EXECUTIVE SUMMARY

JOINVILLE AIRPORT
LAURO CARNEIRO DE LOYOLA
SBJV/JOI

April/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 Joinvile Airport/SC Lauro Carneiro de Loyola – SBJV/JOI 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 **Joinville Airport/SC – Lauro Carneiro de Loyola** (IATA JOI or ICAO SBJV), which processed 486 thousand passengers in 7 thousand operations in 2018[1].

1.1 Overview

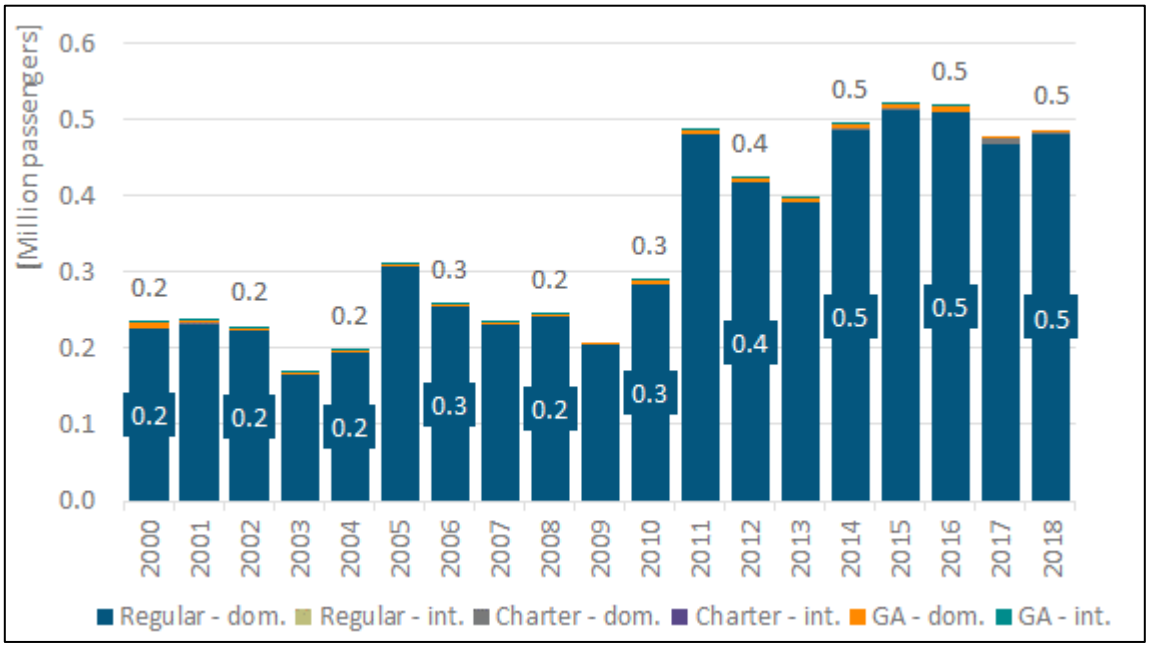
The Airport lies in Joinville, the most populated city in Santa Catarina, distant about 130 km from Curitiba and 200 km from Florianópolis.

The regional economy's highlight is the manufacturing sector, which includes metallurgy, appliances and automation, and seaport activities. The Airport lies close (70 km) to the terminals of Babitonga Bay, notice being due to the São Francisco do Sul seaport and the Port of Itapoá, one of Brazil's leading container-handling facilities.

The Airport is also 10 km distant from the North Industrial Zone, which houses the Joinville dry port, and 50 km from the city of Jaraguá do Sul, which stands out for its textile and electronic equipment industries.

The number of passengers at SBJV more than doubled from 2000 and 2011, when it served almost 500 thousand passengers. The number hovered near this level in the following years, logging 486 thousand passengers in 2018 (4.2% average annual growth rate in 2000-2018).

Figure 1-1: Passenger history (origin, destination and connections) for the Airport

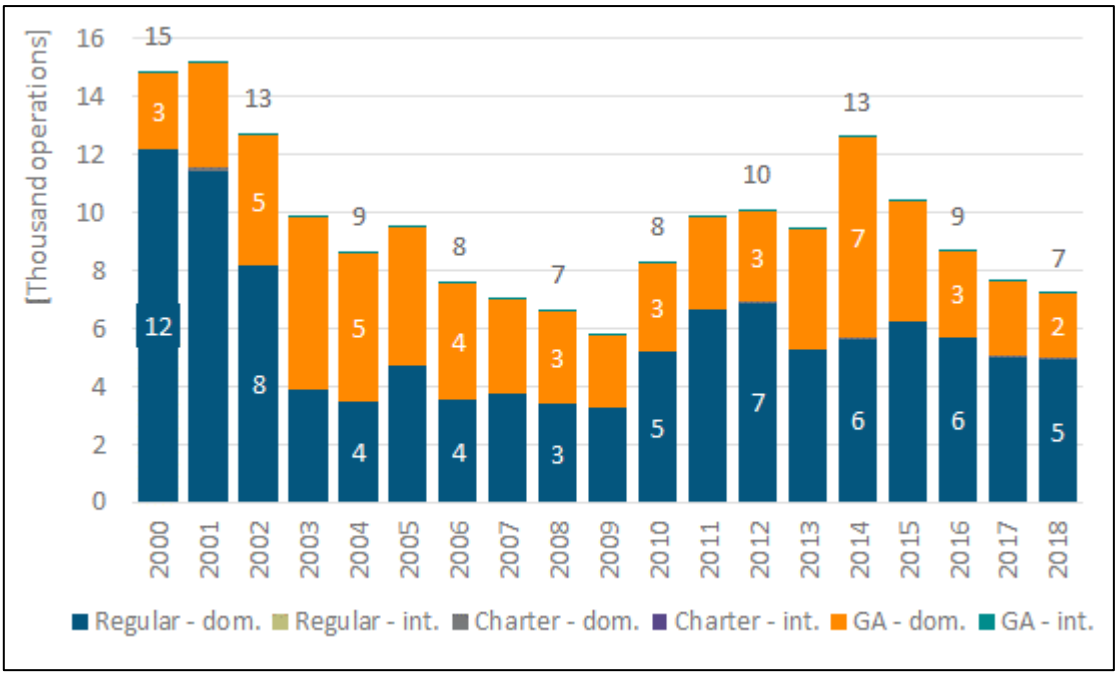


Source: Infraero

[1] Sources: ANAC and INFRAERO statistics.

The Airport had 7 thousand operations in 2018, of which 68% were regular domestic, and 31% were general aviation flights (Figure 1-2). The drop in total commercial aviation operations seen from 2012 to 2018 is due to a combination of the instability seen in Figure 1-1 and the increase in aircraft size.

Figure 1-2: Annual operations history (landings and take-offs) at the Airport



Source: Infraero

In 2018, the Airport had regular domestic routes[2] connecting with the Viracopos (SBKP) and the São Paulo/Congonhas (SBSP) Airports, as Figure 1-3 shows (line thickness reflects relative route frequency).

[2] Only considers routes with twice-weekly or greater frequency.

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

Figure 1-3: Map of the Airport's domestic routes in 2018

Source: OAG and ANAC

Regarding the pandemic impacts, it stands out that the airport continued to receive flights from the essential airline network in March. The demand in March 2020 was 65% of the previous month. However, in April, the airport had its operations completely interrupted.

As concerns cargo handling, the Airport processed a mere 1 thousand tons in 2018 in the holds of commercial aircraft.

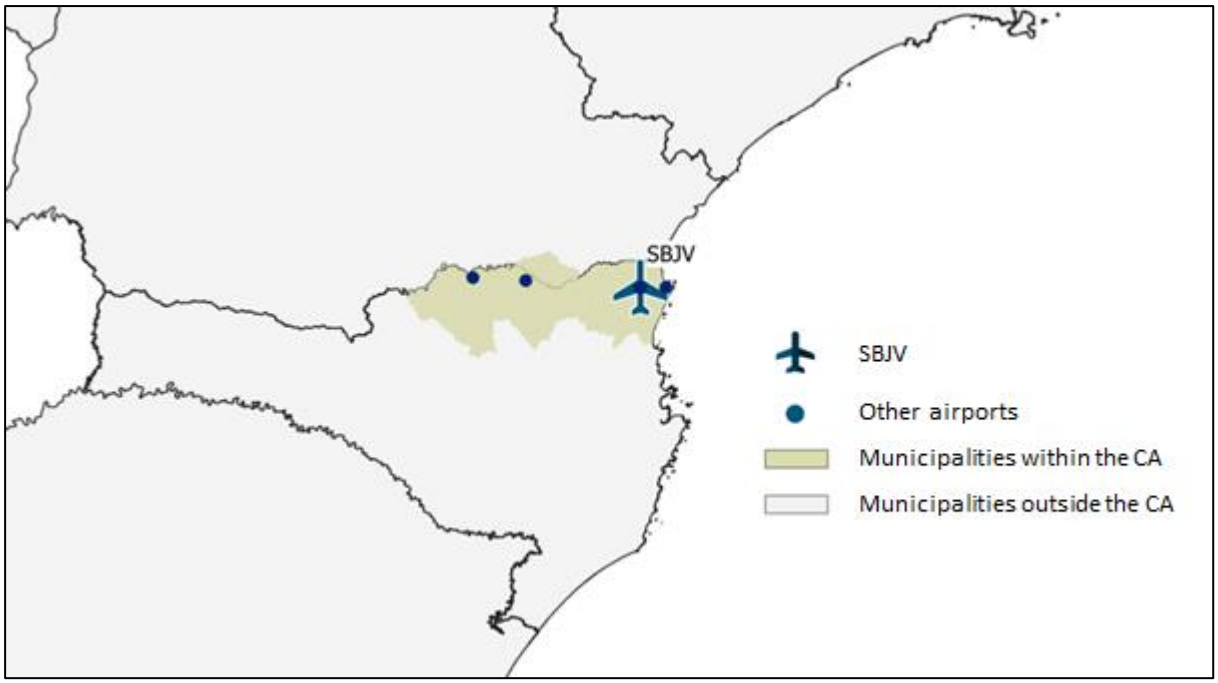
Catchment area

SBJV's Catchment Area (CA) is defined based on the "City Catchment Areas" ("Regiões de Influência das Cidades" – REGIC)[3], study, by the Brazilian Geography and Statistics Institute (IBGE), which covers a range of economic and socio-cultural aspects of the population.

[3] 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.

According to the REGIC, Joinville is under the influence of the Metropolis of Curitiba, so that its CA lies within Curitiba's. Overall, the Joinville CA, seen in Figure 1-4, covers more than 25 municipalities and a total area of 15 thousand square kilometers.

Figure 1-4: 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[4] conducted in 2014.

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

Commercial aviation passengers

To forecast domestic passengers with origin or destination in the Catchment Area[5], 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.

[4] EPL is a Federal-government agency focused on country-wide transportation & logistics planning.
[5] Includes the Curitiba Airport.

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 and adjustments regarding the COVID-19 pandemic.

Connecting and layover[6] passengers were forecast as function of the Airport's increased airline-network capillarity and domestic connections rate benchmarks. No international passenger flows are expected at SBJV.

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.

Total passengers

Figure 1-5 shows the consolidated results of the above forecasts. Total passengers at SBJV will grow 2.7% p.a. from 2021, the first, to 2050, the final full year of the concession, at which time 1.2 million passengers are expected.

Figure 1-5: Total passengers forecast at the Airport by flow type

Source: GCA Consortium

[6] Passengers who do not deplane at the Airport and therefore generate no fee revenues.

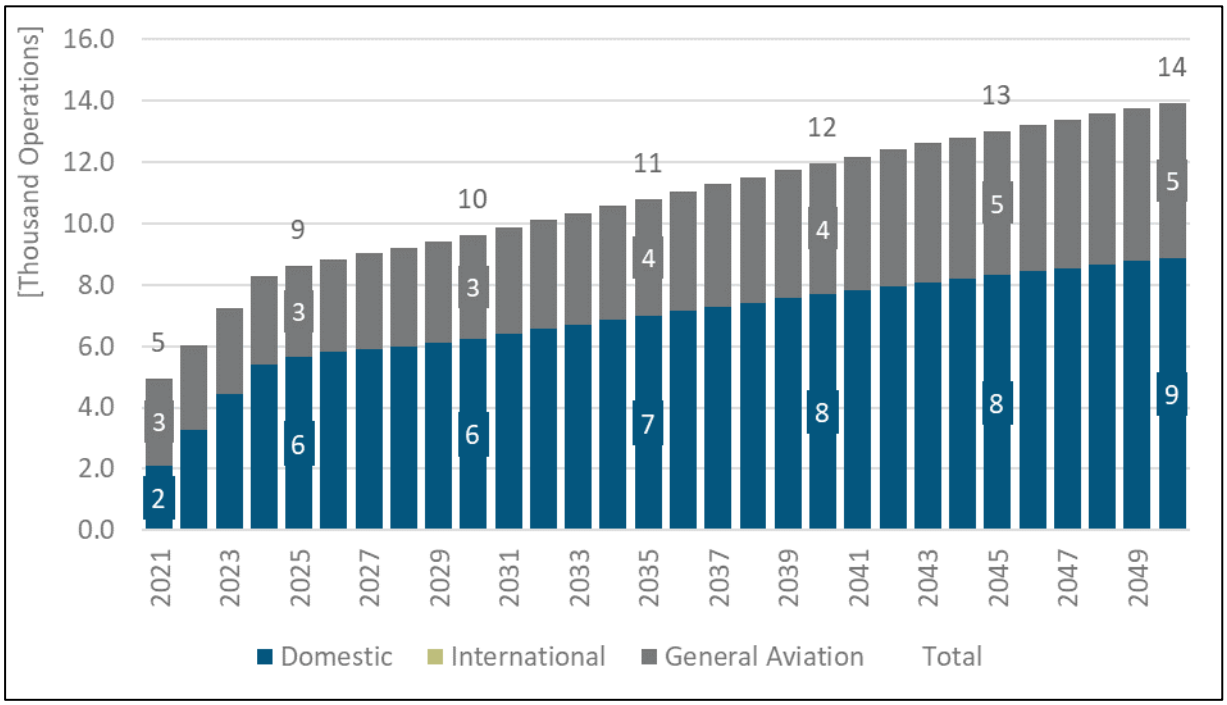
1.2.2 Aircraft operations and airline network

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 Airport will log 9 thousand domestic commercial and 5 thousand general aviation operations, with average annual growth rates of 5.1% and 2.0%, respectively.

Figure 1-6: Total annual Airport operations forecast



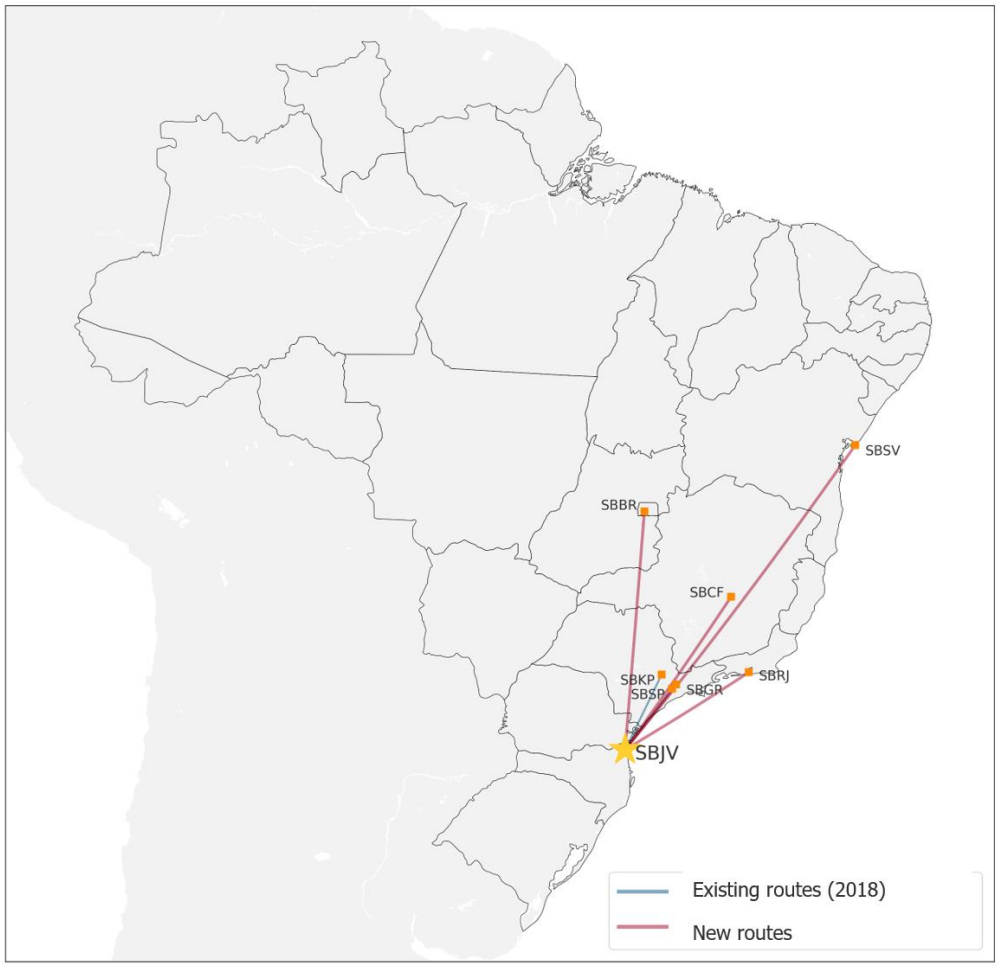
Source: GCA Consortium

No international routes are expected at the Airport for the duration of the concession.

Airport insertion in the airlines network

During the concession period, the Airport is expected to begin serving the Northeast and Center-West regions of Brazil, with routes connecting with Salvador and Brasília, and to increment the connection with the Southeast with new routes connecting with Rio de Janeiro and São Paulo. The number of domestic destinations at SBJV is expected to increase from 2 to 7 from 2018 to 2050.

Figure 1-7: Domestic 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 under one million passengers per year, like SBJV, the applicable service level criterion in the initial investment phase is based on 1.3 times the number of seats in the critical aircraft[7] (or, in the case of simultaneous operations in 45 minutes, 1.3 times the number of seats available). In later phases of the project, the benchmark becomes the 30th busiest hour of the year.

The results for both criteria have been calculated as of 2018 based on Infraero records, and forecast according to domestic peak-factor benchmarks (peak demand/annual demand).

[7] The aircraft with the largest number of seats available at the airport in the reference period. For this Airport, this is the B738 (186 seats).

- Using the criterion of 1.3 times the number of seats on simultaneous operations in 45 minutes or on the critical aircraft, the study finds 587 passengers for departures and arrivals, and 958 simultaneous passengers at concession start, in 2021;
- Using the 30th busiest hour produces the following numbers:
    - 2021 (concession start): 182 departing passengers, 170 arriving passengers, 6 connecting passengers and 283 simultaneous passengers;
    - 2050 (final full year of the concession): 370 departing passengers, 346 arriving passengers, 12 connecting passengers and 573 simultaneous passengers;

The Engineering Report discusses the use of this data for PT dimensioning.

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 7 commercial aircraft runway operations per hour in 2050.

Dimensioning also considers peak usage of apron positions based on 2018 maximum usage records[8] and peak factor benchmarks. According to the forecasts, a minimum 4 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. Considering the Airport's expected improvement and expansion works, no restrictions on traffic growth have been forecast for any of the Airport's systems.

1.2.4 Cargo

Concerning international cargo, only import flows are forecast, steady at 1.9 thousand tons until 2050[9]. For domestic cargo flows, the study projects a total 3 thousand tons by the end of the concession.

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.

[8] Based on ANAC data.

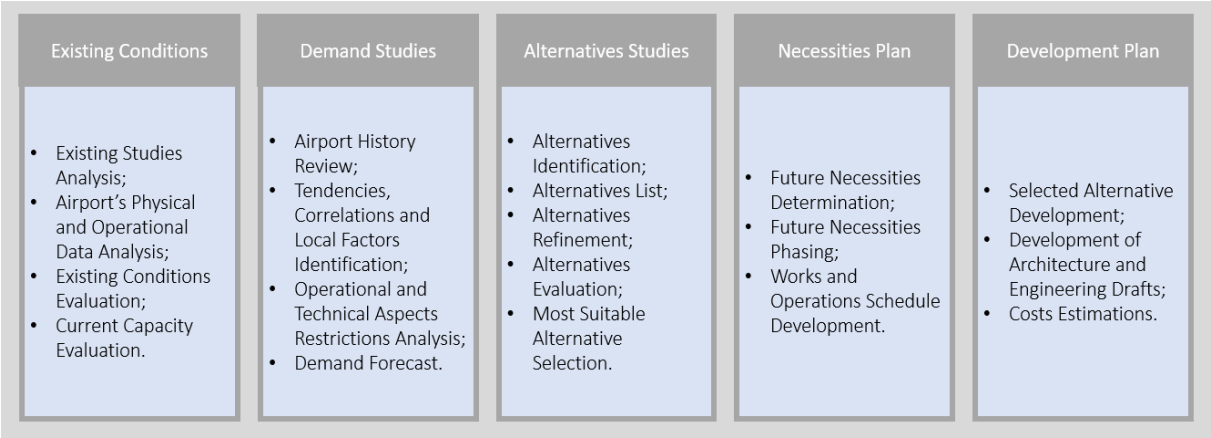
[9] Indirect non-air import flow with ground receipt under customs transit regime at the TECA, for clearance and subsequent release to the end customer.

2 ENGINEERING STUDIES

This section presents the Executive Summary of the Engineering Studies for the concession of the Joinvile Airport/Lauro Carneiro de Loyola – SBJV/JOI.

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.

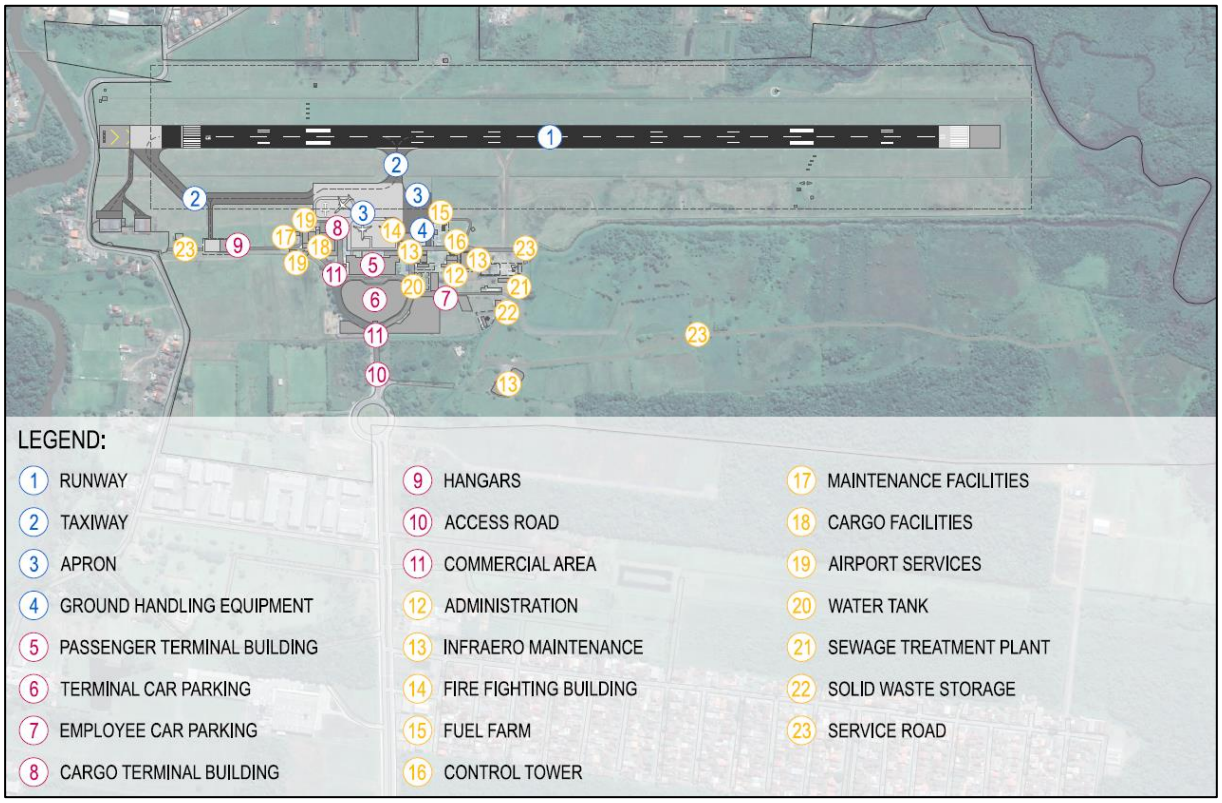
2.1 Existing Conditions

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.

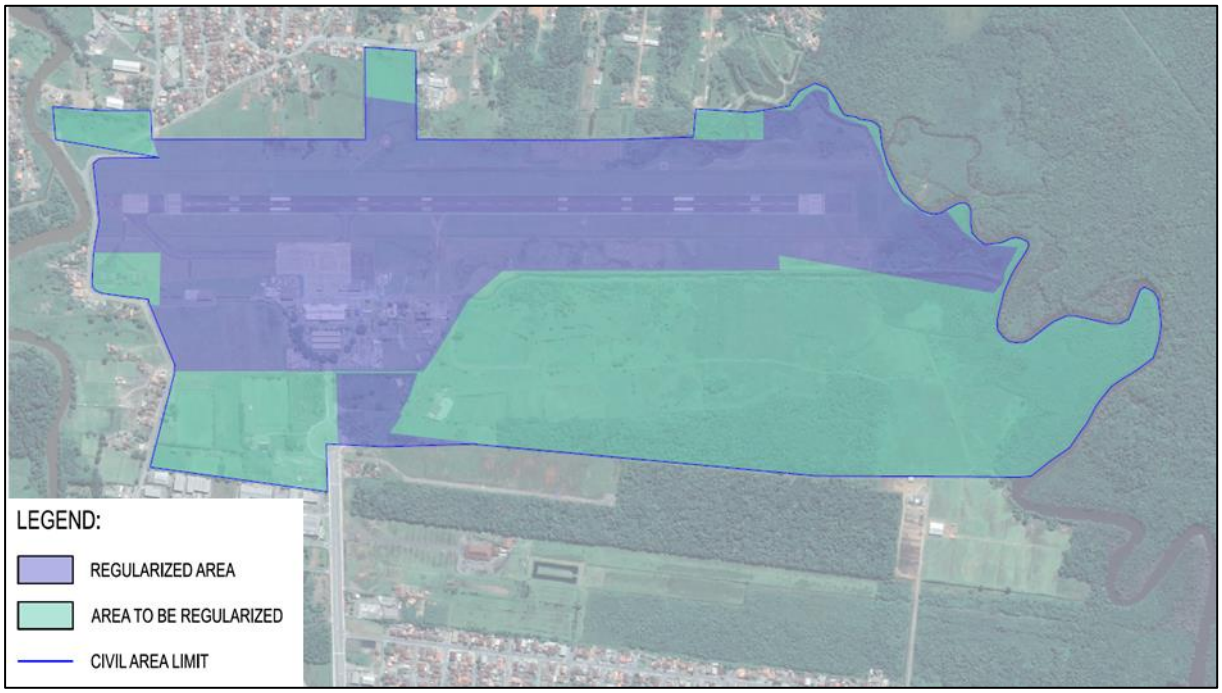
Figure 2-2: Current Facilities Situation



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 and area to be regularized. The regularized estates belong to the Federal Union, Ministry of Aeronautics and INFRAERO. The estates to be regularized are properties of the Federal Union and third parties, pending documents for transferring the area to the Airport, pending occupation of the area by the airport operator or irregular. 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 a new firefighting building. 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. The continuation and completion of the paralyzed works was considered in the development plan, since a new firefighting building is needed. The amounts considered in the CAPEX were deducted, in order to take advantage of what is already built.

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)	20,2	7	Suitable

Source: GCA Consortium.

Table 2-2: Taxiways Capacity

Taxiway	Width (m)	Width Without Shoulders (m)	RBAC154 Code	Critical Aircraft	Situation
Taxiway A	23	23	B	AT72	Not Suitable
Taxiway B	23	23	B	AT72	Not 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
B	-	-	-	-	0
C	-	-	-	-	0
D	-	-	-	-	0
E	-	-	-	-	0
F	-	-	-	-	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
B	-	-	-	-	2
C	-	-	-	-	4
D	-	-	-	-	0
E	-	-	-	-	0
F	-	-	-	-	0
Positions (Remotes + Boarding Bridges)	F/E/D/C	E/D/C	E/C	D/C	C
A	-	-	-	-	0
B	-	-	-	-	2
C	-	-	-	-	4
D	-	-	-	-	0
E	-	-	-	-	0
F	-	-	-	-	0
Total Boarding Bridges	-	-	-	-	0
Total Remote Stands	-	-	-	-	6
Total Number of Stands	-	-	-	-	6

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
B	-	-	-	-	25
C	-	-	-	-	45
D	-	-	-	-	75
E	-	-	-	-	85
F	-	-	-	-	130

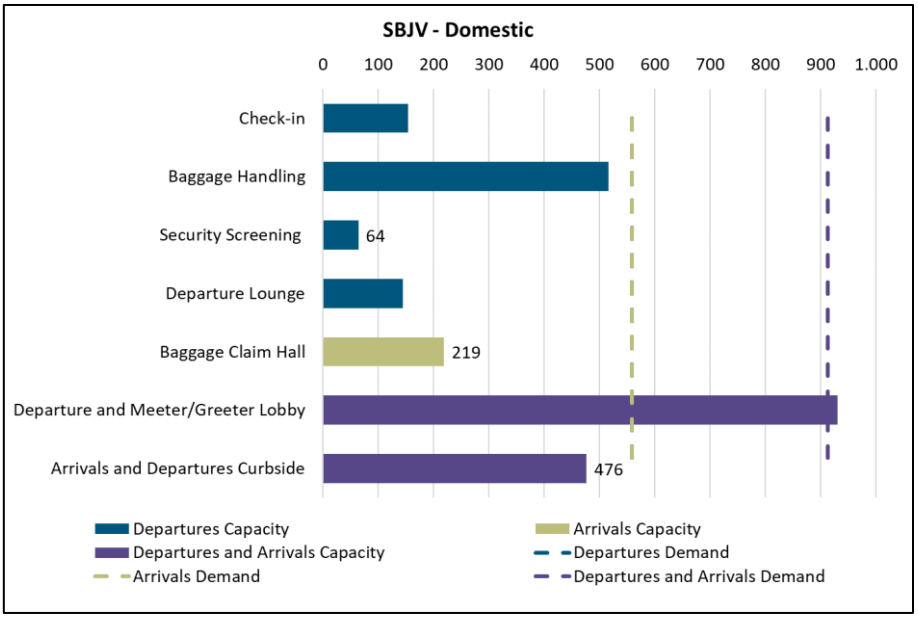
Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Capacity	F/E/D/C	E/D/C	E/C	D/C	C
A	-	-	-	-	0
B	-	-	-	-	5
C	-	-	-	-	5
D	-	-	-	-	0
E	-	-	-	-	0
F	-	-	-	-	0
Total	-	-	-	-	10

Source: GCA Consortium.

2.1.2.2 Passenger Terminal System

Figure 2-4 summarizes the results obtained from the installed capacity and the existing demands of the departures and arrivals flows.

Figure 2-4: Terminal's Components Capacity



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 thresholds (15-33) and IFR day/night accuracy CAT I for threshold 33. With PAPI systems at both thresholds, the runway is capable of landing jet aircraft by either threshold.
Cargo Terminal System	• **Cargo Terminal Building:** suitable to current demand. • **Airside Aprons:** 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:** 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:** not 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:** suitable to current demand. • **Catering:** not suitable to current demand. • **Airport Services:** not suitable to current demand.
Basic Infrastructure System	• **Electric Power:** suitable to current demand and presents non-conformities. • **Water Consumption:** not suitable to current demand. • **Sewage Treatment:** 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 2-5 shows the results of the studies of demand.

Figure 2-5: 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 2-6, 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 2-6: Necessities Plan

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

SBJV	Current	Phase 01	Phase 02
DEMAND	**2018**	**15 Years**	**30 Years**
Annual Passengers Movements			
Regular Aviation	478,050	805,265	1,016,700
General Aviation	6,063	7,852	10,432
Total	484,113	813,117	1,027,132
Cargo (tons)			
Total	478,050	805,265	1,016,700
Aircraft Movements			
Passengers	4,923	6,997	8,878
Air Cargo	-	-	-
General Aviation	2,235	3,814	5,056
Total	7,158	10,811	13,934
RUNWAY SYSTEM			
Design Aircraft Code	C	C	C
Number of Runways	1	1	1
Runway Length (m) (1)	1,540	1,515	1,515
Operation Type	PA1	PA1	PA1
APRON SYSTEM			
Passengers Apron (2)			
Contact Stands	-	-	-
Remote Stands	4C	4C	5C
Total Number of Stands	4C	4C	5C
Cargo Apron (2)			
Total Number of Stands			

SBJV	Current	Phase 01	Phase 02
PASSENGERS TERMINAL SYSTEM			
Departure Peak Hour Capacity	61	615	615
Arrival Peak Hour Capacity	219	615	615
Terminal Building			
Total Area (m²)	3,350	10,600	10,600
Baggage Handling System			
Processing Capacity (bhp)	167	204	231
Car Parking			
Total Area (m²)	8,380	13,780	16,480
Number of lots	310	510	610
Curbside			
Departure Curbside Length (m)	46	63	71
Arrival Curbside Length (m)	46	59	66
Total Length (m)	91	122	137
Ground Handling Equipment			
Total Area (m²)	850	1,150	1,150
CARGO TERMINAL SYSTEM			
Cargo Terminal Building Area (m²)	1,015	400	400
GENERAL AVIATION SYSTEM			
General Aviation Terminal (m²)	-	-	-
Total Number of Stands	-	4	4
General Aviation Terminal Car Parking	-	-	-
Hangars and Aprons Area (m²)	2,520	2,400	2,400
ADMINISTRATION AND MAINTENANCE SYSTEM			
Administration [3]			
Total Area (m²)	730	899	899
Maintenance			
Total Area (m²)	2,740	2,740	2,740

SBJV	Current	Phase 01	Phase 02
OPERATION SUPPORT SYSTEM			
Fuel Farm			
Total Area (m²)	1,620	1,620	1,620
5-day storage (m³)	119	172	216
Fire fighting Building			
Category	6	7	7
Total Area (m²)	295	5,295	5,295
AIRLINES SUPPORT SYSTEM			
Maintenance Area (m²)	75	900	900
Cargo Processing Area (m²) (4)	930	300	375
Aircraft Maintenance Area (m²)	-	-	-
INDUSTRIAL SUPPORT SYSTEM			
Mail Area(m²)	-	-	-
Catering Area (m²)	-	300	300
Airport Services Area (m²)	390	900	900
BASIC INFRASTRUCTURE SYSTEM			
Water Tank (m³)	65	245	315
Solid Waste Area (m²)	116(5)	40	40
Electric Power Area (m²)	294	1.454	1.454
Sewage Treatment Units (6)	- (7)	2	3

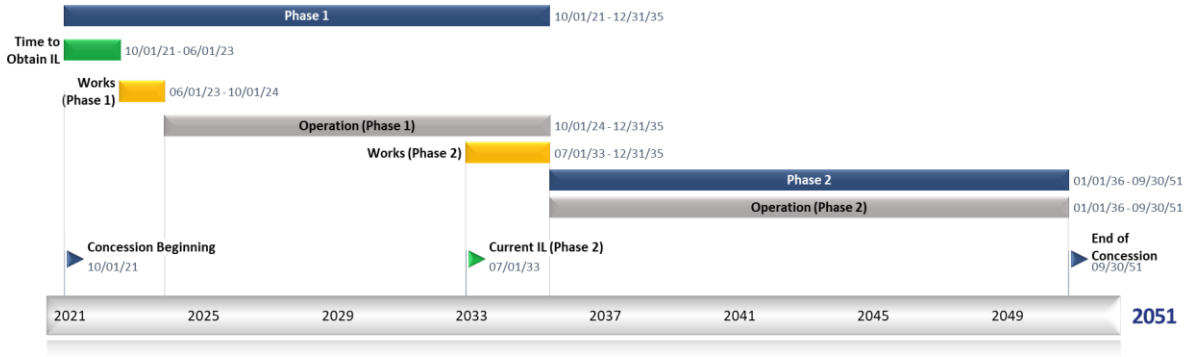
(1) It's been considered the Landing Distance Available (LDA).
(2) The cargo apron can be reversible, that means, shared with the commercial aviation.
(3) The area can be considered inside the PTB.
(4) Area can be considered inside the PTB or Cargo Terminal Building.
(5) Existing Solid Waste Area is inadequate, a new system is proposed.
(6) Compact Sewage Treatment Unit, D70 model.
(7) Currently the airport doesn't have an area 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 2-7.

Figure 2-7: Phasing and Works Estimated Schedule



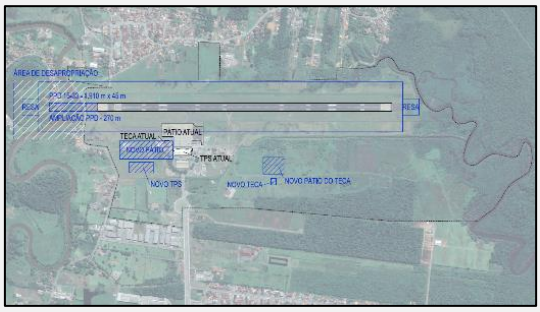
Source: GCA Consortium.

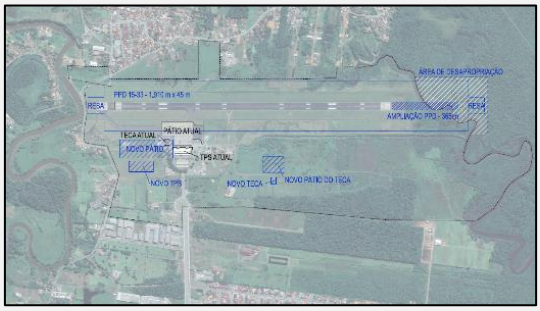
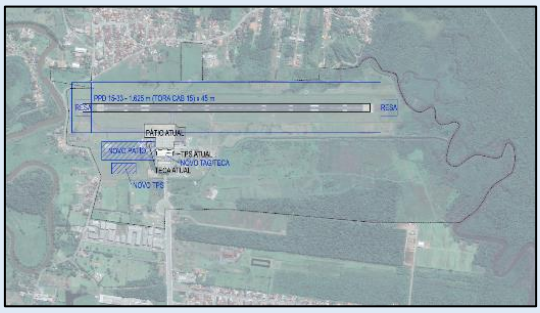
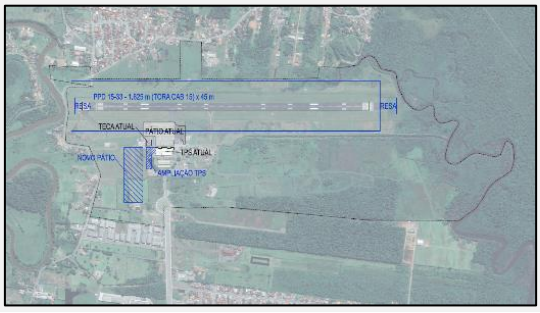
2.4 Alternatives Study

In order to choose the best alternative for the development of the airport site, it was considered the best solution for all infrastructure non-conformities, allowing the future development of the airport site in an optimized way, assuring a high level of service for all installations, minimizing the interference in the existing facilities and presenting compatible costs with the airport revenues during the concession period.

The proposed alternatives and their main characteristics are presented in Figure 2-8.

Figure 2-8: Proposed Alternatives

Alternative 01		• Runway extension of 270 m with river diversion (Costs > R$ 20 MM); • New passenger terminal building implementation with 11,200 m^2 (Costs > R$ 68 MM); • New apron implementation with 22,000 m^2 (Costs > R$ 9 MM); • New cargo terminal building and apron implementation (Costs > R$ 5 MM); and • Expropriation of 120,000 m^2.

Alternative 02		• Runway extension of 365 m with river diversion (Costs > R$ 27 MM); • New passenger terminal building implementation with 11,200 m² (Costs > R$ 68 MM); • New apron implementation with 22,000 m² (Costs > R$ 9 MM); • New cargo terminal building and apron implementation (Costs > R$ 5 MM); and • Expropriation of 100,000 m².
Alternative 03		• New passenger terminal building implementation with 11,200 m² (Costs > R$ 68 MM); • New apron implementation with 22,000 m² (Costs > R$ 9 MM); and • Use of existing infrastructure.
Alternative 04		• Passenger terminal building extension (Costs > R$ 70 MM); • New apron implementation with 22,000 m² (Costs > R$ 9 MM); • Use of existing infrastructure; and • Expansion difficulties after the concession period.

Source: GCA Consortium.

The presented costs were obtained from reference figures by square meter (m²) and have the purpose to compare in a macro way the different alternatives. The detailed cost analysis was made only for the chosen alternative and it is presented in the CAPEX report.

From the studied solutions, it is observed that alternatives 01 and 02 have significantly higher implementation costs than alternatives 03 and 04.

Although the extension of the Runway to 1,910 m in length provides a gain in terms of takeoff weight for aircraft, it has been noted that its expansion presents severe complications from the environmental point of view, whether the extension is carried out in the direction of threshold 15, or in the direction of threshold 33. In this second case, the environmental damage would be further aggravated, because in addition to the river displacement, there is a need for deforestation and a landfill over a larger area.

In addition, the range studies have shown that the current runway length is enough for critical aircraft operation without further restrictions.

As for the implementation of a new Air Cargo Terminal and dedicated aircraft apron, it was concluded, from demand studies, that the volume of air cargo at the airport over the concession period does not yet justify this new construction, and can be serviced by a smaller infrastructure.

Alternative 03 respects the guidelines of the Master Plan regarding the location of the new PTB and aircraft apron but rules out the expansion of the Runway and implementation of a new Air Cargo Terminal and dedicated aircraft apron, significantly reducing implementation costs.

Alternative 04 considers the reform and expansion of the current PTB, thus avoiding the implementation of a totally new building. The cost analysis showed that this alternative is slightly more economical, however the geometric arrangement of the aircraft apron and PTB would imply limitations under the operational point of view and future expansion, causing it to be discarded.

Thus, alternative 03 was selected as the most advantageous for the development of the airport site.

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.

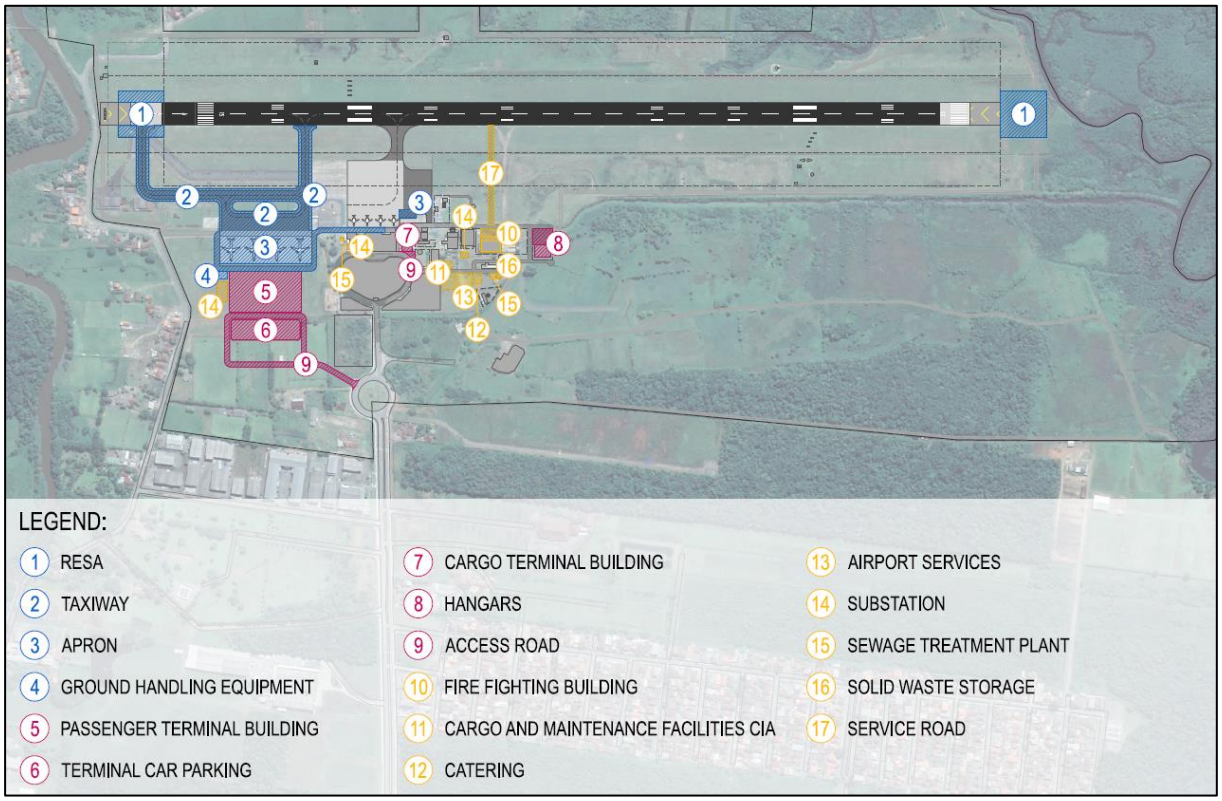
Below, the main investments for each phase of the planning are presented, as well as the implementation plants identifying the interventions at the airport and their subsequent level of details.

2.5.1 Phase 1

The first phase of the concession is expected to occur between the years 2024 and 2035, since the period between 2021 and 2024 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 2035.

In the Figure 2-9, it is presented the implementation proposed to Joinville Airport, considering Phase 01.

Figure 2-9: Development Plan – Phase 01 Implementations



Source: GCA Consortium.

The main interventions proposed in this phase are:

- Implementation of RESA on the thresholds 15 and 33;
- Displacement of threshold 15 by 15 m;
- Runway 15/33 strip leveling;
- Reconstruction of access taxiway A;
- Apron 2 implementation to commercial aircrafts;
- Access taxiways C and D, new parallel taxiway E and taxilane F implementation to the new apron 2;
- Relocation of the fire fighting building and incorporation of the area to apron 1;
- New passenger terminal building and terminal car parking implementation, using the existing terminal for general aviation.

2.5.2 Phase 2

The second phase of the operation is expected to be between the years 2036 and 2051, 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 2050.

In Figure 2-10, it is presented the proposed implementation for the Joinville Airport, considering the Phase 02.

Figure 2-10: Development Plan – Phase 02 Implementations

Source: GCA Consortium.

The main interventions proposed for this phase are:

- Terminal car parking extension;
- Apron 2 extension.

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	122,520,377.44
Phase 2 Airport Expansion	14,068,018.25
Airport Expansion Subtotal	**136,588,395.69**
Phase 1 Airport Expropriations	934,312.18
Phase 2 Airport Expropriations	-
Airport Expropriations Subtotal	**934,312.18**
CAPEX Total	**137,522,707.87**

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	119,075,389.21	3,444,988.23	-	122,520,377.44
Phase 2 Airport Expansion	6,735,294.01	7,332,724.24	-	14,068,018.25
Airport Expansion Subtotal	**125,810,683.22**	**10,777,712.47**	**-**	**136,588,395.69**
Phase 1 Airport Expropriations	-	-	934,312.18	934,312.18
Phase 2 Airport Expropriations	-	-	-	-
Airport Expropriations Subtotal	**-**	**-**	**934,312.18**	**934,312.18**
CAPEX Total	**125,810,683.22**	**10,777,712.47**	**934,312.18**	**137,522,707.87**

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 Joinville.

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 Institute of Environment (*Instituto de Meio Ambiente – IMA*).

These data oriented the technical field visit to the Airport of Joinville, which occurred on May 9, 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 airport of Joinville, one of the busiest of the South of Brazil, is located in the urban region of Joinville city, in Santa Catarina state. The operations began in its current location in 1964. Under Infraero's administration since 1974, the new airport has been to important remodeling constructions. In the 90s, the new Passenger Terminal and the maneuver yard were expanded, while a new arrival room was created and climatized. In the end of this same decade, a modern passage terminal was built. In the begging of the 2000 decade, the runaway, taxiway and stop-way were resurfaced, and the functioning of Control Tower of Joinville was reformulated. In 2002 a new Passenger Terminal was inaugurated, increasing the airport's capacity.

Regarding environmental regularity, the Airport of Joinville is regular concerning the operating licensing of its current activities and infrastructure. The Institute of Environment (*Instituto do Meio Ambiente - IMA*), environemental agency of Santa Catarina, 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
LAO 3.153/2020	FATMA (current IMA)	DIV/00300/CRN and DIV/22251/CRN Digital process IMA 13.964/2019)	July 06, 2020	July 06, 2024	Effective

Source: Consórcio GCA

According to the brief licensing history of the airport, we highlight the administrator effort in obtaining the License renewal over the 15 years.

After reading all the documentation made available by Data Room, as well as all the files of processes DIV/00300/CRN and DIV/22251/CRN, we still have doubts on the reason for such delay.

The environemental agency did not answer Infraero's request on clarifying the delay in the conclusion of the process.

On April 30, 2009 FATMA issued the Notification Letter (*Ofício*) 241/09 demanding:

- • Maintenance register and PGRS implementation, according to the plan authorized by FATMA;
- • Installation of the containment system in the sector of oily and other dangerous waste;
- • Maintenance plan of the treatment by root zone system;
- • Monitoring plan of the surrounding areas;
- • Copy of the environemental licensing requirement in newspapers.

Internally, the LAO renewal request was forwarded to FATMA Legal Department, questioning the legality of the situation. The bases of the inquiry were:

- • No EIA-RIMA was presented when LAP 209/01 was issued;
- • The supposed need for environmental compensation and creation of conservation units;
- • Environmental noncompliance issues regarding inadequate effluent disposal from the root system.

However, there is no answer for such document attached in the process files.

After a long period of 21 months, Infraero submitted a technical report in order to comply with the Notification Letter (*Ofício*) 241/09 from FATMA, answering all the requests. Nonetheless, the environemental agency did not answer such report.

Since then, the process DIV/00300/CRN had its focus on LAP and EIA/RIMA request and issue for enabling the expansion constructions.

On November 16, 2012, Infraero cancelled the LAO renewal request and attached several opinions on effluents analysis, and registered the effluent discharge point at the website www.aguas.sc.gov.br/ceurh/cadastro.

On September 18, 2015, FATMA requested the insertion of LAO renewal request in the SinFAT. It generated a discussion on duplicity on payment of fees by Infraero. The issue was only solved in April/2018 with the process DIV/22251/CRN.

Infraero presented a new technical report on the constraints, accompanied by an ART.

The main licensing issue is related to the effluents treatment system, which is composed by:

- • oil and grease separator boxes (where food is manipulated),
- • decentralized system of septic tank and filter, located in the two ends of the Passenger Terminal, Cargo Terminal, Control and Maintenance Tower. Only the section against fire has an independent treatment system, composed by septic tank, filter and sink.

After passing through the septic tank and filter, the effluents are conducted to the root zone treatment system with an area of 208 m² (26 x 8m).

After passing through the root zone system, the final effluent is disinfected using chlorine tablets, by 30 minutes of contact in a tank with baffle plates.

The final effluent, already treated, is discharged in a drainage ditch that flows to Iririu-guaçu river.

The treatment system maintenance requires periodic cleaning. The last cleaning action was performed in December 2017. According to the data, the effluent quality is monitored each three months, using as sampling points the entry and end of the root zone treatment system.

According to the opinions attached to the constraints report JV.01/814.73/2287/01, the results comply with the discharge patterns for DBO e pH. The last dissolved oxygen measurement result was a little lower than the limit, perhaps in consequence of the treatment system cleaning.

Finally, in response to the document submitted by Infraero in the end of 2018, the IMA issued, in June 2019, the Notification Letter (*Ofício*) n. 504/2019, notifying Infraero to present, within 120 days, the documents and clarifications requested by Technical Information (*Informação Técnica*) n. 1316/2019, aiming at LAO issue. The requested documents were the following:

- • evidence of legal binding between the applicant and the entrepreneurship;
- • a review of the effluent quality monitoring programme of the enterprise, including parameters of free residual chlorine, settleable solids and total non filtrable solids. The sampling shall be made each two, and not three, months. The first monitoring campaign shall be performed, and its results submitted to IMS/SC in a conclusive technical report;
- • evidences of the cleaning procedures performed at the units of the individual effluent treatment system from the last year of the airport operation;
- • air quality monitoring programme, considering CONAMA n. 491/2018;
- • Annual spreadsheet (2018) of waste generation and transportation, informing (at least) the quantity of waste generated by class (A, B, C and E), the transport company and the final disposal company. Attach the respective environemental licenses and MTRs copies (when appropriate). The document must be signed by a legally recognized responsible technician;
- • Copy of the document that authorizes structural alterations occurring in the enterprise after the concession of LAO 131/2003, including alterations on the constructed area; updated floor plant with descriptive memorial of all the units of the enterprise, including all the environmental controls. Copy of the certificate of compliance issued by IBAMA;
- • Copy of the publication of the license renewal request submitted after the document presentation.

On November 14, 2019, by the Notification Letter n. 1075/2019/CRN, the IMA extended by 90 days for the Infraero to answer the solicitations in letter n. 504/2019.

On March 31, 2020, the IMA issued the Notification Letter n. 0285/2020/CRN establishing an additional 60 days for Infraero to present the documents pending about the operational licensing process.

Finally, on July 6, 2020, LAO n. 3.153/2020 was issued, valid until 2024.

We recommend that the new administrator, taking over the airport management, request the transference of the current license ownership from Infraero and continue to regularize pending issues.

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

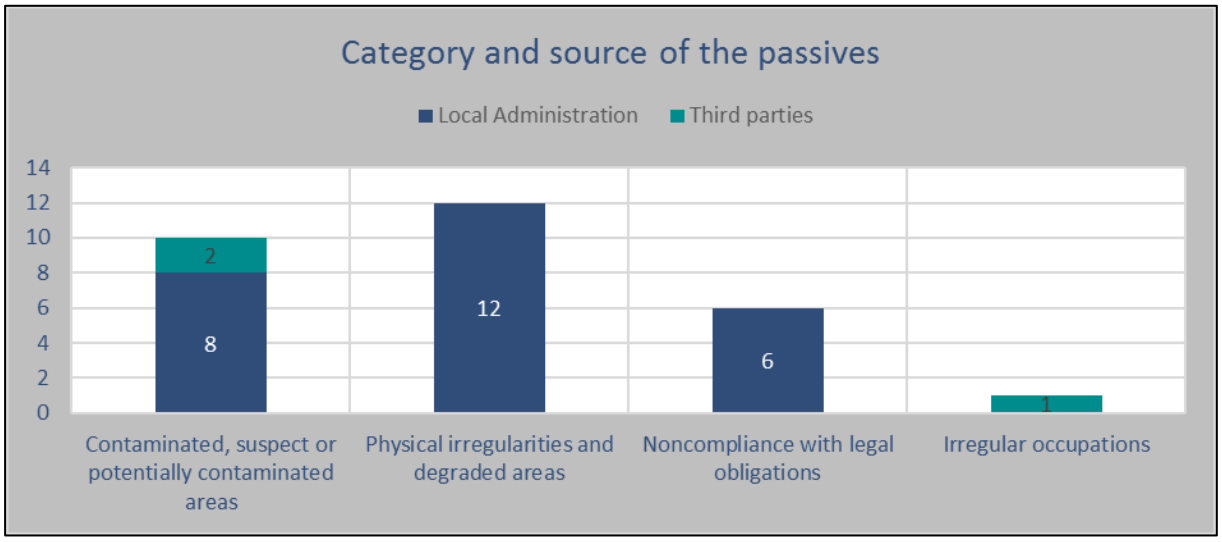
- Soil Use and Coverage including approaches to water resources, permanent preservation areas (APP) and vegetation;
- Irregular superficiaries and occupations in the airport assets area;
- Potential of Cave Occurrence;
- Mining rights;
- Fauna and Fauna Risk;
- Noise;
- Atmospheric Emissions;
- Energy;
- 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.

To perform this diagnosis, the situation surveyed during the field visit and its surroundings, as well as the evaluation of relevant situations, including those made available by the environmental agencies by *Data Room*, the ones provided by the surveillance agencies and the information obtained by bibliographical researches.

Techniques of satellite images interpretation and geoprocessing allowed the identification and delimitation of socio-environmental components and aspects, such as water resources, vegetal coverture and permanent preservation areas (APP) in the airport site and surroundings.

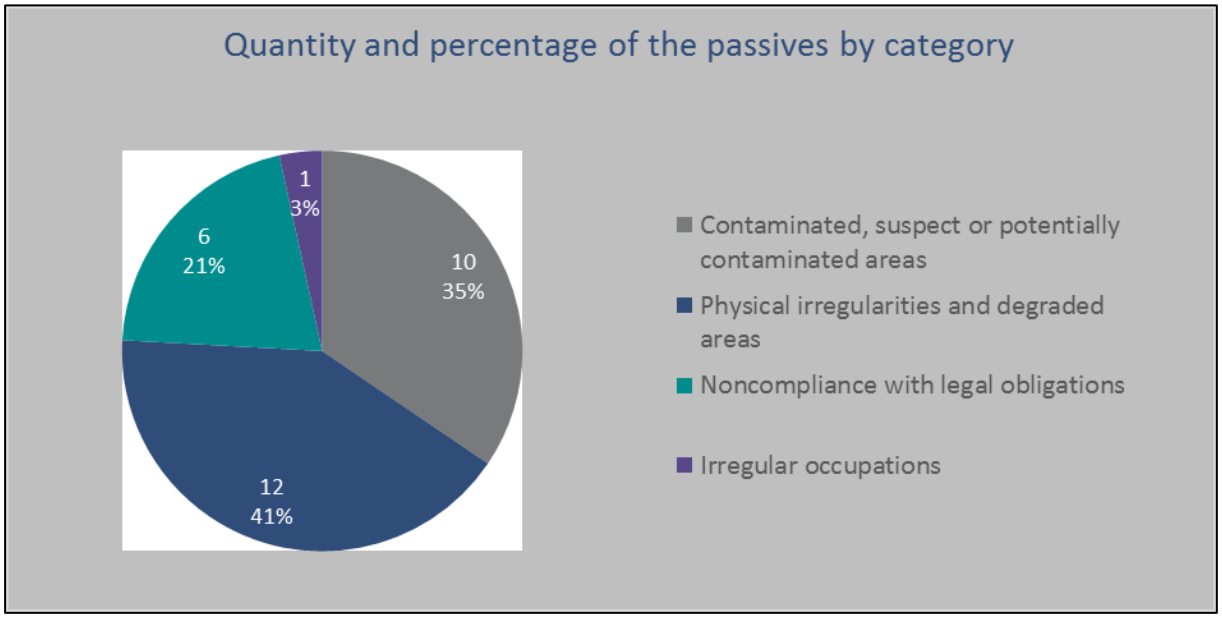
During the preparation of this document, existing socio-environmental passives were surveyed, evaluated and priced. For the Airport of Joinville, 29 passives were identified. From the four passive categories evaluated, 10 were related to contaminated areas, 12 to physical irregularities and degraded areas, 06 to noncompliance with legal obligations and 01 to irregular occupations.

Figure 3-1: Category and source of the passives



Source: Consórcio GCA

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

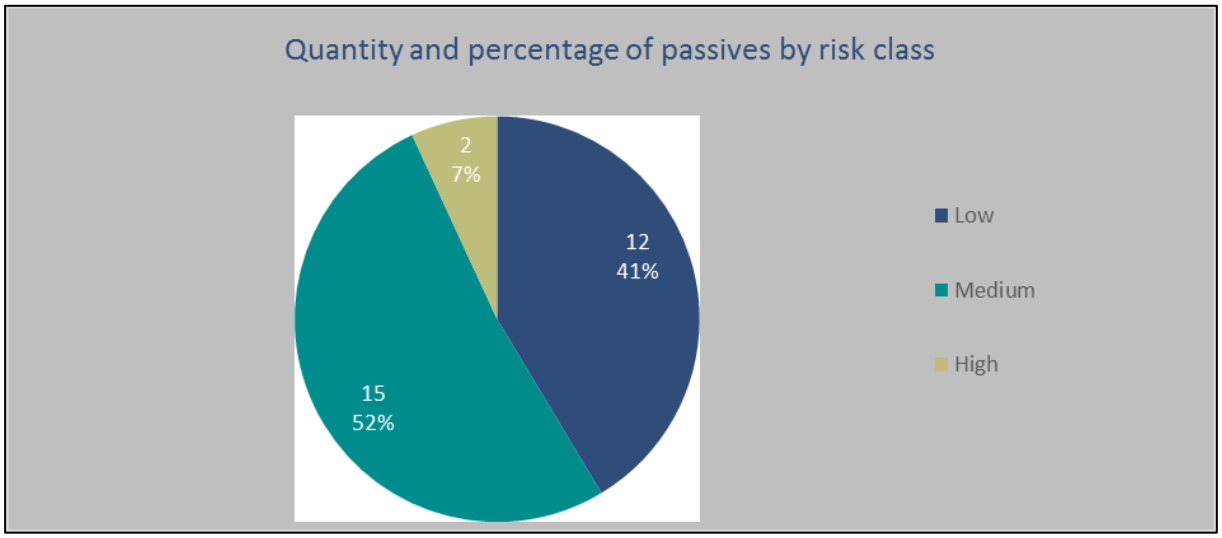


Source: Consórcio GCA

The classification of passives identified according to their Risk Class was assessed based on a methodology adapted from FMEA (*FailureModeandEffectsAnalysis).*

Considering the current scenario, the Airport of Joinville presents passives classified as *of High, Medium and Low* risks. The passives classified as of High risk shall be managed in the short run, and the passives classified as of *Medium to 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: Consórcio GCA

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 verified, that for both the Current and Future Scenarios, the simulated noise contours go beyond the airport's property limits, however, there are no incompatible uses (sensitive homes and receivers - such as public institutions, hospitals and schools) in the regions affected by the contours.

The simulated noise contours, both for Current and Future Scenario, do extrapolate the airport's patrimonial limits, however, there are no incompatible uses (residences and sensitive receptors such as public institutions, hospitals and schools) in the affected areas.

It is important to highlight that the future impact of the noise contours did not consider possible populational densification that may occur during the concession years.

Therefore, we recommend that the future work in partnership with the Municipality of Joinville, so the PZR of the airport may be appropriately incorporated in municipal legislation, avoiding the implementing incompatible uses inside the simulated noise contours. The land use management, in this context, guarantees that technological advances of noise reduction in the new aircraft models will not be compensated by the residential development in the airport's surroundings.

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 focus related to slaughterhouses, extensive agricultural activities, agriculture, landfill, tannery, dumpsites, solid waste overflow stations, sewage/water treatment stations, free markets and food processing industries. Thus, the airport manager shall help the

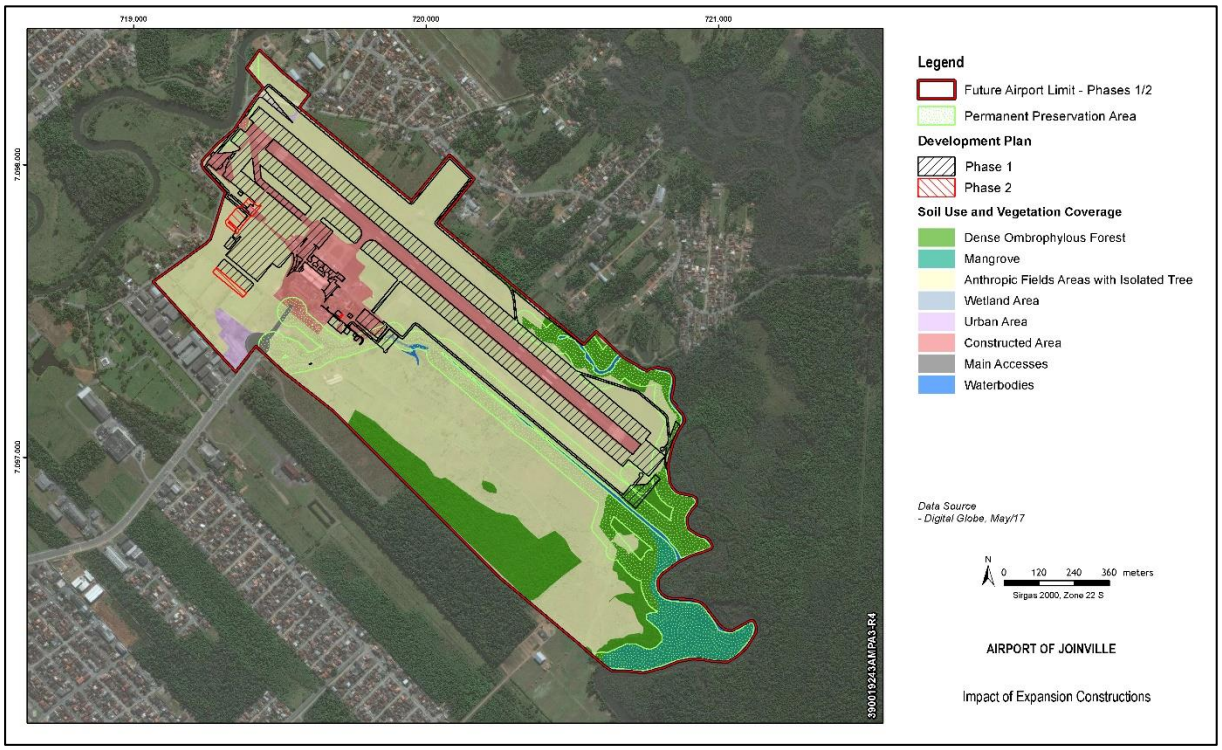
municipality to monitor the focuses and to develop educational actions in order to avoid the appearance of new focuses.

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.

In the airport of Joinville prevails areas of Anthropic fields with isolated trees. However, towards the end 15, Secondary Vegetation of Dense Ombrophylous Forest of Mata Atlântica Biome occurs in advanced stage of regeneration.

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: Consórcio GCA

Evaluating the construction works impact on soil use and coverage in the Airport of Joinville, during the Development Plan implementation in its two phases, the following interventions shall be made: in the Anthropic Fields areas with isolated tree individuals (80.47%); the already constructed areas (15,89%), in the Dense Ombrophylous Forest contact areas (3,12%); water bodies (0,05%), urban areas (0,33%) and wetland areas (0,13%). Interventions in APP will happen only during Phase 1 (7.71%).

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

Chart 3-2: 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 Joinville 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.
RISK SITUATION 2	Delay in obtaining the domain of the lateral end 15, besides of its regulation by the Decree of Public Utility (*Decreto de Utilidade Pública*) n. 18.045/2011 (that modified Decree 16.274/2009).
Identified risk	• Difficulty or delay in expropriation of the aeroclub areas and registrations number 44.679, 44.680 and 102.705. • Delay on Phase 1 construction works, especially the implantation of new taxiways and yard.
Strategies to minimize the risk	• To make a technical partnership with municipality of Joinville and Infraero to follow up the actions.

Source: Consórcio GCA

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 Joinville renewed the license in 2020, the airport manager will receive the airport with an Operating License valid until July, 2024.

In addition, the entrepreneur shall continue to comply with other LAO constraints.

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

Chart 3-3: 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.
To request the OL renewal at least 120 days before its expiration date, according to paragraph 4th of article 12 of Complementary Law n. 140, from December 8, 2011.
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: Consórcio GCA.

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 3-4: 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: Consórcio GCA

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

Chart 3-5: Licensing premises for the expansion and adequation constructions of Airport of Joinville

Evaluated aspects	Phase 1	Phase 2
Impact degree of the constructions	High	Medium
Licensing agency	IMA (State)	IMA (State)
Applicable licenses	LAP and LAI	LAI effective from Phase 1*
Studies to be performed	EIA/RIMA and PCA	-
Maximum estimated timeframe for studies and licensing	20 months	Effective licensing

*Legislation foresees that the LAI may be renewed up to the execution of constructions

Source: Consórcio GCA.

After analyzing the environmental context of the airport and applying the respective legislation – Normative Instruction (*Instrução Normativa*) IMA n. 65/2018, we adopt for this study, the assumption that the environmental agency will request, for the expansion constructions of Phase 1, the obtention of a Preliminary Environmental License (Licença Ambiental Prévia – LAP) and an Installation Environmental License (Licença Ambiental de Instalação – LAI), subsidized by an Environmental Impact Study (*Estudo de Impacto Ambiental - EIA*) and an Environmental Control Plan (*Plano de Controle Ambiental - PCA*), with a timeframe estimated for the License issue of 20 months.

According to IN IMA 65/2018, the EIA must be elaborated whenever the vegetation suppression of primary or secondary Mata Atlântica (and that is the case of the vegetation located at the end 33 orientation) in advanced state of regeneration. Although the study has adopted a solution that does not imply the river transposition at the end 15, vegetation suppression will occur at the end 33 in order to install a patrimonial fence in an area to be expropriated. Vegetation suppression will also be required in the APP located at the runaway side, since such trees are obstacles for the protection surface of the runway.

The LAI effective for Phase 1 will be used for Phase 2, appropriately subsidized by previous studies. LAI expires in 06 years and may be renewed.

The enterprises regulated by EIA are subject to environmental compensation (art. 36 of Law n. 9.985/2000 – National System of Conservation Units (*Sistema Nacional de Unidades de Conservação - SNUC*)). For LAI issue purposes, IMA and the entrepreneur must sign a term of commitment of environmental compensation compliance (Annex 2 of *Portaria* n. 174/2015-FATMA), that shall integrate the LAI. The LAO issue is conditioned to the compliance with the referred term of commitment.

The PCA shall describe in detail the environmental programmes to be implemented during the construction phase for controlling and mitigating the impacted described by the study that subsidized the License issue.

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

Chart 3-6: Estimated timeframes for licensing constructions of high environmental impact

Description	Estimated timeframe
EIA/RIMA elaboration for LAP issue	9 months (AA[1])
PCA elaboration for LAI issue (simultaneous to EIA/RIMA elaboration)	3 months (AA[1])
EIA/RIMA analysis and new LAP issue	6 months (OA[2])
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: Consórcio GCA

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

Chart 3-7: Environmental authorizations and procedures required for the Airport of Joinville

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
Obtainment of the Evaluation Report Malarigen Potential (Laudo de Avaliação do Potencial Malarígeno - LAPM) and Certificate of Sanitary Condition (Atestado de Condição Sanitária - ATCS)	Applicable

Source: Consórcio GCA.

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 3-8: Socio-environmental costs in R$ estimated for the Airport of Joinville

Activity	Phase 1	Phase 2	Total
Licensing and Analysis Fees	55,165.45	13,941.67	69,107.12
Environmental Studies	1,039,937.66	-	1,039,937.66
Environmental Management of the Constructions	1,731,659.68	2,052,654.34	3,784,314.02
Vegetation Suppression and Forest Compensation	119,773.93	-	119,773.93
Confirmatory Investigation of Passives	340,721.91	-	340,721.91
Environmental Passives Recuperation	10,167.00	-	10,167.00
Environmental Compensation SNUC*	575,896.65	23,250.47	599,237.12
Total	**3,873,412.27**	**2,089.846.48**	**5,963,258.76**

* Not applicable in this case

Source: Consórcio GCA

Chart 3-9: Environmental OPEX estimated for the Airport of Joinville

Item	Activity	Total Cost (R$)
2.1	Environmental Licensing Fees	825,730.32
	OL Renewal	*130,122.72*
	TCFA – IBAMA	*695,607.60*
2.2	Operation Environmental Management	3,572,471.16
2.3	Elaboration of PBZPA and PZPANA	205,678.91
2.4	Fauna Management Programme	2,854,361.15
	PF and PGRF Elaboration	*2,494,361.15*
	Fauna handling actions	*360,000.00*
2.5	Noise Management Programme	89,252.79
2.6	Energy and Air Emissions Management Programme	23,817.19

Item	Activity	Total Cost (R$)
2.7	Water Resources and Effluents Management Programme	3,313,271.07
	Sampling Plan Elaboration	*23,817.19*
	Water Resources Monitoring	*3,289,453.87*
2.8	Solid Waste Management Programme	37,282.87
2.9	Social Communication, Environmental Education and Training	481,192.34
	TOTAL	**11,403,057.81**

Source: Consórcio GCA

The Environmental Studies maintained the innovations presented in the study is elaborated by Consórcio GCA 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 (*FailureModeandEffectsAnalysis);*
- 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 **Joinville Airport - SBJV** modelled between 01/October/2021 and 30/September/2051. Currently, the airport's total revenue is R$22MM and its EBITDA margin is 17% (considering 2018 data)[10].

Revenues

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

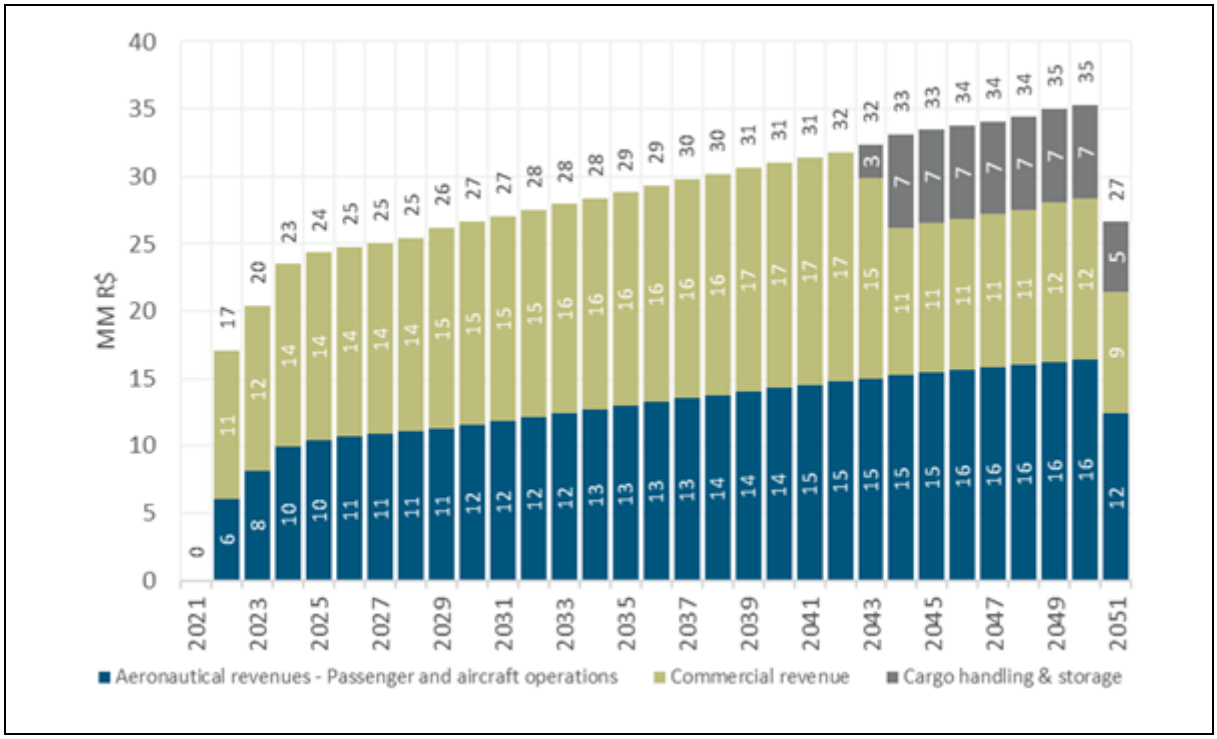
- Aeronautical revenues, resulting from regulated fees on the various operation types. These have been categorized as passenger and aircraft fees and cargo handling and storage fees;
    - Aeronautical revenues – passengers and aircraft operations: applicable to both passenger flows (domestic and international 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 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 2.1%p.a. between 2023 and 2050. Aeronautical revenues will increase during the concession period, from 40% in 2023 to 66% in 2050. It is worth pointing out the increase in revenues from the end of the TECA sub-concession agreement (2043).

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

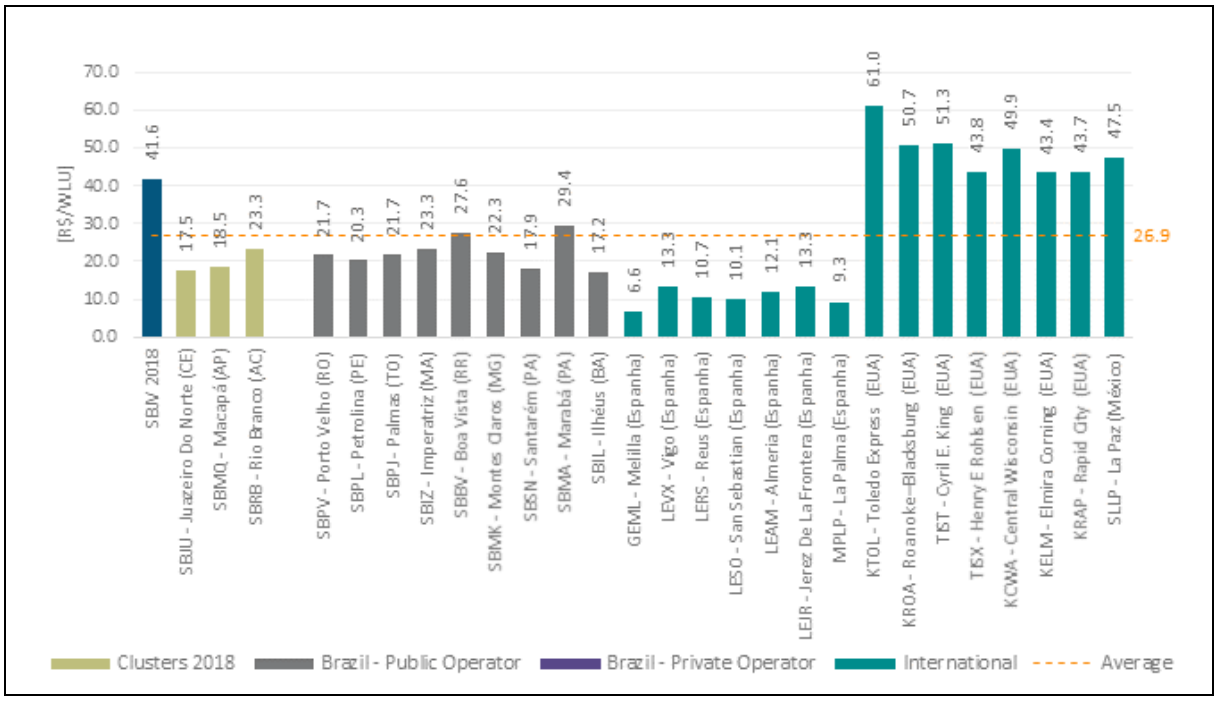
Figure 4-1: Total revenues during concession



Source: GCA Consortium.

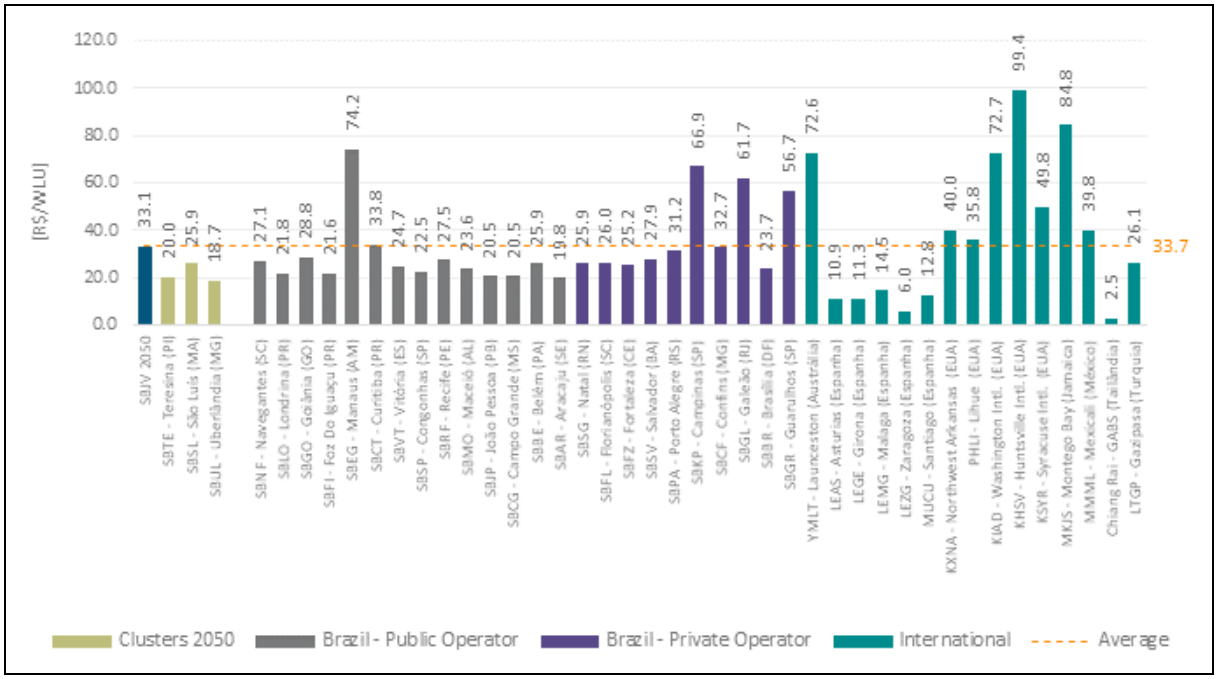
In 2050, the Airport's revenue per WLU will be R$33.1, in line with its comparable airports average (Figure 4-2 and Figure 4-3).

Figure 4-2: Revenue per WLU benchmark in 2018



Source: GCA Consortium.

Figure 4-3: Revenue per WLU benchmark in 2050



Source: GCA Consortium.

Costs and expenses

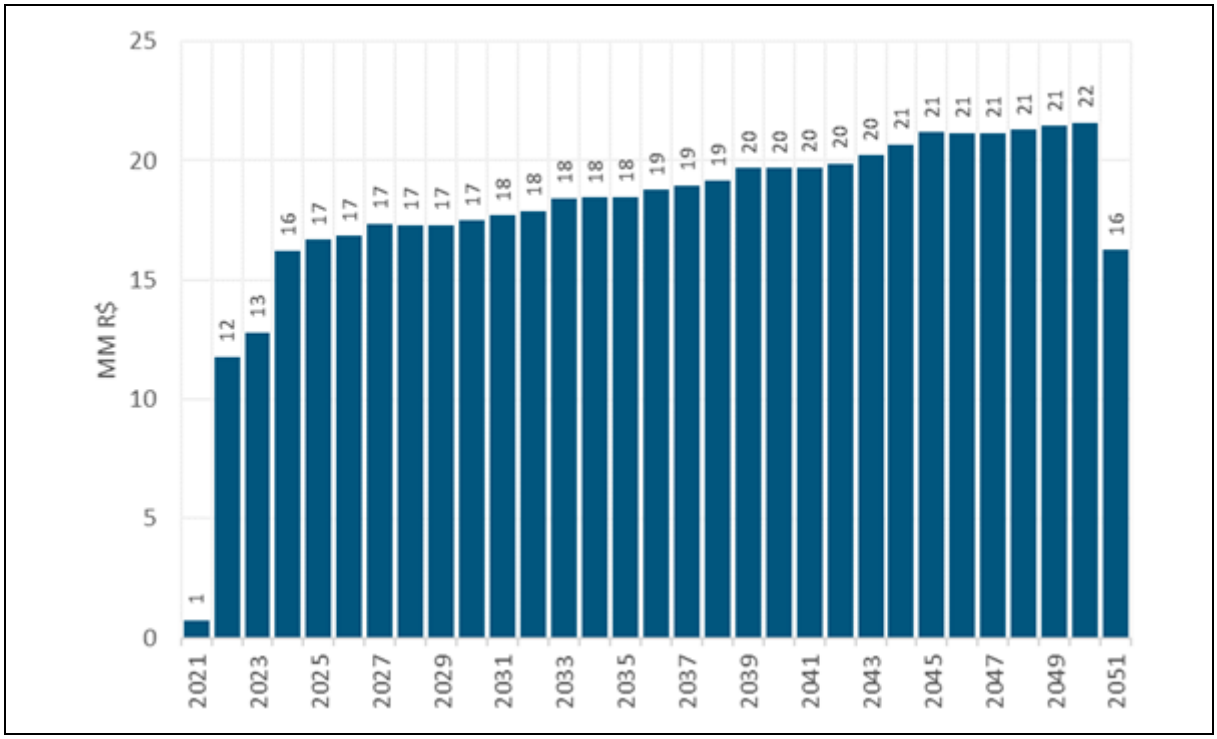
Airport operating costs and expenses are mainly related to personnel and outsourced services, in addition to utilities and public services and consumables.

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$13MM to R$22MM (Figure 4-4). Personnel and Outsourced services costs are the most significant, representing 47% and 29% of total costs in 2050, respectively.

Figure 4-4: 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

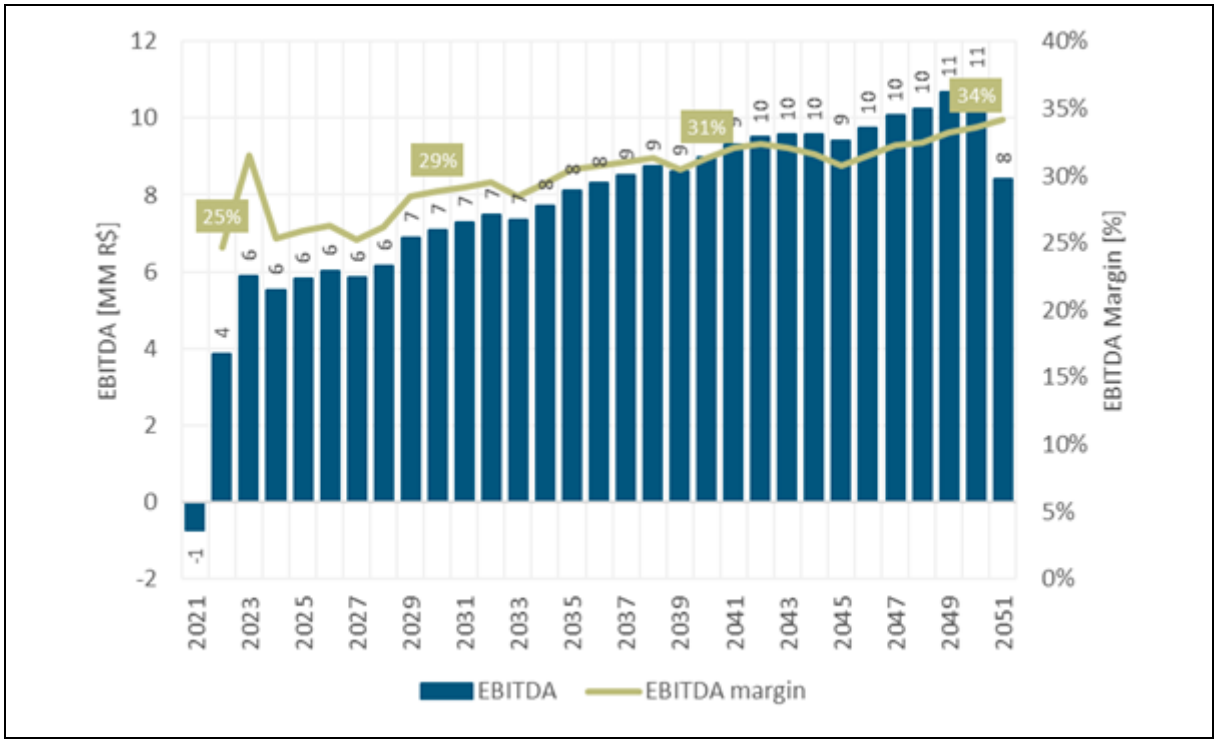
Values in MM R$	TOTAL
OBLIGATIONS TO BE MET PRIOR TO SIGNING THE CONTRACT	**(27.2)**
Funds for Infraero's staff readjustment program	(23.1)
Reimbursement to authors of the feasibility studies	(4.0)
Payment to B3 for holding the auction	(0.1)

Source: GCA Consortium.

EBITDA and margin

Net of grant payments, the concession EBITDA is forecast to be R$6MM in 2023 and to reach R$11MM in 2050 (Figure 4-5), with an average growth of 2.3%p.a. EBITDA margins increase is forecast throughout the concession due to expected economies of scale.

Figure 4-5: EBITDA and EBITDA margins during concession



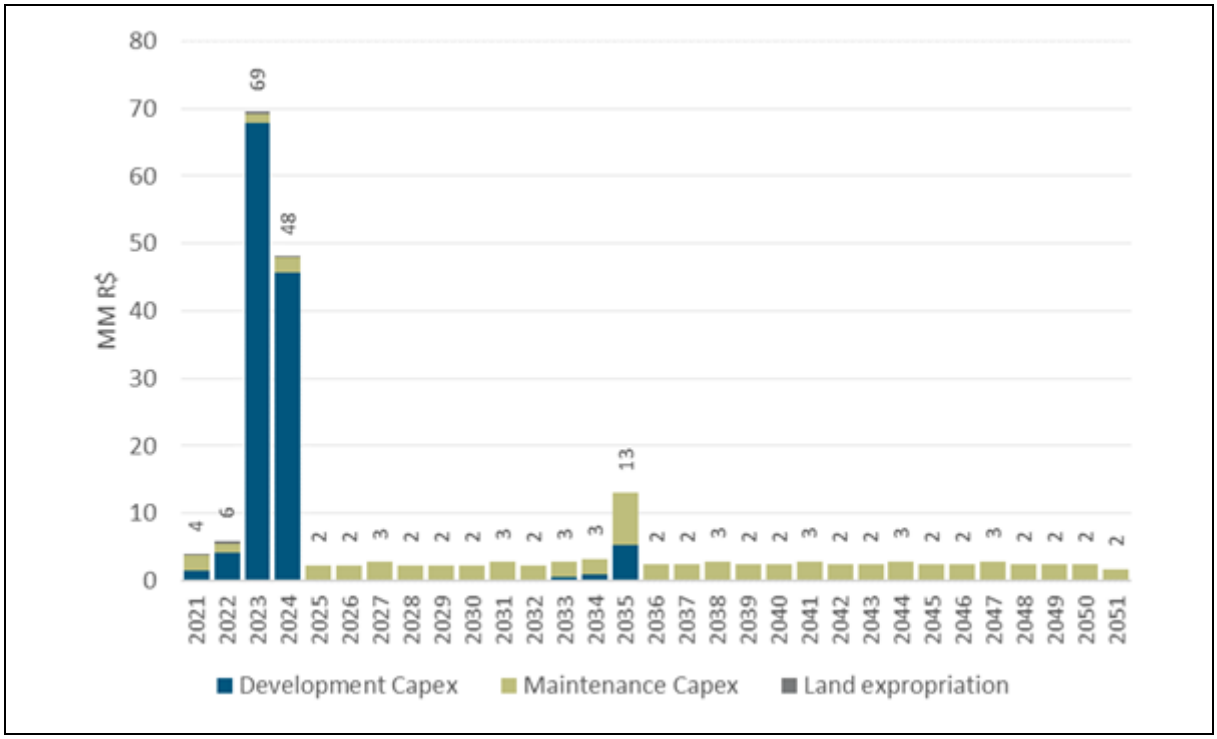
Source: GCA Consortium.

CAPEX

The development plan, expansion of airport assets to meet growing demands and ensure appropriate level of service, requires a total investment of R$205MM.

Development investments (topical and intended to expand airport assets, including expropriations) will be divided into different phases and amount to a total R$127MM. Maintenance investments (periodical and intended to maintain and replace assets, including re-paving cycles) add up to R$78MM throughout the concession period. (Figure 4-6).

Figure 4-6: CAPEX during concession

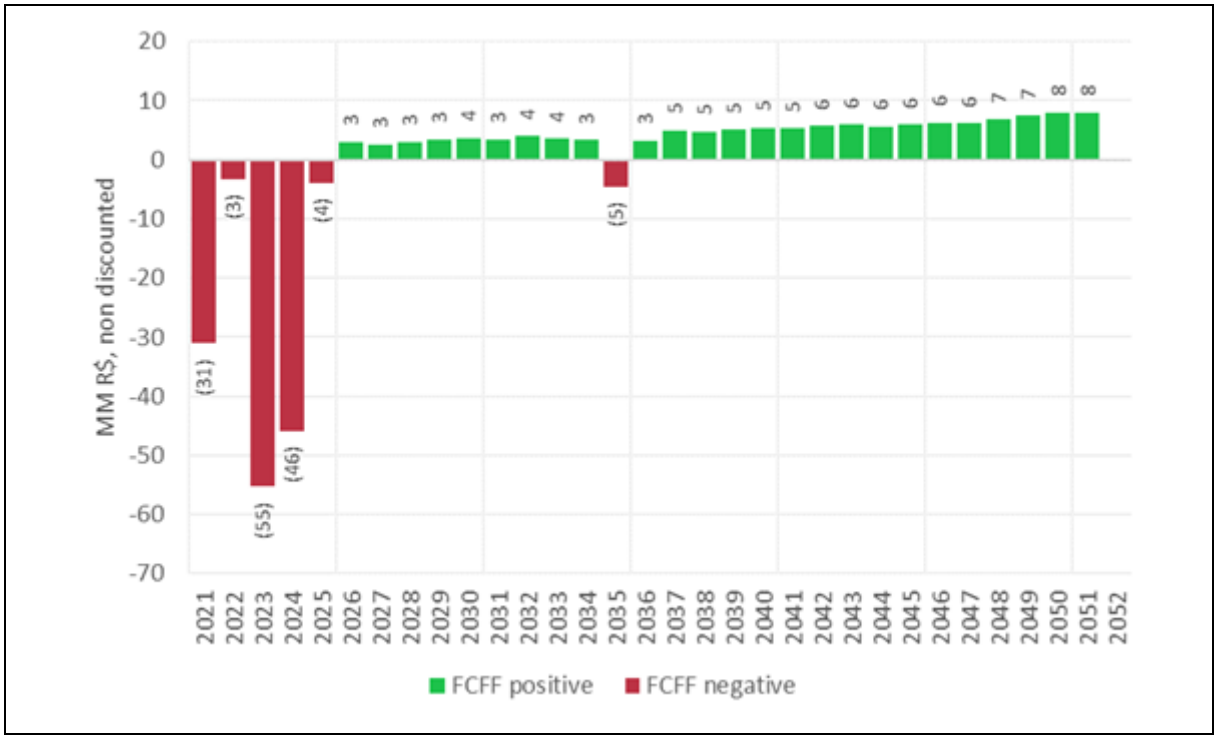


Source: GCA Consortium.

Evaluation of concession's financial feasibility

The project's forecasted free cash flow (FCFF) is presented in Figure 4-7, which shows the FCFF is positive during most of the concession, except during investment cycles, that require funding. The project's IRR is negative (calculated as -0.8%p.a. real) and its MIRR is 4.9%p.a. (real), lower than the cost of capital of 7.23%p.a., thus the concession is not financially feasible.

Figure 4-7: Free cash flow to firm (non-discounted – prior to grant values)

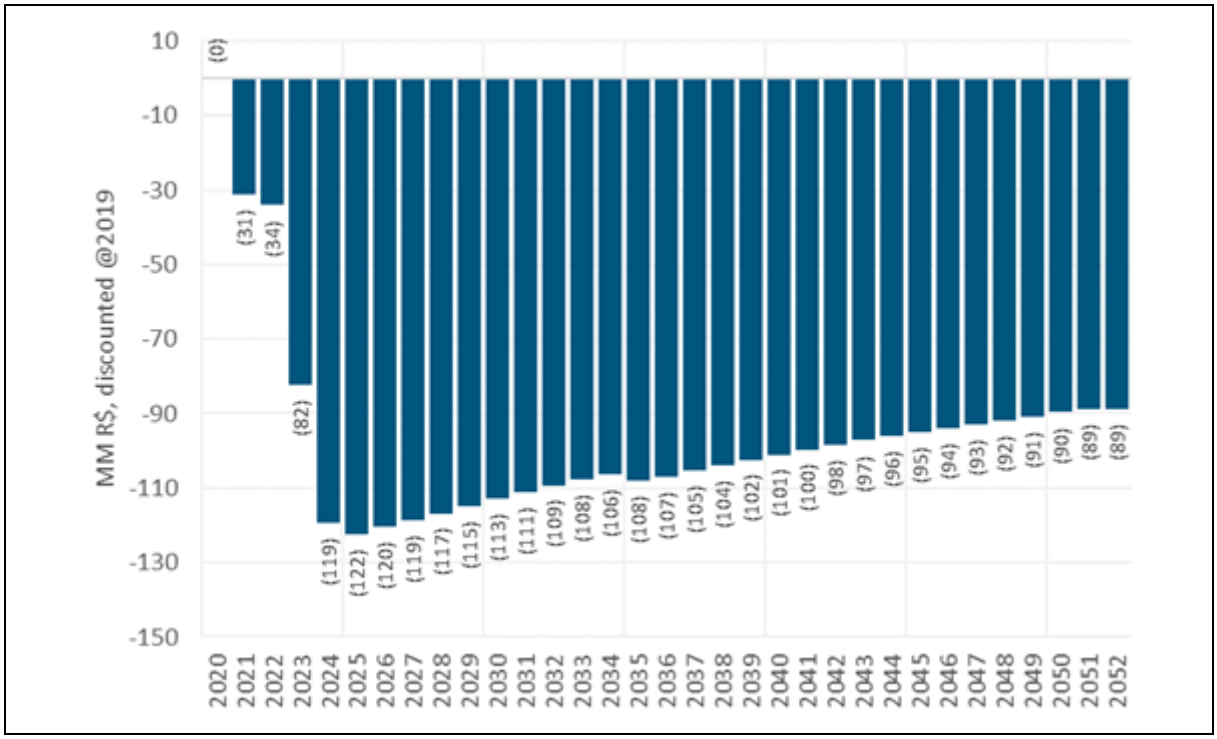


Source: GCA Consortium.

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 4-8. Project does not offer a rate of return to its capital providers, consequently, the NPV is negative (**R$-88.7MM**). As such, the isolated concession of the Airport is not financially feasible and cannot support grant payments made out to the Government.

This result is mainly due to the high relevance of the initial investments to meet required airport's appropriate level of service in comparison with its restricted operating cash flow capacity (although this is positive).

Figure 4-8: Cumulative discounted free cash flow to firm (net of grant payments)



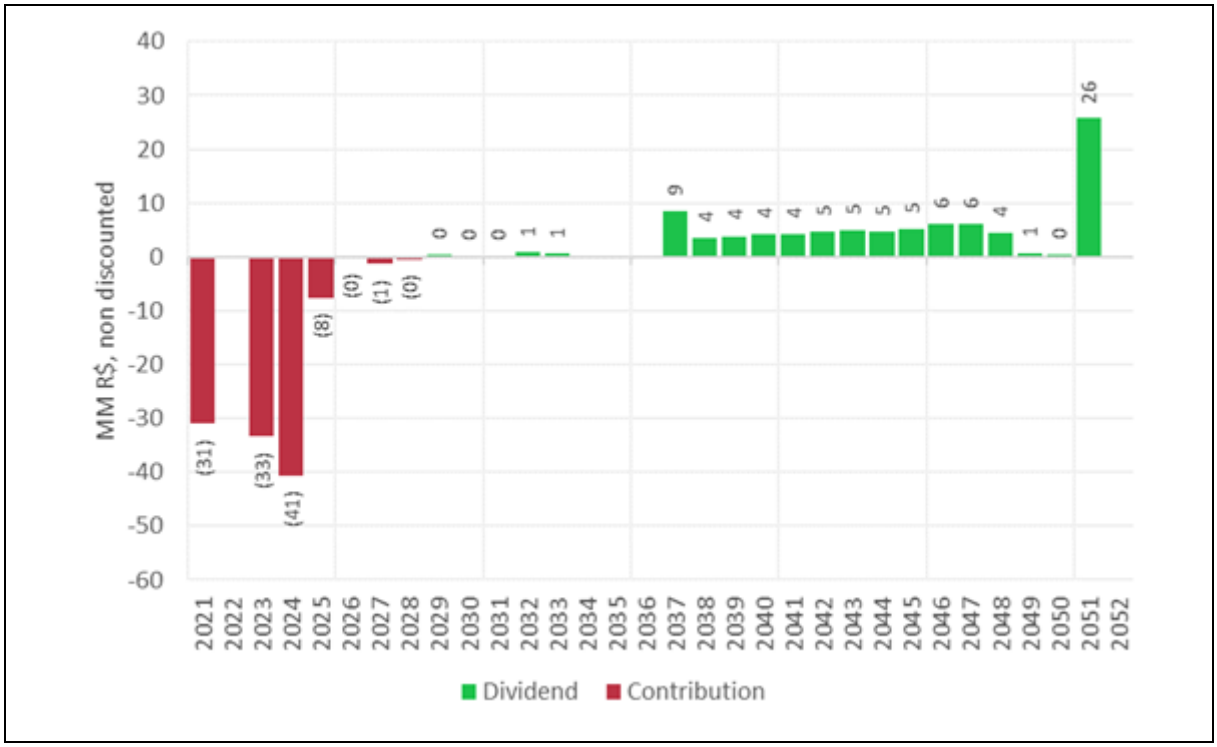
Source: GCA Consortium.

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 resourses during the first development phase. Dividend distribution up to 2037 is limited due to debt service and during funding and respective grace periods, being immediately followed by accumulated resource distribution. Thereafter, dividends will increase over the remainder of the concession period. Between 2047 and 2050 distribution is limited when minimum capital stock requirement must be met. By the end of the concession the paid-in capital is returned to shareholders. Given this scenario, the equity IRR is -1.1%p.a. (real), calculated based on contribution and dividend flows.

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



Source: GCA Consortium.