

RFU GUIDE TO ARTIFICIAL GRASS PITCHES FOR RUGBY UNION



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1. INTRODUCTION

The last 15 years has seen major innovations in the development of artificial grass surfaces and the emergence of longer pile systems. These modern surfaces replicate the playing qualities of the best quality natural turf pitches whilst allowing significantly higher levels of usage.

To assist organisations looking to develop an artificial grass pitch for rugby union, the RFU has produced this guide. It describes in detail the factors that need to be considered by the project team responsible for the design, specification and construction of an artificial grass pitch.

2. WHAT IS ARTIFICIAL RUGBY TURF?

Artificial Rugby Turf is the term chosen by World Rugby to describe artificial grass surfaces designed for rugby union. This diagram shows the typical cross section of an Artificial Rugby Turf surface.



The surface comprises a long pile tufted carpet that is normally laid on a shock-absorbing pad that is laid on a free draining stone or macadam base. The pile of the carpet is partly filled with rubber granules to provide a cushioned surface that in conjunction with the shock pad underneath the carpet, provides the comfort and protection players require. Beneath the rubber granules is a layer of sand that provides weight to hold the carpet in place.

3. WORLD RUGBY REGULATION 22

World Rugby believe artificial grass pitches have a major role to play in developing the game in regions of the world where natural turf is not a viable alternative; either due to an unsuitable climate, inadequate maintenance resources or where the intensity of use is too great to maintain good quality natural turf; which is often the case in England.

World Rugby wants to ensure that only artificial grass pitches of acceptable quality are used for rugby union to prevent players being exposed to any greater risk of injury than when playing on natural turf. To achieve this they have developed their *Artificial Rugby Grass Performance Specification* and incorporated this into the Laws of the Game through World Rugby Regulation 22. This Regulation states that rugby matches (at any level of competition) may only be played on an artificial grass pitch that meets World Rugby *Artificial Rugby Turf Performance Specification* and Law 1.

Whilst technically World Rugby Regulation 22 only covers pitches on which competitive rugby is played, advice received from insurance companies is that any pitch on which contact activity will take place should be certified in accordance with World Rugby Regulation 22 to minimise the risk of player injury and the site owners liabilities.

THEREFORE, THE RFU REQUIRES ANY PITCH ON WHICH CONTACT ACTIVITY TAKES PLACE TO BE DESIGNED, CONSTRUCTED AND CERTIFIED IN ACCORDANCE WITH WORLD RUGBY REGULATION 22.

4. TESTING

World Rugby's 'Artificial Rugby Turf Performance Specification' can be downloaded [here](#). It has been written to ensure artificial grass pitches are constructed with surfaces of proven quality; that the surfaces are installed correctly and that they continue to provide satisfactory playing environments throughout their service lives. This is achieved by three stages of testing and inspection:

Stage 1 - product type approval - the artificial grass surface is subjected to a comprehensive series of laboratory tests that assess its performance, durability and material qualities. Only artificial grass surfaces that have been tested by a World Rugby Accredited Test Institute and shown to comply with World Rugby standard should be considered when designing an artificial grass pitch on which rugby union activities are going to take place. Confirmation that a particular artificial grass surface has been shown to comply with this first stage may be obtained from the RFU.

Stage 2 - initial facility testing and certification - Following construction a pitch is tested to verify the artificial grass surface has been installed correctly and is providing the required levels of performance - even the best quality surfaces will not perform acceptably if they are poorly or incorrectly installed.

Stage 3 - pitch recertification - The pitch is re-tested once every two years throughout its life to verify it is still providing a satisfactory and safe playing environment.

The testing of pitches requires specialist test equipment and expertise and World Rugby has accredited laboratories that have been independently assessed and shown to achieve the levels of competence and professionalism required. Only accredited laboratories can undertake World Rugby testing of products and pitches. At present there are two accredited laboratories located in the UK:



SPORTS LABS LTD



07943 846 611
infor@sportslabs.co.uk

As required by World Rugby, the RFU maintains a register of certified pitches - available [here](#). This is available to anyone wanting to verify if a pitch is World Rugby Regulation 22 compliant prior to playing or training on it

5. MULTI-SPORTS USE

Many artificial grass pitches are used for more than one sport and this inevitably results in compromises in performance. In making such compromises it is important that the playing characteristics of the sports or the protection provided to players is not reduced to a point at which the surface fails to provide a satisfactory playing environment. Football and rugby league can both be successfully be played on certain forms of artificial grass that can also be used for rugby union without a major impact on the playing characteristics of any of the three sports.



Whilst hockey is also played on artificial grass pitches, the requirements of the game, and especially their desire for a surface on which a hockey ball rolls in a fast and true

manner, means that artificial grass surfaces suitable for rugby will not comply with the recommendations and competition regulations of England Hockey.

6. SURFACING OPTIONS

Artificial grass carpets

The range and design of artificial grass surfaces is expanding rapidly and the selection of the best product for any particular scheme can be difficult without specialist knowledge. Described below are the principal aspects of an artificial grass carpet and some of the parameters often detailed by manufacturers in their trade literature.



Pile height is the length of the pile; normally expressed as the height of the pile above the backing of the carpet, it is also sometimes expressed as the total length of the yarn forming the tuft (the two sides of the tuft); World Rugby specify a minimum pile height (above the backing) to help ensure surfaces meet their requirements. Historically World Rugby has specified a minimum pile height of 65mm but a recent amendment to increase the potential for dual use rugby and football surfaces has seen this reduced to a minimum of pile height of 60mm.

Pile yarn is one of the most important aspects of the surfacing system as it influences the playing characteristics, durability and visual appearance of the pitch. Nowadays most artificial grass carpets are manufactured with a pile made of polyethylene. This type of yarn provides a resilient and durable surface, whilst not being too abrasive to players when they fall or slide on it. Some surfaces also include secondary yarns to help provide and retain the desired playing characteristics; these are often polypropylene or nylon.

The surface pile is either manufactured from fibrillated or monofilament yarns. Fibrillated yarns were originally developed for the earlier forms of sand filled artificial grass and are manufactured from thin sheets of plastic that are slit and twisted to form thicker filaments that form the pile. Experience has shown that the abrasive effects of play can cause the yarns to split into increasing fine fibrils increasing the risk of poor foot grip, infill compaction and skin burns.

Monofilament yarns have become the standard for long pile artificial grass because of their enhanced durability and resilience. The yarns are manufactured as individual strands that are plied together to form the individual tufts. The number of plies can vary and is normally specified as the number of ends per tuft; the higher the number the denser each tuft. As monofilament pile yarns are produced in their finished state manufacturers are able to engineer an increasingly complex range of profiles in an attempt to increase the resilience of the fibre so that the tendency for the pile to flatten is reduced.

Pile weight or face weight is the weight of yarn forming the pile; typically ranging from 900g/m² to 2,000 g/m². When comparing carpets of similar pile heights those with higher pile weights will normally be of a high quality, providing greater infill stability (less dispersion) and have a longer lifespan.

The artificial grass carpet is produced in rolls that are normally between 3.5m and 4.5m wide. These are normally laid across the pitch for its full width although a roll may be laid along either side of the pitch when in-laid touchlines are required. The rolls of carpet are joined together by either stitching or using adhesive joints where the two adjacent rolls of carpet are stuck to a backing film. Both methods are acceptable providing the joints are well made.

Play lines can either be painted onto the playing surface or be tufted and inlaid. Tufted lines are incorporated into the carpet during production; inlaid lines are cut into the carpet during installation; they provide permanent markings that reduce on-going maintenance costs, whereas painted lines give greater flexibility to the use of the area. When specifying the type of line markings required remember that any pitch that is to be used in Premiership or Championship competitions should have all markings other than those specified for rugby union applied in paint to allow their removal prior to competition matches.

Infill materials

The majority of artificial grass surfaces are filled with particulate materials. These are normally either granulated rubber polymers or mixes of rubber and sand. The infill materials are used to support the pile of the carpet, to help it remain vertical, to contribute to the playing and cushioning qualities of the surface and to provide weight to ensure the carpet is held in place. The grading, composition and depth of the infill materials are therefore carefully selected by the manufacturer to ensure the combination of the carpet pile and infill materials gives the type and level of performance required from the surface.

An increasing number of rubber polymers are being used. The most common is styrene-butadiene rubber (SBR as it is more commonly referred to); the granules are black in colour and produced from recycled tyres. If an alternative colour is required a polyurethane coating may be applied to encapsulate the SBR granules, but this is more expensive.

As the development of artificial grass surfaces progresses manufacturers are engineering infill materials and profiles to enhance performance. A range of materials including vulcanised and non-vulcanised Thermoplastic Polymers (TPE and TPV) and Ethylene Propylene Terpolymer (EPDM) granules are now being used. As they are specifically manufactured from virgin stock material they may be granulated, extruded or moulded to have the required shape, size and colour for enhanced performance. In addition they can have flame retardant additives incorporated in their formulations to reduce their flammability; an important consideration for certain sites and in particular when surfaces are being laid indoors.



Several manufacturers are also now offering organic infills, based on coconut fibre and cork these infills are designed to provide a more natural playing surface. They do, however, require moisture to keep them at in their optimum condition and are likely to require replacement periodically through the artificial grass carpet's life. In practice such infills are probably more suited for stadium pitches.

Shock pads

To ensure an artificial grass pitch is able to provide the levels of player impact protection considered necessary for the game, it is likely to include a shock pad or elastic layer. Laid beneath the artificial grass carpet they take many



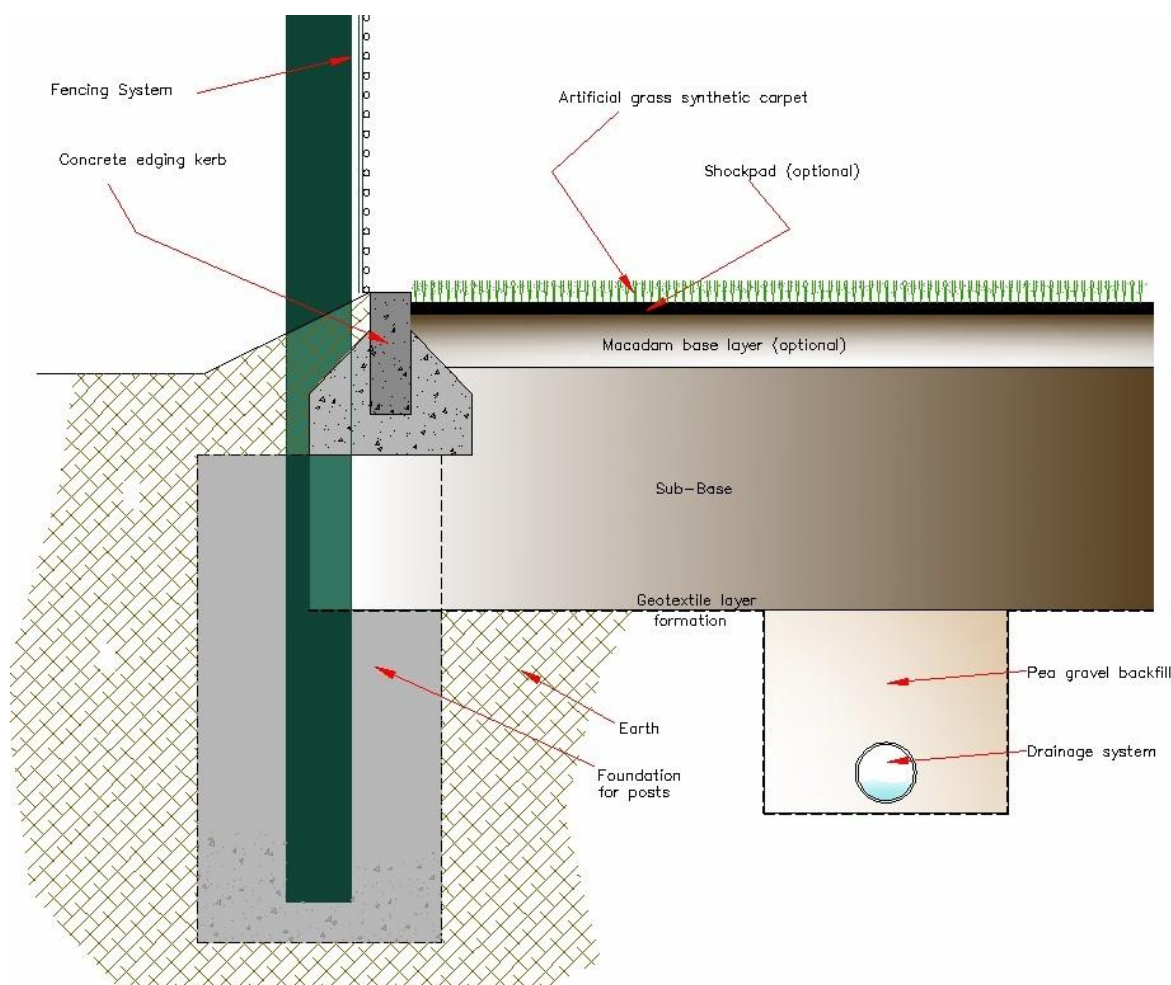
forms including polyurethane bound rubber mixes that are laid with a paving machine (often described as in-situ laid shock pads) or factory produced panels or rolls that are manufactured from a range of materials including rubber granules, polyurethane foam, expanded polyethylene beads and recycled polyethylene foam.

As an increasing number of sand filled artificial grass pitches are being converted to long pile surfaces particular consideration needs to be given when an existing shock pad is to be retained and incorporated into the new artificial grass surfacing system. As the performance and durability of the artificial grass surface is significantly influenced by the shock pad it is important that only systems incorporating shock pads with similar performance characteristics to the one being retained are considered for the resurfacing. To enable this to be achieved the properties of the retained shock

pad must be measured on-site prior to quotations being sought (which will require the existing artificial grass surface to be cut to allow access to the shock pad) so that contractors bidding for the resurfacing work will know what the performance of the shock pad is and design accordingly. The RFU would recommend the use of a World Rugby accredited test institute for this task.

7. BASE CONSTRUCTIONS

The base on which the artificial grass surface is laid is required to provide a stable and free draining platform on which the artificial grass surface is laid. It should be capable of supporting and transmitting the loads placed on the surface during normal use and maintenance and provide adequate protection to the sub-grade from penetrating frosts. The drawing below shows a typical pitch construction including sub-base, drainage, fencing etc.



The pitch should have a drainage system that is designed to remove surface water from the playing surface at a sufficient rate to prevent flooding and to ensure that excess water is not allowed to build-up within the sub-base causing a reduction in its structural integrity. The drainage system will typically consist of a series of lateral drains laid beneath the pitch at between 8m and 15m centres, depending on site conditions. The lateral drains will connect into collector drains located on the outside of the perimeter edgings that will discharge into a suitable outlet. This will need to be identified (often before planning approval is granted) during the design of the pitch. Outlets can include storm water sewers, soak-aways and nearby watercourses. Whichever form is chosen, permission is normally required from the relevant statutory body.

Most commonly, bases for long pile artificial grass pitches are now constructed from unbound or 'dynamic' graded free draining aggregates (coarser gradings in the lower sections, finer gradings at the top) typically installed to a depth of 300mm - 450mm depending on ground conditions.

If an unbound base is poorly constructed it can suffer from localised movement resulting in undulations that, in extreme cases, can affect the playing qualities of the surface. This has resulted in some contractors promoting the use of bound or 'engineered' bases of porous (open textured) bituminous macadam.

8. FENCING



Perimeter fencing is normally erected around community pitches to contain balls, to protect the playing surface from contamination and to help prevent unauthorised use and vandalism. Fencing heights vary, 3m is often used but this can increase to 5m where the site requires as many balls as possible to be retained within the pitch. Where site security and ball retention is not a serious issue or where an internal spectator compound is provided 1.2m high fencing with a top rail is often used to enable good spectator viewing.

The fencing is normally constructed from weld mesh panels or rolls that are suspended from box section posts. Weld-mesh is used, as it is better suited to the repeated impacts of balls hitting the fence than cheaper chain-link mesh. Steelwork should be galvanised to minimise premature corrosion and may be plastic coated to improve its appearance.

Access gates should open outwards to ensure the safety of players. At least one pair of double gates should be provided to allow maintenance and emergency vehicle access.

9. FLOODLIGHTING

In order to maximise the use of the pitch most are floodlit. Lighting of full size pitches is normally achieved by a number of lamps mounted on columns positioned along the sides of the pitch. Typically eight columns, fifteen or sixteen metres high, are used on full sizes pitches.

As many league and cup competitions specify the minimum level of lighting they require it will be necessary to determine the competitions that the teams using the pitch will compete in and design accordingly. Guidance on floodlighting and lighting levels is provided in the RFU's [Floodlighting, Installation and Management Guide](#).

When designing a floodlighting system, it is important that an assessment of the available power supply is made to determine if adequate capacity is on hand, as bringing a new supply to site can increase costs dramatically. The total installed power requirements for a full size pitch is likely to be in the order of 35 to 40 kilowatts.



10. DESIGN TEAM

Having decided an artificial grass pitch is right for your organisation you are committing to a large capital investment that should be supported by thorough design and planning if it is to be successfully built and operated. Experience shows the design, specification and project/construction management of the pitch is best undertaken by people with specialist expertise. A typical project team is likely to include:

- Design consultant
- Geo-technical engineer
- Project manager / quantity surveyor
- Floodlighting engineer
- Sports surface test laboratory
- CDM Coordinator (as required by the Construction Design and Management Regulations 2015)

Project team members should be appropriately qualified in their respective disciplines, be independent of suppliers and manufactures and have adequate professional indemnity insurance cover. Each specialist should be carefully selected and should provide references from previous relevant engagements.

The appointment of a project team is likely to incur professional fees, some of which may have to be paid early in the project development phase and possibly before any external funding awards have been secured. Adequate budget allowance for professional services should therefore be made at an early stage of a project. Most external funding agencies, however, consider the fees incurred by the use of professional advisors as a justifiable part of a project's cost and will allow them to be included in funding applications; indeed many see the use of specialists as a way of ensuring a pitch is built to the required standards and within budget.

The complexity and size of a project will ultimately dictate the level of external professional advice and services that will be required. As a budget guide, professional services may be expected to typically cost between 5% and 10% of the actual cost of constructing the pitch depending on the complexity of the scheme. As a number of the services required will be the same, irrespective of the size of the project, the allowance for professional services on smaller projects (small sided pitches, etc.) will be proportionally high than on larger projects.

11. PROCUREMENT & FRAMEWORK APPROACH

There are various forms of specification that can be used when inviting contractors to bid for the construction of an artificial grass pitch. Most artificial grass pitches are, however, designed and procured using the design and build approach where a number of contractors are invited to submit their proposals for the design and construction of the facility. In this type of contract the customer needs to prepare a design brief (or Employer's Requirements document) that adequately describes what is required. The use of a specialist architect or consultant to prepare such a document is strongly recommended.

As a result of the expansion in the market for artificial grass pitches there has been a corresponding increase in the number of contractors offering their services as constructors of such facilities. Not surprisingly, the large number of contractors operating includes companies of a wide range of size, structure and ability, from which a choice must be made for any project. Selecting the correct company is crucial if your pitch is to meet your expectations.

To reduce the risk of poor quality installations the RFU have joined Sport England, the FA, England Hockey and the Football Foundation in entering a framework agreement with specialist manufacturers of artificial grass pitches. The agreement places enhanced responsibilities onto the partner companies to project manage the design, construction and on-going maintenance of the new facilities, with particular focus on quality, performance and longevity. For further information on the Framework Agreement please contact your RFU Area Facilities Manager.

The Sports and Play Construction Association (SAPCA) is the UK trade association for the sports facility construction industry. SAPCA represents most specialist constructors, professionals, manufacturers and suppliers of sports surfaces and related products. Details of SAPCA and its members may be obtained from their website www.sapca.org.uk.

12. QUALITY MONITORING DURING CONSTRUCTION

To ensure the artificial grass pitch has the right playing characteristics for the game, is safe to use and at the same time is able to withstand rough treatment and remain operational for a realistic period of time it is essential that proper quality assurance procedures are applied throughout the construction process. Independent site inspections should be undertaken throughout construction with particular attention being paid to the completion of each key stage. A typical schedule of inspections included in the RFU framework methodology should include:

STAGE OF CONSTRUCTION	INSPECTED FOR
Formation	<ul style="list-style-type: none"> • profile and gradients • adequate compaction
Drainage system	<ul style="list-style-type: none"> • channel spacing and falls • permeability of infill
Edgings	<ul style="list-style-type: none"> • design levels • haunching and line
Base	<ul style="list-style-type: none"> • construction depth • grade • compaction • permeability • surface regularity
Shock pad	<ul style="list-style-type: none"> • construction depth • permeability • surface regularity • tensile strength – laboratory test • shock absorption
Artificial grass surface	<ul style="list-style-type: none"> • joints • joint strength – laboratory test • infill application • carpet characteristics – laboratory tests • infill characteristics – laboratory tests

13. MAINTENANCE OF ARTIFICIAL GRASS SURFACE

The maintenance of the artificial grass surface is of vital importance if the surface is to retain acceptable performance over a long period. The manufacturer's guarantee will usually be conditional on the recommended maintenance requirements being carried out with reasonable diligence. Failure to make adequate allowance for the required maintenance equipment and training may result in a field not being certified to World Rugby Regulation 22 on the retest.

Prior to selecting a surface, the manufacturer's advice must be sought on the maintenance equipment to be used and how regularly the maintenance works should be carried out given the proposed programme of use. If you cannot follow the recommendations you should not select the surface.

You should also look to agree how often the manufacturer/installer should return to site to undertake more major rejuvenation works to ensure the infill is evenly spread over the site to protect the fibres. This maintenance agreement will help protect your warranty provided by the surface manufacturer. Many installers offer a periodic inspection service as part of their after-sales care. This should be welcomed and encouraged so any shortcomings in maintenance are identified before they have a detrimental effect on the playing surface.



Three types of maintenance are normally required:

Routine regular maintenance

- Drag matting / brushing to redistribute infill
- Brushing to lift the pile that will flatten through the actions of play. Failure to do so will result in more fibrillation and matting of the carpet's pile with a deterioration in performance
- The localised topping up of infill materials to ensure consistent ball and foot responses from the surface and

to provide support to the carpet's pile

- The removal of litter, leaves and other debris from the surface for appearance and to prevent contamination

The frequency of such maintenance will vary but is likely to be at least weekly and on regularly used pitches more frequently. Such maintenance is undertaken using specialist plant and is likely to take around two hours per session for a full size pitch.

Routine periodic maintenance

- Relieving compaction of the particulate infill to ensure consistent ball and foot response.
- Removal of any moss or weeds that germinate within the surface, particularly around the edges of the pitch where it is harder to get mechanical brushes into.

The relieving of compaction will require specialist equipment and is likely to be required between one and four times per year, depending on usage. Where a pitch operator has a number of pitches they may wish to purchase the necessary equipment, whereas an operator with only one facility may find it more cost effective to enter a maintenance contract with a specialist company.

Rejuvenation

Even with good levels of maintenance, dirt and fibre debris (resulting from the wearing of the carpet pile) will eventually become trapped within the fill material. At some stage during the surface's life it will probably be necessary to remove the contaminated fill and replace with new material before serious problems of compaction (leading to a harder playing surface) and a reduction in porosity (eventually causing flooding on the surface in wet periods) start to occur.

Maintenance costs

The maintenance of artificial grass pitches should only be undertaken by fully trained and competent persons; at some sites these are volunteers, at others ground-staff are employed. It is suggested that a budget of £11,000 to £13,000 per annum be allowed for regular and routine periodic maintenance. For pitches subjected to lower levels of use costs reduce to around £4,000 per annum. As a guide 10 hours match play (30 players over an area of approximately 6,500m²) will typically result in one hour's required maintenance activity on the pitch.

Rejuvenation processes are expensive (up to £35,000 plus VAT for a full size pitch) and adequate allowance should be made from day one of the pitch's life.

Maintenance logs

The installation contractor or surface manufacturers should provide a maintenance register or log when the pitch is handed over following installation. The register is a working document that should be completed each time any form of maintenance is undertaken. This enables the pitch operator and the contractor/manufacturer to check that the correct levels of maintenance have been carried out if deterioration in the performance of the pitch or signs of premature or excessive wear occurs.

Maintenance of floodlights

The maintenance of the floodlighting system is also important if it is to continue to meet the performance specified at the design stage. Maintenance will include routine work on all the associated electrical services, cleaning of fittings and the correct adjustment to maintain the alignment of the lamps. Many floodlighting contractors now offer annual maintenance contracts and these are worthy of consideration.

14. REPLACEMENT FUNDS

Project co-ordinators should be aware of and plan for the full life costs of the pitch and supporting infrastructure from an early stage. Information should be sought regarding the on-going costs of routine maintenance of the chosen playing surface, together with the life expectancy and cost of replacement at the end of the surface's

useful life. The manufacturer of the surface will be able to provide guidance on the likely life of the surface - provided it is properly maintained – and its replacement cost. Similar information should also be obtained in respect of the floodlighting and fencing.

A sinking fund should be established as soon as the new pitch is brought into use to ensure that sufficient funds are available to replace the surface when it reaches the end of its life. As the cost of replacement is in the future, it will be necessary to save the amount of money required at that future date, not today’s cost. This means that it is not possible to take the today’s cost and divide it by the number of years until replacement is due. A more complex calculation that takes into account compound interest to the replacement date needs to be used.

Current estimates for the resurfacing of a full size pitch (including removal of the existing surface and disposal of the surface and fill) suggests a budget of between £150,000 and £180,000 plus VAT is realistic. Based on 5% inflation a sum of £180,000 will equate to £293,202 in 10 years’ time. To achieve this figure, and assuming a compound interest rate of 5%, a monthly contribution of £1,924 (£23,311 per annum) is required every month from the first month of the pitch’s life.

15. OTHER SOURCES OF USEFUL INFORMATION

- World Rugby Regulation 22
- FIFA Quality Concept for Football Grass
- RFL Performance and Construction Standards for Synthetic Turf
- RFU’s Floodlighting, Installation & Management Guide
- European Artificial Grass Organisation (ESTO)
- Sport and Play Construction Association (SAPCA)

16. CONTACTS

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DISCLAIMER

Whilst every effort has been made to ensure the accuracy of the information contained in this publication any party who makes use of any part of this document in the development of an artificial grass pitch shall indemnify the Rugby Football Union, its servants, consultants or agents against all claims, proceedings, actions, damages, costs, expenses and any other liabilities for loss or damage to any property, or injury or death to any person that may be made against or incurred by the Rugby Football Union arising out of or in connection with such use.

There are many ways of constructing an artificial grass pitch. These guidelines do not constitute any form of approval from the Rugby Football Union on a particular form of surfacing or construction but are intended to provide information to potential consumers to allow them to make informed choices when designing and selecting surfaces, contractors, etc.