CAPACITY PLANNING USING SUBSYSTEMS HANDLING OF AIRCRAFT, PASSENGERS AND BAGGEGE USING MS EXCEL

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The purpose of this work is to familiarise one with planning of utilisation of airport capacity. The planning is divided from the viewpoint of time, which is very important to define, so that the company would know its future plans. It also informs about the division of airports from the point of view of capacity, from which the whole administration follows. It describes the contract signed between the airport and the airline company so that the individual flights could be realised. Another topic that will be discussed in my work is Slot coordination, which is a crucial part of planning at airport. It furthermore deals with technical clearance of airplane, fuel refill and luggage check-in. Programme MS Excel is described, which, when used right, is a great asset for the company. The theoretical part is an analysis of two airports, Airport of M. R. Štefánik and Airport Praha-Ruzyně. It evaluates their planning, method of administration and flight organisation and capacity utilisation. The last part of this work consists of a proposal for a more effective flight planning mainly from the viewpoint of time. It is divided into two parts – a so-called planning from the point of view of passengers and from the point of view of airplanes.

Keywords – *airport, airline, check-in, Slot coordination, capacity.*

1. INTRODUCTION

The task of airports is to achieve the highest possible utilisation of airport, a so-called track system, and terminals. Based on signed contracts, the airport must cooperate with airlines. Planned flights are arranged beforehand. The airport is responsible for preparation of devices, equipment and personnel to deal with technical clearance of airplane and the check-in of passengers and their luggage. It is a difficult process which must be carried out at a specific prearranged time and every delay costs the airport considerable financial sanctions. Because of this, the airport managers have to consider the planning and the very process of controls and check-ins.

2. PLANNING

Efficiency of the movement of airplanes and passengers between airports is in principle dependent on two basic airport operational characteristics:
- the real demand for services from the side of airlines and passengers
- airport capacity.

Capacity can be defined as the maximum number of operations that the system can serve in a given time interval. The airport capacity is therefore determined as a number of operationally tolerable flight activities. There are also other gauges that hold the same importance for expressing the airport capacity. What is meant is mainly the definition of effective movement of passengers through a specific location of the terminal and the ability to realise some activities in the critical parts of the terminal (e. g. at the check-in). Hence, the airport capacity is determined by the capability of individual airport facilities, in co-operation with other devices and services of the airport, to be able to attend to regular flight traffic of transit flow in a specific time interval at an arranged level of quality. As long as the capacity of some equipment or services is lower than the capacity that is required by the transit flow it will come to delay. [1]

Delay is defined as the period (time difference) between the assumed time of flight operation and the real time in which the operation will happen. The delay of the airplane represents the time difference between estimated arrival time to the beginning point of approach to the runway and the real arrival time to this point.

The delay may be caused by various factors, e. g. the need of mechanical repair before the departure, troubles emerging by loading the

luggage onboard, unfavourable weather conditions that may cause a flight delay or in a situation when the airplane is one of those, that have to wait before landing because of insufficient airport capacity. Unfortunately, nowadays, a great number of delays are very often caused by the influence of factors connected with the issue of managing the movement of airplanes in a significantly compacted aviation area. [1]

2.1 Division of airport according to capacity restrictions

Capacity restriction changes with the conditions at individual airports. Based on their size the airports can be divided into three categories:

- uncoordinated airport at which it doesn't come to the exceeding of the capacity limits even at a time of increased flight traffic,
- airport with planned traffic (semi-planned airport) at which the demand nears the capacity and sometimes it may come to partial passing, which is solved by a partial regulation or agreement between the airlines when planning the traffic,
- fully coordinated airport at which it is not possible to solve the capacity problems in a short-term time limit (e. g. by constructing a new RWY or reconstructing the terminal). Free time slot is the time of landing or departure that is available or the time that is assigned to the movement of the airplane for the specific day at the international public airport at which a special mode for securing the airplane's permeability has been established. This process allowed that for the whole duration of working of the airport the users are guaranteed the required services at the stated time. [1]

2.2 Airport slots and slot coordination

Request for a slot is sent by the airlines to the slot coordinator of the airport in a written form at an appointed time. In a case of a business flight, the request is handed in SCR form (Slot Clearance Request/Reply) according to IATA norms. The request must include the trade name of carrier, his residence or permanent address, airplane type and its seat capacity, required date or time period, working days, the estimated time of departure (ETD) or arrival (ETA), departing airport or landing airport and finally the purpose of the flight. [2]

The process of slot distribution is always executed in the same way. Up to a certain fixed date of acceptation of the request the coordinator assigns a corresponding priority to each request. In a specified time the coordinator evaluates the submitted requests and draws up a preliminary flight plan for the purposes of slot coordination.

Possible conflicting situations, e. g. when two airlines demand the same slot, are resolved on an international level twice a year at the Schedule Coordination Conference (SCC) coordinated by IATA. The coordination conference results in creating the final form of flight schedule of the airline company and airport flight plans in such a manner that the delays are prevented and capacity restrictions are fulfilled. [2]

2.3 Contract signed between the airport and airline company

The contract that is signed between the airport keeper, or more precisely between the handling services provider and the airline company is called Standard Ground Handling Agreement (SGHA). This contract is drawn up according to IATA norms that are released in Airport Handling Manual (AHM) published by the IATA organisation. Besides the charges for providing of services, stipulated in the contract are also the agreed requirements of airline companies, e. g. the number or check-in counters per flight, the time of check-in process commencement before the departure, the time of plane lingering on the airport and other requirements of technical handling. Based on these regulations and the Ground Operation Manual (GOM), that every airline company owns, it is possible to lay down a demand for capacity that is necessary to be secured for flight planning. [3]

## 3 ANALYSIS OF UTILISATION OF CAPACITY AT INDIVIDUAL AIRPORTS

3.1 Airport of M.R. Štefanik

Airport Bratislava is the largest international airport in the Slovak Republic and is located 9km north-east of Bratislava city centre. The strategic plan of Bratislava Airport is efficiently manage and profit, providing regular, safe and economical flights, public service, to ensure the satisfaction of returning to the airport. [4]

The main project in 2009 and 2010 was undoubtedly the construction of the new terminal, which is expected to be completed in June 2012.

Operating performance fully reflected the fading global economic crisis, which was still causing consumers to spend less for travel. Apart from the crisis, extraordinary and unpredictable factors played a role, namely the volcanic activity in Iceland, an unusually high number of strikes within the air transport industry in western and southern Europe, as well as the extraordinary unfavourable climatic conditions at the end of the year, which limited the activity at several western European airports with connections to Bratislava

Both indicators, i.e. the number of take-offs and landings, as well as the volume in tonnes at landing in 2010, declined by 8% (movements) and 12% (tonnes). As regards individual types of transport, international charter flights registered a rise in the number of movements, when there were 320 more movements in 2010 than in 2009. There was a very mild increase in the number of movements in the segment of other domestic flights (i.e. private flights, training flights, air rescue flights, government flights and technical stopover landings). [5]
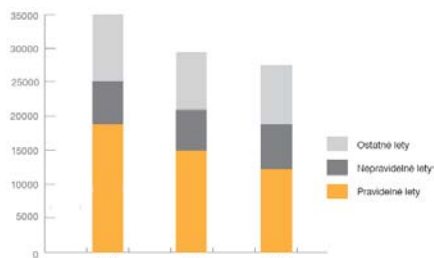

Obr. 1 – The number of aircraft movements at Bratislava Airport

From the survey, we can calculate the capacity utilization at Bratislava Airport. As I mentioned, on the runway is given the maximum capacity of 200 000 aircraft movements a year. Looking at the table, the number of aircraft movements in 2010 for Bratislava Airport is the 27220th It follows that the runway system at Bratislava Airport is used for 13.61%. [6]

Currently at Bratislava Airport three terminals, where passengers per year capacity is 3.5 million. After completion of the work there is a complex project with a capacity of 5 million passengers per year. The question is how much capacity is used terminal before completion.

When comparing the operating performance for 2009 and 2010 have recorded annual decline in passengers at 3%. [4]
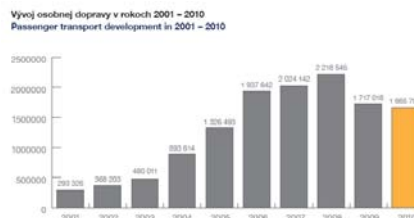
Obr. 2 – The development of personal transport at Bratislava Airport

If again we compare the capacity and demand, we find that the terminals of Bratislava Airport in 2010 were used for capacity-47.59%. For the year 2008 were used in 63.39%. [6]

After the reconstruction could be using a smaller space terminals, but as a longer-term reconstruction projects envisaged in the future with increased demand for air travel. Prices for air travel declining and people are increasingly using faster, more comfortable, safer mode of transportation. Also, modern area of the airport will help boost visitor numbers.

3.2 Airport Praha

Airport Praha, a. s. (hereinafter Prague Airport) operates the most important international airport in the Czech Republic and the second-largest in Central and Eastern Europe. Along with its exceptional location in the very heart of Europe, the airport is taking on importance as a transfer hub. There are currently 53 airlines at Prague Airport providing regularly scheduled connections

between Prague and 133 destinations in 52 countries around the globe. Five regular cargo carriers and dozens of other companies provide charter flights [7]

Prague Airport's mission is to provide high-quality services to passengers and business partners, primarily aviation and handling companies as well as businesses such as shops, restaurants, accommodation services providers and transport service providers. Prague Airport's most important tasks also include ensuring the highest level of safety standards. Prague Airport has a policy that if you are happy passenger airport, the airport can be satisfied [7]

The long-term airport plan is to overhaul the main runway designated Runway 06/24. The overhaul will be a regular spring and autumn maintenance takes only three to five days instead of the previous two to three weeks. [7]

On the basis of operating performance can be Prague - Ruzyne Airport compared by use of the runway system. As I said at Bratislava Airport, The runway layout determine the maximum number of aircraft movements to 200 000 - 285 thousandth When I set out the calculation for 100% Shareholders' use RWY 200 000 aircraft movements a year. The number of aircraft movements for Prague Airport is 156 052 in 2010. It follows that the track at the Prague airport system is utilized to 78.03%. [6]

Prague-Ruzyne Airport passed in 2011, a total of 11,788,629 passengers, which represents year on year increase of 2%. The result reached Prague Airport despite the fact that its largest trading partner Czech Airlines undergoing a restructuring process and also slightly decreased the interest in charter flights. Planes are fuller because of the increased yoy passengers occurred despite drop in comparison with the previous year by 3.4%. [7]

Prague airport, as already mentioned, belongs to Level 3 in terms of utilization of airport capacity. The Online Coordination System (OCS) is a powerful system that provides registered aviation customers with a comprehensive range of tools to query, sort, view and download slot and schedule information in a wide variety of formats. Customers can also request new slots or make changes to their existing slot portfolio by editing records of their schedules directly in the coordinators' databases. [8]

The program is designed so that the customer will see the calendar that displays the various days and times when it is still possible to apply for a slot. Planning the program is set to three colors. Green boxes show the free slots. Occupied slots are red. slots that are not available for operational reasons, are orange. [8]
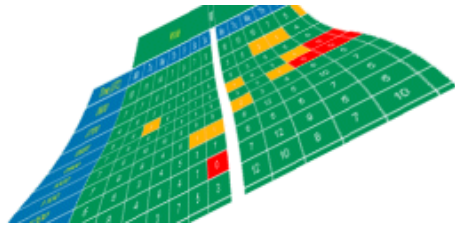
Obr. 3 - Program OSC využívaný na letisku Praha-Ruzyně

4 PROPOSAL FOR A MORE EFFECTIVE AND TIME-SAVING PLANNING AT AIRPORTS

As I stated before, the Praha-Ruzyně Airport uses slot coordination for aviation management, which is operated with the help of The Online Coordination System (OSC) program. This program makes their work easier as it carries out half of their competence. It assigns free slots to airline companies and plans the flight transport. Subsequently, the task of managers is to secure equipment and tools for effective planning of flights.

The M. R. Štefánik Airport falls under the second category in compliance with capacity restriction. That means, that there is a lower number of flights from the airport on one side, but on the other side, the flight planning is a prolonged effort on the managers' part as they don't use any program. They execute the flight planning on their own by experience and time schedule. This planning takes a lot of time as they must weigh up all the alternatives and make an effort for the planning to be prosperous for both the airport and the airline company. The priority is for the plane not to be left circling over the airport unnecessarily as well as for the planning time not to be prolonged and with it the flight delayed. Time is

money and that is the motto that managers have to remember.

4.1 Proposal of planning form the viewpoint of passengers

In my first proposal we are dealing with the question: "Will the airport manage to check-in all the passengers for the respective number of flights?"

The proposal is realised in the program MS Excel. The base is formed by a time axis, which is divided into parts after every 10 minutes and reflects one day, so called 24 hours or 144 columns. As we know, passenger check-in is done 120 minutes before the flight itself (standard check-in) and ends 30 minutes before the flight. During this time all passengers have to be checked in and ready for the flight. This is why proper planning and organisation of the given process is very important.

Under the time axis is one free row. Every cell in a given row is coloured with different colour. If the airport wants to plan a flight, they add the number of passengers they plan to check in into the cell for a specific time, a so-called number of passengers for a concrete flight. After adding the number of passengers the numbers will be automatically filled into the respective coloured cells over the time axis. These numbers reflect the quantity of passengers the airport has to check in the given 10-minute intervals from the beginning of checking in for a particular flight.
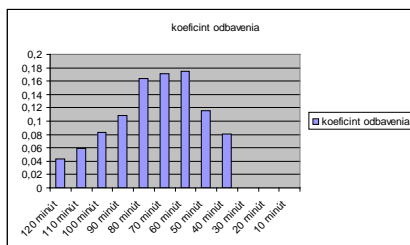
Obr. 4 - Koeficienty rozdelenia počtu cestujúcich v 10 minútových intervaloch od začiatku odbavovania na daný let

In the second part of this proposal we are dealing with the calculation of check-ins for the clearance of all flights. Based on the total number of passengers we count with this calculation the number of those passengers that need to be checked in. We used the conditional command IF, in which we worked with the information that the check-in of one passenger takes 2 minutes. So if we have a time axis parted every 10 minutes, one check-in is able to check in 5 passengers.

After producing the final number of needed check-in desks the airport calculates not only the planned quantity of opened check-in desks but also the staff assigned for clearing the given flights. Following this they will be able to answer the question, whether the airport is able to secure all needed staff and whether it is able to check-in the passengers for that one flight. In the case of a negative answer it has to change the departure time of the airplane and move the flight to a different time.

The third part is devoted to security inspection at the airport. It wasn't possible to represent the course and duration of the security control at the time axis as it is not stated when precisely this inspection starts. The airport determines the time after a certain period of the check in process when a certain number of passengers gathers up and finishes after the check in process is over after the last passenger is inspected.

It is however possible to determine an approximated duration of the whole process as we know the number of passengers and the approximated length of the inspection per one passenger.

It is a simple calculation which is based on information, that a security inspection takes 20 seconds per one passenger, so in one minute 3 passengers undergo the security check. Because of this the number of passengers can be divided by 3 and we get the time in minutes that is needed for the security check of all passengers for a given flight.

The second sheet of MS Excel displays the charts for planning of passenger check-in. These charts show the necessary number of checked in passengers on the time axis as well as the required number of opened check-ins on the time axis. Depicted is a whole day, the so called 24 hours and 2 hours of the previous day that are directly connected with the planning. It is granted

that in case that some flights on the first sheet are moved, the program will automatically recalculate the required number of open check-ins and redraws respective charts.

4.2 Device design for flight planning in terms of aircraft and technical clearance for flights

Technical clearance for low-cost carriers mainly takes 30 minutes.
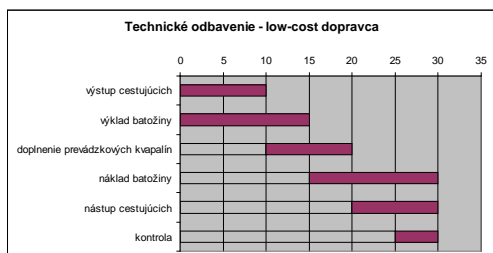
Obr. 5 - Technical clearance for low-cost carriers

Check-in process for conventional carriers mainly takes 60 minutes. This time is the agreement between the airport and airline. The subsequent Gantt chart are displayed activities should be carried out in the technical handling of the classical carrier.
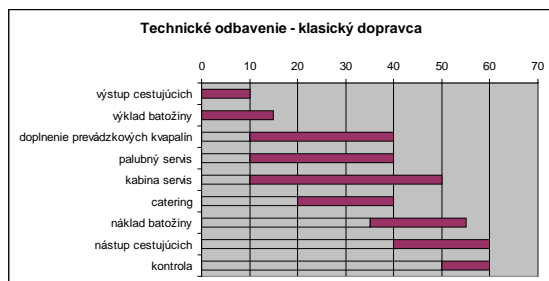
Obr. 6 – Technical clearance for conventional carriers

After clarification of the necessary work carried out in the technical clearance and duration of such arrangements, we proceeded to itself. The timeline will be recorded aircraft requiring arrival at the airport, to make the flight. If the plane would arrive, of course, must be clear about what the carrier is. Therefore we had to split carriers. The carrier needs including technical clearance, which must be provided with the correct execution of each activity and, therefore, must be present the necessary staff. Each activity requires a smoother, so it is necessary to determine the necessary number of facilities and staff.

The proposal we set the required number of employees who may be revised and adjusted, as required by the carrier.As in the first proposal, the manager, who plans flights, must be entered in the time of aircraft departure. It depends of course on whether it is a low-cost and traditional carriers. The program is designed so that in a time box, ie. 10 minutes to can be written for low-cost carriers andaircraft carriers for 3 flights. The fields we can be written the value of 1, 2, 3, the number of departing aircraft. After writing the numbers, the program automatically calculates need for employees. Again, flights marked a different color for better visibility in planning. According to these calculations manager knows how many employees when needed.

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