

# Artificial Turf

Guidance notes on the construction, maintenance and performance of artificial turf pitches

**Version 2.0, November 2009**



**Facility Development Unit**



The Department of  
Arts, Sport and Tourism  
An Roinn  
Ealaíon, Spóirt agus Turasóireachta

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## A word from John Delaney, Chief Executive Officer

“ One of the most enjoyable aspects of my position as CEO of the Football Association of Ireland is the opportunity it gives me to visit local communities and to witness the remarkable achievements in providing quality football facilities. I know that many years of planning and hard work have gone into these ventures.



The pathway to develop these facilities can be long and arduous but there is assistance available through the Department of Arts, Sport and Tourism and from the Football Association of Ireland's Facility Development Unit. Therefore, I am delighted to support the development and distribution of this, the latest in the FAI's series of guidance notes for clubs, leagues and facility operators.

I would like to take this opportunity to thank you for the work undertaken or about to be undertaken by you and hope that you find that these guidance notes assist you in maximising the quality of your facility as well as delivering value for money.

*John Delaney*



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 Football Association of Ireland, 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 Football Association of Ireland arising out of or in connection with such use.

There are many ways of constructing an artificial grass football pitch. These guidelines do not constitute any form of approval from the FAI 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.

The last decade has seen major innovations in the development of artificial grass surfaces designed for football. The development of long pile artificial grass surfaces now allows the game to be played on artificial surfaces that replicate the playing qualities of the best quality natural turf pitches whilst increasing the levels of use. The success of these surfaces is such that they are now being used in major competitions including FIFA World Cup qualification matches and the UEFA Champions League.

To help clubs and organisations wishing to install artificial grass pitches the FAI have produced two guideline documents to provide assistance during the design, procurement, construction and operation of artificial grass football pitches. The two parts are:

- *FAI Guidance notes for Artificial Turf Pitches* (this document) which describes the many factors that need to be considered during the design, specification and construction of an artificial grass pitch. It discusses the appropriate standards for the levels of competition and types of use to take place on the pitch, the surfacing and construction options being offered by contractors and includes advice on maintenance, life cycle costs and sinking funds.
- *Guideline Template - Design Brief for Artificial Turf Pitches* – this document is intended to form the basis of a design and build type specification for an artificial grass pitch. It includes clauses for many of the elements of the construction and gives advice on the project specific items that need to be considered and described on a site-by-site basis.

This document is available upon request from the FAI Facility Development Department.

## 2.0

# Use of artificial grass pitches in FAI competitions

In Ireland, artificial grass pitches have up to now been primarily installed for revenue generation and training purposes. Over the last few years they have, however, started to be used for competitive matches, in youth and junior leagues affiliated to the FAI. Following their introduction into FAI competitions in 2006, the FAI has again approved the use of such pitches in their respective competitions from season 2009/10 for the following competitions:

- FAI League of Ireland competitions
- FAI Senior Cup
- FAI Intermediate Cup
- FAI Junior Cup
- FAIS league and cup competitions
- FAI affiliated league and cup competitions

**The use of such pitches is however dependent on compliance with FAI conditions of use, which have been approved by the FAI Rule Book and which should be read in association with these guidelines.**

In summary it has been agreed that matches from season 2009/10 may be played on artificial grass pitches as follows:

FAI League of Ireland competitions	FIFA One Star (2009 edition) standard, or the equivalent International Artificial Turf Standard (IATS) (2009 edition)
FAI Senior Cup	
All other FAI and FAIS league and cup competitions	

To qualify for use in FAI League of Ireland Competitions or the FAI Senior Cup, the pitch must be **fully tested annually** to FIFA One Star Standard and be certified by the FAI as meeting the appropriate standard before play is allowed. To qualify for use in all other FAI league and cup competitions the pitch must be inspected in accordance with FAI requirements annually and be tested once every three years.

The object of inspections and testing is to ensure pitches are retaining acceptable and safe performance at all times. If the FAI becomes concerned about the performance of a pitch they reserve the right to have it tested or inspected at any time. Any pitch found to be non compliant with the FAI requirements will need to be refurbished in order to reinstate the required performance within an agreed time period. Failure to make good defects may result in the field being excluded for use in FAI league and cup competitions. The cost of any maintenance works and subsequent testing is the responsibility of the facility operator or club using the pitch.

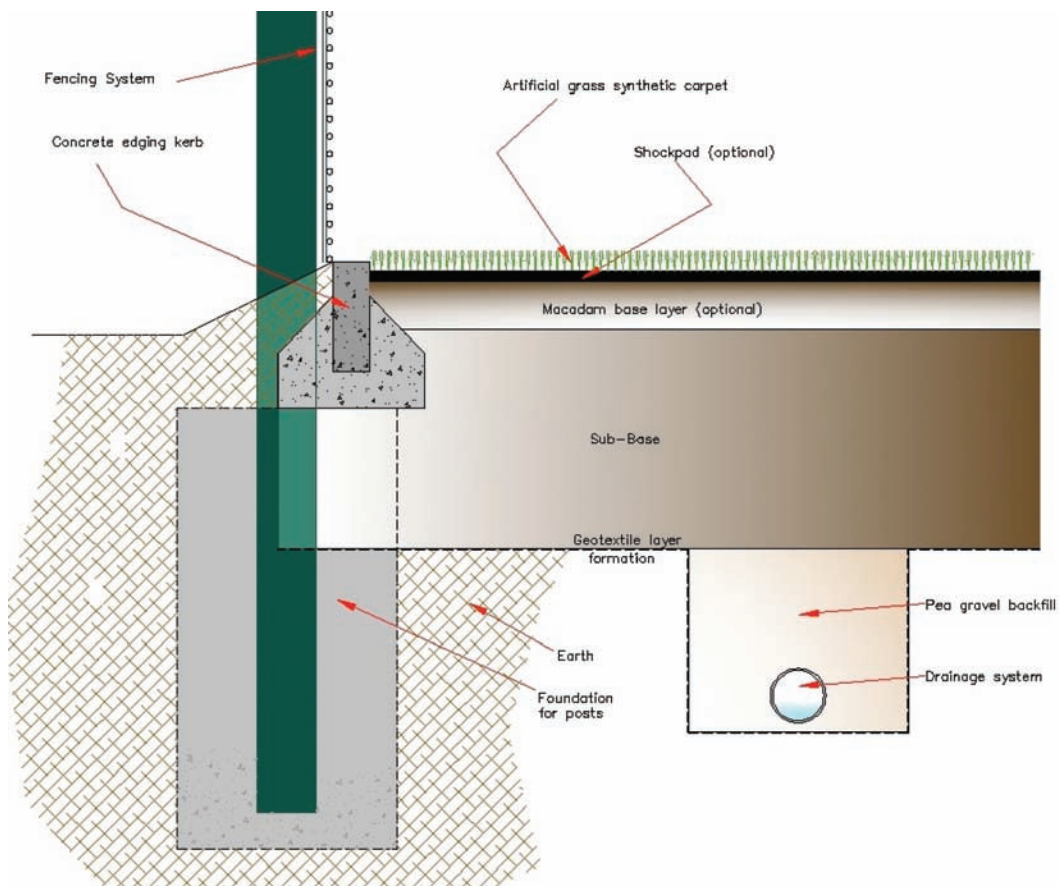
Where pitches constructed prior to the 2009/2010 season are to be used in FAI league and cup competitions they shall be tested in accordance with IS EN 15330-1 with the ball roll maximum limit being extended to 12m in accordance with the FIFA One Star Standard.

## 3.0

# Developing your artificial grass pitch project

Although to many, an artificial grass pitch is just the surface on which they play, it is in fact, a complex piece of engineering that needs to provide the correct playing and safety characteristics whilst ensuring adequate durability to withstand the effects of use and the ravages of the climate.

The playing surface will have been developed by specialist manufacturers that have carefully selected the combination of pile yarns, carpet designs, infill materials and possibly shockpads to provide a playing surface that meets the required standards. Having selected the appropriate playing surface for your needs, it is essential that it is laid on a sub-base and drainage system that is capable of withstanding the different stresses and climatic conditions that it will be exposed to throughout its life. It is recommended that a geo technical survey be carried out at an early stage of the design process to ensure the design team have a full understanding of the site conditions.



**Drawing 01 - cross section showing typical construction of an artificial grass pitch**

It cannot be over emphasised that failure to give full consideration to all elements of the pitch's design and maintenance is likely to result in a pitch that fails to achieve and retain the appropriate levels of performance. This means resurfacing will be required sooner than anticipated; whilst a poorly designed or constructed base will require expensive remedial works at the time of surface replacement.

Skimping on an adequate design for the prevailing site conditions and intended usage patterns or failing to maintain the playing surface may reduce costs initially but in the longer term it will result in unnecessary expenditure. **Making adequate budget allowance for all elements from the outset is the key to a successful facility.**

In order that adequate funding is generated to allow a pitch to be correctly maintained and the appropriate allowance for a sinking fund made, it is essential that the pitch is financially viable. Past experience has shown initial revenue predictions to often be wildly optimistic resulting in shortfalls that are difficult, if not impossible, to make up. This inevitably results in cutbacks in expenditure on items such as maintenance that result in a more rapid deterioration in the performance of the pitch leading to a further drop-off in income, as players move elsewhere, and a shorter life span for the surface. To ensure your scheme does not make the same mistakes **it is vital that realistic and accurate financial predictions be made during the initial planning stages of the project.** Such predictions should be based on confirmed usage patterns identified once hire rates have been established.

## Professional Advice

An artificial grass pitch is 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 – **this should not be the installation contractor.** It is advised that the first professional appointed is a specialist consultant with the necessary technical knowledge and expertise of artificial turf pitches. This person should be able to demonstrate a track record of specifying artificial grass pitches which meet the relevant performance standards and be familiar with the requirements of the Sports Capital Grant Programme. **The FAI will be able to supply you with a list of suitable professionals.** If appointed, this person will be able to recommend suitable personnel for the following roles and who should be appointed at appropriate stages of your project;

- Engineer or architect: to prepare drawings for planning through to sign off
- Geo-technical engineer: to carry out a ground survey at your site
- Project manager; to oversee the construction phase
- Floodlighting engineer; to design a floodlighting scheme

All professionals appointed **should be appropriately qualified in their respective disciplines, be independent of suppliers and manufacturers and have adequate professional indemnity insurance cover.** Each specialist should be carefully selected and should provide references from previous relevant engagements. In addition, the FAI should be consulted on all football projects, particularly where a grant has been applied for or received under the Sports Capital Grant Programme.

The engagement of professional advice is likely to incur fees, some of which may have to be paid early in a project 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 higher than on larger projects. **Further information on this subject is provided in the FAI's Guidance notes on managing facility development projects.**

### Needs analysis

When developing their business plan a club should consider the potential conflict between maintaining acceptable performance (as defined by the FAI) and deteriorating performance through high use.

It is suggested that clubs negotiate suitable longevity and performance warranties from the artificial grass surfacing system's supplier to ensure that the pitch will last in line with the Club's business plan and intended usage levels. A sinking fund should be established also to ensure sufficient funds are available when the surface needs replacing. Clubs are also encouraged to understand the full levels of maintenance required by the surface, which will be necessary to validate any warranty.

### Feasibility study

When considering the installation of an artificial grass pitch it is recommended that a feasibility study should be undertaken to identify what you really want to achieve from your pitch; this decision process is a fundamental element in the success of the future pitch and should be carried out together with your specialist consultant. You should challenge yourself to think about the future of your organisation and ensure that you, and your colleagues, share a common vision. Depending on the level of external funding, you may be required by the key funding agency, to have the feasibility study undertaken by an independent body.

At this stage you should ask yourself;

- What are the priorities from your football development plan? Will training be the main use or will you be looking to stage matches on the pitch too?

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- Will any other organisation or club be a partner in the venture?

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- What are the demands for the artificial grass pitch in your area?

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- What will your hiring fee structure be across the various times the facility will be open?

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- Can the proposed hiring fees be afforded by the local community and will this provide sufficiently towards your sinking fund?

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- Have you taken advice from the FAI?

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- What surface is most suitable for your clubs anticipated usage requirements?

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- What similar facilities in the local area can you visit, gather information from and accordingly note what potential mistakes can be avoided in your project?

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- Are you able to commit to the maintenance requirements of the surface? The maintenance of the artificial grass surface is of vital importance if the pitch is to retain acceptable performance and be long lasting. It is therefore essential that this vital aspect of the pitch's management is not overlooked.

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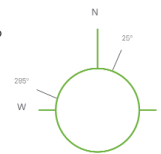
## Where is the best location for a pitch?

The design and cost of a new artificial grass pitch will be greatly influenced by the site on which it is to be built and it should be recognised that some sites are probably not cost effective to develop. Factors that will influence the construction costs include topography, access, drainage, availability of an adequate power supply (for lighting) and most importantly ground conditions.

Before commencing the design of the pitch the design team will require as much information as possible about the site and its surroundings. It is therefore essential that adequate resources are budgeted at an early stage of a project as this greatly reduces the risk of unforeseen problems (and increased costs), during construction or even later. Of greatest importance is an understanding of the ground conditions, as the largest risk of unforeseen problems and additional cost normally occurs here. A specialist geo-technical survey should be undertaken where boreholes or trial pits are excavated to allow a detailed examination of the substrata across the proposed site.

Ideally a pitch should be located:

- close to changing accommodation and other support facilities;
- on relatively flat ground - to reduce construction complexity and costs and to prevent contamination of the playing surface from run-off from adjacent banking, etc;
- so the main playing direction is approximately north (between 285° and 20°) / south, to minimise the effect of a setting sun on the players, although the inability to achieve this orientation need not preclude the construction of a pitch;
- in a sheltered location away from exposed terrain;
- where the installation of services (electricity and drainage) will not be prohibitively expensive;
- where easy access for maintenance and emergency vehicles is available;
- where players, spectators and maintenance equipment do not have to cross natural turf areas, as mud, debris and other contaminants will all contribute to the deterioration of the playing surface;
- away from trees as roots and leaf litter can cause on-going structural and maintenance issues.



## 3.0

# Developing your artificial grass pitch project

## Pitch dimensions

A pitch comprises the area within the field markings and run-offs (the areas beyond the markings which are provided to ensure players do not injure themselves by running into fencing, hoardings and other obstacles). The FAI has established recommended pitch sizes to ensure facilities are suitable for all potential levels of use, categories of competition, etc. These, along with the recommended run-offs, are detailed in Table 1. The run-offs should be surfaced with exactly the same artificial grass surface as the playing area.

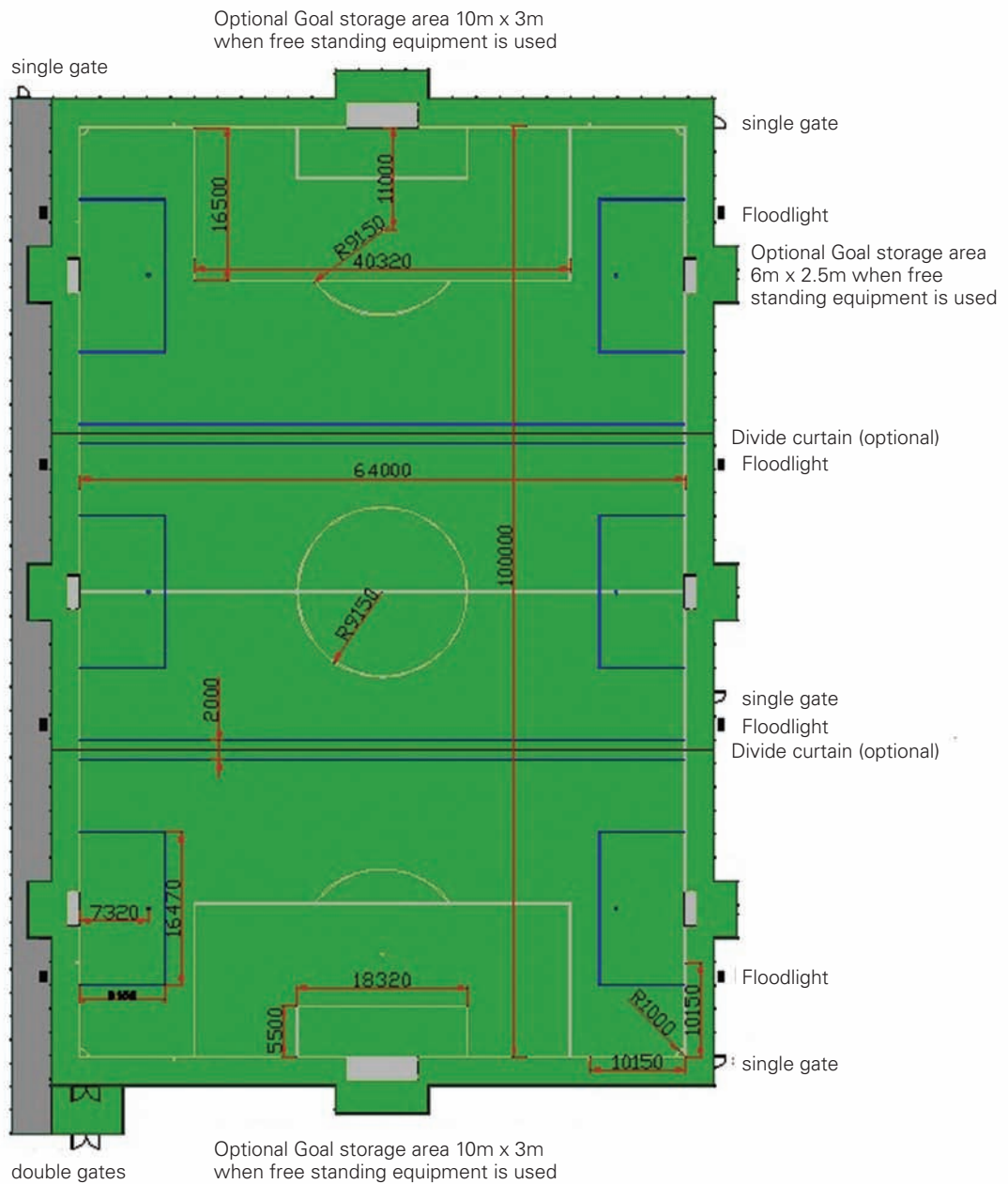
Drawings 02 and 03 show the dimensions and typical layouts of a senior 11 a-side and a small sided training pitch

**Table 1 – recommended pitch sizes**

Game	Age group		Length	Width	Run-off at ends	Run-off at sides	Total area
Eleven-a-side	Senior & Youth (u17-u18)	Min	100m	64m	3m	3m	106m x 70m
		Max	105m	68m	5m	5m	115m x 78m
Eleven-a-side	7-a-side	Min	50m	30m	2m	2m	54m x 34m
		Max	60m	40m	3m	3m	66m x 46m
	5-a-side	Min	25m	15m	2m	2m	29m x 19m
		Max	42m	25m	3m	3m	48m x 31m

**Note:**

- 1 When folding goals are used run-offs should be extended (typically by 200mm) to ensure the stored goals do not encroach onto the run-offs.
- 2 For competitive games the dimensions of a pitch will have to comply with the relevant competition regulations.

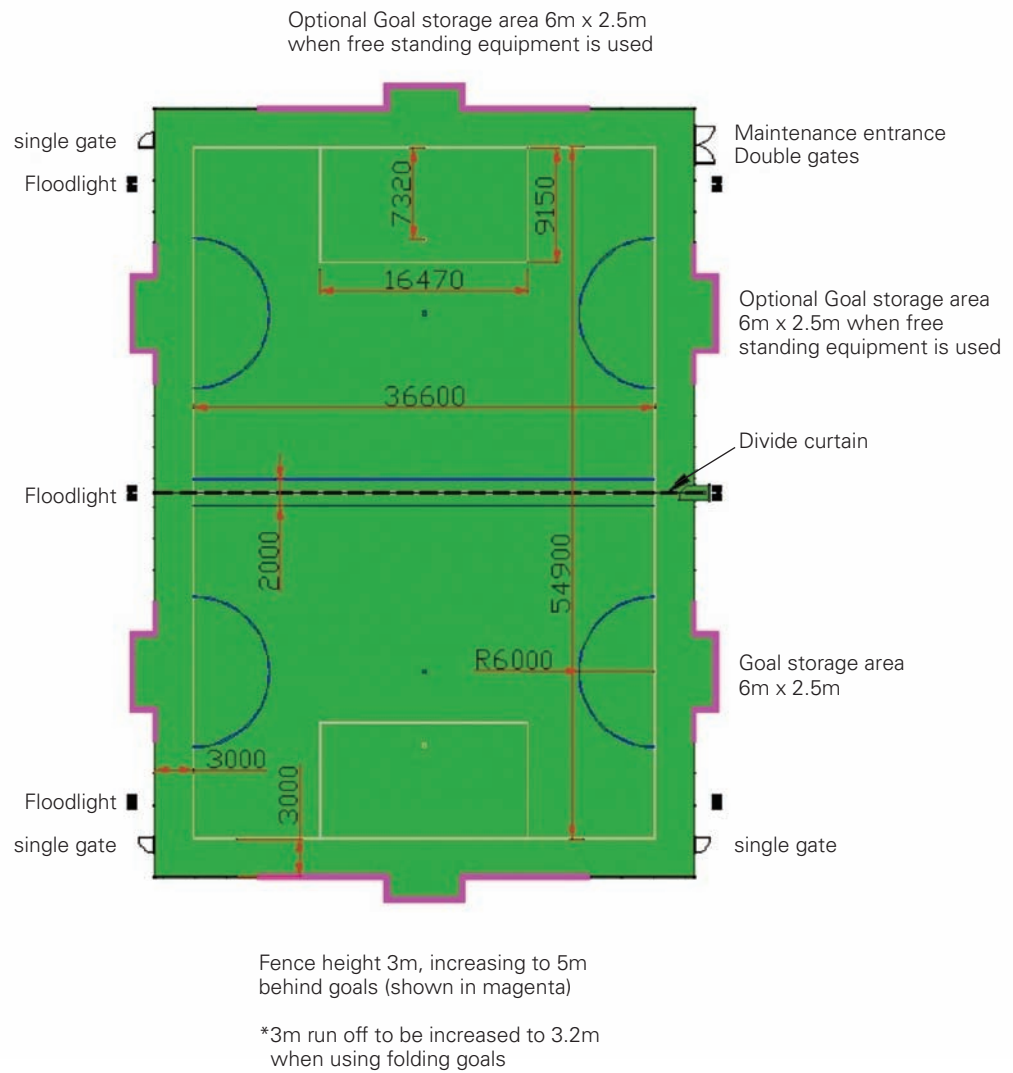


\*3m run off to be increased to 3.2m when using folding goals

**Drawing 02 – dimensions of typical full size community pitch**

# 3.0

## Developing your artificial grass pitch project



**Drawing 03 – dimensions of typical training pitch (playing area 60m x 40m)**

## Pitch layouts/designs

To help obtain the maximum benefit from the pitch it is important it is designed to be as player friendly as possible. The following features have been identified as good practice:

- run-offs in accordance with Table 1
- permanent line markings for the principle sports. If the pitch is to be used for FAI League of Ireland competitions and FAI Senior Cup the only permanent line markings should be those specified in the Football Laws of the Game. All other markings should be applied in removable paint to allow their removal prior to competitive matches.
- provision of folding goals
- provision of recessed areas for goal storage when folding goals are not used.



**Recesses for goal storage, high fencing behind the goal, paved access – all examples of good design**

- eight floodlight columns to allow uniform lighting of individual segments of a pitch when split for cross-pitch community use

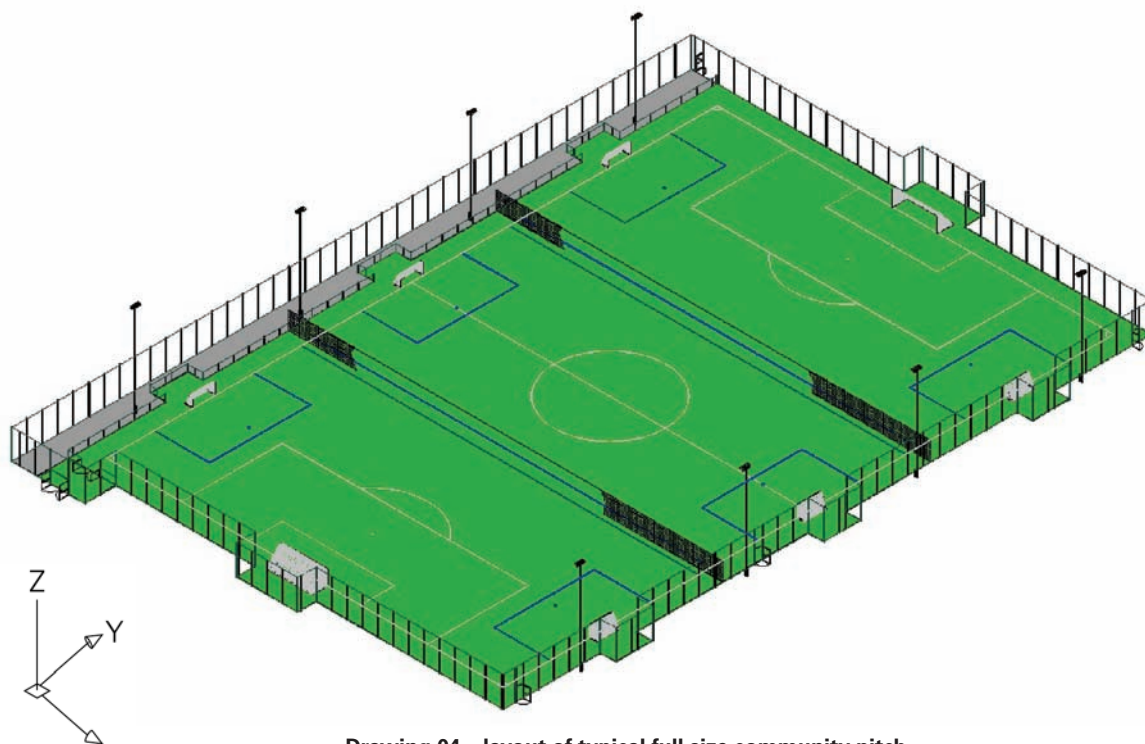
## 3.0

# Developing your artificial grass pitch project

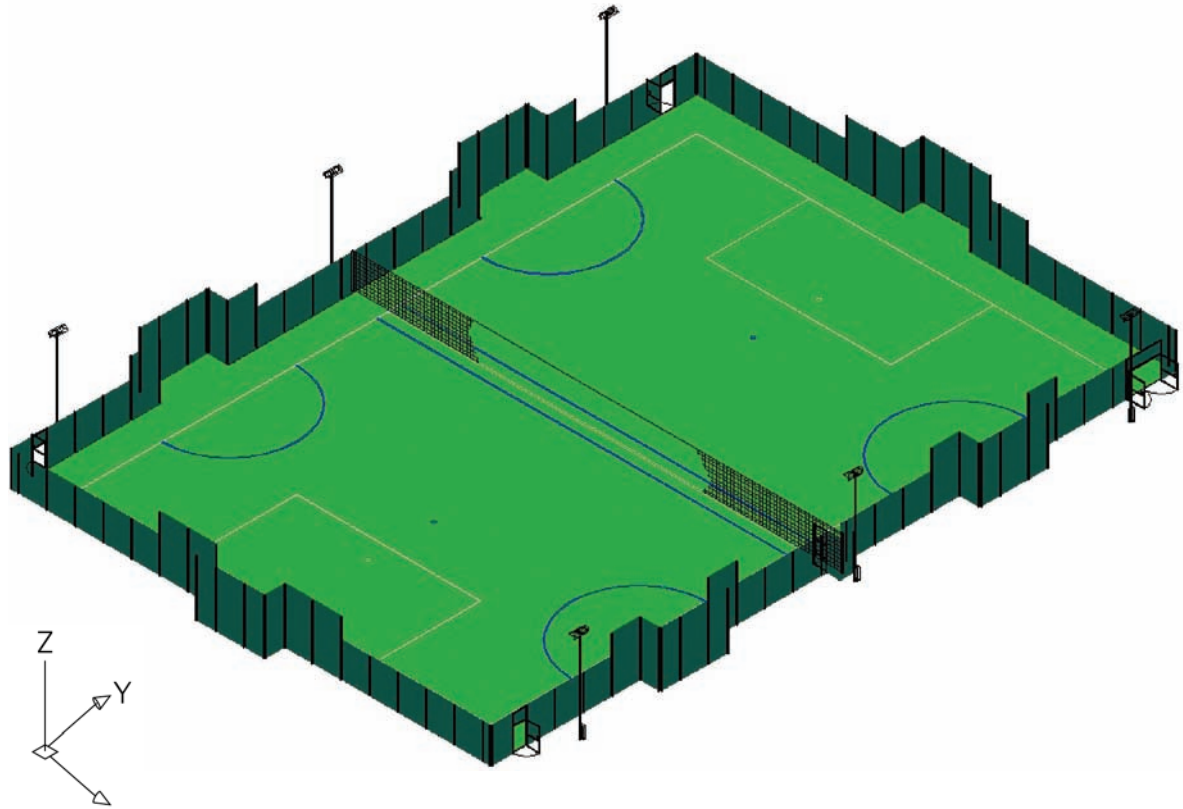
- use of portable division nets to allow the segregation of the pitch to allow cross pitch play. When considering division netting the disadvantage of having wire cables strung across the width of the full size pitch and the potential trip hazard billowing netting can form in windy conditions need to be seriously considered. **If the pitch is to be used for FAI league or cup competitions any wire cables must be fully removed from the pitch and run-offs prior to matches taking place. Failure to comply with this requirement may result in referees cancelling matches.**
- paved access ways for players, spectators and maintenance
- higher fencing (typically 5m) behind goals

For specialist training and competition sites consideration should be given to providing a small warm up area for teams waiting to play; as should provision of a covered spectator facility, separated from the pitch by a low fenced area.

Drawings 04 and 05 show how many of these features may be integrated into a pitch's design.



**Drawing 04 – layout of typical full size community pitch**



**Drawing 05 – layout of typical community training pitch**

The design of the pitch and supporting infrastructure (clubhouse, car parks, footpaths etc) should comply with the Access for People with Disabilities Regulations (2000). Footpaths should be wide enough to permit wheelchair users access to spectator areas and dropped kerbs should be provided at crossing points. Car parking should include a disabled person's hard-standing parking bay, allowing direct pathway access to any support facilities and the pitch.

### Eleven a-side pitches

In 2001 FIFA recognised that if artificial grass surfaces were to be accepted at the highest levels of the game it was necessary for them to replicate the playing qualities of good quality natural turf whilst also ensuring the risk of player injury was not increased. To ensure these objectives were achieved FIFA established its *Quality Concept for Football Turf* (see [www.fifa.com](http://www.fifa.com)). Under constant review as the technology to manufacture and test surfaces evolves the *FIFA Quality Concept for Football Turf* is a comprehensive set of test criteria designed to ensure only the highest quality pitches can achieve and retain the prestigious FIFA Recommended designations.

The *FIFA Quality Concept for Football Turf* has two categories; the **FIFA Two Star** category is the higher grade and is intended for professional clubs wishing to compete on artificial grass surfaces at the highest levels of competition. It is this category that UEFA have adopted for their competitions. The requirements of a FIFA Two Star certified pitch are extremely demanding and are likely to only be retained in the longer term by pitches that have low to moderate use.

The **FIFA One Star** category (2009 edition) is aimed at pitches that are going to be subjected to higher levels of use; it has slightly wider bands of performance and more severe durability requirements than the FIFA Two Star category. It is this category that the FAI has adopted as its minimum standard for all FAI affiliated league and cup competitions.

Note: As companies wishing to benefit from the prestige of having FIFA certification on their pitches have to pay a licensing fee, FIFA have also published the International Artificial Turf Standard (IATS); this is technically equivalent to the FIFA One Star category.

### Training pitches

The *FIFA Quality Concept for Football Turf* is a certification scheme for full size (11 a-side) pitches. Many artificial grass training pitches are not full size but still need to be built to provide durable, safe environments with the desired playing qualities. The FAI therefore recommend that they are constructed with artificial grass surfaces that meet the laboratory test requirements of the FIFA One Star category (2009 edition) and that pitches are independently tested following construction in accordance with IS EN 15330-1. If (as is also recommended) a pitch is periodically retested through its life the maximum ball roll limit after 1500 hours play should be increased to 12m (in line with the FIFA One Star category - 2009 edition).

### Multi-sports pitches

Many artificial grass pitches have to be 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 – GAA

The GAA has developed its own standard for artificial grass pitches (*GAA Performance Standards and Construction for Synthetic Turf Pitches*) and any organisation considering a dual use football and GAA pitch should ensure it fully satisfies FIFA and GAA standards.

## Football – Rugby

The International Rugby Board has also developed its own standard for artificial grass rugby surfaces used for competitive play (*IRB Regulation 22 – Artificial Playing Surfaces*) and if a pitch is intended for football and rugby it should comply with the FIFA One Star Standard and IRB Regulation 22.

## Football – Hockey

Whilst experience shows high level hockey cannot be played successfully on all types of long pile surfaces, certain forms do allow low level and basic hockey training to take place. When hockey is required as a secondary sport the artificial grass surface should satisfy the football requirements of the FIFA standard and the International Hockey Federation's (*FIH Handbook of Performance Requirements for Synthetic Turf Pitches*).

**Table 2 – appropriate standards for intended use**

Intended use	Frequency of use over eight year period	Standard	
FAI League of Ireland clubs wishing to hold UEFA competition matches on their artificial grass pitch	Low to moderate*	FIFA Quality Concept Two Star category**	
FAI League of Ireland competitions and FAI Senior Cup	Moderate to high	Pitches constructed prior to 01/01/2010	FIFA Quality Concept One Star category) / IATS (re-tests to be in accordance with 2009 edition
		Pitches constructed post 01/01/2010	FIFA Quality Concept One Star category / IATS (2009 edition)**
All other FAI affiliated league and cup competitions	High	Pitches constructed prior to 01/01/2010	IS EN 15330-1 (re-test ball roll < 12m)
		Pitches constructed post 01/01/2010	FIFA Quality Concept One Star category (2009 edition) / IATS (2009 edition)***
Community and local competitions	High	Pitches constructed prior to 01/01/2010	IS EN 15330-1 (re-test ball roll < 12m)
		Pitches constructed post 01/01/2010	FIFA Quality Concept One Star category (2009 edition) / IATS (2009 edition)***

\*Typically no more than 30 hours per week

\*\*Plus annual pitch recertification during the period March – July each year

\*\*\*Annual FAI inspection, re-testing every three years in accordance with FIFA recommendations

### Pitch certification

The objectives of the FIFA Quality Concept for Football Turf and FAI guidelines are to ensure pitches are constructed with artificial grass surfaces of the required quality; that the artificial grass surfaces are installed correctly and that they provide satisfactory and safe playing environments throughout their service lives. This is achieved by a three stage process:

Stage 1 - product type approval -The artificial grass surface is subjected to a comprehensive series of laboratory tests that assesses its performance, durability and material qualities of the surfacing system. Only artificial grass surfaces that have been tested and shown to comply with the relevant standard for your scheme should be considered for possible selection when designing an artificial grass pitch.

Stage 2 – initial facility testing and certification - Following installation the pitch is tested to verify the artificial grass surface has been installed correctly and is providing the anticipated levels of performance.

Stage 3 – pitch recertification - The pitch is re-tested throughout its life to demonstrate it is still providing a satisfactory and safe playing environment.

Whilst community use pitches may not be subjected to competition rules, pitch operators still have legal responsibilities to ensure the facilities they provide are fit for purpose and are not a hazard to users; simply assuming your pitch is satisfying the requirements of the FIFA standards is unlikely to be an adequate defence in the event of a personal injury compensation claim as it is well known that the performance of an artificial grass surface will change over its life.

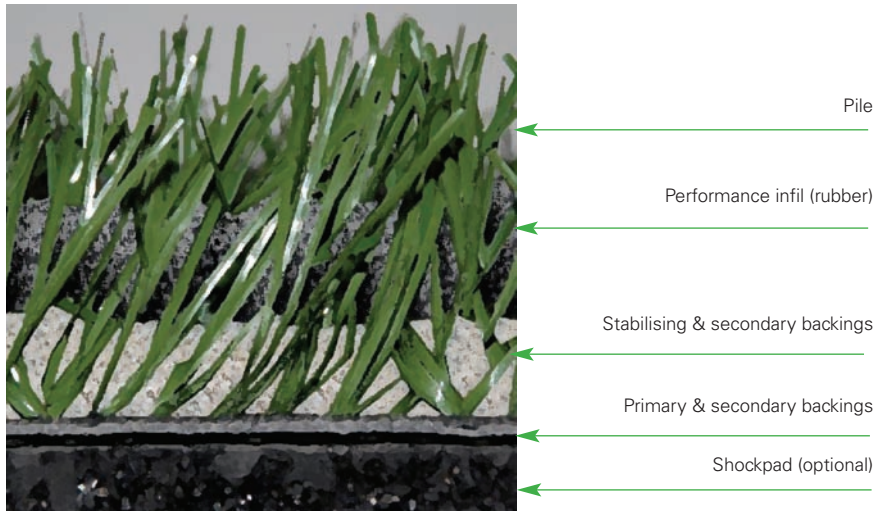
Table 1 summarises the various standards for artificial grass pitches, their intended use and their suitability for different usage patterns artificial grass pitches are exposed to. It is very important that you identify at an early stage of your project the level of certification your proposed pitch will require and ensure that the design of the pitch is able to achieve and retain this, without being compromised by use or inadequate maintenance.

The testing of pitches requires specialist test equipment and expertise and as part of their *FIFA Quality Concept for Football Turf*, FIFA has accredited a number of laboratories that have been independently assessed and shown to achieve the levels of competence and professionalism that is required. Only accredited laboratories can undertake FIFA testing of surfaces and pitches. To ensure total impartiality FIFA also specify that the laboratory appointed to undertake a pitch (field) test should not have been involved in the design, specification or procurement of the field. Details of suitable laboratories may be obtained from the FAI.

## 5.0

# Surfacing options

An artificial grass football surface is made up from a number of components including the artificial grass carpet, infill materials and possibly a shockpad that have been carefully selected so that together they provide the appropriate levels of performance and durability. If any of the components are changed the performance of the surface will be different. Drawing 06 shows the principal elements of a typical artificial grass surface.



**Drawing 06 – principal elements of an artificial grass surface**

## Artificial grass carpet

Almost all forms of artificial grass football surfacing are based on tufted carpets. In this method of construction the carpet pile is formed by looping the pile yarn through a backing material (normally a woven mesh called the primary backing) and cutting it to the required length.

The back of the primary backing is coated with a secondary backing that holds the tufts in place and aids the dimensional and structural stability to the carpet. Holes are normally pierced through the primary and secondary backings to aid drainage.

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

**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 yarns are formed into the pile or tufts of the playing surface by one of two manufacturing processes.

**Fibrillated yarns** were originally developed for the earlier forms of sand filled synthetic 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, however, that the abrasive effects of play can cause the pile yarn to split into increasing fine fibrils making it increasingly hard for the surface to provide the playing characteristics required for football.

Fibrillated yarns do provide good stabilisation of the rubber infill, preventing excessive movement and dispersion, and are therefore considered by many to be more suitable for pitches in which contact sports such as rugby are also being played.



**Monofilament yarns** are increasingly being used by manufacturers 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. Binding the individual monofilament strands into a carpet's backing has been a source of weakness in some forms of monofilament carpets and it is important that the carpet manufacturer can demonstrate adequate tuft bind properties for their carpets.

As monofilament pile yarns are manufactured 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. Whilst most pile yarns are straight it is also possible to texturise the yarn during manufacturing so it develops a degree of curl. This can aid infill stability and enhance the playing characteristics for secondary sports such as hockey.



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**Pile length** is the length of the carpet's 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). The height of carpet piles range from 40mm to in-excess of 60mm. Shorter pile carpets will normally be laid on some form of shock pad to ensure the playing surface provides the required dynamic response whilst longer pile surfaces will have greater depths of infill materials that are designed to provide the required levels of performance.

**Dtex** is the ratio of mass of the pile yarn to its length (1 dtex = 1g per 10,000m). Carpets with higher dtex values will have greater fibre content than carpets with similar stitch rates and pile heights but lower dtex values.

**Pile thickness** is measured in microns and is normally between 100 and 300 microns.

**Pile weight** or face weight is the weight of yarn forming the carpet pile; typically ranging from 750g/m<sup>2</sup> to in-excess of 1800 g/m<sup>2</sup>. When comparing carpets of similar pile heights those with higher pile weights will normally be of a higher quality, providing greater infill stability (less dispersion) and have longer service lives, although carpets with very high stitch rates can result in carpets having less desirable playing characteristics due to the high frictional properties of the surface.

**Primary backing** is the backing cloth into which the pile is tufted; it is normally manufactured from polypropylene. A good primary backing needs to resist fraying, absorb the secondary coatings, be weather resistant, and have high dimensional stability to ensure the finished carpet will not creep or stretch. Some higher quality carpets will also include a reinforcing layer or scrim that is designed to provide additional strength and integrity to the primary and secondary backings – particularly important when sports such as rugby are to be played on a surface or on very high intensity use areas (five-a-side pitches, etc).

**Secondary backing** is a coating (latex or polyurethane) applied to the primary backing to hold the tufts in place and to increase the dimensional stability of the finished carpet. Coating weights are typically between 600g/m<sup>2</sup> and 1,300 g/m<sup>2</sup>. In some products the coatings are applied only to the individual tuft rows, leaving the areas between the tufts uncoated for drainage; in others, the entire backing is coated and the carpet is perforated for drainage. If perforated, the size, number and placement of perforations will vary from product to product. If carpet is to be used indoors and drainage is unnecessary, it may be ordered without perforations to increase its strength.

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 the 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.

## 5.0

## Surfacing options



**Carpet installation process.**

When specifying the type of line markings required remember that **any pitch that is to be used in FAI Competitions should have all markings other than those specified in the Laws of the Game applied in paint** to allow their removal prior to competition matches.

The Laws of Association Football allow lines to be up to 125mm wide. To ensure adequate adhesion of in-laid lines it is recommended that lines on artificial grass pitches be between 100mm and 125mm wide. All lines should be of the same width. When a pitch is to be marked with more than one set of markings (for cross pitch play, other sports etc) care needs to be taken to ensure small sections of 'green carpet' are not left between adjacent lines, as the small area of contact between the carpet and adhesive may increase the risk of joints failing prematurely.

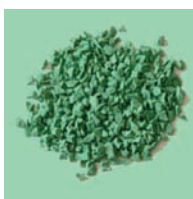
### Infill materials

The majority of artificial grass football surfaces are filled with particulate materials. These are normally either granulated rubber polymers or mixes of rubber and sand, although certain companies are now starting to also offer organic infills.



SBR granulate

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.



TPV granulate

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. The granules may be produced using ambient or cryogenic production processes; ambient granulating involves passing the rubber through a series of rotating knives till it is cut to the required size, whilst cryogenic granulate is produced by freezing and shattering the rubber to produce granules of the required size. Both forms of production have been shown to produce infills with good performance.

As the development of artificial grass surfaces progresses manufacturers are engineering infills materials and profiles to enhance performance. A range of materials including Thermo Plastic Elastomers (TPE), Vulcanised Thermo Plastics (TPV) and Ethylene Propylene Terpolymer (EPDM) granules are now being used. As they are specifically manufactured from virgin stock material they may need to be granulated, extruded or moulded to have the required shape, size and colour. The use of these materials has increased after questions were raised about the potential toxicological and environmental impact of filling artificial grass surfaces with recycled tyres. Subsequent international studies and literature reviews of published research, including one by FIFA, have, however, concluded that the research does not substantiate the claims.

One major advantage of the new infill materials is that 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.

## Shockpads

A shockpad or elastic layer will contribute and help maintain the dynamic properties (ball rebound, shock absorption and vertical deformation characteristics) of the playing surface. They take many forms including polyurethane bound rubber mixes that are mixed and laid with a paving machine (often described as insitu laid shockpads) 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 the market develops manufacturers are engineering enhanced properties into their shockpads and this is starting to allow innovative design solutions for the artificial grass playing surfaces and the bases on which the playing surfaces are built. The incorporation of shockpads into the surfacing system also allows the use of shorter pile carpets with less infill, which can aid the maintenance requirements of the playing surface.

## 5.0

## Surfacing options



**Insitu rubber pad being laid on macadam base.**



**Preformed panel pad being laid on unbound base**

Experience has shown that the increased cost of incorporating a shockpad into the artificial grass playing surface can be offset by the retention of the required playing characteristics for a longer period of time. Higher quality shockpads can also be expected to perform for the life of two artificial grass carpets making the initial capital outlay even easier to justify.



### Types of sub-base

The sub-base of the pitch 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 most commonly used forms of sub-base for artificial grass football pitches are constructed from unbound graded aggregates that are designed to provide an inert, stable and free draining sub-base for the artificial grass surface; occasionally the unbound base is constructed from carefully selected aggregates that are loose-laid to aid the dynamic properties of the playing surface.

The correct selection and installation of the aggregates being critical if these objectives are to be achieved. 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 and in view of this risk some contractors promote the use of bound or engineered bases of porous (open textured) bituminous macadam as commonly used on hockey and multi-sports pitches.



**Construction of unbound base**



**Construction of bound (macadam) base**

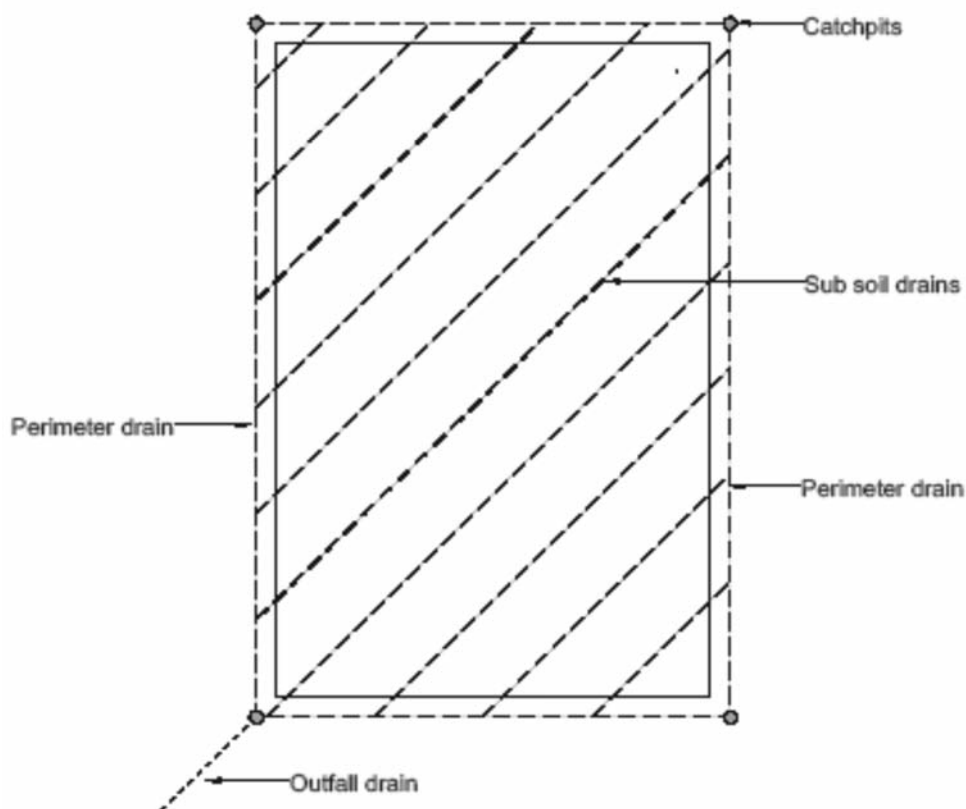
Macadam bases may be formed in either one or two layers. Two-layer constructions were originally introduced to ensure that the construction complied with the required tolerance for surface regularity, particularly for hockey. Nowadays the use of laser-controlled paving machines (on full size pitches) to install the top layer of foundation and the macadam means that the tolerances can now be achieved with a single layer of macadam, although the structural benefits of two layers are still worthy of consideration for difficult sites. As the rigidity of the engineered base puts greater demands on the dynamic performance of the artificial grass surfacing it means the benefits of installing a shockpad greatly increase.

## Drainage

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 5m 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.

Drawing 07 shows the layout of a typical sub-pitch drainage system.



**Drawing 07 – typical sub-pitch drainage system**

## 7.0

## Fencing

Perimeter fencing is often erected around a pitch 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 or be supplemented by ball stop netting 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.

A minimum of 5mm is the typical gauge for the security fencing. 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 footballs 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.



**Gates should open outwards – double gates should be provided for access by maintenance plant and emergency vehicle**

Where appropriate, particularly on small-sided football pitches, rebound walls or fences can be installed. These are normally 1.2m high and constructed from a variety of materials (normally exterior grade timber panels) that are stained or painted to improve their appearance. A number of companies also offer rebound fencing formed from weld mesh panels. The use of such fencing is particularly desirable on multiple blocks of small pitches as it allows supervision and viewing of the total area.



**Weld mesh fencing with dense gauge mesh along lower section**

The use of dense weld-mesh panels is also worthy of consideration behind and alongside goals etc (on pitches where rebound walls are not required) as they offer greater resistance to the repeated impacts of balls.



In order to maximise the use of full size community pitches, division netting can be installed to split the main pitch into two or three separate areas of activity. The netting is normally suspended from tensioned steel cables that are hung across the pitch, from fence to fence and supported with portable intermediate posts. When considering the installation of division netting the ability to safely remove and store the netting and cables when the full pitch is being used needs to be taken into account.



To minimise the risk of players colliding with division nets, play lines can be installed to define the sides of cross field pitches. **However, these should not be marked onto pitches being used for FAI competitions.**

## 8.0

# Goals and sports equipment

Incorrectly used goals can lead to serious injury or even death so goal post safety should always be of paramount importance to designers, builders, operators and users of football pitches. **Only goals that fully comply with IS EN 748 (full size goals) or IS 356 (Youth Football, Futsal, Mini-soccer and Small-Sided Football) should be used.** The procurement, installation, maintenance, storage and inspection of all types of goals should be undertaken in accordance with IS 357.

When selecting goals and other sports equipment, consideration must be given to the precise uses of the pitch, so that changes in activity can take place with the minimum of effort and inconvenience. Goals can be freestanding, and therefore easily moved, although it is important to make proper provision for their storage when not in use. **The run-offs of the pitch should not be used for this purpose.**

To comply with Irish Standards all freestanding goals must be fitted with supports, anchors or weights to stop them toppling over, irrespective of size or type. There are a number of options for anchoring goals including:

- folding goals – recommended for full size pitches where cross field play is also envisaged
- use of integral weighted goals – recommended for small-sided goals and full size goals that are used during training in different parts of a pitch

Corner flags, etc can either be free standing or socketed depending on the intended usage patterns of the pitch.



**Small sided football and full size folding goals**

## 8.0

## Goals and sports equipment



**Small sided goal with integral weights**

## 9.0

# 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.



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. A club should also consider the requirements they will need to satisfy if promoted to a higher division. For further information please refer to the FAI's '*Guidance notes on the installation and maintenance of floodlights*'.

Where no requirements are stated, the minimum levels of performance should be in accordance with the minimum maintained levels recommended in the FAI's, '*Guidance notes on the installation and maintenance of floodlights*'. They are as follows in Table 3.

**Table 3 - FAI competition and training lighting recommendations minimum maintained luminance levels (lux)**

Televised Events		Non Televised Events		
UEFA (Preliminary Rounds)	League of Ireland & Competitive non-senior Internationals	Regional Development Centres & non senior international friendlies	Senior, intermediate, junior and schoolboy Football	Training
1200 – 1400 ( $E_v$ )*	800 ( $E_v$ )*	500 ( $E_h$ )	250 ( $E_h$ )	150 ( $E_h$ )

$E_v$  = Vertical Lumination

$E_h$  = Horizontal Lumination

To minimise running costs the lighting system should allow part illumination of the pitch (for cross pitch small-sided football) and a lower level of lighting for training etc, as given in Table 4.

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

**Table 4 – Floodlighting for training and cross pitch play**

<b>Use</b>	<b>Property</b>	<b>Standard</b>
Cross field play and training	Maintained average illuminance	120 lux

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 an eleven-a-side pitch is likely to be in the order of 35 to 40 kilowatts.

The use of programmable controllers to turn off the lights at a programmed time is desirable when the planning approval for the scheme specifies a cut-off time. Where this system of control is used at least one luminaire on each operational portion of the pitch should remain on for a five minutes period following cut-off to allow safe egress from the pitch. A visual warning to alert players that the cut-off time is approaching is also desirable. Flashing beacons mounted to the floodlight columns are most commonly used to achieve this. To enable the maintenance of the lighting system to be related to 'burning hours' it is recommended that an 'hours-run' counter be included in the lighting systems control / monitoring equipment.

The provision of weatherproof power sockets mounted to one or more floodlight columns is also desirable. Sockets allow the easy use of ancillary temporary public address systems and cleaning equipment, etc.

When submitting a planning application for floodlights the planning authority is likely to require a lighting spillage drawing showing the levels of light pollution and their impact on the surrounding neighbourhood. Lighting engineers or specialist lighting contractors can provide such plots.



The key to successful procurement is ensuring that a fair and competitive process is undertaken. This should also ensure the process meets national and European legislation.

Key in any consideration of procurement methodology is a proper understanding of the governing guidelines or directives within which the choice of procurement route is exercised. This is particularly important in the public sector or where grants are sourced in the public sector.

## Methods of procurement

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 and this is used by the contractor to develop their detailed design proposals. The FAI's Guideline Template - Design Brief for Artificial Turf Pitches has been prepared to form the basis of such a document.

With a design brief completed, the procurement process moves to the selection of tenderers, putting the scheme out to tender, resolving tender queries, evaluating and reporting on tenders and making recommendations.

There are two evaluation methods commonly used today; Lowest price and "MEAT" (Most economically advantageous tender). Where the 'lowest price method' is used it is imperative that financial data is considered in conjunction with the technical merits of each bid. The "MEAT" method takes a range of key parameters into account and weights each parameter according to its importance to the project and the final outcome. The basis of the "MEAT" analysis must be published in the tender documentation and is also designed to result in the selection of a contractor on a fair and competitive basis. Price will remain a key measure and ensuring a bid's technical merits are taken into account remains central to the final analysis. A "MEAT" analysis might include an examination of the following areas:

- Financial
- Technical
- Quality
- Commercial

Throughout this process specialised professional advice is imperative to author and/or review the design brief, finalise tender documentation, advise on tender queries, evaluation and reporting, generally handling the process through to recommendation and selection.

## Contractors

As a result of the expansion in the market for artificial grass surfaces 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.

Quotations should be sought from specialist artificial turf contractors that have a proven record and relevant experience of installing artificial turf pitches. It is strongly recommended that clients inspect similar projects undertaken by any contractors being considered. It is also important to establish the contractor's relationship with the manufacturer of the surfacing system being offered; as longer term relationships bring the benefits of brand loyalty. An up to date list of contractors is available from the FAI.

## Quality monitoring

As the artificial grass pitch is required to have the right playing characteristics for the game, be safe to use and at the same time 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.



**Poorly made joints can create hazards to players. A comprehensive programme of quality monitoring helps eliminate poor workmanship**



**An image of a carpet undergoing a joints strength test.**

Site inspections and materials sampling should be undertaken throughout construction with particular attention being paid to the completion of each key stage. The inspections are normally undertaken by a specialist sports surface engineer or competent professional. A typical schedule of inspections would include:

Stage of construction	Inspected for:
Formation	<ul style="list-style-type: none"> <li>• profile and gradients</li> <li>• adequate compaction</li> </ul>
Drainage system	<ul style="list-style-type: none"> <li>• channel spacings and falls</li> <li>• permeability of infill</li> </ul>
Edgings	<ul style="list-style-type: none"> <li>• dimensions</li> <li>• design levels</li> <li>• haunching and line</li> </ul>
Base	<ul style="list-style-type: none"> <li>• construction depth</li> <li>• grade</li> <li>• compaction</li> <li>• permeability</li> <li>• surface regularity</li> </ul>
Shockpad	<ul style="list-style-type: none"> <li>• construction depth</li> <li>• permeability</li> <li>• surface regularity</li> <li>• tensile strength – laboratory test</li> <li>• shock absorption</li> </ul>
Artificial grass surface	<ul style="list-style-type: none"> <li>• joints</li> <li>• joint strength – laboratory test</li> <li>• infill application</li> <li>• carpet characteristics – laboratory tests</li> <li>• infill characteristics – laboratory tests</li> </ul>

The maintenance of the artificial grass surface is of vital importance if the pitch is to retain acceptable performance over its life time. The surface's guarantee will also usually be conditional on the recommended maintenance requirements being carried out with reasonable diligence. **It is essential that this vital aspect of the pitch's management is not overlooked.**

Prior to selecting a surface, the manufacturer's advice must be sought on the maintenance equipment to be used in conjunction with the artificial grass pitch and how regularly the maintenance works should be carried out given the programme of use identified within the initial feasibility study. 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/perform 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 (quarterly) inspection service as part of their after-sales. This should be welcomed and encouraged so any shortcomings in maintenance are identified before they have a detrimental effect on the playing surface.

## Recommended footwear

The advice of carpet manufacturers and yarn suppliers is that boots with aluminium studs should NOT be used on artificial grass pitches; failure to follow this advice may invalidate a manufacturer's warranty. Plastic screw-in and moulded studs are normally considered acceptable, although their ability to provide satisfactory traction and grip varies and research is ongoing as to what forms of studs are the most suitable for artificial grass surfaces, with the development of new profiles being envisaged.

The use of flat sole footwear will accelerate the deterioration of the carpet.

*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 a faster surface and more fibrillation and matting of the carpet's pile with a deterioration in performance
- The localised topping up (penalty spot, centre spot, corner kick areas etc) of fill 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.

The **frequency of such maintenance will vary and needs to be adjusted to reflect the hours of use but is likely to be at least weekly.** Such maintenance is undertaken using specialist plant and is likely to take around two hours per session for a full size pitch.



**Ride-on brushing system with oscillating brushes**

The provision of litter-bins at the entrance to the pitch and other strategic positions around the pitch is advisable as this reduces the amount of litter dropped on the pitch and reduces the chances of contamination of the surface. Likewise boot cleaning brushes should always be sited at all entrances, particularly those used by players retrieving balls from adjacent grass areas / pitches.



**Drag mat and triangular brush**

## 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 – small sided football areas with intensive use having the greatest demand. 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.



**Drag mat and triangular brush**



## 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. Based on 2008 Institute of Groundsmanship (IOG) recommended salary rates and an estimate of the likely levels of maintenance required for a floodlit community / school eleven-a-side pitch, it is suggested that a budget of €11,500 to €14,000 per annum be allowed for regular and routine periodic maintenance. Whilst small areas will take less time to maintain, the concentration of play may require maintenance at a greater frequency.

Rejuvenation processes are not cheap (up to €45,000 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, together with a record of the estimated usage for the period since the last entry. 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.

If the pitch contractor provides a maintenance register, its completion is likely to be a condition of the warranty offered by the pitch contractor and artificial grass surface manufacturer. Equally some external funding agencies may require on-going completion of the register as a condition of funding.

## Floodlighting

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 'aiming angles' of the lamps. Many floodlighting contractors now offer annual maintenance contracts and these are worthy of consideration.

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 expectancy 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 €190,000 and €240,000 plus VAT is realistic. Based on 5% inflation a sum of €240,000 will equate to €372,400 in 10 years time. To achieve this figure, and assuming a compound interest rate of 5%, a monthly contribution of €2,443 (€29,605 per annum) is required every month from the first month of the pitch's life.

To also ensure €40,000 is available for rejuvenation in year five a further sum of €750 per month (€8,780 per annum) is required to be invested in a sinking fund. Whilst the cost of resurfacing smaller sized pitches will be less, the more intensive wear patterns are likely to mean replacement of the surface is required sooner, thereby reducing the length of time available to accrue the required replacement funds.

## Artificial grass surfaces

FIFA Quality Concept for Football Turf Handbook of Requirements  
[www.fifa.com](http://www.fifa.com)

FIFA guides to Football Turf developments  
[www.fifa.com/aboutfifa/developing/pitchequipment/footballturf/development](http://www.fifa.com/aboutfifa/developing/pitchequipment/footballturf/development)

IS EN 15330-1: Surfaces for sports areas – synthetic turf and needle punched surfaces primarily intended for outdoor use – Part 1 Specification for synthetic turf surfaces.  
[www.nasi.ie](http://www.nasi.ie)

FAI's, 'Guidance notes on managing the development of facilities'  
[www.fai.ie](http://www.fai.ie)

Guide to the Construction and Maintenance of Synthetic Turf Sports Pitches  
[www.sapca.org.uk](http://www.sapca.org.uk)

## Pitch fencing

Guide to the Construction and Maintenance of Fencing Systems for Sports Facilities  
[www.sapca.org.uk](http://www.sapca.org.uk)

## Goals

IS 357: Football Goals – Code of Practice for their procurement, installation, maintenance, storage and inspection  
[www.nasi.ie](http://www.nasi.ie)

Goalpost Ireland  
[www.goalpostireland.ie](http://www.goalpostireland.ie)

## Floodlighting

FAI's, 'Guidance notes on the installation and maintenance of floodlights'  
[www.fai.ie](http://www.fai.ie)

FIFA Guide to Artificial Lighting of Football Pitches  
[www.fifa.com](http://www.fifa.com)

## Maintenance of artificial grass surfaces

Guide to the Maintenance of Synthetic Sports Surfaces  
[www.sapca.org.uk](http://www.sapca.org.uk)

## Trade associations

European Synthetic Turf Organisation (ESTO)  
([www.eu-syntheticurf.org](http://www.eu-syntheticurf.org))

International Association of Sports Surface Sciences  
[www.isss-sportssurfacescience.org](http://www.isss-sportssurfacescience.org)

Institute of Groundsmanship  
[www.iog.org](http://www.iog.org)

UK Sport and Play Construction Association  
[www.sapca.org.uk](http://www.sapca.org.uk)

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