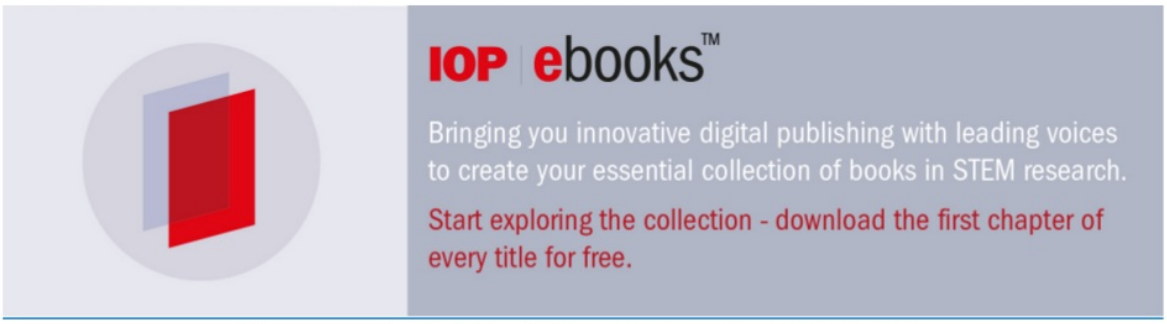
Experimental Study of Model in Folded Plate Soft Clay

by Ratna Dewi

Submission date: 13-Mar-2020 03:29PM (UTC+0700)
Submission ID: 1274883755
File name: 16._J._Phys.__Conf._Ser._folded_plate.pdf (522.5K)
Word count: 2938
Character count: 13955

Journal of Physics: Conference Series

Experimental Study of Model in Folded Plate Soft Clay



IOP Conf. Series: Journal of Physics: Conf. Series **1198** (2019) 082024 doi:10.1088/1742-6596/1198/8/082024

Experimental Study of Model in Folded Plate Soft Clay

Evin Oktavina*, Maulid Iqbal, Ratna Dewi

Department of Civil Engineering University of Sriwijaya

*E-mail: evin.oktavina@yahoo.co.id

Abstract. South Sumatra is a lowland with various types of clay and swamp with a relatively low soil carrying capacity and varies depending on their physical and mechanical properties. The purpose of this research is to know the carrying capacity of foundation folded plate with a various variation of a model on soft clay soil. This research is an experimental research. The experiment of soft soil sampling is done through experimental laboratory procedure done by laboratory test model (mini scale) in test box that is by loading test to plate model. The result of this research is an examination of physical properties which have been done in Soil Mechanics Laboratory of Faculty of Engineering Department of Civil Engineering Sriwijaya University that remolded soil is soft clay based on testing of water content, specific gravity, volume weight, filter analysis, hydrometer and limit waterberg. From the research results obtained the value that the type I folded plate with size b: 250 mm and t_1 : 10 mm, the maximum foundation bearing capacity of LVDT I is 0,059, type I with size b: 300 mm and t_1 : 10 mm type I with size b: 300 mm and t_1 : 10 mm 0.059 and type I with size b: 350 mm and t_1 : 10 mm 0.067 mm. The table above explains that Type II folded plate with size b: 250 mm and t_1: 10 mm, the maximum foundation bearing capacity of LVDT I is 0,072, type I with size b: 250 mm and t_1 : 10 mm type I with size b: 300 mm and t_1 : 10 mm 0.083 and type I with size b: 350 mm and t_1 : 10 mm 0.095 mm. index. The greater the load then the carrying capacity of the foundation the smaller the decrease. This is because in the testing of the Box has been doing the reinforcement of the soil through the installation of the model of plate foundations vary. So that the porous cavities are filled with particles that bind each other causing the soil structure becomes denser and easily compressed. And if the pressure from the loading then the decline of the soil will be less.

Keyword: folded plate, soft clay, LVDT, foundation bearing capacity

1. Introduction

1.1. Background

South Sumatra is a lowland with various types of clay and swamp soil has a relatively low soil carrying capacity in the form of clay or peat soil. The soil is the place to lay the foundation for a construction to carry and carry the burden of the building without collapsing and excessive deformation. The carrying capacity of soils varies greatly depending on their physical and mechanical properties.

The shallow foundation that is commonly used in the form of a concrete plate of a certain size is placed on a depth of real shallow soil. The shallow foundation support capacity can be determined from the calculation by adjusting the test of the soil data on the foundation.

A folded plate is one of the shallow foundations with a steel plate on the end there is a fold plate. The basic model of deformation behaviour compared to the conventional foundation model established under the same conditions.

The result of this research is the foundation configuration which gives the effect of acceleration and deformation which is placed on the expansive ground. The reduction of the foundation size to increase

the pressure on the foundation and also the reduction of the foundation reduction to increase the pressure on the foundation should be cautious for the removal of shallow foundations on shallow expansive soils.

1.2. Problems

Problems encountered are on determining the results of how the influence of the carrying capacity of folded plate foundation with various variations of folded size.

1.3. Research Objective

To know the carrying capacity of foundation folded plate with a variation of a model on soft clay soil.

2. Literature Review

The soil is the surface layer of the earth derived from the parent material that has undergone further processing, because of natural changes under the influence of water, air, and various - organisms both living and dead. The degree of change is seen in the composition, structure, and color of weathering results (Dokuchaev 1870). 2.1. Definition of Soil The soil is a natural object composed of solids (mineral materials and organic matter), liquids and gases, which occupy the surface of the land, occupy space, and are characterized by one or both of the following: horizons, or layers, which can be distinguished from their origin as a result of a process of addition, loss, transfer and transformation of energy and matter, or capable of supporting rooted plants within a natural environment (Soil Survey Staff, 1999).

2.1. Soil Classification

Classification of soil, in general, is the grouping of different types of soil into groups according to the nature of the technique and its characteristics.

2.1.1 USCS (Soil Classification System Unified Soil Classification System)

The soil classification system was first proposed by Casagrande and subsequently developed by the United State Bureau of Reclamation (USBR) and the United State Army Corps of Engineers (USACE).

Table 1. USCS Soil Classification System (Bowles, 1991).

Soil Type	Prefix	Sub Group	Suffix
Gravel	G	Gradation Good Bad	W P
Sand	S	Gradation Berlanau Clay	M C
Lanau	M		
Clay	C	wL <50%	L
Organic	O	wL> 50%	H
Peat	Pt		

2.1.2 Classification System AASHTO (American Association of State Highway and Transportation Official)

The AASHTO classification system is useful for determining the quality of land for roadworks, namely the base layer (subbase) and subgrade.

This classification system is based on the following criteria:

a. Grain Size of
b. Plasticity
c. When the rock (the size larger than 75 mm).

2.2. Clay Ground

Clay is a multi-component soil consisting of three phases: solid, liquid and air. The solid part is a polyamorphous composed of inorganic and organic minerals.

The properties of clay are as follows:

a. Fine grain size, less than 0.002 mm.
b. Permeability is low.
c. Capillary water rise is high.
d. Very cohesive.
e. High shrinkage levels.
f. The consolidation process is slow.

2.3. Foundation

Any civil buildings such as buildings, bridges, highways, tunnels, towers, dams/dams and so on should have a foundation that can support it. The foundation is part of a building that serves to pass the weight of the building to the ground where it stood (Terzaghi, Peck, 1987).

Based on Reinforced Concrete Structures, the foundation serves to:

a. Distribute and remove the loads that work on the structure of the building on it to the base layer supporting the structure.
b. Overcome the excessive decline and decrease is not the same on the structure.
c. Stabilize the structure in carrying the horizontal load due to wind, earthquake and others.

2.4. Land Support

Capacity The b Bearing capacity is the strength of the soil to withstand a load acting on it which is actually channeled through the foundation. The capacity of the boundary carrying capacity ($q_u = q_{ult}$ = ultimate bearing capacity) is the maximum pressure that can be received by the ground due to the working load without causing a shear slump on the supporting ground just below and around the foundation.

There are 3 possible patterns collapse carrying capacity of the land, namely:

a. Collapse of the sliding general (General Shear Failure)
b. Collapse of the sliding local (Local Shear Failure)
c. Collapse of the sliding wedge / penetration (Punching Shear Failure)

2.5. Folded Plate

To plan a reinforced concrete slab to consider not only the imposition only, but also the type of placement and type of connector at the pedestal. The stiffness of the relationship between the plate and the pedestal will determine the magnitude of the bending moment occurring on the plate. There are 3 types of plate platen on the beam, namely:

a. Located free
b. pinned elastic
c. Trap full

3. Research Methodology

This research carried out experimental research, conducted preliminary testing to determine the nature and characteristic of the media used. Implementation of soft soil sample testing is conducted through laboratory procedures that comply with ASTM standards (American Society for Testing Material).

Experimental research is done by laboratory test model (mini scale) in the test box that is by loading test (loading test) to plate model. Data collection method in this research is collecting data with an experimental test in Sriwijaya University laboratory.

3.1. Soil Data

The soil to be taken is soft clay soil with the test to be performed is as follows: Tests conducted on soil, intended to know the parameters of the soil and to identify the soil type. Implementation of soil sampling tests is conducted through laboratory procedures that conform to ASTM standards (American Society for Testing Material).

These studies include:

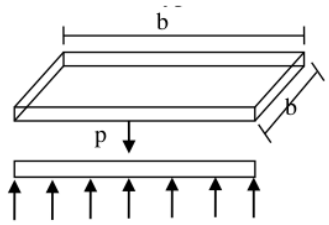
a. Water content testing to determine the water content according to ASTM D 2216-92 test rules.
b. Soil bulk density testing to determine the soil wetness according to ASTM D 4253-91 test rule.
c. Specific gravity (Gs) test to know the specific gravity of soil type with reference standard ASTM D 854-92.
d. Grain size analysis, to know the percentage of soil grain arrangement so that can be known type of soil to be tested according to rule of ASTM test D 422-63.
e. The direct shear test to determine the magnitude of the inner shear angle used to calculate the theoretical support capacity follows ASTM D-3080-9.

3.2. Variations Model Folded Plate

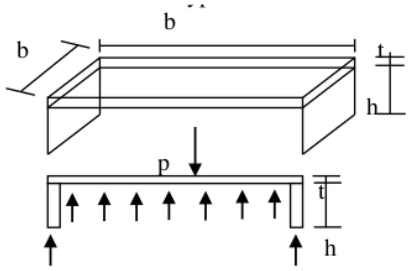
Table 2. Experiment type of foundation by using a folded plate

No	Tipe	Variabel (mm)			
		b	t1	t2	h
1	Folded Plate Tipe I	250	10	-	-
2		300	10	-	-
3		350	10	-	-
2	Folded Plate Tipe II	250	10	10	50
3		300	10	10	100
4		350	10	10	200

a. Folded Plate Type 1



b. Folded Plate Type 2



4. Analysis and Discussion

4.1. The Result of Physical Properties Test of Clay

In this research examination of physical properties in soft clay soil can be seen in the following table:

Table 3. Test Data of Soil Physical Characteristic

No.	Test	Result
1	Moisture (Water Content)	40.39%
2	Density (Specific Gravity)	2.63
3	Liquid Limit (Liquid Limit), LL	47.01%
4	Limit Plasticity (Plastic Limit), PL	24.81%
5	Plasticity Index (Plasticity Index), PI	22.20%
6	Percent Passedsieve No. 200	61.73%

From the physical properties test results obtained land classification based on soil based on ASSHTO included into the type of soil A-7-6, whereas according to USCS the soil belongs to CL group, that is clay with low plasticity.

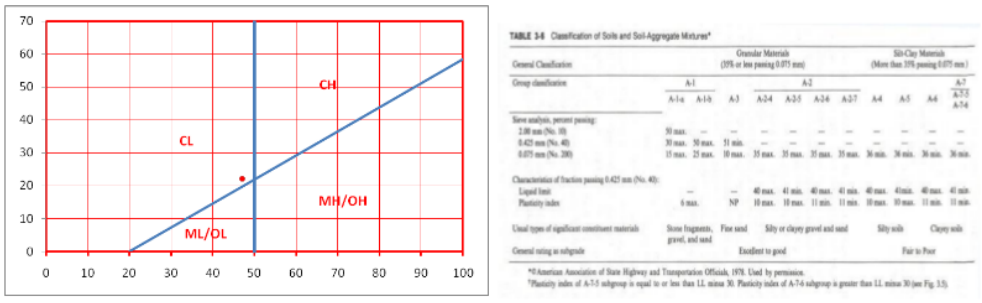


Figure 4.1. Land Properties Index

4.2. Discussion

Based on the results of the research, the compression index value (Cc) on the soft loam soil is smaller. This is because the cavities are filled with particles that bind each other so that the soil structure becomes denser and easily compressed. So when the pressure from the loading then the decrease of the soil will

occur less. The compression process of a small soil type can minimize the risk of damage to the construction above it.

Table 4 The carrying capacity of the foundation obtained the maximum load with a variety of sizes

NO	CHARGE	LVDT Type 1		
		1	2	3
1	0	0,001	0,001	0
2	20	0,002	0,002	0
3	40	0,003	0,003	0
4	60	0,006	0,006	0,003
5	80	0,014	0,014	0,009
6	100	0,020	0,020	0,012
37	120	0,028	0,028	0,021
8	140	0,033	0,033	0,035
9	160	0,036	0,036	0,051
10	180	0,048	0,048	0,059
11	200	0,052	0,052	0,064
12	220	0,059	0,059	0,067
13	240	0,059	0,059	0,067
14	266	0,059	0,059	0,067

The above table explains that the folded plate type I with size b: 250 mm and t_1 : 10 mm, the maximum foundation bearing capacity of LVDT I is 0,059, type I with size b: 250 mm and t_1 : 10 mm type I with size b: 300 mm and t_1 : 10 mm 0.059 and type I with size b: 350 mm and t_1 : 10 mm 0.067 mm.

Table 5 The carrying capacity of the foundation obtained the maximum load with a variety of sizes

NO	CHARGE	LVDT Type II		
		1	2	3
1	0	0	0	0
2	20	0	0	0
3	40	0	0,005	0
4	60	0,003	0,006	0,006
5	80	0,009	0,013	0,011
6	100	0,012	0,024	0,021

37	120	0,021	0,038	0,039
8	140	0,035	0,043	0,051
9	160	0,051	0,063	0,067
10	180	0,059	0,073	0,079
11	200	0,064	0,079	0,086
12	220	0,072	0,083	0,095
13	240	0,072	0,083	0,095
14	266	0,072	0,083	0,095

The above table explains that the folded plate type II with size b: 250 mm and t_1 : 10 mm, the maximum foundation bearing capacity of LVDT I is 0,072, type I with size b: 250 mm and t_1 : 10 mm type I with size b: 300 mm and t_1 : 10 mm 0.083 and type I with size b: 350 mm and t_1 : 10 mm 0.095 mm. From this study it can also be concluded that the greater the burden the smaller the decrease with the use of the foundation plate (folded plate) as the foundation to strengthen the soil carrying capacity enough to affect the soil decline with the installation of plate model it minimizes the risk of damage to the construction on it on the shear strength of soil overall will increase.

5. Conclusion and Suggestions

After analysis and calculation of this research can be concluded as follows:

a. Grounding with the use of Plates (folded Plate) can reduce the decline that occurs in soft clay soil
b. From the results of the study note that the soft soil clay support capacity will increase when given reinforcement in the form of plates this means it can be used as a fine-grained reinforcing solution of soil, especially soft clay soil.

References

[1] Mwasha A, Christopher M, 2011, Journal "The Behavior of Folded Plate Foundation Models for Monopole Structure Erected on Expansive Clay Soil: A Laboratory Experiment", India.
[2] Wesley LD, 1977, "Soil Mechanics", Public Works Publishing Agency.
[3] Hardiyatmo Hary C, 2010, "Soil Mechanics II", Gadjah Mada University Press.
[4] W Guo, J Chu, 2013, Procedding "Suction Caisson Instalation in Shallow Water: Model Test and Prediction, Paris.
[5] Hadihardaja Joetata, 1997, "Base Foundation II Foundation of Foundation and Foundation", Gunadarma.
[6] Das, M. Braja. 1995. Soil Mechanics (Principles of Geotechnical Engineering), Volume I, Erland. Jakarta.
[7] Hardiyatmo, Hary Christady. 1996. Soil Mechanics1. PT. Gramedia Prawedia First. Jakarta.
[8] Hardiyatmo, Hary Christady. 2002. Soil Mechanics 2. PT. Gramedia Pustaka Utama. Jakarta.
[9] Rahmat Hidayat. (2013). Soil Science: Understanding Land According to Experts.
[10] Retrieved January 10, 2013, from http://foresteruntad. blogspot.com/2013/04/ilmu-tanahpengertian-tanah-menurut.html
[11] Terzaghi, K. Peck, RB (1965), Inner Mechanics. Practice Engineering Volume 1. PT. Gramedia Pustaka Utama. Jakarta.
[12] Adha, Idharmahadi., 2008, Practicum Guide to Soil Mechanics.
[13] Bowles, JE, 1989, Physical Properties and Geotechnical Land, Erland, Jakarta.

Experimental Study of Model in Folded Plate Soft Clay

ORIGINALITY REPORT

6%	5%	6%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	pertambangan.fst.uinjkt.ac.id Internet Source	2%
2	digilib.unimed.ac.id Internet Source	1%
3	"Encyclopedia of Engineering Geology", Springer Science and Business Media LLC, 2018 Publication	1%
4	Submitted to Universiti Malaysia Sabah Student Paper	1%
5	www.thaitransport.org Internet Source	1%
6	www.geokniga.org Internet Source	1%

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		