

Research Laboratories

INTRODUCTION

Civil engineering research is supported by seven state-of-the-art research laboratories. Civil engineering laboratories and graduate student offices are all housed in Nitschke Hall, which was built in 1995. A list of the laboratories and their directors are given below:

1. Environmental Geotechnology Lab.: Dr. Heydinger
2. Structures Research Lab.: Dr. Nims
3. Air Pollution Research Lab.: Dr. Kumar
4. Transportation Research Lab.: Dr. Gupta
5. Geochemistry and Environmental Microbiology (GEM) Laboratory: Dr. Gruden/Dr. Apul
6. Infrastructure Information Systems Research Lab.: Dr. Chou
7. Composite Materials Research Lab.: Dr. Parvin

In addition to teaching laboratories that support conventional testing, the following facilities are available to researchers in the Department of Civil Engineering: the Air Pollution Laboratory, where current research projects are in air quality modeling, geographical distribution of radon concentrations, pollution prevention, and environmental information technology; the Bituminous Materials Laboratory, which is equipped with a freeze/thaw chamber, pulse velocity tester, gyratory compactor, and all conventional pavement-testing equipment; the Environmental Geotechnology Laboratory/Banyas Soil Mechanics Laboratory, which has facilities for the full range of geotechnical testing, plus unique equipment for unsaturated triaxial and permeability tests, extreme temperature shear behavior, geosynthetic pullout resistance, and in situ environmental monitoring, and current research projects include the monitoring and study of instrumented subgrade soils and geosynthetic behavior in walls and lined landfills; and the Geochemistry and Environmental Microbiology (GEM) Laboratory, with research focuses on contaminated sediments, pavement materials, biosolids, and sensor development. Common analyses in the GEM lab include measurement of nutrients, organic carbon, components of gas mixtures, and microbial characterization

(enumeration, activity assessment, identification). GEM lab hosts basic equipment for environmental geochemistry and microbiology research such as glassware, balances, pumps, shakers, a centrifuge, incubators, anaerobic glove box, hoods, and ovens. Field equipment for pavement runoff sampling is also housed in the GEM lab. The laboratory is equipped with major instruments such as pH-stat auto-titrator, TOC analyzer (Shimadzu VCPN), Ion Chromatograph (IC; Dionex CS-1000), Fluorescence Microscope (Olympus BX-51), Fluorescent Plate Reader (Gemini XPS spectrofluorometer), and Thermal Cycler (Eppendorf Mastercycler).

In addition, the excellent research facilities at the University include the following: the Infrastructure Information Systems Research Laboratory, which has state-of-the-art data collection, analysis, mapping capabilities for pavement and asset management and an instrumented vehicle for mechanical and digital-visual monitoring of pavement condition, with outstanding computational capabilities for life-cycle predictions; the Laboratory for Composite Materials in Structures/Construction Materials Laboratory, with strong floor and 80 K, fatigue-rated reaction frame with multiaxial 30 gpm servohydraulic loading system and multichannel, high-speed data collectors, and current research projects include FRP repair of beam/column connections, column enhancements, and dynamic behavior of cable stays; the Stress Analysis /Intentional Blast Mitigation Laboratory, which is unique testing facility used to simulate impulse loads on flat structural elements and glazing, and research projects include structural response to blasts and other intense loads and additional capabilities in strain gauging and instrumentation for structural monitoring, with ongoing research of post-tensioned, segmental-concrete, and cable-stayed bridges; other test equipment, including torsion, tension, and compression machines and shake tables for academic instruction; and the Transportation Laboratory, which contains vehicle speed-, volume-, and characterization-monitoring equipment and computer-program-assisted simulation modeling of real-time traffic flow to aid in policy decisions, with current research projects including urban transportation studies, intermodal system modeling, and the Upper Midwest Corridor Multi Modal Freight Study.

INSTRUMENTATION IN ENVIRONMENTAL AREA

A partial list of instruments available to the students is given in Table I. A brief discussion is given below for different instruments:

Table I: Equipment Available for Environmental Research

Equipment Title	Equipment Type	Year Installed	College	Building	Room No.
FT-IR Spectrometer and Microscope	Analytical	2003	Engineering	North Engineering	2065
Ion Chromotography System	Analytical	2005	Engineering	Nitchke	1033
TOC Analyzer	Analytical	2005	Engineering	Nitchke	1033
Titration workstation	Analytical	2005	Engineering	Nitchke	1033
Fluorescence microscope	Analytical	2004	Engineering	Nitchke	1095
GC/TCD	Analytical	2005	Engineering	Nitschke	1095
Fluorescent Plate Reader	Analytical	2005	Engineering	Nitschke	1033
Thermal Cycler	Analytical	2005	Engineering	Nitschke	1033
Anaerobic Glove Box	Analytical	2003	Engineering	Nitschke	1095
TSI Dust Trak - Air quality monitor for measuring particulate concentrations	Analytical	2006	Engineering	Nitschke	1036
Yes 'Plus' - Indoor air quality monitor for measuring pollutant concentrations	Analytical	2006	Engineering	Nitschke	1036
DIONEX QIC Analyzer - Ion Chromatograph	Analytical	1986	Engineering	Nitschke	1036
ANDERSEN Universal Stack Sampler	Experimental	1986	Engineering	Nitschke	1036

Ion Chromatography System

The Dionex brand ICS-1000 is an ion chromatography system. Its current configuration is designed for measuring anions in aqueous solutions. ICS-1000 has dual-piston pumping, electrolytic suppression as well as vacuum degas and column heater options which improve baseline stability and yield lower detection limits. The ICS-1000 also comes with Chromeleon SE software for automation and data handling. Currently, we do not have an autosampler for the IC and analysis of each ion for a given sample takes at least 10-15 minutes.



TOC Analyzer

The Shimadzu brand TOC analyzer uses the 680 degrees centigrade combustion technique with Non-dispersive Infrared (NDIR) detection to analyze inorganic and organic carbon species. It can measure carbon concentrations in the range of 4mg/L to 25,000 mg/L. It is equipped with an autosampler.



Titration Workstation

Radiometer analytical's TitrLab 856 titration system is customized for pH-stat titration experiments. It is equipped with two burettes.

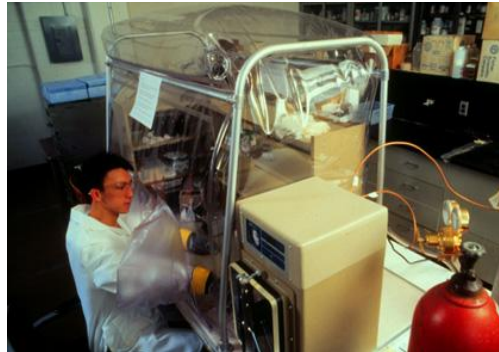


Olympus BX51 upright microscope

Powered by the new UIS2 optical system the BX51 is the ideal choice for fluorescence or DIC microscopy. Based around a well proven Y-shaped frame an extended range of high performance digital cameras, accessories and objectives can be used. This ensures a flexible and modular configuration even for specialized high-end research applications.



Anaerobic Glove Box. 30"L x 28"W x 26"H anaerobic chamber from Coy Laboratories. The glove box front is made of 20 mil pressed polished clear vinyl with 40 mil vinyl bottom extending 2" (51 mm) up on all sides. It is mounted on a 3/4" (19 mm) plywood base covered with a 1/4" (6 mm) foam pad and heavy vinyl. A 1" (25 mm) aluminum tubular frame supports the glove box. All glove boxes come with a large equipment entry installed opposite the entry lock. This entrance consists of a 20" (50 cm) entry cap that is taped in place after installing large equipment in the glove box.



GOW-MAC Gas Chromatograph – Thermal Conductivity Detector (GC/TCD).

GOWMAC Series 400 Gas Chromatograph. The Series 400 can be operated at temperatures from ambient to 300 °C. Temperature controls for injection ports, column oven, and detector are solid state proportioning type with direct dial setting. The thermal conductivity detector (TCD) contains four rhenium-tungsten (WX) hotwire filaments, selected for their sensitivity and stability. The TCD's design combines wide carrier flow ranges with fast response thus allowing more flexibility to adjust conditions for maximum instructional use. Sample introduction is accomplished by syringe injection. Both liquids and gases can be injected using standard microliter or gas tight syringes.



Gemini XPS Microplate Spectrofluorometer



The Gemini XPS spectrofluorometer allows for fast, high-sensitivity measurements as required by most of today's fluorescence-based assays. Cellular and molecular binding studies, DNA quantitation, drug screening, and SNP genotyping analysis all require a high degree of sensitivity. The Gemini XPS system offers a flexible, filter-free environment allowing the determination of optimal excitation and emission settings in 1.0 nm increments providing the best level of sensitivity for variable assay conditions.

Eppendorf Thermal Cycler. The Eppendorf Mastercycler gradient has set the standard for optimized reaction conditions in molecular biology labs. It features a single block that accepts both 96-well plates as well as 0.2 and 0.5 ml PCR tubes. A programmable gradient function enables a temperature gradient of 1°C to 20°C to be generated across the block during all steps of a PCR reaction.

Steady Slope Technology ensures constant heating and cooling rates, and it allows the results of gradient experiments to be transferred seamlessly to routine applications. Triple Circuit Technology provides an additional heating and cooling zone for precise temperature control of all gradient profiles



Concrete Compression 400 kip machine.



Large Shake Table



Lateral load Frame



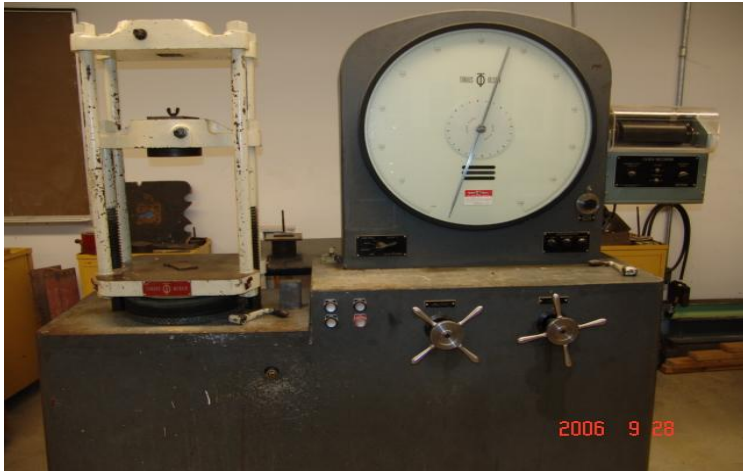
SHRP Gyrotory Compactor



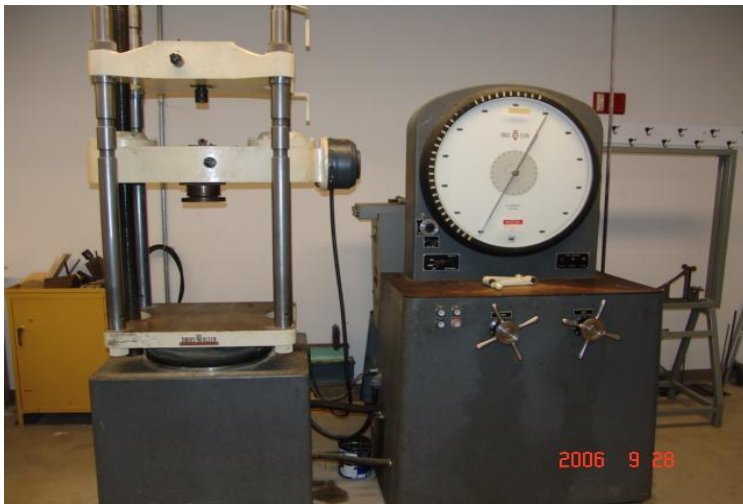
Tinius Olsen 10 kip Tension Machine



Tinius Olsen 60 kip Tension Machine



Tinius Olsen 120 kip Tension Machine



Tinius Olsen Torsion Machine

