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Developments in

# International Runway Friction Testing


**ICAO Airport PMS seminar, Lima, Nov 2003**

Presentation by Delia Harverson

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- Runway friction testing with CFMEs began more than 40 years ago
- The first CFMEs were designed to measure in winter conditions
- The Mu-Meter is an example of these early CFMEs


***CFME**: **C**ontinuous **F**riction **M**easuring **E**quipment*

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Other early CFMEs are

- The Saab
- The Skiddometer

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- **Operational** testing is carried out in natural conditions, in winter, *in order to make immediate operational decisions*.
- **Maintenance** testing is carried out in carefully controlled conditions, including an exact amount of water put down in front of the measuring wheel, *in order to make engineering decisions*.
- Modern CFMEs are designed as much for maintenance testing as for operational testing.

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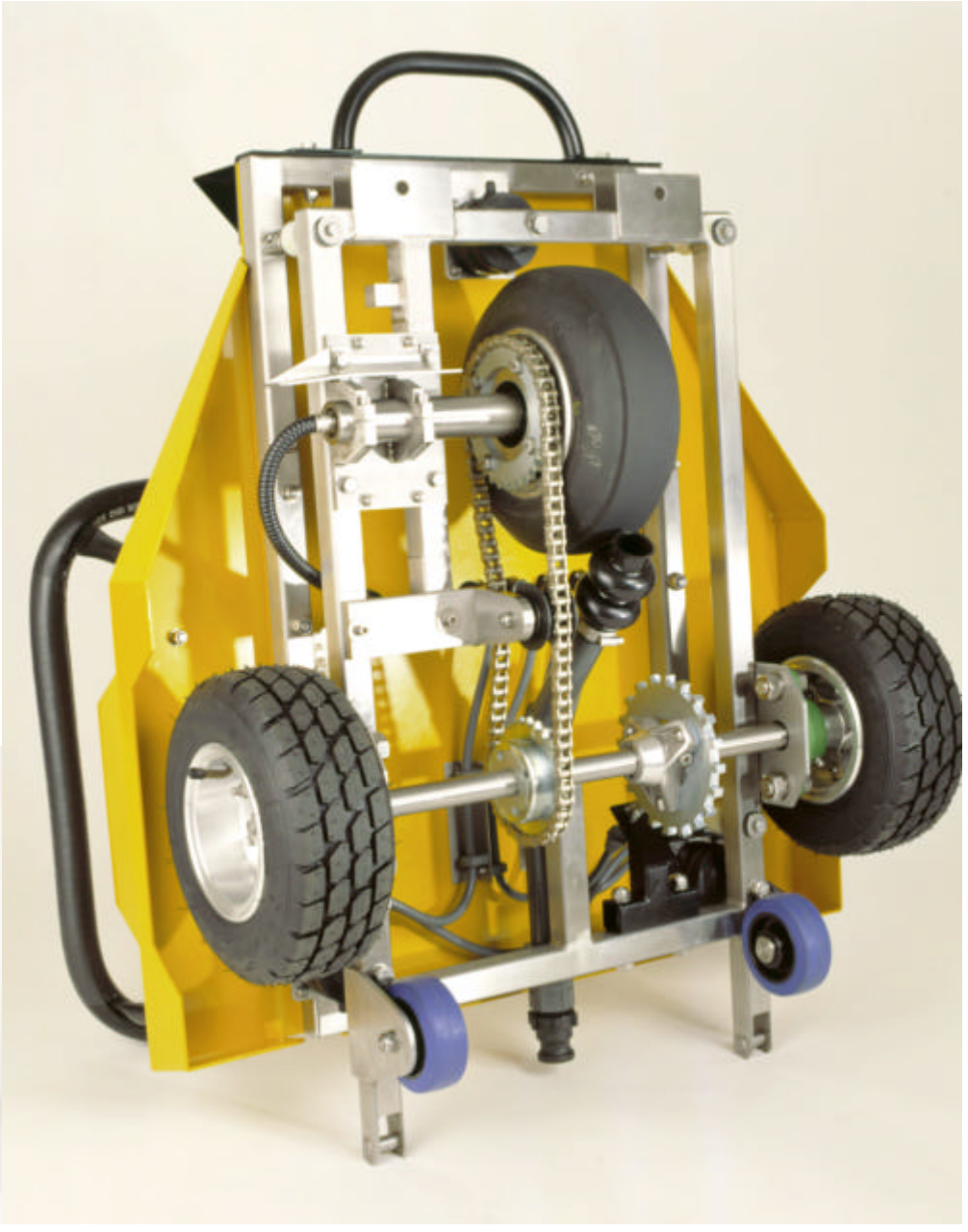
# The MK2 GripTester

- Introduced in 2002
- Braked wheel, fixed slip
  - 15% slip ratio
- Data format designed for export to a PMS



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Is maintenance testing as important as operational testing?

*YES!*

In rain, a runway with poor texture and rubber deposits can be **more** slippery than a runway contaminated with ice and snow

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Are there more overrun accidents on runways contaminated with **ice and snow** than on **wet** runways?

# *NO!*

There are **substantially** more overrun accidents on wet runways

## *Most of these accidents need never have happened*

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Should **engineering** decisions ever be made on the basis of **operational** testing?

***NO!***

**Natural** conditions are much too **variable** to provide a proper basis for engineering decisions

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How does international aviation ensure that maintenance friction testing is consistent **…**

**…** that the same results are obtained in Lima as in London Heathrow?

**…** in Santa Cruz as in Singapore?

*ICAO*

# *Maintenance testing table from the "Green pages" of ICAO Annex 14*

Table A-1

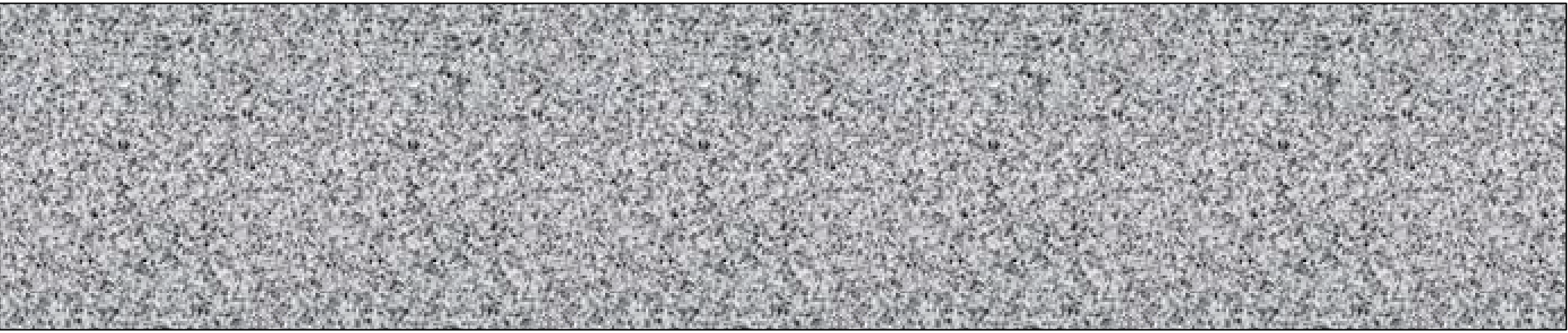
| Test equipment | Test tyre Type | Test tyre Pressure (kPa) | Test speed (km/h) | Test water depth (mm) | Design objective for new surface | Maintenance planning level | Minimum friction level |
|---|---|---|---|---|---|---|---|
| (1) | (2) | | (3) | (4) | (5) | (6) | (7) |
| Mu-meter Trailer | A | 70 | 65 | 1.0 | 0.72 | 0.52 | 0.42 |
| | A | 70 | 95 | 1.0 | 0.66 | 0.38 | 0.26 |
| Skiddometer Trailer | B | 210 | 65 | 1.0 | 0.82 | 0.60 | 0.50 |
| | B | 210 | 95 | 1.0 | 0.74 | 0.47 | 0.34 |
| Surface Friction Tester Vehicle | B | 210 | 65 | 1.0 | 0.82 | 0.60 | 0.50 |
| | B | 210 | 95 | 1.0 | 0.74 | 0.47 | 0.34 |
| Runway Friction Tester Vehicle | B | 210 | 65 | 1.0 | 0.82 | 0.60 | 0.50 |
| | B | 210 | 95 | 1.0 | 0.74 | 0.54 | 0.41 |
| TATRA Friction Tester Vehicle | B | 210 | 65 | 1.0 | 0.76 | 0.57 | 0.48 |
| | B | 210 | 95 | 1.0 | 0.67 | 0.52 | 0.42 |
| GRIPTESTER Trailer | C | 140 | 65 | 1.0 | 0.74 | 0.53 | 0.43 |
| | C | 140 | 95 | 1.0 | 0.64 | 0.36 | 0.24 |

9/11/95

## *Why are the friction levels specified by ICAO different for the different CFMEs?*

**The runway does not have a friction coefficient …**

**… a friction coefficient is always a property of a pair of surfaces.**



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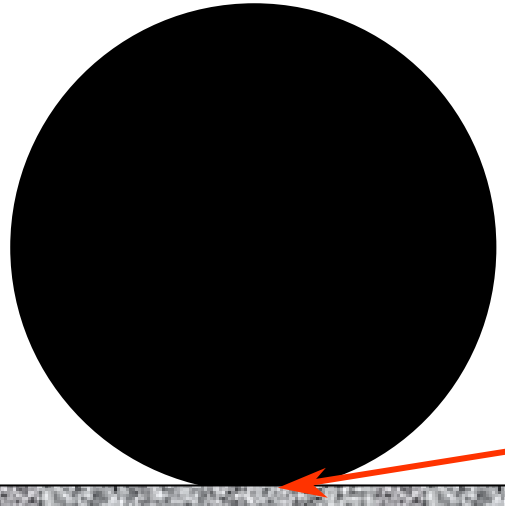
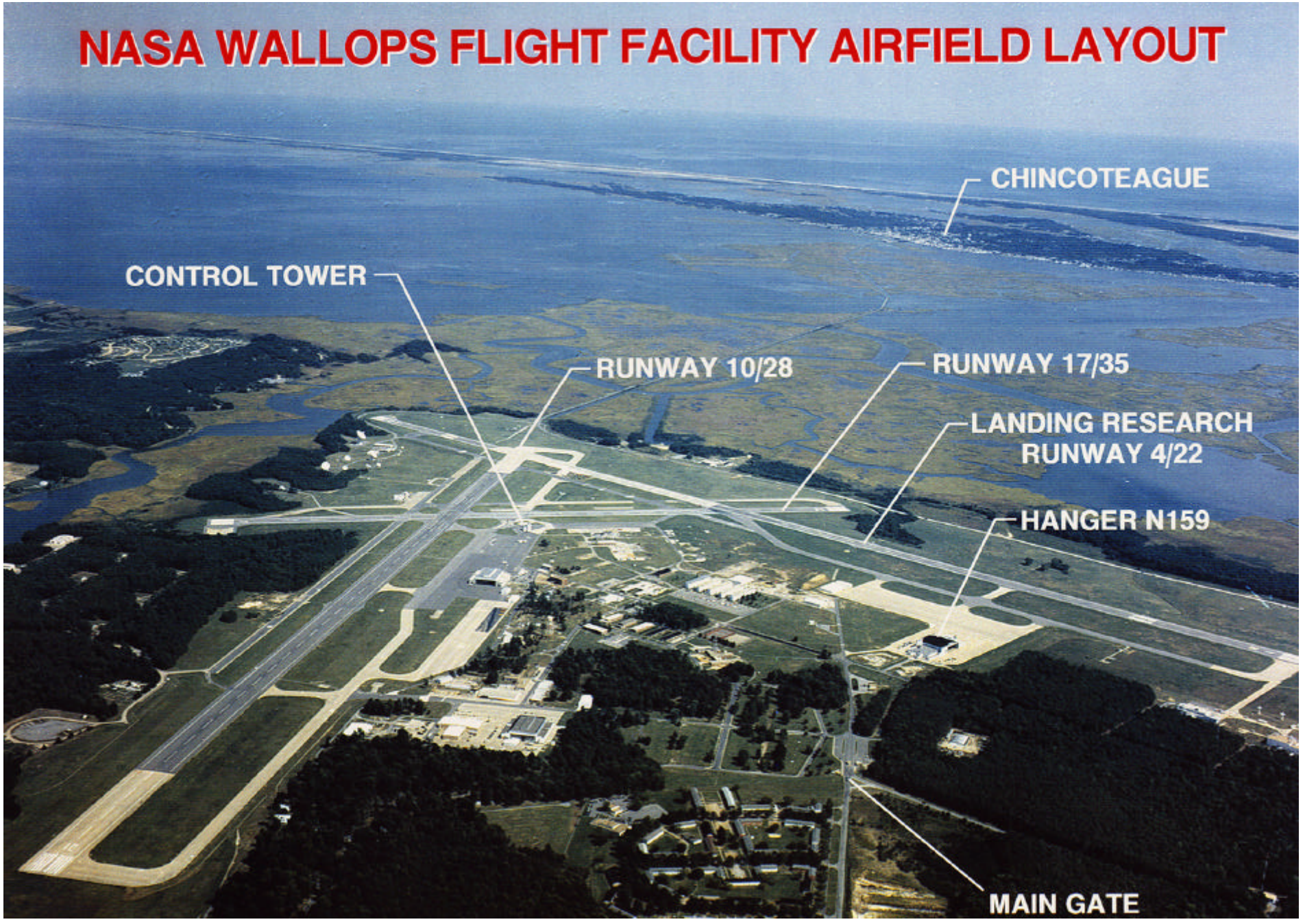


**The frictional force is generated at the tyre-surface interface. Any change to that interface can alter the frictional force.**


NASA WALLOPS FLIGHT FACILITY AIRFIELD LAYOUT
CHINCOTEAGUE
CONTROL TOWER
RUNWAY 10/28
RUNWAY 17/35
LANDING RESEARCH
RUNWAY 4/22
HANGER N159
MAIN GATE

# NASA's Tom Yager at the Wallops Flight Facility

# CFMEs waiting to test at the Wallops Flight Facility

Back to the ICAO Maintenance testing table ...

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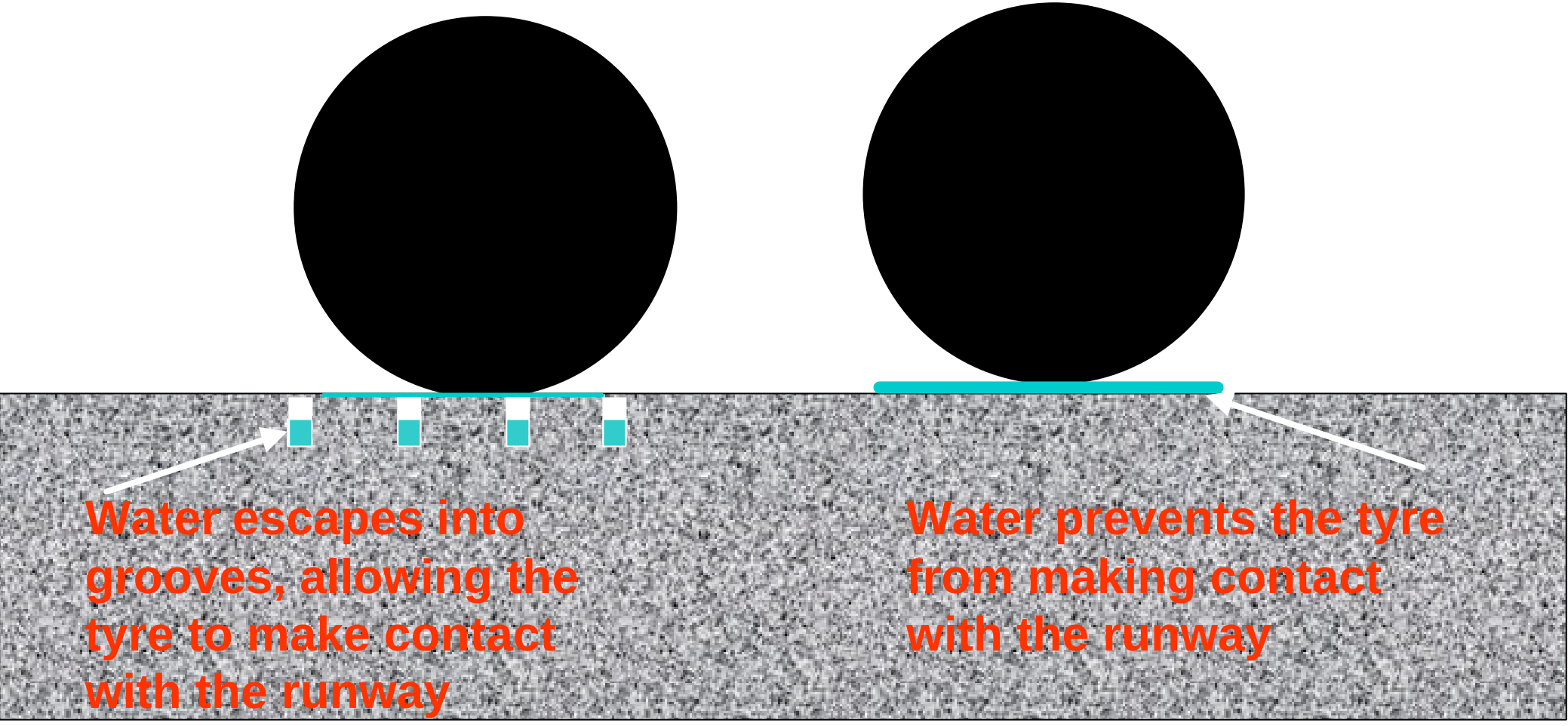
| GRIPTESTER Trailer | C | 140 | 65 | 1.0 | 0.74 | 0.53 | 0.43 |
| | C | 140 | 95 | 1.0 | 0.64 | 0.36 | 0.24 |

# ***Why does ICAO specify the test water depth?***

## *Why does ICAO specify the test water depth?*

**If a runway is to maintain good skid resistance in heavy rain, it must have good texture**



# *Why does ICAO specify the the test tyre?*

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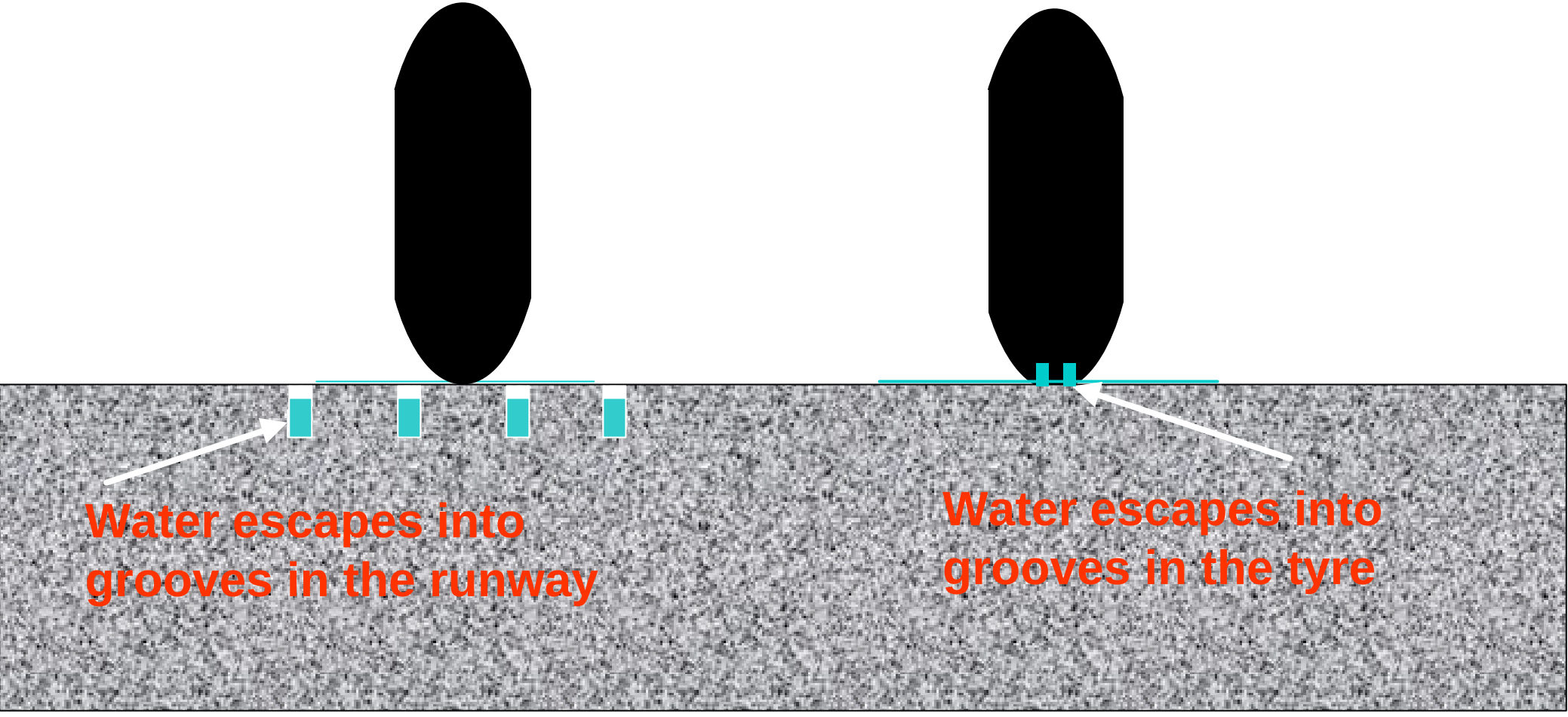
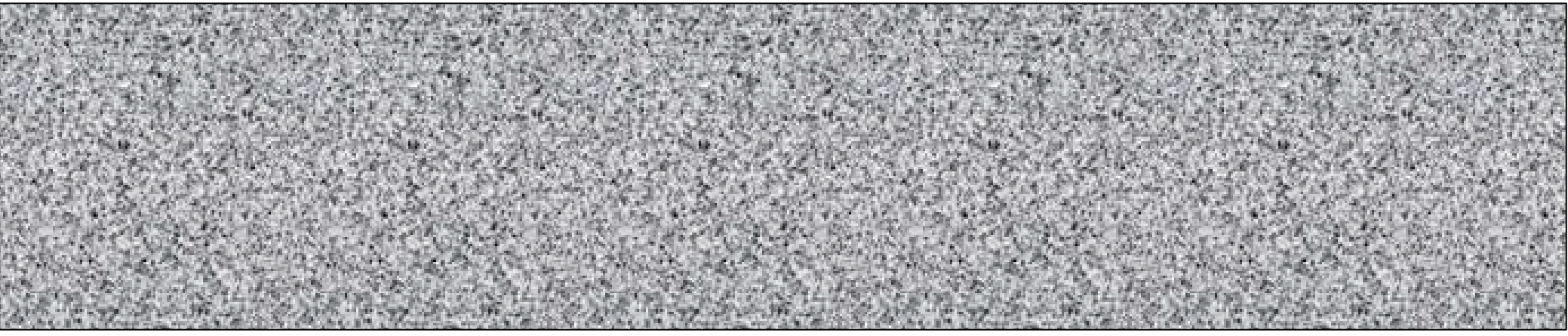
**Test tyres must be consistent and must have a smooth tread**



## *Why does ICAO specify the the test speed?*

- **The faster the test speed, the lower the friction reading.**
- **How much lower?**
- **That depends on the texture of the surface (the stronger the texture, the smaller the effect)**



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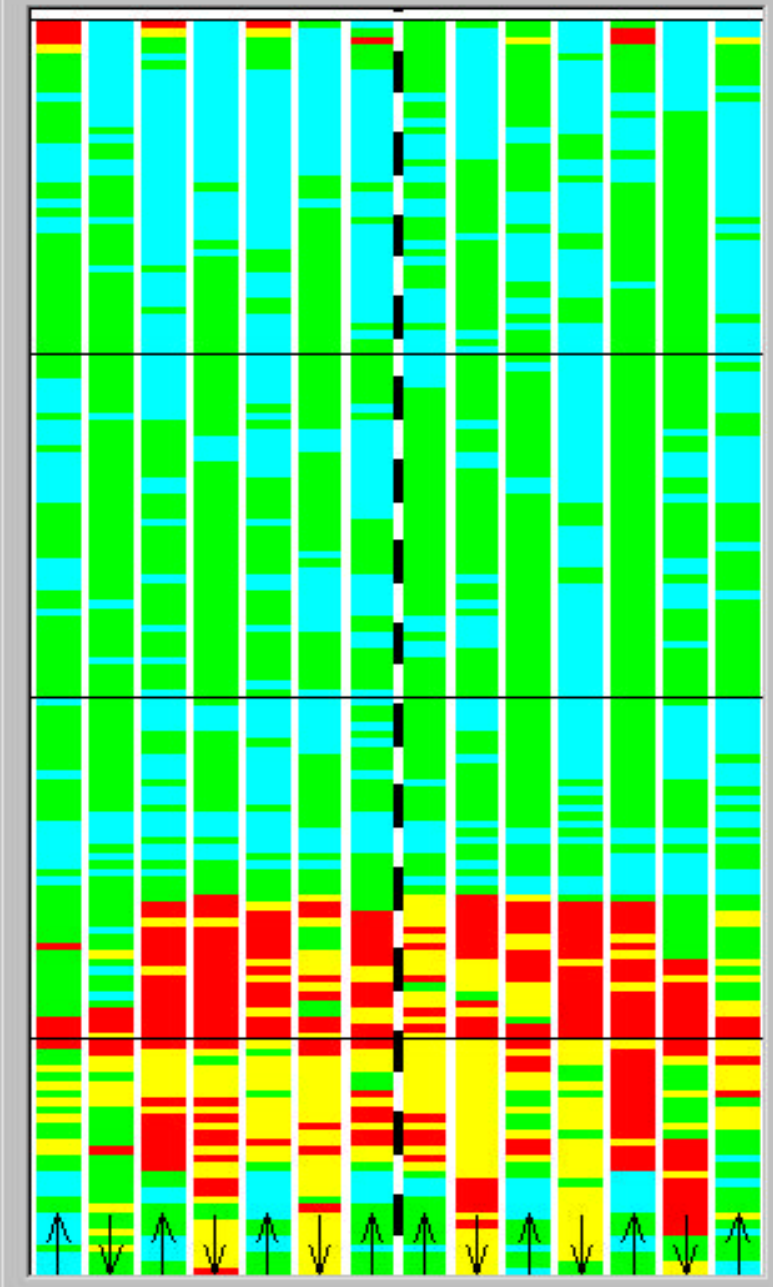
Demonstration Airport



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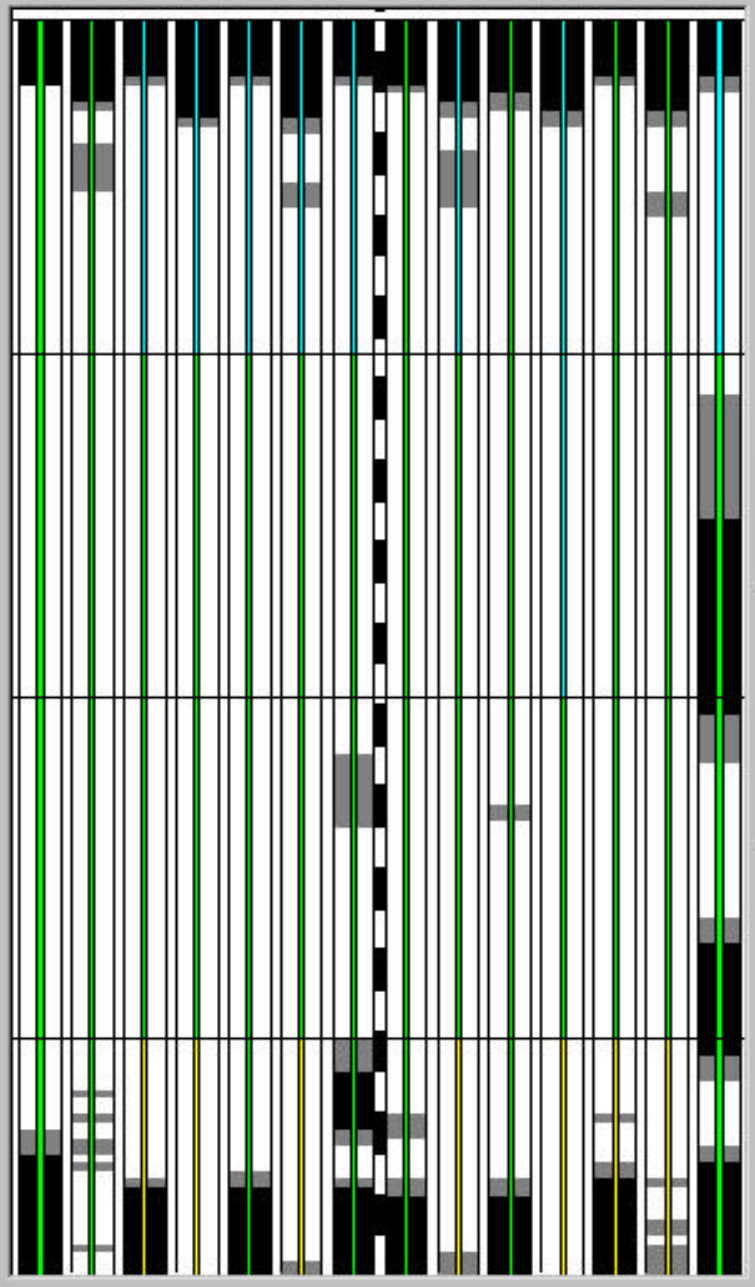
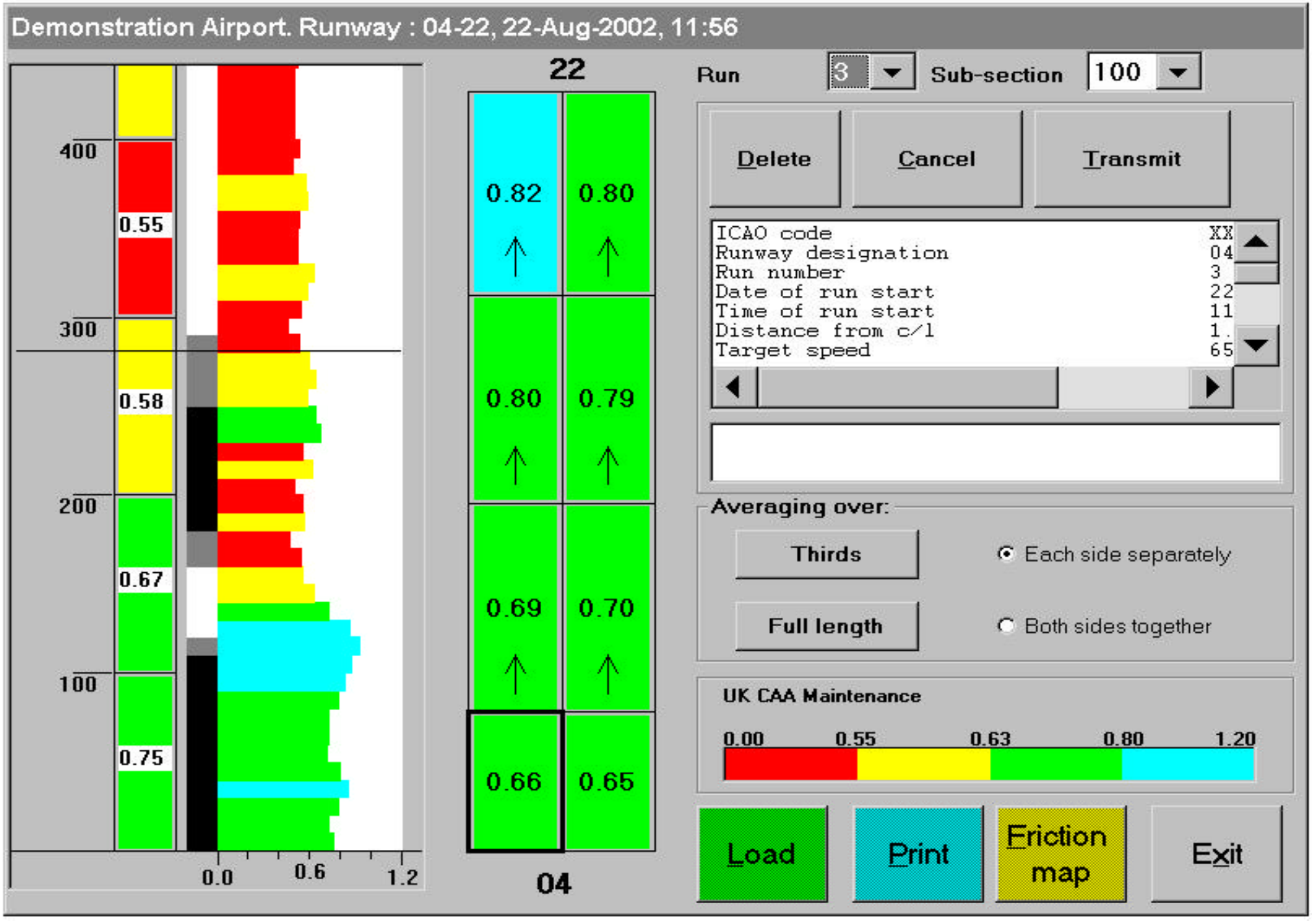


Print

Exit


Demonstration Airport. Runway : 04-22, 22-Aug-2002, 11:56
400
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04
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3
Sub-section
100
Delete
Cancel
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ICAO code XX
Runway designation 04
Run number 3
Date of run start 22
Time of run start 11
Distance from c/l 1.
Target speed 65
Averaging over:
Thirds
Full length
Each side separately
Both sides together
UK CAA Maintenance
0.00
0.55
0.63
0.80
1.20
Load
Print
Friction map
Exit

Thank you for your attention.
Gracias por su atención

I will be happy to answer questions

Estaré feliz de absolver sus preguntas