Evaluation of Aircraft Excursion Risk at Bandaranaike International Airport

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Abstract

Though Safety is one of the top priorities in the aviation industry, according to the IATA statistics (2020), all accident rate in 2019 was 1.13 per million flights. Among the aircraft accidents, the majority of aircraft accidents take place at airports and airport near vicinity areas. Considering the airport-related accidents, a high proportion of aircraft accidents have occurred during the landing and takeoff phases which are altogether only 1% of the whole flight time of 1.5-hours flight duration. Aircraft excursions and incursions are the two key types of accidents at runways. With regard to runway excursions, landing, and takeoff overruns, veer-offs and landing undershoots are common aircraft accident types. As IATA figures, there were 17 runway excursions (32% out of total aircraft accidents) in 2019 and it was identified as an area where further improvements need.

These excursion accidents can take place at any runway facility depends on the aircraft and airport operational and design factors. Thus, risk analysis which assesses potential event probabilities is a vital component in aviation risk management. Quantitative approaches such as risk models and qualitative approaches such as risk matrix, expert opinions, etc. are commonly used in risk assessments. Accordingly, under the Airport Cooperative Research Program (ACRP), Transport Research Board (TRB) developed models for overrun, veer-off, and undershoot probability estimation at landing and takeoff operations. Thus, excursion risk at distinct operational and weather conditions can be estimated along with these event probabilities and the corresponding severities.

Referring to Runway Protection Zones (RPZs) Risk Assessment Tool developed in ACRP 168 by Shirazi et al. (2016), this paper estimated landing overrun risk for 4E category B747-400 aircraft (critical aircraft for BIA) at various operational conditions at Bandaranaike International airport (BIA). The model developed by Ayres et al. (2014) was used to analyze landing veer-off risk. Those estimated landing overrun and veer-off risks were compared with regard to the risk at 30^{o} C ambient temperature. Accordingly, the corresponding overrun risk increase by 27 times at tailwinds 12 knots or above. Similarly, when it rains, the above estimated overrun risk will increase about 5 times. Further, the corresponding veer-off risk increase approximately 10 times when crosswinds above 12 knots. Considering the sensitivity of various weather factors, the impact of fog, visibility, rain, and tailwinds gradually increase on landing overrun risk. In the BIA context, a condition at which tailwinds 12 knots with rain

and reduced visibility will be the worst weather conditions on landing overrun risk. Thus, excursion risks vary at different operational and weather conditions. Additionally, this research emphasizes the importance of runway design elements such as runway length, runway shoulders, airfield safety areas such as Runway End Safety Area, Object Free Area, and arresting systems such as Engineered Material Arresting System, etc. These elements can minimize potential excursion risk by minimizing corresponding event probabilities or respective severities. Accordingly, airfield design elements play a vital role in minimizing and maintaining aircraft excursion risks at a universally accepted target level of safety indeed 10^{-8} for a landing mission.

Keywords: *excursion, overrun, veer-off, undershoot*

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