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Wing Hori-Drain®

Completely resolving the loss of pore water and
bad drainage problems of existing horizontal drains,
offering a new horizontal drainage technology

PVD inserted horizontal drain
excellent in water collection and drainage capability

Wing Hori-Drain®

- A new horizontal drainage method maximizing water collection and drainage efficiency by directly inserting and connecting PVD to a water channel of a horizontal drain
- Excellent economic feasibility that can reduce the cost of construction more than 30% compared to sand/aggregate drainage layers
- Core structure with an outstanding load dispersion effect with over 50% of a contact area

DAEHAN *i.m.* Co.,Ltd.
Since 1987

Wing Hori-Drain®

[Picture and function of each part of WHD]

This is a horizontal drain resolving problems of existing drainage methods. It is constructed by directly inserting PVD to water channels of WHD so it prevents the loss of pore water and improves the water collection rate by more than three-fold.

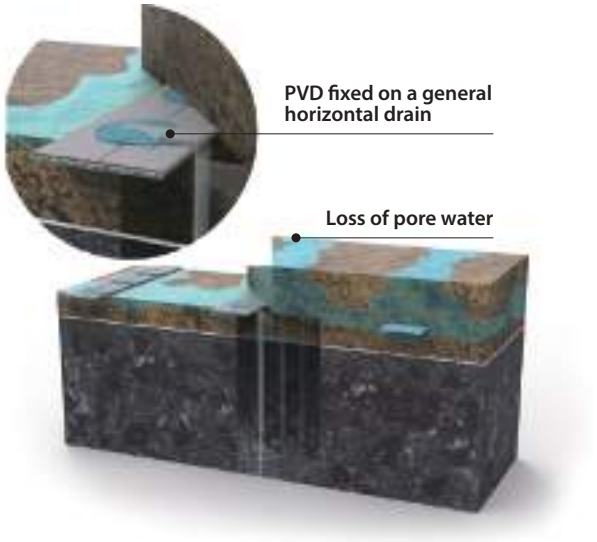
Since water channels with over 50% of a contact area has an excellent load dispersion effect, it maintains excellent drainage performance of a minimum of 3,500cm^3 under 500kPa overburden load. Therefore, it has excellent water collection and drainage capability for pore water delivered from many PVDs.

Simulation of the water collection·drainage according to PHD method

Excellent water collection and drainage

[Pore water drainage of WHD]

Bad water collection and drainage



[Pore water drainage of a general horizontal drain]

Features of Wing Hori-Drain®

Economic Feasibility

Reducing the construction cost by over 30% compared to aggregate horizontal drainage methods

Water collection Efficiency

Over 95% of the water collecion rate, by more than three-fold. Excellent water collecion efficiency compared to existing horizontal drains

Drainage Performance

Over 50% of a contact area, more than three times higher drainage capability compared to existing horizontal drains

Quality Management

Strict quality management system based on ISO9001, CE, and Q Mark Certification

Evaluation of Water Collection and Drainage Efficiency

Test Conditions

In order to compare the water collecting efficiency of WHD connected with PVD inserted directly in to its water channel and general PHD connected with PVD placed on its surface, under each installation condition test water (10/cm³) was supplied for 28 days and the drainage rate and loss rate were evaluated over time.

[Test conditions: test water supply - 10cm³/s, hydraulic gradient - 1/100, evaluating time - 28 days]

Wing Hori-Drain®

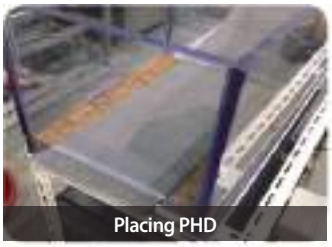

Forming a hole for PVD inserting


PVD insertion and connection


Placing fill materials


Water collecting and draining

General Horizontal Drain(PHD)

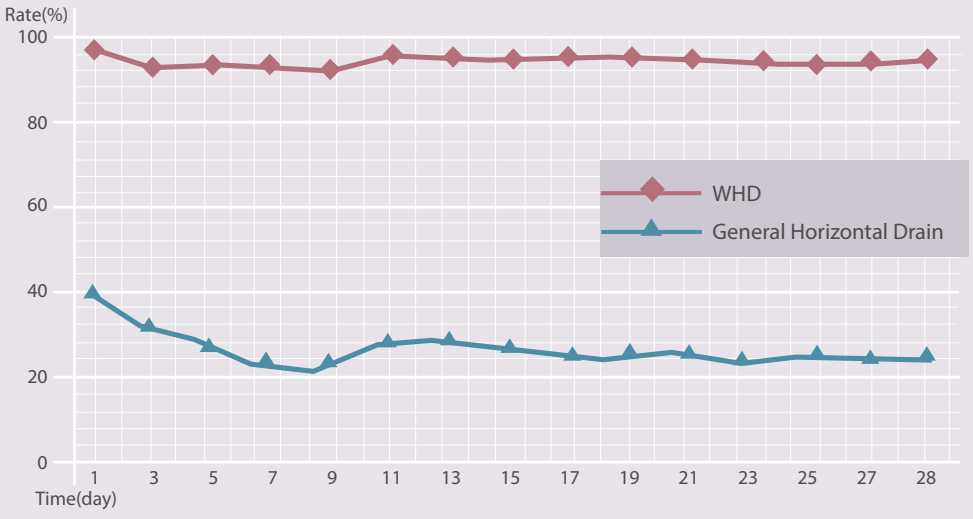

Placing PHD


PVD fixing


Placing fill materials


Water loss

PHD Type	Water collecting Rate	Loss Rate	Discharge Capacity	Note
Wing Hori-Darin®	96.5%	3.5%	9.6cm³/s	Measured value after 28 days
General Horizontal Drain	23.0%	77.0%	2.3cm³/s	

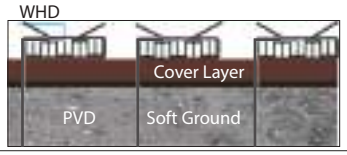
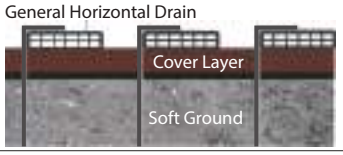
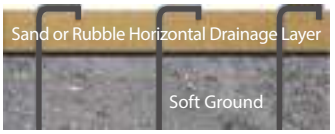


[Water collecting rate analysis]

[Trend analysis of water collecting rate]

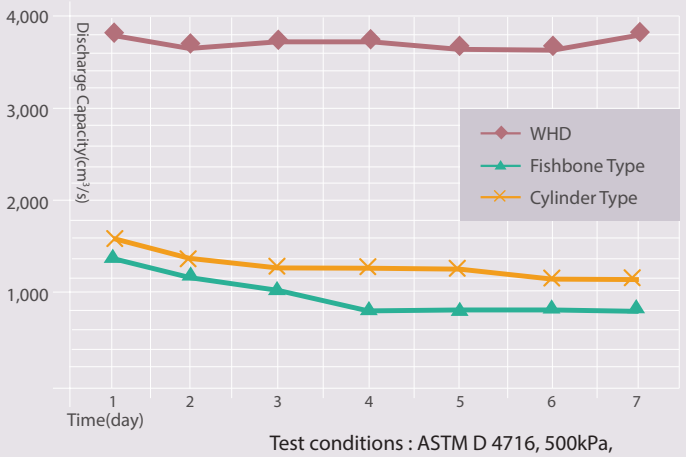
With WHD, which directly connects PVD into a water channel, it is evaluated that a stable water collection and drainage function is maintained but a general horizontal drain shows a tendency that a water collection rate is reduced and loss increases over time.

Comparison of Characteristics and Economic Feasibility of Wing Hori-Drain®

	Wing Hori-Drain®	General Horizontal Drain	Sand or Crushed Stone Mat
Section View			
Overview	- It is Installed by directly inserting and connecting PVD into the WHD water channel. - Pore water moving through PVD is horizontally drained after being directly delivered to the PHD water channel.	- It is installed by putting PVD on the top of a horizontal drain. - Pore water moving through PVD is primarily collected on the top of a horizontal drain. It is horizontally drained after penetrating through the filter material and then delivered to water channel.	- Pore water moving through PVD is horizontally drained through an aggregate (sand or crushed stone) drainage layer.
Characteristics	- The construction cost can be reduced over 30% compared to an aggregate horizontal drainage method. - Pore water is very rarely lost and it has over 95% of a water collecting rate. - It has an excellent load dispersion effect with over 50% of a contact area. It also maintains drainage performance of over 3,500cm^3/s or more even under a high pressure. - It improves bad water collection and drainage problems occurring during the construction of existing horizontal drains.	- It improves economic feasibility compared to an aggregate horizontal drainage method. - It has a high possibility of pore water loss while being delivered to the water channel of a horizontal drain (it causes a bad drainage). - Discarge capacity is significantly reduced under the pressure of embankment due to a small contact area.	- Plenty of cases applied with the method - Materials are expensive. - Material (aggregate) collecting sources are limited and a supply price is instable. - Separate pipe drainage works using a multi-tube are required. - A civil complaint can be filed in an area due to dust and noise around a material collecting source (borrow pit).
Construction Cost	US$6.12/m^2	US$6.27/m^2	US$11.05/m^2

The above construction cost is based on a case in Korea with PVD spacing of 1.5m x 1.5m. It may vary depending on construction conditions.

Drainage Performance Comparison Test



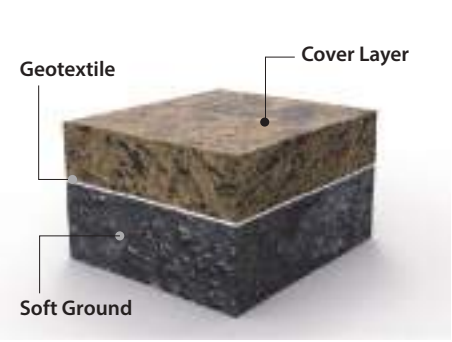
Test conditions : ASTM D 4716, 500kPa,
Pressured for 7 days (hydraulic gradient i : 0.1)

Test result of the drainage performance comparison

Discharge capacity of Wing Hori-Drain® was reduced approximately 2% after 7 days compared to the initial drainage while the discharge capacity of a fishbone and cylinder type was reduced approximately 25%~45%.

Installation Flow of Wing Hori-Drain ® Method

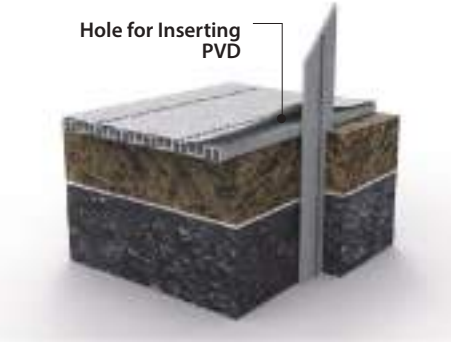
1. Grading of the ground



2. Install PVD

3. Place Wing Hori-Drain®

4. Form an inserting hole

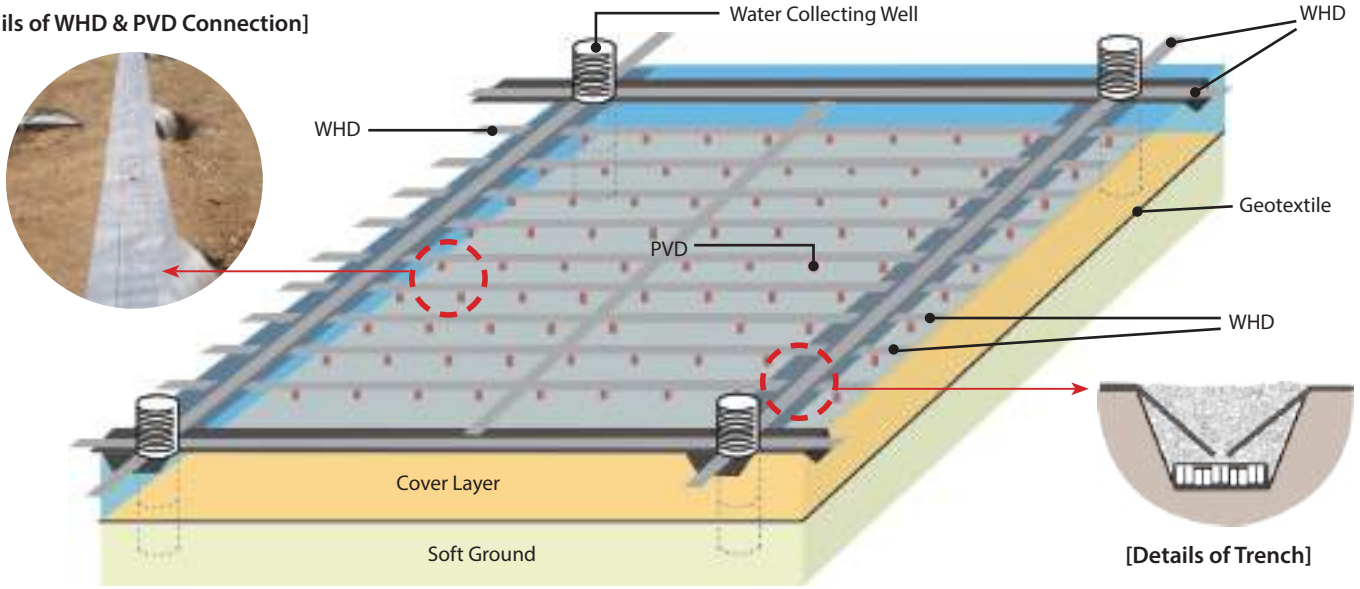


5. Insert & Connect PVD

6. Surcharge

Schematic Diagram of Wing Hori-Drain ® Method

[Details of WHD & PVD Connection]



Pictures of Installation Flow of Wing Hori-Drain ®

1. Place WHD

2. Form an insertion hole inside WHD wings

3. Insert PVD

4. Fix WHD & PVD by stapling

5. Complete fixing WHD & PVD

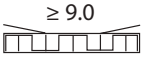
6. Repeat installation

7. Complete construction

8. Place surcharge materials

9. Drain pore water

Specification of Wing Hori-Drain®

Property	Test Method	Unit	WHD 200
Drain (core + filter)			
Core Material			PP, PE
Width	ASTM D 3774, ISO 22198	mm	200 ± 5
Thickness	ASTM D 5199, ISO 9863-1	mm	≥ 9.0
Configuration			
Ground Contact Area		%	≥ 50
Tensile Strength, full width	ASTM D 4595, ISO 10319	kN	≥ 8.0
Discharge Capacity, q_w, 500kPa (i=0.1)	ASTM D 4716	cm^3/s	≥ 3,500
Filter			
Tensile Strength, MD	ASTM D 4595, ISO 10319	kN/m	≥ 7.0
Elongation	ASTM D 4595, ISO 10319	%	15 ~ 60
Permeability	ASTM D 4491, ISO 11058	m/s	≥ 1 X 10^{-4}
AOS, O_{95}	ASTM D 4751, ISO 12956	μm	≤ 80
Nominal Dimensions			
Roll Length		m	50~100
Outside Diameter of Roll - approx.		m	1.10
20' container loading capacity - approx.		m	8,000
40'HC container loading capacity - approx.		m	17,600

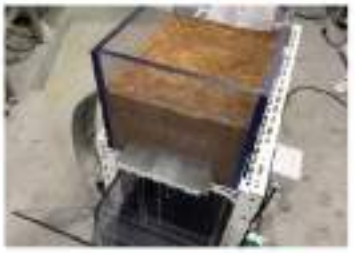
Notes:

- Discharge capacity, q_w, is based on index test with rigid-rigid bedding condition and calculated based on $q_w = Q/i \cdot R_T$, where Q is the flow rate per each unit of time(m^3/s), i is hydraulic gradient and R_T is the temperature correction coefficient.
- The values given are indicative and correspond to average test results obtained in our laboratory and independent authorized institutes. The above information is subject to revision according to new developments and findings.
- Various specifications of WHD are available upon customer's demand.









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