Artificial Grass For Sport

Part 3 of 8

Wembley Primary School, Yarraville

Ivanhoe Grammar School - Activity specific carpets used

1.7 Multi-Use and Multi Sports Areas

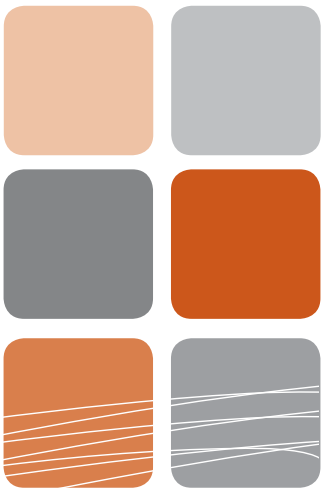
Although artificial grass pitches come in a myriad of forms, no one type of surface is suited to all sports.

As is defined in Section 2 (Planning) there are several early planning considerations that are critical to the success of any sports facility, such as determining which sports are to be provided for, the standards of playing performance needed, the degree of intensity of use and the intended maintained lifespan of the area in question.

If there is a priority sport(s) for an intended facility, then that sport(s) requirements should dictate the carpet system choice. Sand-based pitches have generally been the choice where a variety of sports are to be played (they are sturdy and durable), particularly in a school situation; but third generation pitches with their longer pile and soft infill provide a potentially more suitable field type where ball bounce needs to be restrained and where player surface impact (heavy falling) is more likely. They also allow potentially more community use after school hours.

Kunyung Primary School, Mt. Eliza - Before

Kunyung Primary School, Mt. Eliza - After



The table below outlines the varieties of artificial grass systems available and their suitability to different sports. It illustrates the breadth of playing characteristics catered for by different types of artificial grass.

Type of Surface		Sport/Activity										
		Athletics Training	Basketball	Football		Hockey		Netball	Rugby (Union & League)		Tennis	
				Full Size	Small Sided	Full Size	Training		Full Size	Tag	Full Size	Mini
Type 5: Synthetic Turf	Non Filled (Shockpad Optional)	3	3	3	3	1	1	3	4	2	3	4
	Sand filled	2	3	2	2	2	2	3	4	2	3	4
	Sand filled (with shockpad)	2	3	3	3	3	2	3	4	2	2	2
	Sand dressed (with shockpad)	2	3	3	3	1	2	3	4	2	3	3
	Needle Punch	2	2	2	2	2	2	2	4	2	3	3
	Needle Punch (with shockpad)	2	2	3	3	3	2	2	4	2	2	2
	Longpile (shockpad optional)	3	4	1	1	3	2	4	1	1	4	4

Key:	1 = Recommended Surface	2 = Suitable Surface	3 = May be used with caution but not recommended	4 = Surface not considered suitable

Table 1: Suitability of Artificial Grass for Sport
Table supplied by the Sports and Play Construction Association (UK)

Notes:

1. The above table makes reference to existing, proven synthetic turf types. New types may challenge the aforementioned classifications of surface suitability.
2. This is a UK table. Check with Australian sporting parent bodies for advice regarding Australian specifications.
3. The 'Football' referred to above is of the soccer variety.
4. Whilst only one long-pile reference is made above, long-pile carpets range from 35-40mm (Australian rules football, cricket, low-level hockey and soccer), to 55-60mm height (preferred soccer surface), to 65mm (often with a shock pad as well) for rugby. New 85mm carpets have been developed for athletics field games (shot put, javelin, etc).

As well as the issue of the surface type and its applicability to different sports, multi-sports use of a synthetic turf pitch also requires skilful planning of ancillary facilities. An example of this might be the floodlighting of a hockey and tennis shared pitch:

- What type of lights are applicable for both sports?
- What height should the towers be?
- Where should the towers be located?
- With on-field or off-field fittings such as goal posts and court nets – how easily are these elements changed over?
- Where can they be moved that is safe and secure?

With some of these issues the answer is locked-in to the needs of the primary sporting tenant, but in many cases, better, workable compromises can be developed in the early planning/design phases.

The following publications provide in-depth information and will help stimulate thinking about multi-sport and multi-use areas:

- Football Foundation: Artificial Grass Pitches (2008).
  Website: www.thefa.com
- Sports England/Sports and Play Construction Association: 'A Guide to the Design, Specification and Construction of Multi-Use Games Areas (MUGAs) Including Multi-Sport Synthetic Turf Pitches (STPs). Part I.'
  Website:
  www.sportengland.org

A 'Compromise' Carpet System?

The table shown below is taken from the University of Ballarat publication 'Development of Standards for the Use of Artificial Turf for Australian Football and Cricket' (2009). It provides a comparative analysis of the key characteristics required for artificial grass fields to be approved for Australian rules football, soccer and rugby. The table shows the compatibility of each sport's specified turf, with the areas highlighted in yellow indicating the high degree of similarity in the AFL/Cricket Australia and soccer specifications. The carpet system being installed at J. J. Holland Reserve in Kensington (yet to be tested onsite at time of publication, no rubber infill) may well meet all of these requirements.

Characteristic	AFL/CA Community Level Standards	FIFA 1 Star Standards	IRB Reg 22 (Applies to Nat/ Int'nal Levels)	FIFA 2 Star (Applies to Nat/ Int'nal Levels)
Critical Fall Height	1.2m	-	1.0m	-
Hardness	65G – 120G	-	-	-
Vertical Deformation	-	4 – 9mm	4 – 10mm	4mm – 8mm
Energy Restitution	-	55% - 70%	30% - 50%	60% - 70%
Abrasion – change in friction force	50%	30%	-	30%
Friction – coefficient of friction	0.35 – 0.75	0.35 – 0.75	-	0.35 – 0.75
Traction football studs	25Nm – 50Nm	25Nm – 50Nm	30Nm – 50Nm	30Nm – 45Nm
Traction cricket spikes	15Nm – 25Nm	-	-	-
Traction cricket studs	7Nm – 15Nm	-	-	-
Ball Roll Calibrated Ball	4m – 12m	4m – 10m	-	4m – 8m
Ball Roll cricket	4m – 15m	-	-	-
Vert. Ball rebound calibrated ball	0.6m – 1.0m	0.6m – 1.0m	30% - 50%	0.6m – 0.85m
Vert. Ball rebound (cric)	0.1m – 0.4m	-	-	-
Angled Ball rebound calibrated ball	45% - 70%	45% - 70%	50% - 70%	45% - 60%
Angled ball rebound cricket	35% - 60%	-	-	-

Table 2: Comparative listings - Key sporting standards

Kuranjang Reserve, Melton

1.8 Injuries and Artificial Grass

1.8.1 Introduction

Many sections of this guide cover issues of direct relevance to player safety; be that through the planning phase (correct assessment of likely facility use), the design phase (choosing the right artificial grass option), the project delivery phase (getting a quality, approved playing surface), the management and operation of the facility (safe use practices) or the ongoing maintenance phase (maintaining optimum surface performance, including user grip).

The information below relates to injury prevention (reference is made to a range of relevant issues elsewhere in this guide) and to injury research. Readers are encouraged to explore those other sections of the Guide in order to maximise the ability to plan, design and construct a safe, enjoyable and durable artificial grass sporting environment.

1.8.2 Injury prevention

In Section 3.4 of this guide (Artificial Grass Selection) several key selection criteria are recommended, many of which are directly relevant to injury prevention. Key issues/subject areas (with index references provided) include:

- What sports will be played on the proposed sporting area? (Section 2.)
- What are the required sports surface performance criteria for each of those activities? (Section 1.6)
- What type of artificial grass system best matches these requirements? (Section 1.5 and 1.6)
- How can it be maintained at that level for the longest possible period of time? (Section 6.0)

Other parts of the Guide that have direct relevance to injury prevention include:

- Section 2.3.3 (Risk Management Plans), and items in section 3 (Design). Issues such as: Floodlighting (Section 3.9), Shoe Cleaning (Section 3.12), Pitch Layout/Linemarking (Section 3.13), Safe Design (Section 3.22) and Footpaths (Sections 3.18, 3.20).

1.8.3 Injury research

A recent feasibility study[7] aptly states: *'Many sports and individuals have pre-conceived views on the use of artificial grass sporting surfaces which may not reflect current reality in terms of the technology, the playability or the safety of those surfaces. Although third generation surfaces are still relatively new, there is a range of research available that provides us with some key observations to consider.'*

Some of those issues are:

(i) Playability

FIFA commissioned 'Pro-Zone Studies'[8] to analyse soccer match playing patterns over the past decade. Of particular relevance is the review (Technical Study 4) undertaken on the 2007 U-20 World Cup where the playing patterns of 52 matches (29 played on artificial grass, 23 played on natural turf pitches) were analysed. The conclusions documented were:

- Artificial grass does not dramatically affect the pattern of the game.
- There were no differences in the number of possession transactions.
- There was a higher frequency of attempted passes.

(ii) Comparative analysis: Injuries occurring on artificial grass and natural turf pitches.

- FIFA's Medical Assessment and Research Centre (F-MARC) compared injuries that occurred at the FIFA U-17 tournament in Peru (2005) with injuries sustained at the previous FIFA U-17 tournament which was played on natural turf. The research[9] showed that there was very little difference in the incidence, nature nor cause of injuries observed during games played on artificial grass compared with those on natural turf.
- A study reported in the British Journal of Medicine (2006)[10] showed that there was no evidence of greater injury risk when soccer was played on either artificial grass or natural turf in the Swedish Premier League.

[7] Artificial Grass Fact File' prepared by the Smart Connection Company for the Boroondara City Council (2009).

[8] Validation of Pro-zone: A New Video-based Performance Analysis System (2006). International Journal of Performance Analysis in Sport – 6, p108-119

[9] http://www.fifa.com/mm/document/afdeveloping/pitchequip/turf_roots_1_11166.pdf

[10] 'Risk of Injury' Ekstrand, Timpka, Hagglund – British Journal of Sports Medicine Vol 40 (12)

(iii) Related matters

a) Infill spray:

While still under a watching brief in several countries, completed studies generally show that infill rubber does not pose a serious health risk:

- Allergies: Some people can have an allergic reaction to latex which is sometimes found in car tyres (the recycling source of much infill rubber granules). However, it is a small percentage of the material mix in tyres.
- Most latex is found in rubber gloves and balloons – and the impact that it has on people who are allergic is minor.
- Infill ingestion: Given that there can be a light spray of infill rubber granules when either an Australian rules football, cricket ball or player land on a third generation 'dressed' pitch, observation will need to continue regarding any incidences of infill particles getting into players eyes, inhaled into the respiratory tract or ingested through the mouth.

American research published in May 2009 (study conducted by the New York State Department of Health)[11] advises that artificial grass fields using rubber granule infill are neither a significant source of exposure to respirable particulate matter, nor, from an analysis of ambient air sampling, was there any concern raised about cancer/non-cancer health effects for people who use or visit the fields.

Top Tip

Current international and local studies have identified that health risks resulting from contact with rubber crumb are low and/or unlikely.

b) Biological activity:

The feasibility study referred to earlier in this section states that there is less biological activity in an artificial grass system, and that pathogens are not broken down as easily as in a natural turf system. Therefore there are potential health issues where bodily fluids (spittle, blood, sweat, etc), bird droppings and animal faeces/urine are not cleaned up properly on artificial grass (refer: Maintenance Section for advice).

c) Heat stress

Artificial grass surfaces heat up significantly more than natural turf surfaces on hot sunny days. High surface temperatures can lead to heat stress-related conditions, especially for children. Watering surfaces to cool them during such weather is not necessarily the answer for several reasons, such as the likely significant increase in humidity which is not desirable.
The New York study referred to previously advises that:
'Awareness of the potential for heat illness and how to recognise and prevent heat related illness needs to be raised among users and managers of sporting fields, sports administrators, coaches and parents.'

The introduction and enforcement of appropriate heat policies by sporting bodies/clubs is essential.

[11] 'An Assessment of Chemical Leaching, Releases to Air, and Temperature at Crumb-Rubber In-filled Synthetic Turf Fields'. (May 2009) New York State Department of Environmental Conservation and New York State Department of Health.

1.9 Lifespan and Lifecycles

1.9.1 Lifespan

The lifespan of an artificial grass sporting facility is difficult to accurately anticipate as it is determined by a range of factors including:

- The astute selection of an appropriate location and site (stable land, controlled impact from trees, etc).
- Good design (appropriate base design, good drainage, appropriate specification of a good carpet system, etc).
- The quality of raw materials used.
- Usage rate: High-use facilities will generally wear-out before less well-used facilities.
- Good use spatially of the facility, eg. where possible avoiding channelled traffic by moving training sessions around the pitch.
- Good usage practices (insisting on shoe-cleaning, sand re-distribution, monitoring and immediate repair of seam issues).
- Mid-life rejuvenation (removal and cleaning of infill material so as to limit compaction and its negative impact on vertical drainage).

Maximising the lifespan of an artificial grass surface is often essential to a club or facility manager to make their facility financially viable. For example, getting a synthetic hockey pitch to last 10 years instead of eight might allow a club to generate the final $50,000 required to pay out its loan or complete their amortisation savings target.

Purchasers of artificial grass should investigate warranties offered by suppliers/installers as to whether they relate to the lifespan of the original fibre, the knitted carpet, or the workmanship of the installation. (For more information, refer to Section 1.13.2).

Baseball training

1.9.2 Lifecycle

The lifecycle of a sporting facility usually relates to a longer period of time than just its lifespan because it considers the lifespan of a range of elements at the facility (basework, drainage, pad, carpet, floodlighting, irrigation system, etc).

The period chosen for the lifecycle would usually be set at the lifespan of the longest lasting element in the construction. For example, the lifecycle of a new artificial grass complex might be viewed as 30 years – the period in which the baseworks/drainage should stay stable, but through which period the pad/carpet might be replaced twice, the floodlight fittings twice, etc.

The term lifecycle is often used in reference to longer-term financial planning, and in this regard, lifecycle costing is an important accounting/budgetary process that recognises that the cost of assets is not the same annual figure repeated, but in fact recognises that there are key stages where larger costs are incurred such as major maintenance, major refurbishment or replacement of key elements.

Bringing all these costs into a long-term budgeting horizon allows an organisation to work out the true annual income generation/savings required to meet long-term liabilities.

The lifecycle cost of a surface consists of three different costs:

- Initial capital costs
- Maintenance costs and
- Replacements costs.

Reducing the initial capital cost through choosing a cheaper surface may, due to the poor durability of the surface, result in high maintenance costs and the need to replace the surface sooner. Selecting a high-quality surface may cost more initially, but will likely reduce the overall lifecycle cost of the surface.

Wherever possible, the emphasis should be placed on obtaining the ideal playing characteristics and durability. These aspects will determine the long-term success of the surface.

Examples of the lifecycle costs for different types of sporting fields (natural and artificial) are provided in Section 1.10, and Appendix 5.

1.10 Lifecycle Cost Comparison: Natural Turf versus Artificial Turf

There are a number of studies available that indicate the cost of installing, maintaining and replacing a good quality natural surface over an extended lifecycle (say 30 years) is similar to that of providing a similar-sized artificial surface for the same period of time. This is demonstrated in the indicative lifecycle cost table below (Table 3). This table shows the cost of ownership over 30 years, synchronising two 15-year natural surface cycles with three 10-year artificial turf cycles.

The figures below are based on high quality sporting fields – an international standard FIFA 2 Star artificial grass pitch and its very high quality natural turf equivalent (hence the 15 year re-build cycle and the high annual maintenance cost). They are based on recent research[12], and have been extrapolated out to a 30-year period.

Table 3: Cost of Ownership over 30 years:

	I	II	III
	Natural Turf	3rd Generation Artificail Grass Soccer Pitch	
Item		**Maintenance fully at commercial rates**	**Maintenance utilising club/school volunteers**
1. Construction	$400,000	$670,000	$670,000
2. Maintenance			
- 30 years x $40k pa	$1,200,000		
- 30 years x $20k pa		$600,000	
- 30 years x $5k pa			$150,000
3. Replacement			
- Years 15 & 30 @ $55k	$110,000		
- Years 10, 20 & 30 @ $350,000		$1,050,000	$1,050,000
TOTAL	**$1,710,000**	**$2,320,000**	**$1,870,000**

Notes:

- The figures shown above reflect today's Australian dollar values. For an understanding of the effects of inflation and compound interest on sinking fund target savings, refer to the 'inflation, compound interest and amortisation' commentary at the end of this section.
- Column II shows the 'worst-case' scenario costs for an artificial grass pitch – that is all maintenance being undertaken at full commercial rates. In a large majority of cases (especially with local government ownership and some school situations) the bulk of this maintenance can/is done by club volunteers – the column III scenario.
- The above model assumes that the natural turf field is of a high standard (i.e. has basic water supply available). Without reasonable water supply, the natural turf pitch will cost almost as much over the lifecycle, but deliver far less community benefit.

This above cost analysis would only be relevant if the two different types of pitches (natural turf/artificial grass) were delivering a similar number of playing hours. Recent research studies in Australia[13] estimate that one synthetic turf pitch has the usage capacity of 3-3.5 natural turf fields (average weekly use: natural turf = 15-20 hours, artificial grass fields = 60+ hours). So the calculations in Table 3 therefore could be adjusted to reflect that one artificial grass pitch achieves usage capacity equal to at least three natural turf pitches. In that case, the real comparative analysis reflects:

- Cost of the artificial grass pitch over the 30 year lifecycle $2,320,000
- Cost of the three natural turf pitches over the 30 year lifecycle (3 x $1,710,000 AUD) $5,130,000 AUD

[12] 'Artificial Grass Fact File' prepared by the Smart Connection Company.
[13] 'Development of Standards for the Use of Artificial Turf for Australian Football and Cricket' (University of Ballarat – 2008).
[13] 'Artificial Grass Fact File' prepared by the Smart Connection Company for the Boroondara City Council (2009).

By providing one artificial grass field instead of three natural turf fields, not only is the artificial grass field provider potentially saving $2,810,000 over the 30-year period ($3,260,000 if the maintenance costs of the artificial grass field are delegated to the tenant club), but the installation of the single artificial grass pitch has the potential to return the equivalent of two natural turf fields to the broader community for alternative use (one of the three fields being converted to artificial grass), and the equivalent of three natural turf sporting fields annual watering requirement is potentially negated.

Table 4: Lifecycle costings related to Tennis Courts / Fittings

Surface	Life Expectancy Range (Yrs)	Planned Life (years)	Typical Replacement Cost (1)	Annual Replacement Cost	Annual Maintenance Cost	Total Annual R&M Cost
'Filled' Art. Grass						
Standard	10 to 12	10	$14,500	$1450	$600	$2,050
Premium	12 to 18	15	$18,000	$1200	$600	$1,800
Synthetic Clay	12 to 18	15	$23,000	$1,533	$1000	$2,533
Ancillary Facilities						
Lights: Side, low, 1 court	30 to 40	30	$16,000	$533	$300	$833
Lights: Side, low, 2 crts	30 to 40	30	$12,000	$400	$300	$700
Lights: High, corners, 1 crt	30 to 40	30	$25,000	$833	$300	$1,133
As above– 2 court	30 to 40	30	$15,000	$500	$300	$800
Fencing – single court	25 to 35	30	$8,500	$283	$100	$383
Fencing – 4 court encl.	25 to 35	30	$4,000	$133	$100	$233
Net Posts	30 to 40	35	$500	$14	$0	$14
Nets	5 to 7	5	$250	$0	$50	$50

Table supplied by Tennis Victoria

Table 4 provides a further example of lifecycle costing as it applies to artificial grass tennis courts, including ancillary components. Note that these are 2006 figures.

Notes

1. Cost of removal/tipping of existing surface included where appropriate.
2. Multiple court enclosure costs shown on per court basis.
3. Data from Tennis Victoria Technical Services project management database and research analysis.

1.10.1 Inflation, compound interest and amortisation

For simplicity, lifecycle cost analysis is often undertaken using current day dollar values (i.e. taking 'cost' as at today and dividing it by the number of years remaining until replacement is due). If a capital replacement (sinking) fund is to be established that reflects exactly what needs to be accessed in future years, then inflation and compound interest need to be added to the equation.

As an indicative example, assume the replacement cost in 10 years is $360,000. Based on 5 per cent inflation, a sum of $360,000 will equate to $586,404 in 10 years time. Assuming a compound interest rate of 5 per cent applies, a capital replacement (sinking) fund contribution of $3,848 per month will be required every month for the 10 year lifecycle of the surface.

Note the difference. On current day dollar values, $3,000 would be added to the sinking fund each month over 10 years ($360,000 divided by 120 months). Factoring in inflation and compound interest means that raising a 'year 10' figure of $586,404 requires $3,848 per month from the first month of the facility's life.

Top Tip

A valuable publication titled Life Cycle Cost Guidelines is available from the Western Australian State Department of Sport and Recreation.

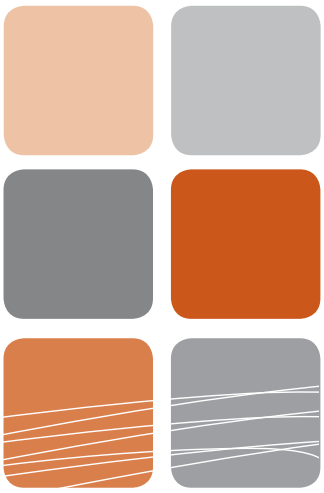
www.dsr.wa.gov.au

At Appendix 7 and online at: www.sport.vic.gov.au a 'Pitch Evaluation Model' template is provided. This template will help determine the required annual savings targets over a period of time leading up to the refurbishment or replacement of an artificial grass facility, assist in the preparation of a business case related to sporting facilities, or carry out an analysis of the respective lifecycle costs of a natural turf facility versus an artificial grass facility.

The model operates on discounted cash flow, factoring in inflation and compound interest, to become a more realistic predictor of required annual sinking fund requirements.

When developing these pitch financing models, facility owners/managers need to be aware of both the ongoing routine maintenance costs, and the facility's life expectancy, as well as the expected cost of eventual replacement. The same should be done for components such as the floodlighting and fencing.

On the income side of the calculations, owners/managers need to make realistic and accurate income predictions. Widely optimistic predictions often lead to subsequent significant expenditure cutbacks, often in areas (i.e. surface maintenance) where cutbacks can be counter-productive to the full utilisation of the surfaces.



1.11 Local Government Policy Considerations

A number of policy positions need to be considered when planning for artificial grass surfaces. This section provides an overview of the key considerations.

1.11.1 Open Space & Fencing

Fencing off sporting facilities within public open space is often not the desired outcome in terms of the aesthetic appearance created, nor the conceptual issue of 'alienating public open space'. But many local government authorities (LGAs) acknowledge the significant benefits of artificial grass pitches (refer Section 1.4 of this guide), particularly the capacity of a single artificial grass field to effectively replace three to four natural turf fields. In the latter argument, accessible public open space acreage is actually enhanced. Clubs that previously required two to four natural turf fields on which to conduct their activities might need just one artificial grass field. This has been the experience with hockey facilities in Melbourne over the past 15 years.

Open space that becomes available as a result of the installation of an artificial grass pitch can be returned to passive recreational open space or allocated for other purposes.

The fencing off of an artificial grass facility can be undertaken in different ways. One metre high fencing around the playing area keeps unwanted traffic off the pitch while still allowing casual access. Where full height external security fencing is preferred, then sensitivity is required in finding a site that is more acceptable for such design and use.

Note: The Melbourne hockey experience achieved significant public open space savings because the sport was flexible in the way that it restructured its fixtures to maximise use of single artificial grass pitches. Other sports may need to be similarly flexible in their programming and fixtures if public open space gains are to be made.

1.11.2 Facility Management and Control

In many situations it is wise to establish an artificial grass field as a multi-sport/ multi-user facility, thereby enhancing the capacity of the field to generate additional use and income. To build or re-carpet a synthetic field is a costly exercise so every opportunity should be taken to broaden its appeal to the sporting marketplace.

This broad usage and marketing of an artificial grass field is often best captured where the management and control of the facility is not given over to a single sporting group, but is instead controlled by a multi-club, multi-sport management committee or an independent body (the local council for example), or leased/ delegated to a commercial operator.

Funding agencies often prefer management models that work towards sharing and maximising the use of a facility and enhancing and maximising participation.

There are exceptions to this rule where individual clubs with 25-30 teams can fill the fortnightly match/training roster or situations where the facility owner can install a formal agreement with a principal tenant that manages the facility and must achieve significant usage/ income targets.

1.11.3 User-Pays and Artificial Grass

There are several excellent facility management/operation examples noted in the Case Studies Section of this guide (Appendix 2).

One of the challenges arising from the trend towards artificial grass is the difficulty for many local councils to develop consistent user fee charges across the range of natural and artificial sporting surfaces.

Historically, community sporting clubs have generally been recognised for their contribution to the community, with councils charging rental which often represents a small percentage of annual costs to maintain facilities.

The advent of artificial grass has generally seen a different cost recovery approach. In many cases, community clubs are now required to contribute significant funds towards up-front capital costs, manage maintenance responsibilities and, through capital replacement plans, contribute significantly towards the future replacement cost of the facility.

This change has largely come about because the move to artificial grass for some sports shifts costs from mainly recurrent expenditure to large capital expenditure – which is then repeated every 3, 5, 10 years as is applicable. Because costs and replacement timelines are easily known, these costs have translated into often substantial amortisation commitments for user clubs.

This approach is drawn into focus by the analysis presented in Section 1.10 of this guide ('Lifecycle Cost Comparison: Natural Turf versus Artificial Turf') which shows that over a 30 year lifecycle, the cost of building, maintaining and replacing natural turf sporting areas is similar to that of equivalent facilities featuring synthetic surfaces. Councils should consider this analysis in the development of appropriate fee structures that equally share cost recovery and facility subsidy initiatives.

Note: It has been said that some synthetic surface facilities attract higher fees because they are fenced and not constantly available to the general public. If a club seeks exclusivity, then higher fees may be appropriate, but in many cases fences are in place because of the potential of expensive damage being done to valuable community assets.

1.12 Licensing, Certification and Accreditation

Although these terms are individually defined in Section 1.2: Glossary of Terms, it is worth repeating them in order to better understand the difference between like terms. Potential purchasers of artificial grass facilities need to understand this sometimes confusing terminology.

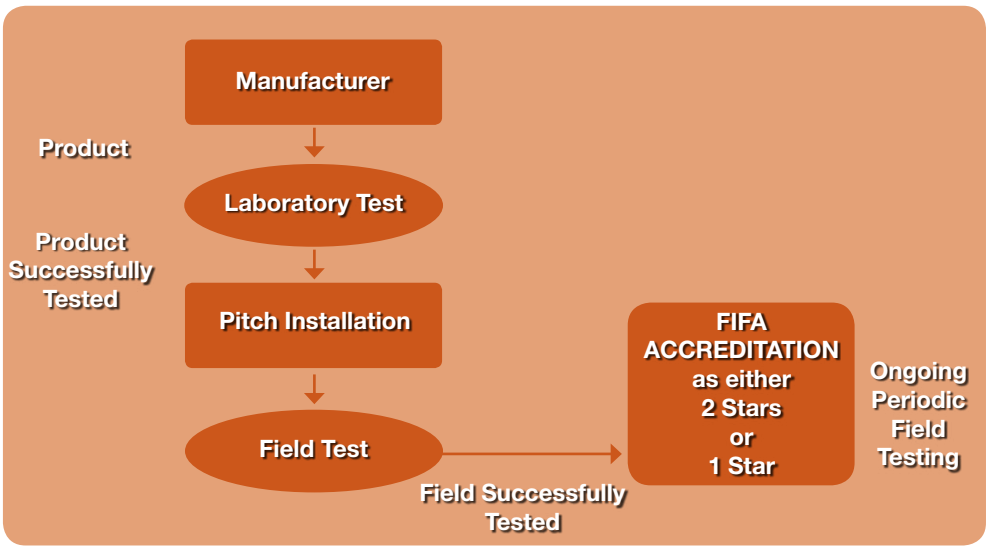
1.12.1 Licensing

A licensing agreement is generally the formal agreement entered into by a turf manufacturer and the sport's governing body regarding the conditions under which approval of turf products may be granted. This is usually based on test results from laboratory or field, or both, by an accredited test house.

Note: Some sports have different levels of licensing, with the lower level being the full list of suppliers whose products meet the specifications, and an upper level who are designated as preferred suppliers.

1.12.2 Certification

- Industry certification: This refers to the seal of approval that is granted to a company by the relevant artificial grass manufacturers or installers industry body. In Australia, one such body is the Synthetic Turf Council (www.syntheticturfcouncil.org). The European equivalent is the European Sports Turf Organisation (www.eu-syntheticturf.org).
- Product certification: A product (artificial grass system) that is approved by a sport's parent body via early laboratory testing using an accredited testing house.
- Installed field certification: Some parent sporting bodies make it mandatory that the installed field is tested against required performance measures before it is given the 'green light' for match use. When not mandatory, councils, clubs and schools should still have their facility tested for peace of mind or to obtain evidence that the facility is capable of hosting appropriate competition and elite events.



FIFA's Quality Concept for Artificial Turf Pitches

1.12.3 Accreditation

This generally relates to laboratories that are accredited by a sport's peak body to carry out the laboratory (sample product) or installed field testing.

It is important to know the difference between a manufacturer (company making the yarn or knitting the yarn into the carpet), a supplier (company that manufactures the carpet or lays the carpet), the installer (the company that lays the carpet), and a contractor (company that constructs the base-work under the shock pad and carpet, or company that lays the carpet, or runs the whole job with sub-contractors called in to do specialised aspects).

It is also important to be able to separate company names from product names, when sometimes they are both (eg. Rebound Ace, En-tout-cas).

1.13 Quality Assurance, Control and Warranties

Both in the interests of the purchaser of an artificial grass sporting facility and the contractor delivering the project, a system of quality control needs to be in place that checks materials and workmanship throughout the contract period.

1.13.1 Quality assurance and control

Essential to a successful project is having clearly defined specifications, an approved 'quality system', and thorough inspections by knowledgeable supervisors.

1.13.1.1 Specify it

At the specification and tender writing stage it is essential that a quality (control) system is either specifically nominated or called for from the bidding contractors. This 'system' or process will involve the nomination by the contractor of a project quality manager who would be responsible for the implementation of the project's quality system. The quality system would also include a system of Inspection and Test Plan (ITPs) that:

- Identifies the project.
- Lists all hold points during construction (including the supply of materials) that will require verification before the works are covered or installed (see below). The contractors should show evidence that various stages of the project, eg. levels and surface finishes are being met for at least 10 significant events along the way.
- Identifies the criteria for verification before the works are covered or installed (see below).
- For each hold point, records that the quality has been verified, the date the work is verified, and is signed off by the project quality manager.

ITPs should be prepared for a minimum of 10 significant items, including work by the sub-contractor, and be submitted as part of the tender bid. Preferably they would be nominated by the client in the specification and tender documentation.

Failure to submit the ITPs in accordance with the accepted program and in a form acceptable to the superintendent may give cause for the superintendent to withhold the approval for any portion of the works until approved ITPs are submitted. Prior to practical completion, the project quality manager must certify that all non-compliance or deficiencies have been rectified.

Top Tip

Do your homework (you, or your project manager) at the tender assessment stage to find out:

- **Who are the proposed contractors? What is their work reputation?**
- **Who are the proposed sub-contractors? What is their work reputation?**

Top Tip

Knowing who the various players in the industry are, ensure that:

- **You establish with the lead contractor just who is responsible for quality systems/procedures through each key phase of the project, and**
- **You have been provided with a Project Quality System that covers each phase (among the tender bid documents)**

1.13.1.2 Data sheets and reference samples

When contractors bid for the project, it is essential that they supply product data sheets and samples that exactly match all materials to be used on that project. These reference samples should be clearly marked/identified.

It is essential that the product being proposed (and the samples provided) have been laboratory certified as being capable of meeting the performance standards set down by the controlling body of any sport that the facility will be used for. These performance standards are often available on the website of the relevant sporting bodies (see Section 1.6).

Top Tip

Make it clear in your specification that samples provided as part of a tender bid must be exactly the same as the materials that would be used in any subsequent installation. Your specification should make it clear that testing will be done to confirm this consistency.

1.13.1.3 Samples of constructed items

Some projects call for very specific samples to be sourced during the projects construction. An example might be a request for a 300mm x 300mm sample of shock pad to be prepared and stored (for subsequent analysis) each separate day of the in-situ shock pad installation phase. Likewise samples of infills (sand, rubber) and adhesives might be called for.

1.13.1.4 Monitoring the construction

The project superintendent and/or the consultant project manager need to monitor both the supply of raw materials to the site, and observe all surfacing and resurfacing phases.

Top Tip

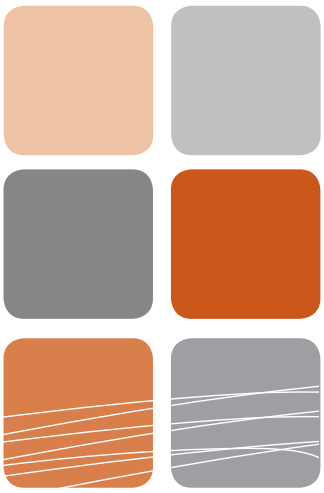
Mark and retain all raw samples as a precaution against problems occurring on site. Should a problem occur, and a dispute arises over cause or liability, detailed analytical and other tests could be conducted on these samples in order to definitively resolve the matter.

By way of example, the construction monitoring, key witness and hold points on a project such as the re-surfacing of wet artificial grass hockey fields could be:

- Pre-commencement (x 1)
- Assess and determine soft spot remediation (if required) (x 1)
- Proof roll of sub-grade (x 2)
- Preparation of spoon drain and drainage structures (x 1)
- Underground drainage (x 1)
- Irrigation mains (x 1)
- Placement of crushed rock pavement (x 2)
- Completion of crushed rock pavement (x 1)
- Completion of bituminous layer (x 1)
- Installation of shock pad (x 2)
- Placement of synthetic surface (x 2)
- Placement/adjustment of sprinkler heads (x 1)
- Pressure testing and commissioning of irrigation system (x 1)
- Final inspection (x 1)

Total: 18 inspections.

Top Tip
A range of items can/should be checked during construction, including:
- conformance to standards for seam strength
- thickness of all layers in the base
- shockpad mix tensile strength
- infill spread rate



1.13.1.5 Testing materials

Shock pad and carpet materials should be checked (against reference samples and specifications) either when delivered to site, or after installation, because there have been cases of more lightweight carpets and pads being installed than was defined in specifications or contracts.

Sand, rubber granules and glue samples should also be checked.

The following surface material characteristics can be tested (recommended minimum test features are bolded):

Shockpad	Carpet
• Tensile strength and elongation	• Fibre type and dtex
• **Density**	• **Pile length / height**
• **Thickness**	• Pile profile
• Weight per unit area	• **Pile density** (tufts per square metre)
• Resilience	• Fibre material
• Compressibility	• Total weight per unit area
• Stiffness	• **Face weight**
	• Tuft withdrawal force
	• Quality of backing materials
	• Pile filling materials
	• Colour of pile

Table 5 - Surface Material Characteristics

Refer to Section 1.5 for important tips on getting the carpet properly tested.

1.13.1.6 Monitoring over time

The specification or contract needs to define the maximum permissible degree of change (related to the key performance criteria), if any, that can occur over a set period. In addition to those performance characteristics, the same applies to surface levels over the pitch, and the bonding of seams and inlaid lines.

Examples of items that may be defined include:

Sand	Seams	Rubber Granules
• Bulk density • Sieve grading • Particle configuration	• Tensile or peel strength (before and after water immersion)	• Size • Shape • Materials • Grading

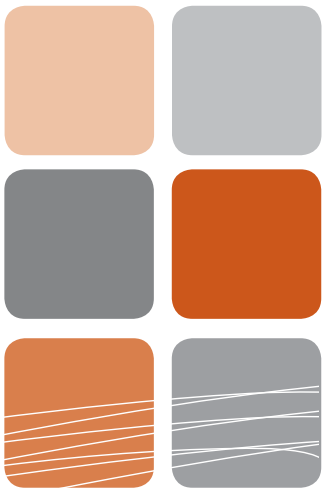
Table 6 - Other Key Performance Criteria/Definitions

1.13.2 Warranties

The supplier or installer warranty might appear to be straight forward: (eg. 'warranty five years') but what does that really mean? Warranties can sometimes be difficult to enact when something goes wrong, so it is crucial to question the potential suppliers, constructors or installers upfront regarding who is providing the warranty on the:

- Civil engineering works that lie beneath or beside the surfacing system (the sub-base, pavement, drainage, irrigation system, floodlighting cables, etc)?
- Shock pad, and for what period?
- Original yarn, and for what period?
- Knitted carpet, and for what period?
- Workmanship standards associated with the installation of the pad and carpet and for what period?

Also ascertain how compensation would be negotiated if the carpet comes apart after only a few years. For example, if the total project, including civil works and surfacing system, cost $1,000,000 and the carpet failed after three years,



the compensation could be calculated using the following formula:

- The carpet was worth $250,000 out of the $1,000,000 project (i.e. the base and pad are still fine)
- The carpet was usable for three of the five-year warranty period, therefore the compensation value might relate to three fifths of $250,000 or $150,000.

Expect that the contractor will investigate whether the recommended maintenance regime was followed or if the surface was more heavily used than outlined under the warranty. This may alleviate them of their responsibility.

The best types of warranties are those that are backed by independent insurance companies. Warranty insurers are ranked and rated (refer www.ambest.com). Look for coverage from a company with an 'A' grade ranking or better.

Top Tip

For the sake of knowing who should be supplying you with warranties related to the yarn, knitted carpet, installed product, etc, find out before you sign a contract:

- **Who is undertaking the civil engineering works associated with the project (testing/surveys, drainage, irrigation, bulk earth works, floodlighting etc?)**
- **Who is supplying the yarn?**
- **Who is knitting the yarn into the carpet?**
- **Who is laying the shock pad and the carpet?**

Top Tip

Warranties generally relate to a maximum numbers of hours of use per annum, a level that can easily be exceeded by highly-popular facilities. Prior to awarding your project's contract, discuss the implications of potentially very high-facility usage rates with your proposed supplier/installer.

Top Tip

Some companies will link their warranties on your surface with their ongoing involvement in the facility's maintenance. During the tender bid review ask about this matter and fully understand the implications for your warranty coverage. Expect to maintain your surface weekly, monthly and yearly, and budget for this.

1.14 Funding Strategies

Local government authorities (LGAs), sometimes with the support of State Government, are the major funder of local-level community sporting facilities in Australia. The requirements for LGA support of projects differ from council to council, but attention to good facility planning and community development principles will help clubs or schools in gaining LGA support. These principles include:

- Thorough pre-planning: Who will use it? When? What for?
- Are there other groups that could also use this facility?
- Could a joint-use partnership between community groups, LGAs, schools or other partners be established which would enable a 'pooling' of funds and resources, and a guarantee of substantial use?
- Could this facility partly or wholly target groups such as – women, children, teenagers, people from lower socio-economic backgrounds, culturally and linguistically diverse backgrounds or people with a disability?

Projects built around these parameters are generally well received by funding agencies because they seek to maximise the potential use of a facility, and seek to attract key government target markets.

Key funding sources/mechanisms are:

Victorian State Government

Department of Planning and Community Development (DPCD) – through Sport and Recreation Victoria, provides a range of funding programs that cover broad leisure planning, specific facility planning/investigation, and the funding of infrastructure development. At the time of writing, funding schemes were in place that covered planning, minor capital works, major capital works, aquatic facility (re)development, sustainable sports grounds and soccer facility development.
See: www.sport.vic.gov.au

Local Government

Speak to your local council's leisure and recreation services unit as early as possible when formulating ideas and seek their advice on how to best advance the project.

Top Tip

Some funding agencies prefer to support new artificial grass facilities rather than the re-surfacing of existing facilities (particularly where the resurface is like for like).

Sporting Associations

Some sports provide funding programs that support facility development i.e. Tennis Australia and the Australian Football League.

Philanthropic trusts and foundations

For instance:

- The Helen McPherson Smith Trust (the Victorian Government's rural and regional community building initiative, located at http://hmstrust.org.au/).
- Foundations for Rural and Regional Renewal ('Small Grants for Small Rural Communities Program' located at www.frrr.org.au/)
- The Australian Sports Foundation (ASF) operates the Sport Incentive Program. Eligible organizations can apply to register sport-related projects in either of the following:
  - Category 1 – to collect donations using the ASF's tax deductible status and to receive consideration for discretionary grants from the ASF, OR
  - Category 2 – to receive consideration for a discretionary grant from the ASF.

An organisation can only register under one category at any given time. Projects must meet certain project criteria.
See: www.asf.org.au/how

Club members

Club members can be a source of income through strategies such as donations (including providing links to potential donors or sponsors), debentures, loan guarantees, legacies and in kind work particularly in the case of exciting new facilities.

Debentures

These are essentially unsecured loans usually provided by people keen to support the sport in a personal capacity. They may seek little or no recognition of their contribution and repayment of the debenture is usually with interest.

Because debenture holders are often associated with the club or association, it is tempting to regard this arrangement as an informal one. However, it is recommended that a formal agreement is drawn up (an indenture) so there is no misunderstanding about the terms under which funds have been provided and any arrangements for repayment and/or transfer of the debenture.

In-Kind Contributions

This can be a valuable and creative way of supporting a project. A common form of contribution is the professional or technical skills and efforts of individuals. Such contributions should be carefully noted and acknowledged but also closely monitored to ensure the in kind pledges are realistic and are provided.

Special activities/events

Special events can be a significant source of fundraising, but remember that many events can be so significant that they require their own project plan, detailed costings and clearly established operational plan.

Sponsorship

Even community level facilities can be attractive to sponsors in terms of buying advertising space at the new facility, or even a naming-rights deal. Keep in mind that raising sponsorship requires careful targeting and good quality presentation material. It is also important to check with the local council regarding any policy or planning implications regarding advertising or signage and naming rights.

Commercial loans

Ultimately it may be necessary to top-up the other forms of funding with commercial loans. Commercial loans or similar banking facilities may also be necessary in order to manage cash flow during the project. Depending on the nature of the economy in which this activity is taking place, the providers of the loan, their terms and interest rates will vary greatly. It is obviously important to be clear about the loan terms and to factor the capital repayment and interest charges into the project cost.

Bank loans may need to be:

- Guaranteed by a local government authority.
- Guaranteed by members (not recommended where risk is involved).

Club funds

The club or playing community may have its own funds which it can devote to the project.

Note:
When raising funds for the eventual replacement or refurbishment of an artificial grass sporting facility, inflation and compound interest need to be factored into calculations so an accurate annual amortisation figure is known. For more information on this matter, refer to Section 1.9 of this guide.

Top Tip

Think about who else could be a stakeholder, and therefore a contributor to your project. The broader the project base, the greater the chance of funding agencies being interested in your project.

1.15 Professional Support

A key success factor in artificial grass installation projects is the involvement of experienced civil engineering expertise (preferably related to artificial grass installation projects), plus experience and knowledge about laying artificial grass and its aftercare.

Where such knowledge and experience is not ensured, project teams should consider enlisting the support of knowledgeable, independent consultants with proven expertise in artificial grass sports surface installation projects. Projects can be compromised by relying too heavily on individual pieces of advice from artificial grass installers, or on the ability of engineers without relevant experience with this particular type of project.

External consulting advice and project management will generally cost between 5% and 10% of the total capital cost, but it can ensure project quality and lifespan that will pay for its own cost many times over. This is particularly the case with large-scale, complex projects.

The consultant's role may include:

- Reviewing current conditions of the site proposed (or helping review potential, alternative sites).
- Undertaking a 'desktop review' of previous, relevant drawings/reports and investigations.
- Supervising new site investigations that might relate to existing services, a site feature survey, geotechnical investigations, drainage, irrigation, etc.
- Producing schematic design options and pre-design cost estimates.
- Producing or reviewing detailed design and documentation.
- Assisting with any Expression of Interest process.
- Providing tender documentation for inclusion into the client's contract.
- Responding to tender 'requests for information'.
- Assisting with tender evaluation and interviews.
- Carrying out construction phase supervision and checking (assessing build quality and design specification conformity – see 1.13.1.4 , and payment approvals).

To carry out these functions successfully the consultant(s) would ideally have extensive knowledge of:

- Current synthetic grass research.
- The performance of different artificial grass surfaces.
- Artificial grass fabrication and construction techniques.
- Artificial grass management and maintenance practices.
- Artificial grass supply and installation costs.

And should be:

- Experienced in the application of relevant standards.
- Experienced in the design and installation of artificial grass sporting surfaces.
- Independent of any one manufacturer/supplier/installer.
- Highly-regarded by people who have used their services.

Obtain a schedule of fees (and references) before engaging a consultant.

1.16 Environmental and Health Issues

In Section 1.11.1 (Open Space and fencing) of this guide a case is put that the installation of artificial grass fields can be an environmental positive because of the number of natural turf sporting areas that are freed up and the reduced level of sporting field maintenance/ chemicals or pesticides that will be needed. The matter is described as a 'trade-off' where fencing might be necessary around an artificial grass field, but the benefits of the artificial grass field outweigh the negatives.

A deeper review of associated issues is necessary though given the questions that are raised by some community groups who are unsure about the short and long term impacts of artificial grass installation.

It is clear from the available research, that well planned, designed, installed and maintained artificial grass facilities provide significant community benefits.

Some of the more significant considerations are:

Loss of natural environments

The amount of land that is being taken up by artificial grass sporting field installations is very small in relation to the amount of sporting openspace that is provided. Population growth and restrictions on the use of water in many localities has resulted in a reduction of sporting openspace. Safe, accessible sporting surfaces are essential for younger people to be able to be active and engaged, and artificial grass is now providing a viable alternative to traditional grass surfaces.

Bowling Green - Donvale

Water use reduction

Several things are currently happening in this area:

- A number of water-dependant en-tout-case tennis courts are being replaced with synthetic clay or other similar surfaces that do not require watering.
- Elite level artificial grass hockey pitches that need to be watered to play on are likely to be phased out as soon as a dry carpet can replicate the required playing conditions. Several trial surfaces are now in place in Australia and are being monitored, hoping to overcome this need for large quantities of water.

While watered carpets were cooler to play on than unwatered, thereby responding to the issue of player comfort, there are now artificial grass products (unwatered) being marketed that claim to have much lower levels of heat retention/reflection (refer to item overleaf).

Water harvesting from artificial grass sporting areas

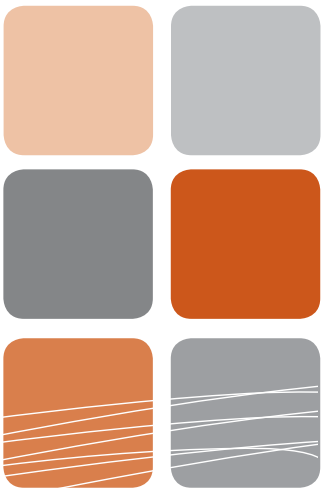
There are a number of reports available (prepared by leisure service consultants and sporting bodies) that have investigated issues around harvesting water run-off from artificial grass sporting surfaces, for re-use on site or locally.

In brief, the water run-off from large artificial grass sporting areas can be of a significant quantity, to the point where storing it in large tanks requires a large capital investment and therefore often becomes economically unviable. Where it can become more financially viable is where there is an adjacent natural holding area – dam, wetland or lake - although these options still require significant additional investment into piping, pumps and filtration equipment.

An alternative way of creating a holding dam underneath the surface is noted in Appendix 2 (Ivanhoe Grammar School).

Heat retention/reflection

Exposed artificial grass surfaces do not absorb heat as well as well maintained



grass surfaces, but do so better than bitumen and many ungrassed areas. This heat retention or reflection has long been known, particularly in the sport of lawn bowls where players are often older, and to whom heat is a more significant issue. The issue has arisen again with the rapid uptake of third generation long-pile carpets with their infill of heat-retaining rubber crumb.

Recent local research for the AFL and Cricket Australia, suggests that: 'in hot conditions an artificial grass sporting area can be up to 40% hotter than a natural turf field, although this increased heat dissipates quickly on a windy day.'[14]. This research also highlights that children are far more at risk from heat stress than are adults. The option of having heat policies in place at least for junior participation on artificial grass surfaces to mitigate this risk is a key consideration. Note that some overseas companies are already marketing products that they claim store or reflect less heat – refer to Section 1.17 (Current Product Developments).

Rubber granule Infill

Most rubber granule infill material is produced from recycled tyres. The suggestion that toxic materials can leach out of the infill rubber has been investigated over recent years with no evidence found to date that contaminated 'leaching' is occurring.[15] Conversely, there are reports available that compare the run-off into waterways from natural turf fields (that contain chemical fertilisers and pesticides), which compare poorly with artificial grass field run-off where the run-off will be of better quality.[16]

Other research reveals that the release of heavy metals and other substances as fibres wear is well within environmental standards, is considered safe in the air and on the turf surface, and that the levels of take up of these substances through breathing, ingestion and body contact is also small and does not present a health risk. [17]

It can be argued that the use of recycled tyres is in itself environmentally friendly because it reduces the quantities of worn tyres that are scrapped and sent to landfill each year (a large artificial grass field can contain approximately 120 tons of crumb rubber or 26,000 recycled tyres).

Lead in yarn

In the early years of artificial grass production there was evidence of lead being used in yarn production, but it is believed to be a rare occurrence currently. It is advisable, as part of the tender process, to insist upon suppliers that all materials must be lead-free.

Less greenhouse gas emissions?

Up until this point in time, there would have been a normal expectation that natural turf fields had less negative impact on global warming than artificial grass fields. In large part this would be because of the role that trees and grass play in the carbon sequestration process, a process that relates to the potential of grass sporting fields to remove carbon dioxide from the atmosphere and store it in the soil as organic carbon.

Recent research from the University of California (UC) at Irvine[18] draws this assumption into question. Their research identifies a marked difference in the performance of ornamental lawns in parks as against that of sporting areas regarding carbon sequestration. Ornamental lawns require very little maintenance and can go 'untouched' for many years (therefore enhancing the carbon retention in the soil). Active sporting areas require constant maintenance, much of it (aeration, etc) which can expose the carbon to the air.

In addition to the carbon retention issue, the UC research makes reference to nitrous oxide emissions which can emanate from natural turf area, caused by the use of fertilisers, particularly inorganic fertilisers.

Disposal of used products

For cost reasons, as well as environmental ones, it is incumbent

[14] 'Development of Standards for the Use of Artificial Turf for Australian Football and Cricket' (University of Ballarat – 2008).

[15] 'An Assessment of Chemical Leaching, Releases To Air, and Temperature At Crumb-Rubber In-filled Synthetic Turf Fields' New York State Department of Environmental Conservation, May 2009

[16] 'Environmental and Health Assessment of the use of Elastomer Granulates (Virgin and from used tyres) as infill in Third Generation Artificial Turf' Ademe/Aliapur - Fieldturf - Tarkett Publication.

[17] 'Hazardous chemicals in synthetic turf materials and their bio-accessibility in digestive fluids'.Zhang, J, Han I. Zhang L and Crain W. (2008). Journal of Exposure Science and Environmental Epidemiology, Vol 18, No 6.
'Environmental and health assessment of the use of elastomer granulates as infill in third-generation artificial turf', EEDEMS.
'Air quality survey of synthetic turf fields containing crumb rubber infill'. Vetrano, K. (2009).

[18] 'Carbon Sequestration and Greenhouse Gas Emissions in Urban Turf '(2010) University of California (Irvine). Published in: Geophysical Research Letters (USA) Vol 37

on clubs or schools to try to re-sell or recycle used synthetic turf wherever possible. It can cost in excess of $30,000 to have a sports-field's artificial grass carpet lifted and disposed of to land-fill, whereas there are often community members or groups that can utilise used carpet and pads effectively. A key removal issue with sand-filled carpet (particularly if damp) is the weight of the product and the heavy lifting and transporting equipment required to shift it.

In the UK, obsolete artificial grass carpets are sometimes used as fuel in kilns and furnaces, while used carpet infill is the subject of testing to find better ways in which it can be removed, cleaned and re-used.

1.17 Current Product Developments

For research results related to field playability and injury prevention, go to Section 1.8. The research referred to in this section (1.17) relates to the suitability of playing surfaces for their particular sport.

One of the constants in the artificial grass industry is the continued search for new and better products. In Australia this is highlighted by the development of an artificial grass carpet that can be used for Australian rules football in winter and cricket in summer, but local companies are also at the forefront, testing hybrid unfilled water-free hockey carpets, plus other developments. Interesting areas of research and development for artificial grass sporting areas include:

An artificial grass carpet for Australian rules football/cricket

Climate change and ongoing drought conditions in Australia have forced these sports to seriously look for a compatible synthetic surface. The advent of third generation long-pile carpets has also opened up possibilities for other contact sports to use artificial grass for their sports.

In 2008, the University of Ballarat completed a research and specification development exercise that called for a new artificial grass product tailor-made to match the game characteristics of Australian rules football and cricket. Key issues for these sports include specific play characteristics, critical fall height, abrasion, hardness, rotational traction, ball rebound and roll, player impact forces and also more generic issues such as cost, heat retention or heat reflection, injury rates, water collection and product durability.

At the time of writing, the first approved product is being installed. The carpet is nominally 40mm high, filled with sand to approximately half the height. It sits on a shock pad that is 23mm thick. Variations to this exact system will no doubt follow.

Common systems for Australian rules football and soccer?

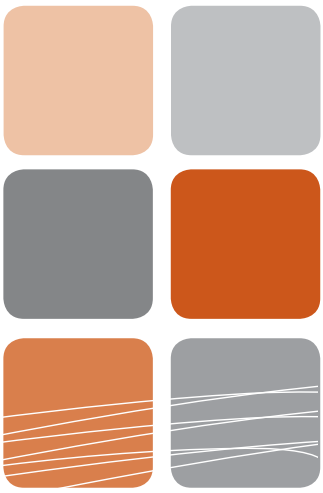
There are many common characteristics about the artificial grass turf systems that have been approved for soccer and Australian rules football, (see table 1, page 38) along with some key differences. The principal difference is in the method of providing shock absorbency, with soccer pitches generally having rubber granule infill within the carpet fibres (with or without a shockpad), while the Australian rules football specification prefers just the shockpad.

At the time of publication though there appears to be developing recognition (1) in Europe of soccer and rugby pitch systems that are similar in construction (shock pad under the carpet) to the approved Australian rules system, (2) and of the use of coloured rubber granule infill for Aussie Rules fields.

Cooler artificial grass carpets?

In the case of summer sports, surface heat reduction is a key design criterion. Over the past decade the incursion of artificial surfaces into lawn bowling has been impacted by the increased playing surface heat reflection. For cricketers, with their extended playing time taking place during the hottest months of the year, this is an issue.

European yarn manufacturers are marketing yarns which they claim



incorporate technology that reduces surface temperatures by up to 35% when compared with regular synthetic turf fields (the first installation of such an artificial grass soccer surface in Australia of this type occurred in Melbourne early in 2010). In the marketing material for one of these products, the claim is made that the product 'dissipates heat into the atmosphere instead of absorbing heat into the yarn, resulting in a lower surface temperature when exposed to sunlight.'

Such advances in technology, if successful, will enable more sports to use artificial grass in warmer climates, hopefully reducing player impacts such as heat stress and rapid dehydration of users.

Rounder sand

Rounder sand particles (same size) are now being used in Australia on artificial clay tennis courts, with the intention of providing greater longevity from the porous infill layer. Traditionally specified sand granules can compact significantly over time adversely affecting vertical drainage.

Teflon coated sand

Some of the rounder sand types referred to above are also coated with a type of teflon to further enhance vertical drainage through the sand infill layer. Several Australian companies are currently experimenting with the development of similar materials.

Different colour rubber granules

Due to the heat-retention properties of black rubber granule infill, and the sometimes darkened nature of the surface, alternate colour rubber granules are now being developed and used. Note though that the longevity/durability of coatings applied to SBR (Styrene Butadiene Rubber - a major component in artificial grass infill systems) is generally unproven at this point in time.

Unwetted carpet for high grade hockey

Due to climate change and the vulnerability of water resources in substantial parts of the world, the International Hockey Federation has called for the development of a playing surface that can be played on dry, which will still produce the playing characteristics required for elite level competition.

Earlier generation watered fields (nylon or polypropylene) cannot be safely played on 'dry' because shoes stick to the surface and there is an absence of the surface conditions that allow for controlled 'slip', rotation and slide. Also, the ball bounce can be affected, with drier fields likely to lead to higher bounce with potentially more risk.

Prototype carpets (high-density, low-pile, unfilled) are now being played on in several locations around Australia, and the hope is that they will meet the required specifications.

Artificial grass for athletics infields

Several companies are now manufacturing extra long-pile carpets (typically 80mm or so with, say, 60mm of sand or rubber granule infill material) that are being marketed as ideal for athletics field games, i.e. discus, hammer, shot put and javelin throws.

Sophisticated water harvesting/storage systems

Sophisticated water storage systems, are being developed and trialled that allow the capture, and often re-use, of significant water volumes. Seek expert opinion regarding water harvesting and storage systems.

Refer to Appendix 2 of this publication (Ivanhoe Grammar School) for information regarding a unique underfield water storage system.

Horizontal drainage via a void space under the shock pad.

In mid 2010, several fields were built with a void space beneath the shockpad and the base. Each were created by laying an interconnected layer of typically 30mm high open-cell plastic panels all over the field.

The hollow space within the panels (strong enough to take carpet rolls and required machinery) allows water to flow horizontally to collection channels and pits. This is an alternative to vertical drainage and the potential differential settlement that sometimes occurs on fields that have buried drainage pipes.

Organic Infill

A developing alternative to rubber granule infill is the option of organic infill, such materials being of plant origin. Able to be re-cycled, these infill types are said to keep the median temperature of artificial grass pitches lower than that of pitches with rubber infill. At the time of publication, the first soccer pitch in Melbourne featuring organic infill had been completed.