



# 757

**BREAKOUT SESSION**

## **Contaminated and Slippery Runways**

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**“I glanced at the air speed indicator and saw it registered 105 knots and was flickering. When it reached 117 knots I called out ‘V1’ [Velocity One, the point on the runway after which it isn’t safe to abandon take-off]. Suddenly the needle dropped to about 112 and then 105. Ken shouted, ‘Christ, we can’t make it’ and I looked up from the instruments to see a lot of snow and a house and a tree right in the path of the aircraft”.**

**Inside the passengers’ compartment Bill Foulkes had sensed that something was wrong:**

**“There was a lot of slush flying past the windows and there was a terrible noise, like when a car leaves a smooth road and starts to run over rough ground”.**

**The Elizabethan left the runway, went through a fence and crossed a road before the port wing struck a house. The wing and part of the tail were torn off and the house caught fire. The cockpit struck a tree and the starboard side of the fuselage hit a wooden hut containing a truck loaded with fuel and tyres. This exploded.**

# Non-Dry Runway Topics

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- Wet runway
  - Regulatory/operations
- Slush / standing water
- Snow covered runway
  - Loose/compact
- Slippery runways
- Crosswind considerations



# Wet Runway Regulatory Requirements

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- FAA historically
  - No definitive regulatory requirements for wet runway performance adjustments in Part 25 or 121
  - Boeing supplied as a subset of slippery runway data

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# Wet Runway Regulatory Requirements

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- FAA current (737-6/7/8/900, 757-300, 767-400)
  - Wet runway is part of AFM certification basis
    - Amendment 25-92
  - Assumptions
    - 15 foot screen height
    - Engine inoperative reverse thrust credit
- JAA Operators
  - New certifications - same as FAA (Note: 747-400 also certified to a different wet runway standard)

Note: This data is based on an agreed upon certification method which adjusts a standard wet runway braking characteristic curve by the individual airplanes anti-skid system efficiency.

# Wet Runway Regulatory Requirements

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- Operational data - JAROPS 1
  - Requires operational wet runway data based on possibility of an engine failure
  - Boeing supplies performance information for wet as a subset of slippery runway data
  - Recommend use of the data based on pilot reported braking action of Good (approximately  $\frac{1}{2}$  the dry runway effectiveness when runway friction limited)
  - This performance level is consistent with CAA certification flight testing accomplished on the 707, 727, 737-1/2/200Adv, 747-100/200

# Boeing Slush/Standing Water Data

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## AFM information

FAA – No AFM requirements

JAA – AFM contains advisory data for more  
recent airplanes

747-400, 777, 737NG, 757-300, 767-400

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# Boeing Slush/Standing Water Data

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## Operational information

- Boeing supplies data in the OM, FPPM, PEM and performance software
- Data in manuals are weight reductions and V1 adjustments
- Assumptions in calculation of performance
  - One engine inoperative
  - 15 screen height at the end of the runway
  - Reverse thrust on operating engines

Note: All engines slush standing water data is still available – very few use this data

- Weight reduction
- **No**  $V_1$  adjustment provided
- Preserves 15% margin



# Snow data

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- Provided in operational software for
  - 737-6/7/8/900, 777, 757-300, 767-400
  - Loose dry snow
    - Calculations based on slush modeling using snow specific gravities — depths to 101 mm
  - Compact snow based on a relationship agreed upon during JAA certification that is equivalent to a pilot reported braking action of “good”

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# Slippery Runway

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## *(Wet, Icy)*

- Weight reduction and V1 adjustment provided
  - Reduced tire to ground friction
  - Credit for reverse thrust
  - Go to 15-ft screen height
- Data a function of pilot reported braking action
  - Good — wet
  - Medium — comparable to 727 ice and compact snow testing — 60's
  - Poor — wet melting ice
- Boeing does not correlate performance data with friction cart information

Data presented in airplane *Operations Manual*, *FPPM*, and *PEM*

# Crosswind Guidelines

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- Boeing publishes takeoff and landing crosswind guidelines in the Flight Crew Training Manuals
  - Derived from analysis and piloted simulations
  - Based on steady winds
  - Function of runway condition — dry, wet, standing water/slush, snow — no melting, ice — no melting
  - Accounts for asymmetric reverse thrust
  - Provides guidance on technique (side slip, crab)

# Example Of FCTM Information May Be Different For TO And Land

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Runway Condition	Crosswind — Knots*
Dry	40
Wet	25
Standing Water/Slush	15
Snow — No Melting**	20
Ice — No Melting**	15

# Crosswind Guidelines

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Recently Boeing extended additional guidance relating runway condition to Pilot reported Braking Action

FCTM Runway Condition Braking (TO and Land Guidelines)	Pilot Reported Action
Dry	Dry
Wet	Good
Snow — No Melting	Medium to Good
Slush/St. Water or Ice — No Melting	Medium to Poor