



The Abbotsford International Parallel Taxiway and Apron Expansion Project Airport Welcomes the World

2011 Canadian Consulting Engineering Awards

Abbotsford International Airport Parallel Taxiway and
Apron Expansion Project

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Two Page Description

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The Abbotsford International Airport Welcomes the World

Parallel Taxiway and Apron Expansion Project

NEW APPLICATION OF EXISTING TECHNIQUES/ORIGINALITY/INNOVATION

In 2008, the City of Abbotsford and the Abbotsford International Airport retained Hatch Mott MacDonald (HMM) to develop a schematic design for the development of a taxiway parallel to Runway 07-25 and the eastward expansion of Apron 1 parallel to Runway 01-19.

The design objectives for the new taxiway were to enhance airport capacity and reduce environmental impacts by reducing runway occupancy times, improving airport access, increasing runway utilization and reducing aircraft taxi times. The expanded apron would improve the safety of taxi operations, maximize aircraft parking on existing pavement surfaces, and increase aircraft parking space for tenants. The project scope also included the addition of a new field electrical centre to provide a modern and safe facility to house electrical equipment for the airport's lighting, signage and navigational aids.

In 2009, the City of Abbotsford and the Abbotsford International Airport engaged HMM, led by project manager Harvie Buitelaar, to provide management and engineering services for the investigation, preliminary design, detailed design, tendering and construction of the taxiway and apron expansion.

HMM used several advanced approaches in the design of the taxiway and apron expansion. We used advanced computer software for the layered elastic design of the flexible pavement structure, which goes beyond Transport Canada's pavement design requirements and criteria. We also used specialized software to model aircraft movements in order to optimize the size of new pavement areas, determine the location of rapid exit taxiways, and provide airport staff with accurate jet blast analysis.

Innovative design features included the drainage system, the field electrical centre and LED centreline lighting. The drainage system's bioswales filter stormwater runoff and the pre-cast perforated manholes remove surface water and replenish the aquifer below the airport property, an essential component of the community's potable water supply. The field electrical centre consisted of a pre-fabricated design that helped meet a very tight schedule for transferring the existing electrical controls and connections to the new electrical centre without disrupting airport operations and navigational aids. The inset LED centreline lighting on Taxiway A provided a new air traffic controlled surface, improved safety, and minimized overall upgrade costs and electrical energy consumption.

The project combined old and new materials to minimize import requirements. We used milled asphalt pavement to rehabilitate essential airport service roads and build new roads that both improved safety and security access and allowed us to avoid transporting waste asphalt off site. We re-used most of the native granular sub-grade material, which allowed us to minimize sand and gravel imports.

COMPLEXITY

The project was complex due to the need to construct the expansions in close proximity to active runways, taxiways and aprons. This required detailed planning of construction phases and stages, regular meetings with airport staff and tenants, and constant updates to the Plan of Construction Operations as required by Transport Canada.

We encountered several site problems and scheduling difficulties during the project. The airport was originally built in the 1940s and many modifications since then, particularly those involving underground services, were not well documented. We had to coordinate closely with our construction contractors and airport maintenance staff to prevent accidental damage to infrastructure that could disrupt airport operations.

Additionally, the annual Abbotsford International Air Show is a major event that the surrounding communities are proud of. In order to hold the event without any disruptions, it required that we stop

The Abbotsford International Airport Welcomes the World

Parallel Taxiway and Apron Expansion Project

construction for five days during the peak of the construction season, and restore all airfield surfaces to safe operating conditions.

ENVIRONMENTAL IMPACT

The rapid-exit taxiways improve runway utilization, reducing aircraft waiting time and the associated fuel consumption. The drainage system naturally filters runoff water and replenishes the aquifer below the airport. The electrical design uses LED centreline and edge lights on the taxiways to extend component life, reduce long-term maintenance costs, and lower overall power consumption. Construction involved only small imports of sand and gravel and was completed without trucking any native granular materials, waste asphalt or concrete from the site.

Landscaping considerations included using overburden to create a natural earth mound that blocks jet blast, and selecting appropriate grasses to promote proper growth, colour and erosion control.

Finally, the design and construction of the new parallel taxiway minimized impacts to adjacent raspberry fields, and improved operations of both emergency vehicle and farming equipment on reconstructed perimeter roads.

SOCIAL AND ECONOMIC BENEFITS

The benefits derived from this project include improved runway usage, reduced taxi times, and minimized aircraft delays and emissions. There are major economic benefits to the City of Abbotsford and the surrounding community by attracting new air carriers, encouraging the expansion of scheduled commercial flights, flight training schools, aircraft maintenance facilities, charter flight services, flying clubs, forest fire fighting fleets and the University of the Fraser Valley Aerospace Centre. The project will also benefit the Abbotsford International Air Show with improved operations and facilities and will enhance the airport's ability to provide critical emergency back-up if the Vancouver International Airport is not operational. The expansion also supports federal, provincial, and local government objectives such as supporting tourism growth, an increase in job growth at the airport, and international trade by being able to accept larger aircraft and allowing international and US visitors to visit.

MEETING AND EXCEEDING CLIENT'S NEEDS

The Abbotsford International Airport's main objective for this project was to improve the airfield while minimizing disruption to the existing airport operations during the construction works. In addition, the Airport insisted on high-quality efforts with due regard to environmental and sustainability considerations. This project had to be fast-tracked with stringent cost containment objectives. Most importantly, it all had to come together on opening day. HMM met and exceeded these objectives.

Effective project management and continuous collaboration with airport staff, tenants, contractors and regulatory bodies played a critical role in the successful completion of the project within a single construction season. Early liaison with Transport Canada and Nav Canada resulted in timely approvals of the development and operational plans needed in advance of construction.

Most important of all, HMM helped the Abbotsford International Airport attain its primary goal of completing the works on time (December, 2010) within budgetary expectations. This was especially challenging when dealing with antiquated infrastructure, difficult construction logistics and the aforementioned listing of complexities. Going forward, we are in various stages of completion for additional work beyond the original scope of work, which includes building a new aircraft run-up apron, four new high-mast apron floodlight poles, and rehabilitating 1,500 m of Runway 07-25, critical areas of Apron 1, and 40% of the Apron 2 pavement.

Full Description

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The Abbotsford International Airport Welcomes the World

Parallel Taxiway and Apron Expansion Project

INTRODUCTION

Abbotsford International Airport is one of the fastest-growing airports in Canada and the official back-up airport for the Vancouver International Airport. Increased air traffic and continued airport growth had pushed the airfield infrastructure to capacity and lowered operating efficiencies. Solutions had to be found for improving service.

In 2008, the City of Abbotsford and the Abbotsford International Airport retained Hatch Mott MacDonald to develop a schematic design for the development of a 2,800 m long Code E taxiway parallel to Runway 07-25 and a 1,500 m long eastward expansion of Apron 1 parallel to Runway 01-19.

The design objectives for the new taxiway were to enhance airport capacity and reduce environmental impacts by reducing runway occupancy times, improving airport access, increasing runway utilization and reducing aircraft taxi times. The expanded apron would improve the safety of taxi operations, maximize aircraft parking on existing pavement surfaces, and increase aircraft parking space for tenants. The project scope also included the addition of a new field electrical centre to provide a modern and safe facility to house electrical equipment for the airport's lighting, signage and navigational aids.

In 2009, the City of Abbotsford and the Abbotsford International Airport engaged Hatch Mott MacDonald, led by project manager Harvie Buitelaar, P.Eng. to provide management and engineering services for the investigation, preliminary design, detailed design, tendering and construction of the taxiway and apron expansion project. Hatch Mott MacDonald was supported by sub-consultant Levelton Consultants Ltd., who provided geotechnical and material testing expertise.

The main elements of the overall expansion include stripping, excavation and stockpiling of approximately 250,000 m³ of native material, construction of a new flexible pavement structure consisting of approximately 33,000 m³ of asphalt, construction of new storm drainage facilities, installation of approximately 25,000 m of airfield cabling for new LED airfield lighting and



The Abbotsford International Airport Welcomes the World Parallel Taxiway and Apron Expansion Project

fiber-optic guidance signage, concrete foundation and ductwork for the prefabricated field electrical centre, new pavement paint markings, and all necessary removals and relocations for existing underground utility services.



Aerial view of the Abbotsford International Airport showing the parallel taxiway and apron expansion during overburden removal



The culmination of teamwork, effective value engineering and strategic scheduling not only facilitated the largest upgrades the airport has ever seen, but also allowed for significant added projects to be incorporated into the overall 2010/2011 airfield expansion program, including a 27,000 m² aircraft run-up apron, 150 m long blast fence, four high-mast apron floodlight poles, and rehabilitation of major components of the primary runway and two aprons.



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NEW APPLICATION OF EXISTING TECHNIQUES / ORIGINALITY / INNOVATION

Technical Excellence

Hatch Mott MacDonald used several advanced approaches in the design of the taxiway and apron expansion. We used advanced computer software for the design and layered elastic analysis of the flexible pavement structure, which goes beyond Transport Canada's pavement design requirements and criteria. We also used specialized software to model aircraft movements in order to optimize the size of new pavement areas and to provide airport staff with accurate jet blast data.



Constructing a drop slab at the interface between new and existing pavement



Milling and resurfacing old pavement



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Paving the parallel taxiway

Innovative design features included the drainage system, the field electrical centre and LED centreline lighting. The drainage system's bioswales filter stormwater runoff and the pre-cast perforated manholes remove surface water and replenish the aquifer below the airport property, an essential component of the community's water potable water supply. The field electrical centre used a pre-fabricated design that helped meet a very tight schedule for transferring the existing electrical controls and connections to the new electrical centre without disrupting airport operations and navigational aids. The inset LED centreline lighting on Taxiway A provided a new controlled surface, improved safety, and minimized overall upgrade costs and electrical energy consumption.



Auguring a new water main
beneath an active taxiway



The Abbotsford International Airport Welcomes the World Parallel Taxiway and Apron Expansion Project



Installation of prefabricated electrical control centre



Installation of duct banks to pass cables for the airport's lighting, signage, and navigational aids to a new field electrical centre

The project combined old and new materials to minimize material usage. We used milled asphalt pavement to rehabilitate essential airport service roads and build new roads that both improved safety and security access and allowed us to avoid transporting waste asphalt off site. We re-used most of the native granular sub-grade material, which allowed us to minimize sand and gravel imports.



Stripping sand and gravel from Apron 1



The Abbotsford International Airport Welcomes the World

Parallel Taxiway and Apron Expansion Project

This project drew on our international airport design expertise and previous experience with similar projects at Toronto Pearson, Los Angeles LAX, and London Heathrow. Experts from our offices around the world supported our main design team in Vancouver; our United Kingdom office provided quality assurance and conducted the detailed hydraulics design while our Florida office provided pavement rehabilitation expertise.



Runway 25 approach

Innovative Solutions

We developed a number of innovative solutions to meet the project's objectives and challenges. Firstly, the design had to contend with uncertainties in the aircraft mix forecasts, which determine the optimal number and location of rapid-exit taxiways. The exit geometry and spacing we ultimately selected successfully increased aircraft exit speeds, reduced runway occupancy times, and provided the flexibility to accommodate future additional exits if the aircraft mix changes.

Secondly, the apron expansion presented a significant opportunity to restructure the aircraft parking arrangement to better serve existing and future airport tenants. The schematic aircraft parking arrangement we developed was flexible enough to accommodate a wide mix of aircraft, where one Code-E aircraft position (such as a B747, or A340) could be swapped for two Code-C aircraft positions (such as B737 or A320).

Thirdly, the expanded impervious taxiway and apron surfaces needed effective surface water drainage. We designed a drainage system that used pre-cast perforated manholes (dry-wells) and infiltration basins to filter runoff and replenish Abbotsford's water supply aquifer. This design significantly reduced capital



The Abbotsford International Airport Welcomes the World Parallel Taxiway and Apron Expansion Project

costs and minimized the risk of bird-strike damage to aircraft by eliminating the need for surface storage ponds.



Installation of pre-cast perforated manhole as part of the natural drainage system



Installation of storm drainage pipe with concrete bedding

Finally, the entire project was completed without exporting any native granular material, asphalt or concrete from the site. We also re-cycled native granular materials for over 95% of the pavement sub-base, thereby minimizing the amount of sand and gravel we had to import.



Recycling old asphalt millings to build a new airport perimeter road, improving circulation of both emergency vehicles and local farming equipment



The Abbotsford International Airport Welcomes the World Parallel Taxiway and Apron Expansion Project

COMPLEXITY

The project was complex due to the need to construct the expansions in close proximity to active runways, taxiways and aprons. This required detailed planning of construction phases and stages, regular meetings with airport staff and tenants, and constant updates to the Plan of Construction Operations as required by Transport Canada. Early collaboration between Hatch Mott MacDonald, the Abbotsford International Airport, Transport Canada, NavCanada, and airport tenants resulted in a smooth approvals process and effective communications between all parties.

We encountered several site problems and scheduling difficulties during the project. The airport was originally built in the 1940s and many modifications since then, particularly those involving underground services, were not well documented. We had to coordinate closely with our construction contractors and airport maintenance staff to prevent accidental damage to infrastructure that could disrupt airport operations.

Additionally, the annual Abbotsford International Air Show is a major event that the surrounding communities are proud of. In order to hold the event without any disruptions, it required that we stop construction for five days during the peak of the construction season, and restore all airfield surfaces to safe operating conditions.



The Abbotsford
International Air Show
preparations



The Abbotsford International Airport Welcomes the World Parallel Taxiway and Apron Expansion Project

ENVIRONMENTAL IMPACT

The taxiway and apron expansion project promoted sustainability during its design and construction. The rapid-exit taxiways improve runway utilization, reducing aircraft waiting time and the associated fuel consumption. The drainage system naturally filters runoff water and replenishes the aquifer below the airport. The electrical design uses LED centreline and edge lights on the taxiways to extend component life, reduce long-term maintenance costs, lowering overall power consumption. Construction involved only small imports of sand and gravel and was completed without trucking any native granular materials, waste asphalt or concrete from the site.



Runway/threshold lights at the threshold of Runway 07

Aesthetics played an important part in the design of the taxiway and apron. Landscaping considerations included using overburden to create a natural earth mound that blocks jet blast, and selecting appropriate grasses to promote proper growth, colour and erosion control.



Earth mound built of stripped overburden, which acts as a jet blast barrier



The Abbotsford International Airport Welcomes the World

Parallel Taxiway and Apron Expansion Project

Finally, the design and construction of the new parallel taxiway expansion minimized impacts to existing raspberry fields, and improved operations of farm equipment on reconstructed perimeter roads. Expanding and operating a commercial airport in harmony with the surrounding farming community is a reflection of the teamwork required between all stakeholders, with an emphasis on accomodating vital industries like agriculture.



Taxiway East showing
berry fields



The Abbotsford International Airport Welcomes the World

Parallel Taxiway and Apron Expansion Project

SOCIAL AND ECONOMIC BENEFITS

Abbotsford International Airport serves a primary market of over 1.3 million regional travelers and supports one of the fastest growing regions in the country. It is a vital element of the infrastructure required for the economic development of the Fraser Valley area and the province of British Columbia.

The project bestows the immediate and long-lasting benefits of reduced operating costs and improved passenger satisfaction. These benefits derive from improved runway usage, reduced taxi times, and minimized aircraft delays and emissions. More importantly, the benefits were generated without creating any lasting or undesirable social impact to adjoining communities or stakeholders.

The project sets the stage for major economic benefits to the City of Abbotsford and the surrounding community by attracting new air carriers, encouraging the expansion of scheduled commercial flights, flight training schools, aircraft maintenance facilities, charter flight services, flying clubs, forest fire fighting fleets and the University of the Fraser Valley Aerospace Centre.

The airfield expansion and rehabilitation program will also benefit the acclaimed Abbotsford International Air Show with improved operations and facilities. The Air Show is a major event for the community, one that reflects the importance of aviation-related activities and industries in the surrounding communities.



Abbotsford International
Air Show



The Abbotsford International Airport Welcomes the World

Parallel Taxiway and Apron Expansion Project

One of the most important aspects of the airfield expansion program is that it will enhance the airport's ability to provide critical emergency back-up if the Vancouver International Airport is not operational.

The expansion also supports federal, provincial, and local government objectives such as supporting tourism growth through increased capacity, supporting an increase in job growth at the airport, and supporting international trade by being able to accept larger aircraft and allowing international and US visitors to visit and invest in BC.



Completed apron expansion



Completed apron expansion



The Abbotsford International Airport Welcomes the World

Parallel Taxiway and Apron Expansion Project

MEETING AND EXCEEDING CLIENT'S NEEDS

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Most important of all, Hatch Mott MacDonald helped the Abbotsford International Airport attain its primary goal of completing the works on time (December, 2010) within budgetary expectations. This was especially challenging when dealing with antiquated infrastructure, difficult construction logistics and the aforementioned listing of complexities. Going forward, we are in various stages of completion for additional work beyond the original scope of work, which includes building a new aircraft run-up apron, four new high-mast apron floodlight poles, and rehabilitating 1,500 m of Runway 07-25, critical areas of Apron 1, and 40% of the Apron 2 pavement.



A WestJet B737 taxiing along newly completed apron expansion

