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Rebuilding Airport Safety

Airport managers and pilots must take precautions so that changes in taxiway and runway configuration during construction and maintenance do not create a hazard.

BY GERHARD GRUBER

Airports, like aircraft, periodically undergo maintenance and overhaul. Unlike aircraft, which can be temporarily taken out of service, airports typically must keep operating even while they are being repaired and expanded — and while parts of movement areas are excluded from normal use. Consequently, safety threats arise both for airports and aircraft operators.

Airports are obliged to provide an infrastructure that will cope with increasing capacity demand for aircraft

and passenger movements. To meet these goals, airport managers must arrange for construction of extensions of the ground facilities. Maintenance (scheduled and unscheduled) is an additional ongoing process.

Equipment and buildings everywhere have a service life. Those within an airport are no exception. Runways, taxiways, aprons and navigational aids (including mechanical and electrical parts) require regular servicing. They eventually will be replaced or renewed when their service

life has expired or when new technology is adopted.

The work required for keeping the airport up to the International Civil Aviation Organization (ICAO) standards may include resurfacing, repainting, extension or construction of any airside surface; the installation, testing or calibration of electrical equipment; and the demolition or construction of buildings.

Airside facilities are exposed to extreme conditions. At many airports, the temperature can vary as much as 65



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degrees C (117 degrees F) during the year, such as minus 25 degrees C to 40 degrees C or minus 13 degrees F to 104 degrees F. These environmental changes eventually take their toll on all exposed materials and equipment. An asphalt or concrete surface expands and contracts with temperature variation, resulting in cracks or buckles.

Weather exposure and ultraviolet light cause fading of surface markings and signs, requiring their repair or replacement. Tire material deposits from landing aircraft obscure the surface markings. Rain, snow and anti-icing chemicals accelerate the aging of paved surfaces and ground installations.

Water seeping into cracked surfaces can erode the underlying road base, creating depressions or “potholes,” which make an uneven or fragile surface. When water freezes between layers of road base material or in cracks, it expands, producing damage. When pavement breaks down, the surface material becomes loose and can break off.

Loose asphalt or bits of concrete create a serious threat of foreign object damage, or FOD, to aircraft because these materials can be sucked into the aircraft’s turbines, or damage tires or the aircraft structure. Repairing such damage may mean an expensive out-of-service period for the aircraft.

The airport operations staff, therefore, performs frequent checks of the surface of the movement areas to ensure an environment free of foreign objects.

Closing Time

Closure of some movement areas typically cannot be avoided when maintenance is necessary. In former times, this was an easy task for many airports. When capacity demand was low, single-runway operation of a dual-runway airport did not create much restriction. The construction/maintenance site and aircraft operation could be well separated. No crossing of an active movement area by ground vehicles was necessary. All the work could be done during daytime.

As traffic increases year by year, however, many airports are running at maximum capacity. Extending the infrastructure often is restricted because of environmental considerations. Building an additional runway is hardly possible for many airports, and even where feasible, it usually takes far more time than expected because of the complex approval process. This, combined with traffic growth, can put considerable pressure on airport infrastructure.

Any maintenance of movement areas (especially taxiways or runways) affects capacity. A capacity restriction must be avoided as much as possible. Therefore, construction often must be performed during nighttime, in different phases (stages), section by section and quite often close to the minimum safe distances from aircraft operations. The re-opening of movement areas after nighttime maintenance is also a big challenge for the airport operations staff.

Any required crossings of movement areas by ground vehicles require special precautions and specific staff training. The coordination of all tasks is complicated and must be carefully scheduled.

When maintenance work is arranged in different phases, ground personnel and pilots must pay close attention, since this will result in frequent closure and re-opening of parts of the movement areas. Consequently, procedures such as taxi routing, wingspan restrictions and approach procedures are changed accordingly. All ground and flight personnel must be informed about the situation by maps, taxi diagrams, instructions, notices to airmen (NOTAMs), automatic terminal information system (ATIS) and other means in time for them to adjust.

Constant Change

Heraclitus, the Greek philosopher, said that it is impossible to step into the same river twice. Airports, thanks to their need for upkeep and growth, are also in a state of constant change. Pilots should never assume that the airport is



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in the same condition as it was the previous day or even earlier the same day. It is extremely important that they check NOTAMs and ATIS prior to every arrival and departure for possible restrictions prompted by maintenance or construction.

Special precautions, such as temporary surface markings, marshaller service and physical barriers, must be applied in complicated situations to maintain the safety level and to help prevent errors by pilots and ground staff. Visual aids must be converted or added to avoid false guidance of aircraft into closed areas and to provide alternative taxi routings.

When temporary centerlines need to be introduced, two methods are

applicable: either painting or pasting. For both methods the surface must be dry before application.

Pasting a temporary centerline by using adhesive reflecting material has the advantage that it is highly visible, even during marginal light conditions. It can be removed easily, causing no damage to the surface. The disadvantage of this method is that the marking is susceptible to damage by the traction of ground vehicles.

Painting a temporary surface marking is quite inexpensive. The disadvantage of this method is its removal, which can only be done by using high pressure water or mechanical methods, and this can damage the surface.

To prevent such damage, usually the painting method is used to cover existing centerlines leading into construction areas. Caution is necessary, because under certain conditions — glare from the sun or other light sources — it might appear that the covered line still exists, particularly when the surface is wet.

Centerline lights and electrical circuits must be reconfigured to prevent guidance of pilots or vehicle drivers into closed areas. Temporary vehicle access roads or taxiways also may be necessary to re-route traffic around construction areas. Every displacement needs careful planning to provide the obstacle clearances required by ICAO.

Some construction and repair work can only be carried out within a specified range of meteorological conditions. Certain phases of projects may have to be completed in a specific sequence. For example, all equipment must be removed from the sensitive areas when conducting calibration flights for an instrument landing system (ILS); paving the surface must be done in favorable weather and must be completed before

surface markings are applied. Changing financial conditions may alter the start date and duration of construction projects.

Considering all these factors, plans should assume that congestion and delays during peak airport operating hours may occur from time to time during construction or repair work.

Displaced Thresholds

One major threat is the temporary displacement of a runway threshold, which is required during runway extension and other construction work near the threshold. It has been shown in the past that accidents and incidents involving displaced thresholds are a serious threat. A pilot may be influenced by habit to use the original threshold, ignoring a temporarily installed precision approach path indicator, even though all its lights are red and all other visual aids — surface markings, threshold lights, etc. — indicate the displaced threshold. Aircraft landing short may collide with the elevated approach and threshold lights.

Experience with displaced thresholds shows that even the publication of an instrument approach procedure involving a localizer and distance measuring equipment is no guarantee against landing short of a temporary displaced threshold. It is much safer when the electronic glideslope is displaced to compensate for the temporary threshold. This practice usually results in a considerable amount of expensive work, such as building a concrete basement for the ILS transmitter, the relocation of all electric equipment and recalibration of the localizer.

Signage

The signage system also needs to be adapted to any new routing situation. Taxi signs and lighting that are, for



A Grim Lesson in the Risks of Airport Construction

On Oct. 31, 2000, a Singapore Airlines Boeing 747-400 began a takeoff roll on Runway 05R at Chiang Kai-Shek International Airport, Taiwan. Heavy rain and strong winds from a typhoon were moving toward Taiwan and visibility was low.

On Aug. 31, the Civil Aeronautics Administration of Taiwan (CAA) had issued a notice to airmen that part of Runway 05R was closed because of construction work, and would remain so until Nov. 22. The 747 flight crewmembers were aware of the partial closure of Runway 05R, and believed they were taxiing to the assigned runway, 05L. But instead of passing the threshold marking for Runway 05R and continuing to Runway 05L, they turned the aircraft onto Runway 05R and began the takeoff.

The airplane struck concrete barriers, runway construction pits and construction equipment. Four cabin crewmembers and 79 passengers were killed; four cabin

crewmembers and 35 passengers received serious injuries. The 747 was destroyed by impact forces and a post-accident fire.

The accident report by the Aviation Safety Council of Taiwan said that Runway 05R “was not available for landing, but pilots were able to request its use for takeoff.” According to the CAA, the report said, there was no runway-closed indication near the Runway 05R threshold because that portion of the runway was still being used for taxi operations on the night of the accident.

“In addition, given the inbound typhoon, it was not safe to erect mobile runway-closure signs, which may have been blown into taxiing aircraft,” the report said. “There were warning signs demarcating the construction area on Runway 05R but the distance from the 05R threshold to the construction area precluded the pilots from seeing those lights.”

— Rick Darby

the time, incorrect must be covered or clearly crossed out so that is obvious that the taxiway is no longer in use. Crossing out the taxiway signs instead of fully painting over or erasing them has the advantage that pilots or vehicle drivers can still use them for orientation.

In case of a runway or taxiway closure, physical barriers and signs must be erected to indicate the closure and to prevent inadvertent entries into

the closed area. Runway or taxiway closure lighting will be required during nighttime.

The safety assessment for every construction area and phase will need to be performed in accordance with the safety management system described in ICAO Annex 14. This includes consideration of jet blast into construction areas.

When tools or other loose equipment is not secured safely, jet blast can easily blow them away. Therefore, the specified safe distances must be kept between construction activity and aircraft operations. Some situations even require temporary blast fences.

Paying Attention

Airport managers and pilots can take away from this discussion two key concepts:

- Situational awareness is extremely important to every operation in the dynamic airport environment, especially during airside construction and maintenance operations, to prevent disorientation and maintain critical obstacle clearance.
- Keep up to date with NOTAMs and ATIS, and always pay close attention to changes in familiar surroundings.

The ICAO safety management system and guidance from Airports Council International are both necessary when planning construction areas with the required level of safety in the interest of the airlines, passengers and construction or maintenance personnel. ●

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