ARTIFICIAL GRASS PITCHES FOR RUGBY

performance standards and design guides for community use pitches and training areas

IRFU
CLUB EXCELLENCE AWARD

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1 Introduction

The development of artificial grass surfaces that replicate the playing qualities of good quality material grass has stimulated much interest in the games of rugby and football. These surfaces, often described as long pile (or third generation) artificial grass, have a much longer pile than the previously used sand filled surfaces and are normally partly filled with rubber or rubber and sand mixes.

The improved qualities of these new surfaces have been recognised by the international governing bodies of rugby union and football and they have each amended their rules to allow the use of artificial grass pitches in their competitions.

To ensure pitches have the desired playing characteristics and provide the necessary levels of player protection, these international governing bodies have specified the performance they require from artificial grass pitches. Their standards are:

- IRB Performance Specification for Artificial Surfaces for Rugby - Regulation 22 (henceforth referred to as 'IRB Regulation 22').

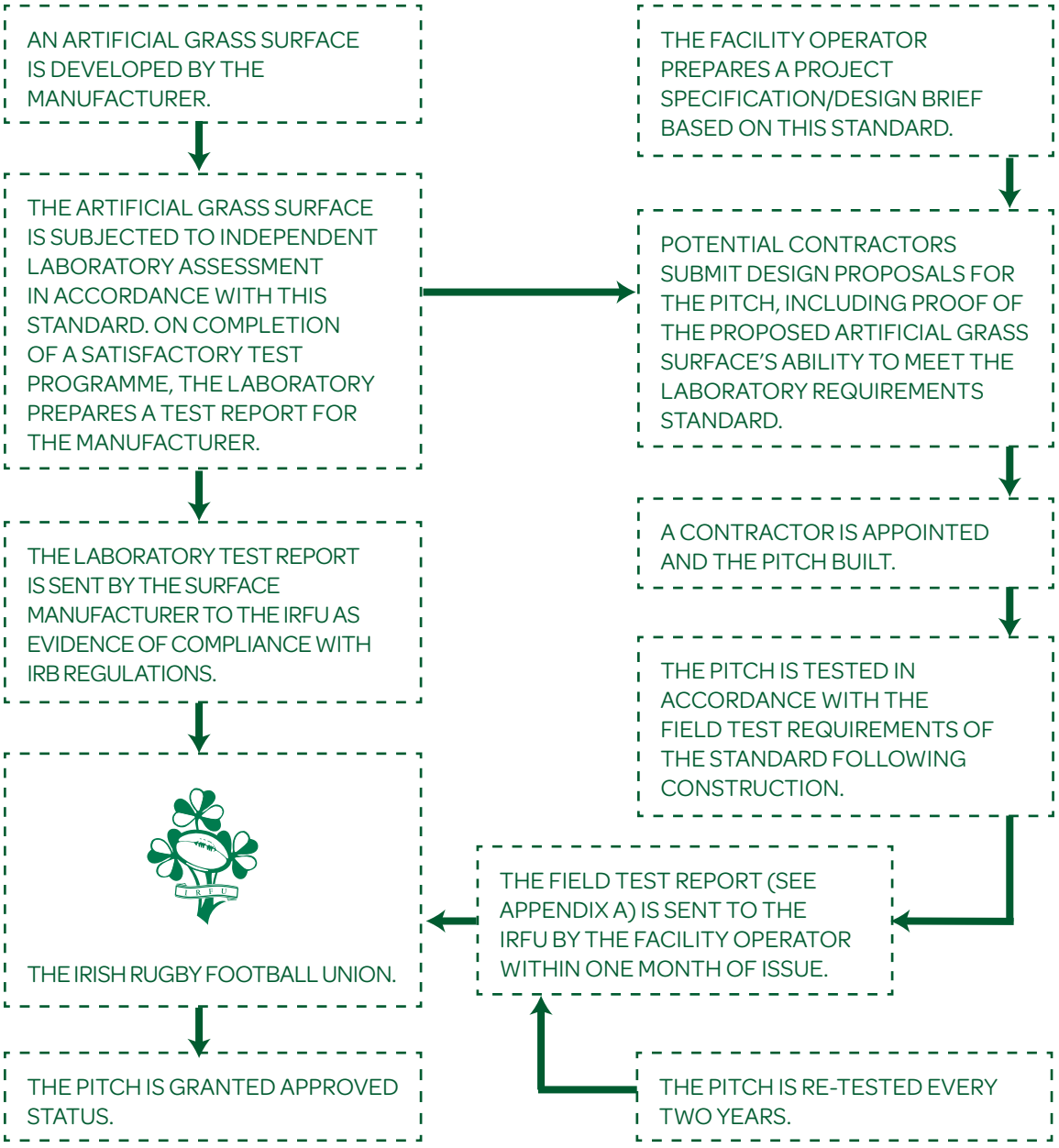
- FIFA Quality Concept for Artificial Turf Surfaces.

Many artificial grass pitches are, however, used by more than one sport and this can lead to compromises in the characteristics of the playing surface. Recognising the synergy between sports, the IRFU has prepared this performance standard and guide for multi-use artificial grass pitches. The standard is based on the requirements of the IRB and FIFA standards, modified to reflect the multi-use nature of the pitch. It details how a pitch should perform (player/surface interaction and ball/surface interaction); it also specifies requirements for the artificial grass surfacing (durability, construction, etc); finally, it specifies requirements for the design and construction of pitches. Surface and pitches satisfying this standard will also satisfy IRB Regulation 22.

2 How should this performance standard be used?

Most artificial grass pitches are obtained using design and build types of contract. In this form of contract, the developer specifies what they require and the contractor prepares a design to satisfy the brief. To ensure dual use multi-use pitches are designed to perform in accordance with IRFU recommendations, the design brief should state that the system of artificial grass surfacing and the construction of the pitch should be in accordance with this standard.

The following flow chart shows the various steps that are required to fully comply with this Standard.



3.1 Normative references

IRB Regulation 22 refers to a number of test methods that are currently still under development by organisations such as the European Standards Organisation (CEN). As these test methods may be revised during the development of the European Standards, this standard refers to the editions available at the time of publication. These normative references are cited at the appropriate places in the text. Subsequent amendments to or revisions of any of these publications will apply to this standard only when incorporated into it by amendment or revision.

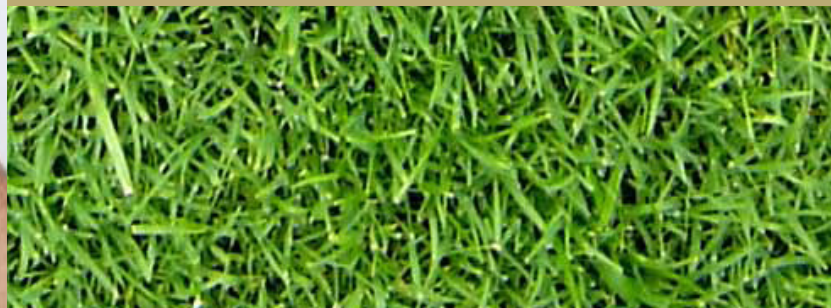
The designation to FIFA refers to test method details in FIFA's Quality Concept Handbook of Test Methods for Football Turf, March 2006.

The designation to UEFA refers to a test method detailed in Section 2 of UEFA's manual, Artificial Grass in UEFA Competitions, Requirements and Recommendations, 2002.

3.2 Laboratory test specimens

3.2.1 Unbound bases

If the artificial grass surface incorporates an unbound base construction that is designed to contribute to the dynamic properties of the surface, laboratory measurements of football rebound, football pace, shock absorption, vertical deformation and HIC shall be made on the artificial grass, shockpad (if applicable) and a depth of unbound base of at least 100mm or the depth stated by the manufacturer to influence the performance, whichever is greater.



3 Artificial grass pitches for rugby - performance standards and design guides for community use pitches and training areas

If the unbound base is not designed to contribute to the dynamic properties of the surface, laboratory measurements may be made with the artificial grass surface laid on a concrete base. Tests for rotational resistance, sliding distance, slip resistance and ball roll/velocity change may be made with the artificial grass surface laid on a macadam, concrete or unbound base, subject to manufacturer's approval.

3.2.2 Engineered bases

If the artificial grass surface is intended for installation on an engineered base, laboratory measurements may be made on a macadam or concrete base, subject to the manufacturer's approval.

3.2.3 Preparation of laboratory test specimens

Test specimens shall be prepared strictly in accordance with the manufacturer's instructions. These should be detailed in the test report. Following preparation, the specimens for sport and player/surface interaction tests should be conditioned using the procedure detailed in the FIFA Quality Concept Handbook of Test Methods for Football Turf.

3.2.4 Laboratory test conditions

Laboratory tests shall be undertaken at a temperature of 23 C+/-2 C. Test specimens shall be conditioned at the test temperature for at least 3 hours prior to the test.

3.2.5

For all tests other than ball roll, wet test specimens should be produced, by evenly applying to the test piece, a volume of water that is equal to the volume of the test specimen. The sample shall be allowed to drain for 15 minutes and the test carried our within a further 5 minutes. For ball roll test specimens, the sample shall be saturated using a hose supply or watering can, taking care to ensure any infill is not disturbed and be allowed to drain for 15 minutes, with the test being carried out within a further 15 minutes.

3.3 Player/surface interaction

In many respects, the primary consideration of a surface when used for rugby is its ability to provide a safe playing environment and withstand the high forces and impacts of players falling onto the surface. For this reason, it is essential that a dual use rugby/football surface satisfies the relevant requirements of the IRB Regulation 22. These are detailed in Table 1. The player/surface requirements should be achieved in the laboratory (product assessment) and on site (pitch assessment).

IRB Regulation 22 contains a requirement for energy restitution. The specified test method allows a number of alternative ways to measure this property. Each method is currently under technical review. Care should be taken when comparing results obtained with one method to those obtained with another.

Table 1 - Player/Surface interaction

Property	Test method	Requirement
Shock absorption	EN 14808: Method 1, 2005	60% - 75%
Deformation	EB14809: Method 1, 2005	4mm - 10mm
Head injury criteria	EN1177: 1998 (treat surfaces as loose particulate material and test in accordance with clause 6.4.3.2 etc.	>1.0m*
Energy restitution	IRB Regulation 22	30% - 50%
Traction/rotational resistance	FIFA 06/05-01	30 Nm - 50 Nm
Abrasiveness	IRB test method: Securisport/Peau 1	130%
Abrasiveness friction	IRB test method: Securisport/Temp 1	T Max 5 C

* To compensate for the reductions in Critical Fall Height that may occur as a result of infill consolidation through use, the IRFU strongly recommends a Critical Fall Height of greater then 1.3m be achieved on new pitches when tested after construction.

The IRB and FIFA have specified different ways to measure the sliding properties of the surface. A surface should satisfy both requirements of Table 2.

Table 2 - Player/Surface interaction - Sliding properties

Property	Test method	Requirement
Slip resistance	EN 14837: 2003 using studded test foot	0.6u - 1.0u
Sliding distance	BS 7044 Section 2.2 Method using studded test foot as specified by FA	0.25m - 0.75

3.4 Ball/surface interaction

Although IRB Regulation 22 contains requirements for the ball/surface interaction, these properties are of greater importance to football; multi-use pitches and training areas should therefore be designed to satisfy the relevant FIFA requirements detailed in Table 3. The ball/surface requirements should be achieved in the laboratory (product assessment) and on site (pitch assessment).

Table 3 - Ball/Surface interaction

Property	Test method	Requirement
Ball rebound	FIFA 01	0.06m - 1.0m
Ball roll	FIFA 03	4m - 10m
Football pace	UEFA Method 2.5	Dry: 45% - 60% Wet: 45% - 80%

3.5 Durability

The ability of an artificial grass surface to retain acceptable playing properties throughout its service life (subject to acceptable maintenance) is an important aspect of a product. Possibly the greatest threat to the performance of an artificial grass rugby/football surface is excessive compaction of the infill materials and or excessive fibrillation of the pile of the carpet. Both the IRB and FIFA have specified the same method for simulating the effects of playing on artificial grass surfaces and assessing the changes in performance that may occur. Following conditioning to simulate use the player/surface and ball/surface properties are reassessed to ensure continuing satisfactory performance.

The requirements for the effects of simulated use may only be undertaken in the laboratory and forms part of the product assessment test programme.

Table 4 - Effects of simulated use

Property	Test method	Requirement
Simulated use conditioning procedure	FIFA 10	
Shock absorption	EN 14808, 2005	60% - 70%
Deformation	EN 14809, 2005	4mm - 10mm
Traction/rotational resistance	FIFA 06	30Nm - 50Nm
Ball rebound	FIFA 01	0.60m - 1.0m
Water permeability	BS EN 12616, 2003 (using a single ring)	>100mm/h

3.6 Properties of artificial grass carpet

The forces and stresses placed on artificial grass pitches, particularly when used for full contact adult rugby, are very high. To ensure an artificial grass carpet is robust enough to withstand these forces, the IRB have identified a number of properties for which they have specified requirements. These are detailed in the following tables.

Many properties of the artificial grass carpet and joints can be affected by prolonged exposure to water. To ensure surfaces retain acceptable longer term performance, samples are artificially aged in water before having the properties reassessed.

The properties of the artificial grass carpet are measured on laboratory samples and forms part of the product assessment test programme.

Table 5 - Properties of artificial grass carpet

Property	Test method	Requirement
Tensile properties of carpet	BS EN ISO 13934 - 1, 1999	> 25 N/mm
Tuft withdrawal before and after water ageing	ISO 4919, 1978 BS EN 13744, 2004	> 25 N
Pile height	Measurement using steel rule/BS ISO 2549, 1972	> 65mm

3.7 Joint strength

One of two methods is normally used to join rolls of artificial grass surfacing; some companies use stitched seams, whilst others use bonded seams. Stitched seams are most likely to fail in tension and should be tested in this mode to ensure adequate joint strength. Bonded seams are more likely to fail in peel (i.e. the carpet peels away from the backing tape to which it is bonded).

The strength of seams is tested in accordance with BS EN 12228. This procedure describes methods for measuring joint strength in tensile and peel modes. The requirements for joint strength may only be undertaken on laboratory samples and forms part of the product assessment test programme. In certain cases, the strength of the joint may exceed the strength of the carpet but the recorded joint strength is below the values specified in Table 6. Providing the carpet satisfies the requirements for the tensile properties of the carpet, the joint strength is considered acceptable in such cases.

Table 6 - Joint strength

Property	Test method	Requirements
Tensile strength before and after water ageing - stitched seams	BS EN 1228: Method 1, 2002 BS 7400 Section 2.4 Method 3, 1989	≥ 1,200 N/100mm
Peel strength before and after water ageing - bonded seams	BS EN 1228: Method 1, 2002 BS 7400 Section 2.4 Method 2, 1989	≥ 75 N/100mm

Note: IRB Regulation 22 currently specifies a tensile joint strength of 2500N/100mm for all types of joint. Experience to date has shown bonded joints are not able to achieve this value, but perform adequately on site. The RFU have proposed the IRB amend the Regulation to the requirements detailed in Table 6.

3.8 Resistance to artificial weathering

To ensure acceptable long term resistance to artificial weathering, the artificial grass surface, including all infill should be manufactured from materials that have levels of resistance to ultra violet (UV) light degradation, weathering and ageing that will ensure the surfacing does not prematurely breakdown, fail or significantly fade or change colour during its normal service life (10 years).

Table 7 - Effects of artificial weathering

Component	Property	Test Method	Requirement
Artificial	Colour change	EN ISO 20105-A02	≥ Grey scale 3
Pile yarn(s)	Tensile strength	EN 13864	% change from unaged to be no more than 50%
Polymetric infill	Colour change	EN ISO 20105-A02	≥ Grey scale 3

3.9 Toxicity

When claiming conformity to this standard, the manufacturer/supplier of the artificial grass surface is deemed to be confirming that the artificial grass surface, including all infill and shockpad materials, have been manufactured from materials that in their finished state do not contain any substance which is known to be toxic or carcinogenic when in contact with the skin or ingested and that no toxic or carcinogenic substances will be released as a vapour, leachant or dust during normal use.

4 Construction requirements

Pitches should be designed and built to the criteria detailed in Table 8.

Table 8 - Pitch design and construction requirements

Property	Test method	Requirements
Surface Regularity (see note below)	3m straight-edge	<10mm
	Maximum greater number of deviations: 20 with no deviation greater than 15mm	
	Deviations greater than 1m in length shall be considered multiple deviations	
Gradients	Surveyor's level	No more than 1.0% in any direction (0.5% recommended)
Deviation from design level	N/A	+1 25mm
Water infiltration rate	BS EN 12616, 2003	>100mm/h

Note: Variations in the distribution of particulate fill within the pile of a carpet can have a significant effect on the regularity of the playing surface. Whilst this can be corrected through maintenance, the regularity of the pitch will also be influenced by the base on which the artificial grass carpet is laid. The base should therefore meet the surface regularity requirement and be checked before the artificial grass is laid.

5 Pitch assessments

Once a pitch has been constructed, it needs to be tested to demonstrate it has the specified levels of performance; this is particularly important for rugby where the severity of player impacts with a surface are greater than in other contact sports, thereby increasing the potential risk of injury. The IRFU has adopted the testing programme detailed in IRB Regulation 22 and require all artificial grass pitches used for rugby (training and competition) to be tested as follows:

- following construction - as some surfaces need a period of time for the infill materials to stabilise before the surface reaches it's optimum condition testing may be delayed for up to three months following completion;
- every two years thereafter – re-testing may be undertaken up to three months in advance of a field's renewal date without the subsequent renewal date changing;
- whenever the artificial grass surface is replaced.

NB: If a pitch fails to satisfy the field test requirements of IRB Regulation 22 (incorporated into this Standard), it should not be used for contact rugby (training and playing) until the necessary remedial works required to ensure compliance are undertaken and the pitch has been re-tested and shown to fully comply.

Testing should be carried out by a specialist laboratory that is experienced in the testing of artificial grass surfaces, using equipment that is formally calibrated in accordance with the requirements of ISO 17025. To ensure there are no perceptions of conflicts of interest, the laboratory should be independent of the manufacturer and installer of the artificial grass surface and should not have participated in the design of the installation.

Tests should be carried out in at least six positions representing high, medium and moderate use areas (two of each), unless performance at a certain location is of concern, in which case that location should be assessed.

Tests on site should be made at the prevailing ambient temperature, but within the range of +5 C to +30 C and under the prevailing surface conditions (dry or wet), unless performance under a certain condition is of concern, in which case that condition should prevail.

The responsibility for organising the testing of an artificial grass pitches remains with the operator of the pitch, although it may be contracted to another party such as the organisation responsible for the construction, operation or maintenance of the pitch. The results of the field tests should be entered onto the IRFU Field Test Report (see Appendix A) and forwarded to the IRFU so they may record the compliance of the pitch.

6 Design guidelines

6.1 Dimensions, run-offs and line markings

The playing enclosure comprises the playing area (the field of play and in-goal areas) and run-off space around it, which are provided to ensure players do not injure themselves by running into surround fencing, hoardings and other obstacles. The run-offs should be surfaced with the same artificial grass surface as the playing area.

Table 11 on page 15 summarises the various pitch sizes for the main categories of dual use rugby/football facility and the recommended run-offs.

Play lines can either be painted onto the playing surface or be tufted and inlaid. Tufted lines are incorporated into the carpet during production and inlaid lines are cut into the carpet during installation. Tufted/inlaid lines provide permanent markings that reduce ongoing maintenance costs, whereas painted lines give greater flexibility to the use of the area. All three methods are considered acceptable.

6.2 Floodlighting

The minimum levels of performance should be in accordance with Table 9.

Table 9 - Minimum levels of floodlighting

Property	Requirement
Maintained average illuminance	> 200 Lux
Uniformity (Min/Ave)	> 0.6
Glare Rating	<50
Lamp colour temperature	Tk > 400K
Lamp colour rendering	≥ 60

For coaching, training and cross pitch play, pitches should be lit to the minimum standards detailed in Table 10.

Table 10 - Minimum levels of floodlighting - training and recreational use

Use	Property	Requirement
Recreational play	Maintained average illuminance	120 lux
	Uniformity (Min/Ave)	>0.6
Training	Maintained average illuminance	100 lux
	Uniformity (Min/Ave)	No requirement

Note: Following installation or re-lamping, a lighting system will normally suffer an initial deterioration in lighting performance; this is typically in the order of 15% to 25%. The lighting levels should then be consistent (subject to routine maintenance, including cleaning of lamp glass, realignment, etc) until the lamps reach the end of their service life. The value of maintained average illuminance is the level of illumination provided after the initial deterioration.

Table 11 - Recommended pitch dimensions and run-offs (Based on common touch and goal lines)

Type of pitch	Category	Playing Area		Recommended run-off beyond playing area			Playing enclosure
		Length	Width	Distance at either end of pitch		Minimum at either side of pitch	(fence to fence) (Refer to section 6.1 of this document)
				Touch-in goal line	Run-off	Run-off	
Full size pitches	Recommended	130.0m	80.0m	10.0m	5.0m	5.0m	130.0m x 80.0m
Training pitches	Training/mini football	55.0m	36.5m	N/A	3.0m	3.0m	61m x 42.5m

The IRB states that: 'The length and breadth of the playing area are to be as near as possible to the dimensions indicated. All the areas are rectangular.' (IRB Law 1 - The Ground)

7 References

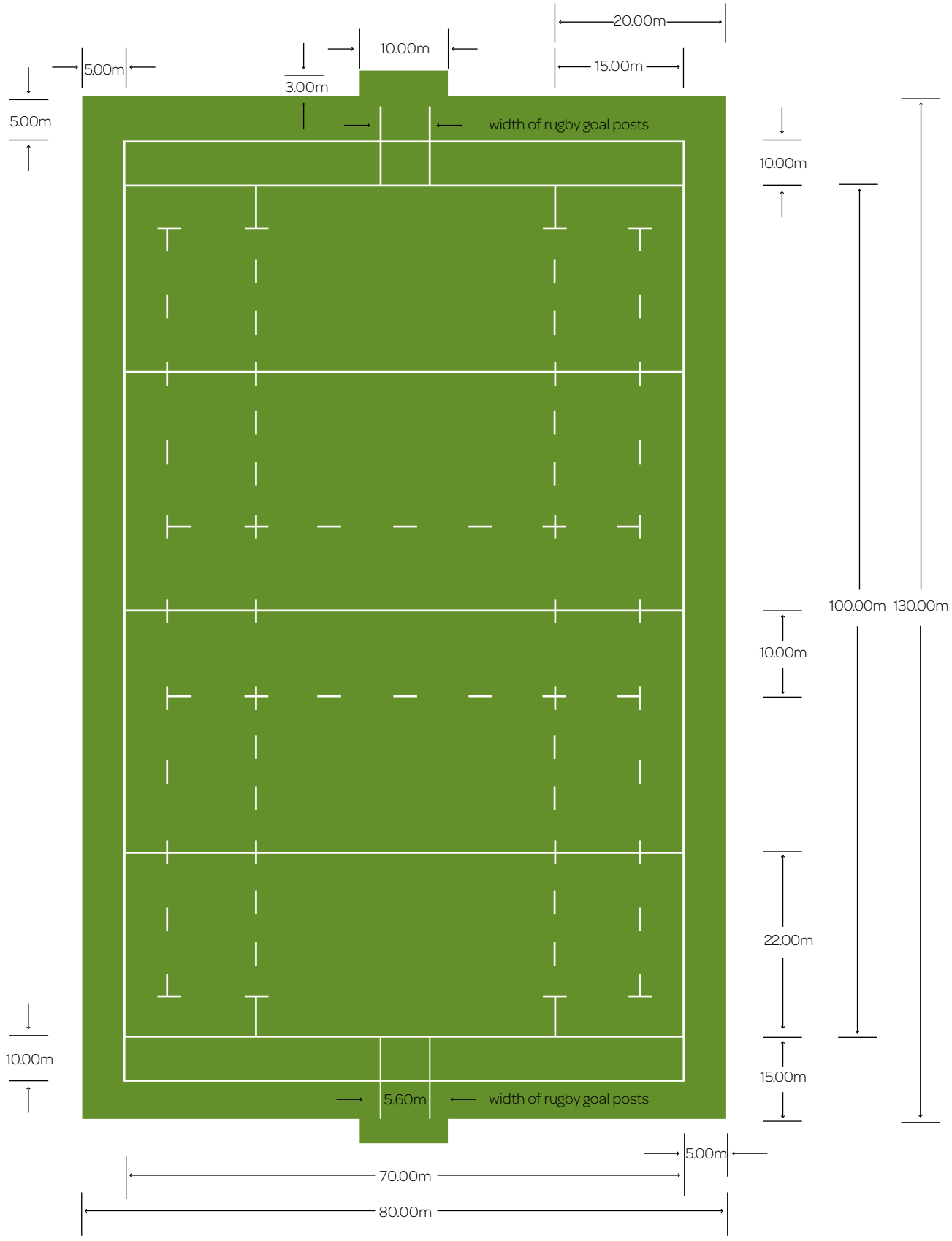
1. IRB Performance Specification for Artificial Surfaces for Rugby - Regulation 22, March 2004 www.irb.com

2. FIFA Quality Concept for Football Turf, April 2006 www.fifa.com/en/development/quality/artificialtest.html

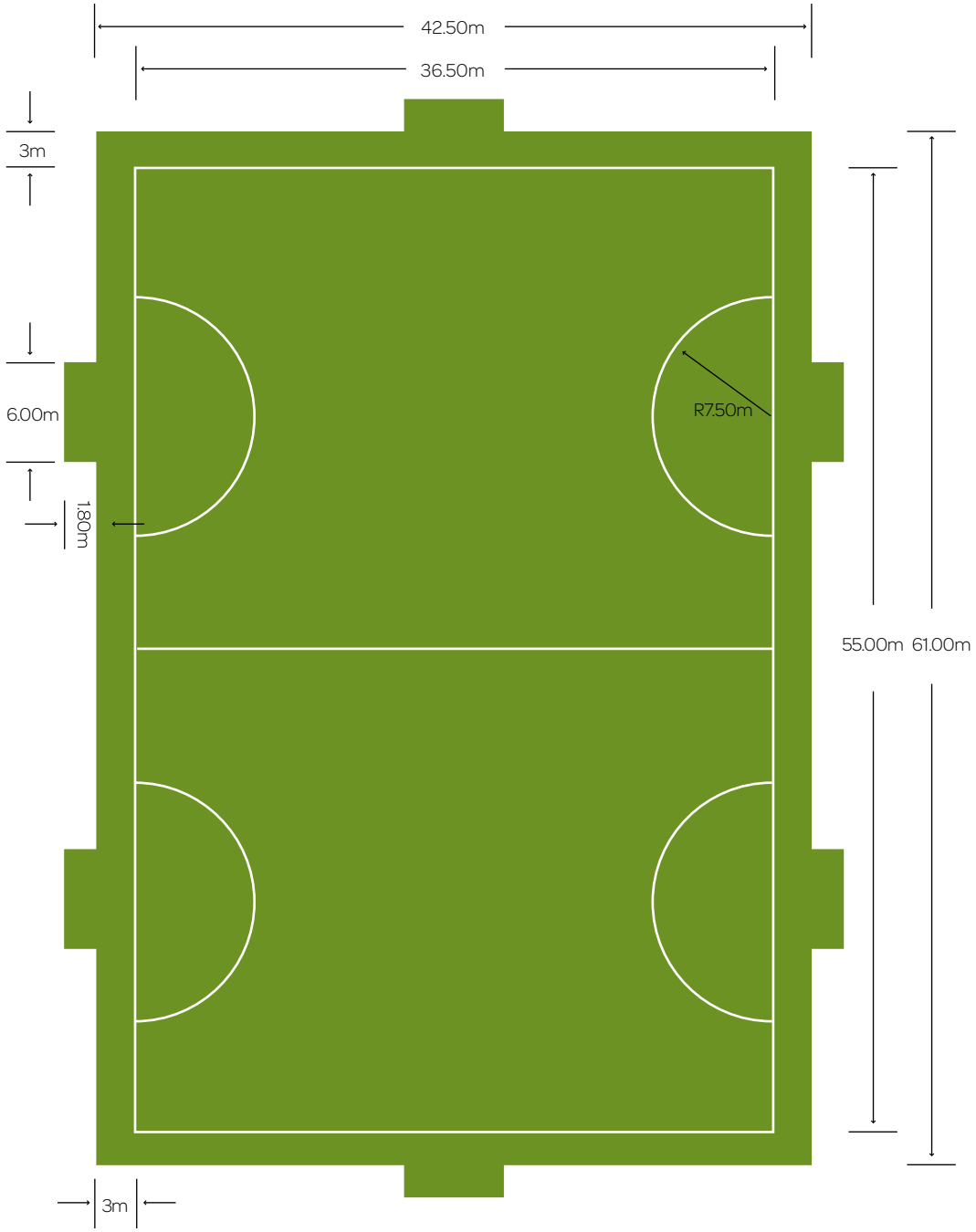
3. Artificial Grass in UEFA Competitions, Requirements and Recommendations, UEFA, 2003 www.uefa.com

Support and advice
For further support and advice on artificial turf pitches and their use for rugby union, please contact your local branch office (see back page).

8 Recommended pitch dimensions (full size pitch)



Recommended pitch dimensions (training pitch)



9 Artificial grass rugby pitch - field rest report

This report must be completed in full and signed by a Director of the laboratory that undertook the field tests and the organisation responsible for the artificial grass pitch.

The completed Field Test Report should be sent (by post, fax or email) to:

Declan O'Brien
Operations Manager
Irish Rugby Football Union
10/12 Lansdowne Road
Dublin 4

Fax: 01 647 3801
Email: declan.obrien@irfu.ie

Please see Appendix A for a sample Field Test Report.

Appendix A

Artificial Grass Rugby Pitch - Field Test Report

Site details				
Club or site name				
Address				
Club or site contact				
Tel				
Email				
Date pitch installed				
Contractor				
Contractor's address				
Artificial grass product name				
Infill	Upper layer			
	Middle layer			
	Lower layer			
Shockpad				
Base				
Type of test	Initial		Re-test	
Re-test: date of last test				

Pitch owner/operator	
Organisation	
Address	
Contact	
Tel	
Email	

Appendix A (continued)

Artificial Grass Rugby Pitch - Field Test Report

Test Laboratory	
Laboratory	
Address	
Tel	
Contact	
Email	
Laboratory project reference	
Signature	

Test Conditions			
Date of test			
Surface condition	Dry	Wet	
Ambient temperature		Surface temperature	

Pitch location		Date of test	

Appendix A (continued)

Artificial Grass Rugby Pitch - Field Test Report

Test results - IRB Regulation 22								
Person/surface interaction								
Property	**Test Position**						**Requirements**	**Pass/fail**
	1	**2**	**3**	**4**	**5**	**6**		
Shock absorption							60% - 75%	
Vertical deformation							4mm - 10mm	
Head injury criteria							Rec: > 1.3m* Min: > 1.0m	
Energy restitution							30% - 50%	
Traction							30Nm - 50Nm	
Slip resistance							0.6 - 1.0	
Sliding distance **							0.25 - 0.75m	

* IRFU recommendation for new pitches
** Dual use rugby/football pitches only

Appendix A (continued)

Artificial Grass Rugby Pitch - Field Test Report

Ball/surface interaction								
Property	**Test Position**						**Requirements**	**Pass/fail**
	1	**2**	**3**	**4**	**5**	**6**		
Ball rebound							60 - 100cm	
Angle ball rebound								
Ball roll**							60 - 100cm	

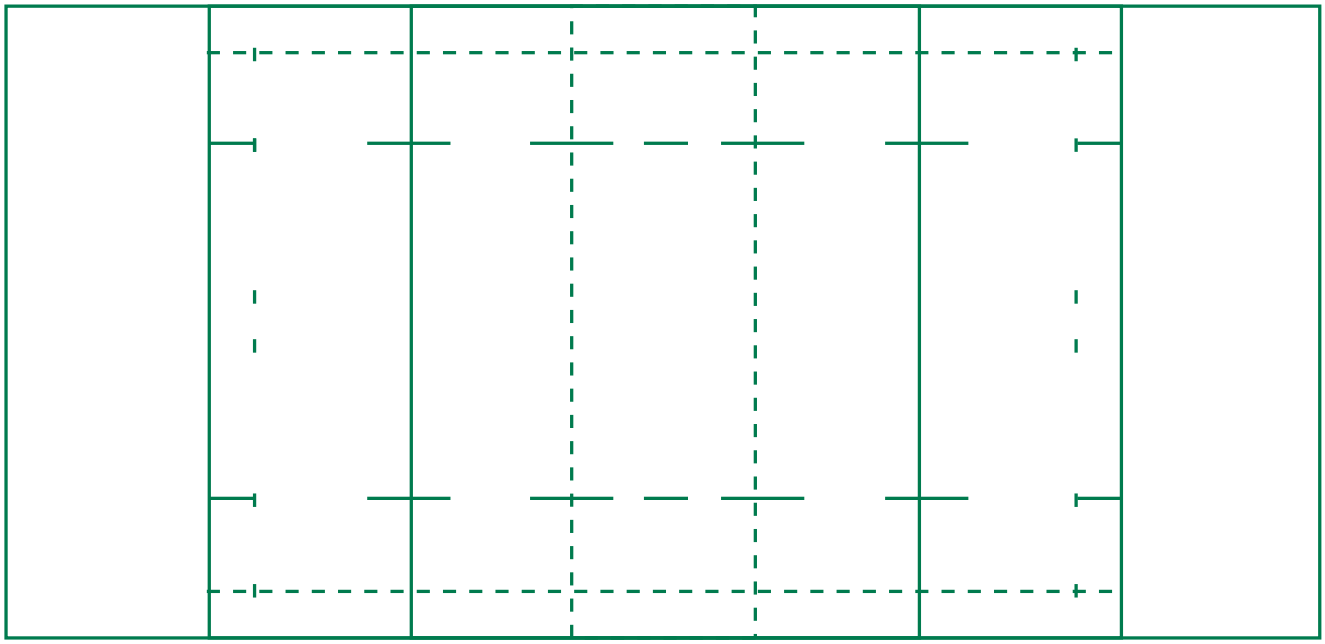
* Tests on rugby only pitches in accordance with IRB regulation 22. Tests on dual use rugby/football pitches in accordance with RFU/FA Standard
** Dual use rugby/football pitches only

Construction								
Dimensions	Length			Width				
Principal gradients	Length			Width			<1%	
Water permeability							>180mm/h	
Pile height							>65mm	
Infill depth								

Appendix A (continued)

Artificial Grass Rugby Pitch - Field Test Report

Plan showing surface undulations exceeding 10mm



Appendix A (continued)

Artificial Grass Rugby Pitch - Field Test Report

Laboratory results

IRB Regulation 22 includes a series of laboratory tests. To fully comply with the Regulations, as required by the Laws of the Game, the artificial grass surface installed on a field must also meet the requirements of the laboratory tests.

When submitting a Field Test Report for a new pitch a copy of the test report showing the installed surface's compliance with the laboratory test requirements of IRB Regulation 22 must be attached to the Field Test Report and the installing company must confirm the artificial grass surface installed is to the same specification as that detailed in the laboratory test report.

Statement of conformity
We confirm that the combination of artificial grass surface, infill, shockpad and sub-base installed on the pitch to which this Field Test Report applies are the same (within industry production tolerances) as those previously tested in the laboratory and as described in the laboratory test report detailed below

Signed				
Name				
Position				
Company				
Date				
Laboratory Test Report Reference No.				
Laboratory report included	Yes		No	

Pitch location		Date of test	

For further information contact the Branch Club Rugby Development Manager:

Munster Rugby
Tel: 021 4323563
Fax: 021 4323956

Leinster Rugby
Tel: 01 2693224
Fax: 01 2693142

Connacht Rugby
Tel: 091 561568
Fax: 0909 643083

Ulster Rugby
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