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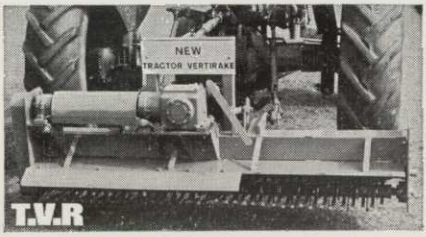

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Front Cover Picture

THE Cambridge Sportsfield Compaction Breaker in action, cutting a slit to provide a vertical drainage channel. See Slit Drainage, Pages 5-9.

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Slit drain system

FOR the majority of natural soils, a good structure is essential if rain water is to percolate freely through the soil. When the structure is damaged, by mishandling during construction or by play in wet conditions or by poor management, the soil transmits water very slowly. The result is a wet, soft playing surface leading to more damage.

By I. G. Daniells, Soil Physicist, The Sports Turf Research Institute

As one possible solution, the existing soil may be replaced by a properly designed sandy top soil which will remain permeable even when compacted.

Slit drainage, introduced into Britain by the Sports Turf Research Institute, offers an alternative way of getting water away from the surface which has proved extremely successful for many clubs of different kinds.

The installation of slit drains creates permeable regions at regular intervals across the playing surface, providing a permeable connection between the soil surface and the drain pipes. Surface water can thus by-pass the much slower route through the soil body.

The main function of slit drains is obviously vertical transmission of water. They will allow vertical infiltration through a compacted, impermeable layer into a more permeable stratum. For example, there may be a compacted surface layer impeding infiltration and below this a less compact, better-structured more permeable layer. Alternatively, a compacted top soil may overlie a drainage carpet of ash or gravel. Slit drains will allow water to flow vertically from the surface, and lateral flow to the drain pipes can take place in the more permeable layer, provided that this second layer is indeed sufficiently permeable. In this situation, the slit drains are acting as true vertical drainage channels.

A second function of slits is to provide additionally for lateral condition of water to the drains where conditions do not otherwise allow this. When the sub-soil is impermeable, so that water cannot readily get away at the bottom of the slits then the slits must convey water sideways to some outlet. In this case it is vital that the slits do make a good connection with the drain pipes via the permeable backfill over the pipes.

The width, depth and spacing of the slits, the spacing of the drain pipes and the material filling the slits are interrelated and all affect the amount of rainfall the slits can cope with. In cases where slits are acting exclusively as vertical drainage channels allowing surface water access to a permeable sub-soil, then narrow slits of the order of half-an-inch may be appropriate, because of their relative cheapness and ease of installation. On the other hand, wide slits may be considered likely to be more permanent and, where an impermeable sub-soil necessitates lateral conduction of water in the slits then a wider slit, say two inches, is definitely required.

The spacing of the slits affects their efficiency in two ways. The closer together they are, the less distance that water has to flow over the surface before finding a vertical channel, and the more slits of a given width that there are over the surface, the greater the capacity of the whole system. Spacings usually vary from one to three feet, depending on slit type, soil type

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and drainage design rate.

All other things being equal, increasing the depth of the slits greatly increases their capacity for lateral transmission. However, the depth of the slits is usually dictated by the requirement to link them propertly to the backfill over the drain pipes. Whenever pipes are installed, it is well to bear in mind possible future slitting, and to arrange the depth of the pipes and the build-up of backfill over them to accommodate slits of a suitable depth.

Materials varying in particle size from fine dune sand to gravel have been used as filling for slits. The coarser the filling, the more permeable it will be and hence the greater will be the efficiency of the slits. It must be remembered however, that permeability depends on uniformity of particle size as well as the degree of coarseness. Very often the particle size of the material over the drain pipes will dictate the degree of coarseness of the slit filling, because of the danger of a fine filling washing into the drains contributing to silting up and possibly affecting the playing surface through settlement. The depth of the slits will decide whether they cut through the coarse aggregate over the pipes or through the finer blinding layer above this. The use of too coarse a slit filling is prohibited by the hazards, to mowing machines and players, of large particles at the soil surface. Thus the problem one often faces is in choosing a slit filling which, while being sufficiently permeable, is neither too fine over the drains nor too coarse at the surface. One solution is to have a two-part slit with, say pea-gravel in the bottom for rapid lateral conduction of water, and a coarse sand (matched to the gravel to avoid being washed into it) in the top of the slit. Gravel flows easily into slits and settles firmly. Wet sand (and even some dry sands) will not flow from a

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hopper without some form of vibrator and there is a danger that sand will not pack tightly in the slits. Allowance should be made for subsequent settlement by filling the slits proud.

The fact that the material in the top of the slits is sand rather than soil can affect the growth and colour of the grass. It will take some time for the grass to re-grow over the slits, and it is often paler in colour due to nitrogen deficiency.

Half-inch slits (usually filled with sand only) may be formed by forcing the soil apart with tractor-drawn mole-plough type of equipment. This method is rapid, as the slits are cut and filled with sand in the one operation. Since the slits are formed by compressing the soil to either side, some surface-heave is inevitable, the amount depending on soil conditions. The surface-heave will settle down in time, helped by rolling, but it is all too easy to seal the top of narrow slits.

Where there is a requirement for lateral conduction of water in the slits, then the wider slits are required. These may be excavated by a narrow trenching machine mounted on a wheeled or tracked vehicle. Excavated soil must be removed from the site, but there should be no surface-heave.

Quite apart from surface-heave, wheel-or track-damage may occur to a turf surface if any type of slit-drainage equipment is used. The damage can be reduced by choosing the right conditions or using boards or steel plates for the equipment to run over where necessary.

On areas of relatively coarse turf like fairways the surface damage that might occur should not seriously interfere with play. Tees are also areas where slit drainage can give benefit. In many cases the only pipe drainage necessary is a single drain on the lower side of the tee, laid to a positive outlet and backfilled appropriately to enable slit drains to connect with it. As regards greens the position is decidedly doubtful—it is difficult to guarantee a uniform putting surface if any kind of slit drainage is installed. On the other hand slit drainage can be extremely useful on approaches, many of which have been compacted and wet (despite drains) since they and the greens were constructed in the first place.

Slit drainage over extensive fairway areas may not be financially practicable for many clubs. However, where there are wetness problems on crucial dropping areas and approaches to greens, provided that existing pipe drainage is sound, or new drains are put in, slit drainage could bring about a big improvement at an acceptable cost.