Greyhound Board of Great Britain

TRACK MAINTENANCE GUIDE

FOREWORD

The causes of injury in racing greyhounds are multifactorial, and GBGB works relentlessly to better understand those causes and to institute best practice to mitigate them as much as possible. A key part of such work revolves around track preparation and maintenance. When Mark Peacock joined GBGB as Track Liaison Officer in 2021, he brought with him a wealth of experience in track preparation and maintenance from the Thoroughbred racing industry. Mark has worked with Dr Christian Spring, group principal scientist for STRI and GBGB's Track Safety Committee (Chaired by Bill Glass) to develop this Track Maintenance Manual, which will provide an invaluable continuing education and reference resource for all racecourse stakeholders. Importantly, it not only provides clear guidance on all stages of the track maintenance process – construction and layout, infrastructure, preparation and troubleshooting - but also provides information on where stakeholders can seek expert help, and emphasises the need for an evidence-based, scientifically informed and flexible, proactive approach.

This publication sits clearly within the GBGB's 2022 Welfare Strategy aims of stakeholders sharing responsibility for greyhound welfare, of adopting a scientific, evidence-based approach, and of providing comprehensive training and knowledge-sharing programmes for all stakeholders. The manual's positive impact on optimising greyhound welfare will be profound. As author of the Welfare Strategy and an Independent GBGB Board member, I would like to commend this manual to it readers, and to thank all of those who have been involved in its production.

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INTRODUCTION

Welcome to the GBGB Track Maintenance Guide. The driving force for this guide is to ensure all tracks have safe, consistent surfaces all year round. Racing surfaces need to be uniform, safe, minimise any risk of injuries and provide close and fair racing under all weather conditions. If we can achieve this, we will have resilient and robust racing surfaces now and for the future.

AIMS AND OBJECTIVES OF THE GUIDE

The aim of this guide is to provide detailed but accessible information on all aspects of track maintenance. It also discusses how surface maintenance interacts with track design, layout, construction and racing operations.

The objectives of the guide are to:

- Promote best practice in terms of track maintenance processes to shore up track safety
- Provide insight into how racing surfaces work and the impacts of maintenance on performance
- Empower track staff to make timely and best practice decisions based on informed decision making
- Promote a dynamic and flexible approach to track preparation, whilst being able to think critically about objectives and the process needed to achieve them

"HEADS UP TRACK PREPARATION" OR "DYNAMIC TRACK MAINTENANCE"

Central to this guide is the move away from prescriptive maintenance. In any job, we have all seen and heard the phrase: "we always do it this way". In our sport, no two race meetings are the same. Track conditions change, weather windows change and how the race is run changes. We must have a more dynamic approach to track preparation. Adaption is key to meeting these changes so the optimum surface is always produced. Best practice dictates that we have a flexible approach to track maintenance. We need to pre-empt issues before they manifest and tackle problems that arise immediately to ensure a consistently satisfactory track surface.

HOW SHOULD THIS GUIDE BE USED?

This guide should provide baseline reference material to help guide all maintenance operations, whilst also providing a training tool for track staff at all stages of their career development. As well as being a tool for informing day to day operations, this guide aims to offer sufficient detail for tracks to tackle short term and longer term challenges.

Training is vital for all staff and their career progression. With knowledge comes empowerment, and with this we can create the best possible greyhound racing surfaces. This guide is intended to help tracks develop the knowledge and expertise of their staff. However, it must of course go hand in hand with practical and vocational training, tailored to the needs of the track and the staff working on it.

> "If we are going to race on the surface it has to be safe for the dogs and consistent at all times. If it is not safe for the dogs we don't race! Welfare of our racing greyhounds is paramount and trumps all other considerations."

HOW IS THE GUIDE STRUCTURED?

This guide has been put together starting at the foundation of any track, the racing surface, and how it has been constructed and laid out (Figure 1). Then we consider the infrastructure needed for safe and successful operation of a track. A large part of the guide looks at the processes and operations carried to prepare a safe and consistent racing surface. Finally, at the end of the guide there is a trouble shooting section on tackling key issues that can occur and where to go when you need help.

Figure 1. Structure of track maintenance guide.

GUIDING PRINCIPLES OF TRACK MAINTENANCE

The following should be considered as the guiding principles of track maintenance:

- Safe surfaces for racing
- Consistent, uniform and fair surfaces
- Resilience against extremes of weather
- Professionalism and professionally prepared surfaces
- Training and professional development
- Flexible and dynamic approach to maintenance
- Appropriate preparation kit
- Functional redundancy and avoiding single points of failure (operational resilience)

“The racing surface needs to be well presented, smooth, consistent and free from surface holes and depressions.”

CONSTRUCTION PROFILE

INTRODUCTION

The track's profile provides the foundation of the running surface. It is critical for determining the performance of the racing surface, as well as the maintenance inputs that will be required to ensure a track has a satisfactory and consistent running surface.

This chapter details how tracks are typically constructed and the materials that are used. It will go into a lot of technical detail to provide a fundamental understanding of the components of a racing surface, how they work and how they should be managed. There will be strong emphasis on how greyhound racing sands work, why we use these materials and how to get the best from them.

TYPICAL TRACK CONSTRUCTION

In simple terms, a greyhound track profile is straight forward. It comprises a depth of sand (minimum of 175 mm but often can and should be deeper), which overlies a sub-base/drainage layer. Historically, drainage layers were constructed with a variety of coarse granular fill materials such as gravel, crushed stone, cinder ash or even compacted soil. More recent constructions have a granular aggregate layer consisting of gravel or crushed stone, within which drainpipes are installed to provide an outlet for excess water to drain away from the track. Typically, the drainage layer is separated from the overlying sand with a geotextile membrane, which is explained in a later section.

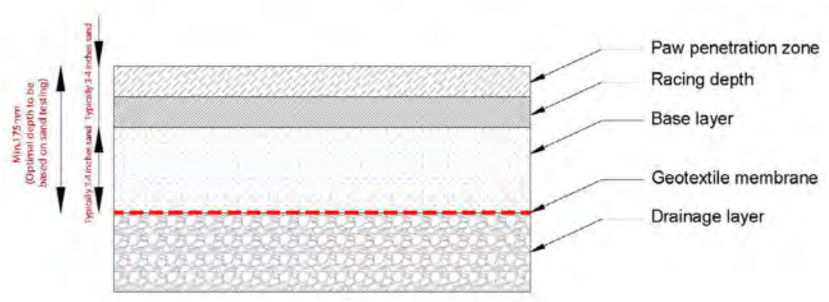


Figure 2. Typical cross-section profile showing different layers.

Figure 2 gives visually the general layers in a greyhound track profile. A detailed overview of the sands typically used on greyhound tracks is given later in this chapter. Details on the main sand layers in the profile can be found in the sand profile box. Drainage aggregate specifications will vary depending on the locally available materials and whether a geotextile is used or not. Historically these could vary from a 5-20 mm diameter gravel through to a 20-40 mm crushed stone.

SAND LAYERS IN THE TRACK PROFILE

Typically, good racing surfaces will have at least 75-100 mm (3-4 inches) of workable racing sand. This layer is where the greyhounds paw interacts with the track surface. It is vital that this layer should provide:

- Suitable cushioning to avoid hard impacts
- A stable surface to ensure the paw does not slip whils in contact with the sand
- Enough grip to push off with each stride, avoiding unnecessary kick back of sand

Below the racing layer is the base sand layer. This has to be a more consolidated layer to give a firm foundation for the racing layer. However, it should not become too compacted through hardpan formation, as this will reduce the ability of water to move into the drainage layer. Hardpans (excessively compacted layers of sand) have a significant impact on track performance and safety. Excessive compaction of sand (hardpans) is discussed in its own section later in the manual (page 104), and will also feature though out.

Traditionally, greyhound track profiles have used a different base sand (often of cheaper or older pre-existing material), on top of which a dedicated greyhound track sand is installed. This can be a cost-effective construction profile, as the base sand can be a cheaper general purpose sand, but it can lead to issues later in the track's life. As there are two different layers, the base sand will tend to consolidate whilst the upper layer is worked. This can result in these two layers not working in harmony and often creating challenges, such as poor drainage. Current thinking is to use a track profile that is homogeneous and consisting of only one sand type. This is to minimise the risk of distinct layers of different physical properties from developing. These two approaches are visualised in Figure 3.

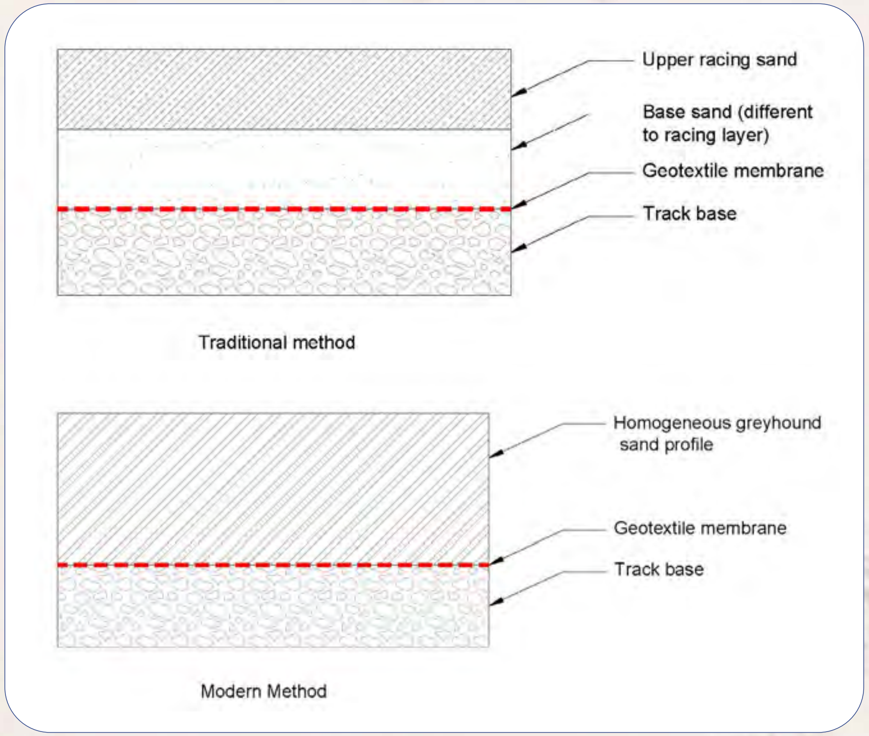


Figure 3. Different approaches to layering of sand types in the profile.

TRACK CONSTRUCTION MATERIALS

SANDS

Sands form the basis of a greyhound racing surface. Their characteristics and performance are vital to producing a satisfactory, consistent and high performance racing surface. However, as sands are so important, it is vital to understand what they are, how we categorise sands, how they work as a racing surface and what a good quality sand looks like.

What are sands? In the simplest terms they are small fragments of rock, typically composed of silica (chemically known as silicon dioxide). Some sands are pure silica, but many also contain other components and is often these components that give the sand its colour (orange/red coloured sands typically will contain iron alongside the silica). If you have a pure silica sand they typically are very pale and often white/cream in colour.

What is the difference between a sand, silt and clay? It is important to know that different aggregates are classified primarily by their size (Figure 4). In the UK, gravels, sands, silts and clays are classified below, based on the diameter of the individual particles.

Particle type	Diameter of particles
Gravels	2 – 8 mm
Very coarse sand (VCS)	1 – 2 mm
Coarse sand (CS)	0.5 – 1.0 mm
Medium sand (MS)	0.25 – 0.5 mm
Fine sand (FS)	0.125 – 0.25 mm
Very fine sand (VFS)	0.063 – 0.125 mm
Silt (Z)	0.002 – 0.063 mm
Clays (C)	Less than 0.002 mm

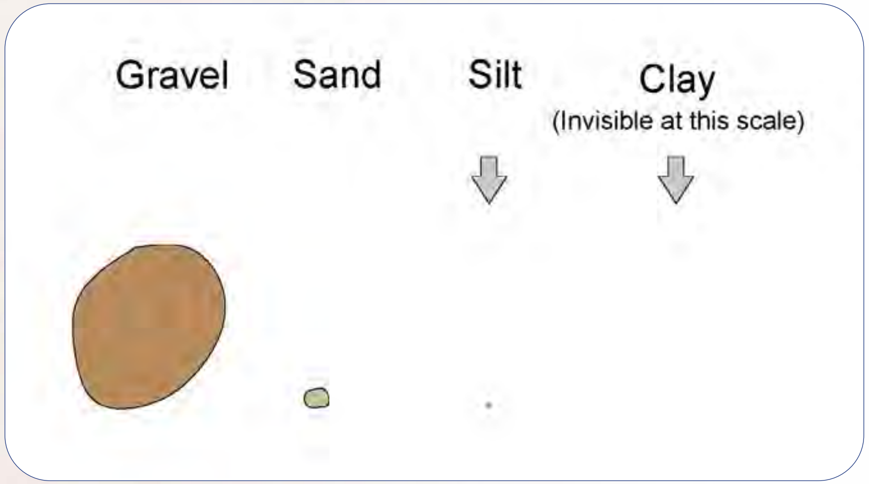


Figure 4. Picture demonstrating size difference between gravel, sand, silt, clay.

Greyhound track sands typically are composed of sand sizes in the fine and very fine categories. They may also contain a relatively small proportion of smaller particles like silt and clay. Some times the term "fines" is used to characterise the total proportion of a sand that is composed of very fine sand + silt + clay. This can then be used to describe the potential for a sand to hold water and, potentially, have restricted drainage. Presented later in the section are the size specifications of sands typically used with success on greyhound tracks.

The particle size distribution of a sand is the primary characteristic that defines its performance. However, the shape of sand grains can also influence their behaviour. Figure 5 shows how sand grain shape is classified. This is based on the combination of how rounded or angular their grains are, as well as their sphericity, i.e. are they like a football or elongated like a rugby ball.

Why is shape important?

If you take particles the same size, rounded particles tend to be less stable and therefore move more easily, resulting in a less stable surface when a greyhound paw interacts with it. Angular particles tend to be more stable and may offer greater grip, but do not pack as densely and therefore will retain slightly less water and will drain more freely.

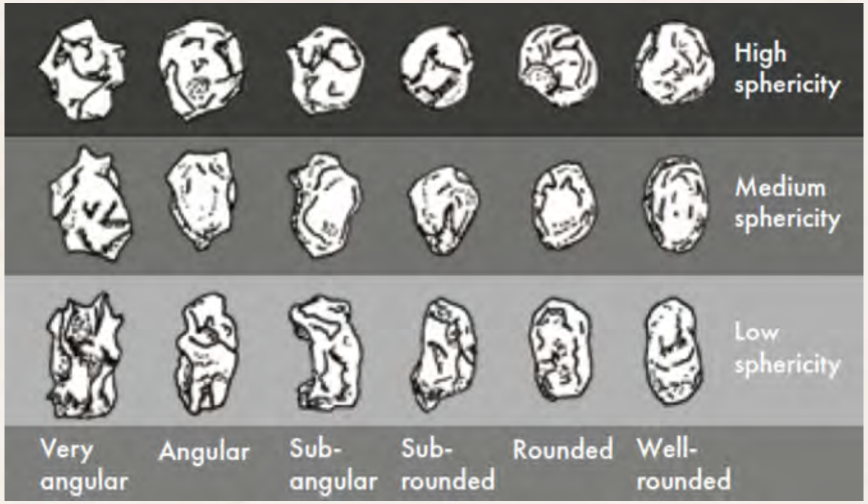


Figure 5. Sand shape based on their sphericity and angularity.

SAND TESTING AND INTERPRETATION

It is vital to ensure that the sands used on greyhound tracks are fit for purpose and optimal for that particular track. It is also important to understand how sands are changing over time so that informed decisions can be made on the suitability of existing or new sources. The aim of testing is to prevent issues and should be done before a sand is installed, either as a dressing during track levelling or a continuous layer when replacing the upper racing surface.

Typical sand testing would comprise particle size analysis to work out the size composition of the sand components and how must silt and clay are in the material. Additionally, sand shape assessment can be carried out visually to provide a indication as to the level of sphericity and roundness.

More recently, testing has started to include the drainage and water retention characteristics of sands. The aim of this testing is to find the optimal depth of that particular sand, that provides the balance between drainage and water retention. It also helps indicate the overall drainage performance of a material when installed on a track.

Interpretation of sand analysis needs to take into account the track and its situation. It is always advisable to get support from STRI/GBGB Track Liaison Officer when interpreting sand analyses. The golden rule is test it, check it, install it. Avoid a costly mistake by doing due diligence at the start.

Why do we use sands as a racing surface?

For those with long memories greyhound racing surfaces did not used to be build from sand. They were originally natural grass surfaces, but these surfaces tended to wear under heavy usage and would often be inconsistent around the track and under different weather conditions. Typically, bends would have the grass worn away causing safety and consistency issues. As a result, bends were then reconstructed from either peat or sand, the aim being to have a more consistent all weather surface. Eventually the tracks rebuilt their surfaces entirely from sand. The reasons why sands were chosen are as follows:

- For their all weather racing capabilities as they were designed to drain, yet hold some water allowing wet weather racing, whilst at the same time be covered and have salt applied to allow racing under sub-zero conditions.
- Easy to manipulate and create a new and more uniform surface rather than a turf track which was more difficult to repair and create a uniform and consistent surface around the track length and across its width.
- Readily available materials that can be engineered to provide the best possible racing characteristics.

However, sand racing surfaces also come with some challenges:

- The granular nature means that sand particles will easily migrate downslope during watering and routine maintenance.
- They can dry out easily under normal conditions if there are periods without rainfall.
- Sands are naturally hardwearing materials and can be abrasive to maintenance equipment and dogs paws alike.
- Whilst salt can be applied to sands, unlike grassed racing surfaces, under cold wet conditions the interaction of sand, salt and water can result in a soft and mushy surface for a while, until the salt has washed out the track profile.

What are the properties and characteristics of sands that make them suitable for racing?

Sands being a granular material have individual particles that fit together in a uniform and predictable way. It is the size of the individual sand particles that determines how tightly or loosely the sand grains fit together. Why is this important? The larger the sand particles, the larger the spaces (also called pores) are between them. Large pores or spaces, result in water easily entering between sand grains, but the water is not held and drains away quickly. The smaller (finer) the sand grains are, the smaller are the spaces between them. Small pores or spaces are more difficult for water to enter, but when it does it is held tightly and more difficult to drain away under gravity's pull (See Figure 6). A good greyhound track sand needs to have a balance between water retention and drainage, although due to the needs of racing and the presence of a camber this means that the emphasis is towards finer sands that hold on to more water than freer draining, coarser sands. In other words, greyhounds actually race of a mix of sand and water. With out both being present in the correct balance, the racing surface will not perform optimally and may be neither satisfactory nor consistent.

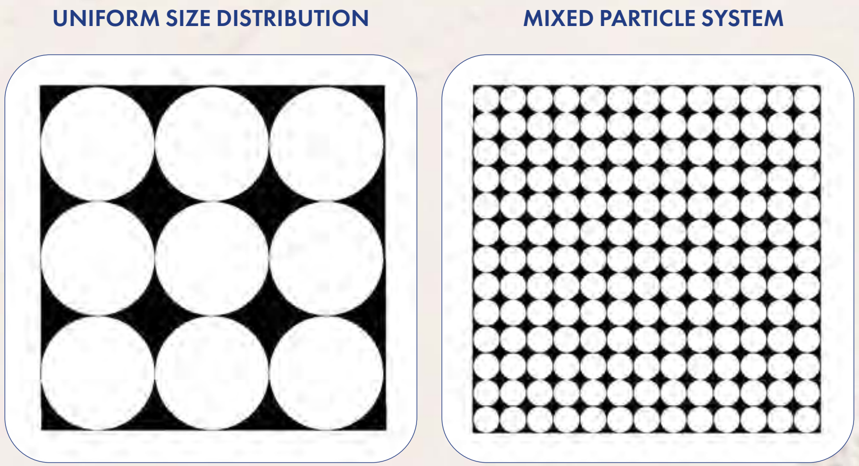


Figure 6. Effect of sand size on pores in a track sand.

As we have established, a racing surface needs to be a blend of sand and water, so what is the water doing? Water is playing several critical roles:

- Water films around sand grains help to bind the sand together to give a stable surface. This is why too little or too much water results in the same effect, namely a soft/loose and unstable racing surface.
- The lubrication effect of water between the sand grains means they can more easily move against each other. This is an important component of the cushioning effect of a greyhound racing surface.

It is also worth bearing in mind that when a track freezes, it is not the sand grains themselves that freeze, it is the water between them. Therefore, if a sand is completely dry it will not freeze. If there is only a small amount of water between sand grains, the surface will freeze more easily, but will also melt more quickly. In contrast, when a sand is saturated, it will take longer for it to freeze, but once frozen will take much longer to defrost.

What does the ideal greyhound track sand look like? We can define what makes a good greyhound sand based on years of sand testing of track sands. Figure 7 gives the typical sand gradings for materials that are currently used and appear to perform well. Greyhound track sands typically would be classified as fine or fine-very fine sands. The amount of silt and clay significantly affects performance, as these very small particles block the spaces between sand grains. Small increases in silt and clay have a major impact on the performance of the sand.

Particle (sieve) size (mm)	% Retained on the sieve (Including winter coarser sands*)	% Retained (Optimum sand grading)
Coarse gravel (4 mm)	0	0
Fine gravel (2 mm)	0	0
Very coarse sand (1mm)	0-1	0-1
Coarse sand (0.5 mm)	0-2	0-2
Medium sand (0.25 mm)	1-30	0-20
Fine sand (0.125 mm)	25-83	40-85
Very fine sand (0.063 mm)	5-42	10-50
Silt and clay	3-10	2-6
Proportion sand ≤0.125 mm	≥80%	≥80%
Proportion of fines (≤0.063 mm)	≥20%	≥20%

*Sands at coarser end may need more water applying in summer but should drain better under wet winter conditions.

Figure 7. Gradings for greyhound track sands.

It is vital to understand that there is no one sand that is optimum at every single track. There are a number of factors that have to be considered when looking at the optimum track sand for a specific site:

- Geographic location and typical weather conditions.
- Geometry of the track such as camber angle.
- Infrastructure at the track such as drainage.
- Usage levels of the racing surface.
- Availability of the sand and its future supply.
- Design depth of the track profile as shallower tracks will tend to hold more water at the surface as compared to deeper profiles.

Example of a covered sand bay.

INSPECTION OF SAND DELIVERIES

Below are some tips on what to check for during a delivery of sand:

- It is vital that you check what is in the back of the wagon before it is tipped out!
- Keep a reference sample of good sand that has been delivered before (or when the track was built) in a labelled box to compare to new deliveries.
- Is the sand what you ordered?
  - Check the paperwork accompanying the delivery
  - Take a sample from the delivery by inserting a length of running rail (1.5 – 2 m long) into the sand in the wagon and emptying into a clean bucket.
  - Visual inspection of sand – compare to reference sample, does it look the same.
  - Feel the sand – does it feel the same or does it feel a lot coarser or finer than the reference sample.
  - Look for contaminants in the sand, such as gravel or stones which may have come from a poorly washed-out wagon or poor handling of materials in the quarry.
- The golden rule, if it looks unusual or significantly different to what has been delivered or used, reject the delivery before it has been tipped!

GEOTEXTILE MEMBRANES

Geotextiles come in many forms, with their main function being to provide a physical barrier between the sand and drainage layer, whilst allowing water to flow into the drainage aggregate. The reason it is important to keep sand and finer particles from contaminating the drainage layer is because they can block the gaps between the drainage stone/gravel rendering this layer less permeable to water. This would result in degradation of drainage performance and inconsistent track moisture.

Geotextiles come in many different forms, but the one selected for use must be compatible with both the sand and drainage aggregate, whilst being hard wearing and freely permeable to water. A general example of a geotextile is given in Figure 8.

Figure 8. Example of geotextile.

Two common issues with geotextiles can occur on greyhound tracks:

- **Blocking** – this is where fine particles that are washed through the sand profile (particularly silt and clays) physically block the pores in the geotextile reducing its ability to allow water through. Excessive blocking will significantly impede drainage in areas affected.
- **Tearing and perforating** – this is where they integrity of the membrane is compromised by damaging it in some way. For example, operating the power harrow or Track-Avator too deep and catching the membrane tearing and damaging it. This renders the geotextile ineffective and sand can contaminate the drainage layer and drainage aggregate will contaminate the track sand. The latter issues is critical as this allows stone sized fragments to work their way into the racing layer, which poses a significant hazard to greyhound safety.

DRAINAGE – HOW IT WORKS ON A TRACK

Have you asked yourself the question "how does water move through our track"? This of course describes the process of drainage, i.e. how water moves away from the area where it was applied/fell as rainfall to a dedicated outlet.

Drainage, along with track watering and sand water retention, are the relevant components that need to be considered when thinking about surface water management. In this section, we are focussing on drainage and water retention, as these directly relate to the racing surface, the infrastructure to support racing and the performance of the sand.

At its simplest level, drainage is the movement of water downwards due to the force exerted by gravity. In other words, gravity pulls water downwards (either vertically or down a slope) but once water that can be pulled out by gravity has gone, what is left will stay there in the surface and is defined as a track's natural water retention. This is a very important concept to grasp.

Gravity pulls out some of the water but can't remove all of it (the rest of this water is trapped between the grains of smaller sized sand). The amount of water retained is primarily determined by the size of the sand grains and the pores between them. Finer sands have small pores which means that water will more slowly drain through them and a greater proportion of water will be held in the sand. If a sand has larger grains (and therefore larger pores) it is easier for gravity to pull water out, which means less is left in the surface (Figure 9). The balance between allowing excess water to drain through our tracks and some water being retained to produce optimum surfaces is one of the critical components of track maintenance. The only way water that cannot be removed by gravity will disappear from the track is either through evaporation from the surface or opening up the surface with tines or harrows, which creates larger pores that allow gravity's force to pull the water further down the profile.

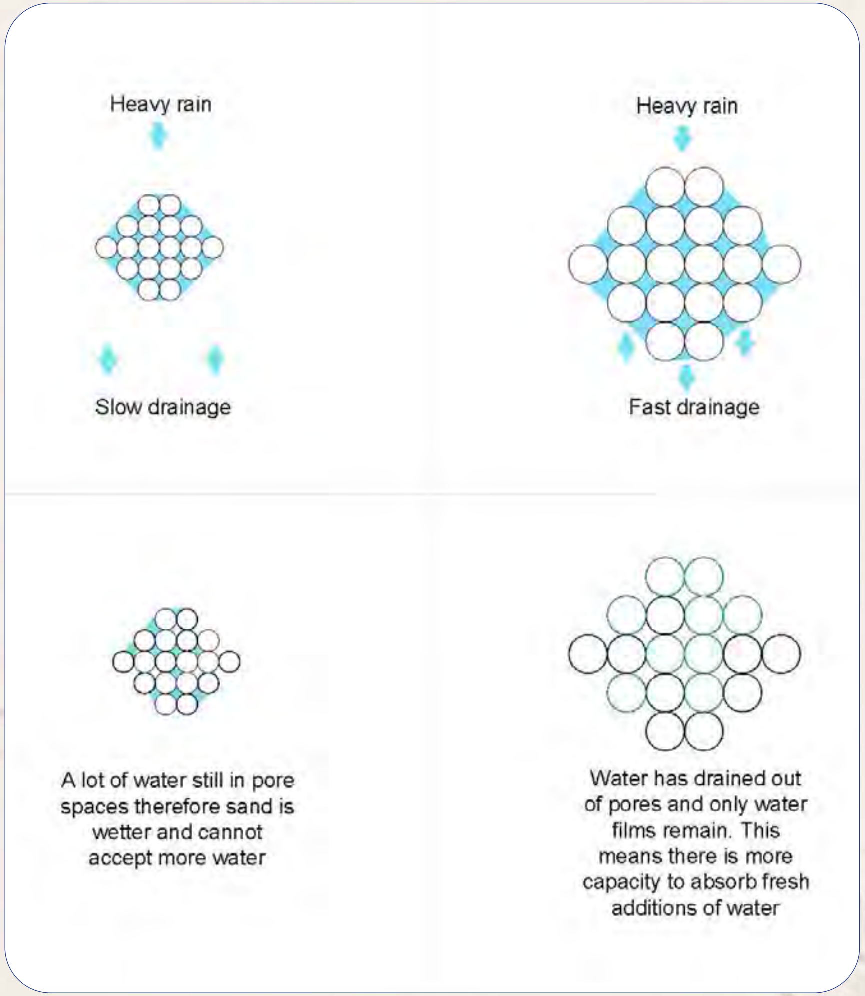


Figure 9. Diagram of water movement in fine and coarse sands.

DRAINAGE INFRASTRUCTURE AND HOW IT EFFECTS TRACK DRAINAGE

Drainage infrastructure, such as drains or stone/gravel drainage layers does not allow more water to be pulled out of the track by gravity. Rather it allows water to more rapidly escape but the level of water retention will be the same once the effects gravity on water have stopped.

Any form of track drainage infrastructure, such as drain pipes, provides more outlets for the water that gravity can pull to drain away from the track. These drains do not pull more water out, they just allow it to move away from the track more rapidly.

One of the major benefits of drainage infrastructure relates to wet conditions. What drains will do is allow more water to escape in a quicker time, reducing the duration a track will be saturated. An analogy might be useful to describe what is going on. If we fill a bath full of water and there is only one plug hole, the rate at which water will drain is limited to the capacity of the one plug. If we have more plug holes more water can drain away at once. At the end of the day the same amount of water will drain away (all the water we put in the bath) the only difference being the speed at which this happens.

Around the UK there are tracks with very little planned drainage infrastructure and others which have full drainage infrastructure (stone raft with pipe drains installed). Does that mean I should have drainage installed on my track? The simple answer is, if you don't have issues with an excessively wet track, then no, your drainage is sufficient. If you do have areas of your track that are excessively wet then drainage may be part of the solution, but very rarely is it the whole answer.

Installing additional drainage can cause as many issues as it may fix. It may not resolve the issue you thought it would fix or it may lead to an inconsistent surface with drier patches over the drains and wet in between. The golden rule when considering any drainage works is "assess every aspect of track maintenance and existing infrastructure that affects water movement and retention". Seek guidance and get advice from experts. Do not be tempted to "go it alone" unless you are confident that you have uncovered the source of the excess wetness. Common causes of track wetness issues are:

- Shallow sand depth.
- Excessive compaction (in essence reducing the depth of sand water can move through).
- Track surface sealing by fine particles.
- Layering in the sand profile.
- Inappropriate pin curb positioning resulting in too much water being held on the inside.
- Blocked geotextiles.

- Blocked drains or drainage layers (if water cannot flow the drain will not work).
- Raised sand levels under the inside rail creating a hump that traps water on the inside running lines.
- Loss of camber or creating a negative camber on the inside.
- Poor bowser design or operation.
- Poor hand watering.
- Leaking water pipes.

In the vast majority of cases in the list above, installing additional drains will not resolve track wetness issues. Identifying and tackling the underlying causes of track wetness will allow natural drainage and gravity to resolve the issue.

SAND MIXING AND OPTIMISATION

We race on a mixture of sand and water. When added together in the right proportions they will provide a consistent racing surface, which is very predictable. This predictability comes from the physical interactions between sand and water. As discussed earlier in this chapter, the primary characteristic of sand that determines the performance of the racing surface is the size of the sand grains. How these sand grains fit together is consistent and only influenced by the interaction with water and track preparation methods.

Mixing of sands has, in some quarters, been seen as something that is undesirable, leading to unpredictable consequences. However, this is simply not the case. With some due diligence and knowledge of how sands work, it is straight forward to mix sands together to achieve the balance of characteristics we are looking for in a racing surface. Mixing sands is a process that can add significant benefits to producing a tailored material that is optimised for that particular track.

For example, adding a sand with less fine sand grains will, over time help improve surface drainage. Likewise, adding a fine grade sand than make up the current track surface will improve water retention. This can have benefits in allowing track staff to adjust sand characteristics to meet the requirements of the season, the track and the racing surface.

However, critical to the successful addition of a different sand to the one installed is how the new sand is spread and blended. It is vital that a consistent mix is created. Layers create issues. If you are creating layers you will end up with an upper track profile that may be less stable, more water retentive with slower drainage capacity. A even and consistent mixing of the new and the existing sand is essential for success.

How can we get an even blend and which processes must be followed?

Firstly, the new sand should be evenly spread across the area to be treated. How this is achieved depends on the equipment available. There are specialist pieces of equipment designed for dressing sports surfaces with consistent depths of material. These could be used to give an even application. However the sand is applied, it should be spread to a consistent depth across the area. The evenness of application must be checked and any inconsistencies addressed.

Secondly, dressed sand needs to be thoroughly mixed with the underlying material. This cannot be achieved through power harrowing alone. There needs to be a vertical mixing of sand, not just a "stirring" of the sand. It is essential the sands are blended to create a consistent mix. Typically, the new sand is rotovated to achieve the vertical mixing, then power harrowed to ensure a consistent blend horizontally. The newly mixed sand will need to be consolidated so compaction levels are consistent around the whole track length.

If you need guidance on sand selection and mixing seek help. Support is available from other groundstaff and track managers, the GBGB Track Liaison Officer and STRI Consultants.

TRACK LAYOUT AND GEOMETRY

INTRODUCTION

All tracks have an individual geometry that was set out when the track was either first built or reconstructed. This means that no two tracks have the same geometry (Figure 10). What are the practical implications of this? It means that each track will have to have a maintenance programme that is tailored to its layout, sand profile, climate and racing schedule – there is no one size fits all approach! Maintenance inputs must be tailored to achieve a satisfactory and consistent running surface, with the relevant maintenance operations being done in response to track conditions and the prevailing weather conditions.

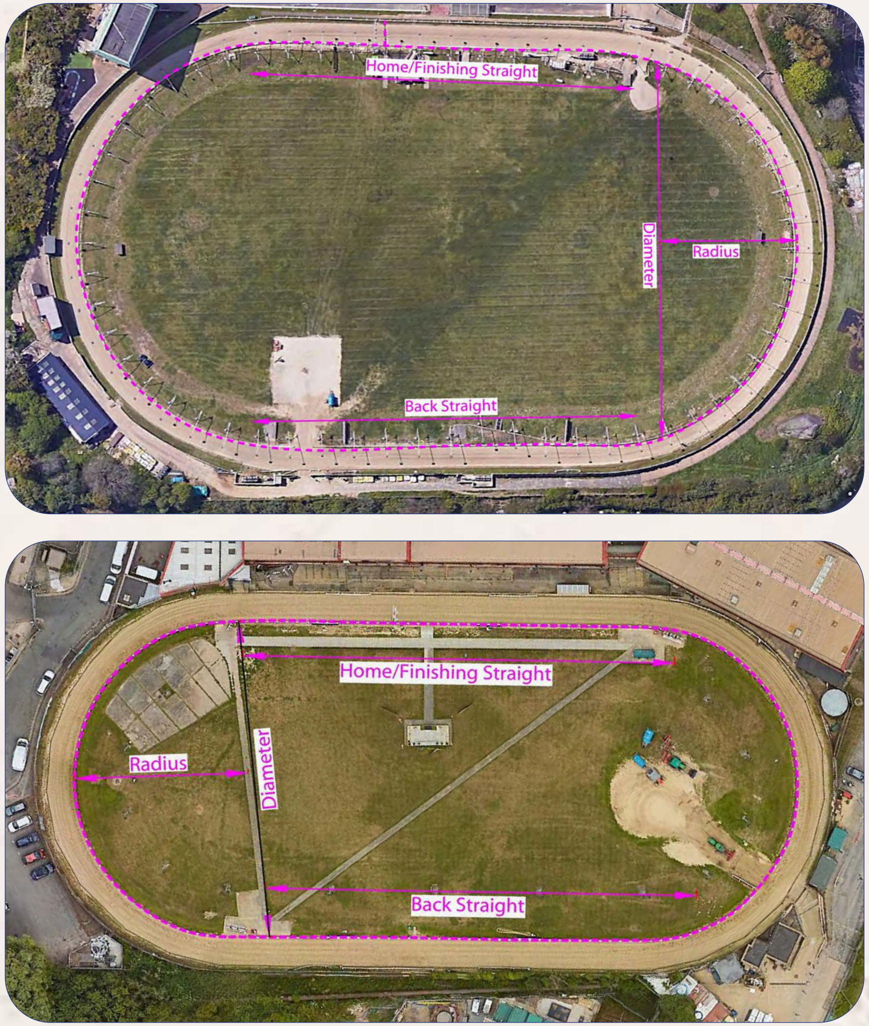


Figure 10. Aerial images of greyhound tracks with contrasting geometry (length, width, bend radii).

TRACK LAYOUT AND DIMENSIONS

There are no hard or fast rules as to how a track should be laid out or the running length of bends or straights. Most tracks in the UK have an oval layout with two straights and two bend complexes which are often broken down into discrete sectors labelled bends 1, 2, 3 and 4 (Figure 11). GBGB track specification guidelines recommend that track widths on straights are 5.5 m or greater, whilst on bends this should increase to 7.5 m.

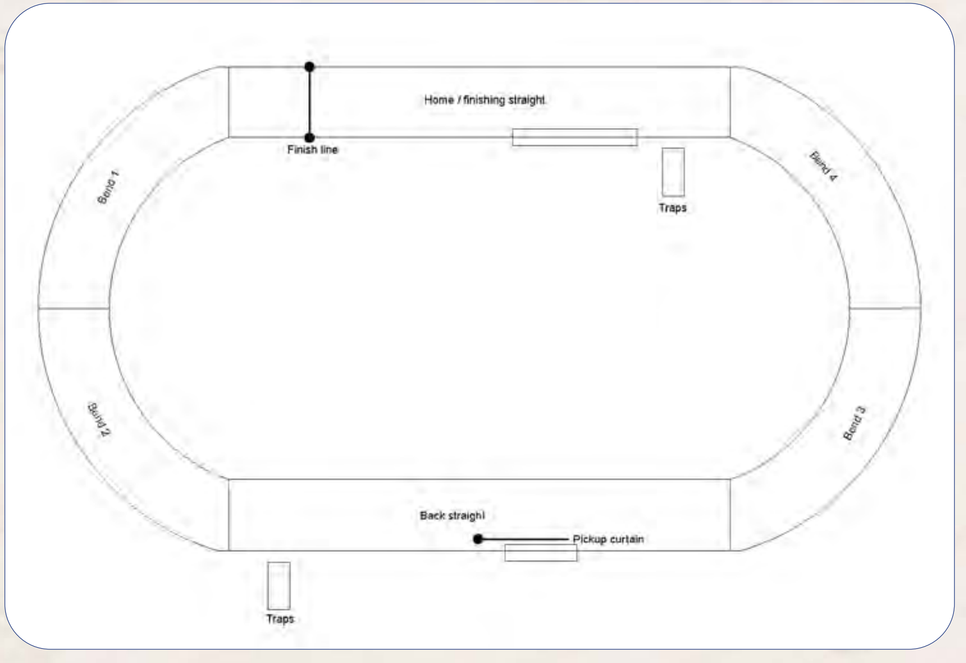


Figure 11. General layout of greyhound tracks in UK showing straights and bends.

The relationship between bends and camber angle will be discussed in the next section. However, it is important at this stage to discuss how bends are laid out, i.e. their geometry. There has been much discussion on the topic of bends over the years, but often little scientific evidence has been presented to support particular configurations. However, there is scientific evidence that bends with a radius of greater than 30 m are typically associated with lower injury rates. This is why the GBGB's guidance is that bend radius should be at least 36 m. Bend radius can easily be found by direct measurement to the inside running rail as per Figure 12. It also important to check whether the radius is consistent around the entire bend. It if isn't, then the forces acting upon the joints and limbs of the greyhound will change around the bend, which is likely to affect the risk of injuries.

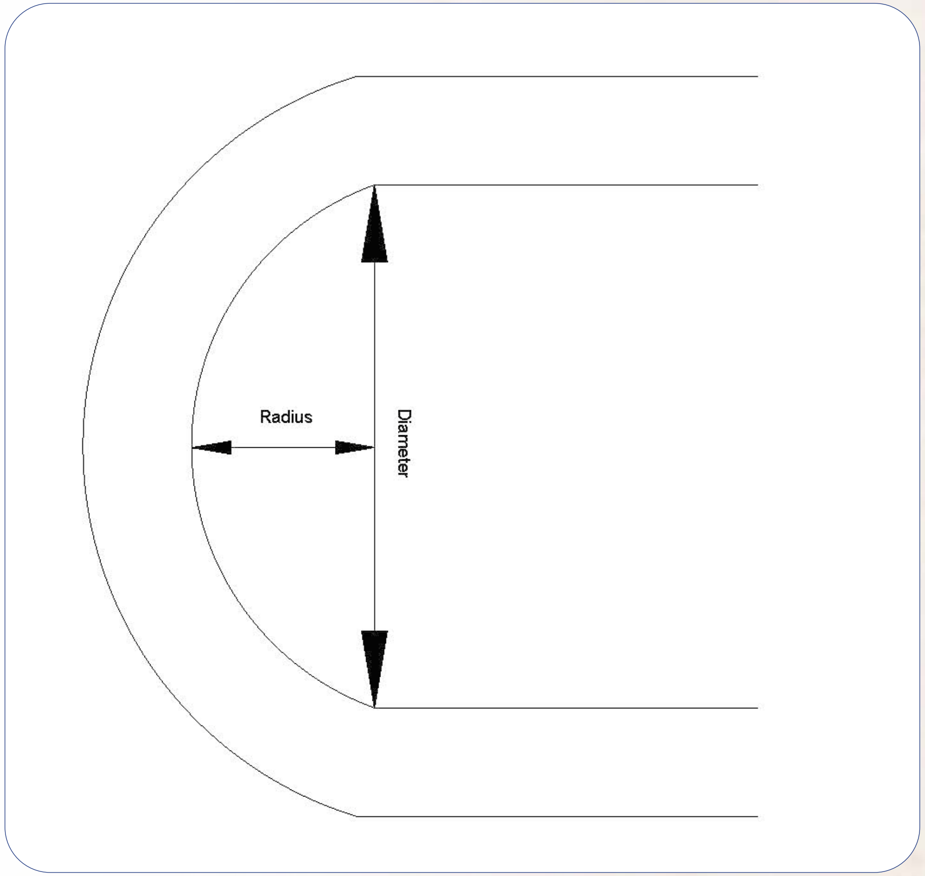


Figure 12. Example of bend radius and diameter.

CAMBERS AND BENDS

What is camber?

Technically speaking this camber should be referred to as the camber angle and it defines the degree of banking or angle of the slope running from the inside to the outside of the racing surface (Figure 13). It is important to understand why surfaces are cambered, as well as what are the advantages and disadvantages.

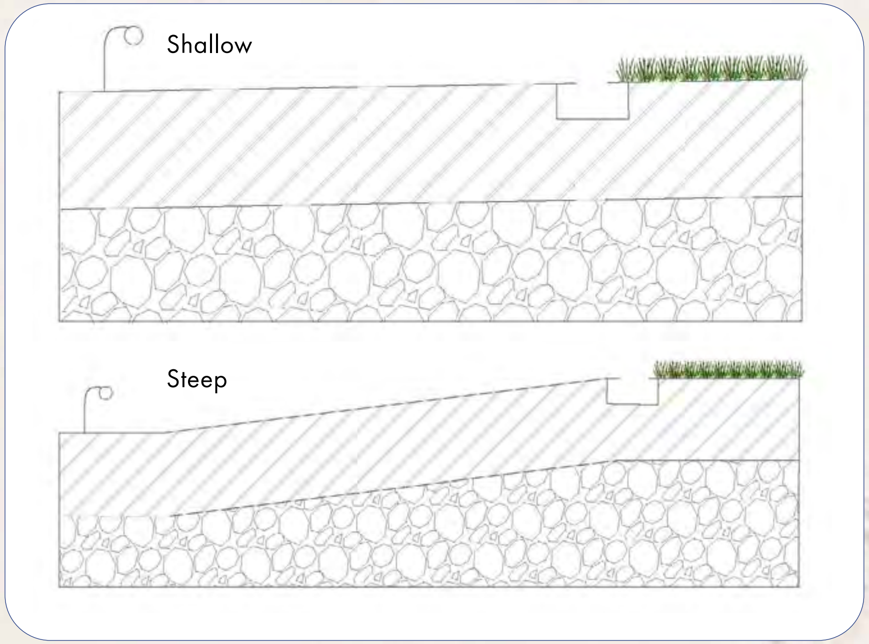


Figure 13. Examples of shallow and steep camber angles.

On straights, camber can be included purely to aid in moving excess surface from racing surface to the infield. It other words it helps with track drainage. The level of camber on the straight in the UK varies between a flat surface at 0° to 4°, but the average among all tracks being 1.4°. As more camber data is collected a better overall picture of optimum camber on straights can be determined.

On bends, the racing surface is cambered to help greyhounds run around the bend. However, there is no universal camber angle that works for all tracks. A fair generalisation is that tracks with greater bend radii (wide, galloping tracks) tend to have slightly shallower cambers whilst tracks with smaller bend radii (narrow and tighter tracks) tend to have steeper camber angles. Typical camber angles across all UK tracks range between 0.5° to 7.7°. The average camber angle on bends is 3.6°. Typically, tracks with narrower radii have more camber than those with wider and more open bends.

It is vital that each track assesses its camber angles on the bends based on their own geometry and injury data. It is important when assessing and adjusting cambers not to make extreme changes, but rather make a modest alteration and assess it impact over a reasonable period of time (weeks and not days!).

A camber can undoubtedly help a dog corner more efficiently and at higher speeds. In other words, a fast dog running at full speed may get more benefit from a steeper camber angle that a slower dog running around the same corner. This because the ability of a dog to run at full speed around a bend is dependent on its velocity, the level of grip and the camber. This is the same principle in motorsport or velodrome cycling.

Higher sustained velocities can be achieved on tight bends by having greater camber angle.

However, as with most things in life there is a compromise. A greyhound race is made up of 6 dogs racing around the track and on bends they typically want to be running on similar lines. This is so they can maintain as high a speed as possible. This is until they realise there is another dog wanting the same piece of sand and the potential for contact increases. Therefore, there needs to be a compromise between feeding the dogs into the bend in such a way that they can easily adjust their running line to avoid contact, whilst cornering at the greatest speed possible and allowing dogs that are forced to run wide to recover and continue racing. This ultimately means that our ideal bend configuration is one which is wide with a consistent and moderate camber angle. If we have a tight and/or narrow bend we may need to consider having a slightly steeper camber angle.

The dominant factor in whether a greyhound can maintain is peak velocity around a bend is surface friction between its paw and the surface. What does this actually mean? It all comes down to grip. We can use the term grip to describe the level of traction a greyhounds paw will have with the sand surface. A surface with optimal levels of grip will mean the greyhound can maintain its velocity without having to check and also gives the dog confidence in the racing surface, to allow it to perform to is maximum. How do we know when the surface has optimal grip? We can measure it with the shear vane, but it is also visibly clear when you examine paw prints around the bend. If the dog has had good levels of grip the paw print will be clear with no signs of slipping or deformation of the outer edge (Figure 14). If a surface has less grip, the paw print will show clear signs of slipping or deformation (Figure 14).

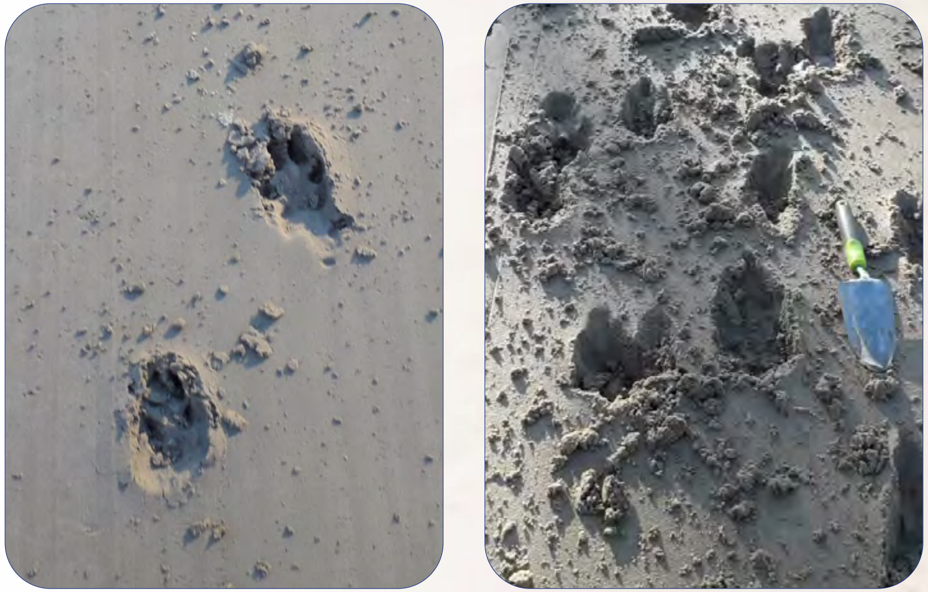


Figure 14. Examples of good paw print and paw print showing slipping.

Why is grip important?

Without a grippy surface, a greyhound will not be able to corner effectively, irrespective of camber. Indeed, as camber angle increases it is even more important that surface grip is maintained as slipping will cause the dog to drift, loose its line, check or at worst result in joint injuries. The three main factors that determine grip levels are track water content, sand grading and its level of consolidation. These all determine the degree of paw penetration and how much lateral force the surface can take before it breaks apart.

CONSISTENCY OF CAMBER ANGLE

To provide a consistent running surface, the camber of the bend should be even from the inside rail to the outside of the track. This is so that if a dog is forced to run wide, it can recover and continue racing, without unnecessarily increasing the forces on its joints or forcing it to boomerang back into the racing pack causing a collision. Examples poor camber profile are shown in Figure 15.

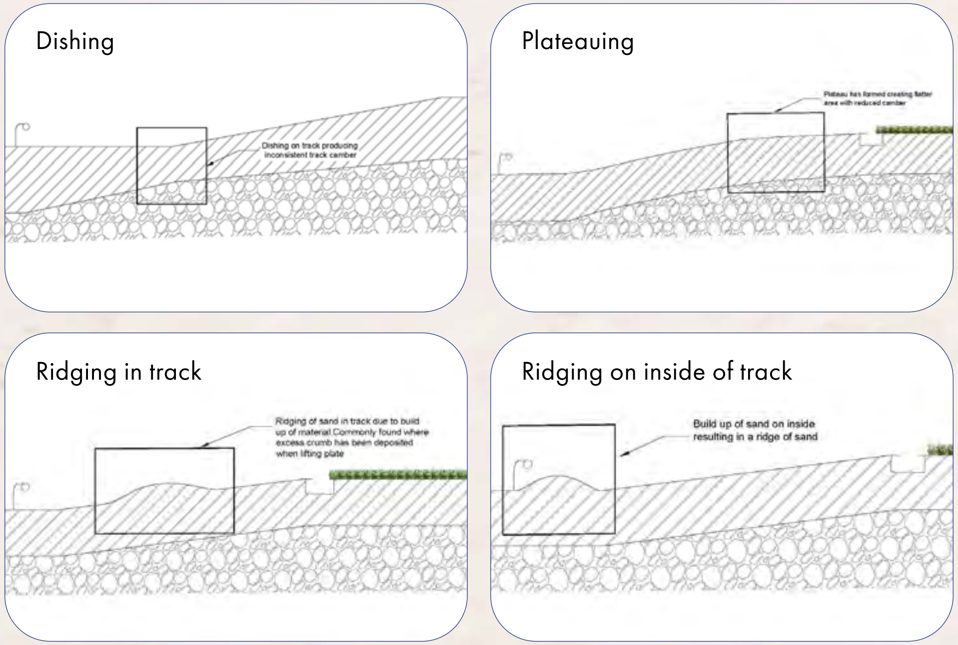


Figure 15. Four most common examples of poor camber profiles.

By far and away the easiest way to measure your tack camber angle is to use an inclinometer (GBGB has issued a straight edge with inclinometer to every track in the UK). With this tool you can rapidly assess the camber angle at different points around and across your bend (Figure 16). These readings should be taken routinely to allow trackstaff to make adjustments where necessary. The results of the readings should be recorded to allow the optimum camber angle to be determined.

Figure 16. Inclinometer and straight edge for use in determining both camber angle and low/high spots.

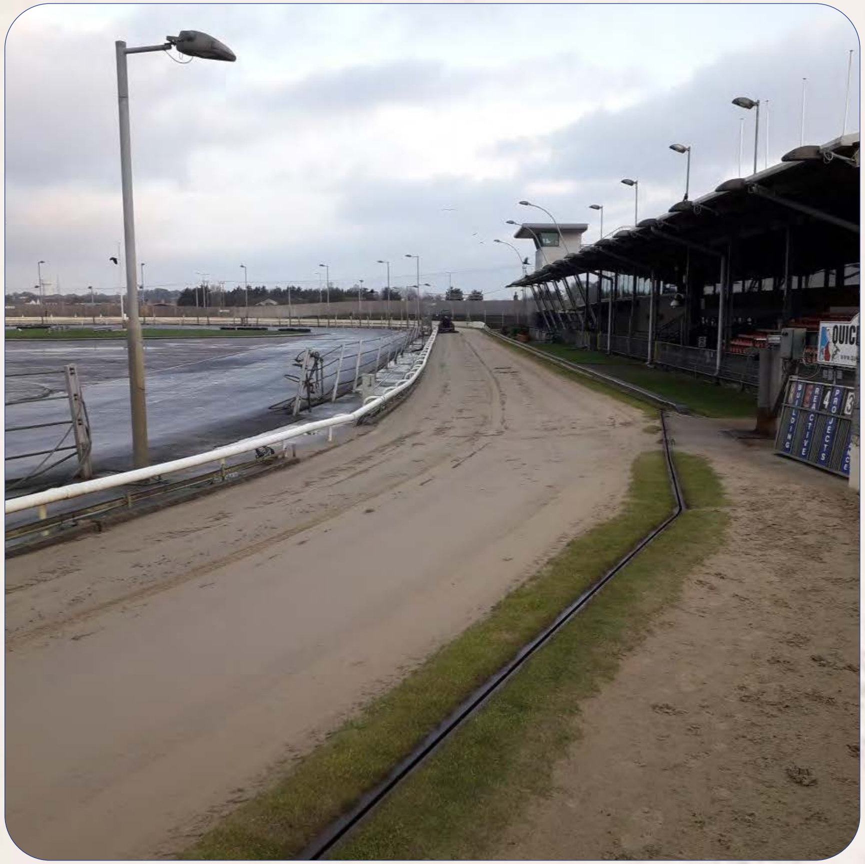
PICK-UP POINTS

Pick up points are an important part of the track as the dogs can decelerate hard chasing the hare. This can potentially be an area when injuries could occur due to over exuberance of the dogs when stopping or going for the dummy hare. Tracks should consider the impact of foot traffic in this area and potentially consider the increased need for additional decompactive works in this zone. The location of pick up points is also important. They should not be located immediately before or after a bend. This is to minimise the effect of the compaction caused by foot traffic when dogs are entering or leaving a bend and the loadings on the animal are not evenly distributed.

ACCESS AND CROSSING POINTS

Tracks should be acutely aware of the impact of both pedestrian and vehicular traffic on compaction. Where pedestrians or vehicles are accessing the track, localised compaction will be increased and these areas will need particular attention when decompacting or resetting the track. Indeed, foot traffic can be more compacting that tractor tyres so pedestrian access points (around traps and pick-up point should be carefully monitored. The effect of compaction can be easily measured and mapped using a penetrometer.

The location around the track where either vehicles or pedestrians enter onto the racing surface should be carefully considered. The consequences of increased compaction on access/crossing points will be less severe on straights rather than on bends or the turn in point for bends. This is because changes in the surface as a dog is turning into or around the bend will impact the level of shock absorption and grip available to the animal. Where possible, access points should be on straights and on the outside of the track, I.e., avoiding compacting the main running lines on the inside to middle of the surface.



TRACK INFRASTRUCTURE

INTRODUCTION

Your track and its satisfactory operation is only as good as the quality and condition of the infrastructure used for racing. In this section, the infrastructure needed to allow safe racing will be outlined and discussed.

SINGLE POINTS OF FAILURE

What is meant by single point of failure. It is when an operation or process is reliant on just one piece of equipment or infrastructure. If this fails, that operation or process cannot be carried out resulting in the racing stopping or not going ahead. For example, if the hare rail cable breaks and there is none spare, racing cannot continue. Therefore, to avoid this, spare cable is kept allowing replacement and racing to continue.

The golden rule to avoid single points of failure is to, where practicable, have adequate back ups or spares to allow racing to continue. For some items of infrastructure this is easier to do than others. For example, if the hare rail breaks it will be impossible to replace during a meeting, but if a pully fails this can be replaced quickly, assuming a spare is available.

WATER MANAGEMENT AND STORAGE

As has been mentioned previously, greyhounds race on a mixture of sand and water. The supply of the latter is vital, without it you cannot race. It is therefore critical that a track knows where its water comes from, its quality and the volumes that can be supplied, either on a race day or considering longevity of supply.

WATER SOURCES

At tracks around the UK, water tends to be supplied from the following sources:

- Borehole (pumping water from an underground aquifer)
- Abstraction from ponds, lakes and rivers
- Mains water

If abstracting from boreholes and other public surface water bodies, this needs to be done under licence from the Environment Agency (in England) or the relevant national agencies in Scotland and Wales. Abstraction licences are issued outlining how much water can be taken in a given period. Water usage data is then required to be submitted as part of the licencing agreement. If more water is taken than permitted on the licence, heavy fines can be issued or legal proceedings started. If the track as a pond which does not take water from a licensable source (i.e. does it have a feed from a borehole, mains or public water body) then an abstraction licence is not required.

To ensure satisfactory and continued operation of a track, it is vital that the volume of water required in a worst case scenario can be met with the current water supply. In other words, is our water supply resilient under the driest summer conditions.

ON-SITE WATER STORAGE

Why would tracks want to store water on site?

The simple reason is that it ensures there is always water available in sufficient quantities during preparation and racing. Storing water at the track builds resilience into track operations. If there is a problem abstracting water, such as a pump failure or issue with supply pipes, having enough water to complete preparation or racing is vital. This allows operations that day to continue, but what about the next day or if the problem will take some time to be rectified? The amount of storage will depend on amount of water needed, available budget for installation and operation and space which can be utilised. It is vital that tracks look at their needs and have a plan for worst case scenarios.

The types of storage that might be considered, along with advantages and disadvantages are given below:

Fixed above ground storage tanks (plastic or lined metal)

Advantages

- Come in a range of storage capacities and sizes.
- Can be located in convenient areas around the stadium.
- Often have pumps but can be designed with back-up gravity feeds.
- Can be inexpensive compared to other bespoke/ tailored options.

Disadvantages

- Storage capacity may only provide supply for one or two days of operation.
- Cannot be installed on sight lines for racing (infield for example).

Ponds and lakes

Advantages

- Can store significant quantities of water.
- Provide visual or biodiversity interest on site.
- Can capture rainfall and be integrated with rainwater harvesting solutions.
- Once built they provide continual and long-term service.

Disadvantages

- Depending on size and liner solution chosen, they can be expensive to create.
- Need maintenance to prevent silting up and controlling vegetation growth.
- Health and safety issues to keep staff and public safe.
- Difficult to expand capacity therefore careful consideration needed during design to ensure it provides sufficient future proof supply.

Underground storage

Advantages

- Saves on space as infrastructure is below ground and can be installed under hard surfaces (carparks for example).
- Can be installed infield as has no impact on racing sight lines.
- Can provide large volumes and with "lay flat geocellular" solutions they do not require deep excavations.
- Easy to integrate with rainwater harvesting solutions.

Disadvantages

- Installation costs can be expensive and disruptive in the short term.
- Non-lay flat geocellular solutions rely on burying big tanks which need large holes that can be expensive to excavate.

Temporary storage

Advantages

- Can be purchased or hired as needed.
- Allows for a flexible approach to water management.
- Often low profile (such as pillow tanks) therefore less likely to obstruct sight lines for racing.
- Often come with their own pumping capabilities.

Disadvantages

- If hiring, can be expensive over the long-term.
- Needs space for installation which on tight tracks may be difficult.
- Not necessarily designed for long-term solution as often they are designed to be deployed when needed.

FLOW RATES AND TIME TO IRRIGATE THE TRACK

Most water storage solutions require the use of pumps, for abstraction and for moving water in pipework to hoses, sprinklers or bowser filling outlets. It is vital that the capacity of the pump matches the peak flow required. For example, if a bowser needs to be filled in 8 minutes, a flow rate that would take 15 minutes is going to limit the ability to apply water as and when trackstaff need it.

Know you water requirements and have a robust solution that can allow you to put as much water on the surface as you need. Design for the worst case scenario and build the resilience into your operation.

Like any mechanical component, pumps need regular inspections and maintenance. Ensure they are serviced as recommended by he manufacturer. There is no point having a full water tank and no way to get the water out of it because a pump has seized! Also consider having a back-up solution that can be used to get water where you need it, such as a spare petrol pump, electric submersible pump or a gravity fed back-up. All of these should still allow the required flow rate to supply water to the track watering infrastructure as needed.

FUTURE WATER SUPPLY ISSUES

The supply of water to all tracks is vital for the continued operation. This is even more critical in summer when the pressure on water supplies is at its greatest. As an industry, greyhound racing is likely to be a lower priority for water supplies compared to domestic, industrial and agricultural usage. This means that when water is in short supply, restrictions may mean that water for use on tracks is most under pressure. It may be that abstraction from particular sources is banned or heavily restricted. It is vital that we build resilience into out tracks by looking at alternative methods for sourcing water and managing its use on tracks to reduce the amount required.

Climate change is one of the biggest threats to water supply that we currently face. This is because its effects often occur gradually, so it can be difficult to visualise its exact impact. This is where science comes in to help. Data shows that we are likely in the UK to experience hotter and drier summers with less water falling as rainfall, whilst in winter we will have milder conditions with potentially more rain. So what does this mean for us? It means that we have to be smarter with our water management and plan now for the changes that are already happening. Resilience, resilience, resilience!

In a world where we get more rain in winter and less in summer, what can we do? In conditions where drainage in winter months becomes more of a challenge and that water restrictions may mean we have less water to apply, what do we do? It is imperative that we act now and the next section looks at some technologies and methods to help with water management.

WATER MANAGEMENT SOLUTIONS TO HELP BUILD WATER RESILIENCE

The intention of this section is to outline potential solutions and concepts of how we can better manage water on tracks. It is acknowledged that, whilst some of the methods and technologies discussed are implemented in other industries, some are novel concepts that will need extensive research and development to ensure they both work and are cost-effective. Remember, no water no greyhound racing!

The first avenue to investigate is how we can capture and utilise rainfall. This is called rainwater harvesting and is common in many green infrastructure projects to prevent flooding in urban areas, whilst providing water for the regreening of these same areas. What does this actually mean? It means installing infrastructure that allows rainfall to be captured when it hits a surface, whether that is a roof of a stadium, carpark or even the track or infield areas (Figure 17). Anywhere rain falls and flows into a drain we can capture it. Often, the challenge is to have sufficient storage capacity to be able to store meaningful quantities of water for use in the drier summer months.

Figure 17. Example of rainwater harvesting.

The second avenue for investigation is the use of alternative, non-potable water. These sources of water may need to be treated to ensure there are no pathogens that could be harmful to human or greyhound health. There are many parts of the world where treated non-potable water is used for irrigating plants and grass. The maxim being, don't throw out today what you might use tomorrow.

A further avenue to be looked at is how drainage water is dealt with on site. Can we have a closed loop system, which is where there is no drainage outlet from site and all water is either re-used or is lost through natural process of infiltration and evaporation. This type of approach is often done in conjunction with rainwater harvesting and/or use of non-potable water. Rather than let our drainage water escape, capture it and reuse it for irrigation. The grand vision would be to have a closed loop system where water can be processed and treated on site, where fresh and alternative sources of water can be used to mitigate abstraction or supply restrictions and where water saving technologies are used to minimise water requirements.

Speaking of water saving technologies, this is the final avenue for investigation. There are a number of existing technologies that may be of use, as well as novel concepts that may help. Such technologies and solutions would include:

- Sub-surface irrigation to keep our track sands consistently moist, reducing the need to apply water to the surface. Some surface water will likely be needed for final preparation, but research has shown that with these type of systems on turf surfaces between 33 – 66% water savings can be made.
- Use of wetting agents/surfactants that can aid with water moving into sands and also be used to help hold water in the racing surface. These technologies are routinely used in industrial, agricultural and turf industries to help manage water more effectively. They are diluted with water and sprayed onto the target surface. Any product used would need to be safe for use with greyhounds.

- Use of water retentive amendments that can be mixed into the top of the track to hold onto water efficiently and will help keep the track surface wetter for longer. This type of amendment would need to be biodegradable so that its effects could be benefited from in summer conditions, but it would not linger into the wetter winter months.

All these technologies would need some level of research to build confidence that they would be suitable for greyhound racing and how they could be deployed effectively. However, we need to act now to have the solutions we need for tomorrow's challenges.

RUNNING RAIL, BARRIERS AND PADDING

There are no specific GBGB regulations governing the installation height of barriers above ground level. Barriers must be installed to the manufacturer's specifications, ensuring there is at least complete barrier protection running around the inside of the track. It is becoming more common for tracks to install a complete safety barrier circuit around the outside of the racing surface. This helps provide additional protection and a closed loop encircling both the inside and outside. It is best practice to find ways to have complete barrier coverage in front of traps when dogs are racing past, thereby minimising the risk of a dog impacting the end of a barrier or leaving the confines of the racing surface. It is standard practice to have double height barrier running around the bends, as it is here that most collisions occur between dogs and the additional height keeps all the action on the track. Intuitively, barrier height should be set so that a dog contacting it will do so above its centre of mass which will help ensure the dog does not tip over into the infield.

BARRIER/RUNNING RAIL MANUFACTURER RECOMMENDATIONS

There are two main manufacturers of safety barriers (also called running rails) that are used in the greyhound racing industry. Barriers International Ltd and Duralock (UK) Ltd both produce greyhound racing specific products.

In the past, Barrier International have recommended to install their barriers with the bottom edge of the barrier 345 mm above the ground. Swan neck uprights should be installed at 3.25 m centres.

Duralock recommend their barriers are installed with the running rail 495 mm from the top edge to the ground. Swan neck uprights are recommended to be installed at 3 m centres.

Contact details of both manufacturers and the specification drawings of their single and double height systems are given in the appendix (page 120)

As each track has a different geometry and layout, the exact barrier and padding requirements should be tailored to the individual needs of the track. To be able to assess the exact requirements a risk assessment-based approach should be followed. This looks at the likelihood of an issue occurring and assessing this based on the severity of the outcome. This will guide what safety infrastructure we need to install on the track to allow safe racing.

Several case studies are put forward to highlight the thought processes to follow when looking to enhance safety of tracks. When it comes to track safety, it is worth having as our mantra "plan for the worst case scenario" as this means we will likely have multiple layers of protection which will provide the safest possible racing environment.

RISK ASSESSMENT CASE STUDY 1

What safety infrastructure should be considered on the outside of bends on a track with tight and steep bends with a retaining wall? The first step is to evaluate how likely it is for dogs to leave the running surface and potentially contact the track perimeter and what would the severity of injury be? A good approach in this case, if space allows, may be to look at multiple layers of protection. Firstly an outside barrier to prevent dogs from impacting the retaining wall. This acts as the first line of defence and may also have the advantage of giving the dogs a reference point for turn in and the sweep of the bend. Secondly, if the dog gets past the barrier the next line of defence is to install padding to absorb energy and to reduce the level of injury to the dog.

RISK ASSESSMENT CASE STUDY 2

What happens if there is a broken piece of barrier on the straight and a dog impacts it? There is a low likelihood of the dog impacting the barrier in this area of the track, but if it were to, then the severity of injury would be high. Therefore, we must assess if the barrier is so dangerous it must be replaced before any racing can take place or if a temporary repair will suffice. No matter what, the damaged barrier must be replaced as soon as possible and not left with a temporary fix in place.

Safety barriers and padding must always be fit for purpose and ready for the worst case scenario should it occur. This means that regular checks should be carried out to inspect the quality, integrity and cleanliness of barrier. This means checking the barrier for any damage or sharps that could injure a dog if it were to impact it. These inspections should be done before each race meeting. This allows sufficient time to replace any damaged safety barriers/pads (spares of which should be kept in stock in case of need). Contact between maintenance equipment and barriers is unavoidable, but when it does occur, trackstaff should be trained to deal with the situation:

- Stop what you are doing.
- Assess the damage done.
- Report the damage to the senior track and stadia staff.
- Mark the damaged areas and remove broken shard of plastic from the racing surface that can stick into the paws of dogs.
- If satisfactory to do so and if this has occurred just before racing, repair the barrier with packing material and tape up.
- If a repair is not sufficient, alert the nominated person with responsibility for the running of that meeting that a replacement is needed and appropriate action to delay racing will need to be taken.
- Remember, barriers and pads are key safety features of the track. They must be fit for purpose at all times to protect and safeguard the greyhounds.

A clean and well looked after barrier and pads gives a professional image to the sport. If it looks professional, it will give the best impression and show that a track looks after its safety infrastructure meticulously. Dirty and taped up barriers or dirty and sagging pads does not inspire confidence that the appropriate attention to detail is taken when it comes to preparing a safe and consistent racing surface (Figure 18).

Figure 18. Examples of poorly maintained safety barriers/running rail.

Where machinery and dogs access the track, the same level of safety protection must be provided. This means installing gates or sliding rails to ensure that complete protection is given. However, check that access points do not have sharp edges or that fittings are sufficiently snug so as to not allow movement if a dog were to impact it. The old-fashioned hand test is as good as any. If it feels sharp or uncomfortable when you run your hand over it, it needs to be fixed.

Pads are there to absorb energy in a last chance to mitigate damage to a dog were it to impact a piece of fixed infrastructure (wall, light pole, traps upright etc.), with examples shown in Figure 19. There are no set standards for these and they are often manufactured to order and so sourcing can sometimes be difficult, although details of known pad suppliers are included in the appendix (page 136). When selecting pads, consider the possible forces involved in the event of a collision.

Figure 19. Examples of pads installed on tracks to protect greyhounds.

HARE RAIL AND HARE

All GBGB licensed tracks currently utilise the outside Swaffham type hare system. This comprises a rail upon which the hare runs on a skid. It is driven by electric motors that pull a plastic coated wire (also known as cable or rope) through close fitting rubber tyres. There are also pulleys that are fitted into the steel hare rail to allow the cable to be pulled around the curved sections of the track. Figure 20 shows the various components of the hare system.

Figure 20. Component parts of the Swaffham hare system.

Actuator on hare rail

Hare drive system at track

Hare pulley and rope

Hare rail drive tyre

Hare rail pulley

Hare rail

Hare system pulley and sand clearance box

Lure (rabbit)

Rope (cable) used in hare system

Slider for holding lure

All the components of the hare rail system are subject to friction wear as either the slider or cable rubs against individual components. This means they need to be constantly checked for wear and replaced as needed. In it vital to have spares of these high wear components, so that the risk of a failure is minimised and if it does occur it does not significantly affect the racing schedule.

The rate of wear is accelerated with the presence of sand and salt. The hare rail should be kept clear of sand to minimise wear. This should form part of the routine infrastructure maintenance regime.

NATURAL OR ARTIFICIAL GRASS?

Hare drive pit with artificial turf added to protect paws from the metal cover

Artificial or natural turf strip in from of hare rail to keep sand from migrating into the system.

It is important to protect the paws of any greyhounds that run wide from impacting unprotected metal surfaces, such as hare drive pit covers. These covers should be protected, ideally with artificial grass and even better if there is a thin rubber shockpad beneath it.

To minimise the risk of paws coming into contact with exposed hare rail, a natural or artificial turf strip before the ironwork should ideally be installed. Additionally, this will help to stabilise the sand in front of the hare rail and help prevent excessive sand migration into the system, thereby helping to extend its lifespan. This green strip can also provide contrast between the running surface and surrounding barrier/padding/fencing, which helps greyhounds to visualise the limit of the sand surface.

TRAPS AND ACTUATORS

Starting traps, both level and handicap, must be to a design and standard approved by the GBGB and with provision for automatic starting. Where the traps are permanently fixed, there must be ample rear access so that it is easy to place the greyhounds in their compartments (Figure 21).

Figure 21. Traps and gantry with both the GT Hare and Ashwells types shown.

Where starting traps must be moved on and off the track for each race (Figure 22), wide gaps in the barrier must allow access off the racing surface, either to outside or inside. These access points must have a removeable barrier which can be replaced once the traps are safely off the racing surface.

Many traps have now moved away from the roller system and instead use a gantry system to which the traps are attached. Most are operated using a compressed air or conventional hydraulic systems to allow them to be raised and lowered, whilst easily and quickly positioned and removed from the racing surface.

Figure 22. Example of handicap traps.

Where traps sit on the racing surface, care should be taken to ensure that they sit level and there is not localised build up or depressions in the racing surface. As these areas are subject to significant foot traffic, care needs to be taken to ensure that sand compaction does not become too severe.

Traps should be serviced regularly to ensure their optimum operation. Daily checks to ensure their functioning should be made. Moving parts should be checked for lubrifaction requirements. Air lines will need to be de-watered, especially during the winter months or following servicing where the airline may have been subject to moist ambient air entering the system.

Where automatic actuators are used (Figure 23), their functioning should be checked prior to the meeting and if a fault is found spares should be carried to allow quick and efficient replacement. The sighting of the actuator should be checked with the hare to ensure that adequate contact is made to initiate the operation of the switch. Staff should be trained on how to deal with actuator failures when the traps are loaded with dogs.

Figure 23. Actuator for initiating opening of traps.

Rubber mats in the traps should be cleaned and sand free for racing. They should be inspected regularly and worn mats replaced. It is advisable that a complete set of mats are kept in stock to allow easy replacement whenever needed.

STORAGE

Tracks rely on numerous pieces of maintenance equipment ranging from hand tools, to trailed equipment like power harrows and plates, through to tractors of all sizes. In an ideal world, all should be stored inside or under cover to minimise the impact of wet and cold weather. This is to reduce the impact of weather damage and to extend the operating life of the equipment. If storing all equipment inside is not possible, adequate weather protection will be needed such as well fitting covers/tarpaulins or construction of lean-to shelters through to the installation of shipping containers in which tools can be stored. The latter also has the benefit of being more secure, thereby aiding in crime prevention.

How much does your track pay for your sand?

It will be a substantial amount of money. So, if we end up losing some to windblow or contamination we are throwing money away. Sand should be stored on a hard base to prevent contamination and at least covered to prevent both wind loss and weeds and leaves being blown onto the pile (Figure 24). Ideally, all tracks should have a dedicated storage bay with three sides (concrete, railway sleeper or other hard wearing rigid material) and with either a roof or heavy duty cover. Keep your investment in sand safe!

Figure 24. Example of dedicated and appropriate sand stockpile storage area/bays.

Given the potential supply issues with sand that have been seen over recent years, it is advisable to have sufficient stockpiles to allow operations for at least one year but ideally two. You don't want to be in the position of desperately needing sand, have no stockpile on site only to be told that your chosen sand is unavailable. If you have a sufficient stockpile and re-order before you use all your material up, you have more time to find the right substitute. Plan properly, invest wisely and take the pressure off.

PICK-UP CURTAIN

If you have a pick-up curtain, make sure it is presentable and fit for purpose. It should be able to be deployed easily, but only when is needed. It should not have a bottom bar so that if a dog were to run underneath the curtain, a severe injury would be avoided.

LIGHTING

Lighting is to provide a clear view of all areas of the track at night, whether that is for the dogs, the stewards box, hare controller, spectators or cameras. All areas of the track should have adequate illumination which is consistent around the whole track circumference.

Lighting units tend to either be overhead spotlight types which are regularly placed around the track, or more like football stadia where there are light clusters installed on high poles positioned in the corners of the stadium and that are designed to shed light over wide areas.

New LED technologies are being embraced to provide very directional, bright, reliable and low operating cost light units. This has seen the gradual phasing out of the older sodium/metal halide/halogen technologies. The LED systems are being more commonly used due to their long lifespans and reduced electricity requirements.

If your lighting needs to be replaced or upgraded, ensure you engage the services of a reputable lighting engineer/company. Always ask them to do a feasibility report on the different options available, ideally including a lighting survey, so you can choose the technology and unit type that is best suited to your track.

TRACK ACCESS POINTS

Track maintenance equipment, as well as foot and dog traffic all need access to the racing surface (Figure 25). This will inevitably cause additional compaction to the sand. The level of compaction and surface disturbance needs to be carefully monitored to ensure maintenance programmes account for this. A track is only as good as its worst spot! Ensure you have a plan of how to carryout additional decompactive work to these specific hardpan hotspots.

Figure 25. Examples of pedestrian and vehicle access points.

There is an additional challenge when it comes to vehicle access points. This is in the form of contaminants being brought onto the track by tyres or machinery. Common contaminants of concern are stones, soil and oil, all of which can come from maintenance areas, turning zones, the infield area and poorly maintenance equipment (Figure 26). Take a long hard look at where you store your kit and what it has to travel through before entering the track. If you bring contaminants onto the track, you are compromising all the hard work you have done to produce a satisfactory and consistent racing surface.

Figure 26. Contaminants brought onto track surface by vehicle tyres.

To prevent contamination of the sand, look at the surface immediately adjacent to the track at the access point. Can it have a hard surface such as concrete or paving slabs installed? If this is not feasible, can ground protection covers or other forms of ground reinforcement be used to prevent stone and dirt pick-up on tyres? Any contaminants spotted on the track should be removed straight away.

TRACK PREPARATION PROCESSES

INTRODUCTION

The aim of this section is to outline the typical tools and processes that are used on tracks to prepare a satisfactory and consistent racing surface. In subsequent chapters the focus will be on how to build a programme using these tools and the thought processes behind them. However, in this chapter, we are going to focus solely on the tools and track maintenance processes themselves.

WHAT ARE THE OBJECTIVES OF MAINTENANCE OPERATIONS?

The absolute priority when preparing a racing surface is that it must be:

- Satistactory for the dogs to race on
  - – offer good cushioning/shock absorption
  - – give grip to the dogs, especially when cornering
  - – provide a stable surface that does not change dramatically
- Consistent around the length and width of the track
  - – minimise variation if going due to camber and traffic
  - – hardpan should be uniform around the track and at no point less than 2.5 – 3″ from the surface
  - – watered to provide a uniform water distribution in the sand
  - – an even surface without significant dips and humps
- Tailored to the layout, geometry and sand used at that track

The golden rule of managing a greyhound racing surface is that trackstaff need to be in control of the racing surface rather than the racing surface controlling them. Trackstaff should have all the tools at hand they need to prepare the surface to a high standard, reading the track and its condition and adjusting maintenance operations to bring the racing surface back to optimum condition. Track maintenance, like preparing any other racing or playing surface, should be done in a dynamic and flexible way that means programmes and operations are altered to meet the needs of racing and the condition of the racing surface and the prevailing weather. A prescriptive approach may work most of the time, but it will catch you out.

There will be times that what you would normally do will not be enough or the wrong thing to bring the surface back to optimum condition. You must be dynamic in how you approach your maintenance reading the conditions of the track and weather to consistently achieve a high quality surface.

Perhaps one way to view maintenance is that once a track has been reset (decompacted typically with the power harrow or Track-Avator), as trackstaff you are then managing the decline of that racing surface until you need to reset it again. Your inputs and the racing schedule are what determines that rate of decline.

GETTING AWAY FROM "DIGGING IT UP"

This is such a loaded word in our industry. It naturally has negative connotations, which of course we know does not reflect what this process does or why it is carried out.

The new terminology we should use (and that some tracks are already adopting) is either "resetting" or "decompacting". Both have logical and positive explanations to give to trainers or those that ask.

Resetting is the process by which the hardpan and any surface inconsistencies are removed and the performance of the track "reset" back to optimum conditions (satisfactory and consistent).

Decompaction is a term often used in other sports industries and works well here. We are decompacting to get rid of compaction that has created hardpans or inconsistencies within the surface.

WHAT DOES A GOOD TRACK LOOK LIKE?

A good racing surface is one that the optimum balance of water between sand grains has been achieved and that the presence of the hardpan is below 2.5-3" from the surface. So what does the optimum surface look and feel like? It should have all the following qualities (examples shown in Figure 27):

- A texture that is between loose plasticine and soft icing on a cake.
- Clean paw prints with no obvious signs of slipping or deformation of the print when the dog is cornering.
- Little kickback of loose sand in corners or when exiting the traps.
- Paw penetration depth will vary between dogs due to their weight and paw surface area, but typically the paw print should be fully formed and typically about 1" in depth (ignoring toe and claw penetration).
- When at optimum water content, take a handful of track sand and form it into a ball. At optimum water content the sand should easily form and hold the shape of a ball and when gently shaken water can be seen to come to the surface, but that when agitation stops the water sinks back into the ball.

Figure 27. Examples of good racing surfaces

Ball test for water content assessment

Clean paw prints with good penetration

CHECKING YOUR TRACKS WATER CONTENT

You can use a moisture probe to quantify the water content in the track. STRI uses one during their visit to objectively measure water content. However, these can be expensive and need experience to interpret the readings (for example, salt application and compaction can both affect readings).

Thankfully, there is a tactile and manual test that can be carried out to assess optimum water content. This is the ball method track water test. To carry out this test do the following:

- Take a sample of sand covering the depth of the racing layer, enough to form a cricket/tennis ball sized ball of sand.
- Form into a consolidated and shaped ball and toss it gently from hand to hand.
- The ball should hold together and water should come to the surface but sink back into the ball when left alone.
- This indicates that the track is at optimum water content.

WHAT DOES A GOOD TRACK LOOK LIKE?

We know what a good track surface looks like, so what about a surface that has issues?

Below are some typical issues and their visual clues (examples are shown in Figure 28):

- Too much water in sand – standing water on top of the sand or creation of a sloppy surface, that when you ball the sand water drains out of it.
- Not enough grip – paw prints are deformed and show signs of slipping on bends and/or a lot of kick back of sand when dogs are exiting traps.
- Sand is too dry – excessive kick back of sand in bends, does not ball easily or water come to the surface when ball is agitated and may see signs of slipping in paw prints on bends (typically occurring with a lot of sand kickback).
- Too firm – shallow paw prints and potential signs of lack of grip, including excessive sand spray.
- Inconsistent water content or compaction – visually different depths of paw print across the width of the track and often can be felt underfoot (walk on heels of shoes and look at depth of indentation).
- Inconsistent camber across track width – obvious dishing on running lines or with tyre marks.

Figure 28. Examples of track surface issues.

Surface water pooling

Inconsistent track (shallow camber angle and ridging of sand on inside)

Sloppy track

Inconsistent track (wet on insde as shown by variable footprint depth)

Shallow paw print

Surface water pooling

HIERARCHY OF MAINTENANCE

This is a way to think about the maintenance you do and how often you do it (Figure 29). It can be useful to use this type of approach when discussing the complexities of track preparation with untrained staff or bystanders. Below is a diagram that hopefully should be self-explanatory, but which visually describes the types of maintenance carried out on tracks.

Figure 29. Hierarchy of track maintenance operations.

TRACK MAINTENANCE TOOLS AND PROCESSES

In this section, each of the main tools/processes used on greyhound tracks are described along with images of what these tools/processes look like.

TRACTORS

Most of the equipment use for preparation is tractor drawn, usually using the three-point linkage and, for powered kit, using the PTO. There are a wide range of tractors available ranging from small low horsepower (hp) compact units through to very large agricultural tractors whose hp is measured in the hundreds. So what types of tractors should tracks be using? There is no hard or fast rule for this. However there are some principles we can follow to guide our decisions:

- Evaluate what your track needs and what you are expecting a particular tractor to do. If it is just pulling the bowser or plate, then a lower hp tractor may be sufficient (25-40 hp). If it is for operating PTO driven kit, like power harrows or BLEC Track-Avators, then a higher hp unit may be needed (50-70 hp for example).
- Compact or larger tractor – this really is a personal choice and dictated by track need. Many tracks operate two compact tractors some operate once compact and one larger intermediate unit. There is no rule on what you need, you need to look at your track, what you are expecting the tractor to do and ensure the units you are looking at meet these requirements. It is all about having what you need, when you need it in a flexible approach. For example you can have a compact unit for plating and bowser work and then a larger unit with front loader for moving sand around.
- Bigger is not always better! Make sure the width of the tractor and the equipment it will be using are matched. For example, don't purchase a large tractor what is wider than your decompaction kit, otherwise you will not be able to work the track up to the inside rail, unless you also by size matched equipment (which may mean purchasing new equipment).
- Tyres – agricultural cleated tyres are not suitable under any circumstance. Turf or low-pressure balloon/floatation tyres should be used to spread the load of the tractor as evenly over the track surface as possible, which will reduce compaction risk. Also consider the tread pattern, go for an option with a minimal pattern to minimise taking foreign objects onto the track and reduce surface disturbance when the sand is wet.

- Consider your rolling factor for tyre packing – the amount of consolidation you get from your tractor is determined by the area of the tyre in contact with the surface and the weight being put through each tyre (axel loading data is useful here). Sometimes a larger tractor with bigger floatation tyres will put less pressure on the surface than a compact tractor with narrower turf tyres. This is not to say for tyre packing you must use a compact tractor with narrow tyres, rather that you should be aware of the effect you will have on the surface with any given type of tractor and tyre combination.
- How many tractors should a track have? Typically, tracks should have a minimum of two tractors, ideally, with both capable of carrying out all track preparation activities. This means that if one breaks down, track preparation can still be carried out, albeit with having to change from bowser to plate constantly. The optimal solution is for tracks to have three tractors so that if one goes out of service, there will be no impact on operational routines.
- Tractor attachments – One tractor (typically the largest and heaviest) should have a front loader to allow easy movement of sand around the track.

TRACTOR HEALTH AND SAFETY (H&S)

Tractors are a vital tool for track preparation. However, there are a number of risks associated with their use that staff need to be aware of and have processes in place to mitigate these risks.

One of the common risks associated with tractor use comes with working around running PTO shafts. All PTO shafts should be guarded and fitted with an approved guard and not an improvised one! PTO shafts maim and kill people every year. See below for further information regarding PTOs, their safe operation and general tractor H&S:

https://www.hse.gov.uk/agriculture/topics/machinery/safe-use-3.htm

https://www.hse.gov.uk/pubns/ais40.pdf

https://www.hse.gov.uk/agriculture/experience/machinery.htm

https://www.hse.gov.uk/pubns/indg185.pdf

Remember H&S procedures are there to protect you and your colleagues. Follow them and ensure other do as well, as when you work all the time with risks it is easy to become complacent and that is when things go wrong!

Examples of different tractor types, sizes and tyre configurations.

POWER HARROWS

These have vertical tines that rotate in a stirring motion. They are designed to break up surface layers and mix sand horizontally. They are very effective at breaking up hardpans and compacted sand as they "chew" through the profile. They can be used to redistributed sand or other additives into the racing layer, but are less effective at vertical mixing. There are numerous brands of power harrow, just as there are with tractors and other kit. As with most things in life, you get what you pay for so a cheap as chips unit may not have the longevity of a more costly and sturdier machine. Choose the best one you can afford as you will come to rely on it! It is also worth noting that for power harrows some of the tines are designed to rotate clockwise and for others on the same unit to rotate anticlockwise. Make sure you fit the correct tines to the rotation of the head (left or right rotation).

GETTING THE DEPTH RIGHT

With all cultivators (power harrows, rotovators and Blec Track-Avator etc.) know the depth of your profile, the depth you want influence and what depth your equipment is set to. This is to:

A. avoid hitting and tearing your geotextile membrane

B. ensure you are working the depth that you require

Always check the actual depth you are working by measuring it by digging down to the bottom of the cultivated layer and measure the depth to unworked sand adjacent to your run. You may think you are going in 6", but check, as you may be working a shallower depth as the sand "fluffs" up under the machine. You either need to adjust the depth settings or plan on a second pass.

TINE WEAR AND EFFECTIVENESS

New tines will give you the greatest effect on the surface. However, we are operating in sand and water which is like grinding paste, so wear on these components will be significant. You must monitor your rates of tine wear so you can change them when they are too worn to achieve your objectives. Have a new set in stock, as that means you have spares when you need them and something to compare to when assessing how much your tines have worn. Don't kid yourself that a stubby worn tine is going in 6", it won't be! This is why you should always check and satisfy yourself you are having the effect you want by measuring the effective depth of cultivation. It goes without saying your rate of wear increases with usage so make sure your tines are effective during the high usage summer months. You may need to be changing tines every 6 months or even more frequently if you reset/cultivate the track more often.

BLEC TRACK-AVATOR

This is bespoke piece of kit made for greyhound racing that had its origins as a turf scarifier/seeder. It has a series of slicing blades that rotate vertically and slice through the track sand "fluffing" it up and decompacting it. Originally designed to breakup frozen tracks, however some tracks use it for routine resetting/cultivation as it is more than capable of going down to 5" or below. If set up correctly it is a very effective piece of kit that can mix the racing layer quickly.

ROTOVATOR

These are land preparation units that have L-shaped blades that rotate vertically and are designed to break up compacted materials and mix them through the operating depth. There are two types which operate identically, other than the direction in which the blades rotate (top to bottom is a stone burier or bottom to top is a classic rotovator). The units commonly found on tracks were produced by Blec and called the Blec-Avator. These are stone buriers whose tines move from top to bottom, with this action designed originally to bury stones at the surface deeper within the profile. In practical terms, for greyhound purposes the direction of rotation is less important. These units are great for mixing sands and materials vertically. However, they are not often used as their action is quite aggressive and does have a tendency to move sand around a lot leading to greater regrading after use.

TYRE PACKING

After the surface has been reset/decompacted, the loose sand needs to be consolidated to create a stable upper surface which can then be prepared for racing. This consolidation is most often done with the tyres of a tractor which is driven around the track pushing the loose sand back into place. It is important to check track water levels as tyre packing dry sand is futile, as is a sloppy wet track. There needs to some water in the track which lubricates the sand grains to give the optimal consolidation. There are no prizes for driving the tractor fast or the distance covered. Tyre packing is best done at a slower speed where the full impact of the weight of the tractor can be brought to bear. Also, after a certain number of passes the sand won't pack down anymore unless we change the packing conditions, i.e. the water content of the track or the weight being imposed. Tyre packing for hours and hours is therefore

futile. When tyre packing, it is vital to check the effect you are having and to allow trackstaff to gauge when enough packing has been done. The motto should be "pack, check, pack, check and are you there yet?". Beware, not achieving sufficient packing will lead to an overly soft and potentially inconsistent surface. Also be mindful of the weather, until the sand is fully packed there is greater risk of a sloppy wet track if there is heavy rainfall. It is also important to check the weather forecast before commencing track resetting to ensure there is not risk of rainfall that could affect surface conditions.

MESH HARROW

This is an traditional method which is not often used these days, but which can be very effective at levelling the track. It involves dragging a heavy gauge metal mesh around the track which removes excess material from high spots and relocates this material to low spots. The result is a surface which is smoother with fewer lumps and humps.

PLATING

The aim of plating is to create a smooth finish to the racing surface. On a prepared surface during racing, plating is done to fill in paw marks and to create a smooth and polished finish. During preparation for the meeting, plating can also be used to move sand from high areas to low areas and to gently modify the racing camber. This is achieved through the setup of the plate, which will dictate how aggressively it cuts into the surface. It is important to note that, if you want to fill in paw marks, it is vital to accumulate a loose crumb of sand in front of the plate that can then drop into low areas. Without this crumb you will only be smoothing the surface and not filling in the holes.

Also to note, wet sand is more "sticky" than dry sand, so when plating a wet track the tractor needs to tow the plate slower. If you travel too fast undulations can occur as a result. Finally, be aware of how any excess crumb is released when the plate is lifted to exit the track. If this is not done gradually, you can form a hump at the vehicle exit point. As always, check the effect you are having and adjust your plate accordingly.

There are two types of plate commonly used. All have a thick rubber mat installed under the metal plate. It is the rubber that is in contact with the sand and which smooths the racing surface. Additionally all plates tend to have some sort of tines attached, the reason for this will be discussed in the next section. The first type of plate is the older SISIS Quadraplay style machine. This has sections which can have a number of tools attached, such as plate, brushes, spring tines etc. Each attachment can be adjusted individually by hand and so for dynamic adjustment you need two people to carry out the operation. Most often these plates are operated and then stopped to allow adjustments.

The second type of plate, and one which is commonly seen on tracks, is the GT Hare hydraulic plate. This is s a very robust and well thought of design. The typical configuration is the plate at the rear with a set of knife tines installed forward of the plate. Sometimes as well as the knife tines spring tines are also fitted. The purpose of the different tines will be discussed in the next section. What makes this plate design unique is the hydraulic controls which allows dynamic adjustment of the plate whilst it is being operated. This gives huge potential to adjust the track quickly and in response to the prevailing conditions. It also means that the operator has to be well trained to understand the impact that even a small adjustment to the hydraulics can have. In the hands of a skilled groundsperson this is a potent tool.

TINE HARROW AND PLATE TINES

This category of machine/tool uses tines that penetrate the sand surface. The intention of inserting tines into the ground is to in some way "fluff up" the surface and in some cases keep the racing surface free from compaction. The first group of tine based tools are those fitted to plates. All plates in service have some form of tines fitted, whether they are spring tines or knife tines (see photographs differentiating the two).

Spring tines are less effective at decompacting the surface but are very good at creating a crumb in front of the plate to fill in paw prints. Knife tines can also create a sand crumb, but also they are much more robust and can be inserted deep into the profile and assist with keeping the racing layer hard pan free. The caveat is that neither of these tines types are effective at removing existing hardpans as they tend to bounce over the compacted hardpan layer.

The second group of tine-based tools are variations on the levelling harrow. This type of tool consists of consecutive rows of thick and robust pins that are pushed into the surface by the weight of the machine and which often has a crumbler roller on the back. As the tines move through the sand they agitate it thereby helping to prevent the formation of overly compacted hardpan layers and in this role they can be very effective. These are commonly used when preparing sand based equestrian surfaces, to achieve the same goals as they would when used on a greyhound tracks, namely to fluff up the surface and prevent compaction. However, as with tines on plates, once hardpan has formed these levelling harrows will tend to bounce over the compacted sand.

All of the non-powered tine-based tools are effective when used frequently to prevent compaction. Therefore, their role is to slow the rate of decline between resetting/decompaction operations. They are not effective at removing existing hardpans!

GRADING

There are many different terms used in the greyhound racing industry for this such as grading, cutting and recambering. They are all referring to the process by which eroded sand is pulled from the bottom of the track back to the outside, thereby re-establishing the tracks desired camber angle. This is done with a specifically designed bar or blade that is adjusted at an angle to cut into the sand and move sand upslope. It is a vital process to ensure that a consistent camber of the appropriate angle is cut into the sand around bends in particular. It can also be useful to allow sand that has migrated around the track to be pulled back into place. A well-adjusted plate can also be used for moving smaller quantities of sand and for levelling. If significant quantities of sand need to be moved or pulled up the track, use of a dedicated grading bar/blade maybe the best option.

RAKING OUT

This is the process by which excess sand washed under the inside barrier and pulling back onto the track to be distributed where needed by the plate. This ensures sand is not wasted and can be used before being contaminated. It is also useful for dealing with raised mounds of sand that may have gathered on under the inside barrier and which may be inhibiting water movement. This process is a manual one that is often completed with the back of a rake and should be done regularly.

HARE RAIL CLEANING

Inevitably sand will enter the hare rail, whether it is blown in, washed in or carried in on maintenance equipment. As the sand level builds up it increases the wear on hare rail system components, especially the cable/rope. This build up of sand should be removed regularly and tracks tend to do this by dragging a cleaning bar through the rail, pressure washing out the sand or when dry, using a modified leaf blower to blow out the sand.

Examples of blowing small volumes of sand out of the rail or using a scraper to manually remove sand accumulations.

IRRIGATION/WATERING

As has been mentioned throughout this manual, greyhounds race on a mixture of sand and water. The sand is already in place on our track, what trackstaff need to do is to apply water in the right amount, to the right locations, in a timely fashion to create a consistent surface. The water needs to be in the track, not on the track!

The best form of irrigation is what naturally falls out the sky. Persistent light to moderate rainfall creates a consistently watered racing surface that is hard to beat. It is the job of trackstaff to try and replicate this as closely as possible using all the potential methods available. It is likely that a combined approach with different methods would be needed to achieve the optimum result and there certainly is not "one size fits all" due to the impact of weather, racing schedules, track sand type, track geometry, infrastructure and available resource.

What we are looking for is a track with enough water to give a soft plasticine like texture, which is yielding to a greyhound's paw, whilst offering enough grip that the paw print does not deform when cornering. If too dry or too wet, a greyhound will not be able to get sufficient grip and may not have sufficient cushioning/shock absorption. The best way to think about it is the well used beach analogy. Where the sand is dry at the top of the beach, it is soft but

not stable or comfortable to run on. Likewise, where the waves are breaking the sand is sloppy, soft and does not offer good grip. Further up the beach where the tide has been gone for a while,
the sand is damp but not wet, it is grippy but too firm with poor paw penetration. The area where the waves are no longer coming in but the sand is wet is ideal. In this area, a paw would penetrate the surface easily giving cushioning as well as being grippy and stable. It certainly is not sloppy with water at the surface.

Water tends to be applied in one of three ways on a track. Each will be outlined below along with advantages and disadvantages:

Sprinklers

Two types of systems have been used. One is using impact heads on poles mounted on the inside of the track. The other is a pop-up system installed either in the ground or elevated behind the inside barrier.

Advantages

- No compaction to the track surface as no machinery is used on track.
- Automatic or manual control.
- Automatic controls allow water to be applied when no-one is there.
- Give rain like effect.
- Good for keeping water levels topped up in track, especially between fixtures or to allow watering to start early on hot days.

Disadvantages

- Prone to coverage issues even when there is a moderate wind.
- High initial costs for installation.
- Requires servicing and recalibration to maintain optimal coverage.
- Pop-ups have moving parts that may not react well to sand ingress.
- Not really suitable for final water applications or in race meetings.

Hand watering

This is where hoses are used to apply water to the racing surface. Hoses and nozzles can vary from ½" domestic units to 1-1.5" fireman's hoses. The output of water being determined by a) pressure in the line and b) the diameter of the hose.

Advantages

- No compaction as no vehicle traffic on track.
- Targeted water application to apply what you need exactly where you need it.
- With high output set up you can put on large volumes quickly, whilst also replicating rainfall.

Disadvantages

- Relies on well trained staff to apply water correctly to the areas that need it.
- Can be easy to washout sand or not get an even application of water creating an inconsistent surface.
- Relies on having the right capacity of flow and the appropriately matched hoses and nozzles.
- Needs more staff resource and time to water the track
- Cannot water in meeting purely with hoses.

Bowsers/tankers

Essentially these are tanks with outlets to spray water onto the track surface and are towed behind a tractor. There are many different types from large agricultural bowsers that can output a lot of water quickly, through to small plastic bowsers that are designed to apply smaller volumes of water. Water can be applied using single or multiple deflector plates, spray nozzles or dribble bars. Multiple nozzle units tend to have the ability to turf on and off specific nozzles to give more control over where water is applied (inside, outside or both). Most units run of a pump but many can also be run with water coming out under gravity. Bowser watering is the most common form of water application and is solely used for watering between races.

Advantages

- Can apply a lot of water quicky
- Can target where water is applied (inside, outside or both)
- Easy to water between races
- Easy to train staff on correct procedures for water application
- Relatively low cost

Disadvantages

- Weight of bowser and water compacting the surface
- Single outlet models lack level of control that might be desired
- High output models run risk of eroding the track
- To get best efficacy often several bowser types are needed (large for initial high output watering and then small for final preparation watering)

Watering strategy

It is vital that the sand profile does not dry out. If it does, it takes time to rewet it (longer than you think) and get water levels back to optimum. The strategy should be to keep the track with adequate water, even when there is no racing. This means that race preparation is a topping up exercise rather than having to significantly rewet the sand profile.

It is also important to realise that on dry days the track will initially soak up irrigation water like a sponge. However, as the upper sand profile becomes more wetter, the rate at which water will move into the surface slows and ponding occurs. Standing water at the surface is not what we want, therefore water needs to be applied over a longer period of time and early enough in the day to allow effective infiltration and consistent wetting up of the sand profile.

With cambered surfaces, how and where the water is applied determines the consistency of the racing surface. The outside of the track (top of the slope) will dry our quickest and the water travel under gravity down the slope wetting the inside. Therefore, if we apply water evenly to the whole track surface it may mean that the inside will become wetter and softer than desirable. Therefore, consider where you are applying your water. Often applying more to the outside is a good idea to get water levels up in these perennially drier areas and let gravity take the water to the bottom of the slope.

How often water is applied is dependent on weather and how well your track sand holds on to water. Frequency of water application between races needs to be judged based on actual track conditions, rather than a predetermined schedule. Be flexible to react to the prevailing conditions and proactive in maintain the optimum surface. Don't fall foul of the "we always bowser after every four races" and on the last race the track is becoming too dry. Inspect your racing surface after each race, there is plenty of time in the meeting to do this and it has the advantage of demonstrating the care taken to produce a satisfactory and consistent surface for every race.

Be flexible in your thinking, use all the tools at your fingertips to get the amount of water down, when you need it and where you need it. In an ideal world pre-racing water would be done without having to use bowsers, such as using a good quality, high output hose with a well-trained operator, with final finessing and in race watering done with a lightweight bowser. If you can't do that, then look at the resources and tools you have and formulate a plan to get the water on with the least possible compaction caused to the running surface.

SALT APPLICATION

When we talks about salt, we are actually talking about sodium chloride (NaCl) which is the same stuff we put on our chips! Salt application is vital in cold weather where there is a risk of tracks freezing.

Just as when salt is applied to roads in winter, salt application means that water will freeze at much lower temperatures, thereby giving protection below 0°C. It is important to note that salt will not protect to all sub-zero temperatures. Typically, it will give benefit down to between -4°C to -5°C.

Salt needs to be applied in advance of frozen conditions. It is important to understand that when a track freezes, it is the water in it that freezes and not the sand. For salt to be effective, it must be dissolved in the water in the track. Granules of salt will not prevent freezing if they are sitting in or on the sand undissolved. It is also important to realise that once a track is frozen applying salt is unlikely to be of significant benefit, because the only way to melt the ice is to apply energy (in the form of heat, such as with the sun's rays). A frozen surface needs to be worked, worked and worked again, as the friction caused by the rubbing of ice and sand together will generate energy and small amounts of heat that can speed up melting. Once things have started to melt, application of salt can help to prevent refreezing.

Salt used on tracks tends to come in three forms:

Rock salt – large/coarse granules of hard salt rock that are dug out of the ground. Typically, takes longer to dissolve than other types of salt due to the hardness and size of the granules. Often worked into the upper track profile well in advance of cold weather to give a baseline protection from freezing. Care should be taken to ensure that large lumps of rock salt are not present in the upper racing layer as they would act in the same way as stones.

PDV granular salt – fine granular salt for either industrial use or animal/ human consumption. Produced by evaporating salty water to produce consistent and pure fine crystals. Often used immediately before potential freezing conditions, usually worked into the upper profile and spread on the running surface. Again, needs to be dissolved to be of benefit. This grade of salt is easy to spread and get a consistent coverage.

Brine – Brine is a solution of salt, i.e. where salt has been dissolved into water already. Created by mixing salt with water in a bowser and applying the solution to the track surface. This has the advantage of the salt already being dissolved so will take effect more quickly, but also won't protect below -4 to -5°C as it will freeze. There is a limit to how much salt can be mixed in a bowser of water (this is determined by the solubility of the salt which should be given on the MSDS – material safety data sheet). For most PDV salt, per litre of water you can dissolve 350 g of salt. However, the closer you come to the solubility limit, the harder it becomes to dissolve more salt and the longer it will take. Agitation through stirring is often vital to help with speeding up the process. Do not add your salt to the bowser before putting in the water, which at best will result in undissolved salt and the bottom and at worst a brick of salt that is difficult to get rid of. Fill your bowser to at least ½ full, ideally ¾ full and start adding the salt slowly. This should allow you to see how well it is dissolving and you can stir with a stirring rod to speed up the process. You could even use a paint/cement stirrer to help with agitation to speed up the solubilisation of the salt.

All forms of salt will cause corrosion to metal, whether it is a hare rail or other infrastructure, as well as machinery. Those using brine will use a plastic bowser to reduce the corrosion risk to a metal tank and fittings.

Granular salt tends to be applied with either a disc type spreader (spinning disc throws salt across surface) or with a drop spreader which drops the salt directly onto the surface. Note that clumpy salt will not spread evenly and can risk blocking the spreader resulting in poor consistency of application and therefore inconsistent protection from freezing. On this note, storage of granular salt is important as it absorbs water from the air creating clumps or at worst one solid brick of salt. This is not ideal as the salt will require breaking up before being able to be spread and even then, if the salt is not comprised of broadly the same sized granules it will not spread evenly. Therefore, it is well worth protecting salt from absorbing water by storing indoors or at least underneath protective covers.

For optimum frost protection, it is important to know your track. Often certain areas will freeze first and thaw last. Often this is associated with the location of track buildings and the position of the sun in winter. These high risk areas should be given the maximum protection, as any section of frozen track (wholly frozen or with chunks of ice in it) will prevent racing.

If the track is frozen (partially or fully) or there is perceived to be any risk to the safety and welfare of dogs running on the surface, racing should be delayed or called off. If it isn't satisfactory and fit for racing, we should not be running dogs on it!

A well know side effect of applying salt is the risk of wet weather. Rainfall or heavy irrigation will mean a salted track risks becoming soft, with a sloppy surface. Further work needs to be done to evaluate methods to prevent and remediate when this happens such as flushing the salt out with water/wetting agent or surfactant/application of calcium. With cold winter conditions become less common with climate change effects means that hopefully this becomes less of an issue.

Alternative frost protection materials have been investigated before, such as the use of magnesium chloride ($MgCl_2$). These operate in the same way as traditional sodium chloride salt (NaCl). Magnesium chloride was found to be effective down to -2°C but was significantly more costly to purchase and was still very corrosive to metal. The solubility of magnesium chloride is much greater than sodium chloride, as 530 g magnesium chloride dissolves in 1 litre of water compared to 350 g of sodium chloride. This means that magnesium chloride would be a better brining agent as more can be dissolved more easily, as compared to traditional salt. The cost in particular probably explains why it is not commonly used. GBGB continues to look at alternative materials for use in preventing frozen tracks in winter.

TRACK COVERS

Another commonly used method to protect tracks from frost, excessive moisture and speedway debris is the use of covers. Different types of covers may be used to protect against each of the issues. Frost covers work by trapping air on top of the sand creating an extra insulating layer which keeps more heat in the track sand, hopefully preventing it from freezing. Thermal insulated covers have also been used to increase the insulation effect. The use of multiple layer covers should be investigated further, such as fleece germination sheets laid onto the surface and then traditional tarps laid on top to create more thermal insulating layers.

Covers to protect the sand surface from excessive water and speedway debris need to be hardwearing, durable and impermeable. These can also be used to help with frost prevention but may not be as effective as specialist thermal insulation covers.

Covers will only help when the track is already frost free. They need to be used well in advance of freezing conditions, as they only trap the existing heat in the track and cannot build up more heat, so the more temperature we have in the surface the greater the protection that is offered.

Covers can be time consuming to deploy, so make sure there is adequate resource available to deploy them. When removing covers, ensure all debris is brushed off prior to cover removal to prevent this from dropping on to the surface and contaminating the track sand.

Example of covers being used at Swindon.
Photo courtesy of Cozee Covers.

NEW AND EMERGING MAINTENANCE TECHNIQUES

The main issues that arise with tracks and the performance of the racing sand range from excessive and/or inconsistent compaction and water retention, drainage issues and layering with the track profile through to stone contamination. Techniques and equipment are currently used to help mitigate these issues, but other sports surfaces and industries utilise different tools that can potentially be of great benefit. Some of these tools are starting to be trialled and used by trackstaff to help tackle challenges with less impact on the racing surface. Several examples are given in the call out boxes in this section.

The greyhound racing industry should not be afraid to look at what other industries are doing to solve some of the same issues faced on tracks. It is far easier to repurpose an existing tool/machine, as they will typically be mature technology with a proven track record, just not in greyhound racing. Be open minded, look for solutions that will tackle the challenges faced when operating and maintaining a track. Don't be afraid to trial different approaches, as after all we are maintaining a sand which can be "put back" into racing trim a lot easier than many other high performance sports surfaces.

DECOMPACTIVE AERATION

In most other sports, compaction of the playing/racing surface is a major issue. Tools to decompact these surfaces have been used for decades. One such tool that has occasionally been used on tracks and is now being looked at again is use of decompactive aerators such as the Verti-Drain (often just as Vert-Draining) or the Wiedenmann Terraspike. This operation works like hand forking by fracturing the sand and breaking up compaction, but without causing significant surface disruption and the need to tyre pack the track. It can also be used to help provide pathways for water held in the track to drain into permeable sub-bases.

AIR-INJECTION AERATION

There are a number of aerators used in sport turf management that use air injected into the surface to decompact it. This approach, like Verti-Draining, creates minimal surface disruption. The SISIS Aer-Aid has been trialled on a track. It does not have the depth of operation of a Verti-Drain, but it has other benefits. When it was used on a wet track with water trapped in the surface layer, the air forced the water to the surface and it then drained deeper into the profile down the tine holes resulting in a more consistent and less sloppy running surface. This type of tool may be very useful in winter management when a surface is holding on to too much water.

SAND CLEANERS

The presence of foreign objects in tracks is an ever present risk and poses a hazard to paws and lower limb joints of greyhounds. Tracks with stone or speedway contamination know only too well the issues that can be caused. Trials have taken place with sand cleaners, similar to those used on beaches and other sand-based surfaces for removing stones and other debris. These have shown the benefit of using these sand cleaners to remove foreign objects. Examples of sand cleaners include the Barber Sandman 850, Barber Sand Man TT and Pinguino Sand Cleaner.

ESSENTIAL TRACK MAINTENANCE EQUIPMENT

It is vital that trackstaff have at their disposal the equipment they need to prepare the racing surface to an acceptable standard for satisfactory and consistent racing. Each track must have suitable equipment provision to allow trackstaff to deal effectively and in a proactive way with any issue or situation that could occur under normal conditions, including wet, cold or hot weather.

To ensure satisfactory operation of the racing surface, trackstaff must not only have the right equipment (serviced and fully operable) but should also have the relevant training and experience to operate it. Likewise, tracks must have enough staff onsite to effectively manage the racing surface and all operations either before or during a race meeting.

To provide guidance, the following section provides details on the minimum equipment that should be available and in fully functioning condition for every race meeting. Failure to provide this minimum level of equipment significantly increases the risk of producing a poorly performing and inconsistent race surface, that potential presents a welfare issue to greyhounds running on the surface.

Whilst it would be ideal to have duplicates for all equipment used on the track, this is not practical for most tracks. However, certain apparatus should have a suitable back-up to ensure the continued, satisfactory operation of the racing surface. For example, if the track has a bowser and it cannot operate under gravity, if the pump fails and the track has no other means of applying water (which is essential to producing a satisfactory and consistent running surface) then this will jeopardise the race meeting.

MINIMUM EQUIPMENT LIST

Below is what would be considered to be the minimum level of equipment provision to be able to prepare and operate a track:

- 2x tractors (of suitable size and specification for track usage and fitted with low pressure non-agricultural tyres).
- 1x plate (Quadraplay style or GT Hare hydraulic style) with suitable tines for "fluffing" the surface for repair of paw prints.
- 1x bowser of sufficient capacity to water the track in 1 pass and with ability to gravity feed in the event of a pump failure.
- 1x decompaction tool (power harrow or Track-Avator types).

- 1x grading bar/blade (a tool for recutting a camber back into the track surface).
- 1x salt spreader for winter preparation.
- Suitable water storage capacity and delivery to ensure adequate water supply for at least 1 complete meeting, but ideally 2-3 meetings, in case of key infrastructure failures such as borehole pump.
- Selection of hand tools for localise preparation of the surface such as rakes, shovels and workshop tools for replacement and repair of on track infrastructure and adjustments to equipment.

It must be noted, that this is a minimum equipment list and many tracks will need greater level of provision to meet their basic needs. It is recommended that tracks assess their individual needs in light of their geographic location, track sand, track geometry and racing schedule and ensure they have suitable equipment to tackle likely issues that could occur during preparation and racing.

In addition to the minimum equipment list, it is recommended that tracks also have:

- Third tractor, potentially with a front loader for materials handling.
- Back-up water application method (spare bowser, hoses, sprinkler system).
- Spare plate in case the primary plate fails.
- Rotovator or stone burier for vertical mixing of sand or as back-up to power harrows in the event of the latter's failure.
- Fixed pin levelling harrow or similar to be used between decompactive aeration to prolong the window of satisfactory operation before a hardpan develops too close to the racing surface.
- Mesh drag harrow to level the surface following tyre packing or other surface disruptive maintenance.
- Frost covers to protect the racing surface from freezing.
- If the track has speedway, track covers are essential to prevent contamination. These can also be used to minimise water loss from the surface under hot weather conditions or prevent excessive rain from entering the track in very wet weather.
- VertiDrain or similar decompactive aerator to deal with deep compacted layers, improve water movement in winter and to decompact a track quickly with minimal surface disruption.

SPARES

It is also vital that tracks keep a stock of both high wear consumable parts for equipment (such as tines on power harrows) but also key infrastructure (such as rope, actuators, pulleys, hares, tyres for hare system). Each track should look at its operation and assess the risk to the safe and continued operation if a part or component was to fail on a piece of equipment or track infrastructure. If the failure of that part meant operations would have to stop, a spare should be available to ensure operations are able to continue or start again as soon as possible. For example, if an actuator were to fail that operated the traps, a suitable spare should be available to ensure minimal disruption to track operations.

TRACK MAINTENANCE OPERATIONS

INTRODUCTION

You cannot run a track or a race meeting in a prescriptive way. There is no "one size fits all" approach. When building a track operation schedule/programme, it must be flexible and able to respond to the prevailing conditions, whether that is weather or usage driven. Plans need to be able to change according to the situation, which is why successful tracks have the right equipment in the hands of well trained and experienced staff who are empowered to react to what they see in front of them or what track data is telling them. If you hadn't guessed already, one of the key messages that will be hammered home in this section is "prescriptive approaches cause problems, whilst flexible ones solve them".

MAINTENANCE SCHEDULES AND SCHEDULING

The factors that you need to consider when designing your maintenance schedule need to be track specific and will include:

- Racing schedule
- Climate and seasonal effects
- Sand type
- Track layout
- Staff resource
- Maintenance equipment availability
- Infrastructure that needs looking after

A track's maintenance schedule needs to reflect the track and how it is used. As one or more of the factors listed changes, the schedule or plan will also need to adjust to accommodate this (see example in call out box). This is why the plan needs to be flexible and can never be prescriptive. We also need to appreciate the cascade effect on how plans may need to change. In the example in the call out box, the response to a specific change in conditions (in this case hot weather) has resulted in knock on effects on adjusting the plan to account for this. This meant the programme had to change to account for the impact of the change in frequency of watering and the impacts that had on compaction and its remediation.

EXAMPLE OF HOW MAINTENANCE PLAN NEEDS TO CHANGE

Let us take the common situation of watering during hot weather. It goes without saying that in hot weather watering frequency needs to change. We will need to apply water more often prior to racing and during the meeting. So if we put on 4 bowsers before racing and then every 4 races, our programme needs to be sufficiently flexible to allow watering intervals to be changed. So now we might need to apply 6 bowsers before racing with watering starting earlier to allow water to soak in. We may now need to water more frequently during the meeting, so the interval changes from every 4th race to every 3rd race (the exact values of course depend on your track and your situation!). We can see that a change in condition necessitates a change in the maintenance plan.

However, this change also has a knock-on effect. If we run the bowser round more times, we are creating more compaction, which means decompaction/resetting will need to carried out more frequently to address this. This will mean finding more windows in the racing schedule to allow this vital maintenance to be completed. Hence why a track maintenance programme needs to be flexible and not prescriptive!

Whilst a maintenance schedule or plan needs to flexible to meet changing conditions, we need to take on-board the experience from what has happened before and what was successful and incorporate that into the plan. Don't reinvent the wheel, but take the key learnings forward, along with an expanded understanding of what makes a good racing surface and use that to shape a maintenance programme.

It is also vital that tracks avoid "kneejerk" reactions to issues or challenges. It is critical to take stock when an issue occurs, look back through history for responses that were effective at tackling it or if it is new issue look at the causal factors and develop a plan to resolve them. Seek help and guidance from others, such as GBGB's Track Liaison Officer or STRI (see the chapter on getting support later in the guide). Also be aware that changes in a programme sometimes take longer than you would think to come into effect. If a change is made to the programme give it time to take effect and keep monitoring the impact. The worst thing you can do is to keep chopping and changing constantly and without truly evaluating the effect you are having.

FREQUENCY THAT OPERATIONS ARE CARRIED OUT

It is essential to realise that there is no one maintenance programme that is best and will work at every track irrespective of location, layout, sand type and racing schedule. The frequency that operations are done is entirely determined by the condition of the track and what the racing schedule and prevailing weather is at the time.

The maintenance programme must be flexible and dynamic, reacting to what the track is telling us it needs, to allow the best possible, satisfactory and most consistent running surface to be produced.

The ability to adjust plans based on the detailed knowledge of how a track changes over time and operation is essential. This is to ensure that the most relevant track preparation is carried out at the best time to get the maximum benefit. What has been discussed throughout this guide, in terms of maintenance being dynamic to conditions and flexible and not prescriptive, is a way of thinking. This approach needs to operate to account for season, weekly, daily and, most importantly, race by race changes. To achieve this trackstaff must be fully engaged with reading their racing surface, whilst understanding how it does and will change under any set of circumstances. This will require different threads of evidence being assessed to allow informed decisions to be made. This will mean interpreting the tactile feel of the racing surface and how a paw interacts with it, working hand in hand with quantitative monitoring data, such as use of the penetrometer to measure the firmness and compaction of a running surface.

CONSISTENCY IS EVERYTHING

Producing a consistent racing surface is the aim of best practice track maintenance. Ultimately, this means the racing surface should be uniform in its performance both around its entire length and across the whole width of the track.

KNOW YOUR TRACK

To be able to understand how your track changes with season, between resetting operations, on a daily and race by race basis, trackstaff need to have a detailed knowledge of how their track profile works under their unique conditions. To do this, trackstaff need to walk and monitor the track regularly. Below are best practice guidance on how key decision makers interact with the racing surface:

- Walk the track before the start of the days preparation to understand if their plan going to meet their objectives.
- During preparation, the surface should be monitored to ensure that preparations are having the desired effect.
- During the race meeting, the track should be walked to ensure that interaction of dogs with the surface is good and if adjustments are needed to the preparation programme they can be implemented. This should be done on a race by race basis to ensure the surface is optimum for every race.

It is not best practice is to stick rigidly to a preformed plan irrespective of what is happening on track. For example, if the track surface is drying our quicker than expected, sticking rigidly to "we water every 3 races" approach will not create the safest and most consistent running surface. Our watering frequency must change to meet the prevailing conditions.

How often and when particular operations are carried out will be governed by the following factors (which have been discussed at length throughout this guidance):

- **Racing schedule** – this determines windows of opportunity for decompactive or renovation works, but also the rate at which the track will become more compacted. More racing = more compaction therefore the profile will need decompaction more frequently.
- **Climate and seasonal weather** – cold and wet winter weather will necessitate different frequency of maintenance and season specific operations (such as salt spreading and use of thermal covers), whereas hot summer conditions will mean more watering and greater compaction issues with the additional vehicle traffic.
- **Sand type** – some sands and profiles will hold more water so watering frequency is reduced, but may need more work in winter during wet weather. Knowing how your sand reacts is vital in its preparation and planning what should be done and when.
- **Track layout** – drainage infrastructure, topography and geometry of the track will affect the racing surface and therefore the processes needed to prepare it. Not to be overlooked is the effect of surrounding buildings, for example, in winter these can cause areas of the track to freeze or stay frozen for longer due to their shadowing effect.
- **Resource availability** – available staffing levels and maintenance equipment availability and condition, will directly influence the ability to carry out necessary operations. The scheduling of preparation and the processes required will be influenced by the available resource. It should be noted that if a track is to be prepared for racing it needs to have the minimum resource required to be successfully operate.
- **Condition of infrastructure** – if the track's racing infrastructure is in poor condition it will require more frequent maintenance and inputs to keep it running. At all times, the key infrastructure required for racing should be of a suitable standard and condition to be able to carry out its function safely and consistently. If this is not the case, it should be repaired or replaced as soon as possible.

There are a number of track characteristics that need to be considered on a regular basis to devise that day's preparation for a race meeting. These characteristics have been discussed throughout the guide and would include, but not be limited to:

- Weather conditions in the lead up to and during racing.
- Levels of compaction and depth of hard pan.
- Track water content.
- Consistency of racing surface around whole track.
- Consistency of surface levels.
- Camber across the track and its consistency around the track.

- Build-up of sand in unwanted places (under inside rail, outside of track, around traps, vehicle access points and hare rail).
- Presence of foreign objects such as stones or shale.
- Level of cushioning and grip available to greyhounds running on the surface.

RACE MEETING PREPARATION

Without being prescriptive, the typical processes carried out to the racing surface in preparation for a meeting will depend on how the track is performing. If the tack is getting too compacted, decompaction work should be done to remove the influence of any hardpan. The typical processes involved would include:

- Decompaction with power harrow/Track-Avator.
- Tyre packing to consolidate the decompacted but loose sand back into a racing surface.
- Plating or minor regrading to pull back any sand moved down slope by decompaction.
- Watering and plating in combination to bring the track back to race condition.

It is important to note that the effectiveness of each of these operations needs to be monitored so that preparation can be adjusted as needed. For example, has sufficient tyre packing been done across the track width so that a consistent surface has been created. It is also noteworthy that after decompaction, water levels in the track with be measurably lower as trapped or locked up water is released into the lower profile. This will mean more water will need to be applied to bring track water levels back to optimum.

If the hardpan has not risen too high in the track profile, then routine race preparation would include the following:

- Pulling out any sand build up under the inside rail to prevent a sand ridge forming that can trap water on the inside creating inconsistent going across the track.
- Minor regrading to ensure a consistent camber and levels across the running surface.
- Use of knife tines on a plate or levelling harrow to keep the upper surface open and reduce the likelihood of pan formation in the racing layers.
- Plating and watering to achieve a consistent and optimally moist running surface.

These processes of course need to adapt to local and seasonal conditions. For instance, in summer months watering will be needed to start earlier to ensure adequate time for it penetrate into the sand profile and more water will likely be needed to replace increased evaporation losses.

SUMMER WATERING

As well as increasing the amount and frequency of water application, a significant consideration in summer is keeping water levels in the track. This is vital to prevent the surface from drying out, which often means applying water on non-race days to keep water content topped up. This avoids the need to chase water levels on race days and ensuring water can seep gradually into the track profile, more closely mirroring the effect of rain. Keeping on top of track water content allows the racing surface and its preparation to be at its most resilient to changeable conditions and situations, whilst allowing groundstaff to have greater control over the racing surface.

It is impossible and not desirable to have a prescriptive approach to track preparation. The most important thing is that a satisfactory and consistent racing surface is produced, the processes, their frequency of implementation and the order they are carried out must be determined based on local conditions and the nature of the track surface being prepared. What is vital is that the effect of all track maintenance processes are monitored by groundstaff so that best possible racing surface is produced as efficiently and effectively as possible.

SOME GOLDEN RULES FOR TRACK PREPARATION

Below are some golden rules to help shape your thinking when it comes to track preparation on race day:

- Be flexible and not rigid or prescriptive in how you approach track preparation.
- Understand the processes and tools available and how to get the best out of them.
- Know your starting point and where you want the racing surface to get to.
- Prevent problems from occurring by tackling surface issues early or before they manifest themselves in the track.
- Assess the condition of your surface and the effectiveness of your maintenance inputs.
- Be visible to all those at the track during race meetings, be engaged with the racing surface and carry out frequent track walks to assess how your surface is performing and changing.

RECORD KEEPING

As with all industries, keeping records is vital in the smooth running of greyhound tracks and the preparation of racing surfaces. The objectives of keeping records include:

- To demonstrate that processes and checks are being carried out.
- To allow historical analysis of track or equipment performance.
- To facilitate thorough investigation of incidents either on track or off track.
- To conform to statutory requirements and to protect the health and safety of staff and visitors.
- To help facilitate training of new members of staff.
- To enable effective review of:
  - Staff performance
  - Equipment effectiveness
  - Process efficacy and efficiency
  - Track and environmental conditions

Without adequate records it is very difficult to unpick what has gone on in situations where an issue has occurred, especially given the multitude of factors needed to be considered in the investigation process. Put simply, without adequate records it is typically impossible to get to the bottom of what has occurred and more importantly why and how this can be prevented in future.

Below are the type of records that tracks should be keeping in relation to the racing surface, the processes involved in preparing it and how this preparation is carried out. This list is indicative of commonly kept records, but is not necessarily exhaustive, you may find other types of records that are of benefit:

- Track maintenance records to show what work was carried, where it was done, when it was completed, who did it and was the outcome checked.
- Track map of problem areas such as where injuries occur or location for concentrations of stones or other foreign objects.
- Surface assessment data if measurements of pan depth, penetrometer readings and track water content are taken.
- Weather information that affected preparation and racing (for example, temperatures, rainfall, frost incidence etc).
- Checklists to define what jobs need to be done, who did them and when and were due diligence checks completed.
- Check sheets for equipment maintenance.
- Equipment servicing records and calibrations (if needed).

- Records of processes and how they are to be implemented. For example standard operating procedures (SOPs) or methods statements for processes carried out on the surface.
- Statutory health and safety records, such as risk assessments, training records, accident logs etc.
- Staff training records to demonstrate who is qualified to do what, official certificates of training (e.g. first aid or tractor training) and inhouse training logs.
- Personnel records, staff appraisal records and personal development plans.
- Incident investigation records, for example, when serious injuries of greyhounds occur during racing.
- Certificates for training, equipment operation, service records for equipment.

Examples of key track related records are given in the Appendix. The intention is that you you can use these examples directly or create you own.

MONITORING OF THE TRACK

Later in the guide there is full section devoted to track monitoring. However, monitoring processes are only as useful as the records that are kept of the outcomes. For example, monitoring track compaction is vital, and readings from an approved penetrometer will guide decisions, but unless the readings are noted down it will be impossible to evaluate trends over time, in relation to conditions and preparation processes. The golden rule being, if you monitor, measured or assess something make a record and keep it somewhere safe! More on monitoring later.

EQUIPMENT MAINTENANCE

We can only prepare a top quality racing surface if the equipment we are using is operating effectively. All equipment that is used on track, from hand tools through to tractors and PTO driven equipment must all be safe to use and work as they are intended. This is to ensure that they will do the job intended and can be used safely by a trained operator.

At the end of the day, a well looked after piece of equipment will have a longer and more successful working life that something that is used and abused. If you want to use it in the future, look after it today.

This guide is not intended to be an operational manual for the equipment we use on tracks, but rather to guide our thought processes and what types of equipment maintenance is required. For specific maintenance requirements on each piece of kit please refer to manufacturer’s guidelines and manuals.

SOME GOLDEN RULES FOR EQUIPMENT MAINTENANCE

Below are some golden rules to help safely maintain track preparation equipment:

- Poor equipment leads to poorly prepared racing surfaces. Look after your kit and it will look after you!
- Only use equipment you have been trained to use.
- Use only equipment that is fully operable with all the necessary safety features in place (such as PTO guards and covers on moving parts).
- Regularly check your equipment, especially for high wear parts and those that need lubrication.
- Follow manufacturers guidance for servicing requirements and intervals.

Below are the different types of maintenance that may be needed on track preparation equipment:

- Basic daily and weekly fluid and lubricant level checks for tractors and relevant PTO driven apparatus.
- Grease points on tractors and implements.
- Checking that equipment is operational prior to carrying out track preparation.
- Prior to preparation, checks for wear and tear on consumable and high wear components such as tines, blades, rubber mats etc.
- Check all safety features of equipment prior to use.
- Check when next service interval needs to be completed.
- Check records for maintenance history of each piece of equipment.

It is important that records of checks be kept to ensure machinery is in optimum condition and that its serviceability is being evaluated. These records should be audited periodically to ensure that processes are being followed and that staff are keeping up to date with equipment maintenance.

It is advisable that a master folder for equipment is kept (physical and/or electronic). This is to make finding records and information easier and efficient. How many times have you had to go hunting in the back of the workshop for a manual or servicing record, and imagine how much time would be saved if that information were in one place? It is advisable that the following information is kept in the master equipment folder:

- Equipment details, specification and information
- Operation manuals
- Service guides and records
- Records of regular checks, as should be outlined in SOPs

INFRASTRUCTURE MAINTENANCE

Just as it is important for maintenance equipment to be checked and serviced regularly, likewise fixed infrastructure that is often essential for racing, but exposed to the elements all year round and in a challenging environment (salt + sand + water = metal hell) must be checked regularly. If these infrastructures fail, racing is often not possible resulting in costly delays or abandonments.

As part of track operating processes, regular (often daily) checks on the operation and integrity of the following need to be made:

- Hare rail system (lure, slider, pulleys, drive wheels, cable and metal rail itself).
- Traps and actuators (do they operate as intended and reliably).
- Lights and their operation (especially important in winter).
- Pumps and irrigation equipment (are they working as intended and outputting the required volume of water).
- Barriers and access points (is there any damage, alignment issues or any sharp edges that could affect a greyhound were it to impact it).
- Pick up curtain (if installed does it operate correctly either in manual or automatic mode).

The frequency of checks needs to be driven by track operational procedures, risk of failure on greyhound safety, racing schedule and intensity of racing. Tracks should have checking procedures and policies in place to ensure that all infrastructure is fully functional for every race. Back-ups and operationally critical spares must be available for rapid deployment in the unlikely event of a failure. There needs to be multiple layers of protection and checks to ensure that failures don't occur. For example, we should never be in a situation where the hare has not been run or traps checked prior to racing. If we get to that point, then our policies and procedures are either not fit for purpose or the human factor needs to be addressed.

If the worst-case scenario happens and infrastructure fails, then there should be procedures in place to deal with this, staff should be trained on what to do and back-up plans should be ready for deployment. For example, what is the process that should be followed if the hare cable/rope snaps, do staff know how to change it and can this plan be implemented as quickly and efficiently as possible during racing?

For some failures, such as traps not working, there will be specific GBGB rules and process that should be followed. Make sure staff are aware and trained to deal with these situations. It is best practice to run mock incidents so that staff are fully aware of the processes and procedures needed to rectify these issues. There is no value in having a great plan, but no one knows what it is or has ever implemented it before. There is a reason why training processes need for practiced, it is because the human brain has evolved to learn most effectively when specific actions have been previously carried out.

INFLUENCE OF SEASONS

As with most racing surfaces, weather conditions will affect the performance and the aim of maintenance is to minimise these impacts. Track maintenance needs to be tailored to take into account seasonal variations and the effects they have on the sand, the aim being to produce resilient, satisfactory and consistent racing surfaces not matter the weather.

It is important that we appreciate the challenges that each season presents when managing a sand and water racing surface. This section will outline for each season the main challenges that need to be factored into track preparation schedules. The main issues and management strategies associated with weather are discussed in the section dealing specific problems and solutions.

WINTER

Winter can be one of the most challenging season, especially if weather turns colder. The main challenges that need to be considered are:

- **Frozen conditions** – When ground temperatures come close to 0°C there is a risk of water between sand grains in the track freezing. If the water completely freezes the racing surface will become solid rendering it unsatisfactory for racing. Even if the track is not frozen solid, but even partially frozen the surface can still post a hazard to greyhounds and may stop racing operations. It is important to understand that it is the water that freezes and not the sand. It is also important to realise that we measure air temperature but it is actually the temperature of the ground which is relevant. Typically, mitigation methods to prevent tracks freezing include salt and brine application and the use of insulating ground covers.
- **Snow** – On an already frozen track, snow can keep the track frozen for longer. On a unfrozen track, it can act like a frost cover as it insulates the surface. However, it is not possible to race on the snow as it does not have the requisite characteristics and may cause cold injuries to paws. The appropriate response to snowfall will depend on the depth of snow on the track and the condition of the sand beneath. If the underlying sand is frozen, then it is highly likely that clearing the snow will be easier, but the track will still be frozen. If the track sand is unfrozen and there is a significant depth of snow, this can be physically removed but the risk to the racing surface must be assessed. Thin layers of snow can be left to melt or melted through physical working of the sand and snow mixture.

- **Drainage** – Winter is often a time of significant rainfall which tests the ability of water to either move through our track sand profile or be shed from the cambered surface into drains or the infield. If drainage does not work on the track, problems will soon manifest themselves. In reality, on a wet sand surface, the ability to absorb water and transmit it to an underlying drainage system is more restricted. In this case, we often have to rely on shedding excess water to the infield by allowing it to run down the cambered surface under gravity. For this to be effective, we need to maximise the potential for water to move from the inside line and off the track. Therefore, any raised areas of sand on the inside of the track will restrict movement resulting in puddling of water. Look at potential catchment points in low areas and ensure water has an avenue to escape the track. If there is deep seated compaction that is slowing water flow through the profile we should consider using tools such as the Verti-Drain to open up this compacted sand allowing water to flow more easily into a dedicated drainage system. If you think you have a drainage problem see the earlier section dedicated to drainage and, if you need it, seek guidance from an expert.
- **Lighting** – With winter comes shorter day length, lower sun angles and generally darker conditions. Lighting of the track in winter is essential to ensure good visibility for not only the dogs and spectators, but also trackstaff. Check to ensure your lights are working and providing adequate illumination. You many need to get a light survey done to map light levels around and across the track.
- **Health and safety** – With the colder conditions both trackstaff and greyhounds need to have suitable personal protective equipment to ensure that they do not suffer harm from cold temperatures or wet weather. A warm worker is a happy worker that is more attentive and less likely to make errors. Consideration should be given to allowing workers to take breaks in dry and warm surroundings and with suitable provision of warming food and drinks. For greyhounds, in colder conditions more attention may well be needed for a warmup to ensure muscles are operating to the full potential.
- **Risk of abandonment** – At times, the above issues can pose too great a challenge. In winter there is greater risk of abandonments due to weather conditions. Care needs to be taken on whether a surface is satisfactory to race on or not. Don't be tempted to run on a surface that unfit for racing, no matter how marginal. If the track surface is not right, don't race.
- **Impact of weather on travel and access to site** – under snowy or icy conditions all access ways and paths should be safe for all types of foot and vehicular traffic.

SPRING

Spring is like the steppingstone between winter and summer. In early Spring, conditions can be quite wintery. However, as we have seen over more recent years, Spring can also be dry and that can catch tracks out. Sometimes we haven't reacted to the drier conditions and stepped up our water inputs resulting in increased injury risk. However, if we are monitoring our tracks, our data or readings should be telling us we are not achieving our prerequisite water contents, so need to increase our inputs. This is a prime example of reacting preventatively to changing conditions, rather than sticking to a premeditated and prescriptive plan that doesn't dynamically adjust for conditions. Additionally, if we increase our watering inputs we also need to adjust the frequency that decompactive works are carried out, i.e. we need to reset the track surface more often.

SUMMER

Summer brings with it good weather (hopefully) but also brings a number of significant challenges:

- **Watering** – As temperatures increase, we will lose more water from the track surface through evaporation. We need to replace these evaporation losses by applying more water. This means we need to reset the track more frequently to prevent hardpan formation in the racing layer. We also need to be aware that as we work the surface more frequently to prevent compaction build up, this loosening of the sand also allow water we have built up in the track to drain away. This is why your track is inevitably drier immediately after resetting compared to beforehand. For more details on watering, see the earlier sections on track maintenance processes.
- **Water supply and storage** – During periods of high water usage, the ability to supply and store the water needed can be a challenge, especially under drought conditions. This is why tracks should review their water supply and storage needs before the onset of issues. Checking capacity of borehole pumps and increased storage capability (permanent or temporary) is vital.
- **Hardpan prevention** – With increased bowser activity comes increased compaction and risk of hardpan formation in the racing layer. This means that tracks will have to do more decompactive work through resetting with the power harrow or Track-Avator. Tracks should be monitoring the build-up of compaction on a daily basis to inform when remediation is needed. Schedules need to allow sufficient windows for this to be carried out. Equipment used should be in good working order and tines/blades should not be overly worn. The impact of resetting should be assessed to ensure the desired effect has been achieved.
- **Temperature monitoring** – Under hot weather, GBGB's Hot Weather Policy sets out measures to be taken and temperature thresholds above which racing cannot take place.
- **Track moisture levels** – As greyhound racing takes place on a sand and water mixture, the level and consistency of water in the track determines the performance of the racing surface. You need to know for your track what your optimum water levels are (for most tracks this lies between 28-33% volumetric water content. (consistency and longevity).

- **Health and Safety** – This affects all users of the track, whether they are human or canine. This is a priority concern as the safety of dogs, workers and a visitors is paramount and cannot be jeopardised for any reason. Issues of concern relating summer effects would include, but not be limited to:
  - **Temperatures** – ensure all humans and dogs are not a risk of exposure due to extremes heat.
  - **The impact of sun** - need for shade and sunscreen in hot weather.
  - **Hydration in all weathers** – dehydration can occur in all conditions, but the risk significantly increases in hot weather.
  - **Personal protective equipment** – ensure that relevant PPE is provided for the task and the conditions. For example, in hot weather staff should be issued sunscreen, sun hats and lightweight clothing to prevent overheating.

It is vital that tracks know how their site and racing surface reacts to different weather conditions. For example, open and exposed sites may have different challenges as opposed to a more enclosed and shady environment. It is always amazing to see just how much of a difference local conditions can make, for example, if you have a part of your track in shade in winter, you will tend to know that it is the shady area that suffers most severely and for longer from frost. The golden rule here is, "know your site, know the impact of site specific challenges and formulate your maintenance plan accordingly".

CLIMATE CHANGE

Hopefully everyone is aware of climate change. The weight of scientific evidence shows that its impacts are real and here, influencing all aspects of life of earth. Greyhound tracks are not immune to its effects. It is vital that, as an industry, we understand the challenges that climate change is and will continue to bring and the need to future proof and make our tracks more resilient to its impacts. The main impacts on greyhound racing of climate change will include:

- **Winter.** Wetter and milder winter conditions. This doesn't mean frozen conditions will not occur, but they will be less common and potentially less predictable. However, we need to be aware that winter conditions will be wetter, therefore water management and drainage on tracks will become ever more vital to continued winter operations.
- **Spring.** Springs are more likely to be starker transitions between winter and summer with more variable conditions. Some years this may mean they are drier, whilst others are wetter. We need to ensure our tracks are prepared for all potential weather conditions in Spring and that maintenance programmes are flexible to adapt to these changeable conditions. The onset of drier and compaction prone conditions are likely to occur earlier in Spring than we might be used to, so monitoring of pan depth is even more important to inform decompaction regimes.

- **Summer.** Summers are likely to become drier with increased probability of extreme weather, be it heatwaves and drought or heavy summer rainfall and thunderstorms. With drier and persistent hotter conditions, water availability and use efficiency will become ever greater challenges. Along with this comes greater risk of regulatory measures to limit water use, therefore tracks should look to invest in water capture, reuse and efficiency systems.

STAFF TRAINING

You can have all the best equipment for preparing a track, but to be effective it still needs the skill and dedication of a trained operator. Staff training is essential to produce high quality racing surfaces which are satisfactory and consistent. Staff need to understand not only how to prepare a track, but also why they are doing particular operation and how it is impacting the characteristics of the racing surface. For example, trackstaff can be trained to use a power harrow, but if they know why they are doing it and the impact it has, they can make appropriate adjustments to what they are doing based on conditions and what they are trying to achieve.

Staff need to be trained to ensure they are competent to carry out the tasks they are entrusted with for the satisfactory operation of the track. Health and safety is paramount, and therefore staff must be trained on any impacts their actions can have on the wellbeing of dogs, fellow workers and spectators. A key part of staff training must be on the health and safety implications of the operations they carry out. There will be statutory training needed for certain aspects of trackstaff's jobs and, as employers, tracks need to ensure that staff are fully trained to carry out the work they are being asked to do and that records demonstrate this.

Staff training is also important to ensure that they feel they are valued and there is career progression. Investing in ongoing training for staff can help them to develop their skills and knowledge, improve performance, enhance team working and increase staff retention. All staff should have a career plan with key performance indicators and training objectives to help each member of the team to develop to their full potential. This can be wrapped up in staff appraisals, which is an important forum to allow these conversations to take place and be recorded, whilst also helping to engage staff with their own and others development. A well trained and motivated team will perform better than one which is less skilled and that is less invested in their jobs.

The types of training that staff will need will include but not be limited to:

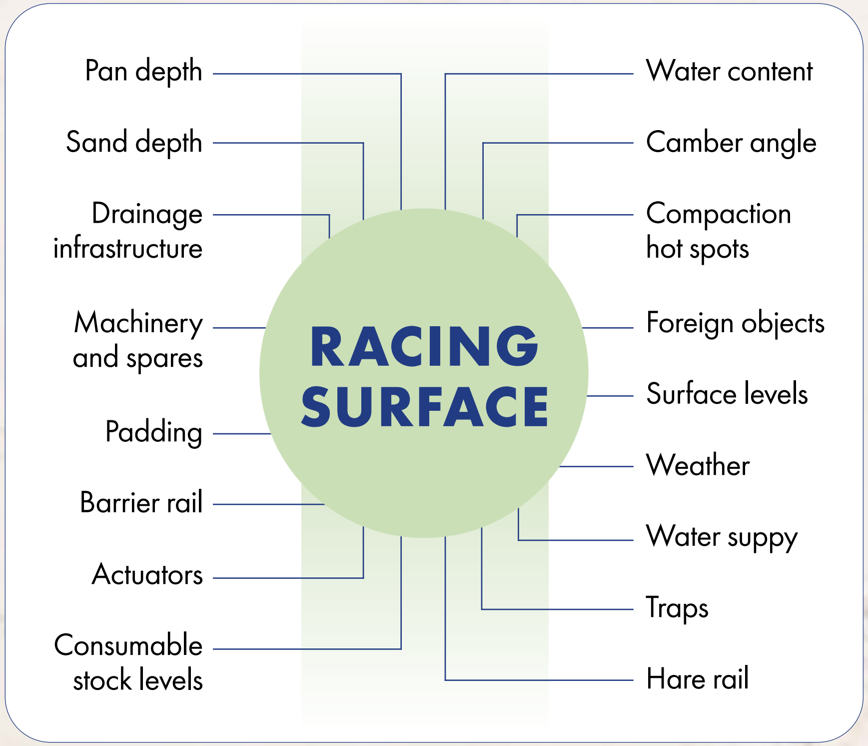
- Track operations (how a track works and why particular processes are carried out)
- Track maintenance equipment, processes and infrastructure and how they need to be used.
- Rules and regulations associated with racing that impact on trackstaff operations.
- Health and safety training, including any statutory training for use of machinery and other equipment.

- Team and HR training. To help teams to develop and work together. A happy team is a productive and effective team.
- Continued professional development (CPD). Even once you have been trained on a process, there needs to ongoing refresher training to help staff develop a more holistic understanding of what they are doing, why they are doing it and the impact it has on track safety and operations.

Example of pond used for water storage and track watering.

MONITORING AND RECORD KEEPING

This section of the guide outlines what tracks should be monitoring and why it is important. The diagram below highlights the characteristics of the surface and its preparation that should be assessed on a regular basis:



INTRODUCTION

Regular monitoring of the track, as well as keeping records, allows tracks to assess the condition of the surface at any point in the process of preparing it for racing, as well as during racing itself. Keeping records of this monitoring is essential to be able to assess how effective it has been at producing a satisfactory and consistent surface. It is only by keeping detailed records of the monitoring processes used and the results, that we can assess how effective we are being over time and to demonstrate that we are producing surfaces of the required standard.

SAND DEPTHS

The depth of sand influences how the track holds on to water and how quickly and where compaction layers can form. Minimum sand depths given in GBGB guidance are 175 mm (approx. 7 inches), however most track operate with between 200-250 mm (approx. 8-10 inches). The optimum depth of sand for each track should be determined through laboratory analysis. If sand depths become too shallow, an inconsistent surface can be formed, typically in the form of wet spots. The relationship between sand depth and track water content, when irrigated with the same volume of water is given in (Figure 30). If you water your track for what you assume is 250 mm of sand, but you only have 200 mm in places, the shallow areas will be filled up with more water and therefore be wetter.

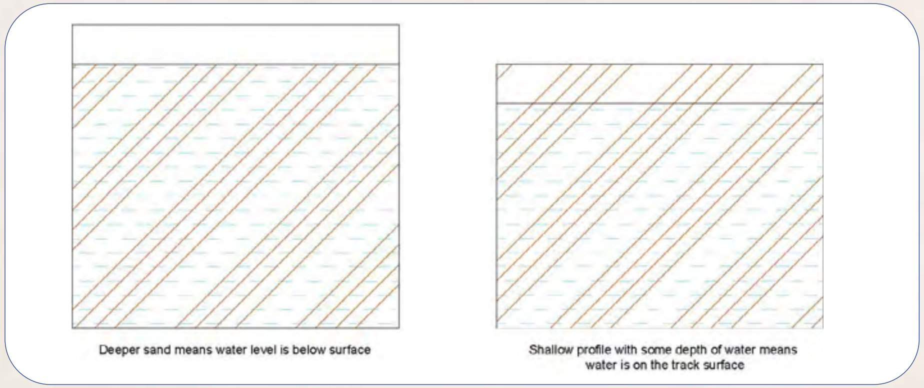


Figure 30. Sand depth and its effect on track wetness.

Sand depth should be checked regularly, at least once a week, as the influence of watering, rainfall and machinery all can move sand significantly resulting in shallow profiles. This can be done by digging a test pit around the track and set locations and measuring the depth of the entire profile and the individual layers (Figure 31). Also other assessments such as camber angle and surface level measurements with a combined spirit level and inclinometer can highlight low spots, which may have lost sand.

Figure 31. Sand depth assessment.

HARDPAN DEPTH/SURFACE FIRMNESS

The presence of a hardpan (a compacted layer of sand that is very hard and consolidated) naturally occurs through compaction of the sand profile by machinery, humans and dogs trafficking the surface (Figure 32). It can be identified through a tightening of the track sand and when a test pit is dug, often a thin dark layer where silt and clay has been deposited on the compacted sand. Compaction starts at the surface and spreads deeper over time. Our preparation activities loosen the sand in the racing layer, but the compaction will continue to build beneath. Decompaction is achieved by resetting the track surface using tools such as a power harrow and a Track-Avator to loosen the sand to a greater depth. However, compaction can still build up deeper in the profile and if this has a negative effect on drainage and water movement, deeper decompaction with tools such as aerators like the Verti-Drain and Terraspike will be needed.

Figure 32. Hardpan in track profile.

Hardpans can cause a number of serious issues on tracks. First and foremost is the relationship between shallow hardpans and serious injuries to greyhounds racing on the surface. These injuries tend to be associated with the hock and other impact injuries. This is because the greyhound's paw is either coming directly into contact with the hardpan causing jarring to bones and joints and/or a less grippy racing surface due to shallow sand (dry or wet) causing slipping of the paw in bends which in turn puts additional lateral forces on joints intended to operate vertically. There are other track conditions that can lead to increased risk of specific injuries and they are outlined in the following information box.

Hardpans can also be associated with drainage related issues, which can create inconsistencies within the racing surface. As hardpans are consolidated sand layers, they often restrict the flow of water through the profile. This may be of benefit to free draining profiles, as long as the pan is not too close to the surface, but for more water retentive or winter racing profiles this can be a significant issue to be resolved.

Hardpan depth has traditionally been measured by probing the surface with an implement, such as a trowel, screwdriver or metal ruler. However, these techniques have been found to be variable depending on who does it and how the measurement is taken. The modern approach is to use an approved penetrometer that has a free fall weight of 1 kg dropped from a set height to drive a 1 cm^2 probe into the surface (Figure 33). This standardisation of probe insertion takes the operator error out of the measurement. The amount of penetration can then be read off the scale and this is directly related to both track water content and compaction/hardpan depths. The standard is to drop the weight once to characterise the immediate paw-surface interaction and then on the third drop the reading reflects the presence of any compaction layers in the racing profile. Further information on the approved penetrometer can be obtained from GBGB's Track Liaison Officer or STRI. The method for using the penetrometer is given in the Appendix. The optimum depth of penetration of the penetrometer on the 1st and 3rd drop are continuously reviewed and reflect current best practice advice. As a result of advancements in current scientific knowledge, they are subject to occasional adjustments and so readers are referred to the latest published GBGB guidelines.

Readings of hardpan depth should be made from around and across the track in its entirety. This should also include areas known to be susceptible, such as crossing points and traffic routes for machinery, humans and dogs.

Figure 33. Penetrometer for measuring hardpan depth and track firmness.

Track conditions and their relationship with injury risk – Certain track conditions tend to be associated with increased risk of particular types of injury.

Too compact and firm a surface – Increased risk of hock, joint and percussive bone injuries. Foot injuries can be more common.

Shallow wet and sloppy layer over compacted sand – Increased risk of hock, joint and percussive injuries since such surfaces behave the same as hard tracks.

Soft and overly wet surfaces resulting in sloppy and/or very deep paw surface penetration – Possibly increased risk of muscular injuries and greater exertion needed by the greyhound. Split webs more common.

TRACK WATER CONTENT

As greyhound racing takes place on a blend of sand and water, the amount of water in the track profile needs to be constantly monitored (even on non-race days). The evenness of water around and across the track is vital in producing a satisfactory and consistent racing surface at all times. Monitoring water content can highlight wet and dry spots, drainage issues and the efficacy of irrigation. Typical water contents for racing have been aimed at between 28-33% (on a volumetric basis) but the optimal content for each track will depend on the unique layout and sand at each track.

Track water content can be measured quantitively with a moisture probe, but care should be taken as often data between different probe types are not directly comparable. A moisture probe allows a track to quickly assess the variation in water around and across the track, which can be used to inform irrigation practices. The standard probe used by STRI is a Delta-T Devices Theta Probe.

However, a more tactile test can be carried out to assess the relative effect of water with a tracks sand. This involves taking an even sample of track sand over the racing depth and forming it into a ball in your hand. The following classification process can then be used to assess if the track sand is too dry, too wet or optimal.

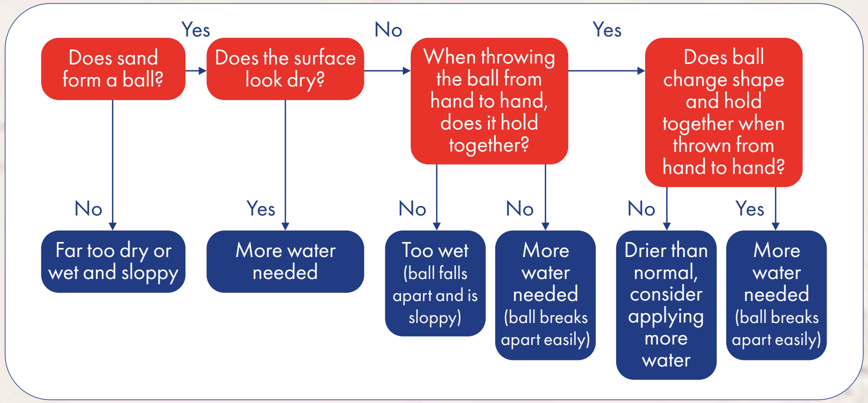


Figure 34. Flow diagram giving process for carrying out the ball test for track water content.

Assessments should be carried out around and across the track during preparation to inform the need for watering. Likewise, track water content should be assessed through a meeting to determine if the watering programme needs to be adjusted.

CAMBER ANGLES

There are no industry standards for the optimum camber angle, as this needs to reflect the layout, geometry and sand of each track. However, it should be measured to help tracks establish their own optimum and to identify if the camber is being lost. For the vast majority of tracks, the camber should be consistent across the width of the track to both aid with water movement and produce a predictable footing for greyhounds running on the surface.

The current method used by GBGB to assess camber angle is to use a digital inclinometer built into a 1.2 m spirit level. This allows for:

- The rapid determination of camber angle (measured in degrees).
- The effective camber angle to be assessed quickly at different points across the width of the track to ensure a consistent grade.
- To pick up subtle negative cambers which will trap water.
- Highlight surface levels of concern (such as high or low spots) and the depth of tyre marks.

Readings should be taken from key points around the track, especially from known problem areas.

SURFACE LEVELS

The aim of track preparation is to produce a smooth and consistent race surface with no ridges or depressions. The 1.2 m straight edge of the spirit level and inclinometer is used to measure and gaps under the metal bar. This can highlight to trackstaff where sand may be being lost down slope due to water movement and machinery use. Dishing and low spots are prime areas for water to gather creating differential going around and across the racing surface. Special attention should be given to vehicle access points and around traps. In both these situations, sand can build up where traps are swept out and where the plate releases excess crumb.

WEATHER

Weather is the main external factor to racing that influences track preparation. It goes without saying that preparation will be affected by rainfall, wind, hot and dry conditions, snow and sub-zero temperatures. Tracks should have a process by which weather conditions are monitored at least on a daily basis but often much more regularly in extreme or changeable weather. This should directly inform decision making on planned and actual surface preparation. There are numerous mechanisms for obtaining weather forecasts and many tracks will utilise multiple sources to gain the fullest and most accurate picture of what may happen.

It is also recommended that weather conditions during preparations and a meeting are recorded. This is to help build an understanding of how the track changes under any given set of weather conditions, when prepared in a specific way. The ultimate approach would be to have a weather station onsite to collect key data such as rainfall amounts, air temperatures, relative humidity, windspeed and direction, all of which can and do affect track preparation and performance.

FOREIGN OBJECT DEBRIS (FOD)

Greyhounds should race on a surface comprising nothing else than sand and water. However, foreign objects can find their way onto the track through a number of different pathways. The types of foreign object that commonly end up in track surfaces include:

- Stones and gravel coming from tractor tyres, contaminated deliveries and torn geotextile membranes.
- Shale and sharp small fragments of materials coming from speedway activities.
- Organic detritus, particularly wood and leaves from trees or grass clippings.
- Plastics from cables ties, broken rail and general litter
- Litter from spectators or speedway (latter predominantly being visor tear-offs)

All of these foreign objects should not be in the track sand and should be removed where at all humanly possible. It is vital and best practice that groundstaff should walk the track every day to remove any foreign objects from the surface (Figure 35). Walking the track prior to trials and racing must be a key part of routine operational procedures. Any object present within paw depth of the surface poses a risk of injury to greyhounds.

Figure 35. Track staff removing foreign objects from the racing surface.

For those tracks that co-exist with speedway, provision and use of suitable covers is needed to protect the greyhound surface as far as possible from shale contamination. Care should be taken when deploying and removing covers to ensure shale does not work its way into the track. It is important the speedway operators understand the impact on greyhound welfare of foreign objects and are engaged in a proactive and positive way to help minimise risk of contamination.

ENGAGING WITH YOUR RACING SURFACE

It is vital that groundstaff walk their track frequently, even between races, to assess its condition, remove FODs, check key track infrastructure. This isa fundamental part of best practice, as informed decisions can be made as a result of this information. It also ensures that those at the track can see the care and diligence that track staff take to ensure their racing surface is satisfactory and consistent. Engaging with your racing surface is highly positive and promotes the image of well trained professionals taking all steps needed to produce a high quality surface.

HARE SYSTEM

Wherever there are moving parts, the combination of sand, water and salt is bad news. This is the perfect storm for wear and corrosion. One of the main systems on a track with moving parts is the hare system. The rail will wear, erode and corrode with use, whilst the slider/skid, rope, pulleys and drive tyres are also constantly subject to wear. All components of this system should be full checked and operational before each meeting. Additionally, monitoring of wear levels should be carried out on a regular basis and maintenance carried out when necessary. It is also vital to carry spares of all these high wear items to ensure continued operation and prevent meeting abandonments.

As part of routine maintenance, inspection and cleaning of sand out of the hare rail is a vital preventative maintenance process. When new slider/skids are installed, it is recommended that they are run to ensure they are fitted correctly and that there is no risk of it seizing immediately before or during racing.

TRAPS AND ACTUATORS

The traps are in continual use during a meeting and are a vital piece of track equipment. Without them racing cannot take place and a failure to open or only partially open risks injuring greyhounds. As a result, trap operation must be checked prior to each meeting and preventative maintenance checks carried out on high wear or risk components.
As these systems work on hydraulics or compressed air, any routine maintenance on the pressure systems should be checked through multiple operating cycles of the traps. For example, if operating a compressed air system and maintenance is carried out on a component that allows ambient moist air into the system, sufficient checks should be made to ensure that any water in the air system that could cause the traps to malfunction is dealt with.

As well as routine checks on the physical operation of the traps (activation, opening and moving in and out of position), staff training on emergency procedures is essential. All operators need to know what to do if the traps do not activate as intended.

Actuators that activate the system need to be checked as part of the pre-race preparations. This is to ensure that they operate as intended. As with all checking processes, a log should be kept of who checked what and when.

RUNNING RAIL AND ENTRY POINTS

The running rail/barrier is design to help keep the dogs on the racing surface in the event of a collision and out of the way of any infield track infrastructure. The integrity of these barriers is paramount. They should be checked for damage and sharp protrusions or edges that could injure an animal if they were to bump into it. Any damaged sections should be replaced and any sections subject to temporary repair replaced as soon as possible. The running rail can easily be checked as part of the track walk that should be carried out prior to each meeting.

Points where vehicles or dogs and handlers cross or enter the track should have suitable removeable rail or gates access. These should be checked for their functioning and any edges or protrusions that may risk injury if a greyhound was to contact it.

PADDING

Many tracks have padding on the outside of the track in key locations as extra protection for the dogs if they run off the track surface. There are no set specifications for this padding but is typically consists of an impermeable covering material over a thick layer of foam.

If the track has padding installed, regular checks should be made to ensure it is in a fit condition and secure to the wall. Padding will need periodic cleaning to ensure optimum presentation. Over time, it may become fragile and degraded by weather conditions and need replacing. There are no official sources of padding, with most tracks sourcing it from independent suppliers. Details of some commonly used suppliers are given in the appendix (insert link to contacts in appendix).

WATER SUPPLY

If water is abstracted under licence, records must be kept of how much water is used over a given time period. These records are mandatory as part of the terms of the abstraction licence. However, if you don't abstract water from a licensable source, it is still best practice to keep a record of how much volume you use to aid with current and future planning of water supply to a track. This will become ever more important as climate change and regulatory pressures increase. This will necessitate tracks to investigate and use innovative methods for water capture and supply to ensure a robust and resilient water management strategy.

It is best practice to keep a record of how much water is applied to the track during preparation and a race meeting. This is to help inform decision making on what is normal for that time of year and to identify any trends that need to be considered during racing incident investigation.

MACHINERY CHECKS AND OPERATION

It is important to have processes set up to check equipment before use and these checks recorded (who did the checks, what was checked and what was the outcome). Often this is done using checklists/sheets for each piece of equipment.

The reason for doing these checks and keeping records are:

- To protect staff when operating equipment
- Ensuring equipment is in good condition and fit for purpose
- Meeting health and safety requirements
- Adhering to manufacturers servicing and operation requirements.

Daily checks may differ from weekly, monthly or annual inspections. The requirements of each need to be tailored to the type and depth of check required. For example, annual checks will tend to go into more detail on the mechanical functioning and may require fully or partially stripping the tool to access internal wear components, as compared to daily checks which are focussed on the safe operation of equipment.

Remember it is important that all machinery records detail relevant information, such as:

- Date
- Equipment checked/inspected
- Staff who did the checks and their competence to do them
- What was done as part of the check/inspection
- Were any parts changes or repairs carried out
- Any outcomes and notes associated with the check
- Signature of who carried out the check and any auditing of this inspection.

These records as important to be able to demonstrate that equipment is safe and fit for use. This is especially important if there is any incident or accident.

STOCK LEVELS

All tracks will have consumables that will be used during normal racing operations. These include:

- Sand
- Salt
- Spare barrier/running rail, T-pieces and swan necks
- Consumable wear parts such as tines on power harrows, Track-Avators and plates
- Hare rail components (ropes, skids, pulleys, tyres, actuators and hare/lure).
- Lubricants and fuel
- Assorted equipment spares such as link pins, screws/bolts, spark plugs, belts etc.
- PPE such as ear defenders, eye protection, coveralls, gloves, spill kits, oil change kits, eye wash etc.

It is best practice to maintain a stock list and on it should be the minimum quantity of each material type. Stock levels should be checked routinely with these checks documented. Any shortfall should be replenished. It is always better to have more in stock and be able to use it, rather than an issue occur that needs resolving and it can't be dealt with due to not having the appropriate material in stock. In times where there are long lead times and uncertainty of supply, it pays to have additional stock available to ensure continued and safe operation of the track.

DRAINAGE INFRASTRUCTURE CHECKS

Given the nature of the sands used on tracks, finer particles can find their way into both surface and sub-surface drains. Both will need checking and cleaning out periodically. Surface drains are typically easier to clean by either digging out the accumulation of finer particles or washing out any accumulating material.

Sub-surface drains should have silt traps installed to capture finer materials before they get into the drains proper. These should be checked and cleaned regularly (the intervals between checks will depend entirely on track specific conditions). If there is concern about sub-surface drains being blocked, specialist camera inspection can locate blockages and these can then be removed by high pressure water jetting. It is good practice to jet wash drains periodically to ensure material does not build up in drain lines. This is particularly important prior to winter racing.

PRESENTATION

A track that is well presented will give the impression of being well looked after. It also presents the best possible and professional image of the industry to those that work in it, as well as the viewing public.

As presentation is so important, checks on presentation should be carried out regularly and the findings used to inform track maintenance plans. Sometimes these checks are best done by someone who is not routinely involved in maintaining the track day to day, as sometimes fresh eyes will spot issues to address.

Typical presentational issues can include, but not be limited to:

- Excessive weed growth in visible areas around the track and stadium.
- Cleanliness of track infrastructure such as light poles, pick up curtain, traps etc.
- Barriers should clean and free from temporary repairs (taped up for example).
- Track preparation machinery should be clean and look professional.
- Maintenance facilities and the track environs should be clear of rubbish and tidy.
- Staff should be well presented and issued with uniforms
- Any track infrastructure or boundaries such as fencing should be well kept and painted to ensure a consistent and well-kept finish.

CONSISTENCY

Our aim in preparation and monitoring is to produce a satisfactory and consistent racing surface across and around the full track. The surface should be free from bias and large differences in the going of the sand.

A key part of preparing a satisfactory and consistent racing surface is to understand how inconsistent the surface is and address this with maintenance inputs. This requires assessing the condition of the surface across and around the full area of the track. This assessment should be recorded to demonstrate that inputs have been made to address and inconsistencies and to ensure that the surface is fit and suitable for racing. It is best practice that tracks record their objective and subjective assessments they have used to inform decision making. This is particularly important when carrying out injury investigation, as it can highlight or rule out the relative impact of the racing surface on a particular incident.

There are no official guidelines on what must be monitored and recorded. This is left to each track to develop their own protocol. Tracks are advised to seek guidance from GBGB's Track Liaison Officer and STRI to help develop an approach that is tailored to the requires of that particular track.

A TIDY STADIUM IS A WELL MAINTAINED STADIUM

Tracks should have a weed management plan to keep weed populations under control and maintain the professional presentation of the track. This should include combined use of physical measures such has hand weeding, strimming, brushing and repair of damaged hard surfaces, as well as appropriate use of herbicides. It is well worth tracks getting someone trained and certified to be able to spray professional herbicides with a knapsack, as in combination with physical control, will provide cost and time effective weed management. Please follow label guidelines and be careful of herbicide use in areas where humans and dogs could come into contact.

SPECIFIC PROBLEMS AND SOLUTIONS

The aim of this section of the guide it to highlight some of the common issues that can occur on a track and potential solutions that might be implemented. This is not an exhaustive list, nor are the solutions presented the only options. The details given are to generate ideas for trackstaff on how to tackle some of these common problems and should not be followed prescriptively.

EXCESSIVE SURFACE FIRMNESS

When the track surface becomes too firm, either as a result of compaction or being too dry, a number of issues can occur. If the track is too dry, the surface can:

- Become slippery as there is not enough water to hold the track sand together when dog is pushing off during their stride.
- Firmer running surfaces will result in dogs carrying more speed into bends which may exacerbate slippage and increase risk of joint and/or impact injuries.

The solution is to ensure enough water is applied to soften the surface and allow the sand to have sufficient cohesion and stability when cornering.

If the firm surface is due to compaction near the top of the track profile, this needs to be addressed through decompaction (typically using a power harrow or Track-Avator). The type and intensity of decompaction will be determined by the depth and severity of the compacted hardpan layer. Multiple passes with the decompactor may be needed to effectively deal with this issue and equipment should be set to the appropriate depth to break up compacted layers, whilst not jeopardising the track base or any geotextiles layers. Know the depth of your track sand.

CHOOSING THE RIGHT DECOMPACTION METHOD

Decompaction with the PTO driven equipment such as power harrows and the Blec Track-Avator can effectively deal with both shallow and deep compacted sand and pans of varying hardness. They break up the compaction during track resetting, which allows the sand to be kept uncompacted for as long as possible.

Non-powered tools such as the teeth/tines on a plate or a levelling harrow, are useful for keeping this racing layer open and compaction at bay. However, once compaction starts to build, in the form of a hardpan, these tools start to struggle to effectively break it up. Past work has show that once the hardpan has formed, these tools start to ride over the hardpan rather than bite into it, thereby breaking it up. This means that trackstaff feel they may be tackling the issue, but in fact the pan still remains.

This is why it is vital to routinely measure and assess the depth and severity of a hardpan, so that the right tool can be used appropriately to keep a sufficient depth of sand in the racing layer.

Use of power harrows and Track-Avators are only possible outside of a race meeting. Therefore the build up of compaction, in the form of a hardpan, must be routinely monitored on a daily basis to inform when decompaction and track resetting is needed. It also needs to be borne in mind that compaction does not form at the same rate across and around the whole track surface. It will form unevenly and in areas where tyres, greyhound and foot traffic are routinely in contact with the surface. This is why these areas should be monitored intensively as the track is only as good and the worst area.

If there are significant concerns about the depth of hardpan during a meeting, options become more limited. In reality, the only available process is to insert the teeth/tines on the plate deeper into the track to try and break it up. Care must be taken to ensure that the situation is not made worse by having a loose/sloppy sand over a shallow hardpan. Remember, if the track is not satisfactory, we should not be racing on it. It can be a tough call, but ultimately greyhound welfare is paramount and trumps all other considerations.

DRAINAGE ISSUES

When we talk about drainage issues, there is a need to be specific as to the issues actually observed and the underlying causes. Problems typically classified as “drainage issues” would include:

- Localised wet spots around the track
- Standing water in particular locations
- Excessively wet sand around the whole track or a particular section

Each of these drainage issues will be tackled in their own section. However, the root causes for each often overlap, and therefore these will be detailed in their own section.

LOCALISED WET SPOTS

At some stage, most tracks will experience areas that are wetter than others. It is unavoidable as tracks are cambered and water will flow under gravity from high areas to low areas down a slope. This means there is always a tendency for the inside of the running surface to be wetter than the outside. This needs to be accounted for in water application prior to and during a race meeting. The main causes for localised wet spots on a track are given in Figure 36.

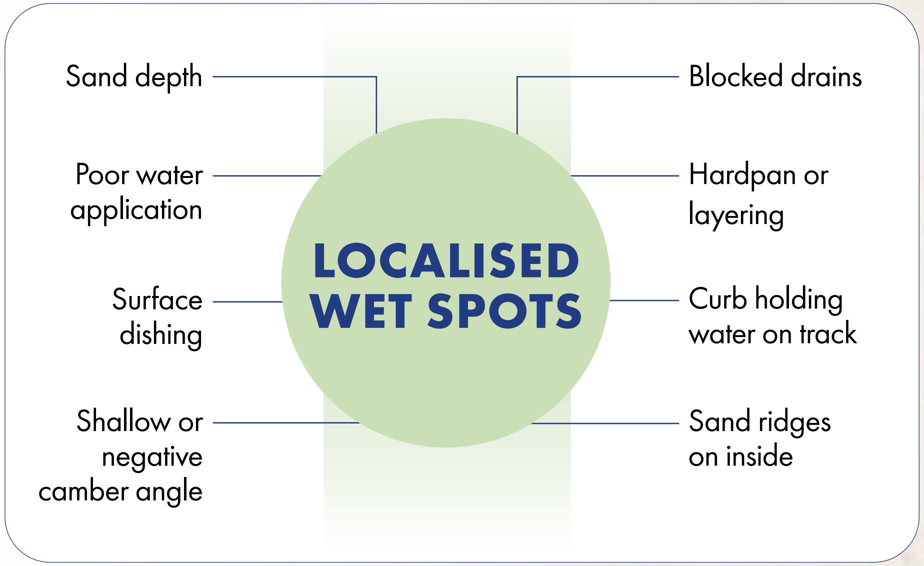


Figure 36. Causes for formation of localised wet spots.

STANDING WATER

There are times when standing water may be seen on the track surface. Sometimes this is in localised areas and at others it can be large portions of the track, the latter being typical during prolonged and/or heavy rainfall. The main causes for standing water on the surface are outlined in Figure 37.

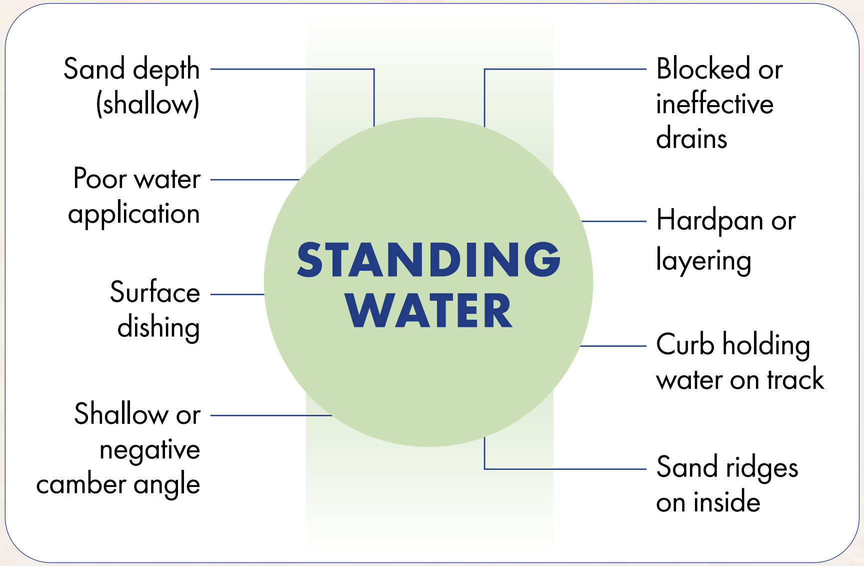


Figure 37. Causes for standing water on track surface.

LARGE AREAS OF WET TRACK SURFACE

Often this is a result of track layout and infrastructure related issues as wider areas of the running surface are affected. This often means there is less that can be done in the immediate run-up to or during a race meeting and that more intensive and long-term solutions may be needed. The main causes for an excessively wet track surface are outlined in Figure 38.

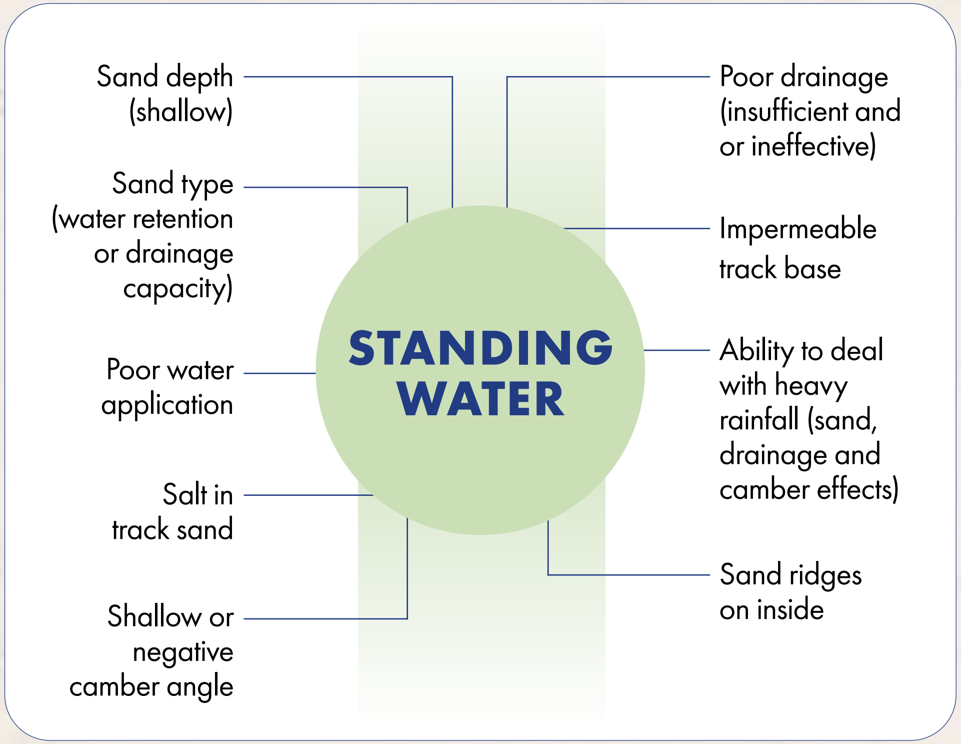


Figure 38. Causes for large areas of wet track.

MAIN CAUSES OF DRAINAGE ISSUES

Below are the main causes of drainage issues detailed in the previous sections:

- **Sand depth** – shallow areas will tend to fill with water and reach saturation quicker than areas with greater sand depths. These areas often also hold water for longer so remain wetter than other areas of the track. Solution = adjust sand depths in shallow areas to match up with the rest of the track.
- **Dishing or low spots** – low areas will tend to collect and hold onto water longer than other areas as you are effectively creating a bowl. Often the result of a combination of sand migration, loss of camber and ineffective sand movement when watering, plating and/or regrading. Solution = top up sand levels if needed, redistribute any sand that has migrated and is contaminant free and recut the camber angles if needed. If low spots are associated with the lowest points on the straights, look to provide water exit points onto the infield via drainage channels or local drains.
- **Sand ridges** – accumulation of sand, typically under the inside rail or adjacent to it, forms ridge that acts as a barrier to stop water flowing off the racing surface and onto the infield. This means that the inside of the track will remain wetter and any fines that washed out the track collect over time on the inside. In heavy rainfall, the primary method

for getting rid of excess water is to allow it to run under gravity over the racing surface and onto infield. Any obstacle will mean that rainfall or heavy irrigation will cause water to build up on the inside. Solution = remove the sand ridge allowing water to flow freely down onto the infield. This can be done by hand (raking out) or using the grading blade/bar to pull the sand back onto the track where it was lost form in the first place.

- **Camber angles** – as water moves downslope under gravity, any slackening of the slope angle or even creating a negative camber (the slope of the track heads to the middle of the track rather than the infield) will slow and stop water movement. A consistent camber across the track at a sufficient angle will aid water flow, especially under rainfall or heavy irrigation. Solution = monitor the angle of the camber and any areas where cambers are becoming shallow or negative need to have an appropriate camber angle reinstated.
- **Hardpan and track layering** – over compacted sand will form a hardpan which is naturally impervious to water which slows its transit through the track profile. Likewise, if there are multiple disconnected layers in the sand, these too can also inhibit free water movement downwards. If the presence of a hardpan or layering anywhere in the profile is associated with a wet area that doesn't drain freely, they should be removed to improve vertical water flow. Solution = decompact the track to create a uniform layer of sand which will allow water to flow through it consistently. This can be achieved with a power harrow or Track-Avator, but deeper compaction or layering will require the use of decompactive aeration (Verti-Drain/Terraspike). All these operations will need to be repeated and therefore ongoing monitoring of the health of the track profile is essential.
- **Blocked drains** – water can only escape from the track is we give it an outlet. If we keep the plug in the plughole, the bath will fill up. Blocked drains act like a plug in the plughole. When water does drain through the track, we need to give it somewhere to go. Drains do not necessarily pull water out of the track profile, they give it somewhere to go. Solution = if drains are suspected to not be functioning, they need to be inspected and cleaned out. If there are no drains then consideration could be given to installing new ones, but this should only be done in conjunction with ensuring water can actually run off and through the track surface. Inappropriately installed drains have caused problems in their own right as you can easily end up with drier and wetter sections as water drains down under gravity.

LAYERING IN THE PROFILE

The ideal track profile consists of a uniform depth of sand which does not contain individual layers. Layers form when sand properties differ, with sand with similar properties binding together. Layering can be caused by a range of factors:

- Differences in particle size, sand type or fines content
- Differences in water movement through the profile
- Differences in how compaction has built up over time

Why is layering an issue? Layers form areas of weakness or inconsistency within the track profile. They can inhibit water movement and form slip plains that allow the overlying sand to slip more easily over the underlying sand giving rise to a less stable and slippery racing surface. The ideal profile consists of uniform thickness of sand which is interconnected and allows water to move through it. Figure 39 gives examples of a good profile, as well as different types of layering.

Figure 39. An excessively layered profile, one with fines migration and an example of a good profile.

Layering can also be in the form of fines contaminated materials. These may have been washed downwards until the have hit a compacted layer or consist of fine/dirty material that was once added to the track surface and has now become buried.

The solution to layering often relies on remixing the different sand layers to create a homogenous and unform single layer of sand. The best equipment to use will depend on the depth and nature of the layering. Typically, power harrows and rotovators/stone buriers are used to break up the layers and mix the sand. For deep layering below the operating depth of conventional decompactive equipment, the use of decompactive aerators may be needed. These are effective but give shorter term effects as they do not mix the sand, but rather punch through layers, loosening them and creating connectivity between each layer.

FLOODING

In situations where flooding occurs due to either high water table or surface water flooding (heavy rainfall), it important to realise that once the sand profile is completely saturated the only option is to keep off the surface. By trying to work the sand or even taking a tractor on it will cause more damage and result in greater levels of work after the water has receded.

Where flood water is coming from a high water table and saturating from beneath, there is little you can do until ground water levels have dropped. In reality, there is very little you can do to prevent this from occurring unless you hydrologically isolate the full site, as drains can only transmit water where there is air space to allow it to flow. A detailed and specialist drainage network can be created, often relying on pumping of water to create the space to manage the saturated profile.

For situations where flooding has occurred due to surface water build up (burst riverbanks or heavy rainfall exceeding local drainage capacity), there are more options to be able to use temporary pumps to remove the excess water. Depending on the origin of the flood water, care may be needed if sewage or other contaminants are on the track surface. If there is standing water on the track, fine material from the track can form a layer on top of the sand profile, which can effectively seal the surface. If there are no contaminants, this can be rotovated back into the track sand, but if it has become contaminated, the affected layers will need to stripped off and disposed of.

It is vital that saturated sand is not worked or trafficked. This is because the agitation of the sand will create a sloppy mush that will take longer to dry out than if was left untouched. Also, you run a high risk of destroying surface levels and cambers which can only be cut back into the track once the sand is workable.

FROZEN TRACK

The ideal management focusses on preventing the track surface from freezing. However, there will be situations that tracks will be caught out or temperatures are so cold there is no protection that will stop the track sand from freezing. If you end up with a frozen track, the following can be done to make the sand workable and maximise the opportunity for ice to melt and racing to go ahead:

- **Assess the depth of frozen sand** – if the entire track profile is frozen that the likelihood of being able to work the sand sufficiently for racing to go ahead is extremely unlikely. If there is a thin layer of frozen track this may melt naturally or with some input can be made raceable. A thicker layer of frozen material reduced the chances of racing, and it is important to make a realistic assessment of the likelihood of making the surface raceable in the time available and under the prevailing weather conditions.
- **Tackling the frozen sand** – if it looks feasible to tackle the frozen track, the main objective of maintenance is put energy into the surface. The frozen water between the sand grains melts due to energy inputs (naturally from the sun), which can be in the form of friction when tines move through the frozen material or sand grains move against each other. This imparts energy which in turn causes the onset of thawing. In this situation, the use of power harrows, rotovators and Track-Avators can be used to break up the frozen material and impart the all-important energy to start thawing. It is best to start with shallow working depths to break up the frozen track sand into as fine a tilth as possible. The key is to keep working the sand

slowly and maximising the amount of friction between the tines and the frozen water in the sand. The depth to which you should work in each pass will be depending on the level of freezing and needs to be judged on a track-by-track basis. The key is slow and steady wins the race.

- **Prevent refreezing** – on a cold winter day that barely gets above freezing, care must be taken to prevent thawed sand from refreezing. If this is a risk, the use of PDV salt worked into the surface can be essential as this will help prevent refreezing. A brine can also be helpful in this case to introduce a salt solution, as salt only works at preventing freezing when it is dissolved either in the track or the tank.
- **If the track is not fit do not race** – welfare of greyhounds is paramount, therefore if there is any risk of the surface not being sufficiently thawed and satisfactory for racing, racing should be abandoned. Chunks of frozen sand can be as harmful to greyhound paws as stones!

SNOW COVER

Ideally, if snow is forecast, then preventative measures can be taken such as application of salt (especially if combined with sub-zero conditions) or ideally the use of covers to contain the snow and allow it to be cleared without melting into the track. If an unfrozen track is covered by snow, there is opportunity to get the track prepared for racing. Excess snow can be physically removed by hand and any thin layers of remaining snow on the surface can be worked into the track sand. However, do not work thick layers of snow into the track as it can cause the track to potentially freeze or become sloppy and unworkable. When clearing the track make sure that the snow is placed in a location where, when it melts, it is not going to flood the track surface.

CONTAMINATION FROM SPEEDWAY/STOCKCAR

Dirt based speedway/stockcar racing is not compatible with greyhound racing, but as they both use ovals historically, they have shared the same sites. Material thrown from the back of bikes or cars must not be allowed to mix with greyhound track sand. It is more than a visual eyesore, the fines contained in the soil element of speedway/stockcar track will affect the drainage and shale particles can cut greyhound paws. The precautionary measures have been detailed earlier in this guide. If a track surface has become contaminated with shale and speedway track fines, the following measures may need to be considered:

- Remove larger particles through manual stone picking or automatic travelling sand sieves (similar to those used to clear beaches).
- Remove areas of contaminated sand and replace with fresh material.
- Under the right track conditions, fine contaminants can be washed out of the profile, but care must be taken to allow the effluent to drain onto the infield.

SUBSIDENCE AND LOW/HIGH SPOTS

Greyhounds should be racing on a consistent surface and any significant surface levels deviations can affect how greyhounds interact with the surface and how water drains from the track. Low and high spots are typically the result of localised sand movement. They should be rectified through appropriate use of the grading blade/bar and plate to move sand from high spots and drop it in low areas. Additional sand may be needed if significant sand migration has occurred.

Subsidence is where there is a dramatic loss/collapse of the track surface. Subsidence has numerous causes and the first step to rectifying it is to establish what the causes are. Until that root cause is dealt with, it is likely to come back. For example, if it has been caused by rabbit burrowing activities, it will be necessary to control or exclude the rabbits from the affected area to ensure it does not happen again. Some causes of subsidence can be more difficult to resolve than others, such as undercutting of an underground spring, sinkholes or collapse of old mining workings. These will require specialise services to rectify.

Once the underlying cause has been dealt with, the hole can be filled with the same or compatible material used to construct the track originally. Temporary packing of the hole can be carried out on small areas and the materials needed will depend on the track construction profile. However, if a temporary solution is used, it must be replaced with a permanent fix as soon as practicable.

Any repair work must result in a racing surface that is consistent with that surrounding it. If it is not consistent, there is a risk to greyhounds when they run on the affected areas as the footing will be different to what they expect.

INCONSISTENT CAMBER ACROSS TRACK

Inconsistent cambers can cause a number of issues, such as:

- Poor water movement from the racing surface
- Trapping or ponding of water in low spots or areas with a negative camber
- Inconsistent going across and around the track
- Dogs not being able to hold their line around a bend.

If cambers are inconsistent or have dropped over time due to sand migration, a number of remedial activities may be needed:

- Pulling sand (uncontaminated) from under the rail or the inside of the track up to the middle and outside.
- Recutting the camber using a grading blade/bar and judicious use of the plate going either from inside to outside or outside to inside depending on where sand needs to be moved to.
- Move sand from gather points such as high spots and deposit in low areas

Often, addressing camber issues needs a combination of hand work (such as raking out) and tractor work (blading and plating) to resolve the issue. If cambers are dropping or becoming inconsistent too quickly, a review of track maintenance procedures needs to be instigated. The use of a straight edge and inclinometer can be used to assess the consistency of camber and whether rectification works have returned the track profile to its optimum.

EXCESSIVELY DEEP TYRE MARKS/PAW PRINTS

Where tyre marks of paw prints are unacceptably deep, this indicates the track surface is too soft. This might be due to holding too much water or lack of compaction from tyre packing after resetting the track. The root cause of the soft surface needs to be established as the required remedial works will be different for different root causes:

- Excessive water retention due to either layering or shallow areas
- Excessive water retention due to negative cambers, sand ridging on the inside or low spots
- Poor water application
- Insufficient tyre packing

POORLY FILLED PAW PRINTS AFTER PLATING

The aim of plating is to produce and smooth and consistent finish to the racing surface. Paw prints from previous racing should not be visible and the paw prints filled with sand from the crumb built up in front of the rubber on the plate (Figure 40). If paw prints are not properly filled, greyhounds will not be running on a consistent surface and instead will be running on a uneven surface and at greater risk of injury. If paw prints are still visible after plating this is typically the result of:

- Travelling too fast to allow the crumb in front of the plate to drop into the holes. Remember, the wetter the sand the slower you will need to travel to allow the crumb to drop into the paw print.
- Insufficient crumb created in front of the plate. It is the crumb that fills the holes and not the downward pressure of the plate. If more crumb is needed, then the tines in front of the rubber will need to be adjusted.

Figure 40. Paw prints that nave not been properly filled.

RISK OF HEAVY RAINFALL

If the forecast is predicting heavy rainfall, the track needs to be prepared to allow excess water to shed from the surface, allowing it to become raceable as quickly as possible. Typical preparation for heavy rainfall will include:

- Plating of the surface prior to rainfall to ensure a quick and efficient run off of excess water.
- Ensuring no paw prints remain that will hold water creating mini puddles which will give an inconsistent going and act as the start points for track erosion.

- Ensure the camber of the track is optimised to shed water to the inside and away from the track.
- Ensure that there are no impediments preventing water flowing to the infield of the track (sand ridges or negative cambers).
- Think ahead and ensure all the prep work needed for racing is done before the rainfall (for example resetting of the racing surface) so it may be feasible to race on the surface without having to put a tractor on it.

In dire situations, the use of the plate can sometimes be used to move excess water off the track. However, this has drawbacks as it can negatively affect surface levels, cerate inconsistent going and increase sand migration to under the inside rail. It should be used with caution and only in extreme need.

WATER SUPPLY ISSUES

Hot summers may lead to increased water usage and if that exceeds the ability of the tracks water storage capacity or supply volumes action is needed. The first action should be to install additional storage capacity. This can be in the form of permanent tanks or temporary storage, such as pillow tanks.

Another strategy that can be employed is to create a water storage pond or similar that allows any water draining from the track or falling as rainfall to be collected and stored. This can then be used as needed and to bolster any water abstraction. The use of rainwater harvesting will need to become more commonly used to supplement abstraction sources. There are a number of approaches that can be used, but look at your stadium, there are many surfaces that water will easily run off and can be collected (roofs and carparks for example). This will need to become a greater focus, as regulation will likely mean that abstracted water sources are less commonly available.

In the most extreme situation, water can be purchased from suppliers and delivered at high cost by tanker. This is unlikely to be palatable due to high costs, but it can allow racing to continue and may need to be considered in worst case situations.

Remember, greyhound racing takes place on a mix of sand and water. If we can’t ensure a satisfactory and consistent racing surface, then racing must be suspended.

HOT SUMMER CONDITIONS

As long as air temperatures allow racing, summer conditions can prove testing for many tracks. This is due to the need to increase the amount of watering to produce a satisfactory and consistent running surface. Under hot conditions, water loss through evaporation is increased which means more water will be needed to ensure a satisfactory track. Tracks should not be allowed to dry out with water inputs made even on non-race days. It is far better and easier to keep track water levels at a baseline level and top them up, rather than having to chase watering close to the start of a meeting.

Summer track watering needs to be flexible and dynamic to the conditions and frequency of racing. It may be necessary to water the track 7 days a week to ensure the optimum racing surface. It is also important to remember that, when we have to apply greater volumes of water, to start watering earlier in the day to allow water to sufficiently penetrate the track profile. Dumping a lot of water on at the last minute does not produce the best or most consistent racing surface and increases the risk of injuries.

SAND SUPPLY ISSUES

Sand is a non-renewable resource and as such its supply is finite. The types of sand used on greyhound tracks are specific and not commonly used by other industries. This means that our sands are somewhat niche and at greater risk of supply issues. Undoubtedly, sand supplies are becoming scarcer and our need for very specific grades of sand with tight tolerances means that, as an industry, sand supply will continue to become more challenging. There are a number of strategies that tracks need to employ to help prevent major issues around lack of sand supply:

- Know where you get your sand from and why you use that particular sand.
- Engage with your quarry/supplier to find out what is the longevity of availability of this sand at current rates of usage (remember we are using sands that other industries don't and our demands are tiny and not sufficient to keep a quarry open).
- Engage with local or regional suppliers, including small independent quarries to see what they produce and if they are prepared to work with you to develop a bespoke material.
- Ensure you maximise the storage of sand at your track to ensure that you always have sufficient supply to cope with immediate track demands.
- Storage at tracks should look to maintain the quality of stored sands and to prevent wastage, so having proper protected storage bays is a "must have" mission critical facility and not a "nice to have".
- Seek help and guidance when looking for materials, as this will help ensure that if you change sand sources the material is suited to your track, racing schedule and maintenance approach.
- Finally, look after the sand you have and don't waste it. Make sure every grain of sand is giving you benefit and not lost due to contamination or migration.

EXCESSIVE SAND SPLASH DURING CORNERING

If there is a fountain of sand coming from greyhounds as they are cornering, this means they have exceeded the capability of that sand to hold together. In other words, the energy they are putting into running is not all translated into forward motion meaning that some of that energy is lost as the sand sprays backwards when running.

So what does this mean for track safety? Excessive sand splash means that greyhounds do not have sufficient grip in the corner. This will lead to

greater injury risk. Excessive sand splash is the result of the track sand being either too dry or too wet and sloppy. The perfect running surface should barely have any sand splash and nice clear consistent paw prints.
If you see significant sand splash that should trigger you to take a long, hard look at your racing surface and paw prints. It means we need to adjust our maintenance regime and potentially how the track is being managed. Act now to help prevent injuries whilst dogs are cornering.

MITIGATING INJURY RISKS: INSPECTION PROCESS FOLLOWING AN INCIDENT

As with any athletic pursuit, for humans or animals, it is impossible to completely eliminate the risk of an injury occurring. However, any potential risks should be mitigated as far as possible and we need to be confident that the physical properties of the running surface are not increasing the level of risk.

Each track should know what their baseline injury rate is, however minor, both over a full year and on a weekly and monthly basis. When there is an unusual increase in total injuries or injuries of a particular type, this should trigger an immediate response to evaluate what is occurring and if the track is a component of this.

An injury to a greyhound is rarely just down to one factor. Whilst there are many contributing factors that can result in an increased risk of injury, it is important to consider track surface as part of this risk assessment.

Dog factors (innate and acquired)

- The health of the greyhound
- Greyhound preparation and training
- Breeding and genetics
- Number of races run by a dog
- Diet, nutrition and exercise regime

Track factors

- Racing surface preparation
- Water content of surface
- Sand type and track profile characteristics

Race factors

- Racing incidents such as contact between animals or simply a dog being forced off its stride or running line
- The prevailing weather conditions

Figure 41 outlines a broad range of both direct and indirect factors that influence risk of an injury occurring and classifies them into different groups. What we must be certain of is how the track fits into this. This is where having a fundamental understanding of the racing surface and quantitative evidence of how the racing surface is performing (such as water content, penetrometer and hardpan readings) is essential to assessing if the racing surface has played a contributing role.

BREEDING FACTORS	GREYHOUND TRAINING FACTORS
• Breeding – physiological changes inheritable characteristics (weaker/finer bones) • Breeding – stud selection (is a line prone to injuries?)	• Early injury detection • Nutrition • Hydration • Condition of training surfaces • Injury treatment and rehabilitation • Race day dog prep (warming up) • Does training reflect racing? • Dog conditioning – dog preparation • Physiological stress
RACING SURFACE FACTORS	**RACING OPERATIONS FACTORS**
• Racing surface inconsistent • Racing surface too firm/soft • Racing surface has insufficient grip	• Infrastructure failure (e.g. traps or hare failure) • Race distance and its effect on greyhounds • Distance and travel time • Ambient weather conditions • Racing schedule • Collision during racing (dog on dog or dog on infrastructure)

Figure 41. Direct and indirect factors that can influence the risk of an on-track injury.

If an injury does occur, there should be process at each track, which is understood by all, to evaluate what has occurred. As appropriate, and in conjunction with racing office staff, this is likely to involve a combination of the following actions:

- Review of video footage of the incident
- Discussion with the attending vet as to the nature of the injury
- Establishing if there was contact between dogs or if a dog was forced off its intended line
- Evaluation of paw prints for unusual characteristics and the racing surface in the incident area
- Checking track performance data to understand if the track was running normally
- Checking track maintenance records
- Investigating the recent running and medical history of the dog
- Consideration of the question: "Is there anything that you would have done differently?"

They key is to understand how tracks are running and if the surface could have been a contributory factor among a range of other potential reasons. We should always be looking to assess and identify any appropriate improvements that could be made to ensure a consistent, satisfactory racing surface. If all necessary due diligence has been conducted both before and afterwards, you can be confident that the track surface is acceptable and safe for racing to continue.

Review of incidents is an important step towards ensuring racing surfaces are as safe as possible. It should not be seen as something to be ignored and avoided. It is part of the due process of operating a track and striving to understand how the best possible surfaces can be produced.

WHEN TO ABANDON A RACE MEETING

Abandoning or suspending racing is the last action on anyone's mind. However, if the track is not fit for racing it should not be run on. Greyhound welfare is the primary concern and must not be trumped by any other consideration. If there is an abandonment or suspension which involves the track surface or racing infrastructure, there should be an investigation to determine what has gone on and how can it be avoided in the future. If there is any doubt as to the safety of the track at that point in time, the precautionary principle should be not to race. Each track should have a clear procedure to be followed if racing needs to be abandoned. This process should be documented, as well as the subsequent investigation. Don't be afraid to seek help and guidance from GBGB's Track Liaison Officer or STRI.

GETTING SUPPORT

At some stage, you are likely to come up against challenges that seem insurmountable or the root cause of which is illusive. When issues do occur and you feel that you are not able resolve it or your actions are not having the desired effect, ask for help. Help is out there, just ask.

When a track problem rears its head, remember, these issues are not usually unique, other tracks will have or have had the same or similar issues before. Someone, somewhere has had to tackle this or a similar situation before. Across the industry, there are centuries of greyhound track preparation knowledge. You just need to tap into it.

This section will outline some of the avenues for getting support when challenges occur.

OTHER TRACKSTAFF

Colleagues in the industry are a massively valuable resource. It is highly likely that a member of trackstaff somewhere in our industry has tacked this or a similar issue before. You should not be afraid to reach out to colleagues, after all you are all trying to produce high quality, satisfactory and consistent racing surfaces every time you race.

This is why it is so important for trackstaff to engage in workshops and other knowledge transfer and education events. It is really important to create a network of trackstaff who can interact with each other. At the end of the day, we are all preparing sand and water and there is no copyright on its preparation. Share your experiences and knowledge and as an industry we can grow and become stronger.

INDUSTRY EVENTS AND TRAINING

These haven't always been as frequent or consistent as we would like. However, part of the strategy to grow the professionalism in our industry means that industry training, events and workshops will be more common. Use these events to network with all those participating in the preparation of racing surfaces and running of dogs on them.

Usually, these events are run under the banner of the GBGB. These events often have a targeted message and try to balance knowledge sharing, training and practical skill development. It can be challenging these days to get everyone together face to face at a track with the full racing schedules currently in place, but when the opportunity arises grab it with both hands. If you want to know when the next seminar, event, workshop is, please get in touch with the GBGB Track Liaison Officer.

GBGB TRACK LIAISON OFFICER

The role of the GBGB Track Liaison Officer is to be the key link between the GBGB and trackstaff and stadium officials. The aims of this role include but are not limited to the following:

- Point of contact with GBGB on all matters racing surface related.
- Assist groundstaff with tackling issues, training and day to day track preparation processes.
- Help tracks with grant funding applications to GBGB managed funds.
- Work with STRI to run GBGB Track Support Programme.
- Work with STRI and other industry organisation to promote best practice and professional development for track maintenance and preparation.

STRI

STRI are engaged by GBGB to act as technical consultants to the greyhound racing industry, with regard to track surfaces and their preparation. STRI have a long history of working with the greyhound racing industry ranging from track visits, materials testing, research. In their current role, key services carried out by STRI include:

- Carrying out independent track surface assessment visits as part of GBGB's Track Support Programme.
- Engaging with groundstaff during visits and events to provide training on all aspects of material selection, track construction, design and maintenance.
- Support for tracks undertaking minor or major track development works (such as drainage improvements or surface relays).
- Materials and track surface testing.
- Research and development on all aspects of track surfaces and materials.
- Developing guidance for track and trackstaff.

GUIDANCE INFORMATION

This track maintenance guide is a key resource for information on track design, materials and preparation processes. This guidance has been written to be accessible, whilst covering all aspects of how we design, build and operate racing surfaces. This guidance provides the framework for all the other factsheets and technical information available to groundstaff.

Other information sources are also available such as materials coming from GBGB Welfare committee and the Track Safety sub-committee, such as summer track preparation guidelines.

APPENDIX – BARRIER SPECIFICATION DRAWINGS

DURALOCK PERFORMANCE FENCING

DOG TRACK RACERAIL WITH T-CON [OR]

MADE IN BRITAIN

VERSION: 1 - 09.2018
PAGE: 76C

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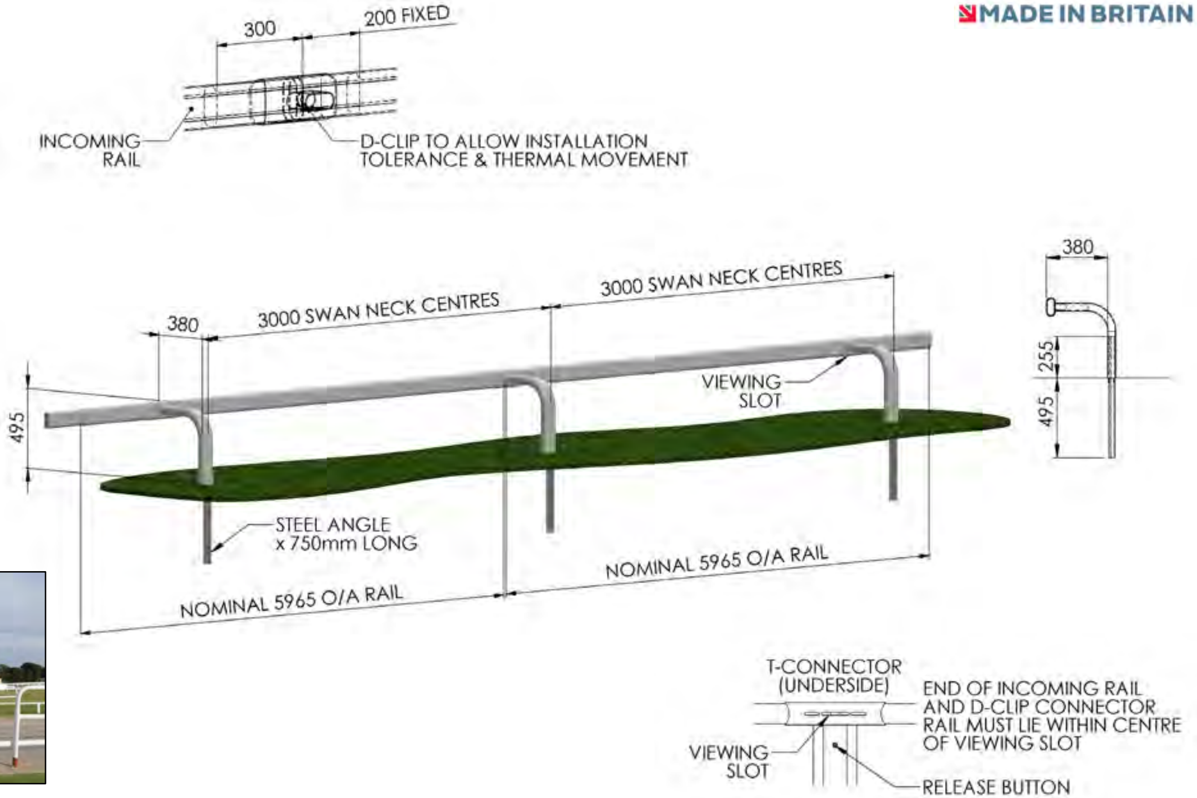

CONTACT
t: +44 (0)1608 678238
e: SALES@DURALOCK.COM
w:WWW.DURALOCK.COM

COMPONENTS:

- SWAN NECK POST
- T-CONNECTOR
- 108MM X 50MM RAIL
- 50MM X 50MM X 3MM, 750MM LONG GROUND FIXING STEEL

DURALOCK (UK) LTD
ENSTONE BUSINESS PARK
ENSTONE
OXFORDSHIRE
OX7 4NP

APPENDIX – BARRIER SPECIFICATION DRAWINGS

DURALOCK PERFORMANCE FENCING

DOG TRACK RACERAIL WITH T-CON [OR]

MADE IN BRITAIN

VERSION: 1 - 09.2018
PAGE: 76CD

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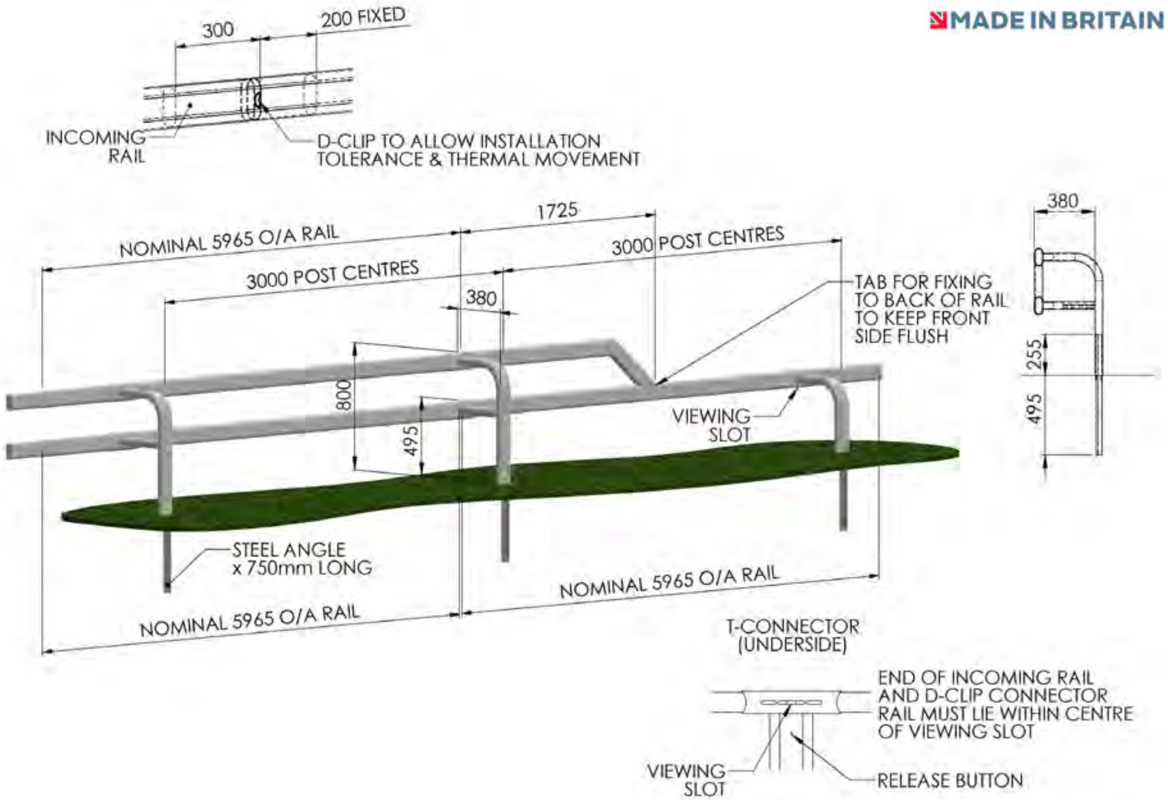

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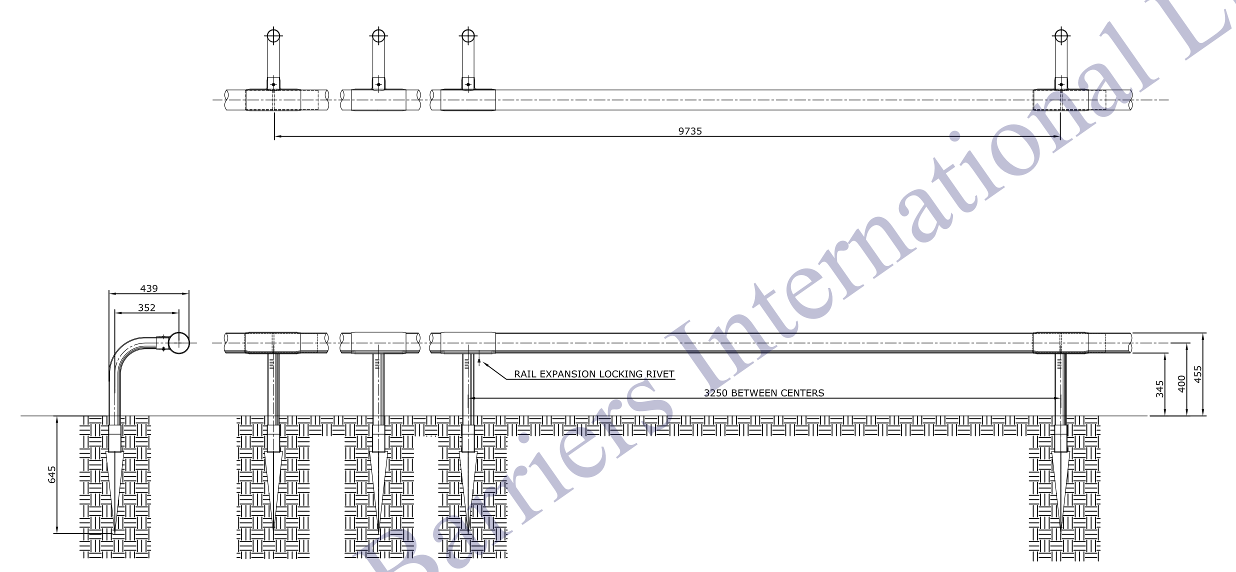
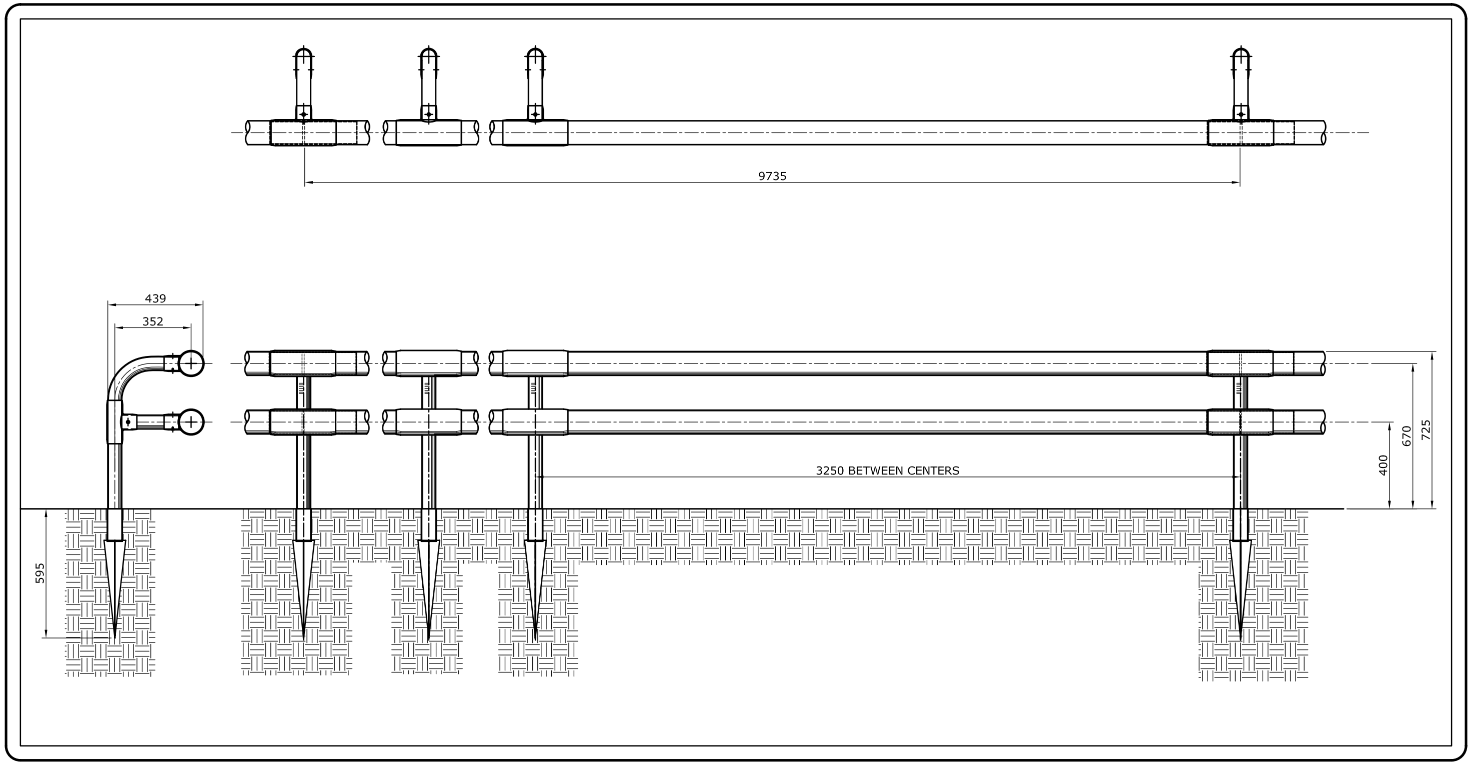


System No.	800	Colour:	White/Blanc/Weiß
		Or:	
Description:	Greyhound Single Racerail - Fixed System. (High UV Formulation)		
Description:			
Beschreibung:			

Barriers International Ltd.
Cullivers Leaze, Foxley, Malmesbury, Wiltshire. SN16 0JJ.
Tel: +44 (0)1 666 829 100
E-mail: sales@barriersint.com Web: www.barriersint.com

Drawing No: 800
Date: 16.12.2009 Issue: 01
Scale: 1:20 Units: mm

APPENDIX – BARRIER SPECIFICATION DRAWINGS



System No.	801	Colour:
		Colour:
		Colour:
Description:	Double Greyhound Racerail on swanneck post	
Description:	Double Greyhound Racerail on swanneck post	
Beschreibung:	Double Greyhound Racerail on swanneck post	

Barriers International Ltd.
PO Box 999, Malmesbury, Wiltshire, SN16 0RX. UK
Tel: + 44 (0)1 666 829 100 Fax: + 44 (0)1 666 823 800
E-mail: sales@barriersint.com Web: www.barriersint.com

Drawing No:	BAR 801	Issue:	02
Date:	01.01.2010		
Scale:	N.T.S.	Units:	mm

APPENDIX – BRINE AND FROZEN TRACK INFORMATION

BRINE SOLUTION MIXING RATES

FOR 10% SOLUTION		FOR 15% SOLUTION		FOR 20% SOLUTION	
VOLUME OF TANKER (LITRES)	NUMBER OF 25KG BAGS	VOLUME OF TANKER (LITRES)	NUMBER OF 25KG BAGS	VOLUME OF TANKER (LITRES)	NUMBER OF 25KG BAGS
1000	5	1000	8	1000	10
1200	6	1200	10	1200	12
1400	7	1400	12	1400	14
1600	8	1600	13	1600	16
1800	8	1800	15	1800	18
2000	9	2000	16	2000	20
2200	10	2200	18	2200	22
2400	11	2400	20	2400	24
2600	12	2600	21	2600	26
2800	13	2800	23	2800	28
3000	14	3000	24	3000	30
3200	15	3200	26	3200	32
3400	15	3400	28	3400	34
3600	16	3600	29	3600	36
3800	17	3800	31	3800	38
4000	18	4000	32	4000	40
4200	19	4200	34	4200	42
4400	20	4400	36	4400	44
4600	21	4600	37	4600	46
4800	22	4800	39	4800	48
5000	22	5000	40	5000	50
5200	23	5200	42	5200	52
5400	24	5400	44	5400	54
5600	25	5600	45	5600	56
5800	26	5800	47	5800	58
6000	27	6000	48	6000	60

APPENDIX – BRINE AND FROZEN TRACK INFORMATION

THE FROZEN TRACK - CAUSES AND PREVENTION

What is Freezing?

Sounds simple enough, but freezing and thawing are complex processes and under normal circumstances are the reverse of each other. When water freezes the water molecules come together in an ordered fashion to make ice.

Wet Sand and Freezing

Normally wet sand freezes at 0 C like plain water. It is important to realize that it is the temperature of the track which needs to be measured, not the air temperature, since they can be different. The track can be just above freezing despite the air temperature being much colder. The track acts as a heat sink, and takes much longer to cool down than you would expect. So one night of hard frost may not freeze a track, but given a full 24 hours of frost, the track will freeze.

The Boggy Track

It has often been reported that winter-time tracks become boggy, with no real explanation. The culprit is the application of salt directly to a wet track. When salt mixes with water, the final volume of the brine is larger than the original water volume, or put another way, if you add enough salt to water to make a 20% brine solution, you will end up with 10% more water than you started with. So adding salt to a wet track has the same effect as adding more water: a boggy track.

Frost Prevention the Old Way

The common approach to protecting tracks is to apply salt directly to the wet sand. Obvious, you might think, but this method has several drawbacks. Firstly, the salt is on the surface, and not within the track; secondly the wet track will become boggy; thirdly the raw salt is in direct contact with the greyhounds' feet; and lastly, the track will become colder because when salt mixes with water it makes the water colder (this is how ice-cream used to be made!). Basically there are no valid reasons to apply salt directly to a track. It does work, sort of, but not nearly as well as it could.

Frost Prevention the New Way

If the salt is dissolved in the water tanker to make a 10% to 20% solution (this is between 100 Kg and 200 Kg of salt per 1000 litres of water), then we can start to make science work for us. The volume expansion and temperature drops occur in the tanker, so that has negated two problems. This brine can now be used to water the track as you would do in the summer, and has two advantages: the brine will percolate down through the track and protect the whole depth of the sand, and secondly there is very little risk of damaging the greyhound's feet. Just remember to wash out the tanker to avoid corrosion of any metal parts.

APPENDIX – BRINE AND FROZEN TRACK INFORMATION

More Salt Vicar?

So what can be done when the brine-treated track eventually freezes? Not a lot. It is important to understand that the track will not be protected below -4 C (25 F) whatever is done, despite strong brine being able to resist freezing down to -21 C. It appears that the sand grains dramatically alter the freezing point - a fact which I have repeated many times in my experiments with track samples and studies on established tracks. There is a temptation to add more salt to a track to prevent freezing, but once the track is colder than -4 C, no further protection is possible, and adding more salt will only increase the risk of damage to the web skin of the greyhounds' feet. It is difficult to say 'no more salt', since as humans we like to do something, but in the case of a frozen track below -4 C, there are very limited options, and adding more salt is not one of them. It really comes back to proper preparation and using a combination of techniques to protect the track: covers, brine, and scuffing the surface to trap air in the track.

Magnesium chloride

As one of my studies, I assessed the effectiveness of different chemicals as track antifreezes. Alongside good old salt, magnesium chloride is an excellent alternative, albeit more expensive. If you live by the sea, just put sea water on your sand track all year round. Few tracks have this geographical luxury, so salt, magnesium chloride, or a mixture of both are the most practical chemical solutions to use as track antifreezes. My trials also included calcium chloride, but this was found to be hazardous to handle, and is known to cause blisters (please note I did not experiment on animals - calcium chloride is well-known for its toxicity).

Conclusion

The application of science to the world of wet sand tracks has revealed some valid explanations and rational practices that can be used in the black art of track maintenance. What I have described above does work, and has been used on some UK tracks with good results. More science, more confidence, less guesswork!

Richard Payne
MRCVS

Email: richard.payne@nottingham.ac.uk

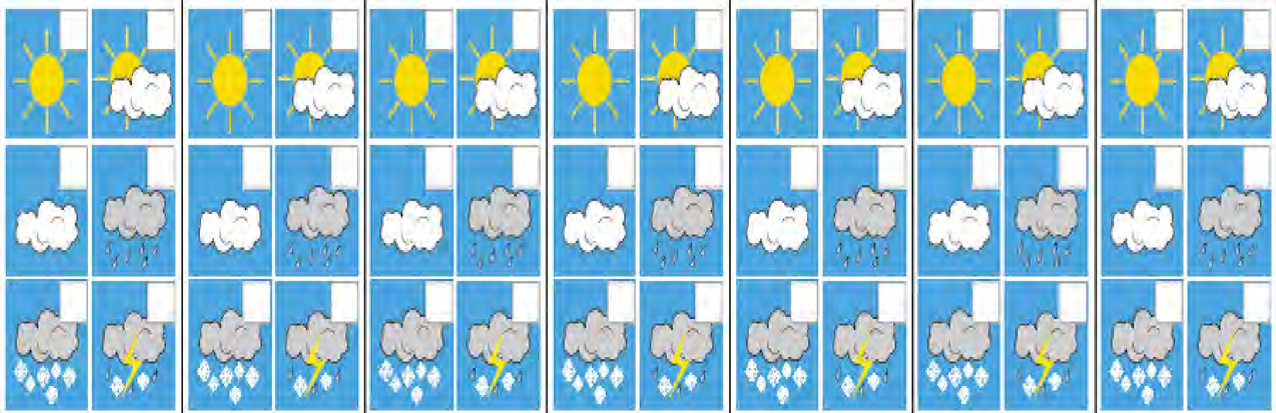
Richard Payne sits on both the GBGB's Track Safety Committee and the Veterinary Sub Committee, and has completed several projects on the behaviour of wet sand tracks.

APPENDIX – CHECKLISTS & WORKSHEETS

Example of Track infrastructure checklist							
Week Commencing							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Task							
Check/grease/oil/clean-out all traps	☐	☐	☐	☐	☐	☐	☐
Operate/test all traps	☐	☐	☐	☐	☐	☐	☐
Check Hare and Rope, rails,pulleys,skate & sock	☐	☐	☐	☐	☐	☐	☐
Inspect/test compressor/s for traps, drain moisture	☐	☐	☐	☐	☐	☐	☐
Test Hare	☐	☐	☐	☐	☐	☐	☐
Clear Hare rail of sand build-up	☐	☐	☐	☐	☐	☐	☐
Empty sand collecting pits	☐	☐	☐	☐	☐	☐	☐
Sweep parade paths	☐	☐	☐	☐	☐	☐	☐
Inspect running rails and T-pieces, repair as necessary	☐	☐	☐	☐	☐	☐	☐
Check wall padding	☐	☐	☐	☐	☐	☐	☐
Strim running rail/perimeter fenceline	☐	☐	☐	☐	☐	☐	☐
Mow grass in middle of track	☐	☐	☐	☐	☐	☐	☐

APPENDIX – CHECKLISTS & WORKSHEETS

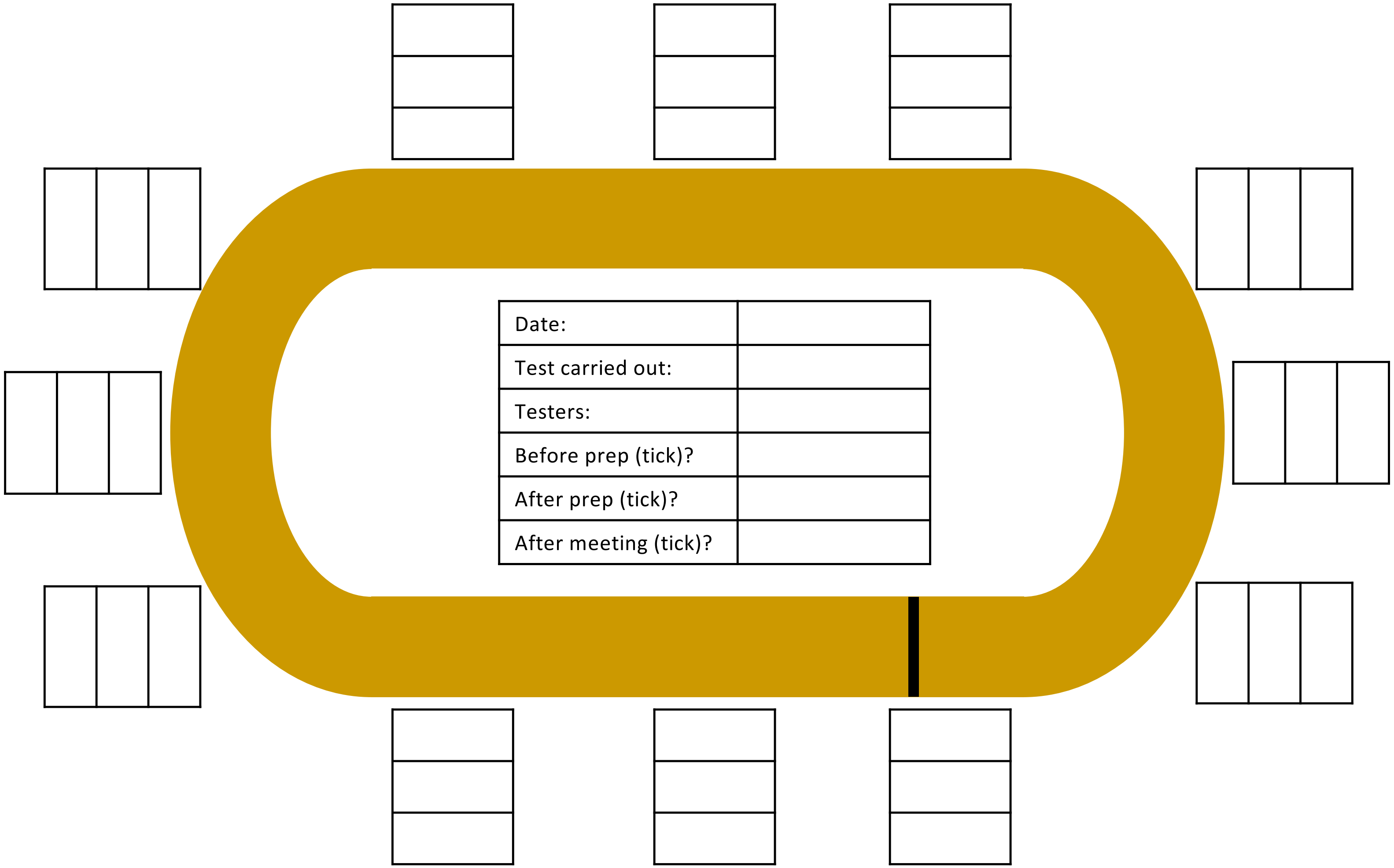
Track Maintenance Week Commencing ....

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Race or Trial							
Weather Conditions (Tick Box)							
Temperature (min/max)							

APPENDIX – CHECKLISTS & WORKSHEETS

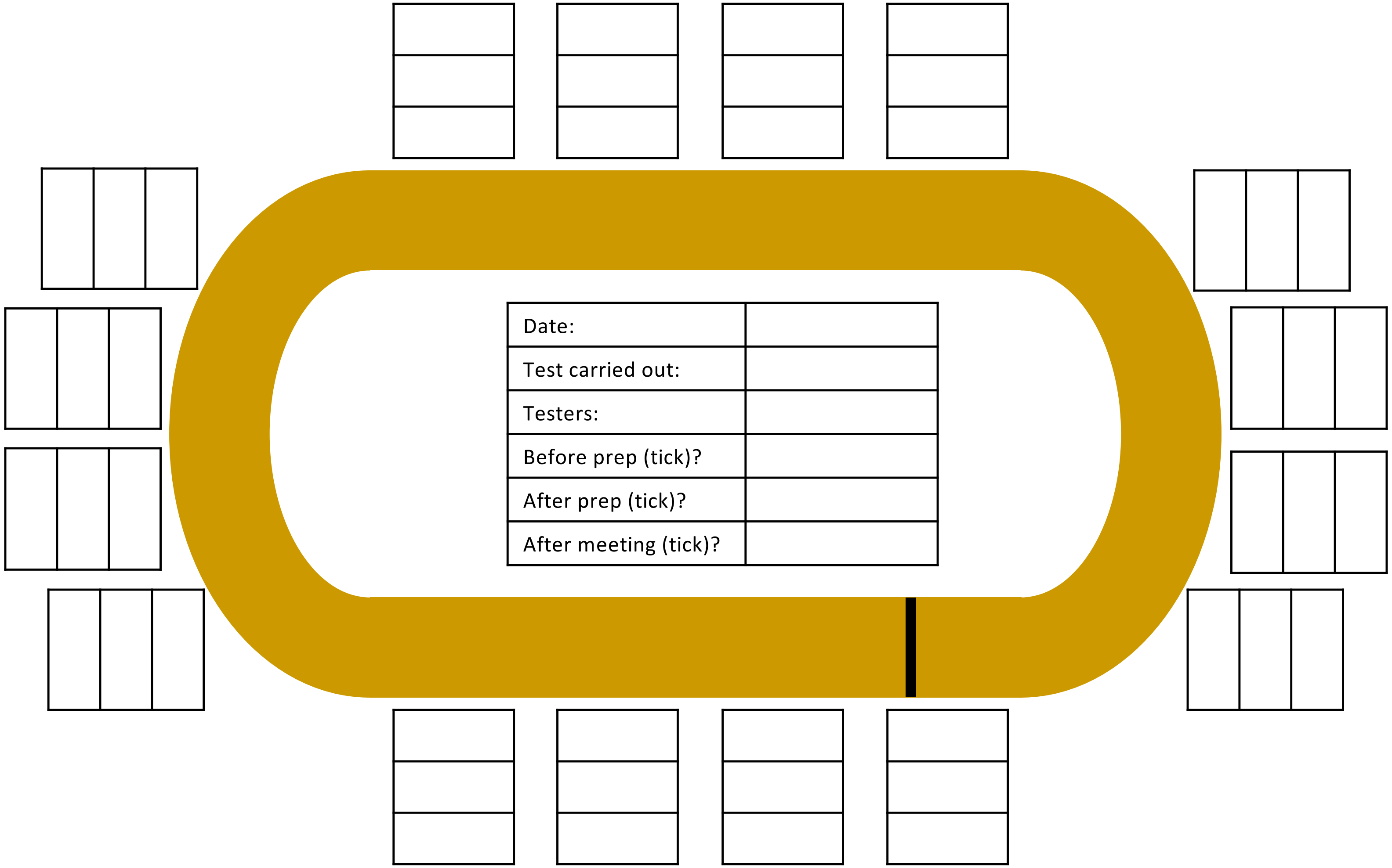
		Example of Weekly Trackwork Checklist					
Week Commencing:							
	MONDAY	**TUESDAY**	**WEDNESDAY**	**THURSDAY**	**FRIDAY**	**SATURDAY**	**SUNDAY**
Tasks							
Hand Raking	☐	☐	☐	☐	☐	☐	☐
Levelling mesh/board	☐	☐	☐	☐	☐	☐	☐
Levelling Harrow	☐	☐	☐	☐	☐	☐	☐
Tyre Packing	☐	☐	☐	☐	☐	☐	☐
Plate with Knives/spring tines	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:
Bowser Applications	☐ NUMBER APPLIED:	☐ NUMBER APPLIED:	☐ NUMBER APPLIED:	☐ NUMBER APPLIED:	☐ NUMBER APPLIED:	☐ NUMBER APPLIED:	☐ NUMBER APPLIED:
Hose Application	☐	☐	☐	☐	☐	☐	☐
Sprinkler Application	☐	☐	☐	☐	☐	☐	☐
Track Decompaction/Reset	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:
Penetrometer readings	☐	☐	☐	☐	☐	☐	☐
Other operations	☐	☐	☐	☐	☐	☐	☐ ....
Infrastructure Checks							
Running Rail/Barriers/Wall padding	☐	☐	☐	☐	☐	☐	☐
Hare System	☐	☐	☐	☐	☐	☐	☐
Traps and Actuators	☐	☐	☐	☐	☐	☐	☐
Check Cambers	☐	☐	☐	☐	☐	☐	☐
Sand Depths	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:	☐ DEPTH:
Check Drainage infrastructure	☐	☐	☐	☐	☐	☐	☐
Tine/Knive/Blade wear on equipment	☐	☐	☐	☐	☐	☐	☐
Track Additions							
Add Sand							
1st/2nd bend	☐	☐	☐	☐	☐	☐	☐
3rd/4th bend	☐	☐	☐	☐	☐	☐	☐
Home straight	☐	☐	☐	☐	☐	☐	☐
Back Straight	☐	☐	☐	☐	☐	☐	☐
Salt application							
Salt into depth 6"	☐	☐	☐	☐	☐	☐	☐
Salt into depth 3"	☐	☐	☐	☐	☐	☐	☐
Salt onto track Surface	☐	☐	☐	☐	☐	☐	☐
Track Covers Applied	☐	☐	☐	☐	☐	☐	☐
Frozen Track							
Power Harrow	☐	☐	☐	☐	☐	☐	☐
Blec Trac-a-vator crumbler	☐	☐	☐	☐	☐	☐	☐
Salt reapplied	☐	☐	☐	☐	☐	☐	☐
Meeting abandoned	☐	☐	☐	☐	☐	☐	☐
Race/Trial Activity							
Pre-race foreign object pick	☐	☐	☐	☐	☐	☐	☐
Hand Rake	☐	☐	☐	☐	☐	☐	☐
Plate after every....... Race/s	☐	☐	☐	☐	☐	☐	☐ ....
Bowser after every...... Race/s	☐	☐	☐	☐	☐	☐	☐ ....
Hose/sprinkler after every race/s	☐	☐	☐	☐	☐	☐	☐ ....
Other operations during trial/races	☐	☐	☐	☐	☐	☐	☐ ....

APPENDIX – EXAMPLE TRACK MAP RECORDING SHEETS



Date:	
Test carried out:	
Testers:	
Before prep (tick)?	
After prep (tick)?	
After meeting (tick)?	

APPENDIX – EXAMPLE TRACK MAP RECORDING SHEETS



Date:	
Test carried out:	
Testers:	
Before prep (tick)?	
After prep (tick)?	
After meeting (tick)?	

APPENDIX – INCLINOMETER METHOD

METHOD FOR HOW TO USE THE BOSCH GIM 120 1.2 M STRAIGHT EDGE AND INCLINOMETER ON GREYHOUND TRACKS TO ASSESS CAMBER ANGLE OF THE TRACK AND EXTENT OF SURFACE DEPRESSIONS/HIGH SPOTS.

Introduction

The measurement of camber angle has been possible through manual means for a long time. However, this process has required measuring the heights of the inside and outside of the track from fixed points and manually calculating the angle of the slope. To make this process as easy as possible and usable by all groundstaff, the use of an automated tool to measure camber angle has been introduced. The BOSCH GIM 120 allows camber angle (expressed in degrees °) to be measured quickly and easily. The device has an inbuilt digital inclinometer, as well as functioning as a straight edge to allow the extent of surface dishing or high spots to be measured.

Principle of operation

The digital inclinometer is turned on and the straight edge placed on the surface orientated across the track, i.e. with one end of the straight edge pointing to the inside and the other to the outside. The digital inclinometer will then provide the camber angle (make sure the unit is set to read in °, which can easily be adjusted by pressing the unit button on the device). The device will show the direction of the slope, i.e. is there a positive camber running from the outside to inside of the track, or is there a flat or negative camber which has implications on water movement and consistency of going across the surface.

Additionally, gaps under the straight edge will provide a visual guide to how even is the track surface. Gaps under or at one end of the straight edge indicates dishing due to sand loss or build-up of sand on the inside or ridging within the racing surface. The extent of these gaps can be measured with a tape measure or graduated chock.

Method for taking a camber angle reading

To take a reading please follow the steps below. However, before first use follow the check process given in the manufacturer's instruction manual. If the unit needs calibration, please follow the manufacturer's guidelines. It is recommended that the unit is checked regularly to ensure values are correct. The regularity of checks will depend on how often the unit is used, the more frequently it is used the more regularly checks will need to be carried out.

APPENDIX – INCLINOMETER METHOD

1. Turn on unit.

2. Check unit is set to read in degrees (°).

3. Place unit on surface at 90° or right angle to the slope.

4. Take reading from screen after a couple of second to allow the reading to stabilise.

5. Move to next position.

APPENDIX – INCLINOMETER METHOD

The unit will give slope angle in both directions, so it is important to know if the value shows a positive camber (slope running from outside to inside) or a negative camber (slope running from inside to outside). The direction of the slope can be gauged from the arrows given on the read-out screen or the built in bubble gauge.

Where to take readings and how many to take?

There are no hard and fast rules on the number of readings you should take, as the more readings you take the better understanding you will have of the slope of your track and how it changes along a straight or around a bend. As a rule of thumb, the minimum number of test locations for each straight or bend complex (e.g. bend 1&2 or bend 3&4) should be three (typically from each third of the straight or bend). Readings should be taken as a minimum on the inside and middle of the track width, but it is highly valuable to also take readings on the outside third of the track width. The reason for taking readings from multiple locations across the track, in each test location, is to assess camber consistency. The image below shows standard test locations used by STRI during their visit.

APPENDIX – INCLINOMETER METHOD

The inclinometer allows rapid measurement of camber angle, with a whole track being assessed in a matter of 10-15 minutes and can be done at the same time as taking penetrometer readings. Ideally, readings should be taken weekly to assess the impact of weather, racing, and maintenance on camber angle and sand movement.

Please note, readings should be taken from the prepared racing surface.

What are the general guideline values?

Each track has a unique geometry and its relationship with the optimum camber angle will be track specific. In general, narrower radius bends will have greater camber, whereas more open bends with greater radii typically run with less camber. The exact optimum will depend on your track geometry and how the surface is prepared.

It is recommended that tracks assess when their surface is running at its best and try to keep the camber angle around this value. During periods of heavy rainfall, disruptive maintenance operations or high levels of track activity, camber angle should be measured more frequently.

The optimal running surface will have a consistent camber angle across the whole track width. If this is not the case, this indicates that the track needs to work on bringing the surface profile back to a consistent slope (often this means moving sand from where it has accumulated to where it has been lost from).

APPENDIX – KEY SUPPLIER CONTACTS

Sport governing body and track support consultants

- GBGB (Greyhound Board of Great Britain)
  Genesis House
  17 Godliman Street
  London
  EC4V 5BD
  www.gbgb.org.uk

- STRI (sports turf research institute)
  STRI Group
  St. Ives Estate, Bingley,
  West Yorkshire,
  BD16 1AU
  T: +44 (0)1274 565131
  E: enquiries@strigroup.com

Sands and associated products

- Overton UK Ltd (Sand cleaners)
  Overton (UK) Limited
  14 Farrier Road
  Lincoln
  LN6 3RU
  Tel: +44 (0)1522 690011
  Email: sales@overtonukltd.com
  www.overtonukltd.com/products/beach-cleaners/

- SCAM Srl (Pinguino Beach Cleaner)
  Via Maestri del Lavoro 14/16
  47122 Forli FC, Italy
  Tel: +39 0543 722377
  www.beach-cleaning-machine.com/

- Day Aggregates (Pegasus Supplier)
  Contact Details
  Head office
  Transport Avenue,
  Brentford,
  Middlesex,
  TW8 9HF

  Sales office
  Spitfire Quay,
  Hazel Road,
  Southampton,
  Hampshire,
  SO19 7GB
  Tel: 08000 448101
  www.dayequestrian.co.uk/

APPENDIX – KEY SUPPLIER CONTACTS

- Garside Sand (Supplier of Garside WFSS also known as Pro Arena)
  Garside Sands,
  Eastern Way,
  Health & Reach,
  Leighton Buzzard,
  LU7 9LF
  Tel: 01525 237911
  Email: garside.sands@aggregate.com
  www.aggregate.com
- Bathgate (Supplier of moist equestrian sand)
  Bathgate Silica Sand,
  Arclid Quarry,
  Congleton Road,
  Sandbach,
  Cheshire.
  CW11 4SN
  Tel: 01270 762828
  Email: sales@bathgatesilica.co.uk
  www.bathgatesilica.co.uk/equestrian
- Fife Silica Sand (Supplier of Fife Silica Equestrian Sand and part of Patersons Quarries - Patersons of Greenoakhill Ltd)
  Burrowine Moor Quarry
  By Alloa
  Clackmannanshire
  FK10 3QD
  Tel: 01236 433 351
  www.patersonsquarries.co.uk/

Track maintenance equipment

- Mumby Machinery – Spares and repairs for Blec machinery
  Mill House Farm,
  Deeping Road,
  Baston,
  Peterborough,
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  Tel: office = 01778 346222, Gary mobile = 07860 489714
  Email: sales@mumbymachinery.com
  www.mumbymachinery.com/

APPENDIX – KEY SUPPLIER CONTACTS

- KTF-Kennel & Track Fabrication (also Hare system installer and repairer)
  8 Church Road,
  Pamber Heath,
  Hampshire,
  RG26 3DP
  Tel: 07867501621
  Email: Info@ktfabrication.co.uk
  www.ktfabrication.co.uk/
- G T Hare Systems Ireland Ltd (Also Hare systems provider)
  Ballinamore Marina,
  Ballinamore,
  Co. Leitrim,
  Ireland
  Tel: Gavin - 00353-876573254
  Email: Harespares@live.ie
  www.gtharesystems.com

Track infrastructure

- Steriline racing greyhound products (Australian inside hare system)
  www.sterilineracing.com/our-products/dog-racing-lure/
  www.sterilineracing.com/contact-us/
- Stuart Canvas Ltd (Track covers and wall padding)
  Unit 6 Hardwick Grange,
  Woolston,
  Warrington,
  Cheshire,
  WA1 4RF,
  United Kingdom
  Tel: +44 (0)1925 814525
  Email: sales@stuartcanvas.co.uk
  www.stuartcanvas.co.uk
- Foams 4 Sports Ltd (Wall padding supplier)
  Unit 1,
  Grosvenor Industrial Estate,
  Grosvenor St,
  Ashton-under-Lyne,
  OL7 0RE
  Tel: 0161 339 6100
  Email: sales@foams4sports.co.uk

APPENDIX – KEY SUPPLIER CONTACTS

- Barriers International Ltd. (Safety barrier – round profile barrier)
  Cullivers Leaze,
  Foxley,
  Malmesbury,
  Wiltshire,
  SN16 0JJ
  United Kingdom.
  Tel: 01666 829 100
  Email: Sales@barriersint.com
  www.barriersint.com/other-sports/greyhound-rail/
- Duralock (UK) Ltd
  Enstone Business Park,
  Enstone,
  Oxfordshire,
  OX7 4NP
  Tel: 01608 678238
  Email: SALES@DURALOCK.COM
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APPENDIX – PENETROMETER METHOD

METHOD FOR HOW TO USE THE PENETROMETER ON GREYHOUND TRACKS TO ASSESS SURFACE FIRMNESS, COMPACTION DEPTH AND GREYHOUND FOOTING.

Introduction

The penetrometer used by STRI on greyhound tracks originates from the horseracing world. It was developed by the French horseracing authorities for assessing the going of their tracks, and it is still one of the main tools they use. STRI has been using this style of penetrometer on all sports surfaces (pitches, golf courses, horse racing, equestrian arenas and greyhound tracks). Over several decades of use it has been found to give an excellent reading of how compact a surface is, in a way that is free from operator bias (i.e., the values obtained are not affected by which operator carries out the testing, as is often the case with trowels and other implements shoved into the track surface). This is now the standard way STRI assesses compaction and surface firmness of greyhound racing surfaces.

Principle of operation

The principle for using the penetrometer is simple (Fig. 1). A 1 kg weight (Fig. 2) lands on a 1 cm^2 probe (Fig. 3) which is driven into the surface. At the top of the penetrometer is a graduated scale marked in cm with 0.5 cm graduations (Fig. 4). This allows readings to be made to the nearest 1 mm and mm is the best way to record the values.

Fig 1. Penetrometer.

Fig 2. 1 kg weight.

Fig 3. 1 cm^2 probe.

Fig 4. Graduated scale.

APPENDIX – PENETROMETER METHOD

Method for taking a reading

Below is the method for preparing the penetrometer and taking a complete reading from one location on the track. The number of locations and where to take readings from is discussed in the in the next section.

The process for taking a reading is as follows:

1. Remove the base plate cover and put somewhere safe!
2. Place the penetrometer vertically on the surface
3. Drop the weight from the top of the penetrometer (i.e., it is dropped the full height of the penetrometer so that the top of the weight touches the underside of the handle).
4. Take a reading from the graduated scale. This is the 1st drop reading.
5. Keeping the penetrometer exactly where it is, drop the weight a further two times (this makes 3 drops in total).
6. Take a reading from the graduated scale. This is the 3rd drop reading.
7. You have now taken a complete reading.

In between readings, check that an accumulation of sand has not built up on the bottom plate of the penetrometer (you can often check this by looking at the mark left on the surface – if the sand surface is intact you are fine, if you have lifted some of the sand away, check and clean the base plate). Alternatively, I tend instinctively just to wipe the base plate between readings on my boot to scrap off any sand accumulation.

After completing your testing, clean the penetrometer and put the base plate on (remember sand grains stuck between to pieces of metal = a stuck base plate!).

Note, due to repeated percussion caused by the weight of dropping on the probe can cause the screws holding the base plate on to become loose over time. Check them regularly and put some screw grip/threadlock adhesive on to hold the screws in place.

Where to take readings and how many to take?

There is no universal process for where and how many readings to take. This is a decision that must be based on local factors (schedule, resource availability and level of variation expected across and around the track).

As a minimum, readings should be taken from each straight and bend with a reading on the inside, and outside of track. It is also strongly recommended to also take readings from known problem areas such as crossing points across the track for vehicle and foot traffic. This is because your surface is only as good as the worst point.

APPENDIX – PENETROMETER METHOD

Tracks are strongly encouraged to design a testing scheme that works for them. A good option is to split each straight and bend complex (1&2 and 3&4) into three zones and in each zone take readings at three points across the track (Fig. 5).

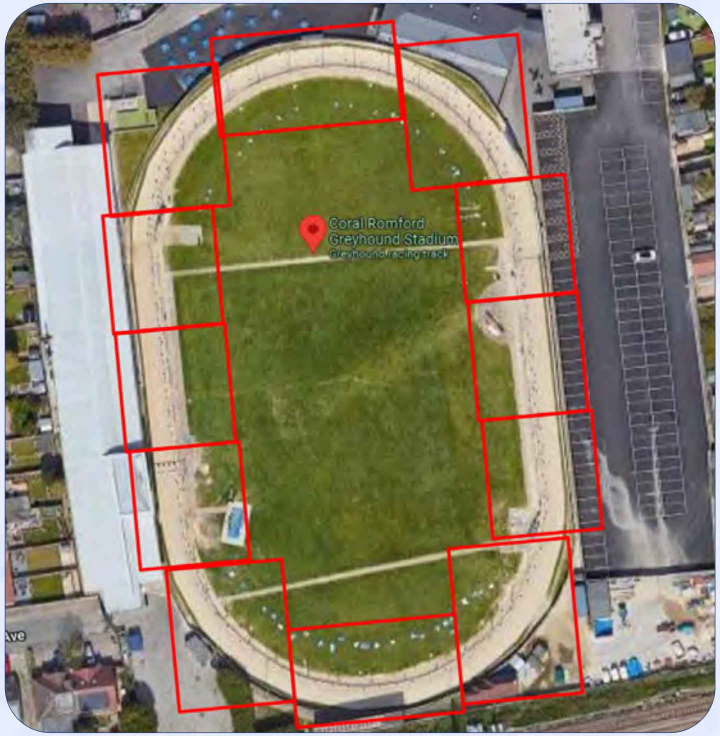

Fig 5. Suggested zones around the track. Readings taken in each zone going across the track.

Determining when to take readings is also critical. As a minimum, to be able to understand the condition of the racing surface immediately prior to the meeting (as close to trials and racing as possible) is essential. The optimal timings to carry out readings is:

- **Prior to that day's preparation** (informs if there are any compact/firm areas or hardpans building up).
- **Immediately prior to the meeting** (this is what the greyhounds are racing on).
- **After the meeting** (informs where you ended up at the end of racing, how much change was there, had maintenance been effective at keeping the racing surface at its optimum and inform what the next day's/meetings prep might need to consider).

Taking readings during the meeting is also a useful tool in a track's arsenal and sends out strong messages:

a) provides an understanding of how the surface is performing during racing.

b) visual demonstration of the thoroughness of preparation and ongoing engagement of groundstaff with the racing surface.

APPENDIX – PENETROMETER METHOD

What are the general guideline values?

Guideline values have been produced from over 4 years of data collection to determine what is normal on greyhound tracks in the UK (Table 1). It is recommended that tracks look to set their own threshold values that can be used to trigger when the surface is getting too firm and needs remedial activity. When doing this, bear in mind you might not be able to carry out remedial works immediately so give yourself a little extra margin when setting your threshold values. Setting threshold values needs to be tailored to the layout, sand and operating schedule of each track.

TABLE 1. GUIDELINE VALUES FOR PENETRATION DEPTH VALUES

	PENETRATION DEPTH – 1ST DROP (MM)	PENETRATION DEPTH – 3RD DROP (MM)
HARD	<35	<75
FIRM	35-44	75-84
NORMAL	45-80	85-125
SOFT	>80	>125

GLOSSARY

% passing This is the amount of material that passes through a sieve with particular size of hole in the mesh.

% retained This is the amount of material that is held on a sieve with a particular size of hole in the mesh.

Abstraction The process of taking water from surface and sub-surface water sources for use in irrigation.

Actuator The device that sends a signal for mechanical devices to operate, such as the opening of the traps.

Aeration Operation that inserts tines (typically cylindrical) into the racing surface.

Aggregate Term used to describe all granular materials used for construction, including sands, gravels and crushed stone.

Air injection aeration Aeration that used compressed air to fracture any hard layers of sand in the track. Can also be used to bring trapped water to the surface to allow it to escape down the aeration hole.

Barrier Device to keep the greyhounds on the racing surface and to prevent them leaving the confines of the track under racing conditions. Often barrier is installed to protect greyhounds from leaving the prepared surface and coming into contact with track infrastructure.

Base/consolidated layer Lower part of the track profile which provides a stable foundation for the racing layer to sit upon. It must allow water movement to create appropriate retention in the racing layer and not become too consolidated and compact as to affect the performance of the track surface.

Bend radius This is the geometric value of the distance from the curve of the inside running rail to a line that runs across the diameter of the bend (i.e. an imaginary line between the start and end of a bend complex such as bends 1 & 2 or 3 & 4).

Borehole Infrastructure to draw water from an underground source, such as a natural sub-surface aquifer.

Bowser Tank mounted on wheels that is drawn by a tractor, whose purpose is to apply an even and targeted coverage of water to the racing surface.

Brine A solution of salt, such as sodium chloride or magnesium chloride, that is sprayed on a track surface to help prevent surface freezing.

Camber (camber angle) The angle of the slope from the inside of the running rail to the outside of the running surface. This parameter should be measured degrees (°) as this is the standard unit of measurement for angles.

Cinder ash Residue from industrial furnaces that have been used to provide a firm but draining base. However, these materials have in the past been associated with possible heavy metal contaminants, so are avoided in favour of stable and inert aggregate materials.

Clay Particles which are less than 0.02 in diameter.

Coarse sand Sands which range from 0.5 - 1 mm in diameter.

Compaction Pressing together of sand grains by vertical forces from vehicles and foot traffic. Happens naturally over time, but accelerated when more intensive track watering is needed. A particular problem if concentrated into a shallow depth creating a hardpan.

Compressed airline Pipework that takes air from a compressor to a device that needs to be operated, such as traps.

Compressor Device that takes air at normal pressure and compresses it to increase the pressure so that the air has greater force/energy to allow it carry out great work/ operate mechanical systems, such as traps.

Crushed stone Stone that has been crushed mechanically to produce a granular aggregate, which is often angular in nature. The wear characteristics of the aggregate are determined by the parent material. Therefore, if a soft stone is used (such as a soft limestone) it will more likely breakdown than a hardwearing material, such as granite.

Cultivation Any process that physically disturbs the running surface. Typified by decompactive resetting operations of the running surface using the power harrow and/or Track-Avator

Cultivator A device that is designed to be used to cultivate the track surface.

Cushioning This is the level of shock absorption of the sand. It is important that the sand:water racing surface has adequate cushioning to prevent impact injuries to limbs and joints, whilst still allowing suitable cohesion between sand particles to give optimal grip when cornering.

Decompaction The technical term for opening up the porespace between sand grains, thereby removing compaction within the track profile. Resetting the track is one form of decompaction.

Decompactive aeration Process of decompacting the track by inserting tines into the surface to replicate the action of a garden fork, either through the action of creating holes and/or lifting the sand to break it up.

Deflector plate Device fitted to the nozzle outlet of a bowser that creates the fan pattern spray of water.

Drainage aggregate Materials used create a porous layer or depth through which water can flow. Typically these are natural rounded gravels/stone or crushed rock. The latter can be identified due to the angular nature of the aggregate particles. Care should be taken that any drainage aggregate to ensure it is resistant to chemical and physical weathering.

Fine sand Sands which range from 0.125 - 0.25 mm in diameter.

Fines The total amount of very fine sand, silt and clay in a material. Fines are associated with increased water retention and compaction risk.

Flow rate Rate at which water can be draw or moved in a river or pump. Typically flow rates are measured in a unit of volume in a set time period, such as litres per second or gallons per minute. For example, if you have a 3000 l bowser and your pump can abstract water at 12000 l per hour. it would take 15 minutes to fill the bowser.

Functional redundancy This relates to having appropriate backups for key infrastructure and processes. I.e. we are not relying on only one option (a single point of failure) but have several options. For example, a track should have several tractors for preparation and if one fails then a meeting can still be held with only one tractor being operable.

Geotextile A fabric membrane which is used to separate the sand profile from other layers within the track, such as drains or drainage layers. The specification of the geotextile needs to be compatible with the performance of the sand and the nature of the underlying material.

Grading a track surface Creation of a uniform and appropriately cambered racing surface suitable to the geometry and layout of the track.

Grading blade/bar The implement commonly used to move sand and cut a suitable uniform camber into the running surface.

Graunlated salt Processed salt formed by evaporation, which means the salt is readily soluble. Comes in various size grades from fine to coarse, with finer particles dissolving quicker than coarses ones.

Gravel Larger particles of weathered and transported rock which are naturally occurring. Typically rounded

	in shape due to them being transported by water or ice. Gravels tend be fall between 2.0 - 8.0 mm in size with materials greater than 8.0 mm in diameter being classed as stones.
gravel/stone sizes particles	These are used in drainage and range typically from 4-8 mm in diameter for gravels and up to 40 mm for civil engineering type stone drainage bases.
Hardpan	Excessively compacted layer of sand that builds up over time due, primarily, to vehicle and foot traffic. Poses significant risk to greyhounds if too close to the surface. Summer months accelerate its formation due to increased bowser usage. Once established, can only be broken up using power equipment such as a power harrow or Track-Avator.
homogenised profile	A track profile that is uniform and consistent and therefore behaves as one layer. Modern track profiles tend to consist of only one sand type to avoid future incompatibility between the different sand layers.
HSE (Health and Safety Executive)	The government body responsible for overseeing regulations and their implementation that covers all health and safety activities.
Layered profile	Porfile where there are either layers of different sand or where the same sand is behaving differently in distinct layers (such as those formed through longstanding compaction). Layering can cause issues as it can restrict the movement of water and reduce the binding capabilities of racing layer to the base sand.
Medium sand	Sands which range from 0.25 - 0.5 mm in diameter.
Non-potable water	Water that is not of a quality for consumption by people.
Particle size	The unique distribution of different sized grains in a material. Measured as the diameter of the particles when passing through a sieve of known aperture size.
Particles	Individual grains of material such as grains of sand or gravel or stone fragments.
PDV salt	Pure Dried Vacuum salt, which typically has a fine grain size and is dried for ease of pouring or application. Often used for industrial processes or inclusion in food preparation.
Pores	The spaces present between individual grains of sand or drainage aggregates. These pores can be filled with air, water or a combination of both. The size of the pores between particles is determined by the size of the particles (large particles have large pores and small particles have small pores). The balance between large and small pores determines the drainage and water retention characteristics of the material.

PTO (Power Take Off)	The device on a tractor that converts engine power to mechanical motion to drive an implement using the movement of a rotational shaft.
Racing layer	The upper layer of the track profile where the greyhounds paw interacts with the sand. It is this layer that provides the appropriate level of cushioning and grip to the racing greyhound.
Resetting	The new term for "digging up". Resets the hardpan and compaction within the track leaving a good working depth of sand for racing on. Intervals between resetting are determined by the rate at which the track compacts. For example, greater racing intensity and more vehicle traffic will mean that resetting will have to be done more frequently and based on track monitoring results. Often done with a power harrow or Track-Avator to physically break up hard sand layers.
Rock salt	Mined salt from seams underground that is typically brown in colour and supplied as coarse granules that do not dissolve as quickly as PDV salt. Often used as a material to be worked to a greater depth in greyhound tracks. Care should be taken no to use too coarse a granule size, which undissolved can act as gravel sized particles in the sand surface.
Running/ racing surface	This is the part of the track on which the greyhound runs and that provides the required cushioning and grip characteristics. Any part of the track surface which can be run on by a greyhound constitutes the racing surface and should be consistent across and around the track.
Salt	A crystalline material that is used to reduce the freezing point of water, thereby helping to prevent it from freezing in the track under winter conditions.
Sand	Particles of weathered rock between 0.063 - 2.0 mm in diameter. Most greyhound sands have grains between 0.063 - 0.5 mm in diameter.
Sand cleaner	A device that runs through the sand sieving out foreign objects of varying size. Typically used on beaches to remove rubbish and stone fragments.
Silica	Silica is the main component of all rock minerals and as sands are weather pieces of rock, their grains are made up from very high quantities of silica. Silica sands are pure with very few impurities, but other sand types, such as iron sand, are still silica dominant but have increased quantities of impurities in the sand grains (which often results in different colour sands).

Silt Particles which range from 0.02 - 0.063 mm in diameter.

Soil Soil is composed of inorganic mineral fragments of different size (sand, silt and clay sized particles), in addition to organic residues for plants and animals. The properties of soil are determined primarily from their constituent parts, such as proportion of sand, silt and clay.

Spray bar A bar that has holes or small nozzles fitted that applies water evenly across the racing surface. These can be spray bars that mirror rainfall or dribble bars that wet the surface with a constant stream of water.

Sub-surface irrigation Irrigation that is supplied from below a surface, rather than applied at the top of a track.

Surface water Water bodies that are found at the earth's surface, such as streams, rivers, lakes, ponds and reservoirs. They can be natural or human made water courses/storage.

Term Definition.

Traps The starting boxes used to contain six dogs and release them simultaneously once the hare passes the box. Traps must be fully opened when the hare is approximately 11 m from the front of the traps.

Very coarse sand Sands which range from 1 - 2 mm in diameter.

Very fine sand Sands which range from 0.063 - 0.125 mm in diameter.

Wetting agent /surfactant Materials that alter the surface tension of water which can be used to either increase drainage/penetration of water, or under certain circumstances increase water retention.

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