Test methods for assessing the performance of sports surfaces

By

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Objectives of today’s presentation

- To summaries who and why standards for sports surfaces are developed
- To illustrate the main tests being used
- To highlight some of the limitations of the tests
- To highlight areas requiring further development
Why?

- To control the way the game is played
- To provide a suitable playing environment
- To compare surfaces objectively
- To ensure adequate durability
Who develops standards?

- National sports governing bodies
- International sports governing bodies
- National / International standards bodies
  (ASTM, BSI, DIN, CEN etc.,)
- Trade associations
### Current international governing body standards

<table>
<thead>
<tr>
<th>Year</th>
<th>Body</th>
<th>Sport</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>FIH</td>
<td>field hockey</td>
</tr>
<tr>
<td>1990</td>
<td>IAAF</td>
<td>track &amp; field</td>
</tr>
<tr>
<td>1995</td>
<td>WBB</td>
<td>bowls</td>
</tr>
<tr>
<td>1997</td>
<td>ITF</td>
<td>tennis</td>
</tr>
<tr>
<td>2001</td>
<td>FIFA</td>
<td>football (soccer)</td>
</tr>
<tr>
<td>2002</td>
<td>UEFA</td>
<td>soccer (European)</td>
</tr>
<tr>
<td>2003</td>
<td>IRB</td>
<td>rugby</td>
</tr>
</tbody>
</table>
Current national standards

DIN
BS
OST
AFNOR
ASTM
European

Germany
UK
Austria
France
Nordic countries
USA
CEN (2005/6)
Ball - surface interaction

- ball rebound
- ball roll
- pace
- spin

Player - surface interaction

- shock absorption
- deformation
- friction / traction

Durability
Selection criteria

• Suitable for lab and site
• Reproducible
• Repeatable
• Available
Ball rebound

FIH
ITF
FIFA
UEFA
IRB
CSTCROMFORD@AOL.COM
Ball rebound - variables

- Ball type
- Drop height
- Rebound measurement
Variations in ball rebound
Ball roll

FIH
WBB
FIFA
UEFA

CSTCROMFORD@AOL.COM
Ball roll - velocity change

Calculate deceleration (ms\(^{-2}\)) over specified distance (DIN)

Calculate change in velocity (ms\(^{-1}\)) over specified distance (UEFA)

Calculate equivalent ball roll (FIFA)
Ball / Surface Pace

ITF
FIFA
UEFA
IRB
Tennis Pace

\[ \text{SPR} = 100 \left(1 - \mu\right) \]

\[ \mu = \frac{V_{ix} - V_{fx}}{(1 + e)V_{iy}} \]
Football Pace
Shock absorption

- Force Reduction - Artificial Athlete Berlin
- NSF Sports Floor tester
- HIC & Gmax
- French Foot
- Clegg impact test
Force Reduction

FIH
IAAF
ITF
FIFA
UEFA
IRB
Force Reduction

Falling mass = 20 kg
Spring rate = 2000 N/mm
Drop height = 55mm
Force on concrete = 6.60 kN
Force Reduction

\[ FR = \left( 1 - \frac{F_{\text{max (testpiece)}}}{F_{\text{max (concrete)}}} \right) \cdot 100\% \]
Force Reduction

‘Flat foot’  Studded foot
NSF Sportfloor Tester

FIH
FIFA
IRB
Peak deceleration (BS / ASTM etc)
Accelometric method (F & CEN)
Clegg impact test
Vertical Deformation

- Vertical Deformation - Artificial Athlete Stuttgart
- NSF Sports Floor tester
- French Foot
Vertical Deformation

IAAF
FIFA
UEFA
IRB
Artificial Athlete Stuttgart

Falling mass = 20 kg
Spring rate = 40 N/mm
Drop height = 120mm
Vertical Deformation

\[ VD = \left( \frac{1500}{F_{\text{max}}} \right) \cdot d_{\text{max}} \]
Rotational Friction

WBB
ITF
FIFA
UEFA
IRB

CSTCROMFORD@AOL.COM
DIN friction test

IAAF

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Slip resistance

IAAF
WBB
ITF

CSTCROMFORD@AOL.COM
Slip resistance

FIH
WBB
FIFA
IRB
Sliding properties
Conditioning
Effects of climate
Effects of wear
What is missing / being developed?

- Realistic friction tests:
  - Translational
  - Rotational

- Energy restitution

- Spin
Acknowledgements

Union of European Football Associations

International Association of Sports Surface Sciences

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