

A Review of Mechanical Impact Testing Devices for Sport Surfaces

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STARSS Conference
17th & 18th September 2007

www.sportsurf.org

Introduction

Sports Surfaces are complex structures that are made from many layers.

Many of the materials used to build sports surfaces are both stress and strain rate dependent.

Since the inception of artificial surfaces in the mid 1960s many test devices have been developed to assess their behaviour.

This presentation reviews devices that are used to measure the impact response of sport surfaces.



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Berlin Artificial Athlete

20 kg Falling Mass

50 mm Drop Height

2000 kNm⁻¹ Spring

Force measured on sports surface
compared to concrete

Contact pressure depends on
surface



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Contact Pressure

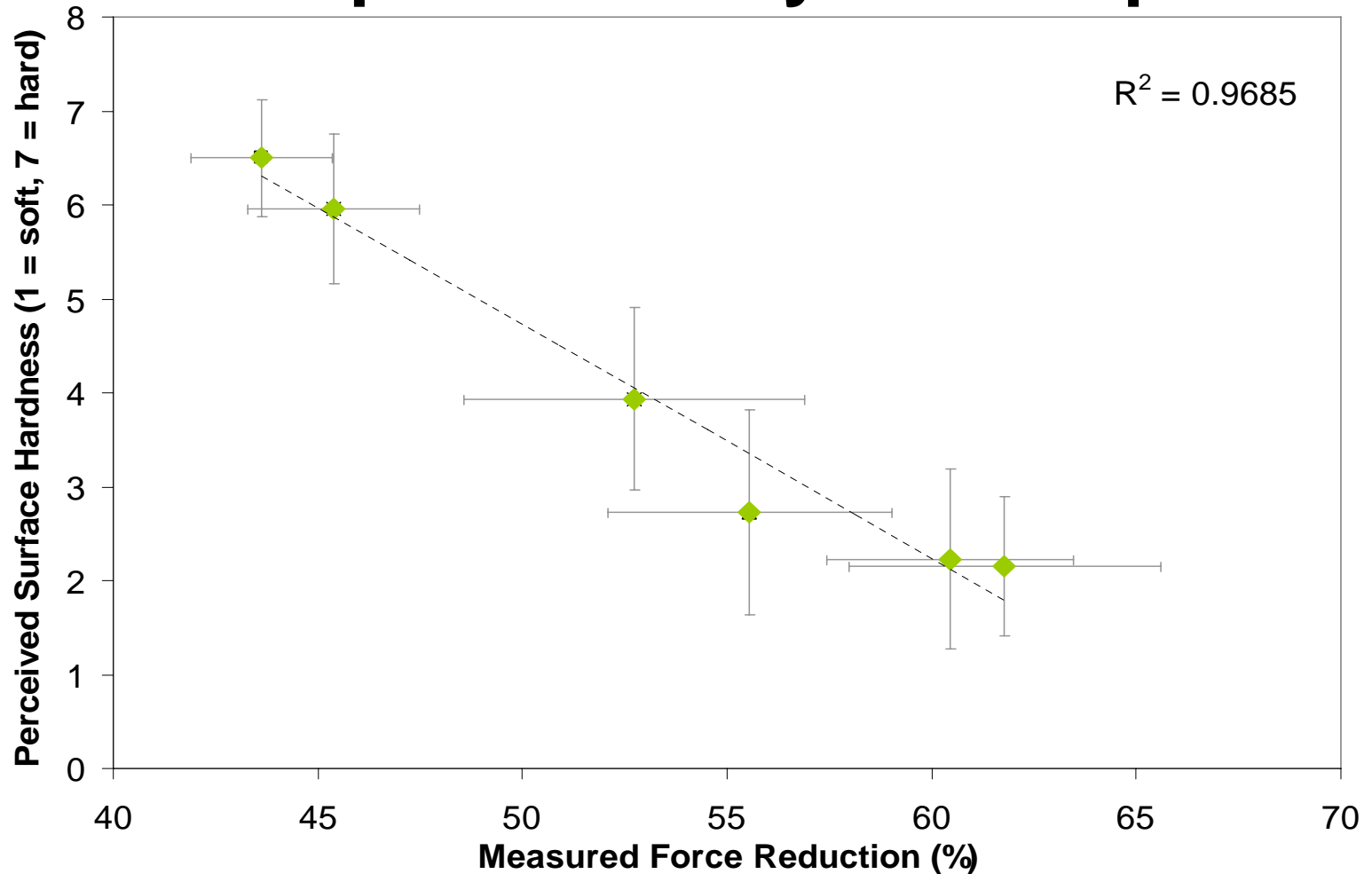
Surface Type	Contact Pressure (Typical)
Concrete	1700 kPa
Acrylic (Tennis)	1600 kPa
Macadam (Tennis/Netball)	1500 kPa
Athletics/Running Track	900 – 1000 kPa
Synthetic Turf	700 – 800 kPa



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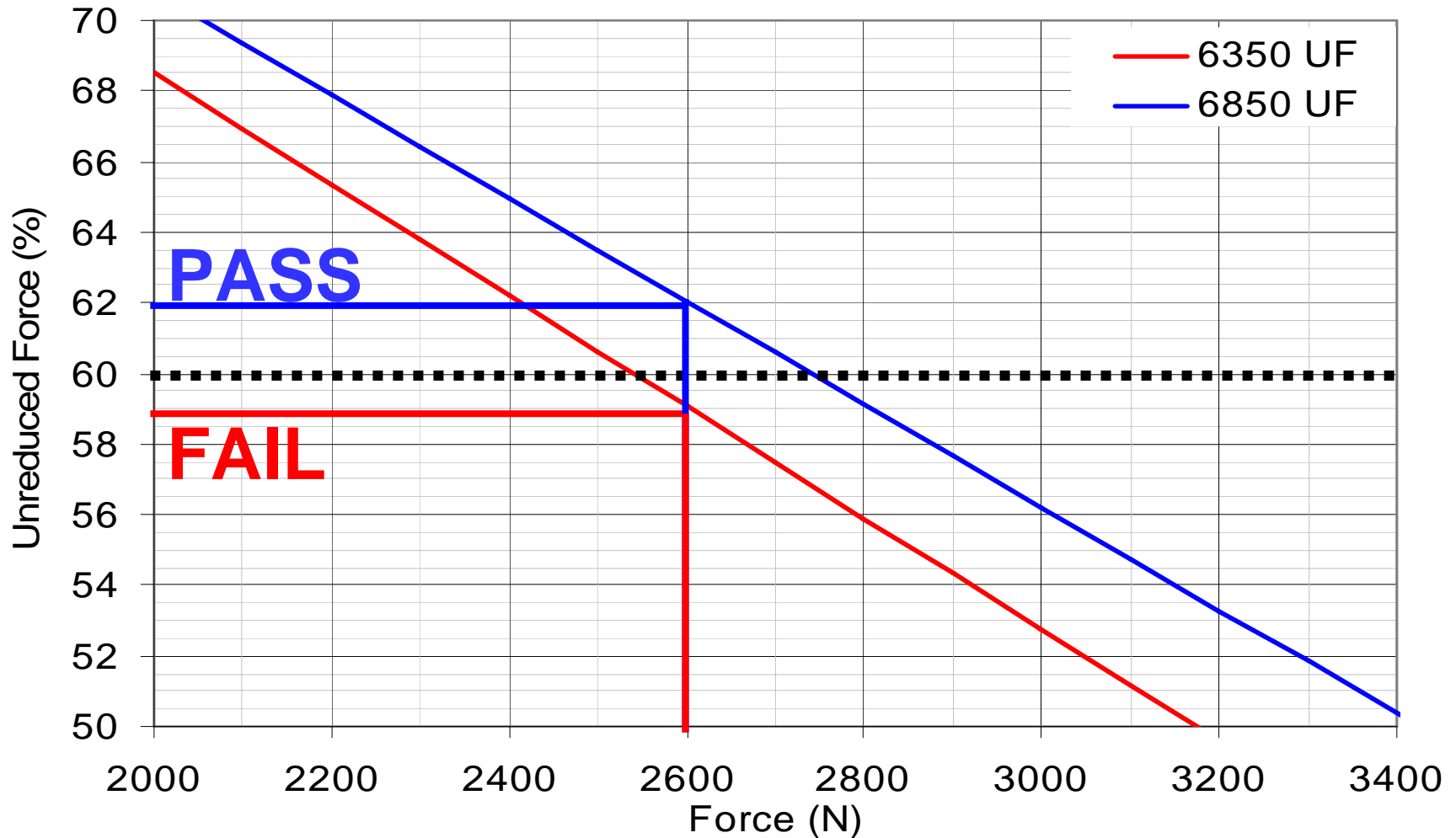
BAA Compared to Player Perceptions



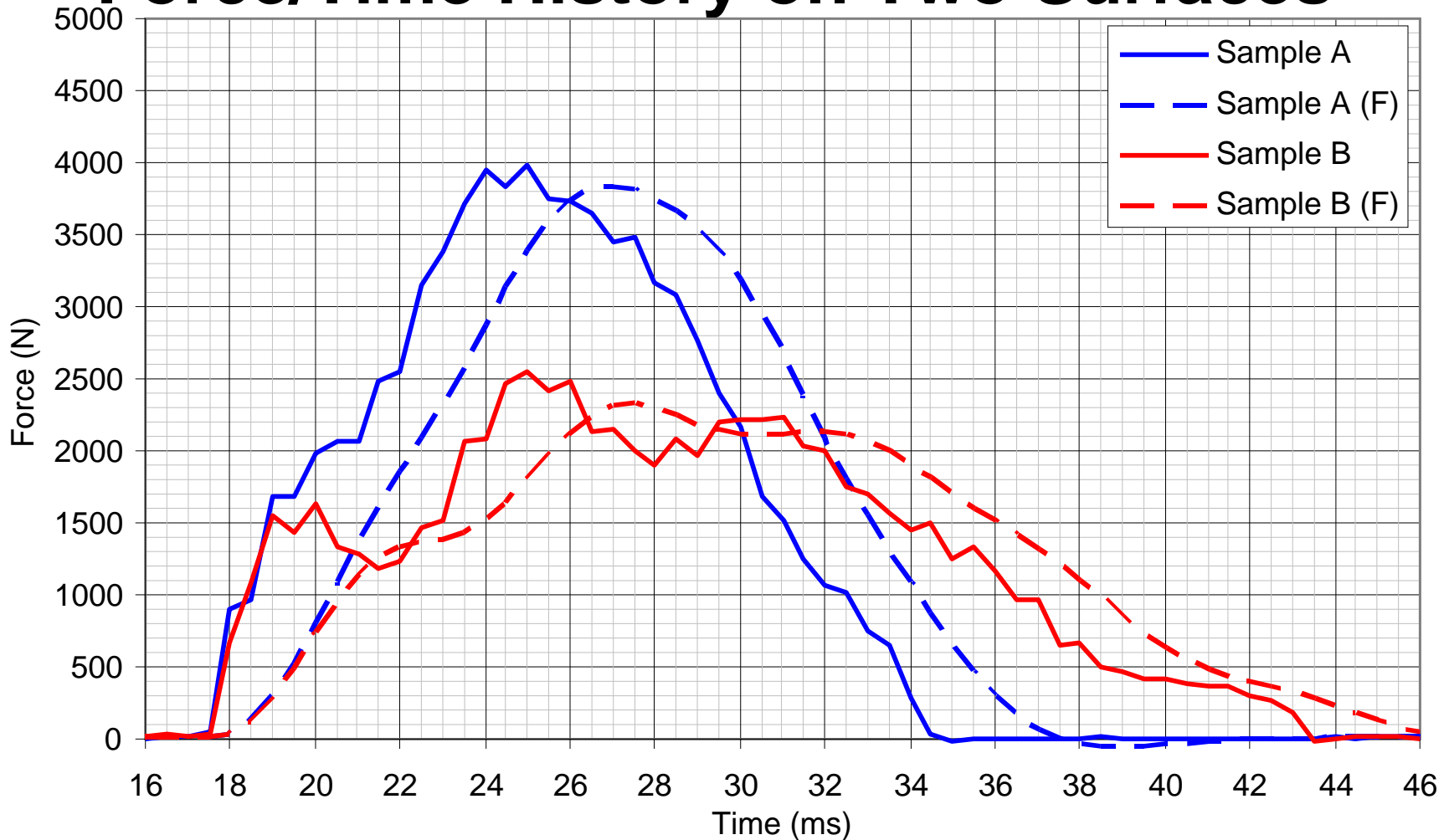
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The Influence of Unreduced Force



Force/Time History on Two Surfaces



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Clegg Impact Hammer

Measures the peak deceleration upon impact with the surface.

Direct surface impact

0.5, 2.25 and 4.5 kg impact weights

50 mm diameter

High contact pressure & short contact time



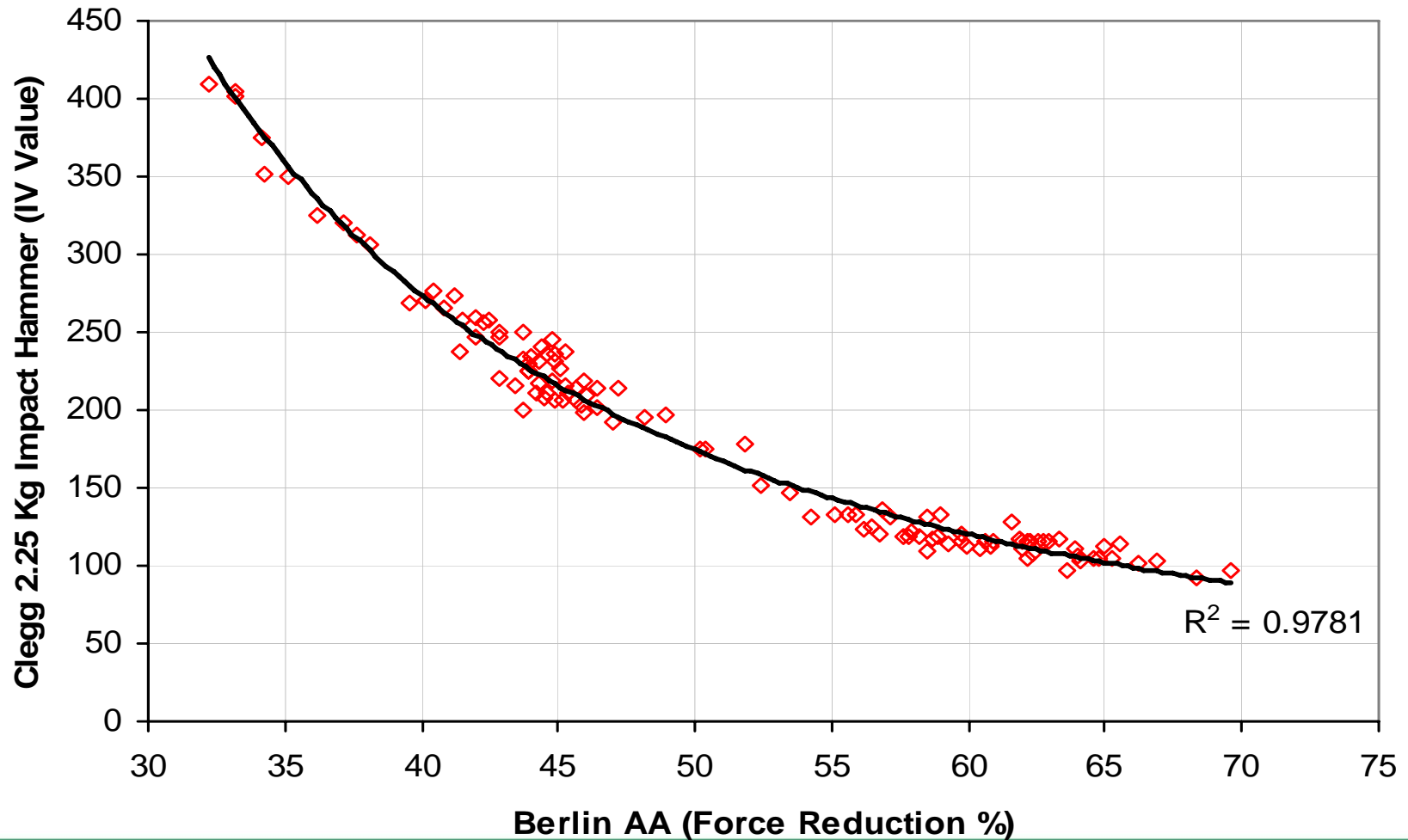
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Clegg and BAA Relationship



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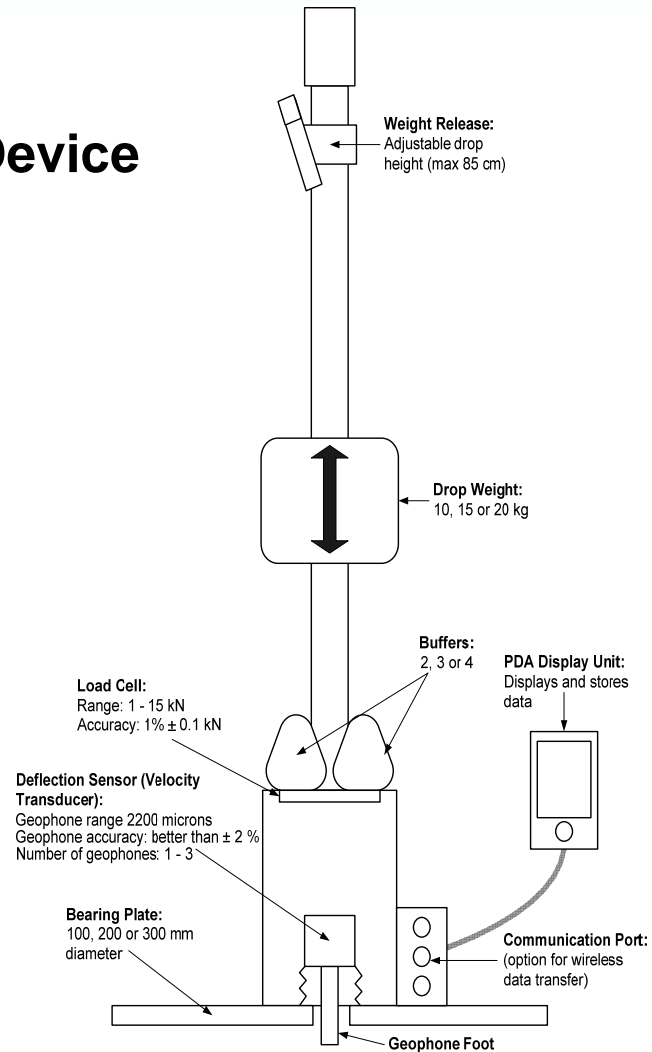
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LWD

Developed as a Civil Engineering Device

Measures Load & Deflection

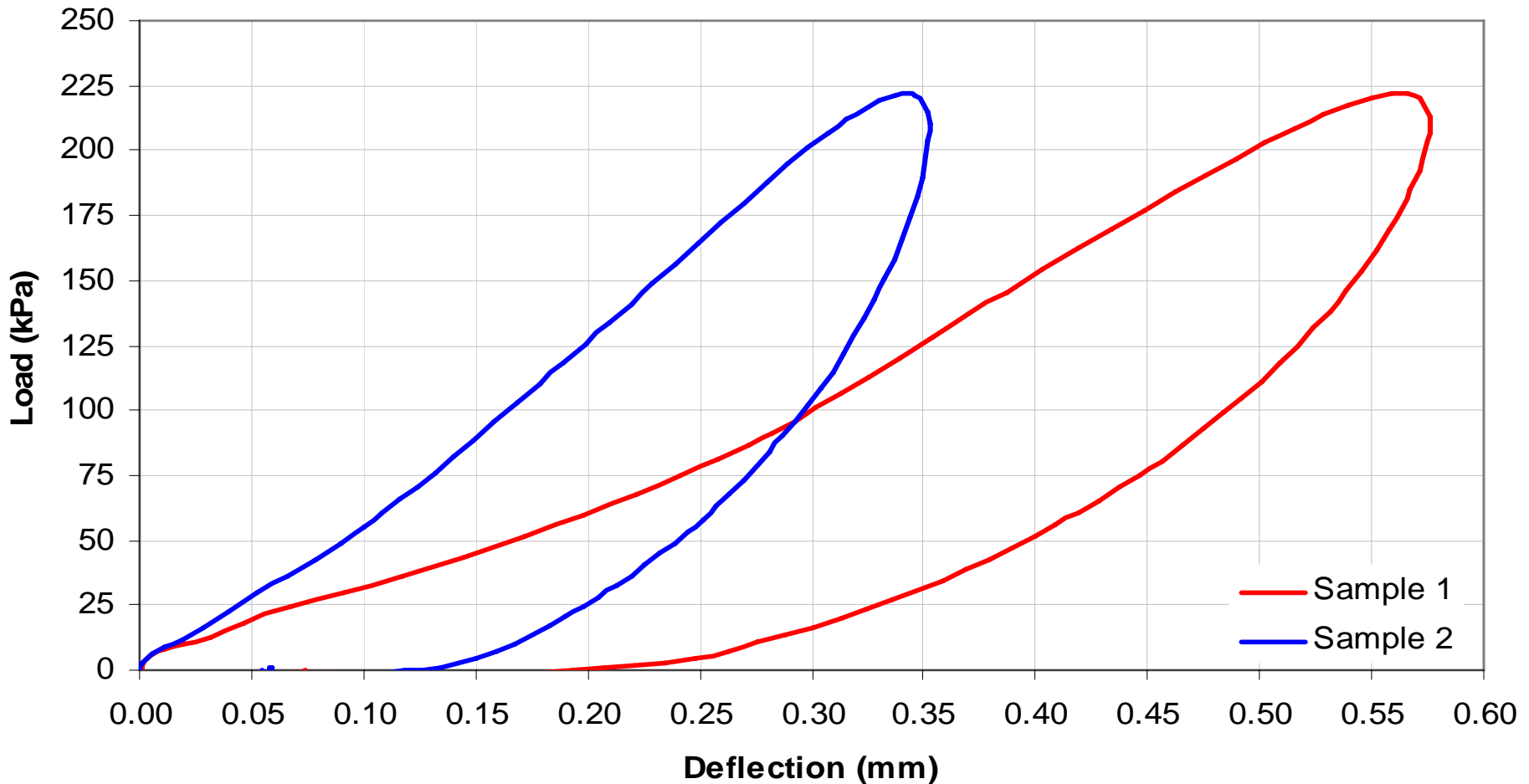
Very Flexible (drop height, contact area, contact duration)



Note: data reproduced from manufactures information sheet



LWD: Load/Deflection



Discussion

Mechanical testing does not simulate player loading well but is a useful way of ranking surfaces.

A range of measurements at different impact loads could be used to assess the surface and improve understanding of its non-linear behaviour.

Validation with user perceptions can be a useful tool to help develop testing devices.

The simple Clegg Hammer could be a useful monitoring tool for pitch operators