Smart Guide 2

Guide to Football Turf

Synthetic and Hybrid Technology

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Disclaimer

Smart Connection Consultancy do not accept any liability for the accuracy of the information provided. All material and information that is provided from the third parties is done so in good faith to assist organisations understand the key issues around synthetic sports surfaces. We will continually update the Smart Guide to attempt to keep the industry updated.

About the Smart Guide to Synthetic Sports Surfaces

Smart Connection Consultancy is committed to sharing knowledge and learnings with the industry and has produced a number of volumes of the Smart Guide to Synthetic Sports Surfaces which can be downloaded free of charge from our website www.smartconnection.net.au

The volumes have been updated for 2024 & the Smart Guide to Synthetic Sports Surfaces include:

- Volume 1: Sports Fields Surface Standards – Performance, Construction, Environmental, Safety & Sustainability
- Volume 2: Football Turf – Synthetic and Hybrid Technology
- Volume 3: Maintenance of Synthetic Turf (Long Pile)

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Contents

1. Changing Participation & Lifestyle Demographics

1.1. Introduction

The changing face of Australia is impacting many local governments in metro-areas around capital cities, resulting in growing demands for more 'active places' despite more of our population becoming sedentary. There is a need before planning for new sports facilities that there is a deeper understanding of the impacts of the demographic changes.

The first section of this guide explains these key changes.

1.2. Societal Changes

The demographics of western societies are changing significantly, and Australia's population will increase drastically over the next 30 years. So that we can plan for facilities and strategic priorities we need to consider the following:

1. General Population Growth

- Australia's 2022 population statement reflects the impact of Covid-19 on the population, resulting in smaller and older estimation population growth, prior to the pandemic. It still expects growth over the decade from 25.7 million (2021) to 29.9 million by June 2033 and projected to grow to 39.2 million by 2060/61.

- The greatest long-term, demographic challenge is the ageing population, with the number of over 65's doubling in the last 70 years, with this cohort continuing to increase moving forward from 16.8% (2020/21) to 19.9% (2032/3) and 23.1% by 2060/61.

- The largest geographic growth areas are still around capital cities, as the urbanisation continues to grow, although during and post-Covid the move away from the capital cities has nearly doubled, but still relatively low overall.
- With considerable proportions of society already demonstrating sedentary tendencies as they grow older, today's sedentary children will be tomorrow's sedentary adults, who when they, in turn, have children, are likely that their children will also be sedentary. So the health impact could be catastrophic. The consensus of research identifies the need to focus on children to encourage them to be more active.

2. Ageing Society

- As Australia's population grows older, society will need to have the infrastructure in place to cope with the additional growth in chronic physical (and mental) health conditions, and that impact on the health departments at Commonwealth and State levels.

- The burden of the ageing society will be felt economically at both State/Territory and Commonwealth levels. With reduced young workers, older people may be encouraged to stay or re-join the workforce to keep the Country functioning.

- Without appropriate taxes on the older population (e.g. GST) that goes to the Commonwealth Government, compared to the States currently, there will not be adequate income to invest into long term infrastructure needs.

- Significant opportunities for the community sport and recreation sectors including additional volunteers; new clientele for newly retired, with disposable income; increased numbers for physical, mental health activities and programs.

- As healthy Australian's age, their participation preferences will change and move from competitive to participatory, and so more options need to be provided.

- The demand for 'new' older Australians could see demand for increased leisure travel and experiences rather than traditional provision.

3. Children and Youth

- The recent (2021) publication of the Global Active Kids Score Card1 gave Australian young people a "D-", which was the same as two years ago.

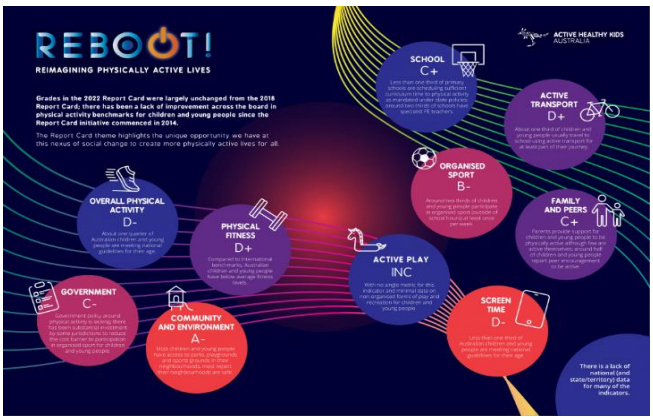


Figure 1: Active Healthy Kids Australia Info-graphic shows the sedentary lifestyles of our children (2022)

[1] https://achper.vic.edu.au/achper/public/news/news-items/2022-Australian-Physical-Activity-Report-Card-released.aspx

- Childhood obesity affects growth and development, and the biggest increase in weight gain is from childhood to early adulthood[2]. 1 in 4 young children (2-4 years old), 1 in 4 children (5-17) and 1 in 2 young people (18-24 years old) are already living with being overweight or obese.
- There are 4.7 million children (0-14 years of age) living in Australia (19%) compared to 3.5 million in 1968 (29% of population) which demonstrates the continued drop as our population grows[3]. 70% of children (2-17 years) do not meet the physical activity guidelines and only 2% of teenagers (13-17 years) meet the guidelines[4].
- Many young people have moved away from traditional sports clubs and are joining other 'Play and Pay' options, where the emphasis is on fun and less on pathway development
- Increased sedentary lifestyles are becoming the norm with younger people, who may be missing guidance by parents/guardians due to their own sedentary lifestyle choices.
- School and Higher Education settings critical to encouraging young people to be 'active enough'.
- School curriculum will impact the level of participation, if this continues to fall, children's health will continue to decline.
- There would be benefits of a Children's Physical Activity Strategy across Australia which addresses all environments, including play, preschool, primary and secondary schools, home, and community, as well as opportunities to exercise, recreate and participate in community sport.
- Children's behaviours need to be understood, when designing exercise, recreation, and entry level sports programs to have a considerable emphasis on fun, mateship and physical literacy.
- Adaptive sports programs are needed for children and young people and delivered in a manner that understands needs and encourages retention.
- Design of future facilities need to be able to accommodate these adaptive programs, as younger people move away from traditional provision.
- The emphasis of technology in young people's lives needs to be embraced by sport/recreation providers and not seen as a competition all of the time.
- There will need to be greater emphasis on physical literacy for children as if they do not develop this, then as adults they will struggle with common day to day physical literacy tasks.

4. Diverse Demographic

- Australia continues to embrace multi-culturalism across its planes, with 7.5 million (29.1%) of the population born overseas[5], ranking Australia 9th against the United Nations international comparison.

  The largest populous countries are England (967,000), India (710,000) and China (596,000).
- The demographic profiles, definitions and characteristics are changing and how they expect to be communicated, interacted, and engaged with, will continue to evolve as well. Understanding these changing demographics is critical for future planning and provision.
- The life expectancy in Australia continues to increase at the last census (2021) at 81.3 years for males and 85.4 for females, an increase of 1.6 years for males and 1.2 for females. Interestingly life expectancy in the USA has been on the decline over the past couple of years reducing from 79 years (2019) to 77 in 2020 and 76 in 2021. This is expected to be the norm with many Western Countries as the sedentary lifestyle take hold. This generational problem is everyone's challenge for the future.

5. Inclusion and Inequalities

- The Australian cultural profile continues to rapidly diversify[6] and this will influence our social, cultural and political systems over the future decades and impact on their expectations for participation opportunities in play, exercise recreation and sport. By 2060, 74% of the population growth is expected to come from overseas migration[7].
- Australia's proportion of First Nations people is increasing, from 2.3% (2001) to 3.2% (2021) and is expected to grow faster than the general population, to reach 1 million by 2027.

[2] National Obesity Strategy (2022-2032) (Health Ministers Meeting 2022) (https://www.health.gov.au/resources/publications/national-obesity-strategy-2022-2032?language=en)
[3] Australia's children: in brief – AIHW (2019) (https://www.aihw.gov.au/reports/children-youth/australias-children-in-brief/summary)
[4] Department of Health and Aged Care: Physical Activity Guidelines (https://www.health.gov.au/topics/physical-activity-and-exercise/physical-activity-and-exercise-guidelines-for-all-australians)
[5] ABS/GOV/AU/People/australia's-population-country-birth/2021
[6] ABS (2022) Migration: statistics on Australian International Migration, International migration and the population by Country of Birth
[7] Australian Government (2021) Intergenerational report (Treasury)

- Sport can bridge the cultural divide at community levels, by being a vehicle to introducing new arrivals into their community by creating strong diverse community clubs.
- The gender gap is still apparent across sport, with men historically receiving greater support and opportunities to participate, represent their country, be featured in the media and have more success in administration. The last few years have seen some rebalancing of these inequalities with many State/Territory governments supporting sports to embrace these inequalities and rebalance this gender divide.
- Opportunities for all abilities has started to be embraced but does not reflect that people with a disability comprise around 18% of the community, including disabilities relating to sensory and speech, intellectual, physical, psychosocial, head injury, stroke or acquired brain injury or other restrictions in everyday activities due to other long-term conditions or ailments[8].
- These and other inequalities impact on sport, and how sport needs to consider creating a fairer, more just and inclusive society. By sport considering a more inclusive approach then the way the industry plans, provides and measures success will also have to change.

1.3. Impact on Sports Particvipation

With the need to encourage more people to exercise, play, recreate and participate in community sport to offset the prevalence of sedentary lifestyles, Local and State Government are aware that there is not enough "active spaces" to accommodate the majority of our 26 million inhabitants. This challenge will continue to grow as the population increases over the next 20 years.

With the growth of our population over the past decade and especially the significant increase in vertical living, the amount of open space per head of population is decreasing significantly in and around most cities.

1.4. Impact on Sports Surfaces

Meeting future demands, expectations and needs that will have a significant impact on the quality of life of the community the following opportunities should be considered.

- Surfaces need to be designed to meet a changing user need, one that embraces multi-use, multi-sport and adapted for key cohorts (e.g. children, young people and older people).
- Siting of facilities need to be close to the community cohorts that the organisation is trying to embrace and encourage to be active.
- Use of colour and surface type to encourage children and youth to be more active will be critical to change their mood regarding exercise and play. This is especially true in schools and youth precincts.
- Flexibility of space to be used by different cultures is important for an inclusive strategy, with social/community space for gatherings also embraced.
- A move away from single sport markings to either integrated play spaces or for multi-lined spaces.

Photo 1: Sydney Parkland Trust Centennial Parklands Multi-sport Field (NSW)

- Design of facilities should be tailored to specific age groups. Pairing older people's needs with those of children and people with a disability (e.g. walking sports with adaptive junior programs) will encourage more intergenerational use and attract more cohort groupings
- Adaptive sports can be targeted at primary cohorts as well as secondary groupings.
- Surfaces will need to be chosen to ensure they can be fit for purpose (e.g. acrylic surfaces can host more use and intense durability than synthetic grass).
- Design ensures access for all abilities;
- Gender is considered integral to all designs, including the sports being played, the facilities being used and the spaces for people to watch, volunteer and participate;
- Multi-sport and multi-use has to be the core of future design to encourage our diverse society to be part of the equation for community success.

The impact of open space footprint reduction, in real terms that many local governments, as the custodians of open space, are challenged with include:

- Reduction of open space (per head of population) as the community population intensifies;

[8] AIHW (2022) People with disability in Australia 2022

- Need to balance both active needs with passive needs in communities for open space;
- Expansion of many football codes from winter only means that the "passive" sports fields usage in summer is now being displaced by more active needs;
- Natural grass cannot cope with the demand (intensity of usage and breadth of usage) for fields to recreate and participate on;
- The embracement of various surface technologies provides opportunities for satisfying the increased demands;
- Sports surface innovations are driving technology improvements form a performance, environmental, community and economic perspective.

Photo 2: Monash University Campus appealing to the younger cohort (Vic)

Understanding the best 'fit for purpose' surface type to reflect the following:

- Performance standards – alignment of design to ensure that the surface meets majority of user's needs. There is no benefit in procuring a 'stadium standard' surface for community informal usage and vice versa;
- Intensity and durable standards – additional understanding of the surface options to be able to cope with the usage (hours and foot traffic) to ensure the design and procurement. An acrylic surface is probably the most durable surface, but may not meet the performance standards (e.g. Rugby);
- Scope of use – ensuring that the design scope is broad enough to encourage more people to use the facility, including the embracing 'adapted sports' such as 5-a-side football, Rugby 7's, Hockey 5's, 3x3 Basketball etc;
- Balancing needs – reducing the need for more active places by using technology to reduce passive spaces.

Design and management of the field of play to focus on long-term strategy, designing for 50 years will ensure that the climate and environmental sustainability is considered strategically. The key aspects to be considered would include:

- Embrace a 50 year design and landscape strategy to minimise the impact on climate;
- Reduce the extreme weather impacts (heat and storms/flooding) on the sport through good Environmental Sustainability Design (ESD);
- Landscape integration – with the field of play being one element that should be considered for the whole site/complex. Embrace the expert guidance from the Australian Institute of Landscape Architects (AILA) Climate Positive Design action plan, as best practice within Australia;[9]
- Strategy alignment – explore and commit to the UN's Sports for Climate Action Initiative, and any within the sport or government;[10]
- Surface technology – encourage and embrace innovative technology that reduces the impact on fossil fuels in the making of the surface. Also be receptive to use synthetic technology combined with natural components (e.g. organic infill) that impacts on key environmental issues such as heat, microplastics and the circular economy.

The initial capital cost need to be considered holistically as a 'Whole of Life' cost, preferably over 50 years. This will ensure that generational decisions are made.

This should include:

- Capital Costs – for the field of play, and any major replacements (e.g. lights);
- Maintenance – the operational costs to keep the field of play safe and performing to the required standards or needs;
- Replacement – the routine replacement of turf, etc. over the 50 years;

This can provide an annual amortised rate which can be used to calculate the hourly rental costs for the field.

[9] Australian Institute of Landscape Architects (AILA) Climate Positive Design action plan CLIMATE_POSITIVE_DESIGN_Action_plan_for_LAs.pdf (aila.org.au)

[10] UN's Sports for Climate Action Initiative Sports for Climate Action | UNFCCC

1.5 Types of Surface

To make the decision on the type of surface that will be needed for a specific project there are a number of variables that need to be considered.

In essence, a surface should be considered not only by itself but as an element of the network it is part of, whether that be by sport or indeed by geographical region as many times re-working of the programming of fields can allow teams to play on non-home fields to rest them during the week so that matches can be played at weekends.

Photo 3: NSW Field after synthetic field installed (installed by Turf One)

The most common decision-making points are based around:

- Playing capacity

What are the needs of the community that need to be aligned with current and future plans for sports fields? What type of surface needs to consider the playing capacity embracing soil technology, irrigation, drainage for natural fields and synthetic technology when the intensity of use cannot be met on natural turf.

- Standards of play

Is there a specific standard for the level of sport that is linked to the International Sports Federation or National Sports Organisation that the sport or clients wishes to have in place, and depending on the sports, some standards and sports can be co-located on the same surface type.

- Economic considerations

Exploring what can be afforded at the capital installation time and for the recurring budget costs of maintenance and replacement costs is critical to any decision making process. There is also a need to consider the revenue strategy opportunities to offset the Whole of Life budget costs.

- Technical consideration

Understanding the technical aspects that will need to be considered to achieve the previous three decision making points is critical in an objective manner. Using the Furture Proofing Tools to assist with this.

- Strategic alignment

How does the suggested decision align with key strategic and policies of the purchaser and the key stakeholders needs to be identified?

- Environmental benefits

Undrstanding the benefits and implications for the environment of the various options to assist with the decision-making point, from Green Engineering best practice, water sustainability, to installation methods, management sustainability and impact on the environmental footprint.

This Guide aims to provide advice to organisations who are keen to explore how synthetic sports field technology can complement their natural turf fields and satisfy the growing demand by all codes. This Guide addresses:

- The evolution and benefits of synthetic sports surface technology;
- An explanation of what a synthetic football turf system consists of; and
- The global and local standards needed for each sport that should be embraced

2. Synthetic Sports Turf Technology

2.1. Evolution of Synthetic Turf for Sports

Synthetic grass was originally designed as an urban playing surface meant to replace the concrete and brick that covered the US recreation areas in city schoolyards. During the Korean War, the U.S. Army had found urban recruits to be less physically fit than rural recruits. Attributing this to lack of green space in cities, the Ford Foundation funded research for Monsanto to create a synthetic grass replica in 1962.

It had to be wear-resistant, cost efficient, comfortably cushioned, and traction tested. Two years later employees of the Chemstrand Company, a subsidiary of Monsanto Industries, developed a synthetic surface called ChemGrass and installed it at the Moses Brown School, a private educational facility in Providence, Rhode Island.

The new product met each of the Ford Foundation's original criteria except one: It was expensive to produce making it an unviable option for inner-city playgrounds. However, it soon found a new home and a new name.

In 1965, the Astrodome, the world's first domed stadium opened in Houston, Texas, featuring a glass-covered roof that allowed real grass to grow inside the dome. However, the athletes that used the facility complained they couldn't follow the path of the ball because of the glare caused by the glass. Painting the glass killed both the glare and the grass, so the lifeless lawn was replaced in 1966 with the revolutionary ChemGrass, which was quickly dubbed AstroTurf®[11]

1st Generation Artificial Grass
© Loughborough University; www.sportsurf.lboro.ac.uk
• 10 – 12 mm fibre length, integral shock pad developed 1960s, nylon, unfilled, hard, abrasive
• Used for hockey at the 1976 Montreal Olympics

Co-incidentally some 60 years later we are using the updated technology to encourage more children to be active.

The Second-Generation carpet promised to be more aligned to 'natural turf' with an infill that was to act similar to the growing medium of natural fields and to keep the yarn upright. Sand was used, and the yarn was 20-35mm in height. The tightly packed polypropylene blades of grass being used looked very similar to natural grass but did not perform like natural grass.

Photo 4: 2nd Generation Synthetic Turf (source: Cranfield University www.cranfield.ac.uk)

The 1980's version also had some drawbacks including:

- ***Playability*** – the sand infill and yarn combination didn't let the ball have the same playing characteristics as on natural turf. It bounced unpredictably, and the roll was far faster; and
- ***Safety*** – the friction on skin was significant and caused 'skin burns' which then developed into wounds if not treated.

The durability of this Second-Generation Football Turf for community football pitches (5-a-side facilities) was excellent and allowed many more people to play the game. In the UK, 5-a-side football has larger participation rates than 11-a-side, and so this had a positive outcome in the UK.

Four English professional football clubs invested in synthetic turf in the 1980's: Queens Park Rangers (Loftus Road), Luton Town (Kenilworth Road), Oldham Athletic (Boundary Park) and Preston North End (Deepdale).

At the end of the 1990's the European governing body for football, UEFA, ruled that professional level games should not be played on synthetic turf.

[11] Astroturf, The Story Behind the Product that revolutionised Sports Surfaces (Astroturf.com)

In the 1990's the major manufacturers of Synthetic Football Turf understood the benefits the technology could offer to the community and elite sport, but could not convince the world's sport's governing bodies by themselves. In the 1990's FIFA made it clear that the playability and performance standards that were needed for synthetic football turf had to reflect the standards of natural turf.

After much research, the end of the 1990's saw a new generation turf, using a softer yarn, polyethylene, with rubber granules as the key infill component and sand now used more as ballast so that the carpet didn't move.

In the past decade, the sophistication of synthetic Football Turf has been driven by FIFA's performance standards focused on aligning the playability of natural turf with the durability needed for community playing capacity and climate challenges. This has resulted in the emphasis on development being based on:

- ***Infill*** – to ensure ball, boot and player interactions play as a natural field;
- ***Yarn*** – to reflect blades of grass, being designed to stay vertically upright and soft on players skin; and
- ***Shockpad*** – introduced to provide a safer and more consistent performance and playing surface, especially with regard to contact sports.

The result is that synthetic football fields are now being embraced by both community teams and elite players, including Australia and globally.

The current or Third-Generation (3G) turf was developed from these learnings and this is what is used in Australia and globally today. Each manufacturer continues to explore enhancements within the 3G fields to fine tune the experience for the players and the performance outcomes.

Photo 5: Multi-sport field in Sutherland Shire - NSW (Kareela Oval)

Each of the globe's key manufacturers continually evolve their product systems to meet the latest guidelines from the key football codes. 2018 and 2022 has seen new updated performance specifications for Football, Rugby Union and Rugby League; and Australian Rules Football.

2.2. Benefits of Synthetic Turf Football Surfaces

All the football codes appreciate the technological benefits it brings to assist with the growth of their code as the population continues to grow in Australia. The key benefits of installing a synthetic sports field include:

- **Climatic**: Under drought and water restrictions or excessive rain conditions, it can be difficult to maintain a safe and suitable natural grass surface. Synthetic sports surfaces in general are not affected by reduced or increased rainfall;
- **Usage**: There is a limit to the hours natural turf can be used before there is a significant impact on surface condition. A high quality natural turf surface may only withstand use for up to 20-30 hours per week before it starts to deteriorate. Most local councils aim for their natural turf to cope with 30 hours of mederate usage per week and accept end of season renovations will be needed. The greater intensity of usage results in a greater renovation budget being needed. The challenge facing councils is the reduced 'renovation window' at the end of the winter season with football becoming a full year round sport, together with the intensity growing from moderate to high usage. Synthetic surfaces can sustain significantly higher use than natural grass, with 60 hours plus per week as an acceptable expectation;
- **Maintenance**: Optimising the playing capacity of a natural turf surface can be time consuming, expensive and generally requires a qualified person with many Councils finding that if they do not increase weekly maintenance, at the end of each year the renovation costs increased dramatically. Synthetic surfaces require lower ongoing maintenance and limited renovation compared to natural turf surfaces;
- **Consistency and quality of play**: Synthetic surfaces provide a consistent and safe surface all year round for all sports to play on, improving the quality of performance for each sport compared with natural playing surfaces;

- **Health**: By allowing play on the surface more often and under safer conditions, it enhances physical health of participants and reduces their injuries; and
- **Club sustainability**: With the sustainability of many club's dependent upon their ability to coach and train juniors most evenings on the field and to provide a kiosk service off the field on match day to generate income, the ability for synthetic fields to have next to no cancellations of fixtures should be a benefit to all clubs.

2.3. History of Synthetic Sports Turf in Australia for Football Codes

Australia has started to embrace the synthetic sports turf technology as a norm now, with the last twenty years the key milestones have included:

- 1998 – Astroturf (USA) installed Football (soccer) field into AIS (Canberra);
- 2005 – Victorian Soccer Stadium installed three football turf fields (Darebin) with a FieldTurf product installed by TigerTurf;

Photo 6: Victorian State Football Centre, Darebin

- 2008 – AFL published community field guidelines, with Cricket Australia for Australian Rules Football fields;
- 2010 – AFL's first field installed at JJ Holland Park, City of Melbourne by Team Sports (now Polytan);
- 2014 – Rugby Union's first field installed and Certified fields at Blackman Park, Lane Cove by Team Sports (now Polytan);

Photo 7 Blackman Park, Lane Cove, NSW

- 2016 – Australia's first multi-sport certified field at Moore Park, Sydney, allowing Football, 11-a-side, 5-a-side (FIFA Quality mark), Rugby Union (Regulation 22 standard) and Rugby League (Community Standard) installed by Polytan;
- 2017 - Rugby Union's first standalone field – commissioned by Randwick City Council (NSW) at Latham Park against World Rugby's Regulation 22 standard, installed by Turf One;

Photo 8; Latham Park, Randwick, NSW

- 2018 – Rugby League's first League only field in Blacktown, NSW
- 2021 – NRL updated their performance standards The first full field with cork was installed at Easts Rugby Club by Turf One (Field Turf product) and is used for community training, competition and Shute Shield games. The additional hours training capacity has allowed the Club to regenerate itself with a growing membership base and economic improvement to the bottom line;
- 2021 – Standards Australia publish AS TR CEN 17519: 2021 Surfaces for Sports areas – Synthetic turf sports

- facilities guidance on how to minimise infield dispersion into the environment.[12]
- 2023 – NSW Chief Scientist and Engineer published her Review of Synthetic Technology report.[13]
- 2024 – New Thought Leadership, on Environmental best practice integrated into the Smart approaches to design, construction and management of synthetic sports turf.

2.4. Current Approach to Synthetic Turf

The current '3G' Football Turf is at a crossroads with the demand to play a greater intensity on community fields and for more hours is challenging manufacturers to be more innovative in the design and production of turf systems. This includes:

- Adoption of dual use yarn technology (monofilament & fibrillated tape) to reduce migration of infills, ball splash and increase durability of the yarn;
- Increase the amount of yarn in each field (weight) and reduce the infill levels by use of shockpads.
- Some of these initiatives haven't been adopted globally, which showcases that Australia can be leading the world.

Looking forward we will see the polymers being made from the bio-chemical industry (e.g. sugar cane) as opposed from the petro-chemical industry. The environmental drivers from the quality companies are growing daily with innovative solutions being developed to meet the more holistic needs.

12 Standards Australia AS TR CEN 17519:2021 Surfaces for sports areas — Synthetic turf sports facilities — Guidance on how to minimize infill dispersion into the environment. *(SA TR CEN 17519:2021 Surfaces for sports areas — Synthetic turf sports facilities — Guidance on how to minimize infill dispersion into the environment | Standards Australia Store*

[13]NSW Chief Scientist and Engineer published her Review of Synthetic Technology report Synthetic Turf in Public Spaces | Chief Scientist (nsw.gov.au)

3. Football Turf – A Synthetic System

3.1. Introduction

To be able to design and preserve a Football Turf system that is fit for purpose for a particular project we should appreciate each of the components that contribute to it's success. These include:

- Performance surface (grass carpet, infill and shockpad); and
- Pavement and drainage strategy – civil construction

The performance criteria are normally identified by the Sports International Federation, as the starting point with additional requirements for each region of the globe. The civil construction standards should be focused on for two key components, the aspirational life expectancy of the pavement base (e.g. 20, 30 years etc) and the drainage strategy aspirations (e.g. ARI of 5%). Both of these will be impacted by the environmental conditions of the site.

3.2. Performance Surface System

Each manufacturer has its own system, but the latest generation of synthetic fields generally comprise a synthetic grass carpet containing a layer of stabilizing sand, topped with in-fill, which historically has been but will now be organic matter. This is then recommended to be laid on a shockpad – if the system uses one – and then onto a suitable base, which is crucial for the overall quality and lifespan of the system. This normally comprises of a civil engineered pavement constructed upon a sub-base.

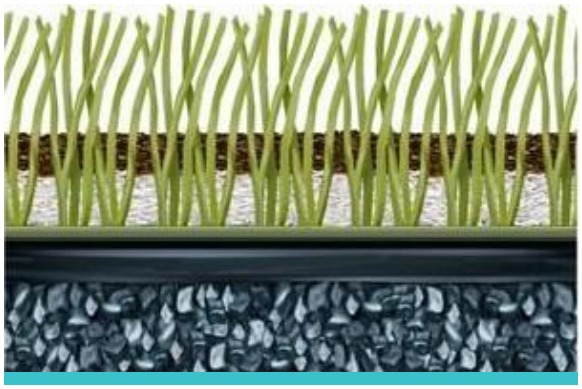


Figure 2: Source FIFA quality concept for Football Turf, showing the turf, performance infill and sand infill, shockpad and typical pavement base

3.2.1. Third Generation Football Turf Yarn

The third generation Football Turf yarn is normally made from either a polyethylene or polypropylene fibre, which is extruded from polymers in a manner that allows them to be strong enough to stand upright, which is assisted with infill, similar to natural blades of grass. The balance between thickness (normally over 300 microns) and softness is critical to achieving a durable and playable finish.

There is a range of yarns that are on offer in systems, including:

- **Monofilament Fibre** – a single length or blade which tries to replicate that of a single blade of natural grass. The negative of this system is that it normally exhibits greater infill splash and movement of infill across the field, thus more maintenance is needed.
- **Tape** – the yarn is produced in a sheet (slit-film sheet) then cut to the width desired, so the texture has more uniformity than the single blade of the mono-filament yarn with the superior turf bind and very durable.
- **Dual Yarn System** – some manufacturers are offering a combined yarn system that offers the aesthetics of a monofilament yarn with the superior tuft bind and durability of a tape sheet. This type has been the Authors recommendation for the past decade as it is more durable, encapsulates the infill, reduces ball splash and maintenance needs.
- **Textured Monofilament –** a straight monofilament yarn that is heat set to product a tight curly appearance which non – directional for Hockey, or with '3g' football turf systems then acts as a deep thatch to capture some of the infill.

In the next generation of football turf fields (4G) there is no performance infill and the thatch yarn acts as the performance infill' solely.

The yarn is made in various lengths depending upon its use and type of sport. Indeed, over the past five years the trend has been for facilities to have a yarn length between 50 and 60mm. Fields with infill under 50mm being more prone to need additional maintenance as the infill disperses quickly from key areas and this impacts performance, so although common in Europe we would not recommend them in Australia.

Rugby Union has a new minimum requirement of 50mm. It is recommended that unless the field is in a 'closed environment' with daily maintenance that the field infill levels are held at a minimum of 60mm with a shockpad, to reduce risk of injury for the players.

- **Pile Weight/Density**

Identifying the quantity of yarn within a square meter, using the number of stitches and the gauge manufacture. As a rule, the tighter the pile, the higher the price and

better quality. The linear density is a measure of the weight of the yarn and is referred to as the 'Denier'.

- **UV Resistance**

As Australia has one of the most aggressive climates with one of the highest UV levels in the world, it has a direct impact on the longevity of the synthetic turf system. The yarn should be provided with a warrantee against UV degradation. Some cheaper yarns that are being imported into Australia may not have been tested to the appropriate levels needed, and this should be considered. The UV stabilisation is a big part of the yarn cost and is tested using a QUV machine that exposes the yarn to high levels of artificial UV light and combined with artificial weathering (heat, light, rain etc.) simulates eight years of exposure. This now involves 5,000 hours of testing.

- **Colour Fastness**

Extensive weathering such as heat, rain and wind can impact on the colour fastness of the pigments in the yarn. When combined with intensive play, the pigments, if not stabilised with the yarns' polymers, can cause accelerated breakdown. In some earlier yarns (pre-2002) the use of heavy lead pigments (e.g. lead chromate) were used. The key manufacturers in the late 1990's embraced the EU Packaging Directive removing heavy metals from recycled plastic packaging products (1994). Some cheaper imported products may not have embraced these standards. It is important that any purchaser of synthetic surfaces ensures that this is adhered to by the supplier.

The Australian standard for colour fastness in artificial light, which can be used to test the colour fastness, is AS2001-4.21-2006 which also addresses the minimum UV degradation.

The safety of the colour pigment is not addressed by any Australian standard and the European DIN standard 18035 states that the levels should be:

Table 1: Acceptable heavy metal levels (source: DIN 18035)

Heavy Metal	Acceptable Level	Units
Lead	<0.04	mg/L
Cadmium	<0.0005	mg/L
Chrome Total	<0.05	mg/L
Mercury	<0.001	mg/L
Zinc	<3.0	mg/L

3.2.2. Next Generation Systems

Innovation will continue to push the boundaries of how synthetic turf is developed and designed. The latest of innovation is in response to the community concerns regarding microplastics and rubber infill.

The next generation designs focus on removing the performance infill (e.g. rubber/organic) and have this replaced as:

- Thatch and sand – a significant thatch that normally is 50% of the yarn height, and captures the sand, as ballast, below the thatch level to provide support;
- No infill with increased thatch thickness

The consequence is this, that next generations systems do not meet the strict performance criteria of Critical Head Impact, skin friction and a rotational performance.

With the reviews of this product range, it is not recommended that any next generation systems are considered for sports performance surfaces currently (2023).

3.2.3. The Carpet Backing

The backing material is critical as it holds the tufted or woven yarn in place but also needs to be durable enough to hold the field in place, so there is no shrinkage or expansion. It is also critical for connecting each roll of grass on the field, allowing water to pass through the surface.

The tufted yarn option is predominantly tufted through the backing and the yarn needs to have a coating or glue type bonding agent so that the tufts cannot be easily moved or pulled out.

The most commonly used coating is a polyurethane bonding agent, due to its superior water resistance. Latex, thermo-plastic coatings, natural rubber and other bonding agents can also be used. The porosity of the backing is normally achieved in one of two ways; either using a heat soldering hole and puncturing across the roll of grass or having the polyurethane backing only attributed to the yarn tufted areas and the space in between the tufts is therefore more porous.

The majority of carpet backing is double backed with the 'secondary backing' sprayed on to seal the carpet tufts. Some manufacturers only 'seal' the turf and gauge, leaving the space between not double sealed, allowing for greater water porosity. These pictures below provide an understanding of the two key options.

The water porosity through the carpet backing must be achieved for the key sports. For instance, in Football (Soccer) the FIFA guidelines are 180ml per hour. In Rugby Union the World Rugby guideline is 500ml per hour, whilst Australian Rules (AFL) is 200ml. It is recommended

all pitches should have a porosity rate of 500ml per hour. It is important to design drainage rates to cope with this.

Photo 1: Turfed grass backing options

The holes in the back of the carpet are traditionally spaced, but for high porosity needs it is recommended to have twice the number of holes. Also, it is not recommended to have the carpet to go onto a concrete or insitu shockpad if the water is expected to travel horizontally or laterally. A vertical draining solution is best.

3.2.4. Carpet Seams and Joining

The carpet is normally created on rolls of 3.2m-4.5m in width and these are laid width wise across the field. The 'straight lines' are normally integrated when woven and the circular lines laid at installation.

Any other straight seams are usually secured by sewing or using an adhesive, depending upon the manufacturer's system. The important point is that the carpet should be seamless and have a maximum possible joint strength.

The adhesives used should be proven in Australia and are not considered volatile in adverse weather conditions (e.g. heat, rain, wind, humidity etc.).

Photo 2: Example of seam failure

3.2.5. Infills

The infill for football fields assists the performance of the whole synthetic grass system, with the aim of replicating natural turf growing mediums in a natural pitch where the grass/synthetic yarn is held upright. The infill can be compiled from sand, rubber or plastic (either recycled or virgin) or organic infills.

Photo 3: Silica Sand (source: www.flexsand.com)

The amount of fill in a 3G field is normally determined by the manufacturer when they consider the length of the grass yarn, the performance outcomes, use of shockpad and purpose of the field. For Soccer we would recommend a minimum of 50mm. Rugby can be played on a system less than 60mm (i.e. 50mm minimum), but it is recommended that for open parklands that only 60mm is used in accordance with Regulations. There are five key infill options with various combinations as follows:

i.) **Sands** – Most surfaces will use silicon sand, which is rounded, non-toxic and chemically stable, and many companies use this as ballast and have the performance infill on top. By itself it can be hard on the players over time

ii.) **Crushed or Recycled Rubber (SBR)** – The most popular and cost-effective choice in the Asia Pacific region, derived from recycled motor vehicle tyres. The crumbed rubber is normally 0.5mm-2mm in size. The colour is black, which means that there is tendency to retain heat compared to lighter infills. This is being phased out globally due to the microplastics issues.

iii.) **Virgin Rubbers and Plastics** – There are several options including:

- **TPE** – Thermo Plastic Elastomer compressed into shape, including long life and can come in many colours. Also, TP and TV's are from the same Thermo Plastic family; and
- **EPDM** – Provided from three monomers; ethylene, propylene and diene and normally in light green or light brown in colour.

Both of these options are being phased out in Australia over the next decade.

Photo 4: EPDM infill (source: MELOS)

iv.) Organic – With the pending demise of the globe's best performance infill due to the concern of microplastic, organic options are mow becoming more available. In Australia we now have options including cork, cork and coconut husk and woodchip. In Europe there are also options including olive pips, walnut husks and corn husks, with others to follow for sure.

Photo 5: Organic Infill (source: Limonta)

It is important that with organic infills that a number of aspects are considered. Including:

- The infills ability to not float with excess water; so the drainage needs to be cognisant of this through the carpet, to reduce ponding within the carpet;
- A dual yarn system to encapsulate the yarn to reduce migration and floating;
- A dual yarn system, with tape over the top should reduce the breakdown of the infill;
- A high hub around the field to contain any infill migration within the field of play.

The European Union has banned the use of intentionally added microplastics into synthetic sports fields, from 2031, with current fields being allowed to continue until that date. The majority of fields are now exploring the use of organic infills as the performance infill of choice if they wish to continue with certified fields.

There are options for non-filled or sand fields being used for football (soccer) but these can't obtain the International Federation Certificates for Football, Rugby Union, Rugby League currently, and wouldn't expect to be used for Australian Rules either.

Australia does not have the same legislation but does have keen community environmental groups that are eager to stop rubber being used. We should be embracing this community approach in our design.

The migration of the rubber infill can be reduced by an estimated 98% if the designs and managers of the field of play adopt Australian Standard SA TR CEN 17519:2021 (Surfaces for sports areas – Synthetic turf sports facilities – Guidance on how to minimise infill dispersion into the environment).

In addition, it is recommended that the turf chosen is NOT a monofilament but a dual yarn system to reduce migration of infill and ball splash.

- **Amount of Infill**

The amount of infill used in a field will depend on how the manufacturers systems work and against what sports performance standards are chosen. The important considerations are mix of infill, weight per square meter and the thickness of the yarn fibres to allow the yarn to stay upright. Our recommendation is that if the field is an open field (i.e. not a stadium) then the minimum height of yarn should be 50mm.

By having a shockpad, there is less need for an extra-long pile field (65-70mm) which removes the level of infill needed by 50% according to FIFA[14]. This will also have a significant impact on the recycling of the infill at the end of life. Over the past 5 years we have seen the use of shockpads reduce the infill levels from 25+ kg/m^2, to approximately 6kg/m^2. This reduces the microplastics migration and use of dual yarn also keeps the infill in place.

- **Safety of Infill**

There has been community discussion around the environmental and health and safety impact of some

[14] Environmental Impact Study on Artificial Football Turf (Environmental Research and Consulting for FIFA: March 2017)

infills, which is covered later. We would recommend that to provide community comfort the rubbers used are virgin rubbers and have been assessed to EN71.3 (Specification for migration of certain elements) which is Europe's Safety Standard for Toy Ingestion.

There is a move to adopt virgin rubber, so as to move away from the recycled infills, which are the most economical option. The virgin rubbers predominantly add an additional 8-10% to the field project costs.

Europe had new standards (2020) which are aligned with the level of acceptable of the eight most dangerous PAH's. All infill in Australia should have certification that they can achieve this level. Rugby League in the UK and in Australia are the first body to adopt this new standard.

The synthetic turf carpet infill needs to comply with the requirements of the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulations XVII Entry 50. The infill placed within the synthetic turf carpet should comply with the draft REACH restriction requirements of the European Chemical Agency (≤ 20mg/kg of the REACH 8-PAH's). Obviously with organic infill this is not needed.

3.2.6. Shockpad

The type and thickness of shockpads needs to be considered as part of the overall synthetic surface system. This is to ensure that the important requirements of international sports standards regarding shock absorption, energy restitution and vertical deformation are met.

There are a range of shockpads offered as part of sports turf systems to the market of varying quality which need to be carefully considered. The most important aspect of the shockpad is its ability to help the overall system meet its performance standards over time, not just during the first life of the carpet.

It is recommended that the shockpad be reused and therefore needs to be able to cope with the level of usage that the field will endure. This will be addressed in the warranty offered. The two considerations of the warranty should be the life expectancy and the usage parameters. The parameters must be fit for purpose, as its no use having a 20 plus year warranty if that only covers 2,000 hours annual usage (38.5 hours a week) if the field will average 60 hours a week.

The warrantee needs to be from the manufacturer and NOT the agent. If the agent wishes to provide a longer warrantee, this should only be accepted with the written approval of the manufacturer.

There are two kinds of shockpads:

i.) Prefabricated construction

There are many systems on the market, including roll-out pads, normally up to 10m in width, prefabricated sheets which once laid out can reduce the time of installation. The latest approach to the preformed shockpads is to allow for breathing in the pad for when they expand and contract.

Some shockpads are currently being developed with breathable channels which allow water through easier and trap air, making them cooler (according to the marketing literature). Tests are being held to ascertain the reality of this process. The challenge with these options is that it may reduce the integrity of the shockpad over time and secondly the channels may not be broad enough to cater for a specific rain event (e.g. 1 = 20 years etc.).

Photo 6: Prefabricated Shockpad being laid (source: Team Sports)

ii.) In-situ construction

This surface infill mix comes in a variation of thickness between 35mm and 10mm and consists of a polyurethane binder mixer combined with rubber crumb (SBR). The mix needs to be perfected with the infill for the system to be optimised.

Loughborough University http://sportsurf.lboro.ac.uk identified that the binder (glue) percentage strength should ideally be between 12 percent and 16 percent when laying shockpads. This should be requested at the procurement stage.

The use of in-situ shockpads on top of 'flat'< 1%) impervious layers is not recommended for horizontal drainage as the lateral/horizontal movement of water in these in-situ layers is very slow and is only recommended. In-situ layers work well on open asphalt of road-based for vertical draining bases.

The drainage strategy will have a significant impact on the type of shockpad chosen. It is important to ensure that

the chosen shockpadcan actually move the amount of water that is part of the drainage strategy.

Photo 7: Insitu shockpad being laid (source: Polytan)

It is likely to conclude what industry experts have been saying for some time; that if a synthetic system does not have a shockpad, the level of maintenance needs to be higher and more consistent. The shockpad is providing more certainty of achieving the performance targets over time, particularly with the higher level of use.

The European Synthetic Turf Council (ESTC) provided the outcomes of a thorough research project that recommends that shockpads should be used when there is any doubt that the maintenance levels may not be kept up with patronage usage and with usage intensity.

> *"When a Football Turf (World name for synthetic football field) system is regularly and adequately maintained all systems (with and without shockpad) did retain an acceptable level of performance; and*
>
> *Within the range of tested samples, we see that the systems containing a high-quality shockpad were likely to show less deterioration than the system without a shockpad in cases where the maintenance was not done correctly."*[15]

Due to many fields in Australia being in the open domain of parklands, which encourages even greater use, it is recommended to have a shockpad for every football field.

- **Reuse of Shockpads**

If a shockpad is to be reused, which should be expected for at least two further changes of the carpet, as the majority of shockpads now offer a 20 plus year warranty, the pad needs to be able to demonstrate key performance characteristics. According to the FIFA Quality Manual (2015) it needs to be able to show:

- The shock absorption of the existing shockpad is between 90% and 110% of the shock absorption value declared by the manufacturer when the Football Turf system was initially type approved;
- The deformation of the existing shockpad is +2mm of the deformation declared by the manufacturer when the Football Turf system was initially type approved; and
- The water permeability of the shockpad is greater than 180mm/hr when tested in accordance with EN 12616. Smart Connection Consultancy recommend 500mm/hr.

The shockpad must also be able to meet the following additional requirements of Table 3 (source: NRL Guide to the Use of Synthetic Turf Pitches for Competition and Training – 2020 Edition, page 31).

Table 2: RFL Guide to the Use of Synthetic Turf Pitches

Shockpads and Elastic Layers					
	Shockpads and elastic layers less than 25mm thick	En12230	Unaged	≥ 0.15MPa	
				% loss in strength compared to unaged result	≤ 25%
	Shockpads and elastic layers 25mm or thicker	FIH Hockey Turf and field standards Part 3 clause 8.A.1.2	Unaged	≥ 0.10 MPa	
			After air ageing	% loss in strength compared to unaged result	≤ 25%
	Shockpads with channels and slots	FIH Hockey Turf and Field standards Part 3 clause 8.17.13	Unaged	≥ 0.10 MPa	
			After air ageing	% loss in strength compared to unaged results	≤ 25%

This is a new standard for Australia and should be included in all specifications for all Football codes, with shockpads.

3.2.7. Durability Considerations

The durability of the field should be considered for high wear areas, such as the penalty area, entrance through gates, linesmen areas etc. The suppliers should be asked how they can ensure that the durability of these areas can sustain the usage and even ask for additional guarantees for those areas.

Also request what additional maintenance can be embraced to maximize their life expectancy. It is worth stating the numbers of hours of use the field will expect to receive, the intensity and type of footwear, as all of these components can impact on the Synthetic Football Turf System that will be offered.

[15] Press Release – European Synthetic Turf Council Recommend Shockpads for Synthetic Sports Fields, 2014

3.3. Civil Engineering Solution

3.3.1. Pavement

It is critical to ensure that the sub-base and pavement is designed by a civil engineering specialist so that it can support the Synthetic Surface System. The design should be based against data from the location/field inspections including an expert geotechnical report, topographical survey, drainage study and an environmental analysis.

The focus of the sub-base and pavement base design must be able to achieve the following:

- Support the vehicle load during the construction, maintenance and replacement phases,
- Integrate with the synthetic surface to ensure that the sports' performance criteria are achieved,
- Support the load on the pitch once in use, including players and maintenance machinery, to ensure no negative deformation of the surface, and
- Protect the surface from other sub-grade movement or water.

There should be an appropriately deep bore for each of the light towers in addition to the field analysis which typically would be between 8 and 12 bore holes.

3.3.2. Drainage

Although many people focus on the quality of the performance surface it is just, if not more, important to focus on the drainage strategy to ensure that people can continue to play through a standard rain event or to continue playing after an intense rain event.

The International Federations have a porosity standard, typically 180 mm/hr, but our recommendations are more pragmatic and should contain the following:

- Agree the rain event (ARI) that you want the Football Turf system to cope with, we would suggest a minimum of 1 in 20 year ARI (15%) with an intensity of 20mins. If the rain events are becoming more frequent with climate change, being a 1 in 50 or even a 1 in 100 year event.
- Ensure that the stormwater system can cope with the level of water being discharged, and if it cannot then the drainage system will need to be designed to accommodate this. This could include a vertical draining strategy as opposed to the use of a horizontal drainage cell.
- Develop the drainage strategy, or the capacity of the discharge flow rate needed. It would be suggested to use a vertical draining profile as the base starting point as the approach will detain water in the pavement first before letting it discharge.

The two most common drainage strategies include:

- **Option 1: Free Flowing Aggregate Base (Vertical)**

The aggerate base allows for the water to progress through the carpet and shockpad before using gravity to progress through the voids to a drainage line around the base of the pavement around the sports field. Using different sizes of rock will force the water through and to the outside of the fields.

With void space of approximately 40% between the rocks this allows the water to slowly seep through the pavement and drain to the storm water exit pipe. The depth of the pavement can be linked to the amount of water that needs to be retained and released slowly. .

- **Option 2: Drainage Cell (Horizontal)**

Utilising a 'dry pavement' with a Geotech lining and drainage cell on top and beneath the shockpad allows the water to pass through the turf system.

Photo 8: Example of horizontal drainage cell under shockpad (source: Wayne Stuart - City of Swan, WA)

With the assistance of gravity and an incline of around 1.0%, allowing the water to drain to the edge of the field and to a collector drain, which then takes the water to the storm water pipe.

The cell is predominantly around 30mm in thickness and should be linked to the rain event that is needed. There have been some 10mm cells used that cannot cope with the level of water used, so there needs to be a logic to the size used for each project.

The drainage cell allows for the quick removal of water as long as the storm water pipe can cope with the discharge speed. This may not be the right solution for all fields.

3.3.3 Civil Conclusion Constructions

To ensure that the construction of the civil component consider the following pragmatic steps:

1. Identify the Annual Rain Intensity event and duration that your drainage strategy needs to cope with.
2. Get to know your site, conduct a Geotech and environmental assessment (integral), a site survey and explore flood studies, bushfire overlay etc.
3. Identify if the storm water discharge pipes can cope with, to identify if vertical of horizontal drainage strategy can be used.
4. Design surface fall to embrace drainage strategy.
5. Depending upon the drainage strategy identify the type of shockpad that can be used. If horizontal drainage strategy is chosen do NOT have an in-situ pad.
6. Ensure pavement is designed for the life expectancy (20-50) years and loading expectation (weight of ambulance etc).

3.4. Sports Embraces Synthetic Technology

3.4.1 Importance of Performance for Football Codes

The development of performance standards for all of the main Australian football codes has been one of the reasons for the rapid acceptance of the technology by the majority of the sports community.

The performance standards for each sport identify the safety, performance, playability, technical and durability standards that a synthetic sports system needs to achieve. This demonstrates and provides confidence to the users that the field will play with similar 'playing qualities' of a quality natural turf field. The emphasis of these standards is focused on the interaction between the surface, players and the ball, reflecting the playing characteristics for each football code.

It is critical for all football codes that when a purchaser is considering procuring a synthetic sports system that the installation is to the appropriate International Federation sports required standards, also detailed below.

3.4.2 Governing Body Standards

1. Overview

All the Football governing bodies in Australia have either embraced the global standards from the International Federation (Football and Rugby Union), developed their own directly (AFL) or have enhanced the International Federation standard for local conditions (Rugby League).

Each sports code developed standards from quality natural turf fields with specific performance standards that can be measured in a laboratory and in the field of play. All of the sports have similar processes that need to be followed before a field can be certified against a specific standard. It is worth checking for each sport specifically.

The common approach is:

- Laboratory Test – to ensure that the product/system performs to the Testing Handbook/Guide;
- The installation of a system that has passed the Laboratory Tests;
- Insitu-testing – an Independent Test Institute will then test the field against the appropriate performance standards;
- Certification – the International Governing Body will then issue a certificate for the playing field for the specified standards and duration (1-3 years depending upon the sport).

2. Licensee's / Preferred Producers

Each sport has its own approach to recognising manufacturers or installers in a manner that they believe assures quality for the sport, with details provided later in this section for each sport.

When procuring synthetic systems from Licensees or Preferred Providers they may have Agents within Australia working on their behalf. When considering engaging these Agents one needs to consider their experience, capability and capacity for the project. Even the world's best synthetic surface would only be as good as the construction and installation employed.

3. The Importance of Testing

The importance of having the field tested should not be underestimated, for less than $10,000 it will provide the purchaser with confidence that the system they have purchased meets the safety and performance standards that the International Federation has stipulated. It works as a 'Risk Mitigator' and some sports such as Rugby Union

and AFL will not insure players who play on fields that do not hold a current certification.

FIFA, as the governing body for Football (Soccer), encourage their standards to be improved if a particular region of the globe has specific issues. Smart Connection Consultancy has, over the years enhanced specific FIFA/World Rugby/NRL/AFL standards that will assist with durability, UV, heat issues, management and porosity needs that we have in Australia.

3.4.3 Sports Standards

This section provides guidance for each sport's specific standards in 'layman's terms', identifies key contact information for each sport and recommends access to further knowledge sharing.

1. Australian Rules Football / Cricket

Approach to using Synthetic Surfaces

As custodian of the game, the AFL has recognised the need to develop ways to increase the carrying capacity of their surfaces and protect them against weather extremes as more people wish to play their sport. This approach should assist in increased participation rates, reduce injuries and allow more people to play more often.

Standards for the Sport

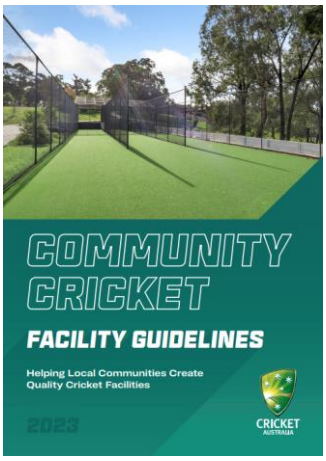
The AFL and Cricket Australia standards that have been adopted are targeted to the community level and not for elite or professional levels. The performance standards can be sourced at the AFL's Community Club website[16].

Regarding cricket, many councils have used synthetic wickets for years and this has historically been covered by soil during the winter months. This often causes safety concerns and reduces the consistency of play where the soil is located. According to Cricket Australia guidance[17], the wicket should be 25m-28m long and 2.4m to 2.8m wide, and the turf should be between 9mm and 11mm in length.

Licensee and Product Endorsement Program

Since the development of standards, the AFL and Cricket Australia established a licensee program that ensures the quality of synthetic surfaces installed will meet the player and ball performance criteria with the surface and has the durability required.

AFL/Cricket Australia has a number of licensed manufacturers and these can be found at www.aflcommunity.com.au.



Contact details:

AFL and Cricket Australia
Executive Officer, AFL/Cricket Australia Synthetic Turf Program
AFL House, 140 Harbour Esplanade
Docklands VIC 3008
GPO Box 1449, Melbourne VIC 3001
t: +61 (3) 8341 6085
e: syntheticturf@afl.com.au
w: www.aflcommunityclub.com.au

2. Football (Soccer)

Approach to using Synthetic Surfaces

Football has been played on synthetic grass for a number of decades with the Federation International de Football Association (FIFA) embracing the benefits of synthetic turf allowing more people to play 'The World Game'. The use of synthetic grass surfaces (designated 'Football Turf' by FIFA) over the past 15 years has resulted in the development of performance standards based on quality natural turf performance standards.

[16] http://www.aflcommunityclub.com.au/fileadmin/user_upload/Manage_Your_Club/Facilities/2B_AFL_CA_Testing_Manual_-_Mar_2018_f__AFL_CA_Synthetic_Field_Standards_.pdf

[17] Community Cricket Facility Guidelines Play Cricket

Photo 9: Football Turf has now been laid in more than 100 fields in Australia

To ensure that the quality of football turf was consistent across the globe, FIFA developed the FIFA Quality Programme in 2001 and is being continually improved with the latest guidelines[18]. These guidelines were updated and re-issued late 2015, and are updated most years. The new FIFA Quality Manual is due out in 2024.

The FIFA Quality Programme for Artificial Turf is a rigorous test program for football turf that assesses the ball surface interaction, player surface interaction and durability of the product.

FIFA has two categories of performance standards, namely:

FIFA Quality mark – aimed at high surface use for municipal or sports club level field (recommended for more than 20 hours use per week).

FIFA Quality PRO mark – for professional and stadium usage (recommended for less than 20 hours use per week).

Within each recommended category there is a durability test (The LisportXL Test), which simulates wear and tear from usage. This durability test is key to the decision making of which type of field to purchase. The FIFA Quality pitch needs 6,200 cycles simulated wear, while FIFA Quality Pro pitch is only 3,200 cycles.

Therefore, the durability of a FIFA Quality systems is generally two times that of a FIFA Quality Pro pitch. FIFA recommend that the FIFA Quality PRO field be used for 20 hours a week and for Professional Football while the FIFA Quality field would be more than 40 hours.

Standards for the Sport

The performance criteria measured are the same for both quality marks, although the acceptable criteria range differs slightly. This allows the FIFA Quality field categories, which only has to be tested every three (3) years, to have greater latitude (less than 5 percent difference in most categories) to meet the needs of the intensity that a 40-60 hour usage pattern would expect. The standards for the two surfaces identified can be sourced in the Quality Manual at on the FIFA website[19].

The re-testing of fields is FIFA Quality Mark pitch every three years and FIFA Quality Pro pitch every 12 months.

Licensee / Preferred Producer Program

FIFA has developed a two-tier accreditation program for manufacturers and suppliers of football turf to the industry to ensure that the client is purchasing from a reputable supplier.

FIFA Licensee

At the time of the Smart Guide going to press, FIFA has 19 licensees of which some are offering products in Australia/ New Zealand. A full list can be found on the FIFA website[20].

FIFA Preferred Producer (FPP)

To provide greater certainty to purchasers of Football Turf, FIFA introduced a second-tier accreditation program in 2004 to focus on the quality assurance of the installation for the Whole of Life of the field.

The key aspect of this FPP status is that the manufacturer has to ensure that any of their distributors, partners, affiliates or anyone representing them, installs a quality product, otherwise as the parent company/FPP they may have to ensure that any corrections or repairs are conducted. For the end consumer the main advantage in using a FIFA preferred producer is that they only have to

[18] FIFA Quality Concept for Football Turf – Handbook of Requirements – January 2012

[19] https://football-technology.fifa.com/en/media-tiles/about-football-turf/

[20] www.FIFA.com/Quality

deal with one company for the whole installation from the construction planning to maintenance.

With Australia/New Zealand the following FPP's offer their products directly or through licensees:

- CC Grass (Tuff Turf);
- FieldTurf (Turf One);
- Greenfields (Synergy Turf);
- Limonta Australia; and
- Polytan.

Full details of contacts for both FIFA licensee's and FIFA preferred producers are listed on the FIFA website[21].

Field Installation

Recent installations over the past 6-7 years for football fields total over 140, Victoria has over 60 and NSW has approximately 50, with the rest of Australia housing in excess of 30 fields. It is expected that another 15 plus pitches to be installed in 2020/21. Recent commitment and installations for Tasmania, ACT, WA, SA and Qld demonstrate how this technology is encouraging people to play the game.

Contact details:
FIFA
Strasse 20, PO Box 8044 Zurich, Switzerland
t: +41 (0) 43 222 777
e: http://www.fifa.com/contact/form.html
w: www.fifa.com

3. Gridiron / American Football

In 1969, Franklin Field, University of Pennsylvania switched from grass to artificial turf. Over the past 40 years some of the National Football League (NFL) teams have changed back to natural grass, with some also deciding to reinvest in the latest generation synthetic technology. The University of Pennsylvania is one example that switched from synthetic (2nd generation) to natural grass before reverting to a 3rd generation pitch.

In Canada, all eight stadiums in the Canadian Football League (CFL) use synthetic sports turf.

There are no standards for gridiron / American football except the Clegg Hammer Test which measures hardness. If an NFL organisation were to consider this in Australia / New Zealand, it is recommended they should consider the World Rugby standards or AFL/Cricket Australia standards, especially due to the critical head fall criteria.

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4. Rugby League

Approach to using synthetics Surfaces

Rugby League in Australia and New Zealand is controlled under their national governing body, namely the National Rugby League (NRL) in Australia and the NZRL in New Zealand.

The International Federation for the sport, the Rugby League International Federation (RLIF) currently seems to have limited scope in relation to synthetic surface governance.

The UK's governing body for Rugby League, the Rugby Football League (RFL) have embraced the technology and set standards which have been used at both community and stadium/professional level. In Australia, the National Rugby league (NRL) has worked with the English RFL and has adopted their standards and enhanced them for Australia.

Standards for the Sport

The Rugby Football League (RFL) standard is based on the European Standard EN 15330-1: Surfaces for Sport Areas has been modified for the specific requirements of Rugby League. The standard takes into account the results of a comprehensive study into the performance of natural grass pitches.

Recognising that many artificial turf Rugby League pitches will also be used for Football or Rugby Union the NRL standard has been aligned with the requirements for FIFA and World Rugby Regulation 22 wherever possible.

Similar to the FIFA Quality Concept, the NRL performance standard recognises requirements for community and stadium use. Products suitable for Rugby League play have to pass initial laboratory approval before being able to be installed and tested in the actual field application.

Whilst community pitches shall be retested every two years, stadium pitches require a field retest on an annual basis.

In general, community grounds have to sustain a much higher level of use compared to stadium pitches that are

[21] www.FIFA.com/Quality

predominantly used for competition matches and professional training. In this respect, the NRL categories 'stadium' and 'community' are comparable to the FIFA Quality PRO and Quality marks.

Photo 10: Stadium Perimeter Advertisement (source: Signgrass)

Product Licensing

There is no product licensing presently in Australia, or by the world governing body.

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Driver Avenue, Moore Park NSW 2021
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e: https://www.nrl.com/contact-us/
w: www.nrl.com

5. Rugby Union

Introduction

Rugby Union has historically been played on grass, despite several proposals over the years for alternative solutions, including clay, shale, sand and the Second Generation artificial grass. All presented similar problems due to the nature of the game and the interaction players have with the surface.

Photo 11: Rugby Union playing on synthetic field (source: Team Sports)

In the past 20 years, the technology around synthetic turf has provided proven solutions for the game of rugby and the rugby world has embraced this because of the benefits for increasing participation, quality of play and consistency for the game.

To ensure the quality and consistency of the surface World Rugby developed the Artificial Rugby Turf Performance Specification 10. This standard was integrated into the Game within Law 1 and Regulation 22 and provides guidance on how it must be used for the game.

World Rugby has only one standard for synthetic turf, that applies to both community and stadium use.

Performance Standards

Similar to the FIFA performance standards, World Rugby has identified three basic categories that are broadly defined as:

- Ball/surface Interaction: The reaction of a ball to the surface;
- Player/surface Interaction: The reaction of a player to the surface;
- Durability: The resistance of the surface to wear and tear and the environment.

The World Rugby requirements include a HIC performance level which, currently, a shockpad is needed to achieve.

The performance criteria can be sourced at: www.http://playerwelfare.worldrugby.org/

World Rugby Preferred Turf Producer

Producers, are recognised by World Rugby as being having the experience to design, manufacture and install good quality artificial turf rugby fields. A list of PTPs can be found on the World Rugby website at: www.playerwelfare.worldrugby.org

Field Installation

Over the past few years global embracing of synthetic turf for Rugby Union has progressed significantly with over 600 rugby fields installed globally. Within Australia there are 9 Fields that currently comply with Regulation 22. These include Lane Cove in NSW, Randwick (x 2), Moore Park and Woollahra.

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6. Multi-Sport Areas

Approach to Synthetic Surfaces

There are many positive examples where a purchaser of a new synthetic sports turf is interested to use the surface for more than one sport. In these cases, a request has been made to ensure the performance standards meet the needs of the sports involved. Some of these collaborations have included:

Football code collaboration (Soccer; Australian Rules Football; Rugby Union and Rugby League).

Moore Park is probably the most comprehensive certified field, designed for the Football codes of Soccer, Union and League.

Photo 12: Moore Park multi-sport field, catering for 11 and 5-a-side Football, Rugby Union and Rugby League

3.4.4 The importance of Testing

The importance of having the field once installed tested to ensure it can be certified against the various sports playing standards is critical to ensure that it achieves the performance standards and to reduce the risk for the owner, the players and can create a positive environment for the development of skills.

In addition, there are other benefits including:

- Peace of mind that you have been provided with the systems performance outcomes that you requested and paid for;
- Ensure that the durability of the system lasts the planned life expectancy;
- That the ongoing maintenance is achieving the outcomes needed to successfully have it retested

There are two approved independent Test Institutes in Australia, and both are listed at the back of this guide. The Test Institutes are in turn accredited by the International Federations to ensure that they are capable of carrying out the testing to the standards as needed. As independent Test Institutes they do not act as consultants on other parts of the surface design or procurement as this then compromises their independence. In the same manner other consultants cannot offer to undertake this part of the process.

4. Hybrid Technology for Football Fields

4.1 What is Hybrid Grass Sports Turf?

Hybrid Grass Systems are simply the combining of the positive properties of natural grass with the strength and durability of synthetic turf fibres into a single sports turf system. This will create a higher quality and more durable all year-round natural playing surface, combining the playability of natural grass with the durability of synthetic turf.

Forms of 'hybrid grass systems' have been around for over 20 years, particularly in Europe. Hybrid grass systems enhance the performance of a natural turf profile by increasing:

- Playing capacity of 30-40 hours per week
- Stability of surface and root zone
- Load bearing capacity
- Durability of the natural grass
- Consistent Playing performance characteristics
- Agronomic performance, (stability and uniformity)
- Bio-mechanical performance
- Professional playing surface longevity >15 yr.

The additional benefit of a hybrid system is that it aesthetically provides a partially green surface, if the natural grass becomes worn through increased usage.

Some considerations in choosing a hybrid solution are:

- Modified maintenance regime compared to natural turf field to manage thatch levels and keep the fibres interacting with the surface;
- On excessively used fields, or where not maintained well, the synthetic yarn fibres can lose interaction at the surface. Where built up thatch or organic matter bury the fibres, resulting in a "false top" reducing infiltration, traction etc;
- Annual renovation required to maintain the benefits of the hybrid system and increase the longevity of its playing life >15 years (GM).

Photo 13: Eclipse Stabilised Hybrid "Ready to Play Turf" (picture courtesy of HG Sports Turf)

There are predominantly two types of hybrid systems used to enhance natural fields of play, including:

- ***Mat System*** – where a mat, carpet, or grid backing (knitted, woven or tufted), similar to synthetic turf backing; supports the fibres which are infilled with various growing mediums in which the natural turf is grown. Knitted and woven hybrid grass systems have very strong fibre anchorage to the backing whilst turfed systems are less so.
- ***Permanent Systems*** – where synthetic fibres are injected or stitched into the surface, not attached to any backing, with some of the synthetic fibre (20mm) standing proud of the pitch and stitched 200mm below the surface, with the natural grass growing between the fibres and the root system intertwining, or anchoring, around the buried fibres.

The hybrid system manufacturer should be consulted to determine the most appropriate system for use in each application and the natural grass species to complement the selected system.

4.2 Profile Reinforcement

In addition to the above hybrid systems, there is also a range of profile reinforcement systems. A profile reinforcement system incorporates synthetic elements within the growing medium to improve the structural performance of the profile, (i.e. reduce divoting). Example of these system include:

- ***Fibre System*** – where various types of synthetic fibre and elastic material are mixed into the soil or growing medium homogenously and into which the natural grass is grown, providing root stability within the growing medium (e.g. sand or soil). Ideally replaced or replenished every 4 years.

- ***Mesh-based System*** – where either a mesh or shredded mesh is mixed into or placed in-situ into the root zone area, where the grass will grow.

4.3 Types of Systems

4.3.1 Mat, Carpet, Grid / Ready to Play Systems

The mat, carpet or grid system can be 'built' into the field of play in-situ or pre-grown at a turf farm/ nursery and then brought to the field as a Hybrid Grass "ready to play" Turf System.

These systems can be incorporated into existing grounds or placed on sand carpeted/constructed fields; however, some of the drainage performance may be restricted and would have to be evaluated on a case by case basis.

The mat system is filled with a growing medium, which could include sand, soil, organic components, to best allow the natural grass to grow in the local environment.

Photo 14: Xtragrass Hybrid Grass

Some hybrid mat, carpet or grid system backings are designed to partially biodegrade over time allowing the roots an open zone to grow down into the lower profile layer thus creating a very stable system that performs as one.

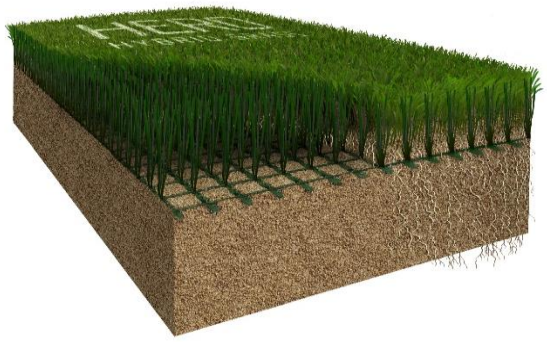


Photo 15: HERO Hybrid Grass

The finished surface presents itself as a mixture of synthetic grass fibres and natural turf.

Advantages

- Quick to install (if grown offsite as a ready-to-play system);
- Good for community and higher use sports fields than natural turf due to its durable and robust construction;
- Good for stadiums where schedules do not allow annual renovation of the field.

Disadvantages

- Cannot be installed after turf is grown;
- Potential to impede on the performance of the playing surface profile growing medium due to mat backing;
- Should not top dress the system as this can bury the synthetic yarn.

Many global stadiums have installed these type of hybrid surfaces and in Australia that includes MCG, AAMI Park, ANZ Stadium, Optus Stadium to name a few and several stadia in New Zealand including Eden Park, Westpac Stadium, McLean Park Stadium and also in Asia including Singapore National Stadium and Nissan Stadium, Yokohama.

At a local community level mat, carpet or grid backing Hybrid Grass installations completed in Australia are in high wear areas, goal squares, centre bounces, soccer boxes, linesman runs and cricket run-ups.

A number of councils have installed these systems, including:

- Casey Council – Casey Fields
- Monash Council – Brandon Park
- Hume City Council – John Ilhan Reserve
- Bayside Council – Dendy Park
- City of Port Phillip – Wattie Watson Reserve
- Whitehorse Council – Mont Albert Reserve
- City of Wyndham – Galvin Park
- Alexandra Football Club
- Carlton FC – Ikon Park

Photo 16: High Wear Area with hybrid surface in goal mouth (source: HG Sports Turf)

Example of the mat, carpet or grid systems are:

- XtraGrass Hybrid
- HERO Hybrid Grass
- Mixto
- Desso Play Master
- Extreme Grass

Photo 17: Hybrid carpet – Mixto by Limonta – www.mixtosystem.com

4.3.2 Permanent Systems

The permanent systems involve the injection of fibres into the surface which are approximately 20mm proud of the growing medium (sand, soil etc.) with the synthetic yarn installed to a depth of 180mm below the surface.

The stitching process is ideally stitched straight after construction, before seeding allowing to ensure 100% is perfect. Although, it can be completed after seeding and after turf sods have been laid, e.g. San Siro, Milan Italy where they annually stitch into new turf.

Many stadiums globally have this type of system. Now the original patent has run out on the Desso Grassmaster, other companies are offering similar technology. The only current stitched field in Australia is Melbourne City Football Club's training venue at La Trobe University, Victoria.

These systems are normally only used in stadiums or high-quality Centres of Excellence and don't have the intensity of usage that community fields would normally have. A stadium field has time to renovate at the end of each season and can accommodate the capital costs over the expected life of 10 years plus.

Photo 18: Desso GrassMaster System

Advantages

- Increased stability of surface and root zone;
- Uniformity and stability;
- Consistent playing characteristics from site to site, sport to sport, country to country;
- Increase playing capacity up to 30-35 hours per week;
- Can be installed with existing fields as long as the growing medium and drainage design meets the high standards needed. The US Golf Association Specification is the standard used to ensure that it's not stitched into native soils or fields with too organic rootzones;
- Does not impede on the performance playing surface profile growing medium;
- Desso GrassMaster machine stitching the yarn into the field and Melbourne City FC GrassMaster Pitch (pictures opposite courtesy HG Sports Turf and SPORTENG).

Disadvantages

- Cost for community fields but for stadiums the cost is offset against the standard of play and life expectancy;
- The event calendar of many Australian Stadiums would be a challenge as a window for renovation annually is needed. Alternatively, a quality Lay and Play system can be used to alleviate this intense usage challenge.

Typical examples in Australia:

- Melbourne City FC Elite Training Pitch – La Trobe University

Examples of the permanent system are:

- Desso Grassmaster
- SIS GRASS

4.3.3 Use of Hybrid Systems for Community Fields

Australia and New Zealand have started considering the adoption of hybrid technology for high use natural turf sports fields for either the whole field or the high use areas.

The high use areas may include goal boxes, halfway line, the 'kicking area' straight up and down between the goals or the line referees' areas on the touch line. High use areas and training fields are also being considered to alleviate wear on primary fields.

Maintenance Commitment

Depending on the hybrid system, the maintenance regime is similar to that for a natural turf playing surface with some restrictions (i.e. slit aeration methods due to the integrity of the backing for mat systems)

Annually it would be recommended that the following maintenance is considered:

- Fraise mowing – cleaning thatch and organic debris
- Vert cutting 15mm deep – opening surface and release buried fibres
- Limited top dressing
- Deep aeration with vertidrain
- Fertilization
- Over seeding/Grass re-establishment
- Irrigation and maintenance

5. Maintenance of the Surface

5.1 The Importance of Maintenance

With the growth in inner urban towns and cities the demand to participate in community sport continues to grow and place pressure on natural grass sports fields. This pressure, combined with the environmental stress of climate change with significantly more rain events and higher frequency of droughts and hot weather days, many local governments sports and educational establishments are investing in Football Turf to compliment natural turf options.

It is critically important if the Football Turf is to achieve its life expectancy and provide a safe and consistent playing surface it needs to be maintained in a manner that will achieve this. This means much more than just regular sweeping, if maintained properly the Football Turf should last 10-12 years of play or 30,000 hours of play. That equates to approx. 60 hours per week, 50 weeks per annum.

The benefits of a good maintenance program include:

- Compliance with manufacturing warranty,
- Consistent playability and performance,
- Increased probability of achieving life expectancy,
- Reduces risk of injuries and impact on players,
- Aesthetically optimised performance.

With fifteen years experience in Australia with over 200 3G Football Turf fields installed, the sophistication of the design of the fields and the Football Turf systems have evolved but the maintenance has not evolved in the same manor with some approaches still vary antiquated. This Smart Guide explores ways that maintenance needs to change to address the variables we now have in a maturing Football Turf market, including:

- Yarn system type: Monofilament, tape or dual yarn combination
- Yarn length: 40m – 70m
- Infill type: Rubber, sand or organic
- Age: New, mature or ageing
- Location: Global, regional location and impact by weather and the environment
- Design considerations: Use of shockpad, adoption of microplastics mitigation and drainage strategies
- Intensity of usage: The number of hours, the number of players and the type of usage (drills, games, adults/children etc)
- Equipment availability: The type of equipment used to maintain the Football Turf
- Technology and monitoring: Embracement of technology to monitor usage and link to maintenance strategies.
- The pavement and drainage strategy for rain intensity days.

With most International Federations requirements, performance surface maintenance manuals must be provided by the installer/manufacturer for the field to guide the owners on their roles and responsibilities for maintenance and upkeep.

The manufacturer's manual is normally linked with their warrantee, with most manuals being generic and only address one of the variables, monofilament. These need to be updated and aligned with the Football Turf system for each site.

5.2 Key Considerations for Maintenance

The key considerations of maintenance should be focused into four key aspects

5.2.1 Design to reduce intensity of maintenance

By understanding how the Football Turf system works, the design can significantly reduce the level of maintenance needed and the frequency. The approach may include:

- Shockpad installation: By having a quality shockpad, (warranty over 20 years and made to EN 15330-4:2022 the amount of infill needed has been reduced significantly. Typically, an infill level without a shockpad would be 25kg/m² sand and 20kg/m² rubber/organic. With a shockpad it would be expected that the performance infill only needs to be 5-8kg/m².
- Yarn combination: By moving away from a monofilament yarn system to a tape or tape/monofilament dual yarn carpet the infill splash is reduced significantly (estimated to be greater than 75%). This should reduce the

frequency of need to brush infill 'back into' the high wear areas and the migrations of microplastics.

- Yarn and carpet structure: High quality thicker pile yarns are significantly more resistant to pile splitting and flattening. Carpets with higher stitch rates are more resistant to pile flattening, yarn splitting and infill dispersion;
- Synthetic turf systems that incorporate shockpads or elastic layers generally suffer less from infill compaction than systems without.
- Removal of spoon drains: Removed all surface drainage and design this to be subsurface under the carpet to ensure no infill migration into waterways.
- Microplastic migration mitigation: Adoption of Standards Australia / European Standards "SA TR CEN 17519:2021. Surfaces for sports areas. Synthetic turf sports facilities, Guidance on how to minimise infill dispersion into the environment". This provides design advice on how to contain microplastics (including infill) within the field of play.
- Player and vehicle entry points: To reduce migration of the infill and reduce dirt being brought onto the fields by boots, shoes and vehicle tyres, have brush trays.
- Facility Equipment: Rubbish bins positioned next to entrance gates, and upstands at base of fence line (200mm min) to alleviate wind blowing rubbish, leaves etc onto the field through the fence.
- Drainage strategy: To reduce infill floatage with a severe rain event consider the drainage strategy to be sufficient to cope with an intensity level in excess of the norm (suggest 1 – 50 year ARI with an intensity for 20 mins). This will reduce the probability of water pooling. By asking for double the normal holes in the latex backing or use of a mesh backing this will increase the porosity of the carpet. This should be considered for organic infill significantly as it floats easier than some rubber options.
- Pavement / Drainage strategy: Consider a vertical draining strategy sub-carpet, with a flat surface and the drainage mechanics is in the shape of the sub-base and pavement. The lack of on field gradient will ensure that there is no lateral surface movement of the water as all the gradient is in the pavement and sub-base.

5.2.2 Maintenance strategy specific for field of play

Too often asset owners are provided with a generic maintenance specification that has probably been used globally and is not specific for a site. In many manuals even the standard design pictures show only a monofilament grass, yet the majority of educated asset owners do not purchase these systems for open parkland fields anymore, yet the maintenance manuals still show them. There is an acknowledgment that this standardised approach needs to change.

The expected site specifics should include:

- Carpet type, dual yarn system
- Layout of site, especially goal area and type of goals used
- Infill type
- High wear areas, especially penalties, corner areas, gate access points, coaches boxes etc
- Age of the carpet / system – as the needs will change
- Intensity of usage and where each type of maintenance should be carried out
- Roles and responsibilities, who will do what maintenance
- Renovation strategy (e.g. infill top-ups etc)

5.2.3 Resource availability

The alignment of resources, skills and experiences are crucial to successful management of maintenance function: Section 4 explores the options in more detail. The key principles need to be:

- The type of maintenance needed and the machinery/equipment needed, whether that is a plastic rake, to add infill around penalty area, to machines needed for brushing and deep cleaning
- The inhouse skills and experience or should it be contracted out to a third party contractor
- Time, needs to be considered and programmed into the fields schedule
- Funding is critical for success within the annual budget and should include the routine maintenance (e.g. brushing), the programmed maintenance (e.g. deep cleans) and the end of season renovation (e.g. infill top-ups).

5.2.4 Monitoring and reviews of performance

Within the maintenance there needs to be regular monitoring and an annual review to ensure that the surface and surrounding areas are being well managed. Section 4 explains the detail and should include:

- Pre and post-match monitoring, including specifically after drills in a specific area that may need a top up
- Regular maintenance (e.g. brushing) and a record kept of what's been done
- Annual or post season review, before the renovation to prepare the field for the next 12 months and including any changes needed to ensure it reaches its age expectations.

5.3 Smart Guide to Maintaining Synthetic Long Pile Turf (2024)

The Smart Guide 3: Maintaining Synthetic Long Pile Turf (2024) provides advice and guidance on:

- General maintenance considerations
- Maintenace equipment
- Maintenance of long turf

It also provides advice on the routines and how maintenance of organic infill will be different from rubber, and why a dual yarn (mono-filament and tape) or tape systems should mean that you have less maintenance to do.

6. The Changing Narrative – Environmental Sustainability, Sport and Surfaces

6.1 Embracing Community Concerns

As the globe embraces concern for all aspects of the natural environment that could have a negative impact on it, are being scrutinised by the community. The challenge of local government is balancing community expectations as the population density increase in placing significant stress on both active and passive natural turf spaces.

Sports field and surfaces are not immune from this level of community interest and the days of 'just placing 40 asphalt netball courts' in a park are (thankfully) well and truly gone, as their impact and loss of habitat is being appreciated more. Sports are having to adapt how they manage and deliver their offering as the availability of sports surfaces, for limited use is being challenged by environmental groups.

There is an expectation that how we "sweat the assets" is becoming more important, we have seen football move their matches from Saturday to now Friday to Sunday, allowing for less fields to be built. Other sports like Netball, with their significant footprint will do the same, or allow other sports to use the space. This approach has been very successful with schools who design Hockey fields to play tennis on in the summer.

The key concerns with regards to synthetic sports fields are focused on a number of perceived health, safety and environmental concerns. Some validity of concern can be shared, but much of the concern can, through good design be mitigated significantly. This section explores these concerns and attempts to provide a balanced perspective to the communities perceptions.

6.2 NSW Chief Secretariat and Engineer Review Report

6.2.1 Introduction

In November 2021, the Hon Rob Stokes MP, (then) NSW Minister for Planning and Public Spaces, requested the NSW CSE provide expert advice on the use of synthetics turf in public open spaces.

Further to the release of the NSW Chief Scientist & Engineer (CSE) independent review into the design, use and impacts of synthetic turf in public open spaces (Review Report), Council is keen to understand its impact on the industry and likelihood on their use of synthetic sports surfaces.

This chapter has been developed by Smart Connection Consultancy, to provide local governments with an executive summary for consideration.

6.2.2 CSE Review Report Dispels Key Myths

The CSE Review Report has dispelled key myths surrounding the use and impacts of synthetic sports surfaces on the users, the environment and the broader community. These are shown below, directly from the Review Report:

"Overall literature reviews and expert advice did not identify major health risks associated with synthetic turf, although there are knowledge gaps, particularly around Australia-specific studies".

"The Review has been advised that health risks through direct (dermal, ingestion and inhalation) or indirect contact (e.g. leachate and microplastics run-off) from synthetic turf is likely to be low".

"Contribution of synthetic turf fields to the Urban Heat Island (UHI) effect is likely to be small, contained within the specific footprint of the surface"

"Even though the health risks of chemicals in synthetic turf are likely to be very low, progressive restrictive reasons to limit potentially harmful chemicals in synthetic turf components may reduce unforeseen consequences to health"

"Sports related injuries many occur on both synthetic and natural turf fields at comparable levels and a good maintenance regime is required to ensure player safety"

"The number of synthetic sports fields (in NSW) represents approximately 2% of the total playing field areas"

"Leachate and microplastic run off from synthetic turf fields are likely to be very low…"

"Estimated that around 10-100kg of infill is likely to be lost from the field of play annually"

Additional commentary that should be embraced include:

- Flooding is a concern for synthetic (and natural) turf fields;
- The impact of heat onto synthetic turf remains a concern for people, and siting of synthetic sports fields near high risk bushfire settings should not be considered;
- Planning for use of synthetic turf should also consider a 'circular economy' approach, embracing recycling at End of Life (EoL);
- Innovations for infill types, yarns from bio-polymers as opposed to the petro-chemical industry are being encouraged;
- Although leachate and microplastic run off from synthetic turf fields are likely to be very low, reasons to reduce chemical and microplastic pollution serve to reduce potential cumulative harm to aquatic and soil life, the environment and ultimately human life";
- Gaseous chemicals are a concern, especially with SBR on hot days;
- Negative perception of lack of accessibility with some synthetic sports fields;
- Concern about impact on biodiversity and environment continue to raise concerns with some community groups;
- Light spill is raised as a potential negative impact (natural and synthetic) from sports fields.

Photo 9: Yves-du-Manoir Stadium (Paris 2024) will have their Hockey field made from 80% biobased material (sugarcane) and will use 39% less water than Rio 2016

Although these myths have been dispelled and issues are still raised, the Review Report identifies that this is summarised against global research due to the lack of research within the Australian specific market.

All of these issues can be seen as opportunities to design and construct a better performance outcome for the users, the environment and the community.

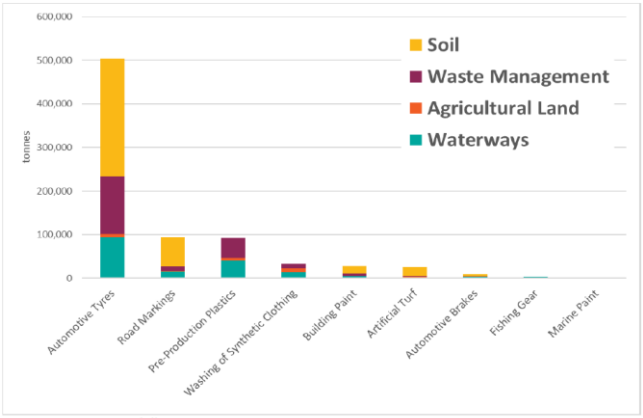
From the findings in each section of the Review Report, together with table 3 in the Recommendations a Risk Mitigation strategy has been developed in Appendix 1.

Microplastics

Microplastics is a term commonly used to describe extremely small pieces (less than 5mm in all directions) of synthetic or plastic material in the environment resulting from the disposal and breakdown of products and waste materials. The concerns around microplastics centres on their potential to cause harm to living organisms in the aquatic and other land-based environments.

The European Commission received a report (DG Environment) in February 2018[22] which explores this in detail and provides the most extensive study to date. It specifically explores synthetic sports surfaces as part of a broader sector of microplastics.

Synthetic fields are "…a relatively small source…"[23] as shown in the table below.



Source: Eunomia modelling

Figure 3: Sources of microplastics found in Europe

Soil is the largest single sink for microplastics and may over time be washed into waterways. The key aspects from a synthetic sports field that could be classified in this category would be the tips of the grass over time as they breakdown, due to UV Radiation which could be between 0.5 and 0.8% and also the infill.

The report suggests that the level of infill that needs topping up over a year would equate to 1-4% of the total infill installed initially. Although some of that is caused from compression, other is lost to the environment. From assuming that on a typical mid-ranged football field

[22] Investigating options for reducing releases in the aquatic environment of microplastics emitted by (but not intentionally added in) products

[23] Section E1.1. Estimating Microplastics

(7,500m^2) with a typical infill of 10kg per metre^2 this would equate to 75 tonnes, with a range of 0.8 tonnes to 3 tonnes per annum. It is envisaged that the 'loss' of infill can be seen to migrate as follows:

- Migration to the surrounding soil area;
- Migration to surrounding paved areas and then subsequently released into the sewerage system via grates etc.;
- Into indoor environments (including washing machines) on kit, shoes and bags of participants, which again will be released into the sewerage system; and
- Release into drains and waterways.

6.2.3 Aspects that can impact on microplastics entering the environment

There are a number of aspects of the design, construction and management of the fields that could impact on the level of microplastic migration into the environment.

This could include:

- **Infill splash** – with the infill migrating off the field of play;
- **Infill being washed away** – in wet weather or through snow;
- **Drainage transportation** – with many early designs having spoon drains at field level;
- **Excessive infill levels** – increasing probability of migration off the field;
- **Player transmission** – on boots etc;
- **Breakdown of yarn** – due to UV degradation with age;
- **Fields not fit for purpose.**

It is critical that purchasers for synthetic sports fields can appreciate how the design, management and construction can have such a significant impact on reducing the propensity of microplastics entering the environment.

6.2.4 Global and Australian Approach to Containment of Microplastics

Globally sport peak bodies and industry associations have embraced this challenge with enthusiasm to reduce the impact on the environment and therefore on society. The majority of global sports International Federations for the sports, including Football (FIFA), Rugby (World Rugby) and Hockey (FIH) have all researched this and have issued guidance on how fields should be constructed and managed.

In Australia, the Australian Standards Committee for Sport CS101, has published SA TR CEN 17519: 2021 *Surfaces for sports areas - Synthetic turf sports facilities - Guidance on how to minimize infill dispersion into the environment.*

This standard will now allow councils to quote this standard in their tender documents, so the dispersion of infills can be reduced. This is positive information we can give to councils and show that the industry is doing something to mitigate the issue.

Smart Connection Consultancy believes that in Australia we can go further as we appreciate the impact on the community and this has been addressed below.

6.2.5 Smart 21 Point Guide to Reduction of Microplastics

Introduction

Smart Connection Consultancy has developed this guide at looking at the five stages of a typical synthetic sports field, namely:

- Design – Performance Field
- Design – Civil Engineering
- Management and maintenance
- Construction
- Replacement

By adopting this 21-point plan, Smart Connection Consultancy believe that the probability of Microplastics will be reduced for sports fields that it will not be of material significance.

Design – Performance Field

By embracing the opportunities at the first stage will have a significant impact on how the field can be managed and reduce the level of infill.

Yarn – to reduce the amount of ball splash – embrace systems that only use dual yarn (monofilament and tape combination only systems) or tape systems. Do not use monofilament as the infill will have a tendency to migrate significantly more.

Yarn UV Stabilising Levels – ensure that the UV levels will provide the durability needed to ensure that as the yarn agers the tips of the yarn will not break down due to the UV radiation levels in Australia.

Durability of Yarn and Infill – ensure that the system can cope with the intensity of usage and the yarn and infill will not breakdown with aged usage. Using the FIFA Lisport Test – the system needs to be able to provide a result in excess of 100,000 cycles (5 times that of FIFA requirement).

Shockpad – this will significantly reduce the level of infill needed in the carpet system and therefore reduce the chance of infill migration.

Infill Type – consider the use of organic infill, therefore reducing the level of microplastics completely from infill.

Infill Quality – the infill needs to be of a quality that does not leech, and certain recycled rubbers may have a greater tendency to leech heavy metals or indeed PAH's. We recommend adopting the REACH Safety Standards to ensure that if any microplastics enter the environment they will be safer and have minimal impact on the environment.

Design – Civil Engineering

Drainage Design – to ensure that the drainage can cope with the Annual Rain event expects (e.g. 1 in 10 years) as this will ensure that the infill doesn't migrate on top of the field etc.

Sub-Surface Drains – ensure that all drains are sub-surface and not the older type of spoon drains around the surface levels.

Non-Porous / Impermeable Layer – below the drainage level or pavement base to ensure that no water or infill can penetrate the subsurface. This layer should also be wrapped around the Collector Drains to ensure a 'closed system'.

Drainage Filter – the drains should have filters to capture any infill before it progresses to the storm water outlets.

Photo 19: Containment strategy: Drains fitted with filter.

Field of Play Perimeter Curb – design a plinth for the fence line to fit into which is approximately 200mm above the pile height to reduce the probability of the infill migrating from the field of play, with a 100mm depth to insert the fence posts.

Photo 20: Containment strategy example 1: Curb to reduce the infill being dispersed outside of the field of play

Access /Egress Gates – at pedestrian and vehicle gates ensure that there is brush mats that are large enough (two strides for pedestrian gates) for people who leave the field of play to capture infill from boots etc. These need to be removable and cleanable to ensure that they do not allow infill captured to migrate into the environment. Vehicle gates are also fitted with a grated system to capture infill from the field of play from the vehicle tyres.

Photo 21: Containment strategy example 2: Pedestrian gate mats that capture the infill

Equipment Sleeves – all field equipment sleeves including goals, posts, and flags should ensure that the bottom does not allow infill to seep into the sub-environment. Each needs to be capped.

Boot Cleaners – each field should have a boot brush cleaner at the exit gates around the field with players encouraged to use them.

Management and Maintenance

Maintenance Brush – the maintenance should be conducted in a manner that does not break off the tips of the yarn, therefore heavy rubber mats should not be used and only a firm brush or appropriate machine.

Cleaning of Brushing – all brushes and machines should be sprayed cleaned before leaving the field of play and any infill returned to the field of play.

Clean all Drainage Channels – all drainage channels should be cleaned during each maintenance operation and findings recorded.

Clean all Gate Mats – at each access and egress points.

Monitor Infill Levels – to record and monitor expected levels.

Construction

Stockpile of Infill Bags – the area is to be quarantined with impervious membrane under bags to ensure no spillage into the environment and all bags are to be cleaned before being taken away. The quarantine area to be cleaned prior to the area being returned to its original function or relandscaped.

Replacement

Recycling – the procurement must stipulate that all new fields procured can be recycled at the end of life, including a strategy for recycling of the carpet and yarn and the rubber infill. The sand should be reused and the shockpad and where possible, the rubber infill should be procured where they can be reused 2-3 times thus reducing the level of microplastics needed for the system over the whole of life of the field.

6.3 Heat Stress

6.3.1 Introduction

A key concern has always been raised about synthetic sports turf, that of the increased propensity for heat on a warm to hot day, when compared to natural grass. Similarly to beach sand, which is hotter again, or rubber, concrete or asphalt surfaces where sport is played, heat in Australia is a concern during summer and the middle of the day.

There are a number of considerations in this complex issue, which the industry is addressing and with the move from rubber infill to organic this will make a significant difference.

It is important to remember that the heat issue in Australia is not only limited to sports surfaces. The number of hot days (over 35°c) in Australia will continue to rise over the next few decades, which will increase significantly by 2050. This will impact on how we conserve sport and how surfaces can make the experience more positive.

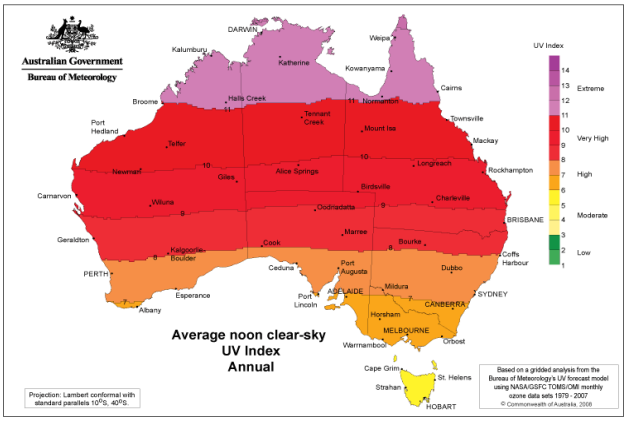


Figure 4: Average Solar Ultraviolet (UV) Index (source: BoM)

With the adoption of different technologies and infills the industry has considered how this issue and associated risk can be mitigated somewhat. The following summarise the approaches that should be considered within the design of new fields.

6.3.2 Technology Innovation

Yarn and cool grass technology

A number of synthetic yarn manufacturers are using specific polymers to offer cool grass technology that can (according to their marketing) reduce heat by up to 5 percent compared with traditional synthetic grass. The author is not convinced that this is making a huge difference that is material.

It seems that the turf systems that have some fibrillated tape that encapsulates the dark infill reduces the amount of UV radiation that is captured by the black SBR and therefor the surfaces remain slightly cooler.

Infill - organic

There was a clear move from rubber and plastic infills to organic infills which have been used in Australia over the past decade and are becoming more sophisticated in options and move reflective of societies desire to reduce the impact on our environmental footprint.

The organic options include:

Cork infill – in recent years we have seen a manufacturer introduce organic infills and when damp, they are very well received by all players as they embrace the water. If there is a larger amount of hot and dry days over a period, say 3-4 weeks the cork infill in the fields may become very dry and show harsh effects such as being rough on the skin and become dusty as the cork dries out and breaks down over time. The cork also needs additional maintenance and replacement will be a higher cost and more frequent than rubber.

Cork and coconut husk – coconut husk has a tendency to break down and needs to be kept damp to maximise its performance. The coconut husk does breakdown significantly and needs continual top-up and regular spraying with water.

Woodfill – an American product derived from southern pine grown wood, harvested in a sustainable and renewable manner. It also absorbs the water and sinks when wet, reducing the floatation challenges of cork. Although new to Australia initial reviews have been very positive.

Within Europe options include: corn husks, olive pips, walnut husks and there will be others as the sector continues to embrace environmental solutions.

6.3.3 Landscape design consideration

The Australian Institute of Landscape Architects have developed a number of Guides for addressing Climate Positive Design.[24]
By incorporating these principals into the design of the sports field and interaction within the parks overall landscape significant difference can be made to address the aspirations of lowering the environmental footprint.

This will include:

- Reuse of top-soil around site, including spectator mounds
- Water harvesting rain water to enhance irrigation of landscape across the site, and downwind of the field so any breeze blows the moisture towards the fields.
- Developing a tree planting and tree canopy strategy for the site to add both shade to spectators as well as reducing carbon footprint, urban heat island impact and increasing vaporisation during hot periods.
- Reduction of concrete within the design and use of natural surfaces, reinforced.

6.3.4 Civil Engineered Solutions

The engineered base according to some manufacturers can anecdotally provide some benefit.

The suggestions that have been put forward include:

- An aggregate vertical draining base (which has up to 40% void space) can hold the water and then stays damp and if damp when the ambient temperature increases can offer some cooling by the moisture evaporating through the system;
- Use of a drainage cell with large vertical channels that hold a little water can be used as above to a lesser extent;
- The shockpad being kept damp in the same manner as above also offering the same benefit.

6.4 Urban Heat Island Effect

The urbanisation of Australia has radically transformed environments from native vegetation through farmland to present day's urban footprints of towns and cities with an urban sprawl. Away from the coastal areas, where the natural land receives a moderating influence of cooling sea breeze, population heartlands in urban areas are now showing 'Urban Heat Island' effects.

[24] https://www.aila.org.au/Web/Web/Values/Climate-Positive-Design.aspx

Urban surfaces such as roads and roofs absorb, hold, and re-radiate heat; raising the temperature in our urban areas. This effect is often worsened by development activity when green spaces are replaced with more hard surfaces that absorb heat.

This Urban Heat Island (UHI) effect shows that the area is significantly warmer than its surrounding rural areas due to number of direct and indirect causes including:

- Absorption of short-wave radiation, in concrete, asphalt and buildings and then slow release during the night;
- Change in surface materials which do not have evapotranspiration properties (e.g. concrete v grass and vegetation);
- Increase of carbon dioxide, through increases in traffic pollutants and people, with reduced trees capturing carbon dioxide in cities; and
- Use of building materials – pavements and roofs has significantly different thermal bulk properties and surface radiative properties (e.g. shade and evaporation). Also, high buildings normally reduce wind penetration, which also acts as a coolant and assists in the disbursement of pollutants.

The Urban Heat Island Effect has the potential to adversely impact a city's public health, air quality and energy use, including:

- Poor Air Quality: Hotter air in cities increases both the frequency and intensity of ground-level ozone (the main ingredient in smog). Smog is formed when air pollutants such as nitrogen oxides (NOx) and Volatile Organic Compounds (VOCs) are mixed with sunlight and heat. The rate of this chemical reaction increases with higher temperatures;
- Risks to Public Health: The Urban Heat Island effect intensifies heat waves in cities, making residents and workers uncomfortable and putting them at increased risk for heat exhaustion and heat stroke. In addition, high concentrations of ground level ozone aggravate respiratory problems such as asthma; putting children and the elderly at particular risk.
- High Energy Use: Hotter temperatures increase demand for air conditioning, increasing energy use when demand is already high. This in turn contributes to power shortages and increasing carbon dioxide emissions[25].

Other documented impacts as a result of the Urban Heat Island Effect include impacts to agriculture, biodiversity, increased water demand, decreased productivity and even increased rates in domestic violence. From the WSROC Strategy the following considerations should be prioritised to assist with their Strategy.

1) Take Action Together
    - Explore funding to monitor the impacts of heat before and after installation of a synthetic sports field.
2) Design and Plan to Cool the Built Environment
    - Ensure that the design integrates into the broader environment to create opportunities for additional cooling designs, including additional trees, water harvesting into wetlands etc;
    - Explore Green Engineering technology and blue and green infrastructure building methods into each project;
    - Explore how the drainage strategy can replace water into the soil as opposed to storm water to keep the ground close to the field moist;
    - Develop light coloured paths, rooves and other hard standing areas to reduce the propensity to capture heat radiation from the normal black surfaces;
    - Landscaping to reduce solar radiation;
    - Encourage innovation from the contracts to drive opportunities.
3) Cool with Green Space and Water
    - Invest in water harvesting and keep as much water on site for alternative uses;
    - Increase the tree canopy in the area around the parkland to provide both shade and other green benefits to the environment;
    - Include water bubblers around the field to reduce heat impacts on players;
    - Water sensitive urban design (WSUD).

6.5 Flooding

Many local governments and sports consider investing in the use of synthetic sports surface technology across a city to satisfy the growing demand for sports as the population increases. Some sports fields are built on a floodplain, which means we will never be able to prevent flooding. Storms and flooding are a natural part of living in that area during winter months.

Organisations should consider as to whether these flood types would most likely impact or even preclude synthetic surfaces being installed and flooding challenges may curtail the ability to install and manage a synthetic sports

[25] http://www.hotcities.org/ and www.bom.gov.au/info/leaflets/urban_design.pdf

field and what mitigation should be considered by themselves and community clubs and organisation's as part of their site feasibility and prior to any investment.

The key consideration is that organisations who are interested in embracing the technology need to appreciate the position on when a known flood risk or site identified as being contaminated, poses too high a risk for a synthetic field project.

With modern technology and ongoing flood modelling, Councils are able to better understand risk and respond appropriately and has developed tools to support organisations in their knowledge and decision making.

6.5.1 Types of and Impacts of Flooding

Some councils have invested significant resources to assist with understanding the impact of flooding on property and provides detailed resources for them to read and appreciate. Council and State Governments have identified the various types of flooding that would typically be expected, including:

- **Overland flow flooding**

Overland flow is excess rainfall runoff from homes, driveways and other surfaces. Overland flow flooding is water that runs across the land after rain, either before it enters a creek or stream, or after rising to the surface naturally from underground. Overland flow flooding tends to affect localised areas rather than the whole city at once. Overland flow flooding can be unpredictable, and its severity will depend on the amount of rainfall.

It is critical to understand overland flow flooding by exploring the natural overland flow path through each specific site or property and taking appropriate steps to prepare and protect the site, where possible.

- **Creek flooding**

During rainfall, water from roofs, driveways, parks, footpaths and other surfaces makes its way to the underground stormwater pipe network. The rain runoff exits the stormwater pipe network into creeks and waterways.

The combination of rainfall, rain runoff and the existing water in the creek causes creek levels to rise. How high the creek level rises depend on the amount and duration of rainfall. Heavy rainfall can cause the creek level to exceed its capacity. This is when creek flooding occurs. Floodwaters may flow over the banks into properties, roads and parks. Storm surge can also cause creek levels to rise. Creek flooding is difficult to forecast, as floodwaters can rise and fall quickly without warning.

- **River flooding**

River flooding happens when widespread, prolonged rain falls over the catchment area of the river. As the river reaches capacity, excess water flows over its banks, causing flooding. This can occur hours after the rain has finished. The level of flooding depends on the speed and volume of water carried in the river.

The frequency of river flooding depends on the severity of weather. The impact on sports fields depends on how close they are to the river and how high the fields are built above ground level.

- **Storm tide flooding**

Storm tide flooding happens when a storm surge creates higher than normal sea levels. A storm surge is caused when a low atmospheric pressure meteorological system and strong on-shore winds force sea levels to rise above normal levels. Flooding can also occur from king tides in some parts of Australia, where the tides occur regularly throughout the year and are noticeably higher than regular tides. King tide information is predictable and readily available in tide books and online.

6.5.2 Flooding and Drainage Considerations for Synthetic Fields

Synthetic sports fields are designed to manage the typical rainfalls that are expected in the geographical area, to ensure that there are no flood waters that interact with the sports system, as flooding can seriously damage the performance surface (grass) and the pavement base.

To minimize this possible effect of flooding impacting on the surface, the aim of any design must be to:

- Ensure that there is no water seeping into the base in a manner that would impact the integrity of the pavement base which the performance surface sits upon, failure to do this could result in the integrity of the pavement/sub-base and movement of the base which would therefore mean the field not meeting its performance standards against the International Federation playing standards
- Move the rainwater flows through the synthetic sports field by designing the best drainage strategy to the storm water discharge to meet the International Federations porosity standards (e.g. FIFA is 180 ml/hr) and to a specific Annual Rain Intensity (ARI) event (e.g. 1 in a 10-year ARI etc.)
- Ensure that the storm water discharge is capable of discharging the ARI agreed flow rates and if not design a retention strategy until it can discharge that rate of water.

Flooding Considerations

Flooding is normally defined as "a situation in which an area is covered with water, especially from rain". This normally means that the level of water or rain cannot be released with the normal drainage discharge channels. In relation to synthetic sports fields the four council defined flood scenarios impact as follows, and may include:

- ***Drainage back-fill*** – where the drainage pipes, whether around the field or the storm water discharge pipes can cope with the level of water that its holding. If it cannot, then the water will back up firstly through the pipes and then through the grass systems before puddling and then flooding. Once the water can be discharged the flooding will decrease, normally leaving a maintenance issue for rectification. The field performance infill, which is normally lighter than water will float and can be blown around the field. This is a maintenance issue and can be rectified prior to the next use.
- ***Flood basin*** – some sports fields are designed to collect and retain excess water from an area in the event of a significant rain event especially in local government owned sites. These are not good for the surface of the sports fields and an option is to raise the field and develop a retention base under the field through either storage cell/basin or in the design of the field pavement being made with stone aggregates (which have void spaces up to 40%). This solution is easy to design and holding the water under the field should have no impact on the playing surface.
- ***Flood path*** – this is the most troublesome of the three scenarios' as the flood path normally brings dirt with it and crosses a field and so disrupts the base if not designed to cope with the movement of the water and also the surface. Again, a solution is to encourage the water through a drainage strategy and under the field before possible retention and discharge.
- ***Wear*** – the impact of flooding on or across the surface of the synthetic playing field could be detrimental to the systems pavement integrity, the carpet and infill. This could also negate any warranty (normally 5 years for the system), as the majority of warranties preclude flooding being covered.
  It is critical then that the design embraces any likelihood of floods, so that appropriate mitigation can be addressed. Failure to design around this or if a Design and Construct specification, would most likely negate any obligation on the contractor and their warranties.
- ***Impacts of standing water*** – the likelihood of water pooling would be due to drainage back-fill which meant that the water cannot drain away quick enough. The consequence is that there could be a level of standing water on the field of play until the drainage an accommodate the discharge of water.
- The impact on the surface will be linked to the time standing and the amount of water on the field. It is highly unlikely that this would be for long if the drainage strategy has been developed accordingly. Normal challenges when this happens, and the consequential actions include:
  - **Playing environment** – this would probably be unsafe and so games/training should be cancelled
  - **Infill** – whatever infill is lighter than water, that will float, if there is a wind while the infill is lifted from within the carpet to be resting on top, then it could be blown across the field and rectification maintenance would be needed. Although this may be time consuming, it is unlikely to be detrimental to the system.
  - **Carpet** – the carpets are normally not glued to the base as they are either sewn or glued together, if sewn there should be no impact. The adhesive is waterproof and so the water should not have a significant impact, if the water is standing for a long period of time (unlikely) then this may release some if the adhesive properties. I am not aware of any research conducted to provide accurate guidance on this.
  - **Pavement base** – the impact on the pavement base could be nil. If the design ensures that it does not impact on the pavement's integrity. Normally an impermeable sheet is used to stop water seeping into the sub-base etc. Depending upon the level of water, this should not create a negative problem with the weight.
  - **Impacts of flowing water** – this would be the most significant challenge that a field would have and the most likely to cause problems for the whole system if mitigation is not designed into it. The flowing water, similar to the 'standing water' would impact on infill migration and pavement base considerations.
  - The added challenges are:
    - ***Silt transfer*** – if silt is brought from outside the field of play and across the synthetic system it would leave a train of sand and silt, that when it dries actually creates a 'crust' level on top of the system and can clog up drainage portals. This can destroy

the system, resulting in the whole system being replaced. At best when this happens the major manufacturers would suggest keeping it wet so that they have an opportunity to vacuum it up. If it goes dry and hard the carpet will most likely be destroyed.

- ***Mitigation of infill*** – it is possible that the infill will be moved with the pace of the water. This is a maintenance rectification issue and as with the standing water scenario earlier, this should only be a maintenance issue and not a major rectification issue. The operator would normally use a specialist brush (e.g. a SMG Grass Master brush system, which is towed behind a small ride on machine). If it were to settle in the local creek there is no evidence that this would be detrimental to the environment.
- ***Water under the carpet*** – sometimes if water is under the carpet on some synthetic surfaces (e.g. bowls and water-based hockey fields) round bubbles occur after water is trapped under the surface. If the design of the synthetic field is correct, then this should not be an issue on 3G long pile surfaces as the weight of the surface (normally 30 - 40kg/m^2) would keep it stable. In addition, if the drainage is working the under carpet will lie flat and dry out as the water recedes.

Synthetic sports fields can be significantly damaged from flooding and careful consideration needs to be sort if there is any likelihood of them being impacted by a flood event.

There are two flooding scenarios that can impact synthetic sports fields:

i. **Standing Water Flooding** – where the water cannot leave the field due to the storm water drainage system not being able to cope with the level water on the field. This can be caused by creek and river flooding or storm water flooding where they block the drainage exit strategy. To mitigate this would consider options such as a retention pavement (using aggregate with void space etc.) or retention tank under the field to cope with the expected rain and volume.

ii. **Overland Flow Flooding** – where the water levels would rise and pass over the synthetic field and with it the water would contain silt and or be at a flow rate that would damage the pavement and or lift the carpet. This is the most dangerous and should be avoided at all costs as the likelihood that this could, depending on the level and speed of movement destroy the pavement and carpet beyond use. This mitigation for this scenario could include:
    - Build above the probable flood levels;
    - Re-route the water flow path around the field;
    - Build the field elsewhere.

The risk of flooding and impact needs to be considered prior to any request for Council and appropriate mitigation strategies identified. These mitigation strategies will impact on the cost of the field and so need to be considered early to establish its affordability. There are very few sites that would be precluded due to flooding, but the impact would be financial and possibly considerate.

6.5.3 Flood Planning Considerations for Synthetic Sports Surfaces

When planning for a future synthetic field an organisation should consider the following prior to determine the probability of a site that may be prone to flooding:

Step 1: Flooding probability – Does the site have a history of flooding, or the probability of flooding in the future and use Council information and knowledge.

Although there are mitigation solutions for most flood scenarios the cost implications would significantly increase as the Residential Flood Level (RFL) increases which would make them unviable economically. It is therefore suggested that this should be considered immediately and any flood level over Councils recommended minimum RFL would mean a significant investment that most likely would preclude a viable economic solution being sought.

Step 2: Type of flood – What type of flood would it be prone to? Explore the type of floods, namely overland flow, river and creek floods and storm tide. From these four types appreciate the impact on the field surface to ascertain if the field can have mitigation strategies applied in a manner that is affordable and workable for that site.

Step 3: Mitigation – If an organisation at this stage is still considering synthetic fields in such an area then they would need to engage with a specialist sports surface engineer or Hydrology Engineers (https://www.engineersaustralia.org.au/Communities-And-Groups/National-Committees-And-Panels/Water-Engineering) and consider the mitigation opportunities as listed below.

Step 4: Consultation with Council – If mitigation is possible and the organisation can afford the solution the solution would meet Council planning guidelines, explore the appetite with Council staff to verify this prior to any substantial work and investment being committed to the opportunity.

- Mitigation Strategies

Council can mitigate these scenario's (left column) by embracing proven design solutions (right column), such as these below:

Drainage back-fill

- Calculate the level of water needed to discharge in an hour from the agreed ARI event, 90% of fields in Australia are aligned with this simple procedure;
- Design drainage strategy (size of pipes, level of retention etc.) that will be needed to move that amount of water through the synthetic sports surface system;
- Ensure that the storm water discharge can cope with the volume of water, if not build a retention/holding tank.

Recommendation: Organisations to identify the ARI event needed to ensure that the storm water can cope with the discharge needed. If not possible explore the level of retention needed under the field to cope with the water

Flood basin

- Calculate the level of water that would expect to be held and for how long in a typical flood that is experienced (e.g. 1,000mm of water for 3 days etc.) and identify that as cubic meters of water that needs to be retained;
- Identify if the field can be built up and the retention space (aggregate base or tank) so that this can hold the water;
- Ensure that any flood flow is curtained by having drains on outside of path and field of play to take the water under the field etc;
- Example (below) of Gore Hill NSW which was designed to cope with a 1m flood annually – under the field.

Recommendation: Design the pathways to ensure that the water does not enter the field of play. In addition, ensure that the retention levels of the pavement base can cope with the required flood.

Flood path

- Create a drainage strategy by taking the water away from the field of play before it gets there;
- If can't redirect by using banks, then capture the water and take under the field of play;
- ELS Hall Park and the water was taken off the hill (north west) and designed to go under the field to reduce any impact on the field of play;
- Lip on side of paths and also sandstone blocks used to redirect.

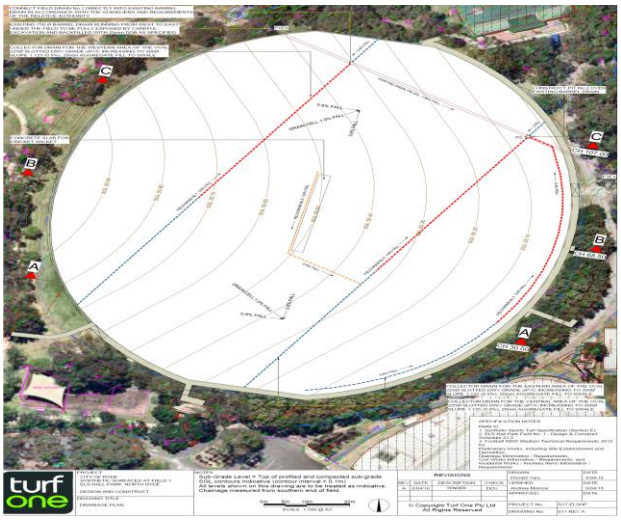


Figure 5: Typical Design for an Overland Flood Scenario by Redirecting the Flood Path Under the Field of Play (source: Turf One)

Recommendation: Design the pathways to ensure that the water does not enter the field of play. In addition, ensure that the retention levels of pavement base can cope with the required flood strategy

6.6 Safety of Field to Users

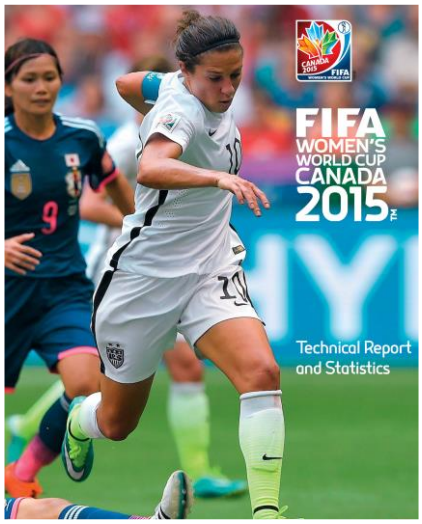
A number of concerns have been raised by some community groups as a reason why not to have synthetics. The evidence suggests that the concerns raised may not be as large an issues as suggested.

6.6.1 Great Injuries on Synthetic Turf

There has been extensive studies by the International bodies of sport (FIFA, World Rugby etc) that indicate that there are not great injuries on synthetic turf. This was a summary finding by the NSW Chief Secretariat & Engineer as well.

Of the various independent studies[26] [27] [28] [29] reviewed from 2006 to 2011, the common finding is that there is not an increase in the number of injuries associated with synthetic turf when compared to natural turf. Seemingly the only negative consideration is where sports people alternate between surface types which may result in varied and increased injuries. This may be similar to long distance runners who run on synthetic tracks then on asphalt, which are more susceptible to shin soreness.

Although the ability of the studies to detect differences in the injury rates was limited by the small number of injuries reported, the studies concluded that there were no major differences in overall injury rates between stadium level quality natural and infilled synthetic turf. Although each study found some differences in specific injury types, there was no consistent pattern across the studies.



The Canadian hosting of the FIFA Women's World Cup technical report states "Although the FIFA Women's World Cup Canada 2015™ was played on artificial turf, there was no significant difference regarding injuries sustained there and those on grass at previous editions."

One of the key safety concerns that have been expressed by sport organisations is the potential for head injuries from contact with a synthetic surface. This concern is assessed by determining the ability of the surfaces to absorb impact using one of two test methods and provides the acceptable level of playing surface for specific sports.

By comparison, a recent study of community and stadium natural surface fields in Sydney[30] were typically below the corresponding expected synthetic level. Many natural turf fields are not tested against a standard. (If they were, many fields would fail the standards set for synthetic surfaces).

Rugby union has begun to test natural turf surfaces in some States of Australia to protect their players. The abrasiveness of synthetic turf fibres may contribute to the injury risk among athletes, particularly for abrasions or 'turf burns.' The degree of abrasiveness appears to be dependent on the composition and shape of the turf fibres. A study conducted at Penn State University suggests that synthetic turf with nylon fibres is more abrasive than synthetic turf with other fibre types.

Regarding injury, a study conducted by FIFA's Medical Assessment and Research Centre (F-MARC)[31] compared the injuries sustained at the FIFA U-17 tournament in Peru in 2005 which was played entirely on artificial turf, with the injuries sustained at previous FIFA U-17 tournaments which were mostly played on natural turf. The research showed that there was very little difference in the incidence, nature and cause of injuries observed during games played on artificial turf compared with those on grass.

In another study reported in the British Journal of Sports Medicine, Reference results showed there was no evidence of greater injury risk when playing soccer on artificial turf when compared with natural turf in the Swedish Premier League. The researchers did report an increased incidence in ankle injuries on artificial turf; however, the study was limited due to its small sample size.

The limited results collated by FIFA suggest that the rate of injury on third generation synthetic turf is similar to that of natural turf, but the type of injury may differ.

The Synthetic Turf Council has provided independent research papers for confirmation of injury occurrence when natural grass and synthetic grass is compared.

[26] Ekstrand J, Nigg B. Surface-related injuries in soccer. Sports Medicine 1989; 8:56-62.
[27] Arnason A, Gudmundsson A, Dahl H. Soccer injuries in Iceland. Scandinavian Journal of Medicine & Science in Sport 1996; 6:40-45.
[28] Stanitski CL, McMaster JH, Ferguson RJ. Synthetic turf and grass: A comparative study. Am J Sports Med 1974;2(1):22-26.
[29] Engebretsen L. Fotballskader og kunstgress. Tidsskrift for den Norske lægeforening 1987;107(26):2215
[30] UST study of NSW community natural grass standards (2011) by Acousto Scan
[31] FIFA Medal Assessment and Research Centre (2006)

6.6.2 Infill Health Perceptions

1. Perceived Concerns

There has been significant perceived concerns regarding the health of infill, mainly the recycled SBR (car tyres) that are used within the performance infills.

With the transition to organic infills these concerns will be removed. That said global independent research has identified little or no evidence that there should be any concerns.[32] [33] [34] [35] [36] [37] [38] [39] [40]

Australia is not as mature as Europe on The chemical controls of products entering our Country, so the Author recommends that we adopt the following global standards for safeguarding rubber if still used.

Exploring key safeguards for rubber infills the following should be considered:

- ***For Heavy Metal Concerns*** – Ensure the infills have been tested against EN 71.3 (2013) Table 2 Category III, which is the standard for Safety of Toys – Part 3 Migration of certain elements, and Category III (Scraped-off materials). In the US, an equivalent standard for heavy metals is the ASTM F3188 – 16. In addition, the European Standard DIN 1803.5 parts 6 & 7 / ESM105 are advised. These tests are harder to achieve in the recycled rubber as the source is not always known;
- ***For PAH Concerns*** – ensure that the sourced tyres have been certified to the European REACH regulation Annex XVII. This can also be used for the virgin rubber infills as well; and
- ***For UV Concerns*** – the infill should be tested using the Extended Test Method for FIFA Quality Manual (2015) or the AFL Community Facility Manual for UV test of 5,000 hours. The UV testing should be linked to the level of UV for the region. Over the next two years Smart Connection Consultancy will be encouraging all suppliers to Australia to have UV tests of 10,000 hours and a tenacity test of ≥75%.

2. Specific Concerns

i. Perception of Goalies in America Contracting Cancer

The University of Washington Women's Assistant Head Soccer Coach Amy Griffin became concerned about the amount of cancer among soccer players in Washington State and compiled a list of soccer players with cancer. Coach Griffin was especially concerned about the number of goalkeepers she identified with cancer and wondered whether exposure to crumb rubber infill in artificial turf might be causing it. The list included 53 people, most of whom played soccer and in the goalkeeper position.

Due to heightened public concern and the large number of people on the list, public health officials at the Washington State Department of Health and researchers from the University of Washington School of Public Health formed a project team to investigate following the Department of Health Cluster Guidelines and published their findings in April 2017.[41]

The overall purpose of the investigation was to explore whether the information from Coach Griffin's list warranted further public health response. The main goals of the investigation were to:

1) Compare the number of cancers among soccer players on the coach's list to the number that would be expected if rates of cancer among soccer players were the same as rates among all Washington residents of the same ages.

[32] STC Executive Survey Catalogue of Available Recycled Rubber Research (March 3, 2016) http://c.ymcdn.com/sites/www.syntheticturfcouncil.org/resource/resmgr/docs/stc_cri_execsummary2016-0303.pdf

[33] Ruffino, B., Fiore, S., & Zanetti, M.C., (2013). Environmental-sanitary risk analysis procedure applied to artificial turf sports fields. *Environ Sci Pollut Res Int.* *20*(7):4980-92. doi: 10.1007/s11356-012-1390-2

[34] Ruffino, B., Fiore, S., & Zanetti, M.C., (2013). Environmental-sanitary risk analysis procedure applied to artificial turf sports fields. *Environ Sci Pollut Res Int.* *20*(7):4980-92. doi: 10.1007/s11356-012-1390-2) Abstract Summary - http://link.springer.com/article/10.1007/s11356-012-1390-2

[35] Krüger, O., Kalbe, U., Richter, E., Egeler, P., Römbke J, & Berger, W. (2013). New approach to the ecotoxicological risk assessment of artificial outdoor sporting grounds. Environ Pollut. Apr;175:69-74. doi: 10.1016/j.envpol.2012.12.024.

[36] Sunduk, K., Ji-Yeon, Y., Ho-Hyun, K., In-Young, Y., Dong-Chun, S., & Young-Wook, Lim. (2012). Health Risk Assessment of Lead Ingestion Exposure by Particle Sizes in Crumb Rubber on Artificial Turf Considering Bioavailability. Environ Health Toxicol. 2012; 27: e2012005. doi: 10.5620/eht.2012.27.e2012005

[37] Menichini, E., Abate, V., Attias, L., De Luca, S., di Domenico, A., Fochi, I., Forte, G., Iacovella, N., Iamiceli, AL., Izzo, P., Merli, F., & Bocca, B. (2011). Artificial-turf playing fields: contents of metals, PAHs, PCBs, PCDDs and PCDFs, inhalation exposure to PAHs and related preliminary risk assessment.Sci Total Environ. 409(23):4950-7. doi: 10.1016/j.scitotenv.2011.07.042

[38] Simon, R. (Feb. 2010). Review of the Impacts of Crumb Rubber in Artificial Turf Applications. UNIVERSITY OF CALIFORNIA, BERKELEY LABORATORY FOR MANUFACTURING AND SUSTAINABILITY

[39] Rachel Simon, University of California, Buheberg, Review of Impacts of Crumb Rubber in Artificial Turf Applications (Feb 2010) p31

[40] Review of the human Health and ecological safety of exposure to recycled tire rubber found at playgrounds and synthetic turf fields. Prepared by Cardno ChemRisk, Pittsburgh, PA (Aug 2013) http://c.ymcdn.com/sites/www.syntheticturfcouncil.org/resource/resmgr/files/rma_chemrisk_update-_8-1-13.pdf

[41] Investigation of Reported Cancer among soccer Players in Washington State (Washington State Dept. Health: 2017) http://www.doh.wa.gov/Portals/1/Documents/Pubs/210-091.pdf

2) Describe individuals reported by the coach in terms of their demographics, factors related to cancer, and history of playing soccer and other sports.

The findings identified the different cancers that the players had contracted and compared that number against the average (standard deviation of 95%) and found that the occurrence rate was within the range expected for that size of population. This is shown in Table 1 below.

Table 1. Observed cancers from coach's list and expected cancers: soccer players ages 6–24 years diagnosed during 2002–2015

	Observed cancers from coach's list	Expected cancers	Ratio of observed to expected	95 percent confidence interval
All soccer players				
All types of cancer	28	1,384	0.02	0.01-0.03
Leukemia	6	131	0.05	0.02-0.10
Hodgkin lymphoma	5	147	0.03	0.01-0.08
Non-Hodgkin lymphoma	6	89	0.07	0.02-0.14
Goalkeepers	14	153	0.09	0.05-0.15
Select/premier soccer players	15	284	0.05	0.03-0.09

The overall conclusion from the WSDOH report stated:

This investigation did not find increased cancer among the soccer players on the coach's list compared to what would be expected based on rates of cancer among Washington residents of the same ages. This finding is true for all soccer players on the coach's list, as well as soccer players on the list at the WYS-defined select and premier levels, and goalkeepers on the list. The variety of fields and residences suggests that no specific field or geographic residence is problematic in terms of soccer players getting cancer.

In addition, the currently available research on the health effects of artificial turf does not suggest that artificial turf presents a significant public health risk. Assurances of safety, however, are limited by lack of adequate information on potential toxicity and exposure. The Washington State Department of Health will continue to monitor new research on health and environmental impacts of crumb rubber.

Thus, the Washington State Department of Health recommends that people who enjoy soccer continue to play irrespective of the type of field surface.

ii. Link with Rubber Infills and Leukaemia or Other Cancers

According to recent research in 2015 and 2016 and in response to significant community concern during 2016 in the Netherlands the Dutch Governments' research results[42] states:

"No indications were found in the available literature of a link between playing sports on synthetic turf fields with an infill of rubber granulate and the incidence of leukemia and lymph node cancer. Moreover, it is clear from the composition of the rubber granulate that the chemical substances that are capable of causing leukemia or lymph node cancer are either not present (benzene and 1,3-butadiene) or are present in a very low quantity (2-mercaptobenzothiazole).

Photo 22: Multi-sports field at St Kevin's College, Toorak (source: Tuff Group)

Since the 1980's, a slight rise has been observed in the number of people aged between 10 and 29 who get leukemia. This trend has not changed since synthetic turf fields were first used in the Netherlands in 2001."

In response to community interest in the USA leading toxicologist Dr Laura Green, pragmatically considered and addressed a series of concerns raised by a Principal of Jonesport Elementary School in Main (USA). This response is potentially the most detailed explanation of the perceived links of recycled SBR tyres to cancer, found by the author of this FAQ Fact Sheet[43]. In brief her conclusion states:

[42] National Institute for Public Health and the Environment (RIVM) Ministry of Health, Welfare and Sport, Netherlands, report on 'Playing sports on synthetic turf fields with rubber granules' 20-12-2016 OomenAG, de Groot GM (RIVM Summary Report 2016 – 0202) accessed on 22nd December 2016: http://www.rivm.nl/en/Documents_and_publications/Common_and_Present/Newsmessages/2016/Playing_sports_on_synthetic_turf_fields_with_rubber_granulate_is_safe

[43] Dr Laura Green Memorandum, June 29, 2015 Re: Comments on CPSC Report #20150608-22F81-2147431268 Assessment of the risk of cancer posed by rubber mulch used in playgrounds http://c.ymcdn.com/sites/www.syntheticturfcouncil.org/resource/resmgr/Files/Rubberecycle_-_Dr._Green_let.pdf

"Overall, then, the evidence on crumb rubber and rubber mulch does not suggest, let alone demonstrate, that rubber poses a significant risk to the health of children and others. As such, I believe that Principal Lay can rest assured that the mulch in her playgrounds has not put her students at risk of developing cancer."

In 2006, the Norwegian Institute of Public Health published their report,[44] the investigators noted:

"Worse case calculation based on air measurements carried out…… does not cause any increased risk of leukaemia as a result of benzene exposure or any elevated risk as a result of exposure to Polycyclic Aromatic Hydrocarbons (PAH's).

Photo 23: Multi-sports field (Moore Park, NSW)

[44] Dye, C.; Bjerke, A.; Schmidbauer, N.; Mano, S. Measurement of Air Pollution in Indoor Artificial Turf Halls, Report NILU OR 03/2006. Norwegian Institute for Air Research: Kjeller, Norway, 2006.

Smart Connection Consultancy

Smart Connection Consultancy offers an innovative approach that delivers outcomes to enhance the experience of participation in physical activity, recreation and sport in local communities.

We specialise in the planning, development, management and procurement of synthetic sports surface technology. We see this technology as complementing natural grass and encouraging more people to be active, play and achieve success in sport because of its extended durability.

By embracing the skills sets and knowledge of our collaborative consultants, we can provide an integrated and holistic approach to our client's projects.

Smart Connection Consultancy is the Technical Consultants for the Rugby Australia, Football Federation Australia, the National Rugby League and sits on the AFL technical committee.

> "Smart Connection Consultancy has been an invaluable source of information for both the federation and our affiliated clubs. Martin specifically has responded to requests at short notice, provided valuable insights and produced quality pieces of work that haves allowed the football community to achieve deadlines and desired outcomes – we will certainly be using him again".
>
> *Football Victoria*

Field of Expertise

In collaboration with industry experts, we provide our clients with high level quality service that is offered for a very affordable investment.

We work with synthetic and natural surfaces for the following sports facilities:

- Australian Rules Football Ovals
- Athletics Tracks
- Bowling Greens
- Cricket Fields and Wickets
- Football (11-a-side, Futsal and 5-a-side)
- Golf Courses
- Hockey Fields
- Multi-sports Areas
- Rugby Union Fields
- Rugby League Fields
- Tennis Facilities

Commitment to Knowledge Building

We are committed to providing leading edge advice and knowledge so that the industry and our clients can appreciate how synthetic sports turf can complement their natural turf options.

We offer the industry and our client's advice, mentoring and knowledge sharing so they can contextualise the opportunity and strategically consider options. Our approach provides rigor and we use independent research as a base to ensure that the most appropriate options are determined.

These services include:

- Knowledge sharing master classes
- Planning and facility development workshops
- Business case workshops linked to Whole of Life Asset management costing strategies and income generation strategies
- Sports participation growth strategies linked to synthetic surfaces
- Synthetic field installation tours - Practical reality
- National Sports Convention

Feasibility and Funding Advice and Solutions

Completing a Business Case to justify the need of a synthetic surface can be streamlined by using our *Smart Whole of Life Costing Model.* We support clients in developing financial strategies, funding applications and where applicable offer funding packages with major financial institutes. Our offering includes:

- Financial strategy development to address WOL costings
- Funding applications for government grants
- Funding solutions with major lending institutes

We understand the use of supply modelling by using demographics of the local community, the needs and the opportunities for activating and retaining them in active recreation and sport which is paramount for a Feasibility Study or Business Case.

Our supply and demand modelling is critical in determining the needs for sports facilities, including:

- Supply and demand analysis
- Community consultation options

Masterplanning and Design Solutions

We will work with you in exploring the site parameters and constraints together with the opportunities to ascertain the best design and management options for your park or venue.

Smart Connection Consultancy has been collaborating with SportEng since 20016 to provide the civil engineering aspect of each design and procurement project. Our collaboration can offer:

- Stakeholder consultation and technical approval
- Concept design options and strategy
- 3D design and fly through options
- Geotech analysis and assessment
- Council presentations
- Cost estimate for concept design

We can mentor your team to understand how to best manage the facilities once built, as this is vital if the funding is based on your organisation's ability to generate revenue.

We can support program development and provide advice on how to maximise the balance between club, school, commercial and your own programs, including:

- Program development strategies
- Price benchmarking
- Performance reviews

Photo 24: Moore Park Multi-sports field (NSW)

Procurement and Project Management Support

Over 20 years' experience in procurement and in collaboration with SPORTENG we offer a full procurement service. These services include:

- Procurement strategy development
- EOI and RFT document development
- Design & Construct or Detailed Design options
- Tender evaluation facilitation
- Comprehensive tender evaluation tools to ensure a rigorous and transparent process to procure the best product which is fit for purpose and achieves best value for the community

Collaborating with SPORTENG, we provide the detailed civil engineering hold points to ensure that every step of the installation meets the appropriate civil and performance standards, including:

- Site inspections and reports
- Witness and critical hold points
- Respond to construction RFI's
- Attend practical completion and defect inspections
- Site assessments and conditional audits

Photo 25: Chatswood High School NSW

Our Clients

We have successfully completed a significant number of sports performance standards reviews, sports strategies, master plans, feasibility studies, business cases and procurement projects. Our client base includes:

- International Federations – FIH, FIFA & World Rugby
- National and State Sports Organisations – NRL, AFL, Hockey Australia, Football Australia, and State bodies
- Local Governments in Victoria, NSW, ACT, Qld, WA.
- Universities and Schools across the Country

Additional Organisations include – Mariners FC, Macarthur Football Association, Delfin Lend Lease, Veneto Club, Monash University, Southern Cross University, Queensland University of Technology and University of Queensland.

Smart Synthetic Sports Field Health Check

Review your field, understand risks and extend life expectancy

Australia's leading synthetic sports surface consultancy is offering the **Smart Synthetic Sports Field Health Check**, for clients who wish to find out what condition their synthetic fields are in and what is the probable life expectancy.

Smart Connection Consultancy has been involved in over 70% of all the synthetic football fields (all codes) developed and installed in Australia in the past decade. We work closely with our clients to maximise their usage and life expectancy of their fields.

The Smart Synthetic Sports Field Health Check consists of:

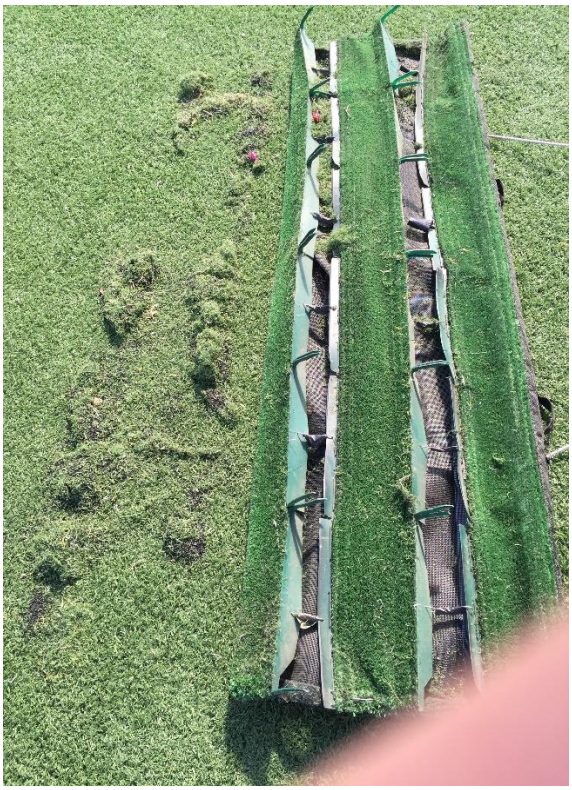
- Conducting a site analysis and field review to ascertain its current status;
- Assessing current maintenance practices to explore if this can extend the life of the field;
- Reporting on findings with improvement strategies;
- Risk assessment with mitigation strategies;
- Predicting life expectancy; and
- Replacement costings and modelling.

An Assessment Report provided within 48 hours of field assessment.

"The Smart Sports Field Health Check allowed us to appreciate the challenges we had, reduce our risks by adopting the risk mitigation strategies identified and we believe that we have extended the expected life by two years by adopting the recommendations for remediation and maintenance."

(Mick Roberts, Sports Grounds Manager, ACT Government)

Call (03) 9421 0133 and talk to Martin Sheppard or email martins@smartconnection.net.au to find out how the Smart Sports Field Health Check can extend the life of your synthetic sports field.



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