD 3: 3.000	PPD 1: 2.218 PPD 2: 1.798 PPD 3: 3.000
Operation Type	PA2	PA2	PA2	PA2
APRON SYSTEM				
Passengers Apron [2]				
Contact Stands	10C 4D	13C 2D 1E	14C 2D 1E	15C 2D 1E
Remote Stands	8C 2E	12C 1E	15C 1E	17C 1E
Total Number of Stands	18C 4D 2E	25C 2D 2E	29C 2D 2E	32C 2D 2E
Cargo Apron [2]				
Total Number of Stands	6C 2E	2D 2E	2D 2E	2D 2E
PASSENGERS TERMINAL SYSTEM				
Departure Peak Hour Capacity	1,396	1,614	1,614	1,614
Arrival Peak Hour Capacity	1,464	1,487	1,487	1,487

SBCT	Current	Phase 01	Phase 02	Phase 03
Terminal Building				
Total Area (m²)	77,160	79,990	79,990	79,990
Baggage Handling System				
Processing Capacity (bhp)	1,054	1,243	1,521	1,671
Car Parking				
Total Area (m²)	124,310	124,310	124,310	124,310
Number of lots	4,191	4,191	4,191	4,191
Curbside				
Departure Curbside Length (m)	300	249	277	302
Arrival Curbside Length (m)	280	229	255	278
Total Length (m)	580	478	533	580
Ground Handling Equipment				
Total Area (m²)	5,250	6,230	7,170	7,930
CARGO TERMINAL SYSTEM				
Cargo Terminal Building Area (m²)	15,460	15,460	15,460	15,460
GENERAL AVIATION SYSTEM				
General Aviation Terminal (m²)	-	-	-	-
Total Number of Stands	-	6	6	7
General Aviation Terminal Car Parking	-	-	-	-
Hangars and Aprons Area (m²)	37,000	37,000	37,000	37,000
ADMINISTRATION AND MAINTENANCE SYSTEM				
Administration [3]				
Total Area (m²)	5,730	2,274	2,274	2,274
Maintenance				
Total Area (m²)	7,205	6,275	7,275	7,275

SBCT	Current	Phase 01	Phase 02	Phase 03
OPERATION SUPPORT SYSTEM				
Fuel Farm				
Total Area (m²)	12,000	12,000	14,600	17,500
5-day storage (m³)	1,731	2,615	3,190	3,780
Fire fighting Building				
Category	9	9	9	9
Total Area (m²)	8,220	15,220	15,220	15,220
AIRLINES SUPPORT SYSTEM				
Maintenance Area (m²)	290	9,290	11,290	13,290
Cargo Processing Area (m²) (4)	11,580	11,580	11,580	11,580
Aircraft Maintenance Area (m²)	-	-	-	-
INDUSTRIAL SUPPORT SYSTEM				
Mail Area(m²)	30	630	630	630
Catering Area (m²)	-	3,000	4,500	5,250
Airport Services Area (m²)	5,450	9,450	11,450	13,450
BASIC INFRASTRUCTURE SYSTEM				
Water Tank (m³)	2.220	2.370	2.920	3.440
Solid Waste Area (m²)	712	712	712	712
Electric Power Area (m²)	3.343	3.693	3.693	3.693
Sewage Treatment Units (5)	- (6)	4	7	10

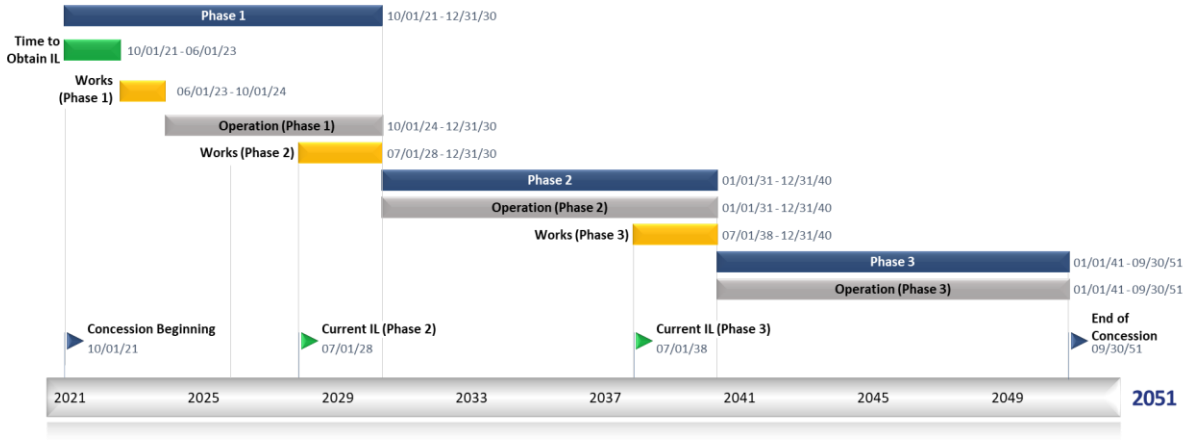
(1) It's been considered the Landing Distance Available (LDA).
(2) The cargo apron can be reversible, that means, shared with the commercial aviation.
(3) The area can be considered inside the PTB.
(4) Area can be considered inside the PTB or Cargo Terminal Building.
(5) Compact Sewage Treatment Unit, D70 model.
(6) Currently the airport has an area of 7,680 m² designated to Sewage Treatment Units.

Source: GCA Consortium.

After scheduling needs, based on the capacity of the airport systems, it was possible to define for each component when the interventions should be initiated, so that the service level can be maintained throughout the period.

Considering the concession starts in 2021, it's estimated a 20-month period to get the installation licenses (IL) necessary to start the works. After obtaining those licenses, the work can be started. Thus, as a result of the interaction of several planning elements, the work and operation phases were set, as shown in Figure 2-9.

Figure 2-9: Phasing and Works Estimated Schedule



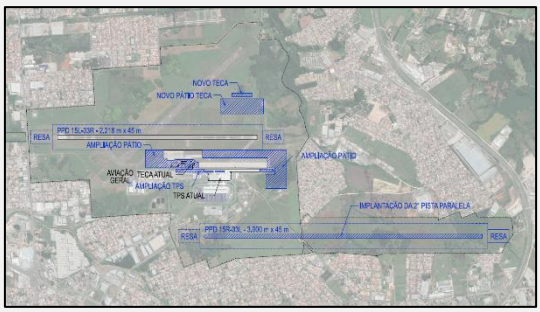
Source: GCA Consortium.

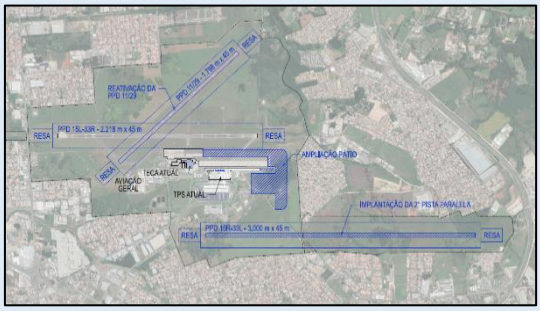
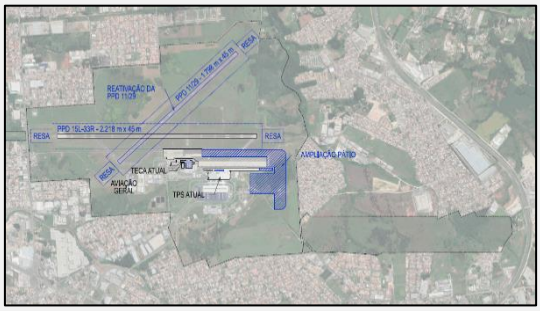
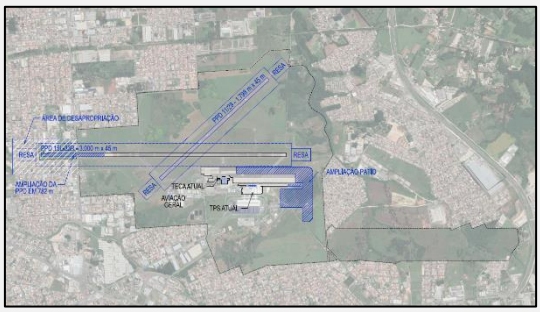
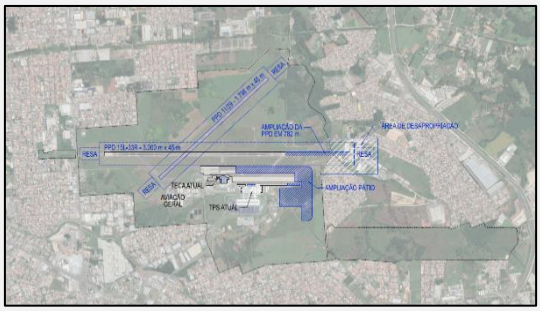
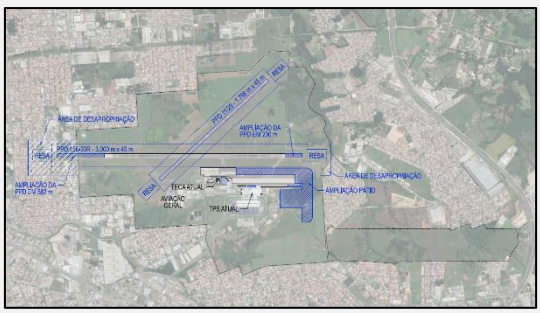
2.4 Alternatives Study

For the choice of the most advantageous alternative for the development of the airport site, we sought the one that presented solutions for all infrastructure non-conformities, allowing the future development of the airport site in an optimized way, guaranteeing an adequate level of service for all installations , minimized the interventions in the existing installations and presented costs compatible with the revenues of the airports of the concession block during the concession period.

The proposed alternatives and their main characteristics are presented in Figure 2-10.

Figure 2-10: Proposed Alternatives

Alternative 01		• Implementation of new Runway and taxiways (Cost> R$ 200 MM); • Implementation of a new Cargo Terminal Building, apron and other infrastructure (Cost> R$ 40 MM); • Expansion of the TPS aircraft yard (Cost> R$ 70 MM); • Main Runway with 3,000 m x 45 m; • Significant increase in the capacity of the runway system (parallel runways with independent operation).

Alternative 02		• Implementation of a new runway and Taxiways (Cost> R$ 200 MM); • Expansion of the TPS aircraft yard (Cost> R$ 80 MM); • Main Runway with 3,000 m x 45 m; and • Significant increase in the capacity of the runway system (parallel Runways with independent operation).
Alternative 03		• Expansion of the Aircraft apron (Cost> R$ 80 MM); • Main runway with 2,218 m x 45 m; • Track system capacity compatible with demand during the concession period; • Limited reach; and • Lower cost alternative.
Alternative 04		• Expansion of runway 15-33 (Cost> R $ 70 MM); • Expropriations (Cost> R $ 290 MM); • • Expansion of the Aircraft apron (Cost> R $ 80 MM); • Main runway with 3,000 m x 45 m; and • Track system capacity compatible with demand during the concession period.
Alternative 05		• Expansion of runway 15-33 (Cost> R $ 45 MM); • Expropriations (Cost> R $ 150 MM); • Expansion of the Aircraft apron (Cost> R $ 80 MM); • Main runway with 3,000 m x 45 m; and • Track system capacity compatible with demand during the concession period.
Alternative 06		• Expansion of runway 15-33 (Cost> R $ 70 MM); • Expropriations (Cost> R $ 215 MM); • Expansion of the Aircraft apron (Cost> R $ 80 MM); • Main runway with 3,000 m x 45 m; and • Track system capacity compatible with demand during the concession period.

Source: GCA Consortium.

The costs presented were obtained from reference values per m² and aim to compare the different alternatives in a macro way. The detailed cost analysis was performed only for the selected alternative and is presented in the CAPEX report.

The demand and capacity studies showed that the implementation of new taxiways to access the current Runway 15-33, associated with the reactivation of Runway 11-29, would be sufficient to meet the projected demand during the concession period, postponing the need to implement the new parallel track. However, the current 2,218 m of the current Runway 15-33 is insufficient for the operation of larger aircraft to more distant destinations such as Europe and the United States, requiring its expansion to approximately 3,000 m. Thus, although alternative 03 has the lowest implementation costs, it was decided to discard it as it does not allow commercially viable reach to these locations.

Alternatives 04, 05 and 06 studied options for expanding the Runway 15-33 respectively in the extensions of threshold 15, threshold 33 and in both directions. In the three alternatives, there was a need for significant interventions in the airport environment with high expropriation costs. In this scenario, the implementation of the new parallel runway, as provided for in alternatives 01 and 02, gained prominence since the costs would be similar, but with the advantage of interfering less in existing structures, in addition to significantly increasing the capacity of the airport runway system.

Finally, comparing alternatives 01 and 02, it is observed that the expansion of the aircraft yard, exclusively to the east side of the PTB, as proposed in alternative 02, in addition to presenting interesting geometry both from the operational point of view and from the point of view of utilization. the airport site, still preserves the current Cargo Terminal Building, thus avoiding the need to build new infrastructure in the northern sector of the airport. Thus, of the configurations analyzed, alternative 02 proved to be the most advantageous.

2.5 Development Plan

After the selection of the most appropriate alternative and the Requirement Plans, it was designed the airport's development plan for the concession period. Furthermore, it was developed an architecture and engineering preliminary design. Thus, the costs of the project and operation along the implementation phases were estimated in order to enable the airport economic-financial modeling.

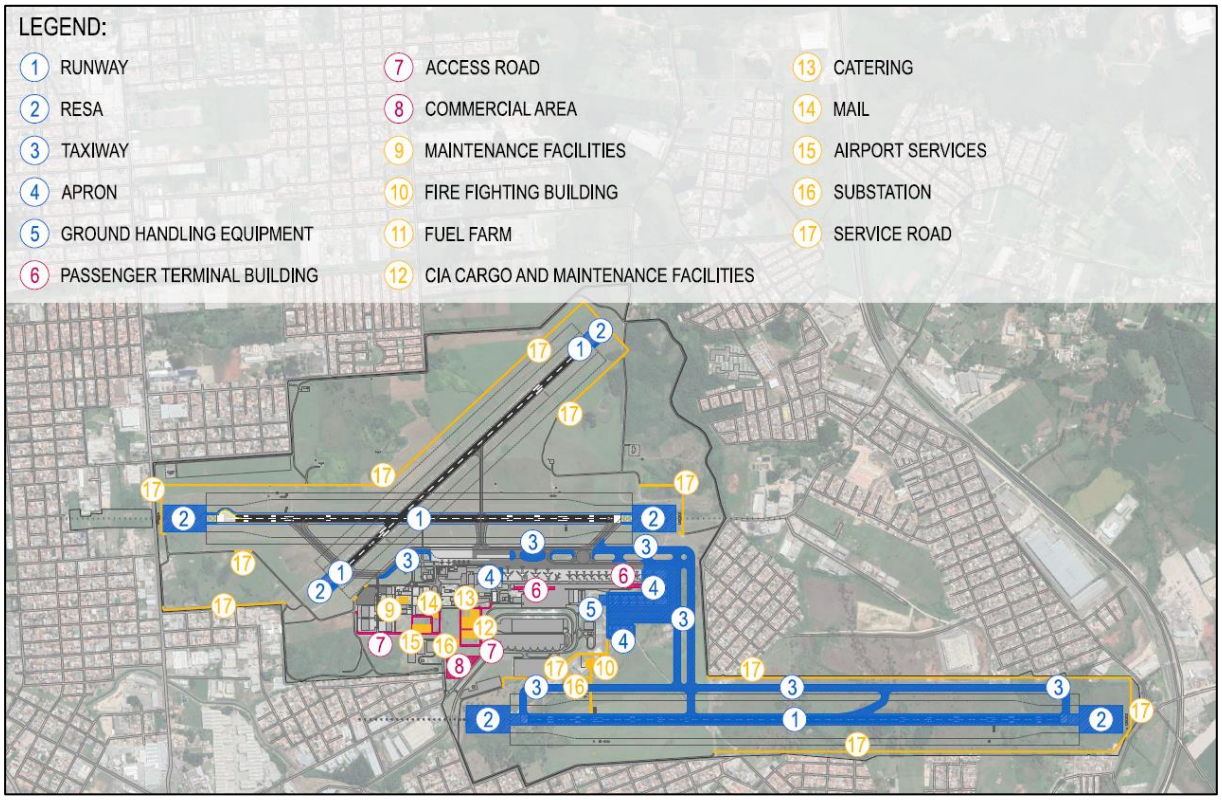
Below, the main investments for each phase of the planning are presented, as well as the implementation plants identifying the interventions at the airport and their subsequent level of details.

2.5.1 Phase 1

The first phase of the concession is expected to occur between the years 2026 and 2030, since the period between 2021 and 2026 will be used to get both the environmental licenses and carry out the constructions, so that all proposed works meet the demand of the year 2030.

In the Figure 2-11, it is presented the implementation proposed to Curitiba International Airport, considering Phase 01.

Figure 2-11: Development Plan – Phase 01 Implementations



Source: GCA Consortium.

The main interventions proposed in this phase are:

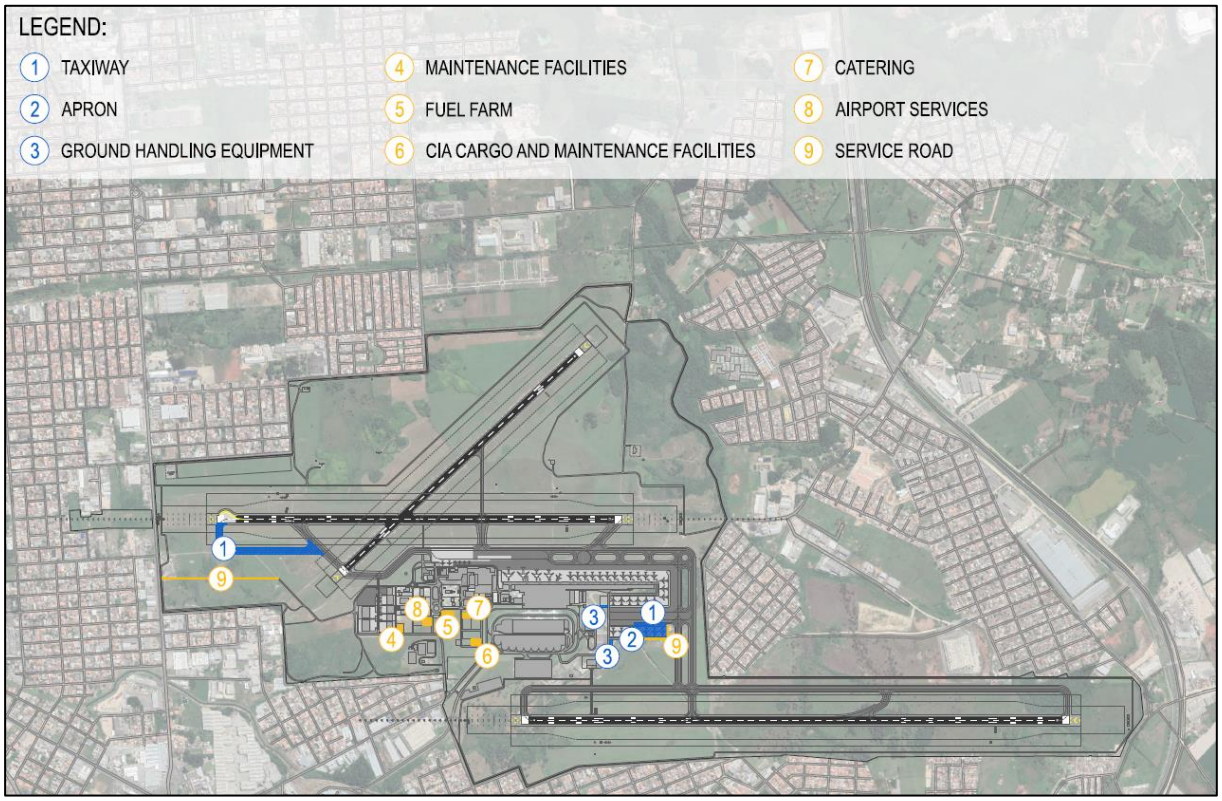
- Implementation of RESA at thresholds 11, 29, 15L and 33R;
- Adequacy of the shoulder of the runway15L / 33R;
- Implementation of a blast pad at both ends of the runway 11/29;
- Displacement of the axis of parallel taxiways A and B to a distance of 172.5 m from the axis of the runway;
- Expansion of the passenger terminal and implementation of new boarding bridges;
- Repositioning of some boarding bridges in the existing passenger terminal;
- Expansion of apron 1 and construction of apron 3, both for commercial aviation aircraft and construction of access routes K and L and taxilanes P and Q;
- Implementation of the runway 15R / 33L and access taxiways U, V, W, Y, Z and AA; and
- Repositioning of the cargo apron positions.

2.5.2 Phase 2

The second phase of the operation is expected to be between the years 2031 and 2040, since the period for obtaining the environmental licenses and carrying out the constructions happen in the previous phase, in order to all proposed works meet the demands of the year 2040.

In Figure 2-12, it is presented the proposed implementation for the Curitiba International Airport, considering the Phase 02.

Figure 2-12: Development Plan – Phase 02 Implementations



Source: GCA Consortium.

The main interventions proposed for this phase are:

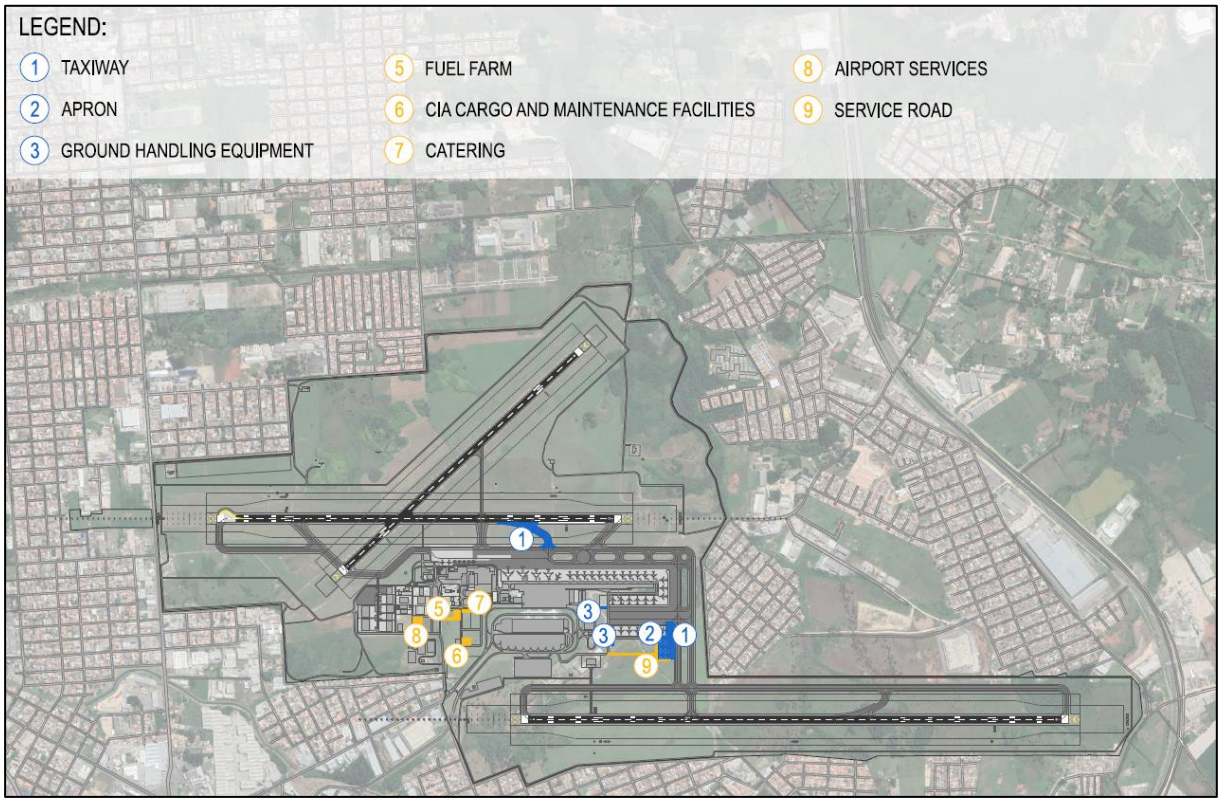
- Passenger terminal new boarding bridges implementation;
- Construction of the parallel taxiway S and taxiway R, which provides access to the threshold 15;
- Apron 3 and its taxilane Q expansion.

2.5.3 Phase 3

The third phase of operation is expected to occur between the years 2041 and 2051, since the period for obtaining the environmental licenses and constructions take place in earlier stage, so that all proposed works meet the demands of 2050.

The Figure 2-13 presents the implementations proposed for the Curitiba International Airport, considering Phase 03.

Figure 2-13: Development Plan – Phase 03 Implementations



Source: GCA Consortium.

The main proposed interventions for this phase are:

- Apron 3 expansion for the commercial aviation and the taxilane P expansion;
- Construction of the rapid exit taxiway T;
- Implementation of a new boarding bridge.

2.6 CAPEX

To elaborate the budget for the planned investments, prices were considered in accordance with the reference tables of SINCRO and SINAPI, in order to get referential unit cost per airport component. It was also considered the BDI rate, according to the TCU guidance and SICRO methodology. So, from the planned investments, unit costs and BDI rate, it was obtained the budget for the investments to the airport development. The Table 2-7 summarize the investments by implementation phase.

Table 2-7: CAPEX – Summary per Phase

DESCRIPTION	VALUES (R$)
Phase 1 Airport Expansion	431,279,315.39
Phase 2 Airport Expansion	67,650,347.24
Phase 3 Airport Expansion	53,665,902.36
Airport Expansion Subtotal	**552,595,565.00**
Phase 1 Airport Expropriations	21,110,642.68
Phase 2 Airport Expropriations	-
Phase 3 Airport Expropriations	-
Airport Expropriations Subtotal	**21,110,642.68**
CAPEX Total	**573,706,207.68**

Source: GCA Consortium.

The Table 2-8 compiles the investment, maintenance and expropriation expenses values for each phase, considering the investments used for the resurfaces in the runaway system (which is included in “Maintenance” in Table 2-8).

Table 2-8: Components Summary

DESCRIPTION	DEVELOPMENT (R$)	MAINTENANCE (R$)	EXPROPRIATION (R$)	VALUES [R$]
Phase 1 Airport Expansion	414,239,660.82	17,039,654.57	-	431,279,315.39
Phase 2 Airport Expansion	29,084,515.04	38,565,832.21	-	67,650,347.24
Phase 3 Airport Expansion	18,083,309.51	35,582,592.85	-	53,665,902.36
Airport Expansion Subtotal	**461,407,485.37**	**91,188,079.63**	**-**	**552,595,565.00**
Phase 1 Airport Expropriations	-	-	21,110,642.68	21,110,642.68
Phase 2 Airport Expropriations	-	-	-	-
Phase 3 Airport Expropriations	-	-	-	-
Airport Expropriations Subtotal	**-**	**-**	**21,110,642.68**	**21,110,642.68**
CAPEX Total	**461,407,485.37**	**91,188,079.63**	**21,110,642.68**	**573,706,207.68**

Source: GCA Consortium.

3 ENVIRONMENTAL STUDIES

The Report 3 – Environmental Studies was elaborated to comply with the *Public Notice (Edital de Chamamento Público) N. 2/2019* regarding projects presentation, surveys, investigations and technical studies required to subsidize the concession modeling for expansion, exploration and maintenance of the Airport of Curitiba.

The report presents all the environmental studies performed in the field and in the office, by means of primary and secondary data, including a detailed assessment of every document provided by the Secretariat of Civil Aviation (*Secretaria de Aviação Civil – SAC)*, disclosed in Data Room, and of environmental processes verified at the Environmental Institute of Paraná (*Instituto Ambiental do Paraná – IAP*) on April 25 and August 20, 2019.

These data oriented the technical field visit to the Airport of Curitiba, which occurred on May 6th and 7th, 2019.

Environmental studies were conducted in order to meet the guidelines presented by the public notice, considering that all of the requirements were properly addressed in the report, according to certain analytical chronology, by means of careful evaluation of the airport's compliance with the respective licensing procedures, expansion studies, master plans and previous environmental studies.

The International Airport of Curitiba is located in São José de Pinhais city, 19 km far from Paraná capital, South of Brazil. In 1974, INFRAERO started administering the Afonso Pena Airport, inaugurating the first Logistics Cargo (*Terminal Terminal de Logística de Carga - TECA*) of the network. In the same decade, 1977, the passenger terminal was significantly remodeled and expanded, and its customer service was magnified in four times.

In 2013, the Airport of Curitiba was considered the best airport terminal for the first time, according to the Passenger Satisfaction Research. In the following year, 2014, besides of the consecutive award, the airport had its aircraft yard and parking lots expanded. In addition, it was considered the best airport of the country by the National Secretariat of Civil Aviation of Infrastructure Ministry (Secretaria Nacional de Aviação Civil do Ministério da Infraestrutura – SAC/MI). Until 2017, it was again repeatedly considered the best terminal according to the Passenger Satisfaction Research.

The airport of Curitiba is regular concerning the operating licensing of its current activities and infrastructure. The Environmental Institute of Paraná (*Instituto Ambiental do Paraná – IAP)*, the environmental agency of Paraná state, is responsible for the environmental licensing of the enterprise. Information on the Operating Licenses (OL) is detailed below.

Chart 3-1: Operating license data

License	Issuing Agency	Process n.	Issue	Expiration	Status
2.120	IAP	15.503.313-4	April 23, 2019	April 23, 2023	Effective

Source: GCA Consortium.

The report detailed the compliance *status* of Operating Licenses (OL) n. 2.120 of 2019 constraints, as well as the historical and relevant points of the processes.

The main constraints to be considered for future renovations are:

- Follow up of the contaminated area in the deactivated PAA, under Raízen/Shell responsibility;
- Complete isolation of the pluvial water drainage with the installation of retention boxes and CSAO in the old yards and other areas with contamination risk, such fuels and oily materials storage sites.

Since the beginning of its operations, the enterprise received several expansion and improvement constructions. The environmental report presents the main actions, constructions, intended constructions and their respective environmental licenses obtained after 2006.

The following documents were surveyed and reported, regarding the airport manager: authorizations, license agreements and other licenses, including those obtained by its concessionaire enterprises. A list of ongoing agreements, with the activities susceptible to licensing, was also presented.

Regarding the regularity of the enterprise, notifications and noncompliances of the airport were surveyed and exhibited to several agencies, National Agency of Sanitary Vigilance (*Agência Nacional de Vigilância Sanitária -Anvisa*) and National Agency if Civil Aviation (*Agência Nacional de Aviação Civil -ANAC*).

The airport is part of some legal procedures basically related to commercial agreements on concession of use and disseisin. Besides, there is a legal procedure in MPF/PR that investigates the construction of the third runaway.

The information on past notices and fines do not oblige the next manager, which is not responsible for their payments. However, the current airport manager is responsible for eliminating the facts that originated such notices, as well as for managing ongoing mitigating or recovering actions.

A socio-environmental assessment of the Airport of Curitiba was performed and presented by means of the socio-environmental diagnosis in this report, considering the following aspects:

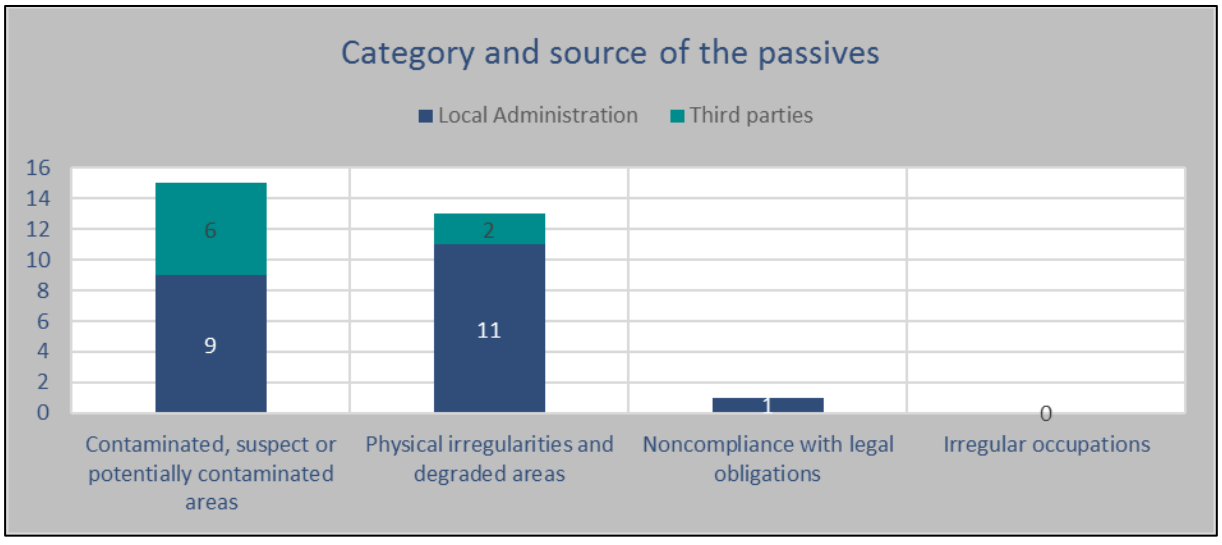
- Soil Use and Coverage including approaches to water resources, permanent preservation areas (APP) and vegetation;
- Irregular superficiaries and occupations in the airport assets area;
- Potential of Cave Occurrence;
- Mining rights;
- Fauna and Fauna Risk;
- Noise;
- Atmospheric Emissions;
- Energy;
- Basic Sanitation including approaches to water supply, effluents, solid waste and drainage system;
- Degraded areas, erosions and silting;
- Environmental Risks/Emergencies;
- Conservation Units, Protected Assets and Communities, including the analysis of heritage, archeological or pre-historical sites and traditional communities;
- Stakeholders engagement;
- Environmental Management System.

The main issues identified concerning the abovementioned aspects are:

- There are superficiaries in the airport's patrimonial area that are not related to the airport activities. There is an entertainment area for the employees and a soccer field in the land already expropriated for the airport expansion;
- Considering its patrimonial limits, the airport in entirely located in a region of high probability of caves occurrence;
- The airport of Curitiba is listed as one of the main airports used for wild animal traffic in Brazil, in 17th place;
- The site presents contaminated areas registered in the environmental agency: the deactivated area of fuel supply (for vehicles) and the old area belonging to Shell;
- The Historical Archeological Site Afonso Pena I, Afonso Pena II and Afonso Pena III are located in the airport's site. Based on the interventive archeological diagnosis results, concerning the recommended preventive and mitigatory measures, the archeological monitoring need was reinforced in the referred areas;
- In the Airport of Curitiba and its surroundings, considering an area with 3km of radius from the enterprise patrimonial limits, 06 conservation units/ urban green areas were identified.

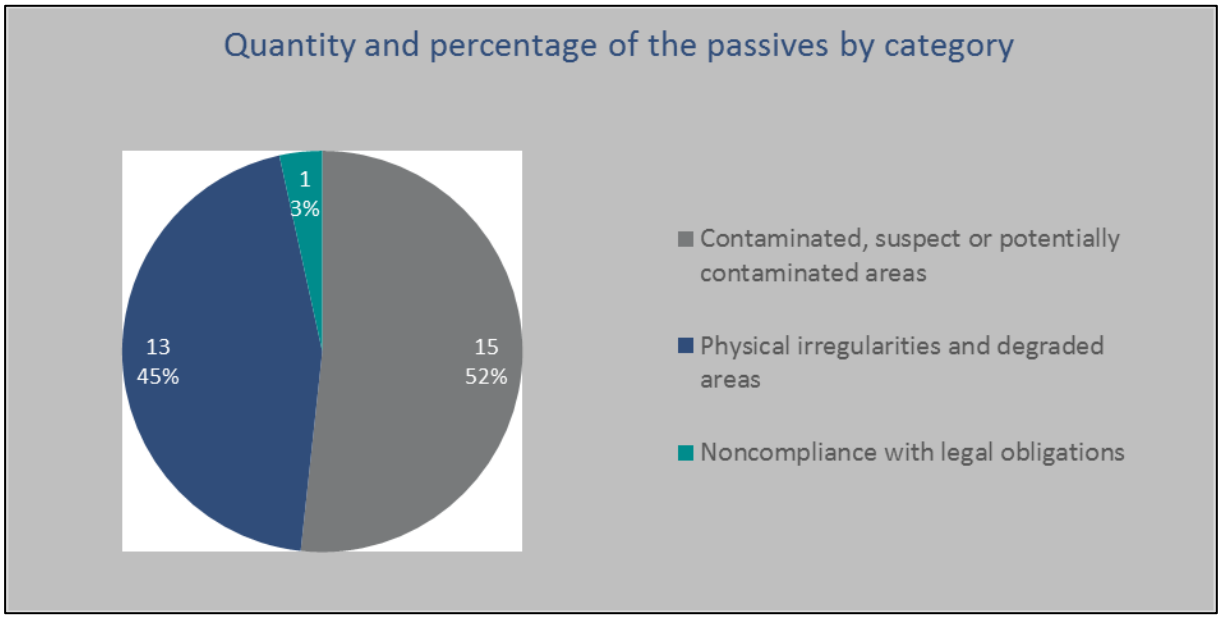
During the preparation of this document, existing socio-environmental passives were surveyed, evaluated and priced. For the Airport of Curitiba, 29 passives were identified, 21 originated by local administration and only 08 by third parties. From this total, 52% were related to contaminated areas, 45% to physical irregularities and degraded areas and 3% to noncompliance with legal obligations. No passives related to irregular occupations were identified.

Figure 3-1: Category and source of the passives



Source: GCA Consortium.

Figure 3-2: Quantity and percentage of the passives by category

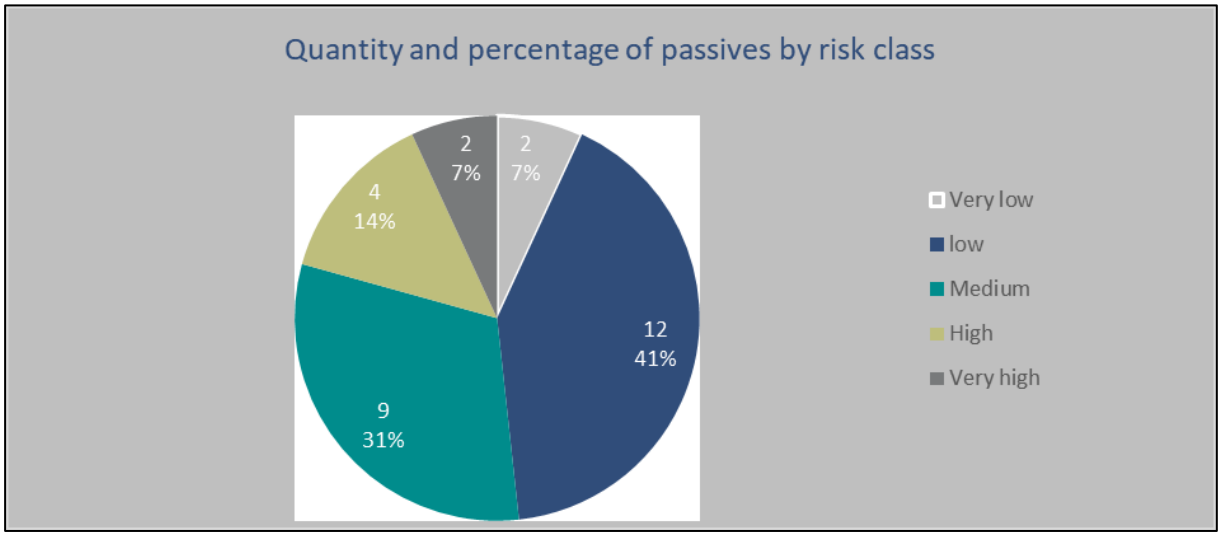


Source: GCA Consortium.

The classification of passives identified according to their Risk Class was assessed based on a methodology adapted from FMEA (*Failure Mode and Effects Analysis).*

Considering the current scenario, the Airport of Curitiba presents passives classified as of Very High, High, Medium, Low and Very Low risks. The passives classified as of Very High to High risk shall be managed in the short run, and the passives classified as of Medium to Very Low risk may be managed according to their respective criticalities in short or medium term.

Figure 3-3: Quantity and percentage of passives by risk class



Source: GCA Consortium.

The study includes a detailed analysis of current and future compatibility of the airport activities and soil use, dedicated to verify if the protection plan against obstacle, the noise zoning plan and airport

safety area were properly incorporated in the guidelines and legislation that regulates the occupation of the airport's neighboring areas.

In order to guarantee the good development of the enterprise, the neighboring areas shall continue to be compatible with the airport activities. To achieve this goal, the airport manager shall update and approve the appropriate plans, especially in case of meaningful alterations in operation and infrastructure.

The study also estimated the quantity of people affected by the aeronautical noise levels, according to the chart below, for the Current and Future development scenarios.

Chart 3-2: Aeronautical noise impacts on the neighboring population in the current and future scenario

Area inside noise contours	Number of people living inside the contours		Number of residences inside the contours	
	Current Contours	Future Contours	Current Contours	Future Contours
65 -70dB	7,101	16,641	2,154	5,091
70 - 75dB	1,267	3,492	392	1,054
75 - 80dB	0	10	0.06	3
80 - 85dB	-	-	-	-

Source: GCA Consortium.

Besides of estimating the number of people living inside the contours, the Environmental Report also identified receptors affected by the aeronautic noise because of public activities (e.g. hospitals, schools and others) both for Current and proposed Future Scenario.

For the Airport of Curitiba, the Future Scenario may affect, in total, 06 sensitive receptors, besides of the 2 already affected.

Regarding risks to the Fauna, the study identified the main focuses of attraction inside the Airport Safety Area (ASA), a circular area with 20 km of radius, marked from the geometric center of the longest runway. We highlight the focuses related to irregular waste disposal, landfill, cold store, parks and zoos. Thus, the airport manager shall help the municipality to monitor the focuses and to develop educational actions in order to avoid the appearance of new focuses.

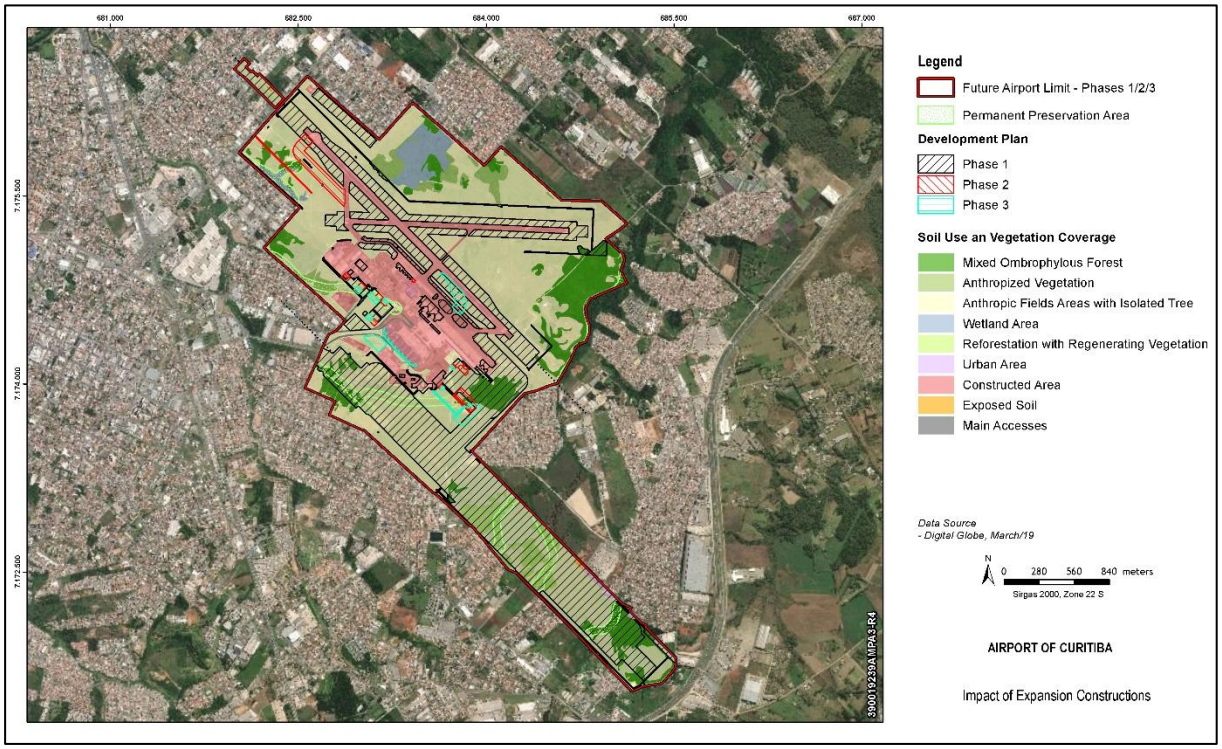
Based on all these surveys, the main goal of the study was fulfilled, especially regarding the legal and environmental restrictions of the airport and its neighboring areas. Socio-environmental criteria to be incorporated to the project were identified and oriented the Development Plan in order to minimize environmental impacts.

The airport presents some environmental restrictions that may difficult its expansion, such as:

- There are springs and mixed ombrophylous forest in the airport site;
- Although no caves were identified, the site is in an area with high probability of cave occurrence.

Therefore, the Development Plan for the Airport considered every restriction and environmental criteria surveyed in the study. The solution proposed is the one with the lowest environmental impact in the airport region and that allows its compliance with applicable legislation. The following figure shows the impact of expansion works on soil use and coverage.

Figure 3-4: Impact of the adequation constructions on soil uses and coverage



Source: GCA Consortium.

Evaluating the construction works impact on soil use and coverage in the Airport of Curitiba, during the Development Plan implementation in its three phases, vegetation suppression will be required. Interventions in APP will be necessary, during the 3 phases, with only 7. 54% of the intervention areas in Permanent Preservative Areas.

Concerning socio-environmental risks associated to the project, *i.e.*, situations that may impair or delay the execution of foreseen activities and constructions, one risk situation was identified and summarized below.

Chart 3-3: Risk and their respective strategies to minimization

Socio-environmental risk management at the Airport	
RISK SITUATION 1	Intense population density in the airport's surroundings
Identified risk	Airport operations may affect the neighboring population with unpleasant levels of noise. Conflicts between airport activities and surrounding soil use and occupations.
Strategies to minimize the risk	To establish technical partnership with São José dos Pinhais municipality to incorporate the Specific Noise Zoning Plan (PEZR) in municipal legislation and in the procedures of real estate approval in areas affected by the airport noise contours and other use and occupation restrictions concerning operational safety. To perform educational and awareness activities with the surrounding Community on the importance of preserving and respecting the airport's property limits.

Source: GCA Consortium.

Considering that the local availability of input and raw material suppliers, and of waste disposal sites required to implement the Development Plan are essential to the Project feasibility, the Environmental Report listed potential licensed suppliers to help estimating costs in the Report of Engineering and Related Issues.

The study also presents the licensing guidelines required for the entire concession period, accompanied by the respective schedules for the implementation and operation phases of the airport.

For the Operational phase, considering that the airport of Curitiba is regularized, and that the concession begins in the second half of 2021, the Operating License renewal shall be requested by the new airport operator. Normally, the licenses issued for Airport of Curitiba expire in 4 years. Therefore, the airport manager will receive the airport with an Operating License valid until April 2023.

Based on these conditions, the chart below presents recommendations to the future airport manager, regarding the conduction of the airport's operating licensing:

Chart 3-4: Recommendations for conducting the airport's operating licensing

Recommendations for conducting the airport's operating licensing
Once you took over the airport's management, you must request the license titularity transference to your name and CNPJ.
During the airport operation, all the constraints of the future Regularization Operating License (or similar) must be addressed. Periodical reports on the activities' execution must be presented to the environmental agencies.

Recommendations for conducting the airport's operating licensing
To request the OL renewal at least 120 days before its expiration date, according to paragraph 6th incise III of article 2 of State Decree n. 47.400 of December 4th, 2002.
After the end of each construction phase, if authorized by means of an Installation License, the entrepreneurship shall request these constructions to be included in the current operating license, avoiding the issuing of several OL for the same airport enterprise.

Source: GCA Consortium.

Besides of the operating environmental licensing of the airport, the airport operating activities will be regular by the issuing of authorizations, exemptions and complementary grants and documentation approval by regulatory public agencies. The chart below presents the estimated timeframes used in the present study.

Chart 3-5: Estimated timeframes for other authorizations, grants and licenses

Description	Estimated timeframe	TOTAL
Regularization/Renewal/ Transference of Grant for water resources use (AA[1]) and Grant Issuing (OC[2])	2 months (AA[1]) 2 months (OC[2])	4 months
Regularization of Federal and State Technical Registration (AA[1])	2 months (AA[1])	2 months
Elaboration/Regularization/Renewal of IPF and PGRF (AA[1]) and validation in ANAC (OC[2])	15 months (AA[1]) 3 months (OC[2])	18 months
Elaboration /Regularization of noise contours and PZR (AA[1]) and validation and registration in ANAC (OC[2])	6 months (AA[1]) 3 months (OC[2])	9 months
Regularization of PBZPA and PZPANA(AA[1]) and validation in ANAC and DECEA (OC[2])	6 months (AA[1]) 4 months (OC[2])	10 months
Mining block request to DNPM (AA[1]) and mining block issue (OC[2])	2 months (AA[1]) 2 months (OC[2])	4 months

Notes:

[1] AA- Airport manager

[2] OC- Responsible agency

Source: GCA Consortium.

Regarding the expansion and adequation constructions phase, the Development Plan proposed for Airport of Curitiba will be implemented in three phases. The chart below summarizes the licensing assumptions for each phase.

Chart 3-6: Licensing assumptions for the expansion and adequation constructions of Airport of Curitiba

Evaluated aspects	Phase 1	Phase 2	Phase 3
Impact degree of the constructions	High	Medium	Medium
Licensing agency	IAP (State)	IAP (State)	IAP (State)
Applicable licenses	PL and IL	IL effective in Phase 1*	IL effective in Phase 1*
Studies to be performed	EIA RIMA e PCA	-	-
Maximum estimated timeframe for studies and licensing	20 months	Effective Licensing	Effective Licensing

*Legislation foresees that the IL may be renewed up to the execution of constructions from Phase 2 and Phase 3.

Source: GCA Consortium.

Currently, IL n. 23.211 is effective until March 13, 2020.

The constructions from Phase 1 of the Development Plan that include implementation of runway 3th, RESAs, expansion and installation of taxiways, yards and service avenues, among other structures were classified as of high environmental impact. The constructions of Phases 2 and 3 were classified of medium.

According to the license criteria defined by *Resolução SEMA* n. 6, of March 24, from Paraná State, the constructions that do not result in alteration of the airport's category may be licensed by a Simplified Environmental License (LAS). The constructions foreseen for the Airport of Curitiba will not modify its current category (4E), however, we carefully choose to assume that the complete licensing may requested for the constructions execution, with Preliminary License (PL) issue, Installation License (IL), subsidized by an Environmental Impact Study (*Estudo de Impacto Ambiental – EIA*) and an Environmental Control Plan (*Plano de Controle Ambiental - PCA*), estimating the timeframe of 20 months for the Licenses issue.

The same IL, effective for Phase 1, will be used for Phases 2 and 3, appropriately subsidized by previous studies, that may by elaborated considering the constructions foreseen for all the development phases. We highlight that the IL expired in 06 years and may be renewed by the end of the concession.

The estimated timeframes for the environmental licensing of the constructions considered the impact degrees previously described, results being presented below.

Chart 3-7: Estimated timeframes for licensing constructions of high environmental impact

Description	Estimated timeframe
EIA/RIMA elaboration for PL issue	9 months (AA[1])
PCA elaboration for IL issue (simultaneous to EIA/RIMA elaboration)	3 months (AA[1])
EIA/RIMA analysis and new PL issue	6 months (OA[2])

Description	Estimated timeframe
PCA review and compliance with the constraints after the PL issue	1 month (AA[1])
Analysis and new IL issue	4 months (OA[2])
TOTAL	**20 MONTHS**

Notes:

[1] AA- Airport manager

[2] OA- Environmental Agency

Source: GCA Consortium.

The airport manager should also analyze verify other authorizations required to enable the Development Plan, concerning the licensing of all its three phases. The chart below summarizes this evaluation for Airport of Curitiba.

Chart 3-8: Environmental authorizations and procedures required for Curitiba

Authorization/Procedure	Applicability for the Development Plan
Municipality Opinion	Applicable
Authorization for Vegetation Suppression (ASV) and/or Intervention in APP	Applicable
National Institute of Historical and Artistical Heritage (*Instituto do Patrimônio Histórico e Artístico Nacional - IPHAN*) Opinion	Applicable
Grant of water resources use	Applicable
Mining Block	Applicable
Authorization from Conservation Units Managers	Applicable
Authorization for intervention in traditional communities or its surrounding zones	Not applicable

Source: GCA Consortium.

To achieve excellence in socio-environmental management, this study presented mitigation measures, suggestions on Sustainability Guidelines, Environmental Management System, Environmental Plans and Programmes and Environmental Development Indexes to the future airport manager, considering all the environmental subjects assessed herein.

Finally, the study presents the socio-environmental cost budget foreseen for the expansion constructions (CAPEX) and for the airport operation (OPEX), summarized below:

Chart 3-9: Socio-environmental costs in R$ estimated for the Airport of Curitiba

Activity	Phase 1	Phase 2	Phase 3	TOTAL
Licensing and Analysis Fees	11,478.88	4,304.58	4,304.58	20,088.04
Environmental Studies	964,755.79	-	-	964,755.79
Environmental Management of the Constructions	1,701,921.40	2,052,654.34	2,052,654.34	5,807,230.08
Vegetation Suppression and Forest Compensation	3,202,325.81	39,272.41	7,476.05	3,249,074.27
Confirmatory Investigation of Passives	433,950.80	-	-	433,950.80
Environmental Passives Recuperation	209,430.00	-	-	209,430.00
Environmental Compensation SNUC *	2,028,381.32	133,915.77	80,105.68	2,242,402.77
Total	**8,552,243.99**	**2,230,147.10**	**2,144,540.65**	**12,926,931.74**

* Corresponds to 0.5% of the value of the investment when analyzed by EIA RIMA in cases of significant environmental impact

Source: GCA Consortium.

Chart 3-10: Environmental OPEX estimated for the Airport of Curitiba

Item	Activity	Total Cost (R$)
2.1	Environmental Licensing Fees	715,285.68
	OL Renewal	*19,678.08*
	TCFA – IBAMA	*695,607.60*
2.2	Operation Environmental Management	26,546,821.98
2.3	Elaboration of PBZPA and PZPANA	205,678.91
2.4	Fauna Management Programme	5,374,361.15
	PF and PGRF Elaboration	*2,494,361.15*
	Fauna handling actions	*2,880,000.00*
2.5	Noise Management Programme	89,252.79
2.6	Energy and Air Emissions Management Programme	23,817.19
2.7	Water Resources and Effluents Management Programme	5,099,518.40
	Sampling Plan Elaboration	*23,817.19*
	Water Resources Monitoring	*5,075,701.21*

Item	Activity	Total Cost (R$)
2.8	Solid Waste Management Programme	37,282.87
2.9	Social Communication, Environmental Education and Training	2,477,640.69
	TOTAL	**40,569,659.67**

Source: GCA Consortium.

The Environmental Studies maintained the innovations presented in the study is elaborated by GCA Consortium of the 5th Round of Airport Concessions from Federal Government, which culminated in the concession of 12 airports for private initiative. They are:

- Analysis of soil use and occupation inside noise contours, by means of identifying the quantity of residences and their respective areas, people and average quantity of people per residence based on census information (IBGE, 2010);
- Survey of focuses of fauna attraction, using criteria defined by specific aeronautical legislation;
- Survey and analysis of collision indexes involving aircrafts and fauna, according to data provided by CENIPA;
- Identification of areas vulnerable to the airport activities, since there are fauna and flora species of restrict distribution located in regions under the aerodrome influence, according to ICMBIO criteria;
- Risk evaluation of environmental passives based on a methodology adapted from FMEA (Failure Mode and Effects Analysis);
- Indexes proposition according to GRI Standards (version 2016) and GRI G4- Airport Operator Sector Disclosures (version 2013) references, correlating them to the Sustainable Development Goals (*Objetivos de Desenvolvimento Sustentável -ODS*), to the IFC Performance patterns, and with the guidelines of Global Pact.

In addition, with the participation of several professionals specialized in the environment area and with effective practice on airport operation, the flowing innovations were performed in the Environmental Studies:

- Identification of all kinds of irregular superficiaries and occupations in the property and the expansion area;
- Survey of potential cave occurrences in the airport area and its surroundings;
- Information on the existence of mineral deposits in the airport area and its surroundings;
- Evaluation of mining rights in the airport area and its surroundings;
- Amplification of identified classes of environmental passives and its respective results presented by an Excel spreadsheet, with friendly and intuitive interface;
- Survey on receptors sensitive to aircraft noise – public institutions, hospitals and schools – located inside the airport noise contours;
- Indication of licensed potential suppliers of inputs and raw materials, close to the airport, for the Development Plan constructions;
- Indication of licensed sites for adequate waste disposal, close to the airport;

- Evaluation of the airport position on the ranking of airports used for animal traffic, as well as proposition of actions to prevent traffic;
- Use of indicators from the Guide of Good Practices for Elaborating Indicators of Operational Safety elaborated by the Brazilian Group of Operational Safety in Airport Infrastructure (BAIST), published in August 2019;
- Quantification of the expansion construction impacts in Permanent Preservation Areas (APP) and proposition of differentiated forest compensation, according to local legislation;
- Use of data on water, obtained by SPT drilling performed by GCA, to guide the estimated budget of Confirmatory Investigations and sites with suspected contamination in the airport;
- Incorporation of sustainable proposals in the Development Plan;
- Definition of Sustainability guidelines for the airport operations, aligned with the policies adopted by the Ministry of Infrastructure.

4 ECONOMIC AND FINANCIAL EVALUATION

This section presents the Executive Summary of the Economic and Financial Evaluation for the 30-year concession of **Curitiba International Airport - SBCT** modelled between 01/October/2021 and 30/September/2051. Currently, the airport's total revenue is R$229MM and its EBITDA margin is 53% (considering 2018 data)[11].

Revenues

The economic and financial evaluation is based on revenue projections which include:

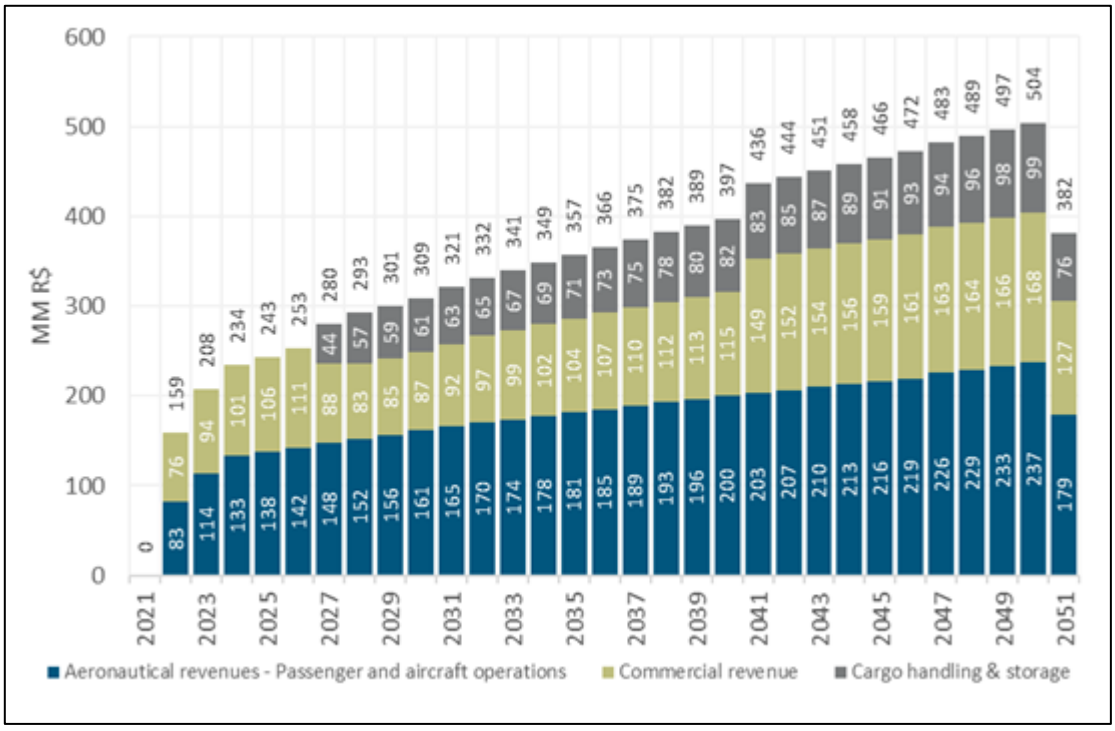
- Aeronautical revenues, resulting from regulated fees on the various operation types. These have been categorized as passenger and aircraft fees and cargo handling and storage fees;
    - Aeronautical revenues – passengers and aircraft operations: applicable to both passenger flows (domestic and international boarding or connection fees) and aircraft operation and parking, by operation type (domestic and international landing and parking fees, and landing and boarding and parking fees for general aviation);
    - Cargo handling and storage: due for cargo handling and storage services where rendered directly by the Airport operator at the air cargo terminal (TECA), and may divide into import, export and domestic cargo;
- Commercial revenues, related to services and goods provided to passengers, airlines and other business users, i.e. international air cargo terminal, retail, food & beverages, car parking, aircraft fuelling, car rental etc.

Forecasts for Aeronautical revenues are based on expected Airport throughput, which include passenger flows, cargo, mix of aircraft types and aircraft operations, and their respective regulated fees. Meanwhile, forecasts for commercial revenues consider not only expected demands and their respective impacts over each category of business, but also efficiency gains resulting from contract renegotiations between the concessionaire and the lessees of commercial areas, following market benchmarks.

Total revenues are expected to grow an average of 3.3%p.a. between 2023 and 2050 (first and final full year of the concession). Aeronautical revenues share will increase during the concession period, from 55% in 2023 to 67% in 2050. It is worth pointing out the increase in revenues from the end of the TECA sub-concession agreement (2027).

11 All monetary value presented in this report is given in constant Real (R$) values based on January/2019 real prices, following SAC/MI guidance.

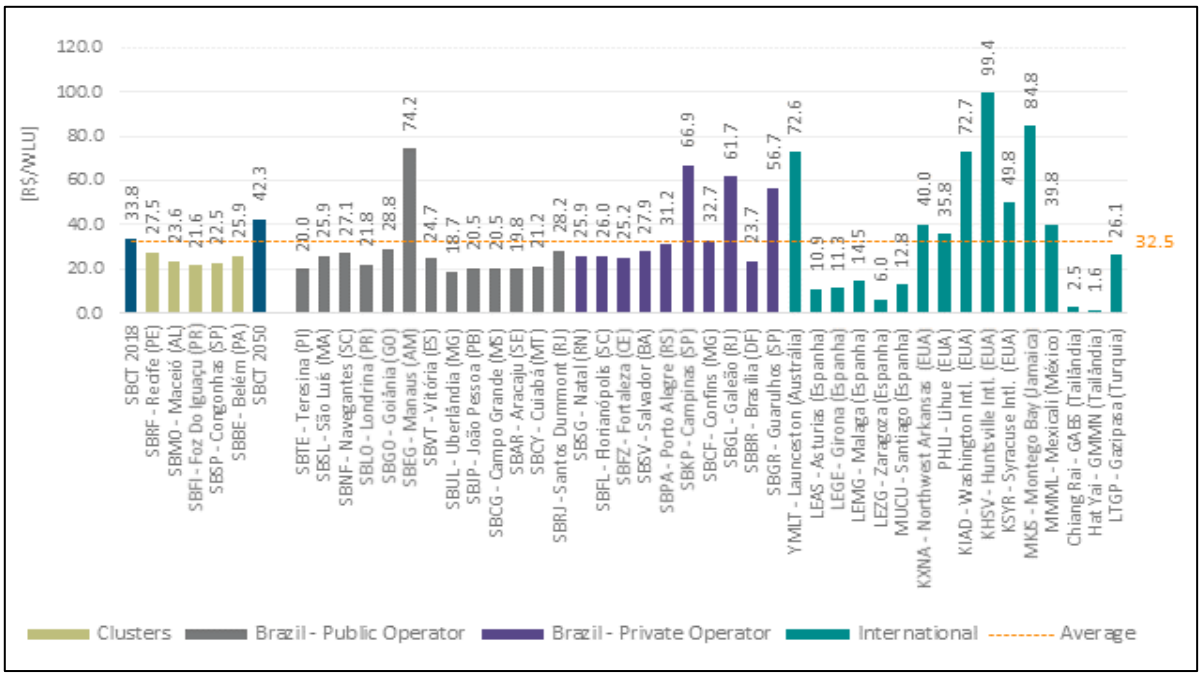
Figure 4-1: Total revenues during concession



Source: GCA Consortium.

In 2050, the Airport's revenue per WLU will be R$42.3. Airport indicators are above the average of comparable airports (Figure 4-2).

Figure 4-2: Revenue per WLU benchmark



Source: GCA Consortium.

Costs and expenses

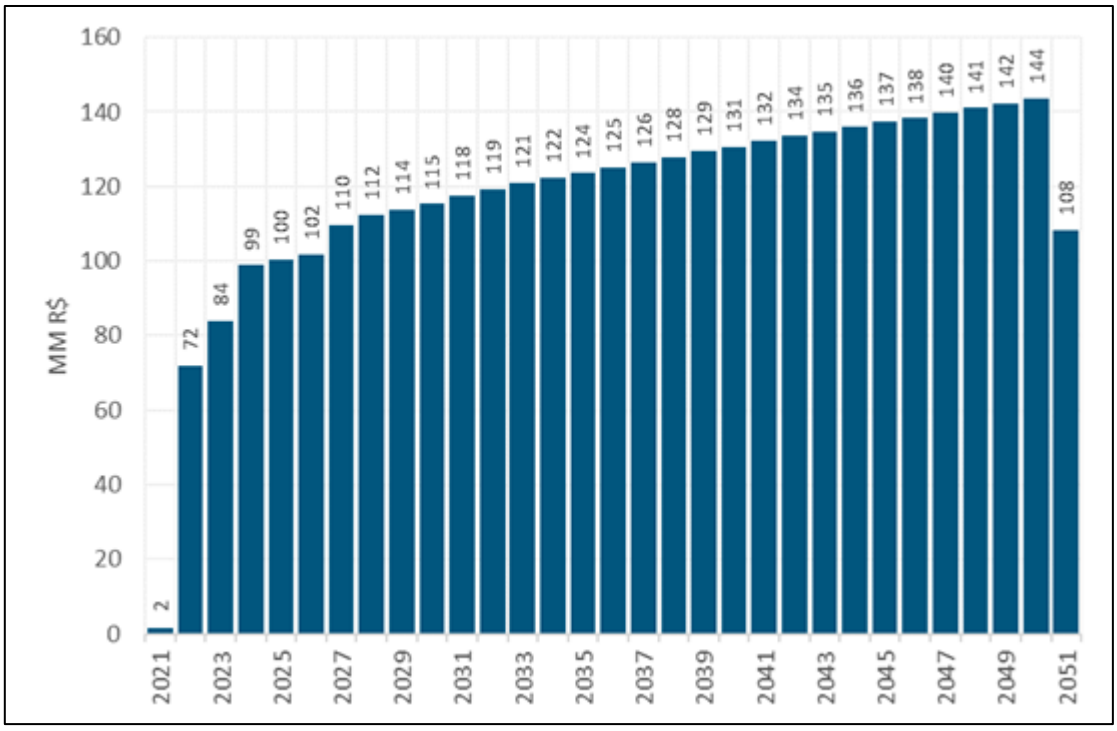
Airport operating costs and expenses are mainly related to personnel and outsourced services, in addition to utilities and public services and consumables.

After the concession, the concessionaire will take up new obligations, which include performance bond, socio-environmental expenses and property tax (IPTU). The concessionaire must also pay grants, applicable according to the feasibility of the concession and therefore not discussed under this item.

Costs and expenses forecast take into account the most appropriate forecast drivers for each item, that is, the variables that best explain the evolution of the observed costs. Additionally, costs and expenses forecasts were based on current values and considered initial efficiency gains derived from private management as well as economies of scale, determined from benchmark analyses.

Total costs and expenses forecasts show an annual average growth rate of 2.0% between 2023 and 2050, increasing from R$84MM to R$144MM (Figure 4-3). Personnel and Outsourced services costs are the most significant, representing 49% and 35% of total costs in 2050, respectively.

Figure 4-3: Costs and expenses during concession (prior to grant values)



Source: GCA Consortium.

It is important to emphasize that, before entering into the concession agreement, the concession holder will be required to settle funds for Infraero's staff readjustment program, reimbursement to authors of the feasibility studies, and compensation to São Paulo stock exchange (B3) for holding the auction (Table 4-1).

Table 4-1: Obligations to be met prior to signing the contract

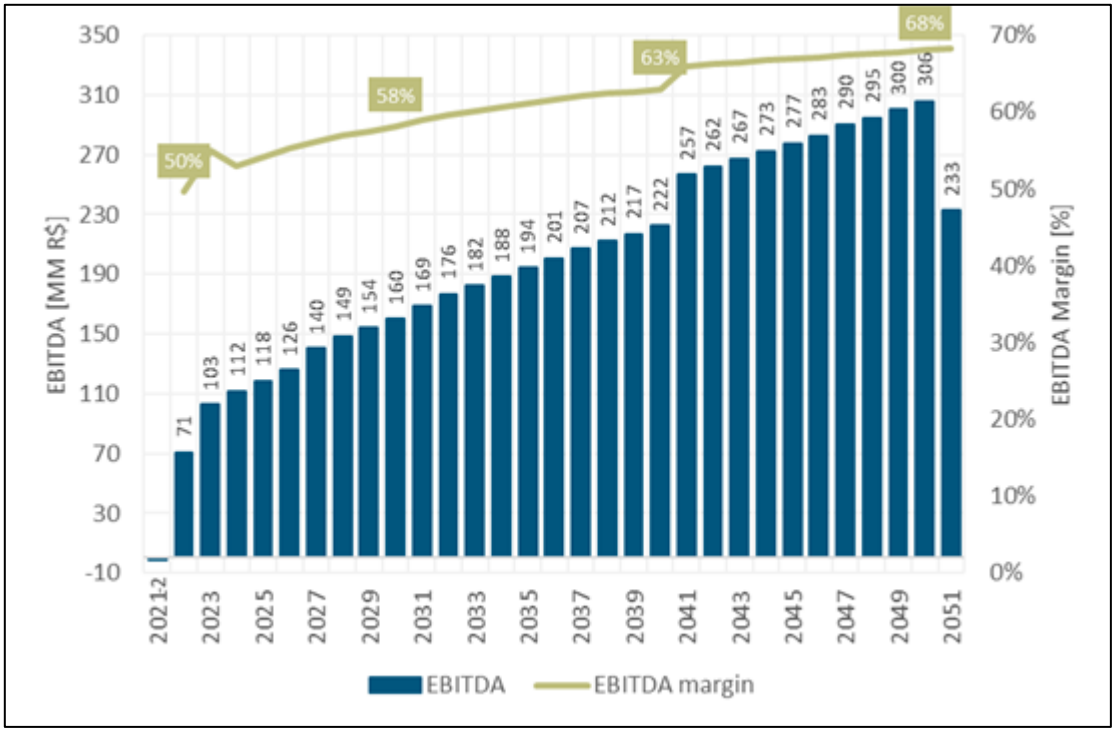
Values in MM R$	TOTAL
OBLIGATIONS TO BE MET PRIOR TO SIGNING THE CONTRACT	**(292,1)**
Funds for Infraero's staff readjustment program	(286,8)
Reimbursement to authors of the feasibility studies	(5,2)
Payment to B3 for holding the auction	(0,1)

Source: GCA Consortium.

EBITDA and margin

Net of grant payments, the concession EBITDA is forecast to be R$103MM in 2023 and to reach R$306MM in 2050 (Figure 4-4), with an average growth of 4.1%p.a. EBITDA margins increase is forecast throughout the concession due to expected economies of scale.

Figure 4-4: EBITDA and EBITDA margins during concession



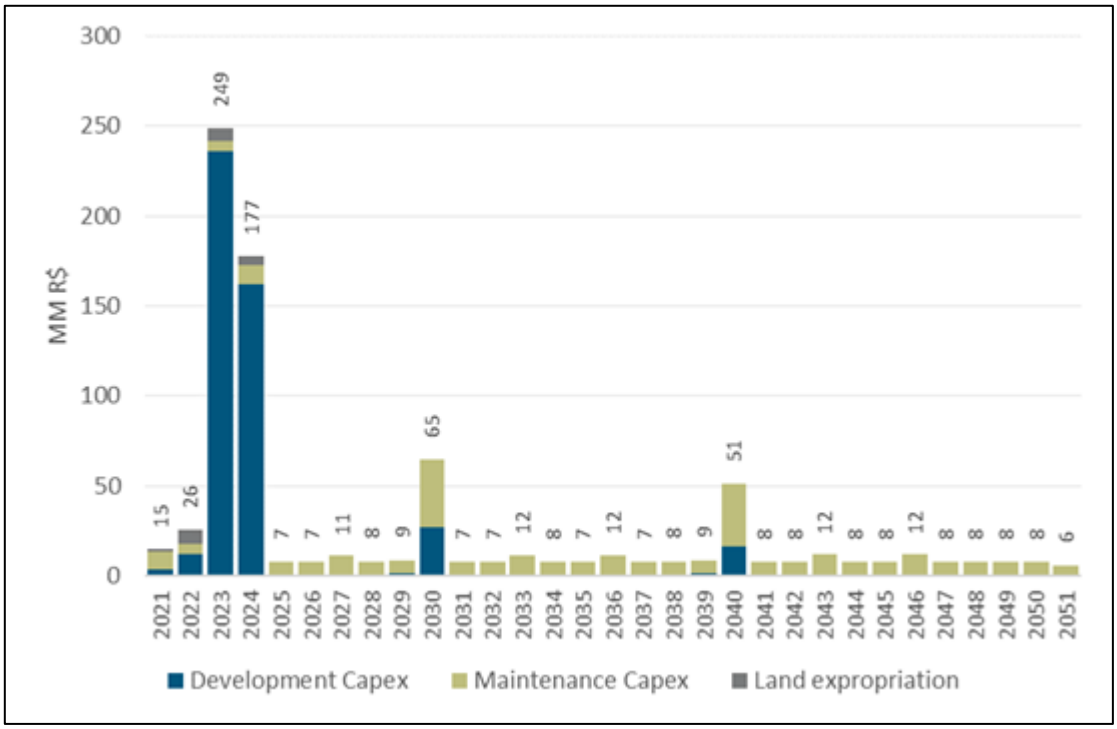
Source: GCA Consortium.

CAPEX

The development plan, expansion of airport assets to meet growing demands and ensure appropriate level of service, requires a total investment of R$792MM.

Development investments (topical and intended to expand airport assets, including expropriations) will be divided into different phases and amount to a total R$483MM. Maintenance investments (periodical and intended to maintain and replace assets, including re-paving cycles) add up to R$309MM throughout the concession period (Figure 4-5).

Figure 4-5: CAPEX during concession

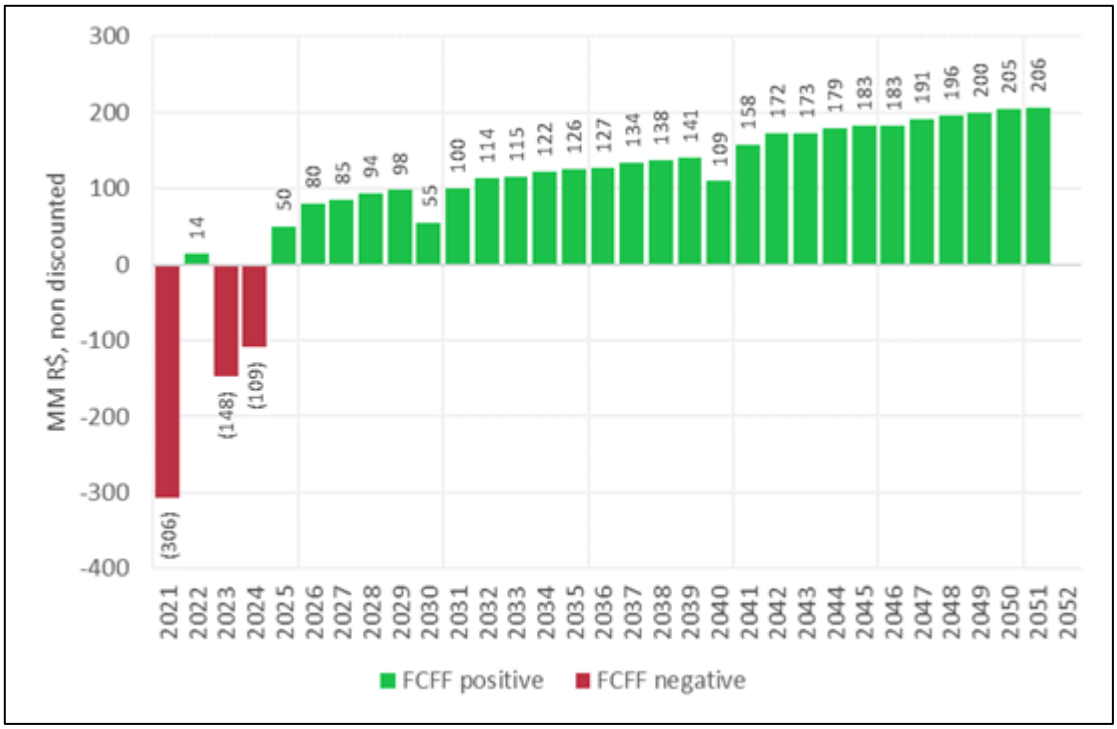


Source: GCA Consortium.

Evaluation of concession's financial feasibility

The project's forecasted free cash flow (FCFF) is presented in Figure 4-6 , which shows the FCFF is positive during most of the concession, except during investment cycles: the project's first phase will require funding, while following phases will lead to FCFF reduction. The project's IRR, prior to grant values, is 13.8%p.a. (real) and its MIRR is 8.7%p.a. (real).

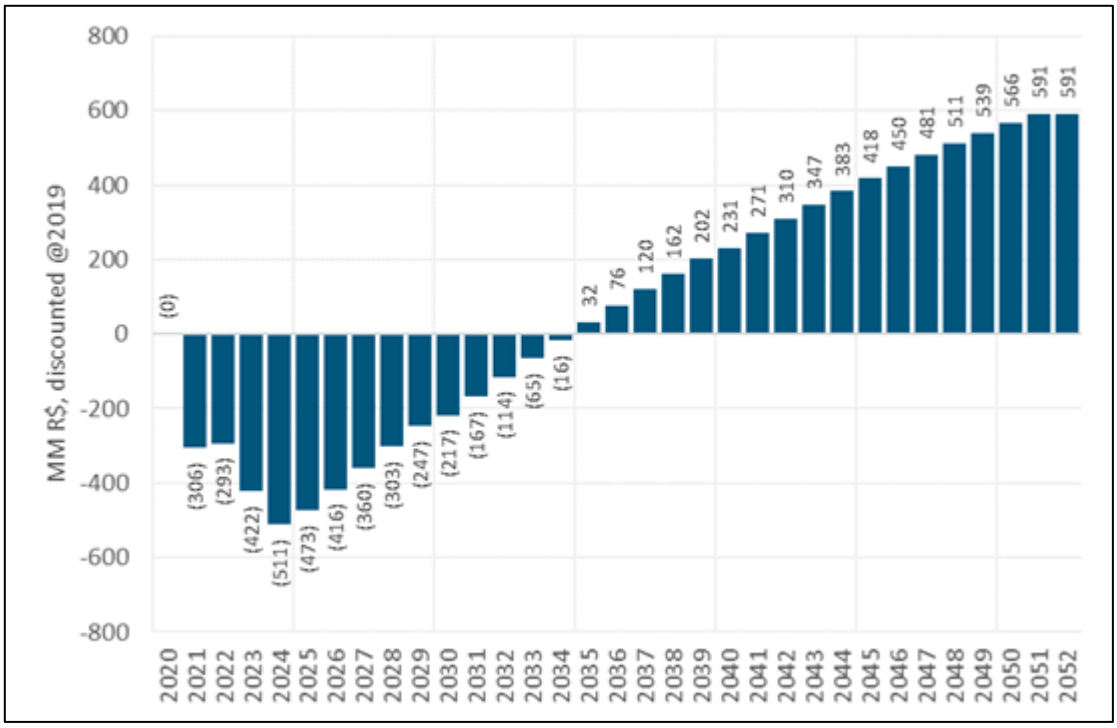
Figure 4-6: Free cash flow to firm (non-discounted – prior to grant values)



Source: GCA Consortium.

The cumulative discounted FCFF (given the referential weighted average cost of capital – WACC set at 7.23%p.a., real), from which the NPV net of grant payments is determined, is shown in Figure 4-7. The NPV of the project is **R$591.5MM** (net of grant payments). Since the internal rate of return is higher than the cost of capital and the NPV is positive, the concession is financially feasible.

Figure 4-7: Cumulative discounted free cash flow to firm (net of grant payments)



Source: GCA Consortium.

Definition of grant payments

Once the concession's financial feasibility is confirmed, it is possible to determine the grant payments that allow for a fair return to the concessionaire, given the project's risk pattern (i.e. identical to the costs of capital).

- SAC/MI defined grant payments divided in an initial fixed payment, equivalent to 50% of pre-grants NPV (to be paid by the concessionaire as lump sum upon entry into the agreement), and variable annual payments (equal to a percentage of the concession holder's gross revenues in each period)[12] and set so that project NPV = 0 at the regulatory cost of capital.

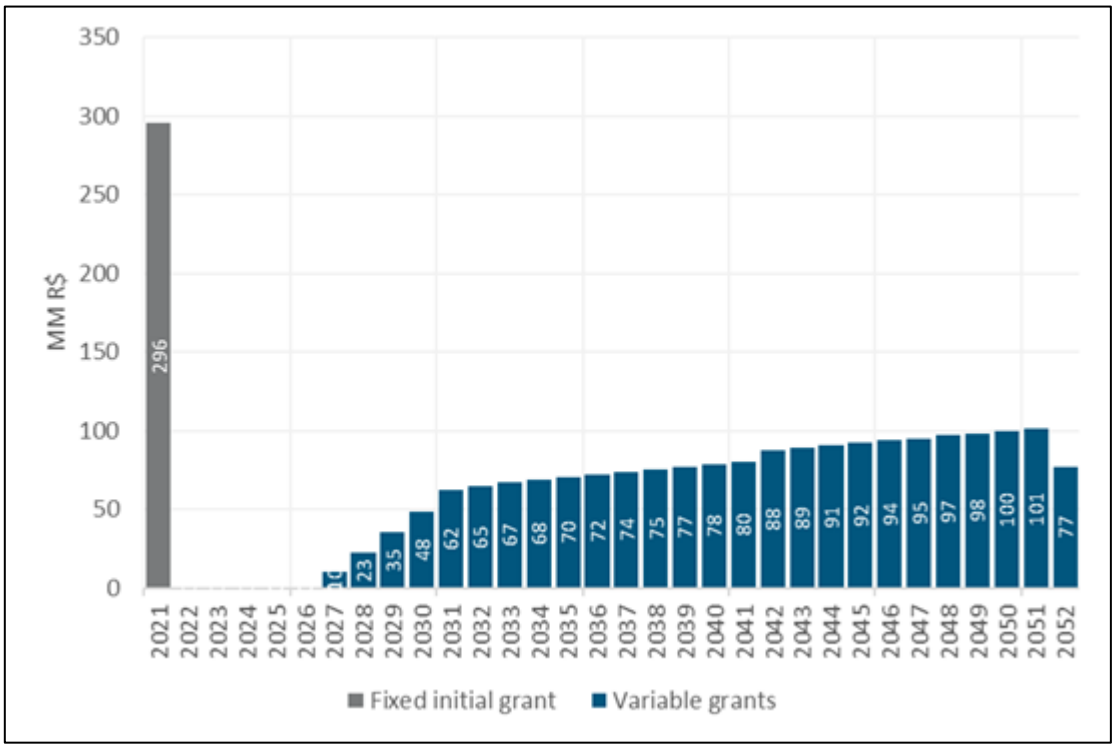
Resulting grants are:

- Fixed initial payment: R$295.7MM (based on January/2019 real prices);

12 The following methodology is prescribed: on the fifth full calendar year of the concession, the concession holder will begin to determine the variable grant, to be proportional with the previous fiscal year's gross revenues. From the 6th to the 8th calendar year, the concession holder will recognize increasing shares – at 40%, 60% and 80% - of the final variable-grant percentage. From the 9th calendar year, the final variable grant rate would apply (that is, the rate set to make the concession' NPV equal to zero). According to the applicable provisions, payment may be made until May of the year immediately subsequent to that of the determination – therefore, the first payment has been assumed to be made in 2027, and the final one in 2052.

- Variable payments: final percentage of 20.8% of gross revenues.

Figure 4-8: Grant payments flow during concession



Source: GCA Consortium.

Table 4-2 shows the sum of the grant payments flow over the concession period in two forms: (i) non-discounted; and (ii) at present value net of cost of capital.

Table 4-2: Total grants to the government (discounted and non-discounted)

Values in MM R$	Total, non discounted	Total discounted @7.23% a.a.
TOTAL	**2.221**	**811**
Fixed initial grant	296	296
Variable grants	1.926	515

Source: GCA Consortium.

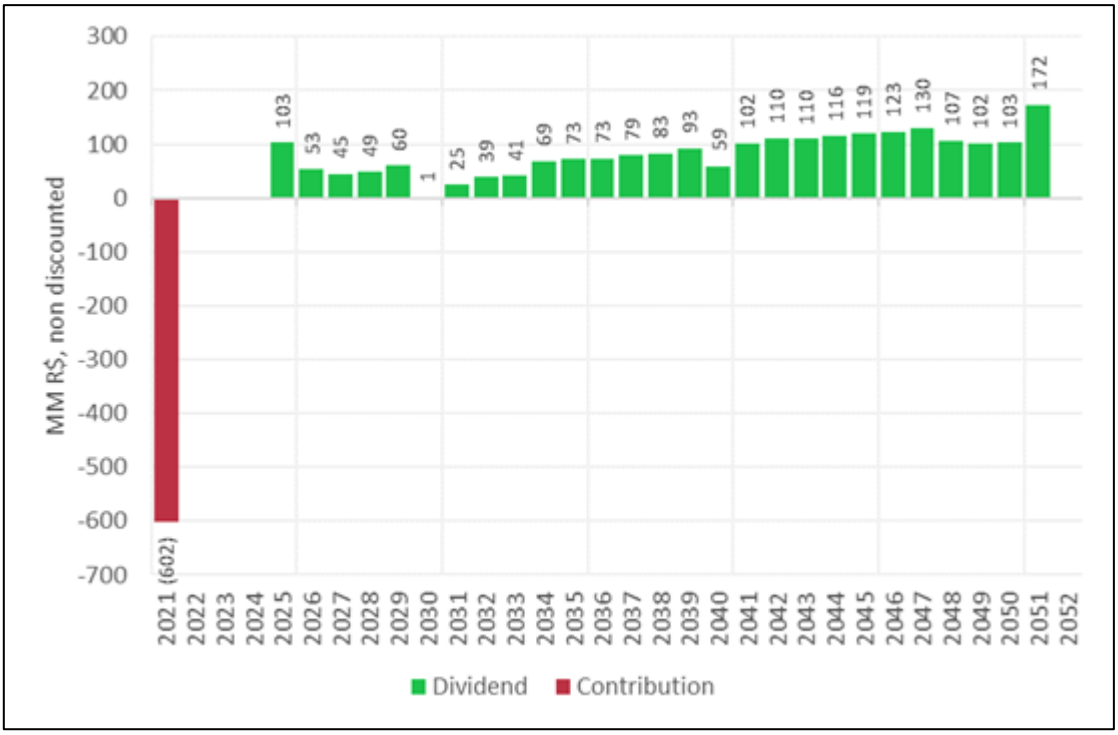
Attractiveness to shareholders

Analyses of the project's attractiveness to shareholders consider: (i) third-party funding (long term BNDES loan and issuing of debentures, given market conditions and minimum covenants); (ii) equity needs; and (iii) the possibility of dividend payments throughout the concession.

Figure 4-9 presents the forecast flows of capital injections and dividend distributions. The concessionaire needs to inject equity resources only in 2021, just before the concession period begins, collecting increasing dividends over the remainder of the concession period. Dividend distribution is interrupted only during funding and respective grace periods and is immediately followed by accumulated resource distribution. In 2030 and 2040, dividend distribution decreases due to

investment cycles. The equity IRR, calculated based on contribution and dividend flows, is 7.9%p.a. (real).

Figure 4-9: Contribution and dividend flows, non-discounted (post-payment of grants)



Source: GCA Consortium.