ACRP Problem No. 12-02-25

*Climate Change Adaptation Planning: Risk Assessment Model Pilot*

**ACRP Staff Comments:** The results from ACRP Synthesis Project S02-06, Airport Climate Adaptation and Resilience, should be available in the fall of 2011, and would serve as initial input to the proposed research.

**TRB Aviation Group Committees Comments:** AIRFIELD AND AIRSPACE CAPACITY AND DELAY CMTE - Recommended. The research appears to be worthwhile, but the funding level appears high. Suggest it be reduced to $500,000. ENVIRONMENTAL IMPACTS OF AVIATION CMTE - Support. This is a high value project, but the project statement is too aggressive for the funding or timeline; the scope should be trimmed or funding increased. While not all airports are thinking of adaptation, this information could be a significant asset to furthering the consideration of adaptation, its form and content.

**Review Panel Comments: Recommended** — ACRP Synthesis 11-03/Topic S02-06, Airport Climate Adaptation and Resilience, is due later this year. Two airports are to be used as the basis for analysis. The project panel would have to consider the output of the synthesis project and its impact on the definition of this problem as well as significant input on the choice of pilot project airports.

**AOC Disposition:** Approved and funded at $500,000. There is industry interest and a desire to be proactive with this issue. The research product needs to be better defined and focused on thematic, general issues instead of looking at two example pilot airports. Researchers should be sure to reach out to other agencies studying this issue.
I. PROBLEM TITLE
Climate Change Adaptation Planning: Risk Assessment Model Pilot

II. RESEARCH PROBLEM STATEMENT
Airports have already developed skills and resources for adapting to significant changes, such as new larger aircraft, security screening, airline mergers, environmental and community expectations, funding cutbacks, global safety regulations and rapidly evolving computer technologies. Climate change is likely to have subtle as well as dramatic effects on airports in the future, introducing yet another adaptation challenge. Airports occupy large acreage, often encompass multiple watersheds, and are sited in many diverse environments around the world. Thus, the potential climate change impacts and adaptation actions will vary widely. Some aspects of airports that are particularly important for climate change adaptation are:

- Many critical airports are located on the coasts or along water bodies that may experience flooding under some projected climate scenarios.
- Infrastructure investments often last more than 50 years. Utility and storm water infrastructure can be among the first assets affected by climate changes, so airports may need or benefit from developing long range infrastructure management plans and start making changes now to the designs and locations of facilities to avoid future costly relocations.
- In addition to aircraft flight, airport function depends on connectivity to ground transportation systems such as road and rail connectors. These facilities may or may not be owned or controlled by the airport, yet the impacts to an airport would be severe if climate change were to sever the airport from the community it serves.
- Aircraft, airport and airspace operations are weather dependant; aircraft assets are extremely expensive precision machines that must be protected from salt water, excessive windborne dust, etc.
- Airports often host emergency city/regional command center operations during times of crisis, and are a focal point for rescue, evacuation, emergency supply chains. These expected roles are both an opportunity for the airport to play a critical role in facilitating regional preparedness, as well as a potential vulnerability if the airport were severely damaged by storms or sea-level rise.

Other Department of Transportation agencies and a number of states and their subdivisions are undertaking planning efforts to address adaptation to climate impacts. Finally, recent guidance from the Council on Environmental Quality will require the Federal Aviation Administration and other federal agencies to consider the effects of climate on proposed projects during National Environmental Policy Act review.

III. OBJECTIVE
The objective of this project is to prepare a vulnerability and risk assessment model to evaluate the projected impacts of global climate change at two candidate airports. The airports would be
chosen to reflect both possible coastal (sea level rise) and inland (high heat events) issues. This will serve two major functions: (1) to assist airports advance existing adaptation assessment activities and (2) to assist the FAA in developing a model for other airports to implement. Based on the feedback received through the pilot, FAA could revise and finalize the model for national application. Because of the objective for national application, a pilot airport should be chosen that would have potential climate stressors shared by a range of airports in the country.

This project would be modeled after the Adaptation Conceptual Model Pilots Program currently being undertaken by the FHWA at five pilot locations.

IV. RESEARCH PROPOSED

The goal of the Risk Assessment Model is to help airport decision makers identify which assets and relationships (a) are most exposed to the threats from climate change and/or (b) are associated with the most serious potential consequences of those climate change threats.

The conceptual model consists of three primary components, as shown in the figure below:
1. Develop inventory of assets and relationships (i.e., external services on which an airport relies, such as electricity, water and surface transportation);
2. Gather climate information; and
3. Assess the risk to assets, relationships and the transportation system as a whole from projected climate change.

![Diagram of Risk Assessment Model](image)

Source: FHWA, 2010

Each of these components is described in more detail below.
**Asset Inventory and Prioritization**

The Study Team will first compile an inventory of all assets and relationships at the pilot airports that they wish to evaluate during this pilot phase. Example asset categories include: airfield, aprons, gates, terminals, garages, physical plants, utilities, and access infrastructure. When compiling this inventory, the Study Team will also gather any information that may help to later evaluate how resilient the asset is to climate stressors, and how costly damage to the asset could be.

The Study Team will "screen" the identified assets based on the relative importance of each asset. Airports may have existing evaluation tools or guidelines they use to prioritize assets for maintenance or repair. Other criteria used to prioritize assets could include the level of usage, its value in emergency situations (e.g., for evacuation), and/or redundancy.

**Climate Information**

Concurrent with the development of the asset inventory, the Study Team will also gather local- or regional-level information on past changes and projections of future climate. Historical climate and weather information will provide clues as to how assets may withstand future climate stressors. Projected climate information is important for estimating future climate conditions to plan for. Both of these types of information will be used later in this risk assessment. There are several sources of uncertainty in projections, including: (1) uncertainties with physical processes and their representation in global and regional climate models; (2) uncertainties with future greenhouse gas emissions; and (3) the stochastic and unpredictable aspects of the climate system. Therefore, it is important to consider a range of future climate scenarios.

The Study Team will conduct a screening analysis to set aside potential climate change effects that are both relatively uncertain and small in magnitude.

**Assessing Risk**

Risk is the potential for a particular outcome resulting from an event—in this case, a climate stressor. It is determined by the product of: (a) the likelihood of the impact; and (b) the consequence of the impact. The likelihood of an impact is, in part, a function of the likelihood of the climate stressors. It is also a function of the vulnerability of the transportation element to climate change. Vulnerability also affects the magnitude of the impact.

In this phase, the Study Team will: (1) screen out assets that are less vulnerable to projected climate effects; (2) assess the likelihood of a particular impact resulting from a defined set of stressors, (3) assess the consequence of the impact, not just in terms of what it does to a particular asset, but in terms of how it affects the surrounding community and beyond, and (4) assess the integrated risk of the consequence and likelihood. The Study Team will identify information sources that could be consulted or compiled to evaluate the effects of current climate stressors on assets, and will identify climate stressors that are already taken into account in the design, operation, and maintenance of existing assets.

For assets deemed "vulnerable", the risk assessment for an asset should jointly consider the likelihood that the asset will experience a particular impact, and the consequence of that impact. Assets that have a low likelihood of being impacted by future climate and a low consequence of that impact occurring will be screened, recorded, and revisited as resources allow. The remaining assets, grouped according to high/low likelihood and high/low consequence of impact, is the outcome of the Risk Assessment Model. As a result of this analysis, the Study Team will have a prioritized list of assets at risk from future climate change impacts, developed according to their
own criteria. The integrated risk is often represented by a two-dimensioned matrix that classifies
risks into three categories (low, moderate, high) based on the combined effects of their likelihood
and consequence.

V. ESTIMATE OF THE PROBLEM FUNDING AND RESEARCH PERIOD
Recommended Funding: $800,000
Research Period: 2 years

VI. URGENCY AND PAYOFF POTENTIAL
At the conclusion of this project, the Study Team will have identified the assets that are most
critical to the pilot airports, and most at-risk to climate change. The ultimate purpose of
identifying these critical vulnerable assets is to inform decisions on how to prepare for and adapt
to climate change.

This will help airports identify risk reduction options (adaptation strategies) for assets that scored
either medium or high risk based on an integrated assessment of likelihood and consequence.
Although identifying and implementing adaption options is not included in the pilot program,
adaptation measures can occur in two timeframes:

- **Opportunistic adaptation measures**, or measures that take advantage of scheduled or necessary
equipment planning, maintenance, repair, or end-of-life cycles to respond to identified risks from
future climate stressors.
- **Proactive adaptation measures**, or measures that are implemented before scheduled or
necessary equipment planning, maintenance, repair, or end-of-life cycles to prevent impacts from
climate stressors from occurring.

Because of the considerable investments made in airport infrastructure, knowledge regarding
potential climate stressors and forms of adaptation may save capital and operating costs in the
future. Airport infrastructure that is not designed and built to be resilient to probable future
changes may require expensive retrofit and replacement. Further, better understanding of airport
climate vulnerabilities should help FAA, airports and others address proposed CEQ NEPA
guidance that would require the assessment of climate change on proposed projects.

VII. RELATED RESEARCH
ACRP Synthesis S11-02-06, *Airport Climate Change Adaptation and Preparedness*, will be compiling
resources on planning for climate change adaptation.

Other transportation agencies and TRB are preparing climate adaptation plans for different
transportation sectors and regions. These include:

- FHWA Adaptation Conceptual Model Pilot Program
- FHWA Gulf Coast Study
- TRB Special Report 290: Potential Impacts of Climate Change on US Transportation
- Caltrans Climate Change Adaptation and Transportation System,

VIII. PERSON(S) DEVELOPING THE PROBLEM
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IX. PROCESS USED TO DEVELOP THE PROBLEM STATEMENT

The authors of this problem statement are leading a workshop on climate adaptation planning for TRB’s Committee on the Effects of Aviation on the Environment in May 2011. The products of that workshop are expected to include a comprehensive list of assets that should be evaluated as part of a Risk Assessment, as well as identification of regional collaboration and communication tools. In preparing for that workshop, the authors have identified a need to test this proposed method at a candidate airport.

The ACI-NA Environmental Affairs Committee Steering Group reviewed and supports this proposed project.

X. DATE AND SUBMITTED BY

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REFERENCES:


Council on Environmental Quality. Instructions for Implementing Climate Change Adaptation Planning in Accordance With Executive Order 13514