FIH FIELD TEST REPORT

Location: Club Sport Francès, Vitacura, Santiago de Chile

FIH Global Category

11 a-side field

Initial Field Test

Date of Field Test: March 29th 2017 /June 27th 2017

FIH HOCKEY REVOLUTION

FIH QUALITY PROGRAMME FOR HOCKEY TURF

Introduction

A hockey field is a major investment and the *FIH Quality Programme for Hockey Turf* has been developed to provide assistance for all those building a new field or owning an existing facility by providing international standards of quality-assurance.

The programme provides consistent and dependable industry standards and ensures the appropriate quality of performance for the intended level of play - whether it is community development, international competition, or anything in between. It protects the investment made by facility owners by ensuring the field meets the expectations of those who will be using it.

To ensure that hockey fields are being built to the highest standard and that FIH Approved Products are being installed correctly, the Quality Programme includes the certification of hockey fields. A FIH Certified Field is independently tested by a FIH Accredited Test Institute to ensure it meets the requirements of the Quality Programme. Tests include measurements of how the ball interacts with the playing surface, verifies adequate comfort and performance is being provided to ensure the well-being and protection of players and includes checks to confirm the field has been built to the dimensions, line marking, slope and surface drainage requirements of the FIH.

Field Certification also includes a comprehensive series of quality control checks to ensure the installed Hockey Turf used is the same as the FIH Approved Product; ensuring manufacturing and installation mistakes do not go undetected.

New fields (less than 12 months old at the time of test) are certified for three years. Fields more than 12 months old are certified for two years.

The FIH certifies 4 different categories of hockey field:

Global Elite

A field with a Global category surface that meets the requirements for top-level FIH international competitions.

Global

A field with a Global category surface. Primarily used for top level national competitions and some international events.

National

A field with a Global or National category surface. Primarily used for lower level national, regional and club play.

Multi-Sport

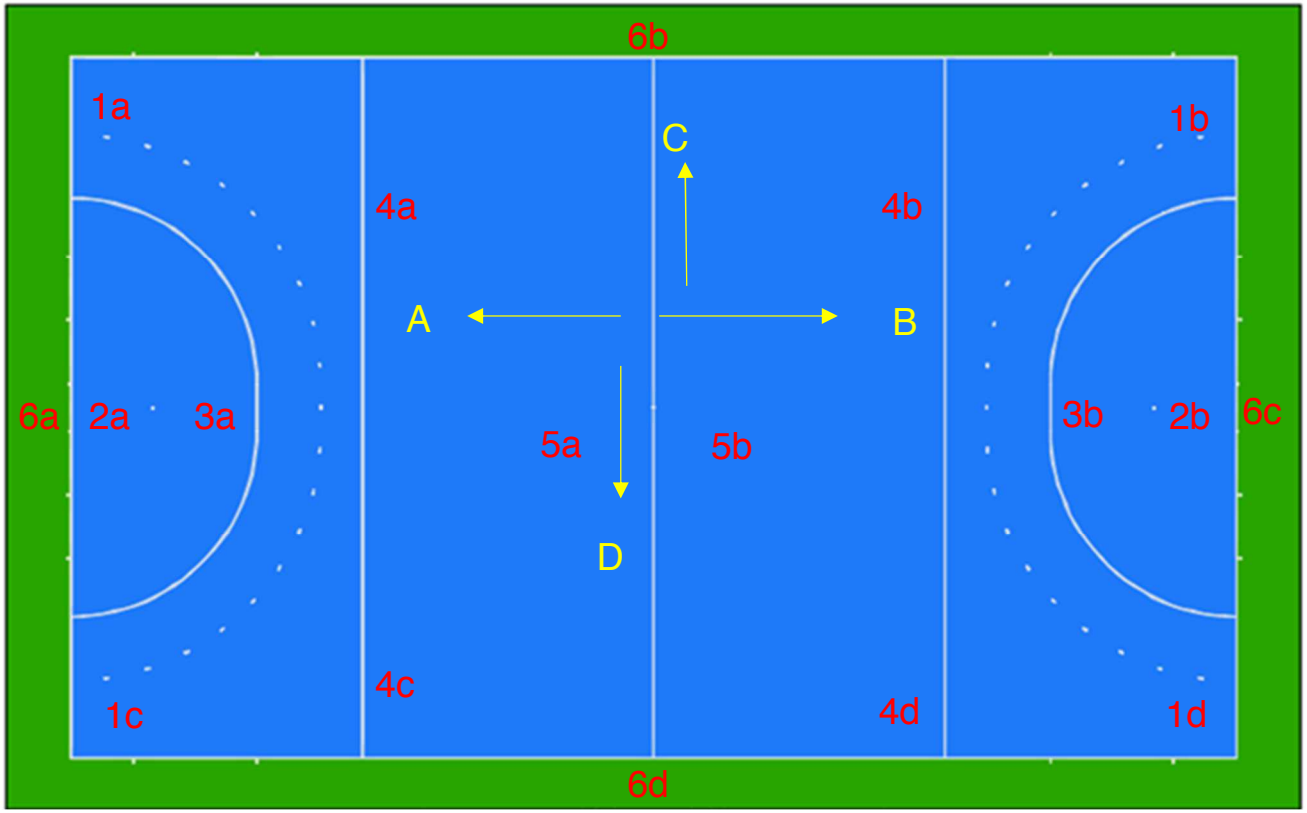
A field with an FIH approved surface (normally multi-sport) that is used by a number of sports. Typically used for community and development level hockey.

Site & Field Details:			
Field Name		Club Sport Francès	
Location / Address	Road	Lo Beltran #2500, Vitacura	
	City	Santiago de Chile	
	County/State/Province	Santiago	
	Post code	7640349	
	Country	Chile	
Facility Contact Details	Name & Position	Alfredo Maturana Pape	
	Email & Telephone	+56 22768 5790	amaturana@sportfrances.cl
Date of Installation / Resurfacing		Installation: 2009 / Resurfacing: March 15th 2017	
Name of FIH Certified Field Builder / FIH Preferred Supplier		-	
Installed Hockey Turf product		Greenfields TX EL 15	
Name of FIH Certified Manufacturer / FIH Preferred Supplier		Greenfields	
Category of FIH Product Approval		Global	

FIH Accredited Test Institute Details						
Test Institute Name			Labosport S.A.S.			
Field Test Engineer(s)			Mickaël Benetti			
Date Test Undertaken			March 29th 2017 / June 27th 2017			
Project / Report Reference			R170679-B1(17031LSSA)			
Conditions at time of test						
Surface condition	Wet (irrigated)	X	Wet (rain)			
Air temperature (°C)	Min.		15°C / 10°C		Max.	25°C / 17°C
Surface temperature (°C)	Min.		16°C / 15°C		Max.	18°C / 18°C
Wind speed (km/h)	Min.		1.4 km/h / 1.1 km/h		Max.	2.5 km/h / 1.8 km/h

Field Orientation, Test Positions and Ball Roll Directions

Test Positions Used		
1	1a	
	1b	
	1c	X
	1d	
2	2a	
	2b	X
3	3a	X
	3b	
4	4a	
	4b	X
	4c	
	4d	
5	5a	
	5b	X
6	6a	
	6b	
	6c	X
	6d	



Ball / Surface Interaction

The interaction between a hockey ball and the Hockey Turf are probably the most important characteristics of the field for a player. The surface needs to be consistent and true with an acceptable speed and resilience. These properties are described as ball roll and ball rebound in the FIH Quality Programme for Hockey Turf.

Ball Rebound

Hockey balls should not bounce too high or too low; the bounce also needs to be consistent. These aspects of a hockey field are assessed by measuring the height a hockey ball rebounds when dropped vertically from a height of 2.0m. Tests are made in a number of locations on the field. To satisfy the requirements of the *FIH Quality Programme for Hockey Turf* the hockey field must have rebound characteristics in the required range and be consistent across the field.

Ball Rebound (mm)							Overall Mean	Specification	Pass or Fail
	Test Positions								
	1	2	3	4	5	6			
1	382	391	395	389	386	381	383	100mm – 400mm	Pass
2	377	384	376	388	389	386			
3	373	378	386	378	396	376			
4	378	382	377	382	398	386			
5	380	384	378	384	387	372			
Mean	378	384	382	384	391	380			

Ball Rebound Consistency (% variation from overall mean)							
Test Positions						Specification	Pass or Fail
1	2	3	4	5	6		
-1%	0%	0%	0%	2%	-1%	< ± 10%	Pass

Ball Roll

Ball roll assesses the speed of the surface. This is measured by rolling a hockey ball down an inclined ramp and measuring the distance it travels and the degree to which it deviates from a straight line. Tests are made in a number of locations on the field and in different directions. To satisfy the requirements of the *FIH Quality Programme for Hockey Turf,* the hockey field must have the required speed, be consistent irrespective of direction and the ball must not excessively deviate from a straight line.

Ball Roll Distance (m)												
		Test Position										
Test	Direction	1	2	3	4	5	Direction	1	2	3	4	5
1	A	15,34	13,21	16,32	12,36	13,29	B	12,90	15,49	12,84	13,76	13,59
2		15,38	13,38	16,54	12,48	13,65		12,99	15,63	13,00	13,78	13,78
3		15,46	13,76	16,71	13,90	14,21		13,23	16,36	13,11	14,45	14,55
4		16,34	13,82	16,83	14,00	14,58		13,65	16,68	13,32	14,62	14,67
5		16,52	13,89	16,90	14,13	14,98		13,70	17,00	13,48	14,74	15,11
Mean		15,81	13,61	16,66	13,37	14,14		13,29	16,23	13,15	14,27	14,34
1	C	14,83	14,34	14,40	16,38	11,92	D	15,94	13,18	15,76	12,38	15,30
2		14,97	14,54	14,68	16,67	12,23		15,96	13,45	15,78	12,49	15,78
3		14,98	14,73	14,98	16,67	12,78		16,86	13,78	16,01	12,55	15,99
4		15,07	15,46	15,36	16,72	13,02		16,93	13,91	16,38	12,61	16,30
5		15,13	15,98	15,43	16,76	13,49		17,40	14,09	16,47	12,61	16,32
Mean		15,00	15,01	14,97	16,64	12,69		16,62	13,68	16,08	12,53	15,94
Overall Mean		14.70 m		Specified Range:		≥ 10.0m		Pass or Fail			Pass	

Ball Roll Consistency (% variation from overall mean)							
Direction	Test Positions					Specification	Pass or Fail
	1	2	3	4	5		
A	8%	-7%	13%	-9%	-4%	< ± 15%	Pass
B	-10%	10%	-11%	-3%	-2%		
C	2%	2%	2%	13%	-14%		
D	13%	-7%	9%	-15%	8%		

Ball Roll Deviation

The degree to which a ball deviates from a straight line during the ball roll test is measured.

Ball Roll Deviation (°)												
Test		Test Position										
	Direction	1	2	3	4	5	Direction	1	2	3	4	5
1	A	0,3	0,3	0,6	0,9	0,0	B	0,0	0,9	0,6	0,6	0,3
2		0,6	0,6	0,6	0,9	0,3		0,0	0,9	0,6	0,6	0,6
3		0,9	0,7	0,6	0,9	0,6		0,6	0,9	0,6	0,9	0,3
4		0,9	0,7	0,9	0,9	0,9		0,6	0,9	0,9	0,9	0,9
5		0,9	0,9	1,1	1,1	1,1		0,6	0,9	0,9	1,1	0,9
Mean		0,7	0,6	0,7	0,9	0,6		0,3	0,9	0,7	0,8	0,6
1	C	0,0	0,0	0,3	0,6	0,3	D	0,3	0,6	0,3	0,0	0,3
2		0,3	0,0	0,3	0,6	0,6		0,6	0,9	0,5	0,6	0,6
3		0,3	0,3	0,6	0,6	0,9		0,6	1,1	0,6	0,7	0,6
4		0,3	0,3	0,6	0,6	0,9		0,6	1,4	0,9	0,7	0,9
5		0,9	0,9	0,9	0,9	0,9		0,9	1,4	1,1	0,9	1,1
Mean		0,3	0,3	0,5	0,6	0,7		0,6	1,1	0,7	0,6	0,7
Maximum Mean		1,1□		Specified Range:		≤ 3□		Pass or Fail			Pass	

Player / Surface Interaction

The dynamic and friction characteristics of the Hockey Turf are essential if the surface is to provide suitable playing conditions to protect the welfare of players. The surface needs to provide adequate protection when players run or fall onto it but at the same time it cannot be so soft it results in players suffering from fatigue or overuse injuries. The surface also needs to provide the right levels of foot friction. If the grip is too low players cannot stop and turn with confidence and there is a risk of them slipping. If the grip is too high, there is a risk of foot lock and players suffering ankle and ligament injuries.

Shock Absorption

Shock absorption assesses the cushioning provide by the Hockey Turf. It is measured using a machine that simulates a player running on the Hockey Turf. The peak force during the foot impact is measured and compared to the value measured on concrete. The result of the test is expressed as a percentage reduction in the peak force. The higher the result the greater the shock absorption. A minimum value is specified to ensure fields are not too hard and an upper limit is specified to ensure fields are not too soft and tiring.

Shock Absorption (% Force Reduction)									
Test	Test Positions						Overall Mean	Specification	Pass or Fail
	1	2	3	4	5	6			
1	65.3	64.2	64.3	64.5	64.7	63.3	59.2%	40% - 60%	Pass
2	59.9	60.4	59.6	58.7	60.7	60.0			
3	57.4	58.8	58.2	58,3	59.0	59.3			
Mean	58.6	59.6	58.9	58.5	59.8	59.6			
Shock Absorption (% variation from overall mean)									
	-0.9%	0.7%	-0.5%	-1.2%	1.1%	0.8%	-	≤ ± 5% FR	

Shoe / Surface Interaction

Shoe / surface interaction is assessed by measuring the resistance the surface offers to a loaded test plate designed to simulate a typical hockey shoe, rotating on the surface. If the level of resistance (measured as the torque required to cause the test plate to start to rotate) is too low players will find the surface slippery. If the level is too high players may experience excessive foot grip.

Rotational Resistance (Nm)									
	Test Positions						Overall Mean	Specification	Pass or Fail
Test	1	2	3	4	5	6			
1	38	38	38	38	38	38			
2	38	38	38	38	38	38			
3	39	40	38	38	40	38	39	25Nm – 45Nm	Pass
4	40	40	39	40	40	38			
5	41	42	39	40	40	38			
Mean	39	40	38	39	39	38			
Rotational Resistance (variation from overall mean)									
	0	1	-1	0	0	-1		< ± 3Nm	

Construction & Installation

The quality of a hockey field's construction can greatly influence the way in which the field performs. Properties including water permeability, surface profile, surface regularity, quality of carpet joints, field dimensions and accuracy of line markings all need to be correct if a hockey field is to meet the expectations of players and provide an enjoyable and safe playing environment.

Water Permeability

The Hockey Turf needs to be able to disperse rain and excess water from the playing surface at an adequate rate to ensure play is not disrupted in anything but the most extreme conditions. Water permeability is assessed by measuring the rate at which water flows through the Hockey Turf into the underlying drainage system.

Water Permeability (mm/h)						Overall Mean	Specification	Pass or Fail
Test Positions								
1	2	3	4	5	6		≥ 150mm/h	Pass
>2000	>2000	>2000	>2000	>2000	>2000	>2000		

Slope and Profile

The slope and profile of the field are measured using a surveyor's level. Spot levels are taken to determine the profile of the hockey field and the gradients in each of the key directions of the field calculated. The plan on the next page shows the profile and gradients of the hockey field.

Direction	Maximum Gradient (%)	Specification	Pass or Fail
Longitudinal (1)	0.5%	≤ 0.2%	Fail
Latitudinal (1)	0.85%	≤ 0.4%	Fail

Note 1 Gradients of up to 1% may be used when existing fields are being upgraded or the field in locations that experience extreme climatic conditions.

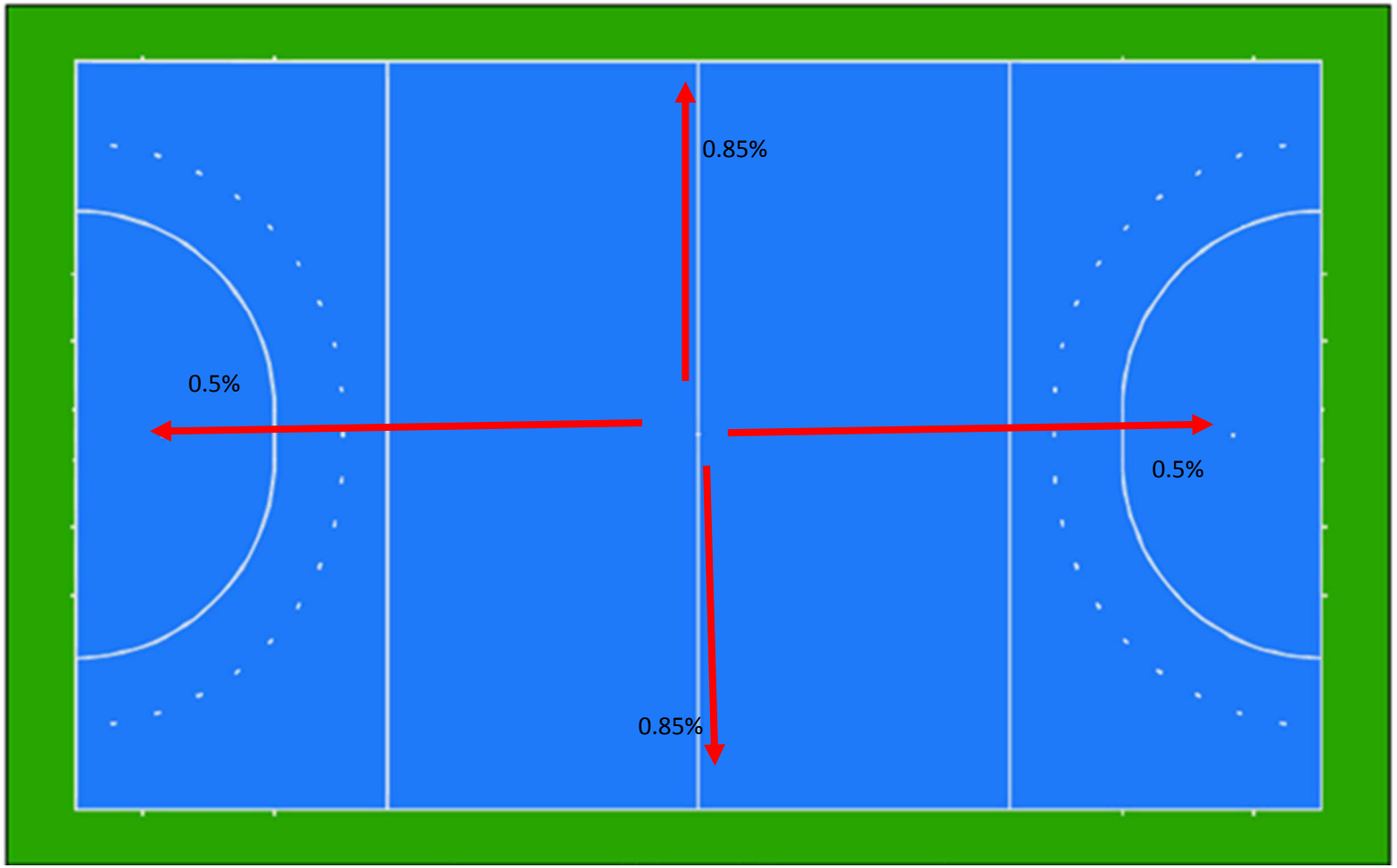


Figure 1 - Field Profile and Principal Gradients

Surface Regularity

Surface Regularity measures the smoothness of the field. Excessive undulations will cause the ball to deviate and in extreme cases lift from the surface with the risk of a player being injured. Surface Regularity is measured using 3m and 300mm straightedges. The 3m straightedge is pulled across the whole of the hockey field, along its length and across its width, and any excessive depressions or high spots are recorded and reported. These are also measured using a 300mm straightedge to ensure there are no localised ridges or troughs that could cause a ball to lift from the surface. The plan on the following page shows the location of any non-compliant areas on the field.

Number of excessive undulations or high spots recorded		Specified Requirement Maximum Permitted Undulation or High Spot		Pass or Fail
3m straightedge	300mm straightedge	3m straightedge	300mm straightedge	
0	0	≤ 6mm	≤ 2mm	Pass

Carpet Joints

There should be no gaps between adjacent rolls of Hockey Turf or inlaid line markings that might cause a ball to deviate or that may be vulnerable to failure due to the stresses placed on the surface during normal play. Additionally there should be no trapped pile in a joint. When bonded joints are used there should not be excessive beads of glue lying on the Hockey Turf surface. To ensure there are no poor joints the whole field is inspected and any unacceptable joints noted. The plan on the following page shows the location of any unacceptable joints found.

	Yes / No	Pass or Fail
Were any joints with a maximum gap at the top of the pile equal to our greater than the carpet stitch gauge plus 2mm found?	No	Pass
Was any Hockey Turf pile trapped in any carpet joints?	No	Pass
Were any adhesive beads found within the pile of the Hockey Turf?	No	Pass

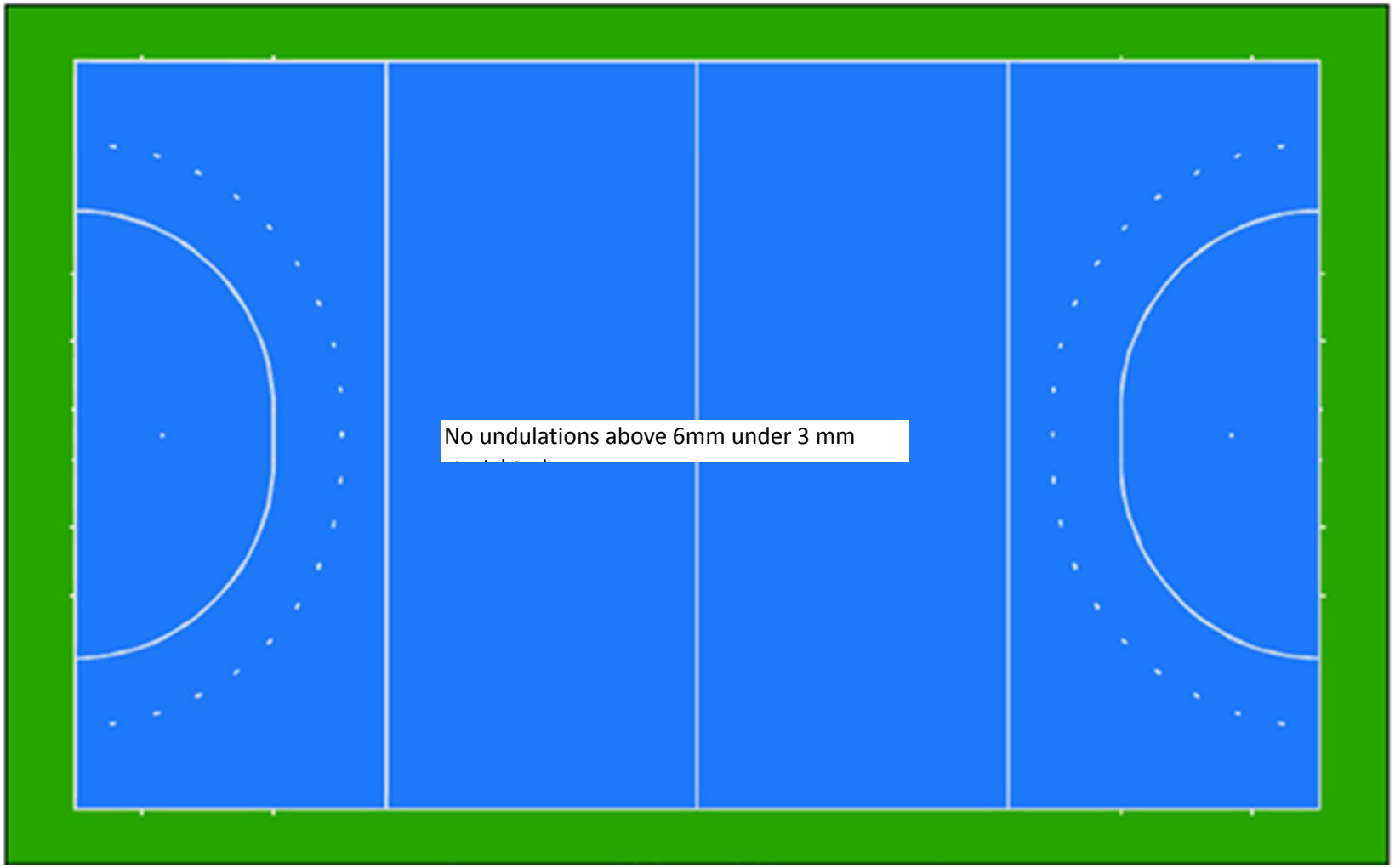


Figure 2 - plan showing positions of any excessive undulations or high spots, poor carpet joints etc.

Field Markings

Field markings are specified in the *Rules of Hockey*. During an FIH field test the markings are checked along each boundary and at each end of the field.

Lines may be painted or incorporated into the hockey turf.

The 5m dashed lines around each circle-line are mandatory for international matches. For all other matches local competition rules specify if they are required. The presence of the lines is not mandatory for FIH Global certification of a field.

The results of the checks are detailed on the following pages. The table refers to the notation used on this diagram.

Run-offs

Run-offs are required to ensure there is an adequate safe zone outside the field of play that players can run safely onto before coming into contact with fences, lighting columns, etc. The sizes of the run-offs considered necessary for hockey are specified in the *Rules of Hockey*.

The inner portion of a run-off must be surfaced with a similar Hockey Turf to the Field of Play. The outer portion of the run-off may be another form of surface providing it is laid to the same profile as the Field of Play. When Hockey Turf is used for the full run-off this is reported as the inner run-off and its length needs to comply with the total distance of the inner and outer run-off (minimum or recommended).

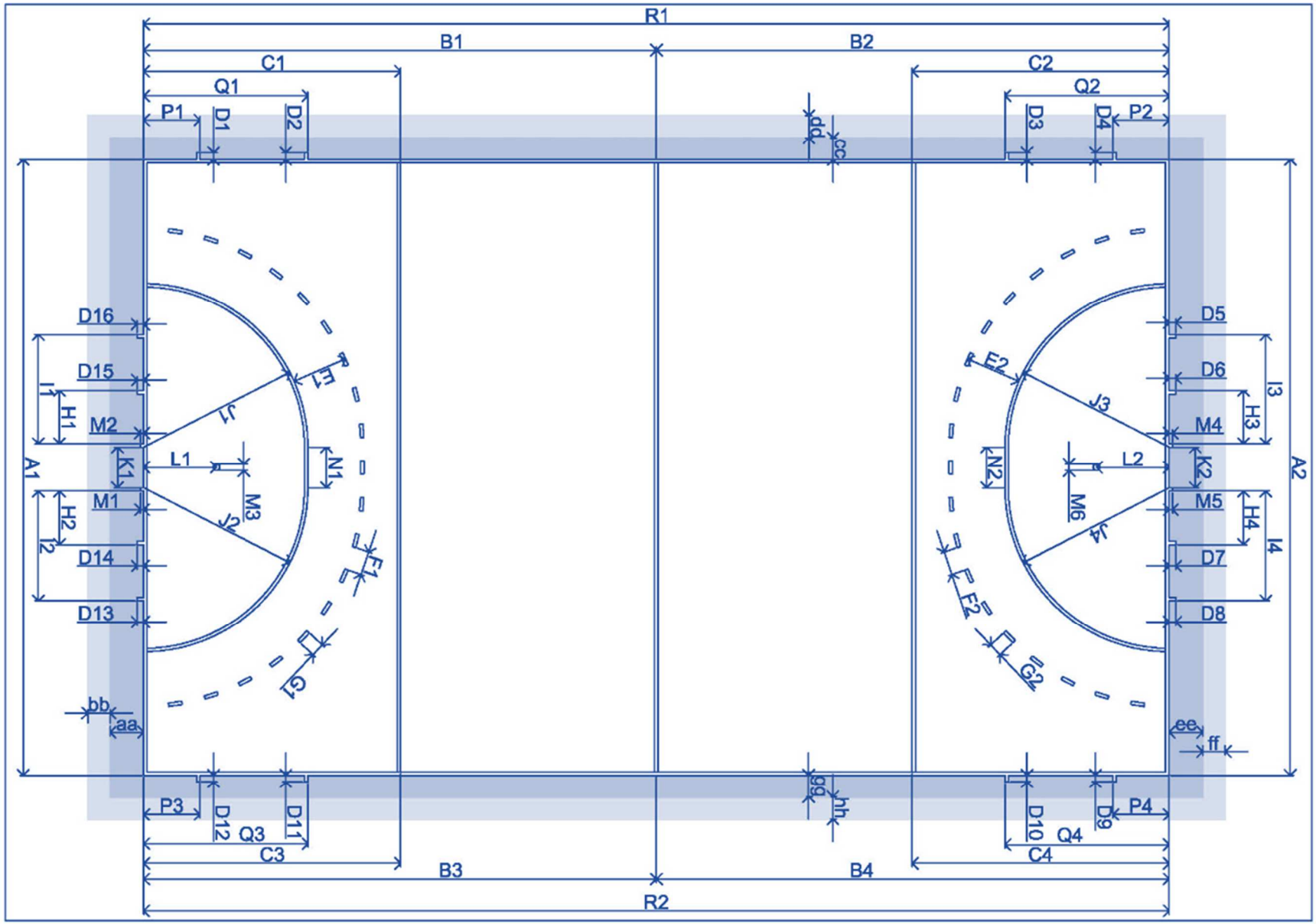


Figure 3 – key to field markings and run-offs

Line markings (m)									
Distance	Tolerance	Ref.	Actual	Error	Pass / Fail	Ref.	Actual	Error	Pass or Fail
55.00	± 50 mm	A1	54.996	4mm	Pass	A2	55.009	9mm	Pass
45.70	± 50 mm	B1	45.712	12mm	Pass	B2	45.696	-4mm	Pass
		B3	45.702	2mm	Pass	B4	45.712	12mm	Pass
22.90	± 50 mm	C1	22.906	6mm	Pass	C2	22.912	12mm	Pass
		C3	22.902	2mm	Pass	C4	22.908	8mm	Pass
0.30	± 30 mm	D1	0.301	1mm	Pass	D2	0.302	2mm	Pass
		D3	0.302	2mm	Pass	D4	0.302	2mm	Pass
		D5	0.302	2mm	Pass	D6	0.302	2mm	Pass
5.00	± 30 mm	E1	4.996	-4mm	Pass	E2	4.998	-2mm	Pass
3.00	± 50 mm	F1	2.990	-10mm	Pass	F2	2.998	-1mm	Pass
0.30	± 30 mm	G1	0.299	-1mm	Pass	G2	0.298	-2mm	Pass
4.975	± 50 mm	H1	4.980	5mm	Pass	H2	4.978	3mm	Pass
		H3	4.973	-2mm	Pass	H4	4.976	1mm	Pass

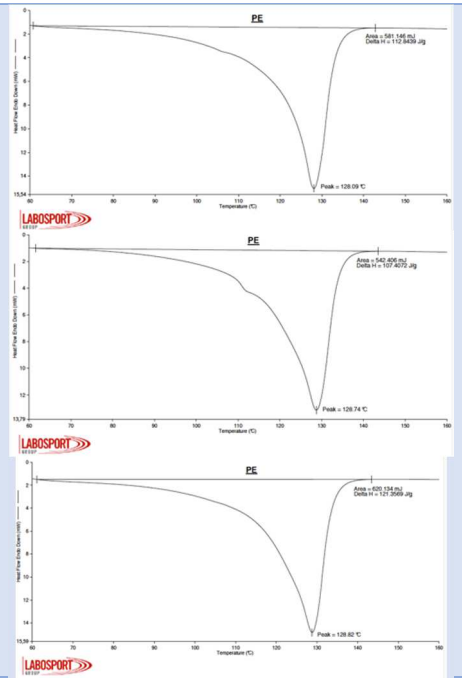
Distance	Tolerance	Ref.	Actual	Error	Pass / Fail	Ref.	Actual	Error	Pass or Fail
9.975	± 50 mm	I1	9.978	3mm	Pass	I2	9.980	5mm	Pass
		I3	9.980	5mm	Pass	I4	9.979	4mm	Pass
14.63	± 30 mm	J1	14.632	2mm	Pass	J2	14.638	8mm	Pass
14.63	± 30 mm	J3	14.628	-2mm	Pass	J4	14.630	0mm	Pass
3.66	± 50 mm	K1	3.660	0mm	Pass	K2	3.668	8mm	Pass
6.475	± 30 mm	L1	6.480	5mm	Pass	L2	6.476	1mm	Pass
0.15	± 30 mm	M1	152	2mm	Pass	M2	152	2mm	Pass
3.66	± 50 mm	N1	3.660	0mm	Pass	N2	3.668	8mm	Pass
5.00	± 50 mm	P1	5.000	0mm	Pass	P2	4.999	-1mm	Pass
		P3	4.998	-2mm	Pass	P4	5.002	2mm	Pass
14.63	± 50 mm	Q1	14.632	2mm	Pass	Q2	14.634	4mm	Pass
14.63	± 50 mm	Q3	14.632	2mm	Pass	Q4	14.632	2mm	Pass
91.40	± 50 mm	R1	91.414	14mm	Pass	R2	91.408	8mm	Pass
Difference between field diagonals (< 300mm)		Diagonal 1	106.682	Diagonal 2	106.684	Difference	2mm	Pass / Fail	Pass
Line widths (75 ± 10mm)		75 mm		Line colour: white		White			
Details of any other markings on field		No							

Run-offs (m)								
	Surface	Specified Requirement		Measured Distance				Pass or Fail
		Back lines (m)						Fail
		Rec.	Min					
Inner run-off	Hockey Turf	3.0	2.0	aa	2.972	ee	2.982	
Outer run-off	Hockey turf or alternative surfacing	2.0	1.0	bb		ff	0.00	
Total		5.0	3.0		2.972		2.982	
		Side lines (m)						
Inner run-off	Hockey Turf	2.0	1.0	cc	2.962	gg	2.960	
Outer run-off	Hockey turf or alternative surfacing	1.0	1.0	dd		hh		
Total		3.0	2.0		2.962		2.960	

Hockey Turf Field Sample Quality Assurance

A key feature of the *FIH Quality Programme for Hockey Turf* is the quality assurance it brings to the construction of hockey fields. FIH Approved Products have to pass a stringent series of tests before being certified [(1)]. This is to ensure that they have the performance and durability characteristics required to provide a long lasting well performing hockey field. It is therefore very important that the actual Hockey Turf installed on a field is of the same quality and specification as the approved product. To verify this, samples of the Hockey Turf used to surface the field are taken by the Test Institute and tested to characterise them. If the installed materials are found to be different to the approved product the field will not qualify for FIH Certification.

Property	Units	Manufacturer's Specification	Permitted Tolerance	Field Sample Result	% Variation	Pass or Fail
Synthetic turf carpet						
Pile type	-	Curled	Same as FIH Approved Product	Curled	Same	Pass
Pile colour – playing area	RAL	Reflex Blue	Same as FIH Approved Product	Reflex Blue	Same	Pass
Pile colour – run-offs	RAL	Olive Green	Same as FIH Approved Product	Olive Green	Same	Pass
Secondary backing	-	-	Same as FIH Approved Product	Textile	Same	Pass
Carpet mass per unit area	g/m^2	4000	≤ ± 10%	3905	-2%	Pass
Tufts per unit area [(2)]	Tufts / m^2	67370	≤ ± 10%	69091	3%	Pass
Filaments per unit area [(2)]	Filaments / m^2	673700	≤ ± 10%	690910	3%	Pass
Stitch gauge	mm	3/16"	Same gauge	3/16"	Same gauge	Pass
Pile height above backing	mm	14	≤ ± 5%	13	-4%	Pass
Pile yarn linear density	Dtex	N/A	≤ ± 10%	8411	N/A	N/A
Total pile weight	g/m^2	N/A	≤ ± 10%	1865	N/A	N/A

<table>
<tr><td colspan="4">Synthetic Turf Pile Polymer Analysis</td></tr>
<tr><td colspan="2">DSC trace – Approved Product</td><td></td><td>DSC trace – Field Sample</td></tr>
<tr><td colspan="2">No declaration – 2009 report</td><td></td><td> 
</td></tr>
<tr><td>Permitted Tolerance</td><td>Same as FIH Approved Product</td><td>Pass or Fail</td><td>N/A</td></tr>
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Notes:

1 As the FIH continues to update the Quality Programme for Hockey Turf it introduces new tests and requirements. This may mean that products tested in accordance with earlier editions will not have been required to have all of the characterisation tests listed above measured when the product was approved.

2 If it is not possible to extract tufts from the carpet backing (e.g. when there is an integral shockpad or knitted construction, etc.) the pile mass per unit area above the substrate is determined and the filaments per unit area calculated.

Shockpad					
Property	Units	Manufacturer's specification	Permitted Tolerance	Field Sample Result	Pass or Fail
Shockpad type (1)	-	-	Same as FIH Approved Product	In-situ	Pass
Thickness (1)	mm	15	≥ 90%	15.3	Pass
Shock Absorption (2)	% FR	No declaration	≤ ± 5% absolute (3)	43.8%	N/A

Notes

1 Applicable to new fields or when a new shockpad is laid on an existing field during resurfacing.

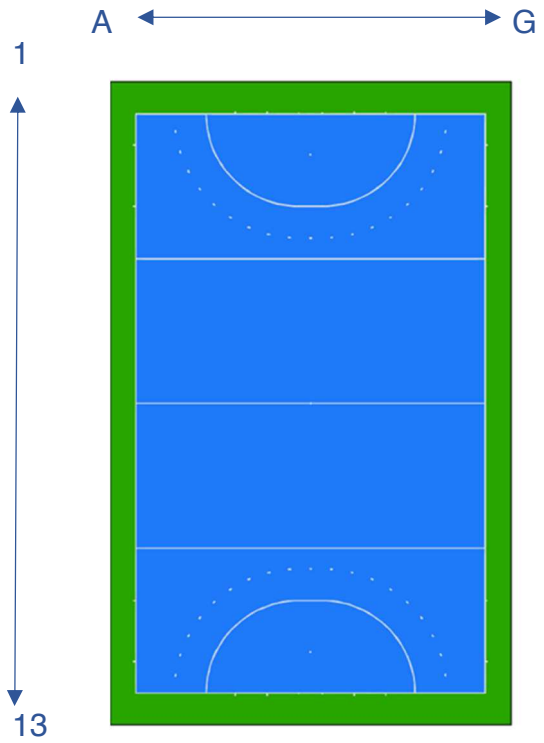
2 If an existing shockpad is retained when an existing field is being resurfaced it needs to comply with this requirement to ensure the combination of new carpet and existing shockpad are similar to the FIH Approved Product.

2 As detailed in the Manufacturer's Product Declaration detailed in the Product Approval Report.

Assessment of Above-Ground Irrigation System

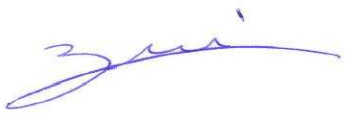
Some forms of Hockey Turf are designed to be used wet. In order to ensure the above ground irrigation system installed on a field with such a surface is able to provide an adequate and even distribution of water over the whole field, the irrigation system is tested as part of the field assessment. The system needs to be capable of applying the quantity of water required for the Hockey Turf system within a maximum of 8 minutes.

	A	B	C	D	E	F	G		
1	3,2	3	3,3	4,1	3,6	3,5	3,4	Average depth of water collected (mm)	3,0
2	2,8	2,8	3,1	3,8	3,5	3,6	3,5		
3	2,5	2,6	3	3,7	3,6	3,7	2,5		
4	4,2	2,7	3	3	2,8	2,4	2		
5	3,6	2,9	3	2,8	2,7	2,6	2,9	Maximum variation between adjacent measuring points (mm)	1,7
6	3,2	2,4	2,6	2	2,1	2	3,6		
7	3,8	2,4	2,3	2	2,1	2,6	2,6		
8	3,3	2,6	2,5	2,2	2,5	2,7	2,5		
9	2,4	2	2,1	2	2,2	2,8	2,1	Pass	X
10	3,5	2,3	2,8	3,7	3,4	3,1	3,5		
11	3,2	3	3,1	3	3	2,8	3,4	Fail	
12	2,8	3,6	4,3	4,3	3,8	2,6	3,3		
13	2,9	3,5	4	4,2	4,2	3,7	2,8		
Depth of water required (mm) (as detailed in product test report)								N/A	



Test Institute Declaration

We certify that the tests described in this report have been carried out in accordance with the latest requirements of the *FIH Quality Programme for Hockey Turf* and the report accurately reflects the outcome. We further certify that in our opinion there were no defects that compromise the quality, performance or durability of the field at the time it was tested.

Name (printed) Authorised Signatory	Eric Chauvin
Authorised Signatory	
Name (printed) Lead Field Test Engineer	Mickaël Benetti
Signatory	
Date	July the 7th, 2017