



THE Louis Berger Group, INC.

Safety and Its Relationship with Pavement Maintenance

ALACPA Short Course on Pavements Maintenance



Airfield Safety

- The safe operations of aircrafts around and within the airport is the responsibility of the pilots, the airlines, the airport authority, the airspace governing authority, the airport's employees and anyone who works at the airport
- Safety today also encompasses security concerns along with the safe travel of passengers and cargo into and through the airport. It is so broad that Safety & Security Manuals are volumes thick, requiring weeks of diligent studies and training
- This course will only deal with the airfield pavement component to safety and why pavement maintenance is important to the safe operation of aircrafts within the airfield



Course Objective

- Safety & Its Relationship with Airfield Pavement
 - Runway Excursion
 - Foreign Object Debris
 - Pavement Condition
 - Operations & Economic Impacts





Runway Excursions

- **Runway Excursion** is an incident involving only a single aircraft, where it makes an inappropriate exit from the runway. This can happen because of pilot error, poor weather, poor pavement texture, or a fault with the aircraft.
- **Overrun** is a type of excursion where the aircraft departs at the end of the runway.
- **Veer-off** is a type of excursion where the aircraft departs the side of a runway





Runway Excursions

- American Eagle jet skids off O'Hare runway; no injuries
- Commuter plane skids off runway in Chicago
- Delta plane skids off runway after landing in Detroit
- Runway Excursion Incident Boeing 777-200 at Singapore Changi Airport
- American Airlines Flight 2253 runway overrun at Jackson Hole Airport, Jackson Hole, Wyoming
- TACA Flight 390 overran the runway after landing at Tegucigalpa's Toncontin International Airport





Runway Excursions

- An average of 417 excursions occurred between 1995 through 2008, which was about 29% of the total accidents that happened in the 14-year study period; which equates to 30-incidents per year 1 every two weeks +/-
- Excursion range from takeoff veer-offs & overruns to landing veer-offs and overruns





Causes of Runway Excursions

- Pilot Error
 - Aircraft landing speed
 - Aircraft landed too far down the runway
 - Bouncy landing
 - Aborted take off
- Aircraft Malfunctions
 - Thruster failed
 - Engine throttle/control
 - Tire blowout
- FOD
- Weather
 - Raining, snowy, windy storm event
- Pavement
 - Wet pavement
 - Snow, slush, ice covered pavement
 - Poor pavement condition & texture





Runway Excursions & Pavement

- Runway pavement condition plays a key role in the safe operations of aircrafts maneuvering on them
- The contact area between the ground and the aircraft tire should provide a level of service that allows the aircraft to come to a controlled stop during poor weather conditions
- The term “level of service” encompasses the critical tire/ground contact area which comprises of the pavement surface condition along with its skid resistance and the aircraft tire ability to “grip” the runway surface; a “dynamic system”



Runway Excursions & Pavement

- Poor pavement condition and skid resistance levels along with poor wet weather can decrease the frictional forces that help maintain safe aircraft maneuverability
- Snow, slush, ice, wet and flooded runways creates slippery surfaces while poor pavement conditions such as potholes and uneven surfaces creates a “rough ride” during the high speed deceleration
- Runway with deep ruts tugs on the aircraft wheels and makes for a “swishy” ride (uncontrolled aircraft movements)



Runway Excursions & Pavement

- When an aircraft is forced to follow deep rut tracks on an uneven “bumpy” pavement surface with poor skid resistance during bad weather; it’s an equation for disaster
- Damages to the aircraft’s landing gear along with the possibility of skidding off the runway, damaging the aircraft, injuring the crew and passengers or even death are factors that must be considered when addressing the durability and serviceability of the runway pavement system



Foreign Object Debris

- FOD – foreign object debris is any object, live or not, located in an inappropriate location in the airport environment that has the capacity to injure airport or air carrier personnel and damage aircrafts
- FOD Damage- is any damage attributed to a foreign object that can be expressed in physical or economic terms which may or may not downgrade the product's safety or performance characteristics





Foreign Object Debris

- FOD is a hazard, with the potential of damaging an aircraft as it attempts to land or take off
- Potential damage includes cutting of aircraft tires, being ingested by the engines or becoming lodged in mechanisms that affect flight operations
- Personnel injuries or even death can occur when jet blasted FOD is propelled through the airport's environment at high velocity





Sources of Foreign Object Debris

- FOD comes from many sources:
 - Personnel
 - Airport infrastructure (pavement, lights & signs)
 - Environment (weather, snow, ice, wildlife)
 - Equipment operating on the airfield (aircrafts)
 - Airport operations vehicles
 - Maintenance equipment
 - Fueling trucks
 - Aircraft servicing equipment
 - Construction equipment





Sources of Foreign Object Debris

- Common FOD found at various airports:
 - Aircraft & engine fasteners (nuts, bolts, safety wire, etc.)
 - Aircraft parts (fuel caps, landing gear fragments, oil slicks, metal sheets, trapped doors & tire fragments)
 - Mechanic tools
 - Flight line items (nails, ID badges, soda cans, pens, etc.)
 - Apron items (paper, plastic, luggage, pens, badges, etc.)
 - Runway and taxiway materials (pavement chucks, rubber joint material, paint chips)
 - Construction debris (stone, wood, loose pavement & aggregate)
 - Plastic/polyethylene material
 - Natural material (plants, wildlife, ash)
 - Contaminants from winter condition



Foreign Object Debris Fundamentals

- FOD comes from many sources; the potential of loose pavement becoming an airborne missile is highly probable in an airfield were the pavement is in poor condition,
- Loose chunks of pavement and other FOD can become an aircraft wheel hazard that can puncture tires and cause uncontrollable aircraft maneuvers.
- Loose chunks of pavement can be hurled across the airfield impacting awaiting aircrafts, or ingested by the waiting aircrafts engines



FOD Prevention

- The best protection from pavement FOD, is to prevent its creation and keep the airfield surface free of pavement related FOD
- Proper pavement maintenance and frequent airfield sweeping will help minimize potential pavement related FOD
- This requires multiple daily FOD evaluations and removal, a continuous cycle that keeps the runway safe





Pavement Condition

- Airfield pavement is the backbone of the airport, its operational integrity provides safe passage for those who use it
- Like a rattle snake if you turn your back on it, it will strike you
- Neglecting the airfield pavement is just like the rattle snake, when the pavement starts to fail, it damages aircrafts and puts individuals lives at risk
- The loss of operational revenue, the higher cost of repair or replacement, the liability of aircraft damage due to poor or failing pavement, can be quantified, so why throw revenue and profits away, when good FOD control, pavement maintenance practices and sound rehabilitation and construction methods can reduce potential financial liabilities



Pavement Condition

- “Happy” pavement is well maintained, safe and clean pavement, pavement in good condition
- Happy pavement has a pavement condition index value of “good” (PCI = 56 to 100)
- It lacks failing joints, for which the loose material can get sucked up by an engine
- It lacks potholes, spalling, loose chunks of pavements that can be kicked up underneath a tire and cause a blow out or damage to the aircraft
- It lacks scaling, raveling, or small loose particles that shoot across the airfield like shot-blast pellets



Pavement Condition

- Its surface texture exceed the maintenance planning level, providing the friction level that provides controlled maneuverability
- The surface is smooth to the ride, not bumpy, as if you are galloping across the airfield on a horse
- Pavement that is in “good” condition has a less chance of producing pavement related FOD, and damaging aircrafts
- It also has the ability of providing appropriate skid resistance, reducing large rehabilitation bills and provides a safe pathway for passengers to and from the airfield
- It is cleaned frequently and has minimal surface contamination
- Overall, Happy pavement minimizes operational and economic impacts to the airport while offering a comfort of safety



Operational & Economic Impacts

- Poor condition airfield pavements need to be shutdown frequently to provide patch work type repairs; these shutdowns are typically done at night, for an airport with a single runway, and have limited time frames, which the work quality is typically fair
- Crashes on a runway will shutdown the airfield for an extended period of time, an airport with a single runway has to basically close its doors until the investigation and the cleanup, removal of the incident, has been completed



Operational & Economic Impacts

- An airport that is closed for days, can lose millions of dollars in revenue
- Poor construction repairs can cost two to three times more than the original repair price of a “done right” reliable repair
- Lack of maintenance, sweeping, or removal of contaminants creates a hazardous environment, which can cause damages to aircraft, and unnecessary litigation, compensation and liability expenditures



In Closing

- Safety is everyone's responsibility who works at the airports; although Pavement Condition and Pavement related FOD is a small component of the airfield safety program, it is a major role in the safe movements of aircrafts in the airfield
- Airfield pavement is the backbone of the airport, the shutdown of the runway due to an incident may cause grave economic and operational impacts that may take years to recover
- Keeping the airfield pavement in good condition and free of FOD requires good planning and accurate identification of appropriate rehabilitation projects and a committed maintenance and clean program
- Airfield incidents can be prevented, it is up to the airport operator to ensure that the proper safety/security and pavement management programs are executed and being followed today and everyday on after



References

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Forum for Open Discussion

