

# First – preliminary – results from the test and development project

*Analyses carried out in the June-August 2022 period by Teknologisk Institut (Danish Technological Institute) and engineering consultancy Sweco for Silkeborg Municipality and DBU (Danish Football Association)*

## **Silkeborg and DBU will show the way for artificial turf pitches of the future**

At the Søholt Sports Facility on Ansvej in Silkeborg, Silkeborg Municipality has installed two new, third-generation artificial turf pitches next to an existing artificial turf pitch and the JYSK Park football stadium.

Apart from intending to create the best possible conditions for local football clubs practicing and playing at Søholt, Silkeborg Municipality is – in cooperation with the DBU and through a test and development project – looking to show how to design, maintain and use artificial turf pitches in an environmentally friendly way.

The environmental impact of artificial turf pitches is currently being discussed in the EU, and one suggestion for an upper limit for the dispersal of microplastics from an artificial turf pitch to its surroundings is 7 g/m<sup>2</sup>/year.

The new artificial turf facility at Søholt has been designed according to the recommendations described in the new, joint European guide for the construction of artificial turf pitches – CEN report (DS/CEN/TR 17519 – "Surfaces for sports areas – Synthetic turf sports facilities – Guidance on how to minimize infill dispersion into the environment").

The purpose of the test and development project in Silkeborg is to verify whether the

recommendations described in the CEN report are sufficient to keep the spreading of microplastics below a 7 g/m<sup>2</sup>/year limit. This corresponds to maximum 50 kg a year per 11-a-side football pitch. Another objective is that the project should build on experience from the test project finalised by Ecoloop in Kalmar, Sweden, in 2019. The project is based on and adds to the experience of the test project carried out by Ecoloop in Kalmar, Sweden, in 2019. In connection with the Ecoloop project, the conclusion was that the dispersal of rubber granules can be kept at an absolute minimum if pitches are constructed with simple containment measures – including fencing with barriers along the perimeter of the pitch as well as specially designed clean-down points at entrance/exit areas. The experts behind the Kalmar project conclude that at least 99% of the potential spread of microplastics from an artificial turf pitch can be prevented.

Apart from the purely football-related aspect, the ambition behind the Søholt project is thus to install a football facility setting the standard for the environmentally friendly artificial turf pitches of the future. At [silkeborgbanen.eu](https://silkeborgbanen.eu), anyone interested can follow readings and experience from the project. The below – preliminary analyses – are the first partial results published from the project.

## Facts about the Silkeborg pitch (Silkeborgbanen)

Address: Søholt Idrætspark, Ansvej 116, DK-8600 Silkeborg

The actual test pitch – Silkeborgbanen – is also referred to as Pitch 8. It is an 11-a-side pitch with an extra area at the western end of the pitch. The total area of the field is 9,442 m<sup>2</sup>.

If the EU chooses 7 g/m<sup>2</sup> as the upper limit for annual dispersal of microplastics from an artificial turf pitch to the surroundings, this means that 66 kg of rubber granulate per annum is the maximum amount which may be dispersed from the Silkeborg pitch to the surroundings.

A graphic model made available at [Silkeborgbanen.eu](http://Silkeborgbanen.eu) illustrates different zones showing:

- Where infill granulate should be (Green Zone)
- Where infill may be – but from where it should not spread (Yellow Zone)
- Where infill granulate should generally not be found (Red Zone)



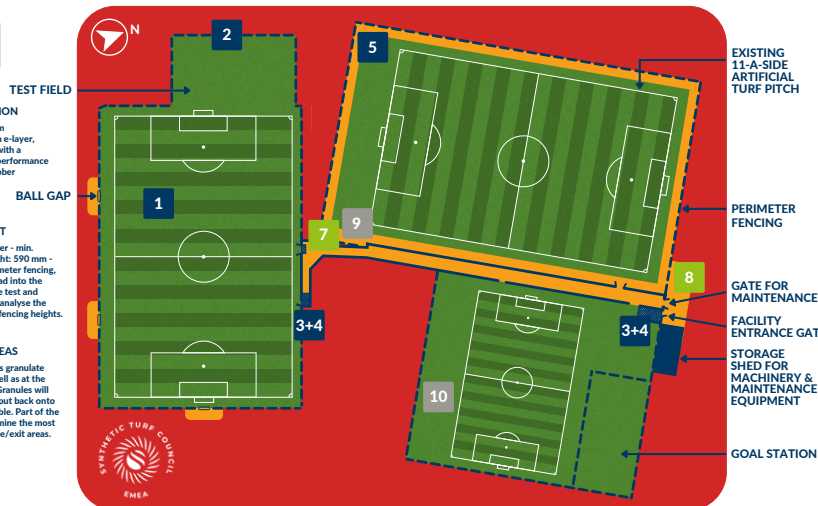
## ENVIRONMENTALLY FRIENDLY MEASURES FOR ARTIFICIAL TURF PITCHES WITH GRANULATE INFILL



The Municipality of Silkeborg (Silkeborg Kommune) is expanding the facilities at Søholt with a new artificial turf field. Planning the new pitch as a test and development project in cooperation with the Danish Football Association (DBU), the municipality is looking to show how to construct, maintain and use artificial turf pitches in an environmentally friendly way. Pitch construction is based on recommendations from the joint European guide for the construction of artificial turf pitches – CEN report (DS/CEN/TR 17519).

### FIELD DESIGN

- SYSTEM CONSTRUCTION**  
Classic artificial turf system construction with a 25 mm e-layer, 40 mm artificial turf yarn with a stabilising sand layer and performance infill in the form of ELT rubber granulate.
- INFILL CONTAINMENT**  
An infill containment barrier - min. height: 290 mm, max. height: 590 mm - is mounted along the perimeter fencing, preventing granulate spread into the red no-go zone. Part of the test and development project is to analyse the effectiveness of different fencing heights.
- ENTRANCE / EXIT AREAS**  
Mesh grating is installed as granulate traps at the test field as well as at the main entrance/exit area. Granules will be collected, cleaned and put back onto the pitch in so far as possible. Part of the project is testing to determine the most efficient design of entrance/exit areas.



- BOOT BRUSH STATIONS**  
User-friendly boot brush stations are installed at entrance/exit areas to prevent granulate spread from the yellow in-between zone; and signs make players aware that correct use of the facility equals taking good care of the environment.
- WINTER MAINTENANCE**  
Deposit snow in the green zone along the pitch perimeter or along the long side of the pitch - alternatively, in the yellow in-between zone.
- DRAINAGE**  
Surface water from downpour remains - and seeps into the ground - within the area.

● GREEN ZONE - WHERE INFILL SHOULD BE

● YELLOW ZONE - FROM WHERE INFILL SHOULD NOT SPREAD

● RED ZONE - WHERE INFILL SHOULD NOT BE FOUND



### PITCH MAINTENANCE

- MAINTENANCE EQUIPMENT**  
Maintenance equipment should stay within the area of the green and yellow zones. Maintenance staff is aware that correct maintenance equals taking good care of the environment.
- CLEANING MACHINERY**  
Maintenance personnel must clean machinery used for other pitch facilities, before such machinery leaves the yellow in-between zone.



### PITCH CONSTRUCTION

- SAFE STORAGE OF INFILL**  
During pitch construction, granulate is safely stored inside the yellow in-between zone. Subsequent to pitch opening, granulate is safely stored at the municipality storage facility.
- PITCH RENEWAL**  
In future, when the pitch needs to be renewed, the pitch owner must ensure environmentally safe clean-up and disposal.





### **Rubber granules on artificial turf pitches**

In comparison to conventional grass pitches, artificial turf pitches increase the number of hours that you can play football year-round. Artificial pitches can be played on all year round and can withstand more intensive and frequent use than conventional grass pitches, as well as extreme rainfall and droughts. As a rule of thumb, a well-maintained artificial turf pitch makes it possible to play at least twice as much football throughout one year in comparison with a traditional grass pitch.

For most artificial turf pitches, the use of rubber granules is essential to ensure that playing characteristics are as close to those of natural grass as possible. Infill granules also protect players from injury. The most widely used rubber granulate for infill is made from end-of-life tyres (ELT). This material is both durable and elastic with high friction, and worn-down tyres thus have some relevant functional properties.

Rubber granules on artificial turf pitches are typically 0.8 to 3 mm in size and are thus categorised as microplastics.

Artificial turf pitches with rubber granules are fully accepted by the major football organisations FIFA and UEFA - and are allowed for play at all levels, including Champions League and the World Cup.

### **Unintentional dispersal of rubber granulate from artificial turf pitches**

Summarised results from German, Dutch, Norwegian and Swedish studies indicate that between 290 and 690 kilos of granules per pitch are potentially spread from pitches without containment measures each year. Total dispersal per pitch is made up by i.a.:

- 250 kg/year deposited on soil and paved areas around the pitch
- 40 kg/year carried off the pitch by players to changing rooms / parking areas / cars / homes
- 0-250 kg/year pushed off the pitch in connection with snow clearing
- 10-200 kg/year discharged via water

Dispersal via surface water is not so relevant in Denmark, where rainwater traditionally percolates from artificial turf pitches to drains located underneath the pitch. In Denmark, there are thus no open wells through which rubber granulate may spread with surface water.

Drainage water from the pitch in Silkeborg will be analysed for microplastics content which may originate from the artificial turf system.



### Dispersal of rubber granules by footballers

During summer 2022, Danish Technological Institute has carried out the first analysis of how much rubber granulate football players unintentionally carry off the pitch on their clothes and in their football boots. The test group (consisting of 17 persons) was a group of Silkeborg IF talent players (15 players wearing football boots) and 2 coaches (wearing flat shoes). At the end of a practice session, with both hard practice and drills where players were lying on the artificial turf, players were stopped right after they had passed the clean-down exit area, where granules from i.a. boots should be collected. Each player then stepped into a bag and was cleaned free of granules (on the outside of clothing and boots as well as on the inside of boots). Players had neither been informed about this testing in advance, nor were they given any separate instruction to clean football boots/shoes or the like prior to leaving the pitch and encountering experts from the Danish Technological Institute.



The test was carried out in dry weather and must be repeated – in both dry and wet weather. The experts behind the Kalmar project documented that wet weather conditions increase the potential spread of microplastics - also via players and coaches. It is planned that the Danish Technological Institute will conduct more analyses as early as September 2022 - and preferably in rainy weather conditions.

The result of the first test was that each person had carried an average of 0.163 grammes of granulate off the pitch, made up by:

- 0.059 grammes on the outside of clothes and shoes
- 0.104 grammes from the inside of football boots/shoes

Silkeborg Municipality has indicated that around 360 players used the Silkeborg pitch during the week when the analysis was carried out (week 25). Assuming that 360 players use the pitch every week, 52 weeks a year (i.e. including traditional holiday weeks), under similar weather conditions, this adds up to a total loss of granulate from the pitch via players of 3.1 kg/year.

Some artificial turf pitches – including the Silkeborg pitch – will be used more than this, but hardly by more than 800 players a week. Assuming that 800 players use the pitch for 48 weeks a year (i.e. not during holiday weeks), then total loss of rubber granulate via players will amount to 6.3 kg/year.

Although further analyses are needed – not least under different weather conditions – these preliminary results are so significantly below previous analyses (on pitches without retentions measures) that Danish Technological Institute would like to make the following statement at this stage:

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*Our preliminary results from the Silkeborg pitch, where we have looked at the amount of granulate unintentionally carried off the artificial turf pitch by players, are significantly below the 40 kg/year level that previous studies have indicated.*

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## Fencing panels prevent the spreading of rubber granulate – and height matters

Danish Technological Institute has also carried out a preliminary study to clarify how much granulate is spread through the fence – over the panels which function as granulate containment barriers. Different panel heights are tested to determine the most efficient height. Throughout one month, Danish Technological Institute had placed geotextile fabric all around the pitch. This fabric has then been collected and subsequently checked for rubber granules. During the month in question, when the geotextile was installed, no real maintenance was carried out on the pitch – in other words, no large machinery was used on the pitch during this period – so this is a significant factor, for which reservation is made. A new analysis will be carried out at the end of 2022, by which time the pitch will have been in use for six months and will have been maintained on a weekly basis.

Assuming that the preliminary test month can be multiplied by 12 months to achieve total, 12-month dispersal to soil and paved areas around the pitch, it adds up as follows:

- With 20 cm fencing panels (lower than CEN recommendations): 1.4 kg/year
- With 40 cm fencing panels (lower than CEN recommendations): 0.4 kg/year

The CEN report recommends 50 cm fencing panels / barriers along the perimeter of the pitch.

Despite reservations relating to the lack of maintenance and the fact that results are based on one month only, Danish Technological Institute concludes that perimeter fencing panels limit dispersal, and the height of panels is important for the amount of granulate spread to areas around the pitch:

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*Over the next two years, we will continuously – at approximately 6-month intervals – measure the dispersal of rubber granulate to areas next to the pitch. Our preliminary analysis shows that barriers impede unintentional dispersal of rubber granulate, and panel height matters.*

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Danish Technological Institute expects to be able to present further preliminary results from the Silkeborg pitch in October and November 2022, when more analyses will be done – including i.a. drainage water analyses.

Read more about the test and development project at [Silkeborgbanen.eu](https://silkeborgbanen.eu)