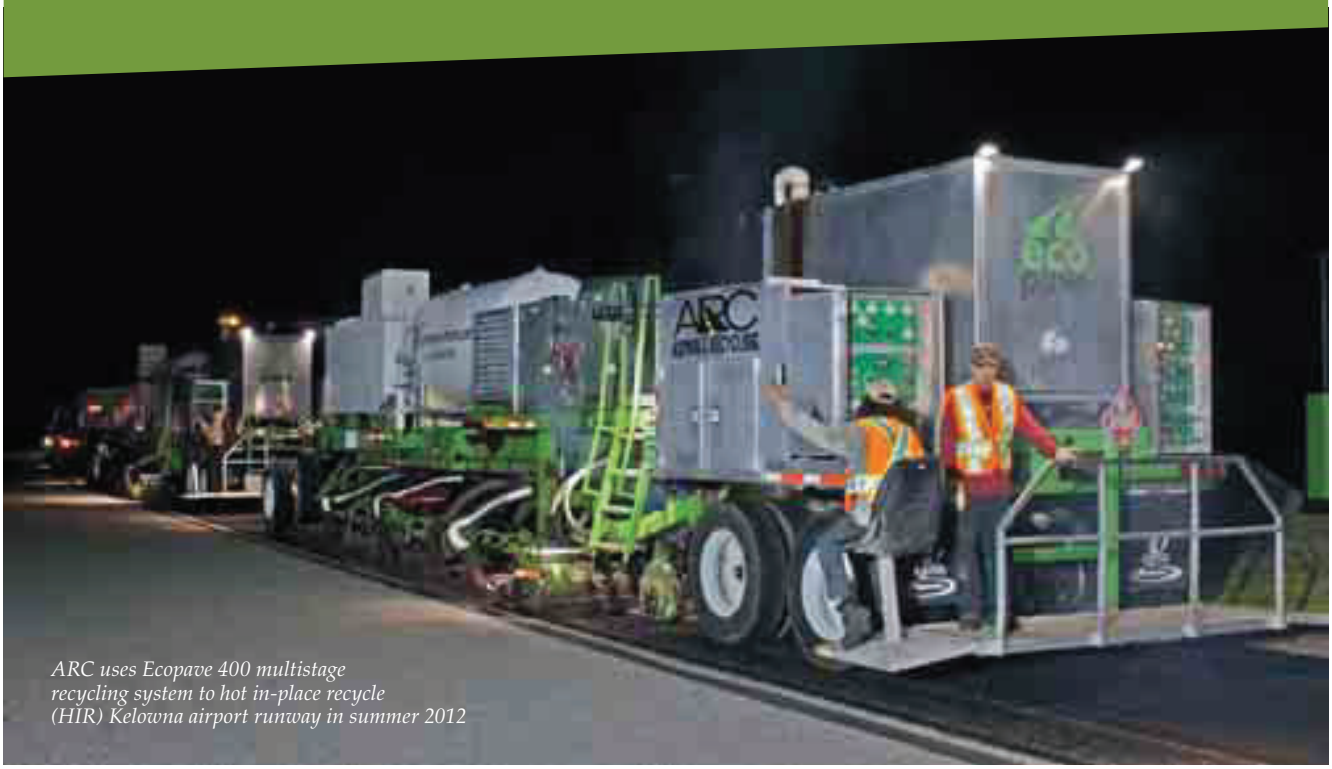
HIR Solves Cost Challenge to Runway Reconstruction

By Monty Kallio



ARC uses Ecopave 400 multistage recycling system to hot in-place recycle (HIR) Kelowna airport runway in summer 2012

Resurfacing asphalt runways at busy airports with commercial air traffic is always a challenge for owners, project managers and paving contractors. When this work is required at single runway facilities, the difficulties are compounded by severely limited working hours, typically scheduled during the night.

In 2011, the City of Kelowna, B.C., tendered a combined hot in-place recycle/mill-and-inlay for Kelowna Airport (YLW) Runway 16-34, its sole 2,600 x 61-m (8,530 x 200-ft.) runway. The tender also specified milling and inlaying of pavement on three taxiways and localized areas of the ramp/apron.

YLW is the busiest single runway airport in Canada, with about 1.4 million passenger movements annually. It is a vital component of the economy of the central Okanagan region and services an area population of over 100,000.

The project could not impact the daytime flight operations at YLW, where typical daily aircraft movements include 64 scheduled passenger flights, mostly 737s and Dash 8s (Q400), and 20 to 30 cargo/freight movements. A local flight training school with 15 aircraft and a vibrant general aviation community also utilize the airport. In addition, a major aircraft maintenance company capable of performing scheduled checks and repairs on a range of aircraft up to 757s operates out of the facility, while the provincial air medevac agency overnights and maintains a number of its aircraft at YLW.

CONSTRAINED WORK SCHEDULE

To accommodate these aircraft movements, runway shutdown was limited to a single five-and-a-half-hour period per 24-hour day; there could be no contractor access to the runway until 12 a.m., while all equipment had to be clear and the runway cleaned and swept by 5:30 a.m. the following morning, with the runway reopened for traffic at 5:55 a.m. Severe penalties would be imposed for any flight delays caused by the construction work or in the event of weather-related reopening delays.

The 2011 low tender, at C$6.4 million, far exceeded the budgeted amount for the work, and the project was canceled. The city then issued a request for proposals, opening up the project to alternative approaches to accomplish the resurfacing.

In 2012, SNC Lavalin Inc.'s engineering proposal was chosen by the city. SNC Lavalin specified and managed a revised strategy of separating the runway work from the taxiway work into two separate contracts. The entire width of the runway would be resurfaced by hot in-place recycling (HIR), with the addition of a plant-produced, virgin asphalt mix including the addition of an antistripping additive. The taxiways

would be repaired under a separate mill-and-inlay project, along with some areas of pavement reconstruction.

Renovating the runway as a separate HIR contract allowed three regionally located hot in-place contractors to bid on the runway resurfacing by pricing directly to the owner without going through, or being subcontracted to, general contractors.

Ken Fyvie, SNC's airport pavement specialist, was tasked with preparing contract documents and specifications and managing the two projects while maintaining the airport's operational requirements. Fyvie has extensive experience both with airport projects and hot in-place asphalt recycling, and believed that a 100-percent recycle of 50 mm (2 in.) of the runway, and adding 30-percent-virgin asphalt, would improve the existing in-place mix design of the 26-year-old runway pavement.

The Kelowna Airport projects were again tendered in 2012 by Kelowna as a hot in-place recycle with ad mix on Runway 16-34 while, in a separate tender, the taxiway pavements would be rehabilitated as a mill-and-fill, along with some reconstruction. The work-time limitations were increased by one hour over 2011, from 11 p.m. to 5:30 a.m., and the onerous penalties for daily delays and delayed completion were removed.

ARC Asphalt Recycling Inc., a Kamloops company specializing in HIR, submitted the low bid on the runway project at C$2.3 million, while the conventional milling and paving ramp work was later won by Peters Bros. Construction Ltd. of Penticton, B.C. at C$650,000. The cost of the two 2012 projects together was less than 50 percent of the 2011 tendered price when the runway and taxiway work were combined.

HIR TRAIN AT WORK

ARC is a well-established HIR contractor with a reputation for high-quality workmanship. The company's experienced and skilled crew utilize a state-of-the-art *Ecopave 400* multistage recycling system. ARC's typical recycling train consists of a preheater to get initial heat penetration into the pavement and to remove residual moisture that may be present, followed by heater/millers, each capable of milling, grinding and windrowing 25 mm (1 in.) of RAP and adding a portion of the rejuvenating/recycling agent.

Following the second milling machine is a combined pick-up machine/admix hopper/pugmill mixer pushed by the paver, in which the virgin mix is added to the recycled material and thoroughly mixed. The recycled asphalt mixture is then placed by a Cat AP 1050B paver and compacted by a Cat pneumatic roller and a Cat vibratory steel compactor.

As in all HMA paving, warm ambient temperatures allow more workability and time for compaction. In HIP recycling, the sun also provides valuable energy by heating the existing pavement surfaces. To provide more heat during night operations, ARC modified its recycling train by incorporating a second preheater and by adding a third heater/miller. The extra preheater provided enhanced

initial heat penetration and surface drying, while the additional grinder unit lessened the amount of material required to be removed by each unit, to achieve the specified 50 mm depth. Both additions would also increase the pace of production. A third roller, a rubber/steel combination, also was utilized to ensure the required compaction.

To produce the required admix, ARC set up its 2005 Terex 150 tph asphalt plant just five minutes from the jobsite. Although adding 30 percent of virgin HMA in the HIP process only required approximately 200 tons per shift, the custom nature of the added material made it cost-effective for ARC to use its own plant versus purchasing HMA from area stationary asphalt plants.

At Kelowna airport HIR project, recycled asphalt mixture is placed by a Cat AP 1050B paver

PASSES 7,217 FEET LONG

Runway 16-34 had been extended within the past few years, so the full length didn't need to be resurfaced. Each pass of the recycling train would be 2,200 meters (7,217 ft.) long. Passes would be 3.65 m (12 ft.) wide, and with overlaps, 18 passes would be required to complete the runway. With only six and a half hours of runway time allowed per shift, which equaled a maximum five and a half hours of production time due to moves on and off the runway, it would not be possible to complete a full length pass per shift.

ARC started the Project on June 10, 2012. Kelowna is in the center of the Okanagan Valley, with daytime temperatures in the 30°C (86°F) range possible in June, and the norm in July and August.

Spring 2012 in the region was colder and wetter than usual; the first half of the project saw average nighttime lows of just over 10°C (50°F) and sporadic precipitation. When July came, nighttime lows stayed in the mid-to-high teens Celsius, while daytime temperatures were regularly in the high 20s to mid 30s.

The residual mat heat from hot daytime temperatures made a measurable improvement in productivity. Initial production in the cooler June temperatures made it possible to complete only about a half pass per shift. The later, warmer weather allowed ARC to complete two full passes in three shifts; average production was between 1,400 and 1,500 m (4,593 to 4,921 ft.) of runway length per night.

To improve the existing mix design, the admix was coarsened, with a 19-mm (3/4-in.) maximum aggregate size, and about 4.5 percent asphalt cement. As there was potential for stripping in the existing mix, an antistripping agent was incorporated into the 150/200, group A admix asphalt cement. Tricor Refining's *Cyclogen L,*

supplied by Pounder Emulsions, was the specified rejuvenator, and was added at 0.4 liters per square meter (12.5 oz. per 1.2 square yard) or 0.33 percent by weight of the recycled mix component of the existing pavement.

The longitudinal profile of the runway also needed to be enhanced. Automatic slope and grade controls on each milling unit and on the paver contributed to achieving an excellent ride. The cut depth and ratio of admix had to be very consistent and the Ecopaver's auto-add system was strictly monitored. Any variation could result in an unacceptable bump or dip, or changes to the recycled asphalt mixture properties. As there was at least one transverse joint within each pass, extreme care was required to make each takeoff and remain within the smoothness specification, 6 mm (0.24 in.) maximum deviation measured using a 4.5-m (14.76-ft.) straight edge.

To enhance long-term performance, both the longitudinal and transverse joints were sealed using *Reclamite Preservative Seal* from Tricor Refining LLC, manufactured and supplied by Pounder Emulsions.

In the HIP process, the paver moves continually and a constant head of material is retained in front of the screed, so end-of-load segregation does not occur. Even with the coarsened admix utilized on the project, ARC limited segregation to three small locations, early in the project, all along the first pass, on the outer edge of the runway. These open areas were later sealed and sanded with *CRF Restorative Seal,* another Tricor product also manufactured and supplied by Pounder.

ARC completed the project on July 18, 2012, six weeks before the specified substantial completion date.

NO AIRCRAFT DELAYS

Not a single flight/aircraft delay occurred during the project. The owner was extremely pleased with the results; not only with the excellent finished product but with the lack of impact on airport operations. Garth Parker, ARC superintendent, Phillip Elchitz, YLW operations manager and SNC Lavalin's Fyvie all had positive comments about the hard work, cooperation and professionalism of the project team as well as the other participants.

Both Fyvie and Elchitz also had praise for the efficiency and organization of the work done by Peters Bros. on the taxiways and apron areas during the second part of the 2012 airport pavement rehabilitation work.

The success of the project still comes down to bottom line cost; more than C$2.5 million was saved by recycling the existing pavement in-place. Although there are a myriad of environmental benefits to recycling the runway, the cost of construction and life-cycle costs are what the City of Kelowna is responsible for to its taxpayers. Experience shows today's HIR technology is both less expensive compared to convention mill-and-fill processes, while life expectancy of recycled pavements is approaching what can be expected from new pavements.

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