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Simulation-based turnaround evaluation for Lelystad Airport

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ABSTRACT

The airport of Lelystad in North Holland will be upgraded to attract commercial traffic from Schiphol. In this paper we present the simulation-based analysis for Lelystad Airport with the objective of identifying the most promising configuration, identifying potential problems and capacity limitations in the system. Three layouts for the apron were tested and we analyzed in the model the use of vehicles for the ground handling service, different demand levels and different allocations for aircraft, in addition we included the uncertainty inherent to these systems. The results allowed to get to the conclusion that some configurations are more attractive than others but the variability of the system might play an important role in order to make the airport more or less attractive to commercial airlines.

1. Introduction and background

The global air transport industry constantly faces the lack of capacity, particularly at major European airports (Roosens, 2008; ACI Europe, 2010). Airports cope with the problem by developing new infrastructure (e.g. new runways or new gates), or by optimizing existing resources in order to improve the efficiency of the various processes involved in airport operations. Many times building new facilities seem the most logical solution, but it is expensive, time-consuming and cannot be taken for granted in practice. Improving efficiency is challenging, but a task in which techniques from operations research, like simulation, come handy.

Amsterdam Schiphol (AMS) is the main airport in the Netherlands and it was the fifth busiest airport in Europe in 2014 in terms of passenger traffic (ACI Europe, 2014). AMS is also the main hub for KLM, which provided 54% of the seats in 2013; and a major airport for the SkyTeam alliance, whose members – including KLM – are responsible for 66,3% of the airport traffic in terms of air traffic movements (ATM) (Schiphol Amsterdam Airport, 2015). Its role as a hub, called "Mainport" by airport management and the government, is central to the airport strategy, especially considering the small size of the domestic market in the Netherlands and the airport's role as economic engine for the region.

1.1. The Lelystad Airport

Due to environmental reasons, the capacity at AMS is limited to 510.000 ATM per year. In 2014 there were 438.296 movements at the airport, 86% of the imposed cap (Schiphol Amsterdam Airport, 2015). As a result, the airport operator, Schiphol Group, would like to support the "Mainport" strategy by redistributing traffic which does not depend directly on the hub function of the airport (mainly LCC) to other airports in the Netherlands in order to relieve capacity at Schiphol. The preferred alternative is to upgrade Lelystad Airport (LEY) to attract flights to European cities and regions with focus on tourist destinations.

Lelystad is currently the largest airport for general aviation traffic in the Netherlands. It is located 56 km from central Amsterdam, about 45 min by car to the East. The airport is fully owned by Schiphol Group, which also owns Rotterdam airport (RTM) and a 51% stake in the Eindhoven airport (EIN), both in the Amsterdam Multi-Airport System (see Fig. 1).

In relation to Eindhoven (and also to Groningen, in the northeast of the Netherlands, and Maastricht in the south), Lelystad is considerably closer to Amsterdam and thus better located to serve as a secondary airport for the city. In terms of distance, Lelystad airport is also closer to Amsterdam than Rotterdam airport, but considering available connections by train and car, travel time is not so different.

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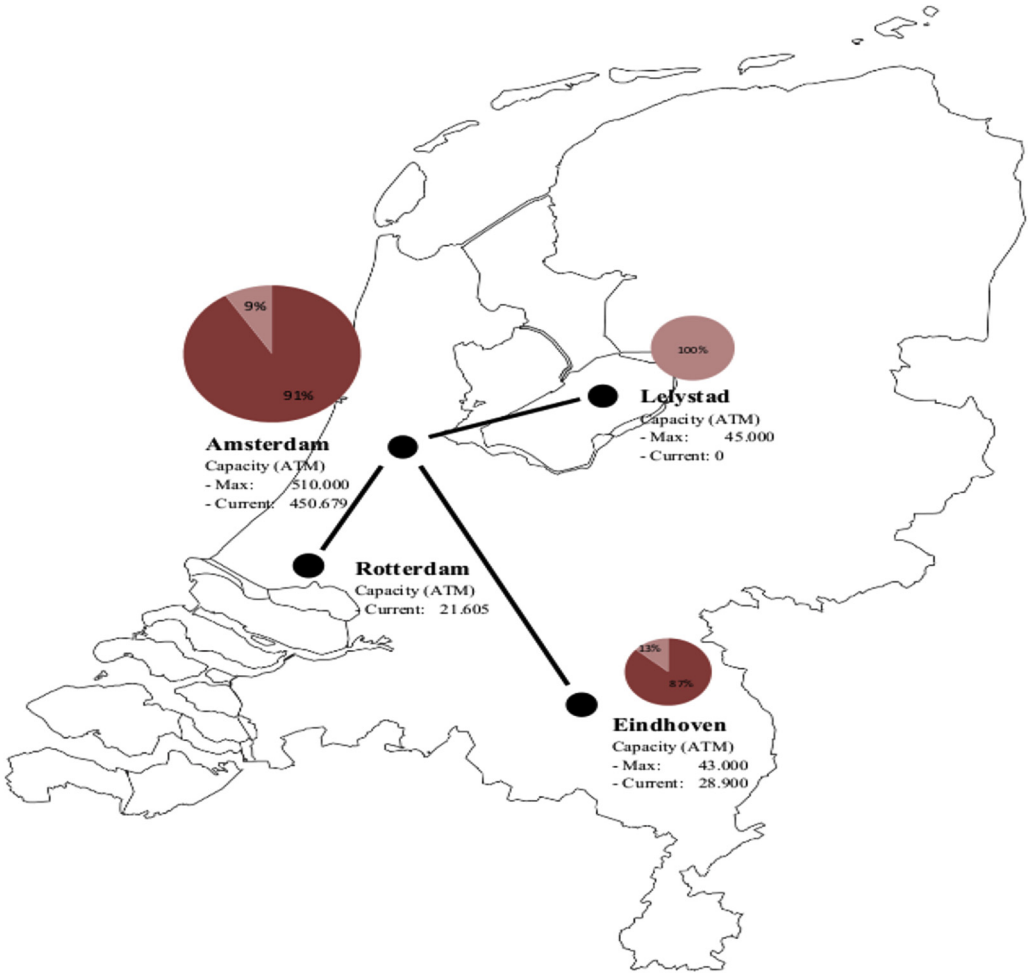

Fig. 1. Location of Lelystad (LEY) in the Amsterdam Multi-Airport System.

1.2. Secondary airports and turnaround time

In recent years LCCs in Europe have focused on short-haul point-to-point leisure traffic. More recently, nonetheless, they have been targeting business travelers more actively, and some of them even offer interline connectivity using simple hub structures (Jimenez, 2015). This means that the development process at Lelystad should consider not only the type of passengers and airlines the operator wishes to attract, but also the performance parameters the airport should have in order to become attractive for them. Hence, it is important to develop tools to benchmark future performance indicators so that the airport operator can match the proper infrastructure with the intended strategy, in order to assess the success of the project.

The ambition to divert short-haul non-hub-related traffic, "with focus on tourism destinations", to Lelystad implies a stronger focus on the airlines that are able to deliver such type of traffic. According to Jimenez (2015), in order to attract airlines, especially LCCs, Lelystad would need to provide the following differentiation factors: availability of slots; low aeronautical charges; incentive programs; and quick aircraft turnaround. Available slots are also crucial for airlines to start new services at times that match their network configuration and are attractive to passengers. At Lelystad the availability of slots can be hampered by general aviation traffic, in case it is not diverted to other airports after upgrading the infrastructure for commercial use; and by the possible conflicts with air traffic in approach and departure trajectories at Schiphol Airport. Low aeronautical charges and incentive programs should be considered by airport planners and managers in their re-development process. Turnaround time (TAT), on the other hand, depends on airport configuration and operations management. Aircraft turnaround is also essential to keep airline operations on time (Schultz et al., 2012) and ensure an appropriate aircraft rotation (Eilstrup, 2000).

TAT is the time measured from the moment the aircraft parks at the correspondent stand until it is ready for taxing out towards the runway. This TAT varies according to operative conditions of the airport and the efficiency of the ground handler. Ensuring quick aircraft turnaround is essential to attract the desired mix of airlines, but it is also crucial to better manage the capacity of the entire Multi-Airport System. Wu and Caves (2000, 2003, 2004) have conducted extensive research on aircraft turnaround and its impact on airline schedule performance. Jimenez (2015) analyzed data from actual airline operations in European airports to assess the variation of TAT per airline type. However, a gap in the literature still remains on how airport design and operations affect TAT airport performance.

1.3. Simulation as a tool for airport planning

Simulation and optimization techniques are used in industry to deal with the decision making activity by searching optimal or feasible solutions to real problems. The use of both, simulation and optimization techniques facilitate the design and assessment of

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