

FEI Standard for Arena Surfaces

Rationale

Sport horses spend significant time in training, warm-up and competition arenas. With every physical effort of the horse, for example when jumping, galloping, or even when static, the horse interacts with the surface. In fact, surfaces can compensate or amplify the effects on the horses' body, depending on its quality.

Volume and intensity of physical efforts in competition and training, regeneration and recovery measures as well as the quality of the surface are very closely linked. If only one of these factors is inappropriate a sport horse risks overload or even acute injuries.

The protection of the Horses' welfare is of paramount importance to the FEI. Therefore the FEI has a vital interest in establishing standards that help owners of training facilities as well as event organisers on all levels to ensure the proper construction and maintenance of their arena surfaces.

What is a Standard?

With the help of science¹ and the feedback from experienced riders², the FEI has been able to establish a first standard for arena surfaces (initially focused on Jumping). By definition a "standard" is an established norm or requirement. It is usually a formal document that establishes uniform technical criteria, methods, processes and practices. The purpose of this paper is to provide this information.

As it is the first draft of the FEI Standard for Arena Surfaces it is expected that its initial implementation will provide new information which then leads to possible modifications of the standard. For the time being it can therefore be considered a "living standard".

It is envisaged that the FEI would begin to introduce the standard at selected events, and ultimately across all levels of international competition. The compliance or non-compliance with the standard will provide the organiser as well as the riders with important information. It is also hoped that it will help the footing manufacturers and footing experts to take necessary measures in order to optimise the surface performance prior to competitions.

¹ Equine Surfaces White Paper 2014

² FEI Competition Arena Study presented at FEI Sports Forum 2014

Training arenas are not under the jurisdiction of any sport governing body. It is totally up to the arena owner to ensure an appropriate and affordable arena surface for his or her horses. However, it is possible to apply the methodology for competition arenas to the training arenas and therefore provide advice on what factor/s might need improving. As sport horses spend significant time on training arenas, this should be of major interest for riders, trainers and owners.

The Components of the Standard

The FEI Standard for Arena Surfaces makes use of two major evaluation tools:

1. Mechanical testing by using a “mechanical hoof” and material testing
2. The application of a Surface Maintenance Protocol

Ad 1. The Orono Biomechanical Surface Tester was developed for use on Thoroughbred racecourses in the United States, and then adjusted for equestrian riding surfaces at Swedish University of Agricultural Sciences in Uppsala. It is often called “the mechanical hoof”, as by dropping a hoof shaped projectile at an angle to the ground it mimics the impact of the horse’s hoof on the surface. The machine is mounted to a truck or van of sufficient weight and is supported by a frame, which is placed on the ground for stability during testing. The



The mechanical hoof mimics the motion of the forelimb of a horse during the early landing/touchdown phase, as a simultaneous downward motion and forward slide of the ‘hoof’ occurs when it contacts the ground. An accelerometer mounted on the metal hoof measures the impact firmness. A load cell measures the force produced by the heavy weight when it contacts the ground and loads the ‘hoof’ to a maximum in both the vertical and horizontal directions. This, in combination with position sensors on the hoof, measures the cushioning of the surface during the loading phase, the amount of grip and the surface responsiveness. For testing of equestrian surfaces the mechanical hoof of the machine has been set to mimic that of a medium-sized Warmblood horse. Materials and the construction (combination of materials) can be evaluated and physically tested in laboratory in advance.

Ad 2. After the evaluation of the properties of a surface, a maintenance protocol will be jointly developed between the event organiser, the local footing expert, and the FEI. In order to obtain the FEI seal of approval, the agreed maintenance protocol must be submitted to the FEI.

It is important to understand how much the functional properties and characteristics change due to the way arenas are used, the environmental conditions they are subjected to and the way they are prepared and maintained. Examples include the varying conditions between summer and winter, the amount of use, and the frequency of maintenance. An ideal surface would provide the horse and rider with consistent and good footing every day regardless of weather and use. It should hold up to the rigors of competition while providing safe, secure and high performance conditions for every rider, assuming optimal maintenance.



Technical Criteria

It is the properties of a surface that affect the horse. In order to characterise a surface it is necessary to define and describe these functional properties. The aim is to use practical and descriptive definitions for the properties that can then be evaluated objectively by mechanical testing.

The following five properties that characterise a surface have been identified:

1. Impact Firmness
2. Cushioning
3. Responsiveness
4. Grip
5. Uniformity

Each of these five properties will be described in more detail below. Each property is objectively measurable. An existing database contains objective and extensive measurements taken from more than 400 competition, training, and warm-up arenas as well as other surfaces e.g. Horse Racing.

Each arena has its own profile. However, by the means of statistical analyses, as well as through correlation of mechanical testing against subjective feedback of experienced riders, it has been possible to develop a range of measurements that can be applied to each of the five properties. These ranges, or thresholds, represent the upper and lower limits for each property and define thresholds.

For ease of understanding, the various thresholds are presented using a green/yellow/ red traffic light system.

The **green** area represents the mechanical measurements that the majority of riders would classify as very good to optimal.

The **yellow** area represents the mechanical measurements that the majority of riders would classify as an overall score of satisfactory to very good.

The **red** area represents the mechanical measurements that the majority of riders would classify as an overall score of not satisfactory to poor.

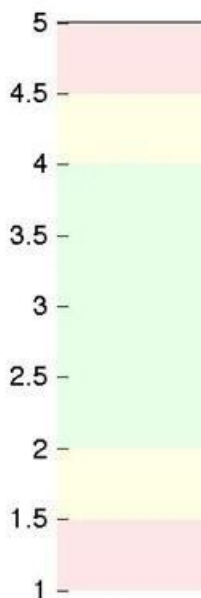
The final evaluation of a surface encompasses all five properties. While each property measurement can vary within the green range, it is not acceptable that a property is located in the yellow or red areas.

Property 1: Impact Firmness

Definition: The shock experienced by the horse and rider when the hoof contacts the surface.

Impact firmness relates to the hardness of the very top surface and the initial stiffness during primary impact, so higher peak acceleration would be measured on a hard surface such as concrete. If a covering of sand of a few centimetres was put on top of tarmac, such as covering a road on race days, the impact firmness would be considerably reduced, but the surface would still provide a large amount of support to the horse. Conversely, if wooden boards were laid on top of a waterlogged part of a field to protect it from the horses' feet from sinking into the soft earth, then the impact firmness would be higher, but the surface would still give under the horse.

FEI Standard



Scale Explanation

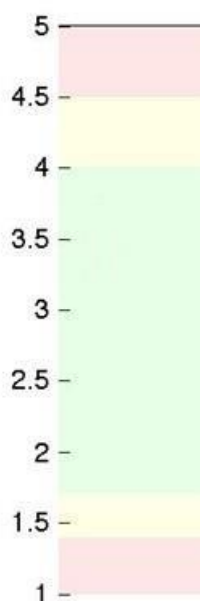
1 is soft and 5 is hard. The red area is an area that will be given a very low over all score if assessed by a top rider. In the same manner the yellow will be given a lower score and the green a top score. Riders will have different opinions on what is absolutely optimal depending on experience and the horse they are riding but most will prefer values around 3.

Property 2: Cushioning

Definition: How much a surface is supportive compared to how much it gives when riding on it.

Cushioning relates to how the whole of the surface reacts to the forces produced by the horse during locomotion. This encompasses the amount of force reduction or damping and the stiffness of the surface during the support phase of the stride, specifically maximal load at midstance, and will be influenced by the amount of elastic compared to the amount of plastic deformation. A compacted surface with no cushioning would produce high peak forces during the support phase, so the amount of deformation would be very small. This would mean the horse could perform very well, but may be injured much more quickly because it is also very stiff.

FEI Standard



Scale Explanation

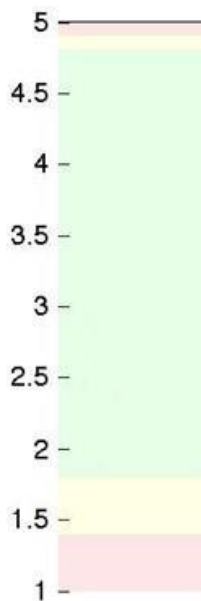
1 is deep and 5 is compacted. The red area is an area that will be given a very low over all score if assessed by a top rider. In the same manner the yellow will be given a lower score and the green a top score. Riders will have different opinions on what is absolutely optimal depending on experience and the horse they are riding but most will prefer values around 3.

Property 3: Responsiveness

Definition: How active or springy the surface feels to the rider.

Responsiveness relates to the natural frequency or tuning of a surface. If a surface responds well to the locomotion of the horse it will feel springy or active, as the timing of the way it moves helps to return energy to the horse. Responsiveness is also influenced by the stiffness of the surface, so is closely related to cushioning. However, a very compacted surface that produces high peak forces may rebound too quickly to return energy to the horse, so it would feel stiff, but also dead.

FEI Standard



Scale Explanation

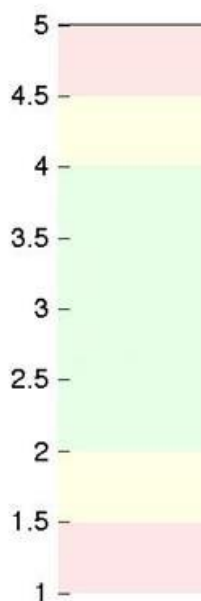
1 is "dead" and 5 is (too) active. The red area is an area that will be given a very low over all score if assessed by a top rider. In the same manner the yellow will be given a lower score and the green a top score. Riders will have different opinions on what is absolutely optimal depending on experience and the horse they are riding but most will prefer values around 3-4.

Property 4: Grip

Definition: How much the horses' foot slides during landing, turning and pushing off.

Grip relates to the interaction between the horse hoof surface interfaces as well as the interaction between the materials that interlock and hold the surface together. If the interaction between the hoof and the surface is stronger, perhaps due to studs, then the surface may shear at a depth below this interface, such as pulling off the top layer of turf during a jump landing. The angle that the limb lands and the speed of the horse is important to how much grip there will be.

FEI Standard



Scale Explanation

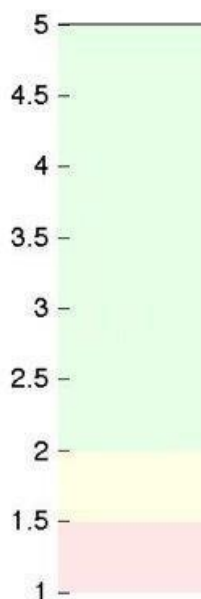
1 is slippery and 5 is high grip. The red area is an area that will be given a very low over all score if assessed by a top rider. In the same manner the yellow will be given a lower score and the green a top score. Riders will have different opinions on what is absolutely optimal depending on experience and the horse they are riding but most will prefer values around 3.

Property 5: Uniformity

Definition: How regular the surface feels when the horse moves across it.

Uniformity relates to how much the functional properties and characteristics of a surface change across the whole of an arena. A surface can be even, so it looks level, but as you ride across it the impact firmness, cushioning, responsiveness and grip change. If these changes are quite small and gradual the horse may adapt to them easily and the rider may not feel any difference in performance across the arena. If they are larger and occur more frequently the horse may find it much more difficult to adapt, and are more likely to trip or have an irregular gait pattern. Arenas where there are obvious differences from one end to another, such as a wet end and a dry end, may cause some disturbances in locomotion during the transition between the wet and dry ends, but then the horse may perform consistently within, but differently between the wet and dry ends. Some surfaces may also be un-level in the sense that they are not flat, and these surfaces are also likely to be very variable in terms of their functional properties and characteristics.

FEI Standard



Scale Explanation

1 is variable and 5 is uniform. The red area is an area that will be given a very low over all score if assessed by a top rider. In the same manner the yellow will be given a lower score and the green a top score. In this case 5 is the absolute top score.

Procedure

Any surface that is subject to a measurement and the setup of a maintenance protocol will either be selected by the FEI or could be measured on request. The latter provided appropriate funding is guaranteed.

The following outline procedure is proposed:

1. Arena owner/organiser submits their arena/s for testing.
2. First testing carried out – report provided assessing arena/s against the five properties.
3. If result is 'green' –
 - a. Arena owner/organiser submits maintenance plan/protocol including but not limited to planned maintenance operations, timetable and reporting format.
 - b. FEI assesses plan/protocol and either 'accepts' or provides input for improvements
 - c. Once maintenance plan/protocol is agreed/accepted, FEI issues certificate of 'standard'
 - d. FEI and arena owner/organiser agree timeframe for re-testing/re-validating arena/s
 - e. In the case of a competition arena, if initial testing has been significantly prior to competition (time to be defined), re-testing should take place within an agreed 'window' immediately before event.
4. If result is 'yellow/red'
 - a. FEI and owner/organiser (with their contractor/advisor) agree plan to rectify shortfalls in order to bring the arena/s up to standard – timeline for re-testing would be agreed.
 - b. Upon re-testing, if result is 'green' – continue as per step 3, if 'yellow/red' repeat step 4.