

Airfield Pavement Management Framework Using Advanced Modeling Techniques

Project Number:

22PLSU01

Start Date:

04/01/2022

Principal Investigator(s):

Momen Mousa

Louisiana State University

Lead Institution:

Louisiana State University

Funding Source(s):

Tran-SET

Louisiana State University

Total Project Cost:

\$ 46,896

Developing an airfield pavement management framework

Airport authorities constantly collect pavement condition data and utilize life-cycle cost analysis to select construction and maintenance alternatives. The current Federal Aviation Administration (FAA) Advisory Circular 150/5380-7B recommends using pavement condition index (PCI) to assess airfield pavement condition for planning of maintenance and rehabilitation (M&R) treatments. It is well-recognized that structural and functional performance of airfield pavement may deteriorate differently, and hence, two pavement sections with the same PCI may have different deteriorations and need different M&R treatments. As such, the structural condition index (SCI) and foreign object damage (FOD) should be considered along with the PCI to help airport authorities determine the time and type of pavement repair. This project aims to develop a comprehensive airfield pavement management framework that can predict the service life of airport key components (runway, taxiway, and apron) in terms of PCI, SCI, and FOD based on airport conditions and without the need for frequent monitoring of pavement conditions.

Problem Statement

Airport authorities constantly collect pavement condition data and utilize life-cycle cost analysis to select construction and maintenance alternatives. The current Federal Aviation Administration (FAA) Advisory Circular 150/5380-7B recommends using pavement condition index (PCI) to assess airfield pavement condition for planning of maintenance and rehabilitation (M&R) treatments. Pavement condition index (PCI) is a rating index of pavement condition between 0 and 100 (with 100 being perfect) based on visual survey of pavement distresses. The PCI is calculated based on all the pavement distresses including structural distresses (e.g., transverse, longitudinal, corner cracking, corner break, pumping, shrinkage crack, spalling-joints, spallingcorner, shattered slab) and functional distresses (e.g., corrugation, faulting, heave/swell, bleeding). It is well-recognized that structural and functional performance of airfield pavement may deteriorate differently, and hence, two pavement sections with the same PCI may have different deteriorations and need different

M&R treatments. As such, the structural condition index (SCI) and foreign object damage (FOD) should be considered along with the PCI to help airport authorities determine the time and type of pavement repair. The major difference between PCI, SCI, and FOD is the types of pavement distress considered in the calculation of index values. In general, SCI is a pavement condition index similar to PCI, but it considers only structural distresses. The FOD is also similar to the PCI, but it considers only the pavement distresses that can potentially create loose foreign objects, which may cause potential damage to aircraft engine and tires. Since the pavement distresses and the corresponding failure thresholds of each condition index (PCI, SCI, and FOD) are different, it is difficult to compare the ability of using different condition indexes on estimating the service life of airfield pavement.

Objectives

The main objective of this study is to develop a comprehensive airfield pavement management framework that can predict the service life of airport key components (runway, taxiway, and apron) in terms of PCI, SCI, and FOD based on airport conditions and without the need for frequent monitoring of pavement conditions. This framework will be beneficial to airport authorities in Region 6 as it will help them consider both the functional and structural performance of their pavements. This will help airport authorities in making effective decisions for the maintenance and rehabilitation of airport pavements, and hence, optimizing the use of available funds.

Intended Implementation of Research

Workforce Development, Education, and Outreach: This research project will provide funding to one master student at Louisiana State University. This will help recruit and train future leaders in the Transportation Sector. The research team will also prepare educational materials to be incorporated in courses at LSU and share it with



other universities. The educational material will also be summarized and disseminated to government entities and the industry. Results of this work will be also disseminated at national conferences such as TRB and ASCE. It will also offer one summer internship to high school students within the High School Student Research (HSSR) Intern Program organized by Dr. Adam Melvin at LSU.

Anticipated Impacts/Benefits of Implementation

The findings of this project will be incorporated into an enhanced decision-making tool that can help airport authorities (1) predict the service life of their pavements without monitoring the PCI, SCI, and FOD over years, and (2) determine the most cost-effective treatment to be applied as well as the optimal timing to apply this treatment. To ensure that the tool is practical and easy to use, it will be developed using macros in Microsoft Excel to be used without the need for coding software (such as MATLAB or Python). The project team are planning to pursue commercialization for this tool in the future.

Web links

- Tran-SET's website
<https://transet.lsu.edu/research-in-progress/>

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

Learn More

For more information about Tran-SET, please visit [our website](#), LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Dr. Momen Mousa (Tran-SET Program Manager) directly at transet@lsu.edu.

