Greyhound racetrack maintenance all in using the right equipment

by Bill Vessey

Is your track too fast or too slow? Too hard or too soft? Charlie Mitchell is the man to call.

Charlie, from Delaware, Oh., is the inventor of the Larcom & Mitchell Race Track Surface Conditioner.

"Basically," Charlie explains, "it cuts the hard places and packs the soft spots. I developed it on a horse track, I moved into the thoroughbred industry, and now I'm in the greyhound industry as far as maintaining tracks."

Charlie has equipment located around the world now, in Australia, Tasmania, Spain, France, England and Canada, in addition to here in America.

"The equipment maintains the surface," Charlie says, "gives you a consistent cushion, and it's very critical to have the track even, consistent. That's what the big roller does, maintains that cushion."

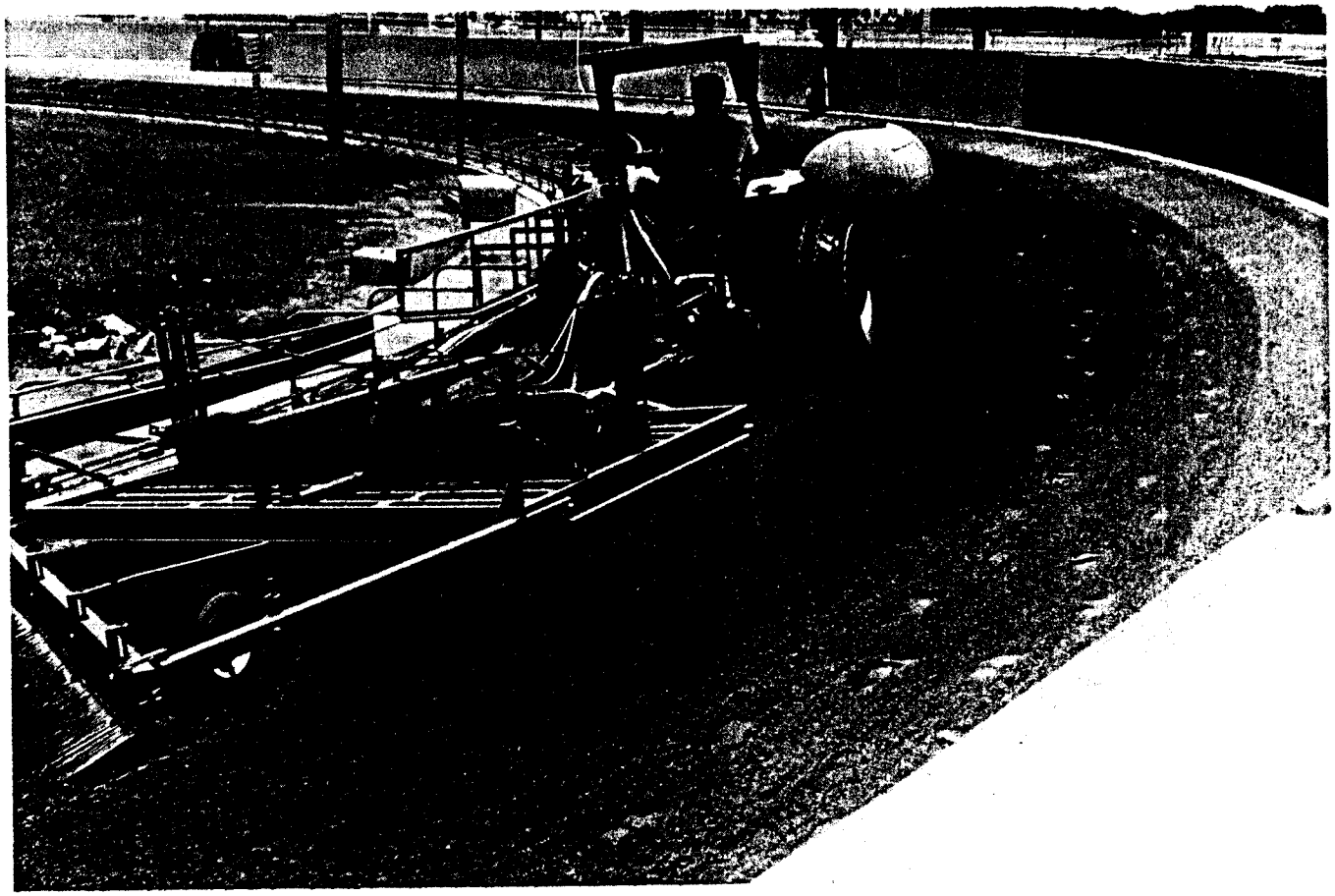
Charlie has been around racing since 1952. He's been working with race tracks since 1978, at this time he has over 600 units in operation, and he's been involved with the greyhouhds for the last 7 or 8 years.

"It started when a friend of mine with a horse track in Ohio asked me to help. His track surface was like a road."

Charlie says at the time he was in the farm equipment business. He was farming, and he had a machine shop.

"I really didn't have time to do it, but I told him I would," he said. "So I made up a unit, took it to Florida in December, 1978, and it did everything he wanted it to do. I added a little bit more luxury to it, and I sold two more units in March, one to Pompano, and one to South Florida Training Center. People weren't going to come back if they didn't do something with the track. So that's how it started. In fact, the track in Pompano was an old harness track, and it was so hard that the teeth on the machine would squeal at a high pitch. It was harder than blacktop out there."

Charlie has 13 units in operation at greyhound tracks in the United States. The majority of them are in Florida. The others are in Plainfield, Tri-State, Harlingen, and Corups Christi, Texas;



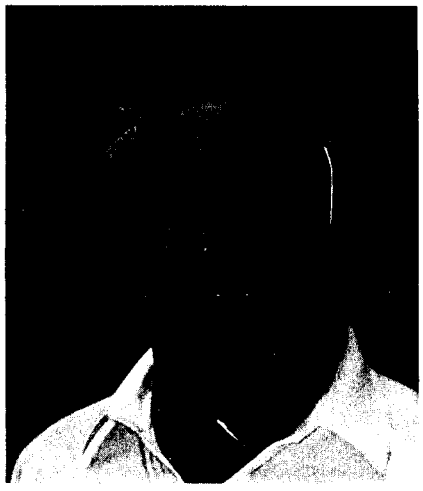
The Larcom & Mitchell Race Track Surface Conditioner (pictured in use at Corpus Christi) can add moisture to a racetrack surface during the drag.

and 3 tracks in Wisconsin, in Hudson, Geneva Lakes and Dairyland.

Charlie says Corpus Christi has been using it since opening, "But they got a little short on water, which causes a lot of problems. But they solved those problems by watering with hoses and getting enough water into the base of the track so that it's firm and has some body to it."

And with the water being critical, that makes it doubly tough in South Texas.

"That's the reason you have to put water on the track during a matinee, because the wind and the sun will dry it out so fast," Charlie explains. "Usually, in the evening performance, if it's watered properly during the day, you can get through the evening. But if you need to water, it's there. The tanks are mainly for matinees where you have a lot of moisture loss."



Charlie Mitchell

Charlie adds you can also control the speed of the track by the depth of the cushion.

"That is the way you can tell whether the track is right or not, by the consistent speed of the dog. If the dog gets to going too fast, you can just change the machine an eighth of an inch."

"The machine will do the job, it's just a matter of the people knowing the right amount of moisture needed to maintain that cushion. If the track gets too dry or too soft, the dogs will pull muscles. If it gets too hard, they can go too fast and break bones. It's a very close margin of being right or wrong, but if you're going to be off, you'd rather have it a little bit too wet."

Charlie says his is a fun job, and that he learns something new every day.

"Every track is different, and every day is different," he said. I enjoy my job because it's a challenge. There isn't anything cut and dry about taking care of a racetrack."

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THE BASIC PHILOSOPHY BEHIND RACE TRACK MAINTENANCE

I'll attempt to explain this title so that it will be a little more understandable . What we are trying to do with the race track is to add material to it so that it will be more manageable. Materials such as sand, bark, gypsum and soil sulphur so that the track becomes manageable. This provides a track that is kinder to horses and is easier to maintain. Thus, we can keep it the same (or as close to the same as possible) for longer periods of time. Subsequently it should take any kind of weather we get. Basically we try to design additives to a track according to the climate, by when they race, by how much they race, and what type of horses race. We try to add materials that will compensate for those few things.

What we look for, and what we strive to maintain in track maintenance, is to have a track that is full of moisture for as long as we can keep it that way. The correct and normal type of moisture for any kind of a California track is 10% moisture. To show what a narrow window this is, if a track has 14% moisture, it would be considered sloppy, with less moisture it would be considered muddy. If the track is 8 % moisture it would be considered dusty. So you can understand what a finite picture we have as to how close our water table must be. It almost has to be a bit oversaturated to be wet and correct. The reason that you must have correct moisture is that moisture is one of the key ingredients in maintaining a track to enable a horse to get ahold of it. If it is somewhat dry, a horse can not get ahold of it properly. The soil falls apart under the horse's feet and it would be like trying to run on a dry, sandy beach.

Moisture is one of the most important ingredients that you have in a track. I deal with the top first six inches of material. I refer to the top three inches as the cushion. The next three inches I refer to as the base. If you hear me mention those two terms, they are what I am talking about. In order for the track to recoil at the proper time (by recoil I mean that a track should provide a horse with give and should recoil). The track should push up on a horse's foot. When a horse's foot hits he rocks forward and compresses the material underneath his foot, he exerts 5000 pounds of pressure per square inch. This on a bone that is no bigger then the bone in your wrist. You can understand the importance of having a track be resilient, and having a recoil effect. One that is soft, kind, and yet be of a composition that a horse can get ahold of.

If any ingredient is off in track maintenance, it is impossible to make it correct by compensating with one of the other ingredients. If your sand content is not right, if your clay is not right, if your organic isn't right, if the maintenance is not followed correctly each day, if the water content is off, if it is a little dry, if it is a little too wet, the track will not respond in the favorable way that we want it to, and there is a problem. In getting it to respond in a favorable way, I keep the base (the material below the three inch cushion) soft but not as soft as the top three inches. That way the whole ground absorbs the shock so that when the horse's foot comes forward, and it thrusts down into the ground, there is a shock absorber made up of the top three inches of cushion and the next three inches of base. The ground absorbs all the shock. The recoil goes into the ground and not up the horse's leg. If the cushion is thin or the cushion is not adequate enough, the recoil comes too soon. So when the horse's foot releases and tries to propel forward, the shock absorbing effect has already

taken place, and instead of the ground absorbing the shock, the shock goes up the horse's leg. It only takes so many of these to start to injure the horse in one way or another. If the track is too soft, if the base is too soft, if there more than two and three-quarters or three inches of cushion the recoil comes too late. That is why on a muddy track, a sticky, drying out track, or a track labeled good, it is a laboring type of track. The recoil, the help, the shock absorbing, or the push that a track should normally give to a horse comes too late, and it actually makes the horse work harder to pull his feet out of this material. That is because the track is not properly tuned for whatever reason. Normally this type of track will be a track that is drying out from a rain, or the type where there has been too much cushion away, or the type where the track is too soft.

Track maintenance may sound like an art, and I believe it is. You have to understand the maintence part of it, you have to understand equipment, you have to understand horses, and you have to understand the way that all of these things must work together for the good of the animal. If one of these items is missing, it is impossible to make it right. If the track is too dry there is nothing you can do about it other than add water to make it correct. If the track is too wet it is impossible to do much to it to get it correct. If the track does not have enough cushion, you can not make up for it by having a real soft base. If the track has a lot of cushion and a hard base, it still doesn't have the correct recoil effect. Without every ingredient being correct; meaning that the base has to be reasonably firm, but not so firm that the shock goes up the horses leg, there is a problem. The cushion needs to be adequate. If the cushion is thin it does not provide the horse with enough shock absorbtion.

I believe in a track maintenance program where the base has fifty percent of the track, and the cushion the other fifty percent. If one of these is inadequate, you can not make up for it with the other. People do try to do that in this business. Some try to make up by making a safe track with a lot of cushion and a hard base. Or people try to make up for it by having a thin cushion and a soft base. It is like baking a cake. If you do not follow the recipe instructions explicity, the cake does not turn out correctly in the end. It is also like growing grass. You must have the proper soil, the proper seed, the proper nutrients, the proper amount of water, the proper amount of fertilizer, and the proper amount of sunlight. If one of these is missing you will not receive the desired turf.

I believe track maintenance should be as follows: I believe it is important that with the knowledge of what we know to do daily - if something fails, it has a reflection of the horse's injuries. I've been doing this work for 23 years. I've worked at major tracks in California, New Mexico, Idaho, Oregon, and five tracks in Sao Paulo, Brazil, the second largest city in South America. It is my firm belief that if you do not follow everything that is required, it has a direct relationship to the horse's injuries. If the base is too hard, it may fracture or break bones. It can cause bone chips. It is hard on everything that has to do with a horse's bone structure. If the track is too soft, and it only has to be minutely too soft; if the recoil effect comes too late, it is hard on soft tissue, perhaps causing injuries to tendons, suspensories, ligaments, backs, and hind quarters. And it only has to be a little bit off. To be honest with you, this is really hard work. It is difficult to get it correct, but I've been doing this type of work long enough to see that the things that I do on a daily basis have a positive effect on how the horses handle the track.

Dr. George Pratt of M.I.T believes as I do regarding track maintenance. Dr. Pratt has done considerable research on this. He is also into recoil. I believe that when the track does recoil properly, it is as safe as it can possibly be. This is something that I can substantiate by the number of injuries that have been reduced. I'd like to take credit for that but I can not. Much of the credit has to do with the material. Material is such that if a horse does not get ahold of it, it is almost impossible to make up for it (to make it right), so it takes all the ingredients. It takes the right material, it takes the right maintenance, it takes the proper tools, it takes the proper equipment, and it takes the proper manpower. Everything must be right to result in the ideal track. I repeat, if you miss one ingredient, you have failed to achieve your goal.

Information that I have been attempting to impart has been a combination of what I've learned during my years in this position, working at other tracks, and with some experimentation, and what I've learned at many seminars I have attended at the University of Arizona in Tucson. In putting everything together, it is about the only thing in this profession that makes sense. I relate much of what I do to football and the types of injuries the players receive playing on Astroturf as compared to playing on natural turf. If you would ask any football player, I am sure that the great majority, if not all, would prefer to play on natural turf because it is so much more resilient - so much more natural. The steps that I take in our business are, in my opinion, so much more natural for a horse. I believe that the further away from the natural setting that you obtain for a horse, the harder it is for him.

I know that we are not going to reduce all the injuries in this business - we never will. But if we have a track that we continually try to keep fine-tuned, and by fine-tuned I mean having the correct material and equipment for the area, the correct cushion and base, the correct watering, and trying to maintain the track the same each and every day, we will reduce the injuries and in the long run that has to help our business greatly.

The difference in track maintenance on the east coast and on the west coast is dramatic. The east coast must have the base (the material that is just below the three inch cushion) impermeable. In other words it is as hard as they can make it, within reason, due to the inclement weather that they receive. If their base gets wet underneath and should freeze, or if they should freeze, or if they should have a freezing rain, or a freezing rain at night, there are problems. They have a variety of problems quite different from what we have. Fundamentally they are concerned with combatting the weather much more so than we are. They have to be concerned with more inclement weather conditions than we do.

For several years the thought here in the west was to keep a real hard base as they do in the east. We found that by so doing it was extremely hard on the horses. It made the track hard and the horses could not get ahold of it. It also did not provide the horses with any resilience - it did not offer them the necessary give. It made the injuries that occur in racing even worse. It caused suspensory strains, tendon tears, and bone chips and breaks. Every type of injury that we see in the horse were made worse. Fortunately, we've gotten away from that pretty much in the last five or six years. We are all trying to address the base a little more than we formally did, and that makes a lot of sense to me.

Racing as much throughout the year as we do now, I am able to try new ideas. I don't wish to say "experiments" because that is not the correct word. I am able to try different thoughts that seem to help reduce injuries overall. I believe that by proper maintenance, seminars, upgrading equipment, addressing the base, and by generally upgrading the track, I believe that we can make a difference.

The injury reports that we have kept at Santa Anita, Del Mar and Fairplex over the previous year when we had a different philosophy show that things are better and injuries are reduced. We certainly haven't reached the point where we can elimate them, but if you just help the injury rate 10 to 15 percent, that's monumental in terms of year-around racing! It certainly makes a tremendous difference. Basically, the changes that we have made are that the track bases are not as firm as they are back east and once were in our area. We do not have to address the weather as much as they do. It seems to make a major difference.

Track surface influences on the racing greyhound

by
Robert L. Gillette, DVM
The University of Kansas

Understanding the factors involved in injuries of the racing greyhound helps us to develop the knowledge we need to determine the best way to prevent and treat racing injuries. All athletes, regardless of species, are susceptible to injuries when performing their sporting event. The human runner looks ahead and plans how they will run. If they see a pothole they adapt their running style to prevent themselves from incurring injury. An equine athlete has a jockey to help prevent injury. The jockey guides the horse from trouble or slows them down as they enter the turn.

Although the greyhound is trained to run on an oval track, they race mostly by instinctive reaction. When the lure goes left at the turn the greyhounds go left regardless of the fact that they are going at speeds sometimes eclipsing forty miles per hour. In addition, as the track is prepped prior to the race the soft top layer is made smooth which hides the sometimes uneven firm layer beneath.

"Although the greyhound is trained to run an oval track, they race mostly by instinctive reaction."

As the greyhounds race, these discrepancies, or "potholes," are not apparent and they are unable to adjust. This leads to uncontrolled running and increases the chance of injuries.

The performance of a racing greyhound is influenced by internal factors and external factors. The internal factors include the greyhounds' anatomical make-up, his physical condition, and his internal psychology. The external factors include the environmental conditions, the lure, dog to dog interaction, the race course, and the track surface.

The relationship between the greyhound and the racing surface is similar to the relationship between the human and the shoe. The surface must protect the foot during surface impact and at the same time allow the foot to grip the track for controlled running. A race basically consists of a series of collisions between a greyhounds' feet and the race track it is running on.

Impact forces are produced when the foot comes into contact with the surface. These forces are absorbed either by the greyhounds' leg and body, or by the track surface or both. Traction is needed between the foot and the racing surface so that the foot can grip the surface. Poor traction leads to uncontrolled running and inefficient use of energy.

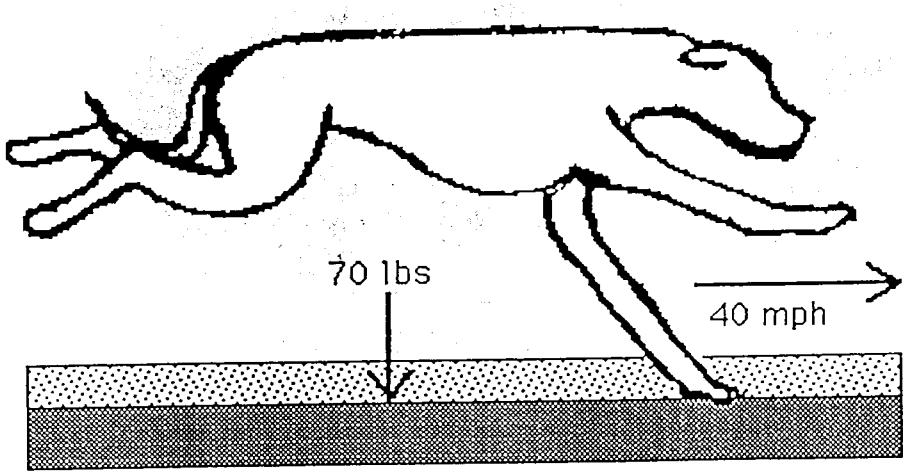

Figure 1. The horizontal and vertical factors involved during foot strike while running on the straight-a-way.

The one factor that is universally constant is the greyhounds' foot impact (fig. 1). The forces of impact are dependent upon the velocity of the greyhound and the weight of the greyhound. The racing surface should be maintained to provide for the maximum weight and maximum velocity that could occur during a race.

The track surface is generally made up of three components: sand, clay/silt, and water. Sand describes particle material that is larger in size. Clay/silt describes particle material that is smaller in size. The ratio of sand and silt is determined by the amount of moisture in that particular environment. Water is the key component and the percentage that should be added is dependent upon the local environmental conditions, i.e. humidity; rain/snow; temperature; and wind. The correct ratio provides a cushion to protect against the impact forces, and provides a cohesive surface for good traction (fig. 2a).

Water fills in the areas between the particles. Too much water produces a sloppy track. The particles cannot come into contact with each other and are held apart by the water (fig. 2b). The track material cannot hold its shape or form. A "soupy" consistency is produced. A low water content affects sand tracks differently than tracks with a high silt content. Due to the larger particle size, a dry sand track has air in between the particles and they cannot hold together (fig. 2c). A track in this condition is soft and does not provide the traction needed for controlled running. A silt track has a higher ratio of smaller particles. When it is dry the particles pack together and the track becomes hard (fig. 2d). A track in this condition does not provide protection against the impact forces.

The track must be watered evenly for the length of the racing surface (fig. 3). The areas that are not watered sufficiently produce soft spots or hard spots, depending on the surface content ratio. The areas that are over watered make soupy areas. Uneven watering can cause track inconsistencies. The greyhounds are not capable of safely adjusting to the various surface textures and are prone to injuries.

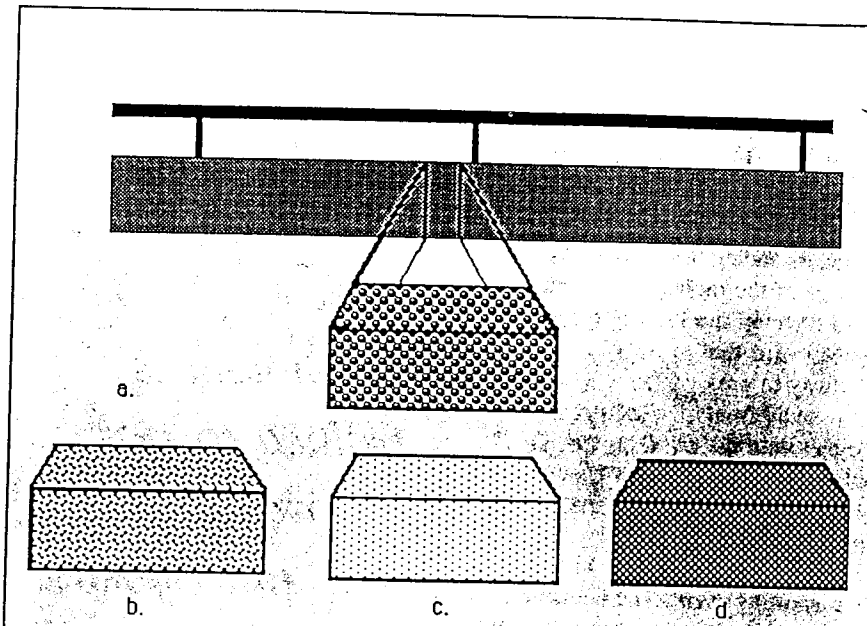

Figure 2. Track surface material contents. (a) A proper content ratio of sand, water, and clay. (b) High water content, a sloppy track. (c) A dry sand track. (d) A dry clay track.

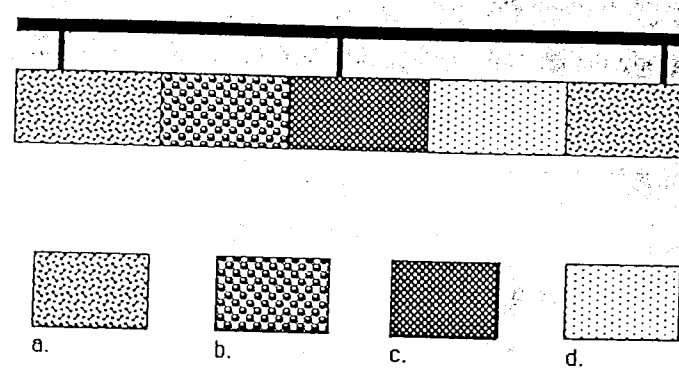

Figure 3. An example of a track that is unevenly watered. (a) Overwatered (sloppy) section. (b) Properly watered section. (c) Underwatered clay section (hard). (d) Underwatered sand section (loose).

The track surface must be uniform which means that track maintenance is critical. When the track is ready for racing, the surface is theoretically divided into two layers. The upper layer, or absorptive layer, helps to cushion against the forces of impact. The base layer, or traction layer, is firm and supplies the traction needed for control and power production.

The proper depth protects against impact and at the same time allows the foot to grip the track (fig. 4a). If the absorptive layer is too shallow then the foot collides with the firm traction layer

design; 2) surface material; and 3) track maintenance. The track designs that have been developed in the last decade have certainly improved the racing environment. It should be noted that all three components are equal in their importance. A properly designed race track without the correct racing surface or poor maintenance may not be any safer than a track of lesser design with a good surface and superior maintenance.

Certainly our ultimate goal is to prevent all injuries from occurring. We certainly have benefitted from the advances in track design that have come about in recent years, but to keep up with this scientific progress we must research further the racing surface materials and track maintenance that is needed for a safe and consistent racing surface.

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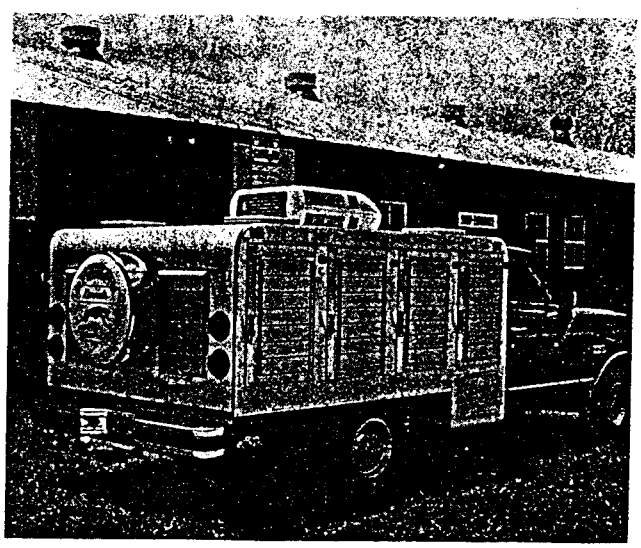

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After extensive studies on racing related injuries, Japanese researchers moved toward accident prevention

The Science of Safety

By Les Sellnow

Working quietly, without fanfare, the Japan Racing Association has been involved during the past 10 years in an ongoing project aimed at reducing injuries to race horses. The guiding force behind the project is the 10-member Committee on the Prevention of Accidents to Race Horses formed in 1982.

A report authored by Dr. Yahiro Ueda (director, Equine Research Institute, the Japan Racing Association) has made public the results of the continuing effort. By 1989, Dr. Ueda said in the report, the rate of accidents (breakdowns) occurring had dropped to 1.91 per cent of horses racing after reaching a peak of 2.17 per cent in 1984. (Japan has approximately 6,300 starters annually.) He also reported that 1989 saw a sharp decline in the rate of accidents occurring during training, a figure that had remained constant for several preceding years. The accident rate for horses at training tracks dropped from a high of 0.192 per cent to 0.081 per cent in 1989.

While substantial progress has been made in reducing injuries, the JRA is not slackening its efforts to reduce the number even more. Research continues and as new procedures prove their worth, they are initiated, Dr. Ueda said.

Assisting the main committee of 10 are other groups of experts representing a variety of disciplines and expertise. The subcommittees cover three principle areas: The body of the horse itself; track facilities; and training and riding techniques. Each subcommittee consists of 10 persons involved in practical work in the respective fields.

The JRA operates 10 race courses and two training centers. To enter a race sanctioned by the JRA, a horse must be trained by a licensed trainer at one of the training centers for a specified period. There are about 4,500 horses stabled at the two training centers on a daily basis. To monitor their health, the JRA owns veterinary clinics furnished with advanced equipment and experienced veterinarians, according to Dr. Ueda. Normally, horses in training will remain at the center until the morning of competition and then are vanned to the race course. If the course on which they are to run is across the country, the horses are shipped earlier and temporarily stabled at the track.

Because all of the horses are under the observation of JRA veterinarians, it has been possible for researchers to gather solid and consistent data during the 10 years the overall safety campaign has been under way.

During one year of the study, the focus was on serious accidents that occurred during races at the JRA race courses. All JRA races are photographed by a patrol video camera from both front and side and during that year, 58 accidents showed up clearly in the videotapes. Using a motion analyzer, Dr. Ueda and his colleagues were able to study in detail conditions leading up to the specific step where the breakdown occurred.

"In observing these conditions," he said, "I paid particular attention to such matters as the development of the race; weaving; lane changing and lead changing; which leg was leading at the time of the accident; the actions of the horse and rider; the point where the accident took place, and the spread of the pack at the time of the accident."

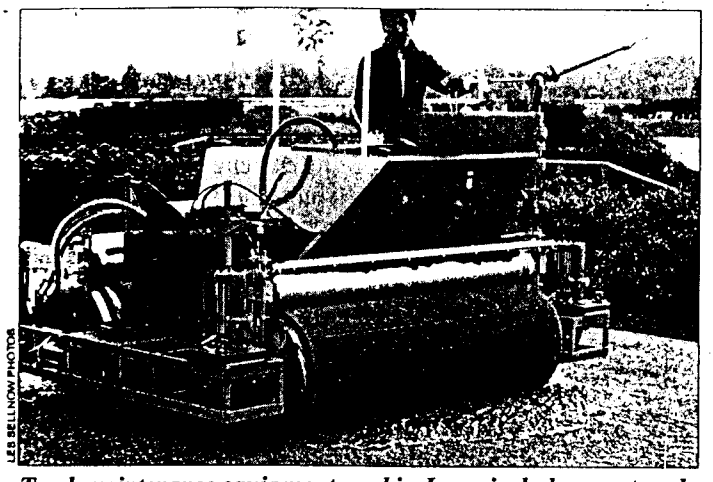
Accidents, he said, tended to occur to the leading leg regardless of whether the horses were running clockwise or counter-clockwise. In accidents involving forelegs, the leading leg and the injured leg were the same in 72 per cent of the cases.

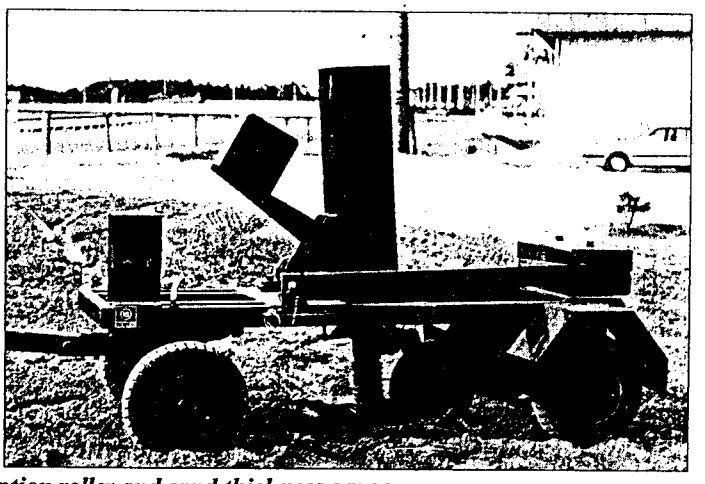
"In the case of 34 of the 58 horses studied (58.6 per cent), some kind of motion was observed immediately prior to the accident," Dr. Ueda said. "Forty-two such motions were observed, of which the most common were lead changes (16), use of the whip (13), and diagonal veering (7).

"Accidents were found to occur more often at or near turns—63.3 per cent of all cases. Most of these—56.9 per cent—took place while passing around the turn or moving from the turn into the stretch. This is also a point where many horses change leads."

When computing total statistics, the Japanese researchers found that 99.5 per cent of all breakdowns during that one-year period occurred either on the turns or in the stretch.

"In considering the connection between the point at which the accidents took place, the leading leg, and, the injured leg," Dr. Ueda said, "we found that the leading leg and the injured leg were often the same in accidents occurring on the stretch or when moving from a turn into the stretch—85 per cent of all cases. However, this connection was observed in only 63 per cent of accidents which occurred while passing around a turn."





Track maintenance equipment used in Japan includes a water-absorption roller and sand thickness gauge.

Studying Fractures

Another phase of the study, carried out between June of 1983 and December of 1986, involved recording data on horses which suffered fractures during that time frame.

During 3½ years, it was found that 488 of 728 serious breakdowns occurred during racing and 240 were recorded during training. A survey sheet was prepared for each horse and the staff at the veterinary clinics, stewards' sections, and track engineering divisions investigated each item that applied within their specific specialties. Trainers and jockeys also were questioned.

In the general study it was found that the average rate of breakdown occurrence was 1.58 per cent of all horses competing on turf courses and 1.65 per cent on dirt courses.

"Among the turf courses," Dr. Ueda said, "accident rates were highest at tracks in fast condition; the firmness of the track is thought to be an important factor. Dirt courses, on the other hand, showed very high rates of accidents when tracks were in heavy condition, indicating that a high water content reduces or even eliminates the shock-absorbing effect of cushioning sand."

He also said that accident rates were markedly lower in higher-class races as compared to those where lower purses are the norm.

"It may seem natural for a superior horse to be (involved in) fewer accidents," Dr. Ueda said. "Viewed another way, a horse may have been assigned to races with lower classes because it has some potentially accident-causing (problem), which keeps it from performing to capacity."

No significant relationship was found involving the distance of the race and the rate of accidents, either on turf or dirt, he said.

In the portion of the study involving 728 horses which suffered fractures of such severity that they had to be removed from the track by van, it was found that the most frequent sites of serious accidents were "the distance from the third to the final corner and the home stretch, although each track presents its own distinctive features."

Fractures of the component bones of the carpal joint and fetlock joint accounted for three-fourths of all injuries. Fractures of the component bones of the carpal joint, Dr. Ueda said, were common among injuries occurring during races, while fractures of the component bones of the fetlock joint occurred more frequently during training.

During one year of this particular study, it was found that 60 per cent of the horses injured had a history of a previous illness or injury.

"In an overwhelmingly large number of cases," Dr. Ueda said, "a horse which had previously injured a foreleg suffered another injury to the same leg."

Influence of weather

Overall, it has been found by Japanese researchers that accidents *during races* were most common during early spring, while *training* accidents were more frequent during winter. Cold weather, said Dr. Ueda, is thought to have a strong influence on early morning training and the potential for accidents.

"We believe that low temperatures affect both horses and the ground," he said. "In cases involving humans, low temperatures have been reported to slow the speed of neural transmissions. When a horse is running at high speed, slow neural transmissions can lead to missteps by diminishing the horse's ability to respond rapidly to changing track conditions. And since humans are similarly affected, low temperatures can diminish the rider's ability to control the horse with accuracy and adjust his own movements to the horse's.

"Ground is affected by low temperatures when freezing causes the ground to become hard. When low temperatures affect both horses and ground, the effects on horses (and riders) are more pronounced. Therefore, we instruct our trainers and jockeys to see that all horses are thoroughly warmed up prior to training."

Looking toward prevention

While studies of injuries were being conducted, the committee also was focusing on research designed to develop scientific foundations for the establishment of accident prevention measures.

Utilized in the study were horses whose shoes were fitted with accelerometers. The specially-equipped horses were used in test runs at the various JRA tracks, with measurements and analyses made of the shock produced at the point of hoof impact with the ground and of the wave patterns produced by acceleration during running. (Acceleration in this context involves the speed at which the foot slides into the surface on which it is landing. The higher the acceleration, the greater the impact.)

"At turf courses," Dr. Ueda said, "acceleration declines dramatically as water content rises."

Of major import in achieving lower acceleration on dirt courses, Dr. Ueda said, is the depth of the cushioning sand.

"Acceleration that registered 130 to 140Gs with 4.5 centimeters (there are slightly more than 2.5 centimeters per inch) of cushioning sand declined to 85 to 95Gs when the thickness of the cushioning sand was increased to nine centimeters," he said. "Increasing the thickness to more than nine centimeters

(Continued on next page)

Japanese Research

(Continued from page 4319)

resulted in approximately the same readings.

"From this investigation, it was found that in order to raise the cushioning capacity of a turf course it is necessary to maintain the water content above a certain level. To raise the cushioning capacity of a dirt course, however, greater priority should be placed on the thickness of the sand than on the track's water content."

It was also found in the study that harrowing a track dramatically reduced acceleration rates. As a result of this finding, it is now the policy that one hour after training opens at the JRA training centers, tracks are closed for 15 minutes for harrowing, similar to custom long common in North America.

"The average acceleration of courses made rough by hoofprints was 126Gs," said Dr. Ueda. "After harrowing, this figure declined by some 38 per cent to 78.3Gs.

"A comparison of shock wave patterns found patterns of a dangerous type, in which the track bed was exposed (and) the sand layer extremely thin, in some 68 per cent of cases (during training sessions) prior to harrowing. After harrowing, shock wave patterns were of safe types in 94 per cent of the cases, indicating a very stable running surface.

"In comparing acceleration wave patterns, it was found that leg movements were different on each landing when the track had not been harrowed; after harrowing, leg movements were uniform on each landing (thus reducing the potential for disastrous missteps)."

The years of research also revealed a pattern as to age of horses suffering injury. The greatest number, both in racing (53.8 per cent of the total) and in training (49.3 per cent of the total) were injured during their 3-year-old year. Four-year-olds and 2-year-olds were nearly identical in overall figures, but varied when training was compared to racing. The percentage of the injured horses which suffered their breakdowns at four are 19.7 per cent of the total during racing and 15.1 per cent of the total during training. For 2-year-olds, the figures are 14.4 per cent during racing, but 24.9 per cent during training.

New equipment

As a result of its research, the JRA has developed new track maintenance equipment to solve some of the problems that the studies unearthed.

Included are:

- Turf perforator—Makes holes in turf courses to prevent hardness.
- Level hallow—Evens out cushioning sand to a uniform thickness.
- Track hardness measuring van—Measures the entire track for hard spots.
- Dirt cleaner—Removes pebbles from cushioning sand.
- Water absorption roller—One of the measures used to improve very holding turf courses.
- Automatic water sprinkler—Maintains the water content of the track through an even sprinkling of water.
- Sand thickness gauge—Measures the thickness of cushioning sand while moving along the track.
- Side raker—Rakes sand accumulated under side rails.

Listed by Dr. Ueda as measures that have already been implemented or are being put into use at JRA facilities during the current fiscal year are:

- Education of staff regarding accident prevention through training sessions, preparation, and distribution of pamphlets.
- Surveys as necessary on the circumstances surrounding accidents occurring during races and training.
- Use of data on track hardness to determine the best times to carry out track bed improvement.
- Utilization of movable fences on the turf course to protect the surface.
- Aeration of all turf courses with the turf perforator machine twice annually.
- Utilization of the automatic water sprinkler to moisten tracks to as near optimum condition as possible on race days.
- Use of the water absorption roller as a new means of improving very holding turf courses.
- Use of recently developed equipment to adjust and manage dirt tracks so that cushioning sand measures six to seven centimeters in thickness for races and seven to eight centimeters in thickness for training.
- Use of the harrower on all tracks between training sessions.
- Employment of enhanced measures to deal with severe cold, such as adjustment of training schedules, greater use of blankets, and education on warming up.
- Guidance aimed at improving training and riding techniques, such as individual instruction and providing information on jumping hurdles and lead changing.
- Expansion of the role played by health and sanitation consultants in preventing reoccurrences of injuries.

Still other avenues of research are being explored, including surveys and studies on the current crop of yearlings and other young horses which will be runners of the future. Automatic blood analyzers are being employed to diagnose medical conditions.

A survey also is being conducted to determine whether training that relies mainly on a sloped track and use of a swimming pool has any advantage in preventing accidents.

Being reviewed is the maximum number of horses permitted in a race. The goal is to cap the number at 18.

Current research also seeks new direction in such diverse areas as stable construction and track management under adverse weather conditions as well as development of new materials to be used on track surfaces.

Banking of race tracks in Japan is in the moderate range. Dirt courses at each JRA race course, according to Dr. Ueda, are banked from 1.7 to 3.0 per cent while turf courses are banked from 1.6 to 4.5 per cent.

"Angles vary for different race courses and different turns," Dr. Ueda said. "The pitch tends to be gentle at the first and second turns and sharper at the third and fourth turns. I believe that a certain degree of banking is beneficial, a certain degree meaning slightly greater angles than those mentioned above. However, the patrol videotapes indicate that making it possible for horses to execute smooth lead changes is even more important than banking in reducing accidents."

While racing safety progress has been made in Japan during the past 10 years, Dr. Ueda said, it has been a slow, painstaking process.

"Seven years were required for results to be seen in the form of lower accident rates," he stated.

The effort will continue, he said:

"Finding better ways to prevent accidents is our constant goal in the world of racing, and the surveys and research we have done so far have helped to clarify our priorities. All that lies before us is to put each measure into practice with patience and dedication. But in view of the complex mix of factors involved in accidents to race horses, even the most carefully developed measures will only succeed if there is a commitment on the part of everyone to put their specific talents to work in preventing accidents." ■

RACETRACK SURFACES DON'T HAVE TO BE HARD

by Jim Jennings

For some reason, many trainers think that a fast track must be a hard track. And that is what they want, regardless of the consequences. But there is a growing movement of people who say this is not so, and their results are proving it.

Bob Moore, track superintendent for 25 years at Hollywood Park in Los Angeles, and his son, Dennis Moore, track superintendent at Los Alamitos Race Course in Los Alamitos, California, have in the last few years begun some innovative programs that have softened the surface of their racetracks, resulting in fewer injuries to horses, while not slowing the race times at all.

"When I first came here to Los Alamitos and began ripping the track up, the trainers thought I was crazy," Dennis said. "Now they tell me the track is in better condition than it's ever been."

Dennis has been at Los Alamitos for five years. But that is not the limit of his experience. He was track superintendent at Santa Anita before that, and virtually grew up on the backside of Hollywood Park, since his father worked there for most of Dennis's life.

"Now we run with a 2½-inch cushion on top of our base," Dennis continued, "and we haven't slowed the times up a bit. As a matter of fact, both the 400 and 440 yard track records were broken in our last meet, and out of 59 days of racing, we only had to destroy four horses due to injuries. That's the fewest ever in the history of the track."

Prior to Dennis coming to Los Alamitos, each year the track officials put a layer of sand on top of the track and mixed it with the top cushion. Dennis said, "It would be there about two or three weeks and then it would be gone. Just from the pull of gravity, it would work its way down through the dirt, and before long there would be none left on top."

Last year, while the track was dark, Dennis and his crew took a rototiller that runs off the power takeoff of a tractor and mixed sand with the clay base down to a depth of nine inches. This gave him the same mixture all the way down through his base and kept the sand from filtering out. It also gave him only 10 percent clay in his track surface, a mixture that prevents the base from getting too hard too quickly.

Now, during the Quarter Horse meet, he will rip the track once a week, using the scarbar on a road grader, down to a depth of six inches. Then he'll use a roller harrow and pack the base while leaving the 2½-inch cushion. "That gives the horse something to get hold of," Dennis said.

Dennis noted that on a daily basis, he and his crew will blade the track -- the dirt is continually moving toward the inside rail due to the way the track is banked, and this dirt has to be moved back to the outside -- water it, cut it and then harrow it. They'll harrow it again after each race, knocking out the prints and maintaining the base. The track superintendent said that it was essential to have water on the track so the base won't harden so fast. He said that in the summer, they will put 48,000 to 56,000 gallons of water on the track per day.

At Hollywood Park, Bob Moore does much the same thing as Dennis. He maintains a cushion of about 2 5/8-inches on top of his base, and like Los Alamitos, Hollywood Park's injuries have come way down in numbers. Bob explained, "About three or four years ago we found that Hollywood Park was having a lot of horses come down with what they started calling "Hollywooditis" back trouble. Horses would come to Hollywood, and a long about three fourths of the way through the meet they would develop back trouble. We did some investigating and found that we were having trouble keeping the base so it wouldn't get too hard on us."

"We knew," he continued, "that there was an old asphalt base down about two feet under the track, but we did some core testing and discovered that in places it was down only a foot or less. So we decided to remove that asphalt base."

After they removed the asphalt, the Hollywood maintenance crew came back with four inches of 3/4-inch crushed rock, which was placed 24 inches down. Then they came in with six inches of decomposed granite, and finished with a top running surface about 14 inches thick.

Bob said, "We knew we had plenty of moisture below our track -- the water table is pretty high there -- but that asphalt was keeping it from coming up into our base. We knew that water would percolate up through that crushed rock and granite, on into our base and keep it damp."

"Then," he continued, "we had to determine what amount of clay, what percent of silt, what percent of sand we needed for a running surface. Through experience over the years, we were aware of the problem of the running surface balling up under the horse's foot. When a horse would come up with his hoof, some of the running surface would lodge in the frog of his foot, and when he would come back down it would be like a ball. His hoof would rock, and we decided that could be causing a lot of the breakdowns we were having."

"We came to the point where we decided we didn't need near as much clay as we had -- approximately 20 percent. So we broke that down and ended up with about 11 percent clay in the surface. We mixed some course, medium and fine sand, and some silt with the clay, and broke it down to about 26 percent coarse sand, 45 percent medium sand, and 22 percent fine sand, one percent very fine sand and five percent silt. That gave us a surface that would let the water go through, but wouldn't ball up under the horses' feet."

He added, "Oh, it'll still ball up to a certain amount if it gets too wet. If the humidity is going to be pretty high, I have to watch my watering at night. I have a weather service that I call every day, and depending on what they tell me, I do what I must to the track."

Bob noted that last year at Hollywood Park, they had a very successful meet, and had the least breakdowns that they had had in the history of the track.

Both Bob and Dennis use an instrument on their track called a pentrometer. This is an instrument used to check the firmness of the base. The tip of the pentrometer is pushed into the base, and a gauge at the top registers the amount of pressure needed. Bob and Dennis both like for their tracks to register from 30 to 40 on the instrument. Anything less than that, and the base is too soft. Anything more, and the base is too hard.

Bob said, "If it goes over 40, I'll go in and rip the base down about six inches, and then by the following morning I'll have run over it with roller harrows and set it back up so it won't be too soft." Dennis follows the same policy.

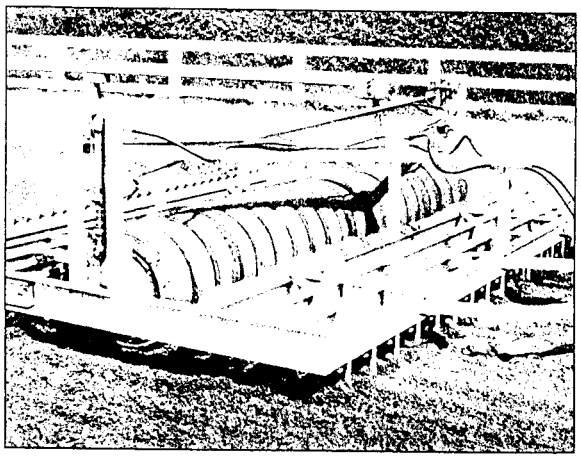
Dennis thinks that someday there will be a standard set up for all racetracks, and he hopes this takes place, although he realizes that due to weather conditions, no two tracks can be set up just alike. The standards could be adjusted, though, for particular areas, resulting in improvements all the way around and causing fewer injuries.

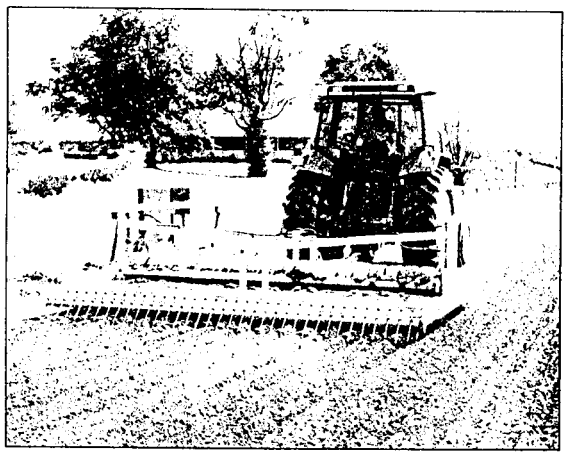
Taking steps for safer tracks

SURFACES

Keeneland and Remington Park work to reduce injuries with deeper cushions

by Marianna Haun





Marianna Haun photo

TRACK CONDITIONERS
The new harrows used by Keeneland have three rows of teeth in front and in back with the roller in between

THE racing surface at last fall's meeting at Keeneland produced some lightning fast times. It also produced a number of injured horses and angry trainers. This resulted in a renovation of the main track's surface for this year's spring meet, which was one of the safest meetings in recent years.

In January, to learn how to come up with a better racing surface, Keeneland officials went to California to meet with Steve Wood at Santa Anita Park, and later visited the Fair Grounds in New Orleans, Louisiana.

"We were concerned about making sure the horses came back safe (from the track)," said Mike Young, Keeneland track superintendent. "It seemed like in the past horses ran down real bad on this track and burned through their bandages on their legs. So we made a trip to Santa Anita to see how they did their track surface. We spent a couple of days talking with Steve Wood. I really liked the way they did the track at Santa Anita, but it wouldn't work here because it is a dry weather track mostly. If they get a lot of rain, they can get into trouble.

"We could never do here what they do in California. They'll go out three times a week, sometimes more, and they will rip their cushion up eight inches deep. Then they will come back in and compact it back down. The cushion and the base measure is pretty deep and they are pretty much the same. They'll compact it back down and till it back up until it measures about three inches deep. Then they will have a softer cushioning under it. But if they get rain, that is going to really make it deep. With the rain we get in this part of the country, it just wouldn't work.

"We picked up some ideas from Santa Anita. We purchased a couple of conditioning machines like they use there. They've got three rows of teeth in the front and the back with a roller in between."

Young said using the new machines, the track is worked up in front, then compacted back down by the roller, and then the back teeth can be set to work the cushion up to a three-inch level. This works the ground evenly and takes the guesswork out of putting the finishing touch on the track surface.

Sand is the key

The key to a safer Keeneland surface this year, Young said, was adding more sand to the track.

"We weren't concerned about the speed of the track so much as the safety," he said. "Last year we added 500 tons of river sand and 500 tons of mortar sand. But the track really needed more sand. It didn't have as much cushion. We probably had a three-inch cushion on the track, but there really wasn't a barrier (between the cushion and the base) and as it got wet it seemed like it was going down to the base pretty good and that was what we were concerned about. With the equal mixture, it made the track so that when the horses hit it, they were going right through it. And, with the right moisture on it, it was really lightning fast. It was too fast."

This year, using what they learned at Santa Anita and at Fair Grounds, which has a spongy-type sand which the horses seemed to bounce off of really well, Young said they used a new mixture of 1,000 tons of river sand and 200 tons of mortar sand. The river sand that Keeneland used this spring came from Boonesboro, Kentucky, off the Kentucky River.

"You've got to find a sand that will hold some water, but that will also turn a lot of water away and will pack. It seems like the river sand has the right mixture of silt, soil, and sand to keep the moisture from going right down to the base of the track. The sand comes from where the river floods and then recedes leaving the sand behind. The flood mixes everything up and you get the loam, silt, and everything in the sand you need.

"The mortar sand comes from any company that sells sand. It is a coarser sand than the river sand. We mix it with the river sand because if you put in all river sand, it could be slick. So you've got to mix something with it so the horses won't slide and they can get a hold of the track.

"We put a little more cushion on the track and made it a little deeper and did a lot more work with it. It packs better now and seems to turn water better. We did some work with the drainage on the track. We had one place where we had a problem. We went in and poured a new curb around it, and added a few extra drains in places where the water could get off a little faster.

"But mostly it was just the sand and the way we did things that really made a difference. We had less injuries during this last meet than any I can remember. We came away from the Fair Grounds with the idea of adding more sand to the track, and it is working. I brought back samples from their track. I think in working with the sand to try and get the right mixture, we used more of what they were doing than we did at Santa Anita. But at Santa Anita, we got a lot of ideas on what they were doing (in maintaining the track) and the equipment they were using. We will keep working with the track, but at least now I know we're on the right track to a safer track."

Safer surface

Dr. George Mundy, chief veterinarian for the Kentucky Racing Commission, concurred with Young's assessment that the spring meeting at Keeneland was much safer than the previous one.

"During the running of races this spring at Keeneland," Mundy said, "the number of musculoskeletal injuries was greatly reduced. There were no catastrophic injuries during the meet. There was a total of four injuries during the meet—two on the main track and two on the turf course. Of those four, three were bowed tendons."

Mundy said he was encouraged by what he saw this spring at Keeneland, but he is still waiting to get more data to follow the statistical trends on track safety.

Marianna Haun photo

DEEPER CUSHION
Keeneland track superintendent Mike Young illustrates depth of the cushion

Jimmy Croll, who trained Holy Bull at Keeneland during the spring meet, agrees that the surface this past meeting was an improvement. "The track conditions at Keeneland this spring are much improved over last year," Croll said. "Last year, it wasn't too good. They had a lot of trouble last year. The track was pretty bad. But they've changed the track. The track this spring is much, much better. Now it's slower, but so what? It's safer. I like it this spring. I think the track is great now."

Changes at Remington

The track surface at Remington Park in Oklahoma City, Oklahoma, has had its share of problems, but now its racing officials are happy with the current surface and its safety record. When the facility opened in 1988, it was the first track in the world to conduct racing over Equitrack, an all-weather surface.

Equitrack, which was a product of En-Tout-Cas, Inc., was a surface composed of natural Oklahoma soil that was coated with a polymer to insure faster and better drainage on a traditional base. But the track was not popular with horsemen, particularly horsemen who had to ship in their horses to run on it. In the summer of 1991, the all-weather surface was taken out and replaced with a traditional track surface.

"Perception by horsemen was one of the reasons for changing over from Equitrack," said Gerry Zevenbergen, track superintendent for Remington Park. "It was hard for shippers to come in to Remington and win—that was the perception that was out there. Whether that was true or not, I don't know. But if we had a race—say the (Remington Park) Derby where we were offering $300,000—the perception was that somebody couldn't ship in here a week ahead of time and win. The perception was that somebody who was already working over that surface would have an advantage.

"We put the new track in during the summer of '91. From the horsemen's standpoint, they love the new surface, plus it has been obvious in our big stakes races that we definitely have considerably more big horse ship-ins than we had in the past.

"After Equitrack, we went to a conventional racing track surface. The racing surface itself is made up of 85% sand, leaning more towards the finer sands, and 15% silt clay. It is basically a river-type sand, but it has been screened. Underneath that we have a limestone base and underneath that we have three-quarter-inch gravel. We have a total of about six inches of material above the limestone. The actual running surface, which is six inches, is all uniform running material. It is just compacted in different layers.

"We have a modified cushion of four inches, but with the roller harrows we use, the front gang of teeth cut at a four-inch depth. The roller then recompacts the material and the back gang of teeth cuts about 2½-to-3 inches, depending on whether we are running Thoroughbreds or Quarter horses. We shallow up a little bit with Quarter horses because of the shorter distances.

"So it is in layers. We'll have 2½-to-3 inches of fluff, and 1-to-1½ inches of semi-compacted material, and then two inches of compacted material—all over the limestone."

Zevenbergen said they have been pleased with the few number of injuries that have been experienced with the new surface. "The one thing that Equitrack had going for it was that it had an extremely low injury rate," Zevenbergen said. "That was part of their promotional effort. We have (now) what we feel is comparable to what we had even during Equitrack in regard to low injury rates. We've been very happy in that regard."

The biggest challenge for Zevenbergen has been the cold weather. "We race in the winter here. When it snows, we let it snow and then we blade it off in the morning before the races. Snow doesn't bother me nearly as much as just the extremely cold weather.

"We have weather here where it is ten degrees outside. Basically we end up having to stay on it for 24 hours a day, harrowing it and trying to keep it from freezing. We'll even use some heat-generating chemicals as a last resort. The problem is that as soon as you melt something, it literally takes less than five minutes for it to freeze again when it is ten degrees outside. During the winter, we have to harrow after each race.

"I don't like the winter time here. Every winter, I contemplate whether this is a good idea or not. But we are going on our third year with this surface and have had a fairly low injury rate on it and wide acceptance by the horsemen. We've gotten a lot of good accolades and remarks about it from horsemen. So we must be doing something right." ®

Marianna Haun is a staff writer for the THOROUGHBRED TIMES.

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Layers of safety

Proper mix of materials for site climate and conditions is critical for a safe racetrack

CONSTRUCTION

by John P. Sparkman

ENSURING the safety of a racetrack begins long before the first horse steps onto a surface that can look as enticing as a secluded South Pacific beach. Track construction is a collaborative process that requires the timely cooperation of engineers who design the track, the construction firm which does the actual building, the consultant advising on soil mixtures, soil material suppliers, the owners of the track supplying the finances, and finally, the weather.

The process starts with the engineer. The principal engineer may design the whole project, or he may be responsible only for the track itself. William S. Foy of L. E. Gregg and Associates of Lexington, Kentucky, has had more than 40 years of experience in constructing and renovating track surfaces all over the country.

"Mr. Gregg and I got into it in the 1950s," Foy recalls. "We were working for the state highway department, and they loaned us out to Keeneland as consultants when they rebuilt their track, and after that we went into business for ourselves. Then when New York rebuilt Aqueduct (1959), they wanted a surface just like Keeneland because they thought it was the best surface in the country."

Gregg and Foy, however, soon found the situation to be somewhat different in New York.

"That was a horrible mess. The construction company for the physical plant had just walked away, and there were posts and wires sticking out of the track area.

"Each track is different, and materials in each area are different, but the concept is still basically the same. It's a matter of trying to adapt local materials to the ideal situation. You have different kinds of problems at every different track. In New York, the problem was finding the right materials. It's an easy thing to design, but not an easy thing to do. Considering variations in materials, it's not easy to come up with the perfect solution the first time. We finally found the right kind of sand up near Albany."

From Belmont to Xalapa

L. E. Gregg and Associates subsequently was involved with the reconstruction of Belmont Park, Saratoga, and other racetracks around the country, and also in the design and construction or resurfacing of numerous training tracks in central Kentucky, including Calumet Farm, Pillar Stud, Whitaker Farm, and Xalapa Farm.

Having supervised the construction of the Pillar Stud (now 505 Farm) training track used for Fasig-Tipton's annual two-year-old sale, the author has some first-hand knowledge of the difficulties sometimes imposed by local conditions, such as the *karst* topography (featuring sinkholes and caves) of Central Kentucky.

Foy agrees, "*Karst* topography presents some problems, but you can design around them. You can run into things like natural underground springs like we did at Pillar, but you just have to work around them. It can cost you money, though. But the actual soils on-site and the natural drainage are more important."

Like roadways, racetracks are constructed in layers. Bill Foy generalizes, "For the base course, you want something that's stable and hard. Around here, you'll mix clay and sand and compact it for stability. The cushion is for the protection of the horse. It's more sand and loam for a softer surface that won't compact."

Drainage is the key

Bart C. Standley, vice president of Edminster, Hinshaw, Russ, and Standley, Inc. of Houston, Texas, served as the chief engineer in designing the new Sam Houston Race Park near Houston that opened successfully on April 29, 1994. Standley's firm had no prior experience in designing racetracks, but was widely experienced in related designs such as roadways and golf courses. He discovered quickly that drainage for the track surface, especially in Houston's humid climate, was of primary importance.

"The key to a track system is the ability to drain quickly, and we had a lot of experience with drainage systems," Standley relates. "The most important factors are 1) knowing the type of soil conditions that you begin with through geotechnical tests; 2) understanding the kind of natural drainage conditions that exist on-site; and 3) understanding the types of soil materials available in the area."

Standley and SHRP tried to utilize ideas from several different racetracks to come up with the best solution for their particular conditions. "We visited several tracks, like Remington, and talked to lots of people," Standley says. "Then we had to take the knowledge of all the consultants and come up with a combination that would function here the way other track surfaces function. The key thing is to find the right materials to go in the sandwich."

Sam Houston sandwich

"Sandwich" is an appropriately descriptive term used to denote the layered nature of the track surface. Standley worked with consultant Dennis Moore of Track Tek, Inc., of Fallbrook, California, to determine the proper ingredients for the Sam Houston sandwich.

As the son of the late Hollywood Park track superintendent Bob Moore, and brother of former Santa Anita superintendent Ron Moore, Dennis Moore brings an impressive racetrack pedigree to back up his reputation as one of the premier track surface consultants in the country. In his 23 years in the business, Moore has been responsible for developing the track cushions at tracks such as Hollywood Park, Remington Park, Woodlands, and Nad al Sheba (for Sheikh Mohammed al-Maktoum in Dubai), in addition to Sam Houston. He is currently assisting with the development at Lone Star Park near Dallas, Texas.

> *"The number one thing for me has always been the safety of the horses and riders. Fast times just aren't important to me."*
>
> **—Dennis Moore, Track Tek, Inc.**

Moore described the Sam Houston track sandwich from the bottom up:

"At the bottom you have the compacted fill. That's just the existing ground excavated to the proper depth, graded out and compacted. Then you have a course of three-quarter-inch to 1¼-inch rock on the bottom, six inches thick. Next, you have a two-inch layer of pea gravel. On top of the pea gravel, you have six inches of limestone screens (crushed fine limestone screened to three-sixteenths-to-three-eighths inches in size). That's graded and compacted, and you have to grade and compact it to follow the final gradations of the track. Whatever grade you want to have on the turns, or from the inside rail out on the straights you have to follow that in the base.

"The running surface is on top of the limestone screens. We used ten inches of material at Houston, and we used a very fine type of sand there because of the weather conditions. The mixture there is 85% fine sand, and the rest silt and clay. The basic function of the silt and clay is to bind and hold the sand together. We lay down the sand in five-inch lifts, so the bottom five inches gets compacted some by the trucks laying down the top."

As horsemen will be quick to note, tracks with too much fine sand will quickly get cuppy or loose when the weather turns dry. Moore, however, has learned through unhappy experience that too much sand is far better than too little.

"A cuppy track or a loose track you can control, there are things you can do," he notes. "But a track with coarser sand and a lot of loam, if you get a lot of rain it gets sloppy and muddy, and horses start going through to the base, and how do you control that? You do have to have the proper equipment, the will, and the right man in charge to maintain a sandy track. You can have the greatest surface in the world, but if it's not maintained, what good is it?"

Bottom line safety

The bottom line for Moore, however, is always safety. "The number one thing for me has always been the safety of the horses and riders. Fast times just aren't important to me. That ten inches of cushion at Houston is great for safety, because it's a long way down to your really hard base. Some people think it's too much to work with, but if you have two inches of rain in an hour and wash off two inches of a six-inch cushion, you don't have anything left to work with."

Photo by Z

Right recipe

Nelson Barfield of Addicks Services, Inc. in Houston supervised the actual construction of the Sam Houston track surface. Like engineer Standley, Barfield had no prior experience in track construction, but was widely experienced in roadways, golf courses, and private developments, and found many similarities. Barfield, of course, worked closely with both Bart Standley and Dennis Moore.

Barfield compares preparing the cushion for a racetrack to preparing a gourmet meal. "You've got the recipe (from Dennis Moore). Now you've got to find all the right ingredients and improvise for your particular conditions. You have to locate the materials and install them with the highest quality controls.

As is frequently the case, Barfield had to search far and wide to find the proper mix of materials for SHRP. "We had probably a dozen suppliers give me sand samples, and we would mix them and send them to the testing lab in California. They would analyze them and tell us how close we were. We finally had a couple of different samples approved, but the one we thought was most ideal just wasn't available in time, so we went to plan B. We had some problems with that, too, though, so we had plan C tested and that turned out to be better than A or B either one, and the supplier was able to get the sand to us in a very short period of time."

Sand from a supplier on the Brazos River, about 40 miles west of Houston was eventually chosen, and the supplier was fortunately able to work within the severest limit frequently placed on track contractors: time.

Barfield agrees: "It was really tight schedule-wise. Having the right phone call made at the right time of day was sometimes the difference between being able to open on time or not. It could have been a major headache, but we had the owners the decision makers on-site, and that made everything possible."

Sam Houston Race Park was constructed in the nine months from July 1993 to April 29, 1994. The opening date being written in the proverbial stone, contracts with construction suppliers allowed no time extensions, and little room for budget maneuvering.

Just as every climate and soil mixture is different, every construction site for a track has different characteristics that must be taken into account in the design. Pillar Stud's training track was built into a gently sloping hillside, and material from the upslope side was moved to the downslope of the hill to produce a level surface.

Major investment

Joe Mims of Skilton Paving and Construction, Inc. of Lexington, supervised construction of the Pillar track, as well as similar projects at Xalapa and Calumet. Mims notes that, "Finding the right location is the biggest problem. You don't want to hit a lot of rock, so you can keep expenses down. And you can run into some bad soils within a relatively small area, so you have to test the soil beforehand to make sure you have good soils all around your track.

"You've got to have good top soil to mix with your mortar sand for the surface. It's got to be real loamy so that the water will penetrate through it."

Mims observed that a training track is a major investment for any farm. "You're talking about a $500,000 to $750,000 investment for a six-furlong track, just for the track itself, so you'd better get it right the first time."

Pillar's (now 505 Farm) training track has been noted for its safety, and Sam Houston's new surface has elicited positive reviews from all concerned. After hearing complaints from trainers in recent seasons, Keeneland Race Course in Lexington resurfaced its track before the opening of the 1994 spring meet. The change brought markedly slower times, especially early in the meet, and almost universal approval from trainers as a safer, kinder surface for their horses.

Keeneland Association President Bill Greely has been pleased with the results of the renovation. "We sent (track superintendent) Mike Young to some other tracks, particularly Santa Anita and Fair Grounds, to see what they were doing that we weren't. As a result, we purchased two new harrows with a roller in the middle instead of behind. We also added more cushion to the surface. Now we have three inches of harrowed cushion instead of two, and an inch of compacted cushion.

"This track was redone in the '50s and they took out the clay base then. They put in a 12-inch base of compacted sand and soil and a three-inch cushion. We feel like we've made the track safer by adding the extra cushion and improving our maintenance techniques."

With challenges from animal rights advocates screaming over the all-too-rapidly approaching horizon, adding new layers of safety for horse and rider is a timely and humane approach. ®

John P. Sparkman is bloodstock/sales editor of Thoroughbred Times.

Worshipping the ground they run on

Developing a training surface with Dennis Moore

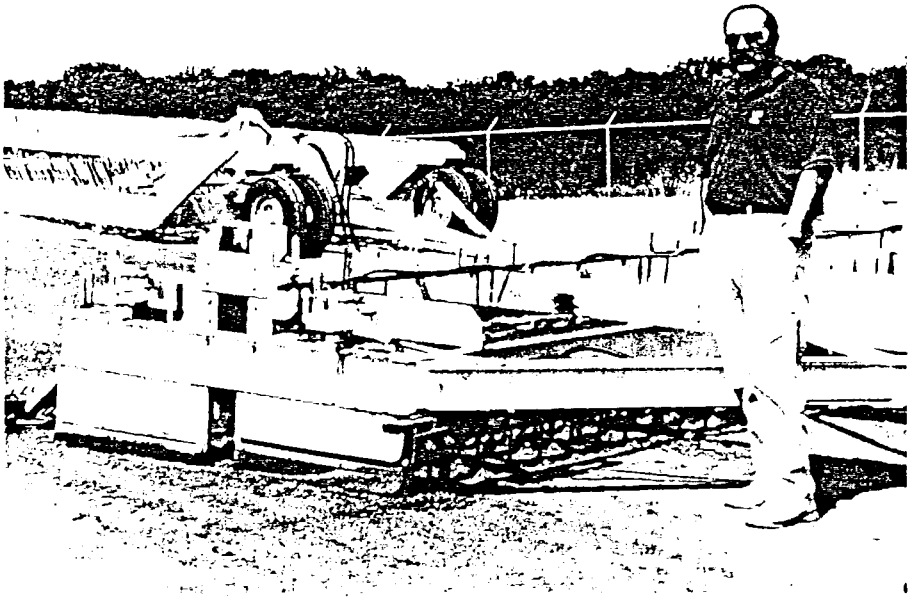
Many respected trainers, track men and veterinarians see improved running surfaces as one way to combat the alarming attrition rate in young racehorses.

by Lesli Krause Groves

Dennis Moore, itinerant guru of racing surfaces, wants to know: "Why spend a hundred thousand dollars for an animal, then break him down on a training track that wasn't properly cared for, designed or built?" All trainers pay homage to soundness, but track men, like Moore, take it even further. They worship the ground upon which racehorses run, and believe training surfaces directly affect the lifespan of a horse's limbs.

One reason that a training surface's importance is often ignored is because breakdowns seem to love the limelight. Many lameness problems start quietly and discreetly during training, and don't announce themselves until the grandstand is full of people. Some folks may blame the commercial racetrack for the problem. Others just assume it was inevitable. Moore believes, as do a growing number of respected trainers, track men and veterinarians, that improved training surfaces are one way to combat the alarming attrition rate in young racehorses.

Besides overseeing the track maintenance programs at Remington and Sunland Parks, The Woodlands, Ruidoso Downs and Los Alamitos Race Course, Moore travels as a consultant to people wanting to build or improve a race surface. He is a second-generation track man whose father, Bob Moore, was in charge of maintaining Hollywood Park's track from 1946 until 1979.



Dennis Moore oversees the track maintenance programs at Remington and Sunland Parks, The Woodlands, Ruidoso Downs and Los Alamitos Race Course.

Does the type of training track used really make that much difference?

Trainer D. Wayne Lukas must think so.

"A year after Lukas's California training track was built they had some some severe problems with it, and hired us to go in and redo it," Moore recalls. "There was a substantial increase in the percentage of horses he was getting to the track once the corrections were made. So that's the difference."

"Too many people take a field and blade the tumbleweeds off, and that's what they train their horses on," Moore pointed out. A better approach, according to Moore, requires building a base for the track and bringing in select materials for the cushion. Also important are the right water truck, a roller harrow and a dedicated maintenance program. Before you even begin the project, Moore suggests consulting an architect, an engineer and a contractor — and finding professionals experienced with track requirements.

Your subliminal adding machine may be sending signals that say, "Whoa! Who could afford all that?" Moore agrees the undertaking is expensive. "Everyone thinks they are better off having their own training track, when in fact, they're probably better off if they lease stalls from somebody that has an existing track," he said. "People don't realize the cost of constructing a training track, and then the cost of maintaining it after that."

Regardless of whether you're ready to have blueprints drawn, or just curious about what an expert might do differently, Moore's pattern for a training surface is interesting.

For starters, an engineer or architect

will undoubtedly refer to a topographic map when advising you on a track site. The "topo" map uses graphics to depict a property's relative elevations. If the site you've selected is already fairly level, the less cutting and excavation required, which means major savings. However, you obviously don't want to build a track in a low area, where all the water's going to congregate.

Also, be sure you have enough land for the size track you've opted to build. "Most Quarter Horse trainers will usually go with a 5/8-mile track, and most training tracks will be between 50-60 feet wide," said Moore. Fifteen acres are required for a track that size.

"The excavating — what we call the site work — will probably be the most expensive (factor)," Moore explained. After the heavy equipment has carved out the oval, the crew brings in pneumatic and vibratory rollers to pound the sub-soil into hard and flat submission.

"If you don't have a solid foundation, you start getting uneven spots and holes in your track, and that's where you break down horses," the expert said.

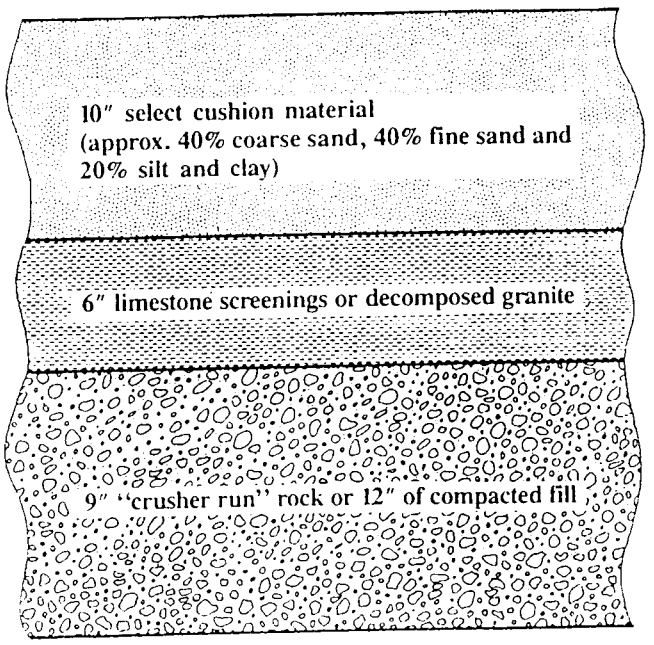
Moore's standardized recipe for a training track starts with a nine-inch layer of rock. Moore prefers what he calls "crusher run" rock, the diameter of which will consistently be from three-quarters to 1¼ inches. In some areas, the rock could be replaced by 12 inches of compacted fill.

Next, Moore adds a six-inch layer of limestone screenings or decomposed granite. The screenings average about a 3/8-inch diameter. Such a base is a boon to drainage and more immune to the contraction and expansion caused by temperature extremes. After these ingredients are in place, the giant rollers pave the way for the topping.

The icing on this cake is the cushion upon which the horses run. Moore's basic formula for this 10-inch layer of select material combines 40 percent coarse sand, 40 percent fine sand and 20 percent silt and clay. In warm, dry regions, Moore might want the clay content to be eight or nine percent, as the clay acts to bind the sand together. In areas that get a lot of rain, he would opt for a sandier cushion.

The material that goes into the base and cushion is sold either by yardage or tonnage. The material itself is not the big expense, but having it trucked in to your site can be costly. The distance from the source of the materials to the site determines the price of trucking. This variable makes estimating the price of a training track completely dependent upon its specific location.

The ingredients in Moore's training track recipe.



Moore said before the cushion material for The Woodlands racetrack was purchased, soil samples were analyzed from six different area pits. They bought from the pit with dirt that came closest to Moore's specifications, then blended in sand until they hit their mark.

"Most people building a training track make their mistake by just taking whatever material's available to them on-site," Moore said. "That's when they begin to have trouble, because if you have too much clay, when it rains, it's going to get muddy and stay muddy longer, and in the summer it will get real hard. You need to have a material that you can work and that is going to be kind to the horses at all times."

Also, be aware that the sand will break down with use. As a result, the proportion of clay in the cushion will increase. When the surface content starts to change, Moore suggests having another soil sample analyzed to determine how much sand should be added, and whether it should be fine or coarse.

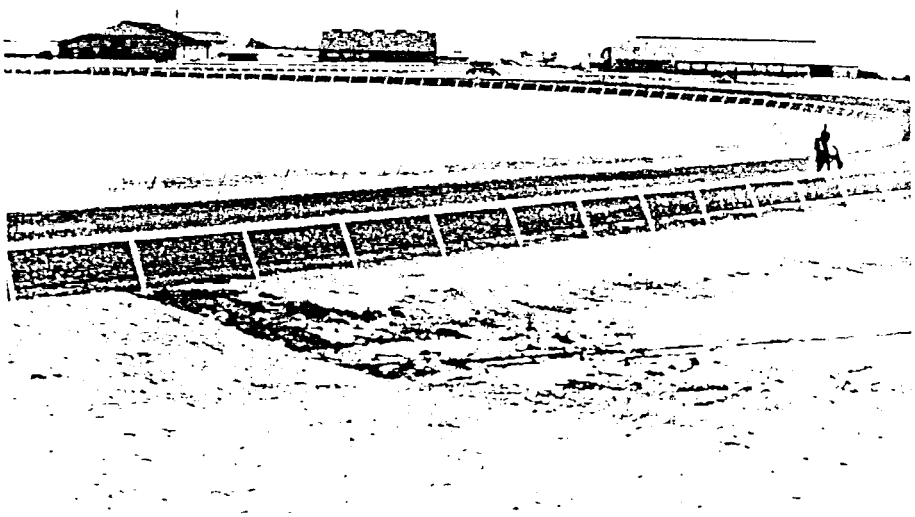
Moore, the racetrack gourmet, has one other ingredient he sometimes adds to the cushion. He refers to it as "organic," explaining that it's usually made up of ground-up fir or pine bark. "A misconception upon which we've tried to educate horsemen is that hard tracks don't necessarily mean fast tracks. Hard tracks, a lot of times, mean dangerous tracks in the long run. We use organic to give us a live, springy track. This, too, can be a very fast track. The horses catch it right and it feels good to them."

Moore continued, "You have to be careful as to what time of year you have the organic in there, because if it's wet, it tends to hold moisture and it's going to take you a little longer drying it out. It's very good in summer *because* it holds moisture, but mostly because it gives your track that life that you're looking for."

The 40:40:20 ratio with a sprinkling of organic, Moore explained, is simply a rule of thumb, and one which has changed since he first got involved with track surfaces. Depending upon the region and what a specific trainer wants from a track, the ratio is then adjusted.

For you statisticians or potential training track builders out there, Moore estimated a 5/8-mile oval, 60 feet wide would require 6,000 yards of select cushion material as well as 6,000 yards of limestone screenings or decomposed granite.

To the untrained eye, a professional racing surface will look tortilla-flat, but it should actually be slightly inclined from the inside edge to the outside. The degree of inclination, or "grade" of the track,



Moore designed the track at the Lazy E Training Center at Guthrie, Oklahoma. It is currently the only training track in the United States to utilize the synthetic cushion material "Equitrack." Lazy E owners justified the expense of Equitrack, which is compatible with the surface at nearby Remington Park, by building lease barns and offices.

should not exceed three percent on the straightaways, six-and-a-half percent on the turns. "You have a transition area of about 150 to 200 feet where you gradually go to your six-and-a-half percent off of your three (percent)," said Moore.

To be sure the grades are correct will require a professional survey. Moore says the grades should be re-inspected about once a year, depending on usage and weather abuse.

After you go to the trouble and expense of developing a surface to this point, you must protect your investment with a maintenance program. "The minimum amount of equipment for maintenance would be a water truck and a harrow, preferably a roller harrow," said Moore. "A roller harrow has a roller that divides the teeth of the harrow, and lays the track back down together after horses have worked on it. It keeps your track from getting holes in it, and allows you to maintain a consistent cushion depth. Since you're not fighting post times, you could go with a 15-foot roller harrow, which would probably run about $15,000, but will last forever if you take care of it."

"You need a water truck that has boom arms on it and has enough force operating the pump that will cause the water to penetrate the surface," he continued. "A lot of places just have a gravity-flow truck and fan sprays, and the water goes everywhere. You get a wet spot here, a dry spot there. It's better to have boom arms that are 18 inches off the ground, with jet sprays set at six- to eight-inch centers, depending on what kind of jet sprays you use. They stay consistent with the surface and allow the right moisture penetration."

You can't modify your existing straight harrow to act like a roller harrow, but your truck, or a used water truck like you might buy from a construction company, still has potential. "You could take any existing water truck and modify it by adding an auxiliary engine and a pump," Moore said. "You could probably do something like that for — it depends on how elaborate you get — anywhere from $5,000-$10,000."

Occasionally, you'll need to "rip and renovate" the surface. "Go down six inches, dig it up, loosen the base up, get all the uneven spots out and roto-till the material. Your coarser materials are going to work down to the bottom, and you need to till that to bring it back up into your top cushion material." By frequently monitoring the surface's hardness with a pentrometer, you can determine when that renovation needs to be done.

Moore believes that the inevitable change from one surface to another also contributes to breakdowns. A horse becomes conditioned to one track, then switches to race somewhere else. "No two tracks are the same," he acknowledged. "The only way we're ever going to overcome that is for everybody to be racing on the same surface, and that's not very feasible or possible."

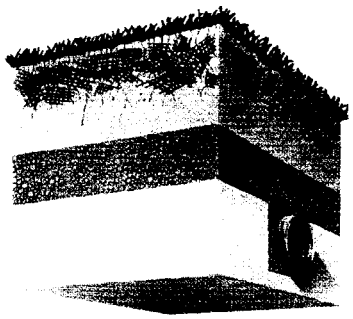
A universal racing surface is currently as hard to imagine as Astroturf might have been to the Four Horsemen playing football at Notre Dame in the 1920s. But Moore sees the patented "Equitrack" substance as a stride in that direction. Simply put, Equitrack is made by sifting sand to achieve grains of a consistent size, then coating each grain with a polymer and then a heavy-weight oil, which acts as a binding agent. The resulting consistency has been compared to greasy brown sugar. It does not retain water, so mud and freezing are not a big problem.

After working with Equitrack at Remington Park and the Lazy E Training Center nearby in Guthrie, Oklahoma, Moore comprehends its strengths and weaknesses better than most. "We've seen fewer breakdowns here (at Remington) than you would on a conventional surface," he said. "Equitrack, or a synthetic surface like Equitrack, will be the only surface that we all can race on, if the technology is ever developed where we don't see the problems with it that we've seen in the past. And I think if we ever get to that point in this industry, then we'll see a lot less breakdowns in horses."

While that wonder-surface of the future is being developed, Moore will continue traveling to those places where racehorse people gather — like Remington, Ruidoso, Sunland, Los Alamitos and the Woodlands — as he preaches the importance of good track surfaces for the training and racing of horses. □

The StrathAyr desig

The StrathAyr System



Profile of StrathAyr System

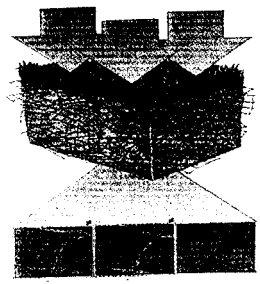
The StrathAyr System is a natural turf profile with a reinforced sand rootzone that provides long term economic and athlete safety benefits not previously available. Its capacity for intense use is such that, despite the initial capital cost, the cost per event is lower than for conventional fields, creating a long life/low maintenance option for sports fields, racetracks and high use amenity areas.

StrathAyr's agronomic background, use of experts and techniques from around the world and strong commitment to Research and Development have resulted in a system with superior agronomic and reinforcement attributes (research data available on request).

ReFlex® reinforcement provides a load bearing capacity equivalent to a secondary bitumen road.

Further, the incorporation of ReFlex® mesh elements prevents compaction, and enables rootzone aeration which encourages vigorous turf growth and rapid repair.

The concept combines a high-growth rootzone environment with rapid drainage rates, increased moisture retention, quicker wear recovery and maintains healthier turf all year.

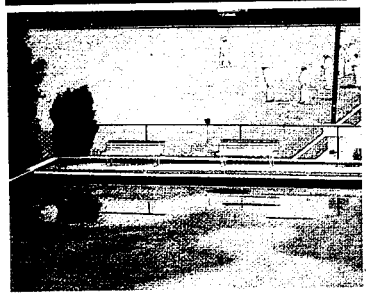


Self Cultivation Effect–as the surface springs back after compression air is sucked into the rootzone.

ReFlex® mesh elements have been extensively tested in several Universities over 10 years.

Industry consultants such as RootZone Laboratories International, in Canberra, Australia, enable StrathAyr to test the performance standards and agronomic aspects of all StrathAyr System constructions. The StrathAyr System design is consistent across all sports and countries. Only the turf species selected will vary according to the climate and the sport.

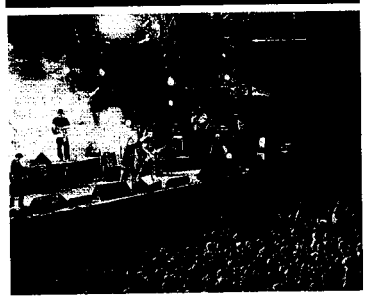
Allweather



Allweather Bowling Club

It provides a safe playing surface regardless of weather conditions. The high drainage rate (exceeding 100 mm/hr) provides a consistent surface whether wet or dry. There is never a need to cancel because of wet weather.

Multi Use



Concert at Parramatta Stadium

StrathAyr also gives your venue more options for use more often. As well as playing any sport- various codes of football, baseball, cricket, bowls, tennis, it's suitable for concerts and carparking.

*ReFlex is the registered trade mark of Netlon Limited in Europe, the USA and other countries.

The Bottom Line▼ More intensive use of grounds means lower cost per game.

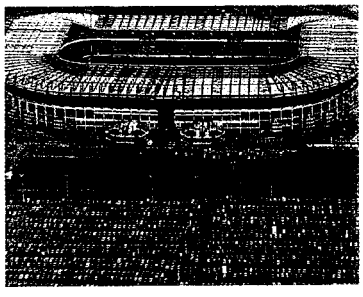
n and concept on turf

High Use

Rugby at Parramatta Stadium

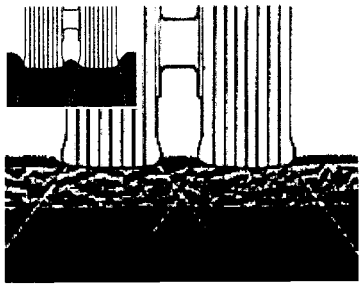
The Melbourne Cricket Ground is believed to record the highest ground usage of any stadium in a cool climate zone. In the first year after construction with the StrathAyr System, 97 games of football were played over 22 weekends, there where 36 days of cricket, and several concerts. In Parramatta Stadium's first year there where140 games of Rugby League, with training 3 night/week and 42 other events. Usage rates continue to rise.

Load Bearing



Parking on support ground, Murrayfield, Scotland

The StrathAyr System provides load bearing capability equivalent to a secondary bitumen road. It is suitable for heavy fire fighting equipment and enables parking on sports fields. For concerts and shows, chairs can be placed directly on the turf.



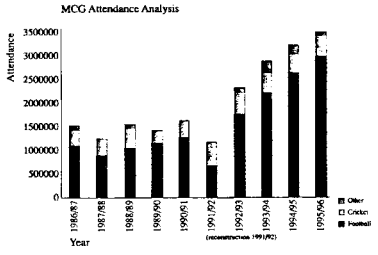
ReFlex® mesh elements distributes load more efficiently to resist rutting

Safety

Australian Rules Football

Player safety dominates the benefits provided by the StrathAyr System. The surface is proven to have a cushioning effect on impact which provides a lower potential for injury than with conventional sports fields. This means a longer sporting life for equine and human athletes.

Cost Effectiveness



MCG Attendance Analysis

Indefinite life, increased usage, reduced maintenance and greater income dramatically overshadow the higher capital cost. The System provides a long life, low maintenance option not previously available for sports fields.

Global Growth

The list of projects incorporating the StrathAyr System continues to grow:
A soccer pitch built for the Under 17 World Cup in Egypt in Sept 1997.
Five lawn bowling greens and the National Sports Complex in Malaysia for the 1998 Commonwealth Games.
The course proper and a training circuit at Singapore's new $1 billion Kranji race track.
StrathAyr SquAyrs at Old Trafford, England.
Homebush Showgrounds, Sydney, and Bruce Stadium, Canberra, Australia - venues for the 2000 Olympic Games.

The Bottom Line▼ The cushioning effect can extend the careers of sporting champions.

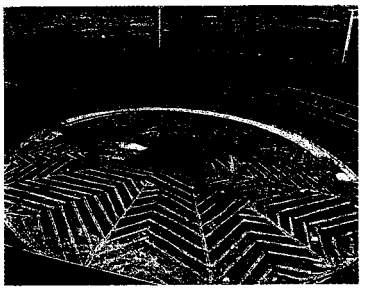
Typical installation and the tools we use

StrathAyr Machinery

StrathAyr has developed and patented several machines which mechanise all aspects of StrathAyr System installations. Together the MixAyr, FeedAyr and PaveAyr facilitate precision installation.

Construction

The construction sequence for the StrathAyr System



A. Base preparation and drainage installation

Bulk earthworks provide a stable sub–base which is shaped to match the contours of the final playing surface. This project function is similar to that for a road base while the rest of the construction involves specialised sportsfield installation technology.

Drainage trenches are formed in the consolidated sub–base and a geotextile fabric is laid over the sub–base and under the drains if necessary. Gravel and drainage pipes are laid in trenches.

B. Gravel and Sand

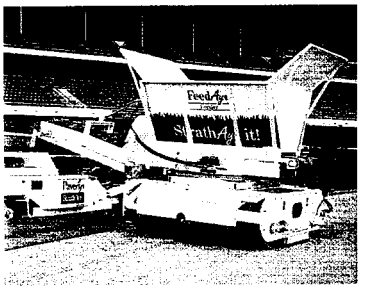
Very specific fine gravel is laid over the sub–base and drainage trenches. A bottom rootzone sand layer is placed and levelled ensuring a neat interface between the gravel and sand. The depth of this bottom sand layer depends on laboratory analysis of gravel and sand used.

The StrathAyr MixAyr

C. Matrix Installation

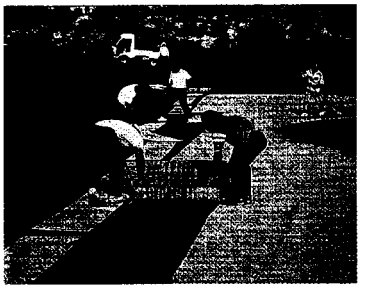
The StrathAyr MixAyr mixes mesh elements, peat and sand to produce a consistent matrix. A production rate of 100 t/hr provides economical mixing.

The matrix is loaded into the FeedAyr which carries it over the sand growing medium base and provides even consolidation without compaction. The low flotation of the FeedAyr at 5psi/35kpa fully loaded, represents a lower ground pressure than pedestrians. Multi purpose attachments are avaliable for top dressing, lime spreading, and placement of gravel.



The StrathAyr FeedAyr & PaveAyr

The FeedAyr feeds the matrix into the PaveAyr as they travel side by side. The PaveAyr installs the matrix of sand/peat moss/ReFlex® mesh elements. Top dressing can be applied simultaneously.



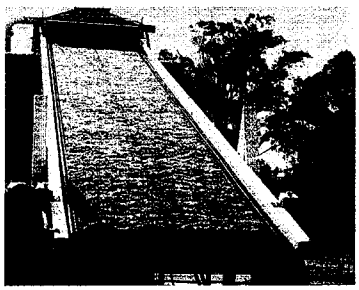
D. BAyr Root Turf Installation

BAyr Root Turf is an important component of the StrathAyr System although areas can be seeded or sprigged if time permits.

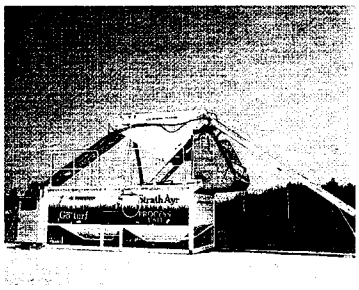
The Bottom Line▼ The diversity of use increases a venue's earning potential.

Some of the innovative StrathAyr products

BAyr Root Turf



BAyr Root Turf is turf vegetative mat free of any soil. It establishes rapidly, with dramatic root development. No foreign materials are introduced to the site and it can be transported across borders and onto environmentally sensitive sites.

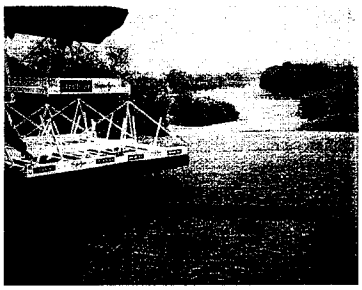


BAyr Root Turf Processor

The BAyr Root Turf Processor enables total removal of soil from harvested turf over a wide range of soil and turf types. Turf is processed in large or small rolls, with a water recycling option available.

The SprigAyr attachment fits onto the BAyr Root Turf Processor, to produce BAyr Root Sprigs (clean/soil free sprigs /stolons) of warm season grasses.

SquAyrs



SquAyrs are solid slabs of mature turf, fully reinforced with Reflex® mesh elements, specific sand, peat moss and the roots of BAyr Root Turf. They provide rapid repair with instant load bearing and usage capability. A reserve stock of SquAyrs provide insurance against usage damage. SquAyrs facilitate stadium multi use and changeover between sports and events.

SquAyrs are available in small (1.2 m x 1.2 m) , large (2.4 m x 2.4 m), or they can be tailor made to any size.

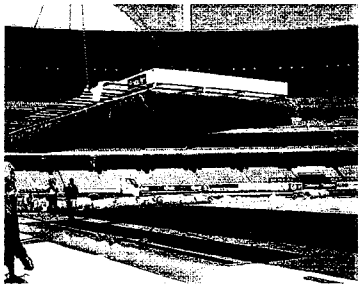
The StrathAyr Grab, available in manual or hydraulic mode, lifts and positions the SquAyrs.

Share the Wear

This concept involves installing the top part of the profile so that sections can be swapped to distribute wear. As high use areas show wear they are exchanged with areas of low use to allow them to repair.

Logos

SquAyr sections can be large enough to match logo size, enabling change over of logos between events



MCG Portable Pitch

Trialled at the Melbourne Cricket Ground in 1997. The MCG Portable Pitch has potential to solve problems associated with having cricket pitches on football fields. The pitch is transported in two slabs, each 12 m x 2.5m x 250 mm and weighing 16 tonnes. At the end of the cricket season the Portable Pitch was removed and replaced with SquAyrs.

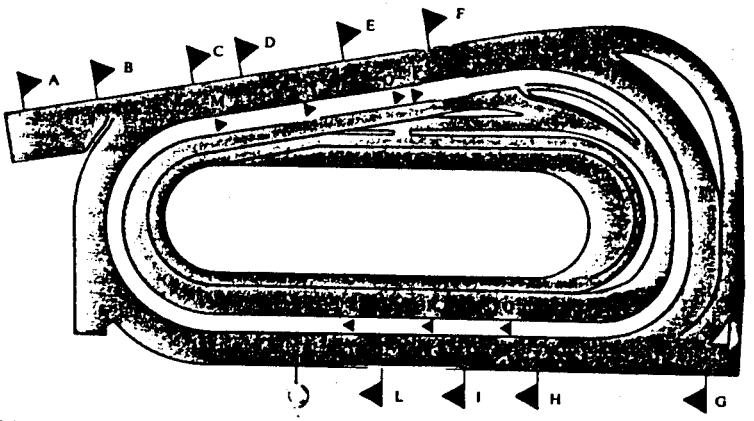
StrathAyr entered the Guiness Book of Records for the pitch as the largest piece of turf lifted without support.

Olympic Involvement

StrathAyr SquAyrs were utilised at the Atlanta Olympic Games with mini SquAyrs used to repair the surface, including durring the half time break of the soccer Gold Medal match.

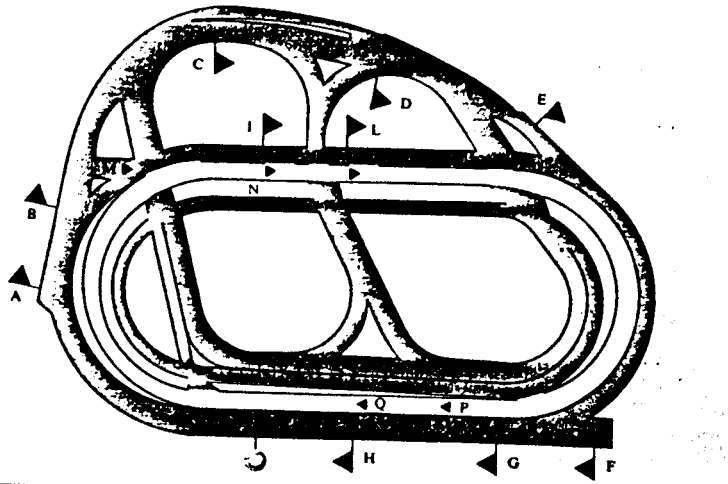
The Bottom Line▼ The StrathAyr System saves you time and money.

KYOTO. Twelve miles (20 km) from Kyoto and 24 miles (40 km) from Osaka, this racecourse has two tracks: an outer grass course and an inner sand track. The grass course measures 1 mile 1¼ furlongs (1,911 m) round the outer bend and 1 mile 1 furlong (1,802 m) round the inner one, with a width of 82–114 ft (25–35 m), depending on the stretch. The finishing straights measure 440 yds (406 m) and 374 yds (342 m) respectively. The oval sand track is concentric to the grass course and is 1 mile 28 yds (1,626 m) long, 82–88 ft (25–27 m) wide. The courses are right-handed.



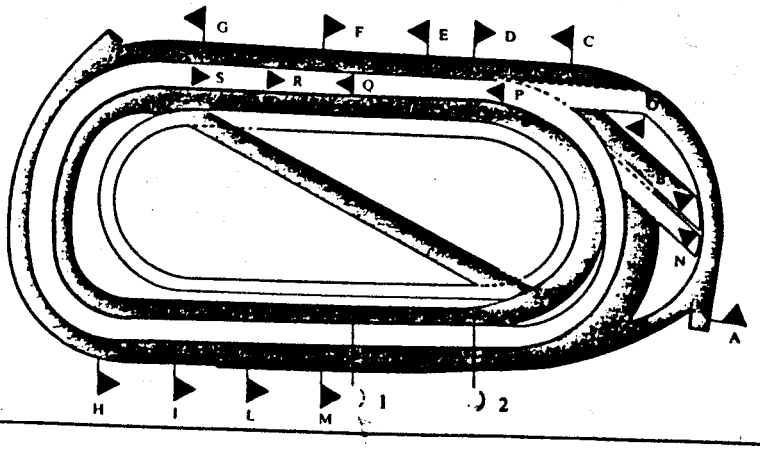
A – 7½ furlongs (1,500 m – small course); 1 mile (1,600 m – large course). **B** – 7 furlongs (1,400 m – small course); 7½ furlongs (1,500 m – large course). **C** – 7 furlongs (1,400 m – large course). **D** – 6 furlongs (1,200 m – small course). **E** – 5½ furlongs (1,100 m – small course). **F** – 1 mile 7 furlongs (3,000 – large course). **G** – 1¼ miles (2,400 m – large course). **H** – 1 mile 3 furlongs (2,200 m – large course). **I** – 1 mile 2 furlongs (2,000 m – small course). **L** – 1 mile 1 furlong (1,800 m – small course); 1 mile 2 furlongs (2,000 m – large course). **M** – 6 furlongs (1,200 m). **N** – 5½ furlongs (1,100 m). **O** – 5 furlongs (1,000 m). **P** – 1 mile 5 furlongs (2,600 m). **Q** – 1 mile 1½ furlongs (1,900 m). **R** – 1 mile 1 furlong (1,800 m). **S** – 8½ furlongs (1,700 m).

NAKAYAMA. This racecourse is in Funabashi City, 18 miles (30 km) from Tokyo. It has an outer grass course of which the longer course, running round a wide bend adjacent to the opposite straight, measures 1 mile 1 furlong 82 yds (1,875 m), while the inner course covers a distance of 8½ furlongs (1,699 m). The grass course varies in width from 65½ ft (20 m) to 105 ft (32 m), depending on the course being followed, and the finishing straight is 339 yds (310 m) long. Concentric to and inside the grass course is a sand track which is 7 furlongs 170 yds (1,556 m) long, 65½ ft (20 m) wide, with a finishing straight of 336 yds (308 m). The racecourse also has a steeplechase course with two parallel diagonals. The round circuit is 7 furlongs 55 yds (1,450 m) long whereas the two diagonals measure 700 yds (640 m) and 630 yds (576 m). The steeplechase course is 56–98 ft (17–30 m) wide. The training courses are positioned between the sand track and the steeplechase course. The courses are right-handed.



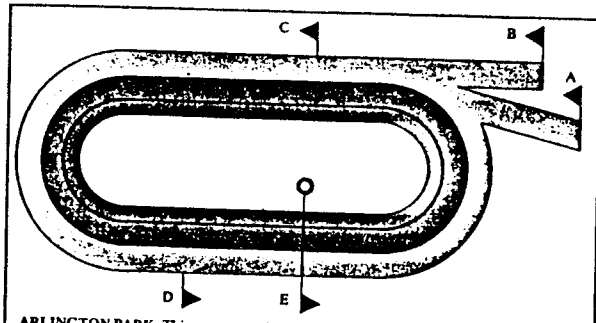
A – 1 mile (1,600 m). **B** – 2 miles (3,200 m). **C** – 6 furlongs (1,200 m). **D** – 5 furlongs (1,000 m). **E** – 1 mile 4½ furlongs (2,500 m – small course). **F** – 2½ miles (4,000 m – small and large courses); 1 mile 3½ furlongs (2,300 m – large course). **G** – 1 mile 2 furlongs (2,000 m – small course). **H** – 1 mile 2 furlongs (2,000 m – large course). **I** – 5 furlongs (1,000 m). **L** – 5 furlongs (1,000 m). **M** – 6 furlongs (1,200 m). **N** – 1 mile 5 furlongs (2,600 m). **O** – 1 mile 4½ furlongs (2,500 m). **P** – 1 mile 1 furlong (1,800 m). **Q** – 8½ furlongs (1,700 m).

TOKYO. This racecourse is in Fuchu City, 17 miles (27 km) from the heart of Tokyo. There are two racetracks: one inner sand track of about 1 mile 1½ furlongs (1,900 m) long, 81–87 ft (25–27 m) wide, with a finishing straight of 521 yds (477 m), and an outer grass course, 1 mile 2½ furlongs (2,100 m) long with a finishing straight of 555 yds (508 m). There is a third course, for steeplechases, within these two. In the last 273 yds (250 m) and after the winning post up to the 1-mile 1-furlong (1,800 m) post, the track is absolutely flat. The grass course also has a wider outer bend than the one on which the 1-mile 2-furlong (2,000 m) start is located. The starts for the 1-mile 1-furlong (1,800 m) and 8½-furlong (1,700 m) races are in the space between the two bends (on the grass and sand tracks respectively). The courses are left- and right-handed.



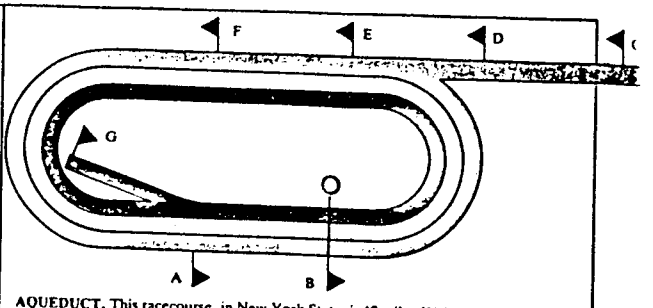
A – 1 mile 2 furlongs (2,000 m). **B** – 1 mile 1 furlong (1,800 m). **C** – 1 mile (1,600 m). **D** – 5 furlongs* (1,000 m). **E** – 7 furlongs (1,400 m). **F** – 6 furlongs* (1,200 m). **G** – 6 furlongs (1,200 m). **H** – 1 mile 5 furlongs (2,600 m). **I** – 1 mile 4½ furlongs (2,500 m). **L** – 1¼ miles (2,400 m). **M** – 1 mile 3½ furlongs (2,300 m). **N** – 8½ furlongs (1,700 m). **O** – 1 mile (1,600 m). **P** – 7 furlongs (1,400 m). **Q** – 6 furlongs (1,200 m) **R** – 5 furlongs* (1,000 m). **S** – 5½ furlongs (1,100 m).

**first post.*



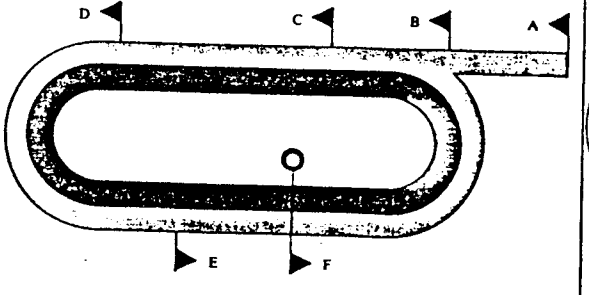
ARLINGTON PARK. This racecourse in Illinois lies 23 miles (37 km) from the center of Chicago. It has one outer oval sand track which has two concentric grass tracks inside. The sand track covers an overall distance of 1 mile 1 furlong (1,800 m) and along the finishing straight has a width of 101 ft (30.8 m). On this track the distance from the last bend to the finishing post is 342 yds (313 m). The grass tracks measure 1 mile (1,600 m) and 7 furlongs (1,400 m) respectively. The courses are left-handed. Seats a total number of 30,598.

A – 1 mile (1,600 m). B – 7 furlongs (1,400 m). C – 5 furlongs (1,000 m). D – 1 mile 2 furlongs (2,000 m). E – 1 mile 1 furlong (1,800 m).



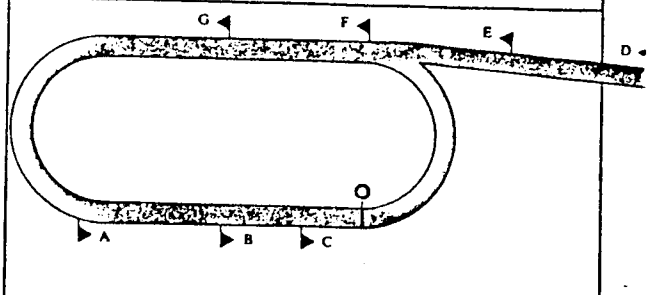
AQUEDUCT. This racecourse, in New York State, is 12 miles (19 km) from New York itself and has two sand tracks and one grass course. The outermost sand track is oval-shaped and covers a distance of 1 mile 1 furlong (1,800 m), and is 100 ft (30.48 m) wide along the finishing straight and 110 ft (35.2 m) across the opposite straight, narrowing, however, to 100 ft (30.48 m) at the end. The distance from the last bend to the finishing post is 385 yds (35.2 m). The inner sand track is also oval-shaped and is 1 mile (1,600 m) long and 90 ft (27.4 m) wide along the finishing straight. The grass course is 7 furlongs 14 yds (1,413 m) long. The courses are left-handed.

A – 1 mile 2 furlongs (2,000 m). B – 1 mile 1 furlong (1,800 m). C – 1 mile (1,600 m). D – 7 furlongs (1,400 m). E – 6 furlongs (1,200 m). F – 5 furlongs (1,000 m). G – 1 mile 1 furlong (1,800 m).



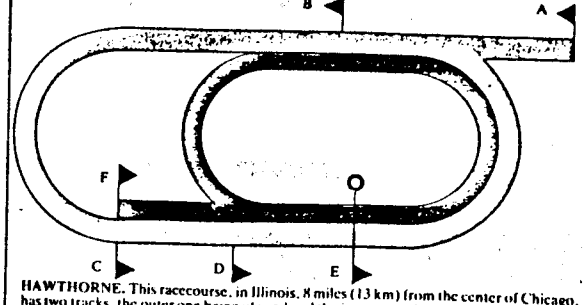
ATLANTIC CITY. This racecourse, 14 miles (22.5 km) from Atlantic City and 46 miles (74 km) from Philadelphia, has an outer sand track and a concentric inner grass track. The sand track is oval in shape and covers a distance of 1 mile 1 furlong (1,800 m). The width of this track is 100 ft (30.48 m) and the distance from the last bend to the finishing post is 316 yds (289 m). The grass course is 1 mile (1,600 m) long and 100 ft (30.48 m) wide. The courses are left-handed. Seats a total of 16,000.

A – 7 furlongs (1,400 m). B – 6 furlongs (1,200 m). C – 5 furlongs (1,000 m). D – 1½ miles (2,400 m). E – 1 mile 2 furlongs (2,000 m). F – 1 mile 1 furlong (1,800 m).



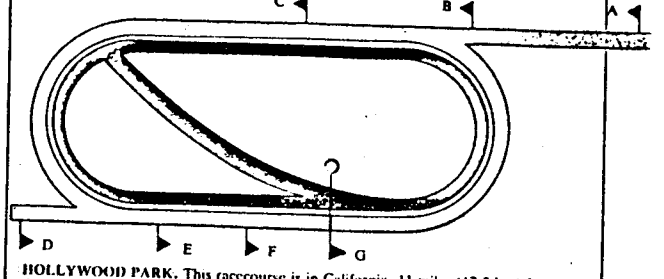
CHURCHILL DOWNS. This racecourse is on the outskirts of Louisville, Kentucky, and has an oval-shaped track 1 mile (1,600 m) long. The track is 80 ft (24.3 m) wide along the finishing straight and slightly narrower (79 ft (24 m)) across the opposite straight. The distance from the Derby start and the finishing post is 440 yds (402 m) whereas from the last bend to the finishing post it is 411 yds (390 m). The course is 120 ft (36.5 m) wide at the Derby start and left-handed. Seats a total of 45,000.

A – 1 mile 2 furlongs (2,000 m). B – 1 mile 1 furlong (1,800 m). C – 8½ furlongs (1,700 m). D – 1 mile (1,600 m). E – 7 furlongs (1,400 m). F – 6 furlongs (1,200 m). G – 5 furlongs (1,000 m).



HAWTHORNE. This racecourse, in Illinois, 8 miles (13 km) from the center of Chicago, has two tracks, the outer one being of sand and the inner one of grass. The sand track is 1 mile (1,600 m) long and oval in shape. It is 75 ft (22.8 m) wide along the finishing straight, but around the finishing post broadens to 82 ft (25 m). The opposite straight is 75 ft (22.8 m) wide. The distance between the last bend and the finishing post is 2 furlongs (400 m). The grass course covers a distance of approximately 6 furlongs (1,200 m) and has a chute for the 1-mile (1,600 m) start. The courses are left-handed. Seats a total of 15,000.

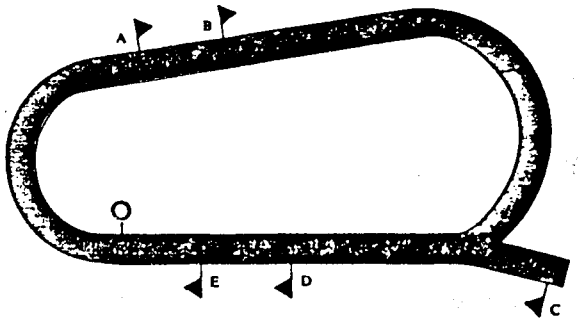
A – 6½ furlongs (1,300 m). B – 5 furlongs (1,000 m). C – 1 mile 2 furlongs (2,000 m). D – 1 mile 1 furlong (1,800 m). E – 1 mile (1,600 m). F – 1 mile (1,600 m).



HOLLYWOOD PARK. This racecourse is in California, 11 miles (17.5 km) from Los Angeles and 8 miles (13 km) from Hollywood. It has two tracks, one outer oval sand track and an inner grass course with one diagonal. The sand track is 1 mile (1,600 m) long and 80.5 ft (24.5 m) wide across the straight opposite the winning straight, which is 90.5 ft (27.5 m) wide. The track measures 323 yds (295 m) from the start of the finishing straight to the post. The grass course is 7½ furlongs (1,450 m) long and both courses are left-handed. Seats a total of 28,897.

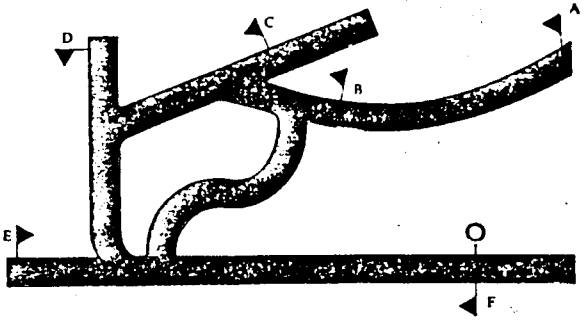
A – 7 furlongs (1,400 m). B – 6 furlongs (1,200 m). C – 5 furlongs (1,000 m). D – 1 mile 2 furlongs (2,000 m). E – 1 mile 1 furlong (1,800 m). F – 8½ furlongs (1,700 m). G – 1 mile (1,600 m).

EDINBURGH. Situated in Musselburgh, 6 miles (10 km) from Edinburgh. A flat oval grass track, the circular part covering 1 mile 2 furlongs (2,000 m), plus an additional 2 furlongs (400 m) chute, the site of the start for the 5 furlongs (1,000 m) and 1 mile 7 furlongs (3,000 m) races. The last furlong (200 m) before the winning post is uphill and the course is right-handed.



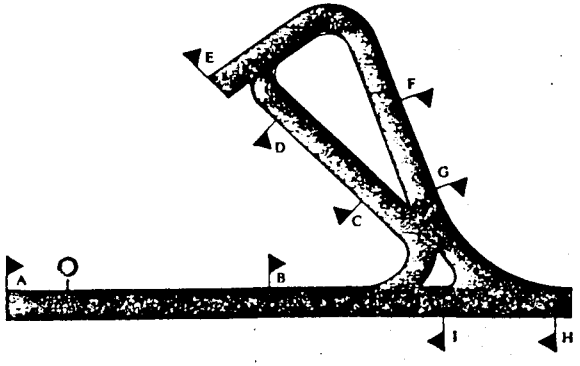
A – 1 mile (1,600 m). B – 7 furlongs (1,400 m). C – 5 furlongs (1,000 m); 1 mile 7 furlongs (3,000 m). D – 1¼ miles (2,400 m). E – 1 mile 3 furlongs (2,200 m).

EPSOM. 15 miles (24 km) outside London. The racecourse is named after the nearby town which took its name from a Latin inscription found on a fragment of a Roman tombstone: (PRINC)EPS O.M., the first part of which (PRINC) was missing. The grass track is in a very irregular circle and the longest stretch, the Derby Track, measures 1¼ miles (2,400 m). The first 5 furlongs (1,000 m) are on an uphill gradient, but the rest of the track goes downhill to the finishing straight which is 4 furlongs (800 m) long and slopes upwards towards the end. The straight track measures 5 furlongs (1,000 m). The most important races run here are the Derby (since 1780) and the Oaks (since 1779) over a distance of 1½ miles (2,400 m). For these, as in most other races, the course is left-handed, but the Great Metropolitan Handicap over 2¼ miles (3,600 m) starts at the finishing post and results in the horses running along the straight in both directions.



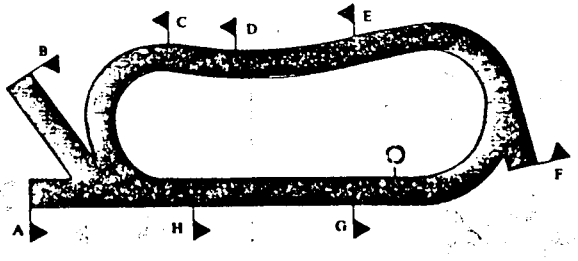
A – 1 mile 4 furlongs (2,400 m) – (Derby). B – 1 mile 2 furlongs (2,000 m). C – 7 furlongs (1,400 m). D – 6 furlongs (1,200 m). E – 5 furlongs (1,000 m). F – 2 miles 2 furlongs (3,600 m).

GOODWOOD. 70 miles (112 km) from London. The grass track covers 2 miles (3,200 m) overall and has a very unusual, shape, the only one of its kind. The straight course is 6 furlongs (1,200 m) long. For races over 2 miles 3 furlongs (3,800 m) and 2 miles 5 furlongs (4,200 m) the horses run in both directions along the straight. The most important race run here is the Sussex Stakes over 1 mile (1,600 m), which dates back to 1841.



A – 2 miles 5 furlongs (4,200 m). B – 2 miles 3 furlongs (3,800 m). C – 1 mile 6 furlongs (2,800 m). D – 1 mile 2 furlongs (2,000 m). E – 1½ miles (2,400 m). F – 1 mile (1,600 m). G – 7 furlongs (1,400 m). H – 6 furlongs (1,200 m). I – 5 furlongs (1,000 m).

HAYDOCK PARK. 188 miles (302 km) from London. This grass track is almost oval in shape and covers 1 mile 5 furlongs (2,600 m) with a finishing straight of 4 furlongs (800 m). The course is almost flat and left-handed. The straight track measures 5 furlongs (1,000 m) which, just before it meets the main circuit, is joined by the short chute, site of the 6-furlong (1,200 m) start.



A – 5 furlongs (1,000 m). B – 6 furlongs (1,200 m). C – 7 furlongs 40 yds (1,436 m). D – 1 mile 40 yds (1,636 m). E – 1 mile 2 furlongs 131 yds (2,120 m). F – 1¼ miles (2,400 m). G – 1 mile 6 furlongs (2,800 m). H – 2 miles 28 yds (3,226 m).