

New Runway Ready for Take-Off

Rebuilding a critical runway at Fairchild Air Force Base required attention to every last detail—from the concrete to the construction technique to the calendar.

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From bombers to refueling tankers, Fairchild Air Force Base outside Spokane, Wash., for the last 70 years has played a vital role in supporting U.S. military missions around the globe. Today, the 92nd Air Refueling Wing, as part of the Air Mobility Command, and its associate, the 141st Washington Air National Guard (ANG) Air Refueling Wing, are the only Active Duty/National Guard teams designated to handle refueling and support for the entire U.S. fleet.

Pilots, flight crews, airmen and civilian personnel rely on the only runway on base, Runway 05-23, for all support activities. When it began to show signs of deterioration, and required increased and costly maintenance, base civil engineers knew the time had come for extensive renovation and reconstruction.

To meet its mission requirements for global air support, Fairchild AFB needed to relocate both wings—approximately 1,300 personnel—to alternate facilities in order to continue operations. Moreover, the project needed to be completed in one construction season to maintain operational efficiency.

With speed and sustainability in mind, Atkins, a global engineering and design consultancy serving as the lead design consultant on the project, set two primary objectives to meet Department of Defense (DOD) “green” goals at the outset of the renovation. The first was to minimize the amount of excess concrete not used in the reconstruction (either hauled off-site or remaining on-site). The second goal was to maximize the utilization of asphalt millings and any existing crushed aggregate base materials—thus minimizing the need for imported materials.

A RUNWAY IN NEED OF REPLACEMENT

Prior to renovation, Runway 05-23 stretched approximately 13,900-ft from threshold to threshold, with 1,000-ft paved overruns on each end. Overall width was 200-ft, with 50-ft of asphalt pavement on each side. The runway consisted of both concrete and asphalt surfaces.

Many of the pavements at Fairchild AFB were rebuilt in the 1950s and early 1960s, when the property underwent a major reconfiguration in preparation to accommodate B-52 aircraft. These pavements remained in service with only occasional maintenance until 2002, when the usable pavement was reduced from 300-ft to 250-ft. The outer 25-ft of existing pavement was abandoned in place. Remaining outboard (non-critical) asphalt pavements were removed to the aggregate base layer and new asphalt surfacing was placed to create a 200-ft wide runway with 25-ft shoulders. Along with asphalt pavement replacement, some selective concrete panel replacement also was conducted.

A pavement condition report prepared in November 2005 indicated that the primary load bearing pavement sections were below the critical Pavement Condition Index (PCI) of 70 for runways. The asphalt surface showed cracking due to cyclic high and low temperatures at the site. An alkali-silica reaction (ASR) investigation conducted by the U.S. Army Corps of Engineers also indicated progressive ASR in the concrete—with the presence of ASR in sample cores with natural-aggregate concrete and the pea-gravel repair materials.

ASR is a form of alkali-aggregate reaction found in concrete, caused by a reaction between the alkaline cement and reactive forms of silica in the aggregate. The reaction produces a gel that exerts pressure, resulting in cracking, and ultimately, failure. Pronounced ASR deterioration required continuous maintenance to keep the runway free of foreign debris.

The concrete keel section (center 50-ft of the runway) had been exhibiting signs of significant deterioration and, combined with 50 years of heavy use, was generating foreign object debris. This deterioration prompted the need for reconstruction.

THE RE-DESIGN

While keeping the runway length the same, the design team reduced the width to the Air Mobility Command standard 150-ft of full strength concrete pavement, flanked by 25-ft asphalt shoulders. The paved overruns are 1,000-ft by 150-ft wide. Along with the reduction in the width of the runway, reconstructing portions of the connector taxiways also was necessary, with replacement of a concrete surface identical to the runway. The renovation was scheduled for a 10-month window beginning in February 2011.

MATERIALS BALANCING ACT

As part of the strategy to comply with DOD’s sustainability requirements, existing concrete would be removed, crushed and re-used as much as possible.

The project team knew they would have to manage ASR-affected concrete with care. Due to the destructive nature of ASR material, the Air Force placed tight restrictions on where it could be reused. And with ASR-affected crushed concrete only being placed beneath shoulder and overrun areas, it was not anticipated that all concrete materials could be completely reused in the runway reconstruction. An earthwork balance exercise helped minimize the amount of existing concrete material left over.

Conversely, insufficient asphalt millings were available to completely fill voids left by pavement removal. To avoid the need to import large volumes of fill material from offsite locations, the millings were supplemented with existing crushed aggregate base typically found in the areas just be-



Construction of the new runway at Fairchild Air Force Base was completed on schedule in November 2011.

neath the existing asphalt pavement. This combination of asphalt millings and reclaimed crushed aggregate base material was used to fill the voids beneath the new concrete pavement structure.

THE TOTAL NUMBERS

By the time all the work had been completed, some 146,000-T of concrete had been recycled back in and used as aggregate base material. This accounted for roughly 60 percent of the total amount of concrete removed from the project. In addition to the recycled concrete, the aggregate base material placed under the runway also consisted of approximately 4,400-T of recycled asphalt millings. Additionally, another 87,000-T of concrete and 63,000-T of asphalt millings was salvaged to a local construction company for use on other projects. Everything on site that could be used was; extraneous materials were recycled and the project did not endure any of the delays that are common on runway renovations in other parts of the country.

RAPID PAVING AND PRODUCTION

The construction season in the Pacific Northwest is typically less than 10 months, leaving little leeway for delays. In fact, the average low temperatures are below freezing from November through March. Surveyors and construction crews teamed up to reconstruct the new runway with greater speed and efficiency than

might otherwise be typical of a runway renovation of similar size and scope.

Throughout construction, the paving subcontractor used a stringless guidance system for placing the graded crushed aggregate base course, which provided a platform for subsequent material layers. The stringless guidance system consists primarily of a GPS-guided machine control system that tracked elevation and slope as material was placed.

Advantages to this system were numerous. First, the approach allowed for more time on actual production and less time waiting for surveying and grade checking. Operators could finish jobs faster—and with minimal supervision—even in dusty, foggy, or dark conditions. Second, the need for stakes and stringlines, and the time needed for their installation, were alleviated. Personnel and machine costs also were reduced through the improved productivity.

The original schedule for concrete paving assumed production rates for single-lane paving to be on average 1,800-yd³ per day, with additional time needed for concrete curing and dowel bar installation between each lane.

The contractor proposed paving two lanes wide, a width of 37.5-ft, eliminating the additional curing and installation time between each pour. Furthermore, production rates ended up averaging 2,500-yd³ per day. This alone proved a tremendous improvement in saving time.

ENERGY MANAGEMENT

The Runway 05-23 project also included the installation of a new runway centerline and edge lighting system; runway distance markers; airfield signage; precision approach path lighting systems; approach lighting systems; electrical duct system and associated drainage; and revisions to the airfield lighting vault. The glide slope antennas, shelters and associated equipment also were relocated due to a change in threshold crossing height.

Through previous design considerations with Air Mobility Command, Atkins designed the airfield lighting systems to incorporate the use of LED lights and signage. Despite their higher upfront cost, the long-term benefits far outweigh this expense. LED lights have a longer life expectancy, consume less energy, and reduce stress on the airfield lighting cable. Additionally, the lights have an acute on/off contrast and produce a pure color that does not fade over time, which means safer, more reliable conditions. LED technology was used for the runway centerline lights, touchdown zone lights, runway guard lights, taxiway edge lights, and runway and taxiway signage.

The renovation of Runway 05-23 was completed on time in November 2011. Soon after, more than 1,300 airmen and civilians who were temporarily deployed to Grant County International Airport and Spokane International Airport returned to Fairchild AFB. With the construction completed, the 92nd Air Refueling Wing and 141st Washington ANG Air Refueling Wing can continue their support to the global mission.

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Aerial view of renovated Fairchild AFB Runway 05-23, outside Spokane, Wash. The redesign recycled about 146,000-T of concrete back into the project, one of many integral sustainability measures the design team incorporated. PHOTOS COURTESY OF U.S. AIR FORCE