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Research Communication

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A Report on The Design and Field Execution Study for Friction Pile Process

***Abstract*: Objectives of studies are based on the design and field execution for the cast in-suite friction pile process. And additive detailing in improvements of concreting's and steel aspects ratio 40% of the steel used in a total amount of concrete. Drilling methods heavy rotational machines sets at shaft rods driven into a specific depth, facets of co-ordination points in a site plots. A base casing set with a ground to direct drilling followed the bentonite wash boring process, pumped used to slurry tanks. Erect the reinforcement cages with safety aspects, check the density 1.01 that specific property pored the concreting in boreholes castoff in a trime pipes shakes. And numerical investigations of BBS schedules, as final works completed to passing the pile load test. The consequence is total load settlement is not greater than twenty millimetres. Each concreting pile work starts before testing the slump values. The slump values range is not less than 150mm and not more than 160mm it followed ranges of values because is better workability in a pile concreting works. And followed spot test in field execution gauge erection process. It's checking in interior strips and hoops reinforcement spacing following the designs codes, and check the lapping length 2 rods joint connections, checks the vertical alignments.**

Key words: Drilling process, trime pipe, Concreting, BBS schedules, pile testing.

A diagnostic model for the structure of the geo-synthetic reinforcement (GR) in a heaped dike. This paper further approves this model with measurements from seven full-scale tests and four arrangement of scaled model investigations. Cast in-suite pile is to driven the specific depth and filled with a cast in place reinforcement cage. With longitudinal and transverse reinforced bars. CISS pile are as often as possible utilized for massive lifeline structures foundation[1]. Conventional when the building site comprises of delicate soft (or) liquefiable soil (or) when a huge sidelong soil twisting due to seismic stacking is normal. Precast cement concrete and RC pile strengthened solid pile treated[2]. The soil has been effectively connected to delicate ground improvement and axial load reaction of a solitary precast pile is currently treated soil depends on the shear reaction approach[3]. The single precast RC pile with bond treated soil strengthening is performed to check the adequacy and precision of the proposed methodology[4]. Lowering of drag load is believed for piles in some sort of group owing to the conversation between soil and pile[5]. It has been pointed out that the group result depends not just on typically the configuration of the pile group, but also upon soil slip along typically the pile-soil interface, governed primarily by the interface scrubbing coefficient and the garden soil settlement[6]. Various factors need to be included in an assessment of the group result, including the pile space, the quantity of piles in the group, the relative place of piles in the group, the pile variety, the pile installation approach, the surface loading as well as the stiffness of the garden soil[7]. The area study was executed by installing 21 full-scale tests on hollow bar micro piles at two sites[8]. Time-dependent grouting methods had been accustomed to evaluate the grout-ground bond strength[9]. The observed load-displacement behaviour indicated that typically the induced bond diameter involving the hollow-bar micro-piles seemed to be greater than the outcomes of theoretical calculations in addition to that their estimated bond strength was greater than typically the values recommended in present codes[10]. Geotechnical Eurocode 7 recommends verification of limitation claims by one or a combination of four attainable methods there are the use of computations, adoption of prescriptive methods, experimental versions and load testing or an Observational Approach[11]. Besides, based on the geotechnical design the European program code introduces geotechnical categories of constructions from 1 to 3, from relatively simple structures to structures relating abnormal risks, strange or exceptionally hard yard and loading situations. The geotechnical classes are in brand with local regulations.

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Materials and Methods: **Concrete Material:** It used in a minimum grade of concrete is M-25 but actually to be used for M30 and the maximum water/cement ratio is (50%) mix in required amount weight for cement. The concrete shall be the evaluation of cement to be utilized for piling ought to be least M25 (or as required at the site for burden conditions) with the base bond substance of 400 kg/m3 but mostly used in M30 grade concrete. Blending is completed in the mechanical blender as it were. In the event of pile accordingly presented to free water or if there should arise an occurrence of the pile where concreting is done submerged or boring mud utilizing strategy other than tremie, 10% additional bond over the structure evaluation of cement at the predetermined droop is utilized subject to a base amount of concrete determined previously. For the structure, reason forbore cast-in-situ pile, the quality of solid blend utilizing previously mentioned amounts of the bond is taken as M20.

Fig. 1. Concreting in pile after erecting the steel cages, tremie shakings of concrete flow compact inside of pile bored holes.

Concreting for the pile is to be finished with tremie of reasonable width. Normally adjusted shingle of proper size might be utilized as coarse total. It gives high droop with less water concrete proportion. For tremie pipe cementing totals having ostensible size more than 20mm must not be utilized. Scale batching is the total is constantly estimated by gauge bunching offering due to leniency for the water content in the total. Volume clumping of total ought not to be utilized.

Steel Material: The cast in place concrete friction pile used in high-quality steel grades. Forever Fe 415, 500, 550 HYSD bars are mostly provided. And follow 1810 section A reinforcement expect for steel lap embedded in 1.524m or less in the pile as well as provide reference 1810A, International building code 1810, [12]. The required reinforcement will be assembled and tied each other secondary helices reinforcement. And pile as a unit before the reinforcement cage portion on the pile is loaded up with concrete expect in augured. Uncased cast placed pile will be set after piles are concreted. And most important thing followed by % of reinforcement quantity in total concreting of the pile. 40% of the reinforcement cage used in the total amount of concrete.

Bentonite: Bentonite is required to the bored pilling process, the drilling shaft drilled in specified depth required which sufficient supports to resist the collapse of borehole[13]. And to limit unsafe effects of pressure alleviation and consequent unsettling control of encompassing ground. Practically all drilled pile development need a casing cylinder to offer help to the side of drill opening that is headed to bring down the supported case and sequential concreting to complete process for a pile. Indeed event in case the soil is cohesive or firm soil packing is wanted to neutralize the potential gaps. Drilling slurries with the utilized of which, packing kept can be avoided. The mechanical action in boreholes due to the slurry drill in borehole its gel formation property. Which adequate imperviousness to work against hydrostatic pressure of slurry. To recognize the stability of borehole and resist the collapsed sides of boreholes[14].

Drilling Methods: Drilling process of bored piles used in a rotation hydraulic pressure devises. In drilled a pre-moulded foundation pile to specific earth by impartial axial loadings, that drilling hydraulics machines shafts are impartial torque of approximately equal magnitude to the top and bottom portion of the pre-cast pile foundations. Clutch mechanics are followed by the driving process in co-ordination points in site plots.

a

b

c

Fig. 2. Picture a, b, c the drilling process is start and machines set correct coordination pile points.

Rotational shaft rod faceted for non-rotational engaging to the system of drilling machine its respectively clutching actions to press driven and takeoff and clear the driven shaft end blades and after or repeating to driven the lowermost portion of the foundation piles. That kind of action is minimized the twisting moment and even those overload, at the ratchets members it relived the clutches assembly slip to fall driven sides. Its most carefully to assembly the shaft prevent damage to the side walls bored holes.

Wash Boring Methods: The usage of wash borings is the maximum commonplace method for advancing a tedious of the mill because the technique is relevant to any soil, the intensity is limited only by the equipment's working, samples can be keen on a ramification of equipment, and in situ assessments can be done as the borehole is advanced, an ordinary drilling. Machines and its connected system are shown in figure 3. Hole drill pile that passes via a rotary table, powered by using an engine with the essential energy. The hollow drill pipe carries the right slicing device. A base casing is set with a T-segment above the ground to direct the drilling water to a maintaining tank. A pump will pressure water down the drill pile to elevate the cuttings, which can be tested to improve the concept of the formation being drilled. The water is pumped from the top of the tank, with additional water provided as important. Drilling ûuid can update the water if conceding happens. Everywhere one major drawback conventional borehole method is that it affords an estimated region of the failure base at one point along with an entire level. consequently, as a way to enhance the reliability of the slip surface region, multiple boreholes need to be drilled. but, this is time-consuming and it isn't always cost-powerful. consequently, the overall number of boreholes typically used in investigations.

Concrete Displacement: The bentonite slurry should have a low viscosity and contain the minimum possible amount of suspended soil particles if it is to be displaced by concrete placed through a tremie pipe or by pumping. It is therefore normal practice to use de-sanding equipment and, if necessary, de-silting equipment to remove soil particles from the slurry, or to replace the contaminated slurry with fresh or reconditioned slurry before the concrete is placed. Sometimes there can be a build-up of fine silt and clay particles in the slurry which cannot be removed by conventional de-sanding or desilting equipment. A practical upper limit has, therefore, to be set on the density of the slurry, after which it is considered to be unsuitable for re-use.

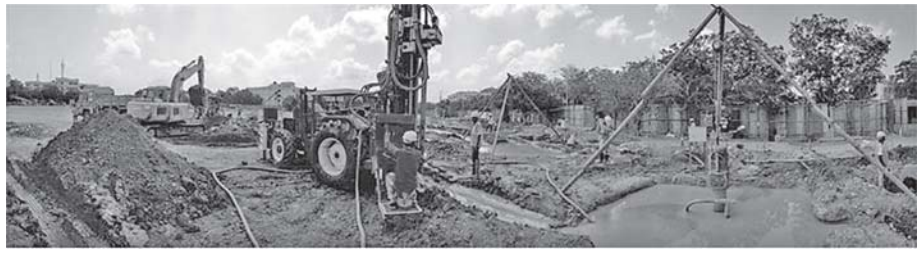


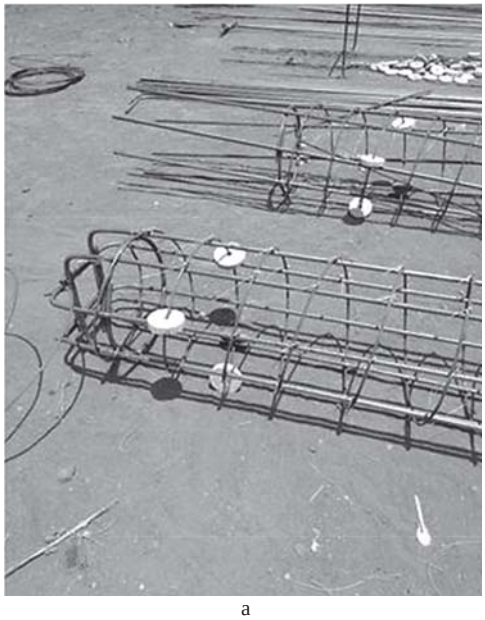
Fig. 3. Wash boring methods followed to drilled in pile borehole process.

Design Aspects for Cast-in-situ Concrete Friction Pile: These pile as end-bearing pile friction category the pile it sockets into the rock. It maximum load-carrying capacity is 150 to 300 tones that pile is designed is preferable in site conditions. For most bored to the sandy soil and cohesive soil is the maximum N values 40 to 50 ramming blows. Bored stiff cast in situ concrete piles construct in clay soil, the competence must be ascertained from shear strength of the supporting soil. Maximum bearing capacity of the pile in granular soil is taken by 0.3333 to 0.5 of maximum bearing resistant in the identical soil. Minimum spacing of pile is 2.5D to 3D. where D represents a diameter of piles. And the maximum limitation arrangement of longitudinal reinforcement is 40% into the dimension of the pile. The minimum limit is 32% into dimensions of the pile. Minimum numbers of primary rods are used 6-numbers and sizes is 12mm. minimum numbers of lateral or secondary reinforcement are used in 8mm and 150mmcentre to centre spacing is spiral form. And the most important thing is interior stripes provided in each 1.5m segments as like a length of steel cages. The M-25 grades are used but actually, usages in the site are M-30 grade concrete and following the proper mix design and used admixtures depends upon the cement quantity. Can subsist any cases avoid cement content less than 400Kg/m3. IS 2911 Part 1/sect. 2-2010.[15].

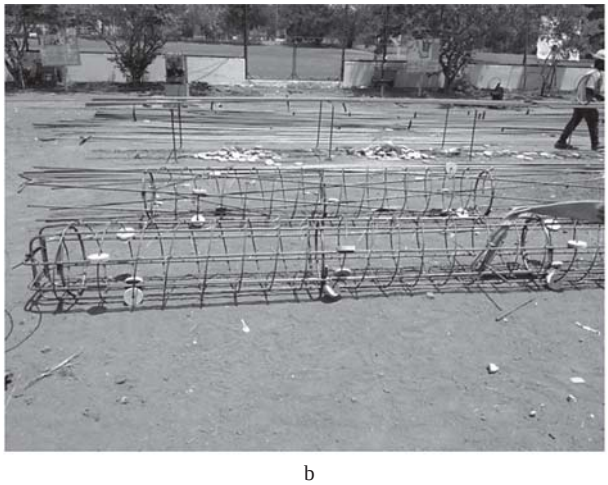
Lapping: Lapping is a conceptual usage of steel reinforcement connection with 2-cages, the total length of the pile is greater than 6-meters it creates the different parts of cages (refer figure 5). For model 20-meter depth of piles create 3-different part of reinforcement cages identically bottom cage, middle cage, and top Reinforcement cages with proved the proper cover blocks. Each cage erect in boreholes use the cranes, in sequence connectivity of provided the lapping. The lapping length of 2-longitudinal bars is 50 times in the main bar diameter. For the model diameter of the rod is 16mm is 0.8-meter and the adequate lap is welded.

Fig. 4. Lapping connection check in erection process in boreholes.

Reinforcement Cage Design: The RC cage design is followed by the construction process of schedules. It's simple to erect with proper props and concreting in the cast in place mass base substructures, comprising its reinforcement cage is distribution process. It following the workmanships different units perform the miscellaneous roles and have different responsibility guide following the standard cords. Yet they much all functioning collaboratively to discussed and ensure the safety features



a



b

Fig. 5. Picture a, b represent the Fabrication of works in on-site. That pictures include the Pile reinforced cages, bottom and middle cages.

create RC cages. It is 2- types category's followed the cage preparations permanent work design another one is fabrication design. The flinch of the cage construct process is for the geometry and reinforced steel to be designed by a permanent works designer. The job performance is like outcomes for permanent works designers to plan stimulating, easy to reinforcement stimulating or reinforcement are refining the lateral stiffness in the remedial condition. Its accessible allows for some least internal invigorating in the permanent works, Section drawings and it is modified the required addition things of the actual design. Make clear the designer base condition. Fabrication methods follow the design works assembled in both off-sites and onsite depends upon the works situations. The large complicated rebar cage detailing onsite is necessary. Assembling and lifting may be done by a monopoly unit. The units work within segments of completed the jobs, performed the contracting and subcontracting of cage preparation and to do well passing the cage in quality controls aspects of design forms and to again the verifications erect and concreting.

Erection of Reinforcement Steel Cage: The process following the detailed planning in pre-lifting operations for heavy lifting cages. It can do by concurrently with the fabrication process. Lifting operations on crane operations it yonder the scope of these forms.

Refer mechanical operations lift the heavy cages accurate place on the work. The impermanent condition is disputable the overall reinforcement cage lifting process, in heavy engineering cages, lifts and support system can still result is collapses for any change, mostly avoided the prematurely removed or damages.

a

b

c

d

Fig. 6. Erections of reinforcements steel cages.

Risk Assessments: Before the initiation of creation, site supervision, enlisted safety officials and other operate concerned must to together a direct examination of the potential threats emerging from the creation of fortification confines and define pertinent well-being measures to guarantee the security of workmanship. The hazard evaluation report ought to incorporate the names and places of the individuals who directed the evaluation, the date of the appraisal, and pertinent preventive and defensive measures proposed. The appraisal incorporates assessment of the dependability of the support confine creation area, for instance, regardless of whether the ground is even; and whether the paraphernalia is safe. On the off chance that it is important to move the manufacturing work or there is any huge change, a brittle threat examination and hazard assessment should be led.

BBS Calculations: Bar Bending schedules calculations are used for % of reinforcement cage in weight identified. It basic preparations for calculating the weight in reinforcement cage and estimate analysis of quantities. BBS preparation is referred to the approved section drawing and calculating the (volume of Steel bars x (unit weight of steel materials)) and adding the total numbers of bars in compression and tension reinforcement bar. Since following like simple volumetric dimensions is multiply with the unit weight of materials, values come-out to and again the multiple with the number of materials. Finally considered the weight of steel cages.

Table 1. Example Model Pile.

Description of pile	Required length
Depth of pile	21m
Diameter	0.6m
Inner Space ring (dia)	16mm
Spacing of hoop reinforcement c/c	150mm
Bottom anchorage length	300mm
Lapping wiled	1500mm

(refer to Table.1). That solution following the 3 steps of the process: Vertical bar, inner stiffener ring and outer helical ring. BBS for Column post, Each pole required length, So we need to lap extra bars to meet our necessity of 20 m stature. And added the lap length is 40d. mostly should be tied in the middle portion not in an upper and bottom section because of the lapping of cages.

Calculations for Model Pile: *Cutting length of longitudinal bars :* Total length and anchorage bend + total height of the pile +additional length of bars in upper direction main bars+ lap length - a clear cover of the bottom. The total length of the vertical bar is 23.899m.

Cutting Length of Inner Stiffener Rings: (Total length of pile /spacing)+1= (21000/2000)+1=12numbers. Length of Each Ring, Since it is circle like cross-section we need to identify the perimeter of ring length of Inner spacer ring = Circumference of Inner Ring = 6.28r. Where 'r' is a radius. Presently we have to know the curve of internal spacer ring We know the width of the pile(600mm) so it is anything but difficult to identify the breadth of the internal ring and the sections. The diameter of the inner ring is pile-dia - clear cover - diameter of outer spiral ring – diameter of vertical bars. The diameter of the inner ring is 514mm. where r=D/2=257mm. Length of inner space ring is 1.612m.

Cutting Length of External Helical Rings: Diameter of outer spiral ring(diameter of pile – clear cover) = 550mm. Consequently the radius of spiral ring (r) is D/2= 275mm. and length of 1-spiral ring is 6.28x275=1.727m, Total number of helical ring requirements is (21000/200)+1=101Nos.

Table 2. Bar Bending Schedules in Overall Pile Reinforcement.

Specification	Diameter of rods	Quantity	Bar length	Overall length
Longitu-dinal bar	20mm	12 No's	23.899m	276m
Inner stiffener ring	16mm	11Nos	1.612m	17.732m
External helical rings	8mm	101Nos	1.727m	174.427m

Load Test on a Pile: Load test on a pile is one of the best methods of determining the load-carrying capacity of a pile. It may be conducted on a driven pile or a cast in-suite pile, on working of the pile or a test pile is one which is used primarily to check estimate capacity. That setups for the load test on a pile consists of two solid blocks arrangements, provided with an 2-types of I beam girder, ISMB 600 primary girders seat in two numbers in longitudinal directions and touch with middle portion jacks, and 11 numbers of ISMB 300 secondary girder provided in traverse directions all the beams provided in proper supports in rigid mass (1m3) concrete blocks. (Refer the figure 8)

The test pile should be at least 3B or 2.5 m clear from the anchor piles. The load is provided in a top portion beam girders 252.34 Metric Tones + beam girder weights.

Fig. 8. Pile load test arrangements girders seat on 1-meter cube concrete blocks.

252.34 MT Total load provided. The load is applied through a hydraulic jack resting on the reaction girder. The measurement of a settlement of the pile is recorded with the help of three dial gauges, with respects of a fixed reference marks. The test is conducted after 3 days after the installation of the test pile in sandy soils, and after one month after the installation of the test pile in silts and soft clays. Driving test pile the soil properties are altered and with time many original properties are restored. The load applied the equal increments of about 20% of the allowable load. Each load increment is kept for sufficient time till the rate of settlement of the pile is not more than 0.1mm/hours in sandy soils and 0.02mm/hour in clayey soils or a maximum of two hours (IS:2911-1979) [16]. For each load increment, settlements are observed at 0.5, 1, 24,20, 60 minutes. The loading should be continued up to 2-times the allowable load or up to the load verified the total settlement reaches a specific value. Increment of load settlement verified after the same process for load decrement at 1 hours interval and the final rebound is recovered 24 hours after the entire load has been removed.

Conclusion: Results of studies indicate the proper criteria of pile designs. Site model (600mm diameter and 21-meter depth) friction piles are perfect passes in limiting settlement criteria. According to IS 2911 part-4 1974. Fifty percentage of load total settlements is equal to 1/10th of the diameter of the pile. The net settlement is >20mm and gross settlement>25mm. For total load (242.34 Metric Tones).

Future Scopes: The types construction process is well better to check the maximum factor of safety in overall settlements, and again identified the load ranges is 2 times into actual load increment is required ranges of total settlement.

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