allowing the operator to select the trenching speed best suited to conditions. Soil disposition is either by auger or conveyor, dependent on model, and it comes up in a fine friable condition making for easy backfilling with a Davis hydraulic angle dozer. Once again the fitting of this attachment does not interfere with the trenching ability of the machine.

Polythene Drainage Tubing

Muntz Plastics make 'Landcoil' Polythene Land Drainage Tubing. This tubing was primarily developed for draining agricultural land but in recent years it has been used quite extensively on sports grounds, tennis courts, etc. It therefore has an application on golf courses. The piping is supplied in black only.

'Landcoil' is a 2 in. diameter tube manufactured from polythene in coils 660 ft. long. The polythene from which it is made has been selected to give a tough tube which has a high crush resistance. At the same time it is sufficiently flexible to allow it to be manufactured in easily handled coils.

In order to provide maximum water absorption, there are 16 rows of small slots running along the length of the tube. These slots are scientifically designed to prevent larger soil particles from entering the tube. Where it is necessary to make a joint between two lengths of 'Landcoil', or it is required to discharge through an outfall into a dyke, a slightly larger diameter tube is available to sleeve over the perforated tube.

'Landcoil' may be used with or without permeable fill except that permeable fill must be used in all situations where it would be used with conventional materials.

Pitch Fibre for Drainage

SURPRISINGLY, pitch fibre pipe is sometimes considered to be a new material, yet it has a development history of at least 150 years. It is known with some certainty that a type of pitch fibre pipe was used to carry water in Germany about 1860. A recorded installation was its use for mains water in Hamburg in 1850 and, when these were uncovered in 1914, they were found to be sound. Such durability is only to be expected of a material, the greatest proportion of which is pitch, a natural preservative. The early method of manufacture was to roll up sheets of pitch impregnated paper onto a mandrel until the desired wall thickness had been obtained. This form of manufacture is crude compared with present day techniques which produce a homogeneous wall of cellulose and asbestos pitch fibre completely impregnated with hard coal tar pitch.

Pitch fibre pipe is now well established for drainage purposes and in 1944 the United States Department of Commerce accepted a standard for the pipe. Although quantitites of pitch fibre conduit have been imported into this country since 1903, no drain pipe was manufactured here until 1952. Perforated pipe for underground drainage work is manufactured to the British Standards Specification for drainage pipe and then perforated.

Characteristics of the Material

The pipe is 70% pitch by weight and consequently has excellent chemical resistance. Laboratory work and field experience has shown that it will satisfactorily cope with aqueous solutions in the p.h. range of 0·3 to 12·5. Aggressive soil conditions, even those with an artificially high sulphate content, created by the use of clinker, ash or slag fills, are not detrimental to the pipe. The smooth bore and self centring joints give it good hydraulic flow properties and the system of dry jointing means ease and speed of installation. The pitch also inhibits the growth of fungi and plant life generally on its

surface. Its light weight, shatterproof qualities are great advantages on site. A 10 ft. length of 4 inch pipe weighs 25 lbs. and an 8 ft. length of 6 inch pipe weighs only 44 lbs.

Purpose of Drainage

Effective sub surface drainage is simply the control of unwanted water. Rain not disposed of by surface run-off, absorption by vegative cover, evaporation or transpiration, is unwanted water. Rain enters the ground and seeks a given water table. Topography, soil types and strata profiles are the basic factors which determine the hydraulic shape of the water table. Water tables are rarely consistent, seasonal fluctuations can affect the shape and height considerably.

Effective sub surface drainage ensures that the water table is stable, has increased soil bearing strength, minimal frost heave, optimum soil aeration and low soil erosion.

Soil water can be shown to consist of three main types.

Hydroscopic Water (undrainable). A thin film of water adhering to soil particles which does not affect soil water or vegative growth.

Capillary Water (undrainable). A film of water around each soil particle providing moisture for vegetable growth which does not affect soil bearing strength.

Gravitational Water (drainable). This follows the path of least hydraulic resistance, entering fissures, capillary interstices, seepage zones, underground rivers, etc., until it establishes a ground water table at impervious strata. This type of water fills soil voids below the water table, displaces oxygen, reduces soil bearing strength and discourages the activity of micro organisms. The main purpose of surface drainage is, therefore, to remove and control gravitational water.

Why use Pitch Fibre Pipe?

Pitch fibre perforated pipe has been used very successfully for the drainage of golf course greens, tees and fairways. Clay tiles have been extensively used in the past for this type of drainage, but green keepers are now recognising the advantages of pitch fibre pipe. Pitch fibre pipe, although initially more expensive, over a period of say 50 years shows considerable cost savings because clay tiles lose their effectiveness and quickly silt up. Tiles used under adverse conditions are practically useless after 5 years.

Key Terrain have been manufacturing perforated pitch fibre pipe and conventional drainage pipe for nearly 20 years at their Larkfield factory, having built up considerable expertise in their use. The Technical Service Department of Key Terrain Limited, Larkfield, Maidstone, Kent, are pleased to answer specific questions in the use of pitch fibre pipe.
