Airport Concrete Pavement Technology Program

Request for Proposal (RFP) ACPTP 2024-9

Assessment of Flooding Resilience of Concrete Airfield Pavements

RESEARCH PROBLEM STATEMENT

Concrete airfield pavement design parameters are currently based on the assumption that historic records can be used to predict future risk of flooding. With ongoing climate change, many engineers are acknowledging that current flooding models may no longer be valid, making guidance on design needs challenging, and increasing the risk of flooding occurring in some locations. In response to inquiries from Congress, the airfield pavement community must address the need for airfield pavements to be increasingly resilient.

This project will focus on flooding as a cause of pavement distress and seeks to:

- Better understand the impacts of flooding.
- Assess the ability of various concrete pavement structures to recover from inundation.
- Develop data-based guidance for airport designers and operators on ways to minimize pavement related flood impacts.
- Develop guidance documents that represent an action plan or template for reopening the pavement while minimizing pavement damage.

While there is a substantial need for improved prediction models to address the risk of flooding from tidal effects, storm surge, or overflowing rivers, that subject area appears to have significant research already being conducted. This project is not intended to add to that research, but rather to reference the predictions being developed by others and develop suggested pavement focused response activities for airport owners to adopt at the design, rehabilitation, and post-flood stages to minimize operational impacts.

OBJECTIVES

The aim of this project is to address three overarching questions:

1. If an airfield has a history or has become susceptible to flooding, what mitigation actions can be taken before flooding occurs?
    a. What approaches can be used in design and construction to reduce sensitivity to flooding such as improved drainage, the use of stabilized bases and/or the use of rehabilitation strategies such as concrete overlays?
    b. Furthermore, describe scenarios when one design feature may produce better results and be more cost-effective than others.

2. What are the impacts of flooding on an airfield?
    a. What are the factors that influence risk, such as pavement structure, soil type, and drainage?
    b. How much is the pavement load capacity reduced because the support system is saturated?
    c. What is the relationship between load capacity and the moisture content in the foundation system?
    d. What would be the impact on the future life of the pavement if it is loaded while still saturated?
3. What is an appropriate assessment / response plan for post-flood pavement condition to resume operations balancing operational necessity, safety, and limiting pavement damage? This may include specifying availability of pavement evaluation testing equipment.
    a. Can there be a staged opening with weight reductions, particularly if the airfield is a lifeline for incoming support?
    b. What testing procedures should be used to assess a pavements' capacity after a flooding event?

Because there are many variables, a one-size-fits-all solution does not make sense. Rather the need is for a decision-tree methodology that guides practitioners through the process of obtaining relevant data, and applying the correct models to make appropriate decisions for their facility when an event occurs.

At a minimum the guidance documents should address:

- What design and construction modifications could be made that improve a pavement's resiliency to flooding?
- What activities can be undertaken to minimize the impact of future flooding events?
- What data are needed to guide post-flood opening decisions? How can the data be obtained?
- Can the rate of pavement deterioration and longevity be determined for a range of pavement design features and types of loads?

A potential goal for this project is for the data to be collected by instrumenting and conducting NDT assessments of airfields known to be susceptible to frequent flooding in order monitor parameters such as (but not limited to):

- Subgrade moisture content
- Subgrade stiffness
- Moisture movement through the subgrade
- Overall pavement stresses under loading at various time intervals after a flood event occurs. How long is it before capacity returns to pre-flood conditions?

The Project Technical Panel (PTP) envisions that two sites may be monitored, focusing on thinner or general aviation airport pavements. Teams should recommend site selection they deem appropriate, although the PTP may offer suggestions of potential locations subject to storm surge or flooding to the successful proposer. Consideration may also be given to using an accelerated loading testing facility for a more controlled environment. The data from the field tests should be used to develop the models that will be referenced in the guidance documents.

TASKS

The Principal Investigator (PI) will be responsible for executing a series of sub-tasks that, when completed, will result in completion of the objectives of this study within the time and budget available. The proposal does not necessarily need to reflect the exact budget, or the performance period indicated in the RFP; however, any deviation must be justified and clearly explained.

Task 1 - Literature Review

The literature review should include at a minimum:

- Listing of appropriate sources for data on flooding risk.
- Publications, reports, and papers addressing effects of foundation moisture state on load bearing capacity.
- Approaches to measuring moisture content in the field.
- Approaches to measuring load capacity in the field.
- Models for correlating moisture content with load capacity.
- Models for predicting remaining service life for systems loaded while saturated.

Task 2 – Work Plan

A draft workplan with detailed sub-tasks should describe the activities planned and the locations to be investigated to meet the goals of this project.

Note: Following the completion of Task 1, the research team will develop a revised detailed work plan. The PTP will meet with key members of the research team to discuss the final work plan; the ACPTP project director and PTP will determine whether the meeting will be in-person or virtual. The PI shall not proceed with Task 3 until the PTP has reviewed and approved the work plan. The work plan should also include time for reviewing a draft final report and completed final report.

Task 3 – Project Implementation

After approval of the work plan, the investigator may proceed with the project that may include:

- Field instrumentation and monitoring through at least one flood event at two sites. While this RFP is focused in concrete, preference will be given to sites with both existing asphalt and concrete sections.
- Laboratory study to characterize the materials in place at the field sites.
- Development of design and construction modifications for resiliency.
- Development of models and guidance documents.

Task 4 – Preparation of Deliverables

The team will prepare and submit the final required deliverables 3 months prior to the end of the contract.

- A full report discussing the work conducted, the data collected, and the findings developed.
- Recommended changes to FAARFIELD if appropriate.
- Recommended changes to Advisory Circulars 150/5320-6G *Airport Pavement Design, Evaluation* and/or 150/5370-10H *Standard Specifications for Construction of Airports and* 150/5370-11B *Use of Nondestructive Testing in the Evaluation of Airport Pavements* or other advisory circulars if appropriate.
- Guidance document for post-flood actions directing pavement reopening.
- Training resources (PowerPoint slides and handouts).

Key members of the research team and the PTP will meet to discuss the work conducted and the outcomes of the project. The one-day meeting will be held at a mutually agreed upon location for 1-2 key members of the research team; a virtual meeting may be substituted at the discretion of the PTP and ACPTP project director. The PI will have 1 month to submit revised final 508 compliant documents that addresses the input from the PTP.

REPORTS

- Literature review and revised work plan for PTP review and approval
- Quarterly progress reports detailing work conducted and data collected
- Task 4 project reports
- Final 508 compliant Best Practices Guide
- Training resources

FUNDS AVAILABLE: Not to exceed $1,000,000

CONTRACT TIME: Not to exceed 36 months (contingent upon site flooding)
Literature review: 6 months
Work plan: 30 months
Draft/Final reports: 3 months

ACPTP 2024-9 PROJECT MANAGER: Peter Taylor, ptaylor@iastate.edu, 515-294-9333

QUESTIONS ON RFP: E-mail to ACPTP@iastate.edu prior to March 15, 2024. Answers will be posted at https://cptechcenter.org/airport-pavements/acptp/

PROPOSAL PREPARATION INSTRUCTIONS: https://cptechcenter.org/airport-pavements/acptp/

ESTIMATED NOTICE TO PROCEED DATE: July 1, 2024

PROPOSAL DUE DATE: **March 29, 2024** not later than 4:00 P.M. (Central Time)

PROPOSAL SUBMIT: ACPTP@iastate.edu (PDF proposal plus Excel spreadsheet, see instructions)