WASTE TO PRODUCT: POTENTIAL OF CONCRETE WASTE ADDITIVE FOR STRENGTH IMPROVEMENT OF PEAT SOIL

NORAZLINA BINTI RAZIZI

DIPLOMA IN CIVIL ENGINEERING TECHNOLOGY

UNIVERSITI MALAYSIA PAHANG

UNIVERSITI MALAYSIA PAHANG

DECLARATION OF THESIS AND COPYRIGHT

Author's Full Name	:	NORAZLINA BINTI RAZIZI
Date of Birth	:	
Title	:	WASTE TO PRODUCT: POTENTIAL OF CONCRETE WASTE ADDITIVE FOR STRENGTH IMPROVEMENT OF PEAT SOIL
Academic Session	:	2022/2023

I declare that this thesis is classified as:

☒	CONFIDENTIAL	(Contains confidential information under the Official Secret Act 1997)*
☒	RESTRICTED	(Contains restricted information as specified by the organization where research was done)*
☒	OPEN ACCESS	I agree that my thesis to be published as online open access (Full Text)

I acknowledge that Universiti Malaysia Pahang reserves the following rights:

1. The Thesis is the Property of Universiti Malaysia Pahang
2. The Library of Universiti Malaysia Pahang has the right to make copies of the thesis for the purpose of research only.
3. The Library has the right to make copies of the thesis for academic exchange.

Certified by:

(Supervisor's Signature)

(Student's Signature)

Ts. Dr. Nurmunira Binti Muhammad @ Atan

Name of Supervisor

Date: 3 Feb. 2023

_ New IC/Passport Number Date:

NOTE : * If the thesis is CONFIDENTIAL or RESTRICTED, please attach a thesis declaration letter.

THESIS DECLARATION LETTER (OPTIONAL)

Librarian,
Perpustakaan Universiti Malaysia Pahang,
Universiti Malaysia Pahang,
Lebuhraya Tun Razak,
26300, Gambang, Kuantan.

Dear Sir,

CLASSIFICATION OF THESIS AS RESTRICTED

Please be informed that the following thesis is classified as RESTRICTED for a period of three (3) years from the date of this letter. The reasons for this classification are as listed below.

Author's Name

Thesis Title

Reasons (i)

(ii)

(iii)

Thank you.

Yours faithfully,

____

(Supervisor's Signature)

Date:

Stamp:

Note: This letter should be written by the supervisor, addressed to the Librarian, *Perpustakaan Universiti Malaysia Pahang* with its copy attached to the thesis.

MAKLUMAT PANEL PEMERIKSA PEPERIKSAAN LISAN

(only for Faculty of Computer's student)

Thesis ini telah diperiksa dan diakui oleh
This thesis has been checked and verified by

Nama dan Alamat Pemeriksa Dalam :
Name and Address Internal Examiner

Nama dan Alamat Pemeriksa Luar :
Name and Address External Examiner

Nama dan Alamat Pemeriksa Luar :
Name and Address External Examiner

Disahkan oleh Penolong Pendaftar IPS :
Verified by Assistant Registrar IPS

Tandatangan :
Signature

Tarikh :
Date

Nama :
Name

SUPERVISOR'S DECLARATION

I/~~We~~* hereby declare that I/~~We~~* have checked this thesis/~~projec~~t* and in my/~~our~~* opinion, this thesis/~~projec~~t* is adequate in terms of scope and quality for the award of the degree of ~~*Doctor of Philosophy/ Master of Engineering/ Master of Science~~ in Diploma in Civil Engineering …………………………..

____

(Supervisor's Signature)

Full Name : Ts. Dr. Nurmunira Binti Muhammad @ Atan

Position : Senior lecturer

Date : 3 Feb. 2023

Universiti Malaysia PAHANG

Engineering • Technology • Creativity

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

____

(Student's Signature)

Full Name : NORAZLINA BINTI RAZIZI

ID Number : RA21142

Date : 13 DECEMBER 2022

WASTE TO PRODUCT: POTENTIAL OF CONCRETE WASTE ADDITIVE FOR STRENGTH IMPROVEMENT OF PEAT SOIL

NORAZLINA BINTI RAZIZI

Thesis submitted in fulfillment of the requirements
for the award of Diploma of Civil Engineering Technology

Faculty of Civil Engineering Technology

UNIVERSITI MALAYSIA PAHANG

JANUARY 2023

ACKNOWLEDGEMENTS

All honor and glory towards the Almighty God, thanks to Allah SWT for all of the opportunities, knowledge, guidance, and blessings that He presented me throughout the course of this research.

First and foremost, I would like to express my appreciation to Dr. Nurmunira binti Muhammad@Atan for sharing her pearls of knowledge with us over the course of this research especially her support, motivation, advice, and guidance offered to me during my studies. I would also want to pay my gratefulness to my beloved Mr. Ziunizan, Mr. Azmi, and Mr. Haliman the Technical Staff Laboratory for giving direction on the laboratory activities.

A special thanks to my mates, Hasya Najihah and Muhammad Syahmi for their cooperation and assistance throughout the laboratory experiment. My siblings deserve the same thanks for their valuable time and assistance when I need it. Thanks to all of them because this research will not be completed without their cooperation and assistance.

ABSTRAK

Tanah gambut adalah lembap dalam bentuk semula jadinya, dengan paras air yang sangat tinggi di permukaan tanah. Ia juga lembut kerana ia adalah organik (kebanyakannya terdiri daripada komponen tumbuhan yang mereput) dalam alam semula jadi. Tanah gambut juga dikenali sebagai tanah organik. Tanah gambut mempunyai ketumpatan pukal yang rendah kerana ia bersifat organik. Tanah gambut menjadi lembap kerana paras air yang tinggi dan kualiti tanah yang lembut, dan sukar untuk berjalan di atas tanah gambut yang tidak dikeringkan tanpa tenggelam. Akibatnya, ramai juruukur tanah tidak suka meninjau kawasan tanah gambut dara. Tanah gambut tanah pamah dara di Malaysia sering ditenggelami air dan paya. Oleh sebab itu, beberapa kawasan rawa gambut telah ditetapkan sebagai paya. Mereka tidak diternak dan disimpan tanpa rosak. Walau bagaimanapun, apabila pembangunan semakin maju, semakin banyak tanah mineral (bukan organik) telah habis, dan sempadan paya gambut telah didekati. Di tempat-tempat tertentu di Malaysia, seperti dalam kajian kami di mana kami memperoleh sampel dari Pekan ke Gebeng, terdapat sedikit pilihan untuk jenis tanah yang digunakan kerana negeri ini mempunyai bahagian tanah gambut yang besar. Kajian ini bertujuan untuk memahami penstabilan tanah gambut dengan bahan buangan yang dikenakan menaikkan kekuatan mampatan tak terkurung tanah untuk meningkatkan kekuatan ricih tanah gambut. Gambut telah distabilkan menggunakan bahan tambahan terhasil sisa konkrit. Dos ideal sebatian ini telah digunakan dalam nisbah kajian terdahulu. Kesan peningkatan kekuatan menggunakan pendekatan penstabilan telah diperiksa menggunakan ujian kekuatan mampatan tak terkurung (UCS) pada dua (2) hari pengawetan yang berbeza, iaitu 7 dan 28 hari pengawetan udara. Keputusan menunjukkan bahan tambahan sisa konkrit meningkatkan kekuatan tanah gambut dengan ketara. Kerja ini meningkatkan kualiti tanah yang tidak baik dengan menjadikan sisa industri dan institusi lebih berguna.

ABSTRACT

Peat soils are damp in their natural form, with a very high water table at the soil surface. They are also soft since they are organic (mostly composed of decomposing plant components) in nature. Peat soils are hence also known as organic soils. Peat soils have a low bulk density since they are organic in nature. Peat soils get damp due to the high water table and soft quality of the soil, and it is difficult to walk on an undrained peat soil without sinking. As a result, many soil surveyors dislike surveying virgin peat soil regions. Virgin lowland peat lands in Malaysia are frequently inundated and marshy. Because of this, several peat bogs were designated as swamps. They were not farmed and were kept unspoiled. However, as development advanced, more and more mineral (non-organic) soils were depleted, and the peat swamps' borders were approached. In certain places of Malaysia, like in our study where we obtained samples from Pekan to Gebeng, there are few options for what sort of land to use because the state has huge sections of peat land. This study aims to comprehend the stabilisation of peat soil with waste products subjected to raise the unconfined compressive strength of the soil in order to improve the shear strength of the peat soil. Peat was stabilised using a concrete waste-derived additive. The ideal dosage of these compounds was utilised in the earlier study ratio. The effect of strength increase employing the stabilising approach was examined using the unconfined compressive strength test (UCS) at two (2) distinct curing days, namely 7 and 28 days of air curing. Results showed that concrete waste additive considerably increased the peat soil's strength. This work enhances the qualities of poor soils by making industrial and institutional waste more useful.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

CaO	Lime

LIST OF ABBREVIATIONS

UMP	Universiti Malaysia Pahang
FTKA	Fakulti Teknologi Kejuruteraan Awam
LOI	Loss on Ignition
LULC	Land Use Land Cover
NUF	Neutralisation Underflow Residue
BS	British Standard
ASTM	American Society for Testing and Materials
OPC	Ordinary Portland Cement
DoE	Design of Experiment
OMC	Optimum Moisture Content
MDD	Maximum Dry Density

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Constructions on poor soil, such as peat soil, cannot be avoided when demand for land rises and availability becomes restricted. When subjected to even mild load increases, peat soils develop instability and significant primary and long-term consolidation settlements, according to the research findings. Many studies are being conducted to determine the best means of stabilising and upgrading peat soil. The approaches primarily focus on peat soil alteration and stability. Peat soil stabilisation is intended to strengthen the strength of this fragile and extremely compressible soil**.** There are several methods for stabilising and improving soft soil, one of which is the use of admixture.

Pahang's primary industrial region is called as Gebeng. But the majority of the area is covered with peatland. This study will use the Unconfined Compressive Strength Test (UCS) method to measure the shear strength of peat soil and add concrete. Concrete waste is created by many structural industries , particularly in the civil engineering sector, and this includes waste produced by educational institutions for instructional purposes. The concrete waste generated by the UMP structural laboratory will be used in this project. By utilised this waste, we may help SDG 11's objectives of sustainable cities and communities by enhancing the problematic soil.

There are several types of admixtures available. Chemical admixtures or chemical stabilisation have traditionally involve the treatment of soft soil with some type of chemical substance, which when applied to such soil causes a chemical reaction between the soil particles and chemical reagents. This chemical reaction improves soil's physical and engineering attributes such as moisture content, consistency limitations, strength, and volume change, among other things. Due to the typical properties of peat soil, which include a high natural moisture content, high compressibility and water-holding capacity, low specific gravity, low bearing capacity, and medium-to-low permeability, it is highly recommended to conduct the test by combining peat soil with concrete waste.

The purpose of this study is to see either aggregated concrete waste, is possible in increasing the shear strength of the peat soil. As a result, research was carried out to create and evaluate the performance of industrial waste in strengthening peat soils and improving soil stability in order to identify the acceptability of concrete waste for use in peat soil stabilisation.

1.2 Problem Statement

Geotechnical and civil engineers have recognised peat soil as one of the most challenging and troublesome soils on the planet. Peat soil's most notable qualities are poor shear strength, high compressibility, high moisture content, and high organic content, which make it an inappropriate soil type for building operations.

There is a lot of concrete waste in Malaysia that may be used. This project will make use of laboratory concrete waste. Gypsum waste from the factory would be combined with concrete debris from the University of Malaysia Pahang's laboratories for testing. The cement concrete will be crushed and mixed with gypsum. The study makes extensive use of industrial waste to increase the compressibility of problematic soil. The waste is collected from industry and academic institutions that commonly produce concrete waste from structural laboratories.

1.3 Objective

The following objectives are chosen for this study based on the significant characteristics of peat soil such as high compressibility, low shear strength, and high moisture content characteristics gained from theoretical analysis and evaluation of peat soil response to loading:

1. To improve peat soil strength with concrete waste
2. To understand the effect of curing time at 7 and 28 days on the soil strength of peat soil mix with 10% concrete waste by weight of soil.

1.4 Scope of Study

A site visit will be undertaken to Gebeng, an industrial region in Pahang State, to analyse the conditions that encourage the production of peat soil. A map of Pahang State's soil types will be used to identify the site of sample collection. The purpose of this study is to estimate the strength of peat soil using a chemical stabilisation approach, a mixture of industrial waste (gypsum) and concrete waste from UMP's Concrete & Structure Laboratory, and a mixture of industrial waste (gypsum). The visual classification of peat soil is utilised to facilitate sample collection, and the samples will be delivered to the FTKA Geotechnical Laboratory for further testing.

Unconfined compressive strength (UCS) tests will be performed on untreated peat soil and treated peat soil with different concentrations of gypsum and aggregated concrete waste. The test findings will be analysed to predict the stress-strain behaviour and strength of peat soil treated with different quantities of gypsum and aggregated concrete waste

1.5 Importance of Study

The purpose of this study is to understand the fundamental behaviour of Malaysia's problematic geotechnical soil. Researchers and industrial practitioners still lack understanding of soft soil.

As the result, by applying the soil stabilisation method to see the reaction between peat soil toward chemical agent. The chemical reaction that occurs within the soil will change the moisture content, shear strength, compressibility, pH values, and engineering properties of the soil. The soil bonding process may be increased by the chemical stabiliser, however the type of stabiliser employed will determine the type of bonding and the rate at which it develops.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

2.1.1 Peat

Regardless of the fact that peat-based marginal topography has become more and more necessary for building for financial reasons. Because of the difficulty in getting access to the site and other concerns related to peat's unique qualities, engineers are cautious to construct on peat. The behaviour of peat and the development of soil improvement techniques for peat soil formation have so received very little attention. Based on an analysis of the engineering parameters and the soil index, the best procedure should be selected.(Gertler, 2003)

Figure 2.1. Peat soil

Low peat soil bearing capacity was observed, with the water table and the presence of subsurface woody debris both having an impact (Rahman et al., 2016). Peat is therefore unsuitable in its natural form for sustaining any building. Due to its organic makeup, peat has a very acidic character. Create a way to stabilise this kind of peat using gypsum and waste aggregated concrete.

Due to its poor shear strength, high compressibility, and high initial water content, it is regarded as one of the problematic soils and is highly avoidable by the building industry. Peat soils are regarded as a problematic soil due to its high compressibility, high water content, and low shear strength (Sani et al., 2021). For the engineers, the presence of soft or peaty soil poses a serious difficulty. Pre-construction difficulties, post-construction failures, construction expenses, maintenance issues, and short- and long-term effects are only a few of the ways that these traits contribute to construction problems and difficulties (Hua et al., 2016).

These qualities result in hurdles before construction, failures after construction, high expenses during construction, maintenance problems, and both immediate and long-term effects, among other concerns and problems (Hua et al., n.d.). Problems and challenges are regularly experienced when construction on peat fields. Even a little increase in load would create instability and long-term consolidation settling due to the extremely poor bearing capacity (Wahab et al., 2020). Major obstacles that engineers must overcome include instability, slip failure, localised sinking, and long-term settlement (Nasrun & Bin, 2018).

2.1.2 Concrete waste

Ordinary Portland Cement (OPC) is a common material used for soil stabilization. However, the material's price has risen rapidly as a result of the sharp rise in energy costs, and it is hazardous to Mother Nature. Furthermore, organic matter in peat contains humic acid and other organic acids such as fulvic and humin, which tend to delay the hardening of the OPC and significantly reduce the obtained strength and durability of the formed mineral structure. Because of the high affinity of acid and organic matter in peat for calcium, as well as its high cost and hazardous nature, stabilisation of peat using OPC as the sole binder is not recommended. To strengthen peat, an alternative cost-effective and environmentally friendly binding agent is required (Afnan Ahmad, 2022). In this case, the concrete waste from UMP Concrete & Structure Laboratory will be used in this study. Student or technical staff at the university will do the concrete works, as a result the initiative to use its concrete material that has already been improved or strengthened.

Figure 2.1.2 Concrete Waste

2.1.3 Unconfined Compressive Strength Test (UCS)

The Unconfined Compression Test is a laboratory test used to derive the Unconfined Compressive Strength (UCS) of a soil specimen. Unconfined Compressive Strength (UCS) stands for the maximum axial compressive stress that a specimen can bear under zero confining stress. Since stress is applied along the longitudinal axis, the Unconfined Compression Test is also known as Uniaxial Compression Test. UCS is a parameter widely used in geotechnical design. Figure below shows UCS Machine.

Figure 2.1.3: UCS Machine

2.2 Relevance of the Study

Despite of the fact, we use all of the waste is for utilizing industrial waste to significantly increase the compressibility of problematic soil. The technique of stabilising soil involves mixing it with various elements to enhance the engineering features of the soil. To enhance a soil's engineering qualities and performance, soil stabilisation entails changing or maintaining one or more soil parameters (Afrin, 2017).

soil stabilisation by adding various elements, such as chemical and mechanical stabilisation. However, the focus of this study is on chemical stabilisation, which entails combining chemical processes, such as the addition of soil amendments, with deep, medium, or top soil layers. In this study, gypsum and concrete scrap will be employed as chemical additives.

2.2.1 Challenges of Modern Facilities on Peat Land

Peat soil is difficult to recognize and analyze in regards of shear strength. The accuracy in determining shear strength is influenced by the origin, water content, organic content, and level of humification of peat soil (Huat et al., 2014). Peat's high levels of breakdown and moisture reduce its shear strength, however a high mineral concentration might increase shear strength (Zainorabidin & Mansor, 2016). Due to its strong fibre content, shallow peat often has higher shear strength than more humified peat that varies in depth (Norhaliza et al., 2019).

Hence, by using a sustainable design, choosing the right materials, cutting construction costs, increasing service life, and requiring less maintenance are only a few of the difficulties associated with developing infrastructure on peat. The most frequent issues with peat construction include settlement, inadequate bearing capacity, poor stability during excavation, and high ground water tables.

2.4.2 Chemical Stabilisation

Chemical stabilisation is a method of soil stabilisation in which processes within the soil are sparked and the soil's geotechnical properties are changed by the use of chemical agents. Soil alteration, soil stabilisation, or both can be categorised as types of soil improvement. To alter a soil's physical properties, active additives like cement and lime are used, whereas soil stabilisation entails improving a soil's texture, strength, CBR value, and shrink-swell qualities to make it totally suitable for long-term building (Sani et al., 2021).

When crushed concrete waste are mixed with peat soil, there is an increase in the shear strength of the peat soil. This shows that there is a chemical reaction that occurs in peat soil and concrete waste.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The research approach that will be applied to this study will be covered in this chapter. A study's methodology serves as the reason for the choice selected to carry out the study's objectives. To accomplish two goals, the approach will be implemented in two stages. The methodology flowchart is shown in figure 3.1 to clearly explain the approach taken to accomplish the goals. How to perform tests is covered in great length in Chapter 3.

3.1.1 Flow Chart

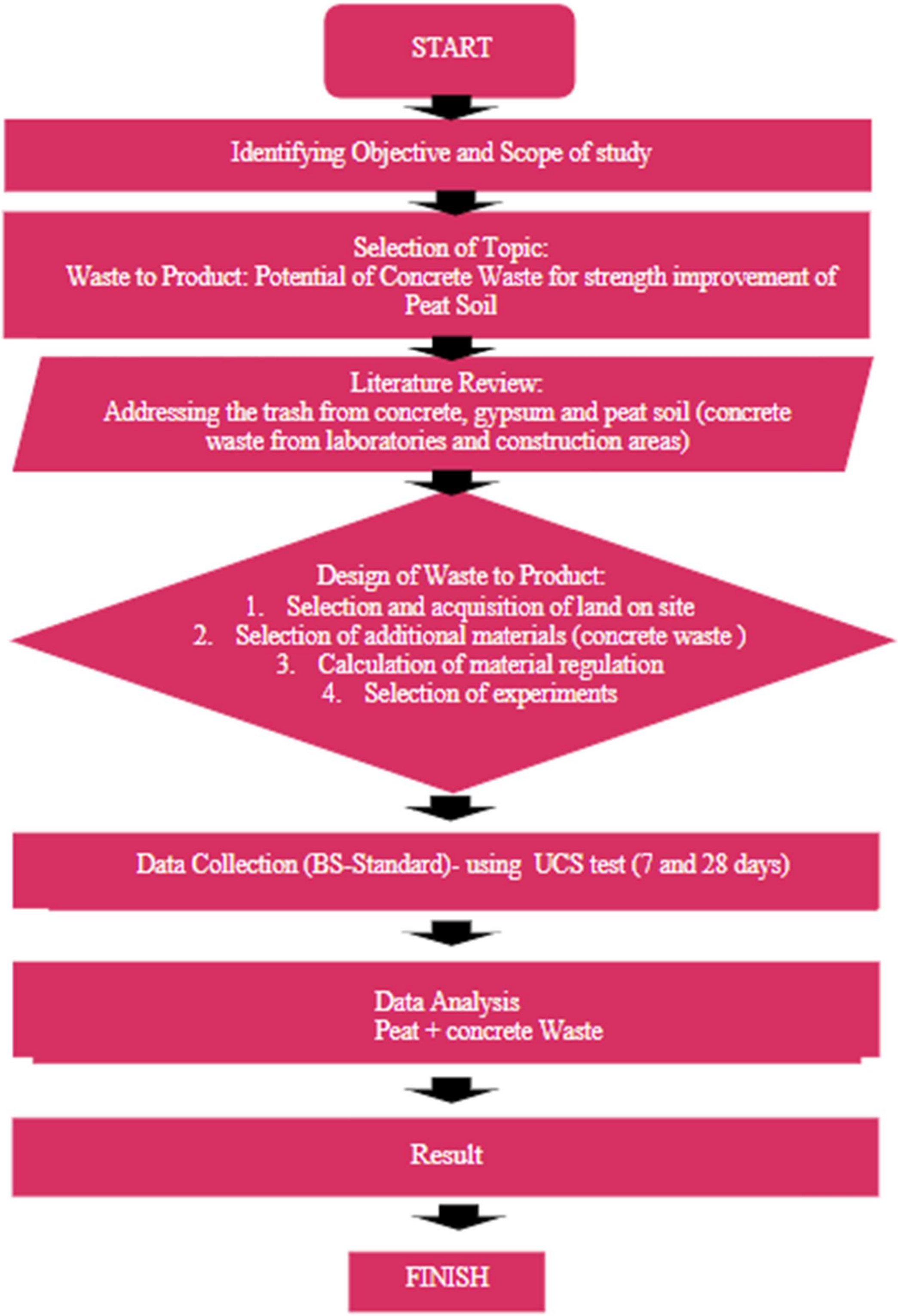

Figure 3.1.1 :Flow chart

3.2 Research Methodology

This research is an experimental study that focuses on aggregated concrete waste as a soil stabilisation additive to reinforce problematic soil. The peat soil sample was taken from a peat industrial region in Gebeng, Pahang State. Lab testing methods for this study will be carried out in accordance with British (BS 1377:1990) standards. The experimental study mainly focuses on laboratory testing to identify the significant characteristics of peat soil and the suitable dosage/proportion of stabiliser (concrete waste) that should be applied economically to offer efficient stabilisation of peat soil strength. Both treated and untreated soil samples were tested for engineering properties such as unconfined compressive strength test (UCS).

3.3 Sample collection

In order to determine the factors that favour the development of peat soil, a short site visit was performed to Gebeng (an industrial region) in Pahang State. Samples were obtained for laboratory testing as indicated in Figure 3.3 below. The site investigations assist in gathering broad data on the genesis and evolution of peat soils. It has been shown that environmental elements like temperature, humidity, and rainfall, among others, are the most crucial at the site visited, aside from the creation and growth of peat soil. It has been discovered that these factors affect the growth, features, and formation of peat soil in both direct and indirect ways.

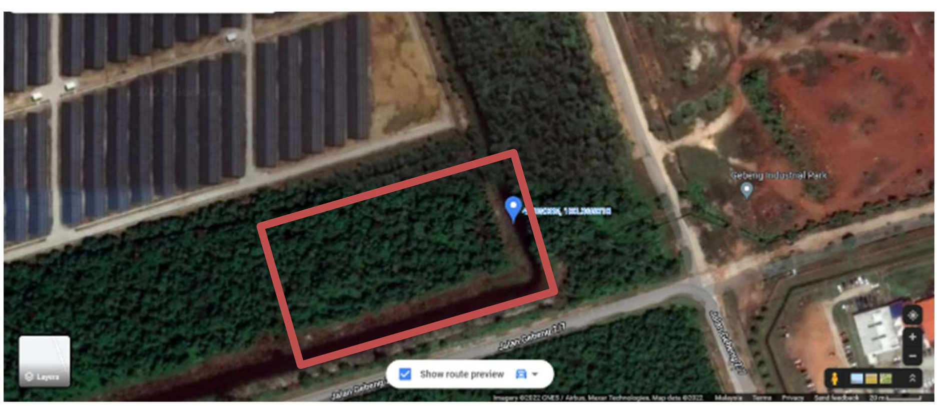

Figure 3.3 : The site at Gebeng, Pahang

The sample of peat soil that was taken was smelly and varied in colour from black to dark brown. Peat soil is further distinguished from inorganic soils like clays and sand by being spongy and very compressible. Cross-referencing the location with the Pahang state land use map, which was centred on the reported position, was done. The industrial region in Gebeng, Pahang (4°00'18.0"N 103°22'12.2"E), was chosen as the study's focus.

3.4 Preparation (Air drying soil)

For the production of the sample, British Standard 1377 Part 1:1990 was utilised as a guide. It was done because peat soils are sensitive to the air-drying test procedure. Before being physically broken down into any aggregate form, peat samples were first openly air dried at room temperature for 24 hours, then dried in an oven for the same amount of time at 105°C. Another pre-test sample preparation method is sieving.

Figure 3.3.1i : Air drying the soil

The concrete wastes were collected from the concrete and structural laboratory UMP and were crushed to a size of 1-2 mm with LA machine and later with steel hammer. Figures below depict the blocks from the concrete rubble in their initial and final sizes after being crushed and sieved to the required size.

Figure 3.3.1 ii : The crushing process of concrete waste from cube to fine aggregate

3.4.1 Sampling the soil

The experiment was conducted in the Faculty of Civil Engineering Technology's (FTKA) Soil Mechanics & Geotechnics Laboratory at UMP. The experiment was used to describe the geotechnical characteristics of the soil. The sample's on-site moisture content was assessed as soon as it arrives at the laboratory to prevent moisture gain or loss. Since peat soil is readily disturbed, the test was finished rapidly to prevent any change in the amount of water in the soil sample.

Figure 3.3.2 : The samples

3.5 Expected Outcome

The basic behaviour of Malaysia's problematic soil may be addressed by this research. Industry researchers and professionals still have a limited understanding of the variations in soil moisture content. To choose the appropriate building method, this is crucial in the early phases of construction, such as the design stage. The results of this study should provide fresh light on the relevance of variations in soil moisture content, or unsaturated soil. Furthermore, current or popular soil improvement methods like soil replacement and removal are inefficient since they disrupt the ecosystem. Finally, avoiding the procedure of removing and refilling soil will yield a more sustainable method.

3.6 Gantt Chart

In Table 3.5's Gantt chart, planning for the completion of Final Year Projects was shown. Within the 14 weeks plan period, which runs from October 2022 to January 2023, the study will be finished.

TASK/ WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14
BRIEFING														
LITERATURE REVIEW														
RESEARCH														
EXPERIMENTAL														
CURING TIMES														
RESULT														
ANALYSIS														
WRITE / CREATE														
EDIT														
REVIEW														
SUBMIT														

Table 3.5 : **The Gantt Chart**

CHAPTER 4

RESULT AND ANALYSIS

4.1 Introduction

The results of the research are given and analysed in this chapter with reference to the project's two primary objectives, which were to identify the engineering properties of peat soil and to analyse the strength of stabilised peat soil aggregated concrete waste. The chapter prior that described the study's methodology covered these topics. This chapter presents the conclusions drawn from the data analysis. As a result, this chapter includes discussion, data explanation, and hypothesis testing. The usefulness of aggregated concrete waste additive in peat soil strengthening was tested using index characteristics on peat soil. From the table 4.1, as the result, concrete with 10% concrete have the highest strength between all.

4.2 Results of tests on physical and geotechnical properties

From the figure 4.2, as the result, concrete with 10% concrete have the highest strength between all.

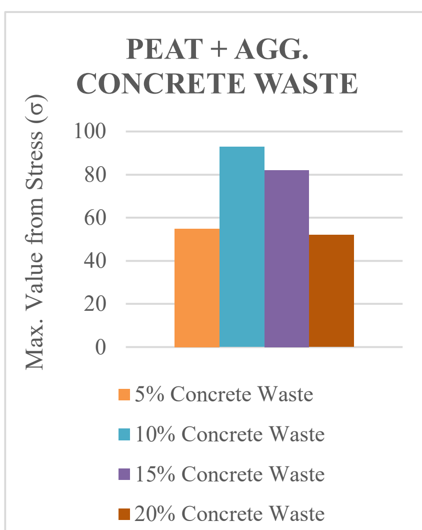

Figure 4.2 i : Graph for the Optimum ratio for Peat + Concrete Waste

The data obtained for the shear strength are shown in figure below . This Shear strength were being used to analysed either the crushed concrete waste could be use as additive in improving the Peat soil for the future use. The shear Strength for the untreated Peat soil is 36kPa while for the uncured is 82 kPa. For our research, we need to identified either the curing time effected the shear strength of peat soil in 7 and 28 days.

Parameter	UCS for Peat (kPa)			
	Untreated	Uncured	Cured (Air curing)	
			7TH DAY	28TH DAY
Peat	36	-	-	-
P (90%) +CW (10%)	-	82	97	180

Table 4.2: **The result for 90% Peat soil + 10% Concrete waste**

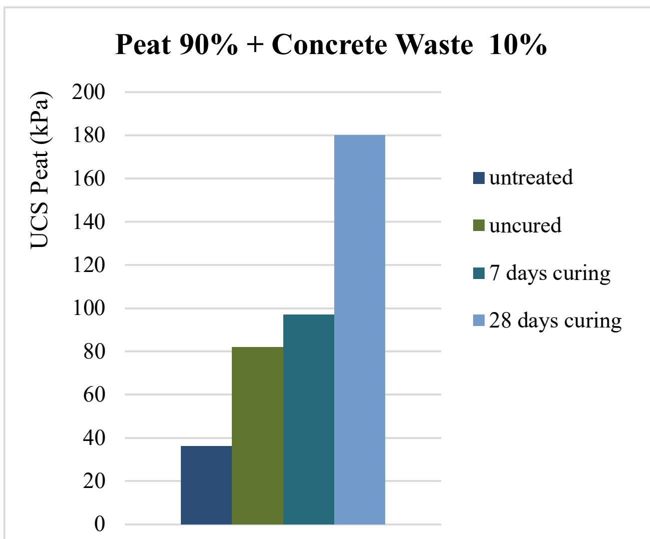

Figure 4.2 ii : Graph for the result (90% Peat + 10% Concrete waste)

As the result here, the treated peat soil which had been cured for 28 days have the highest shear strength. To analysed the final result for 7 and 28 days, three samples had been made to determine the average shear strength in every curing days. The figure below show the result for every samples and the average data.

According to the data, mixes of concrete waste appear to have cementation properties. Compressive strength of stabilised peat soil rose from 97 kPa to 180 kPa after 7 days and 28 days of curing, respectively. With an increase in the curing time, stabilised peat's compressive strength rises. As a result, stabilised peat demonstrated a significant increase in compressive strength after peat soil stabilisation, which also supported the potential of using concrete waste as binder materials.

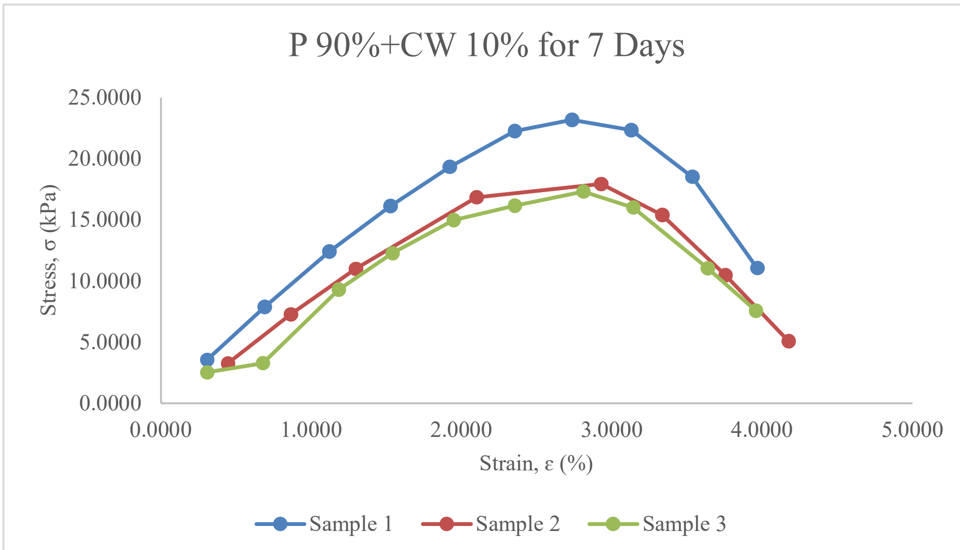

Figure 4.2 iii : Result UCS for 7 days

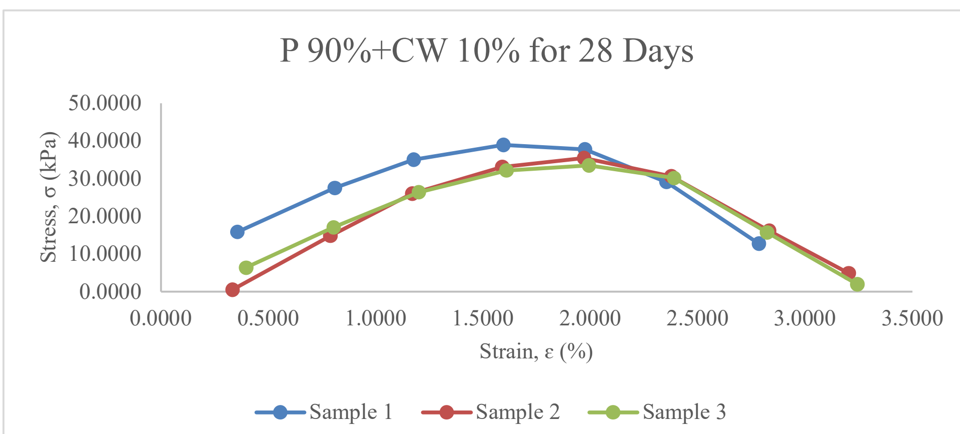

Figure 4.2 iv : Result UCS for 7 days

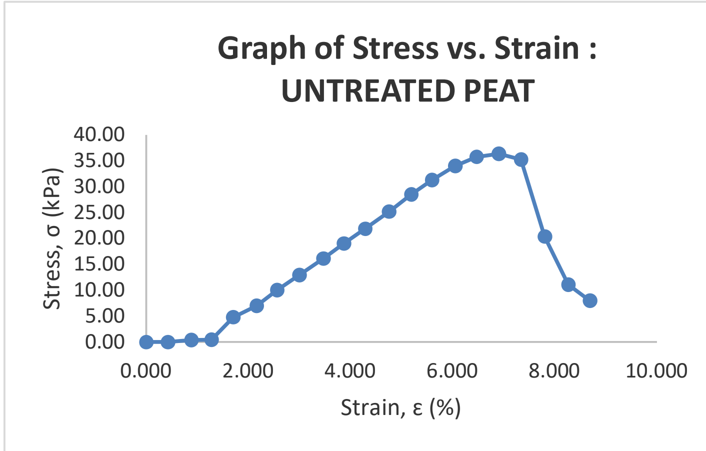

Figure 4.2 v : Graph for the Untreated Peat

Graph shown the stress vs strain of peat soil which had been test using UCS test on untreated peat soil. Untreated peat soil is actually peat Soil with no additive add in it.

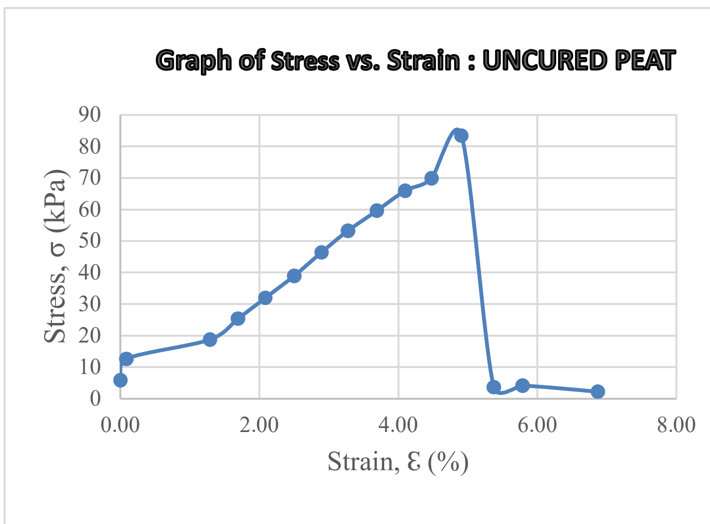

Figure 4.2 vi : Graph for the Uncured Peat

Graph shown the stress vs strain of peat soil which had been test using UCS test on uncured peat soil. Uncured peat soil is actually peat Soil with no curing days. We test it after done making the samples. So it is immediate test.

CHAPTER 5

CONCLUSION

5.1 Introduction

This study focused on the evaluation of the potential of Concrete waste additive for strength improvement of peat soil. The main of this study are to improve peat soil strength with concrete waste and to understand the effect of curing time at 7 and 28 days on the soil strength of peat soil mix at optimum ratio.

The findings of this study is to indicates that the waste of concrete materials manage to improve the peat soil in the peatland to overcome the issue on construction. As a result of its high organic matter and moisture content, peat soil presents a difficult problem for construction operations. However, stabilising soil has been shown to be a great way to increase the engineering qualities of the soil as well as reduce coal ash waste by using it as a component of a binder. Therefore, it is strongly recommended that concrete waste be used to improve the soil.

REFFERENCES

Hauashdh, A., Saphira Radin Mohamed, R. M., Jailani, J., & Rahman, J. A. (2020, May 1). *Stabilization of Peat Soil Using Fly Ash, Bottom Ash and Portland Cement: Soil Improvement and Coal Ash Waste Reduction Approach - IOPscience*. Stabilization of Peat Soil Using Fly Ash, Bottom Ash and Portland Cement: Soil Improvement and Coal Ash Waste Reduction Approach - IOPscience. Retrieved January 23, 2023, from https://iopscience.iop.org/article/10.1088/1755-1315/498/1/012011

Pumping, D. C. (2019, April 22). *How Long Does Concrete Take to Dry? | Dynamic Concrete Pumping*. Dynamic Concrete Pumping. Retrieved January 23, 2023, from https://www.dcpu1.com/blog/how-long-does-concrete-take-to-dry/

Ahmad, A., Sutanto, M. H., binti Ahmad, N. R., Bujang, M., & Mohamad, M. E. (2021, November 29). *The Implementation of Industrial Byproduct in Malaysian Peat Improvement: A Sustainable Soil Stabilization Approach*. PubMed Central (PMC). Retrieved January 24, 2023, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8658223/

H. Radwan, M. K., Lee, F. W., Woon, Y. B., Yew, M. K., Mo, K. H., & Wai, S. H. (2021, November 23). *A Study of the Strength Performance of Peat Soil: A Modified Cement-Based Stabilization Agent Using Fly Ash and Polypropylene Fiber*. MDPI. Retrieved January 24, 2023, from https://www.mdpi.com/2073-4360/13/23/4059

P.K., K., & M.P., P. (2010, April 1). *Peat Stabilization using Gypsum and Fly Ash | Journal of Civil Engineering, Science and Technology*. Peat Stabilization Using Gypsum and Fly Ash | Journal of Civil Engineering, Science and Technology. Retrieved January 24, 2023, from https://doi.org/10.33736/jcest.75.2010

Savo Kawa Abdulkareem, S. Hassan. (2019). Organic and Peat Engineering Properties , and their Suitability for Construction Projects Project Done by : Savo Kawa Sozi Hassan Project was Supervised by : Dr . Nihad Baban The American University of Iraq , Sulaimani. https://www.researchgate.net/publication/332715015

Duraisamy, Y., Huat, B. B. K., & Aziz, A. A. (2007). Methods of utilizing tropical peat land for housing scheme. *American Journal of Environmental Sciences*, *3*(4), 258–263. https://doi.org/10.3844/ajessp.2007.259.264

APPENDICES

Appendix A: Conducting the UCS test at Geotechnical laboratory

Appendix B: Preparing the samples for UCS

Appendix C: Preparing the mixture for the samples

Appendix D: Adjusting the load dial reading and deformation before run the test

Appendix E: Run the test for the samples at Geotechnical Lab