THE PREPARATION OF SUBGRADES

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The soils of Denmark are mainly glacial in origin. Due to the granular nature of the materials special measures in the preparation of subgrades are comparatively rare. Laboratory studies are contemplated, however, in connection with road planning, especially with regard to the possibility of damage caused by frost.

Little attention has been paid to the selection of materials for embankment construction. However, where soft soils are encountered it is common practice to excavate and replace them with suitable materials.

Compaction of embankment by special rolling equipment is not common since it is considered that the amount of compression obtained by cartage during the course of construction is sufficient. In some cases the finished embankment has been allowed to settle for a time before pavement construction. In any event the bottom of the roadbed is always rolled with light rollers, for instance a two-axle, 2.5 ton roller, or alternatively heavier three-axle rollers.

A road rammer, illustrated in Figure 1, has been designed in Denmark for the

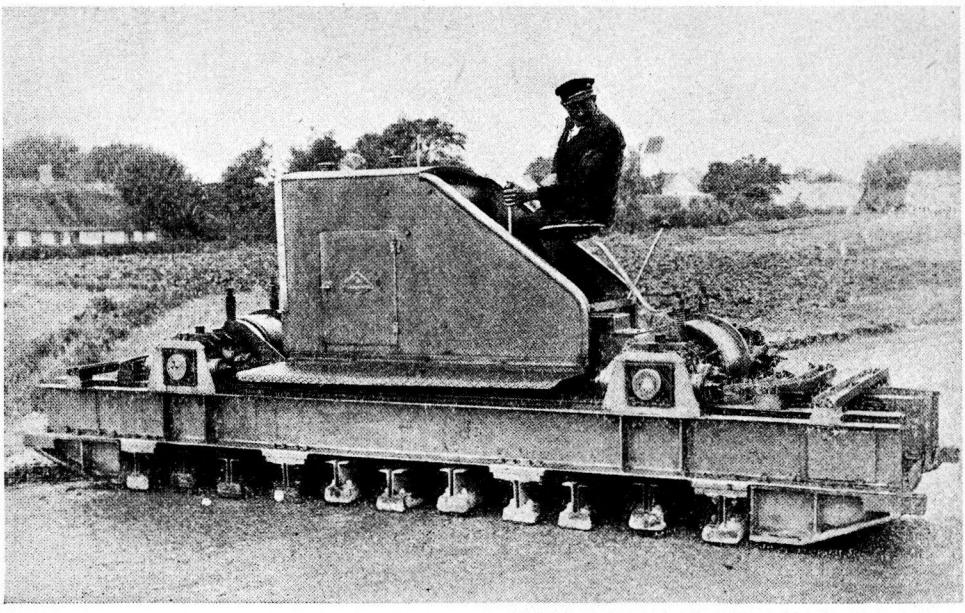

Figure 1. Völund 15-Ton Road Rammer, 1937 Model with 2 Cylinder Völund Crude Oil Engine

Area of a foot pad on firm bottom	1600 sq. cm.	Lifting height of foot pads	35 mm.
Area of a foot pad on soft bottom	2450 sq. cm.	Revolutions per min.	80
Weight of one tamping unit (foot pad)	1975 kg.	Speed at 80 r.p.m.	0.5 km. per hr.
Radius of Crank Throw	20 mm.	Length	5.00 m.
		Width	1.45 m.
		Height	1.82 m.

purpose of compacting embankments This machine which weighs 15 tons has three sets of "foot pads" which are alternately raised and lowered by a small crude oil motor The "foot pads" have a curved surface so that the bearing area is increased in soft ground The machine's special working method, with combined ramming and pressure operation, results in a smooth and coherent elastic mass of road material without undulations

Another machine which has also been used is the so-called "Delmag Frosch," a German explosion-hammer which is now supplied in two sizes of 500 and 1000 kilos

Where the ground is clayey it is becoming general practice to use an insulating layer of sand, gravel or slag varying in thickness from 10 to 30 cm Such a layer provides more even distribution of pressure and serves to prevent capillary moisture from making its way into the pavement proper It is apparent that such layers are more efficient in preventing frost damage than are drains except in locations where free water is present close to the surface

Drainage has been employed in many locations The designs of the drainage systems vary greatly in different parts of the country depending on a judgment of what is considered to be best suited for the particular purpose

It is to be supposed that many such drainage schemes will not exactly result in a lowering of the ground water level but under thaw will carry away the water which in a period of frost has gathered as ice in the soil They may possibly check any pumping action by the traffic, and on the whole cause a beneficial ventilation of the subsoil

It would undoubtedly be of great importance if the performance in practice of drainage schemes were based upon some preceding examination of ground water elevation and soil It would be possible then to arrive at a better knowledge of the manner in which the drains are working and to obtain a more rational basis for the most efficient execution of drainage schemes