Beneficial Use Case Study

Calgary International Airport Runway and Tunnel

Coal Combustion Product Type
Fly Ash

Project Name
Calgary International Airport Runway and Tunnel

Project Location
Calgary, Alberta

Project Participants
TransAlta, LaFarge Canada, PCL Construction, CH2M HILL, AECOM, Hatch Mott MacDonald, Dufferin Construction

Project Completion Date
2014

Project Summary
With roughly 18 million passengers and 240,000 aircraft landings and takeoffs in 2019, Calgary International is the fourth-busiest airport in Canada. At just over 3,600 feet in elevation, it is also one of Canada's highest airports. Owing to the thinner air, airplanes—particularly large aircraft or those carrying a heavy payload—require longer runways for take-off and landing. In 2011, the airport set about building a new runway that could accommodate the largest planes in the world. At the same time, it built a concrete traffic tunnel under the new runway, extending the existing Airport Trail both to provide a new access point to the airport and to link with one of Calgary's primary east-west connectors through the city.


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Project Description
Prior to construction of the new runway, aircraft landing at Calgary International used one of two other runways that ran at angles toward each other—a less than optimal situation depending on prevailing wind conditions. The new runway was designed to run parallel to the longer of the existing runways to help facilitate the flow of air traffic.

Although the need for an additional runway had been recognized up to 40 years earlier, construction only began in 2011. A life-cycle analysis had already been undertaken that concluded the durability and maintenance costs of concrete were more favorable than asphalt—and so concrete was selected as the surfacing material.

To increase the airport's capacity to accommodate international and other larger aircraft (including the Boeing 747-800 and Airbus A380), a runway length of 14,000 feet (2.65) miles was specified. The Calgary Airport Runway Development project consisted of one million square meters of concrete paving, or 400,000 cubic meters of concrete. TransAlta supplied fly ash for the concrete mix, which used a 15 percent replacement of portland cement. The resulting runway, 17L/35R, is now Canada's longest, and its placement represents one of the largest ever undertaken in Alberta.

Concurrent with its construction, the six-lane, 2000+-foot-long Airport Trail Tunnel was built underneath the runway to provide better traffic circulation around the airport. Engineers chose a cast-in-place concrete rigid frame design using a cut-and-cover construction method (rather than boring a tunnel under the runway). Here again, the structure's life-cycle costs and durability were major considerations in the design.

Owing to the relatively short time period—three days—between the placement of the concrete and the removal of the formwork during casting of the tunnel's concrete segments, an initial rapid rise of concrete strength was required. A mix design that maximized the use of fly ash was used to temper the subsequent heat of hydration. Additional cooling measures, including the use of ice and a liquid nitrogen injection system, were also used during batching.