AIRPORT PAVEMENT MANAGEMENT SYSTEM BASED ON STRATEGIC MAINTENANCE PRINCIPLES

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ABSTRACT

Airfield Pavements are different from highway pavements in that sense that maintenance strategies in Airfields primarily emphasize subjects like FOD (Foreign Object Damages, defined as loose particles greater than 3 mm) friction, roughness and rutting. A simple pavement management system has been developed so that all the types of distresses used in the PMS system have their own distress development model depending on the type of material and depending on the development of the individual distress types.

The general conditions and the development and the prediction of the condition of the individual wearing courses or sections of wearing courses are assessed by linking the different distress types together using individual weights for the calculation of a classification Index adopted to the specific type of pavement and to the individual airport.

Further, the development and prediction of the structural condition of the pavement or sections of the pavement are assessed by linking the distress types together with the bearing capacity calculated from the measurements from HWD (Heavy falling Weight Deflectometer). Based on these results the development and the prediction of the PCN values are calculated.

KEYWORDS: AIRFIELD / PAVEMENT / ASPHALT WEARING COURSE / MAINTENANCE / QUALITY CONTROL /PAVEMENT MANAGEMENT SYSTEM

1 INTRODUCTION

RoSy®, a pavement management system (PMS), was developed in 1982 for a client, who wished to have a survey of his roads and their condition in order to optimise pavement management for the entire road network. Soon the road agencies of the major municipalities inquired the system, which was developed to a standard program for road maintenance. Basic data and condition data were collected by means of a visual inspection and noted on a standard form. Over time the system has been further developed and so has a special data collection system, CamSurvey. RoSy is a Windows-based piece of software with registers in Access and is continuously being developed in order to increase userfriendliness.

RoSy is applied as:

- Database – for data collection
- Tool – for registration of the individual defects' development and for various index development over time
- Tool for maintenance strategies (optimum) and for budget prognoses
- Tool for creation of presentations

The following information can be stored in the database:

- Main information – every section is stored with a unique name/signature and area
- Pavement layers
- Traffic
- Distress
- Index as required, e.g. PCI
- Bearing capacity measurements
- Roughness measurements
- Friction measurements
- Data from core takings
- Signs
- Lightning
- Markings
- Manholes & gullies
- GPS-positioning
- Price lists
- Activity strategies
- Photos

The person/agency responsible for the maintenance decides which distress data to collect. A standard distress registration (the visually inspected condition) for asphalt areas includes:

- Small cracks
- Large cracks
- Alligator cracking
- Ravelling/aging
- Spalls and potholes
- Depressions
- Rutting
- Loss of chippings
- Patched areas

Registered data is forming the basis of pavement maintenance optimisation. In RoSy Airport bearing capacity data (collected with Falling Weight Deflectometer) has been fully implemented and influences on the result together with distress data (registered or predicted) and traffic load.

The system contains deterioration models for every distress type, and the deterioration models are e.g. a function of traffic load and pavement structure. The deterioration models base on many years of experience gained from studies of structures and the climatic influence in Scandinavia.

The deterioration models are currently adjusted to the pavement structure in question on the basis of measurements and registrations as these are performed. The models in RoSy are based on formulae and are specially adjusted to the individual users.

The advantage of RoSy Airport is that strategic and long-term maintenance and budget calculation are performed for the airfield pavements. In this way airport authorities will be able to handle the tasks they have as responsible for an airfield area by means of a management program, primarily how to secure the flight safety but also how to handle parameters such as comfort and accessibility. This is obtained with a good survey of the airfield lane system, condition status of the various objects that are part of the airfield area and with a continuous calculation and prediction of the various distress types and standardisation against the indexes PCI and FOD.

2 STRATEGIES FOR AIRFIELD PAVEMENT MAINTENANCE

The maintenance of airfield pavements comprises:

- That pavement areas will have at least the required functional standard
- That pavement structures will have at least the required bearing capacity, that is at least the required structural condition standard
- That the wearing course will have at least the required level as regards acceptable aging – this means that the deterioration condition should at least correspond to the decided minimum requirements as to acceptable stiffness.

Based on distress surveys, bearing capacity measurements and core taking, the above-mentioned conditions are evaluated for each object.

The results gained from the distress registrations are stored in the Pavement Management System and on the basis of the registrations the development of pavement condition can be evaluated.

In combination with knowledge on costs for and depreciations on various relevant maintenance methods, various maintenance strategies may be worked out. On the basis of these a maintenance plan may be made for the individual pavements and then as a total for the individual airfield pavement areas.

By means of the PMS software, the plans will be made on the basis of e.g. the most economical and optimum strategy or on the basis of various budget constraints.

3 THE ROSY DATABASE

The database can be extended to store all distress types that are considered necessary for the calculation of indexes and for assessment of the condition of the area and any maintenance needs.

Functions are available for storage of data and for optimisation of future maintenance. Furthermore, visualisation of results in a map is possible. Reports may be printed for the individual objects, for groups of objects or the entire infrastructure network. The distress types in the system are adjusted according to the user's wishes. Every distress type will have a distress development model which is adjusted to the real deterioration pace. The condition may be shown as the amount of each individual distress type or as various required indexes, e.g. PCI.

Various index-values may be calculated and progressed for the total condition but also for the individual distress types. On the basis of the progressed distress data other indexes may be predicted, e.g. FOD.

Today RoSy® has been developed to comprise a concept in which the program is a tool in a comprehensive package with condition surveys, measurements, calculations and annual following-up, updating and calculation of the maintenance need.

4 STRATEGIC MAINTENANCE PRINCIPLES

The strategic advantages of the RoSy Airport software is that through the prediction of each individual distress type development a more accurate evaluation of the future condition may be obtained.

The index value may be calculated in real time and may at the same time be seen in a distress picture. This gives a better insight in how the reality is and how the individual distress types influence on the various index values.

The RoSy Software is constructed in a simple way that allows the owner of a RoSy software to have functions integrated in the software, as required.

Advantages with RoSy:

- RoSy is a system which has over many years been further developed and improved on the basis of the users' requirements
- Direct retrieval of index such as PCI, as required
- Direct retrieval of other indexes, e.g. FOD, etc. as required
- Direct communication with maps
- More parameters e.g. bearing capacity may form part of calculation of various indexes
- Deterioration models which are suitable for the pavement in question, the climatic influence and the traffic load
- The possibility for the user to select a specially adapted system so that no third parties can exploit the information
- RoSy can handle various side area elements (e.g. signs, lightning, markings etc.)
- RoSy can handle tasks in connection with maintenance tasks (e.g. excavations, repair work, etc.)
- The possibility for the user to have a new function added
- Closer communication with the manufacturer

5 CONCLUSION

The RoSy Airport system is capable of calculating the most optimum way of spending the resources in order to ensure the best possible condition on runways and major taxiways, and letting other less important pavements age to the service level decided by the airport authorities.

6 BIBLIOGRAPHY

[1] Korsgaard, Hede, Andersen and Andersen, “Evaluation of the Condition of an Airfield Pavement Based on Changes in Yearly Measurements”, 5th International Conference on the Bearing Capacity of Roads and Airfields, Norway, 1998

[2] “A Guide to Airfield Pavement Design & Evaluation”, Directorate of Civil Engineering Services, 1989

[3] ICAO Design Manual

[4] Ullidtz, “Pavement Analysis”, Elsevier Science Publishes B.V., 1987

[5] Ullidtz, “Modelling Flexible Pavement Response and Performance”, Polyteknisk Forlag, 1998

[6] HDM-4 Newsletter, ISOHDM Project Secretariat, School of Civil Engineering, University of Birmingham, 1998

[7] Korsgaard, Hede, Andersen and Landbo, “CPH/PMS98, A New Pavement Management System Developed at Copenhagen Airport”, The Federal Aviation Administration Technology Transfer Conference, Atlantic City, USA, 1999