Results of ACRP Synthesis 11-03/S02-06: Airport Climate Adaptation and Resilience
Transportation Research Board Annual Meeting
January 25, 2012

Chris Baglin
Principal – Energy, Environment, and Climate Solutions
AEA Group - Project Performance Corporation
Synthesis Report goal

To identify current plans and practices for managing climate risks at airports, through:

- Review of current climate adaptation and resilience activities relating to airports and other infrastructure, citing what has been useful to transportation facilities
- Study of the physical, business, security and financial risks to airports
- Preparation of case examples
Airport aspects considered

Airports are complex, with many functions and assets to protect:

- Runways, taxiways, aprons, aviation signage
- Tenant and vendor property and equipment
- Energy, telecommunications, other links
- Pipelines, fuel farms, other infrastructure
- Roads, bridges, walkways
- Other

Airports have multiple roles, including:

- Commercial and general aviation
- Inter-modal transportation links
- Support of disaster relief
- Other
Results – Literature Review of current practices in climate adaptation

**Airports:**
- State/Regional/Local plans
- UK risk analyses

**Transportation:**
- State/Regional/Local plans
- FHWA, DoT, TRB, other

**General:**
- All scales, most sectors
Results – Literature Review

Sources provided expert opinion on:

- Broad classes of climate change phenomena
- Likely changes in environmental conditions
- Primary impacts to airports
- Effect of impacts on operations, infrastructure
- Potential adaptation responses
### Sample climate risks

<table>
<thead>
<tr>
<th>Temperature changes</th>
<th>Precipitation changes</th>
<th>Extreme events</th>
<th>Sea level rise</th>
<th>Wind Changes?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Heat-related effects on lift-off load limits, at high altitude or hot weather airports</td>
<td>• Heavier, more intense rain events will lead to more flooding and erosion</td>
<td>• More intense storms, with possible decrease in their number</td>
<td>• A long term issue when on its own</td>
<td>• Concerns over velocity and directional changes noted, but not much analysis in the literature</td>
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<tr>
<td>• Heat-related weathering and buckling of pavements and concrete facilities</td>
<td>• Combined with increased temperatures, there will be less snow and ice</td>
<td>• More lightening events</td>
<td>• A near term issue when combined with increased storm events</td>
<td>• Very difficult to model</td>
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<tr>
<td>• Health and safety limitations on construction and similar activities</td>
<td>• Combined with increased temperatures, there will be more drought</td>
<td>• More thunderstorms</td>
<td>• Subsidence, uplift and other factors will mediate sea level rise impacts, positively or negatively</td>
<td>• Effects on infrastructure and investment (if found to be a likely impact)</td>
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<tr>
<td>• Impacts on landscaping, wildlife management</td>
<td>• Change in the freeze/thaw cycle</td>
<td>• More severe winter storms</td>
<td>• Issue for long term research</td>
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**Temperature changes**

- Increased temperature will lead to less snow and ice
- More drought

**Precipitation changes**

- More intense storms, with possible decrease in their number
- More lightening events
- More thunderstorms

**Extreme events**

- More severe winter storms
- More intense storms, with possible decrease in their number

**Sea level rise**

- A long term issue when on its own
- A near term issue when combined with increased storm events
- Subsidence, uplift and other factors will mediate sea level rise impacts, positively or negatively

**Wind Changes?**

- Concerns over velocity and directional changes noted, but not much analysis in the literature
- Very difficult to model
- Effects on infrastructure and investment (if found to be a likely impact)
- Issue for long term research
Results - Survey

Responses suggest:

No “business as usual” attitude: Most respondents believed weather-related disruptions were increasing, without a direct attribution to climate change

A focus on primary mission: Respondents were much more likely to name climate change effects they expect **airside** than locally or regionally
Survey responses suggest:

Several catalysts: Adaptation drivers are diverse and exist at many levels:

- National guidance or directives
- Regional collaboration efforts
- Professional society guidance
- Executive management
- Airport asset or other system managers
- Airport technical staff (engineers, planners)
Integration of climate adaptation into organizational processes:

- Design standards for physical assets
- Design standard for single project (ad hoc)
- Capital Improvement Plan
- Organizational decision making
- Disaster management/emergency response
- Master Plan in development
Results - Case Examples

• **Addressing climate change effects in the present day.** In response to the actual climate effects in Alaska, Congressional leadership in program oversight, a state climate change task force, and highly-motivated public servants helped rationalize the approach to addressing impacts experienced at many village airports.

• **Airport-level climate change planning.** New CEO brings sustainability agenda to job at new airport and empowers technical staff to devote time to developing a White Paper on climate risks and adaptation. The result is a highly competent work product that introduces climate risks to a workforce unacquainted with them.
Case Examples

- **Regional climate change planning.** Senior managers of a coastal airport were brought onto a Steering Committee of a project studying regional vulnerabilities to sea level rise. Participation helped define the issue for them and these managers now intend to consider adaptation through formal planning processes.

- **Process in place for a Climate Action Plan.** Through an FAA grant, an airport developed a Sustainability Management Plan that includes plans for a Water Master Plan and Climate Action plan among others. The airport states it would use these as a platform for introducing review of climate impacts and adaptation.
Case Examples

• Project design with a view to climate change. A regional adaptation planning process provided sea level rise modeling to planners at a coastal airport. During technical reviews for other purposes, the planners designed in an ability for a perimeter dike to accept additional load in the future.

• Project design with a view to climate change. Use of a climate change analysis protocol for the engineering profession freed technical experts to see past simple use of the historical record with respect to two airside water management issues.
Case Examples

- **Bad outcomes from weather (snow storm, drought) catalyzed**
  - Accelerated review of two major funding proposals:
    - $10m for snow removal equipment
    - $18m for a reclaimed water pipeline
  - Consideration of climate change-related risks that are on the horizon, including air quality impacts

- **Standard Operating Procedure**. A case example from a southern state details an airport’s response to extreme weather, under current conditions.
### Drivers of adaptation activities

**Airports are responding to**

<table>
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<th>Internal Advocates</th>
<th>External Motivators</th>
<th>Experience</th>
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<tr>
<td>- Executive as champion</td>
<td>- State, regional, and local adaptation planning efforts and work products</td>
<td>- Severe weather events and related costs</td>
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<td>- Program-level advocate</td>
<td>- Federal grants in support of planning frameworks</td>
<td>- Awareness raised from sustainability and greenhouse gas mitigation activities</td>
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<td>- Professional judgment of technical staff</td>
<td>- Model adaptation guidance from professional societies</td>
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Report highlights

• There are important interdependencies with tenants, other airports, and other partners which may be locally, regionally, and nationally based.

• Adaptation planning efforts occurring in an airport’s geographic region can raise awareness at the airport.

• Risk management, as informed by vulnerability assessments especially, is a commonly suggested approach to adaptation. Related tools of interest include NEPA, asset management, and Environmental Management Systems.

• There are various types of data and information useful to determining baseline conditions as well as to planning and other activities related to climate risks. The identification of needed data sets, e.g. asset inventories and information on the useful life of assets, is an important exercise.
Recommendations

Future research might include:

- Guidance for inventorying assets and activities at airports
- Comprehensive review of climate impacts and risks to airports and all aspects of their facilities, operations, and interdependencies related to passenger, cargo, and other air service activities.
- Comparative research on methods for risk management across different spatial, temporal, geographic, and geopolitical spheres
- Identification of data producers and data stewards in Federal, state, tribal, and municipal agencies
- A broader survey of airport adaptive capacity
Recommendations (cont’d)

• An annual report on relevant climate projections in a readable form, tailored to airport facility and operational concerns

• A research roadmap for the technologies that could be brought to bear on the anticipated risks to airport facilities and operations.

• Review of aviation professions to develop an understanding of entry points for climate change education and awareness raising

• Ways to leverage airport personnel expertise and knowledge base for local partners seeking transportation sector leadership.
Chris Baglin  
Principal  
Energy, Environment, and Climate Solutions  
Project Performance Corporation  
Part of the AEA group  
ph: 703.748.7547 cell: 571.271.1115  
email: Chris.Baglin@ppc.com