WICK DRAIN METHOD OF STATEMENT

In the past, the engineers had some difficulties in making designs on compressible grounds. That's why the need for various improvement methods have occurred. Unforeseeable long-term placement in the ground compels us to superfluous labor force and also extra costs in addition to waste of time. When the simple and ordinary ground improvement methods are used in the projects, it takes a rather long time. Such a waste of time can only be prevented by creating artificial vertical drainage ways which provides the pore water flow. Those artificial vertical drainage ways called Wick Drain consists of plastic wicks that acting as free drainage ways.

Raga Makina is the company that is the most experienced and preferred one in ground processing equipment sector. **Raga Makina** is the first wick drain producer and exporter company in Turkey. **Raga Makina** has many experiences and references in wick drain production and application. **Raga Makina** manufactured its first wick drain is 2002. Since 2002, **Raga Makina** has been featured in many wick drain applications in and outside of Turkey.

There are two types of wick drain manufactured by **Raga Makina**. According to the ground type and desired depth, the required type can be preferred. It is enough to use the one without pre-drilling soft ground. Wick drain with pre-drilling should be preferred in hard and difficult ground. **Raga Makina** makes it possible to apply wick drain on difficult ground with its own design and production Raga RR9 model pre-drilling Machine.

Especially the main purpose of using wick drain is fastening drainage and compression of ground, in addition of creating a stage which has an ability to carry loads while consolidating. The prominent basis of **Raga Makina** is to protect the national products that manufactured in appropriate quality. Based on this idea that **Raga Makina** provided quality and nationwide distribution with imports in bored piles, jet grouts, mini piles, diaphragm wall etc. equipment group. On the other hand **Raga Makina** makes domestic and overseas marketing for wick drain units. This is because **Raga Makina** aims at presenting quality and technology to the customers worldwide. When manufacturing is the matter, **Raga Makina** gives better results according to foreigner competitors.

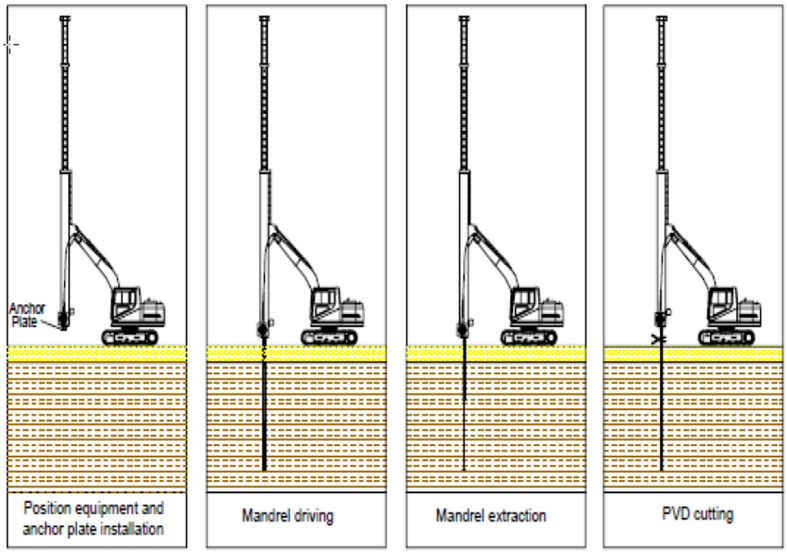
Raga Makina has designed the wick drain system with taking aim at higher water flow capacity, filtering specialty with higher resistance and stabilized structure.
The application is as follows;

Wick drain is produced as being able to move up and down along the the mast in a vertical manner for easier assembling and implementing. It's a big ad- vantage that machine can be mounted to all types of excavators in each tonnage Wicks are added to drain drum which locates on the machine. Sand, gravel or suitable materials (30-40 cm) should be placed to where wick drains will be already installed in. Afterwards the machine should be vertically positioned. Now the machine is ready to create drainage ways. Excavator puts wick drains into the ground with the help of static hydraulic power. Mandrels that involved in **Raga Makina** branded wick drains was specially designed and also registered. Wicks are
located into the ground through the mandrel

Drainage points should be already identified before the process. Placing wick operation is needed to be repeated on each drainage point. Required depth can be changed from one place to another. As a solution, wick drains are usable in various sizes for different drainage projects.

Stoppers make the wick drains be fixed into ground within needed depth. Hereafter mandrel takes out itself. By the stopper wick drains do not move out while the mandrel is working. Drainage way is already done with the located wick drains. For the next drainage point, it is required to cut the wick drain after the mandrel is taken out. The described steps are enough for soft soil. But for the harder and more difficult ground, it is required that crush the rocks to drive the mandrel. For these cases, the wick drain system with pre-drilling developed by **Raga Makina** can be used. Wick drain application will greatly reduce the ground improvement time. When other methods are used, it can take more than a year. This time can be reduced from years to few months.

All vertical drainage wicks will go to maximum allowable/anchorable depths or until refusal as per following method :



Installation sequence

a- Thread the vertical drainage wick off the wick roll/spool, up the wick tube, and over the top wick roller and down through the mandrel.
b- Place the drainage wick through or around the anchoring device and tuck the loose end of the wick up into the mandrel about 6 to 8 inches (150 to 200 mm). Pull the drainage wick's excess slack tight through the mandrel and vertical drainage wick tube by reversing the vertical drainage wick roll by hand .By reversing the vertical drainage wick spool or

wick roll, the anchoring device will retract up tight against the bottom tip of the mandrel. This will prevent dirt or mud from entering the mandrel during the insertion of the mandrel into the ground.

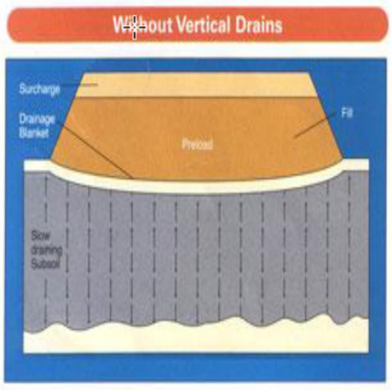
c- Move the machine/mandrel to the specified vertical drainage wick location and insert the mandrel with anchoring device in place using static force (and /or vibratory force if necessary) into the ground to the desired depth.

d- Extract the mandrel, leaving the anchoring device and the completed or installed vertical drainage wick in place, uncontaminated and the proper depth.

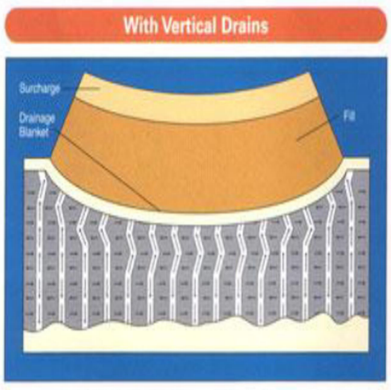
e- Cut the vertical drainage wick off the contract-specified length above the working surface.

PVD CONSOLIDATION PROCESS

In saturated soils such as clay and silty clays, which have a large percentage of voids or pores usually filled with water, large settlements will occur over a long period of time when a load such as a road embankment is placed on top of the soil. The load will result in an initial increase in pore water pressure which will dissipate slowly as the pore water drains off. During this process called consolidation, the load is gradually transferred to the soil particles as the volume of the voids is reduced and this culminates in the form of settlement.

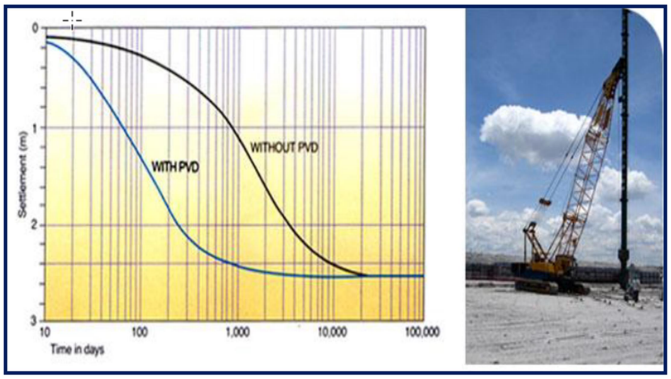


Without inserting PVD, dissipation of excess pore pressure is a slow process



With PVD, the excess pore pressure dissipates quickly through shorter drainage paths.

ACCELERATION OF CONSOLIDATION USING PVD



Due to the very low permeability of clay soil and silty clay soil, the consolidation process will take many years. In order to accelerate and reduce the consolidation time, vertical drains are installed at regular close spacing to the full depth of the compressible layer, to create artificial and shorter horizontal drainage paths for the pore water to drain off. In addition, this will also take advantage of the higher permeability of the soil strata or sand lenses in the horizontal direction. During this accelerated process, the soil will gain an increase in shear strength.

WORKING OF PVD AND ITS MAKE

By installing PVDs at a suitable spacing, the distance that water has to travel through the low permeability soil is reduced considerably and consequently water drains out in a relatively very short period of a few weeks or months. Band drains can be installed vertically to depths exceeding 65 meters. The drains are usually placed in a square or triangular configuration of 1 to 1.5 m depending on the desired consolidation time. Under excess hydrostatic pressure, water has only to travel the horizontal distance to the nearest drain to reach a free drainage path. Consequently, the higher horizontal permeability of the clay is also taken to advantage. The water flows through the filter fabric of the drain and into the channels of the drain core where it can flow vertically out of the soil. This flow may be either up or down to intersecting natural sand layers or to the surface where a sand drainage blanket or prefabricated strip drains are provided. Vertical drains are normally used in conjunction with preloading with surcharge embankment or vacuum pressure.

BENEFITS OF USING PVD

- High water discharge capacity to ensure sound safety factor
- The unique and flexible core will not pinch off or flatten when the drains bend and folds during the consolidation of the soils
- High compressive strength of the core to prevent the collapse of the flow path
- Deep installation exceeding 40m depth
- Light weight
- Customized core and filter jacket to suit particular soil conditions
- Minimum disturbance to the soil during installation
- Fast installation
- Short consolidation period
- Well proven performance in many projects under different soil consolidation.

Wick drain can be used in all SOFT types of ground improving projects, including projects below.

- Highway embankments
- Bridges and passages
- Barrages
- Railways
- Airports and seaports
- Storage tanks
- Commercial and Residential Buildings
- Mining Wastes and Residuals