

Soil Laboratory Classes in Curtin University, Australia

Amin Chegenizadeh and Hamid Nikraz

Abstract—Soil mechanics is a traditional course in any university. Management of lab classes is one of the main issues to deliver a proper outline. In Curtin University, different methods applied to check the efficiency of these methods. One of them was mainly rely on demonstration and the other one mainly on involving students in running tests. Comparison between these delivery methods also are outlined in summary section. The recommendation also made that the more satisfaction is reachable while the students engaged.

Keywords—Soil, Geomechanic, Laboratory.

I. INTRODUCTION

LAB classes as a compulsory component of any units have a great impact on satisfaction of students. There are some researchers such as [1]-[4] who conducted some studies regarding management of the laboratory. This study novelty is to consider the number of student attendance to draw a proper lab management in handling soil mechanics laboratory.

The importance of proper laboratory class delivery is to help students to get better sense of understanding. In this regard, specifically in soil science and soil mechanics that counts as an issue to manage laboratory classes. Talking about the geotechnical tests always come with time issue, as most of the tests need a considerable amount of time to be done. For instances, teaching triaxial test Consolidated Drained (CD) is very difficult as each phase of the test would take ages if the sample of soil is fine rather than coarse.

This paper mainly introduces the testing system in geomechanic laboratory of Curtin University and compares the method of demonstration and engaging students.

II. DELIVERED TESTS

Particle size distribution (PSD), Compaction, index tests, direct shear and triaxial test and consolidation test were delivered during a year running of geomechanic laboratory.

A. PSD Test

The test method to evaluate the particle size distribution in any soil sample would be counted as PSD test. There are different methods to measure particle size distribution such as sieve analysis, electronic ways etc. In Curtin University, in order to evaluate PSD sieve analysis and hydrometer test were applied.

A. Chegenizadeh is researcher with Curtin University, Perth, Australia (e-mail: amin.chegenizadeh@curtin.edu.au).

H. Nikraz is head of civil eng and with Curtin University, Perth, Australia

A sample of PSD graph can be seen in Fig. 1.

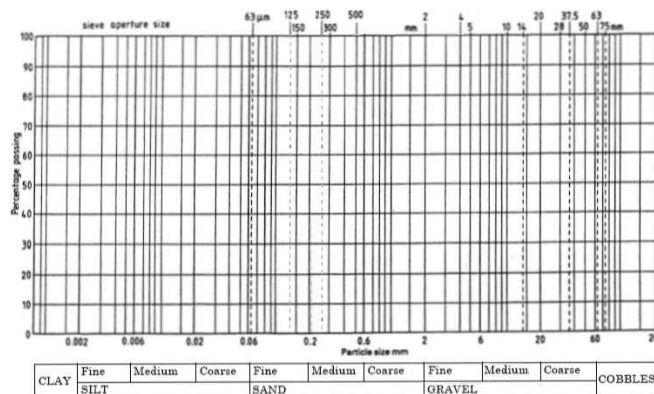


Fig. 1 PSD sample graph [5]

B. Compaction Test

The compaction test is used to evaluate the Optimum Moisture Content (OMC) and Maximum Dry Density (MDD). Fig. 2 shows a typical sheet.

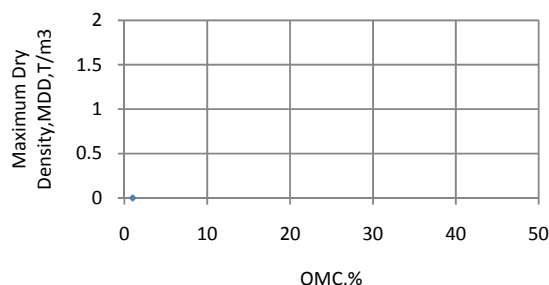


Fig. 2 Typical Compaction Sheet

C. Index Tests

In these tests all the atterberg limits were instructed. Calculation of plastic limits, liquid limit and plastic index were content of this section.

D. Consolidation Test

Consolidation teaching part mainly was focused on calculation of appropriate coefficients of consolidation, compression coefficient and swelling coefficient. Fig. 3 shows a typical sheet.

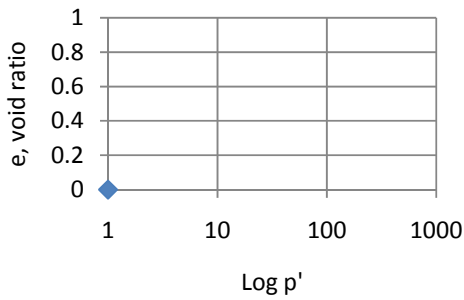


Fig. 3 Typical Consolidation sheet

E. Direct Shear Test

To get the relevant parameters of soil strength (i.e. friction angle and cohesion), direct shear testing was taught in lab class. The automated device was used in order to pass proper and recent content to students. Figs. 4 and 5 show typical sheets.

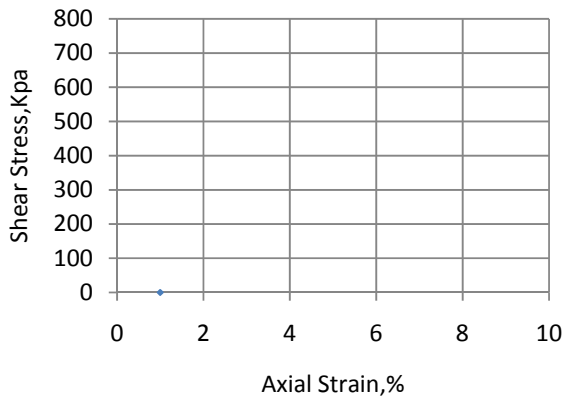


Fig. 4 Typical shear test sheet

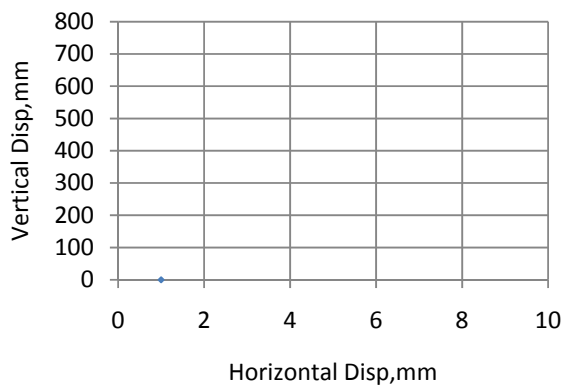


Fig. 5 Typical shear test(displacement) sheet

F. Triaxial Test

In triaxial testing, the students got acquainted with Consolidation Drained (CD) and Consolidated Undrained (CU) and also Unconsolidated Undrained (UU) test.

III. EXPECTATION FROM STUDENTS

Based on different testing which were offered to students, different expectation raised.

A. Particle Size Distribution Test

Particle Size Distribution test run for both fine and coarse material and the students were asked to provide the PSD graph.

B. Compaction Test

Compaction test delivered and the expectation was that students first listen to instructor and then start to get the graph of moisture content against the maximum dry density done.

C. Index tests

Index tests first were instructed by the lab engineer and then students were asked to calculate the soil index based on their lab notes and give the reports of index values.

D. Direct Shear Test

Direct shear test was delivered mainly demonstration type as wasn't possible to prepare sample and run by students. However, students were given a set of real raw data of direct shear test and were asked to provide suitable graphs as outlined in class. The device can be seen in fig. 6.



Fig. 6 Direct shear test machine [4,6]

E. Triaxial Testing

Triaxial test delivered mainly on demonstration type. The students were given the principle of triaxial testing and were asked to each explain what they need to do to handle the tests. The device can be seen in fig. 7.



Fig. 7 Triaxial Test Machine [4]



Fig. 9 Large Direct Shear test [7]

F. Consolidation Tests

Consolidation test was delivered and the students were given raw data to analyses and provide relevant graph as instructed in lab classes. Fig 8 shows the device.



Fig. 8 Consolidation Test [6]

B. Permeability Test

Another plan to enhance student understanding is to include the permeability tests. Curtin University have two types of test apparatus. First one is constant head and another one falling head.

V. PREPARING REPORTS

One of the main tools to evaluate the students work is to assess their reports based on their understanding. The students were asked to provide a report for their tests. The proper guideline was given to them to make sure about consistency of their reports. The guideline included format of preparation such as font, style, and margin and also ethic regarding to preparation of the report.

VI. BLACKBOARD SYSTEM

All the materials presented in an online system called Black Board (BB). BB is a very comprehensive online space which available for both lecturer and students. Students can easily see the materials which lecturer will put on the system. For laboratory course, also all the required material such as guidelines and other necessary information have been put in BB. (See fig. 10)

IV. FUTURE LABORATORY TESTS

There are different tests available in Curtin Geomechanics laboratory which may be implemented next year into laboratory syllables.

A. Large direct shear test:

One of the advantages of running a test in large direct shear device is to consider the scale effect on soil samples. As Curtin University has both small and large then through the comparison of the results of these two tests, scale effect analysis also can be analyzed. Fig. 9 shows the device.

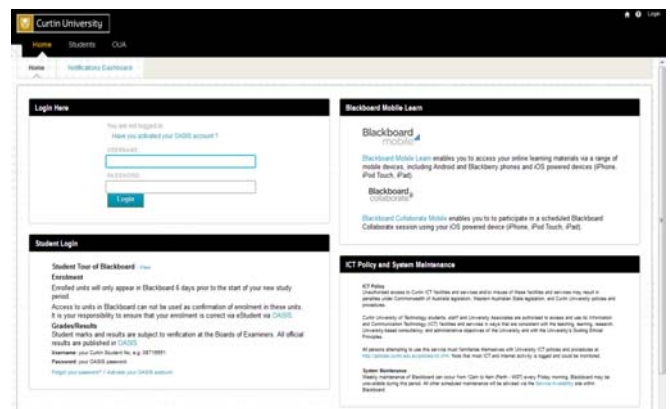


Fig. 10 BlackBoard (BB) [8]

VII. SUMMARY

The lab courses and the way to manage the classes proved that students' satisfaction mainly reached when students involved with running the tests by themselves rather than getting raw data and analyze the results. The number of students showed the class with engaging students attracts more students.

REFERENCES

- [1] S Franklin, M Peat - Australian Journal of Educational Technology, 2001 - ascilite.org.au, Managing change: The use of mixed delivery modes to increase learning opportunities
- [2] S Rozen, L Stein, N Goodman - Engineering in Medicine and Biology Magazine, IEEE (Volume:14 , Issue: 6) - ieeexplore.ieee.org, LabBase: managing lab data in a large-scale genome-mapping project 1995
- [3] AA Fryer, WSA Smellie - Journal of clinical pathology, 2013 - jcp.bmj.com, Managing demand for laboratory tests: a laboratory toolkit
- [4] Facilities in the Department of Civil Engineering at Curtin - Unboundcivil.eng.curtin.edu.au , viewed at 12/5/2013
- [5] tonygraham.co.uk, 2013, Viewed at 13/05/2013
- [6] geocomp.com website, , 2013, Viewed at 13/05/2013
- [7] vjtech.co.uk, 2013,viewed at 12/5/2013
- [8] Curtin University,Black board, 12/5/2013