

# Evaluation of Filtration and Drainage Efficiency of Double Filter System Composed of Granular Soil and Nonwoven Geotextile Layers

## 土壤與不織布複層過濾及排水效能評估



Student: Jui-Jiun, Lin 林瑞鈞 (M10105213@mail.ntust.edu.tw)  
 Advisor: Dr. Kuo-Hsin Yang 楊國鑫博士

Office: T2-104-5  
 Tel: (02)2730-7195

### 1. Background

The objectives of this research are:

- To measure the **permeability** of soil-geotextile **hybrid system**
- To evaluate the **clogging of geotextile** using the **gradient ratio**
- To identify the **optimal thickness** and particle size of granular soil layer
- To **compare** the measured permeability of hybrid system with the theoretical value

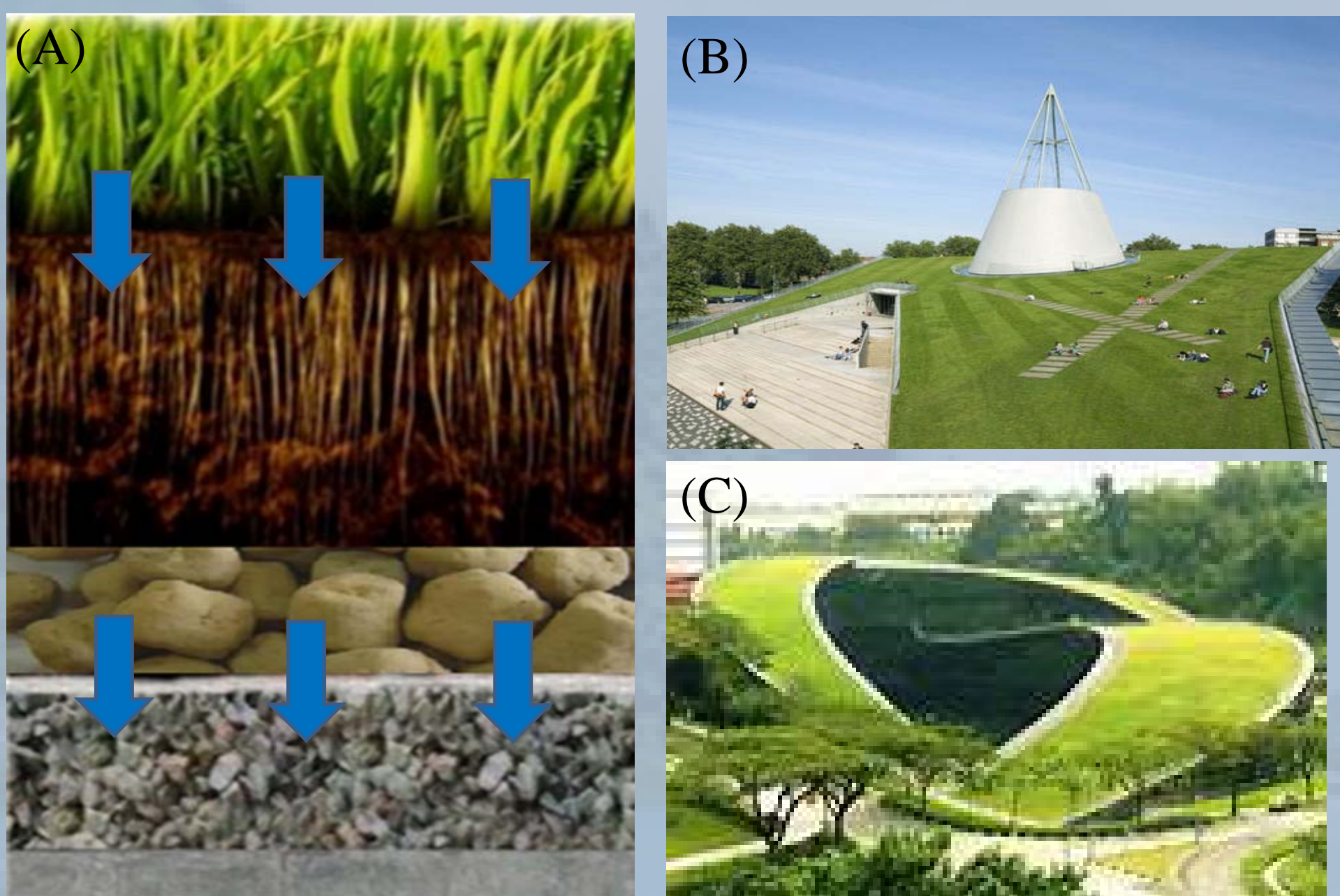


Fig.1. (A) Hybrid system profile of a green roof, (B)&(C) Real cases of green roof

### 2. Methodology

Test variables and equipment setup:

- Test variables include: (1) **soil type**, (2) **geotextile type**, (3) **hydraulic gradient**, (4) **normal stress**, (5) **thickness of granular soil layer**.
- Test equipment

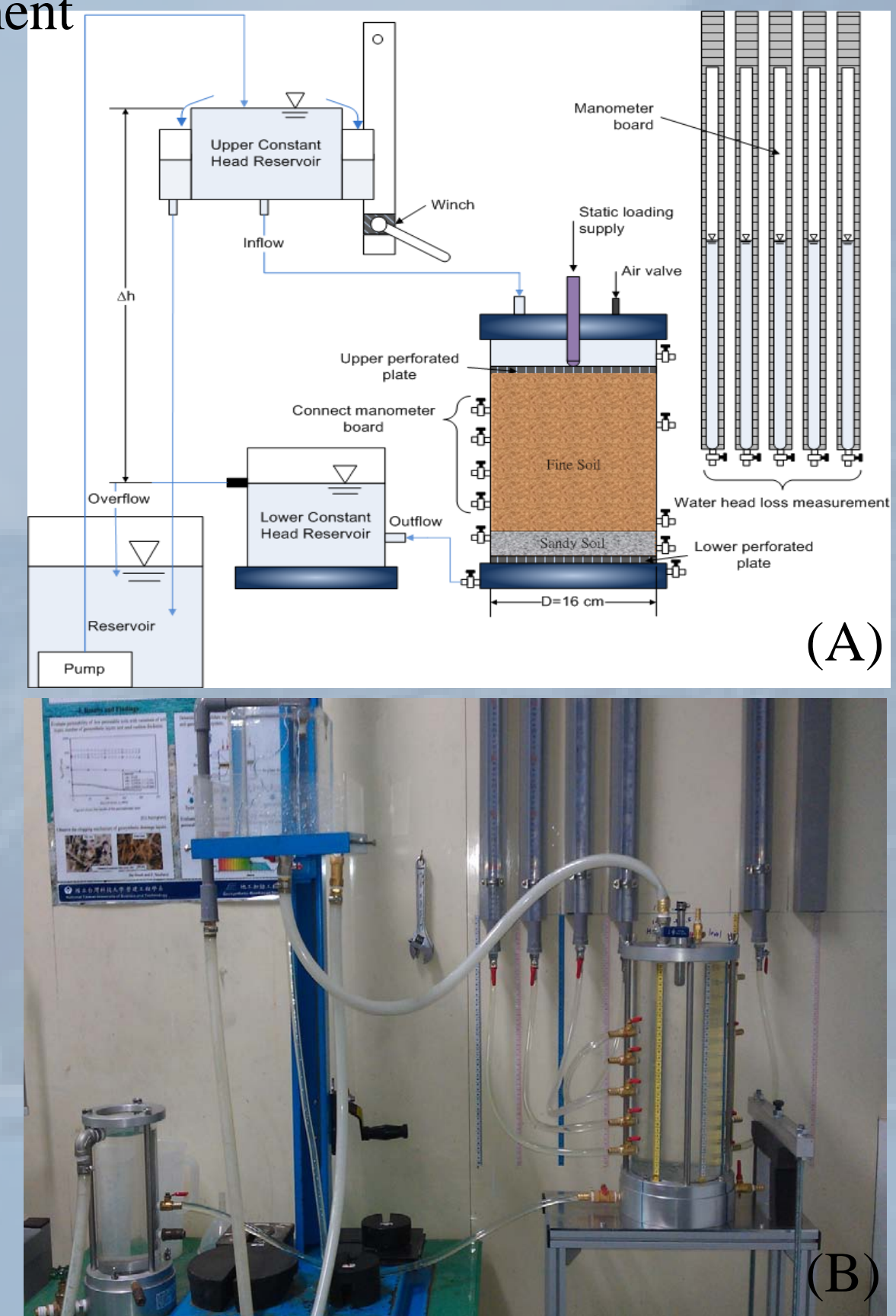


Fig.2. Equipment setup: (A) Schematic illustration; (B) Photo of equipment setup

### 3. Materials

Soil: 4 granular soils and 1 vegetated soil



Geotextile: 2 different thickness geotextiles

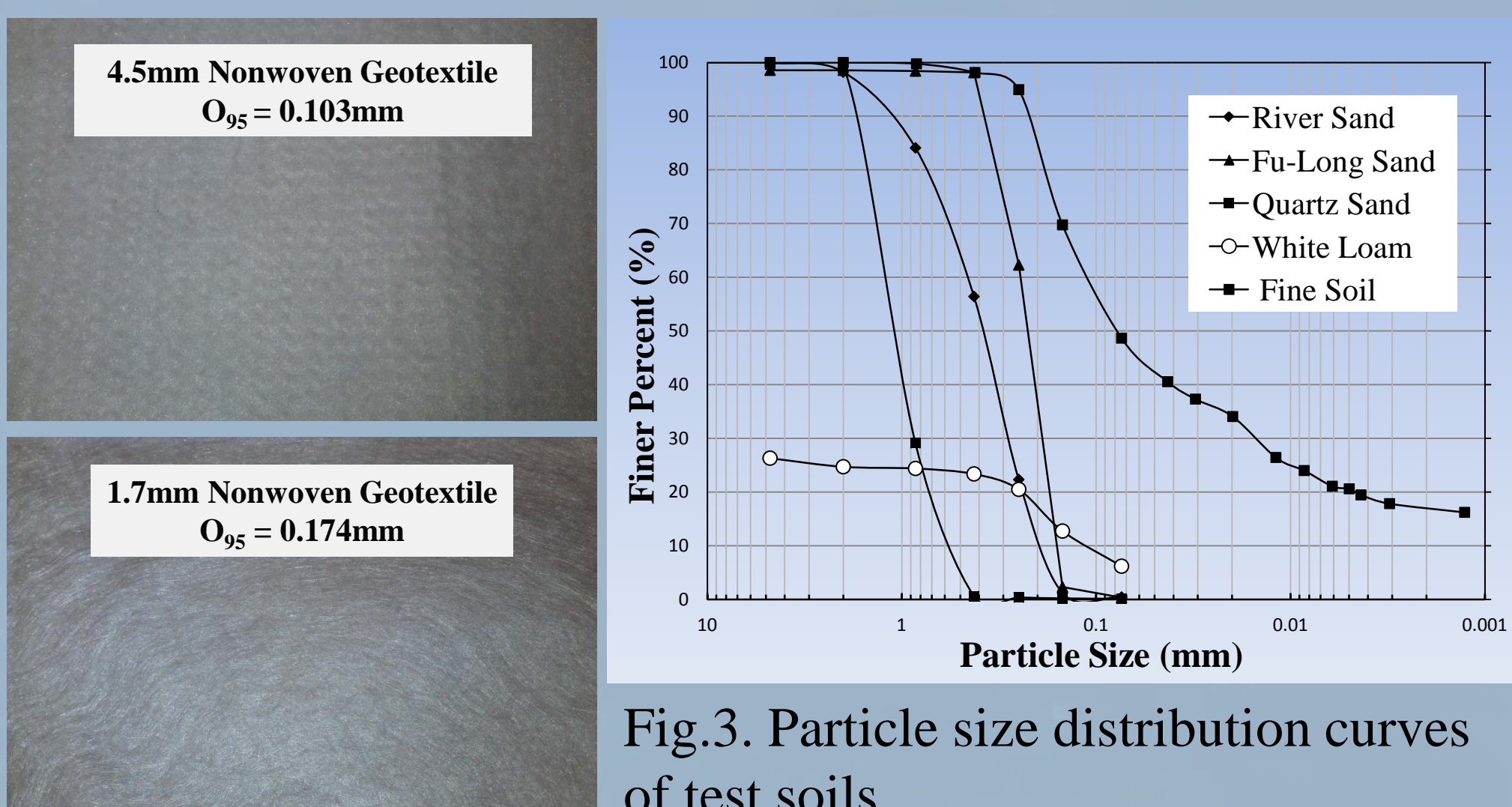


Fig.3. Particle size distribution curves of test soils

### 4. Analyses

Determination of equivalent gradient ratio and permeability of hybrid system.

- The use of gradient ratio to evaluate the clogging of geotextile

$$i_f = \frac{H_2 - H_1}{2.5 + T_g}$$

$$i_s = \frac{H_3 - H_2}{5}$$

$$GR = \frac{i_f}{i_s} = \frac{5}{2.5 + T_g} \frac{(H_2 - H_1)}{(H_3 - H_2)}$$

- GR > 1, clogging happen in geotextile
  - GR = 1, no influence change with or without geotextile
  - GR < 1, loss of soil particle
- The use of permeability to evaluate the short and long term drainage efficiency of hybrid system

$$k_T = \frac{q}{tiA} \frac{\mu_T}{\mu_{20}} \quad (\text{cm/sec})$$