The French approach: intercomparison, management of uncertainties, training of staff

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DGAC/STAC

Runway Surface Conditions Assessment and Reporting

31 March and 1 April 2016
DGAC - Paris 15
CONTEXT

- Implementation of the Runway Condition Report
- Definition of slippery wet runways in accordance with aircraft performances

Below the minimum friction levels
• Limitations of CFME measurements
  ▪ Device-dependency of friction readings
  ▪ Reproducibility
  ▪ Device time stability
• Background of inter-comparison
  ▪ ICAO programme for correlating equipment used in measuring runway braking action (1970’s)
  ▪ Tire/Runway Friction Workshop at NASA WALLOPS Flight Facility (1990’s)
  ▪ International PIARC experiment to compare and harmonize texture and skid resistance measurements (1990’s)

• Still today
  ▪ ROSANNE in Europe
  ▪ International Friction Workshop at Pennsylvania State University in the US
CONTEXT

- Issue with a rigid values – ex-ICAO table A1

<table>
<thead>
<tr>
<th>Test equipment</th>
<th>Test tire</th>
<th>Pressure (kPa)</th>
<th>Test speed (km/h)</th>
<th>Design objective surface</th>
<th>Maintenance planning level</th>
<th>Minimum friction level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mu-meter Trailer</td>
<td>A</td>
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<td>Surface Friction Tester</td>
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<tr>
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<td>0.42</td>
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<tr>
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<td>C</td>
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<td>0.38</td>
<td>0.42</td>
</tr>
</tbody>
</table>

Amendment 12 of ICAO Annexe 14
• Trend monitoring concept

Is it the very same device?
Is the device time-stable?

What’s the trigger?
Still necessary
FRENCH APPROACH

Inter-comparison on a higher level

- Measurements
  - ISO 17025
  - Training
  - Management of uncertainties
  - Time-stability

- Reference device

- Inter-comparison
  - ISO 17043
  - Conformity assessment
  - Correlation
MEASUREMENTS

- Training
  - Identification of critical tasks
  - Definition of required skills
  - Development of criteria for qualification, renewal or suspension of qualification

- Planning of friction testing
- Friction test preparation
- Metrological confirmation of equipment
- Performing measurements as a driver
- Performing measurements as operator
- Analysis of friction results
- Interpretation of results
- Report
MEASUREMENTS

- Uncertainties
  - Identify all possible sources for uncertainties
  - Quantify the uncertainty due to these sources
  - Reduce the uncertainty of the measurement

Diagram:
- Device
- Operator
- Calibration Nozzle
- Testing tire
- Speed Water film
- Material
- Method
- Environment
- Friction result

Direction générale de l’Aviation civile - Service technique de l’Aviation civile
MEASUREMENTS

Level 1 -> Brainstorming

Level 2 -> Testing

2 levels

Friction coefficient

Effect of tire wear

Maintenance planning friction level

Minimum friction level

Test surfaces
MEASUREMENTS

- Stability
  - Through the calibration

Is it stable?

Calibration N  Measure N  Calibration N+1  Measure N+1  Calibration N+2
MEASUREMENTS

- Stability
  - Through tests on a reference surface
REFERENCE DEVICE

- Used by an ISO 17025 lab
- Used for CFME inter-comparison
- Participated to international test campaigns
  - Tire/Runway Friction Workshop at NASA WALLOOPS Flight Facility
  - Joint Winter Runway Friction Measurement Program
  - International Friction Workshop (2013)
- Time-stable
REFERENCE DEVICE

Correlation with aircraft performances?

Mu-Meter

Research

FAA
CAA UK
DGAC
INTER-COMPARISON

Conformity assessment
Correlation
## INTER-COMPARISON

### Test facility

<table>
<thead>
<tr>
<th>Test surface</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>Semi-granular bituminous concrete (0/10)</td>
</tr>
<tr>
<td>E2</td>
<td>Semi-granular bituminous concrete (0/10)</td>
</tr>
<tr>
<td>M2</td>
<td>Very thin bituminous concrete (0/6)</td>
</tr>
<tr>
<td>G5</td>
<td>Slightly painted surface</td>
</tr>
<tr>
<td>G6</td>
<td>Painted surface +</td>
</tr>
<tr>
<td>G0</td>
<td>Low friction asphalt concrete</td>
</tr>
<tr>
<td>G4</td>
<td>Painted surface +++</td>
</tr>
<tr>
<td>L1</td>
<td>Resin Epoxy</td>
</tr>
</tbody>
</table>

- **Yellow**: Medium to high friction level
- **Yellow**: Low friction level, around the minimum friction level of the reference device
- **Red**: Very low friction level
INTER-COMPARISON

• Results

Too much dispersion => Not conform

Few dispersion
Surface discrimination
Good correlation => Conform

Not able to discriminate surfaces => Not conform
INTER-COMPARISON

Minimum friction levels

Reference device X

Correlation
Y = A.X + B

Device Y₁

Device Y₂

Device Y₃

Device Y₄
CONCLUSION

- Reduction of the overall uncertainty of friction measurements
CONCLUSION

• Plan for actions
  ▪ Inter-comparison Mu-Meter/IMAG
  ▪ Promotion of inter-comparison
    • On a local scale
    • On a regional scale
  ▪ Regular updating of minimum friction levels
THANK TO THE WHOLE TEAM

• Jean-Louis Pirat, Mickael Thiery
• Romain Bouteiller, Hervé Charabani, Sébastien Chevillard, Stéphane Hautin, Stéphane Maindroult, Hassan Safir
• Claire Azoulay
Thank you for listening!