ACRP Problem Statement: 66  

**Recommended Allocation:** $450,000

*Alternative Anti-Icing Airfield Runway Systems*

[Click here to see problem statement in IdeaHub:](http://ideascale.com/t/UKsrZB7y8) *(Note: you must be a registered user in myACRP/IdeaHub.)*

**TAGS:** Airside, Design, Safety

**STAFF COMMENTS**

While ACRP has undertaken many deicing/anti-icing studies, very few look at the airfield, and none explores new approaches.

**AVERAGE INDUSTRY RATING SUMMARY**

<table>
<thead>
<tr>
<th></th>
<th>Committees¹</th>
<th>Airport Community²</th>
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<tbody>
<tr>
<td>Achievable</td>
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<td>Applicable</td>
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<tr>
<td>OVERALL</td>
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<td>3.66</td>
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</tbody>
</table>

*Notes: 1. Includes TRB aviation committees and committees from ACI-NA and AAAE.*

2. Includes airport employees serving on active ACRP project panels.

**USE THIS LINK TO SEE DETAILED INDUSTRY RATINGS.** Click on the arrow in the Problem Statements dropdown menu in the upper right and select the problem statement number.

**USE THIS LINK TO SEE DETAILED INDUSTRY COMMENTS.** Click on the arrow in the Problem Statements dropdown menu in the upper right and select the problem statement number.

**ACRP OVERSIGHT COMMITTEE (AOC) DISPOSITION**

The average AOC rating among its voting members was 2.3 on a scale of 1 to 5. There was no discussion. The problem statement was not selected for ACRP funding and will be returned to the idea collection phase of ACRP’s IdeaHub.
ACRP Problem Statement: 66

Alternative Anti-Icing Airfield Runway Systems

TAGS: Airside, Design, Safety

OBJECTIVE

Summarize existing anti-icing and de-icing practices, and develop new approaches for runway anti-icing to promote runway safety during wintry weather conditions.

BACKGROUND

Many US airfields are subjected to sub-freezing temperatures. Snow, ice, or slush runway conditions significantly impact aircraft landing and takeoff safety. To promote safety at US airfields, snow and ice removal are essential during wintry wet weather conditions. Typically snow and ice removal practices include blowers, brooms and chemicals. However, these practices are costly in terms of time, staff, and environmental resources. Alternative antiicing runway systems or methods should be investigated to evaluate their cost effectiveness and environmental impact. Alternative techniques that are found to be efficient and effective will provide airports with cost savings, reduced down time during wintry wet weather conditions, and lower environmental impacts.

Between 1998 and 2004, runway water, ice or snow contributed to more than 50 airplane accidents (NASA 2004).

Between January 1978 and January 2009, there were 100 accidents / incidents that occurred at US runways with slush, ice or snow involving jet or turboprop aircraft weighing more than 5600-lbs. and having a minimum of two engines (Ayres et al 2011).

Airport authorities use plows, snow blowers, and/or sweepers to remove snow to ensure safe aircraft ground movements during winter storm conditions. Runway de-icing fluids (RDF’s) are used to break the bond between ice and pavement during icy conditions. Salt melts snow and ice; however, applying salt to a runway has the adverse effects of pavement and aircraft landing gear corrosion. Alternatively, more environmentally friendly freezing point depressant chemicals are used for anti-icing agents to reduce ice-pavement bond while complying with US EPA storm water regulations. Although, manually removing snow and applying de-icing solvents is one solution to ensure safe runways during winter conditions, alternative anti-icing/de-icing solutions are available and may be more advantageous.

Pavement heating systems provide a viable alternative to deicing chemicals for maintaining ice-free pavement surfaces. Heated pavement systems (HPS) maintain above freezing slab surface temperatures melting and preventing ice accumulation and other winter-like contaminants. Minimum performance requirements for use of heated pavement systems are included in FAA Advisory Circular 150/5370-17 (FAA 2011).

Alternative de-icing / anti-icing systems are currently being investigated. These approaches need to be summarized for their effectiveness and potential. Additionally, new systems need to be proposed and tested for their viability. Work was conducted by Tuan incorporating conductive concrete to develop a deicing concrete pavement slab (Tuan, 2008). The system was implemented at a bridge deck and tested. An Iowa State University research team led by Halil Ceylen is currently researching electrically conductive concrete heated pavements and using the approach in precast concrete panel units (Abdualla et al., 2016). The previous systems use grid electricity as their energy source. Conversely, Heymsfield et al (2013) incorporated conductive concrete with renewable energy as the system’s energy source. Results in the Heymsfield study showed that the conductive concrete approach is energy inefficient and therefore not a cost effective option in a renewable energy system. An electrically conductive flexible pavement
system was developed by Snowfree using a graphite powder mix and tried at the Chicago O’Hare Airport (Derwin et al., 2003).

Hydronic systems are an alternative approach. Hydronic systems pump heated fluid through embedded conduits within the pavement slab to provide an above freezing temperature slab surface. Hydronic systems are already being used in Europe. Gardermoen International Airport in the Oslo, Norway area uses a hydronic system to heat the airport apron area. Plans for a hydronic system using geothermal energy at the Goleniow Airport in Poland are available in a reference by Zwarycz (2002). In the US, Binghamton University researched the feasibility of using an anti-icing apron system using geothermal energy (Ziegler 2009).

APPROACH TO RESEARCH

IV. PROPOSED TASKS

• Review current airport runway anti-icing practices and categorize these practices as a function of ambient weather conditions. The survey should include domestic and foreign methods.
• Summarize currently used anti-icing practices as a function of their ambient condition suitability and economics.
• Develop an experimental plan to select and judge optimal alternative practices for their suitability.
• Conduct preliminary experimental work using these optimal practices.
• Field Implementation at an airport site
• Develop a numerical model to optimize the design airports considering ambient weather conditions.

COST AND JUSTIFICATION

Estimated problem funding: $450,000

The funding provides support for a three year study. Funding will be used for salaries, experimental equipment/supplies, travel, and computer support.

RELATED RESEARCH

Work on developing a de-icing / anti-icing system was conducted by Tuan incorporating conductive concrete to develop a deicing concrete pavement slab (Tuan, 2008). The system was implemented at a bridge deck and tested. An Iowa State University research team led by Halil Ceylen is currently researching electrically conductive concrete heated pavements and using the approach in precast concrete panel units (Abdualla et al., 2016). The previous systems use grid electricity as their energy source. Conversely, Heymsfield et al (2013) incorporated conductive concrete with renewable energy as the system’s energy source. Results in the Heymsfield study showed that the conductive concrete approach is energy inefficient and therefore not a cost effective option in a renewable energy system. An electrically conductive flexible pavement system was developed by Snowfree using a graphite powder mix and tried at the Chicago O’Hare Airport (Derwin et al., 2003).

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REFERENCES


IDEA CREATOR

*Person who first shared the idea with the IdeaHub community.*

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OWNER/SUBMITTER

*Person who volunteered to be responsible for developing the idea into a problem statement.*

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