PITCH IN

Pitch In to reduce microplastic loss from artificial pitches:

Guidelines for Designers and Procurement Specialists

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The synthetic rubber or plastic granules used on 3rd generation artificial pitches are a potential source of microplastic to the environment. The 'rubber crumb', used to improve quality of play, particularly for football and rugby pitches, can be lost during use, escaping to drains, waterways as well as to soils surrounding the pitch. Once in the environment, microplastic particles can be eaten by animals and may also leach environmental contaminants, such as zinc, at levels that can cause harm to aquatic animals. This is not only harmful to the environment, but also to the players and pitch owners, as reduced pitch infill can lower quality of play and increase the chance of injury. If well-maintained, pitches are topped up at a rate of 2-3 tonnes per year[ii], which is an expense for those who own and maintain the pitches.

The following guidelines have been created for industry to take into account microplastic loss during **design, build and renewal of pitches. These guidelines are also relevant to procurement specialists, and those submitting a pitch construction to tender.** Recommendations are made assuming a new pitch to be built, but many also apply to retrofitting old pitches. The aim is for any changes to be as simple and low cost as possible.

The guidelines have been compiled by KIMO and Fidra by reviewing existing recommendations, reviewing best practice trials conducted internationally and by speaking directly to pitch owners, maintenance staff and industry representatives. This is a constantly changing field and we welcome any feedback from experts to improve or adapt the content of this guide.

Further guidelines are available for pitch OWNERS & MAINTENANCE CREW, and pitch USERS.

Procurement

It is essential that the procurement process starts with a requirement for the pitch to be designed in a way that minimises infill loss. This will ensure that all designers competing for the tender are required to incorporate at least some of the following design protocols, or other innovations, to reduce impact of microplastic pollution.

- Include microplastic management as an element of procurement. Within the procurement strategy, highlight microplastics as an issue and, within the tender process, value strategies which reduce the risks of contamination. Use the following guidelines to provide more specific criteria.

Health and Safety on the Pitch

Health and Safety of pitch users will always be priority in design / build / retrofit of pitches. Any designs should be sure to incorporate required health and safety precautions that already exist. For example, any physical barriers or tarmac surfaces must be beyond the minimum requirements for run-off zones at the edge of the pitch area[1]. Any physical barriers should be designed so that they cannot represent a trip hazard for players, for example.

Another element that has been raised as a potential health and safety risk in recent years is the use of recycled SBR rubber as infill on pitches. Concerns about levels of chemicals leaching from rubber crumb used on pitches have led to press interest and several monitoring studies have investigated the potential impact on health of pitch users. A review of studies by Health Protection Scotland concluded that evidence does not currently support the hypothesis that artificial turf SBR poses a significant health risk[1]. More information about ongoing studies and recommendations to reduce risk of exposure can be found on the website of the European Chemicals Agency (ECHA). Recommendations include ensuring adequate ventilation on any indoor pitches using recycled SBR rubber.

1 **Guidelines for minimum run-off distances can be found, for example, in the Sport Scotland School Playing Fields design guide: https://sportscotland.org.uk/documents/resources/ssc0100192amendedplayingfields_playingfields_web.pdf**

Part 1. Deciding on the type of pitch

This guide is focused on reducing microplastic loss from 3G artificial pitches. However, there may be alternative options, which would lead to significantly less, or no microplastic loss. This first section highlights some of these. If you are past this part of the decision-making process, skip to part 2.

Would a natural pitch be a suitable alternative?

- Make sure to explore the alternatives to 3G artificial turf
    - Online guidance by Sport Scotland can help you choose the correct pitch type.
    - A more detailed report and decision making guide has been created by the government of Western Australia.
    - Hybrid pitches, where natural grass is reinforced by synthetic fibres, are becoming increasingly popular for large venues.

Is non-infill turf a viable alternative for your pitch?

- No-infill technology has developed in recent years and is becoming increasingly popular for community and school play pitches.

Sport England have created a useful guide to options for artificial surfaces for outdoor sports.

Part 2. Deciding on your infill

Alternative infill options

- The most common performance infill for 3G pitches is Styrene-Butadiene Rubber (SBR) crumb, made from recycled tyres. Alternatives are available, however, including organic infills such as cork and coconut husk, which are increasingly being used as an alternative, and they might be a great, cost-effective option for your pitch.
- **Use our summary guide to alternative infills** in Appendix A to see pros and cons of each infill type.
- **Read feedback from pilot studies** testing the quality of these infills to check if it works for you**.**

Remember, the majority of alternatives are still plastic or synthetic rubber, so any spills will still count as microplastic pollution. Even if you choose an organic infill, it's still better to keep your infill on the pitch, both for your pitch and the local environment. So, whatever infill you choose, please keep going to Part 3.

Part 3. Choosing your 3G turf type

- **Choose a high-quality turf that has been 3rd party verified.** A poor-quality turf will disintegrate quickly and pose a health and safety risk, as well as releasing microplastic.

  Look for labels such as *European standard EN 15330-1 2013/ EN 14877:2013, DIN standard 18035-7 2014, RAL GZ-944, FIFA QUALITY standards*.

- **Choose a turf design that reduces loss.** Choose a turf with a higher density of grass fibres, or one that includes a proportion of textured pile. This reduces the amount of infill needed, and the spray (the amount of rubber granule knocked up during play).

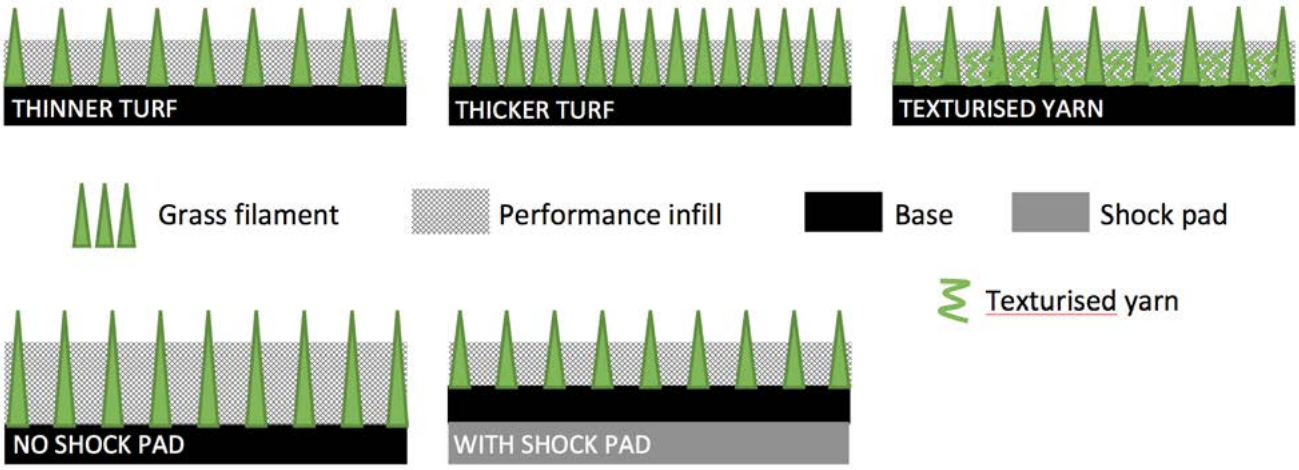

Figure 1 Choose your turf properties to reduce the amount of infill required in the first place, and the amount of splashback or migration of infill on the pitch. For example, use a thicker turf (either a higher density of fibres, or a thicker fibre), or a turf with additional texturised fibres to keep infill in place. You can also use a shock pad to reduce the length of fibre and total amount of infill needed.

- **Incorporate a shock pad into your design** – this can reduce the quantity of infill needed in the first place. Reducing pile length from 60mm to 40mm with additional shock-pad reduces the rubber content needed by 60-70%[2].

Part 4. Designing the pitch and associated infrastructure

NB Any changes to design should pose no additional risk to players. For example, all pitches in the UK have a legal obligation to include a run-off boundary at the pitch edge for health and safety reasons.

4.1 Pitch layout

- Add a solid (e.g. tarmac) surface around the pitch (Fig 2, A). This means that maintenance staff can collect scattered infill material and put it back on the pitch. Design the boundary surface to avoid; 1) joints where infill can accumulate or 2) using loose substrate (e.g. sand/gravel) that may contaminate the infill material. City of Gothenburg recommend a 1-1.5m tarmac boundary.
- Add an elevated edge. If there is no room for a solid surface around the track, or to add additional prevention, include an elevated edge, such as a curb, (this can be angled towards the pitch (Fig 2, B)) to reduce the spread of microplastic. This applies especially if the artificial turf course is elevated relative to the surroundings.
- Consider how the slope of the sports pitch might be adapted to reduce likely loss of infill.
  - A pitch for certain sports can be sloped by around 1-2°– for example, creating a central crown to reduce chances of ponding on a poorly drained pitch. However, this also means over time infill might migrate to pitch edges

2 **Personal Communication with a major European pitch manufacturer.**

Figure 2. Image of a 3G Artificial Turf pitch with (A) a solid (tarmac) surface surrounding the playing surface, (B) an elevated (concrete) edge with slope angled towards drainage gutter and (C) a ground up barrier (solid wall) surrounding the perimeter. Source: photo © LOA-Fonden, Rune Johansen.

4.2 Physical barriers

- **Install a low-level perimeter boarding at the base of the fencing** around the pitch area. This is one of the easiest ways to reduce infill loss. This should be designed in a way to not pose a risk hazard to players. A perimeter strapping, solid or fine mesh, (circa 6 inches/150mm in height should be included as part of the perimeter fence
    - NB perimeter fencing should be of durable standard, an appropriate height for ball retention and most critically safe, i.e. far enough back from the playing lines not to be a trip or head strike risk or hazard. – Suggested 5m from edge of play (3m run off plus a further 1 – 2m of hard stand for spectating purposes

4.3 Pitch drainage and filters

- **Avoid as far as possible letting storm drains and gutters drain near the path around the pitch,** so that microplastic does not spread unnecessarily to the aquatic environment.
- **Storm drains and drainage troughs with open shafts should be avoided.**
- **Include silt traps in drainage plans** to avoid infill being lost down storm drains. Approximately 35% of infill lost to drains can be prevented from entering watercourses through the use of simple silt trap. Advanced silt traps which filter out microparticles are available and if budget allows, these would filter out a higher percentage of infill from stormwater.

4.4 Helping players keep the infill in

- **Include in the design areas for players to remove infill before leaving the pitch (Fig 3).** Consider fitting a brush-off zone or stamp off tray at the exit to collect loose granules as users leave the pitch. Existing brushes should be surrounded by a physical barrier to stop granules escaping to the wider environment. NB this is already a Sport Scotland Recommendation.
- At the entrances/exits to the pitch install:
  - o a 'cattle-grid' style exit to collect loose granules as users leave the pitch
  - o 'boot brushing' stations, within the pitch perimeter
- **Put filters in shower drains.** Place granular traps in changing room drains - this will prevent microplastic spreading with shower water.

Figure 3. Foot grate - can be used to stamp off (image from www.sportsequip.co.uk)

On existing pitches:

Retrofit

- **Install a simple ground-up barrier around the perimeter of the pitch area,** to reduce loss of infill to the surrounding environment – a perimeter strapping, solid or fine mesh, (circa 6 inches/150mm in height included as part of the perimeter fence
    - NB perimeter fencing should be durable, an appropriate height for ball retention and most critically safe, i.e. far enough back from the playing lines not to be a trip or head strike risk or hazard. – Suggested 5m from edge of play (3m run off plus a further 1 – 2m of hard stand for spectating purposes
- **Consider installing removable filters or advanced silt traps** in storm drains surrounding the pitch to ensure granules are not lost to drainage water.
- **Consider fitting a brush-off zone or stamp off tray at the exit(s)** to collect loose granules as users leave the pitch. See section 4.4 (Fig 3).

Help players to keep the infill in

- **Provide information on best practice.** Use posters on the edge of the pitch to instruct best practice
- **Put filters in drains.** Place granular traps in drains from the changing room will prevent microplastic spreading with shower water
- **Collect granules from kit.** In the changing room, include a collection bin for loose pellets found in shoes and kit

Installation and end-of-life

- Operate a careful site during installation. Enforce measures to minimize contamination of the environment with infill, or other loose material.
- Clean up after pitch installation/ removal / renewal. When an artificial pitch is removed, surrounding verges should also be scraped to remove the microplastics from the environment.
- Dispose of your pitch responsibly. A pitch should be disposed of responsibly. Stockpiling or inappropriate disposal will lead to further loss of plastic to the environment as the old pitch disintegrates.

Pitch end of life

Disposal of the pitch at the end of life can be a major contributor of microplastic to the environment, as well as having a major influence on its environmental impact. This should be a major consideration to any new pitch. Pitches should be:

- **Designed to be as recyclable as possible**
- **Installed with an appropriate end of life disposal method planned**

According to recent analysis the most environmentally friendly method of disposal is by separation and recycling of individual components, which can lead to up to 99% recycling rates[3]. Re-use is sometimes referred to as recycling, but often leads to scattered smaller pieces of pitch in a variety of locations and does not solve the final problem of disposal.

Appendix A

Alternative infill options

NAME	WHAT IS IT?	COST	ADVANTAGES	DISADVANTAGES
SBR Rubber	Used car and truck tyres, ground to a crumb.	LOW	• Cheap and easily available • Durable • Makes a good, comfortable playing surface	• MICROPLASTIC leak into environment • Can get very hot in the sun • Can smell bad • Potential to leach chemicals / heavy metals into the environment (with concerns raised for human health in public press)[4]
Coated SBR Rubber	Crumb rubber (as above) coated with a polyurethane plastic film.	MID	• Can be made into different colours • Can reduce the amount of chemicals leaching from rubber crumb while outer film is intact. • High durability, according to manufacturers.	• MICROPLASTIC leak into environment • Plastic outer coating might wear off over time. • Additional use of virgin rubber plastic. • Final mixture makes material more difficult to recycle.
TPE (Thermoplastic Elastomer)	Virgin (non-recycled) plastic-rubber pellets	HIGH	• Durable • Advertised as free of heavy metals and reduced leaching of chemical substances • Good quality TPE makes a good playing surface	• MICROPLASTIC leak into environment • Using virgin material instead of re-use or recycling. • If poor quality, it can harden over time and even melt if it gets too hot. • Tests have shown that some TPE does contain heavy metals and other chemicals.
EPDM rubber (Ethylene Propylene Diene Monomer)	Virgin rubber pellets.	HIGH	• Cleaner and cooler than SBR rubber • Advertised as non-toxic • Advertised as resistant to wear and tear and to resemble a natural surface.	• MICROPLASTIC leak into the environment • Using virgin material instead of re-use or recycling. • Contain chemical fillers – not enough studies to ensure they can't leach chemicals into the environment. • Reports of premature ageing, and potential reactions with turf carpet fibres.
MIXES	Alternative organic infills e.g. coconut husk, rice husks, walnut shells… or a mixture of these	HIGH	• Naturally breaks down if it leaks into environment • Keeps turf cool	• Can freeze to a solid uncomfortable surface • Concern of fungus growth if wet regularly. • Break down of material could lead to insect infestations? • Unclear how durable this is.
CORK	Ground natural cork, which is the bark from the cork oak tree.	MID	• Naturally breaks down if it leaks into environment • Naturally strong and waterproof • Keeps turf cool and makes a good playing surface. • Can be 100% natural – no additives needed	• Needs to be replaced regularly (ever 3-4 years) • If not properly maintained can compact hard. • Problems reported with dust / fungus after wet weather.
SAND	Silica sand – usually used as a base filler on 3G pitches or as main infill in hockey pitches.	LOW	• Cheap and easily available • Creates solid base • Loss into the environment in small quantity unlikely to cause harm	• Sand dust can cause irritation if inhaled and is associated with long-term health effects. • Hard surface – not a suitable replacement for 3G performance infill.

Adapted from PlanMiljo 2017 – Environmentally friendly substitute products for rubber granulates as infill for artificial turf fields.

4 Implications of chemical leaching from SBR rubber on human health are the subject of a number of ongoing studies, which indicate that exposure from chemicals within the SBR rubber indicate a very low level of concern. Current recommendations and updates on study results can be found at https://echa.europa.eu/-/recycled-rubber-infill-causes-a-very-low-level-of-concern.

Figure 4. 3G artificial turf with TPE pellets acting as performance infill (Gothenburg, Sweden)

Figure 5. A pitch that is elevated to its surroundings, and close to an open gutter represents a risk of granules escaping directly to storm water

Figure 6. Rubber granules scattered on the outside edge of a pitch - the fence is open at the base allowing granules to escape easily

Figure 7. A poor quality pitch where both infill and grass are escaping, and the pitch has become unusable

Figure 8. A non-infill design, with underlying shock pad