



# RECOMMENDATIONS ON THE BASE CONSTRUCTION OF AN ARTIFICIAL GRASS SPORTS PITCH

## INTRODUCTION

This document has as sole objective to raise the awareness of those undertaking the construction of an artificial grass sports pitch, and to help them asking the right questions in order to build a base that will be appropriate to the installation of artificial grass. Each country has its own specificities, and each location requires specific recommendations according to the climate, the type of soil and the building materials available in the area. It is therefore advisable to contact an architect or a specialised consultant in order to set up the right specifications, and to refer to the codes of good practice as well as to the guidelines provided by the Sports Federations (FIFA, UEFA, FIH, ITF, National Federations.....)

LANO SPORTS cannot be held responsible for constructions realised solely on the base of this general kind of information, without the approval of a specialised research consultancy.

## GENERAL POINTS

When conceiving an artificial grass sports pitch, one has to pay special attention to:

- the location and the orientation of the pitch;
- the nature of the subsoil and its stability;
- the climate and drainage;
- the construction of the sub-base;
- the possibility of having to build shock-pads;
- the choice of artificial grass and its installation.

These general considerations can differ from sport to sport.

## 1) LOCATION AND ORIENTATION OF THE PITCH

- When looking for a location where to build a new pitch, one needs to take into account the differences in level, which will have to be filled in, in order to create a flat base that will meet the requirements of the rule book.
- The pitch will be oriented in such a way that the sun will cause minimal hindrance to both players and spectators. The preferred orientation for a pitch axis is north-south, with the longitudinal axis at 15° in relation to the north-south axis. Local conditions (shade, hours when the pitch will be used, obstacles, ...) may justify a different orientation of the pitch.
- When building a sports pitch, one has to strip the site of the topsoil, the turf and the vegetation covering it. This not only means that the vegetation will be destroyed, but also that the humus will be removed. The site will be excavated down to natural ground ('cut to solid'). In so doing, one reaches directly the subsoil and one avoids the possible growth of vegetation on the future sub-base.

## 2) SUBSOIL AND SUB-BASE.

Removing the layer of humus will lead us to the **subsoil**. Any kind of additional excavation or treatment of the subsoil should be guided by the following basic concepts.

- The **Sub-base** is the layer between the subsoil and the upper layers.
- Any additional excavation of the subsoil will take into account the thickness of the upper layers and of the surface that will be constructed. In so doing, one will make sure that the play surface is at the right level. One should generally foresee earthworks down to 30 to 50 cm from the final level.
- If at all possible, the sub-base will be built with the use of laser adjustment techniques, so that the play surface has the right flatness. The flatness that needs to be achieved on the sub-base is of about 3 cm compared to the theoretical sides, and no deviation of more than 50 mm from the 3 M rule should be tolerated.
- The slope of the sub-base will usually be identical to the one required by the sport surface.
- The sub-base must be stable and compact: it is advisable to check its stability with a « Dynaplaque » type test. Out of the 50 to 60 measurements, the results, called dynamic module, may not be inferior to 40 Mpa. This level of value corresponds to a surface where the loads of all vehicles, machines and materials needed in the construction can be used without leaving any tracks.

- If the stability level cannot be reached, one will have to proceed to the draining of the subsoil. The drainage will vary according to the types of soil, to their water content and to their drainage possibilities: the study of these elements requires the competent help of a department of civil engineering. It might be necessary to resort to hydraulic binders (lime, cement, ...) and to a drainage of the subsoil.
- Once the subsoil has been treated, the sub-base must:
  - **PRATICABLE FOR CARRIERS:** so that the vehicles and machines needed in the construction do not distort the surface: Proctor distortion under 90% and dynamic Module above 40 Mpa.
  - **ALLOW A CORRECT DRAINING:** the necessary permeability must be superior to  $1 \times 10^{-4}$  m/sec.
  - **ALLOW A CORRECT FILTRATION:** while allowing the water to seep, the sub-base must make it impossible for the particles from the upper layers to seep into the subsoil, or vice versa.

Most often the sub-base will not have the qualities required above. Therefore one shall proceed to the construction of an additional foundation layer (see below § IV BASE OR FOUNDATION LAYER).

### 3) DRAINAGE.

- The drainage system will ensure that all surface water is removed from the site, and protect the installation from the effects of ground water from the surrounding areas. The system will vary according to the region, the climate and the permeability of the subsoil. Parallel drains are usually placed every 5 to 10 m in the subsoil and/or in the sub-base. They are connected to collector drains which are located on the outside of the perimeter edging. In extreme cases, one may resort to a drainage system where drains are placed as fish bones.
- The draining trenches will have a drain, the inside diameter of which will not be inferior to 58 mm. It will be bedded on clean stone or sand, and protected by a filtering geotextile. The draining trench will be at least as deep as the diameter of the drain plus 150 mm.
- Drains will have a minimal slope of 0,5 %.

- Drains will be connected to lateral collectors, the diameter of which will not be inferior to 91 mm and the slope of which will be at least 0,5 %. These collectors should be accessible through one or more hand holes for easy access for maintenance.
- Drains and collectors will always be located below the critical freezing level, so as to ensure a good evacuation of the water especially when it starts thawing.
- The draining principles described above should be adapted to the specific environment. Drainage systems must be installed even in hot countries (tropical or equatorial zones), where the daily levels of rainfall can be very high.
- On the other hand, in hot and dry countries, we recommend a watering system, especially if the play surface is likely to dry up too quickly, even during a game. In this way, the artificial grass surface will keep a pleasant temperature.
- LATERAL DRAINAGE: Runoff water will naturally flow down along the slope of the pitch, to a gutter located at each longitudinal side. Gutters will have a minimal slope of 0,5 % and be connected to one collector, which will be separated from the draining collectors.

#### **4) BASE OR FOUNDATION LAYER.**

- When the sub-base is not compact enough, or does not allow correct draining or filtration as described above, one will proceed to the installation of a Foundation layer or Base on top of the sub-base. This foundation layer will serve as draining and filtering layer.
- This layer will be made of hard, clean, crushed, frost-resistant aggregates, with a granulometry which will ensure a sufficient permeability. of  $1 \times 10^{-4}$  m/s. The thickness of this layer may vary between 25 and 35 cm.
- It is advisable to place a separation/filtration geotextile between this base and the sub-base.
- The base will be built on a slope of 0,5 to 1% starting from the longitudinal axis. This will allow water runoff to flow towards the outside perimeter of the pitch, where it will be collected in the gutters located along the pitch, but outside of the playing surface.

## 5) THE UPPER LAYER.

This layer is directly built on the sub-base if the sub-base meets the requirements, or on the base.

- It is capable of supporting the loads of all vehicles, machines and materials to be used in the construction of artificial grass, without causing deformation of the site.
- It ensures a sufficient permeability to collect runoff in the draining systems, as defined above.

Several techniques are possible, the choice of which will depend on the sport surface to be built, as well as on economical constraints or on local habits.

### – **DYNAMIC (ROCK OR SAND) :**

This is a technique often used in the construction of football, hockey, rugby pitches or multi-use games areas, to which it is well suited.

It will be made of frost-resistant materials, the granulometry of which will become finer and finer as one is nearing the surface. The final layer will be made either of fine particles or of sand.

- The whole layer will be mechanically compacted 2,5 to 5 cm high. The dynamic Module will have to stay above 40 Mpa.
- The flatness requirements will be followed with care: 3 mm of level difference according to the 3 M rule (some types of sports are sometimes less restricting: check the standards of the Federations).
- Even the slightest local deformation (flash) will be filled in with sand or very fine particles before the artificial grass (or shock-pads) is installed.
- Slopes of 0,5 to 1% will be checked again and corrected if need be.

### – **DYNAMIC (LAVA/RUBBER) :**

This technique is an interesting alternative to the preceding one, and is often used in the Netherlands and in Belgium. Its main advantage is to improve the resilience of the base. This technique is especially recommended for hockey pitches.

### – **BITUMINOUS COATED MATERIALS :**

This type of base has the advantage to last longer as it suffers less from the deformations of the subsoil. Its installation, however, is more expensive.

- Bituminous coated materials will be placed on the foundation layer.
- A layer made of a bituminous sand emulsion ensures the good fixation of the other bituminous layers.

- The bituminous layer may be waterproof. It will, however, be made of a first layer of 35 mm consisting of materials with a 0/10 mm granulometry, then of a final layer of 25 mm consisting of materials with a 0/6 mm granulometry.
- In some cases, the bituminous layer will be permeable and will consist of 2 layers, the thickness of which will be identical to those of the impermeable system. The formulation of the coated materials will, of course, be adapted in order to allow a good permeability.
- Whichever the case, the flatness rules will have to be followed as defined above, and the acceptable 3 mm difference of level will have to be checked according to the 3 M rule.
- The layer thus achieved will have a dynamic Module of 60 to 70 Mpa.
- Bituminous bases are especially used in England for hockey pitches and for multi-use games areas. They could also be used for the construction of tennis courts.

– **UPPER LAYER IN POROUS CONCRETE:**

This kind of layer is ideal for artificial grass tennis courts.

- This layer of concrete consists either of a single-course slab 8 to 9 cm thick, or of a two-course slab, the first one being 6 to 8 cm thick, and the upper one 2 to 3 cm thick.
- This kind of concrete will always be made of frost-resistant crushed gravel and of cement (300 kg/m<sup>3</sup>).
- The concrete will be placed on a base as described above. The slope and flatness properties will be followed with the utmost care.
- The slab will be divided in sections (36 for a tennis court) to be separated by an expansion joint (middle joint) and by contraction joints.
- The installation of artificial grass can be done on an existing porous concrete slab if one has previously checked its permeability and the condition of its surface. It might be necessary to resurface it before installing the artificial grass pitch.

## 6) SHOCK-PADS.

The introduction of a resilient layer between the base and the artificial grass is used to provide a greater degree of comfort to players, and to give the play surface a greater softness. Shock- pads are especially recommended for sanded or « water based » hockey pitches, as well as for football pitches of the first or second generation (totally or partially sanded artificial grass).

Football pitches of the latest generation, which are filled with rubber granules, do not require shock-pads according to the construction of the artificial grass pitch.

Other kinds of artificial grass, even of the latest generation, will require the introduction of a resilient layer.

*It is therefore necessary to ask LANO SPORTS about the use of this resilient layer, which, in some cases, may hinder the playing characteristics and the ball rebounds.*

### **No shock-pads are needed for the practice of tennis.**

#### – **PREFABRICATED SHOCK-PADS:**

Some shock-pads are delivered in rolls and ready to be set up directly on the base. These shock-pads are between 8 to 15 mm thick. They will be placed along the length of the pitch, at right angles to the installation of the artificial grass.

#### – **IN SITU SYSTEMS:**

In situ systems are made of rubber crumbs mixed with a polyurethane binder. This technique requires the presence on site of an efficient and homogenous mixing system, as well as the use of a laser finisher in order to reach the flatness described above. These shock-pads are 15 to 25 mm thick.

## 7) ARTIFICIAL GRASS.

ARTIFICIAL GRASS will be set up either:

- on a crushed dynamic base;
- or on a bituminous coated base;
- or on a base in porous concrete.

The installation on shock-pads will depend on the type of artificial grass, on the specific requirements of the chosen sport and on the standards to be met.

***THE CHOICE OF ARTIFICIAL GRASS IS JUST AS FUNDAMENTAL AS ALL THE OTHER ELEMENTS MENTIONED ABOVE.***