CANADIAN CONSULTING ENGINEERING AWARDS 2013

Edmonton International Airport - Air Terminal Building Expansion 2012

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Stantec

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1 Project Information

Project Name: Edmonton International Airport – Air Terminal Building Expansion 2012

Location: #1, 1000 Airport Road, Edmonton AB, T9E 0V3

Completed: February 2012

Category: B. Transportation

2 Project Summary

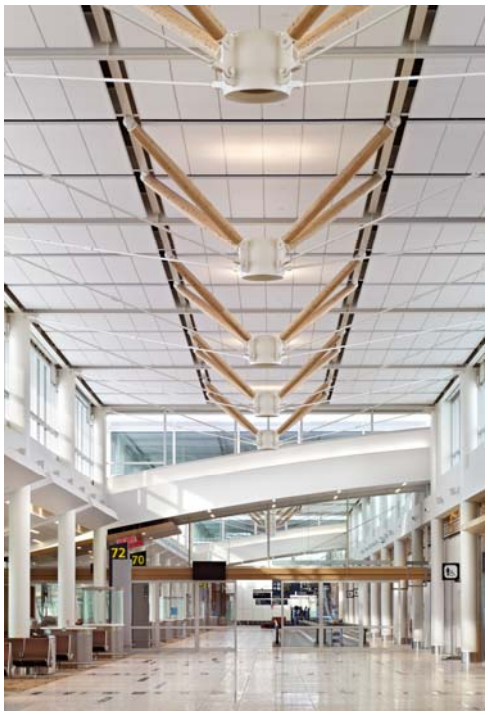
The Edmonton International Airport – Air Terminal Building (ATB) Expansion 2012 provides an enhanced travel experience. The terminal is a hub for business and social gathering, featuring local culture, art, and shopping. Stantec used a collaborative design-assist approach to provide architectural, interior design, structural, mechanical, and electrical engineering services. The resulting facility maintained operation during construction, was completed under budget and ahead of schedule, features sustainable and energy-efficient innovations, and provides flexibility for evolving operational requirements.

3 Project Highlights

3.1 Innovation

Steel procurement was fast-tracked following the schematic design phase, which allowed the contractor to secure lower pricing during a slow market period and save an estimated year of project time by collaborating early with the fabricator. Exposed steel structures were selected to improve the functional planning and increase flexibility for future modification.

The floor system design addressed deflection and vibration concerns for long span structures by using a structural concrete slab on non-composite floor deck and composite steel beams spaced to balance and control the floor mass and vibration control requirements.

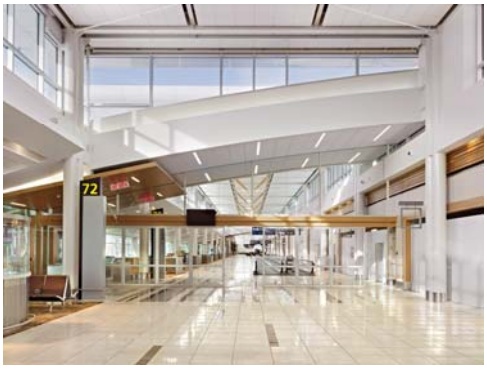


The kingpost system, used to support the high roof structure along the airside seating area corridor, consists of a combination of rod, circular glulam wood, and exposed steel framing spaced in a 4m grid. The system is natural combination and economical use of the strength of steel material for tension, and glulam wood for compression load requirements.

Heating water systems were designed for a 60°C temperature drop between supply and return, nearly three times the typical value, meaning the heating system extracts significantly more energy per volume of which reduces the sizing of the piping system and cuts pumping energy requirements to as low as 5% of conventional system requirements. The design considered piping distribution, selected equipment with applicable performance attributes, and defined control sequences to cascade the water temperature down through multiple uses.

Displacement ventilation introduces conditioned air at the floor level to improve indoor air quality, increase energy efficiency, and lower operating costs. Clean air displaces used air in the breathing zone, removing pollutants. Supply air grilles were disguised in counter-height tables, flight display screens, and art cabinets in the open-concept departure lounges.

Two substations distribute electrical services throughout the terminal expansion, and were designed to automatically transfer loads in the event of a feeder failure or power outage. This includes for connection to an emergency power generator system to support the entire terminal expansion as a standalone terminal and not just the critical and life safety systems – a unique feature as airport retail and food areas are not usually provided with backup power.



Stantec provided acoustic modeling of the public address (PA) system for several areas to address speech intelligibility. The PA system provides zone control via ambient microphones to automatically adjust the paging system volume in response to local ambient noise.

3.2 Complexity

Rapid population growth and 50% increase in ridership since 2004 created the need for a significant and immediate expansion to occur while keeping the existing airport operational and maintaining continuity of service. The ATB expansion had to allow simplicity and flexibility for operators as retail layouts, technology, security protocols, and aircraft sizes are constantly changing.

Stantec used a design-assist approach for this project and collaborated with major trade contractors using a Building Information Modeling (BIM) process to mitigate cost escalation, manage the project schedule, and take advantage of certain economies of scale. This approach delivered an advantageous compressed schedule taking only six months from schematic design to the start of steel erection on-site.

Connecting the new building to the existing terminal required the coordination of all architecture and engineering disciplines. A temporary passenger concourse was constructed to by-pass the demolition areas and maintained passenger pedestrian traffic during construction.

Other consulting teams and contractors were involved in concurrent projects at the airport, requiring communication and coordination for smooth work flow. New mechanical systems for the ATB expansion were integrated into the existing central plant controlled by a separate contractor.

Given the scale of the building and complexity of the systems, a trial run was held at the end of January 2012 to test terminal operations. Over 900 community volunteers acted as passengers in typical airport scenarios and provided feedback for final adjustments prior to the February 2012 opening.

3.3 Social and Economic Benefits

This ATB Expansion improves the passenger experience and increases the airport's capacity from 5 million to 9 million annual passengers bringing significant economic benefits to the Capital Region as a whole, and improving the Edmonton International Airport's ability to attract flights to additional destinations increasing revenue opportunities for the facility. This expansion is part of a larger plan to create a regional centre to connect people and cargo from local to worldwide.

The public art is a reflection of the City and Region supporting EIA's role as a welcoming landmark. Art also provides visual interest and a means of wayfinding in spaces that can often be impersonal. Local art, a key element defining Edmonton's identity, was incorporated in the design to add to passenger experience and to enhance the view of the City in the eyes of visitors. Permanent installations promote five leading arts organizations in Edmonton and another 12 artists from around the world have designed original pieces.

Deliberate decisions were made to integrate the engineering, comfort, function, and aesthetics to enhance the overall experience. For example, ventilation systems were hidden and structural elements were fully exposed to express the openness and warm atmosphere which reflect the prairie landscape. Lighting and daylighting were strategically placed to complement the placement of art features. Growing the airport beyond traditional functions to become a community gathering place capable of more than simply flights will increase airport revenues and enhance community economic benefit.

Environmental Impact

The ATB Expansion is **targeting LEED®** (Leadership in Energy and Environmental Design) certification from the Canada Green Building Council (CaGBC) with sustainable and energy-efficient features.

The 150 m^2 **living wall** is a two-story feature in the arrivals and departures levels using 8,000 hydroponically-fed plants. It is not only aesthetically pleasing but the selected plants also function as an air purifier. It is the first living wall to be incorporated into an airport world-wide.

A **rainwater harvesting system** collects roof water in a 1,600 m^3 non-pressurized concrete tank below the central mechanical room. Annually, over 9 million litres of collected water will be filtered and pumped throughout the building for toilet and urinal flushing, which will provide an anticipated potable water savings of 37% over the baseline.

Low-consumption plumbing fixtures and automatic infrared activation technology further reduce potable water consumption by another estimated 32% totaling a projected total consumption reduction of 69% compared to a typical plumbing system.

A **solar hot water** collection system provides heat for approximately 50% of the typical daily domestic water load for the building.

Displacement ventilation using the floor-level diffusers and higher ceilings, provides greater thermal comfort to occupants while reducing airflow rates, fan energy and energy required to heat and cool outdoor air.

The lighting and daylighting control system provides high quality and aesthetic illumination while lowering capital, maintenance, and energy costs. It allows connectivity to local lighting zones to adjust lighting levels throughout the airport using feedback from daylight sensors.

3.4 Meeting and Exceeding Owners/Client's Needs

Client goals for this project included improving current levels of service and responding to the needs of customers, airlines, tenants, and the airport authority by creating innovative efficiencies through technology and processes. Another goal was for passenger experiences to be intuitive and enjoyable, and for long-term plans, such as common use baggage facilities or potential dramatic changes to security regulations, to be considered. Lasting positive impression on visitors to the region, tenants, and airport staff was a priority to ultimately contribute to EIA's goal of increasing revenues.

The client's project goals were met by addressing and maintaining maximum system flexibility with respect to evolving airport operation requirements. The existing airport terminal remained operational with systems maintained and reused throughout the renovation and construction phases. The design incorporated standardization of equipment for airport maintenance and operations employees, with negligible down-time.

This project was completed ahead of schedule and under budget. Major elements including structural steel and mechanical equipment were procured early and reduced the design and construction schedule significantly.

A wide variety of innovative and sustainable features were incorporated into the expansion, exceeding energy efficiency standards and minimizing operating costs.