

BCE - 150244

# **CONSTRUCTION METHOD OF CAST IN SITU PILE**

A

Project report submitted to the Department of Civil Engineering of Sonargaon University  
(SU) in fulfillment of the requirements for the degree

of

Bachelor of Science in Civil Engineering

**Submitted**

**By**

**GROUP-5 (N)**

**Supervisor**

**Md. Imdadul Islam**

**Lecturer**

**Department of Civil Engineering**

**Sonargaon University (SU)**

**SUMMER, 2015**



**Sonargaon University (SU)**

**SUMMER, 2015**

**CONSTRUCTION METHOD OF CAST IN SITU PILE**

**A THESIS**

**BY**

**GROUP - FIVE**

**BATCH - N**

**Submitted to the Department of Civil Engineering, Sonargaon University, Dhaka  
in partial fulfillment of the requirements for the degree**

**of**

**B.Sc. IN CIVIL ENGINEERING**



**Sonargaon University (SU)**

**Department of Civil Engineering**

**SUMMER, 2015**

## **LETTER OF TRANSMITTAL**

July 10, 2015

To

Md. Imdadul Islam

Lecturer

Department of Civil Engineering

Sonargaon University (SU)

29/1, Kawran Bazar Dhaka-1215, Bangladesh.

**Subject: Submission of Project Report.**

Sir,

This is our great pleasure that we are submitting here with the project report on "CONSTRUCTION METHOD OF CAST IN SITU PILE". It is an important topic. The project report has been done according to the requirement and guidelines of the Sonargaon University (SU).

We hope that this report will certainly help you in evaluating our project report on "CONSTRUCTION METHOD OF CAST IN SITU PILE". We would be very glad to provide any assistance in interpreting any part of the paper, whenever necessary.

Thanking You

Sincerely your

AFM Abdul Hannan

ID-BCE-1403003751

Group Leader

Group- 5 (N)

## DECLARATION

This is to declare that the work and material presented in the report has been carried out by us and has not previously been submitted to any University/College/Organization for any Academic qualification



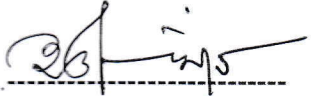



We hereby ensure that the work that has been presented does not breach existing copyright.

We undertake to indemnify the university against any loss or damage arising from breach of the foregoing obligation.

Thanking You

Sincerely your

### Group-5 (Batch-N)

1.  ----- A.F.M. Abdul Hannan ID-BCE-1403003751	4.  ----- Md. Nurul Islam ID-BCE-1403003770
2.  ----- Md. Yousuf Ali Khan ID-BCE-1403003752	5.  ----- Md. Nurul Huda ID-BCE-1402003223
3.  ----- Md. Zahidul Islam ID-BCE-1403003816	6.  ----- Md. Mahbubur Rahman ID-BCE-1402003232

**Department of Civil Engineering**

**Sonargaon University(SU)**



**SonargaonUniversity (SU)**

## **CERTIFICATION**

This is to certify that the project paper on “*Construction Method of Cast in Situ Pile*” is the bona fide record of project work done by A.F.M Abdul Hannan (Student ID: BCE 1403003751) as a group Leader and others for partial fulfillment of the requirement of the degree of B.Sc. in Civil Engineering from the Sonargaon University (SU).

This project work has been carried out under my guidance and is a record of the successful work.

Supervisor

Md. Imdadul Islam

Lecturer

Department of Civil Engineering

SonargaonUniversity (SU)

29/1, Kawran Bazar Dhaka-1215, Bangladesh.

## ACKNOWLEDGEMENT

All praises and profound gratitude to the almighty Allah who is the most beneficent and the most merciful for allowing great opportunity and ability to bring this effort to fruition safely and peacefully.

We sincerely acknowledge and express my deep sense of gratitude to Md. Imdadul Islam (Lecturer) the guide of this project. As a guide he gave a maximum help and coordination in finishing the project work. With his past years of experience and teaching steered us to come out with success through the most difficult problems faced by us. His active interest in this topic and valuable advice was the source of the author's inspiration.

We would like to place on record our deep sense of gratitude to our guides for their cooperation and unfailing courtesy to us at every stage.

We sincerely would like to thank all instructors and staffs of the Civil Engineering Department of Sonargaon University (SU), Dhaka, which contributed in various ways to the completion of this thesis.

Finally, we would like to express our deepest gratitude to our entire group member whose support and manual labor contributed in various ways for the completion of this thesis work.

Authors

## ABSTRACT

The study was conducted in the Department of Civil Engineering at Sonargaon University Bangladesh with the objectives to prepare a project and thesis with a view to partial fulfillment of the requirement for the degree of Bachelor of Science (B.Sc) in Civil Engineering. The work is possible for unconditional co-operation of many people. Structural Design of a building is the responsibility of a civil engineer. Engineer must keep in mind the economic, aesthetics, safety and other aspects of any project. This study concentrates on *Construction Method of Cast in Situ Pile*.

Pile foundations are the part of a structure used to carry and transfer the load of the structure to the bearing ground located at some depth below ground surface to avoid excess settlements or lateral movements. There are many types of pile foundations available to construct in Bangladesh like concrete pile, timber pile, steel pile etc. The concrete pile construction is classified into two types' pre-cast pile and cast-in-situ. The construction of bored cast- in-situ concrete piles is formed by drilling and auguring and then reinforcement is placed and concrete is poured into the hole. For bored cast in-situ piles foundation in stiff clays, the toe of the hole can be enlarged by under-reaming to provide greater end bearing capacity for the piles. Generally in clay soil or cohesive soil friction pile is preferred to transfer the load through the ground and in cohesion less soil end bearing pile is constructed. There are different types of boring process in Bangladesh. Among the process wash boring is commonly used. In this process a hollow steel pipe known as casing pipe is firstly driven. Then a water jet pipe is lowered to produce water jet action. In Bangladesh, another method widely used known as percussion method. In this method by chopping boring is carried forward into the soil. In both procedures steel casing is used to protect collapsing the loose soil. After boring the re-bar cage is lowered and poured by tremie casting method. Gradually concrete is going down into the pile and mud slurry is flushed out. To avoid loose slurry one or two meter concrete is flushed at the end of casting. Finally all drilling assembly is removed from pile location.

## TABLE OF CONTENTS

<b>TITLE</b>	<b>PAGE NO</b>
Title Page	I
Declaration	III
Acknowledgements	V
Abstract	VI
Table of Contents	VII

### **CHAPTER 1: INTRODUCTION**

<b>TITLE</b>	<b>PAGE NO</b>
1.1 General discussion	1
1.2 Background of the study	2
1.3 Objectives of study	3
1.4 Scope of the study	3
1.5 Outline of methodology	3
1.6 Organization of the thesis	9

### **CHAPTER 2: LITERATURE REVIEW**

<b>TITLE</b>	<b>PAGE NO</b>
2.1 Uses of Piles	10
2.2 Structural design criteria	11
2.3 Skin friction	12
2.4 Pile Layout Plan	13
2.5 The Longitudinal and cross section of the pile cap	14



### **CHAPTER 3: CONSTRUCTION MATERIALS OF PILLING WORKS**

<b>TITLE</b>	<b>PAGE NO</b>
3.1 Introduction	16
3.2 Materials used in construction	16
3.3 Cement	17
3.4 Aggregates	18
3.5 Stone chips	19
3.6 Reinforcing steel	19
3.7 Water	20
3.8 Concrete mixing	20

### **CHAPTER 4: CONSTRUCTION EQUIPMENT AND WORKING METHODE OF PILLING WORKS**

<b>TITLE</b>	<b>PAGE NO</b>
4.1 Equipment and Methods	21
4.2 Equipment	21
(i) Tripod Stand	21
(ii) Centrifugal pump	22
(iii) Winch Machine	22
(iv) Mixture Machine	23
(v) Bucket	23
(vi) Funnel	23
(vii) Pipe Holder	24
(viii) Pile Drum	24
(ix) Drilling bit	24
(x) Temporary casing	25
(xi) Trimmer pipe	25
(xii) Drilling Rod	25
(xiii) Drainage system	26

(xiv) Welding machine	26
4.3 Working methods	26
Step 1 Centering the Layout	27
Step 2 Boring operation	27
Step 3 Borehole stabilization	28
Step 4 Preparation of Rebar case	29
Step 5 Placement of rebar case	30
Step 6 Placement of reinforcing cage with plastic spacers	31
Step 7 Concreting into the borehole	32
Step 8 Checking stirrup	33
Step 9 Construction checking	34

## **CHAPTER 5: ESTIMATION OF CAST-IN-SITU PILE FOUNDATION**

<b>TITLE</b>	<b>PAGE NO</b>
5.1 Estimation Criteria for cast-in-situ pile	35
5.2 The assume estimation of the pile	35
5.2.1 Ordinary Portland Cement	36
5.2.2 Sylhet Sand	36
5.2.3 Stone Chips	37
5.2.4 Reinforcement	37
5.3 The Summery of estimated materials for assume 100 nos. of pile	39

## **CHAPTER 6: PROBLEMS WITH THEIR SOLUTION**

<b>TITLE</b>	<b>PAGE NO</b>
6.1 Problems	40
6.2 Solutions against the problems	41

## CHAPTER 7: CONCLUSIONS AND RECOMMENDATION

<b>TITLE</b>	<b>PAGE NO</b>
7.1 Conclusion	43
7.2 Recommendations	43

<b>TITLE</b>	<b>PAGE NO</b>
REFERENCES	45

# CHAPTER 1

## INTRODUCTION

---

### 1.1 GENERAL DISCUSSION

Pile foundations are used extensively for the support of buildings, bridges, and other structures to safely transfer structural loads to the ground and to avoid excess settlement or lateral movement. They are very effective in transferring structural loads through weak or compressible soil layers into the more competent soils and rocks below.

**Piling** is a type of **ground treatment** which is driving a pile into the ground below ground level. Except sheet pile, other piles like **concrete pile, timber pile, steel pile, bored pile** are used to transfer the building load to the ground. It's used to strengthen the soil so that the ground able to support the load of the building. While **sheet pile** is usually used to support lateral load and act as a supporting wall.

There is a lot of different types of piles in the market, many other type of piles have been occurred in the market and still increasing due to improvement of piling technology. Driving method, type of piling machine, procedure of piling are all take into consideration in choosing type of pile.

#### **Length of Pile**

Normally the length of the pile can be 3metres, 6metres, 9metres and 12metres. The depth of piling to be driven into the ground is depending on the condition of ground. If a length of 3m, 6m, 9m, or 12m pile is not enough to support the load of building, another 3m, 6m, 9m, or 12m pile will be joint to the first pile and continuously until it's strong enough to support the load of building. Or so, the first pile or we called it as "starter pile" will be driving in until it can't be driven in anymore.

#### **Precast And Cast-In-Situ Pile**

Pile can be done in precast concrete pile or cast-in-situ concrete pile. Normally precast concrete pile is used for building work or we can known it as spun pile or RC square pile

(Reinforcement concrete square pile). While cast-in-situ concrete pile is used for bridge work or we can know it as bored pile because bridge work has a larger load compare to building work.

Nowadays, piling work is an important ground supporter and is a must to be used on construction unless the condition of soil is hard and strong enough to support the load of building.

## **1.2 - BACKGROUND OF THE STUDY**

Pile foundations are often required to resist lateral loading. Lateral loads come from a variety of sources including wind, earthquakes, waves, and ship impacts. The lateral capacity of a pile is usually much smaller than the axial capacity and as a result groups of piles are often installed to increase the lateral capacity of the entire foundation system. When vertical or plumb pile groups do not provide sufficient lateral resistance the piles can be battered in order to mobilize some of the higher axial capacity to resist the lateral load. The behavior of piles under lateral loading is complicated. This complexity is due to the fact that the pile's deflection depends on the soil response and that the soil response is dependent upon the pile's deflection. Pile are columnar elements in a foundation which have the function of transferring load from the superstructure trough weak compressibility strata or through water, onto stiffer or more compact and less compressible soils onto rock . The may be required to carry uplift lads when used to support tall structures subjected to overturning forces from winds or waives. Piles used ion marine structures are subjected to lateral loads from the impact of berthing ships and from waves. Combinations of vertical and horizontal loads are carried where piles are used to support retaining walls, bridge piers and abutment s and machinery foundation. The cast in situ piles are used for the increasing soil bearing capacity by the negative skin friction as it is practicing in the Bangladesh for the residential building project the soil property is so poor and not sufficient to bear the design load safely by its isolated or combined column footing and that particular case to build up the high rise structure the pile foundation is preferable and there is pre-cast concrete pile also available to increase the load bearing capacity but for the high vibration of driving process it is recommended that to construct the cast in situ pile.

### 1.3 - OBJECTIVES OF STUDY

The broad objective of this report has been made to increase the skill of a Site Engineer in supervision work for Cast-in-Situ Pile construction. Basically, all the affecting factors in supervision work are described in details. So that it can be used as a guide line to a professional Engineer to supervise and execute the activities in proper way during construction of a Cast-in-Situ Pile.

#### **The specific objectives of this report include:**

- ✚ To acquire knowledge about the steps involved in its field construction.
- ✚ To understand the structural drawing of a Cast-in-Situ Pile in real field.
- ✚ To learn about the estimating details of Cast-in-Situ Pile.
- ✚ To supervise the casting work of a *Cast-in-Situ Pile* in field.
- ✚ To focus the rising problems and unexpected events to the Engineers to reduce its obstacles during its proper implementation.
- ✚ To check the preferable reinforcement placement.

### 1.4 - SCOPE OF THE STUDY

Cast in situ pile construction is a challenge depending on the soil condition. In this thesis the construction method of situ pile has been described to the best of knowledge and capacity. The scope of this study is to outlined the boring procedure materials used at the time of boring, how to keep the bore hole stable, time of washing with fresh water the bore hole, lowering down the re-bar case, trimmi pipe and finally pouring of concrete maintain the standard quality.

### 1.5 - OUTLINE OF METHODOLOGY

The following construction method shall be adopted for execution of cast in situ piling works of diameter and length as shown in approved drawings. Sequence of execution of individual pile shall be selected in such a way that the time gap between constructions of adjacent piles with a radius of 4.0m remain minimum 24 hours without hampering other activities of the project work. Other preparatory works like preparation of pile bed, mud

tank, installation of bench mark & reference point for the setting out of piles etc. shall be completed.

**Construction sequence shall be follows:**

- Preparation of bed
- Setting out piles
- Driving casing
- Drilling bore hole
- Cleaning bored hole
- Placing of reinforcement
- Pouring concrete

**Preparation of bed:**

The piling work shall be carried out on approximately leveled ground to facilitate placing of Tripod stand and movement of piling equipment. Bed shall be prepared by cutting or filling of land depending on site condition. The level of the bed shall be maintained to have sufficient cut off head and shall be at least 2.0m above the ground water level.

**Setting out:**

Location of the piles shall be set out with respect to reference points, bench mark etc. and checked by the Engineer before execution of works. Reference points and benchmark will be constructed and secured in such a way that they are not disturbed during execution of work. Location of pile shall be fixed by driving pegs of re-bar into the soil. Top portion of re-bar (approx. 150mm) shall be surrounded by concrete with top of re-bar protruding above concrete for easy identification. The peg shall be removed immediately before start of boring.

### **Driving Casing Pipe:**

Temporary steel casing pipe is driven below ground to resist caving of the soil as well as act as guide for the cutting chisel. The length of temporary casing pipe to be used shall be determined from the bore log or from the record of actual soil strata encountered during execution of boring work. The casing will prevent base heave and stabilize the side of borehole.

### **Drilling Bore Hole (Boring):**

The boring shall be done by rotary drilling method using direct mud circulation to carry the bored soil up the hole. Viscosity of the drilling fluid shall be measured time to time at site by Marsh cone and shall be maintained suitable for the type of soil. Bentonite suspension shall be used to stabilize boreholes depending on soil condition. Bore shall be always filled with water or drilling fluid up to ground level or at least 2m above water table to provide adequate hydrostatic head to stabilize the bore hole. The suspension carrying bore cuttings shall be collected and shall be processed for descending through sedimentation tank and reused or disposed of depending on degree of contamination. If the casing is to be carried out the following day of boring hole the boring shall be discontinued at least 2m ahead of the final boring level and the hole shall be filled up with drilling fluid. The final boring of holes shall be carried out before placement of reinforcement & pouring of concrete.

During the boring of piles samples shall be collected and compared with the test boring. In case of abnormal variation in respect to depth and type of soil is encountered the Engineer shall be informed for his decision. Depth of boring shall be measured from length of drilling rod.