SURFACE DRAINAGE— NEW TECHNIQUES

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The Importance of Surface Drainage

Surface Drainage is basically a question of increasing drainage in regard to both the speed and quantity of water draining *from* the surface *to* the sub soil, that area which has tended so much in the past to be a missing link. Excellent drainage from tile system down below, plenty of water on the top, but no effective link between. Now it is largely speed of drainage, speed of surface drainage, which is so important to Golf. You cannot play properly on a wet surface and this is obvious to all; a wet surface whether it is mud or in fact standing water, will not provide the right playing conditions.

Of course, it goes a lot further than that and there is the question of producing the right sort of grass surface both in quality and quantity. In quantity you want to maintain 100% cover; you don't want bare ground, and you don't want 50% cover, but this is what the wet surface can so often produce. Perhaps even more we should think about the quality of the turf which can arise from putting up with a wet surface. As you know, you are trying to maintain grasses of a certain type mostly on fairways or greens. You are trying to maintain the Bents and Fescues, you are trying to put up with, or if you can, eliminate the Poa Annuas and you don't want perennial rye grasses in most situations. But the wet surface is the one which will encourage an annual meadow grass, perennial rye grass type of sward as opposed to the one which you want, which is more usually Fescues or even Poa pretensis. Smooth stalked meadow grass is a rather more favourable grass and here again, it is very much more at home on a dry surface than the wet one.

A further reason for the importance of surface drainage on the golf course is to produce uniformity. A considerable part of the battle of maintaining turf is producing uniform penetration,

and a uniform result across the surface of a green or across a fairway. This applies to penetration of water, nutrients, fertilisers, etc. It applies to the production of thatch or heavy surface mats, which as you know, tend to occur in isolated places, and alongside. You may get areas without any surface fibre full of worms, full of coarse grasses, full of weeds, and it is this lack of uniformity which will often cause a low quality in many turfs.

Finally, surface drainage is important in countering increased precipitation and increased wear. I say precipitation advisedly rather than rainfall, because these days, apart from our rain and snow, we put so much water on artificially, so that whereas you may have a natural rainfall in the area of 20 to 35 inches, yet with constant watering these days, you are perhaps doubling these figures and this has to be borne in mind as a need for much better drainage through the surface, to get rid of these increased quantities of water. Also there is the question of countering the increased wear. I think we can safely assume that the vast majority of clubs have had a vast increase in the number of members over the last 10 years. This means increased traffic, increased wear, increased compaction, and you need a better surface drainage to counter that.

Before we go to the question of how to achieve this surface drainage we should mention that the drainage from the sub-soil is of course fundamental. It is no use going into measures for improving the surface drainage until you have effective drainage from the sub-soil. This may be a natural permeable material below, more often it means an adequate clay tile or plastic tube system. The point is, of course, that it is no use putting surface measures in such as sand slits and having them fill up with water with nowhere to go.

As to the actual techniques of achieving surface drainage, the ideal method of course, is to treat the soil profile in depth. Most of the early links were put on sand dunes and there you have a free natural drainage, which generally speaking, is satisfactory at all times of the year. That is natural permeability. These days if you are building golf courses in other situations you will nearly always build up a soil profile with a permeable layer at the base of coarse sand, and on the surface, usually a mixture of sand, peat and a certain amount of soil according to the permeabilities which are desired and can be achieved. One can say in such cases that you have one big sand slit and there is no need to go to extra measures to improve it, because you have got a built-in permeability right from the start. More and more golf greens are being built in this way but the cost is considerable. £10—£15,000 per acre is necessary to build up a profile in this way. A typical profile to be used on a football field will have more sand and blinding under the soil layer which is mostly sand and peat to ensure a quick draining profile. An even more permeable profile is possible with 24″ sand, then a layer of sand and peat only, with no soil. This was done in Sweden but one must remember that this profile takes longer to establish a grass sward in these very permeable conditions.

Sand Slitting

Most of you have to deal with the existing conditions and apart from the expense of improvement, there is the interruption to play which cannot easily be tolerated. Therefore the question of sand slits as a means of improving surface drainage has been

considered for quite a number of years past; the producing of vertical bands filled with permeable materials which will then link with the drainage system below.

Early attempts to achieve this used either mole ploughs of some modification, or the smallest dimension of trencher, but there are difficulties with these methods. The mole plough is apt to cause considerable ridging and disturbance of the surface and is therefore mainly suitable when you can tolerate a a wholesale cultivation and reseeding of the ground, and is only suitable in those circumstances. With the trenching machine, the difficulty lies in the quantities of materials which have to be handled, a question of having to move several hundred tons of soil per acre out of the trench and moving several hundred tons of sand back into the trench to make a sand slit. This becomes a very time absorbing and messy operation, very damaging to your turf over which you have to handle and cart these vast quantities of material, and you are often left with a considerable width of slit far in excess of what is needed to carry water away. The size is largely determined by the machine that has made the slit but with a wide slit, you have to cover the scar and reseed it.

The approach which we had in the Cambridge Soil Services to this problem, was to assess certain requirements to make this into as simple a job as possible. First of all, surface water must have easy access into and down through the slit. Secondly, established turf must have as little disturbance as possible which means the cleanest possible cut through the turf with an absolute minimum of ridging due to passage of the implement. Thirdly, we look to economy in the handling of materials which go into that slit, because of the large tonnages which may be necessary per acre and because of the general susceptibility of golf turf to carting materials across them. Fourthly, we look for a ready flow of those bulky materials into the ground and when you consider that the most easily available material is sand which is naturally rather damp, this is not an easy material to flow down through hoppers and through slots, so we are anxious to get the best possible flow with these fairly crude materials.

We arrived at the principle of creating a narrow slit with a vibrating blade. A narrow slit because this is adequate for the passage of water, and is a passage which can be achieved without removing existing soil, often rather a messy operation. A vibrating blade because this makes a very clean cut through turf and secondly, gives a very easy flow of these unfavourable materials like damp sand through the hopper and down into the ground. In our development of this we did look at some of the vibrating blade equipment which is already on the market for creating deep aeration. We modified some of this equipment so that we could put sand down into the ground using this similar vibrating technique.

From there we moved on to a much more comprehensive system. We designed a machine solely for this injection of sand in fairly narrow slits of about ½" - 1" wide and 7" - 9" deep. Since we wanted equipment which would do the whole job fairly quickly, we put three blades on to the machine which we called a Triple Sand Injector. This is capable of considerable outputs of between 1 and 2 acres per day. Making the machinery produce even narrower slits had practical problems such as stones blocking the passage of material into the slit, and this could cause a ripping action of the trench when stones were present in the soil.

Other types of machinery are available. Modification of a hollow tine machine can introduce sand into the holes created in the soil. The cores

are about ½″ wide and 7″ deep and 3 ft. apart. Recovery after this operation is quite rapid. We also looked into larger equipment, tractor hauled and powered by the tractor with a special low ratio gearbox, able to put in 3 slits at a time, and fed by hopper at the rear, slits being 4′ apart, although by coming back over the same area, the distance between slits can be decreased to the required distance apart.

To give an example of sand slitting technique I may mention one football pitch which was in very bad order. After ensuring the sub-soil drains were in good order, sand slitting was carried out with a simple modified agricultural mole plough. The slits were 2″ wide, 12″ deep and 4 ft. apart and filled with an artificial aggregate. It was carried out at the period of spring renovation to allow ridges to be eliminated and re-seeding to be carried out. A great difference was then seen in a 12 months period. The operation was successful despite a ½″ layer of soil having to be put over the slit, in order to re-seed the area. However, this was sandy soil, and even an 1/8″ of wrong soil might seal off the slit. Also, although the soil at the side of the slit is thought of as impermeable, it is in fact not so, and water does enter the slit down its entire length.

To illustrate how quickly an area can be treated, a professional football pitch was treated starting on the Monday, finishing on the Friday and the pitch was played on on the Saturday, illustrating how work can be carried out effectively on an emergency basis and still produce a successful effect.

The process can also be carried out on more favourable soils, where a thin blanket of sand is also spread over the surface of the soil creating continuity between the slits and also to protect the soil from the adverse effects of compaction.