

THE USA ARTIFICIAL TURF GUIDE



TABLE OF CONTENTS

Page 3 Introduction

Page 4 Frequently Asked Questions – Artificial Turf Installation

Page 6 Context in relation to the professional game - Technical Element

Overview

Summary of Field Construction Requirements

Dimensions

Earthworks

Drainage requirement

Sub-base stone

Curbs

Bituminous macadam material

Shock Pads

Artificial Playing Surface

Sustainability in Construction and End of Life Recycling

Equipment

Maintenance

Influence of Use

Management of the playing surface

Page 27 Principal References

Tables

Table 1: Hours of Use v Estimated Playing Surface Lifespan

Table 2: Typical Construction for the makeup of the field base

Table 3: Typical Type 3 Materials for Particle Size Distribution

Table 4: Typical Levelling Layer Materials for Particle Size Distribution

Table 5: Recommended Construction for Synthetic Turf System - Mono Filament Yarn Type

Table 6: Performance Requirements for the field

Page 29 Appendices

Appendix 1: Recommended Quality Plan for key stage inspection and testing during refurbishment or construction of an artificial turf field

Appendix 2: List of items to be supplied with any Tender Submission

Appendix 3: Warranty

Appendix 4: Suitable Footwear Guidelines

Appendix 5: Typical Maintenance Log

Appendix 6: Sample Lab Test Report

Sample Field Test Report

Appendix 7: Test Location Maps By Sport

INTRODUCTION

This document sets out guidance on the installation of a artificial turf multi-sport turf surface. It outlines the key elements that must be considered in terms of:

- i) Procurement;**
- ii) Installation;**
- iii) Post-installation – including maintenance and sustainability.**

The document also outlines the key surface characteristics, requirements and testing parameters, which will help to ensure that the **quality** of surface becomes as fundamental a consideration in the procurement process as costs.

This document outlines suggested minimum standards for the quality and performance of a artificial turf field to be installed for multi-sport use. It is designed to assist owners embarking on such a project and to ensure as far as possible that player safety and quality of the resultant playing surface remains a priority prior to, during, and beyond installation. This level of safety and quality is to match the qualities found in natural grass.

It should be noted that every project is unique with local factors such as land characteristics, ground conditions, budgets and time constraints requiring to be considered on a project by project basis.

Ultimately, the field must comply with the requirements outlined in the version of the One Turf Concept (OTC) that is valid at the date of commencement of the project.

See <https://playerwelfare.worldrugby.org/?subsection=78> for more information on One Turf Concept

This document was set up for the Collegiate event facilities management association (CEFMA), USA Field Hockey , USA Rugby and any other USA sporting community that needs assistance with artificial turf guidance.



FREQUENTLY ASKED QUESTIONS ARTIFICIAL TURF MULTI SPORT INSTALLATION

Construction Timescales & Optimum Installation Period

- Conversion of a grass field to artificial turf typically takes from 10 to 15 weeks. This is entirely dependent on the nature of the conversion and is a baseline guide only.
- The variation in timescale is due to a number of critical factors including the nature of the ground conditions, base construction, i.e. whether there is full base construction required or if there is an existing base under the grass field that will reduce work required and in turn costs.
- Favorable weather is also an important factor at certain stages of the artificial turf-installation process, which is best carried out during dry conditions and ideally above 40 F.

Indicative Costs

- Conversion from natural grass to a One Turf Concept compliant multi-sport artificial turf field is likely to be in the region of \$750,000 - \$950,000 (correct as of June 2018). This is dependent upon elements including overall field dimensions, existing sub base, the extent of immediate field surround works required (usually for a combination of health & safety and aesthetic reasons) and new equipment.
- Where there is a sub-base in place beneath the existing grass field and which could be utilized as part of the artificial turf install, this can result in a significant saving.
- Professional services engaged in delivering the project will typically cost approximately 5-10% of the overall project cost, depending on the individual circumstances of each project as mentioned above.

Maintenance Training Programme & Equipment

- **Under no circumstances should an artificial turf field be regarded as maintenance free.** This was the case with the previous sand-filled second generation (2G) artificial surfaces and has resulted in a legacy of poorly maintained and, in some cases, redundant fields.
- A thorough and robust maintenance programme to keep the field at optimum standard and quality is **absolutely essential**.
- This should be the responsibility of the owner's ground staff on a day-to-day, week-to-week basis, **but must be complemented by regular programmed visits by an identified specialist field maintenance contractor.**
- These specialist visits should be **at least quarterly** with specific works carried out at this interval. The nature of the work undertaken during these visits will require specialist equipment. Given this equipment would receive relatively infrequent use it is unlikely to be cost effective for a field owner to purchase it itself.
- It should be remembered that the levels of use and overall footfall on the surface has a direct correlation to the maintenance programme required. In layman's terms, the heavier the use, the more intense, and indeed crucial, the maintenance programme requires to be. Current guidelines suggest that for every 10 hours of playing use the surface should be groomed for 1 hour. See Table 1. Also please consult the turf manufacturer for their recommendations for surface maintenance.
- **It cannot be emphasized enough that the quality and effectiveness of the maintenance programme has a direct impact on the overall lifespan and quality of that surface.**
- Artificial Turf specific maintenance equipment such as drag brushes, grooming mats and infill distribution equipment is essential and should be most cost-effectively purchased as part of the overall field installation contract. Without such, the level and quality of maintenance required will not be achieved.
- In most instances, the Artificial Turf-specific equipment can be utilized to maintain a natural grass field (e.g. small tractor), providing it is well cleaned and fitted with appropriate couplings. However, where such plant apparatus does not exist this will require to be purchased. As stated above, savings may be made by including purchase of such items in the field installation contract.
- The necessary equipment should normally be procured for around 2-3% of the total field installation cost (i.e. \$17,000 - \$25,500 when based on a \$850,000 installation).

Testing Equipment and Schedule

- The equipment for basic ball roll and ball bounce/rebound tests should be procured for around \$750 and is invaluable in assisting ground staff to maintain a high quality playing surface.
- Official field testing should be carried out every two years by a Testing Laboratory with an North American ISO 17025 accreditation for the testing set out in the One Turf Concept. This is recommended as it will maximize surface quality beyond the testing window itself.

Establishment of a Surface Replacement Fund

- A surface replacement fund, also commonly referred to as a 'sinking' fund, should be established in order that the artificial turf surface, together with any remedial works to the immediate shock pad and base, can be replaced within a specified timescale.
- **As a guide, high quality artificial turf fields can be expected to last from 7 to 10 years.** However this is directly aligned to a robust and well-managed maintenance programme that takes into consideration the level of footfall on the field. For example, a heavily used, well-maintained field can last longer than a poorly maintained field with significantly less footfall.
- With surface replacement likely to be in the region of \$650,000, at the lower end of the field lifespan of 7 years, contributions to the surface replacement fund should equate to circa \$92,000 per annum. Revenues from community field rental are usually directed toward the establishment of this fund. However, community use requires to be carefully balanced to maintain surface quality for professional activity, whether matches or training.
- Should the field lifespan last beyond 7 years then the additional years' contributions can be directed elsewhere, e.g. toward further replacement or into reserves for any unforeseen issues.





TECHNICAL ELEMENT

1. OVERVIEW

1.1 General

The purpose of this document is to outline best practice for the construction of a artificial turf multi-sport field. However, many of the principles and practices as detailed herein can be applied to any facility construction. The requirements aim for a high quality surface for use by multiple sport. The key objectives which underpin this document being player safety and the need to provide a field that performs to as high a standard as possible.

1.2 Specification v Guidance

This document is NOT a specification for the construction of a artificial turf multi-sport field and should not be used as such. It is for guidance only. It identifies minimum standards, which should be applied in the design, specifications and construction of artificial turf fields for multi sport fields which can be applied across all levels of the game to ensure as high quality a playing surface as possible.

1.3 Impact of related research

The guidance covers the construction of new facilities and the refurbishment of existing facilities. The guidance reflects the findings of the player perception studies which examined perceptions of current professional players on the use of artificial turf surfaces at the top level of the game. One fundamental consideration highlighted in the survey was the player's preference to play on surfaces that incorporated a shock pad in the artificial turf system installed. Shock pads have been proven to improve overall safety, long-term performance, and can prolong the life of the surface in both general terms and in relation to the continued compliance with Governing Body requirements.

A further benefit to this approach, dependent on selection of an appropriate shock pad and turf is that it the field may comply with the requirement of World Rugby's Regulation 22. The field should then be appropriate for use for rugby. This opens up a further potential market/customer base and additional income stream. However, this may only be viable in locations where rugby use is sufficiently significant to offset any related additional installation costs. World Rugby's Reg 22 requirements is follows the same idea of the one turf concept however this standard is more stringent and comes off the back of years of research and collaboration with other governing bodies such as FIFA.

1.4 Establishment of the Project Team

Construction and installation of a artificial turf field is a costly and specialist exercise. Therefore, the Owner should consider the establishment of a project team to oversee the design, specification and overall project management. This team should consist of proven professionals with expertise in delivery of artificial turf projects, particularly those in a stadium environment. Such a team will go far to ensuring the success of the project and should include the following individuals;

- Field Consultant (please see 1.5 below for further detail on this particular specialist role).
- Project Manager (if not covered through the services provided by the Field Consultant).
- Contract Administrator.
- ISO 17025 Accredited Test Laboratory from North America.
- Health and Safety Co-coordinator (if not already covered by another member of the project team).

1.5 Employment of an expert Field Consultant

The design, specification and project management of artificial turf fields is a specialist discipline. As such clubs wishing to convert, construct or refurbish a field to meet the requirements of the One Turf Concept employ the services of a suitably qualified, specialist field consultant with extensive experience in the design, specification, procurement and project management of artificial turf fields. This should be carried out by an independent ISO Accredited Test house as mentioned in 1.4 above.

1.6 Formal Inspections/Testing at Key Stages

The construction or refurbishment of a artificial turf field involves complex processes to meet stringent construction tolerances. For this reason, it is essential that a specialist Test Institute monitors the works being undertaken. The Test Institute will be engaged to inspect, sample and test aspects of the works at milestone points in the construction process, ensuring that the specification is met and that the resultant construction will meet the requirements of the One Turf Concept. It may be that the ISO 17025 Accredited Test House (noted in 1.4) may also be able to conduct the key stage tests/inspections. Further detail is given in Appendix 1.

1.7 Field Utilization

It is anticipated that the playing field will be used for football, soccer, lacrosse, rugby, field hockey and other sports/games. This could mean that the utilization (footfall) on these surfaces can be considerable. It is very important that the hours of use are considered and communicated to the supplier of the turf system. The intensity of use can be categorized into low, medium and high use. In terms of a simple approach the number of hours of use would provide some indication of intensity of use. Up to 20 hours per week is low use, up to 35 hours per week is medium intensity of use, about 50 hours is high use.

1.8 Balancing use

This guidance is aimed primarily at multi-sport use fields which in the past have been subject to significant levels of foot fall. If the field is to be used intensively the amount of use will have a direct effect on the performance and safety of the playing surface. Intensively used fields require a robust maintenance regime to be in place, this should include brushing, decompaction and top dressing on a frequency in line with the artificial turf manufacturer's recommendations and commensurate with the levels of use. The pattern of use, or field management, also has a critical impact on the frequency of maintenance required.

1.9 Balancing Cost and Quality in the procurement process

It should also be noted that making the right choices regarding the selection of artificial turf is very important as the cost differential involved in selecting high quality turf over lower quality turf can amount to a fraction of the overall cost of the project.

Selection of high quality, proven artificial turf systems, which will provide a durable, high performance-playing surface, safe for players is a primary objective of this guidance. Given this backdrop and the discussions regarding the use and maintenance of the field, installations will be constructed or refurbished in such a way that they conform to the requirements of the One Turf Concept level. The facility will then be maintained at that level for the duration of its life and tested formally to that standard every two years.

Table 1- Hours of Use v Estimated Playing Surface Lifespan

Average of hours per week	12 hours	35 hours	55 hours
Life expectancy of a field when maintained to the manufacturers recommendations at OTC Level	Up to 12 years	Up to 10 years	Less than 8 years

2. SUMMARY OF FIELD CONSTRUCTION REQUIREMENTS

A field needs to be built to minimum construction standards. Table 2 below provides guidance on the minimum standards expected for the various aspects of the make-up of any field. It makes specific reference to new build construction but applies equally to refurbished fields where relevant.

Table 2 –Typical Construction for the make-up of the Field Base

Element of works	Description of aspect of construction of base related to specific technical requirements
Formation, ground, soil base	Formation: to be trimmed to a tolerance of plus or minus 3/8 inch (10mm) and be within 3/8 inch (10mm) of design level. The surface modulus of the soil platform should be measured by using in-situ CBR tests recording moisture conditions to allow for proper sub-base design to be carried out.
Sub-base layer	Sub-base: to be adequately compacted to achieve a surface modulus of an absolute minimum of 40Mpa and an average of 60Mpa when measured using a LWD device. The normal convention for the thickness of the stone layer is for 6 inches (150mm) (compacted thickness). It should be laid to exacting tolerances and should be trimmed so that no gap under a 10ft (3m) straight edge of greater than 3/8 inch (10mm) is found.
Asphalt base	Asphalt Base: to be measured as a compacted thickness the normal convention for a asphalt layer depth of 2 inches (50mm) and should be trimmed so that no gap under a 10ft (3m) straight edge of greater than 3/8 inch (10mm) is found. The surface modulus of the macadam platform should be no less than 100Mpa with no deformation when tested using an LWD device.

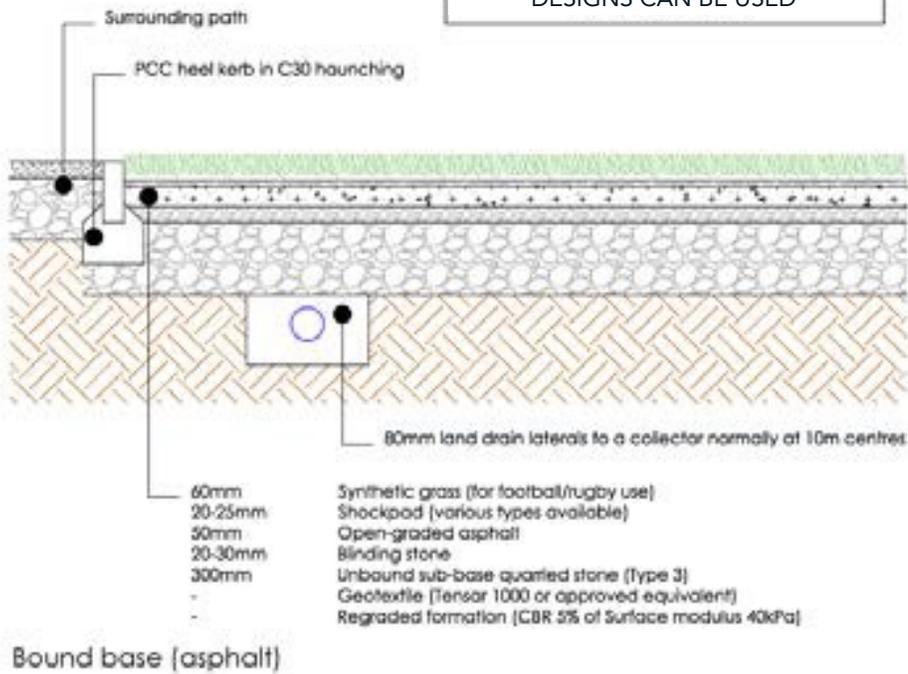
Note - whilst the design detailed in this table is typical, alternative designs may be used.

It is recommended that the field be designed with a thick stone sub-base foundation overlaid with a bound macadam surface, which would be defined as the 'base' of the field.

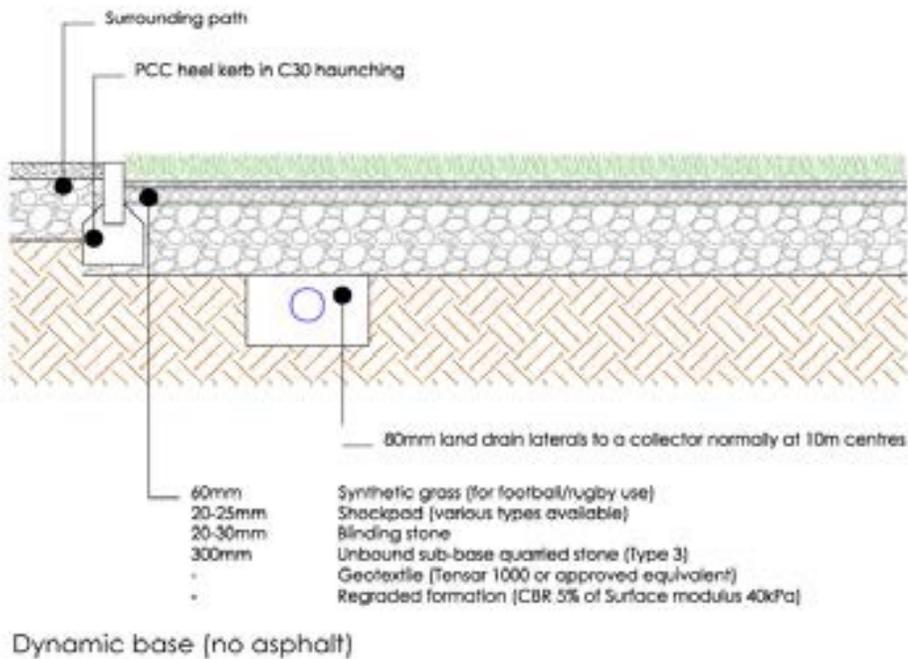
This construction would, in general, be designed to be free draining. Further guidance on the various elements of the foundation, base and synthetic system, which together form the field, is given in the sections highlighted herein:

1. Formation preparation should be in accordance with the Specification for Highway Works;
2. Drainage typically would be set out in accordance with Clause 5 of this guidance document;
3. A geotextile membrane to separate layers would normally be required in accordance with the Specification for Highway Works.
4. Sub-base would be set out in accordance with Clause 6 of this guidance document.
5. Curbs would be set out in accordance with Clause 7 of this guidance document.
6. Macadam would be set out in accordance with Clause 8 of this guidance document.

TYPICAL CONSTRUCTION FOR ARTIFICIAL TURF FIELDS ALTERNATIVE DESIGNS CAN BE USED



2.2 Sketch of 'Typical' make-up of a artificial turf Artificial Turf Field



Note- whilst this make-up are typical other base designs may be acceptable.



3. DIMENSIONS

Field size is crucial for multi-sport fields as you are accommodating many sports. A field 115m x 76m (126yd x 83yd) will allow for all sports to use the field and enough room for a run off. Run off need to be considered where possible for the safety of the user. In the appendix you will see the field dimensions for each sport however you may need to adjust these to have markings for all sports. Land could be an issue when trying to select a site so the dimensions may need to review at the time of field design.

4. EARTHWORKS

Earth working – scraping away the topsoil, organic materials and other non-reusable soils – is designed to produce a flat, stable footprint onto which to build the field. The overall design of the drainage and sub-base platform will be based on the properties of the ground and soils, which the field is founded on. The properties of the soils must therefore be defined by a site investigation, which will assist the field specialist to design the field taking account of any issues highlighted by the investigation. It should be emphasized that this is where the services of an experienced field specialist is particularly valuable when providing interpretation of the information provided in the site investigation report.

There are a number of processes and materials which can be used to improve the formation of a field, such as soil stabilization, and geotextile membranes and grids. These treatments and supplementary measures can render what would have been unacceptable soils to be acceptable, thus creating a suitable surface onto which the field can be founded. Geotextiles or grids can be used to cover the soils acting as a separator membrane and/or a reinforcing structure to the interface between soils and stone. Stabilization Powders, such as lime or cement, can be ameliorated with the soils to enhance the bearing capacity of the formation after treatment.

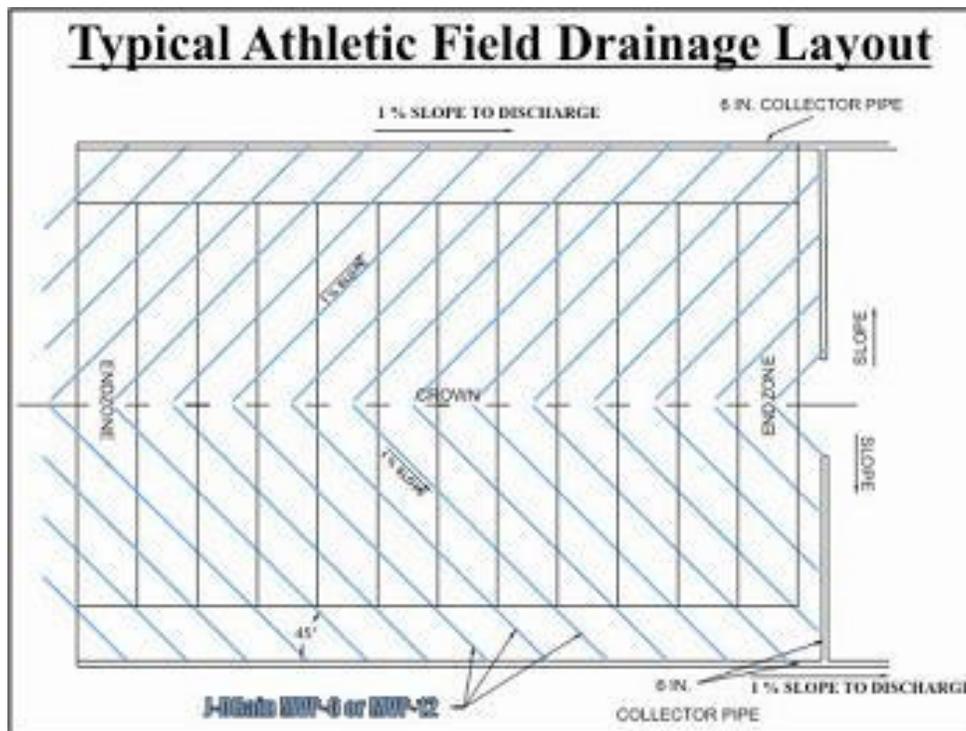
5. DRAINAGE

5.1 Drainage Requirements

The drainage to an artificial field must provide sufficient capacity to transport the rainfall levels sustained by the field surface to a suitable outfall. In terms of discharge rates many drainage calculations are based on 100 year or even 200-year rainfall event levels. The run-off may reach 4" per hour in storm situations. The drainage in these situations reach levels at 14 gallons per second discharge rates. The design therefore, must be designed to meet local planning requirements.

5.2 Typical layout for Drainage

Multi-use fields have particular requirements for efficient drainage. This depends on how the field is laid out, the levels and falls constructed into the field and the soil conditions where the drainage is situated. It is not unusual for a multi-sport field to have a crown in the middle. This is not necessarily the preferred design for an artificial turf field where a fall to a low corner or side is normal. These factors influence the design of the drainage and its subsequent layout. Lateral drainage is normally installed at 26 ft to 40 ft centers, all connected to a land drain, which circumnavigates the perimeter. The drainage will connect to an outfall, which takes the runoff away from the site.



Note - whilst the design detailed in this drawing is typical, alternative designs may be used.

5.3 Performance of Drainage

Artificial turf fields need to discharge run-off quickly due to the requirements for play in all conditions. The design makes an allowance for rainfall events which occur infrequently but which would be classified as a storm under normal circumstances. Rainfall which results in heavy run-off is measured in inches/hour and it is important to understand this terminology. A normal convention applied to artificial turf field is a rate of discharge greater than 7 inches. This value is considered very low and designs should consider a rate of 30 inches/hr as the minimum requirements.

5.4 Attenuation of Run-Off

In new field construction it is normal to make allowance for the attenuation of run-off. This is due to Local Authority (LA) planning restrictions, which can be placed, on developers when connecting to outfalls, which are typically operated by Water Companies.

This involves either using the field base to temporarily store run-off during storms or building capacity within or near to the field. There are many methods of attenuation and an expert in drainage design should be sought to design attenuation capacity into the field should it be required.

6. SUB-BASE STONE

6.1 Materials

There are a number of ways an artificial turf field base can be constructed. This guidance document highlights the most common method currently used. The main criterion, which is applied to all base construction, is provision of a stable platform, which allows through drainage to an appropriate drainage scheme. The base should be stable, durable and flat.

Typically, crushed quarried stone of a particular grading is used to form the base of the field. This material is called 'sub-base' and is regulated by the Specification for Highway Works. The sub-base is normally a good quality, crushed stone aggregate, which is laid approximately 6 inches thick when compacted in place. The sub-base is a pre-cursor achieving the exacting tolerances imposed by the One Turf Concept requirements and will typically be laid so that no irregularity (bump, dip) greater than 1/3" is found under a 10 foot calibrated straight edge rolling bar.

The sub-base is normally laid to design levels and would be found to be within +/- 1/5" of the datum set when measured against said requirements for the construction of the field. Deviations from these requirements will result in unacceptable irregularities in the playing surfaces.

Table 3 – Typical Type 3 Materials for Sub-Base - Particle Size Distribution

Atl Sieve Size	BS Sieve Size	Percentage by Mass Passing
2.5 in	63mm	100
1.25 in	31.5mm	75-99
5/8 in	16mm	43 - 70
5/16 in	8mm	25 - 50
No. 5	4mm	12-40
No. 10	2mm	6-25
No. 18	1mm	3-15
No. 230	63µm	>3

This particle size distribution shall be determined the by washing and sieving methods given in EN 933 – 1:1997.

6.2 Quality & Consistency of Sub-Base

The sub-base will need to be consistent across the supply chain to ensure that the base performs across what is a large surface area. There are a number of checks, which can be carried out to ensure the quality and consistency of the materials supplied (see Appendix 1). A North American ISO 17205 Accredited laboratory for testing sports surfaces should be appointed to monitor the quality of materials and workmanship achieved. Testing should also be carried out on as-laid materials for surface modulus achieved within this important layer.

6.3 Levelling Layer

Sub-base can present an irregular surface profile onto which to lay the asphalt layer. In these circumstances it is normal to deploy a levelling layer to provide an even platform for the asphalt to be laid onto. The levelling layer can have the dual effect of stabilizing the crushed stone, dependent on the grading of the sub-base stone used, as well as providing a flat surface. A typical proven grading for the levelling layer is provided in Table 4. Other gradings have been employed successfully. Also, other methodologies have been employed to level the base prior to laying asphalt layers.

Table 4 – Typical Levelling Layer Materials - Particle Size Distribution

Atl Sieve Size	BS Sieve Size	Percentage by Mass Passing
3/8 in	10mm	100
5/16 in	8mm	75-99
1/4 in	6.3mm	43 - 70
No. 5	4mm	25 - 50
No. 10	2mm	12-40
No. 35	0.500mm	6-25
No. 120	0.125mm	3-15
No. 230	0.063mm	>3

This particle size distribution shall be determined by washing and sieving using the methods given in EN 933 – 1:1997

7. CURBS

In smaller fields where there is not a continuous perimeter wall or edge detail it may be necessary to use pre-cast concrete curb to form a fixed edge of which to abut the macadam surface and the sub-base. Pre-cast concrete curb are normally 6 inches x 2 inches nominal size or nearest equivalent.

All curb should be installed to make due allowance for the subsequent fitting of the artificial turf system to be used. Subsequently, the artificial turf surface shall finish slightly proud of the so curb there is no tripping hazard or depression between the artificial turf and curb. This will, in general, be selected by the contractor as appropriate and is dependent on carpet and infill combinations. There shall be no sharp curb edge presented to the user following installation of the carpet system. All curb shall be located on the inside aspect of the field surrounds.

8. ASPHALT MATERIALS

New asphalt may be required as part of the field construction. Asphalt is used to increase the strength of the base and is recommended, if budgets allow. Asphalt increases the stiffness of the base and increases the bearing capacity in overall terms. Asphalt should be a homogenous platform with no noticeable irregularities greater than 1/3" under a 10 foot straight edge. It should have minimal corrective patching in it and be free from fretting, cracking, surface blemishes, areas of segregation, excessive joints, dips, bumps and rich or lean areas of binder. It should consist of a single layer system comprising of a 1/2" nominal size open graded surfacing layer overlying the sub-base stone layer.

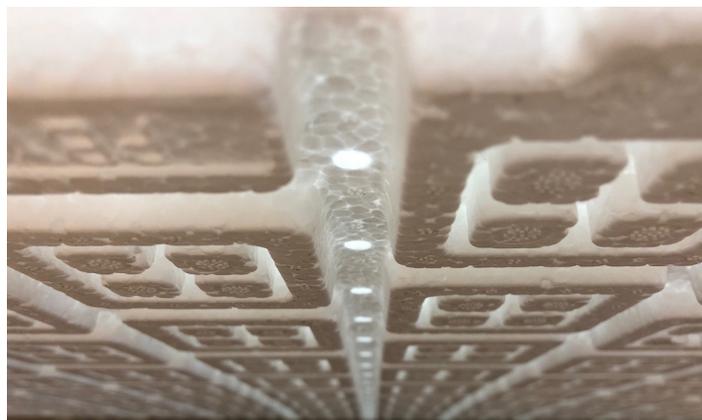
9. SHOCK PADS

9.1 Shock Pad Recommendations

Shock pads are proven to improve safety, performance and lifespan of the field surface. All shock pads being considered for a project must be assessed as part of the artificial turf/pad systems and tested together against the One Turf Concept requirements.

All shock pad systems will be supported by a comprehensive datasheet and a method statement for installation. Shock pads can be problematic to install but form a very important part of the performance of the playing surface so should be subject to scrutiny in detail prior to use in a project.

Shock pads systems in general should be very flat and shock absorptive. They do not vary at any point in the laid pad or deviate from the nominated value (i.e. 1/2" mm/3/4" etc) by more than +1/16" or -1/16". Deviations out with these tolerances may lead to variations in performance. Pads supplied with interlocking tiles or in sheet/roll form shall have joints, which abut each other, do not buckle, warp or ride up on each other. Where the manufacturer recommends taping and gluing the joints this must be done.



10. ARTIFICIAL PLAYING SURFACE

10.1 Surfacing Requirements

The synthetic carpet will meet the requirements of the One Turf Concept.

The artificial turf system shall have independent Laboratory certification demonstrating that this is the case. All certificates should be to the current standard and in any case shall not be more than five years old.

The artificial turf can have any combination of yarn types, thatch, infills however all must meet the requirements set out by the One Turf Concept. A recommended minimum carpet specification is given below in Table 5. It is always best to have the manufacture inform of the infill ratios, or turf characteristics as long as they comply with One Turf Concept.

10.2 Color

The color in general should be green and match the reference sample to be submitted within one position of the green color to BS 5252/4800.

10.3 Wear Tests

It is recommended that turf systems are subjected to Lisport XL wearing. Where the turf system is subjected to at least 6,000 cycles and still demonstrate compliance with the One Turf Concept requirements be procured. As an alternative 20,200 cycles of accelerated wear in the Lisport Classic Test can be used.

10.4 Surface Construction

The artificial turf systems available can be tufted construction, latex/PU backed, fibrillated/monofilament yarn. There is however woven artificial turf systems to which this table does not apply. Where woven artificial turf systems are used then an alternate minimum specification may apply.



10.5 Performance Requirements

Table 6 details the specific performance requirements to be met.

10.6 Line Markings

Line markings should be installed for the primary sport then the other sports markings can be installed around the primary sport. If line markings are to be cut, taped, or glued into the carpet, the carpet specification for line markings materials must be of the exact same carpet as the parent turf system and shall be in accordance with the main carpet specification. If a logo is to be installed the yarn should be the same as the parent turf system.

10.6.1 Method of installation

All line markings which are cut into the turf should be installed and bonded to the panels of carpet using broad woven backing tape, 15 inches wide with a 0.25 inch application of glue spread using a box screed onto the backing tape in even, regular, wide strips. Stitching of seams are acceptable where the carpet system allows. The gluing is viewed as a very important part of the works and, as such, the expectation is that the installer shall exercise a high level of quality control on this element. Samples should be taken from all days of making seams.

The Contractor should ensure that line markings are accurately set out and installed. The line markings must be true and straight and must not deviate by more than 0.1% from straight over the length of the line. Further lines should be set so that their width does not deviate by more than +/- 1/5". The top surface of all line markings shall be within a tolerance of +/- 1/16" of the adjacent carpet surface when measured under a 12" straight edge, regardless of type, and shall be consistently laid so there are no bumpy, irregular seams presented after installation.

Nibs for goals shall be small white squares 4" x 4" and should be securely fixed to the backing tape and set out so as to be flush with the surrounding turf. Penalty spots should be in accordance with the rules of soccer and shall be round. All cut in lines should be fitted prior to adding fill materials.

Table 6 – Performance requirements for the field

Standard Requirements		One Turf Concept Limits	
Ball Surface Interaction	Ball Rebound (m)	0.6 - 1.0	
	Ball Roll (m)	Soccer ball	4m - 10m
Field Hockey ball		Minimum 5m	
Player Surface Interaction	Shock Absorption (%)	55 - 70	
	Standard Vertical Deformation (mm)	5.5 - 11.0	
	Energy Restitution (%)	20 - 50	
	Rotational Resistance (Nm)	30 - 45	
	Head Injury Criteria (m)	Initial \geq 1.3	
	Planarity (mm or inches)	No Deviations \geq 10 mm over 3m straight edge or 3/8" over 10ft straight edge	

Overview of test conditions and summary of requirements

Parameter	Dry	Wet	Temperature Extremes 23 F and 104 F	After Lisport testing	Hot Water Immersion	UV Exposure	Laboratory Requirement		
							Min	Max	Units
Shock Absorption	x	x	x	x			67	68	%
Vertical Deformation	x	x	x	x			6	10	mm/hr
Rotational Resistance	x	x		x			32	43	Nm
Impact Attenuation (HIC)	x	x	x	x			1.3	-	m
Ball Roll (Soccer Ball)	x	x		x			-	12	m
Ball Roll (Field Hockey Ball)	x	x		x			5	-	m
Vertical Ball Rebound	x	x		x			0.6	1	m
Angled Ball Rebound	x	x		x			45	70	%
Skin/Surface Friction	x						0.3	0.75	
Skin Abrasion	x						-30	30	%
Tensile Strength - Yarn	x					x	30	-	Nm
Tensile Strength - Joints	x				x		2,500	-	N/100mm
Tensile Strength - Carpet	x						25	-	N/100mm
Tensile Strength - Shock Pad	x						≥ 0.15Mpa	-	Mpa
Color Change - Yarn	x					x	3	-	Grey Scale
Color Change - Infill	x					x	3	-	Grey Scale
Water Permeability		x					> 500	-	mm/hr

These have been taken from the One Turf Concept document.

Please refer to the latest version to make sure the correct requirements are being applied.

10.6.2 Governing Body Requirements

It is important to understand that both FIFA, FIH and World Rugby have certification systems in place. If a field complies with OTC this does not mean it complies with their standards. If a sports specific field is required, please review their requirements at

FIFA - <https://football-technology.fifa.com/en/standards/football-turf/>

Rugby - <https://www.worldrugby.org/handbook/regulations/reg-22/>

FIH - <http://www.fih.ch/inside-fih/fih-quality-programme-for-hockey-turf/>

10.7 Infill Comprising of Sand

Typically, sand infill shall consist of non-abrasive, non-staining, well-rounded and dust-free particles (sub-angular sands do not perform well in artificial sports surfaces and it would be advisable to reject these). Chemical treatments to either bleach or to coat the sand should be avoided. The preferred size range is 0.1/12mm to 1/25".0mm. Alternative gradings may be tested within the carpet system and therefore will be offered in the One Turf Concept Lab test report. It is therefore advisable to have the sand approved before placing an order.

10.8 Performance Infill Comprising of Rubber or Other Materials

Rubber infill shall comprise of granulated SBR rubber, or synthetic rubber such as TPU, or a non-synthetic cork or other fibrous material. The performance infill shall match the type, gradation and quality of the declared infill of that provided in the Laboratory test report for the artificial turf system tested using it.

10.9 Infill and Top Dressing

Due to the settlement of infill in the initial commissioning period for the field, it is good practice to build in additional maintenance measures to protect the field in its early life. This depends on many factors such as turf system, use, weather conditions, method of infilling and maintenance. It is common in the first 3 to 6 months of use for the Contractor to top-dress the field. This operation is designed to a) ensure that the field performs as intended very early in the life of the facility, and b) to ensure that, when tested, the field meets the One Turf Concept requirements. This work should be called up in any works specification and/or tender offered in order to avoid any confusion as to who is responsible for the work when required. It is anticipated that a minimum of up to 10 tons of rubber will be set aside for this operation to top up the field in the first year.





10.10 Flammability Requirement

There is also a need for the Contractor to provide assurances in terms of flammability via certification in accordance with BS 5867-1:2004.

10.11 Sockets

Sockets are required for goals and flags. Sockets can be the source of a problem in a artificial turf field when goals are changed to accommodate multi-use, and flags are installed and removed during games of football or rugby. Sockets are effectively foundations and as such need to be properly designed to reflect the site's prevailing soil conditions.

Sockets should be properly formed with structural concrete, have a metal tube suitably sized to accommodate the post or flag and be fitted flush with the base so a suitably designed bung can be used to seal off the socket when not in use. When not in use sockets must be covered with artificial turf and filled such that the area complies with the One Turf Concept requirements.

10.12 Field Irrigation Sprinkler Systems

The field may be furnished with a suitable means of irrigation via a pop up mounted sprinkler system. It is not mandatory to include an irrigation system with a artificial turf field. If used this should be located off the playing surface, but may be in the run-off. The sprinkler system therefore must be able to throw water to the central part of the field (approximately 1 ½"). Irrigation systems require large water storage tanks and this must be factored into the specification. Water availability, water pressure, location for the tanks and power for the pumps all need to be considered.

10.13 Sprinkler Heads

It should be noted that sprinkler heads must be covered with artificial turf and shock pad where included in the field footprint. There is a requirement for the sprinkler head cover to comply with the One Turf Concept requirements, to the same standard as the rest of the field, and it will be tested as part of assessment of the field if included within the playing lines.

10.14 Under-soil Heating

Under-soil heating is provided by either a piped water system or electrically heated flat cables or heating mats.

10.15 Covers and Blankets

Covers or blankets should be designed to increase ground temperature in excess of 42ft.

Covers should be sufficiently strong without the need for hems and grommets. The cover should not pull apart in the middle and shall provide protection against turf damage. It also should provide for the right amount of ventilation allowing for the proper airflow required.

The covers should be made of a translucent polyethylene or equivalent material with a reinforced elemental coating woven into the plastic. The cover should be both permeable as well as protective. The covers should be UV treated, anti-rot and mildew resistant and not show any significant wear or degradation by sunlight.

An important aspect of the use of the blanket is winter protection and these should perform well against the harsh effects of the winter season.

10.16 Landscaping/Run-offs/ Field Thresholds

It is not recommended that the immediate threshold of the field run-off is natural grass, pebbles, or other mineral dust etc. Where possible the run-off should all be artificial turf to minimize contamination.



11. SUSTAINABILITY IN CONSTRUCTION & END OF LIFE RECYCLING

11.1 Sustainable Procurement

Everyone should promote sustainable procurement policies in public procurement where funding from the public purse is part of the overall funding package for the project. Sports fields can incorporate recycled materials and products and sustainable practices.

11.2 End of Life Recycling

There are a limited but growing number of manufacturers who offer field construction cradle-to-cradle products. These products include shock pad systems and artificial turf systems. It is also possible to recycle old artificial turf systems by removal of the infill. A small number of companies will recover the infill and turf, and recycle it for subsidiary use.

12. EQUIPMENT

Provision of equipment for the facility should be included in the overall bid.

12.1 Goals

12.1.1

Typically goals should be quick release and designed for situations where goals are assembled and disassembled on a regular basis, e.g. to allow quick changeover from football to soccer or vice versa. Normal construction incorporates quick release corner joints to allow the crossbar to detach from the uprights without the need for tools.

12.1.2

Typically, the goals should be manufactured from 4" x 4 1/4" elliptical x 1/14" thick reinforced aluminum, ensuring that the goals are appropriate for professional matches. All exposed surfaces should be powder coated. It is important that the equipment is checked against all relevant Club Licensing requirements.

12.1.3

Typically, goalpost sockets should be mounted in a concrete foundation, designed to take into account the soil conditions encountered on the site. The foundation shall be mounted underneath a shock pad system to protect players from potential injury. A socket shall be fitted with a artificial turf covered bung, which is level with the surrounding surface.

12.1.4

Equipment should be high quality, durable and safe. All equipment supplied must comply with the relevant codes. Goals should be in accordance with EN748 and should be erected by a specialist contractor and checked in accordance with EN356:2007 prior to handover. An experienced installer should check the equipment and a certificate of conformity shall be issued by the Contractor stating that the equipment is installed correctly.

12.1.5

Where the Client seeks equipment from the Contractor details of the guarantees provided shall be supplied with the prices submitted.

13. MAINTENANCE

Maintenance should include in the main, the synthetic surface and infill, and, where a piped drainage system is installed, this also should be checked and cleaned periodically as outlined in the original installation documentation.

The Contractor should be asked to provide details of maintenance equipment and procedures required to properly look after the field and its infrastructure at the point of handover. There should also be training session(s) provided to highlight the precise details for use of equipment, brushes and localized infilling. Also details of the emergency treatments, which can be applied to the field for purposes of snow removal, spillage of oils, fuels etc. should be provided at this point.

The maintenance required will include a routine maintenance service and a specialist de-compaction service (which lifts the contaminated infill from the surface and then removes the ground in-debris from the infill). By following these maintenance procedures, the field will provide:

- Consistent play quality over the life of the surface;
- A consistent surface in terms of traction and drainage;
- Extended life of the synthetic playing surface.

13.1 General Guidance

The manufacturer will provide guidance for the proper maintenance of their specific artificial turf system. This must be followed to protect and maintain the field in the best possible condition. It is important to protect the warranty for the products installed by regularly maintaining the surface in an approved fashion. There are general maintenance principles, which apply in general to all artificial turf fields used for football. These principals are influenced by use, management, equipment used for maintenance and environmental issues.

13.2 Drainage

The drainage system should be inspected and checked for serviceability at least every 5 years, unless a drainage issue has been noted with the field. Checks to be carried out will include:

- Check all manholes to ensure that the run-off is free running;
- Check the outfall to ensure that it is not blocked;
- Check all components for cracking, sinking and other damage.

The Contractor should provide all such equipment and procedures, which will allow effective maintenance of the drainage to be carried out.

13.3 Goals

Goals must be checked regularly. This could be as often as daily, depending on level use.

13.4 Maintenance Equipment

Example of minimum basic maintenance kit



Tractor



Drag Brush



Drag Mat



Ball Roll

There are a limited number of suitable brushes and drag mats for the maintenance of artificial turf fields.

13.5 Environmental issues affecting Maintenance

The general environment around the field can affect the amount and type of maintenance required. The proximity of trees can be a problem due to debris, leaves and seeds falling onto the field. Shade and moisture can encourage moss and algae to form in the margins, while dust and other particulates can contaminate the fill materials.

13.6 Inappropriate Maintenance

Inappropriate procedures will inevitably reduce the life expectancy of the playing surface. For this reason all related maintenance information must be available at the point the field is commissioned, if not before.

13.7 Maintenance Reporting

All field maintenance activity should be recorded via a maintenance log. This must be made available by the Contractor. After every maintenance visit a report will be given to the Client detailing the nature of the maintenance activity carried out, any further work which may be required and the timescales the Contractor may place on it. The drainage report should detail the nature of the inspection carried out and any significant findings.

13.8 Maintenance Procedures

Maintenance procedures for the field will cover the following areas:

- Removal of litter/debris;
- Cleaning and monitoring of access, entrance and exit gates;
- Brushing of the surface as appropriate;
- Rubber dressing and monitoring of infill levels;
- Monitoring of seams and carpet rippling;
- Levelling and equalization of infill;
- Remarking of lines with specialist paint if lines are not inlaid;
- Vegetation control in terms of weed removal, moss and algae growth;
- De-compaction and deep cleaning of synthetic carpet annually.

14. INFLUENCE OF USE

14.1 Hours of Use

Use is considered as the number of hours that the field is available for bookings and the actual number of hours that the field is used. This is a broad assessment of the footfall on a particular surface and does not provide the full picture of potential wear-and-tear a field surface can sustain. Only the actual number of hours a field is used for should be factored into the wear-and-tear assessment.

14.2 Field size

The size of the field may have a bearing on the density of footfall. Not all fields are the same size and some vary significantly from the standard size due to local factors such as available space and multi-use requirements.

14.3 Type of Use

With a multi-sport surface the different type of use will vary.

14.4 Categorizing Use

Where a playing surface is being used for more than 35 hours per week it can be categorized as a moderately used field. However many fields can be used up to 60 hours per week. This type of use is categorized as heavy use. Heavy use affects the durability and performance of the playing surface over the long-term, and maintenance therefore needs to be tailored to match the intensity of use.

15. MANAGEMENT OF THE PLAYING SURFACE

Experience has shown that multi sport surfaces can be used to support small-sided versions of the game and wider developmental activity. This increases the amount of use on specific areas of the field. Goal areas, shooting areas and sides can experience much higher footfall levels than the rest of the field.

15.1 Rotation of high footfall areas

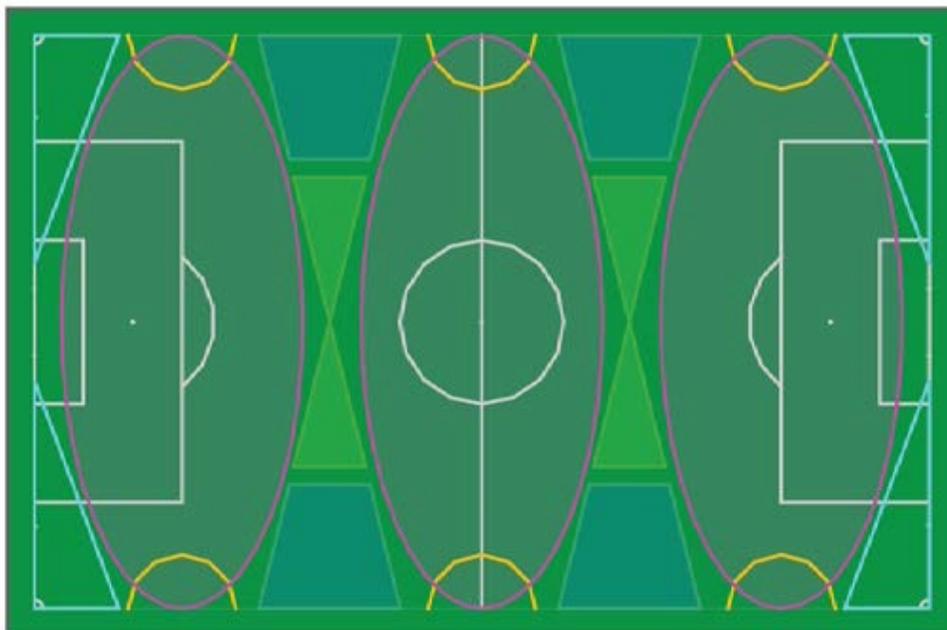
Moving the goal areas can be accommodated on a field when there are no dividing lines installed. This helps by distributing the high footfall areas across a wider area and so avoids specific areas of the field becoming damaged.

15.2 Access and egress

The access point of the field can experience very high levels of use. If possible footwear-cleaning equipment should be positioned at this point. Good practice is to lay down appropriate lengths of artificial turf at the entrance/tunnel to the field to prevent excessive wear.

15.3 Footwear

There are certain types of footwear recommended for use on artificial turf surfaces. Detailed guidance is given in Appendix 5. It is generally agreed that normal molded boots are the best footwear for football use. Blades can be used but some manufacturers ban their use. Where extensively used blades can lead to a general compaction of the pile, affecting performance in the long-term. BS 6366:2011 details approved studs for use in football and rugby, and is the main guidance standard which should be referred to when considering the acceptability of studs.



PRINCIPAL REFERENCES



1. BS 7044-1:1990 Artificial sports surfaces. Classification and general introduction.
2. BS EN 12234:2002 Surfaces for sports areas. Determination of ball roll behavior.
3. BS EN 14808:2005 Surfaces for sports areas. Determination of shock absorption.
4. BS EN 14837:2006 Surfaces for sports areas. Determination of slip resistance.
5. BS EN 14810:2006 Surfaces for sports areas. Determination of spike resistance.
6. BS EN 14836:2005 Synthetic surfaces for outdoor sports areas. Exposure to artificial weathering.
7. BS EN 12228:2002 Surfaces for sports areas. Determination of joint strength of synthetic surfaces.
8. BS EN 12616:2003 Surfaces for sports areas. Determination of water infiltration rate.
9. MCHW Volume 1 – Specification for Highway Works (November 2006), Department of Transport, Highways Agency.
10. BS 1377-2:1990 Methods of test for soils for civil engineering purposes. Classification tests.
11. BS EN ISO 22476-2:2005 Geotechnical investigation and testing. Field testing. Dynamic probing.
12. BS EN ISO 22476-3:2005 Geotechnical investigation and testing. Field testing. Standard penetration test.
13. ISO/DIS 8771 Specification for plastics pipes and fittings for use as subsoil field drains.
14. BS EN 12620:2002 Aggregates for Concrete.
15. BS 5911-4:2002 Concrete pipes and ancillary concrete products. Specification for unreinforced and reinforced concrete inspection chambers.
16. BS EN 1917:2002 Concrete manholes and inspection chambers, unreinforced, steel fiber and reinforced.
17. BS EN 124:1994 Gully tops and manhole tops for vehicular and pedestrian areas.
18. BS EN 1008:2002 Mixing water for concrete. Specification for sampling, testing and assessing the suitability of water, including water removed from processes in the concrete industry as mixing water for concrete.
19. BS 1722:-10: 2006 Fences. Specification for anti-intruder fences in chain link and welded mesh.
20. BS 5252:1976 Framework for color co-ordination for building purposes.
21. BS 4800:1989 Schedule of paint colors for building purposes.
22. BS EN 933-1:1997 Tests for geometrical properties of aggregates. Determination of particle size distribution. Sieving method.
23. BS 4987-1:2005 Coated macadam (asphalt concrete) for roads and other paved areas. Specification for constituent materials and for mixtures.
24. BS EN 1339:2003 Concrete paving flags. Requirements and test methods.
25. BS EN 1340:2003 Concrete kerb units. Requirements and test methods.
26. BS 434: Part 1:1984 Bitumen road emulsions (anionic and cationic). Specification for bitumen road emulsions.
27. BS EN 197-1:2000 Cement. Composition, specifications and conformity criteria for common cements.
28. BS 4027:1996 Specification for sulphate resisting Portland cement.
29. BS 4449:2005 Steel for the reinforcement of concrete. Weldable reinforcing steel. Bar, coil and decoiled product.
30. BS 4482:2005 Steel wire for the reinforcement of concrete products.
31. BS 4483:2005 Steel fabric for the reinforcement of concrete.
32. BS EN 206-1:2000 Concrete. Specification, performance, production and conformity.
33. BS 8500-1:2006 Concrete. Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier.
34. BS 8500-2:2006 Concrete. Complementary British Standard to BS EN 206-1. Specification for constituent materials and concrete.
35. BS 6366:2011 Specification for studs for rugby football boots

APPENDICES



Appendix 1

Recommended Quality Plan for Key Stage Inspection and Testing during Refurbishment or Construction of Artificial Turf Field

The principal of this quality plan is to provide a means of identifying by inspection and testing – or a combination of both – that a high standard is being achieved in terms of materials and workmanship.



1.1 Table of Quality Control Requirements

Item	Type of Testing or Inspection	Reason for Test or Inspection	Outcome	Number of Tests
A)	Tests on formation and sub-base.	To confirm the bearing capacity of the soils and stone base.	Ensuring the formation and sub-base provides a suitable platform for the required application.	20m grid.
B)	Level checks to be done using a 3m straight edge on stone sub-base, checks for surface irregularities to be done.	To test for porosity and regularity.	To ensure that the stone sub-base provides the level of performance required by the specification.	3 tests for porosity.
C)	Inspection of bituminous surface for surface regularity and porosity.	To ensure the surface is fit for purpose.	Ensuring the base provides a suitable platform for the required application.	6 locations for porosity testing and straight-edge survey.
D)	Inspection of shock pad, sampling of materials and laid pad, level checks to be done using a 3m straight edge, check for blemishes to be done.	To test for porosity and regularity and most importantly test for tensile strength and elongation of shock pad as well as thickness.	To ensure that the shock pad provides the level of performance required by the specification.	10 In-situ pad samples for tensile strength and elongation. 50 thickness measurements over the entire surface. Sample of prefabricated pad for inspection only.
E)	Inspection of synthetic turf installation and sampling of seams for testing.	Test seam samples for tensile strength.	To negate seam failure at a later date.	10 seam samples for tensile strength or peel strength.
F)	Initial test on completed field/full compliance testing.	For compliance and to ensure that the field receives a certification.	To ensure that the field complies with OTC .	2 tests: 1 no later than 3 months after hand over & 1 at the end of effects period.

1.2 Quality Control & Sampling

1.2.1 The Contractor should employ all means necessary in order to maintain a clear, explicit, and efficient Quality Control Scheme in tandem with the Employer's Representative.

1.2.2 At the request of the Employer's Representative, the Contractor will be expected to produce information and samples at any time throughout the term of the Works. A delay by the Contractor in the production of such detail may adversely affect the scheduling of the contract programme. The Contractor may not claim for an extension of time because of a delay in the programme because of poor, unsatisfactory or unsuitable Quality Control detail, as dictated by the Employer's Representative.

1.2.3 The Employer should have the right to select any material samples from batches delivered to site and destined for permanent works as required. Samples will be provided at the Contractor's cost. Samples which do not conform to the quality requirements will be resubmitted at the contractor's cost.

Appendix 2

Recommended list of items which should be supplied by a contractor when submitting a Bid:

2.1 Current product certificate for the synthetic turf system to be supplied (alternate certificates may be supplied by agreement with the employer's agent).

2.2 Technical reports for field-testing demonstrating that the synthetic system offered complies with the requirements of OTC or International governing body standards.

2.3 Certificate of conformance for shock pad must be submitted for in-situ shock pads.

2.4 Contractor's warranty.

2.5 Future maintenance requirements for installed field.

2.6 Reference samples of shock pad (A4 size).

Appendix 3

Warranty

3.1 The Contractor shall provide a written warranty in respect of the installation and performance of the various aspects of infrastructure supplied to the Client, in particular the synthetic turf.

3.2 In the case of materials selected by the Principal Contractor and placed in the permanent works he/she shall provide the warranty.

3.3 In the case of the shock pad and synthetic carpet the manufacturer of the shock pad/ synthetic carpet shall provide a warranty. This will be assignable to the Client. The warranty offered by the Contractor shall cover the workmanship, for example, the installation works.

3.4 The warranty will be such that the Contractor will indemnify the Client for all aspects of the works whether subcontracted or not, including but not exclusive to, drainage, base works, shock pad and synthetic systems. In the case of the synthetic turf system the manufacturer will be expected to produce a collateral warranty with regard to the manufacture and performance of the synthetic turf. The warranty for the manufactured product is normally one which provides diminishing cover with time (for example, at Year 1 there would be 100% replacement but at Year 8 there would be 10% replacement). The warranty therefore diminishes with time. Other warranties for base works will be fixed for a set period of time, as will those provided to cover shock pads. The performance of the field can be incorporated into a warranty: here the manufacturer guarantees performance for a period of time – OTC performance for 5 consecutive years – subject to maintenance being carried out in accordance with the manufacturer's recommendations 3.5 It is important to obtain a clear definition of the terms of what the warranty covers when assessing the Contractor's offer. The following details what is typical for artificial turf fields:

- For base works a normal warranty would be for 20 years;
- For shock pad a normal warranty would be for 20 years;
- For synthetic carpet a normal warranty would be for 5 to 8 years.

3.6 Insurance backed warranties or third party warranties, which can be assigned, add extra protection for a Client and should be investigated.

Appendix 4

Suitable Footwear Guidance – Reference should be made to individual manufacturers recommendations

FOOTWEAR GUIDELINES FOR
artificial turf SYNTHETIC SURFACE
To protect & maintain the high-quality playing
surface, approved footwear must be worn
NO BLADES OF ANY TYPES ARE ALLOWED

Under no circumstances should any type of blanes, trainers, or spiked running shoes be worn on the pitch. Only approved footwear may be carried onto pitch. Any player with incorrect footwear will not be allowed t participate. Failure to comply may lead to loss of future book-ings.

In this statement we are not endorsing any of the brands or footwear shown but are merely using them as an example of the types of footwear allowed on our 3G synthetic pitches. The amount of sports footwear available is enormous and we cannot include all, therefore these are only guidelines, and are subject to change if the manufacturer of our pitches change their policy.

We reserve the right to amend their footwear policy at any time, and although will endeavour to give notice of any change we cannot guarantee it.

- Use appropriate, recommended footwear only
- Footwear should be clean and in good condition
- No smoking/naked flames
- No chewing gum

- No food
- No drinks (other than water)
- No animals allowed
- No vehicles (other than approved equipment)

A SELECTION OF SUITABLE FOOTWEAR

Only approved footwear can be taken onto the pitch



A SELECTION OF NON-SUITABLE FOOTWEAR

Please note it is your responsibility to ensure your footwear meets our footwear policy



Appendix 5

Typical Maintenance Log, which would be completed routinely by a maintenance contractor or a member of the ground staff.

Week No.	
Week Commencing: Monday	

MAINTENANCE LOG

MAINTENANCE								
Activity								
Equalizing with drag net								
Removal of debris-garbage								
Brushing (enter a number including 0)								
Decompaction - aering								
Topdressing rubber (penalty point/corner)								
Weed killing/Moss killing								
Ball Roll Test								
Checking of bonding joints/ penalty point/repairs								
Checking drains								
Other activities								
Remarks								
Name/Signature								
(Groundsman)								
DAILY PLAYING HOURS		Monday	Tuesday	Wednes- day	Thursday	Friday	Saturday	Sunday

Weekly Total Playing Hours	
Times Brushed	

ONE TURF CONCEPT

Laboratory Performance Report

System Type

Project Information

Project Name	XYZ System		
Client Information	SampleTurf INC 500 Education Street Collegeville, PA		
Date	June 19, 2018	Sample Arrival	5/8/2018
Report Status	Final		
Job No.	90000/3000		
Prepared by	John Smith Field Operation Manager		
Checked by	Bob Smith Laboratory Director		

Notes:

1. This report has been prepared by Sports Labs USA with all reasonable skill, care and diligence within the terms of the contract with the Client and within the limitations of the resources devoted to it.
2. This report is confidential to the Client and Sports Labs USA accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.
3. This report shall not be used for engineering or contractual purposes unless signed by the Author and the Checker and unless the report status is "Final."
4. *Not all tests carried out are within our scope of ISO 17025 Accreditation
5. This report is not an official World Rugby Laboratory test report and does not imply World Rugby approval.

Summary

System ID	System Description
XYZ System	5 lbs per sq. ft. Sand, 2.3 lbs per sq. ft. SBR, (only 65% Sand, 35% Rubber given), 2.0" Dual Fiber Turf (Carpet type 3G given, added infill depth and free pile for height, guessed at dual fiber), over shockpad

General Information			
Devices:	Artificial Athlete ASTM F1936 Apparatus TRIAx 2010 Data Acquisition	Test Methods:	STC Advanced Artificial Athlete Protocol, EN 1177, EN15301-1 Studded, EN 12335, FIFA Test Method, EN 12616, EN14836, EN 13744 & EN 12228, ISO 13934-1, EN 12230
Job No:	90000	Day Book:	3000
Contract:	<i>Sample College</i>	Client:	<i>SampleTurf INC</i>
Test Date:	1/2/1234	Product Name	<i>Sample College Football</i>
Number of Conditioning Rolls:	50	Carpet Name:	3G
Substrate:	Concrete	Infill:	
		Stabalizing Performance	Sand 30 SBR 70
Exposed Pile (mm):	51	Shockpad:	Yes
Temperature Range:	69 -73	Humidity Range:	45% - 50%

- Advanced Artificial Athlete Tests (Force Reduction, Vertical Deformation, & Energy Restitution) – ASTM F3189 - 17
 - HIC Impact Attenuation (Hemispherical Drop Missile) – EN 1177
 - Rotational Resistance – EN15301-1 Studded
 - Vertical Ball Rebound – EN 12335
 - *Angle Ball Rebound- FIFA Test Method 02
 - *Linear Stud Friction/Deceleration- FIFA Test Method 07
 - *Skin Abrasion- FIFA Test Method 08
 - *Skin Friction- FIFA Test Method 08
 - Porosity- EN 12616: 2002
 - *Product Identification- FIFA Test Method 06
 - *Effects of Artificial Weathering- EN14836
 - * Seam Strength- EN 13744 & EN 12228
 - *Product Stability- ISO 13934-1
 - Tensile Strength of Shockpad- EN 12230

**Not all tests carried out are within our scope of ISO 17025 Accreditation*

Table Contents

Project Information	0
Summary	1
System Description.....	1
General Information.....	2
Test Results	3
Effects of Artificial Weathering	4
Miscellaneous	4
Product Identification	5
Infill Identification - Rubber	8
Infill Identification - Sand	9
TGA- Rubber.....	10
Pictures.....	11
End of Report	11

Test Results

Property	Test Condition	Mean Result
Vertical Ball Rebound	Dry	83 cm
	Wet	74 cm
	After simulated wear 20,200	93 cm
Angled Ball	Dry	62%
	Wet	65%
Head Injury Criteria (HIC)	Dry	1.4 m
	Wet	1.4 m
	After simulated wear 20,200	1.3 m
	-5°C	1.4 m
	50°C	1.4m
Shock Absorption (AAA)	Dry	68%
	Wet	70%
	After simulated wear 20,200	63%
	-5°C	61%
	40°C	69%
Vertical Deformation (AAA)	Dry	67%
	Wet	67%
	After simulated wear 20,200	8.9 mm
	-5°C	8.5 mm
	40°C	11.0 mm
Energy Restitution (AAA)	Dry	10.5 mm
	Wet	10.7 mm
	After simulated wear 20,200	38.3%
	-5°C	29.7%
	40°C	38.8%
Rotational Resistance	Dry	38.3 Nm
	Wet	33.4 Nm
	After simulated wear 20,200	44.0 Nm

Property	Test Condition	Mean Result
Skin / Surface Friction	Dry	0.6μ
Skin Abrasion	Dry	20%

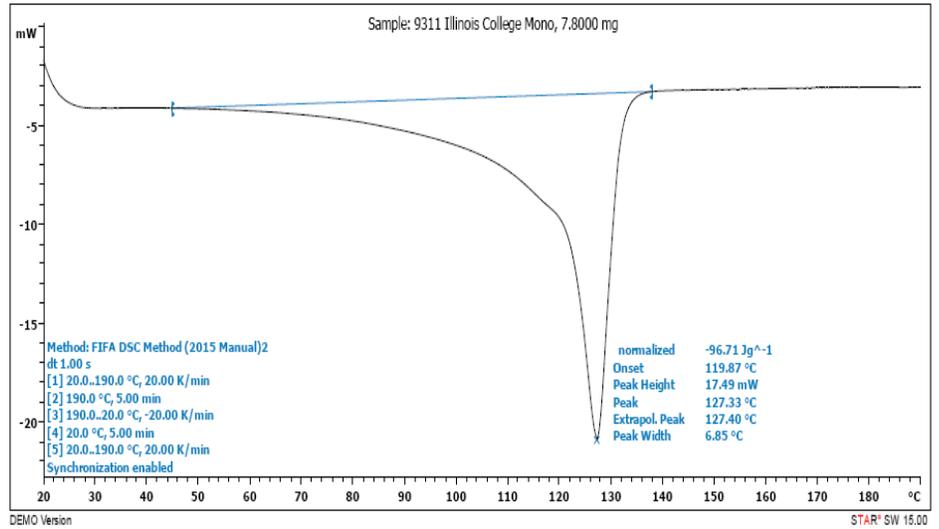
Effects of Artificial Weathering		
Property	Aspect	Result
Pile Yarn (s)	Color Change after UVA	3-4
	Yarn Change in Tensile Strength	0%
Performance Infill	Color Change	4-5
	Visual Change in Composition	No Change

Miscellaneous				
Property		Condition	Result	
Joint Strength	Stitched Joints (Method 1)	Unaged	3200 N	
		Water Aged	2900 N	
	Bonded Joints (Method 1)	Unaged	n/a	
		Water Aged	n/a	
	Bonded Joints Peel (Method 2)	Water Aged	n/a	
Water Permeability		n/a	1442 mm/hr	
Carpet Tuft Withdrawal		Unaged	79 N	
		Water Aged	n/a	
Carpet Strength	Direct Tension	Unaged	Warp	Weft
			19 N/100m	16 N/100m

Product Identification			
Artificial turf and pile yarn (s)	Mass per unit area	2387 g/m ²	
	Tufts per unit area	6715 /m ²	
	Pile length above backing	51 mm	
	Pile weight	1393 g/m ²	
	Water permeability of carpet	>2000	
	Pile yarn characterization	PE	
Total Infill	Infill Depth	36 mm	
	Free Pile Height	5/8"	
Performance Infill	Particle size range	0.8-2	
	Particle shape	2A	
	Bulk density	0.461	
	Polymer type	SBR	
	Thermo-gravimetric analysis	% organic	65 % (61 % Elast)
		% inorganic	35 %
	Infill Amount	35% by weight	
Stabilizing infill	Particle size range	0.315-1.6	
	Particle shape	2B	
	Bulk density	1.493	
	Infill amount	65% by weight	
Shockpad or e-layer (if supplied as part of system)	Shock Absorption	52%	
	Thickness	13.54 mm	
	Deformation	7.1 mm	
	Tensile Strength	50 N	

Product Identification - Mono

DSC



PE (127 °C)

Yarn thickness

0.220 mm

Yarn Width

1.1 mm

Color (RAL 6 Digit)

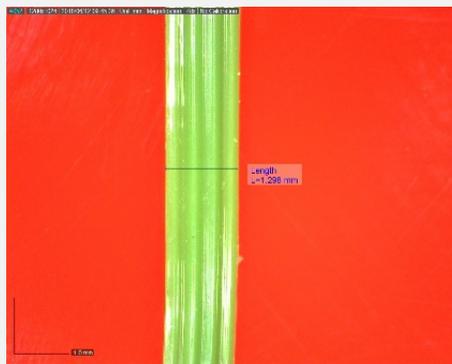
6025

dTex

12213

Yarn Picture

Side View

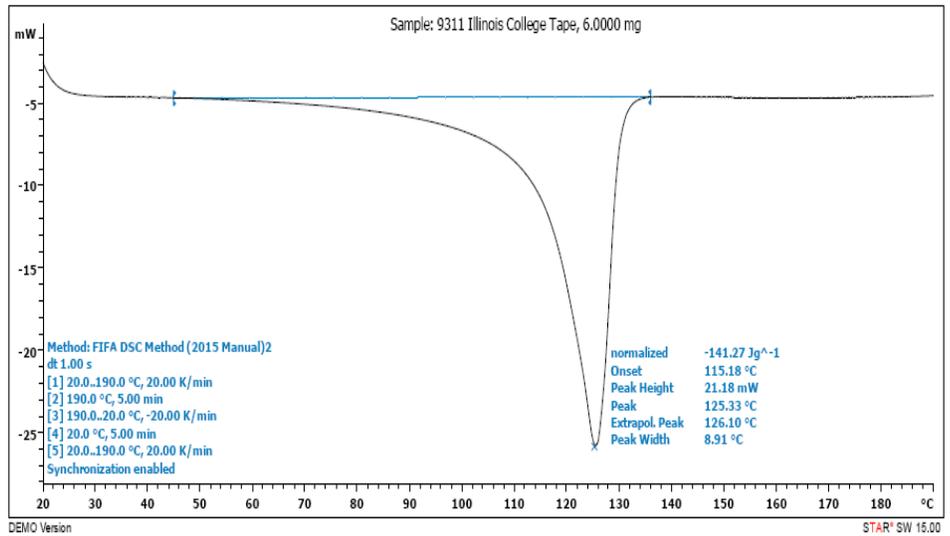


Plan View (Profile)



Product Identification - Tape

DSC



PE (125 °C)

Yarn thickness

0.189 mm

Yarn Width

6.1 mm

Color (RAL 6 Digit)

6025

dTex

5812

Yarn Picture

Side View



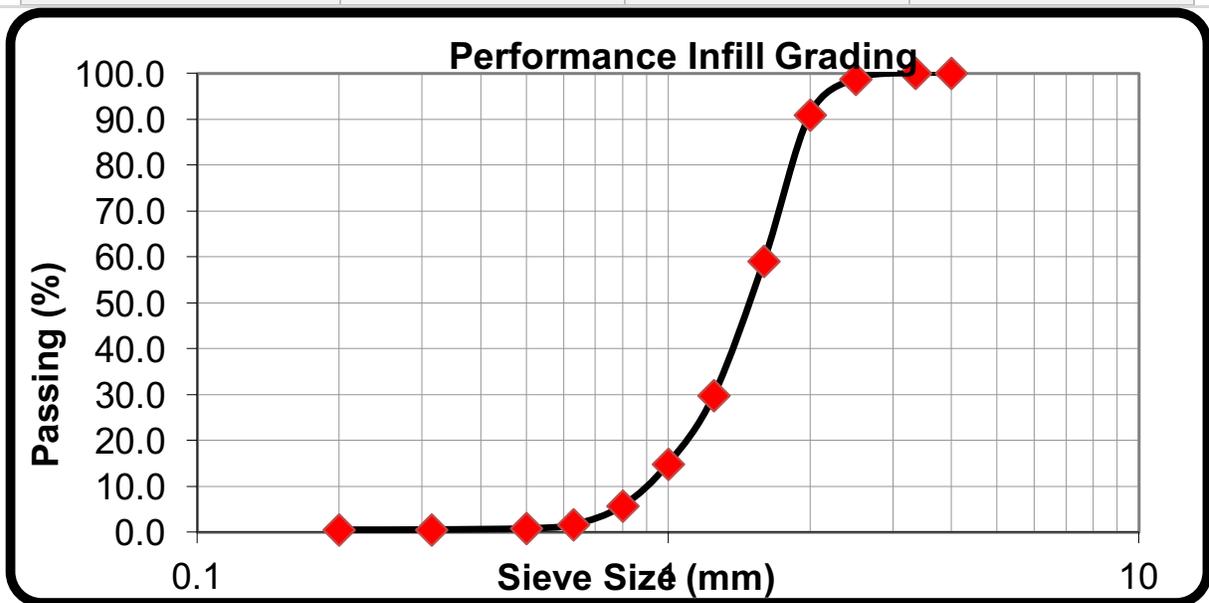
Plan View (Profile)



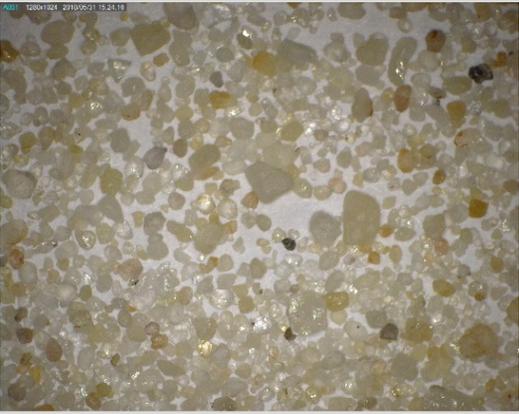
Infill Identification - Rubber

	Characteristic	Results	
Performance Infill (SBR)	Particle Size (mm)	0.8-2	
	Particle Shape	2A	
	Bulk Density (g/cm ³)	0.461	
	Color	Black	

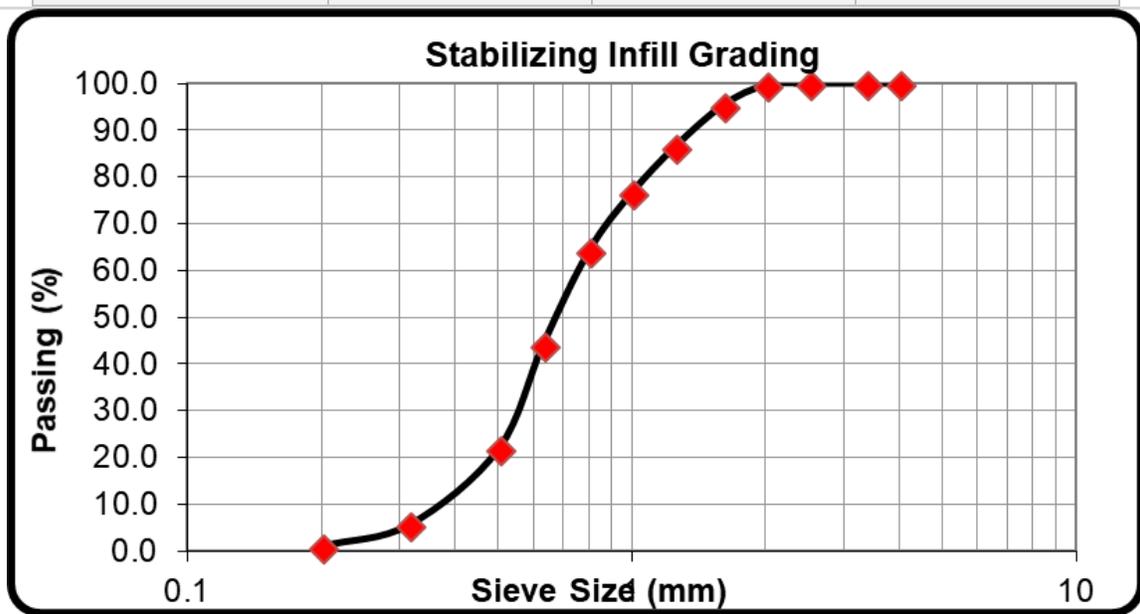
SEIVE SIZE (mm)	Weight (g)	Retained (%)	Passing (%)
4	0.0	0.0	100.0
3.35	0.0	0.0	100.0
2.5	3.0	1.3	98.7
2	18.8	7.9	90.9
1.6	75.8	31.8	59.1
1.25	70.0	29.4	29.7
1	35.5	14.9	14.8
0.8	21.8	9.1	5.7
0.63	9.7	4.1	1.6
0.5	2.0	0.8	0.8
0.315	0.6	0.3	0.5
0.2	0.1	0.0	0.5
Passing to base tray	0.0	0.0	0.5
Check	237.3		



Infill Identification - Sand

	Characteristic	Results	
Stabilizing Infill (Sand)	Particle Size (mm)	0.315-1.0	
	Particle Shape	2B	
	Bulk Density (g/cm ³)	1.493	
	Color	Beige	

SEIVE SIZE (mm)	Weight (g)	Retained (%)	Passing (%)
4	0.0	0.0	100.0
3.35	0.0	0.0	100.0
2.5	0.0	0.0	100.0
2	1.2	0.4	99.6
1.6	13.7	4.3	95.3
1.25	27.9	8.8	86.5
1	31.0	9.8	76.7
0.8	39.4	12.4	64.3
0.63	63.6	20.1	44.2
0.5	70.9	22.4	21.8
0.315	51.3	16.2	5.6
0.2	14.5	4.6	1.1
Passing to base tray	2.8	0.9	0.2
Check	316.3		

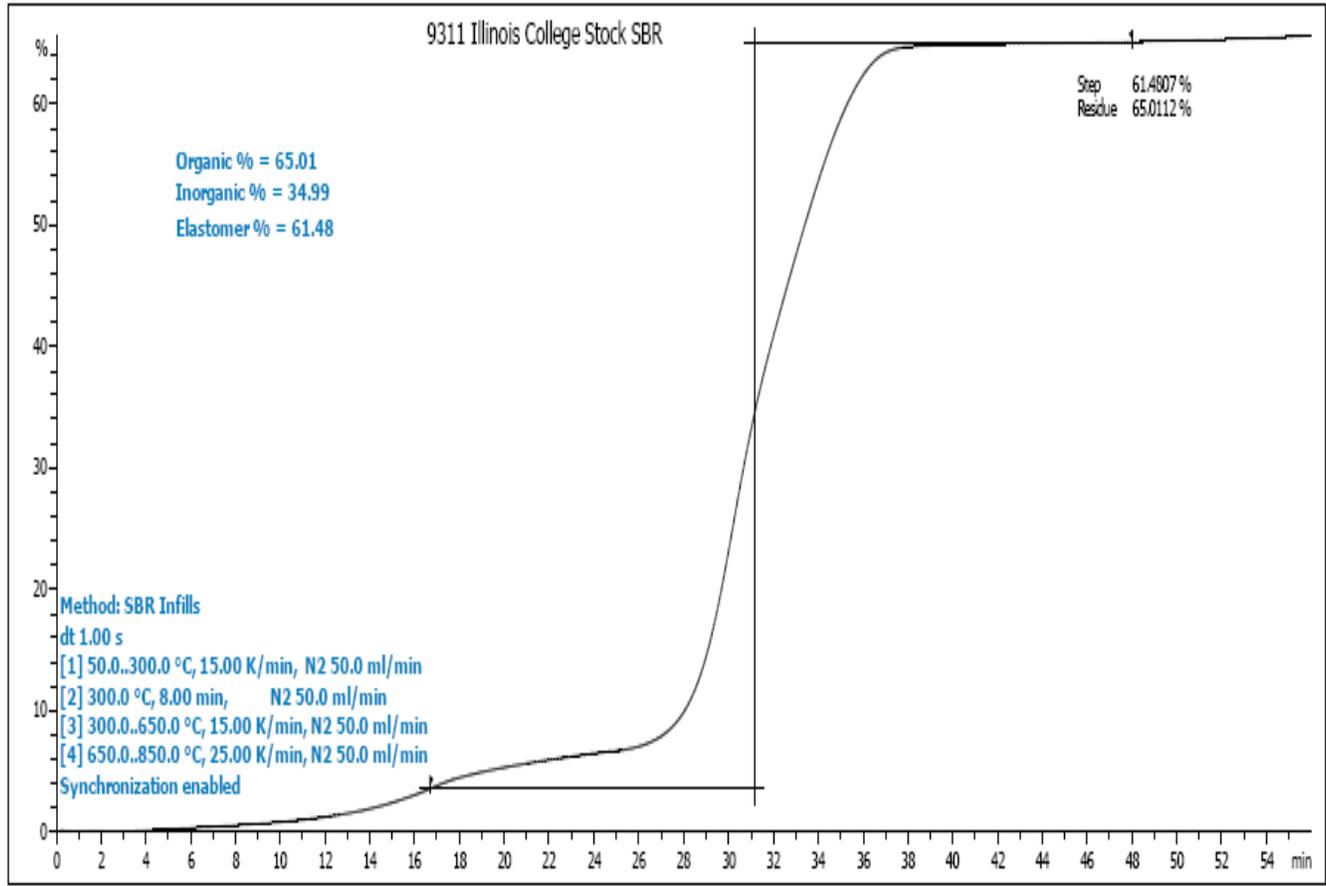


TGA- Rubber

Sp[orts Labs Ltd

22/05/2018

Technician: GW



Pictures

PRE WEAR



SIMULATED USE 20200 CYCLES



End of Report

Sample Field Test Report

FIELD PERFORMANCE REPORT

Field Reference: Sample College Football

Field Address: 500 Education Street
Collegeville, PA

Report Number: 90000/3000s

Report Status: <DRAFT/FINAL>

Issue Date: 6/19/18

Client: SampleTurf INC
55 Elm Street
Springfield, PA

FOREWORD

1. This report has been prepared by Sports Labs limited with all reasonable skill, care and diligence within the terms of the contract with the Client and within the limitations of the resources devoted to it.
2. This report is confidential to the Client and Sports Labs Limited accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.
3. This report shall not be used for engineering or contractual purposes unless signed by the Author and the Checker and unless the report status is "Final."
- 4.*Not all tests carried out are within our scope of ISO 17025 Accreditation.
5. Comments and opinions are outwith the scope of our ISO 17025 accreditation

1.0 INTRODUCTION

- 1.1 Sports Labs were requested by SampleTurf INC to carry out performance testing on the synthetic pitch at Sample College Football Field.
- 1.2 Testing was carried out on 6/12/2018 in sunny and dry conditions.
- 1.3 The pitch is constructed on Dynamic base underlying a insitu/prefabricated shockpad. The synthetic layers comprise of: Long pile, polyethylene fibre carpet, infilled with rubber and sand.
- 1.4 This report refers to the Initial testing of the site.

Substrate Type:	Dynamic		Infill Type:	SBR Rubber & Sand
Carpet Name:	3g		Shockpad:	Yes
Air Temperature during testing (°C):	AM	PM	Weather Conditions:	Sunny & Dry
	18	n/a		
Surface Temperature during testing (°C):	AM	PM	Wind Speed during testing (m/s):	0.0
	23	n/a		
Humidity (%):	AM	PM	Operator:	MR
	55	n/a		

PREPARED BY John Smith
Field Operations Manager



CHECKED BY Bob Smith
Laboratory Manager



2.0 TEST PROGRAMME

2.1 Testing was carried out at 19 and 9 locations across the pitch, as shown in Appendix A.

2.2.1 Vertical Ball Rebound –BS EN 12235:2013

2.2.2 Shock Absorption – AAA Version (Appendix 2) WR Reg.22 (April 2015)

2.2.3 Vertical Deformation – AAA Version (Appendix 2) WR Reg.22 (April 2015)

2.2.4 Energy Restitution – AAA Version (Appendix 2) WR Reg.22 (April 2015)

2.2.5 Rotational Resistance – EN 15301-1:2007

2.2.6 HIC – EN 1177: 2008

2.2.7 * Surface Regularity and Dimensions – EN 13036:2003

2.2.8 * Ball Roll -

*Not all tests carried out are within our scope of ISO 17025 Accreditation.

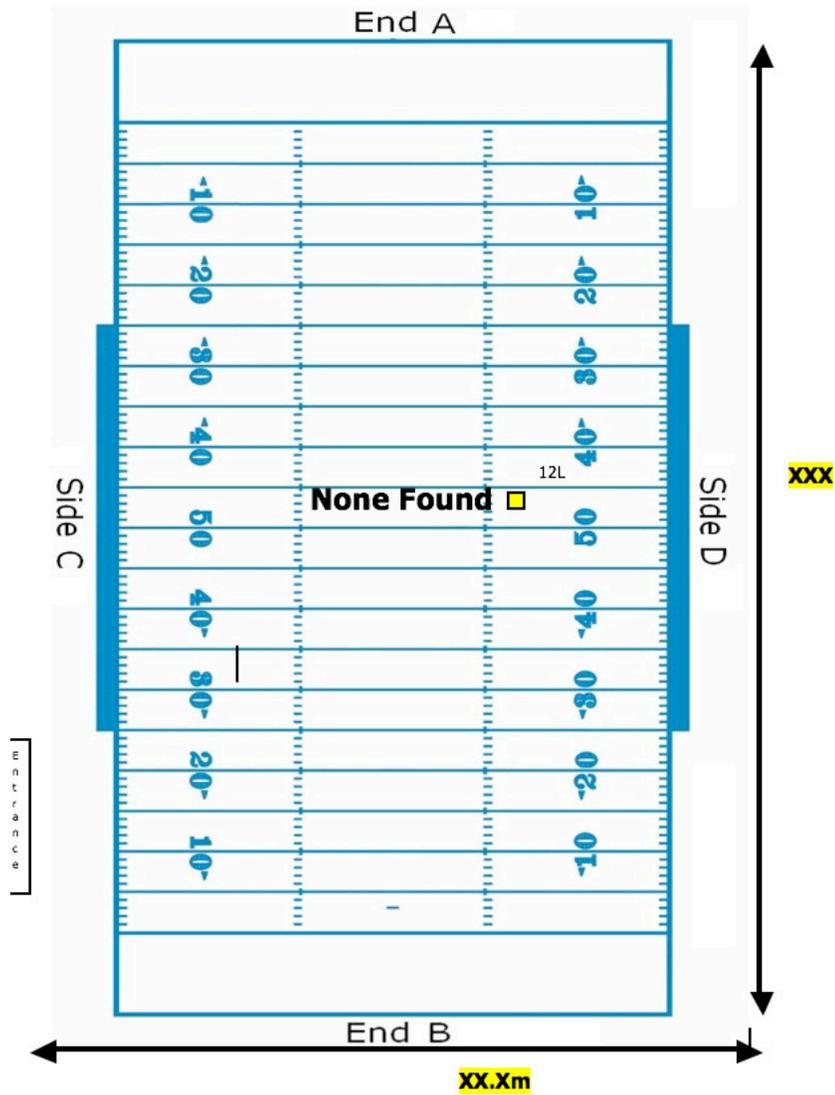
3.0 TEST RESULTS

AAA Property	Specified range	Test Position																		
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Shock Absorption	55 - 70%	63	61	61	65	66	68	65	65	63	61	62	64	62	65	66	67	64	63	65
Vertical Deformation	5.5 – 11mm	7.2	6.8	7.4	5.9	6.1	8	7.5	7.4	7.1	6.0	7.0	7.3	7.1	7.6	7.5	7.0	6.5	5.8	6.6

Property	Specified range	Test Position								
		1	2	3	4	5	6	7	8	9
Vertical Ball Rebound	0.60 – 1.00m	0.80	0.85	0.88	0.79	0.82	0.86	0.85	0.84	0.87
HIC	≥ 1.3m.	2.00	2.50	1.8	2.33	2.47	1.93	1.89	2.52	2.17
Rotational Resistance	30 – 45Nm	32	33	30	34	40	36	38	34	35
Soccer Ball Roll	4-10m	7	6	6	8	5	8	7	6	7
Field Hockey Ball Roll	>5m	12	14	11	10	13	13	12	11	12

3.1 SURFACE REGULARITY AND DIMENSIONS

Plan showing surface irregularities exceeding maximum requirement of 10mm under a 3m straight edge.

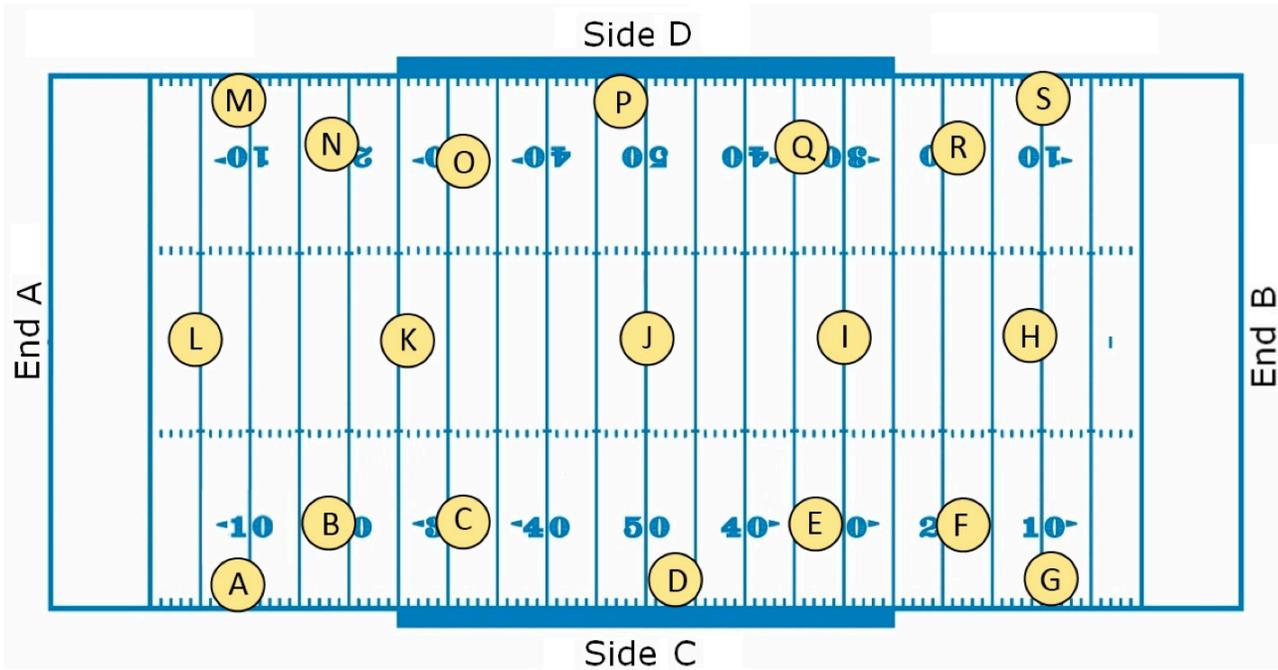


APPENDIX A

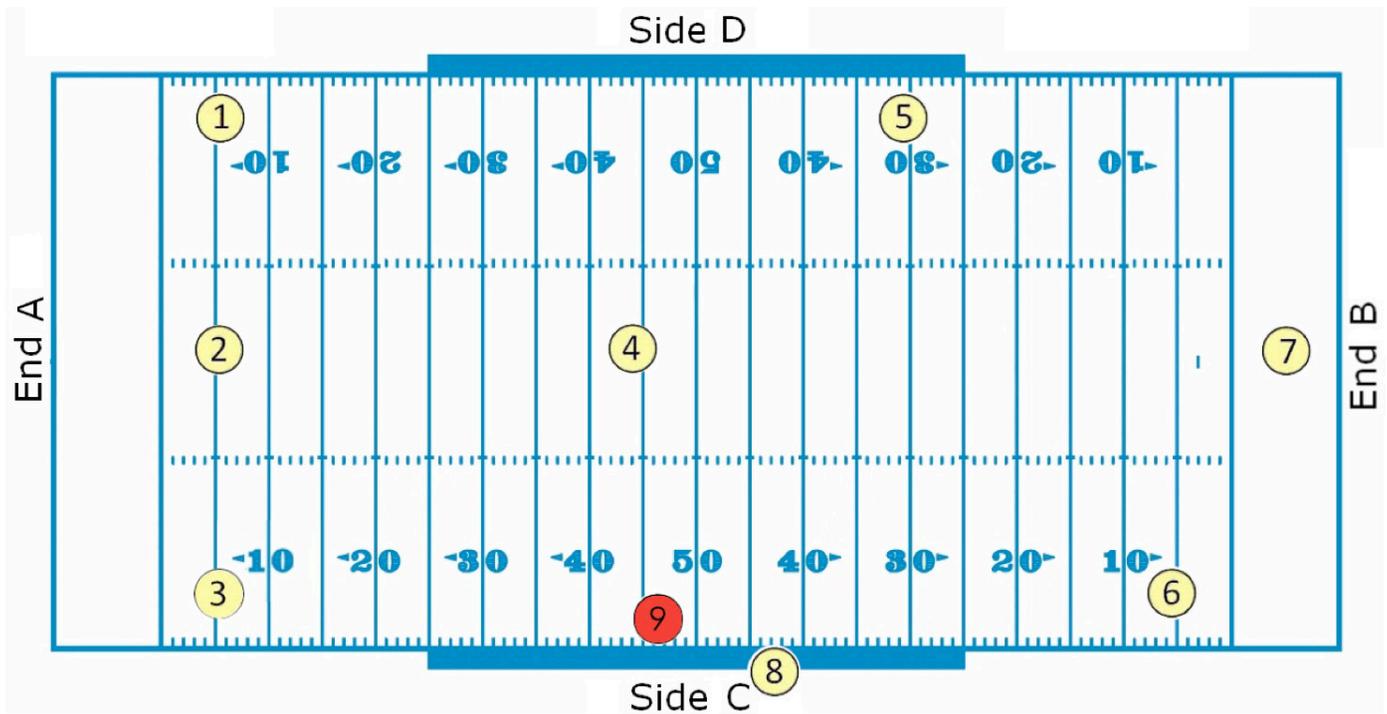
TEST LOCATION PLAN

TEST LOCATIONS

Locations A-S are used for AAA tests (Shock Absorption, Vertical Deformation & Energy Restitution).



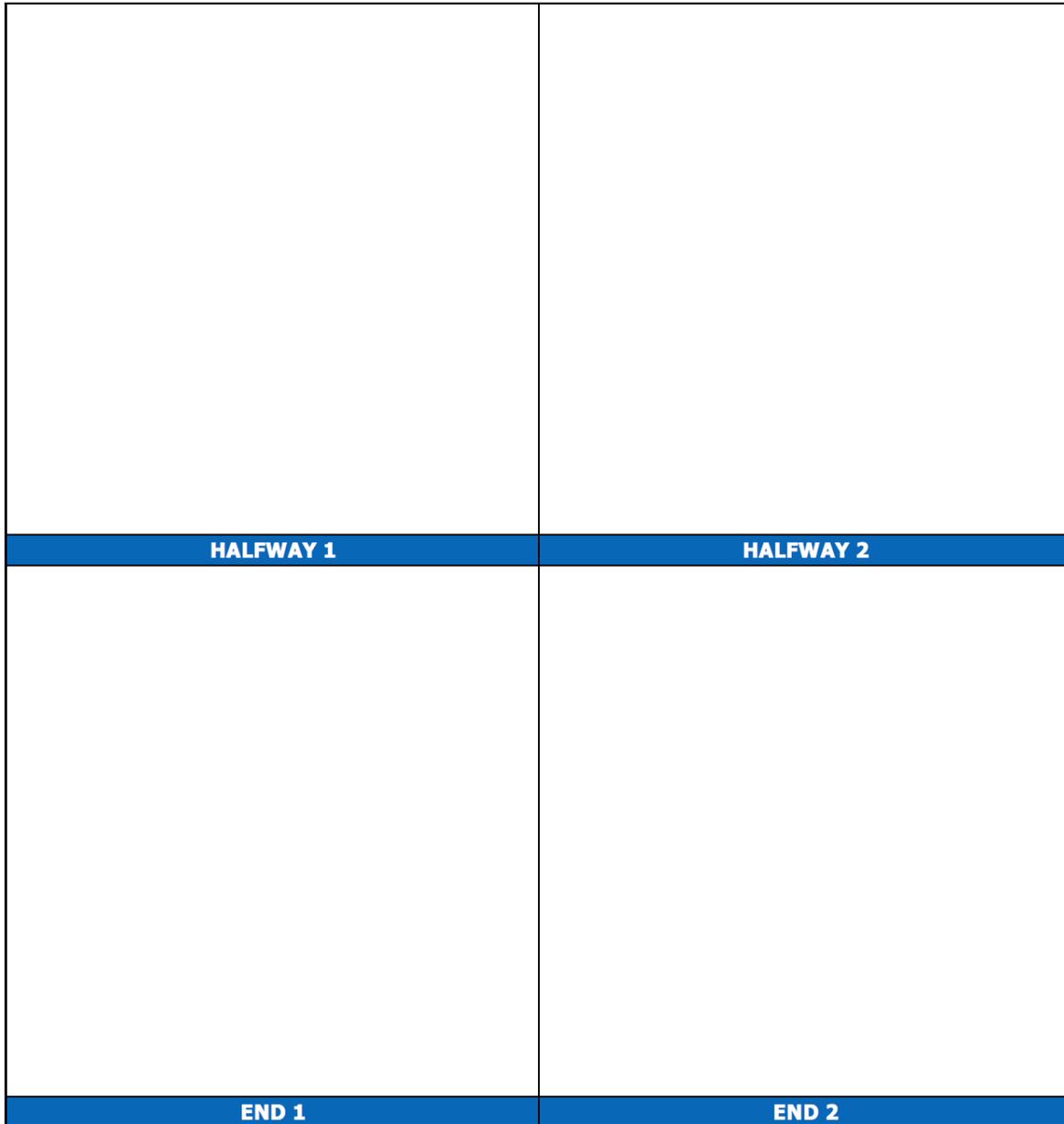
Locations 1-9 are used for HIC, Rotational Resistance and Vertical Ball Rebound.



APPENDIX B

SITE PHOTOGRAPHS

SITE OVERVIEW



DEFECTS- IF NO DEFECTS DELETE AS APPROPRIATE

DESCRIPTION	DESCRIPTION
DESCRIPTION	DESCRIPTION

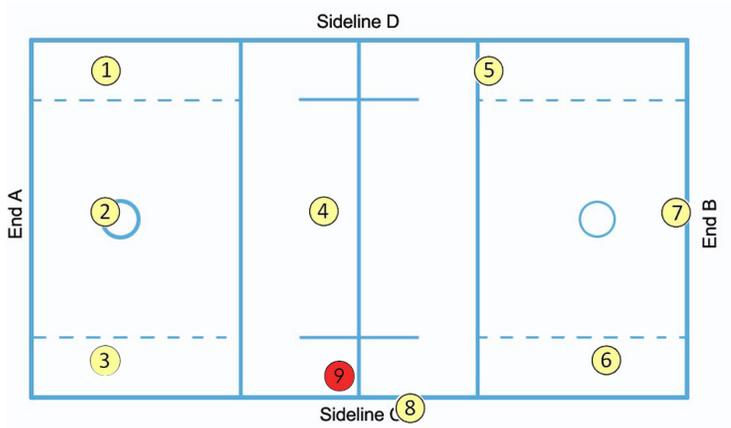
End of Report

Appendix 7

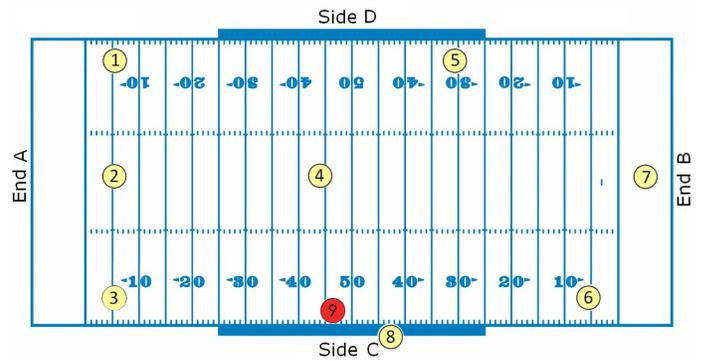
Test location maps by sport

The red location is to be moved to the entrance point to the field or a heavily used location at the tester's discretion.

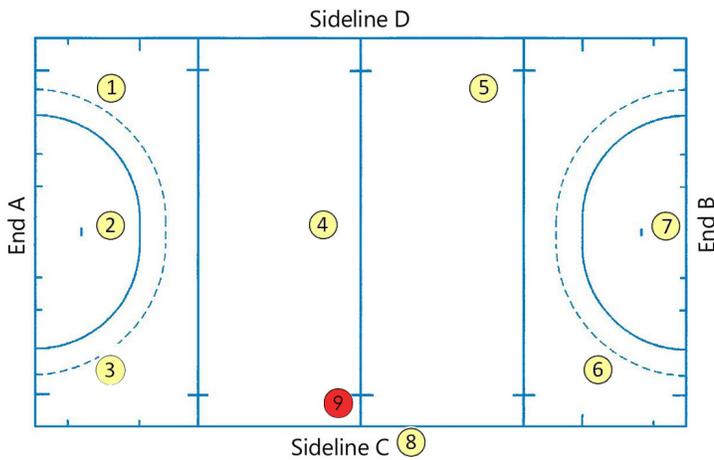
Boy's lacrosse



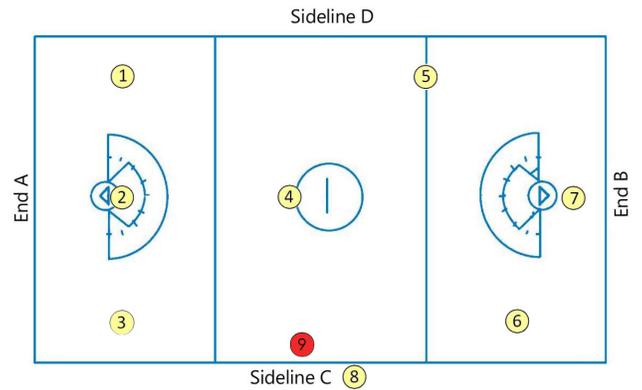
Football



Field hockey

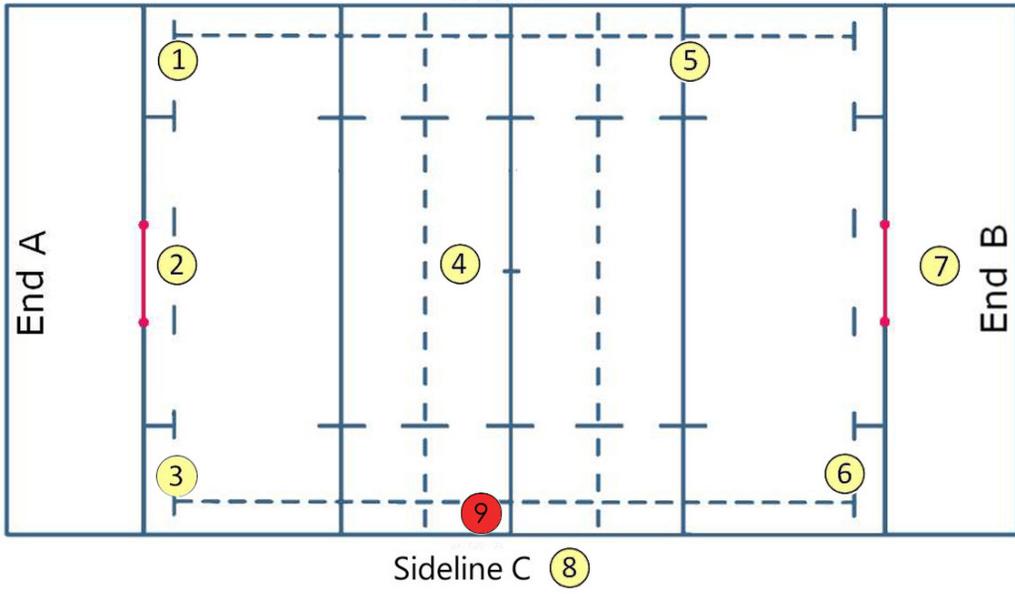


Men's and women's lacrosse



Rugby

Side D



Soccer

Sideline D

