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Innovative Engineers Pave New Paths in Afghanistan

By Major Steven A. Baker

Operation Enduring Freedom moves into its second year, and the engineers in Afghanistan have moved beyond initial-entry operations. They have started to attack some of the daunting general engineering and mobility challenges posed by this arid and austere environment. The 82d Airborne Division's 307th Engineer Battalion airfield repair team at Kandahar International Airport has introduced several construction initiatives in runway repair that will not only prolong the lifespan of the deteriorating airfield but also may change the way contingency airfields are repaired in the future.

One of the first problems that the team noticed in July 2002 was that the concrete runway repairs made by the first coalition engineers to arrive at Kandahar were

causing the asphalt around those patches to crack excessively. (See *Engineer*, July 2002, page 8) The cracks were due to the cold joint between the flexible asphalt pavement and the rigid Portland cement patches. While this technique kept the runway open for the first deployments and resupply, it created unacceptable debris after the summer relief in place of major combat forces. This method of repair—aggravated by extreme temperature swings between the day and the night and extremely dry air—did not provide a suitable long-term solution.

To overcome the cracks in the asphalt around the patches, the airfield repair team initiated several successful material and procedural changes that have been approved by Air Force officials throughout the area of operations. The

first significant method involved cleanly cutting and removing damaged areas, setting the concrete form inside the hole, and then filling the resultant gap between the asphalt and the Portland cement patch with cold-patch asphalt. The technique creates a flexible, easily maintained joint and a repair that can withstand thousands of sorties of traffic with only minimal additional maintenance.

The first step of the method is cutting out and excavating the damaged areas of asphalt. The key to this step is the use of a concrete saw with a diamond-tipped blade to create clean, linear cuts and a skid steer loader to quickly excavate the damaged asphalt down to the subgrade. The subgrade is then compacted and additional fill gravel is added so that the concrete patch created



Task force engineers inspect a damaged section of asphalt.

will be 8 to 10 inches thick. The form is cut and installed to create individual cells that are typically no bigger than 300 square feet. Plastic sheeting is placed over the gravel to prevent water required for hydration from percolating through the gravel. No. 5 rebar (12 inches on center with lateral bracing that is 16 inches on center) provides additional strength and minimizes cracking.

Finally, the site is ready for concrete placement with Type I cement, a change from the initial repairs that were done with Type III cement. The summer heat and lack of humidity caused the team to switch to Type I cement. It provided a mix with slower hydration but still offered the strength required for an airfield. The concrete is placed with an M919 concrete mobile and worked with standard tools and methods, including a hand-operated concrete vibrator, provided and operated by the 769th Engineer Battalion from the Louisiana Army National Guard.

To ensure that enough water is available for hydration, sandbags are placed over each new pad and watered regularly. After several days of curing, gravel is placed in the gap up to the level of the existing asphalt and then cold-patch asphalt is added and compacted to create a level surface for aircraft use. Asphalt sealant is then spread over the asphalt and the cold-patch to waterproof



Offset framework, complete with vapor barrier, is ready for the arrival of the concrete truck and crew.

the joint. The result is a durable surface that can receive thousands of sorties, to include C-5 Galaxy aircraft, with little or no additional maintenance.

Kandahar is such an important logistics hub in the region that the amount of time the airfield can be closed, or its usable threshold altered, is very limited. This is especially true in the summer when hot, thin air and a 5,000-foot altitude force many aircraft to use much of the total length of the 10,475-foot runway. This, combined with the fact that much of the runway is infected with deep spider and alligator cracks, requires rapid runway repair when the pavement does fail. The solution to this

challenge was achieved after operational testing. The result is a quick and effective soil patch that requires minimal maintenance, produces little debris, and can be constructed in 2 to 3 hours by a trained crew.

The early steps in this method mirror those of a preplanned concrete patch. A square or rectangular patch is cut and excavated down to the level of the subgrade. Then 2-inch slump concrete is placed in 2- to 3-inch lifts, raked of large aggregate, and covered with a thin layer of coarse sand. This process is repeated until the grade of the existing asphalt pavement is reached.



A recently stabilized soil patch is prepared for an application of dust control agent.

The last step of the method involves dust control. To prevent “brown-out” conditions that hamper visibility, EK 35®, a commercial dust control agent, is spread over the soil patches in several thin coats until the agent begins to pool. This nonflammable, non-corrosive binding agent not only prevents brownouts, it actually increases the durability of the soil patch. The dust control agent has been so successful that it has been used on many of the high-traffic shoulder areas of the airfield and on many of the helicopter landing zones throughout the Afghanistan area of operations.



An overhead view of Runway 23 shows that Federal Aviation Administration-approved reflective paint, plus a recent application of asphalt sealant, can make a runway look new despite its age.


The advantages of this unique soil patch technique are more than just speed and durability. When the patches fail, as they typically do after about 2,000 sorties, they fail in thin layers that tend to crumble into a nonthreatening sandy residue rather than into dangerous pieces of gravel that could destroy an aircraft engine. This technique does not require cumbersome airfield matting to be drilled into the existing runway surface before aircraft can land. In July and August 2002, more than a dozen C-5s landed on these soil patches without incident.

As a result of the success of these durable soil patches and the outstanding performance of the skid steer, the 307th Engineer Battalion is reviewing its current doctrine and equipment required for the rapid runway repair mission. A significant savings in the airframes required for a light airfield repair package mission could be seen if the skid steers (after heavy-drop certification) replace the current dozer—the deployable universal combat earthmover (DEUCE)—and if the extremely heavy runway repair matting was simply

deleted and replaced with additional cement and finishing tools.

Another innovative construction technique used at the Kandahar airfield involved the close coordination of the airfield repair team, the airfield manager, and the U.S. Air Force. As the long-range plan for the repair of the runway was being jointly scripted, it became obvious that some of the major repairs would reduce the usable threshold of the runway by several thousand feet due to the position of the damaged sections. This was unacceptable during the heat of the summer because the heavily laden aircraft needed as much runway as possible to lift off.

Because Kandahar's main runway is 148 feet wide, the team agreed it would be feasible to offset the runway centerline to the east and then to the west to accommodate repairs on each shoulder. This would keep them from postponing much of the necessary construction into the cooler weather of the fall and winter when the threshold could be reduced without affecting air traffic. While this scheduling option required the airfield repair team to paint

and repaint the runway centerlines, and required the airfield manager to issue numerous Notice to Airmen warnings, it allowed the runway construction to proceed so that much of the major construction would be complete before the onset of winter precipitation. 

Major Baker is the executive officer of the 307th Engineer Battalion, 82d Airborne Division, at Fort Bragg, North Carolina. He recently returned from a six-month tour in Afghanistan as the Coalition Task Force C-7/Task Force Panther engineer. His previous assignments include commander of A Company, 307th Engineer Battalion, and commander of the 82d Airborne Division Advanced Airborne School. He served in the 547th Engineer Battalion in Germany and in Saudi Arabia during Operation Desert Storm and with the New York District Corps of Engineers in New Jersey, Greenland, Albania, Macedonia, and Kosovo. He is a graduate of the United States Military Academy and holds a master's in civil engineering from the University of Florida.