IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 11, Issue 3 Ver. II (May- Jun. 2014), PP 75-78
www.iosrjournals.org

"Runway Excursion: A Problem"

Piyush Gandhewar, Asst. Prof. Hemantkumar G. Sonkusare
4th sem M.tech. Transportation Engineering, G.H. Raisoni College of Engineering Nagpur, India
Civil Engineering Department, G.H. Raisoni College of Engineering Nagpur, India

Abstract: *Landing and takeoff overruns, undershoots, and veer-offs account for most of the accidents that occur on or in the immediate vicinity of the runway. Accident statistics show that, from 1959 to 2009, 55% of the world's jet fatal aircraft accidents occurred during landing and takeoff phases of the flight and accounted for 51% of all onboard fatalities (Boeing 2010). Although in many cases the causal factors involve some type of human error, the conditions at the airport may contribute significantly to the probability and severity of the accidents.*

The purpose of this study was to collect the data of runway excursion accidents and find out the reason how and why they happen. We have mainly focus on contamination of runway.
Keywords: *Excursion, Overrun Veer-off, etc*

I. Introduction

A runway excursion is defined as when an aircraft departs the runway either by veering off the side or by overrunning the runway end. According to research carried out by three groups, The Flight Safety Foundation, the Netherlands Lab R and IATA, runway excursions are now the most common type of event leading to accidents in commercial operations. These excursions are generally as a result of a poor approach leading to an abnormal landing or a loss of control on the runway either during takeoff or landing. However, the research has also shown that a runway excursion need not lead to fatalities if the runway area is designed with a view to enhancing post accident survivability.

We have analyzed the runway excursion accidents involving the worldwide commercial jet aircraft. Which types of accident has been responsible for fatalities in the last decades.

Which types of factors are responsible for accidents due to the excursions either range of flight crew technique and decision, weather, flight crew performance, and systems-related factors, runway condition, contamination, breaking system, etc

II. Types and Runway Excursion Problem

A runway excursion is defined as when an aircraft departs the runway either by veering off the side or by overrunning the runway end.

Types of runway excursions

1-Runway **overruns** occur when the aircraft rollout extends beyond the end of the runway.

2-Runway **veer-offs** occur when:
• aircraft veer off the side of the runway during the
landing roll; or
• aircraft veer off the side of the runway or taxiway when exiting the runway.

A. The Latest Technology for prevention of of Runway Excursion

The **Engineered Materials Arresting System (EMAS)** is the most widely employed type of soft ground arrestor system. It is currently the only FAA-approved system. The EMAS is developed by New Jersey-based Engineered Arresting Systems Organization (ESCO). The EMAS soft ground arrestor bed is a surface of cellular, aerated concrete blocks that collapse under heavy load. They are able to support the weight of airport and airport rescue and fire fighting (ARFF) vehicles with none to minimal deformation, but collapse under the weight of an aircraft. An EMAS bed works by transferring the kinetic energy of the overrunning aircraft into the action of crushing the concrete blocks, creating drag at the front edge of the wheel and decelerating the aircraft
EMAS bed installed at Minneapolis-St Paul International Airport (KMSP), runway 12R end

Source: Engineered Arresting Systems Corporation (Peters, 2007)

III. Contamination & Friction-

A runway is measured to be contaminated when more than 25% of the runway surface area (whether in isolated areas or not) within the required length and width being used is covered by the following-
a) Surface water more than 3 mm deep, by slush and loose snow equivalent to more than 3 mm of water;
b) rubber deposits;
c) snow, slush ice or frost; and
d) other deposits such as sand, mud, dust, oil, etc

Effects of runway contamination-

The presence of water, snow, slush, ice or a solid contaminant (such as rubber deposits from aircraft tyres) on the runway adversely affects an aircraft's braking performance by (FSF)
• reducing the friction force between the tyres and the runway surface; and/or
• creating a layer of standing water between the tyres and the runway. This reduces the contact area and increases the risk of aquaplaning

Number Or Daily Turbojet Aircraft Landing Per Runway End	Suggested Rubber Deposit Removal Frequency
Less than 15	2 years
16 to 30	1 year
31 to 90	6 months
91 to 150	4 months
151 to 210	3 months
Greater than 210	2 months

Table1-Rubber Deposit Removal Frequency

A.Why measure friction?

Flight Safety is the main reason for measuring friction. As the transport aircraft became larger it became also more important to check friction in a better way than making skid test.

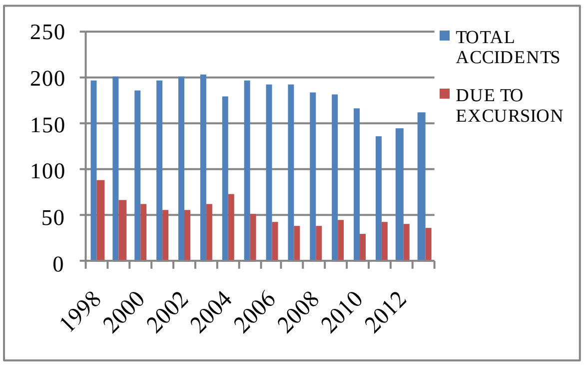
Following reasons for friction measurements are:

- Determine friction characteristics of runways under every conditions
- Check friction characteristics of new or resurfaced runways
- Evaluate periodically the slipperiness of paved runways when wet
- Assess the effect on friction when drainage characteristics are poor
- Evaluate friction of runways becoming slippery under unusual conditions

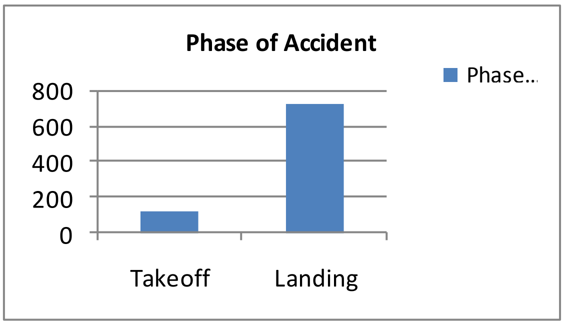
Number of daily minimum turbojet aircraft landings per runway end	Minimum friction survey frequency
Less than 15	1 year
16 to 30	6 months
31 to 90	3 months
91 to 150	1 month
150 to 210	2 weeks
Greater than 210	1 week

Table2-Minimum friction survey frequency

IV. Data Collection of Runway Excursion-



Graph-Total Accidents vs Excursion



Graph-Phase of Accident

The need to minimize the risk of runway excursions is a high precedence worldwide, because:
-airlines and manufacturers are utilising higher-capacity commercial aircraft, which carry more people and require more runway length to land.
-population pressure around airports, and non-aviation development on airport land are reducing the safety margin between aircraft and people if a runway excursion occurs; and
-there is a very real potential for an overrunning aircraft to collide with houses, cars, roads and other public infrastructure beyond runway ends if adequate runway end safety areas (RESAs) or other arresting measures do not exist.

VI. Conclusion

A range of flight crew technique and decision-, weather-, flight crew performance-,and systems-related factors were identified as contributing to runway excursion accidents during the landing of flight. These include-

- flying an unstabilised approach;
- landing too fast, too far down the runway;
- delayed or incorrect flight crew action when using braking systems, and less than adequate awareness of minimum equipment list items and their effect on braking performance;
- not conducting a go-around or diversion when conditions for landing are unsafe or at a higher risk;
- fatigue, stress, and visual illusions;
- less than adequate awareness of the effect of weather on the landing rollout length, possibly due to inconsistent or a lack of adequate approach and landing standard operating procedures;
- water-affected and contaminated runways, often associated with aquaplaning;
- incompatible reporting of runway conditions and braking action at airports across the world; and
- unusual runway design or lighting at some airports.

References

[1]. Eduardo S. Ayra "Risk Analysis of Runway Overrun Excursions at Landing: A Case Study"

[2]. Ernest Heymsfield, P.E., M.ASCE **"**Predicting Aircraft Stopping Distances within an EMAS" Journal of Transportation Engineering, doi:10.1061/(ASCE)TE.1943-5436.0000600

[3]. Rosa María Arnaldo Valdés, Fernando Gómez Comendador, Luis Mijares Gordún, Francisco J. Sáez Nieto "The development of probabilistic models to estimate accident risk (due to runway overrun and landing undershoot) applicable to the design and construction of runway safety areas" (Safety Science) 49 (2011) 633–650

[4]. Manuel Ayres Jr, Hamid Shirazi, Regis Carvalho, Jim Hall, Richard Speir, "Modelling the location and consequences of aircraft accidents" (Safety Science) 51 (2013) 178–186

[5]. Ernest Heymsfield, W. Micah Hale, Tyler L. Halsey "Aircraft Response in an Airfield Arrestor System during an Overrun" DOI: 10.1061/(ASCE)TE.1943-5436.0000331. © 2012 American Society of Civil Engineers.

[6]. Marco Bassani, Emanuele Sacchi, Fulvio Canonico "Performance Prediction for Innovative Crushable Material Used in Aircraft Arrestor Beds" DOI: 10.1061/(ASCE)MT.1943-5533 .0000425. © 2012 American Society of Civil Engineers.

[7]. G. P. Ong, T. F. Fwa, M.ASCE "Wet Pavement Hydroplaning Risk and Skid Resistance: Modeling" DOI: 10.1061/(ASCE)0733-947X(2007)133:10(590)

[8]. M. Gunaratne, N. Bandara, J. Medzorian, M. Chawla and P. Ulrich" CORRELATION OF TIRE WEAR AND FRICTION TO TEXTURE OF CONCRETE PAVEMENTS" **46** / JOURNAL OF MATERIALS IN CIVIL ENGINEERING / FEBRUARY 2000

[9]. G. P. Ong and T. F. Fwa, M.ASCE **"**Transverse Pavement Grooving against Hydroplaning. I: Simulation Model" DOI: 10.1061/(ASCE)0733-947X(2006)132:6(441)

[10]. Peter Múčka "Relationship between International Roughness Index and Straightedge Index" DOI: 10.1061/(ASCE)TE.1943-5436.0000417. © 2012 American Society of Civil Engineers.

[11]. Cyril Baby K. and Boby George, Member IEEE "A Capacitive Ice Layer Detection System Suitable for Autonomous Inspection of Runways using an ROV" 978-1-4673-2706-0/12 ©2012 IEEE