Advanced Geotechnical Laboratory
Swinburne University of Technology

Swinburne University of Technology is undergoing rapid growth, particularly in the area of engineering research and education. Advanced Geotechnical Systems is a dynamic research tier within the Centre for Sustainable Infrastructure (CSI) and is supported by physical testing in the renewed Swinburne Geotechnical Laboratory as well as computational geomechanics with various geotechnical modelling softwares.

Advanced Geotechnical Systems supported by the Geotechnical Laboratory, has been successful in recent years in obtaining continuous research funding and consulting projects from industry, local, state and federal government.

State-of-the-art fully automated geotechnical engineering equipment has been invested in recent years in the Swinburne Geotechnical laboratory. Equipments available include cyclic triaxial equipped with local strain measurements, static and stress path tiraxial, large interface direct shear, direct shear, residual shear, Rowe consolidation, Oedometer consolidation, cyclic and static Indirect Tensile strength (IDT), unconfined compression, California Bearing Ratio, Repeated Load Triaxial Test, swell-shrinkage, shear wave velocity, soil suction, flexible wall hydraulic conductivity. Advanced Geotechnical Systems Tier is supported with computational geomechanics capabilities including software packages such as Flac, Geo-Slope, Plaxis Dynamics, Plaxis 3D, Particle Flow Code (PFC) and Strand7.

Some of our current research areas include:

- Geotechnics of pavements using recycled demolition materials
- Applications of reclaimed and waste materials in geotechnical engineering applications
- Geotechnical laboratory testing
- Field instrumentation and in-situ testing
- Ground improvement, soil stabilization and geosynthetic applications
- Land reclamation and dredging
- Soft soils and problematic soils
- Footings on expansive clays
- Liquefaction analysis
- Pavement stabilization
- Testing and design of alternative landfill cover systems
- Testing and design of mine waste storage facilities

Our research facilities provide a national and international focus in Geotechnical Engineering and supports research within Swinburne’s Centre for Sustainable Infrastructure.
**BASIC GEOTECHNICAL TESTS**

**Particle Density & Water Absorption**
- Soil and Aggregate
- Fine and Coarse material
- Standards Test Methods:
  - AS 1141.5 – AS 1141.6.1 – 1141.6.2 – AS 1289.3.5.1
  - ASTM D 854
  - BS 1377-2

**Particle Size Distribution**
- Soil and Aggregate
- Sieve and Hydrometer Analysis
- Standards Test Methods:
  - AS 1726 – AS 1289.3.6.1 – AS 1289.3.6.3 – AS 1141.11.1
  - BS 1337-2

**Plasticity Index**
- Liquid Limit, Plastic Limit, Plasticity Index
- Casagrande and Cone Method
- Standards Test Methods:
  - AS 1289.3.1.1 - AS 1289.3.1.2 - AS 1289.3.2.1
  - AS 1289.3.9.1 - AS 1289.3.9.2 - AS 1289.3.3.1
  - AS 1289.3.3.2
  - ASTM D 4318
  - BS 1337-2

**Compaction**
- Soil and Aggregate
- Standard and Modified Methods (Mould A and B)
- Standards Test Methods:
  - AS 1289.5.1.1 – AS 1289.5.2.1
  - ASTM D 698 – ASTM D 1557
  - BS 1337-4

**Shrink Swell**
- Linear Shrinkage, Shrink-Swell Index
- Standards Test Methods:
  - AS 1289.3.4.1 – AS 1289.7.1.1
  - ASTM D 4943 – ASTM D 4546
  - BS 1377-2 – BS 1377-5

**Dispersive Characteristics of Clay Soil by Double Hydrometer**
- Standards Test Methods:
  - ASTM D 4221
Hydraulic Conductivity (Permeability)
Constant and Falling Head
Flexible Wall Permeameter
Undisturbed and Remoulded Specimens
Standards Test Methods:
AS 1289.6.7.1 – AS 1289.6.7.2 – AS 1289.6.7.3
ASTM D 2464-68 – ASTM D 5084
BS 1377-5

Swell Pressure of Soils/Clays
Free Swell
Standards Test Methods:
ASTM D 4221
BS 1377-5

Flakiness Index
Pavement and Aggregate
Standards Test Methods:
AS 1141-15
ASTM D 4791
BS 812-105.1

Los Angeles Abrasion
Standards Test Methods:
AS 1141
ASTM C 131 – ASTM C 535

Aggregate Crushing Value
Aggregate Impact Value
Soil and Aggregates
Standards Test Methods:
AS 1141.21
ASTM D 5874 – ASTM D 2940 / 2940M
BS 812-110 – BS 812-111 – BS 812-112

Loss on Ignition and Organic Content
Waste, Soil and Aggregates
Standards Test Methods:
AS 1289.4.4.1
ASTM D 2974 – ASTM D 7348
BS EN 15169
**pH Value**

Electrometric Method  
Waste, Soil and Aggregates  
Standards Test Methods:  
AS 1289.4.3.1  
BS 1377-3

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**Settling Density**  
48 hours settling measurements

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**Emerson Test**  
Standard Test Method:  
AS1289.3.8.1
SPECIALISED GEOTECHNICAL TESTS

California Bearing Ratio
Soil, Aggregate and Geotextiles (Burst Strength)
Standards Test Methods:
AS 1289.6.1.1 – AS 1289.6.1.2 – AS 3706.4
ASTM D 1883
BS 1377-4

Triaxial
Soil, Aggregate and Rocks
Unconsolidated Undrained (UU)
Consolidated Undrained (CU)
Consolidated Drained (CD)
Stress Path Triaxial
Ko (zero lateral strain) Triaxial
Sample size:
25, 38, 50, 75, 100 and 150 mm diameter
Local Strain Measurement (axial and circumferential LVDTs)
Undisturbed and Remoulded Specimens
Standards Test Methods:
AS 1289.6.4.1 – AS 1289.6.4.2
BS 1377-7 – BS 1377-8

Cyclic Triaxial
Soil, Aggregate and Mine Tailings
Sample size:
25, 38, 50, 75 and 100 mm diameter
Local Strain Measurement (axial and circumferential LVDTs)
Undisturbed and Remoulded Specimens
Up to 50 Hz frequency
Strain and Stress Controlled
Standards Test Methods:
ASTM D 5311

Unconfined Compressive Strength
Soil, Aggregate and Rocks
Local Strain Measurement (axial and circumferential LVDTs)
Undisturbed and Remoulded Specimens
Standards Test Methods:
AS 5101.4
BS 1377-7

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One Dimensional Consolidation
Odometer and Controlled Strain
T₅₀ and T₉₀ Methods
Primary and Secondary Consolidation
Undisturbed and Remoulded Specimens
Sample size:
45, 63 and 73 mm diameter
Standards Test Methods:
AS 1289.6.6.1
ASTM D 2435 – ASTM D 4186
BS 1377-5

Hydraulic (Rowe) Cell Consolidation
One Way, Two Way, Vertical and Horizontal Drainage Methods
Sample size:
75 and 150 mm diameter
Undisturbed and Remoulded Specimens
Standards Test Methods:
ASTM D 4186
BS 1377-6

Direct Shear Test (Small and Large)
Residual Shear Strength (Small and Large)
Soil and Aggregates
Undisturbed and Remoulded Specimens
Sample size:
63, 75 and 100 mm (circular and square)
300 by 300 mm (square only)
Standards Test Methods:
AS 1289.6.2.2
ASTM D 3080
BS 1377-7

Internal and Interface Shear Resistance
Coefficient of Soils and Geosynthetic
Soil and Aggregates
Sample size:
300 by 300 mm
Standards Test Methods:
ASTM D 6243
ASTM D 5321
Repeated Load Triaxial Test (RLTT)
Resilient Modulus and Permanent Deformation
Aggregates and Pavement Material
Unbound and Stabilized Aggregate
Sample size:
100 and 150 mm diameter
Standards Test Methods:
AUSTROADS AG:PT/T053
AASHTO Designation: T 307-99
EN 13286-7

Four Point Beam Fatigue Test
Modulus of Rupture, Resilient Modulus and
Fatigue life of stabilised pavement materials
Sample size:
100 (width) x 100 (height) x 400 (length) mm
Standard Test Methods:
AS 1012.11 – 2000
AUSTROADS

Indirect Tensile Test
Indirect Tensile Strength and Resilient Modulus
Stabilized Pavement Material, Bituminous
Mixtures, Rocks
Standards Test Methods:
AS 2891.13.1 – AS 1012.10 – AS/NZS 2891.13.1
ASTM D 6931 – ASTM D 3697 – ASTM D 7369
AASHTO T322
EN 12697
BS DD 213

100 kN Universal Testing Machine,
UTM 100
Stiffness, Resilient Modulus, Fatigue Behaviour
Tests
Compressive and Tensile Strength Tests
Asphalt, Soil, Rock and Pavement Aggregate
Dynamic Properties
Environmental Chamber for Temperature Control
100 kN Cyclic Load Capacity Up to 70 Hz
Frequency
130 kN Static Load Capacity

Laboratory Vane Shear Test
Fine Grained Clayey Soils
Standards Test Methods:
ASTM D 4648
BS 1337-7
Soil Suction
Total and Matric Suction Measurement
Determination of Soil Water Characteristic Curve
Filter Paper Method
Hanging Column
Pressure Chamber (specimens from 25 mm to 75 mm diameter)
Chilled Mirror Hygrometer (WP4C)
Dewpoint and Psychrometric Method (Wescor HR 33T)
Standards Test Methods:
AS 1289.2.2.1
ASTM D 5298 – ASTM D 6836

Geosynthetics Burst Strength
Standards Test Methods:
AS 3706.4
ASTM D 3786
BS EN 14151

Geotextile Tensile Strength
Standards Test Methods:
AS 3706.2
ASTM D 6637
BS EN 10320 – BS EN 10321

Measuring shear wave velocity using bender elements
Sample size:
50, 75 and 100 mm diameter

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