Airport Terminals Layout and Procedures Adaptations in view of Passenger and Baggage Flow Fluidity

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ABSTRACT

The aim of this dissertation is to explore and evaluate solutions that could reduce the minimum time of passengers’ attendance in airport terminals before flights departure time by improving the fluidity in passengers and baggage flow. The solutions in study focus on adjustments to layout and procedures.

The thesis analyzes in detail the passenger and baggage trip process from the ticket purchase to the exit of the flight terminal, giving special focus to the security processes. The main problems of the aeronautical industry were analyzed: security issues of post September 11th and the facilitation which has decreased with the security measures rise. The main solutions that industry has launched to solve security issues and improve facilitation were studied.

Through an iterative exploration has been achieved a solution that answers the thesis objectives. The final solution consists in a service called “Fast Track Service” which allows passengers (who have joined the service – “fast track passengers”) to follow their hold baggage to the boarding gate. The security control of these passengers and their baggage are performed separately from the other passengers. After security control, fast track passengers will use a direct corridor which will forward them to the boarding gates.

Terminal 1 of Lisbon Airport was case study of Fast Track Service applicability. Using the SIMUL8 software the viability of the Fast Track Service in Terminal 1 was analyzed, concluding that service is advantageous for the target – frequent passengers that carry one hold baggage.

Key Words: Airport Terminals, Passenger Flow Simulation, Air Transport Security, Air Transport Facilitation.

1. INTRODUCTION

1.1. Motivation

The motivation of the present study is to achieve solutions that can improve the passenger and baggage flow fluidity in airport terminals, reducing the minimum time necessary of stay of passenger and his baggage at the terminal.

The advent of air transport has allowed that passengers and goods travelled quickly between distant points. In fact, this transport is characterized by its high speed online, but the passenger appearance advance required in terminal is high when compared with other types of transport (ex. train).

Last year there was a loss of passengers on some routes due to the significant increase of high-speed lines trains in Central Europe. The competitive prices of HST1 travel time door to door (less or equal to air transport) and the less exposure to delays and cancellations due to bad weather are the reasons cited for the loss of customers from air transport to HST. The line speed of planes is much higher than of high-speed trains, but the time that is required to spend at the airport (and bigger distances of airports to the city centres) leads to a greater total travel time. The aim of the present study is to find a solution that, by reducing the time spend at the airport, will recover to airlift some of the “lost ground”.

1.2. General Framework

In a market increasingly global, aviation industry has become essential for economic progress. Aviation allows the fast transport of millions of people and goods around the world.

Increased globalization has caused an intercontinental business and economy growth, leading to an increase of the disposable income of people for leisure. It is expected that this trend will lead to a growth in demand for air travel at an average of 4.2% in the next 20 years. (Choi, 2009) At the same time, the demand growth has increased the number of problems necessary to deal with: the increasing of airport users intensified the need to render the departure/arrival faster. However, after the terrorist attacks of September 11 the security control procedures reversed the processes facilitation trend. (Choi, 2009)

1.2.1. The problem of safety in air transport

The air transport security control can be divided into two periods: before and after the attacks of September 11. The events of September 11 have changed the perspective of the western world in general and the aviation industry in particular. In fact, this event has shown two aspects: the first that the civil aviation security wasn’t prepared to deal with...
those types of threats and the second that the western world (particularly the U.S.) had a latent terrorist threat.

1.3. Objectives

The main objective of this dissertation is to find a solution that enables passengers to arrive at the terminal with the shortest time in advance of the values currently practiced, through a reduction of the total time necessary to the several procedures for passengers and luggage.

The test solutions will consist of changes to the layout of the terminal and airport procedures. In addition to a conceptual analysis, there will be an analysis of the viability and quality of solutions by using a simulation model.

2. CURRENT MANAGEMENT PRATICES OF PASSENGERS AND LUGGAGE AT AIRPORT TERMINALS

2.1. Service general objective

The main mission of civil aviation industry is to transport passengers and cargo, having as fundamental requirements the procedures facilitation and security.

2.2. Travel Process

2.2.1. Passenger Travel Process

The process of passenger air travel begins with the flight ticket purchasing and ends when the passenger leaves the destination airport.

Figure 2 illustrates the passengers’ paths that will board at the terminal:

Figure 2 – Passenger routes on Terminal - Departures

Check-in
Check-in can be done in three ways: at check-in desk, self-service machines and Web (check-in online).

Security Control
All passengers wishing to board must pass through passenger and hand baggage security checks.

Passports Control
All passengers travelling internationally must pass the border control.

Departure Lounge
In the majority of airports there is departure lounge area, with shopping and leisure zones immediately after Security Control.

Identity verification and boarding
Just before boarding the plane, the passenger must show a personal identification and a boarding pass.

Arrival

After plane landing the passenger can follow two different paths: board to another flight or leave the airport. Figure 3 illustrates the routing of passengers arriving at the airport.

Departure

The passenger paths in the airport vary depending on the passenger type of check-in and transport or not hold baggage.
After the attempted terrorist attack on Christmas Eve 2009, airports began to acquire body scanners to detect explosives in passenger and the passenger risk assessment processes were revised to become less fallible.

The processes facilitation main measures implemented are:

- The airlines are providing the check-in online service. This service has two objectives: decrease the airlines operational costs (people costs, check-in desks costs, paper) and allow passenger to arrive to the terminal with lower flight advance;
- Airports have made an effort to make the process less dependent on staff and more feasible by passenger (ex. through self-service machines). Airports indicate that the main objective is the facilitation but there aren’t yet studies showing that the self-service machines have processing times lower than the normal counters.

### 3. NEW SERVICE MODEL

#### 3.1. From the commercial purpose to the requirements specification

It is possible on this stage to concretize the initially declared objective for this study: to achieve solutions that allow passengers with hold baggage arrive to the airport with the shorter advance as possible before the flight.

Passengers that don’t carry hold baggage and that have done home check-in, are the passengers that can stay lower time at the airport. Since they don’t have to do check-in neither dispatch baggage, these passengers can arrive to airport and go immediately to security.

For passengers who have to dispatch baggage, there is a time limit for the acceptance of checked baggage: at least 30 minutes before flight - this is the advance that most airlines proceed to the close of check-in operations. However, passengers are advised to arrive earlier to check-in desk due to the passenger’s influx and possible creation of long queues.

It is important to understand the reasons why airlines require a large check-in advance for passengers that carry hold baggage.

Figure 4 features the current approach to passengers and hold baggage terminal processes:

![Simplified diagram of passengers and hold baggage processes at the terminal - Departures](image-url)

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2 Hold Baggage Screening
Phase 1 – Phase 1 begins when passenger and his hold baggage enter the terminal and ends when passenger dispatches the baggage at check-in. This means, it ends the moment passenger is separated from his baggage: from this time passenger and baggage will have different pathways until the moment they are reunited on arrival hall at the destiny airport.

Phase 2 – It is the journey from the moment of separation of passenger and baggage at check-in until the time of passenger boarding and baggage.

\[ \Delta t_n (X) \] – It is the time that \( X \) takes to complete the Phase \( n \)

Where \( X \) is:
- \( P \) – Passenger;
- \( B \) – Hold baggage.

And \( n \) is 1 or 2.

\[ \Delta t_2 (P) \] is equal to the sum of the following times:
- Time of travel from check-in to the Security Control;
- Time on Security Control queue;
- Time of activity in the Security Control;
- Time spent in the delivery room;
- Time to march from the delivery room to the boarding gate;
- Time in queue for boarding;
- Time of shipment activity.

\[ \Delta t_2 (B) \] is equal to the sum of the following times:
- Time on baggage screening (HBS);
- Time of travel of the luggage from the chute to the aircraft;
- Time of loading the luggage on the plane.

In Phase 1 the passenger and baggage are together so \( \Delta t_1 (P) = \Delta t_1 (B) \).

In Phase 2 the passenger and baggage have different paths so \( \Delta t_2 (P) \) may be different from \( \Delta t_2 (B) \).

Airplane takeoff conditions must meet several requirements including:
- Have the passengers on the plane (Process P);
- Have the hold baggage on the plane (Process B).

Once the passengers without hold baggage has no set time limit to reach the terminal can be concluded that the advance requested to passengers with checked baggage is not due to \( \Delta t_2 (P) \). Therefore it is necessary to study if the advance requested for passengers with hold baggage is due to the time baggage takes from check-in until it reach the plane (\( \Delta t_2 (B) \)).

The answer to this question is in principle negative. ANA said that airlines schedule in order to finish P and B substantially simultaneously. That is, \( \Delta t_2 (P) = \Delta t_2 (B) \). Which means that if a passenger with hold baggage arrives at check-in at the last minute before it closes, should be able to embark on time and have his hold baggage embarked as well.

It is important, therefore, to consider what happens if a significant proportion of passengers on a flight with 100 seats come in the last minute before the close of check-in. Since the times of activity in Phase 2 are not equal to zero and, since the Phase 2 activities do not have unlimited capacity, it means that passengers and luggage may not arrive in time for the flight. This would lead to one of two solutions: or the flight rose without passengers or would wait for passengers. The second solution can lead to a delay in departure time and thousands of dollars in additional costs. This is the reason for the advance made to the check-in.

For this reason, companies (and airport managers) periodically study the distribution of check-in arrival time relative to the flight departure time.

Given the previous answer, the desired solution will not modify solely the hold luggage or the passenger processes; the desired solution has to modify simultaneously both processes.

3.2. Iterative solutions exploration

The previous section concluded that the solution to study has to modify the passengers and checked luggage processes. It was decided, therefore, to consider the following solution: passengers will accompany their hold baggage to the boarding gate; at that point the baggage is delivered to an employee who forwards it to the aircraft's hold.

The questions that arise now are:
- How to allow passengers to carry their checked baggage to the gate without degrading the current levels of security?
- Passengers with and without checked baggage can share the same routes?
- What is the target audience of the solution studied?
- What are the customer satisfaction key factors of this service? for
- Can the procedures identified with a positive response in the four previous questions be applied to all passengers with checked baggage?

3.2.1. Solution 1

Passengers who do not want to carry the hold baggage up to the gate continue to perform the normal procedures and can dispatch the checked baggage. Passengers who choose to accompany their hold baggage will share all the spaces with the other passengers by making all processes together with them.
Disadvantages

The implementation of this solution poses some constraints on the shops and the departure lounge airside: passengers with hold baggage can occupy much space and hinder the movement of others, which can cause circulation and operating stores problems. Even reminding that passengers that take their hold baggage to the gate would want to spend very little time in the terminal, its presence (and fast-moving passing) in spaces shared with other passengers would certainly not be a factor in liking for the remaining customers of the airport.

3.2.2. Solution 2

Given the problems of the previous solution is sought a new solution. Thus, the following solution was designed: passengers who have checked-in remotely will take their checked baggage to the gate; security control of all passengers, hand baggage and hold baggage is performed at the outside border of the terminal; passengers wishing to carry their hold baggage to the gate of the plane will not pass through the departure lounge. The remaining passengers can put their luggage in a "bag drop" that will take it to the gate and can, therefore, pass through the delivery room and enter in the stores.

Disadvantages

The hold baggage screening (HBS) would no longer be used. It would be the need for a system that transports hold baggage from the "bag drop" (or check-in) to the chute – it could be a system identical to the HBS but without screening machines. The main disadvantage corresponds to the need for security control of all baggage at the threshold outside the building, so easily create queues outside, subjecting people and their accompanying bad weather and degrading the visual image of the terminal for those approaching it from the landside.

3.2.3. Solution 3

The solution 3 was designed in order to solve the problems of the previous solution. The solution considers that some passengers may carry their hold baggage to the gate, proceed the security control in an independent area of the current and have a "Fast Track" corridor with a direct and fast dial to the gates. The current system of processing passengers and hold baggage remains. Thus, modifications to the plant terminal are minimized.

For better understanding it was assumed that the new service model would receive the trade "Fast Track Service" and the current model "current service". Fast Track Service users as "Fast Track passengers" and passengers using the standard service will be designated as "normal passengers."

Likewise, the Fast Track passengers' baggage will be designated as "Fast Track baggage" and normal passenger baggage as "normal baggage."
Changes to processes within the terminal

![Simplified scheme of the actual passenger processes at terminal - Departures](image)

Figure 7 – Simplified scheme of the actual passenger processes at terminal - Departures

When passengers enter the terminal follow distinct pathways depending on whether they are normal or Fast Track passengers. Fast Track passengers heading directly to the Fast Track security and normal passengers follow the habitual path depending on its characteristics (local check-in or not and transportation of checked baggage).

**Fast Track Service Target**

The feasibility study of the Fast Track service would analyze the advantages and disadvantages that service brings to a distinct set of entities: passengers, airlines and airports.

Essentially there are two distinct groups of air transport users: passengers on leisure time (which for this purpose includes tourism and visits to family and friends) and business travellers.

For the first group of passengers to catch a flight is relatively rare, so they live the experience with interest.

A significant part of the second group of passengers - business travelers - is characterized by travel frequently, and generally carries loyalty cards from companies where they usually fly. Since the reason for travel of frequent travellers is mostly work, travel time means time that could be invested in work or at rest.

From the foregoing paragraphs above it is concluded that the Fast Track system can bring big benefits for frequent passengers in trips with stays long enough to need to travel with hold baggage.

However, it is necessary to limit the number of hold luggage that each passenger can carry. The aim is to control the number of baggages that will be transported in the corridors, loaded into the hold in the last minutes before departure minimizing the risk of the existence of a large number of baggages and lack of staff to treat them. Limit the number of bags per passenger allows foreseeing the number of baggage Fast Track that the flight will have.

**Fast Track Card**

It may make sense to limit the use of the Fast Track service to passengers carrying a special card (Fast Track Card) or a privilege card of some companies with whom there is a corresponding agreement. The main purpose of filtering is to manage demand for the service, avoiding a very large influx of passengers, with that degrade the quality of service.

**Entities Interested in Fast Track Service**

The previous section concluded that frequent flyers will generally benefit from using the Fast Track service when travelling with hold baggage. It is important to analyze the advantages/disadvantages that this service can bring to other actors in civil aviation.

**Airlines**

Central Europe has seen in recent years, a significant increase in lines of high-speed train. This new transportation option has led to significant loss of passengers on some routes. The reasons for this loss of customers are: the high-speed trains have competitive prices and travel times are, in some situations, less than or equal to the time in air transportation, and are too less sensitive to delays and cancellations due to bad weather.

The line speed of the aircraft is far superior to that of high-speed trains, but the time that is required to spend at the airport leads to a greater total travel time. The Fast Track service, reducing the time spent at the airport, allows for air transport to recover some of the “lost ground”. Thus, airlines may have an advantage in signing up for Fast Track Service.

**Airports**

The previous section concluded that the airline can win more passengers with this service. Verifying this situation the airport get immediately more revenue because the fees that airlines pay are also function of the number of passengers boarded.

Analyzing the issue from the standpoint of airports, there is another issue: the revenue from the airside shops have changed? Airports have significant revenue from the airside shops. Loosing frequent passengers to the Fast Track Service will retail have a significant impact? Frequent passengers, by being so used to frequent the same airports
rarely use the length of stay to shop. In the limit buy a coffee or food, but even that can get without paying in the frequent passenger “lounge” that mostly have access. The conclusion is that the airport would not lose significant revenues on the air side retail side with the implementation of the Fast Track Service.

Although in the previous sections it was concluded that airlines and airports may have to gain from the Fast Track Service, there may be an additional source of revenue: the Fast Track card. As mentioned, this membership card can be made for a fee. If passengers see an advantage in this service may be willing to pay for it, or alternatively to induce companies to pay the full cost to the holders of some cards (such as today bear the costs of the lounges).

**Fast Track Service Disadvantages**

Depending on the layout of the terminal, the Fast Track system may involve an additional cost to the airport as may be necessary to reserve some space for the Fast Track Security Control and for the movement of Fast Track passengers.

**Fast Track Security Control**

The Fast Track security control will be very similar to the normal security control. The only difference is that, in addition to the screening of hand baggage, also to screen the hold baggage.

For hand baggage and hold baggage it will be used a machine like the machine N1/2 of HBS. This machine is automatic so there is no needing an operator to decide whether the bags are safe or not. The bags that the machine consider not safe will be opened and reviewed manually by an operator in the presence of the passenger.

Immediately after the hold baggage screening, and in line with the machine, an operator will be positioned and will weigh the hold baggage, put its label, and put a strap that is perishable unambiguously in case of opening - in order to prevent objects allowed in hold baggage and banned in hand luggage being transferred from one to another between this operation and shipping.

This operator may be associated with a baggage handling company and should have access (with obvious limitations of privileges) to the computer systems of the airlines adhere to the Fast Track system.

**Fast Track Baggage Delivery**

As soon as step out from the security control passenger enters on Fast Track corridor and head towards the boarding gates.

In each boarding room there will be a proper place where the hold Fast Track baggage will be placed to, and then be sent out to the plane through its own system.

Given the differences in height between the departure lounge and the basement of the plane, there are two options for the Fast Track baggage handling system:

Option a) A motorized ramp;
Option b) a lift.

**Arrival**

The arrival will render differently depending on the destination airport has the Fast Track service on arrival active or not and, as the passenger is in transit or not.

For the Fast Track service can take place at destination would be appropriate to advocate the possibility of development at the option of an alliance of major airports based companies adhering to the service.

If the destination airport does not have the Fast Track service active, the arrival process will follow the usual steps (described in 2.2.1. Process Passenger Travel (Arrival).

If the airport has the Fast Track system active on arrival and the passenger is not in transit, at the end of the flight passengers wait in the adjacent room to the airplane for landing their baggage that will be delivered in a symmetric process of the shipment.

For the arrival process be faster for fast track passengers the process of online check-in (that they must resort) can give them preference in occupation of the front seats of economy class airplane thus be the first to off the plane. Once the Fast Track baggage were the last to be loaded will be the first to be discharged (because they are closer to the basement door), thus the time from landing to passenger reconciliation with its baggage is minimized.

If the passenger is in transit, the arrival process is equal to the current process (described in 2.2.1. Process Passenger Travel (Arrival). Deliver hold baggage to the traffic passenger could pose some problems including:

1) If the departure of the flight the passenger then go catch is passed shortly after the arrival of the current flight, the passenger may have little time to get to the gate of the flight. If the gate is located far away and the passenger has to carry his baggage, it will worsen the probability of not arriving in time for the flight;
2) The following flight may not have the Fast Track system active.

**4. STUDY METHODOLOGY**

**4.1. The need to resort to simulation**

Within this study the use of simulation has a key role. In fact, to measure if the Fast Track service is advantageous or not it is necessary to study their functioning and the implications of this in a terminal at Lisbon Airport.

Thus, it is necessary to recreate the operating conditions of a model that allows the manipulation of the characteristics (through inputs, rules and parameters) and taking outputs. The simulation model allows the manipulation of system characteristics, such as current and future passengers and baggage routes, arrival and service rates, number of servers, discipline of the queues, passenger routes, etc. It will,
therefore, assess the system sensitivity to changing characteristics.

4.2. SIMUL8 software description

The SIMUL8 is a discrete simulation program that lets you draw diagrams of process model entities. Use blocks to represent specific elements of a system of queues and directed arcs that connect the different blocks establishing the flow of bodies over the diagram.

4.3. Data, results and processes in simulation

The model input variables are the data needed to render the simulation more realistically as possible. Examples of inputs are: a service time of the check-in, number of passengers on a given flight.

The simulation model simulates a set of processes of a system. At the end of the simulation outputs can be removed. Examples of outputs are: the average waiting time to be served, the number of entities that are simultaneously in a given queue, etc.

4.3.1. Simulation processes description

Processes – Configuração Actual

Passengers Processes

For purposes of this dissertation, the passengers can be divided into the following types depending on whether or not carrying hold baggage and depending on the type of check-in:

<table>
<thead>
<tr>
<th>Passengers' types:</th>
<th>A. Passengers with hold baggage</th>
<th>B. Passengers without hold baggage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3. Do on-line check-in before go to the airport and dispatch baggage on desk (or “bag drop”)</td>
<td></td>
<td>B3. Do on-line check-in before go to the airport</td>
</tr>
</tbody>
</table>

According to the characteristics of passengers, mentioned in the previous section, the mandatory activities vary. Using the references of Figure 9, the passenger type A1 and B1 must do check-in on desk, so they have to get to the terminal before the closing time of check-in. Passengers type A2 and B2 do check-in on self check-in machines at the airport. The passenger A3 have already checked-in remotely on Internet and when he arrive at the airport have only to check bags in a "bag drop" or at check-in desk. Passengers who do not carry hold baggage and had checked in online (B3 passengers) can get to the terminal and forward directly to security.

Then it is present a picture that illustrates the required and optional activities by type of passenger:

Required and optional activities per passenger type

<table>
<thead>
<tr>
<th>Passenger Type</th>
<th>Concourse Area</th>
<th>CIB *</th>
<th>CIM **</th>
<th>Bag Drop</th>
<th>Security</th>
<th>Lounge Area</th>
<th>Passport Control</th>
<th>Boarding,</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td></td>
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<td></td>
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<td>(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td></td>
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<td></td>
<td>(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*) Check-in desk
(**) Self-service check-in

Required paths per passenger type and optional paths

Hold Baggage Processes

Hold baggage can be delivered by passengers at check-in desks or "bag drop" desks. After being delivered they enter the Baggage Handling Screening, and then enter the sorting system (which sends each bag to the chute of their flight). When the baggage arrives at the chute it is read its label and the baggage is placed in a container.
Processes - Future Configuration

In the future model shape there are held all inputs and characteristics of the current model and there are add new activities that constitute the Fast Track service.

5. CASE STUDY - TERMINAL 1 OF LISBON AIRPORT

Terminal 1 from Lisbon Airport has been chosen for the study to test the applicability of the concept which is the subject of this dissertation.

5.1. Lisbon Airport

Lisbon Airport is the largest airport in Portugal. It has two runways and two passenger terminals. Terminal 1 is the largest airport terminal, serves Schengen and Non-Schengen flights. Terminal 2 was opened in 2007 and now serves only domestic flights.

5.1.1. Characterization of the Terminal Passenger Flow

For the modelling of passengers and baggage treatment processes from Lisbon Airport is first necessary to analyze the passengers flow that daily pass through the airport. Thus, ANA has released information about all departures and arrivals at Lisbon Airport in the period from June 1 to August 31, 2009.

Below it is present some elements that characterize the flow of passengers/departures during this period (Note - there were excluded from the analysis all non-commercial flights):

- During the months of June, July and August 2009 there were 18,215 departures of aircraft which leads to a daily average of 200 flights;
- There are three departure times peaks:
  - In the morning - between 8h and 10h;
  - The mid-afternoon - between 14h and 16h;
- In the late afternoon - between 18h and 20h.
- The strongest peak is the morning's peak: 20% of the flights take place between 8 am and 10 am;
- During the analyzed months the average passengers per flight is 111 passengers;
- Nearly 80% of flights departed from Lisbon Airport in the studied period are Schengen flights. Less than a quarter of flights have destinations outside the Schengen area.

5.1.2. Fast Track Service - application to Terminal 1

Modifications to the terminal plant

To implement the Fast Track Service it is necessary to make some changes to the plant of the terminal 1 Lisbon airport. These amendments seek to place:

- Space for Fast Track passengers and baggage Security Control and for weighing and tagging baggage;
- Direct corridor linking the space of the previous point to the corridor of boarding gates.

5.2. Simulation Model

As noted in section 5.1.1 there is a peak time in the terminal at Lisbon Airport: between 8 and 10 hours. To simplify the model it was chosen to simulate the movements of commercial flights and departures of the day June 11, 2009 (Thursday) in the period between 7am and 10am.

5.2.1. Actual Configuration

Input Variables Model - Current Configuration

It was took dozens of input variables to simulate the current processes of passengers and luggage treatment on departure. Most data were provided by ANA and was obtained in the literature. Examples of input variables are: number of passengers per flight hour of opening and closing of check-in processing time at check-in.

5.2.2. Alternative Configuration

Input Variables Model - to Fast Track Service

The input variables for the Fast Track Service were obtained through logical reasoning and assumptions. Then it is characterized the main input variables of the fast track model.

Percentage of Fast Track passengers

As explained in Chapter 3, the Fast Track Service will be as target frequent passengers. ANA reported that 35% of passengers using the airport of Lisbon are frequent passengers. It was assumed that only one part of these will want to use the Fast Track Service. It is important to note that the percentage of passengers using the service should be relatively small to avoid creating traffic problems in the corridor of the boarding gates or in the process of loading the baggage.
Thus, it was considered that 10% of passengers on each flight would use the Fast Track service.

**Fast Track passengers arrival on terminal**
Fast Track passengers will arrive at the terminal with the maximum and minimum following antecedents:

<table>
<thead>
<tr>
<th>Flight Type</th>
<th>Pax with/without hold baggage</th>
<th>Advance pax arrives at the terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With baggage</td>
<td>Without baggage</td>
</tr>
<tr>
<td>Schengen</td>
<td>30min</td>
<td>20min</td>
</tr>
<tr>
<td>Non Schengen</td>
<td>45min</td>
<td>30min</td>
</tr>
</tbody>
</table>

**Boarding Gate**
The processing time of Fast Track passengers at the boarding gate will be equal to the normal passengers. However, it is expected that the results of the waiting time of Fast Track passengers are lower than normal passengers due to the following reasons:

- Most normal passengers are in the departure lounge before gate open. When are missing 20 minutes to open the gate passengers that are in the departure lounge go to gate forming the queue;
- The waiting time for boarding should be lower to Fast Track passengers because when they arrive at the gate most of the normal passenger should have already shipped.
- Thus, when Fast Track passengers arrive at the queue the number of passengers in the queue will be reduced so the waiting time to board should be reduced.

**Walking Times**
It was considered that Fast Track passengers with hold baggage have a lower speed by 33% of the speed of the passengers without hold baggage, because they have to drag their suitcase.

### 5.3. Results Analysis
The Fast Track Service stands out with Normal Service for allowing frequent passenger with hold baggage to arrive later to the terminal.

**Average time of stay in the terminal**
The average time of stay in the terminal for Fast Track passenger is 13 minutes while the normal passenger remains on average 70 minutes in the terminal.

**Figure 14 – Partial times comparison: Normal Passenger vs Fast Track Passenger**

**Commercial spaces**
The main differences regarding the use of time inside the terminal are the time spent in the commercial spaces that, in the case of normal passenger is on average 33 minutes and Fast Track passengers can be zero (but solely dependent on his will). The residence time of the Fast Track passengers in stores may be higher if they reach the terminal in advance and have to wait for the opening of the gate.

Most of the passengers’ time of stay is used in normal commercial space while they wait for a call to the shipment. Fast Track passengers use most of the time spent on journeys in the terminal.

**Check-in**
The average Fast Track passenger check-in time is zero because these passengers have proceeded to check-in at home.

**Boarding**
The average waiting time at the boarding gate queue is 13 minute for normal passengers and 1 minute for Fast Track passengers. The difference in waiting times is considerable and is due to the reasons given in 5.2.2. (Alternate Configuration – Boarding Gate).

**Walking time**
The average running time of Fast Track passengers exceeds the normal passenger because its speed is lower than the normal passenger in the gates corridor because they have to carry their hold baggage.

### 5.4. Conclusions
The Fast Track service can provide real time savings to passengers of the target market, and can be installed without significant conflicts with the rest of the airport service, but its implementation should be done gradually. Initially the number of airlines adhere to the Fast Track system should be reduced. The aim is to detect possible weaknesses of the system and correct them. It is also important to analyze the level of adherence to the system by passengers. There should be a marketing strategy to publicize the new service to the passenger audience. When there is greater confidence in the service it may be extended to a greater number of companies.
6. CONCLUSIONS

The Fast Track service brings a gain in quality of service for frequent passengers who travel with hold baggage. This type arises primarily in intercontinental travel passenger but also in some European travel destinations when they are associated with longer stays.

In areas well served by HST (which is not the case of Lisbon) this concept can help increase the competitiveness of air transport on the links that competition is effective.

The solutions studied considered changes to the layout of the terminal and airport procedures. The solution to the problem is the passengers carry their luggage to the door of the plane where the luggage is delivered to an employee who poses in the basement. This service, called "Fast Track Service", carries out the security control in a place apart from the other passengers (normal passengers). After the security control, Fast Track passengers head for the gate using a direct passage "Fast Track' corridor ".

The solution case study applied to the terminal 1 at Lisbon Airport, with the help of SIMUL8 simulation program, concluded that the Fast Track service is advantageous for frequent travellers carrying a baggage.

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