OPEN ACCESS

International
Journal
Of Modern Engineering Research (IJMER)

Determination of the suitable distance between the piles Support aspects excavation

Mahmoud M. Abu zeid,

Lecturer, Civil Eng. Dept, Faculty of Eng., Qena, South Valley University, Egypt,

SUMMARY:- *Knowledge of the appropriate distance between the piles support aspects excavation (Pile Retaining System) is very important, while drilling is very important. Determination of this distance depends on the type of soil, whether sandy soil or clay soil or any type of soils and also depends on lateral pressure resulting from the soil and the reality on these piles. Will be the representation of lateral pressure resulting from the soil is horizontally instead of vertical position while, the piles supported horizontally in order to control the distance which consists then arching the right behind piles of soil, which then collapses the soil. The distance between pilesdepends on several factors as; type of soil, the soil or lateral pressure, the length of pile, and pile diameter has been testing the model 100 cm x 100 cm x 50 cm was pressure to carry distributor equivalent to soil pressure, up 2.5 m taking into account the change in the distance between the piles of 20 cm to 40 cm to know the proper distance, which consists then arching soil with a change of diameter pile in each time to begins from 30 cm to 60 cm. All the tests were carried outin the lab Soil Mechanics and Foundations, Faculty of Engineering in Qena - South Valley University.*

Keywords:- *Piles Retaining System, Coarse Sand, ExcavationDepth, Relative Density, Pile Diameter.*

I. INTRODUCTION

Problems neighbor is one of the most important problems facing the site engineer during excavation, practical program to solve this problem, the work of many experiments and change many factors affecting in knowing the right distance between piles to support aspects of the neighbor During the excavation and this distance may be suitable steadily arching consisting of sand behind the piles. In other words, this distance after collapsing behind the arching sandy soil piles, has the experiment using the coarse sand, which represents the nature of the soil in the situ, must not be less than the length of the buried part of pile in the sand for about 1.5 times the excavation depth, as shown in Fig (1, 2).

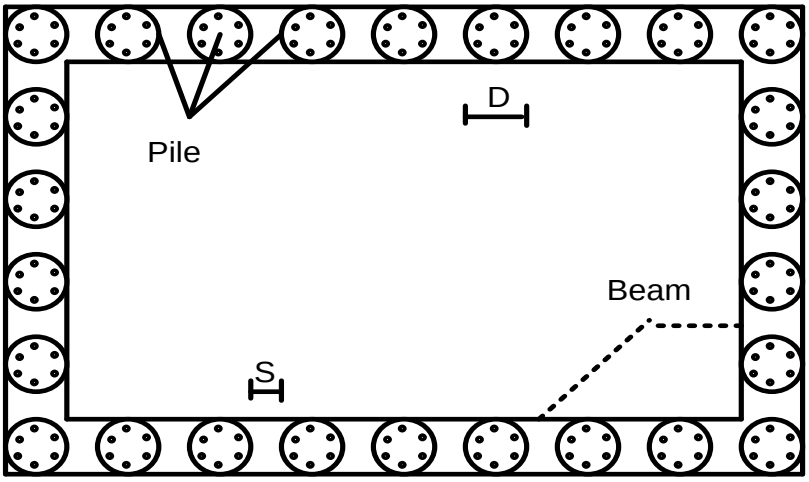


Fig (1): Arrangement Piles In Situ

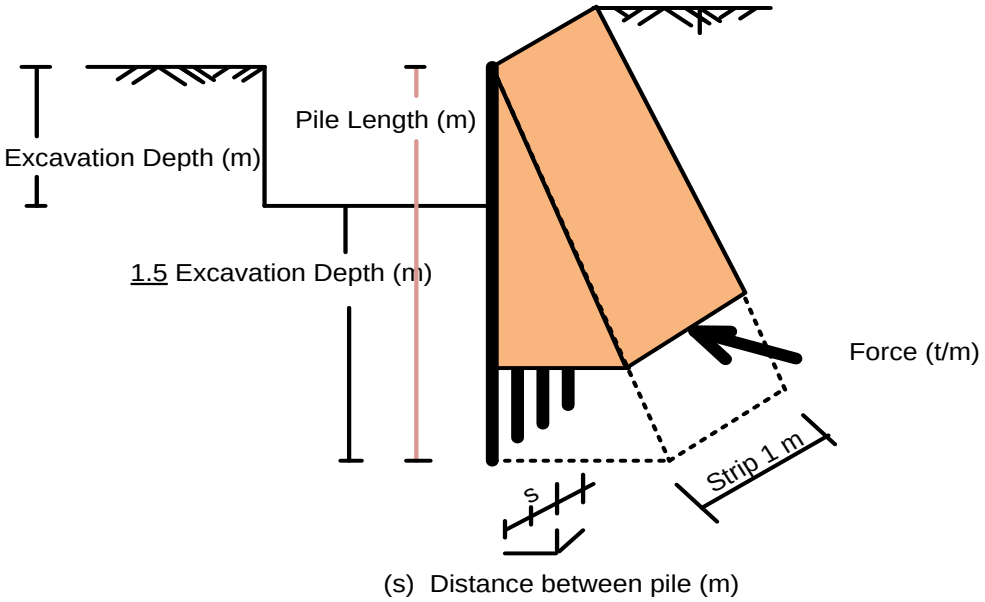


Fig (2): Correlation between Excavation Depth and Pile Length

II. EXPERIMENTAL PROGRAM AND MATERIALS

Experimental program consists of Model to simulate Site, length of the model 100 cm , width of 100 cm and depth of 50 cm represents the construction site work Done circular steel pipe diameter 2.5 cm represent diameter piles excavation(D) was used in this research to choose drilling piles 2.5cm diameter, 3.35 cm, 4.2 cm , and 5.0 cm. Control was in the selection of the distance between them by streams work to control the longitudinal listed in the distance during the lateral load pressure piles of soil in order to choose the suitable distance to the stability of sand behind the arching this piles.Lateral soil pressure coefficient calculated and the depth of excavation to give 1,2,3,4, and 5m carry on piles equivalent and limited density of the sandy soil behind piles (1.56t / m^3 ,1.62 t /m^3 , 1.65 t /m^3 , 1.72 t /m^3, and 1.76t /m^3). Tests were also done and change diameters piles and also change the depth of excavation in each test to reach the required safe distance(S) between piles which to collapses then the soil behind piles, shown in Fig (3).

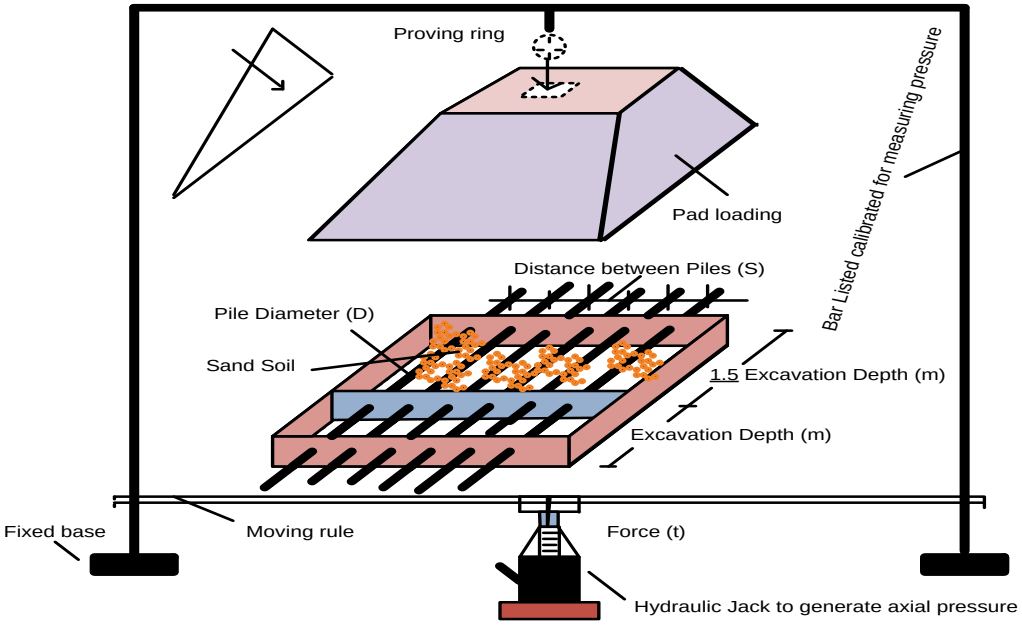


Fig (3): Model to simulate Site

2.1-Materials and Their Quality Tests:

It is important to know the properties of constituent materials of piles, which is a composite material made up of different materials such as concrete and steel bars. Sand soil has properties such as "relative density, shear box test, water content, and specific gravity. In the present study the effect of effect of the soil components on the distance between the piles. The experimentaltests are conducted in the laboratory of soil in the Faculty of engineering, South Valley University.

2.2. Grain size analysis

Particles size analyses were conducted on the three soil samples (coarsesand). The tests were performed in accordance to the (Standard Practice for dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants) and the results shown in Fig (4).

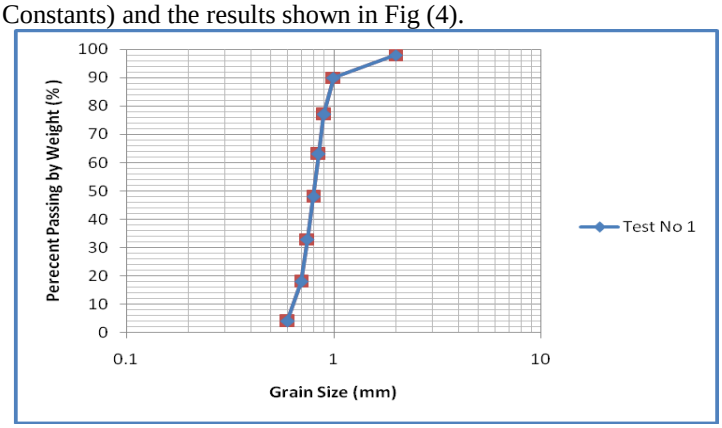


Fig (4): Particles Size Distribution Curve for Coarse Sand

2.3. Relative density.

The relative density is an index property used to describe the compactness of grained soil. It is determined by knowing the natural dry density of sand, also the minimum and maximum dry density when the sand is replaced in its loosest state and its densest state, shown as Fig (5).

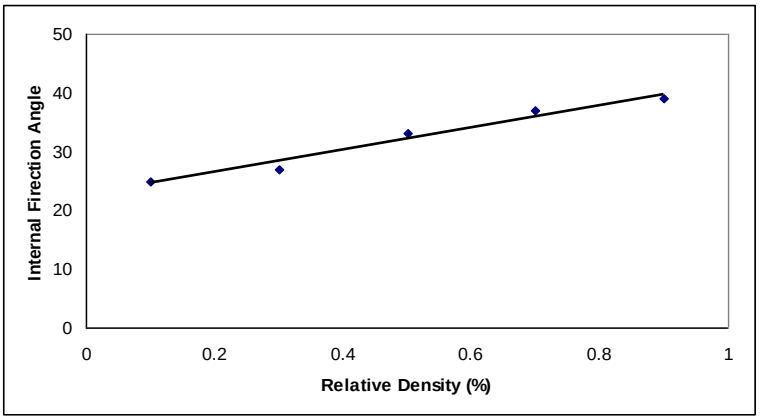


Fig (5): Relation between friction angle and relative density for Sandy Soil

2.4. Sample Categories:

Steel reinforcement used is high resistance steel diameter 16 and 18mm, less distance between the bars is 10 cm distributed full perimeter of pile in accordance with the Egyptian code for the design and implementation of reinforced concrete. The samples are 30cm,40 cm, 50cm, and 60 cm diameters of piles uses, shown as Fig(3). In the present study the total number of piles samples will be tested. The total number of concrete piles sample categorized and distributed according to the following factors:

1- Excavation depth required**.**
2- Diameter pile user (30,40,50 and 60 cm)
3- The density of the sand and active earth pressure for soil behind piles.
5 - Degree of compaction sand

III. RESULTS AND ANALYSIS

The results of the tests that were performed on the piles row within the model used, which represents the excavation site. Piles has been used with different diameters and change the distance between them by the pressure located on sandy soil Compacted, the samples were transferred to the materials and soil laboratory at the Faculty of Engineering, South Valley University .for compaction test for sand and stability arching behind piles, results of relative density. Excavation depth and force affecting on piles from earth pressure explained in table (1).

$$F = 0.5k_a\gamma H^2 \text{……..Eq(1)}$$

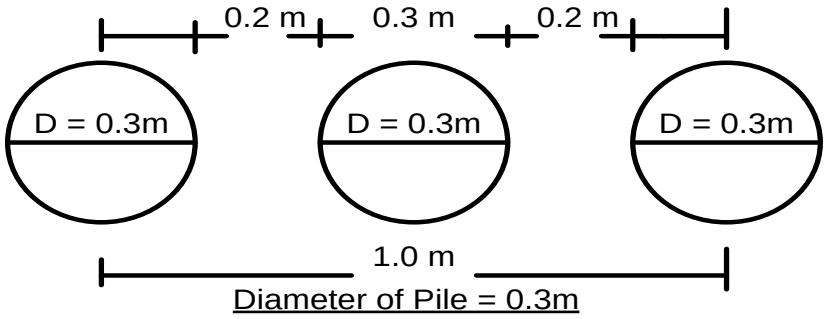
Table (1): Acting force on the pile at different internal friction angle and relative density

Excavation depth(m)	Pile length (m)	D_r (%)	$\gamma_{dry\ max}$ (t / m3)	Friction angle(ϕ)	K_{active}	Force (t/m)
1	1+ (1*1.5)	0.1	1.56	25^0	0.405859	2.0927
2	2+ (2*1.5)					8.3708
3	3+ (3*1.5)					18.834
4	4+ (4 * 1.5)					33.483
5	5+ (5 * 1.5)					52.318
1	1+ (1*1.5)	0.3	1.62	27^0	0.375525	1.9363
2	2+ (2*1.5)					7.7452
3	3+ (3*1.5)					17.427
4	4+ (4 * 1.5)					30.981
5	5+ (5 * 1.5)					48.408
1	1+ (1*1.5)	0.5	1.65	33^0	0.294801	1.5201
2	2+ (2*1.5)					6.0803
3	3+ (3*1.5)					13.681
4	4+ (4 * 1.5)					24.321
5	5+ (5 * 1.5)					38.002
1	1+ (1*1.5)	0.7	1.72	37^0	0.248584	1.3361
2	2+ (2*1.5)					5.3446
3	3+ (3*1.5)					12.025
4	4+ (4 * 1.5)					21.378
5	5+ (5 * 1.5)					33.403
1	1+ (1*1.5)	0.9	1.76	39^0	0.227506	1.2513
2	2+ (2*1.5)					5.0051
3	3+ (3*1.5)					11.262
4	4+ (4 * 1.5)					20.021
5	5+ (5 * 1.5)					31.282

3.1. Use a 30 cm diameter pile

When you use a 30 cm diameter piles,was found to be best suitable distance between piles leave in the longitudinal meter is 20 cm and pressing equivalent to the pressure of the soil or the way burden caused from the adjacent neighbor was found to be Arc be cohesive condition, minimum dry density 1.56t/m^3, excavation depth 5m and The maximum lateral force acting on the number of piles in the longitudinal meter is 52.32 t/$m^/$, shown as Fig (6), This distance approximately equivalent to (0.666666) diameter pile user.

$$S = 0.666666\ D \qquad \text{….Eq (2)}$$



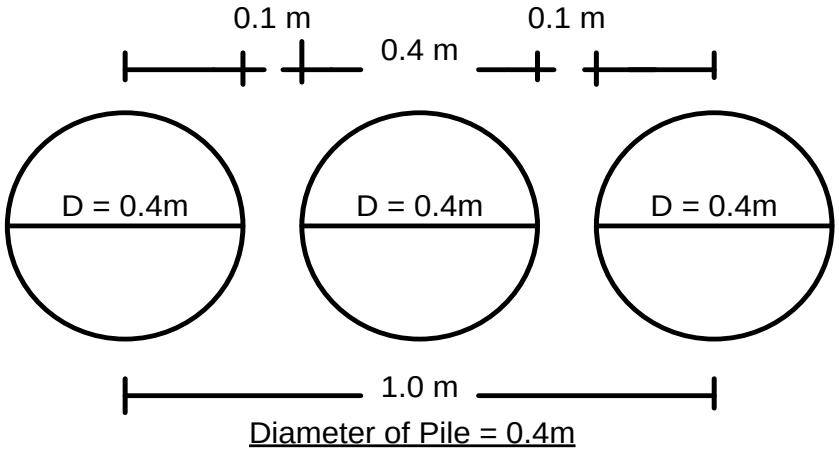
Suitable distance between piles per meter = 0.666666 D

Fig (6):The number of piles per meter and the distance between them

3.2. Use 40 cm diameters pile

When you use a 40 cm diameter piles,was found to be best suitable distance between piles leave in the longitudinal meter is 10 cm and pressing equivalent to the pressure of the soil or the way burden caused from the adjacent neighbor was found to be Arc be cohesive condition, minimum dry density 1.56 t/m^3, excavation depth 5mand The maximum lateral force acting on the number of piles in the longitudinal meter is52.32t/m, shown as Fig (7), .This distance approximately equivalent to (0.25) diameter pile user.

$$S = 0.25\ D \qquad \text{....Eq (3)}$$



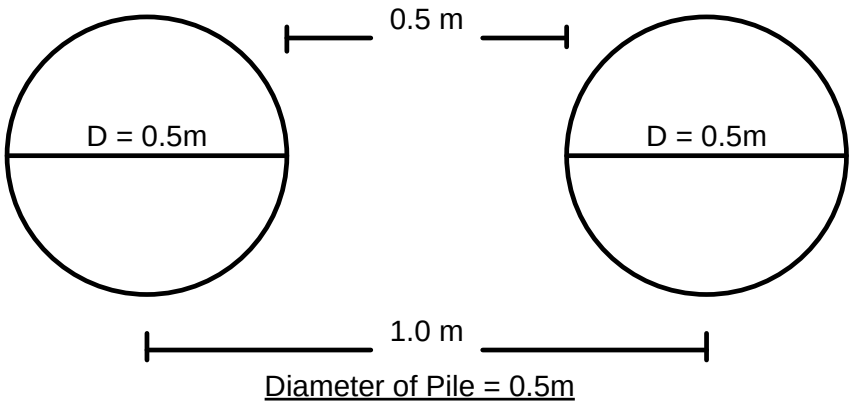
Suitable distance between piles per meter = 0.25 D

Fig (7): The number of piles per meter and the distance between them

3.3. Use 50 cm diameters pile

When you use a 50 cm diameter piles,was found to be best suitable distance between piles leave in the longitudinal meter is 50 cm and pressing equivalent to the pressure of the soil or the way burden caused from the adjacent neighbor was found to be Arc be cohesive condition, minimum dry density 1.56 t/m^3, excavation depth 5m and The maximum lateral force acting on the number of piles in the longitudinal meter is 52.32t/m/,shown as Fig (8), This distance approximately equivalent to diameter pile user.

$$S = D \qquad \text{....Eq (4)}$$



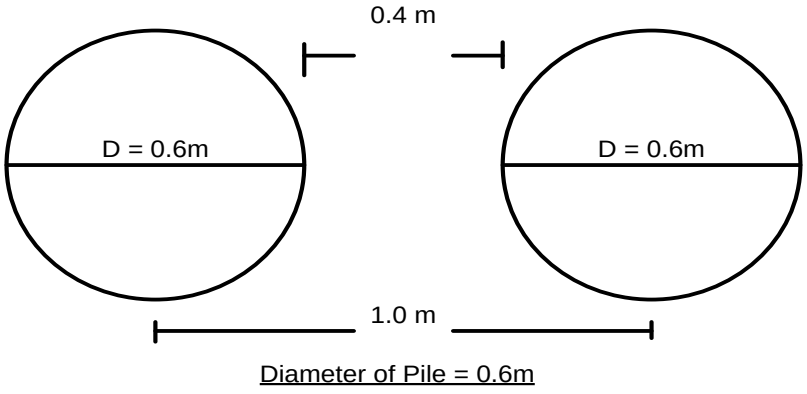
Suitable distance between piles per meter = D

Fig (8): The number of piles per meter and the distance between them

3.4. Use 60 cm diameters pile

When you use a 60 cm diameter piles,was found to be best suitable distance between piles leave in the longitudinal meter is 40 cm and pressing equivalent to the pressure of the soil or the way burden caused from the adjacent neighbor was found to be Arc be cohesive condition, minimum dry density 1.56 t/m^3, excavation depth 5mand The maximum lateral force acting on the number of piles in the longitudinal meter is 52.32 t/m$^/$, shown as Fig (9), This distance approximately equivalent to (0.666666) diameter pile user.

$$S = 0.666666\ D \qquad \text{....Eq (5)}$$



Suitable distance between piles per meter = 0.666666 D

Fig (9): The number of piles per meter and the distance between them

IV. CONCLUSION

The results show that the best required distance between piles during the support aspects of the neighbor or the road loads (Pile Retaining System) approximately equivalent to two third of diameter pile user in the case of the use of diameters 30 cm, (0.25) diameter pile user in the case of the use of diameters 40 cm, (D) diameter pile user in the case of the use of diameters 50 cm. and (0.666666) diameter pile user in the case of the use of diameters 60 cm. Several tests and load times and leaving different distances ranging from 10 to 50 cm and also different drilling depth from 1 m to 5 mwere carried out in the present study.Through the experimental work samples of coarse sand testedat minimum dry density 1.56t/m^3.Increase in soil density equivalent lateral force decrease in acting on Piles.from laboratory and field experiments show us he is the best diameter piles used

in support aspects of drilling(Pile Retaining System) is 0.4 m, because the distance between the piles each other in the longitudinal meter not exceeding 10 cm which is equivalent to 0.25 diameter pile user.

ACKNOWLEDGEMENT

Prof. Dr. Amr Mohamed Radwan, professor of soil mechanics and foundation, former Dean of Faculty of Engineering at Mataria, Helwan University, for his great efforts, continuous support and constructive guidance during preparation of this work, Also for generating many ideas and extensive suggestions, which greatly contributed in achieving this research

REFERENCE

[1]. VenkataRamasubbarao GODAVARTHI* , Dineshbabu MALLAVALLI, Ramya PEDDI, Neelesh KATRAGADDA, and Prudhvikrishna MULPURU, Contiguous Pile Wall as a Deep Excavation Supporting System, Leonardo Electronic Journal of Practices and Technologies/ Issue 19, July-December 2011 p. 144-160.
[2]. Ergun M.U., Deep Excavations, Electronic Journal of Geotechnical Engineering, Available at: www.ejge.com/Bouquet08/UfukErgun_ppr.pdf, 2008.
[3]. Manish Kumar, Deep support systems using diaphragm walls and contiguous piles, National Seminar on Deep Excavation in Urban Environment, Mumbai, 2008, p. 1-18.
[4]. Chang-Yu Ou, Deep Excavation: Theory and Practice, Taylor and Francis Group, London, UK, 2006.
[5]. Puller, M., Deep Excavations: A practical Manual, Thomas Telford, London, UK, 1998.
[6]. Moh Z.C., Chin C.T., Deep Excavation in Soft ground, Proceedings of ASIA Construction: New Frontiers, Singapore, 1991.
[7]. BD 42/00, Design of Embedded Retaining Walls and Bridge Abutments, Department for Regional Development, Scottish Executive Development Department, Northern Ireland.
[8]. Bureau of Indian Standards, Guidelines for Dewatering during Construction (IS: 9759), New Delhi, India, 1981.
[9]. Das B.M., Principles of Geotechnical Engineering, Cengage Learning, CT, USA, 2010.