

Bidirectional Cyclic Direct Simple Shear Soil Testing System

Introduction

Cyclic (dynamic) bidirectional direct simple shear enables researchers and geotechnical engineers to subject specimens to cyclic and monotonic loads in two directions. This allows users to simulate the actual 3D loads and displacements acting on the specimens in nature.

Example applications:

- Simulating the 3D loads and displacements that soil is subjected to for offshore structures.
- Assessing liquefaction triggering and susceptibility considering 3D loads and displacements.
- Application of both components of strong ground motion on the specimen in form of Cyclic Stress Ratio (CSR) or strain rate time histories.

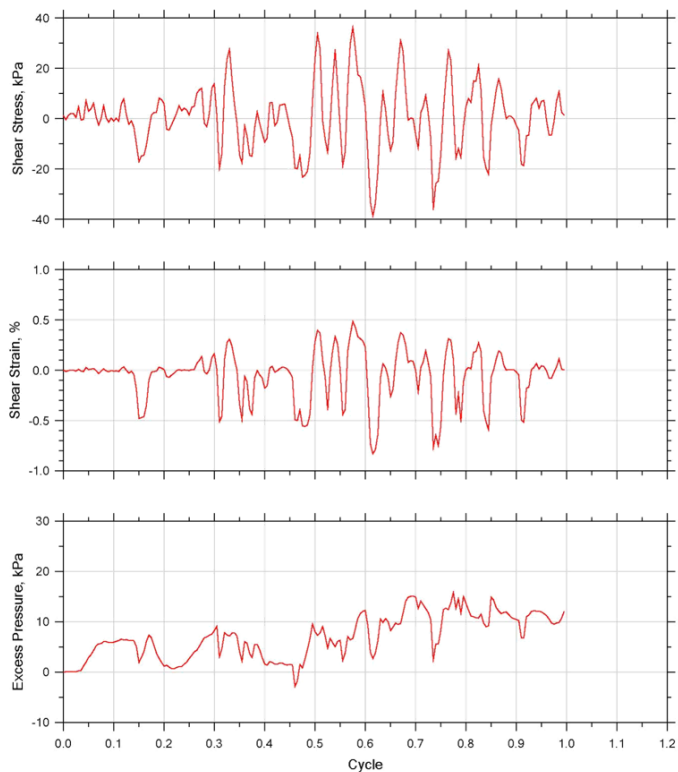
Bidirectional Direct Simple Shear (BDCDSS) Base Unit, comes complete with all appropriate sensor mounting fixtures, water bath container, top platen, lower platen, top and bottom caps with normal and high friction porous stones and lateral confinement system, axial loading ram, force and deflection sensors, automated (computer controlled) constant height deflection control and adjustment system, slide table and components, and related test accessories.

- a. Automated consolidation, bidirectional cyclic direct simple shear and bidirectional post-cyclic shear control and data acquisition software. The equipment uses standard GEOCOMP interface cards and network cabling, connectors, and related computer interface hardware.
- b. Bidirectional Cyclic Direct Simple Shear editing and reporting software and manuals.
- c. Sensors (horizontal 1 and 2 deflection, vertical deflection, horizontal 1 and 2 force, vertical force).
- d. Related data acquisition equipment and computer interfaces.
- e. This system will meet ASTM D6528 testing requirements.

Example image showing zero-backlash linear actuators and robust support frame:



- Bi-Directional CDSS capable of applying both FP and FN components of EQ on the specimen



General System Features

- Incremental quadrature encoder input allows the use of highly accurate and stable digital linear/angular transducers with optimum resolutions.
- Software configurable excitation voltage to easily and conveniently match the excitation to the sensor. Users will be able to match full span sensor output to full span ADC input.
- Faster sampling rates, up to 1000 Hz. Provides more data points for higher frequency tests (i.e. cyclic tests)
- More noise immunity on network provides less packet drops in noisy environments (i.e. pumps and high-power motors)
- Higher resolution in displacement measurements.
- Field upgradable firmware provides easy updates and bug fixes.
- Complete graphical and tabular reporting for each step of the test. Raw data reporting. All tabular reports can be exported to Excel spreadsheets.
- Meets new standards and requirements of existing customers and research institutes.
- All firmware capable of cyclic tests, providing higher frequency sampling rate and motion control for all tests.
- Network access to remotely view & control the test from anywhere at any time.
- International user input

Specifications

- X and Y axis are driven using zero-backlash linear actuators and servo system to enable better control of stress and strain.
- The Z axis has a jack screw and stepper motor as driving mechanism.
- X and Y axis cyclic loading capacities are 1,000 lbf (4.5 kN).
- Z axis loading capacity is 2,000 lbf (9 kN).
- The water bath includes easy side access and separable baseplate with bottom cap.
 - Specimen is laterally supported using membrane and Teflon coated aluminum rings.
- Low-friction linear guides assisted with rigid bearings eliminates rocking of the loading platen and cancels the resultant moments on the system.
- The standard specimen size is 2.5" (63.5 mm) diameter and 1-1.5" (25.4-38.1 mm) height.
 - Also available up to 4" (101 mm) and 2" (50.8 mm) height.
- X and Y axis can apply and maintain the cyclic stress up to 5% Peak-to-Peak shear strain at 1 Hz (for stress-controlled tests with frequencies between 1 and 0.03 Hz.)
- X and Y axis can apply and maintain the cyclic load up to 0.5-0.75% Peak-to-Peak shear strain at 10 Hz.
- System can provide passive or active height control.
- Capable of conducting Direct Simple Shear tests in drained (constant load) and undrained (constant volume) condition.
- Rigid frame and low friction axial loading enable better maintenance of volume during undrained tests.

- Run stress and strain-controlled tests.
- User can apply independent sinusoidal stress or strain on X and Y axis.
- Apply irregular stress ratio and strain rate time history (e.g. earthquake motion) up to 30 seconds.
- Supports use of Linear Encoders for precise and noise free displacement measurement.
- Automatically run the complete test from start to finish (consolidation, CDSS and post Cyclic Shear)
- Generate a full report of the test (processed data) and raw data.
 - User can access the data in CSV format or Geocomp report format.

Example results from different loading patterns

