SPORT SURFACES RESEARCH AND DEVELOPMENT
FRICTION TEMPERATURE ON SYNTHETIC TURFS

COMPARATIVE STUDY OF THE INFLUENCE OF INFILL MATERIAL, SHOCKPAD AND HUMIDITY

"COMPARISONS BASED ON TEMPERATURE INCREASE DURING FALL ON THE SURFACE – LABOSPORT FRICTION TEST."

- REPORT NUMBER: DE180507-A1
- DATE: 07-05-2018
- ORDER FROM: BROCK

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CONTENT

I: Presentation of the study

I-1 Objective of the study

During sports or leisure activities, users may fall voluntarily or not on the synthetic turf surface. Depending on the situation (speed, mass of the athlete), the contact between the skin and the surface may generate abrasion and temperature increase.

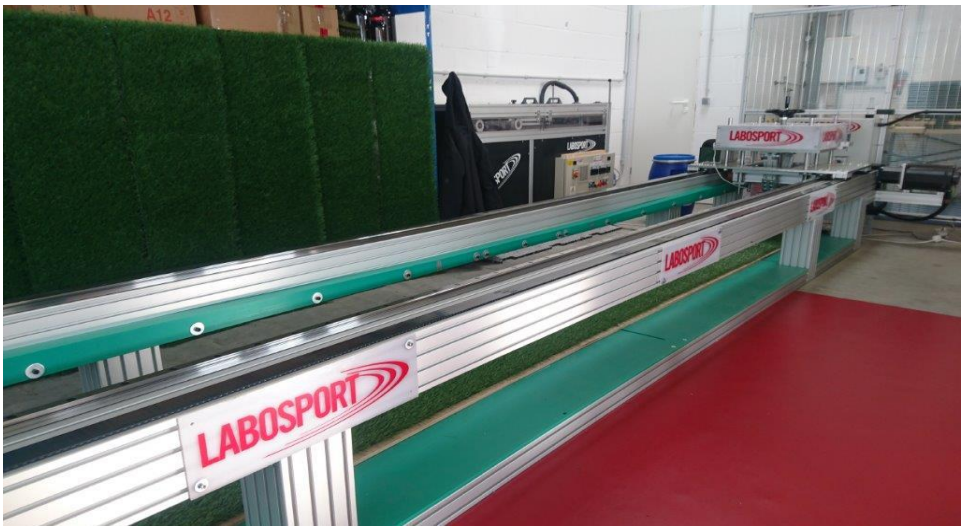
The present study is a comparative assessment of the possible influence of different components and configurations of turf systems:

- Type of infill,
- Infill wet or humid,
- System with or without the shockpad PowerBase 25 mm

The assessed characteristic is the temperature increase under simulated sliding of athlete on the tested surface ("skin friction test")

I-2 Principle of Test Method

An instrumented friction tool is move over the turf system sample to be tested. The mass and the linear speed of the tool are defined and controlled. The sliding tool has a mass of 75 kg and is sliding at a speed of 5 m/s on the surface: these conditions are considered representative of a running athlete falling on the sport surface.
The temperature generated by the friction tool is recorded during the movement and product is characterized by their peak temperature generated by friction.
The results of the tested samples are then compared.



The friction test equipment with a sample in place

Note : restriction of the test
The aim of the test is to be a comparative test. Testing tool used for the friction is not representative of real human skin. Temperature increase during friction is measured, not the mechanical abrasion of a skin. The samples are compared on the basis of temperature increase during the friction. They are not compared based on "mechanical abrasion of the skin".

II: Products tested

The products and components used for the study are:

3 different types of synthetic turf infill material:

- Wood chips
- Crumb rubber
- Cork

Two generic turfs.
Two generic synthetic turfs are used to support the infills for the testing.
The turfs used for this study are :
- 50 mm, Monofilament, polyethylene
- 50 mm, Fibrillated, polyethylene

Preparation of samples
The samples are prepared using infill material (sand and selected infill) and quantities representative or common quantities used in the market.
The tested configurations are listed in the table below.

Preparation of the sample in wet conditions
The main steps for the preparation of the humid samples are:
- Water is added to wood chips, ratio of 550ml of water for 1000ml of infill.
- One hour at room temperature to allow homogenization
- After one hour, the humid wood chips are used to fill the turf sample
- 12h waiting period before testing, to allow the turf fibers to dry

Tested samples
13 different turf system configurations have been tested.
They are detailed in the table below.

Recapitulative table of tested configurations:

Parameters / References	Turf pile height	Fiber type	Infill	Sand	Free Pile Height	Shockpad	Humidity condition
System 1	50 mm	Fibrillated	±18 mm Wood	±14 mm	±19 mm	PowerBase YSR; 25mm	Dry
System 2	50 mm	Fibrillated	±20 mm Crumb rubber	±12 mm	±19 mm	PowerBase YSR; 25mm	Dry
System 3	50 mm	Fibrillated	±18 mm Cork	±14 mm	±19 mm	PowerBase YSR; 25mm	Dry
System 4	50 mm	Fibrillated	no	no	n/a	PowerBase YSR; 25mm	Dry
System 5	50 mm	Mono filament	±18 mm Wood	±14 mm	±19 mm	PowerBase YSR; 25mm	Dry
System 6	50 mm	Fibrillated	no	no	n/a	no	Dry
System 7	50 mm	Mono filament	no	no	n/a	no	Dry
System 8	50 mm	Mono filament	±18 mm Wood	±14 mm	±19 mm	no	Dry
System 9	50 mm	Mono filament	±18 mm Wood	±14 mm	±19 mm	no	Wet
System 10	50 mm	Mono filament	±36 mm Wood	±14 mm	±0 mm	no	Wet
System 11	50 mm	Fibrillated	±18 mm Wood	±14 mm	±19 mm	no	Dry
System 12	50 mm	Fibrillated	±36 mm Wood	±14 mm	0 mm	no	Dry
System 13	50 mm	Fibrillated	±18 mm Wood	±14 mm	±19 mm	no	Wet

Example of free pile height measurement on fibrillated turf :

Example of free pile height measurement on monofilament turf :

III: Results

Table below presents the results of the maximum temperatures reached by the friction tester over the surfaces of the tested samples.
Samples are classified from lowest temperature to highest temperature.

Parameters / References	Turf pile height	Fiber type	Infill	Sand	Free Pile Height	Shockpad	Humidity condition	Temperature Friction °C
System 10	50 mm	Mono filament	±36 mm Wood	±14 mm	±0 mm	no	Wet	39,6
System 9	50 mm	Mono filament	±18 mm Wood	±14 mm	±19 mm	no	Wet	46,2
System 13	50 mm	Fibrillated	±18 mm Wood	±14 mm	±19 mm	no	Wet	56,7
System 12	50 mm	Fibrillated	±36 mm Wood	±14 mm	0 mm	no	Dry	69,2
System 11	50 mm	Fibrillated	±18 mm Wood	±14 mm	±19 mm	no	Dry	84,2
System 1	50 mm	Fibrillated	±18 mm Wood	±14 mm	±19 mm	PowerBase YSR; 25mm	Dry	84,7
System 7	50 mm	Mono filament	no	no	n/a	no	Dry	92,3
System 2	50 mm	Fibrillated	±20 mm Crumb rubber	±12 mm	±19 mm	PowerBase YSR; 25mm	Dry	92,4
System 4	50 mm	Fibrillated	no	no	n/a	PowerBase YSR; 25mm	Dry	94,2
System 6	50 mm	Fibrillated	no	no	n/a	no	Dry	96,6
System 8	50 mm	Mono filament	±18 mm Wood	±14 mm	±19 mm	no	Dry	106,4
System 5	50 mm	Mono filament	±18 mm Wood	±14 mm	±19 mm	PowerBase YSR; 25mm	Dry	107,6
System 3	50 mm	Fibrillated	±18 mm Cork	±14 mm	±19 mm	PowerBase YSR; 25mm	Dry	117,6

IV: Analysis of results

IV-1. Influence of the PowerBase YSR 25 mm

Tests 4 and 6 indicate a similar temperature of friction for the turf without infill material, with and without the PowerBase YSR 25 mm. Fibrillated turf.
Tests 1 and 14 indicate a similar temperature of friction for the turf with infill material, with and without the PowerBase YSR 25 mm. Fibrillated turf.
Tests 5 and 8 indicate a similar temperature of friction for the turf with infill material, with and without the PowerBase YSR 25 mm. Monofilament turf.
Therefore, the analysis of the results of systems 1, 4, 5, 6, 8 and 14 indicate that the use or not of the shockpad PowerBase YSR 25 mm has no significant influence on the temperature of friction.

IV-2. Influence of dry or humid wood chips

Tests 11 and 13 indicated that humidity reduce the temperature of friction: for the wood chips, 84,2°C in dry condition and 56,7°C in humid condition. Fibrillated turf.
Tests 8 and 9 indicate that humidity reduce the temperature of friction: for the wood chips, 106,4°C in dry condition and 46,2°C in humid condition. Monofilament turf.
Therefore, the analysis of the results of systems 8,9, 11 and 13 indicates that, for both monofilament and fibrillated fibers, the use of humid wood chips reduces the temperature of friction in comparison with the dry wood chips.

IV-3. Influence of the quantity of infill (free pile).

Tests 6, 11 and 12 indicate that the use of wood chips reduces the temperature of friction in comparison with turf without infill: turf without infill has a friction temperature of 96,6°C while turf with wood chips and 19 mm free pile has a friction temperature of 84,2°C and turf full of wood infill (no free pile) has the lowest friction temperature with 69,2°C.
Tests 9 and 10 confirm the tendency: the higher the quantity of wood chips, the lower the temperature of friction (in comparison with turf without infill). In this case, turf with humid wood chips and 19 mm free pile has a friction temperature of 46,2°C while the same turf full of humid wood chips (no free pile) has a friction temperature of 39,6°C.
Therefore, the analysis of the results of systems 6, 9, 10, 11 and 12 indicates that, for both monofilament and fibrillated fibers, the higher the quantity of wood chips, dry or humid, the lower the temperature of friction in comparison with the same turf without infill.

Note: results from past studies indicate that some types of infills, on the contrary, generate higher temperature of friction than the turf without infill.

IV-4. Comparison wood chips / crumb rubber / cork

Tests 1, 2 and 3 indicates that dry wood chips has a lower temperature of friction than dry crumb rubber which, in turn, has a lower temperature of friction than cork. Friction temperatures measured are respectively 84,7°C, 92,4°C and 117,6°C.

IV-5. Influence of wood chips in fibrillated or monofilament turf

Tests 1 and 8 indicate that dry wood chips has a lower temperature of friction in the fibrillated turf in comparison with the monofilament turf. Friction temperatures measured are respectively: 84,7°C and 106,4°C. The tendency is at reverse for humid wood chips.
Tests 9 and 13 give lower temperature in monofilament, 46,2°C than in fibrillated with 56,7°C.

V: Conclusions

During sports or leisure activities, users may fall voluntarily or not on the synthetic turf surface. Depending on the situation (speed, mass), the contact between the skin and the surface may generate abrasion and temperature increase or burn of the skin.

The objective of the study was to investigate the effect of various parameters of synthetic turf systems on the temperature of friction.

On the basis of the scope of tested samples, the results of temperature of friction indicate :

Influence of the PowerBase YSR 25 mm
The analysis of the results of systems 1, 4, 5, 6, 8 and 14 indicates that the use or not of the shockpad PowerBase YSR 25 mm has no significant influence on the temperature of friction.

Influence of dry or humid wood chips
The analysis of the results of systems 8,9, 11 and 13 indicates that, for both monofilament and fibrillated fibers, the use of humid wood chips reduces the temperature of friction in comparison with same turfs filled with dry wood chips.

Influence of the quantity of infill (free pile).
The analysis of the results of systems 6, 9, 10, 11 and 12 indicates that, for both monofilament and fibrillated fibers, the higher the quantity of wood chips, dry or humid, the lower the temperature of friction in comparison with the same turfs without infill.

Comparison wood chips / crumb rubber / cork
Tests 1, 2 and 3 indicate that dry wood chips has a lower temperature of friction than dry crumb rubber which, in turn, has a lower temperature of friction than dry cork.
Friction temperatures measured are respectively 84,7°C, 92,4°C and 117,6°C.

Frechen, 07 May 2018,

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