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Precast Hollow Concrete Suction Pile

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Abstract: **Concrete pile is installed under still water (pond, lake or river) by removing water from inside hollow pile thereby creating vacuum inside it with the help of suction machine by the principle of pressure difference or pressure head. First of all underwater surveying is to be done with the help of sonar technique and then the typography of land below water is find out for making it in a single plane by cutting or filling depending upon the requirements. Install the suction pile by lift crane and then remove the water from inside of the pile by suction machine, so vacuum will going to be create inside hollow pile and hence outside of the pile is water and inside of the pile is vacuum therefore the pressure difference will be created due to which large water pressure is applied from outside of the pile will help for pile to go deep inside the soil till hard strata .similarly install all pile which is required for making the structure in the still water.**

Keywords: **Concrete pile, pond, lake or river, sonar technique.**

1. INTRODUCTION

Suction piles are large diameter hollow cylindrical open ended at bottom and closed at top. The term suction refers to the method of installation, by using suction machine to drive the pile inside the water bed, which implies sucking out the water entrapped in pile.

2. STATEMENT OF THE PROBLEM

1.If we use normal concrete pile first we have to form cassion and then digging process to install it so it is time consuming as well as uneconomical.

2.Hammering process require for normal concrete pile to fixed it in the soil bed under water and therefore cracks is formed and hence resulting into the loss of strength of the normal concrete pile.

3. Use of underwater concrete does not give satisfactorily result as the cement is washed away from concrete due to the continuous flow of water.

ABSTRACT: Concrete pile is installed under still water (pond, lake or river)by removing water from inside hollow pile thereby creating vacuum inside it with the help of suction machine by the principle of pressure difference or pressure head.

OBJECTIVES:

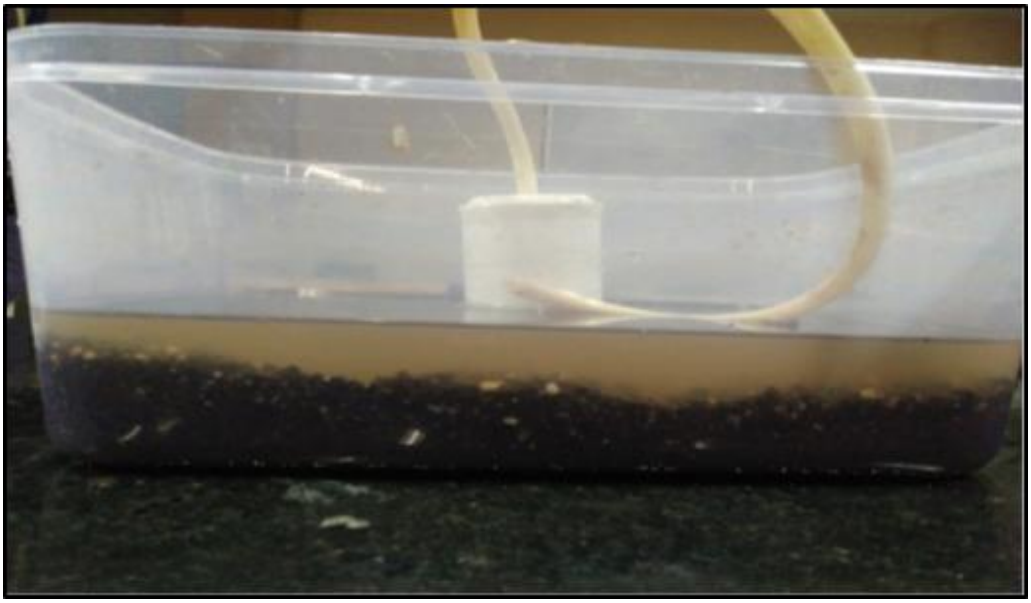
1. Reduce the cost of material for construction of precast concrete pile.

2. Reduce the labour cost.

3. To avoid cracks formation on pile during the installation of pile by avoiding hammering of pile.

4. Maintaining the strength of pile which improves the lifespan of the pile.

3. GRAPHICS



4. TECHNICAL PLAN

EXPERIMENTAL METHOD/METHODOLOGY:

1. Before starting any construction inside water firstly we need to know topography of ground inside the water for that we use sonar technique.

2. After knowing the entire surface we will install hollow concrete suction pile accordingly.

3. Due to the self-weight 20% of pile will go inside soft strata since soil is in submerged condition inside water, the shear strength of soil is negligible.

4. With the help of suction machine remove the water from hollow concrete pile to create vacuum inside the pile. Now inside pile is air and outside is water, pressure head will be created due to this pressure difference is created which helps the pile to go deep inside soil till hard strata.

5. As we know with varying water level water pressure will also vary to overcome such problem we will vary the diameter and thickness of hollow cylindrical concrete at various level.

6. Spacing between two pile should be more than 2.5 times its diameter.

PARAMETERS WHICH ARE TO BE CONSIDER FOR MAKING SUCTION PILE:

1. Wind force (F_{wind})

2. Water wave force (F_{water})

3. Self-weight of pile (w)

4. Siesmic force (F_s)

5 .length of pile (L)

6. Diameter of hollow cylindrical pile (D)

7. Thickness (t)

8. Water pressure (P_{water})

9. Vacuum pressure (P_{vacuum})

FORMULA FOR DESIGNING THE DIAMETER OF PILE:

By using Buckingham's-πmodel analysis,

$D=L*ø(F_{wind}/w,F_{water}/w,F_s/w,t/L,L^{2}*P_{water}/w,L^{2*}P_{vacuum}/w)$

MANAGEMENT PLAN:

1. Use of M27 grade concrete for high compressive strength for better durability.

2. Use of 6,12,16 Tor dia steel reinforcement tto resist lateral forces acting on the pile.

3Diameter and thickness of pile can be calculated by above relation.

4. Use of well graded aggregate and water to cement ratio is 0.35.

5. Avoid aggregate that are suspected to contain silica,use low alkali cement (0.5%)and use of pozzolons to avoid alkali aggregate reaction.

6. Increase the density of concrete by proper compaction.

7. Provide a surface treatment to the concrete with rubberized coating to avoid acid attack to avoid aggressive-water attack and acid attackthereby avoiding the disintegratiom of steeel reinforcement.

8. Use of hydrophobic cement to form water repellant film by adding steasric acid to OPC at grinding state.

OBSERVATION:

Assumption of 400mm dia Piles.

Dia of pile : 400 mm
capacity : 92 MT
No : 1 no
Av. Cut off level : 3.5.0 mtr below (+/-) 0.00 level
Termination level : 20 mtrs below cut off level Reinforcement
: 4 - 16 Tor + 4 - 12 Tor for 6.0m from cut off level
8 - 12 Tor for rest length
8 Tor circular links @ 200mm c/c
16 Tor @ 1000 mm c/c Tie rod
Grade of concrete : M27 [min 350 kgs of cement / cum of concrete & slump 150 -180mm]
Considering over flow of 300mm for M27 grade of concrete (27.0 + 0.30 = 27.30 m)
So, M25 grade concrete : 1x 3.14 x (0.50)2/4 x 27.30 = 5.35 cum = 5.35 cum / pile
Fine sand above cut off level (considering av. depth of (3.5 - 0.3) m above cut off level) = 1x 3.14 x (0.50)2/4 x 3.2 = 0.63 cum = 0.63 cum / pile

Total qty of Concrete & Fine sand:

Dia of Pile	No of Pile	Unit cum. per Pile	Total qty (cum)
500mm - M25	1	5.35	5.35
Fine sand	1	0.63	1

Reinforcement detailing of Piling work.
For, 400mm dia.

Dia of reinforcement	No	Length	Unit wt.	UOM	Total wt.	Remarks
12 Tor	3	7.5	0.89	Kg	20.0	upto 6.0m below cut off level
16 Tor	3	7.5	1.58	Kg	35.55	upto 6.0m below cut off level
12 Tor	8	19.3	0.89	Kg	137.4	rest upto pile bottom (26-7.5+0.8)
8 Tor	102	1.5	0.39	Kg	59.69	stirrups @ 200mm c/c.

Total weight of reinforcement pr 400mm diaa of pile = 285kg

OBSERVATION:

RATE ANALYSIS FOR CAST IN -SITU R.C.C. BORE PILE IN DMC METH OD FOR 25 3 MTR LENGTH

DESCRIPTION	U.O.M	QUANTITY	RATE	AMOUNT (INR)
	Dia	400MM		
CEMENT	BAG	25.67	390.00	10,011.30
M. SAND	CUM	1.08	918.19	991.64
STONECHIPS	CUM	1.549	1,959.98	3,039
F. SAND	CUM	0.63	459.095	289.23
BENTONITE	BAG	17.85	375	6,693.75
21,024.92				
LABOUR				
REINFORCEMENT	K.G	285	6	1,710.00
PILE OPERATOR.	NOS	1.6	300	480.00
MECHANIC	NOS	1.6	300	480.00
HELPER	NOS	6.35	200	1,270.00
FOR CONCRETING				
FOREMAN	NOS	0.25	300	75.00
MASSON	NOS	0.45	300	135.00
BELDAR	NOS	4	200	800.00
COOLIE	NOS	2.6	200	520.00
WATERMAN	NOS	2.5.	200	50.00
6,066.00				
LAB +MAT	27,024.92			
ADD 10% wastage				3,775.39
VAT ON 25% @ 0%	: ON 30% @4%: ON 55%- @13.5%		8.625	3,581.90
O.H & PROFIT @15%				6,766.68
			TOTAL	40,668.89

5. RESULTS

Hollow concrete suction pile require cost of installing single pile of RS40,668.89 whereas the normal concrete pile require cost of installing single pile of RS51,877.91.

6. CONCLUSION

1. If we use precast concrete suction pile in a place of normal concrete pile it should be economical as the labour cost is avoided by using suction machine.

2. We minimize the use of concrete material since it is hollow inside.

3. Earthquake bearing capacity will increase i.e. it can sustain earthquake resistance of 6.8-7.

4. Strength of pile can be maintained by avoiding hammering and hence lifespan of pile increases.

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