English Version

Surfaces for sports areas - Synthetic turf sports facilities - Guidance on how to minimize infill dispersion into the environment

Leitfaden zur Minimierung des Risikos von Umweltkontaminationen durch Kunststoffrasenfüllungen

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European foreword

This document (FprCEN/TR 17519:2020) has been prepared by Technical Committee CEN/TC 217 “Surfaces for sports areas”, the secretariat of which is held by AFNOR.

This document is currently submitted to the Vote on TR.
Introduction

General

Synthetic turf sports surfaces provide attractive, hard–wearing and safe playing areas that can accommodate high levels of use and be used in far more diverse climates than natural turf. The development of these surfaces has led to significant demand with over 16 000 full size sports fields now being used in Europe, and approximately 4 000 new fields being built each year.

Synthetic turf sports surfaces take four generic forms:

— non-filled short pile;
— sand filled or sand dressed short pile;
— long pile with infill (typically rubber and/or sand);
— long pile non-filled.

Infill is applied to the synthetic turf surfaces for three reasons:

— it is used to stabilize the carpet to prevent dimensional expansion and contraction and movement through use i.e. it acts as a ballast. This type of infill is often described as stabilizing infill;

— it contributes or provides the sports performance and impact attenuation characteristics of the sports surface. This type of infill is often described as performance infill. The performance infill is a key component of the surface as it provides comfort and protection to players as they run and fall on the surface.

— it helps control the way the ball interacts with the surface, supporting the pile of the surface so it remains upright.

Short pile synthetic turf surfaces typically have pile heights of between 10 mm and 30 mm and normally only have one layer of infill. This is often a rounded sand. Sometimes the sand has a polymeric coating to change the colour of the infill (i.e. it is coloured to match the synthetic turf colour).

Figure 1 shows the typical cross section of a short pile synthetic turf sports surface.

![Figure 1 — Typical cross section of short pile synthetic turf surface](image)

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Long pile synthetic turf surfaces typically have pile heights of between 30 mm and 60 mm. Most contain two layers of infill, the lower layer (normally sand) is installed to provide ballast and stability to prevent the synthetic turf carpet moving. The upper layer is the performance infill.

There are a number of different granulated materials used to form this layer including various rubbers and thermo-plastics and natural materials such as cork, timber, nut husks, etc.

Figure 2 shows the typical cross section of a long pile synthetic turf sports surface.

![Figure 2 — Typical cross section of long pile synthetic turf surface](image)

Key
1. synthetic turf carpet pile, might be curly
2. performance infill
3. stabilizing infill
4. shockpad (optional)
5. base (or foundation)

Most infills are in the particle size range 0.5 mm to 2.5 mm with some occasionally being larger.

Environmental concerns

Increasing public concern about microplastics has led the European Commission, to investigate ways of reducing the quantities released into the environment. They have defined a microplastic as any solid particle made of a non-biodegradable polymer that is 5.0 mm or less in size. They can be unintentionally formed through wear and tear or deliberately manufactured and intentionally added to products for a specific purpose.

As many infill materials used within synthetic turf sports surfaces are either made from non-bio-degradable polymers that are less than 5.0 mm in size, or incorporate some form granule (e.g. sand) that has a polymeric coating, it is important that the design and maintenance of sports fields having these infills is undertaken in a way that minimizes the possibility of the infill migrating from the sports surface and being dispersed into the environment. This Technical Report describes ways of containing infill materials within the footprint of the synthetic turf field during its construction, operation and end of life removal.
1 Scope

This document describes ways of containing infill materials used in many types of synthetic turf sports fields within the confines of the sports field, so they are not dispersed into the surrounding environment.

The options described are based on examples of best practice identified by members of CEN/TC 217.

This document is intended to be of practical use, to create awareness amongst field designers, venue owners, installation companies and those maintaining synthetic turf sports fields. It is applicable for all forms of synthetic turf sports field, from those used for community activities to those used by professional and elite level athletes.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 synthetic turf surfacing system
all components of the surface that influence its sports performance or bio-mechanical characteristics including the synthetic turf carpet, infill and shockpad

3.2 filled synthetic turf
synthetic turf surface, whose pile is either totally filled or partly filled with an unbound particulate material

3.3 infill
particulate materials used within the synthetic turf surface to provide support to the carpet pile and to aid the provision of the required performance characteristics of the surface

3.4 performance infill
granulated materials used to form the upper layer of infill that help provide the required sports performance and player welfare characteristics of the surface

3.5 polymeric infill
granular infill material formed from non-biodegradable rubbers or plastics, or an infill material that has a coating formed from non-biodegradable rubbers or plastics (e.g. coated sands)

3.6 stabilizing infill
particulate materials used to infill the lower portion of the synthetic turf surface to provide support to the carpet pile and ballast to hold the carpet in place and help prevent dimensional movement
3.7 **shockpads**
elastic material placed beneath a synthetic turf sports surface that is designed to aid the provision of the performance properties of the sports surfacing system

Note 1 to entry: Shockpads are also known as elastic layers.

3.8 **stitch rate**
number of tufts per square meter, which is a function of the number of stitches per linear length multiplied by the spacing (gauge) of the tufting needles

3.9 **field**
playing area including the perimeter margins or run offs

Note 1 to entry: Field is also known as the pitch.

3.10 **base**
all elements of construction beneath the synthetic turf sports surfacing system

4  **Sports performance**

The performance of a synthetic turf sports surface is provided by the interactions of the synthetic turf carpet, the infill materials and, if part of the system, the shockpad.

Occasionally some synthetic turf systems also utilize characteristics of the base construction to achieve the required performance.

EN 15330-1 specifies the properties required of synthetic turf surfaces used for football, rugby, hockey, tennis and multi-sports applications. The requirements of EN 15330-1 are intended to apply to surfaces used for community, educational and recreational sport. For professional and elite levels of competition, many sports governing bodies have published their own specifications.

NOTE The requirements of the sports’ governing bodies differ from those detailed in EN 15330-1 and facility developers are advised to ensure that they select surfaces offering the correct performance for the level of competition to be played on the field.

5  **Infill migration routes**

Experience has shown that infill materials can be transported from a synthetic turf field by a number of different actions including:

— being carried by players (caught in and stuck on clothing and footwear);

— snow removal;

— being carried by maintenance equipment;

— inappropriate maintenance procedures;

— inappropriate installation procedures;

— poor storage of spare material;
— surface water run-off from the field;
— wind dispersion.

6 Means of minimizing infill migration

6.1 General

By incorporating appropriate design features into a synthetic turf sports field and undertaking its construction, operational maintenance and end-of-life removal in environmentally sensitive ways the risk of infill being dispersed from within the field to the surrounding environment can be minimized.

The following clauses describe examples of good practice that have been shown to be effective in ensuring infields are not dispersed into the surrounding environment. Many of these design features work best when used collectively and it should not be assumed that only incorporating one feature will achieve the desired containment.

6.2 Types of synthetic turf surface

6.2.1 Carpet design

The tuft density (expressed as the number of tufts per square meter) of the synthetic turf carpet can greatly influence the mobility of the infill. Experience shows the more mobile the infill is, the greater the likelihood of it being dispersed to the environment around the field. Carpets that have lower tuft densities will generally allow greater infill movement and so the potential for infill dispersion is greater. When selecting a synthetic turf surface for a specific field, choosing one that offers the desired sporting qualities and has a high tuft density (for the intended use), will help reduce the potential of infill movement and loss into the surrounding environment.

Some long pile synthetic turf carpets contain a lower layer of curly tufts (often called a thatch zone), that is designed to stabilize the infill and so reduces the potential for movement and migration.

Other forms of synthetic turf carpet use texturized or curled yarns to form the main carpet pile, and these are also designed to stabilize the infill, which they do quite effectively, but possibly to the detriment of controlling the ball speed, meaning they are possibly better suited to areas being used for recreational and small sided football, where the need to replicate a natural grass field is less important.

The performance standards published by FIFA and World Rugby for synthetic turf football and rugby surfaces, contains an Infill Splash Test. This measures how much infill is lifted from the surface when a ball strikes it. Products having Infill Splash Values of less than 1,5 % are designated 'low splash' and will therefore offer better containment of the infill.

6.2.2 Shockpads

Many long pile synthetic turf surfaces used for sports such as football are often based on carpets having pile lengths of between 50 mm and 60 mm. These are laid directly onto the base of the field and are partly filled with a combination of stabilizing infill and performance infill. As the ball rebound and player welfare properties of these surfaces are provided by the performance infill it forms a significant proportion of the infill depth.

Alternative surfacing systems incorporate shockpads, these obtain some, if not most, of their impact attenuation properties from the shockpad, meaning they can have lower pile heights and lower quantities of performance infill. Anecdotal evidence suggests that the reduced infill quantities results in surfaces the are less likely to suffer from infill migration.
It is recommended that if a shockpad is being used within a synthetic turf surfacing system it complies with prEN 15330-4. This document specifies minimum performance and durability requirements for shockpads.

NOTE 2 Some forms of synthetic turf tennis surfaces incorporate coated sand infills. Generally, shockpads are not used with surfaces intended for tennis due to the need for the tennis ball to bounce reasonably high.

6.2.3 Infill

6.2.3.1 Infill shape

Infill materials are produced in a number of different shapes. Those that are more round will allow faster surface water drainage and are less inclined to compact through use but are far more mobile meaning the risk of dispersion within a field and into the surrounding environment is higher. Infills that are more angular in shape with interlock providing a more stable playing surface that is less mobile.

6.2.3.2 Infill dust control

To minimize the potential of fine particulates being released from the infill, the dust content, when measured in accordance with EN 15051-1, should be classified as 'Very Low' or 'Low'.

6.3 Field design

6.3.1 Field profile

Synthetic turf fields are often built with slopes of up to 1 % in magnitude. This is to aid the movement of water as it drains through and from the synthetic turf surface. The more pronounced the slope the greater the possibility of the infill being carried towards the lower boundaries of the field. Ensuring a field is built with a slope that does not exceed 0,5 % will help to minimize the potential for infill movement, reducing the risk of dispersion into the adjacent environmental and reducing the need to regularly redistribute the infill within the field.

6.3.2 Field drainage

6.3.2.1 Types of field drainage

Synthetic turf fields are either designed to drain vertically where rainwater flows down through the synthetic turf surfacing system into a drainage system laid below the field's base, or horizontally where the water flows down through the synthetic turf carpet, into a drainage mat, that allows the water to then flow laterally to perimeter drains laid around the field. To allow the water to flow laterally the field will normally be built with steeper slopes and, as described in 6.3.1, this can increase the potential for the infill to move towards the sides of the field and subsequently migrate into the surrounding environment.

6.3.2.2 Drainage silt traps

To ensure any infill being carried by rainwater following through a drainage system is captured before the water leaves boundaries of the field perimeter drains should include silt traps to capture it. These typically comprise a filter bucket that provides primary filtration of heavier silts and a secondary micro-filter that captures any remaining small particles. Both the filter bucket and secondary micro-filter should be easily removable for maintenance.
6.3.3 Field perimeter details

Infill will often migrate to the environment surrounding a field if it is allowed to collect around the perimeters of the field and through the actions of play and maintenance lifting and throwing it out of the field. By incorporating containment features into the outer margins of a field this loss can be minimized.

6.3.4 Containment barriers

Incorporating some form of physical barrier to prevent infill leaving the field has been shown to be the best way of minimizing dispersion into the surrounding environment. Different edge barrier designs have proved successful including:

6.3.5 Synthetic turf surfacing laid up to the field boundaries

If the synthetic turf surfacing is to be laid up to the outer field boundaries some form of panels should be used to ensure it cannot be thrown (by maintenance machinery) or bounced (during play) out of the field. The panels should be 500 mm or higher. They may be formed from brickwork, timber, plastic extrusions, metal work or other materials. They should be mounted to the fencing system and sit flush with the edging kerb of the field, so they do not allow infill to migrate under them.

See Figure A.3 in Annex A for typical examples of the fencing and edging details described below.

The noise of balls hitting perimeter edging boards and panels can be a source of concern and objection to those neighbouring a sports field. These use of noise-reducing board/panel systems can significantly reduce these intrusive noises.

6.3.6 Margins between the synthetic turf playing surface and field boundaries

Many fields incorporate some form of paved surrounds that are used for spectator viewing, storage of sports equipment, etc. Other fields are now being built with paved margins that are specifically designed to stop infill lying adjacent to the field boundaries.

Providing the surround/paved margins are at least 500 mm wide a lower edge barrier can be used as the risk of infill being thrown through the fence are much lower. Examples are shown in Figure A.4 in Annex A and comprise:

- 200 mm or higher boards mounted to the perimeter fencing so they sit flush with the ground and do not allow infill to migrate under them. If tanalised timber boards are used it is recommended they be vacuum pressure impregnated softwood timber in accordance with Class 4 of EN 335;

- raised precast concrete kerbs (minimum 200 mm high) positioned adjacent to the fence line so infill cannot migrate under them;

- cast concrete plinth/kerb (minimum 200 mm high) on which the perimeter fencing is flush mounted above.

Paved margins should be designed to allow ground–staff to easily collect any dispersed infill that has worked its way to the sides of the field and put it back onto the playing area, before it leaves the facility. They are often surfaced with asphalt, paving slabs, cast concrete, short pile (non-filled) synthetic turf, etc.

Paved margins should be designed to slope inwards towards the synthetic turf surface. When slot or gully drains are installed to capture water flowing off the margin, they should be fitted with a micro-filter silt traps to capture infill being washed into the drains.
6.3.7 Field entrance points

At all entrances to the field, boot cleaning grates/scraper mats should be installed. They typically comprise:

— smooth bar decontamination grates;

— heavy duty rubber scraper mats.

The decontamination grates/scraper mats should be the full width of the entrance gate and at least 1.5 m in length, so people cannot step over them, with barriers to stop people stepping sideways off them. They should be positioned immediately adjacent to entrance gates, either internally or externally.

The grates/mats should be set in recessed bases that will retain any infill dislodged infill. To prevent the bases filling with water they should contain a drain fitted with a silt trap to capture infill.

Metalwork should be hot dip galvanized in accordance with EN ISO 1461 and care taken to ensure that no sharp edges are left after galvanizing.

Figures A.3a and A.3b in Annex A show examples of cleaning grates/scraper mats.

6.3.8 Boot cleaning stations

Multi-person boot cleaning stations, with suitable signage encouraging athletes to use them, should be positioned at the main points of egress from the field. If mounted outside the synthetic turf field, it should be positioned on a recessed -paved area that is designed to retain the dislodged infill and has a drain fitted with a silt trap to prevent any infill being carried by rainwater run-off.

7 Installation of infill

Significant infill dispersion into the environment can occur during the installation of the infill into the synthetic turf surface. The risk of this occurring can be minimized through good planning and use of appropriate working practices, including:

— ensuring that infill materials are supplied to site in suitable heavy-duty bags that are not torn or open;

— ensuring materials are stored in secure compounds to prevent vandalism of bags;

— only opening bags within the confines of the field and not transporting loose infill from outside the field to the installation equipment;

— ensuring empty infill bags are collected and contained before they leave the field area;

— not allowing the installation of the infill until the perimeter of the field is secure and the appropriate containment measures, as described in this guide, are operational;

— ensuring infill installation equipment and carpet brushes are thoroughly cleaned before they leave the field area.

8 Field maintenance

During use the infill can be dispersed to the margins of the field and it is very important, (not least to ensure good sports performance and player safety) that it is regularly returned to the field. This is easily achieved through the use of mechanical brushes and drag mats.
Brushing will also help prevent the infill from compacting through use, meaning the need to top dress with additional rubber is reduced.

The best type of brush or drag mat to be used will depend on the recommendations of the synthetic turf surface manufacturer and this should always be followed to ensure damage to the carpet, or their warranty, is not violated through the use of inappropriate equipment.

The frequency of brushing of the surface will depend on the frequency of use, the number of players on the field at any one time, footwear, and the type of synthetic turf surface, but a general rule often quoted is that every ten hours of play requires one hour’s maintenance.

The key rules to maintaining a synthetic turf field, as far as infill migration is concerned, are:

— ensuring that the infill depths are as specified by the supplier of the synthetic turf surfacing system in their product datasheet;

— ensuring that the infill is evenly distributed across the field. Do not allow it to accumulate on the sides and ends of the field;

— ensuring that all maintenance equipment is thoroughly cleaned so any infill is removed before the equipment leaves the field;

— ensuring that all drainage silt traps are regularly checked and emptied to ensure they remain operational;

— when using rotary brushes, adjusting the brushing patterns to ensure infill is not flicked up and thrown off the field;

— avoiding to use leaf blowers near the perimeter of a field;

— only open bags of infill within the confines of the field. Not transporting loose infill from outside the field to the installation equipment;

— ensuring that empty infill bags are collected and contained before they leave the field area;

— ensuring that boot cleaning stations are cleaned frequently and the brushes are replaced as they wear.

As some infill will inevitably be caught on maintenance brushes and mats, they should always be stored on hard paved areas. If these have drains, they should have suitable silt traps to capture any infill washed into them.

Spare infill used for the localized topping up and periodic topdressing should be stored in a secure area that will contain any spilt infill.

As field get older and the carpet’s pile flattens there is a tendency to overfill the surface (to protect the pile of the carpet and extend its usable life). Overfilling will increase the potential for infill to migrate off the field and is something that is not recommended.
9 Snow clearance

Possibly the biggest source of infill migration is when fields are cleared of snow.

Ideally snow should be cleared so around 5 mm to 10 mm remains, and this is allowed to thaw naturally, and the infill is not disturbed. In many colder climates where this is not possible, all the snow is removed, and this will inevitably result in some infill being removed.

In such situations it is recommended that any removed snow is stored adjacent to the field's run-offs on areas within the perimeter fencing. These should be designed to ensure snow-melt drains back onto the main field, or into drains that have suitable silt traps to capture any infill being washed away. As the depth of snow can be significant, solid panels should be fitted to the perimeter fencing to ensure infill cannot fall from the snow into the surrounding environment. Figure A.5 in Annex A shows details of a typical snow storage area.

If there is inadequate space for a separate snow storage area, the width of the sports field can often be reduced for the winter months to allow snow storage on the outer portion of the synthetic turf surface.

As the snow melts most of the infill will be deposited on the storage area and can be collected, filtered to clean if needed, and then reintroduced into the synthetic turf surface to ensure the infill levels remain at the correct depth.

Under no circumstances should snow removed from a field be deposited into water courses as this can lead to aquatic pollution. Nor should snow be deposited on soft landscaping where migration and dispersion cannot be controlled.

10 Changing rooms

Wet changing room floors and shower areas, toilets, etc. should have drains fitted with suitable silt traps to capture any dislodged infill.

11 End of life disposal of synthetic turf surfaces

Removal and/or replacement of synthetic turf playing surface is another activity that can result in significant infill dispersion into the environmental if not undertaken responsibly.

It should be ensured that the contractor appointed to lift and remove the old surface is licensed and able to demonstrate a full chain of custody for the materials from the point they leave the field to being recycled, reused or disposed of in accordance with all appropriate waste regulations.

Lifting and transportation of old fields should be undertaken in a way that minimizes the risk of infill migration. These can include:

— a mechanized lifting process that removes the infill from the carpet before the carpet is rolled and removed from the field;

— the use of close-sided trucks or shipping containers when the synthetic turf is removed with the infill still in place.

If infill is removed on site, it should be ensured that it is stored securely before it is transported from the field.

Working areas should be cleaned thoroughly on completion of surface removal.
12 Retrofitting existing fields

Operators of existing synthetic turf fields might wish to ensure to minimize the risk of infill dispersing into the surrounding environment. Whilst some of the design features detailed in this Technical Report may not be easy to fit retrospectively, many of the principles can be adopted:

— good maintenance should be carried out on all fields, including infill redistribution;

— retro fitting fine mesh plastic or canvas screening to contain infill, providing the fence posts can withstand the increased wind loading;

— containment boards can be retrofitted to fence posts;

— retro fitting decompaction grates at all entrances and boot cleaning stations at the main entrance points;

— drain filters can be installed into existing stormwater drains not containing silt traps.

When resurfacing an existing field, consideration on how to contain infill in the future should form part of the project.
Annex A
(informative)

Figures showing typical design details

Figures A.1 to A.5 show typical design details.
Figure A.1 — Fencing panels, used when the synthetic turf surface is laid up to fence
Figure A.2 — Raised edging options used with paved zone to separate synthetic turf surface from perimeter boundary
Figure A.3a — Decontamination / boot cleaning grate (located outside all entrances)
Dimensions in millimetres

Figure A.3b — Decontamination grate / boot cleaning – alternative configuration
Figure A.4 — Boot cleaning station
Key
1 area outside field
2 field side of fence
3 perimeter fencing
4 timber of plastic board
5 hard paving with slope towards field
6 drainage channel/drain containing filter bucket and secondary fine micro-filter
7 synthetic turf surfacing
8 flush edge detail to avoid trip hazard
9 foundation / base

Figure A.5 — Snow storage area
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