

### **3. In Situ Testing**

#### **3.1 Introduction**

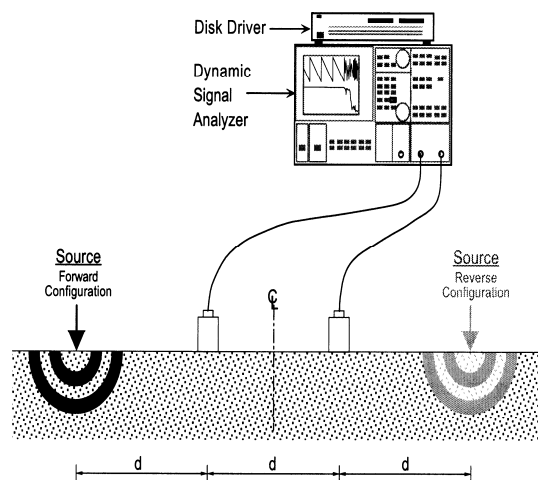
- Aims
  - To classify the soil onto group of materials which will exhibit broadly similar engineering behavior
  - To determine parameters which are required for engineering design calculations (strength, deformation and groundwater flow)
  
- Advantages and Disadvantages (over laboratory tests)
  - Minimizing the effect of soil disturbance for preparation and execution of testing
  - Performing at in situ conditions (same stress conditions and relatively large volume of influential zone)
  - Generally does not providing design parameters of soils directly but obtaining them by applying semi-empirical factors (or relations) to measured values.
  
- The ways to obtain geotechnical informations in situ,
  - By using geophysical techniques
  - By using in situ borehole soil testing techniques
  - By making measurements using field instruments

- In more complex projects, it is common to determine strength and stiffness using both field and laboratory techniques (for example, a combination of SPT, self boring pressuremeter, field geophysics and laboratory stress-path tests with local strain measurements)

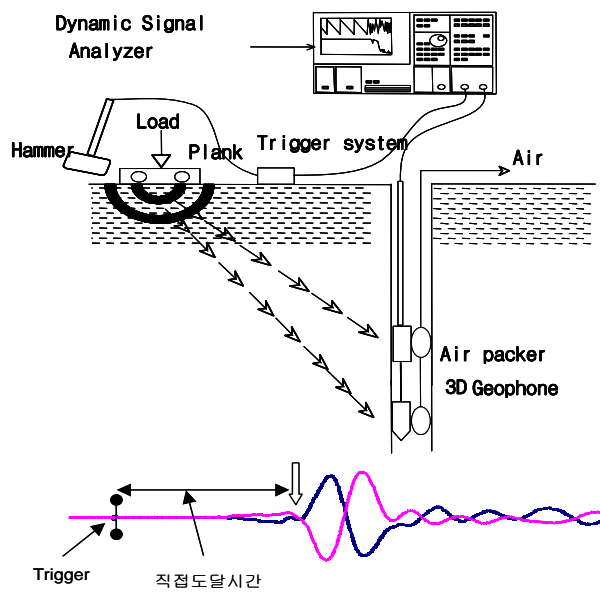
1) Geophysical techniques

- Approximate characterization of ground properties (soil stratification with stiffness (elastic wave velocity et al))
- Cannot provide the direct measurements of the design parameters for geotechnical structures
- Types of geophysical techniques

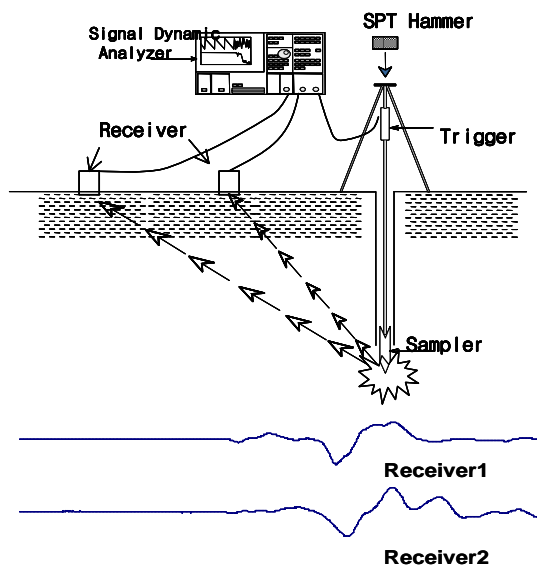
① Spectral Analysis of Surface Waves Measurements (SASW)



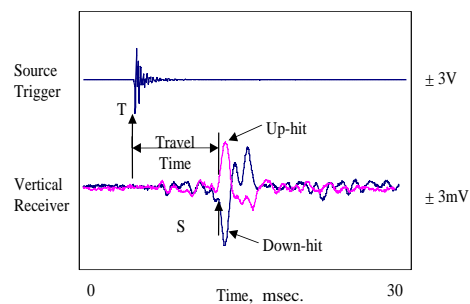
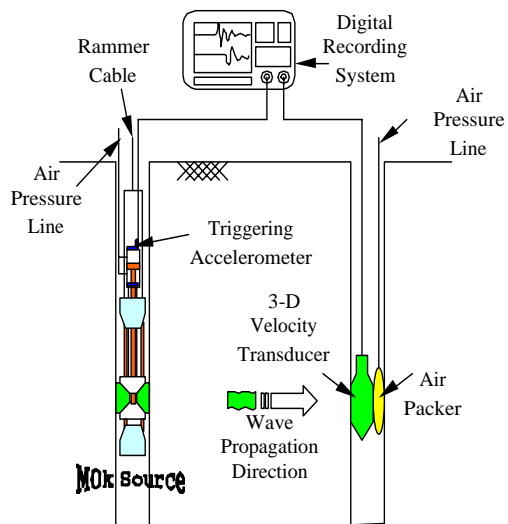
② Downhole Test



③ Uphole test

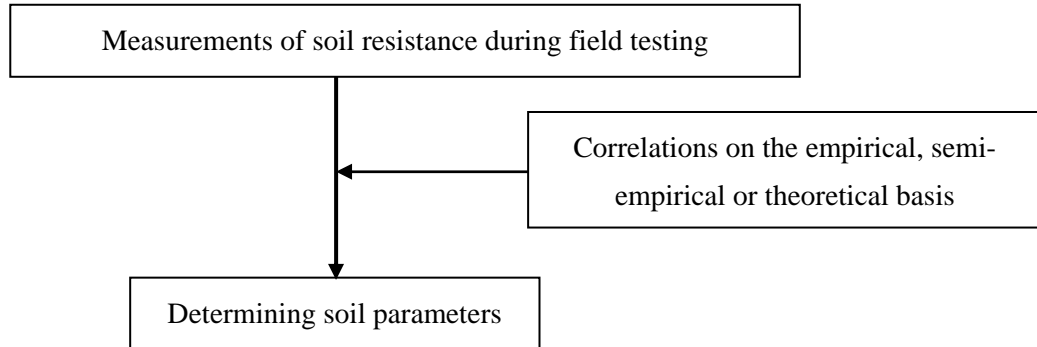


④ Crosshole test



⑤ Electrical resistivity survey

2) In situ borehole techniques



● Parameters from in situ tests with their comparative reliability (Robertson, 1986)

Soil Parameters									
	Profile	$u$	$\phi$	$s_u$	$D_r$	$c_v$	$G$	$\sigma_h$	$\sigma - \varepsilon$
CPTu	A	A	B	B	A	A	B	B	B
DMT	B	C	B	B	C	-	B	B	B
SPT	B	-	C	C	B	-	-	-	-
PBPT	B	-	C	B	C	C	B	C	C
SBPT	B	A	A	A	A	A	A	A	A
FVT	B	-	-	A	-	-	-	-	-

Ground Type							
	Hard rock	Soft rock	Gravel	Sand	Silt	Clay	Peat
CPTu	-	C	-	A	A	A	A
DMT	-	C	-	A	A	A	A
SPT	-	C	B	A	A	A	A
PBPT	A	A	B	B	B	A	B
SBPT	-	A	-	B	A	A	A
FVT	-	-	-	-	B	A	B

<Applicability>

- A : high
- B : moderate
- C : low
- : none