adidas Football Research Innovations

Surface Workshop Sheffield, April 3. 2007
Topics

- Football Innovation in between performance and injury prevention
- FIFA quality concept for artificial turf/ UEFA Football Turf Commission
- adidas approach to analyze traction characteristics
- Conclusion
FOOTBALL INNOVATION IN BETWEEN PERFORMANCE AND INJURY PREVENTION
adidas innovation team  ait.
What ait. does

Product Based Innovation Group

- Working in specific areas of innovation
  - Footwear
  - Apparel
  - Hardware
  - Balls

Supports Brand with Technology & Innovation

- Create Stories / Brand Platforms
Multi Discipline Innovation Group

- Innovation Management
- Industrial Design
- Engineering (mechanical / electronic)
- Development
- Bio Mechanics
- Advanced Marketing Communications

Goal: Create Innovation Concepts
adidas Partner for Football R&D

Uni Freiburg
HPL Uni Calgary
Uni Loughborough STRC
Uni Sheffield SERG
Uni Siegen
Deutsche Sporthochschule Köln

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Product Innovation in Football

Performance

Foot - Shoe - System

Surface-

Injury Prevention

Comfort

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Injury Statistics

High injury rates (13-35 injuries per 1000 h) (Giza, 2003)

64%-88% lower extremities (Ekstrand, 1983)

17%-21% Ankle and 20 % Knee (ACL: 64% Stop to continue sport) (Orchard, 2001)
Reasons for Football Injuries?

- Risk: Time in Season
- Risk: Fatigue
- Risk: Pre-Injuries
- Risk: Missing muscular control
- **Risk: Football boot / ground conditions**
- Others……..
Risk: Football boot / Ground conditions

Football Simulation

Cadaver tests – Studs to minimize direct injuries

Robot Traction Test

HPL Uni Calgary

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Slip resistance

- horizontal movement related to players perception
- the deceleration of the foot during stops
FIFA Quality Concept for Artificial Turf

Traction

- needed for change of direction
- measures torque necessary to start the motion of a studded sole

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FIFA Quality Concept for Artificial Turf

4. Player / Surface Interaction Tests

The characteristics of a surface that a football player needs to play the game fall into several categories. The testing for player/surface interaction consists of shock absorbency, vertical deformation, slip resistance, traction and sliding distance. The criteria were based on the performance characteristics of natural grass. The requirements are as follows:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Test Method</th>
<th>Requirements FIFA RECOMMENDED 2 STAR</th>
<th>Requirements FIFA RECOMMENDED 1 STAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock Absorbency</td>
<td>EN 14808</td>
<td>60 - 70%</td>
<td>55 - 70%</td>
</tr>
<tr>
<td>Vertical Deformation</td>
<td>EN - Low Impact &quot;Stuttgart Athlete&quot; EN 14809</td>
<td>4 mm - 8 mm</td>
<td>4 mm - 9 mm</td>
</tr>
<tr>
<td>Slip Resistance</td>
<td>Slip Resistance Tester</td>
<td>130 - 210 Scale 3 - 5-g Deceleration</td>
<td>120 - 220 Scale 3 - 6-g Deceleration</td>
</tr>
<tr>
<td>Traction</td>
<td>Number to be allocated</td>
<td>30 - 45 N.M.</td>
<td>25 - 50 N.M.</td>
</tr>
</tbody>
</table>

**Laboratory only:**

| Skin Abrasion           | Securisport                  | +/- 15 %                             | -                                    |
| Skin Friction           | Securisport                  | 0.35 - 0.75 coeff. of friction       | -                                    |
FIFA Quality Concept for Artificial Turf

The Licensing Programme

Artificial surfaces will undergo tough quality tests in order to qualify for the FIFA standard and to be eligible for the use of the prestigious FIFA hallmarks.

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adidas Football - Artificial Turf
adidas Traction Tester

Load cell providing force measurement
Applied Normal Load (700 N)
Laptop to record force-time output
Test Boot
Actuator

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adidas Traction Tester

Starting (Translational Movement)

Representative of a player pushing off for a sprint

Performance +++

Injury Prevention +

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adidas Traction Tester

Turning (Rotational Movement)

(excessive rotational traction is correlated with injuries)

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Goal: Quantify traction values of adidas football shoes on FIFA recommended artificial turfs

Objectives

traction benchmark of 4 well-established and successful shoe-natural grass combinations

Compare natural grass combinations to 6 shoe types on 4 artificial turf samples under dry and wet conditions

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Benchmark Traction Natural Turf

Mania FG  Copa Mundial  Pulse X-TRX SG  World Cup

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benchmark traction natural turf

Force-Time Traces

Translation

Rotation

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Natural-turf based **Acceptance Zone** defined using standard deviation of maximum and minimum values of COT & Torque for well-established shoes

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COT v Torque for Accepted Configurations

- Copa on Natural-Dry
- TRX on Natural-Dry
- XTRX on Natural-Wet
- World Cup on Natural-Wet
- Extreme
- Insufficient Torque
- Insufficient Translational Traction

Accepted Zone
benchmark traction artificial turf

Copa Mundial

Predator Mania TRX

TRX Turf

Mundial Team

Predator Pulse XTRX

F30 HG

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Results:

COT v Torque for dry sample 1 Configurations

- Copa Mundial
- TRXturf
- Mania FG
- Pulse SG
- F30 HG

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Results:

COT v Torque for Wet Sample 1 Configurations

- Copa
- Mundial
- Pulse SG
- Mania FG
- TRXturf
- F30 HG

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Results:

COT v Torque for dry sample 2

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Results:

COT v Torque for wet sample 2

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Comparing Torque-Time Traces:

- **Copa Rotation Traces on Dry Surfaces**

- **natural turf - rotation**

- **benchmark traction artificial turf**
benchmark traction

Conclusions:

- Traction outsoles deliver lower torques compared to traditional outsoles
- Important parameters
  - Peak Forces
  - Force Time Curves
- A shoe recommendation is only reasonable for a certain combination of surface and surface condition (moisture, maintenance, wear, aging, …)!

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Study with Football Players: stud configurations and knee injuries

University of Freiburg

Benchmark of different stud configurations (traditional Studs versus TraXion studs).

Measure the influence on specific loads of the human skeleton (especially the knee).

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Electromyography

m. vastus medialis
m. tibialis anterior
m. gastrocnemius
m. peroneaus
m. biceps fem.
Change of directions

- Ankle Dors/Plan Moment
- Ankle Ab/Add Moment
- Ankle Rotation Moment

Footwear options:
- World Cup
- Pred Mania SG
- Copa Mundial
- Pred Mania FG
Final Conclusions

• TRAXION Studs do have positive influence on Performance and NO negative influence on knee injuries!
• We are able to measure and evaluate traction behavior of all shoe surface/ground conditions.
• We want to offer the possibility to choose the optimal Football boot solution for all players!
Thank you!

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