

MODERN APPROACH TO AIRPORT PAVEMENT MANAGEMENT

Andrea Lederleitnerová – Ján Kolesár

The article contains a detailed description of the evaluation process of airport pavement and compares the established traditional process and modern approach. The aim of this article is to find the reasons for implementation of new software regarding operational capability of airport pavements. Article describes the process of assessing operational capability of pavements at Bratislava Airport.

Key words: operational capability, pavement condition index, airport pavement

1 INTRODUCTION

Condition of airport pavement greatly affects the safety of air traffic during take-off and landing. Although improper operating condition of runway during take-off may cause aircraft incident or accident with tragic consequences and major property damage, assessment of airport pavement operational capability is often taken for granted and neglected.

Airport pavement quality has an impact on the smooth flow of air traffic and airport transport capacity, which are directly linked to the volume of financial income. In cases where the runway is particularly rough aircraft fatigue can be accelerated more than it was previously estimated. Ultimately it means not only greater financial costs for aircraft operators and airlines, but a threat to aviation safety as well.

2 TRADITIONAL APPROACH TO AIRPORT PAVEMENT MANAGEMENT

Until recently, the airports used to evaluate the airport pavement state mostly by manual procedure, which is particularly time-consuming and inefficient. The main disadvantage of this procedure is that it does not provide reliable data to support strategic decisions relating to the planning of maintenance, repair or reconstruction. The procedures include visual inspection of airport pavement, identification and inventorying of defects, which are afterwards recorded in the network sheets. Subsequently, based on the experience and the availability of free funds, plan of maintenance and repair is prepared. The whole process deals with the situation more or less from the operational point of view. Strategic consideration is often neglected, not taken into consideration; therefore many inefficient and ineffective actions are done. Their impact is only short-term. Decision making during this procedure is not based on the life cycle of pavement. The necessary maintenance is put aside due to lack of funds, which were previously spent on extensive repairs overpriced by long-term negligence.

3 MODERN APPROACH TO AIRPORT PAVEMENT MANAGEMENT

Nowadays, the majority of processes at the airports worldwide are managed by using modern information systems. That is why a simple question still remains unanswered - why not take advantage of this fact in airport pavement management. The use of new technologies clearly facilitates the process of evaluation airport pavement condition. Firstly, it shortens the time of obtaining information and data about the state of airport pavement; thereby it reduces the impact on the flow of air traffic and the associated financial costs. Modern information systems are then able to provide the calculation of parameters such as pavement condition index and on its basis to assess the condition of airport pavements. Graphical form presenting the results provides a clear display of the current status of airport pavements.

However, modern software is able to go further. On the basis of detailed database containing data regarding airport pavement it will determine the exact time for maintenance, repair or reconstruction. For this purpose, a typical life cycle graph of the pavement (Fig. 1)[4] is implemented. Although the origin of the graph goes back to the roads and pavements, nowadays it is regularly used for airport pavement area. Figure 1 illustrates how a pavement generally deteriorates and the relative cost of rehabilitation at various times throughout its life. A pavement generally performs well for the majority of its life, after which it reaches a "critical condition" and begins to deteriorate rapidly. Several studies have shown that maintaining a pavement in good condition versus periodically rehabilitating a pavement in poor condition is four to five times less expensive. The number of years a pavement stays in "good" condition before rapidly deteriorating depends on several factors, including construction type and quality, pavement use, climate, and maintenance. Figure 1 also shows that the ideal time for major rehabilitation is just as a pavement's rate of deterioration begins to increase. Maintenance and rehabilitation solutions would be easy to plan if pavements exhibited clear signs they had reached this point, but unfortunately, they do not. The shape of the deterioration curve, and therefore the optimal maintenance and repair points, vary considerably within a pavement network. A pavement experiencing a sudden increase in operations or aircraft loading will have a

tendency to deteriorate more rapidly than a pavement deteriorating solely from environmental causes.

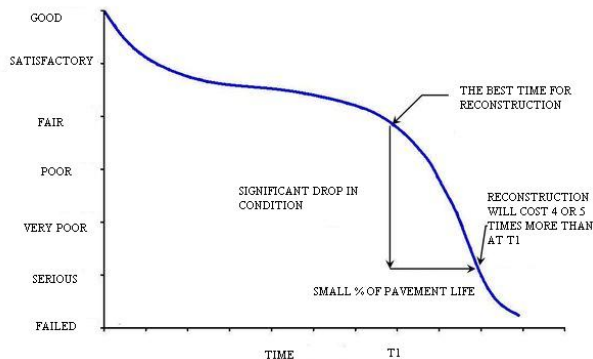


Figure 1 Typical Pavement Life Cycle [1]

The above-mentioned results show, that the modern approach saves airport operators time, cost, manpower and increases safety, capacity and effectiveness of operations at the airport. On the other hand, it is necessary to discuss the financial terms of procuring the system, because it is far from being a little financial item. Although the long-term funds invested in the mentioned software will definitely return. It is therefore necessary to provide support for airport operators from the side of Aviation Authorities and other aviation organizations. Aviation Authorities and organizations should mainly spread information among airport operators on the issue, software and availability on the market, the benefits of its implementation into operation at the airport.

I can clearly positively rate the spread of implementation of geographic information systems at airports in Europe, where countries such as Norway and Spain seek to facilitate their implementation to small and medium-sized airports. Most airports in the U.S. are now using geographic information system in a comprehensive way. Europe is catching up in many respects, with many on the pathway to becoming more enterprise-like. On the other hand, geographic information system for airport management is much less common in Asia, even in some of the more advanced airports in the region. There are only a few exceptions like Beijing and Perth.

The implementation of geographic information system brings many advantages; primarily it becomes a source of information and data, which can be used in multiple ways and secure documents for many processes in airport operations, for example for airport pavement management. It clearly simplifies the process of airport pavement management. In the recent past several studies have been processed linking geographic information system and airport management systems. It is a very

simple process requiring only building the user interface. Shortcomings and advantages of the different systems complement each other, resulting in a maximum possible efficiency.

4 PROCESS OF EVALUATION AIRPORT PAVEMENT CONDITION AT THE BRATISLAVA AIRPORT

Nowadays the runway system of the Airport Bratislava consists of two perpendicular take-off and landing runways and taxiways, which facilitate the landing and movement for all aircraft – from the smallest, single-engine types to aeroplanes of the Boeing 747 type. Runway 13-31 is the main runway and it is 3 190m long and 45m wide. It is equipped with lighting and navigation devices for an exact approach under the conditions of Category III A of the ICAO standard atmosphere. Runway 04-22 is 2 900m long and 60m wide. It is equipped with lighting and radio-navigation devices for an exact approach under the conditions listed in Category I of the ICAO standard atmosphere. Both runways have cement-concrete surface. There are 33 clearly marked stands in the apron area, which covers approximately 143 000m².

In the area of the evaluation and management of airport pavement cooperates the Airport Bratislava with the Department of Transportation Engineering, Civil Engineering Faculty, Slovak University of Technology in Bratislava. Department of Transportation Engineering provides regular visual inspections and checks the runways. The Airport Bratislava has implemented the geographic information system from Intergraph, GeoMedia. Employees of the Department of Transportation Engineering on the basis of visual inspections, which should take place on a regular basis each year before or after the summer season, manually collect data regarding defects of airport pavements and insert them into the GeoMedia. The system includes spatial characteristics and data defining airport and its network of pavements. GeoMedia evaluates PCI (pavement condition index) status of each runway segment. The result can be shown in graphical form, too. Employees prepare a plan of recommended strategic and operational measures including maintenance operations, repairs or restoration.

5 CONCLUSION

The versatility of current technology simplifies the process and reduces the overall financial costs. Airport operators should be aware that it is possible to reach the highest level of operational efficiency only by comprehensive connecting of sub-processes and using the latest technologies in all areas of airport operations.

The Airport Bratislava has made clear step in the right direction by implementing the GeoMedia, but, for now, we cannot talk about successful achievement of objectives. For maximum efficiency it is essential to ensure sufficient input data. Bratislava Airport suffers major shortcomings in this area. The visual inspections are not provided regularly, resulting in decreased efficiency of the whole process. Missing data makes it impossible to complete the life cycle graph of airport pavements and determine the most appropriate time period for reconstruction. Airport operator should be aware that the costs associated with the assessment process of airport pavement are compensated in the form of a higher safety level, smoother traffic flow and less defects on aircrafts.

BIBLIOGRAPHY

- [1] LEDERLEITNEROVÁ, Andrea: Metodika inventarizácie porúch a hodnotenie stavu povrchov letiskových vozoviek. Bakalárska práca. Košice: TUKE LF, 2013. 72p.
- [2] MCNERNEY, Michael T. – HARRISON, Robert: Full-Cost Approach to Airport Pavement Management [online]. [cit. 2013-02-26]. http://michigan.gov/documents/FullCostapproach_60209_7.pdf.
- [3] THURSTON, Jeff: Industry Interview GIS Supports Airports around the Globe [online]. 2011. [cit. 2013-02-27]. <<http://www.asmmag.com/2012-12-30-14-40-18/interview/1151-interview-gis-supports-airports-around-the-globe.html>>.
- [4] Advisory Circular 150/5380-7A: Airport pavement management program [online]. U.S. Department of Transportation FAA, 2006. [cit 2013-02-26]. http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/23094.

AUTHORS' ADDRESSES

Ing. Andrea LEDERLEITNEROVÁ, TUKE, Faculty of Aeronautics, Department of Aviation Engineering, Rampová 7, 041 21 Košice, SR, alederleitnerova@gmail.com

Ing. Ján KOLESÁR, PhD., TUKE, Faculty of Aeronautics, Department of Aviation Engineering, Rampová 7, 041 21 Košice, SR, jan.kolesar@tuke.sk