2018 CANADIAN CONSULTING ENGINEERING AWARDS

Iqaluit International Airport

Category A: Buildings

Stantec

Iqaluit International Airport

Opened in the summer of 2017, this airport terminal building in Canada's far north is the first P3 terminal in North America and Nunavut's first LEED® Silver. The form is an elegant red curve, set against the winter background. It is a subtle and sophisticated response to the environmental challenges of the severe and changing climate of the Arctic, and to the history and culture of this special place in the world with a contemporary airport.

Project Highlights

Q.1 INNOVATION

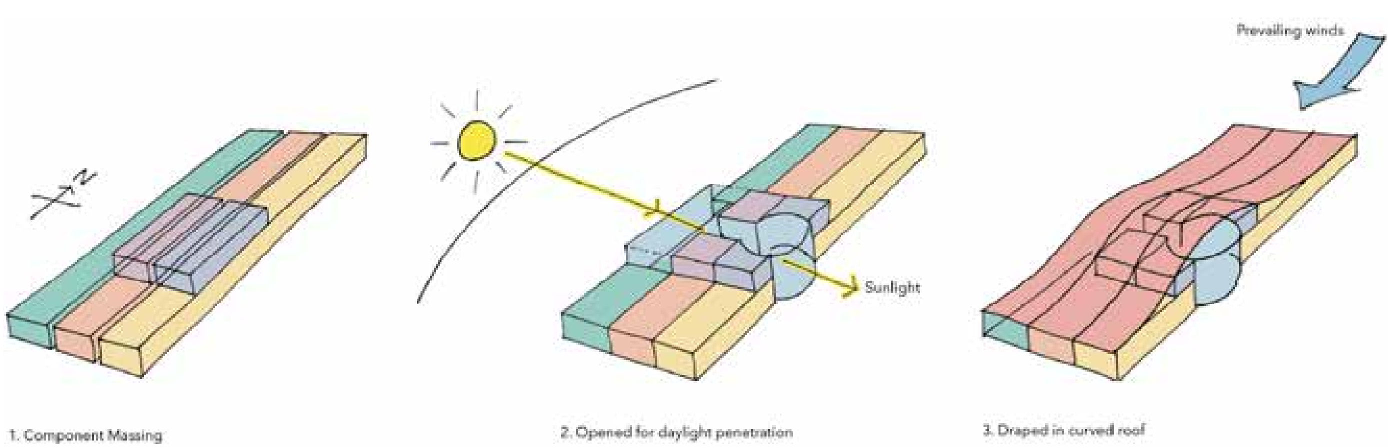
As energy is very expensive and the climate severe, effective sustainable strategies were essential in Iqaluit climate. The building form is compact– a simple rectangle with a curvilinear roof that minimizes the building's surface area and lets the prevailing wind sweep the building free of drifting snow. A system of combined heat and power optimizes energy usage, and a passive cooling system beneath the slab keeps the permafrost, on which the building rests, permanently frozen.

In addition to its primary transportation function, the terminal is a communal meeting place and public forum. The central rotunda was designed to accommodate the features of a public community space. Daylight is a precious commodity in long winter months and the fenestration is designed, not only to mitigate energy loss, but to bring that light deep into these public and administrative spaces. There is provision for artwork throughout - in the wall paintings in the rotunda, the tapestries in the holdroom and the carvings in the glass museum cases. And finally, the building is red - an emphatic response to the local colour choices in housing, to the monochrome winter backdrop, and to the previous terminal building's bright yellow.

The design of the steel roof was also critical to the performance of the building. The steel roof structure was precisely designed to a sinuous curve allowing a smooth continuous surface a roof mounted feature that directs the prevailing winter winds down the lee ward building face.

The building foundations are supported on a thermosyphon system. This is a passive closed loop system, which keeps the permafrost below the building frozen. Providing this stability to the permafrost is crucial, to avoid the settlement and building serviceability issues that would arise with thawing permafrost.

The airport's own diesel fuel supply is used to power the two CHP generators. This supply both normal and standby power for the terminal. The heat from the system is then captured to serve the heating, ventilation and air conditioning (HVAC) systems— providing substantial energy savings.

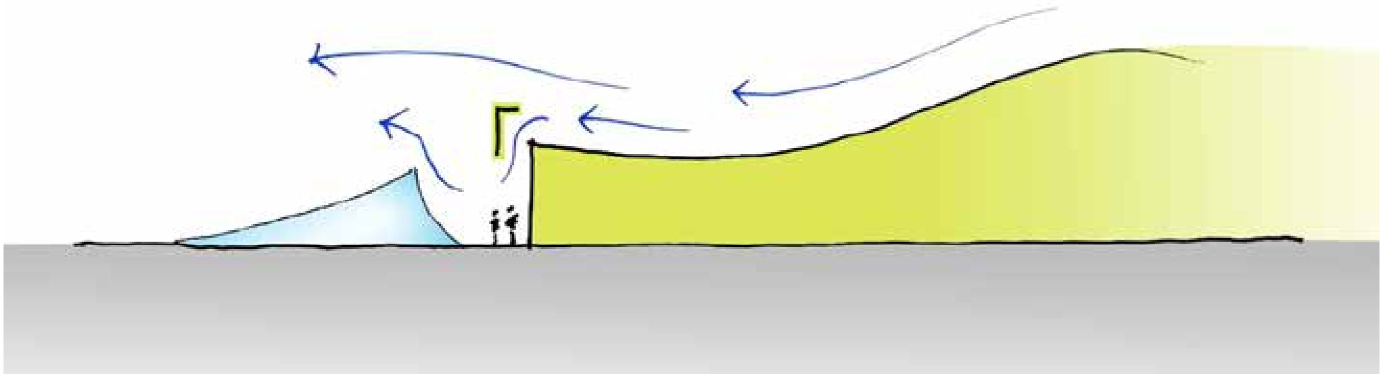


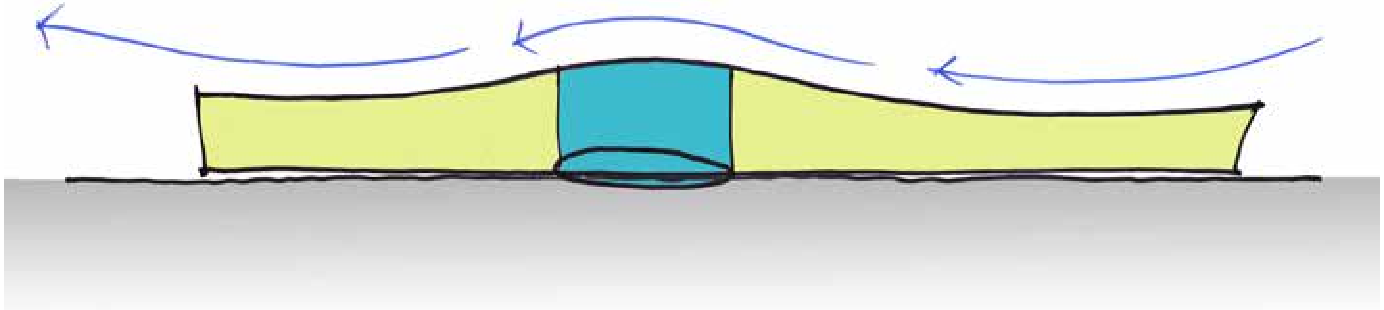
A simple rectangle design minimizes the number of building corners, and the sinuous curving roof minimizes surface area of the building envelope, providing a smooth surface for winds to scour the roof free of drifting snow.

Q.2 COMPLEXITY

There were numerous design targets to be met that required consistent project management to ensure the project remained on schedule. As there is limited time in the year when the airport is ice-free, delays in design could result in significant additional costs to the project for flying materials to site. Successful completion of the projected required delivering numerous design packages on a very tight schedule through an effective project management process.

The “snow scoop” on the south side is designed to move drifts away from the building face.



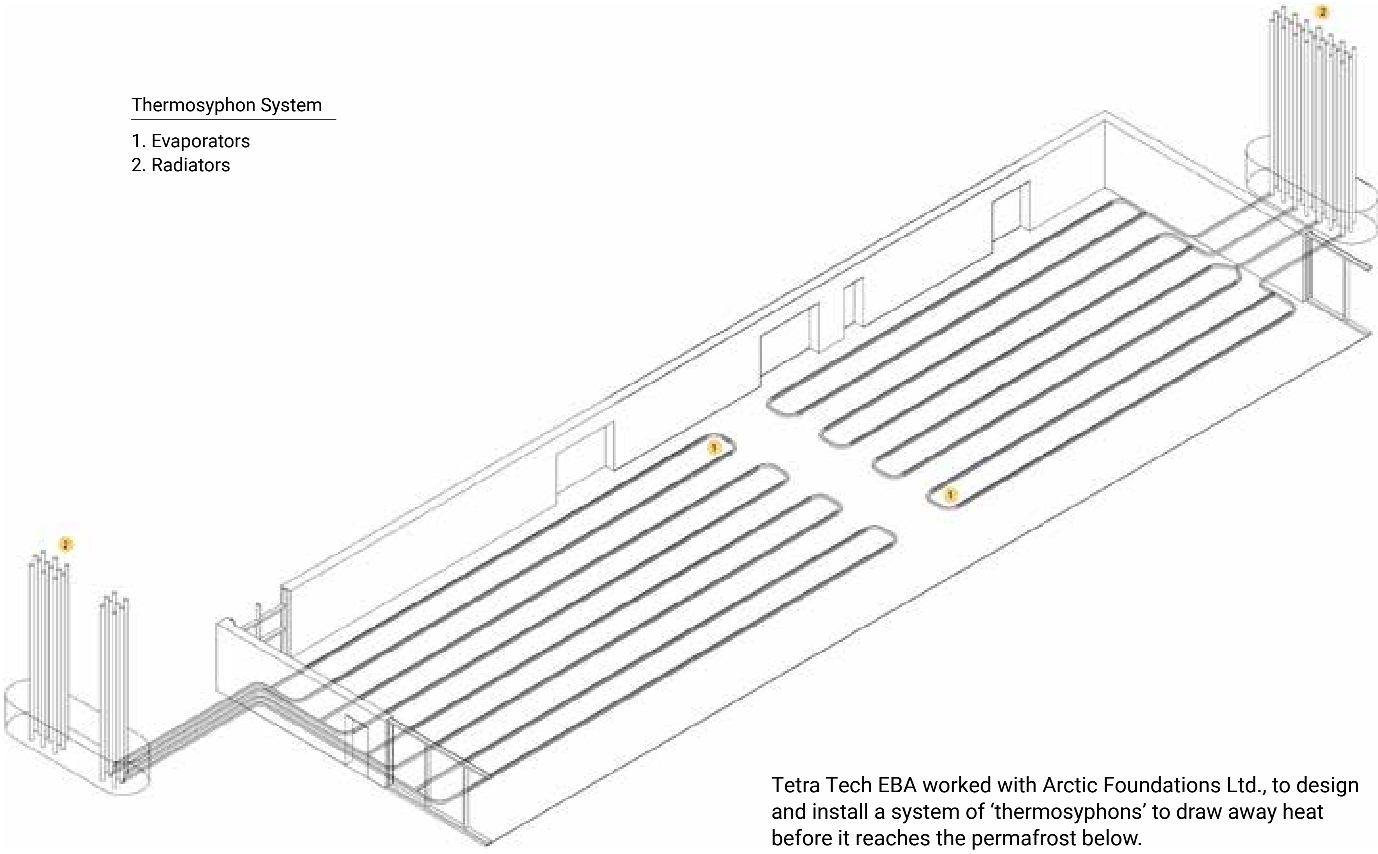


Q.3 SOCIAL AND/OR ECONOMIC BENEFITS

Iqaluit, formerly known as Frobisher Bay, is now the capital of Nunavut, the Territory spanning the eastern half of Canada’s Arctic. To satisfy the demands of a growing capital, its airport had to rise to the challenge of meeting a wide variety of very unique needs. The client’s objectives fell into three main categories: implementation of the latest airport technologies and best practices, mindfulness of the extreme and changing Arctic climate, and incorporation of Iqaluit’s First Nations culture and communities. During the design process, we found that many of the solutions that addressed these objectives serendipitously overlapped.

For example, there is an innovative easy access and wayfinding solution where the passengers are on a single level, with the administration and services on the floor above. This plan provides for the segregation of the three streams of passengers: the international, domestic, and those unscreened passengers travelling to the remote villages. The plan keeps in mind the itinerary of a broader range of travelers than the regular airport while also prioritizing the efficiency of human flow. While passengers will continue to walk across the tarmac to the planes, there is still provision for the future installation of passenger boarding bridges to acknowledge the growing state of the young city.

As energy is very expensive and the climate severe, sustainable strategies were critical in tackling the Iqaluit climate. The building form we chose is compact - a simple rectangle with a curvilinear roof that minimizes the building’s surface area and lets the prevailing wind sweep the building free of drifting snow. A system of combined heat and power optimizes energy usage, and a passive cooling system beneath the slab keeps the permafrost, on which the building rests, permanently frozen.



Tetra Tech EBA worked with Arctic Foundations Ltd., to design and install a system of 'thermosyphons' to draw away heat before it reaches the permafrost below.

Q.4 ENVIRONMENTAL BENEFITS

Airport Terminal Building was designed to meet stringent energy performance criteria set by the Government of Nunavut and the LEED® Green Building Rating System for sustainability targets. In addition to the combined heat and power system, the mechanical design features low flow domestic hot water fixtures, high efficiency boilers, high efficiency heat recovery system, and variable speed vans.

The lighting design reduces energy consumption by 50% over a typical building through reduced lighting power density inside and outside the building, and additional interior lighting controls. The building also features significant improvements in roof and wall insulation over a typical building (90% and 30% respectively). These measures result in an energy use reduction of more than 40% compared to a typical building in the North, and a similar reduction in potable water use. The building is targeting LEED® Silver certification under LEED® Canada 2009 for New Construction.

To ensure that the heat radiating down from the building does not melt the permafrost on which the building rests, a passive system of 'thermosyphons' captures and dissipates that heat before it reaches the permafrost. There is a series of horizontal pipes, 'evaporators', below the slab, filled with CO_2 gas, that captures that heat and delivers it to a series of vertical 'radiators' located around the building perimeter. The gas is cooled by the ambient air, condenses and then returns to the pipes below the slab. The cycle repeats.

The client brief was also very prescriptive for both the percentage of windows and the quantity of natural light in the public spaces. This requirement was 20% glazing in the façade and an average lux level of 75. The essential focus for daylighting is the high volume in the centre of the building — bringing light deep into the rotunda, into the holdrooms and through the connecting corridor between.

Q.5 MEETING CLIENT'S NEEDS

In addition to its primary transportation function, the terminal is a communal meeting place and public forum. The central rotunda was designed to accommodate the features of a public community space. Daylight is a precious commodity in long winter months and the fenestration is designed, not only to mitigate energy loss, but to bring that light deep into these public and administrative spaces. There is provision for artwork throughout - in the wall paintings in the rotunda, the tapestries in the holdroom and the carvings in the glass museum cases. And finally, the building is red - an emphatic response to the local colour choices in housing, to the monochrome winter backdrop, and to the previous terminal building's bright yellow. The histories and cultures of Nunavut are emblematic and are widely represented in our building design.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