

# Bender Element Test

## Working Principle

Shear wave is transmitted through the soil sample using the Piezo-electric bender and shear wave velocity is measured.

## Application

Small strain shear modulus ( $G_{max}$ ) can be determined from this test.



**Bender Element Apparatus**



# Resonant Column Test

## Working Principle

Harmonic torsional excitation is applied to the cylindrical soil specimen and the loading frequency is gradually increased from low value until the strain amplitude attains a maximum. Free vibration decay is tracked.

## Application

To determine the dynamic soil properties such as low-strain shear modulus and damping ratio.



**Resonant column apparatus**

# Cyclic Simple Shear Test

## Working Principle

A cylindrical sample enclosed in a rubber membrane/steel rings is consolidated and then sheared under constant volume condition. Cyclic/Monotonic shear loading is applied in horizontal direction while the normal stress imparted in vertical direction.

## Application

To determine the dynamic properties of soil at large-strain levels.

To study liquefaction potential of soils.



**Cyclic simple shear apparatus**

# Cyclic Triaxial Test

## Working Principle

A cylindrical soil sample enclosed in a rubber membrane is consolidated and subjected to cyclic loading in vertical direction.

## Application

To study stress-strain behaviour of soil in large-strain range.

To evaluate liquefaction potential of saturated soils.



**Cyclic Triaxial apparatus**

# Shake table test

## Working Principle

A soil specimen is constructed within a stack of laminates forming a flexible container, mounted on shake table along with the rigid box. Seismic or other loading signals is applied to the table and the response of the soil specimen is measured via instrumentation.

## Application

To study the seismic response of scaled soil models, with structures if any.  
To investigate the effectiveness of ground treatment strategies under seismic loading.



**Laminar shake table test apparatus**