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A tool to support resource allocation at small-to-medium seasonal airports

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ABSTRACT

During a few months of the year seasonal airports face the challenging task of maintaining service quality while dealing with heavy traffic, often being pushed to operate on the limit of their available capacity. Under such circumstances, efficient allocation and timely reallocation of physical and human resources is what keeps the service quality of airports at an acceptable level.

The paper describes a tool to support allocation of the physical resources, developed for particular seasonal airport falling in the range 1–5 million annual passengers. The tool is designed to work with the traffic schedule – to check it against existing constraints imposed by area, and to assign the appropriate alert if any of the constraints are violated. Thus, the tool provides airport planners with a clear overview of the traffic situation. Its main function is to allow airport planners to check the effects of different actions to resolve particular constraints violations on the overall situation, before making the final decision. Due to non-disclosure agreement, the tool and its features are presented in the paper on somewhat modified example.

1. Introduction

Demand at an airport is rarely distributed evenly throughout the year, month and/or day. It is typically characterized by (more or less pronounced) hourly, daily and/or monthly variations. (Ashford et al., 1997). Monthly variations are typically used to determine the extent to which an airport experiences seasonal concentrations. Seasonality arises from an increase in demand, usually connected to vacation seasons (summer or winter). It may also be imposed by events related to important holidays that may differ depending on the country, region, religion, etc. (Halpern, 2011).

Eurocontrol (2007) identified 39 European seasonal airports using the traffic from 2006 as a reference. Excepting "regular" seasonal airports where seasonality is driven by the tourist season (summer or winter) among these 39, there are six airports that experienced seasonality due to special events in 2006.

Fig. 1 shows seasonal character of seven AENA airports.[1] The distribution of annual departures by month for year 2011 is given in the chart (source: AENA Estadisticas, 2011). There is a clear difference between high season (usually from 4th/5th to 9th/10th month of the year) and off-season traffic. Depending on the airport, the difference can be smaller (Alicante and Malaga) or bigger (Palma de Mallorca, Murcia and Reus), or even very extreme in high season, resulting in sharp peaks (Ibiza and Menorca).

During the high season, an airport is exposed to very high traffic demand, often being pushed to operate on the edge of its available capacity. During these few months of the year it is a challenging task for airports to maintain service quality (acceptable levels of efficiency, punctuality and delays). On the other hand, the available capacity is relatively (sometimes highly) underutilized outside the peak season, resulting in low productivity. Therefore, the successful management of a seasonal airport relies mostly on the efficient allocation of human and physical resources, both during the high

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[1] Airports fall into different size categories: Palma de Mallorca and Malaga – 10 to 25 million passengers; Alicante and Ibiza – 5 to 10 million passengers; Menorca, Murcia and Reus – 1 to 5 million passengers.

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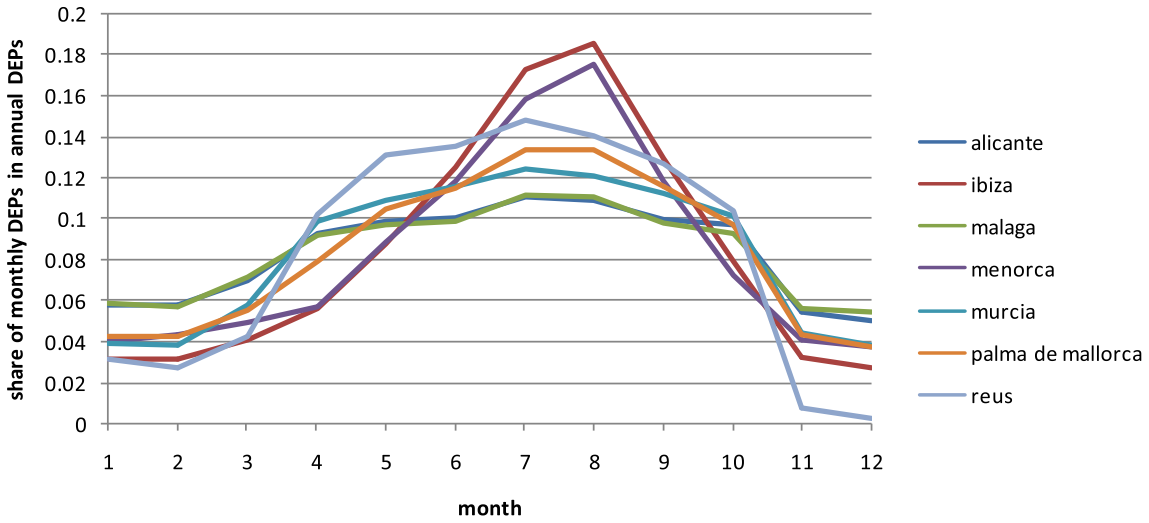

Fig. 1. Monthly distribution of annual departures in 2011 (compiled from: AENA Estadisticas).

season and off-season.

Slot allocation is one of the popular means to cope with airport congestion. It mainly refers to allocation of scarce capacity on the runway. But, in general, it can also be driven by congestion at other airside elements, such as area. E.g. Katsaros and Psaraki (2012) address slot allocation at capacity-constrained airports with seasonal demand, on Greek airports example. They primarily focus on runway capacity congestion, as is the usual case. In this paper we offer a tool for physical (fixed) resource allocation, focusing on the cases at which the main bottleneck is at the terminal building and apron/gate area.

There are various industry tools available on the market[2] developed for similar purpose, primarily to optimize gate assignment, but also for allocation of other fixed resources (check-in, baggage claim belts, etc.). However, these tools are usually not affordable for small-to-medium airports. An appropriate trade-off has to be achieved between airport needs and their readiness to invest in decision support tools. The tool presented in the paper (also in Mirkovic et al., 2013) offers affordable alternative product which is less sophisticated, but still can satisfactorily fulfil the requirements.

The tool is created to check traffic characteristics against different constraints that may appear at the terminal complex. It is meant to be used, firstly, in preparation for the season, once the expected traffic schedule in the winter/summer season is known. Airport planners can use the tool to perform preliminary resource allocation based on the given requirements and constraints. In the second run, the tool can be used on a weekly and daily basis to reallocate resources in order to respond on to traffic changes.

The same tool can also be useful for airports with a more regular distribution of demand throughout the year, in situations when they experience significant increases in traffic volume due to certain events (sports competitions, congresses etc.). Airports are faced with similar challenges when the terminal complex is under reconstruction and the usual traffic has to be handled with less-capacity available.

Section 2 summarizes major constraints related to the terminal complex. Section 3 gives a description of the tool, and is organized in four sub-sections: the first one presents the case study airport; the second discusses the input data required by the tool; the third explains the graphical representation of the traffic data; and the fourth focuses on the alerts that the tool triggers when some of the constraints are violated. In Section 4 it is explained how to work with the tool and concluding remarks are given in Section 5.

2. Terminal complex constraints

Depending on the airport's infrastructure and characteristics of demand, there are various factors that can limit capacity of an airport. These may differ significantly from airport to airport. This paper focuses on the constraints that appear at the terminal complex. Airports with primarily passenger traffic are observed.[3]

Terminal buildings can serve different categories of traffic. It is common to differentiate between domestic and international terminals, or between units within the same terminal. Depending on the region, other specific terminal building modulation can apply, e.g. Schengen, non-Schengen, domestic, or inter-island (as is the case with airports of the e.g. Canary Islands), etc. Also, different terminal units or different levels of the same unit can be assigned to arrival and departure passenger flows. Terminals, terminal levels or terminal units allocated for different categories of traffic/traffic flows (domestic, international, arrival, departure, etc.) are hereinafter referred to as modules.

Capacity constraint in a terminal building, or any of the modules, can be imposed by any processing unit, in arrival or departure flow of passengers or bags, e.g. immigration (passport control), security areas, or baggage sorting areas, etc. Capacity constraints can be either global, imposed by centralized process (e.g. security control in departure flow), or local if they apply for particular module(s) (e.g. baggage claim in domestic terminal module). Depending on the structure of passengers flying to/from the airport (domestic, international, originating, terminating or transfer) and their distribution in time, the same terminal building can process different number of passengers per unit of time (and aircraft carrying the to/from the airport), because the capacity constraint moves from one module to another, or from one processing unit to another. For example, while the airport is struggling with congestion in its international modules, due to passport control capacity constraints, the domestic module might be operating below its capacity.

[2] Offered by: Amadeus, Ascent Technology, Beontra, Seetek, Siemens, Sita, etc.

[3] Out of 528 airports in Europe 370 have only one dominant market segment, out of which 85% are passenger airports (Eurocontrol, 2007).