Surface ‘Requirements’

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Loughborough University

SportSURF Launch Seminar
17th November, 2005

Supported by:

Sport Surfaces

Several generations, many innovations, many products, many myths?

Natural turf vs. Synthetic – future?

Currently large investment – increasing use of artificial outdoor surfaces

Natural Turf - Football

Natural Turf - Rugby

Natural Turf - Lacrosse

Natural Turf - Cricket

Synthetic – Football/Rugby

Synthetic Sand-based

Athletics Track

Surface Behaviour

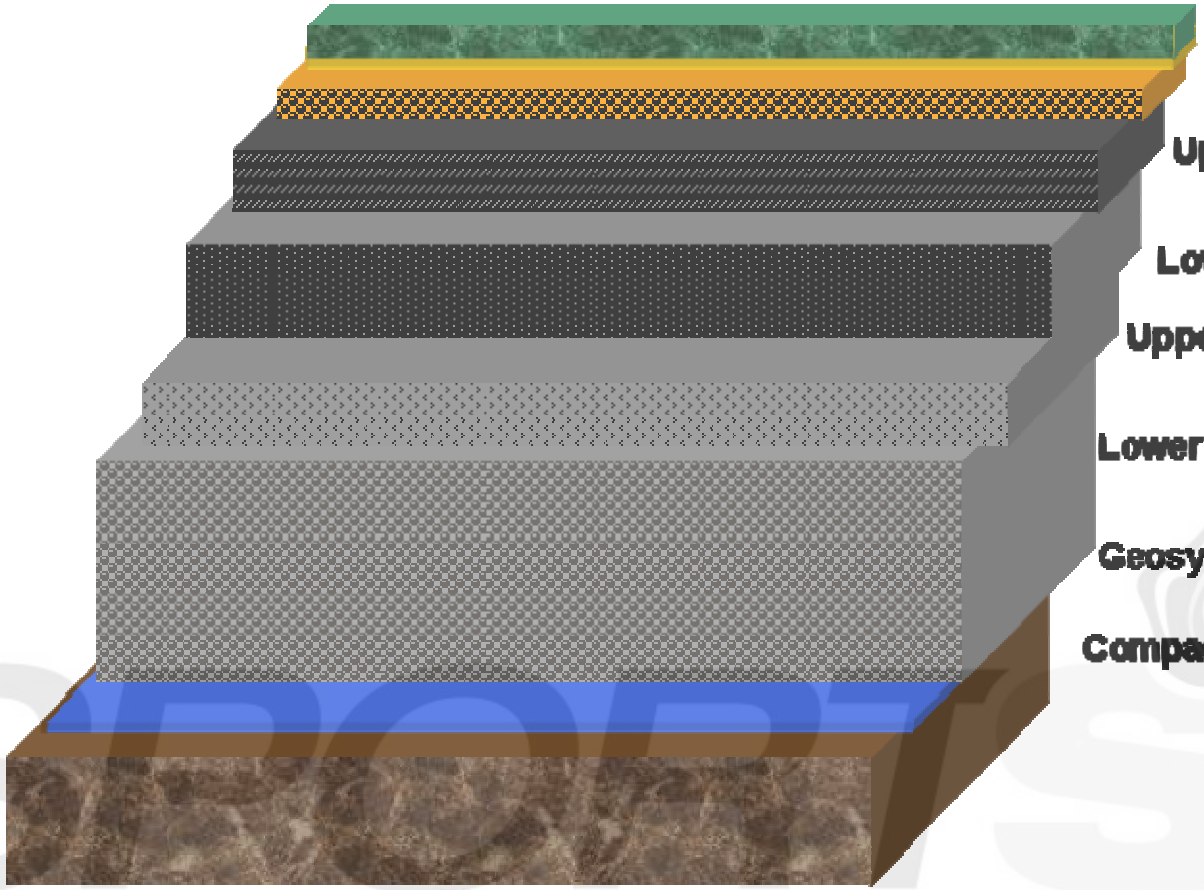
Component materials?

Construction Effects?

Use and maintenance effects?

Testing/evaluation?

Typical Synthetic Pitch Construction



Drainable Foundation

Flat Stiff Substrate

Shockpad Construction Insitu

Synthetic Turf Carpet Laying

Carpet Types - Fill

Four generic surface types – artificial

Sand-filled (sand-dressed) carpet

Unfilled carpet (water)

Rubber crumb filled carpet

Bound rubber crumb

Many variations available….

Sand-filled carpet

Wet compacted sand fill

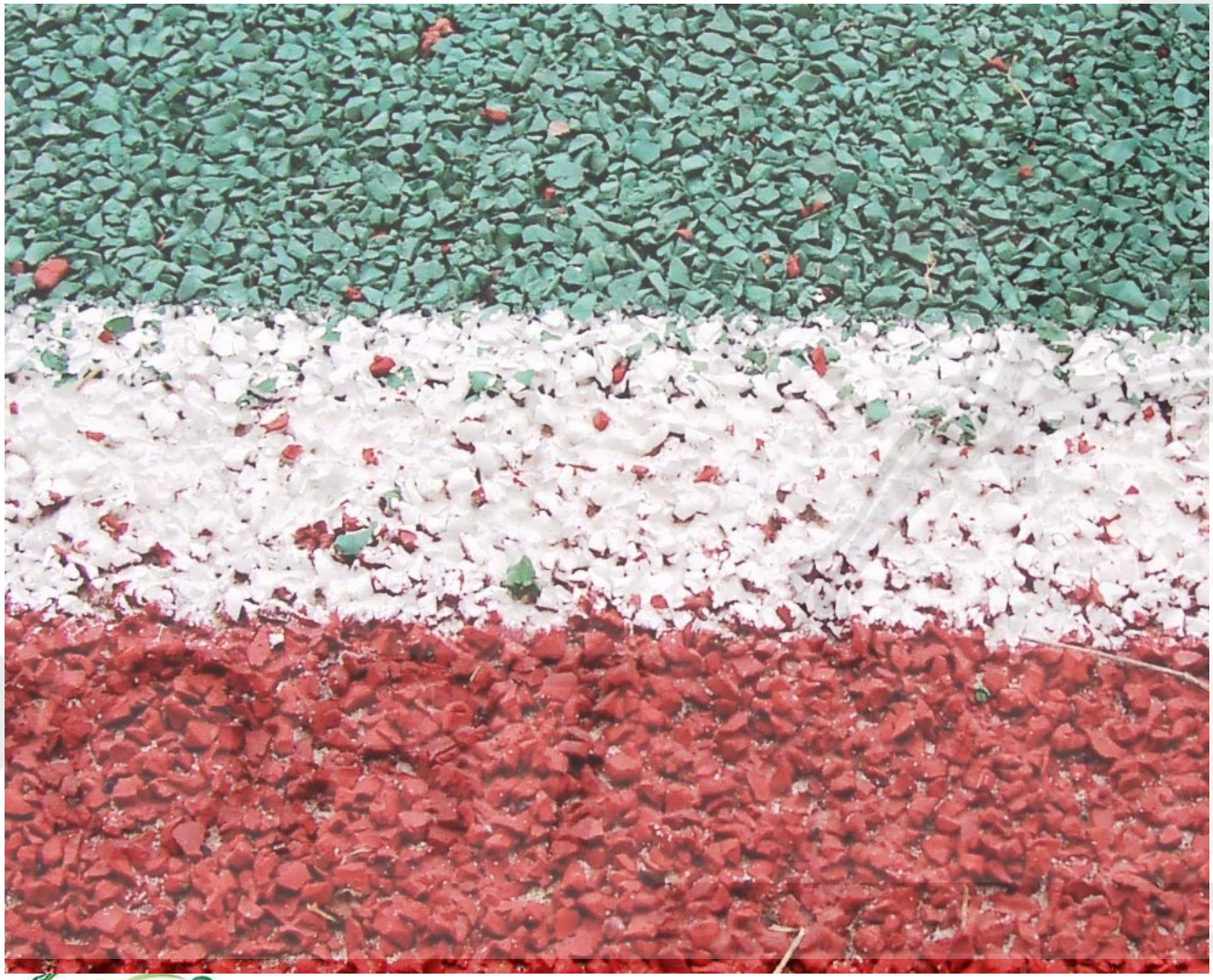
Unfilled carpet – w/based

Irrigation – regular/uniform?

Long pile carpet – rubber infill

Rubber infill

Bound Rubber - Track



Maintenance of Surfaces

Indoor Surfaces

Sports halls, multi use…

Specialist surfaces – tracks, cricket

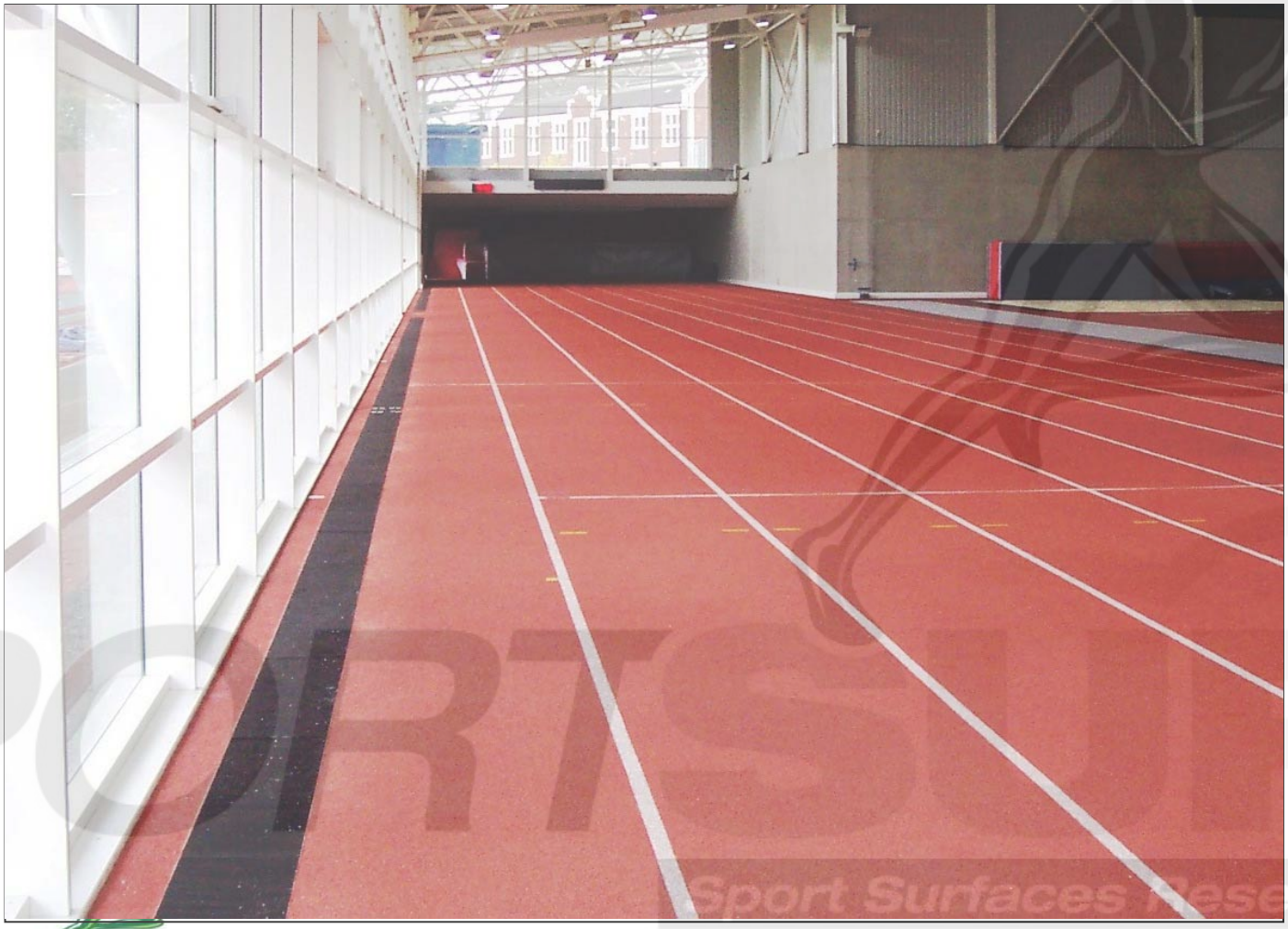
Point elastic/area elastic

Sports Hall – Multi use

Floor Construction – Uniformity?

Cricket – Indoor Training

Athletics – Indoor Training



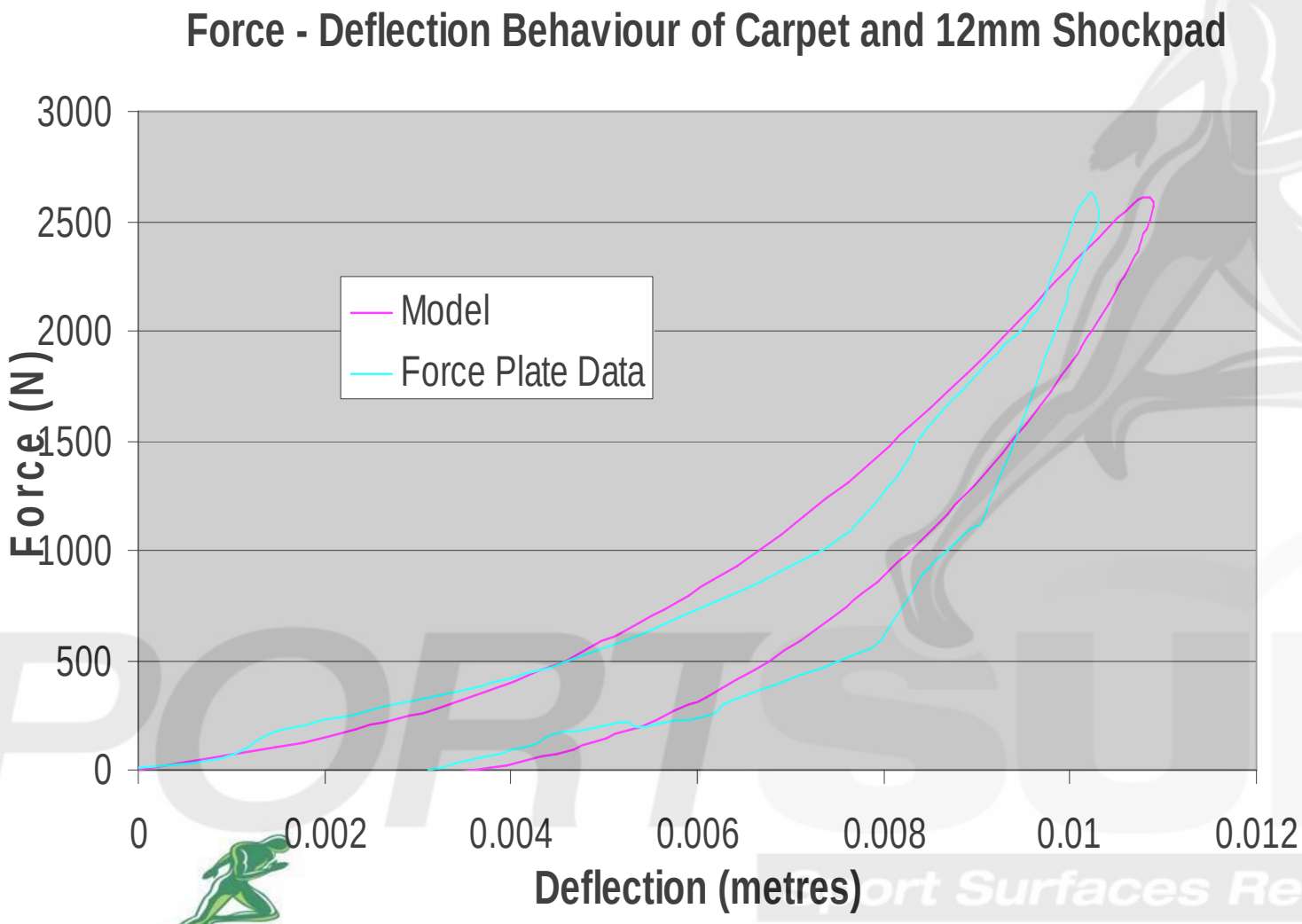
Testing/Evaluation

Some Examples from

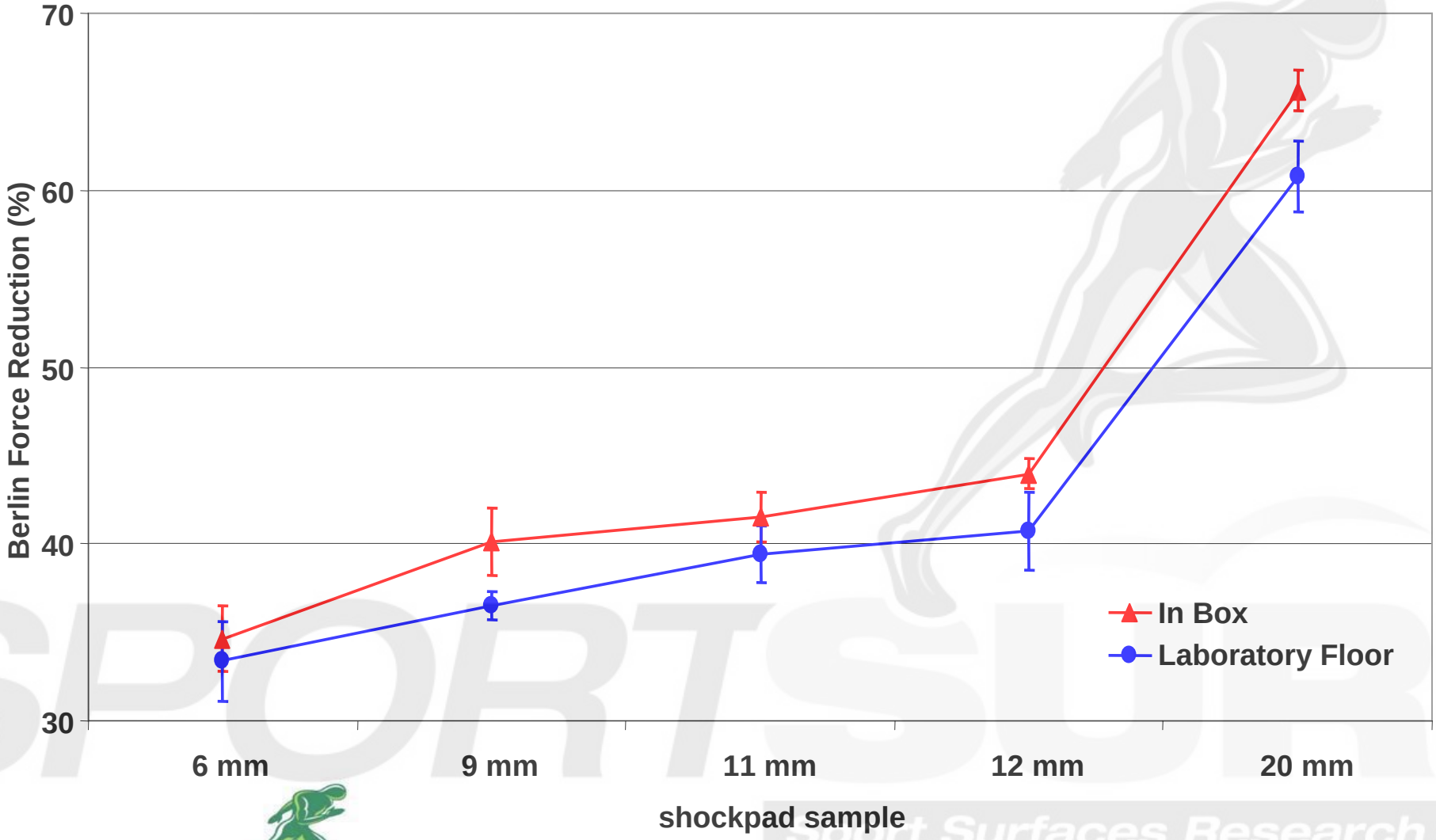
Pitches, Tennis Courts, Sports hall Floors

Pitch Shockpad – Key Layer

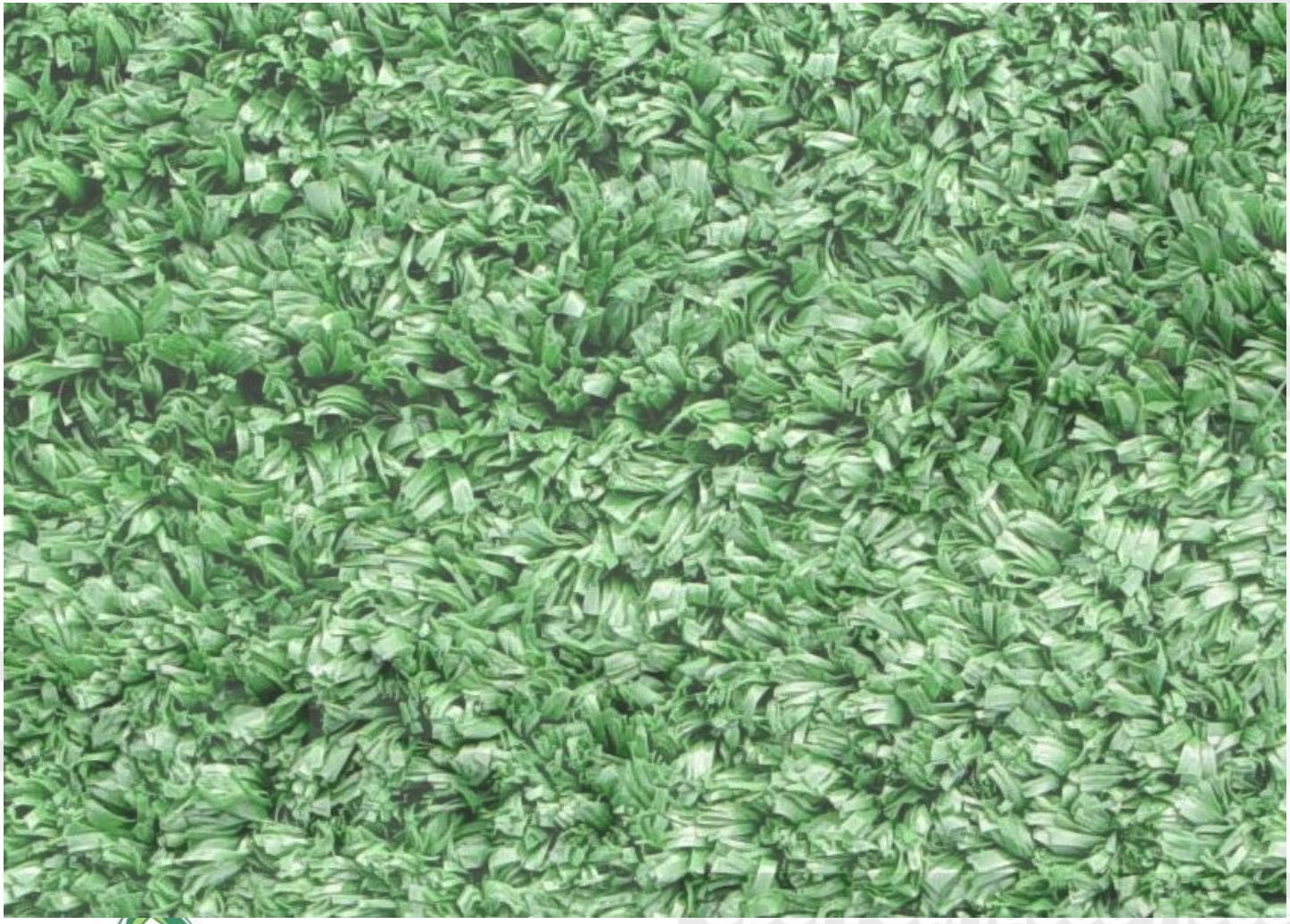
Shockpad - Behaviour



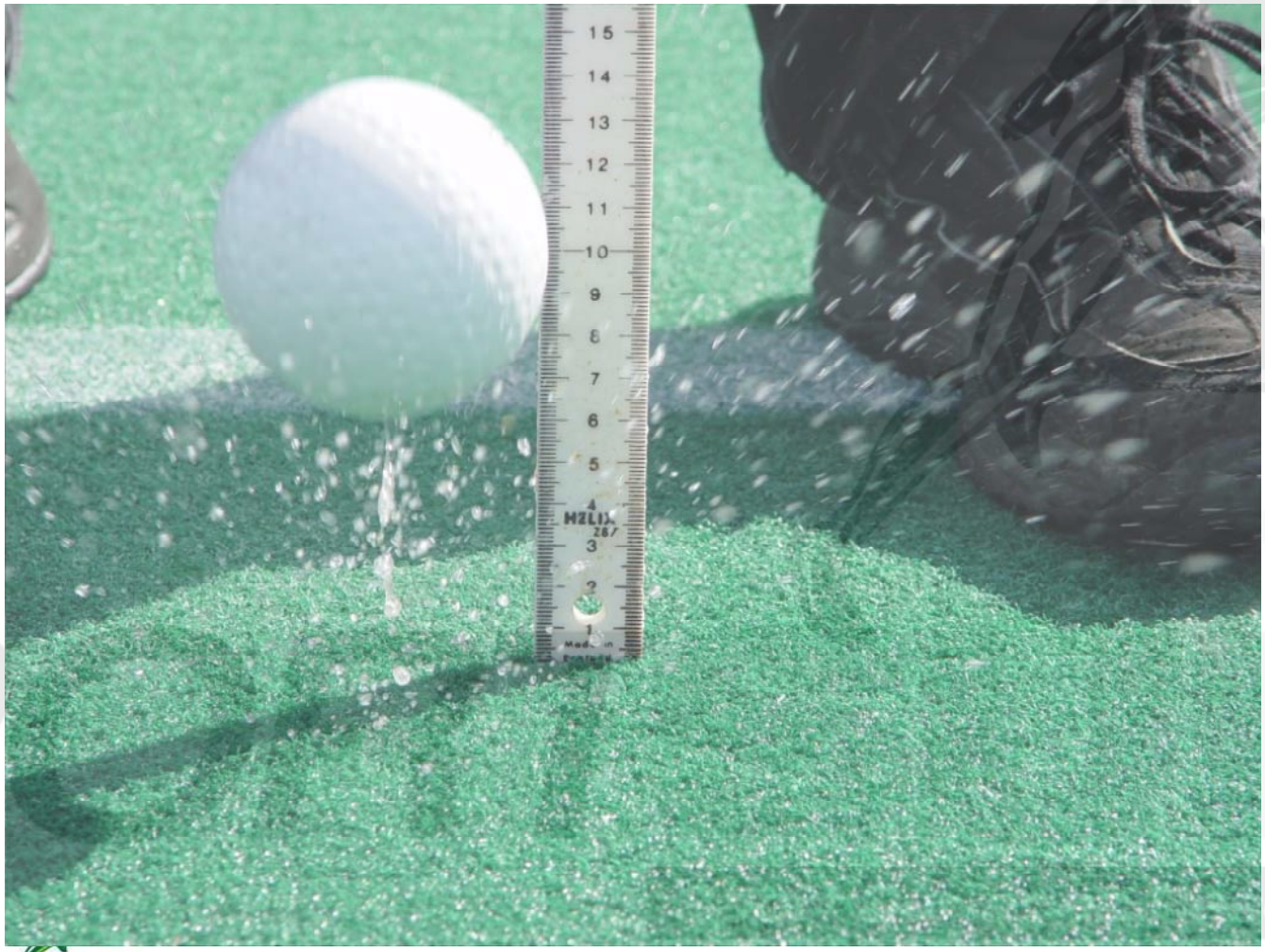
Shockpad – Thickness Effect



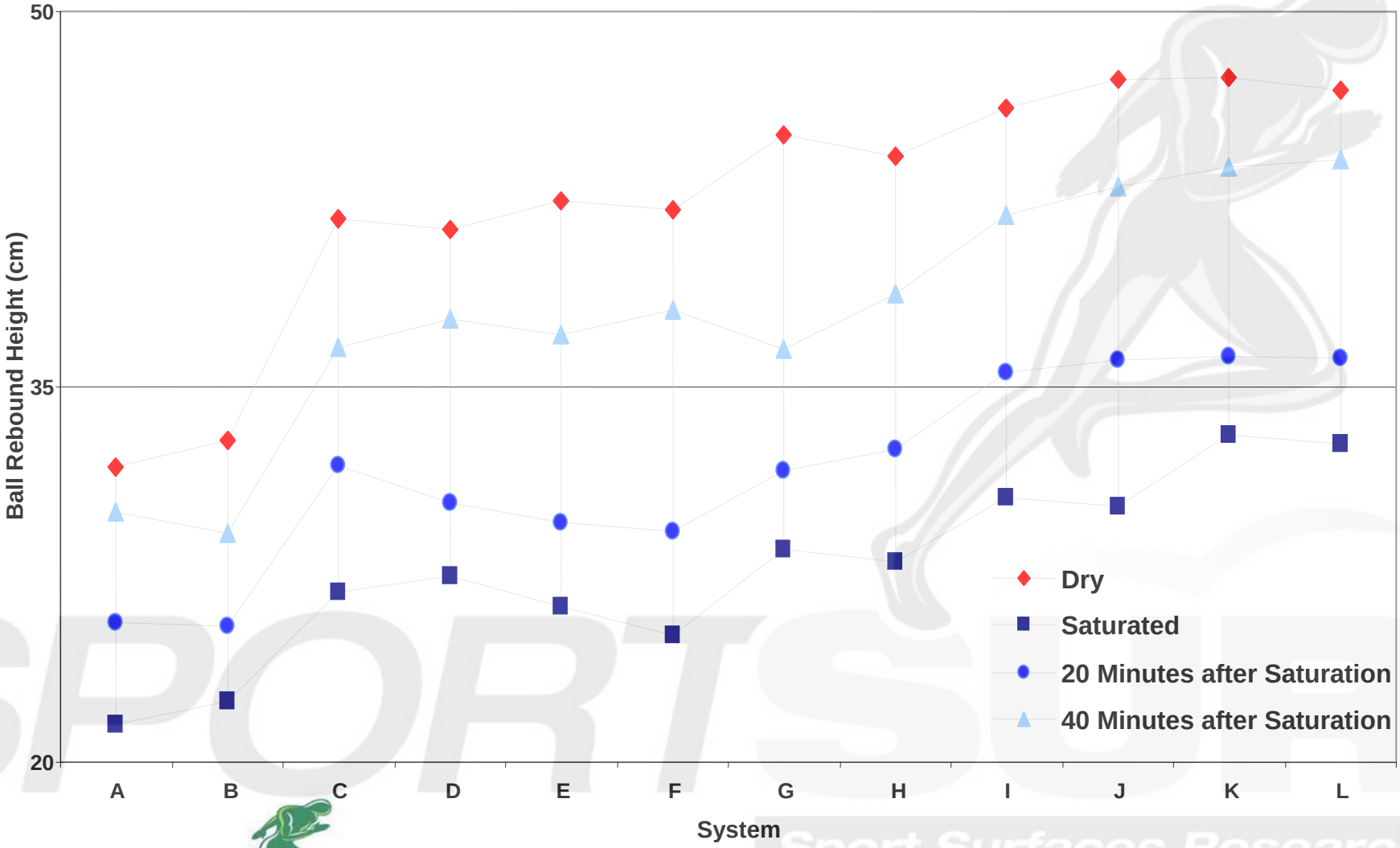
Carpet type – Key Layer



Carpet Fill – Key Factor



Ball Rebound – Water Drainage



Non-uniform drainage

Surface Evaluation

Mechanical Measurements of ‘Performance’

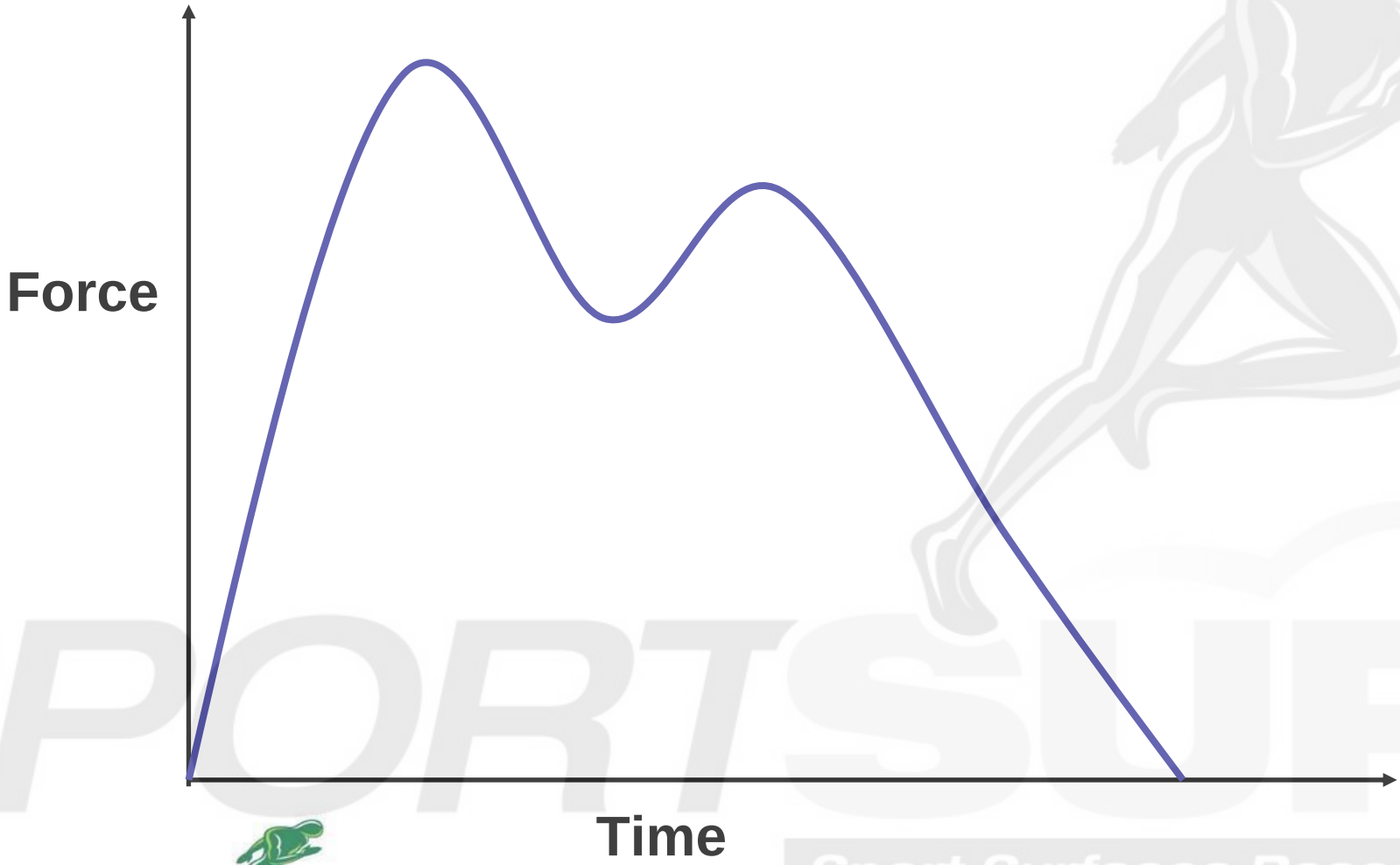
Impact hardness & energy return

Friction – translation, rotation

Spatial & Temporal?

Simple tests required?

Athlete Loading Known?



Berlin Athlete – Impact Test

Drop height: 55cm
Drop weight: 20 kg
Test Foot: 70mm diameter

Typical Contact Pressures:
Concrete: 1700 kPa
Acrylic: 1600 kPa
Synthetic Turf: 700/800 kPa
Load pulse: ~30 milliseconds

Clegg Hammer – Impact Test

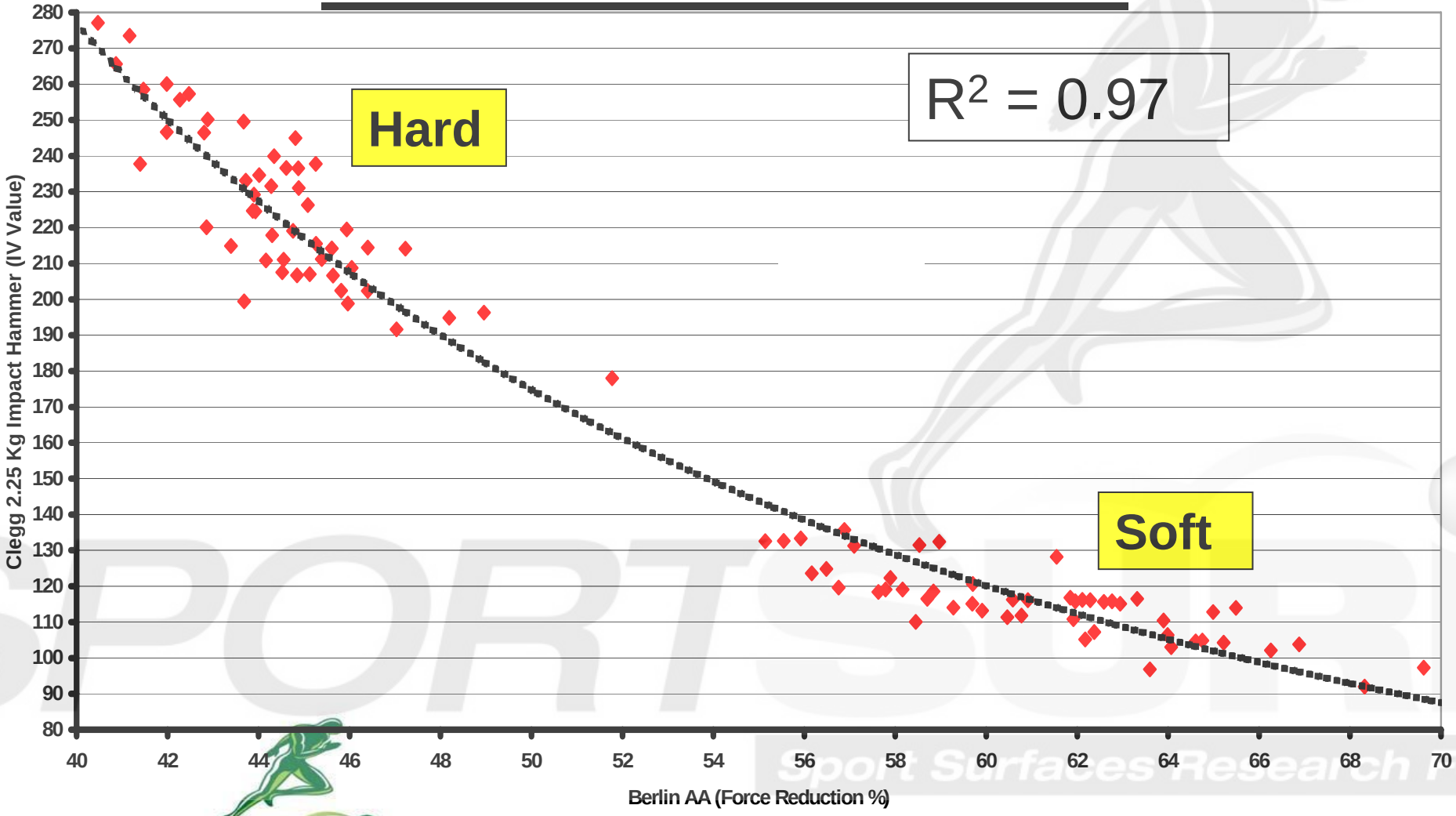
Drop height: 45cm
Drop weight: 2.5 kg (0.5kg)
Test Foot: 50mm diameter

Typical Contact Pressures:
Synthetic Turf: 1000-2000 KPa
Load pulse: ~5-10 millisecs

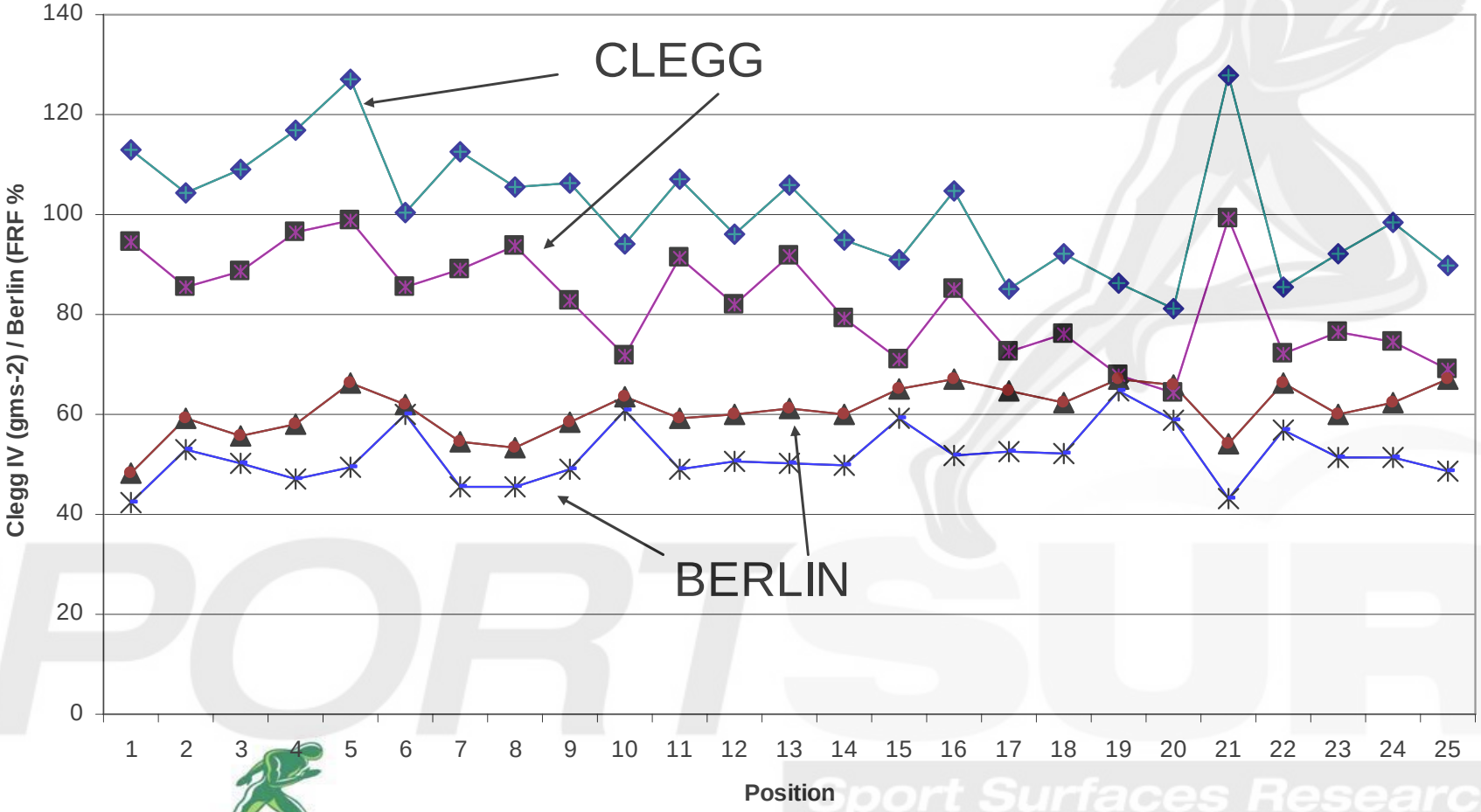
Useful, simple?

Berlin & 2.5kg Clegg Correlation

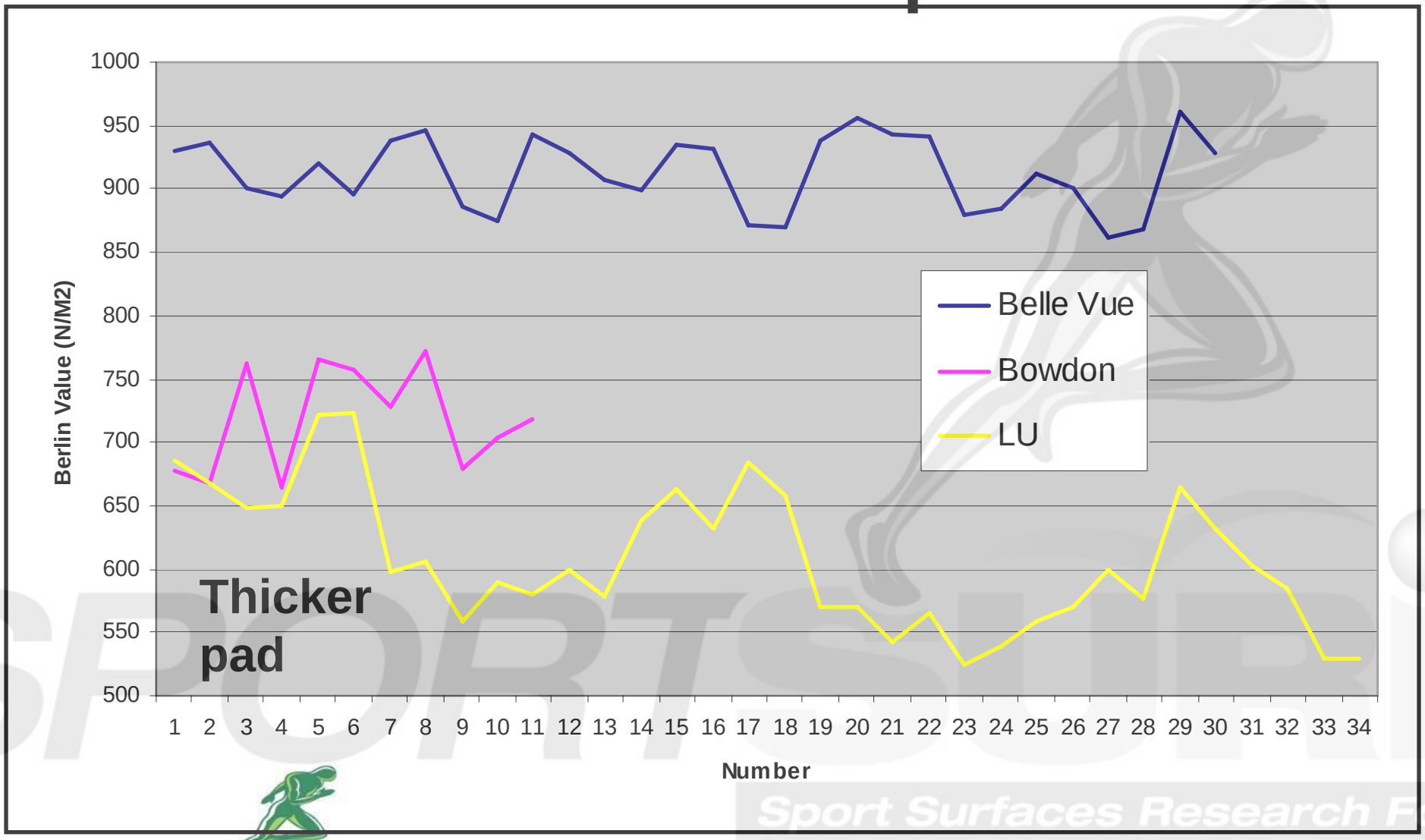
6 Water Based Pitches



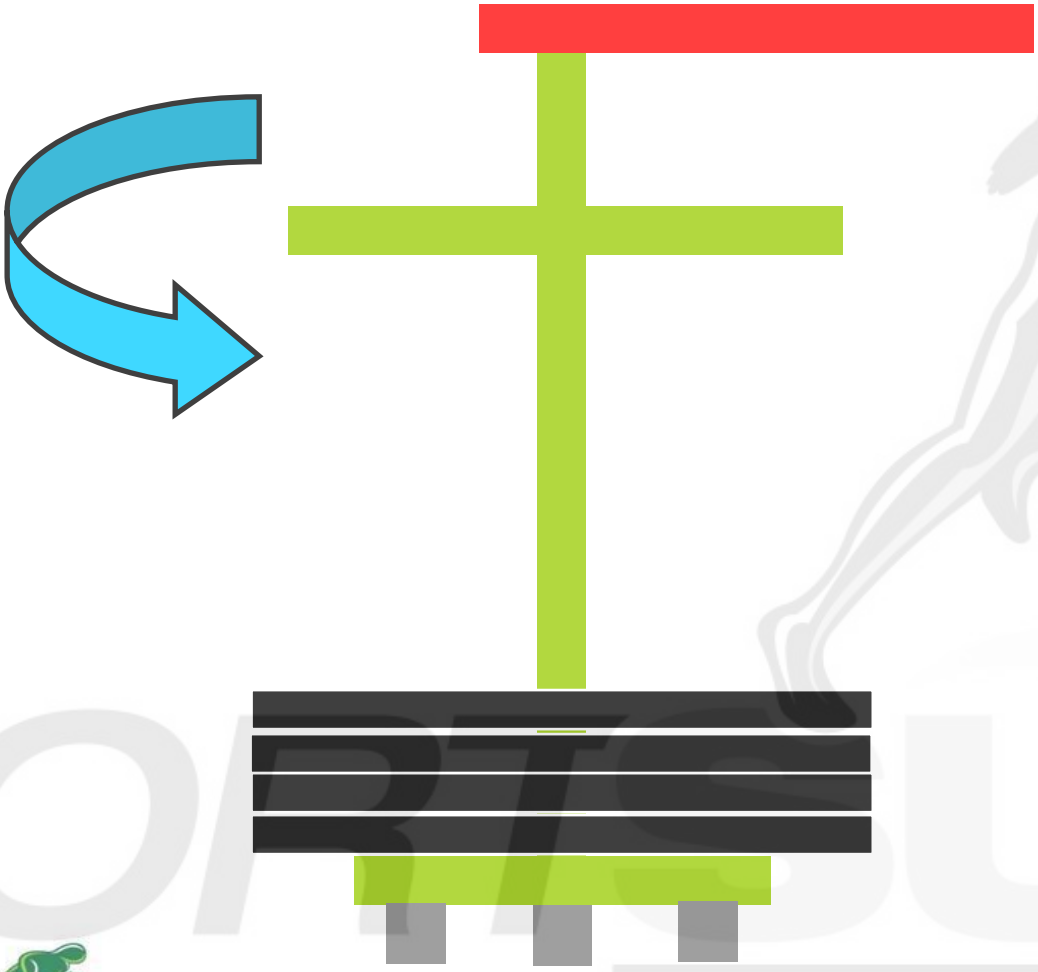
LU Rubber Crumb
Berlin & 2.25 Clegg



W/based Pitch - Berlin Spatial Variation

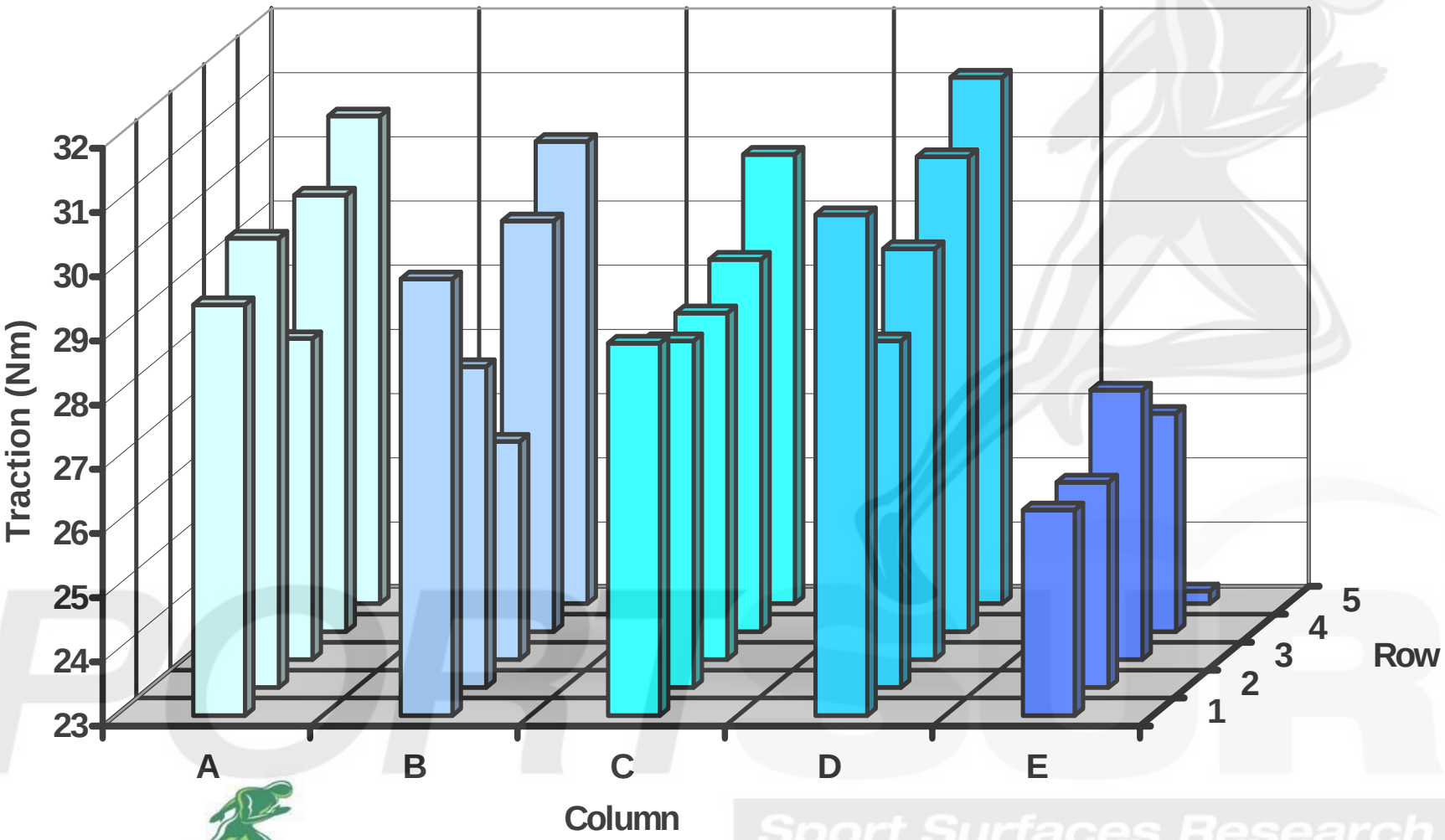


Traction Tester

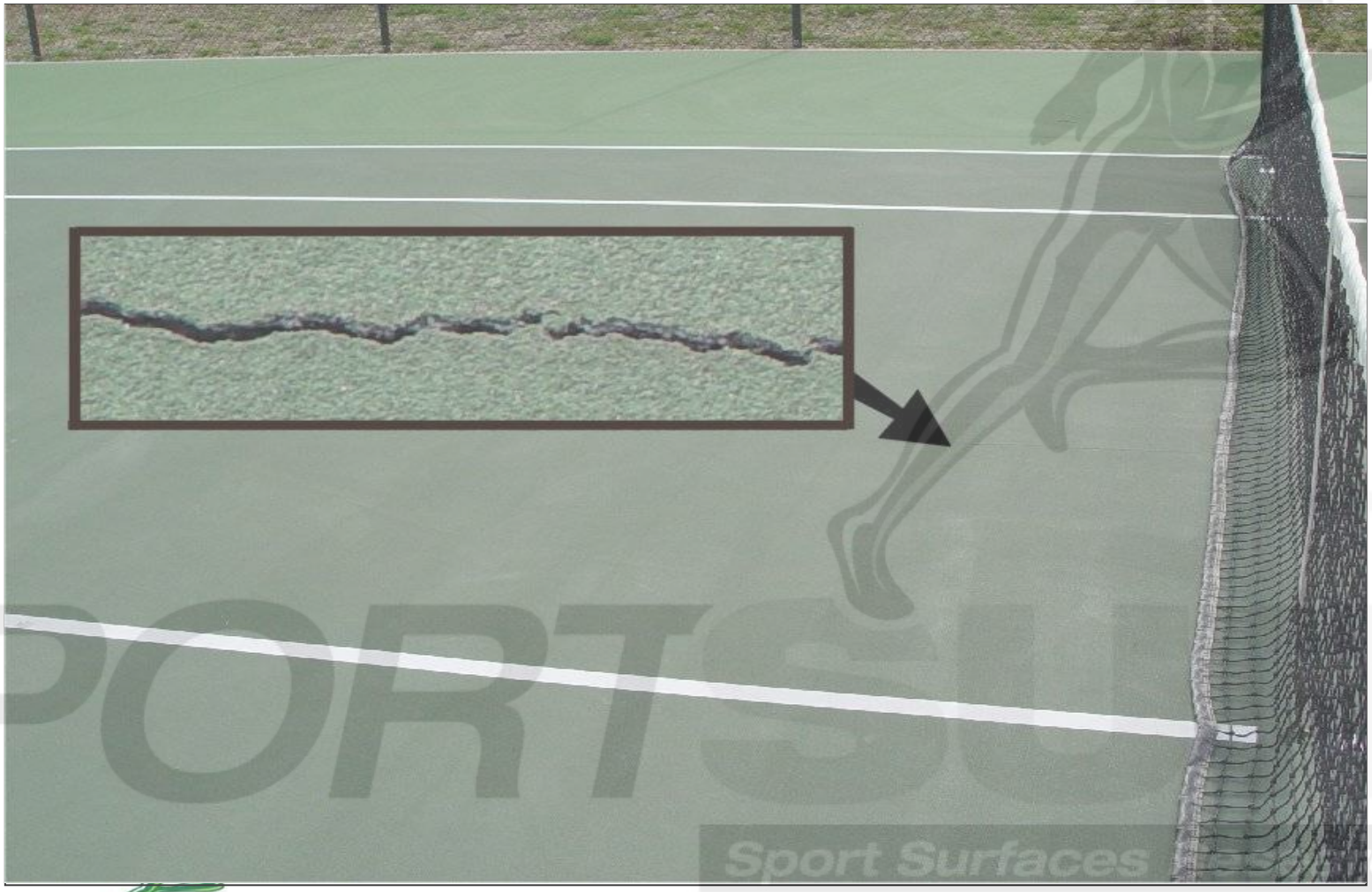


Traction at Pitch F

(Algal Growth Row E)



Tennis Courts



Test Equipment: Prima Plate Test

Drop height: up to 85 cm

Drop weight: 10 - 20 Kg

Pulse Time: 15 – 30 ms

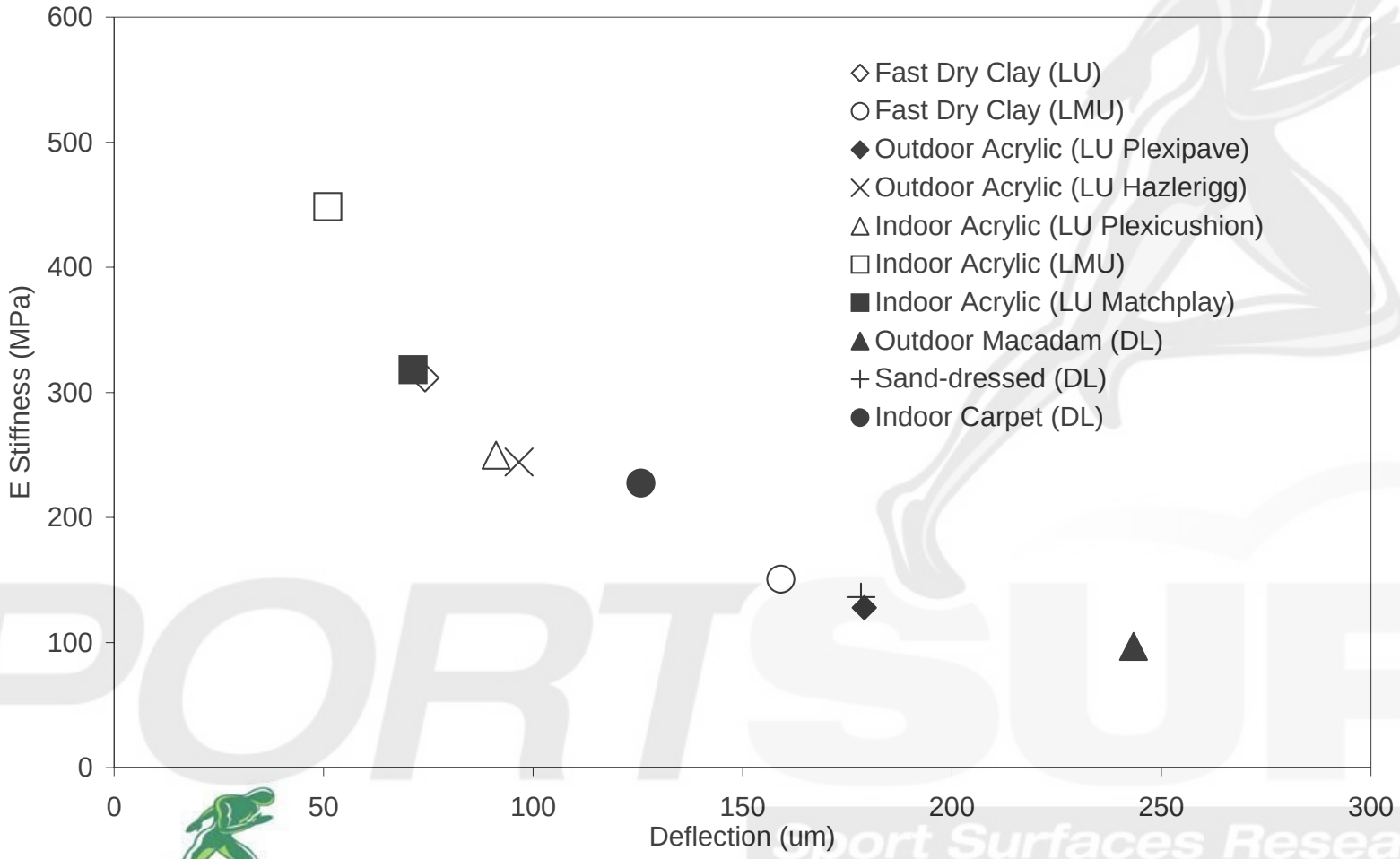
Plate Size: 100, 200 or 300 mm

Load Range: 0 – 15 kN

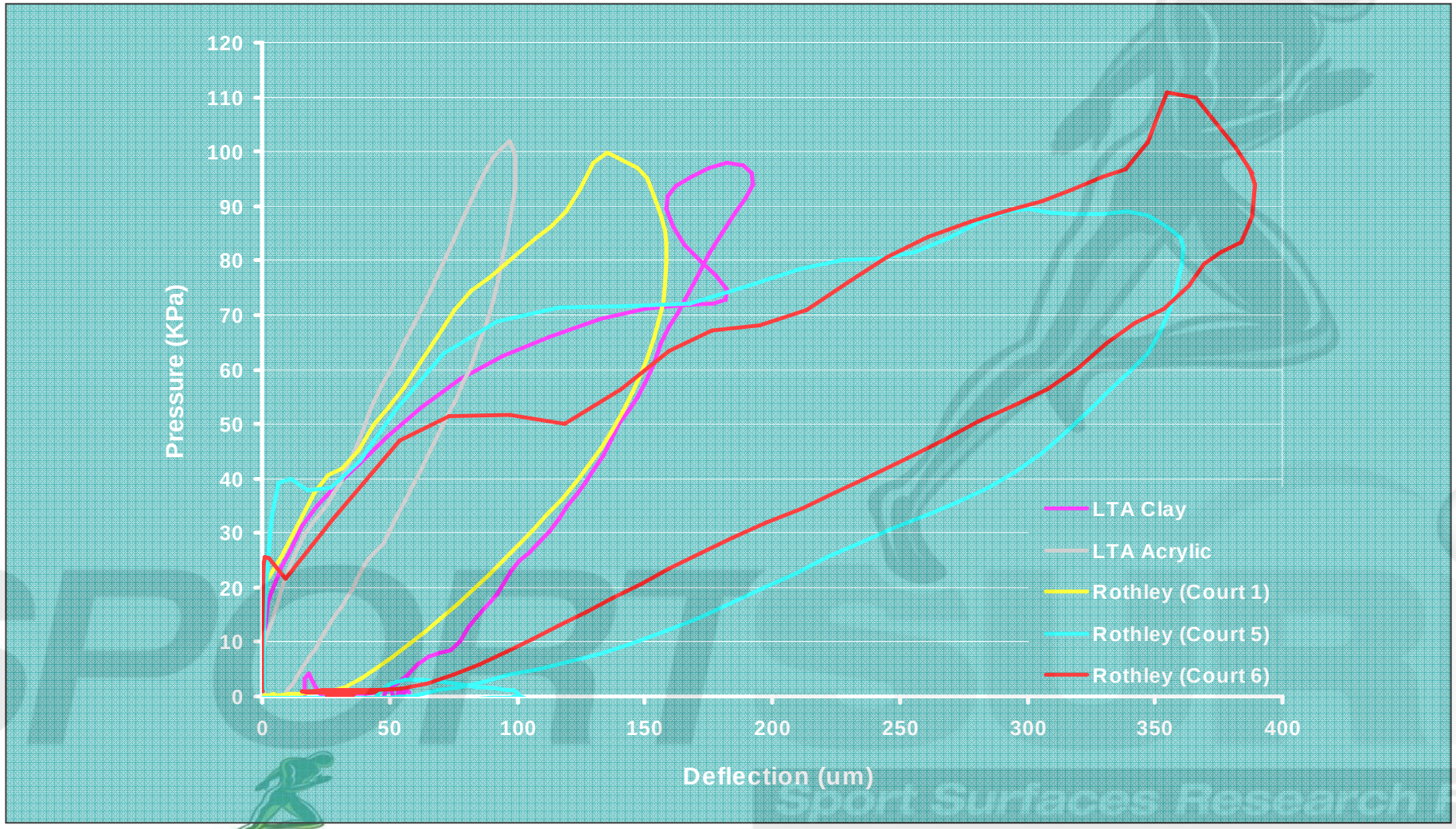
Deflection Sensor: 0 - 2200μm

Sample Frequency: 4000 Hz

Tennis – Range of Surface Types



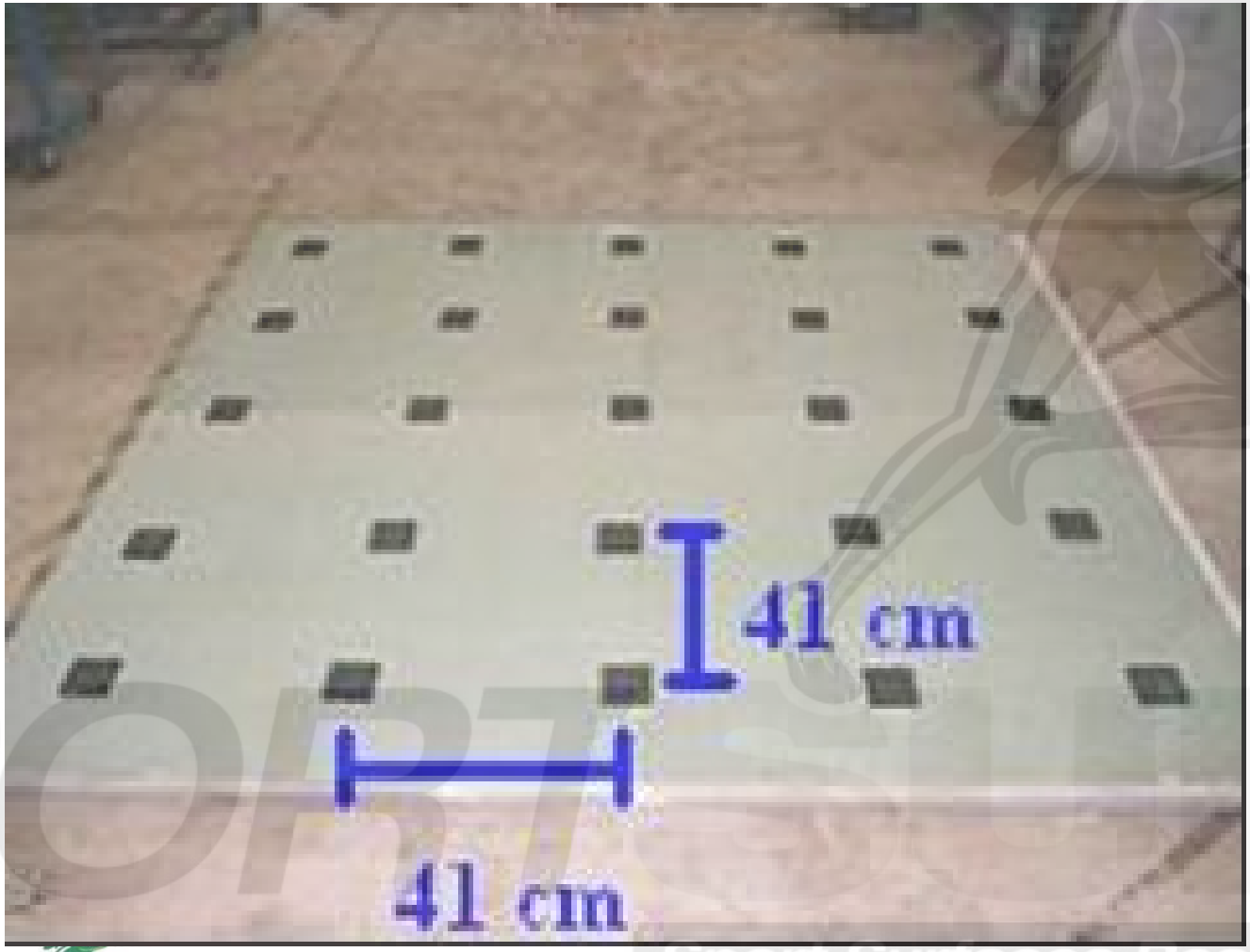
Example Heading (2)



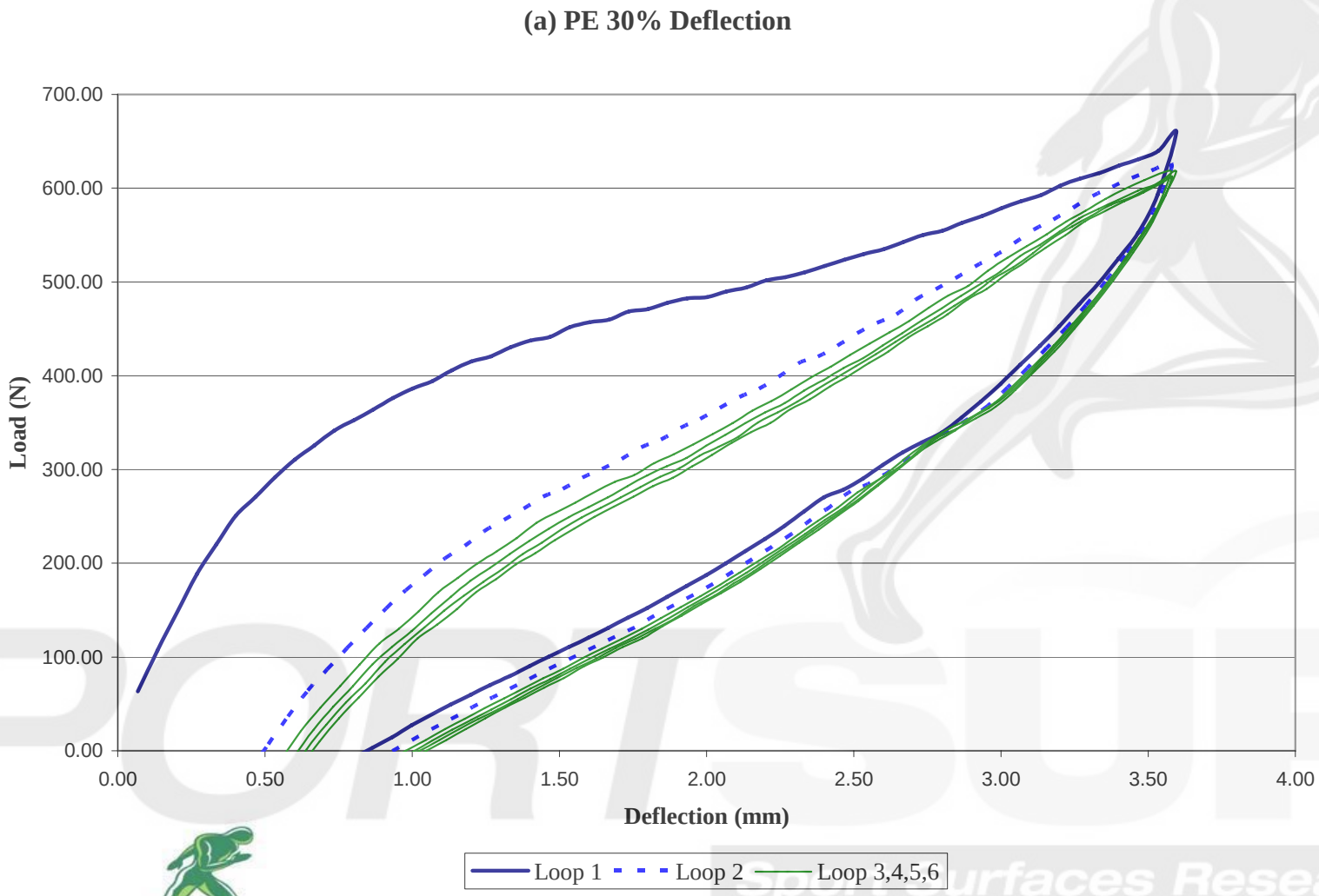
Sprung Floors

- Sports Hall Floors
- Floor boarding and support ‘pad’ system
- Design Optimisation – trial and error
- Measure components and system behaviour
- Model the system – design optimisation

Floor – Pad & Board Effects



Pad Support - Behaviour

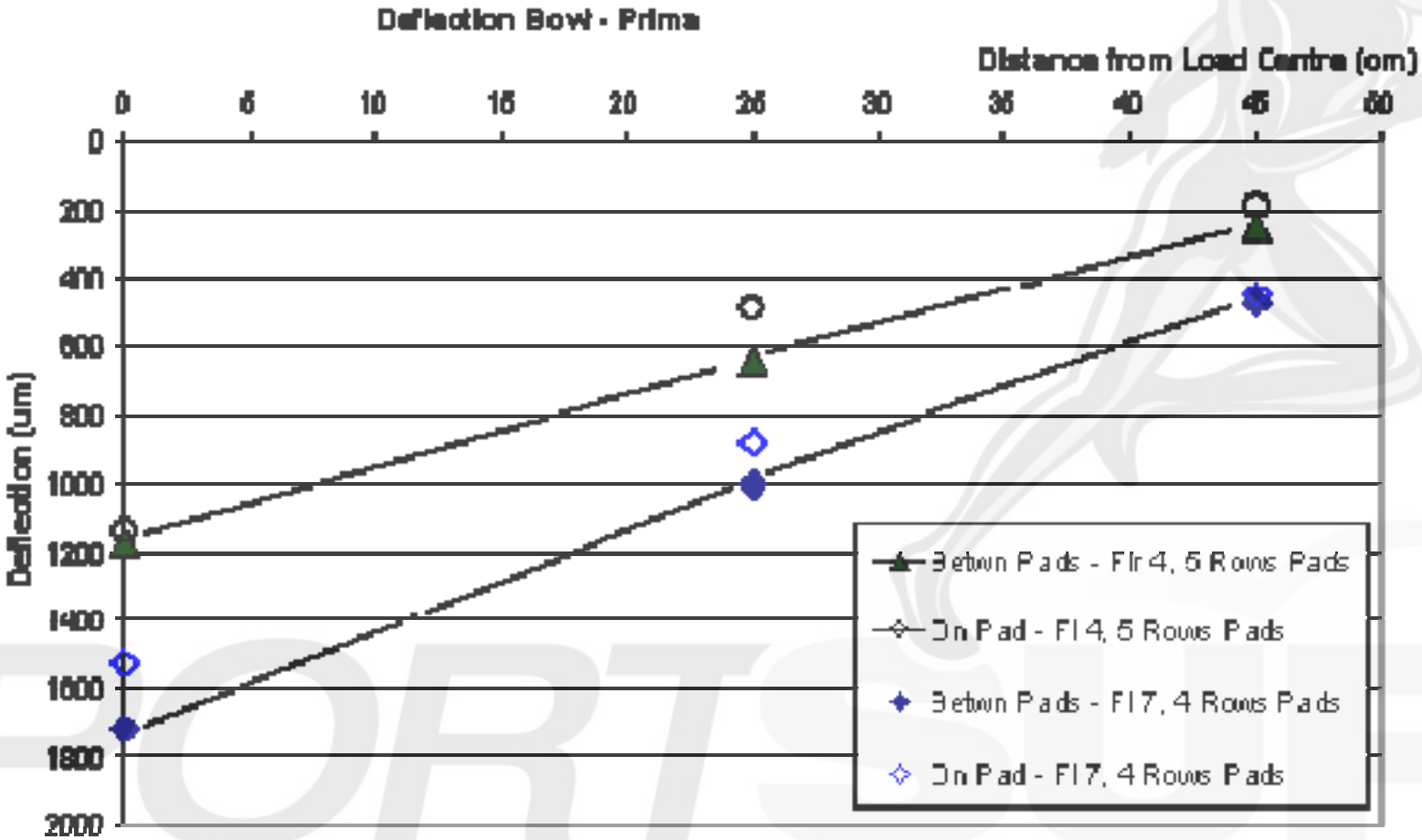


‘Performance’ Testing

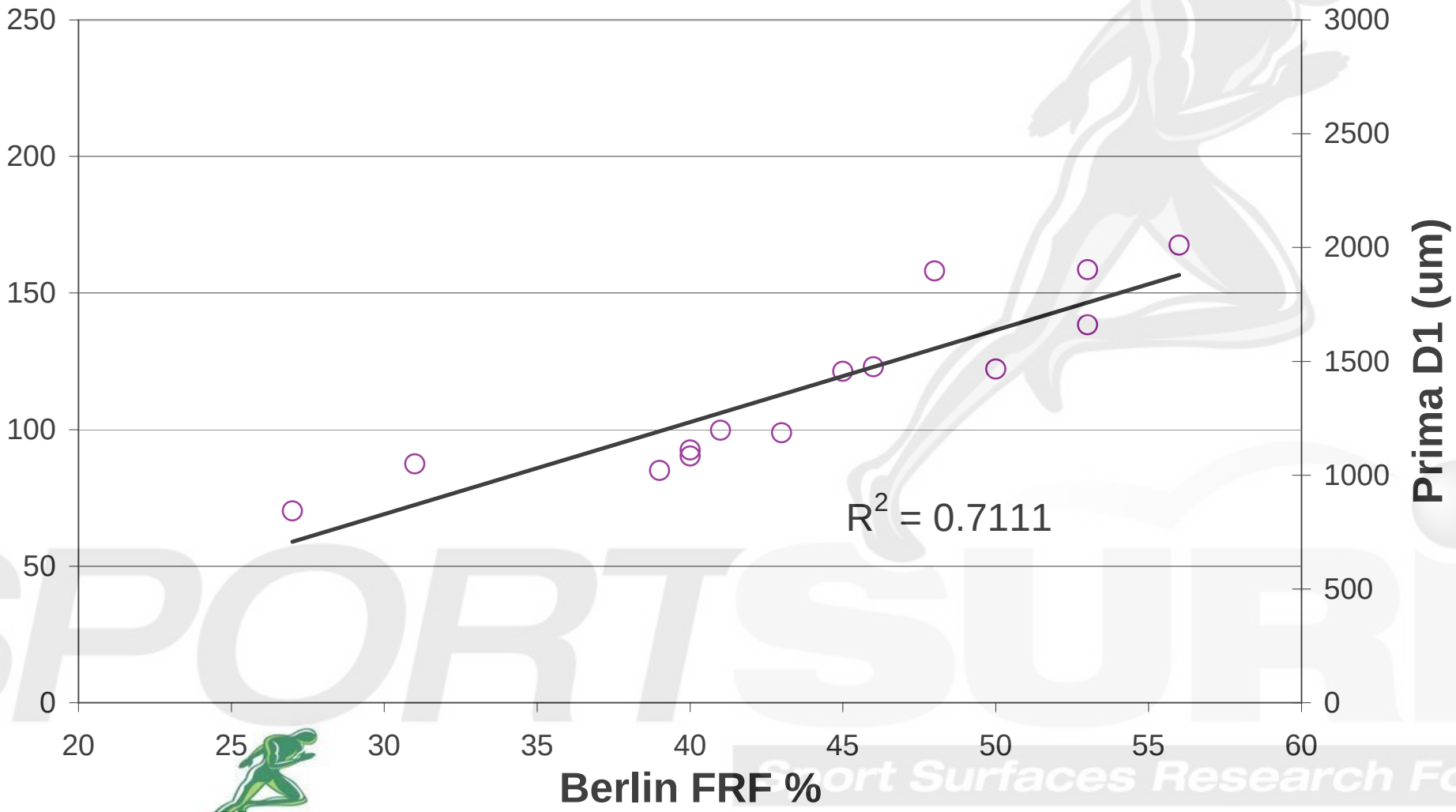
Peak ‘G’ impact reaction & Berlin ‘Force Reduction’

Floor ‘Behaviour’ Testing

Floor – Bending Behaviour



Berlin vs. Prima



Surfaces – Other Issues

HEALTH CONCERNS

SURFACE TEMPERATURE

COSTS

HEALTH

- Constituent materials – Hazards?
- Leachate/degradation – user and environment (discharge)
- Recycled water for irrigation – risks to users?
- Organisms – effective treatment?
- Treatments – effect on products' lifetime?

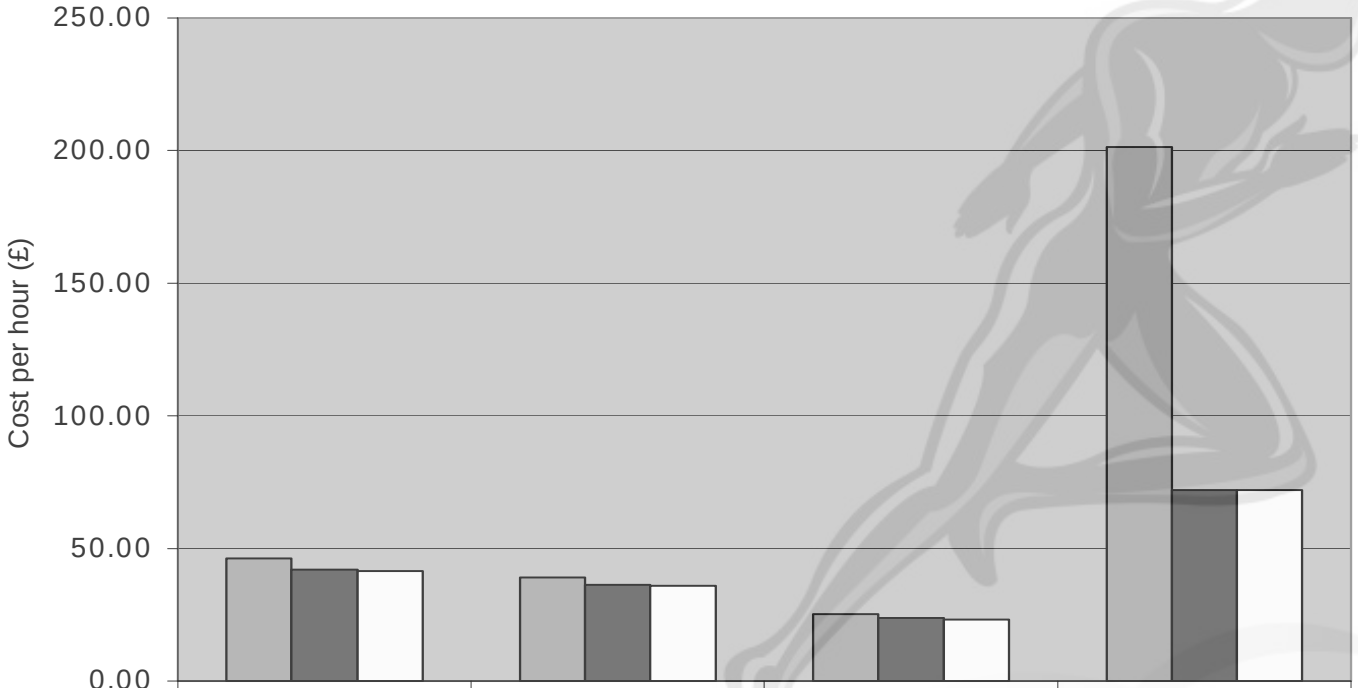
TEMPERATURE

"Synthetic Surface Heat Studies"
C. Frank Williams and Gilbert E. Pulley
Brigham Young University

Surface	*Ave Surface Temp between 7AM & 7PM*	
Art' Soccer	*117.38º F*	*high 157º F*
Art' Football	*117.04º F*	*high 156º F*
Natural Turf	*78.19º F*	*high 88.5º F*
Asphalt	*109.62º F*	
Bare Soil	*98.23º F*	

Safety Officer set 120º F as the maximum temperature that the surface could reach before cooling required.

COSTS (LU-2004)



	Water-based	Sand-filled	Rubber-crumb	Natural turf
National competition	46.26	39.00	25.19	201.44
Club/County competition	41.91	36.38	23.64	72.11
Recreational, training & practice	41.45	35.97	23.23	72.11

	Water-based	Sand fill	Rubber fill	Natural turf
Whole-life cost	£1,846,500	£1,730,800	£1,117,800	£555,970

(Est. on 20 year design life – top level facility)

RESEARCH NEEDS ?

- Lack of coherent information/data on surface types and ‘expected’ behaviour
- No analysis of ‘Play Performance’ Test Data
- Little research into: test methods’ efficacy

  design and construction

  upper materials & interaction

  surface effects on users
- Need coherent interaction between academics and industry

QUESTIONS?

SPORTSURF

Sport Surfaces Research Forum

www.sportsurf.org