

# Silkeborg banen

A test and development project in  
Silkeborg Municipality of Denmark

# About Silkeborgbanen

## Design of eco-friendly artificial turf fields

Silkeborgbanen is a test and development project where the intention of Silkeborg Municipality (a city in the western part of Denmark) and the Danish Soccer Association, DBU, has been to create the best possible conditions for the local soccer clubs and at the same time show how to design, maintain and use artificial turf fields in an environmentally friendly way.

The purpose of the test and development project in Silkeborg is to verify whether the recommendations described in the GEN report (DS/CEN/TR 17519 – “Surfaces for sports areas – Synthetic turf sports facilities – Guidance on how to minimize infill dispersion into the environment”) are sufficient to limit dispersal of microplastics from the field to below an acceptable level.

Opened for play in the early summer of 2022, the Silkeborgbanen field is a full-size third-generation artificial turf field for soccer – with extra playing area at the one end. Total field area is 101.644 sq. ft. (9,443 m<sup>2</sup>). The field is constructed with a synthetic grass carpet with 11,025 diamond-shaped blades/m<sup>2</sup> and 145,505 lb. (66 tonnes) of rubber infill plus E-layer.

## Detailed plan for the containment of rubber granulate

When designing Silkeborgbanen, Silkeborg Municipality, in cooperation with engineering consultants WSP, planned where the rubber granulate should be, where it is acceptable, and where no granulate should be found. Based on this plan, containment measures such as fencing, barriers and entrance/exit gates for both users and maintenance equipment have been installed.

## Danish Technological Institute responsible for test and development

Experts from Danish Technological Institute and engineering consultancy Sweco have collected data from the period from 10 June 2022 to 14 March 2024 – a period of almost two years. Data collection and processing was carried out for Silkeborg Municipality and DBU.

## Still room for improvement – so we will continue

Work is in progress to conduct further data collection to test whether the adjustments in field operation based on findings during the first two-year test period, can further reduce dispersal of microplastics from the field.



# Main results from Silkeborgbanen

## The most important conclusions in the report from Danish Technological Institute are:

- That containment measures (barriers along the perimeter of the facility and gates with grates at exit points) can prevent unintentional spreading of microplastics (rubber granules) to surroundings (including nature), which we all want to avoid.
- That the height of infill containment barriers matters. 24 inches (60 cm) is better than 8 inches (20 cm). The CEN report's recommendation for barriers (20 inches / 50 cm) is sufficient.
- That approximately 70 percent of the small amounts of rubber granulate spread through the fence (over the barriers) is found within 40 inches (1 meter) from the fence. If the area outside the fence is paved, it will be possible to sweep the rubber granulate back onto the actual field area.
- That human behavior – especially during maintenance – is the biggest risk factor in relation to the dispersal of microplastics. During one single snowfall in the last part of the test period, snow was pushed to the perimeter of the facility. At that time, barriers had temporarily (for test purposes) been lowered to 8 inches (20 cm) in an exposed corner, and when snow was pushed all the way out to these low barriers, the result was considerable, unintentional spreading beyond barriers – not into nature, but into a projected spectator area.
- That if the field has proper containment measures, and if a sensible policy in relation to maintenance and snow removal applies, then annual infill dispersal can be limited to less than 22 lb. (10 kg) per year. For comparison, the European Commission used an estimate of 1.102 lb. (500 kg)/field/year as the basis for the ban on the construction of artificial turf fields with rubber granulate, which will come into effect in the EU countries on 17 October 2031.
- That infill dispersal via players and coaches, including balls and training equipment, is insignificant. When players have left the facility through the bespoke exit gate with grates, the total amount of rubber granulate on players and in their soccer shoes is less than 11 lb. (5 kg)/field/year. Most of the rubber granulate carried off the field by players – between 2/3 and 3/4 – is probably emptied onto the floor in the entrance at home or in the changing rooms. From there, it will most likely end up in the trash for incineration. For a field with a capacity utilization like Silkeborgbanen, we thus conclude that less than 3.3 lb. (1.5 kg)/field/year is spread to the surrounding areas (e.g. at the nearby parking lot, in the car, in the changing room and in the bathroom).
- That dispersal via maintenance equipment is insignificant – less than 0.9 lb. (0.4 kg)/field/year – if machines (e.g. tractors) are cleaned inside the field area, as is the case at Silkeborgbanen, and equipment (e.g. aerator, brushes and drag mats) is kept inside the artificial turf field area.
- No micro rubber (from granulate) has been found in the drainage water, nor have significant amounts of environmentally harmful substances been found in the drainage water. Silkeborgbanen has been tested for PFAS contamination in the drainage water, as has a non-infill artificial turf field nearby. The results show PFAS values below the national environmental targets for freshwater environments – and around or below Danish requirements for drinking water. The analyses show that rubber granulate used as infill is not a significant source of PFAS contamination.



Download the comprehensive report from Danish Technological Institute at [Silkeborgbanen.eu](https://silkeborgbanen.eu).

# Recommendations from Silkeborgbanen

Dispersal of infill from artificial turf fields can be limited with simple measures. Here are the main recommendations from Silkeborgbanen, presented in collaboration with Danish Technological Institute.

## Containment barriers work – height matters

Barriers are effective when it comes to keeping infill on the field. However, the height of barriers matters. If you avoid pushing snow all the way out to the field perimeter barriers, 16 inches (40 cm) high barriers can limit total dispersal of infill from the field to less than 22 lb. (10 kg)/field/year. Higher barriers will contribute to a further reduction of dispersal. The European Guide for the Installation of Artificial Turf Pitches, CEN Report (DS/CEN/TR 17519), recommends 20 inches (50 cm) barriers.

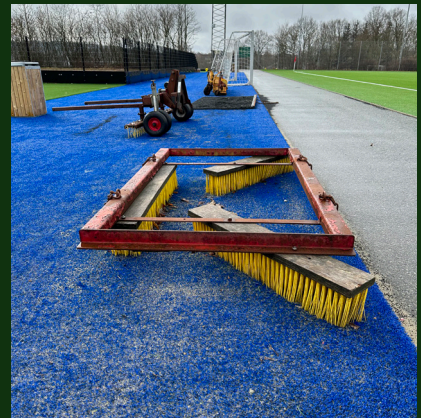


## Entrance/exit gates for players are important

An entrance/exit gate with mesh gratings as “flooring” should be installed at the field, and it must be mandatory for players to enter and leave the field through this area only. The gate should be constructed so that players must pass across min. 5 feet (1.5 meters) of grating – and preferably more. At Silkeborgbanen, players walk across 15 feet (4.5 meters) of grating when they leave the field. This has limited the amount of infill carried off the field by players, coaches and equipment to less than 11 lb. (5 kg)/field/year.

## Pay attention to maintenance equipment

A clean-down zone and entrance/exit gate for maintenance machines and equipment, e.g. tractors, must be established. This gate should not be used by players, coaches or spectators. Before machines leave the artificial turf field, they must be cleaned from rubber granules, either swept clean or cleaned by means of a compressed air pump. At Silkeborgbanen, the equipment is cleaned by means of a high-pressure air pump before it leaves the facility. Afterwards, the equipment must then pass across 5 feet (1.5 meters) of mesh grating. With this simple procedure, the amount of infill transported off the facility via maintenance equipment can be limited to less than 0.9 lb. (0.4 kg)/field/year.



## Maintenance is highly important

Field maintenance has a major impact on the amount of infill dispersed from the artificial turf system. It is always recommended to follow the maintenance plan provided when an artificial turf system is installed. Infill will naturally move from the most stressed (used) areas towards the perimeter of the field. It is important that this infill material is moved back to the most used areas where there is a shortage. In addition, it is important that snow is not pushed too close to the barriers but ideally pushed to designated zones.

# Would you like further information?

If you would like to know more about Silkeborgbanen and our analyses,  
please follow us on [Silkeborgbanen.eu](https://www.silkeborgbanen.eu).

