CASE STUDY AND ANALYSIS OF GROUND TRIP GENERATION RATES AT TWO AIRPORTS IN SOUTHERN BRAZIL

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ABSTRACT

In urban areas, airports are important trip generator centers because they attract large numbers of ground trips and require a significant number of parking spaces. In that light this research employed the case study method to analyze ground trip generation associated to the southern Brazilian airports Hercilio Luz in Florianopolis (Santa Catarina) and Salgado Filho in Porto Alegre (Rio Grande do Sul). Traffic counts were made *in loco* of entering and exiting vehicles and subsequently trip generation rates were calculated by relating them to the numbers of enplaning and deplaning passengers, the numbers of aircraft take-offs and landings and the area occupied by the terminal buildings. The main rates obtained were: a daily average rate of 1.99 trips per passenger at Hercilio Luz airport and of 1.73 at the Salgado Filho airport. Information was also obtained on Peak Hour percentages, ground transport mode choice, and the directional distribution of trips. The study results may contribute to supporting transport planners in adequately dimensioning and designing access roads and other features in the project stage of new airport terminals and in the processes for expanding existing ones.

1. INTRODUCTION

Given the trips made by passengers, people accompanying them, airport staff, visitors and airport users in general, airports are among the main ground trip generating sites in urban contexts. That leads to problems in traffic flows in their vicinity and the need to provide parking spaces for significant numbers of vehicles.

In addition to the demands associated to the airport, in most Brazilian cities airport access ways are also used by the neighboring communities and, depending how much the resulting traffic amounts to, effective service levels may be poor and contribute to prolonging trip times to the airport and increasing uncomfortable levels.

In many countries trips to the airport can be made using various transport modes including automobiles, bus services, trains and metros. In most Brazilian airports, access modes are limited to automobiles and buses with the former predominating.

Thus the quantification of ground trips to and from airports is of fundamental importance and trip generation models are needed to support road system planning for new airports and expansion or improvement projects for existing ones.

The aim of this paper is to present trip generation rates for two airports in southern Brazil obtained from recent studies and make a comparative analysis of them relating the values obtained to the entering/exiting trip characteristics of the airports in question.

The airports studied were the Hercilio Luz airport in Florianopolis, capital of the state of Santa Catarina and the Salgado Filho airport in Porto Alegre, capital of the state of Rio Grande do Sul. Descriptions of the studies themselves can be found in Monteiro and Goldner (2011) and Goldner (2012).

2. BIBLIOGRAPHIC REVIEW

The ground transport aspects of airports have been the object of research studies for a long time now. Among the studies designed to improve mode choice in transport associated to American airports are those of Lehrer and Freeman (1998); ITE 6A19 Committee (1980), Gosling (1997); Shapiro and Katzman (1998); and Foote *et al.* (1997).

The most widely used bibliographic reference outside of Brazil is the 2012 edition of the Institute of Transport Engineers' (ITE) study entitled "Trip Generation" which presents more than a hundred trip generation models for different types of land use, embracing both commercial and general aviation airports.

In the case of commercial airports, the models relate trip numbers to variable factors such as average number of flights per day, average number of commercial flights per day, and the number of airport employees. Other models endeavor to estimate the number of trips at peak hours (from 7:00 am to 9:00 am and from 4:00 pm to 6:00 pm) and at peak hour of generator, relating them to the same variables. Table 1 below illustrates the daily trip estimation models developed by the ITE (2012).

Day	Variable	Nº cases	Average Daily Trips	Flow Direction Distribution	Linear Regression Equation
Week Day	Nº employees	3	13.40	50% in 50% out	Not developed
Saturday	Nº employees	3	12.20	50% in 50% out	Not developed
Sunday	Nº employees	3	14.70	50% in 50% out	Not developed
Week Day	Average Nº flights	2	104.73	50% in 50% out	Not developed
Saturday	Average Nº flights	2	98.46	50% in 50% out	Not developed
Sunday	Average Nº flights	2	119.61	50% in 50% out	Not developed
Week Day	Commercial flights per day	3	122.21	50% in 50% out	Not developed
Saturday	Commercial flights per day	3	113.04	50% in 50% out	Not developed
Sunday	Commercial flights per day	3	137.71	50% in 50% out	Not developed

Table 1 – Daily trip generation model for commercial airports.
Source: ITE (2012)

In Brazil, Goldner and Andrade (2003; 2004) and Goldner *et al.* (2004; 2005a; 2005b) studied the characteristics of ground trips to the Hercilio Luz airport in Florianopolis and the Salgado Filho in Porto Alegre, elaborated trip rates for parking space planning purposes and Logit Multinomial mode choice models as well as conducting declared preference-type interviews to define the best parking charges for those airports.

Other authors have developed different models for ground trip generation associated to airports. Ruhl and Trnavskis (1998) reviewed the literature on those models and reported that, prior to 1969, Munds used a simple formula based on annual passenger rates to derive the number of vehicles entering and leaving airports at peak times. More elaborate vehicle volume forecasting methods have since been developed, mainly using some type of regression equation for statistical analysis. Other studies conducted by Dunlay and Wiersig (1997), Bevan and Meadows (1998) and Manning *et al* (1995) have constructed more detailed airport ground trip generation models. All of those models require information on localization and on the socio-economic characteristics of the population and, even though they do make realistic predictions, they are usually only applicable to the specific areas for which they were calibrated (Dunlay and Wiersig, 1997; Bevan and Meadows, 1998; Manning *at al*., 1995 *apud* Ruhl and Trnavskis, 1998).

Extensive research involving American commercial and general aviation airports was carried out by Ruhl and Trnavskis (1998) in the summer of 1996. Their aim was to gather updated information and data to elaborate airport trip generation models. Their study also revised data obtained by the California Aviation System Plan, the Master Plans of existing airports and included studies of the ground transport aspects of individual airports as well as making traffic counts. A complete data set was prepared to enable an analysis of both trip generation and mode choice distribution aspects for 39 airports offering commercial services.

The statistically significant correlation that they were able to obtain from their samples was based on the measurements of ground trips by vehicles (in terms of daily average traffic volumes) entering and exiting the airport, relating them to the numbers of origin-destination passengers.

The model obtained was:

$$Y = 7.395\ (X)^{0.8526} \qquad (1)$$

Where Y is the average daily traffic (vehicles in and out); and
X is the daily number of origin-destination passengers:

The statistical values obtained for the equation were as follows:
$R^2 = 0.97$
F Test = 1195
Independent Variable Test = 34.6
T Test for the constant = 8.56
Number of observations = 39.

The peak hour traffic at the airports investigated represented 8% of the average daily traffic at big airports and of 20% of the average daily traffic at smaller airports or airports that did not function as hubs, that is, where regional flights were not concentrated on a single airport. The average value for that percentage was around 11%.

Shapiro and Katzman (1998) report that the data compiled for the California Aviation System Plan and the estimates of originating passengers and enplaning passengers were used to derive a correlation between passenger numbers and daily vehicle trips to California airports.

According to those authors the analysis embraced 10 California airports ranging in size from those with under one million enplanements per year and to the Los Angeles International Airport with more than 22 million annual enplanements.

The analysis obtained the following equation:

$$T_{vv} = (3.526 \times Or) + (0.818 \times P_c) - 497 \quad (2)$$

where T_{vv} = total vehicle trips;
Or = number of originating passengers; and
P_c = number of connecting passengers.

In this equation, connecting passengers are defined as enplaning passengers minus originating passengers.

The same authors refer to another study conducted at Eppley Airfield in Omaha, Nebraska in 1995, which yielded the following regression equations:

$$V_{ve} = (1.5937 \times P_e) + 1199, \text{ with } R^2 = 0.815 \quad (3)$$

where V_{ve} = entering vehicle trips; and
P_e = enplaning passengers.

$$V_{vs} = (1.5403 \times P_d) + 1501, \text{ with } R^2 = 0{,}705 \quad (4)$$

where V_{vs} = exiting vehicle trips; and
P_d = deplaning passengers.

In 2008, the Airport Cooperative Research Program published a report on ground access to major airports via public transport written by Coogan in association with Jacobs and Market Sense Consultancy (Coogan, 2008). Their study presented a vast range of information on public transport services to airports in the United States and other countries.

Gosling (2008) wrote a synthesis of mode choice models regarding ground transport modes used to access airports that included a thorough review of the respective literature.

Kouwenhoven (2008) published an article offering a general overview of the role of accessibility as a factor in passengers' airport choices, aimed at verifying the possible relation between accessibility alterations and the volume of passengers using the airport in view of the fact that in the United States people can choose, from among various airports, the one that is most convenient for their intended journey.

Monteiro (2010) analyzed the volume of ground trips by vehicles accessing the Hercilio Luz airport in Florianopolis in future scenarios and the impact of that traffic on the new passenger terminal currently being implanted, verifying the quality of resultant services in the medium and long terms. Monteiro and Goldner (2011) elaborated trip generation rates for the Hercilio Luz airport relating traffic volumes to the number of aircraft take-offs and landings and the area occupied by the terminal building.

Alves and Strambi (2011) studied mode choice patterns in ground access transport modes using a declared preference-type survey to identify the relative importance of factors

affecting mode choice, especially the variable "trip time reliability". The results were used to estimate discrete choice models for mode distribution of ground access to airports. It is interesting to note that reliability of trip time was attributed greater importance than the expected length of trip time and that remained unaffected by systematic variations.

Teixeira *et al* (2012) published an article based on a study of Viracopos Airport making use of Multicriteria Analysis applied to the decision-making involved in the choice of parking options. Their model takes into account the points of view of the various actors' involved as airport users (passengers, visitors, taxi drivers, passenger, freight transport companies, employees and suppliers), the Brazilian Airport Infrastructure Corporation (*Empresa Brasileira de Infraestrutura Aeroportuária* - INFRAERO) and the airline companies. Their model made it possible to propose and evaluate three feasible, alternative proposals to address that airport's parking problems and identify the option that offers the actors involved the best solution in technical terms.

3. DESCRIPTION OF THE AIRPORTS STUDIED

3.1. The Hercilio Luz Airport

Located on the *Deputado Diomicio Freitas* Avenue, in the Carianos district of Florianopolis, 12 km from the city center by road, it can be accessed from the central and northern parts of the island using the *Via Expressa Sul* (South Expressway) and from the eastern part of the island using State Highway SC 405.

The airport operates 24 hours a day and is licensed for IFR (Instrument Flight Rules) operations. It has two runways, the first with an orientation of 14/32 and the second 03/21. The runways are shared with the Florianopolis Air Force Base.

The total area is 9,086,589 m², of which 12,583.90 m² are occupied by the passenger terminal and the covered area in front of it. It is the 14th busiest airport in Brazil and among those that receive the highest number of charter flights in the summer season.

In 2011 the number of enplaning and deplaning passengers passed the 3 million mark. From 2011 to 2012 the number of passengers on domestic flights went up from 2,899,226 to 3,178,877; an increase of 9.65%. When those figures are added to the international flight figures then the enplaning and deplaning passenger figures are 3,122,035 and 3,395,256 respectively, an overall increase of 8.75% from one year to the next. In 2011 there were 49,097 national and international flights and in 2012, 56,086; an increase of 14.24%. In 2013, up until the month of October there had been 45,475 flights, of which 43,649 were domestic flights and 1,826 international. The number of passengers was 3,207,043.

The new passenger terminal at the Florianopolis Airport, currently under construction, is an urgent necessity as the actual terminal has long saturated its nominal capacity for handling 980,000 passengers a year.

In addition to the new passenger terminal the INFRAERO will be building a new apron for aircraft maneuvering, a parking area for vehicles, a parallel taxiway for aircraft to access the main runway (14/32) and a new Aircraft Rescue and Fire Fighting Station building. The new passenger terminal has been designed around the Aero-shopping mall concept which offers passengers a variety of services such as banking (branches and cash dispensers), a food court, and a variety of shops. Figure 1 below shows a scale model of the new terminal.

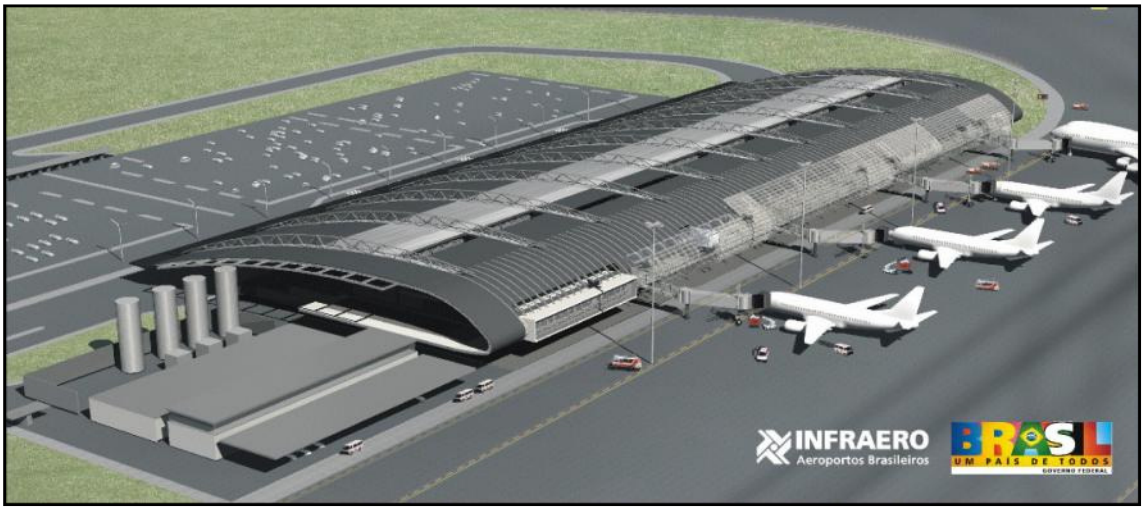

Figure 1 – New Passenger Terminal under construction at the Hercilio Luz airport.
Source: Monteiro, 2010.

3.2. The Salgado Filho Airport

Located in Porto Alegre, capital of Rio Grande do Sul state, the airport currently has two terminals. Work on the new Terminal (Terminal 1) was finalized in 2001 and it is located on the *Severo Dulius* Avenue. The older Terminal 2 is located on the *Estados* Avenue. The airport is 10 km by road from downtown Porto Alegre with two separate access ways due to the location of the two terminals.

According to the INFRAERO (2012), the airport occupies an area of 3,805,810.04 m², of which 37,500 m² are occupied by the new terminal building and 14,500 m² by the old one. There is also a large 8-storey garage building occupying 44,000m^2 and offering 1,400 parking spaces as well as three other horizontal open-air parking areas. Next Figure 2 shows an aerial view of the Salgado Filho Airport.

Figure 2 – Aerial view of the Salgado Filho airport.
Source: INFRAERO (2012)

Enplaning and deplaning passenger figures for 2012 place the Salgado Filho Airport among the most important in Brazil in terms of the domestic and international markets. (INFRAERO, 2012).

According to INFRAERO (2013) terminal 1 will have an 8 million passengers a year handling capacity with terminal 2 handling 2.5 million passengers a year giving the airport an overall annual capacity for handling 10.5 million passengers. In 2012 this airport handled a monthly average of 688,447 passengers, which was 5.49% more than in 2011. In 2013, up until the month of October, the Salgado Filho airport had handled 6,540,463 passengers, which shows that it has not yet saturated its total capacity. The passenger terminals operate 24 hours a day. The runways are open for operations at 5:00 am and close at 1:00 am of the following day.

4. RESEARCH METHOD

The study consisted of making traffic counts at the entry and exit points of the two airports and at the parking lots outside the main areas but dedicated to airport traffic and, based on the volumes registered, relating them to the numbers of enplaning and deplaning passengers, the numbers of takeoffs and landings and the total area occupied by the passenger terminal buildings.

Counting was done in months with traffic rates close to the monthly average and on the busiest day of a typical week which in both cases was a Friday.

Counting at the Hercilio Luz airport was done on October 22, 2010, a Friday in a month with traffic volumes close to the monthly average, and in a typical week. Counts were categorized according to the type of vehicle in 15 minute intervals for the entire operational period from 5 am to 1 am of the following morning, corresponding to the period in which the runways are normally operational (see Monteiro, 2010).

Traffic counts at the Salgado Filho were carried out on June 01, 2012, using the same procedures as above (see Goldner, 2012).

The only differences in the counting procedures at the two airports were that at the Hercilio Luz airport counts were taken at the entrance and exit ways of the airport and at the entrances and exits of the associated parking lots outside the main terminal area whereas at the Salgado Filho airport counts were made at the access and exit ways of the two passenger terminals that are operated there.

Data on the numbers of passengers, aircraft take-offs and landings and the constructed areas of the respective terminal buildings were obtained from the administrative bodies of the respective airports, both of which are operated by the Brazilian Airport Infrastructure Corporation -INFRAERO

5. RESULTS

5.1. The Hercilio Luz Airport

Based on the above mentioned data the trip generation rates can be calculated relating the vehicle traffic volumes (entering, exiting and total) to the numbers of passenger (enplaning + deplaning), the number of aircraft (take-offs + landings) and the area occupied by the passenger terminal building.

Table 2 shows the trip generation rates that were obtained by the calculations.

Total trips per day divided by total pax per day	1.99 trips per pax
Entering Trips per day divided by enplaning pax per day	2.03 trips per pax
Exiting Trips per day divided by deplaning pax per day	1.95 trips per pax
Nº of total daily trips divided by total aircraft	211.63 trips/aircraft
Nº of Entering daily trips divided by take-off aircraft	210.33 trips/aircraft
Nº of Exiting daily trips divided by landing aircraft	212.83 trips/aircraft
Nº of Trips per 100 square meters of Terminal building area (including covered area in front)	126.13 trips per area

Table 2 – Trip generation rates for a typical Friday.

Given that the trip generation rates refer to the daily volume of vehicles it is necessary to find out what percentage of that is represented by the traffic at peak hours (Peak Hour Percentage - PHP). The values obtained for that percentage are set out in table 3.

Peak Hour from 11:30 am to 12:30 pm	PHP
Percentage of entering vehicles	8.32 %
Percentage of exiting vehicles	7.13 %
Percentage of entering + exiting vehicles	7.70 %
Peak Hour from 06:45 pm to 07:45 pm	PHP
Percentage of entering vehicles	7.45 %
Percentage of exiting vehicles	9.99 %
Percentage of entering + exiting vehicles	8.78 %

Table 3 – Peak Hour Percentages (PHP).

The volumes of vehicles can also be analyzed according to their direction to obtain the daily or hourly entering and exiting volumes. Table 4 below presents the percentages for the daily and peak hour volumes.

Directional Distribution	Entering	Exiting
Daily – Friday	48 %	52 %
Peak Hour from 11:30 am to 12:30 pm	52 %	48 %
Peak Hour from 06:45 pm to 07:45 pm	40 %	60 %

Table 4 – Directional Distribution of Vehicle Movements.

5.2. The Salgado Filho Airport

Tables 5, 6, 7 and 8 display the trip generation rates estimated for this case study relating the volumes of vehicles (entering and exiting) to the number of passengers (enplaning and deplaning) and to the number of aircraft (take-offs and landings) for the given periods.

New Terminal	Entering Trips	Enplaning Passengers	Trips per pax
	15,911	8,865	1.79
	Exiting Trips	Deplaning Passengers	Trips per pax
	13,251	8,983	1.48
	Total Trips	Total Passengers	Trips per pax
	29,162	17,848	1.63
Old Terminal	Entering Trips	Enplaning Passengers	Trips per pax
	4,790	3,440	1.39
	Exiting Trips	Deplaning Passengers	Trips per pax
	8,298	3,179	2.61
	Total Trips	Total Passengers	Trips per pax
	13,088	6,619	1.98
New Terminal + Old Terminal	Entering Trips	Enplaning Passengers	Trips per pax
	20,701	12,305	1.68
	Exiting Trips	Deplaning Passengers	Trips per pax
	21,549	12,162	1.77
	Total Trips	Total Passengers	Trips per pax
	42.250	24.467	1.73

Table 5 – Trip generation rates per passenger – Whole day.

Peak Hour	New Terminal	Entering Trips	Enplaning Passengers	Trips per pax
		1.255	827	1.52
		Exiting Trips	Deplaning Passengers	Trips per pax
		965	681	1.42
		Total Trips	Total Passengers	Trips per pax
		2.220	1.508	1.47
	Old Terminal	Entering Trips	Enplaning Passengers	Trips per pax
		328	228	1.44
		Exiting Trips	Deplaning Passengers	Trips per pax
		696	217	3.21
		Total Trips	Total Passengers	Trips per pax
		1.024	445	2.30
	New Terminal + Old Terminal	Entering Trips	Enplaning Passengers	Trips per pax
		1.583	1.055	1.50
		Exiting Trips	Deplaning Passengers	Trips per pax
		1.661	898	1.85
		Total Trips	Total Passengers	Trips per pax
		3.244	1.953	1.66

Table 6 – Trip generation rates per passenger – Peak Hour.

Tables 5 and 6 show the trip generation rates relating the volume of vehicles (entering, exiting and total) per period to the number of passengers (enplaning and deplaning) for the whole day and at the peak hours.

Considering the whole day data, Table 5 shows that the final rate obtained was 1.73 trips per passenger. Considering the Peak Hour data, Table 6 shows that the trip generation rate was 1.66 trips per passenger. In both the whole day counts and the peak hour counts it can be seen that the trip generation rate for the new terminal (1.47) is lower than that of the old terminal (2.30) because of the higher numbers of exiting vehicles registered for the latter. The explanation is that it is possible to enter via Terminal 1 and exit via the Terminal 2 as there is a road connection between the two. Tables 7 and 8 display the trip generation rates relating the volumes of vehicle traffic (entering and exiting) to the number of aircraft (take-offs and landings) for the whole day and peak hour period.

New Terminal	Entering Trips	Take-offs	Trips/aircraft
	15,911	102	155.99
	Exiting Trips	Landings	Trips/aircraft
	13,251	104	127.41
	Total Trips	Total Take-offs and Landings	Trips/aircraft
	29,162	206	141.56
Old Terminal	Entering Trips	Take-offs	Trips/aircraft
	4,790	33	145.15
	Exiting Trips	Landings	Trips/aircraft
	8,298	32	259.31
	Total Trips	Total Take-offs and Landings	Trips/aircraft
	13,088	65	201.35
New Terminal + Old Terminal	Entering Trips	Take-offs	Trips/aircraft
	20,701	135	153.34
	Exiting Trips	Landings	Trips/aircraft
	21,549	136	158.45
	Total Trips	Total Take-offs and Landings	Trips/aircraft
	42,250	271	155.90

Table 7 – Trip generation rates per aircraft - All Day.

The rates displayed in Table 8 refer to the daily volumes of vehicle traffic on the day the counts were made divided by the number of flights made on that same day. The final rate obtained was 155.90 trips per aircraft.

It should be noted that the peak hour in question is 4:45 pm to 5:45 pm but the data supplied by the INFRAERO refer to the period 4:00 pm to 5:00 pm so that there is a slight discrepancy introduced given that it proved impossible to obtain data for the precise period targeted by the study.

The rates set out in Table 8 below refer to the total number of trips divided by the total number of aircraft during the Peak Hour. The overall value obtained for this rate is 180.22 trips per aircraft.

Peak Hour	New Terminal	Entering Trips	Take-offs	Trips per aircraft
		1,255	7	179.29
		Exiting Trips	Landings	Trips per aircraft
		965	7	137.86
		Total Trips	Total Take-offs and Landings	Trips per aircraft
		2.220	14	158.57
	Old Terminal	Entering Trips	Take-offs	Trips per aircraft
		328	2	164.00
		Exiting Trips	Landings	Trips per aircraft
		696	2	348.00
		Total Trips	Total Take-offs and Landings	Trips per aircraft
		1,024	4	256.00
	New Terminal +Old Terminal	Entering Trips	Take-offs	Trips per aircraft
		1,583	9	175.89
		Exiting Trips	Landings	Trips per aircraft
		1,661	9	184.56
		Total Trips	Total Take-offs and Landings	Trips per aircraft
		3,244	18	180.22

Table 8 – Trip generation rates per aircraft – Peak Hour.

Table 9 shows trip generation rates for the Salgado Filho airport per 100 square meters of passenger terminal building area. The data consider the new Terminal, the old Terminal and the Cargo Terminal buildings.

Constructed Area (m²)(CA)	**New Terminal**	**Old Terminal**	**New Terminal +Old Terminal**	**Cargo Terminal**
	37,500	14,500	52,000	8,000
Entering + Exiting Trips	28,967	12,980	41,949	303
Rate (Trips per 100 m² CA)	77.25	89.52	80.67	3.79

Table 9 – Terminal Buildings Areas at the Salgado Filho airport.

In the trip calculation for table 9, truck trips were discounted from the overall counts and registered as a separate count associated to the new Cargo Terminal to be constructed.

6. COMPARATIVE ANALYSIS

One of the important differences between the two airports is the mode choice patterns. At the Hercilio Luz airport, 71.67% of the trips are made by cars, 11.75% by taxis, 11.37% by buses and vans and 5.21 % trucks and other vehicles. At the Salgado Filho airport, the percentage of trips represented by cars is 56% with 32% being made by taxis and only 8% by buses and vans. In the former airport the number of cars is far higher while in the latter the number of taxi trips is much higher.

In the typical demand period investigated (that is, outside of the summer or winter holiday seasons), the main reasons for air travel at both airports are business trips and such trips are typically of short duration. That would explain the high degree of taxi use registered to the Salgado Filho airport. In Florianopolis, taxi fares are higher because the supply side is lower, which would, in turn, explain the lower figures registered for that ground transport mode at the Hercilio Luz airport. Another determinant factor is that in the areas around the Hercilio Luz airport there are various parking areas charging relatively low rates for long parking periods and that would encourage people to use their own cars to go to the airport and come back using their own vehicles.

There is a large increase in demand at the Hercilio Luz airport in the summer months because the city of Florianopolis is actually on an island with 42 beaches and attracts many tourists from Brazil and the Mercosur countries. The Salgado Filho airport, on the other hand, has high demand levels during the July school holidays with a flow of winter season tourists, visiting the nearby touristic cities of Gramado and Canela.

7. CONCLUSIONS

This article has compiled the data of two studies targeting airports in southern Brazil for the purpose of analyzing ground trips associated to them. Trip generation rates were calculated based on entering and exiting traffic counts made *in loco* and on information on passenger demand and on the numbers of inbound and outbound flights supplied by the INFRAERO.

The trip generation rates obtained enable transport planners to design access way dimensions appropriately and thereby minimize the usual delays stemming from traffic congestion, enhancing airport accessibility and the attractiveness of air transport in the regions served by the airports in question.

Neither of the studies made any registrations or calculations for the periods of the year with peak activity because of the great discrepancy between them. Rather the research sought to identify more typical months when there are fewer tourists and the profiles of the demand for air transport in the two cities are similar. It is suggested that other studies of this kind should be conducted during the seasonal peak periods and comparisons made among the average rip generation rates obtained. It is also hoped that the method adopted

in the present work can serve as a foundation for similar studies of other Brazilian and Latin American cities where there is a lack of trip generation models for various kinds of trip generation sites, especially airports.

In addition to the trip generation rates obtained, other important information was gleaned on ground transport mode choice, the directional distribution of ground trips, the average hourly rates and the peak hour rates that will enable comparisons to be made with the other realities in other countries.

It should be noted that there is a wave of airport expansion and improvement activity in course in Brazil the light of two upcoming mega-events it will be hosting: the World Football Cup in 2014 and the Olympic Games in 2016.

It is hoped that the study results may contribute to supporting transport planners in adequately dimensioning and designing access roads and parking areas at the airports studied and at others with a similar demand profile, not only at the project stage of entirely new ventures but also in the processes for expanding existing airports.

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