10. THE AIRLINE PILOTS LOOK AT RUNWAY GROOVING

By Carl F. Eck

Air Line Pilots Association, International

SUMMARY

The airline pilots have now had the opportunity to use grooved runways operationally for over a year. They have found significant benefits from this development and desire its universal application at all airports. Because of variable operating conditions and the fact that grooving only allows a wet runway to approach the braking capability of a dry runway, they do not believe that any reduction in runway length requirements on wet runways should result from this grooving.

INTRODUCTION

Every airline pilot has learned from experience that the braking capability that can be reasonably expected on a dry, clean runway surface is not attainable on all dry surfaces. Even this lesser braking capability deteriorates rapidly when various amounts of water and other contaminants are present. Safety representatives from Air Line Pilots Association, International (ALPA) have searched long and hard for the best way to remove the hazards associated with this condition. Take-off and landing runway distances are all computed on the basis of hard dry runways, and there is for all practical purposes, no extra safety margin available for this braking deterioration in the case of abort at V_1 during take-off. (V_1 is the speed at which the pilot must decide whether to abort or continue take-off.) Landing distances are also too marginal when all the variable stopping factors involved are considered.

DISCUSSION

In August 1965, ALPA published in the AIR LINE PILOT an article entitled "The Short Runway" (ref. 1), which is a case history of what happens when adequate braking capability is not present. The following are excerpts from this article.

"On June 29, 1965, a Federal Aviation Regulations amendment designated as 121-9 was signed by FAA Administrator Najeeb Halaby. The amendment states that beginning on January 15 of next year (1966), a 15 per cent increase in the effective landing runway length will be required for airline turbojet aircraft when landing on a runway which is forecast to be wet at the aircraft's estimated time of arrival, regardless of ceiling and visibility.

"Less than 48 hours later, on July 1, the need for longer runways and adequate over- and under-run areas was once again brought vividly into focus by the crash of a Boeing 707 loaded with 59 passengers and a crew of seven at the end of its landing roll on a rain-slick 7,000-foot runway at Kansas City Municipal Airport (MKC).

"It was only the skill of the pilot and extreme good fortune that averted a tragic fatal crash as the airplane skidded past the end of the wet runway and struck a dike. Hitting the dike head-on would have resulted in an even more severe break-up of the airplane. Knowing this, and realizing that he could not stop the aircraft before reaching the end of the runway, the captain succeeded in swerving the plane, thus hitting the dike sideways.

"Current certification rules require landing aircraft to be able to come to a full stop from a 50-foot threshold height on a dry runway within 60 per cent of the runway's total length. In the case of a 7,000-foot runway, for example, the required distance under current rules for coming to a full stop would be 4,200 feet or less. The remaining 40 per cent, or 2,800 feet, would be provided as a safety margin for adverse runway conditions or for unavoidable variations in landing situations involving touchdown speeds and distances.

"These current rules will remain in effect for turbojet aircraft operation on dry runways only. Under the new rules for wet runway operations, for example, an 8,050-foot runway length would be required instead of 7,000 feet in order to avoid a reduction in landing weight.

". . . Kansas City Municipal Airport is just one of many airports which has been the subject of concern to ALPA during recent years as having inadequate runway length margins for adverse weather operation of jet transports. MKC (the designation for Kansas City Municipal Airport) was 'lucky' in this July 1 crack-up, as it has been in numerous others, in that no fatalities resulted. Only four of the 66 persons aboard the airliner were injured--none seriously.

". . . Over-runs are caused initially by one or more of a number of unavoidable (and usually compounded) conditions--slippery runways, worn, smooth tires, crosswinds and high or fast approaches due to adverse weather--but the causal factor underlying all over-run crack-ups is the fact that most runways are too short for operations under those conditions!

"An over-run on landing is not the only situation in which tragedy lurks on a short runway. A great danger of over-run exists in the case of an aborted take-off, especially during hot weather or on icy or slushy runway surfaces (both are frequent conditions at MKC). It is extremely doubtful whether a jetliner pilot could stop his aircraft before the end of a 7,000-foot runway if he were to experience a power failure at or near V_1, the speed at which he must decide whether to continue the take-off or abort (stop).

"Adding to this problem is the fact that natural and/or man-made obstructions surrounding many airports might make it impossible for him to follow through with the take-off with reduced power capability. It is this area of danger--the aborted take-off--that the new FAR amendment fails to recognize, in that it allows only for landing on wet runways and disregards the need for adequate safety margins for take-offs.

"Another danger connected with landing on a short runway is the fact that the pilot knows that he must touch down fairly close to the threshold end of the strip, especially in bad weather, therefore increasing the possibility of an undershoot. (For a detailed report on the over-all short runway situation and other ALPA investigations and recommendations on the matter, see 'The Need for Longer Runways' in the September, 1964 issue of the AIR LINE PILOT [ref. 2].)"

In order to alleviate the conditions cited above, ALPA has reviewed several ways of reducing the hazards on marginal-length runways besides lengthening the runway, which is obviously one of the best ways. These measures for improvement include adding overrun/underrun, improving the drainage, and increasing the braking capability on the runway. ALPA has especially encouraged these corrective measures at Kansas City as well as at other similar marginal-length-runway locations. Because of the limited ground available at Kansas City, one of the most expeditious ways of improving the safety of operations was believed to be through the improvement of stopping capability by grooving the North/South runway. Thankfully, the airlines and the airport management cooperated and grooved 4500 feet of this runway. However, ALPA is distressed to note that repeated efforts to obtain grooving of the remaining 500 feet at the south end of the runway and 1900 feet at the north end have not been successful. Comments from pilots flying into Kansas City attested to the benefits derived from the grooved portion of the runway. Regrettably, the safety benefits possible from runway grooving at Kansas City have not been completely realized because the portions of the runway where the need is most – that is, the last 500 feet of the runway at each end – are still not grooved. On at least one occasion recently, a jet airliner has almost gone off the north end of the runway. This is attributed by ALPA to the ungrooved condition of the north end of the runway.

The grooved runways at Washington National, John F. Kennedy International, and Chicago's Midway airports, as well as at Kansas City Municipal, have been well accepted by the airline pilots as a step forward toward improved stopping capability on wet runways. It has been found that runway surfaces which are slippery as a result of jet soot, rubber, dust, water, and so forth can be connected to safe stopping surfaces by the use of runway grooving.

Pilots have known for years that the runway length regulations do not provide them with the stopping capability under all operating conditions that they must have.

Invariably, pilots that have used grooved runways under wet operating conditions have obtained improved stopping capability. However, this improvement has only allowed the pilot's stopping capability to approach the dry stopping distances. Therefore, there are a number of operating considerations which necessitate ALPA's demand that the runway length now required for jet aircraft on wet runways be continued. Among these are the following:

(1) The amount of improvement in braking will vary with conditions of the pavement grooving due to wear and the amount of water on the runway.

(2) The 15 percent added landing length for wet runways is marginal because even grooving would not increase friction under snow and ice conditions. Take-off abort distances from V_1 are especially marginal under these conditions.

(3) Stopping distance is affected by variations in touchdown points, speed at touchdown, and aircraft braking efficiency and technique, some of which are affected by the wind and weather involved as well as runway surface.

At the present, the number of jet airports with the following limited runway lengths is

5 below 5000 feet
20 below 5500 feet
35 below 6000 feet
50 below 6500 feet

Runways on which particularly slippery conditions exist should be given high priority. Pilots have named airports at the following cities as needing early attention:

New Orleans, Louisiana (Runway 10)
Boston, Massachusetts (Runway 4R)
Lehue Kauai, Hawaii (Runway 3)
Atlanta, Georgia (Runway 9R)
Cincinnati, Ohio (Runway 27L)
St. Louis, Missouri (Runway 24)
Cleveland, Ohio (Runway 27)
New York's LaGuardia (Runways 22 & 31)
Columbus, Ohio (Runway 10L)
Newark, New Jersey (Runway 22)
Chicago, Illinois, O'Hare (Runway 27R)
Hilo, Hawaii
Grand Junction, Colorado (Runway 11)
Little Rock, Arkansas (Runway 4)
Fayetteville, Arkansas (Runway 16)
Paris, Texas (Runway 21)
Joplin, Missouri (Runway 13)
Honolulu, Hawaii (Runways 4L & 4R)
Rochester, New York (Runway 28)
Akron, Ohio (Runways 19 & 23)
Charleston, West Virginia (Runway 23)

CONCLUDING REMARKS

The airline pilots who have used runways that are grooved have found them to be of distinct assistance in improving stopping capability and maintaining runway alinement.

Therefore, ALPA strongly recommends that runways be grooved similarly to those at Chicago's Midway Airport. However, since the benefits derived from grooving assist only in bringing the runway braking coefficient closer to that for dry pavement, there should be no change in the regulations that presently require additional runway length for wet runways. The extended benefit of runway grooving on blacktop and concrete over a long period of time has not been assessed completely, but ALPA is strongly convinced that there are important benefits to be obtained by runway grooving.

ALPA looks forward to the acceptance of this very worthwhile safety feature by the aviation industry for use at all airports. Runways on which particularly slippery conditions exist should be given high priority for grooving. Even where runway grooving has been provided, ALPA strongly recommends that periodic cleaning schedules be established for removal of carbon, rubber, loose materials, and other contaminants from ALL runways.

REFERENCES

1. Linnert, T. G.; and Burroughs, K. L.: The Short Runway. Air Line Pilot, vol. 34, no. 8, Aug. 1965, pp. 10-13.

2. Linnert, T. G.; and Burroughs, K. L.: The Need for Longer Runways. Air Line Pilot, vol. 33, no. 9, Sept. 1964, pp. 12-16.