

LABORATORY SAFETY MANUAL

Geotechnical laboratory



**BANGLADESH UNIVERSITY OF
ENGINEERING
AND TECHNOLOGY**

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Disclaimer:

The safety measures mention in this manual are applicable for general activities in the laboratory. Students and lab stuffs are asked to follow additional safety measures if it's necessary for any specific experiment.

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Safety manual

This safety manual is applicable for Geotechnical laboratory. This will help both students and laboratory instructors to know about the safety features and safe work practices inside the laboratory.

1. Emergency

1.1 What is an Emergency? (Definitions)

Sudden, unexpected, or impending situation that may cause injury, loss of life, damage to the property, and/or interference with the normal activities of a person or group and which, therefore, requires immediate attention and remedial action.

Following situations may be regarded as emergency:

- 1) A sudden, urgent, usually unexpected occurrence or occasion requiring immediate action
- 2) A state, especially of need for help or relief, created by some unexpected event

Emergency Contact List

Designation	Name	Phone No.
Head of the Department	Dr. Ahsanul Kabir	01711673982

Designation	Phone No.	BUET Office
BUET telephone operator(PABX)	55167100	0

Medical Centre:

Emergency ambulance service/Medical officer	6666
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Designation	Name	Phone No.	BUET Office
Chief Medical officer	Dr. Md. A. K.Masud	01916740809	7344
Senior medical officer	Dr. Mohammad Mashuk Elahi	01552416578	7393
Medical officers	Dr. Md. Hasib iskandar	01720960997	7893
Medical officers	Dr. Md. Mubashwirul islam	01679222750	7817

Fire service and civil defense:

Fire Brigade Emergency/Enquiry	199
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Place	Mobile	Phone
Polashi	01716354370	02-8628688
Mirpur Road	01730002229	02-9001055
Mohammadpur	01712970093	02-9112078

Police & Security:

Designation	Phone
Emergency Call	999
DMP Police Emergency	01713398311,9551188

Directorate of Students' Welfare (DSW):

Designation	Name	Phone No.	BUET Office
DSW	Dr. Md. Mizanur Rahman	01911346993	6135,7143
Assistant DSW	Dr. Md. Raquibul Hossain	01819557960	7224
Associate Directors	Dr. Mohammad Faisal	01794692601, 01926714764	7713, 6168

Residential Halls: (Updated at 03/08/2019)

Hall Name	Designation	Name	Phone No.	BUET Office
Ahsan Ullah Hall	Assistant Provosts	Dr. Md. Iqbal Hossain	01927885215	7430
Kazi Nazrul islam Hall	Assistant Provosts	Dr. Mahbub Hasan	01820291811	7833
Titumir Hall	Assistant Provosts	Dr. Md. Muktadir Billah	01840702279	7718
Sher-e-Bangla Hall	Assistant Provosts	Dr. Md. Shahinoor islam	01922544639	7933
Suhrawardy Hall	Assistant Provosts	Dr. Mohammad Khurshed Alam	01712526059	6390
Shahid Smrity Hall	Assistant Provosts	Dr. Rupak Mutsuddy	01839848062	7224
Chattri Hall	Assistant Provosts	Nishat Sultana	01757786310	7735
Dr.M.A.Rashid Hall	Assistant Provosts	Dr. Md. Shafiul Azam	01535495622	7470

University security & others:

Designation	BUET Office
Security Emergency Call	7777
Security officer	7482
Electricity & Plumbing	7323
Machine Room	7589
Shaheed Minar Gate(Main Gate)	7812
West Palashi (Main Gate)	6592
Bakshi Bazar R/A Gate	7825
Dhakeswari R/A Gate	7759
Palashi R/A Gate	7692
Azad R/A Gate	7760
71,72 No. Building Gate	6330

1.2 What to do in Case of an Emergency?***In the event of an emergency,***

- Get out of immediate danger!
- Report situation to the instructor
- Explain the nature of the emergency.
- Provide your name and location.
- Provide the phone number from which you are calling.
- Answer all questions and do not hang up the phone until the operator is finished.

If the emergency has cause injury to a person,

- Provided it is safe for you, stay with the victim!
- If the victim is conscious, ask what the problem is.
- If the victim is unconscious, check for breathing and bleeding. Do not move the individual until trained personnel arrive or an immediate threat to life exists. Only trained individuals should administer first aid and CPR.
- Keep the victim still, comfortable, and ventilated.
- Protect the victim from any disturbances.
- Search for any emergency identification (i.e. ID)
- Wait for emergency help to arrive. Never leave the victim alone if possible.
- Once the emergency responders have arrived, stay out of the way of emergency personnel and emergency vehicles!

What to do in case of a fire or smoke?

All situations related to fire should be taken seriously. If you hear or see anything uncertain, evacuate the building!

If fire or smoke is discovered anywhere on or about the campus:

- Leave the area where the fire is located, isolating it as well as possible by closing doors and windows around it.
- Activate the fire alarm switch.
- Do not attempt to retrieve valuables.
- Do not use Elevators /lifts .
- Never attempt to fight a fire larger than wastebasket size. Even a small fire can generate enough smoke to cause serious injury. Never attempt to fight a fire by yourself. Call for help. Always stay between the fire and the exit.

If you can't evacuate:

- Find a safe location and call emergency.
- Crawl to the door on hands and knees, so you can breathe the fresher air near the floor.
- Seal your room against entering smoke.
- If it's still smoky in your room, breathe through a wet towel that covers your nose and mouth. Breathe only through your nose.
- Clear flammable debris from the window.

1.3 FIRE EXTINGUISHER INSTRUCTIONS (PASS)

- P * PULL** safety pin from the handle
- A * AIM** at the base of the fire
- S * SQUEEZE** the trigger handle
- S * SWEEP** foam side to side



1.4 What if you or people are trapped in a burning building?

- The universal sign for a person trapped in a burning building is to hang clothing or a sheet out of the window of the room where you are trapped. The firefighters then will know where you are trapped.
- If you are aware that someone is trapped in a burning structure, inform the firefighters immediately.
- Do not re-enter the building alone.
- If you are trapped, stay low to the ground as you try to exit. Do not open any doors that feel hot. Use wet towels or clothes to protect you from flames and smoke.
- If your clothes catch fire, STOP, DROP, AND ROLL!!!

2. General Conduct (All Laboratories)

2.1 Behavior in the Laboratories:

- Act in a professional manner at all times.
- No horseplay and practical jokes.
- Visitors must be escorted.
- Contact information is to be posted on all laboratory doors. If an experiment is being run unattended, the experiment contact information must be displayed.
- Students must be aware of the location and proper operation of laboratory safety equipment, i.e. fire extinguishers, flammable cabinets and fume hoods, eye-wash stations, and personal protective equipment.

2.2 Personal Habits

- Be alert to unsafe conditions. It is the responsibility of each individual to assure a safe working environment for themselves and other workers in the laboratories.
- No eating, drinking, gum chewing or cosmetic application in the labs.
- Closed toed shoes must be worn at all times in active laboratory areas. No sandals!
- Long hair and loose clothing shall be confined. Appropriate clothing must be worn at all times. No shorts, capris, skirts, or sleeveless shirts where chemicals or machines are present.
- Proper Personal Protective Equipment (PPE) must be worn (see Section 4.4). Users of the Lab must be familiar with the hazards of the materials with which they are working. Consult the MSDS sheets, before working with any hazardous chemicals.
- No glassware or utensils that are used for laboratory operations shall be used for storage, handling, or consumption of food or beverages.
- Hands should be washed before using the restrooms and before eating. Areas of exposed skin, i.e. forearms, should be washed frequently if there is potential of contact with chemicals.
- Do not conduct any unauthorized experiments.
- Personnel must have pre-approval by his/her direct supervisor in order to perform work alone.
- Work should not be conducted if the researcher is feeling tired or otherwise impaired.


2.3 Housekeeping







- Lab areas are to be kept clean and uncluttered. This will help prevent spillage, breakage, personal injuries and unnecessary contact with chemicals.
- Contaminated glassware should be cleaned daily.
- Small spills shall be cleaned up immediately from work areas and floors. (Contact Safety & Risk Management for large hazardous spills.)
- Doorways and walkways within the lab shall not be blocked or used for storage.
- Access to exits, hallways, emergency equipment, and utility controls shall remain accessible at all times.
- All tools and equipment shall be returned to their proper storage location after use.
- Chemical containers shall be properly emptied and cleaned prior to disposal. Glass bottles will be uncapped, washed out with an appropriate solvent, triple rinsed with water and placed in the glass container for disposal.
- All non-empty, non-cleaned containers must be labeled with a description of their content!

2.4 Personal Protective Equipment

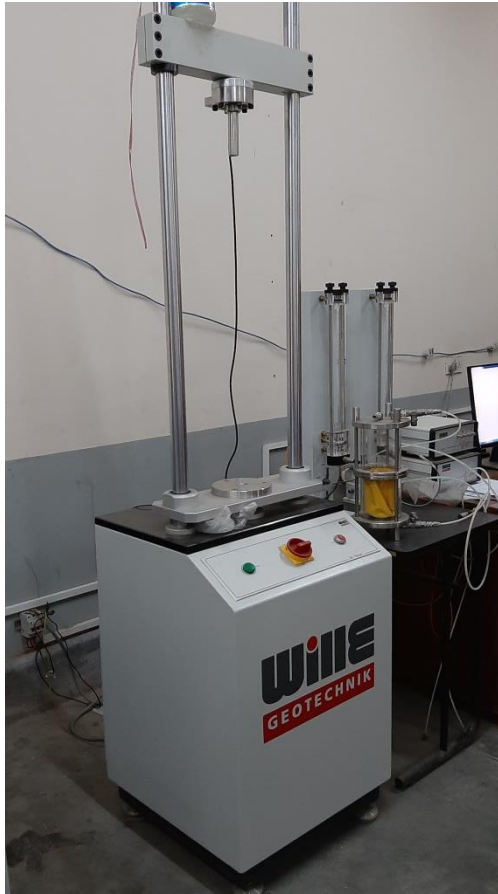
- Proper eye protection must be worn at all times in laboratories. Proper protection includes, but is not limited to, chemical splash safety goggles, face shields, and safety glasses.
- Students wearing contact lenses must be informed of the special hazards associated with their use, (i.e., absorption of chemicals from the air) and must inform their supervisors so that appropriate measures can be taken in an emergency.
- Chemical resistant gloves shall be worn whenever the potential for hazardous skin contact exists.
- Heat resistant gloves shall be used for handling hot objects.
- Abrasion resistant gloves (e.g. leather) should be worn for handling broken glass and other similar materials, but should not be used to handle chemicals.
- Before each use, gloves are to be inspected for damage and contamination, i.e., tears, punctures, discoloration. If deficiencies are noted, the gloves should be cleaned, repaired, or replaced before use.
- Contaminated gloves shall be removed before touching surfaces outside the work area (i.e., doorknobs, faucet handles).
- Shoes that cover the entire foot must be worn in active laboratory areas at all times. No sandals or open-toed shoes shall be worn in active laboratory areas.
- Laboratory coats shall be worn by laboratory employees whenever a reasonable risk of chemical exposure to skin or street clothing exists or when specified by standard operating procedures. They should be kept in an appropriate clean storage area.
- Disposable laboratory coats are recommended when working with highly toxic materials such as select carcinogens, mutagens or teratogens.
- Chemical protective clothing must be removed before leaving the work area.
- Hearing protection (noise attenuating ear muffs or plugs) are required whenever employees are exposed to 85 dB A or greater as an eight hour time weighted average.

3. Physical safety symbols

	<p>Symbol for Gloves Gloves must be worn while working in the laboratory. It is important to choose the appropriate type of glove.</p>
	<p>Symbol for Boots Closed toe shoe that cover the entire feet must be worn all time while working in the laboratory.</p>
	<p>Symbol for Protective Clothing Apron must be worn while working in the laboratory.</p>
	<p>Symbol for Safety Glasses Safety glass must be worn while working with chemicals.</p>
	<p>Symbol for Breathing Masks Use breathing mask while working in an area with potentially contaminated air.</p>
	<p>Symbol for Face shields Face shields must be worn when executing experiments that carry the potential of causing an explosion inside of the hood.</p>
	<p>Symbol for Hearing Protection There is a wide variety of hearing protection devices available. Use one according to your need in the laboratory</p>
	<p>Symbol for Wash Hands Hand washing is a primary safeguard against inadvertent exposure to toxic chemicals or biological agents. The wash hands safety sign lets lab personnel know to wash their hands.</p>
	<p>Symbol for Food & Drink Prohibited No food and drink is allowed inside the laboratory. Especially during class hours.</p>

	<p>Symbol for Fire Extinguisher it's important that every lab be prepared with the correct fire extinguisher, inspection requirements, and training.</p>
	<p>Symbol for No Open Flames Open flame devices carry with them the risk of unintentional fire and serious consequences when not used appropriately. So be careful about open flame.</p>
	<p>Symbol for Poison/Toxic Material The toxic material symbol indicates the presence of substances that may harm an individual if they enter the body.</p>
	<p>Symbol for Explosive Hazard The exploding bomb symbol will appear on chemicals in the lab that have explosive properties</p>
	<p>Symbol for Flammable & Combustible Substances The flammable and combustible symbol signifies substances that will ignite and continue to burn in air.</p>
	<p>Symbol for recycling storage The recycling sign is used in labs to indicate where recyclable items are gathered and sorted.</p>

Some tools and machines:



Advanced triaxial machine



Triaxial machine

A triaxial shear test is a common method to measure the mechanical properties of many deformable solids, especially soil (e.g., sand, clay) and rock, and other granular materials or powders. There are several variations on the test.

In a triaxial shear test, stress is applied to a sample of the material being tested in a way which results in stresses along one axis being different from the stresses in perpendicular directions. This is typically achieved by placing the sample between two parallel platens which apply stress in one (usually vertical) direction, and applying fluid pressure to the specimen to apply stress in the perpendicular directions. Students should use them carefully and ask for help to the instructor if they don't know how to operate the machine.



Shaker machine

A shaker is a piece of laboratory equipment used to mix, blend, or agitate substances in a tube or flask or container by shaking them. It is mainly used in the fields of geotechnical engineering and transportation engineering. A shaker contains an oscillating board that is used to place the flasks, beakers, or test tubes. Students should be careful about every electric connections linked to shaker.¹¹ Make sure the sieves are stacked securely fitting them on top of each other. Place the black cap on the top sieve before lowering the arm onto the stack.



Auto Consolidation System

Auto Consolidation system for incremental consolidation and swell testing fully automates an entire consolidation test. Constant load and constant volume swell tests can be run automatically. Once a sample is placed into the load frame, the test conditions programmed, and the test started. The computer automatically increments to the next stress by using conditions specified by the user. Students should know how to use it and how to set the parameters properly into the system.



Direct Shear Test Apparatus (Manual)



Direct Shear Test Apparatus (Advanced)

A direct shear test is a laboratory or field test used by geotechnical engineers to measure the shear strength properties of soil or rock material, or of discontinuities in soil or rock masses. The test is performed on three or four specimens from a relatively undisturbed soil sample. A specimen is placed in a shear box which has two stacked rings to hold the sample; the contact between the two rings is at approximately the mid-height of the sample. A confining stress is applied vertically to the specimen, and the upper ring is pulled laterally until the sample fails, or through a specified strain. The load applied and the strain induced is recorded at frequent intervals to determine a stress–strain curve for each confining stress. Several specimens are tested at varying confining stresses to determine the shear strength parameters, the soil cohesion (c) and the angle of internal friction, commonly known as friction angle. 12 Students should know how to use the advanced direct shear apparatus carefully.



Different Sieves in the laboratory

A sieve analysis (or gradation test) is a practice or procedure used in civil engineering to assess the particle size distribution (also called gradation) of a granular material by allowing the material to pass through a series of sieves of progressively smaller mesh size and weighing the amount of material that is stopped by each sieve as a fraction of the whole mass. Before using this, students should wear their safety gloves.



Soil sample

Soil test may refer to one or more of a wide variety of soil analysis conducted for one of several possible reasons. Soil tests may be done for geochemical or ecological investigations. During the soil testing, it is very important to wear safety gloves, protective clothing and safety glasses. Because sometimes soil samples may come from various contaminated and toxic environments like power plants, garbage storage, chemical waste storage etc.

4. Reference

1. <https://www.labmanager.com/lab-health-and-safety/2017/09/science-laboratory-safety-and-hazard-signs-meanings>
2. <http://www.healthcareinspirations.com>
3. *Laboratory Safety Policies and Procedures, The University of Connecticut*
4. <https://www.wikipedia.org>
5. <https://www.thesprucecrafts.com/safety-rules-every-woodworker-should-know-3536833>
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7. <https://emergency.vt.edu/ready/guides/building-fire/building-fire-during.html>