Grooved runway surfaces drastically reduce all types of skids, including dynamic hydroplaning

THE EVER INCREASING COMPETITIVE environment of today's global marketplace demands that airplanes continue to fly in all kinds of weather. As such, it is essential that air carriers, airport owners and pilots deliver on their ability to keep flight options safe and on schedule. No matter what the weather, all fixed-wing aircraft require precise, skid-free landings — every time. Even when wet and flooded, runways and taxiways must deliver the best possible overall ground handling and stopping characteristics that today's state-of-the-art technology can provide.

Pilots have observed that transverse-grooved surfaces drastically reduce all types of skids on wet or flooded runways and provide positive nose-wheel steering during landing roll-out. Grooved surfaces also prevent the onset of drift and weathervaning. Pilots find overall ground handling and stopping characteristics on grooved surfaces a dramatic improvement over ungrooved surfaces.

Grooved surfaces also prevent the onset of drift at touchdown in flooded areas due to high cornering forces. From the pilot's point of view, the overall airplane ground handling and stopping characteristics on grooved surfaces show remarkable improvement over other surfaces.

These facts were confirmed in flight test programs conducted by NASA. The tests investigated the differences in wet runway braking effectiveness resulting from grooving the pavement surface. Previous tests have shown grooving to be an effective method for maintaining high friction on a wet surface. More recent research has produced the same results. In addition, a test on different types of grooving determined that sharp edge grooving (diamond saw cut grooves) was the most effective.

>>> TESTING PROCEDURES

IN ONE OF THE TESTS, the landing research runway was divided into separate test sections and bound by 2-inch rubber dams to provide an even water depth. Braking was done for ground speeds ranging from about 50 to 150 knots. The tests involved accelerating to the desired speed from a standstill to the take-off position or landing short of the test section and adjusting speed. This speed, or a slightly higher speed, was held until about 100 yards before the appropriate test sections. At this point, power was reduced to idle and the spoilers extended. The timing allowed the engines to spin down to idle thrust before entering the test area. Brakes were abruptly applied to the maximum deflection while the wheels were still on the dry reference section and were maintained through two wet or flooded test surfaces, one grooved, and one ungrooved.

In another test, eight concrete test surfaces were used to determine which was the most effective grooving configuration. The surfaces included one ungrooved and the rest grooved with different pitches and using different methods, either tining or sawing. The tining technique involved raking or combing the groove shape into the surface while the concrete was still in a plastic state. With the diamond sawing technique, the groove was cut into the cured concrete surface with a diamond-tipped circular blade. These surfaces were all flooded for the test purpose.
ABOUT IGGA

The International Grooving & Grinding Association (IGGA) is a non-profit Trade Association founded in 1972 by a group of dedicated industry professionals committed to the development of the diamond grinding and grooving process for surfaces constructed with Portland cement concrete and asphalt. In 1995, the IGGA joined in affiliation with the American Concrete Pavement Association (ACPA) to represent its newly formed Concrete Pavement Restoration Division. The IGGA / ACPA CPR Division now serves as the technical resource and industry representative in the marketing of optimized pavement surfaces, concrete pavement restoration and pavement preservation around the world. The mission of the IGGA is to serve as the leading promotional and technical resource for acceptance and proper use of diamond grinding and grooving as well as PCC preservation and restoration. For more information, visit www.igga.net.

>>> A PROVEN SOLUTION

There are few worse feelings for a pilot than losing braking effectiveness on a wet runway. On the ungrooved flooded surface, the pilot was helpless. No braking techniques had any positive effect and wheel rotation often ceased, even without brake pressure. Some directional control remained through the use of the rudder, but the cross-wind drift could not be stopped until some side force could be generated through wheel friction.

In contrast, the transverse-grooved saw-cut surface provided impressive braking and the wheels could generate a side force to prevent lateral drift. Pilots found that deceleration on a wet, saw-cut grooved surface is almost the same as the dry surface and any nose-wheel steering lost on the ungrooved surface returns once braking resumes on the grooved surface. The test results indicate that when a runway is flooded, the saw-cut grooved surface provides better braking traction than an ungrooved surface.

Also, grooves with sharp edges are more effective than rounded groove edges. A groove configuration with rounded edges provides the least traction. The sawing technique also provides the most uniform and consistent groove patterns. Vital NASA research has led to the current Federal Aviation Administration (FAA) runway grooving configuration of ¼ inch by ¼ inch (groove depth and width), spaced 1 ½ inches center to center, which is utilized on most major runways in the United States.

Pilots need to know that when they land they can maintain maximum effective braking. A saw-cut transverse-grooved concrete landing surface will ensure that the aircraft will have a safe, uneventful landing despite the weather.

Benefits of a saw-cut grooved surface:

- **MINIMIZED SKIDS:** Overall good ground handling is sustained.
- **MINIMIZED HYDROPLANING:** Positive nose-wheel steering is maintained during landing roll-out.
- **MINIMIZED DRIFT:** Provides high cornering forces.
- **IMPRESSIVE BRAKING:** Reduced stopping distances.
- **SAFER LANDING:** Pilots can maintain control in bad weather landings.
- **CONTINUED LANDINGS IN WET WEATHER:** Pilots can safely land on wet, flooded runways, allowing the air carriers, airport owners and pilots to stick to their schedules during inclement weather.

Consider this ...

- According to the National Air Traffic Controllers Association, on any given day, more than 87,000 flights are in the skies in the United States.
- These airplanes account for approximately 64 million takeoffs and landings a year.
- Transverse-grooved landing surfaces ensure that each of these flights can safely land.