Alidrain PVD

Prefabricated vertical drains for accelerated soft foundation consolidation

SOLMAX

Alidrain® PVD prefabricated vertical drains (PVDs) are used to accelerate the consolidation of soft clay foundation soils.

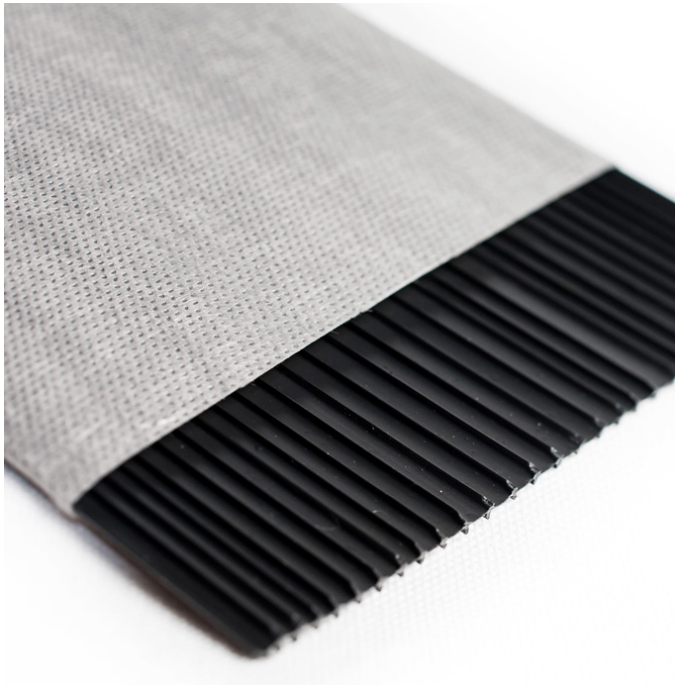
Alidrain PVD consists of a permeable drainage core surrounded by a robust filter jacket. The filter jacket filters the excess pore water from the soft clay foundation soil and enables it to pass into the drainage core, where it is able to rise to the ground surface and drain away.

Prefabricated vertical drain installation rigs

Alidrain PVDs are manufactured in a range of grades that conform to well-recognized international performance specifications, e.g. CIRIA (1991)[1], and meet different drainage requirements and installation conditions. The different grades account for different drainage capacities and different robustness of the filter jacket.

Alidrain PVDs are manufactured in rolls of specific length which are then installed vertically into soft clay foundation layers by means of a special installation rig.

1 CIRIA (1991) “Prefabricated Vertical Drains”, Butterworth-Heinemann, U.K.



Alidrain PVD

FEATURES AND BENEFITS

The horizontal hydraulic conductivity and stress history should be determined based on a proper analysis of the soft clay foundation. This requires a detailed site investigation to be carried out. The Alidrain PVD, installation geometry and discharge capacity govern the rate at which excess pore water can be discharged at ground surface. The extent of the disturbed zone around the PVDs depends on the method of drain installation and the type of installation mandrel used. The magnitude of the applied surcharge loading governs the magnitude of the excess pore water pressures generated in the soft clay foundation and the resulting pore water gradients. A proper design needs to account for all of these factors.

Design and performance

The factors that affect the consolidation performance of Alidrain PVDs are:

- The horizontal hydraulic conductivity of the soft clay foundation
- The stress history of the soft clay foundation
- The spacing and geometry of the Alidrain PVDs in the soft clay foundation
- The discharge capacity of the Alidrain PVDs
- The extent of the disturbed zone around the Alidrain PVDs caused by PVD installation
- The magnitude of the surcharge loading applied on top of the soft clay foundation

Advantages

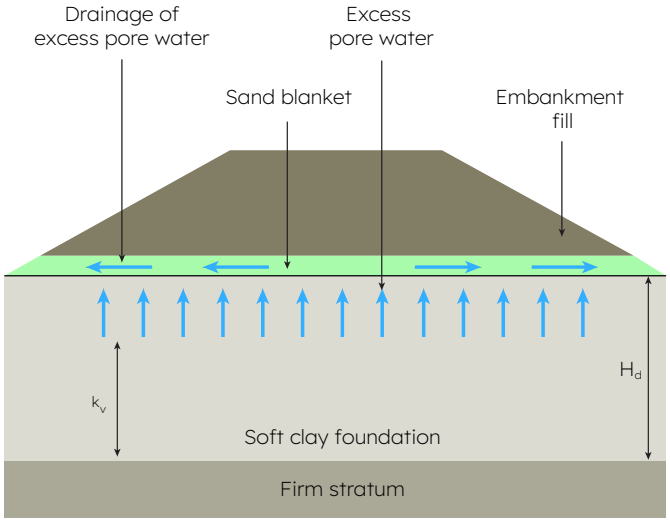
- The Alidrain PVD installation process is very efficient and cost effective
- Alidrain PVDs conform to internationally well-recognised PVD specifications
- Consolidation times for soft clay foundation deposits can be significantly reduced from many years to 0.5 to 2 years depending on PVD spacing
- The rate of gain in undrained shear strength of the soft clay foundation deposits can be increased when using Alidrain PVDs

APPLICATIONS

In thick deposits of soft clay, the time required for consolidation under a surcharge loading may be unacceptably long and foundation instability may be a serious concern. The rate of consolidation of the soft clay foundation layer is a function of its vertical hydraulic conductivity k_v and the vertical depth H_d over which the excess pore water has to flow in order to exit the soft clay foundation. Consolidation periods for soft clay foundations can be many years.

By inserting Alidrain PVDs vertically into soft clay foundation deposits at calculated intervals, the consolidation time can be significantly reduced and the consequent rate of gain in foundation shear strength increased. The rate of consolidation of the soft clay foundation becomes a function of its horizontal hydraulic conductivity k_h and the horizontal spacing between the Alidrain PVDs d_e. In naturally deposited soft clays, the horizontal hydraulic conductivity is several times greater than the vertical hydraulic conductivity, thus the rate of consolidation will be several times greater. Also, the spacing between the Alidrain PVDs is many times less than the thickness of the soft clay foundation layer and thus the length over which the excess pore water has to travel before it can reach a Alidrain PVD to drain out of the soft foundation is reduced significantly (compared to no Alidrain PVDs). This results in relatively short consolidation times for the soft clay foundation.

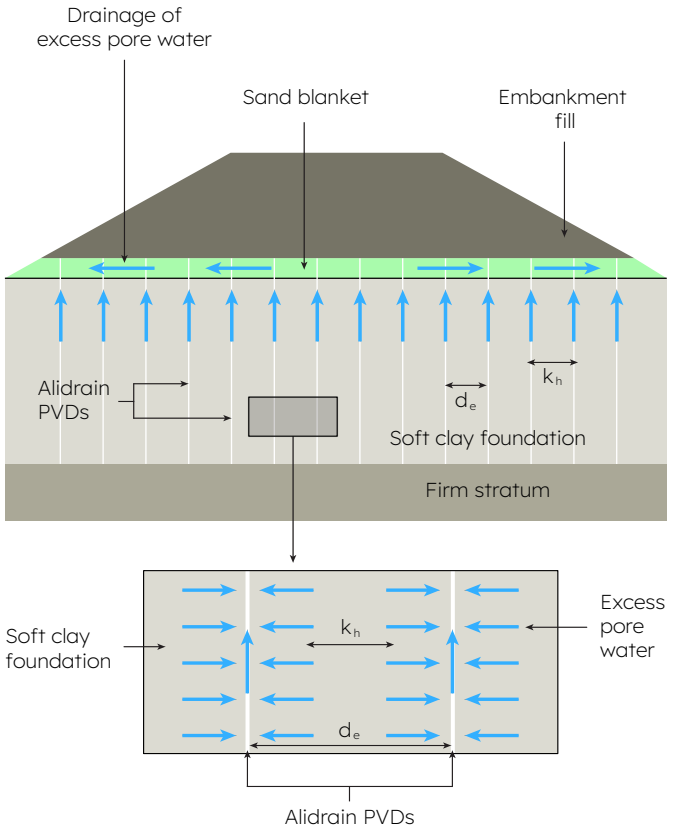
Foundation consolidation with and without Alidrain PVDs



Soft clay foundation consolidation with no Alidrain PVDs

Alidrain PVDs provide a low cost solution to the problem of long term settlements of soft clay foundations. If designed properly, foundation settlement times can be reduced to the extent they occur within the time frame of the construction project, thereby avoiding the need for expensive post-construction maintenance.

Using Alidrain PVDs to accelerate the rate of settlement of soft clay foundation layers also accelerates the increase in undrained shear strength of the soft clay foundation. This increase in undrained shear strength provides an improvement in the stability of the soft clay foundation.



Soft clay foundation consolidation with Alidrain PVDs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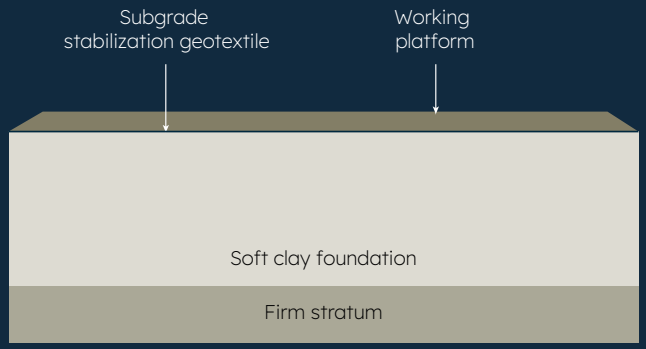
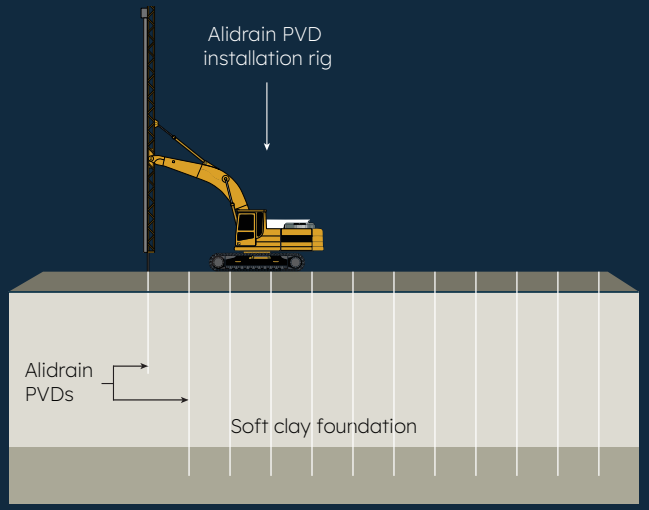
INSTALLATION OF ALIDRAIN PVDs

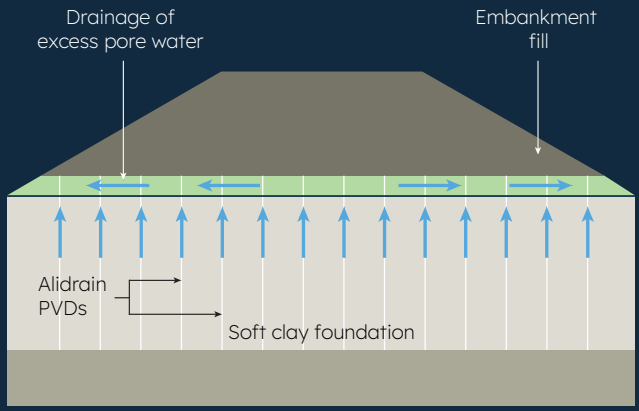
The installation of Alidrain PVDs follows a very cost efficient procedure. This involves first the construction of a stable working platform over the soft clay foundation, then the vertical installation of the Alidrain PVDs into the soft clay foundation, and finally the application of the embankment fill loading.



Construction of working platform on top of soft clay foundation



Installation of Alidrain PVDs into soft clay foundation



Drainage of excess pore water from soft clay foundation

Working platform

To enable suitable PVD installation equipment to be used, a stable working platform must first be constructed over the soft clay foundation. This platform normally consists of sand or gravels and doubles as a stable layer to support the Alidrain PVD installation rigs as well as a drainage blanket to facilitate the removal of excess pore water from the soft clay foundation. To aid the stability of the working platform, a subgrade stabilization geotextile may be placed on the soft clay foundation surface prior to placement of the working platform.

Alidrain PVD installation rigs

Alidrain PVDs are installed by vertically vibrating a hollow steel mandrel containing the Alidrain PVDs into the soft clay foundation to the required depth. The depth of installation is normally the same as the thickness of the soft clay foundation layer. The steel mandrel is then withdrawn, the Alidrain PVD cut and the installation rig is moved onto the next Alidrain PVD installation location where the process is repeated.

In ideal conditions, Alidrain PVD installation rates may be as high as 1,500 linear meters per hour per installation rig, although installation rates are less than this if difficult foundation conditions occur.

Application of embankment fill

Following installation of the Alidrain PVDs, embankment fill is placed across the top of the treated area in order to generate an excess pore water pressure regime in the soft clay foundation. The excess pore water drains through the Alidrain PVDs up to the surface of the soft clay foundation, and dissipates within the granular working platform or drainage blanket.

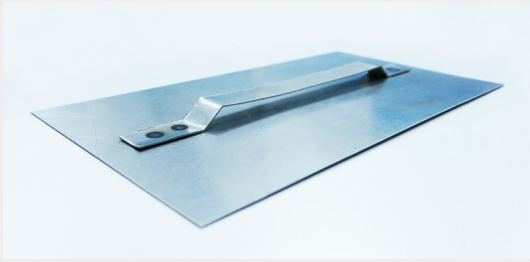
Hollow steel mandrel for Alidrain PVD installation

As described previously, a hollow steel mandrel is used to vibrate the Alidrain PVDs vertically into the soft clay foundation. Most commonly, this mandrel is of rectangular cross section as this results in little soil disturbance, but diamond or circular cross section mandrels may be used depending on the difficulty of Alidrain PVD installation.

Ideally, the installation of Alidrain PVDs should be done with as little disturbance to the soft clay foundation soil as possible. This ensures pore water channels to the Alidrain PVDs are maintained and effective excess pore water pressure dissipation occurs relatively quickly.

Metal shoes for Alidrain PVDs

To ensure Alidrain PVDs remain installed when the hollow steel mandrel is withdrawn, a metal shoe is affixed to the Alidrain PVD prior to its insertion into the soft clay foundation. Several different metal shoe geometries can be used depending on the local conditions. Generally, these can range from flat metal plates to circular bars.



Metal shoe for Alidrain PVDs

About us

Solmax is a world leader in sustainable construction solutions, for civil and environmental infrastructure. Its pioneering products separate, contain, filter, drain and reinforce essential applications in a more sustainable way – making the world a better place. The company was founded in 1981, and has grown through the acquisition of GSE, TenCate and Propex. It is now the largest geosynthetics company in the world, empowered by more than 2,000 talented people. Solmax is headquartered in the province of Quebec, Canada, with subsidiaries and operations across the globe.

Uncompromised quality

Our products are manufactured to strict international quality standards. All our products are tested and verified at our dedicated and comprehensive laboratories which maintain numerous accreditations. We offer our partners a wide scope of testing according to published standards to ensure products delivered to sites meet specified quality requirements.

Let’s build infrastructure better

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