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Covering the overlooked in standards –

measuring the technical characteristics of synthetic fields over time and the implications for long-term maintenance issues.

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Now that the performance tests have been reviewed, two major issues of synthetic turf properties which are only lightly delt with in the UEFA publication shall be addressed. They are **Longevity** and **Maintenance**. Before the light treatment of these two issues is critisized or viewed as a missing area within the documents, the primary focus of the document should be reviewed.

UEFA determined that it's focus should be limited to sports performance issues since the origanizational focus is the playability of the surface within the best interest of the althletes and the game.

Sports Performance, or to use the UEFA term „footballistic qualities" has 2 components;

Sports Function – which are the characteristics that allows the sports to be played on the surface

and

Protective Function – which are the characteristics that reduce risk of injury to a quantifiable level

With this focus in mind, we can see where Maintenance and Longevity can be considered separate issues of **Technical Quality** or **Function** of the synthetic turf. Technical Quality, which is the result of the technical characteristics, establishes the Longevity or durability time period over which the sports performance and usability will be

at an acceptable level. Since the sports functional tests could be derived from the known characteristics of natural turf, there were no objective or reasonable criteria to use as a baseline for the technical tests. Technical discussions continue on this subject -- unfortunately so far without coming to an agreement on common rules. Therefore UEFA has wisely elected to avoid this issue for the moment.

While this is wise for UEFA, it leaves an unsatisfactory situation from the view point of the user or owner who must factor this into budgetary constraints. It has been seen in the cases of other sports where the requirements are limited to Sports Function without addressing technical aspects, that design professionals often miss or ignore this element in their specifications and therefore open the door to unfair or unequal competition between products.

Careful reading of the UEFA document will show that UEFA did not simply ignore the technical aspects, as one might be lead to believe. In its Turf Manual, there are many hints and proposals to bring the questions on technical issues to the mind of the public. But UEFA cannot provide concrete or totally clear or detailed advise on how this should be handeled and so the comments included must inevitably be of a general nature.

This is the point where this presentation wants to fill in. After comprehensive discussions and based on practical experience some concrete information shall be provided. This infomation should be taken as examples for further discussion.

Having said that, we can now get back to the primary focus of this segment – Durability.

Durability

There are two major factors that affect the Durability of a synthetic turf:
Wear and **Aging**

Wear is the deformation and abrasion of the pile fibers which cause a change in the visible appearance of the turf layer as well as a change of performance and finally a shortening of lifecycle. Wear is caused through the use of the turf and from sport shoes, especially studded sport shoes. There have also been cases where exessive wear has been caused by inappropriate maintenance.

The second factor is **Aging**, which is the result of both external and internal factors. The primary external factor is **UV radiation**. Chemicals used for cleaning and weed control can also play a role in aging. Internal factors are the stabilization and loss of strength and suppleness by depolymerisation processes. The stabilization systems are needed to deviate the destructive energy of heat and UV radiation by sacrificing components of the fibers which do not contribute to the technical performance of the fiber. While these stabilizing components are very important for the longevity of the fibers and therefore the turf, they are also the most expensive part of the fiber and there is a very real temptation to shortcut this part of the manufacturing process.

Obviously, the effect of wear is intensified when the turf is exposed to aging since the result of aging is weakened fibers.

Testing and Examination

The first approach to test these characteristics must be to test them individually. In a second step, the combined effect of aging and wear should be investigated.

Lisport Machine

There is a common agreement that for wear testing, the Lisport machine is the most appropriate and effective. The machne employs studded wheels which are drawn or dragged over the surface of the turf. The movement is not a pure rolling, but a combination of rolling and sliding and this in two directions. The rolling-sliding stress is applied for 2000 cycles and then the sample is inspected for visual changes. Following the visual exam, the sample is retested for performance characteristics. While the Lisport test is though to be a rather decent imitation of real wear, the degree of wear represented by this test compared with the eaqlity has not been determined. Thus, it is difficult at this time to objectively access the results. However, the test provides a valuable tool for product comparison by producing a repeatable result of deformation by unified stress action. This is especially the case for comparisons of fiber splitting and felting of the fiber layer. Also, weakness of the backing fabric stability.

A critical element of the UEFA document is the requirement that all test devices be identical so that reliable comparisons can be made. This is especially critical with the Lisport machine since the stress and impacts patterns must be identical to result in truly comparable conditions of the products after treatment with the Lisport machine.

Though we do not focus solely on the UEFA approach, the German efforts to tackle the wear issues of synthetic turfs should be recognized by mentioning the **Stuttgart Cycle Test**. The test was developed at the University of Stuttgart primarily for layered vinyl products. For synthetic turf the test foot was modified to include a rubber ‚ripple' profile sole which simulates use with regular sports shoes without studs/cleats. It has been standardized in EN 660-1 together with EN 1963. The visual appearance of the samples after the test is similar to that of the Lisport test, however, the Cycle Tester does not produce a uniform area on which the performance tests could be carried out. For this reason, the Lisport machine is perferred, even though it has only been in existance for 10 years and the Cycle Tester has been around for more than 30 years.

That addresses wear. The next test in longevity is aging.

Aging

Aging tests were originally performed in Xenon Light Testers or Weatherometers. Samples in sizes up to 30 x 20 cm were exposed to Xenon arc light that exhibits a special spectral distrubution which imitates highly intensive sunlight with high UV radiation found in areas like the tropics, Florida, or high mountain areas. It is important to perform the exposure test with intermittent application of moisture. To do this the samples are sprayed with water or immerged into water for about 4 minutes and then exposed for 18 minutes to light irradiation only.

Since Xenon Testers and Weatherometers are expensive pieces of test apparatus and running the tests is expensive due to the cost of Xenon arc UV lamps, the QUV apparatus has become the predominant test device. It is more cost effective to operate and many different products can be exposed simultaneously as the wetting process is through atmospheric condensation. This also precludes leached components from one sample to spill or affect other products adversely.

The major and quite significant drawback to aging tests is that they cannot be deliberately accelerated. It takes roughly 6 month to achieve a reasonable aging effect.

Following the aging process, the assessment of the sample is performed in a manner similar to that which follows the Lisport test.

In addition to these methods, there is an **Austrian proposal**, which studies the aging behavior of the fibres before they are used in the manufacture of a synthetic turf. For this, the pile yarn is spread to its original width (condition: like the original film they were made from) and glued into special sample holders. The free length of the fibres between the

sample holders is about 40mm. The samples are exposed to Xenon arc or QUV light for about 6 month (until irridiation of 7.5 kJ/m^2 is achieved). The remaining strength of the fibres is tested in a tensile strength machine after 6 month and presented as a percentage of the initial strength. According to the Austrian Guideline, the loss of strength and elongation at break should be less than 50%.

The **DIN 18035-7** aging test procedure is not reasonable as was commented at the ISSS Technical Seminar at Schaffhausen in 2000. The parameters to determine the aging effect are technically not suitable to assess the quality of a product. In order to avoid problems in practical testing, the requirements are set to such a wide range that any product will meet. Thus, what is the value of a test if it does not have selective power?

Maintenance

There are only very few clear proposals of how to maintain synthetic turf of the 3rd generation. These are the essential steps maintenance comes down to:

- **What should be achieved?** main goals
  - -- Removal of litter, grass, leaves
  - -- Cleaning from pollution (dust etc.)
  - -- Removal of any weeds etc.
  - -- uniform condition of in-fill
  - -- regular condition of pile fibres
- **What has to be done ?**
  - -- clean about weekly by using a brush technique in combination with owner vacuuming
  - -- add missing granules at goal lines and penalty points
    weekly to at least monthly owner
  - -- apply weed killer where and **when necessary** owner
  - -- regenerate the pile structure and in-fill

yearly or at least within 3 years professional

by using professional equipment

--> loosening the in-fill by brushing, vibrating, and vacuuming

--> replace removed in-fill with new granules

- **What is important ?** it means in the first place: use proper equipment

  --> brush not abrasive (organic brush fibres only)

  --> wheel tire pressure 0.5 to 0.8 bar, but not exceeding 1.5 bar

  --> tire profile smooth

  --> pressure of brush onto surface controlled

  --> use dragged/drawn equipment (if usable at all) along the turf rolls only, never across

  --> do repairs of damages, especially open seams, immediately

  --> regeneration machine to be effective/efficient

  --> re-infill machine to be effective/efficient