The Next Level Hockey-Pitch!

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Permavoid Limited

Preface

The Permavoid Sports System, developed by Permavoid Ltd, can be used in multiple sports applications.

In the Netherlands Hockey has become a very popular sport and as such there has been a lot of development in construction techniques for hockey pitches; mainly in the synthetic turf or shock pad. This has seen the rise of a new type of synthetic turf - one that needs a lot of water to keep a pitch in optimal condition; so called water-based pitches. This development has led to the fact that hockey pitches have now become intensive water users and in addition to this, the water used has to be of high quality. Unfortunately this water is not always available and depending on the situation can be very expensive.

I would like to take this opportunity to introduce myself. My name is Charlotte van den Berg and from a young age I have played hockey and experienced first-hand that the condition of water hockey pitches can be very varied; therefore, I wanted to know what factors can cause instability in the hockey pitch, which ultimately affects play. With this in mind and the knowledge I have received during my internship at Permavoid Sports - who are experts in sustainable water management - I established that many of the problems faced by players in relation to hockey pitches can and should be improved. To test my assumption I visited 50+ hockey clubs, several municipalities and hockey pitch construction companies to discuss the issues they have with hockey pitches. I also asked for their 'wish list' for an ideal hockey pitch. On reviewing the feedback it appeared that there were more issues concerning the water management of hockey pitches i.e. not only water supply, but also drainage and water quality issues.

A summary of the research is detailed in this paper. The information received from hockey clubs is supplemented by the explanation of the Permavoid Sports System; a system that has the capacity to solve most of the current issues hockey clubs are currently dealing with. As the information isn't just relevant to Permavoid Sports, but also for the hockey clubs, the paper was sent to the clubs that contributed to the report. Also the report was sent to the hockey clubs that didn't contribute to the report, but could be interested in the information because of the qualities the Permavoid Sports System application can add to their hockey pitches. The investigation is based on solutions for hockey clubs; however, whilst undertaking the research it became apparent that the urban area and climate change effect hockey pitches and vice versa. This is why the relation between the urban area, climate change and hockey pitches will be discussed in this paper too. This research is based on the Dutch climate and hockey pitches but the results are valuable to hockey- and even other sports pitches in different climates.

This report has been written for Permavoid Sports in combination with my graduation at the University of Amsterdam. Initially, the paper was written in Dutch, but because I think the Permavoid Sports System contributes to a new way of building hockey pitches I've translated it in English so I can hopefully show more people that this innovative way of building sports pitches is, in my opinion, the right way!

Yours sincerely,

Charlotte van den Berg

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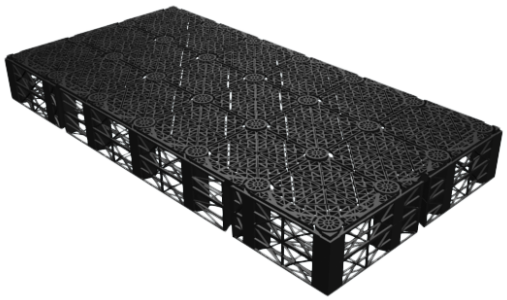
Permavoid Sports and Hockey

Recent developments



The Permavoid Sports system has provided an ideal sub-base in a variety of applications. The sub-base was developed and certified as an alternative sub-base for several sports pitches including hockey (recognized and standardized by the NOC*NSF, Dutch Olympic Committee & Dutch Sports Federation). Hockey in this research has the attention because of the latest developments with hockey pitches. The most innovative change is that hockey pitches transformed from sand infill to water based hockey pitches. The hockey played on the water based hockey pitches is faster and more dynamic, the pitch is leveler and the frequency of injuries of the players has decreased. This is possible due to two main developments:

1) Asphalt is used as sub-base (possibly more level than crushed natural stone)

2) Synthetic grass is water based (faster than sand fill)

The solution of using water to maintain the synthetic grass in perfect play condition needs more explanation. The water that is used to keep these hockey pitches in optimal condition has to be of very high and clean quality to prevent organic pollution of the synthetic grass that has a life span of about 10 years. Furthermore, very large amounts of water are needed for a hockey pitch, annually towards 5000 m3 for each water-based pitch. These water-based pitches are constructed with a turf that delays the transport of water in order to keep the water on the pitch for as long as possible. However, this causes problems during periods of rainfall when an overflow of water stays on the pitch, hence the weather conditions affect the play. Another process within traditional hockey pitches is that the water infiltrates in the ground after is has been used. This is not sustainable and also causes challenges in water management for hockey clubs.

Challenges in water management

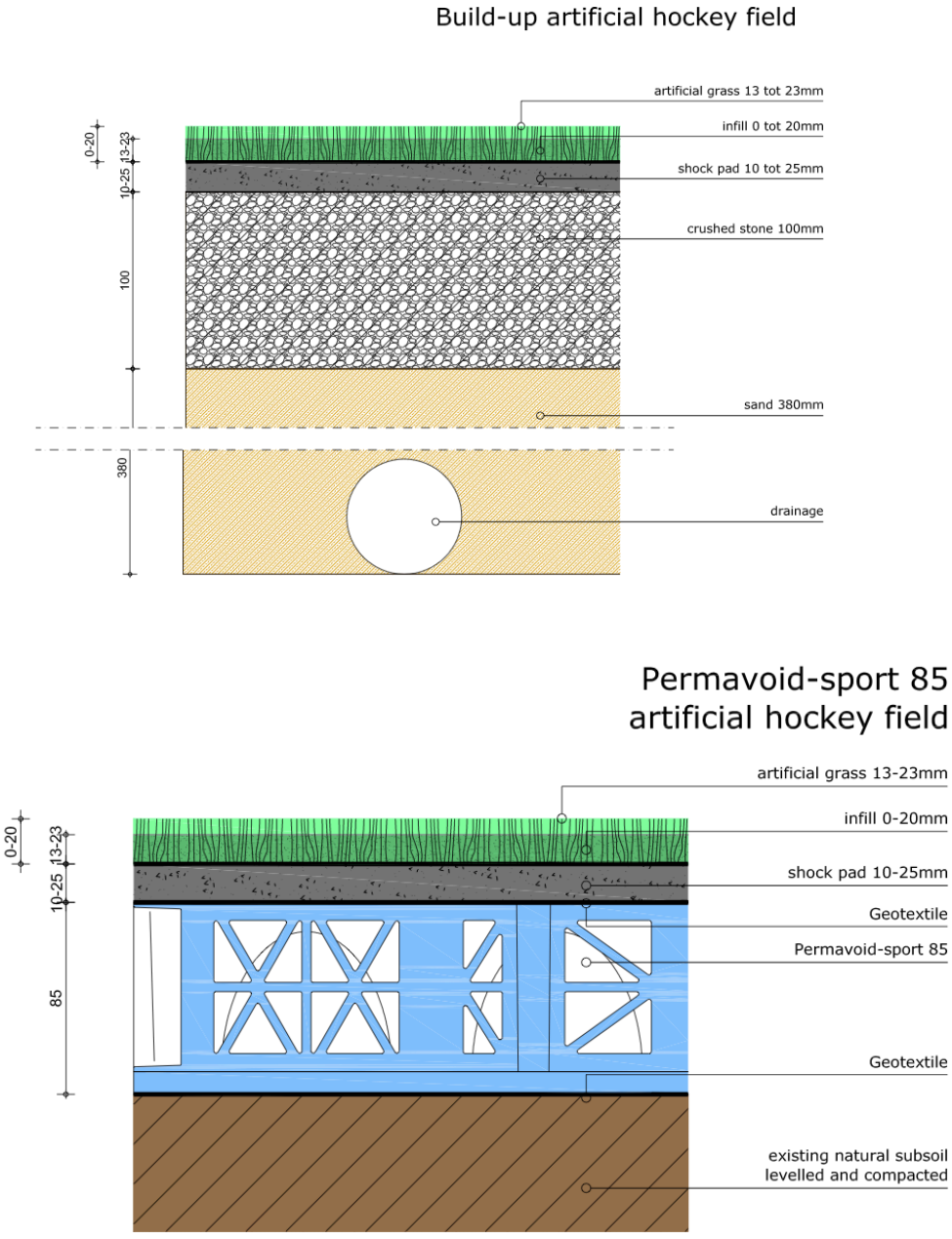
Permavoid Sports' years of experience in water management and urban sports pitches has provided a clear vision on how sustainability can make a difference. In order to allow the Permavoid Sports system contribute to improvements in the technical sports layer, Permavoid Sports co-operates with specialists in various sports disciplines. Permavoid provides a light weight sub-base comprising a water storage used for collection of storm water. Storm water is ideally suited for use in sports pitches because it is clean and usually available in most climates and it is free. If hockey pitches use and re-use storm water instead of expensive tap water a cost benefit can be expected by the hockey clubs, which will also benefit the urban area too. This sustainable way of using storm water contributes to a consistent optimal condition of hockey pitches and helps urban areas cope with the challenges of water management, due to the storm water being more controlled.

Permavoid Sports hockey pitches compared to the traditional pitches

Explanation of the system

The Permavoid Sports System is a sub-base replacement that can be applied directly on levelled ground. The system replaces the lava/asphalt or similar sub-base materials and traditional drainage and adds a water storage to a hockey pitch as illustrated in figure 1. The traditional hockey pitch is also illustrated in Figure 1. The Permavoid sub-base is suited for all synthetic grass systems for sports e.g. soccer, hockey, korfball, rugby and tennis. A shock absorber layer is applied directly onto the Permavoid units on which the synthetic grass layer is then installed.

Figure 1. Comparison traditional- and Permavoid sub-base hockey pitch



1. Storm water management

The sub-base contains 90% hollow space that functions as a storage for 460 m3 of water storage for the size of a hockey pitch. This means that the system can store not just the water used for irrigation; it can also store the rainwater. Traditional hockey pitches are irrigated using available water such as groundwater. Irrigating the pitches this way is expensive and more over the water contains a lot of organic materials that cause pollution in the synthetic grass. Tap water is of good clean quality but an expensive way to irrigate the pitch. Based on the Dutch climate the water storage of the Permavoid System applied to a hockey pitch basically contains an overcapacity of water; therefore, it's able to provide four hockey pitches with water irrigation. This is based on the water use of the *Wagener Stadion* in Amsterdam; a hockey pitch that is known to be in excellent condition.

The water use combined with the local water price gives an estimate of the amount of money that can be saved by a self-serving water hockey pitch. Investment in the Permavoid Sports system was compared to the investment in a traditional sub-base and the difference was divided by the amount of money that can be saved by reusing storm water. This was calculated using one Permavoid sub-base connected to four hockey pitches in different locations; the renovation or new build hockey pitch and compared to the investment of traditional asphalt or crushed natural stone. Table 1 shows the results and what's visible is that the more hockey pitches connected to one Permavoid sub-base, the shorter the period is in which investment in the system can be earned back. After this period the hockey pitch is basically provided of 'free water'. Note that the period of earning the system back is shorter for a new build hockey pitch than in a situation of renovation of a hockey pitch. This is because the Permavoid system replaces the traditional sub-base and drainage, which is already present in a renovation situation.

Table 1. Earn back time for investment in a Permavoid Sports system

Extra investment in a Permavoid Sports system	Irrigating 1 pitch*	Irrigating 2 pitches*	Irrigating 3 pitches*
Lava new construction 100.000 euros	9 years	**4,5 years**	**3 years**
Asphalt new construction 20.000 euros	**2 years**	**1 years**	**0 years**
Asphalt renovation 90.000 euros	8 years	**4 years**	**2,5 years**

**After applying the Permavoid Sports system to one water based hockey pitch*

2. Lightweight

The Permavoid Sports System is extremely lightweight and contains a hollow space of 90% and so the system is 15 to 18 times lighter in weight than a traditional construction. This makes the system suitable for application on all types of soil in different geographic situations and moreover the system can also be applied on the surface so no excavation is needed. The total construction of a Permavoid hockey pitch will only be 12 cm high. A traditional pitch is 50 cm high.

3. Pressure reduction

The construction has the ability to sustain high pressure due to the combination of the lightweight aspect of the Permavoid units and the way they are connected. The Permavoid units interlock to create a structural raft that divides the pressure because of the strong material, connections and inventive structure of the units. This way the force of play along with the weight of the maintenance machines is better divided to the subgrade than in traditional construction. Also, the elasticity of the system contributes to the mechanism of dividing pressure by absorbing some of the load and transmitting this to a high volume of subgrade. Using the Permavoid Sports sub-base lightweight system ensures the pressure is optimally divided thus the chances that the total construction will undulate are minimized. This makes the system suitable for poor ground conditions and ensures that the hockey pitch remains in optimal condition over a longer period of time.

4. Material

The Permavoid Sports system is a modular construction provided by the units interlocking to form a system with conical connections. The Permavoid units interlock to create a structural raft providing an extremely level sub-base for a hockey pitch; equal to the level of an asphalt sub-base. The units are produced from a high quality, strong recycled and recyclable polypropylene. After installation the units can be disassembled and re-used.

Vision Permavoid

Embrace storm water and green space in urban areas

Climate change and environmental impact are very modern issues that concern Permavoid. Nowadays 50 % of the world population lives in the urban area and is estimated to increase up to more than 70% of the world population living in cities in 2025. It is necessary to evaluate the way we design and use the environment in the urban areas. Space for green areas and water management are necessary to create a healthy environment in cities. With more periods of extreme drought and extreme rainfall followed by increasingly more inhabitants the priority to develop cities in a healthy way becomes high. Permavoid, in its fifteen years trading, recognised that the environment is an important factor to everyone's wellbeing and has been motivated to develop innovative water management systems that also contribute to areas of greenery within the concrete landscape. This is applied to rooftops, bicycle paths, parking lots, tree growth facilities and many more.

Case studies sustainable sports pitches

Due to the rise in development in the urban areas, the use of the Permavoid system will help making cities more resilient against issues like climate change. Sports pitches also contribute towards solving water management issues and help to create green areas. The lightweight and high strength of the sub-base replacement means that the Permavoid System can provide a sustainable and cost-effective sports surface and water management system for sports pitches. Therefore, Permavoid Sports has been used in several sports applications such as football, tennis, and equestrian. Below are several detailed case studies created to help towards understanding the sustainable urban transformation.

Tennis court; Denby Dale in Hudderspitch

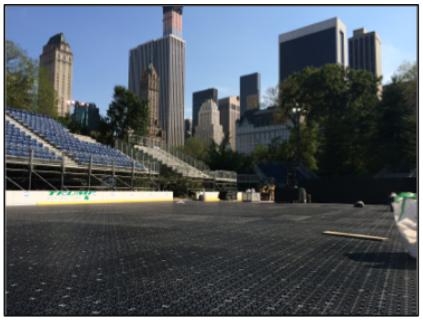
This tennis court is located adjacent to a river which periodically floods (along with additional factors that needed consideration on this project) and as such a system was required that would provide water management capabilities. The Permavoid system comprising a lightweight polypropylene sub-base replacement layer, allows shallow attenuation, infiltration and drainage. Hence it is ideal for sites such as Denby Dale Tennis Club where there is a high risk of flooding. Furthermore, given the lightweight method of construction, no heavy construction plant is required for the system. This was an added advantage for this project due to the sites access limitations.

Soccer pitch; Lambert School in Hull and Christian High School in Glasgow

The sports pitch design included a Permavoid Sports sub-base replacement, which acts as an attenuation component within the site's sustainable drainage system. The shallow nature of the Permavoid Sports installation enabled construction depths to be minimised, reducing cut/fill volumes and allowing potential construction problems caused by the high water table on site to be avoided.

Equestrian arena; Horse Event in New York City

During this event organized in Central Park (New York City) the best riders competed for world titles in equestrian sports. Permavoid Sports contributed with the sub-base system that was not only easily installed but also provided an all-weather and extremely level surface. This makes the system very well suited for temporary events in top sports. After the 'Horse Event' the system was rapidly dismantled and ready for re-use.



Equestrian arena; The Olympics in London

The design remit for this prestige project was complex and very demanding due to the temporary nature of the development, the unique constraints associated with the Royal Park's heritage and environmental setting, combined with exacting performance requirements of the surfacing and construction tolerances to meet international equestrian eventing standards. Some examples of the restrictions were that no excavations whatsoever were allowed within the Park and wherever possible construction materials must have been manufactured from recycled materials. Permavoid Sports installed an all-weather extremely level surface that satisfied all the restrictions and was very suitable for the high performance required of an equestrian surface.

Rooftop soccer pitch; Youth zone in Blackburn

In order to successfully construct a sports pitch on a roof top working with lightweight construction materials is essential. The Permavoid construction is very suitable in this application as it is not only a lightweight sub-base, but also provides a level surface for the technical sports layer to be directly applied. Therefore, the Permavoid system, which is minimal in weight and height, is ideal choice when considering installing a rooftop sports pitch.

Greensource project; South Africa

The Green Source project is a partnership of Ten Cate and Pentair X-flow. The challenge for this project is to produce clean drinking water by a combination of synthetic grass and water purification. This project will be rolled out in areas that, due to the climate or polluted quality of drinking water, are in need of clean drinking water. Permavoid is used in the sub base for water storage for these innovative sports pitches. The first sports pitch has already been built.

Conclusion

Permavoid Sports' reaction to developments such as climate change and environmental impact has led to the development of products that enable sustainable water management. After the successful introduction of the Permavoid Sports system into sports such as equestrian, football and tennis, Permavoid has now made its first steps into the second most popular sport in the Netherlands - hockey. Further to my meetings with a variety of hockey clubs (in the Netherlands) I have been able to understand the needs and requirements in relation to innovation in the area of hockey pitches.

One of the main challenges is that the hockey clubs no longer want to be limited by weather conditions and even after an extreme rainfall event players still want to be able to play hockey. However, to achieve this the options for distributing water needs improvement. Furthermore a solution for the problems surrounding water management, constant irrigation, organic pollution and subgrade issues needs to be established.

The solution would be to use the innovative Permavoid Sports system to address the problems hockey clubs are facing (stated above).

The elements water management, dividing pressure, lightweight aspects and the material of the ISA-sport (NOC*NSF) approved Permavoid Sports System will provide sustainable improvements and consistent qualities for a hockey pitch. Furthermore, the system can offer a solution for hockey clubs dealing with issues such as weaker subgrades and limited water supply resources. Compared to traditional hockey pitches a pitch constructed using the Permavoid Sports system is a pitch with improved level aspects, water management aspects and also reduces the risk of organic pollution. The system is sustainable due to the recyclable material, storm water re-use aspects and it can be disassembled and re-used which all add to extending the life span of the pitch.

The Permavoid system is especially interesting for top league clubs who are considering an investment in a new pitch for the following two reasons. Firstly, the clubs have multiple pitches, which can profit from irrigation due to the capacity gained from using a Permavoid Sports pitch. Secondly, these clubs compete at the highest level in hockey competitions; therefore, they will benefit from the optimal technical sports qualities the Permavoid Sports system provides to the pitch.

Innovation cannot instil a sense of achievement nor increase player performance; however, it can provide an optimal hockey sports surface that is accessible everywhere and for everybody. Permavoid Sports recognises the Netherlands and Europe as leaders in relation to water management as well as leaders in hockey sport facilities and would like to join forces to provide every hockey association a chance of maximum performance combined with joyful play. Now is the time to invest in The Next Level Hockey Pitch!

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