CTR10132 – Transportation Geotechnics and Geonvironmental Engineering
RETAINING STRUCTURES
INTERNATIONAL DESIGN AND BUILD COMPETITION
COURSEWORK (20% of Module Marks)

Deadlines for submission
Report 1 (Conceptual design options): November 9th, 2022 by 1100 (UK time)
Report 2 (Failure analysis of tested walls): January 9th, 2023 by 1600 (UK time)

Notes:
a) This is a group/team submission, and it may be made in teams of 3-4 people.
b) Submission of Report 1 is via e-mail
c) Submission of Report 2 is via Moodle

1. Objective.
The focus of the coursework is to predict the failure of a soil-nailed/anchored/propped/reinforced earth retaining wall supporting a sandy backfill. The objective is to develop an accurate prediction of the behavior of a geotechnical system given detailed information regarding soil, boundary, and initial conditions, as well as the geotechnical and structural loading.

The use of any available geotechnical software and empirical correlations is allowed for design purposes, as is the development of a simple, accurate computer code for making predictions and/or other design/analysis calculations.

2. Design brief.
The design brief comprises two reports:

(i) A 1-page (max) report that includes conceptual design (i.e. layout and materials to be used). This report must be discussed in advance with your lecturer.
(ii) A 10-page (max) report that includes detailed design and analysis considering the test results of a model wall (you choose which of the tested models you want to analyse). This report must be submitted one week after the load testing of your chosen retaining wall has been performed

The report in (ii) shall contain the methods (assumptions, correlations, analytical procedures, numerical procedures, computer software, etc.) that the team employed to develop their prediction. All methods must be properly referenced. Assessment will consider reasonableness of prediction approach equations, material properties, factors of safety, assumptions as well as scientific/engineering rigor of the justifications/explanations provided. “Trial and error” results are not acceptable. The minimum requirement of this report is to demonstrate a meaningful discussion that compares experimental results and predictions performed empirically and/or analytically.

Note that each wall design chosen will be tested twice, both at Edinburgh Napier University and at Lucerne University of Applied Sciences and Arts. Hence report completion of your report would imply discussing any differences in building/testing approach and how these may affect the expected results. **Like in real life, you will be expected to discuss details with your international/local colleagues and this may be require virtual meetings arranged by your team at a time suitable for everyone and this may be outwith your timetable.**

Formatting requirements for all reports:
a. Cover page with names of group members (maximum 4 members per team/group)
b. An unlimited number of appendices can be included as long as they consist of graphs/images or calculations only.
c. 25 mm margins, single spacing, and 12 point Times New Roman font.
d. All pages after the cover page shall contain a header identifying the group surnames and a footer with the page number.

3. Sandbox

A retaining wall/structure needs to be designed and built within an apparatus hereafter referred to as a sandbox. The sandbox is made of plywood and comprises a base and three fixed vertical sides. The fourth side, also vertical, is a removable facing panel that serves as the temporary form against which the wall may be constructed. Internal dimensions of the sand box are: length 660 mm, width 457 mm, height 457 mm.

The sides of the sandbox enclosing the fourth side (the open face) are stabilised by a tie bar. Final sand fill level in the box will be to a sand fill depth of 300 mm (this is the aimed height of the retaining wall).

4. Backfill Sand

The backfill material will be clean, dry sand. The sand is a Leighton Buzzard silica sand, grade 10/18 obtained from Garside Sands, Leighton Buzzard – particle size distribution is shown in Fig.1. The backfill material will be used as is: no water, additives, or chemical stabilizers will be placed in the backfill material.

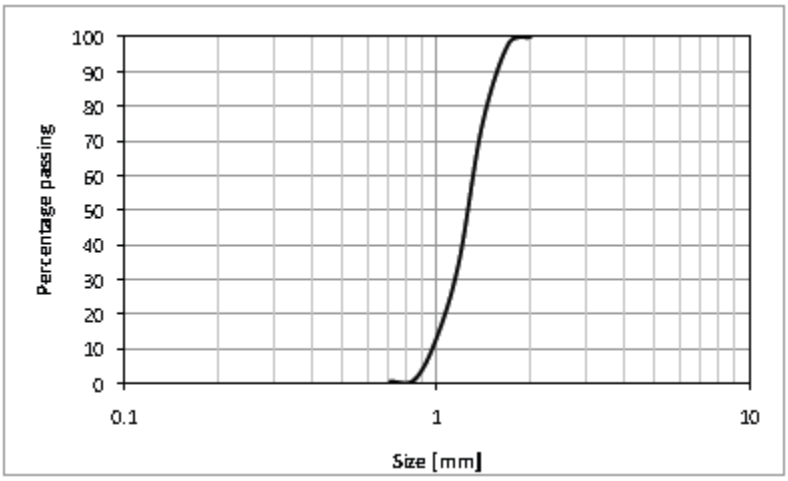

Fig.1. Particle size distribution for Garside 10/18 sand, as quoted by Garside Sands.

5. Wall Materials

The wall materials to be used are the designers' choice and may include cardboard, paper, string, sticky tape, spaguetti, marshmallows or anything else that you can easily acquire, test and use in order to provide a good design and model. Naturally the choice of materials may influence the type of retaining wall you design as well as its predicted failure load.

6. Model testing

A vertical load will be transferred to the structure via the platen using a constant rate of displacement of 1 mm/min by means of a computer controlled testing rig.

Test results in the form of a load-displacement curve will provided to all groups as part of the feedback. However, the aim of the coursework is to predict the failure load for the facing panel. Consequently, comparison of your predictions and the experimental measurements will be made.

Note: You will be invited to the model building and testing sessions but your attendance to these is not a requirement. All walls will be built and tested by the lecturers, aided by laboratory technicians and any students who willingly accept to help by adding a note about this on the first page of your conceptual design options report (i)