Economic Evaluation of Hydronic Heated Airport Pavements

Objectives

- To develop an economic analysis framework to identify advantages of a heated pavement including operational savings and improved safety
- The outcome of this study will provide an approach to decision making regarding whether or not to install heated pavement system, along with benefits to safety, accessibility, operating efficiency and sustainability to the airport

Background

Heated pavement provides an environmentally safe alternative to melt snow and ice without the need for deicing chemicals (e.g., road salt) and snowplowing vehicles.

Hydronic Heated Pavement Systems

Circulate heat transfer fluid (water, a mix of water, and anti-freeze agent such as propylene glycol) in a “closed loop” between pavement and heating source (boiler, geothermal, etc.)

Construction

Research Approach

SELECT AIRPORT ➔ WEATHER CONDITIONS

PASSENGER, CARGO AND DELAY STATISTICS ➔ ENERGY REQUIREMENT TO MELT SNOW/ICE

COST FOR SNOW REMOVAL USING CONVENTIONAL STRATEGIES ➔ BENEFIT AND COST OF SNOW REMOVAL USING HEATED PAVEMENT STRATEGIES

COMPARISON OF RESULTS FOR A 20 YEAR PERIOD

Stakeholders Involved

- **FAA**: Provides capital
- **General Public**: Reaps benefits such as lesser waiting times, lesser delays, loss of travel time
- **Airport Authority**: Part of the initial capital investment, increase in the no. of winter operations, enhanced safety, maintenance costs
- **Airlines**: On-time performance, reduction in the loss of fuel and crew hours, higher market value

Cost Comparison Methodology

### Key Findings

- High cost of installation of heated pavement systems can be justified under the given assumptions
- The benefits associated with hydronic heated pavement systems far outweigh the costs involved
- The annualized costs of conventional snow removal strategies are lower but the high benefits from hydronic heated pavement systems make the project feasible
- Natural gas is the preferred energy operation source

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### Cost Comparison Methodology

<table>
<thead>
<tr>
<th>Cost/Benefit category</th>
<th>Conventional</th>
<th>Heated pavement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial cost</td>
<td>Snow removal equipment purchase</td>
<td>Heating system installation</td>
</tr>
<tr>
<td>Operation cost</td>
<td>Labor, fuel, and deicing agents</td>
<td>Energy source cost (geothermal, energy, fuel, natural gas, and etc.)</td>
</tr>
<tr>
<td>Maintenance cost</td>
<td>Maintenance for system</td>
<td>Maintenance for system</td>
</tr>
<tr>
<td>Soft / Indirect cost</td>
<td>Aircraft, passenger, and cargo delay costs, loss of daily operation revenue and landing fee.</td>
<td>Aircraft, passenger, and cargo delay costs are minimized. Enhanced safety and better working conditions</td>
</tr>
</tbody>
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### BCA Results: Case Study

A case study was carried out for the Minneapolis-St. Paul International Airport, MN to verify the feasibility of hydronic heated airport pavements.

### Testing

- Photo courtesy of Google maps 2014