



**Government of the People's Republic of Bangladesh**  
**Ministry of Housing and Public Works**  
**Urban Development Directorate (UDD)**

**Preparation of Development Plan for**  
**Fourteen Upazilas**  
**Package 03**

# **Draft Survey Report**

## **Geological Survey**

### **of**

## **Faridpur Upazila**

**September 2016**

**Submitted By**

**ইঞ্জিনিয়ারিং কনসালটেন্টস এন্ড এসোসিয়েটস লিমিটেড**  
**ENGINEERING CONSULTANTS AND ASSOCIATES LIMITED**  
● architects ● engineers ● planners ● management consultants  
154, MONIPURIPARA, FARMGATE, TEJGAON, DHAKA-1215, BANGLADESH, PHONE: 8116214, 9110176, 9111277, FAX: 88-02-8119761, E-mail: ecalimited@yahoo.com, ecal@dhaka.net

## LETTER OF TRANSMITTAL



## EXECUTIVE SUMMARY

Development plan of Faridpur Upazila, District Dhaka has been taken under package-3 and the project titled 'Preparation of Development Plan for Fourteen Upazilas' a initiative of Urban Development Directorate (UDD). In this development plan, subsurface geological and geotechnical information's has been considered for a durable and sustainable urban environment. This is basically done to determine the state of the soil below the surface of the project area and natural, such as earthquakes, landslides and soil erosion as a result of the design of the infrastructure development such as geological and hydro-meteorological hazards are evaluated.

To know the subsurface environment of the study area, surveys has been carried out up to 30 meter below the earth surface in the field. Investigations and surveys are geo-morphological survey; drilling of boreholes and preparation of borehole logs; collection of undisturbed and disturbed soil sample as per standard guide line; conducting standard penetration tests (SPTs); drilling of boreholes and casing by PVC pipe for conducting Down-hole seismic test; conducting Down-hole seismic test and conducting Multi-Channel Analysis of Surface Wave (MASW). Laboratory testing of soil samples such as Grain Size analysis, Natural moisture Content, Atterberg Limits, Specific Gravity, Direct Shear Test, Unconfined Compression strength, etc has been performing in the laboratory which will give more qualitative and quantitative information about the subsurface materials. To meet the above geological, geotechnical and geophysical task, 37 boreholes with SPT program, six MASW and seven Down-hole seismic survey programs have been conducted into the field at Faridpur Upazila.

From geotechnical and geological data base would give a clear idea about the geo-hazard status of particular landscape where newly urban developing activities or any other mega infrastructure project is going on and this mentioned investigation also gives idea about the vulnerability of existing build up infrastructure of a particular area. Based on these results, proper management techniques as well as other necessary adaptation process could be addressed before or after the development activities in the studied area. On the other hand, if the infrastructures are built according to this risk informed physical land-use plan, the long-term maintenance cost will be reduced and the developed structure will withstand against the potential natural hazards.

---

Mohammed Jamal Uddin  
Consultant (Geology), UDD-Package-3  
Associate Professor, Dept. of Environmental Science  
Jahangir Nagar University

## ABBREVIATIONS

ASTM	: American Society for Testing and Materials
AVS30	: Average Shear Wave velocity of 30 meter depth
BH	: Borehole
MASW	: Multi-Channel Analysis of Surface Wave
N value	: Soil resistance or compactness
PGA	: Peak Ground Acceleration
PGV	: Peak Ground Velocity
PS logging	: Primary and Shear wave logging (Down-hole seismic test)
SA	: Spectral Acceleration
SPAC	: Spatial Autocorrelation
SPT	: Standard Penetration Tests
UDD	: Urban Development Directorate
EGL	Existing Ground Level
GWL	Ground Water Level

## Table of Contents

Letter of Transmittal .....	1
Executive Summary .....	2
Abbreviations.....	3
Chapter-01: Introduction .....	6
1.1. Background:.....	6
1.2. Scope of Work:.....	7
Chapter-02: Methodology.....	7
2.1. Test Details and Procedure of Down-Hole Seismic Test (Ps Logging).....	8
2.2.1. Procedure of Field Work and Analysis.....	9
2.2. Test Details and Procedure of Multi-Channel Analysis of Surface Wave (MASW) ..	12
2.2.1. Analysis of MASW .....	13
2.3. Test Details and Procedure of Standard Penetration Test.....	16
2.3.1. Drilling.....	16
2.3.2. Data Collection.....	16
2.3.3. SPT Execution .....	16
2.3.4. Soil Sampling.....	18
2.3.5. Carrying out Different Engineering Tests on Soil Sample.....	21
Chapter-03: Survey Result at Faridpur Upazila.....	23
3.1. Geophysical Investigations.....	23
3.1.1. Down-Hole Seismic (PS Logging) Test Results.....	25
3.1.2. MASW Survey Result.....	25
3.2. Geotechnical Investigations.....	26
3.2.1. Standard Penetration Test (SPT) Log Analysis and Interpretation .....	26
Chapter-04: Conclusion .....	31
Chapter 5: References .....	32
Appendix A: Downhole Seismic Test (PS Logging) Results and Graphs	
Appendix B: Multi-channel Analysis of Surface Wave (MASW) Test Results and Graphs	
Appendix C: Geotechnical Borehole Logs and Graphs	
Appendix D: Geotechnical Laboratory Test Results and Graphs	
Appendix E: All Thematic Maps and Final Infrastructure Suitability Map	

## **List of Tables**

Table 1: MASW Data Acquisition Parameters	13
Table 2: Down-hole Seismic Test (PS logging) and MASW test locations	24
Table 3: Bore Hole Information Summary at Faridpur Upazila	27
Table 4: Values of Relative Density (Dr.), Friction Angle and Unit Weight of Non- cohesive soil based on N-values	29
Table 5: Values of Unconfined Compressive Strength based on N-values for Cohesive Soil (Approximate):	30

## **List of Figures**

Figure 1: Determination of the Arrival Time of S-Wave	11
Figure 2: Calculation of the Travel Time	11
Figure 3: Main Step of the MASW Processing Technique	15
Figure 4: Split-spoon sampler.	17
Figure 5: The SPT sampler in place in the boring with hammer	18
Figure 6: Thin-Walled (Shelby Tube) Sampler	20
Figure 7: Undisturbed (Split-Spoon) Sampler	21

## **List of Photographs**

Plate 1: Downhole Seismic Test data logger	8
Plate 2: Wooden Plank as the Vibration Source	9
Plate 3: Geophone	9
Plate 4: Data Acquisition Unit	9
Plate 5: Geophone Lowering In the Borehole	10
Plate 6: Direction of Excitations	10

## CHAPTER-01: INTRODUCTION

### 1.1. BACKGROUND:

Horizontal expansion of urban area is rapidly increasing in Bangladesh with respect to their rapid population growth and increasing life expectancy of the peoples. But present trend of planning practice is mostly oriented towards planning of major cities and towns, not in all other towns or growth centers because huge amount of financial allocation/grants involvement. Recent policy of government, the upazila has been recognized as the most significant tier of administration. So that these areas are need to be planned and developed to accommodate all social, economic, administrative, infrastructure services and service facilities. The government's intention is to reflect the national policy of bringing development administrative and service facilities to the door step of rural masses and to ensure better delivery of government services to the people. Realizing the fact and importance of formulating development plans for upazilas, Urban Development Directorate has come up with a great initiative to plan those areas. At the first phase of this initiative UDD has decided to prepare development plan for 14 Upazilas all over Bangladesh into five different packages. For each package separate consultancy team has been appointed to carry out that job more fruitfully. Desh Upodesh Ltd. in Association with AAIMA International BD Ltd. and Tech-SUS Ltd has been selected for package-3 (covering Faridpur Upazila, Dist: Meherpur; Faridpur Sadar Upazila, Dist: Faridpur; and Baghmara Upazila, Dist: Rajshahi) by project evaluation committee of UDD.

Subsurface geological and geotechnical information's has been considered for a durable and sustainable urban environment. Primarily this work is to determine subsurface soil condition of the project area and evaluating of natural geological and hydro-meteorological hazards such as earthquake, landslide and ground failure which integrate the consequence into the design of the infrastructure.

Regarding this study, following investigations and surveys has been carried out in the field which are geo-morphological survey; drilling of boreholes and preparation of borehole logs; collection of undisturbed and disturbed soil sample as per standard

guide line; conducting standard penetration tests (SPTs); drilling of boreholes and casing by PVC pipe for conducting Down-hole seismic test; conducting Down-hole seismic test and conducting Multi-Channel Analysis of Surface Wave (MASW). Geologically and structurally the area is not much complex, that's why geotechnical and geophysical investigations are covered whole floodplain area except low or marshy land up to 30 meter depth from ground level and almost everywhere soil sediments are fluvial type of deposit which are much soft and thicker.

Following laboratory testing of soil samples such as Grain size analysis, Natural moisture content, Atterberg limits, Specific Gravity, Direct Shear Test, Unconfined Compression strength, etc has been performing in the laboratory which will give more qualitative and quantitative information about the subsurface materials. These field and laboratory test data will be analyzed and integrated into a module to produce risk sensitive micro-zonation maps.

## **1.2. SCOPE OF WORK:**

The aim of this work is to determine subsurface soil condition of the project area and evaluating of natural geological and hydro-meteorological hazards such as earthquake, liquefaction, ground failure and integrate the consequence into the design of the infrastructure. The main objective will be achieved through accomplishment of the following sub-objectives:

- a) Preparation of Geological map of the study area.
- b) Preparation of sub-surface lithological 3D model of different layers through geotechnical investigation
- c) Preparation of engineering geological mapping based on AVS30
- d) Determination of soil type in the project area
- e) Foundation layer identification
- f) Preparation of Seismic Hazard Map
- g) Finally intensity map is prepared for high rise and low rise building

## **CHAPTER-02: METHODOLOGY**

The methods and materials used to carry out of these activities have been described below-

## 2.1. TEST DETAILS AND PROCEDURE OF DOWN-HOLE SEISMIC TEST (PS LOGGING)

---

Main objectives of downhole seismic test to measure the travelling time of elastic wave from the ground surface to some arbitrary depths beneath the ground. The seismic wave was generated by striking a wooden plank by a sledge hammer. The plank was placed on the ground surface at around 1 m in horizontal direction from the top of borehole. The plank was hit separately on both ends to generate shear wave energy in opposite directions and is polarized in the direction parallel to the plank.

The shear wave emanated from the plank is detected by a tri-axial geophone. The geophone was lowered to 1 m below ground surface and attached to the borehole wall by inflating an air bladder. Then, the measurements were taken at every 1 m interval until the geophone was lowered to 30 m below ground surface. For each elevation, 3 records were taken and then used to calculate the shear wave velocity.



Plate 1: Downhole Seismic Test data logger

### 2.2.1. Procedure of Field Work and Analysis

---

- a) A wooden plank with an approximate dimension of 2 ft x 1 ft x 2 ft is fixed to the ground. The wooden plank is placed about 1m from the borehole as shown in Plate 2.



Plate 2: Wooden Plank as the Vibration Source

- b) Cables are wired from the geophone Plate 3 and the trigger to the data acquisition unit Plate 4. Signals in the vertical, radial and transverse directions are recorded by the data acquisition unit.



Plate 3: Geophone



Plate 4: Data Acquisition Unit



- c) The geophone is lowered into the borehole as shown in Plate 5 Then, air is pumped into the air bag to fix the geophone to the casing (PVC pipe) at 1 m interval in depth basically.



Plate 5: Geophone Lowering In the Borehole

- d) Excitations are generated by hitting the wooden plank in three directions by the hammer.



Plate 6: Direction of Excitations

- e) Data is recorded in the data acquisition unit. Figure 1 illustrates a typical dataset in obtaining the arrival time of S-wave. Hitting the wooden plank in opposite directions generates signals as shown in the figure. The time that two curves begin to separate is the arrival time of shear wave. By doing the same analysis for every depth, S-wave profiles are obtained throughout the depth of the borehole.

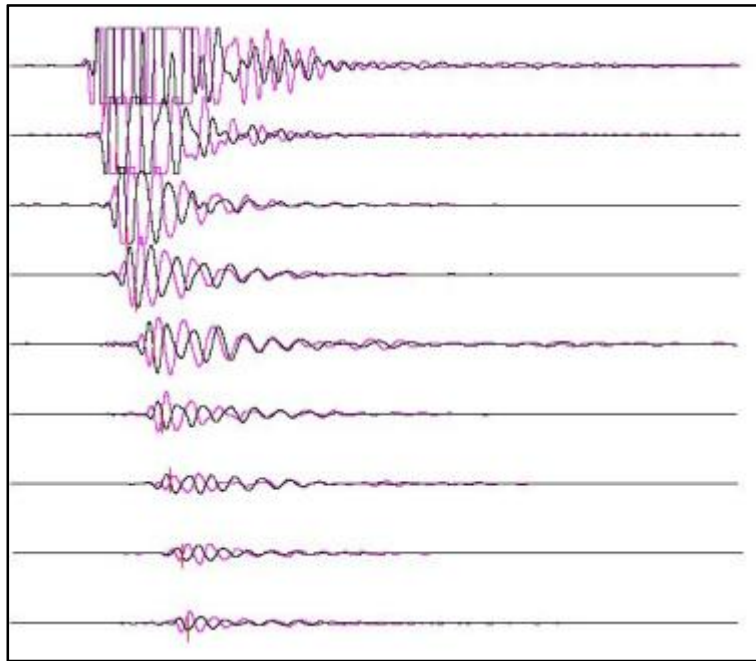
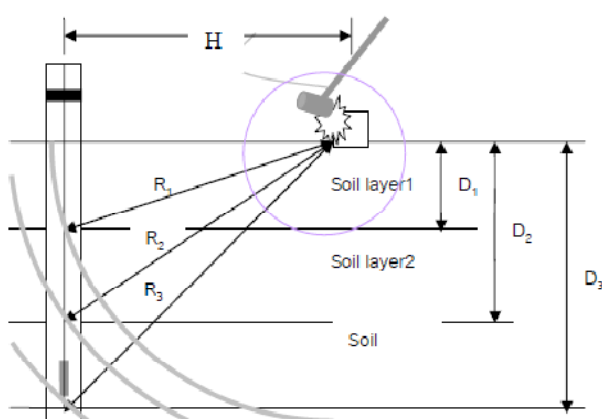


Figure 1: Determination of the Arrival Time of S-Wave

- f) Using the raw data of the test depth ( $D$ ), the shortest pass ( $R$ ) and the recorded arrival time of S-wave ( $t$ ) in the inclined path is calculated to the travel time,  $t_c$ , in the vertical path as shown in Figure 2.



$$t_c = D \frac{t}{R}$$

Where

$t_c$  is the corrected travel time

$D$  is the testing depth from ground surface,

$t$  is the first arrival time from test

$R$  is the distance between the source and receiver

[Auld 1977]

Figure 2: Calculation of the Travel Time

- g) By plotting the corrected travel time versus depth, the velocity of every 1 m interval is calculated from (Auld 1977)

$$V_d = \frac{\Delta D}{\Delta t_c} [\text{Auld 1977}]$$

Where,  $\Delta D$  is depth interval showing similar slope and  $\Delta t_c$  is the corrected travel time difference of  $\Delta D$ .

## 2.2. TEST DETAILS AND PROCEDURE OF MULTI-CHANNEL ANALYSIS OF SURFACE WAVE (MASW)

---

Multichannel Analysis of Surface Wave (MASW) is recent and very popular method for computation of shear wave velocity. This method is widely used for seismic microzonation. A MASW is a seismic surface method, widely used for subsurface characterization and is increasingly being applied for seismic microzonation and site response studies (Anbazhagan and Sitharam, 2008). It is also used for the geotechnical characterization of near surface materials (Park and Miller, 1999; Xia et al., 1999; Miller et al., 1999; Anbazhagan and Sitharam, 2008). MASW is used to identify the subsurface material boundaries, spatial and depth variations of weathered and engineering rocks (Anbazhagan and Sitharam, 2009). We have used the MASW system consisting of 12 channels Geode seismograph with 12 vertical geophones of 10 Hz capacity.

The measuring procedure in this project is shown as follows:

- I. To decide the measuring line
- II. To set receivers along the line at the ground surface. The intervals of each geophone are 3m.
- III. To set an acrylic board at a half interval outside the line
- IV. To shoot it vertically. Then generated elastic waves are recorded by receivers.
- V. To shift the acrylic board between second receiver and the third receiver, and shoot it vertically. Then generated elastic waves are recorded at receivers.
- VI. To iterate this procedure up to setting the acrylic boards at a half interval outside the other side of the line.

The data acquisition parameters are given in table 1.

Table 1: MASW Data Acquisition Parameters

Seismic refraction	
Number of channels	12
Geophone spacing	3m
Array length	33m
Sampling rate	1ms
Record length	2 sec
Natural frequency of Geophone	10 Hz
Source	8 kg hammer
Shot number	13 points, 11 between geophones and 2 outside of measuring line

Source: Park and Miller, 1999; Xia et al. 1999; Miller et al. 1999; Anbazhagan and Sitharam, 2008

### 2.2.1. Analysis of MASW

Data processing consists of two main steps: (i) Obtaining the dispersion curves of Rayleigh wave phase velocity from the records; (ii) Determining the V s profiles from which the Vs30 values are calculated (see figure 3). In the phase velocity analysis, SPAC (Spatial Autocorrelation) method (Okada, 2003) is employed. Okada (2003) shows Spatial Autocorrelation function  $\rho(\omega, r)$  is expressed by Bessel function.

$$\rho(\omega, r) = J_0(\omega r / c(\omega)) \quad [\text{Okada, 2003}]$$

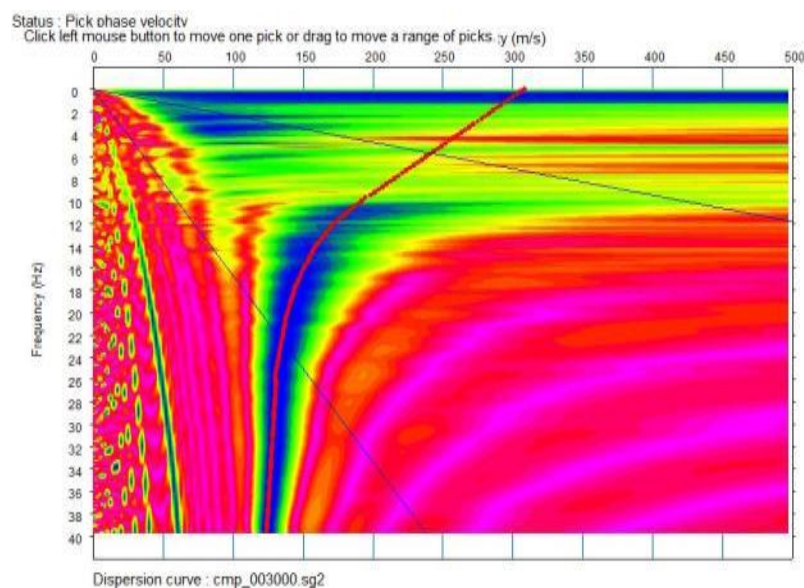
Where, r is the distance between receivers,  $\omega$  is the angular frequency, c ( $\omega$ ) is phase velocity of waves,  $J_0$  is the first kind of Bessel function. The phase velocity was obtained at each frequency using equation (2). A one dimensional inversion using a non-linear least square method has been applied to the phase velocity curves. In the inversion, the following relationship between P-wave velocity (Vp) and Vs (Kitsunezaki et. al., 1990):

$$Vp = 1.29 + 1.11Vs \quad [\text{Kitsunezaki et. al., 1990}]$$

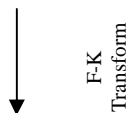
Where,  $V_s$  is S-wave velocity (km/s),  $V_p$  is P-wave velocity (km/s). In order to assume density  $\rho$  (g/cm<sup>3</sup>) from S-wave velocity, the relationship of Ludwig et al. (1970) is used.

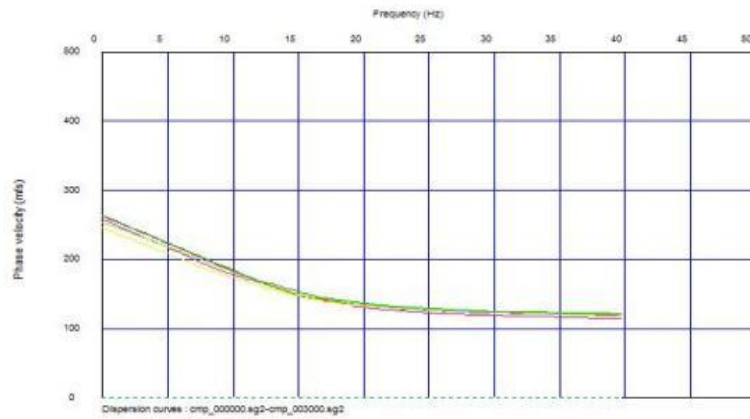
$$\rho = 1.2475 + 0.399V_p - 0.026V_p^2 \quad [\text{Ludwig et al. (1970)}]$$

These calculations are carried out along the measuring line, and the S-wave velocity distribution section was analyzed.



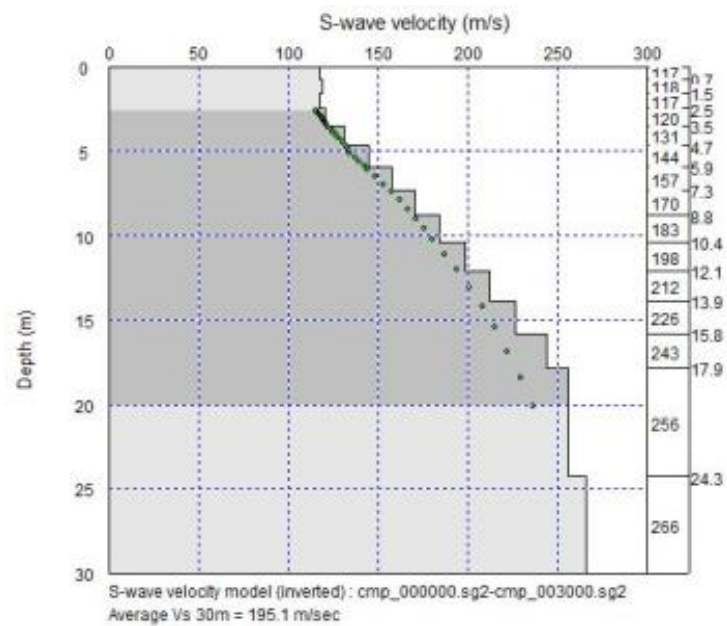
MASW Raw field data





Dipersion for Rayleigh wave

↓  
Inversion



Shear wave velocity profile

Figure 3: Main Step of the MASW Processing Technique

## **2.3. TEST DETAILS AND PROCEDURE OF STANDARD PENETRATION TEST**

---

The geotechnical boreholes have been constructed using wash boring method. In this investigation, 37 numbers of boreholes have been prepared at Faridpur Upazila. The borehole logs are enclosed in the Appendix A. The boring method has been described in the following section.

### **2.3.1. Drilling**

---

The bore holes are being drilled through mechanical percussion wash boring method at the locations previously decided. As 30 m boring is so complicated and time consuming moreover it has done continuously to the end to prevent the possibility of caving of the boring wall, it will be decided to send two sets of worker who will work in 8 hrs until desired depths will be achieved. In this manner the estimated time for boring execution will 13- shifts and 12- shifts are considered for mobilization, assemble and disassemble of the equipment, site cleanup and backfill the bore holes to their pre-existing condition.

### **2.3.2. Data Collection**

---

The field data are being collected according to the respective standard methods. First of all the location, areal coverage, topography, geomorphology of the test site are note down. The soil sample collection procedure is mentioned in the section 2.3.4. While SPT soil samples are collected. At the same time, the ground water table is note down.

### **2.3.3. SPT Execution**

---

As it mentioned earlier, the geotechnical boreholes will be constructed using mechanical boring method. The depth of those boreholes is to 30m. In this method N values (standard Penetration Test) is counted and soil sample also be taken in every 1.5m depth interval. The subsequent procedure which has been followed during the field work is furnished as follows:

- I. Drill a 100-200 mm (2.5-8 in) diameter exploratory boring to the depth of the first test.
- II. Insert the SPT sampler (also known as a Split-spoon Sampler) into the boring. The shape and dimensions of this sampler are shown in Figure 4. It is connected via steel rods to a 63.5 kg (140 lb) hammer, as shown in Figure 5.
- III. An automatic tripping mechanism (in case of rotary drilling used this technique in this investigation), raise the hammer a distance of 760 mm (30 in) and allow it to fall. This energy drives the sampler into the bottom of the boring. Repeat this process until the sampler has penetrated a distance of 450 mm (18 in), recording the number of hammer blows required for each 150 mm (6 in) interval.
- IV. Compute the N-value by summing the blow counts for the last 300 mm (12 in) of penetration. The blow count for the first 150 mm (6 in) is retained for reference purposes, but not used to compute N because the bottom of the boring is likely to be disturbed by the drilling process and may be covered with loose soil that fell from the sides of the boring.
- V. Extract the SPT sampler, then remove and save the soil sample (disturbed sample).
- VI. Drill the boring to the depth of the next test and repeat steps 2 through 6 as required.

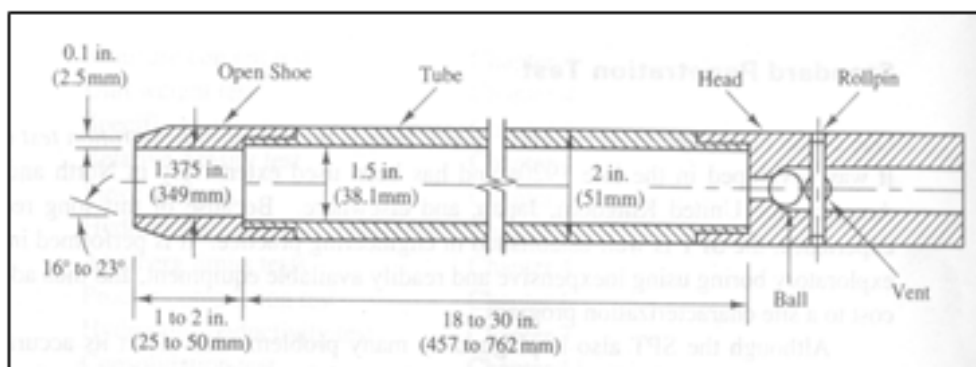


Figure 4: Split-spoon sampler.



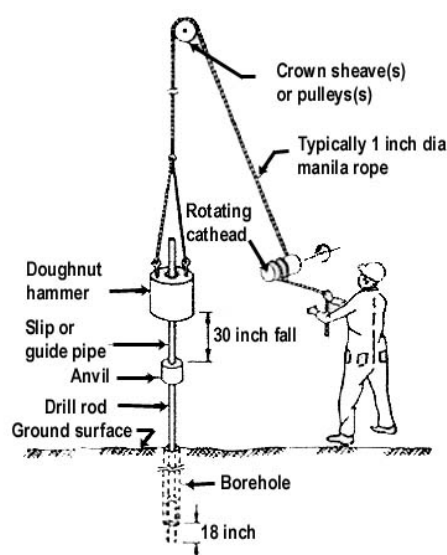


Figure 5: The SPT sampler in place in the boring with hammer

#### 2.3.4. SOIL SAMPLING

Two main categories of soil samples are collected, undisturbed and disturbed. Undisturbed samples, which are required mainly for shear strength and consolidation tests, are obtained by techniques which aim at preserving the in-situ structure and water content of the soil. In boreholes, undisturbed samples can be obtained by withdrawing the boring tools (except when hollow-stem continuous-flight augers are used) and driving or pushing a sample tube into the soil at the bottom of the hole. The sampler is normally attached to a length of boring rod which can be lowered and raised by the cable of the percussion rig. When the tube is brought to the surface, some soil is removed from each end and molten wax is applied, in thin layers, to form a seal approximately 25mm thick: the ends of the tube are then covered by protective caps. Undisturbed block samples can be cut by hand from the bottom or sides of a trial pit. During cutting, the samples must be protected from water, wind and sun to avoid any change in water content: the samples should be covered with molten wax immediately they have been brought to the surface. It is impossible to obtain a sample that is completely undisturbed, no matter how elaborate or careful the ground investigation and sampling technique might be. In the case of clays, for example,

swelling will take place adjacent to the bottom of a borehole due to the reduction in total stresses when soil is removed and structural disturbance may be caused by the action of the boring tools; subsequently, when a sample is removed from the ground the total stresses are reduced to zero.

Soft clays are extremely sensitive to sampling disturbance, the effects being more pronounced in clays of low plasticity than in those of high plasticity. The central core of a soft clay sample will be relatively less disturbed than the outer zone adjacent to the sampling tube. Immediately after sampling, the pore water pressure in the relatively undisturbed core will be negative due to the release of the in-situ total stresses. Swelling of the relatively undisturbed core will gradually take place due to water being drawn from the more disturbed outer zone and resulting in the dissipation of the negative excess pore water pressure: the outer zone of soil will consolidate due to the redistribution of water within the sample. The dissipation of the negative excess pore water pressure is accompanied by a corresponding reduction in effective stresses. The soil structure of the sample will thus offer less resistance to shear and will be less rigid than the in-situ soil.

A disturbed sample is one having the same particle size distribution as the in-situ soil but in which the soil structure has been significantly damaged or completely destroyed; in addition, the water content may be different from that of the in-situ soil. Disturbed samples, which are used mainly for soil classification tests, visual classification and compaction tests, can be excavated from trial pits or obtained from the tools used to advance boreholes (e.g. from augers and the clay cutter). The soil recovered from the shell in percussion boring will be deficient in fines and will be unsuitable for use as a disturbed sample. Samples in which the natural water content has been preserved should be placed in airtight, non-corrosive containers: all containers should be completely filled so that there is negligible air space above the sample.

All samples should be clearly labeled to show the project name, date, location, borehole number, depth and method of sampling; in addition, each sample should be given a serial number. Special care is required in the handling, transportation and storage of samples (particularly undisturbed samples) prior to testing. The types of tube samplers used in this study are described below.

### Thin-walled Sampler

Thin-walled samplers (Figure 6) have been used to collect undisturbed samples from boreholes. These samplers are used in soils which are sensitive to disturbance such as soft to firm clays and plastic silts. The sampler does not employ a separate cutting shoe, the lower end of the tube itself being machined to form a cutting edge. The internal diameter may range from 35 to 100 mm. The area ratio is approximately 10% and samples of first-class quality can be obtained provided the soil has not been disturbed in advancing the borehole. In trial pits and shallow boreholes the tube can often be driven manually

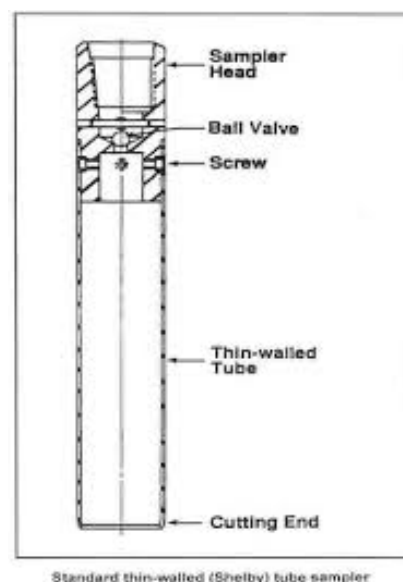


Figure 6: Thin-Walled (Shelby Tube) Sampler

## Split-spoon sampler

Split-spoon samplers (Figure 7) have been to collect disturb samples. It consists of a tube which is split longitudinally into two halves: a shoe and a sampler head incorporating air-release holes are screwed onto the ends. The two halves of the tube can be separated when the shoe and head are detached to allow the sample to be removed. The internal and external diameters are 35 and 50 mm, respectively, the area ratio being approximately 100%, with the result that there is considerable disturbance of the sample. This sampler is used mainly in sands, being the tool specified in the standard penetration test (SPT).

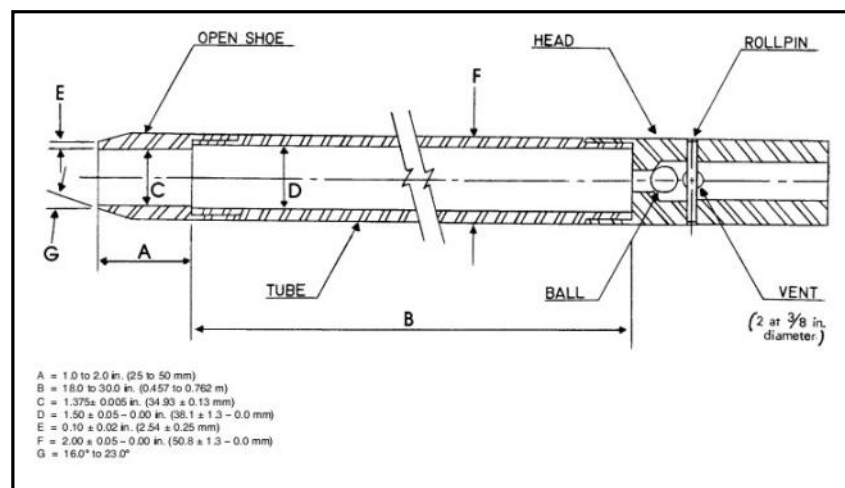


Figure 7: Undisturbed (Split-Spoon) Sampler

### 2.3.5. CARRYING OUT DIFFERENT ENGINEERING TESTS ON SOIL SAMPLE

A wide variety of laboratory tests is performing on soils to measure number of soil parameters. Some soil properties are intrinsic to the composition of the soil matrix and are not affected by sample disturbance, while other properties depend on the structure of the soil as well as its composition, and can only be effectively tested on relatively undisturbed samples. Some soil tests measure the direct properties of the soil, while others measure "index properties" which provide useful information about the soil without directly measuring the property desired.

The test types and standard which have been following given in the following section. Before explaining each of the engineering tests, the standard followed in each test is mentioned here:

- Grain size analysis
  - Sieve Analysis
  - Hydrometer Analysis
- Natural Moisture Content Tests
- Attarbage Limit Test
- Unconfined Compressional Test
- Traxial Test

All laboratory test result are given in Appendix D.

## CHAPTER-03: SURVEY RESULT AT FARIDPUR UPAZILA

### 3.1. GEOPHYSICAL INVESTIGATIONS

---

The main objectives of these investigation to estimate local site effects against earthquakes and the task has been segregated by three-fold: 1) To determine shear wave velocity profile at various sites, 2) To classify soil conditions according to seismic design specifications and 3) To analyze soil amplifications in the area. Field measurements of shear wave velocities were conducted in Faridpur Upazila and described in below.

Shear wave velocity profile ( $V_s$  profile) in the field were carried out by two geophysical exploration methods namely 1) seismic downhole test and 2) Multichannel Analysis of Surface Wave (MASW).

Seismic downhole test is a direct measurement method for obtaining the shear wave velocity profile of soil stratum. However, the test requires borehole which is not time and cost effective for the project. Multichannel analysis of surface waves (MASW) is a non-invasive technique which can be used to determine the  $V_s$  profile at sites. In this project, the seismic downhole and MASW tests were performed at 6 and 5 locations respectively. Locations of seismic downhole test and MASW tests are shown in Map 2. The GPS coordinate of the test locations are showing in Table 2.

Table 2: Down-hole Seismic Test (PS logging) and MASW test locations

Survey Type	Survey ID	Location	Lat	Long	Union
Downhole Seismic Test (PS Logging)	PS-1 (BH-04)	Char Madhabdia Govt. Primary School, Char Madhabdia Bazar, Char Madhabdia Union	23.652707	89.816911	Char Madhabdia Union
	PS-2 (BH-11)	5 nos. Decreeerchar, Munshitanggi Aftabuddin Madrasha, Decreeerchar Union	23.61113	89.86364	Decreeerchar Union
	PS-3 (BH-13)	Faridpur Zilla School field, Faridpur Sadar	23.60888	89.84447	Faridpur Sadar
	PS-4 (BH-20)	Hadhokandi Govt. Primary School, Oposite side of River Research Institute, Kaijuri Union	23.58205	89.83917	Kaijuri Union
	PS-5 (BH-22)	Technical Training Centre, Brahmonkanda, Sreeaungon, Faridpur Sadar	23.5869	89.81373	Faridpur Sadar
	PS-6 (BH-27)	Bakhunda College Field, Bakhunda, Greda Union	23.54565	89.85487	Greda Union
	PS-7 (BH-30)	Madhobpur Govt. Primary School, Mallikpur Bazar, Krishnanagar Union	23.53895	89.73418	Krishnanagar Union
Multi-channel Analysis of Surface Wave (MASW)	MASW-1	Mohim School Field, Faridpur Sadar	23.59924	89.82378	Faridpur Sadar
	MASW-2	Rajandro College field	23.6025	89.84211	Faridpur Sadar
	MASW-3	26 nos Gothadhar Dangi Govt. Primary School, Aliabad union	23.58216	89.88592	Aliabad union
	MASW-4	Miregi Govt. Primary School, BASIC Industrial area, Kanaipur Union	23.55254	89.77844	Kanaipur Union
	MASW-5	Kamorpur Aziz Institute and Primary School, Ambikapur Union	23.59735	89.78988	Ambikapur Union
	MASW-6	Shibrampur R. D. Academy School Field, Majchar Union	23.64024	89.74545	Majchar Union

Source: Field Survey, 2016

### 3.1.1. Down-Hole Seismic (PS Logging) Test Results

---

As a fundamental parameter, shear wave velocity is required to define the dynamic properties of soils. If the soil velocity is less than 180m/s, it can be said as loose or soft soil. Estimation of shear wave velocity ( $V_s$ ) / average shear wave velocity (AVS) and mapping is a way to characterize varying site conditions, and it can also be used to model earthquake-related ground shaking. Estimation of AVS aims to generate a map of estimated shear wave velocities for the upper 30m of the subsurface. Further this map can be used for seismic site response analysis i.e., to determine peak ground acceleration (PGA) and spectral acceleration (SA) values of both bedrock and ground surface. In this context, Downhole seismic test data acquisition has been completed at Faridpur Upazilla in Seven different locations on date 5<sup>th</sup> to 8<sup>th</sup> January, 2016.

The average shear wave velocity (AVS) of each PS logging test are tabulated in Table 3. Work plan of the test depth was 30m, however, in some locations did not reach the geophone to the 30 m in depth due to adverse conditions of PVC.

The shear wave velocities at every 1m interval of each site are given in Appendix A at tabular and also graphical format.

### 3.1.2. MASW Survey Result

---

To predict subsurface shear-wave interval velocities, multi-spectral analyses of surface waves (MASW) are popularly used. Shear wave velocities can also extract additional velocity-related information such as mechanical properties of soils and rocks. In general, MASW data compare favorably to other geophysical methods for predicting interval velocities. Furthermore, comparisons to vertical seismic profiles correlate well with MASW predicted shear wave interval velocities. In this perspective, MASW test has been completed at Six different locations at Faridpur Upazilla by 27<sup>th</sup> to 28<sup>th</sup> November, 2016 and field raw data has been processed and also interpreted.



The results of the MASW test are enclosed in Appendix B at tabular and also graphical format.

## **3.2. GEOTECHNICAL INVESTIGATIONS**

---

To ensure safety of human beings and materials, geotechnical investigations have become an essential component of every construction, it includes a detailed investigation of soil strength, composition, water content, and other important soil characteristics. Investigation borings with standard penetration test were conducted in order to know vertical geological conditions. The borings with SPT were carried out at 37 points at Faridpur Upazila.

### **3.2.1. Standard Penetration Test (SPT) Log Analysis and Interpretation**

---

SPT is a common in-situ testing method used to determine the geotechnical engineering properties of subsurface soils. It was developed in the late 1920s and has been used extremely in North and South America, the United Kingdom, Japan, and elsewhere. Because of this long record of experience, the SPT is well-established in engineering practice. It is performed inside exploratory boring using inexpensive and readily available equipment, and thus adds little cost to a site characterization program. Although the SPT also is plagued by many problems that affect its accuracy and reproducibility, it probably will continue to be used for the foreseeable future, primarily because of its low cost. However, it is partially being replaced by other test methods, especially on larger and more critical projects.

All the borings has to be conducted and preparation of field bore log by visual classification has to be done in the presence of the experienced technical personnel. The borehole records have to be taken that include soil type, nature of sample, soil moisture content and consistency, SPT blow counts (N Value), ground water observation and apparent origin (fill, alluvium, recent sediments, etc.) and daily field logs have been prepared. The bore locations are given in following table 5 and the geotechnical borehole log are enclosed in the below section.

Table 3: Bore Hole Information Summary at Faridpur Upazila

BH-01	MADHABDIA MOYEZ UDDIN SCHOOL Field, Char Madhabdia Union	23.6842	89.80732	Char Madhabdia Union
BH-02	SOUTH DIGRIRCHAR MADHOBIDIA GOVT. PRI. SCHOOL, Madhubdia Union	23.66698	89.83742	Uttar Channel Union
BH-03	Chardurgapur Govt. Primary School field, Ishan Gopalpur	23.67174	89.78958	Ishan Gopalpur
BH-04	Char Madhabdia Govt. Primary School, Char Madhabdia Bazar, Char Madhabdia Union	23.65271	89.81691	Char Madhabdia Union
BH-05	Shibrampur R. D. Academy School Field, Majchar Union	23.64033	89.74549	Majchar Union
BH-06	Pallikobi Jasimuddin Saranshala, Ambikapur	23.61221	89.82033	Ambikapur Union
BH-07	Near Madhankali Swich gate, Ambikapur Union	23.62228	89.85255	Ambikapur Union
BH-08	Adampur Bazar, Goualonda Road, Ambikapur Union	23.62173	89.83853	Ambikapur Union
BH-9	Dhuldi Railgate, Dhuldi Bazar, Majchar Union	23.61963	89.77007	Majchar Union
BH-10	Khalilpur Bazar, Majchar Union	23.61627	89.73603	Majchar Union
BH-11	5 nos. Decreerchar, Munshitanggi Aftabuddin Madrasha, Decreerchar Union	23.61113	89.86364	Decreerchar Union
BH-12	Yasin College, Faridpur Sadar	23.61196	89.85338	Faridpur Sadar
BH-13	Faridpur Zilla School field, Faridpur Sadar	23.60888	89.84447	Faridpur Sadar
BH-14	Vajon Dangga Govt. Primary School, Faridpur Sadar	23.60272	89.86537	Faridpur Sadar
BH-15	Chan Chairman Pukurpar, Baitul-Noor Mosjid, Faridpur Sadar	23.59823	89.84946	Faridpur Sadar
BH-16	94 nos. Zhiltuki Govt. Primary School, Panir Tangki Mor, Faridpur Sadar	23.60121	89.83946	Faridpur Sadar
BH-17	Mohim School Field, Faridpur Sadar	23.5986	89.82333	Faridpur Sadar
BH-18	Raghu Nandanpur Madrasha, Ambikapur Union	23.59732	89.81214	Ambikapur Union
BH-19	Porunpur Govt. Primary School, Porunpur Bazar, Majchar Union	23.60005	89.75507	Majchar Union
BH-20	Hadhokandi Govt. Primary School, Oposite side of River Research Institute, Kaijuri Union	23.58205	89.83917	Kaijuri Union

BH-21	Johora Begum High School Field, Mia Para Road, Parchim Khabashpur, Faridpur Sadar	23.58869	89.82675	Faridpur Sadar
BH-22	Technical Training Centre, Brahmonkanda, Sreeaungon, Faridpur Sadar	23.5869	89.81373	Faridpur Sadar
BH-23	Choyata, Aliabad Union	23.57358	89.88176	Aliabad Union
BH-24	Near Payarpur Godaoun, Kaijuri Union	23.56865	89.83886	Kaijuri Union
BH-25	opposite side of Krish poshikhan Institute gate, Gunggabodi, Krishnanagar Union	23.57589	89.79154	Krishnanagar Union
BH-26	Gobinddapur Hat, Krishnanagar Union	23.57146	89.74718	Krishnanagar Union
BH-27	Bakhunda College Field, Bakhunda, Greda Union	23.54565	89.85487	Greda Union
BH-28	Chacia fokirbari Road, Kaijuri Union	23.54129	89.81203	Kaijuri Union
BH-29	Kanaipur Akhak Centre, Kanaipur Union	23.54651	89.77526	Kanaipur Union
BH-30	Madhobpur Govt. Primary School, Mallikpur Bazar, Krishnanagar Union	23.53895	89.73418	Krishnanagar Union
BH-31	Vhatpara Govt. Primary School, Kaijuri Union	23.53291	89.83473	Kaijuri Union
BH-32	Fursha Govt. Primary School, Kanaipur Union	23.5202	89.80351	Kanaipur Union
BH-33	Dokin Char Kamolpur	23.58859	89.84049	
BH-34	Tonthoniar Hat, End of Kanaipur Union	23.4989	89.78552	Kanaipur Union
BH-35	Nasirar Bazar, Dorghapur, Ishan Gopalpur	23.66123	89.76324	Ishan Gopalpur
BH-36	Near Health Coplex, Ishan Gopalpur	23.63583	89.77994	Ishan Gopalpur
BH-37	Doiarampur Govt. Primary School, Doiarampur, Majchar Union	23.61706	89.79298	Majchar Union

Source: Field data, 2015

While boring and SPT testing, soil samples are being visually classified in the following way:

Sieve	Soils	Designations
+No 4 (4.76mm)	Gravel	
No.4 to No 10(2.00mm)	Coarse	Sand
No. 10 to No 40 (0.42mm)	Medium	Sand
No. 40 to No 200 (0.07mm)	Fine	Sand
No.200	Silt or Clay	

Some soil has one dominant lithology with minuscule amount of other soil type. In such cases, minor soil sample are written in the following manner with along with dominant soil type.

- |           |           |
|-----------|-----------|
| 1. Trace  | 1 to 10%  |
| 2. Little | 10 to 25% |
| 3. With   | 25 to 35% |

SPT- N value is also note down while SPT Testing. Then the collected soil samples are being cross checked with SPT-N values to ensure quality data collection.

Based on N-values, other very useful soil parameters may be obtained from the co-relation charts given by different research workers. Two such useful co-relations for cohesive and non-cohesive soils after K. Terzaghi are given below:

Table 4: Values of Relative Density (Dr.), Friction Angle and Unit Weight of Non-cohesive soil based on N-values

N-values	Condition	Relative Density	Angle of Internal friction (Degree)	Moist Unit Weight (Pcf)
0-4	Very Loose	0-15%	28 <sup>0</sup>	70-100
4-10	Loose	15-35%	28 <sup>0</sup> -30 <sup>0</sup>	95-125
10-30	Medium dense	35-65%	30 <sup>0</sup> -36 <sup>0</sup>	110-130
30-50	Dense	65-85%	36 <sup>0</sup> -41 <sup>0</sup>	110-140
Over 50	Very dense	85-100%	Over 41 <sup>0</sup>	> 130

Table 5: Values of Unconfined Compressive Strength based on N-values for Cohesive Soil (Approximate):

N-values	Condition	Unconfined Compressive Strength (Tsf)
Below 2	Very soft	Below 0.25
2-4	Soft	0.25-0.50
4-8	Medium stiff	0.50-1.00
8-16	Stiff	1.00-2.00
16-32	very stiff	2.00-4.00
Over 32	Hard	over 4.00

In the above table the shear strength of cohesive soil is equal to  $\frac{1}{2}$  of unconfined compressive strength and the angle of shearing resistance is equal to zero. It should be remembered that the co-relation for cohesive soil is not always much reliable.

*The litholog are already written down in a standard format and has been attached in the appendix C.*

## CHAPTER-04: CONCLUSION

Faridpur Upazila and its adjoining areas is mostly comprises by monotonous flood plain area except few depression. Soil quality of the project area is varying as morphological difference, that's why geological, geotechnical and geophysical investigations has been carried out such a pattern to cover all morphological unit. In this consequences, 37 boreholes with SPT, 7 downhole seismic tests and 6 MASW program has been completed in the field as a part of this survey investigation. During this survey, soil samples (disturbed and undisturbed) are also collected for further laboratory test which will give idea about the soil engineering properties. This investigation data will be analyzed and integrated in a module from which it can possible to generate geomorphologic map, sub-surface litho-logical 3D model of different layers, engineering geological mapping based on AVS30, Seismic Hazard Assessment Map, soil type map, seismic intensity map, Peak Ground Acceleration (PGA) and recommended building height maps for both high rise building and low rise building etc

Above investigation and outcomes would give a clear idea about the geo-hazard status of particular landscape where newly urban developing activities or any other mega infrastructure project is going on and this mentioned investigation also gives idea about the vulnerability of existing build up infrastructure of a particular area. Based on these results, proper management techniques as well as other necessary adaptation process could be addressed before or after the development activities in the studied area. It is to be mentioned that the long-term maintenance cost will be reduced and the developed structure will withstand against the potential natural hazards if the infrastructures are built following the risk informed physical land-use plan.

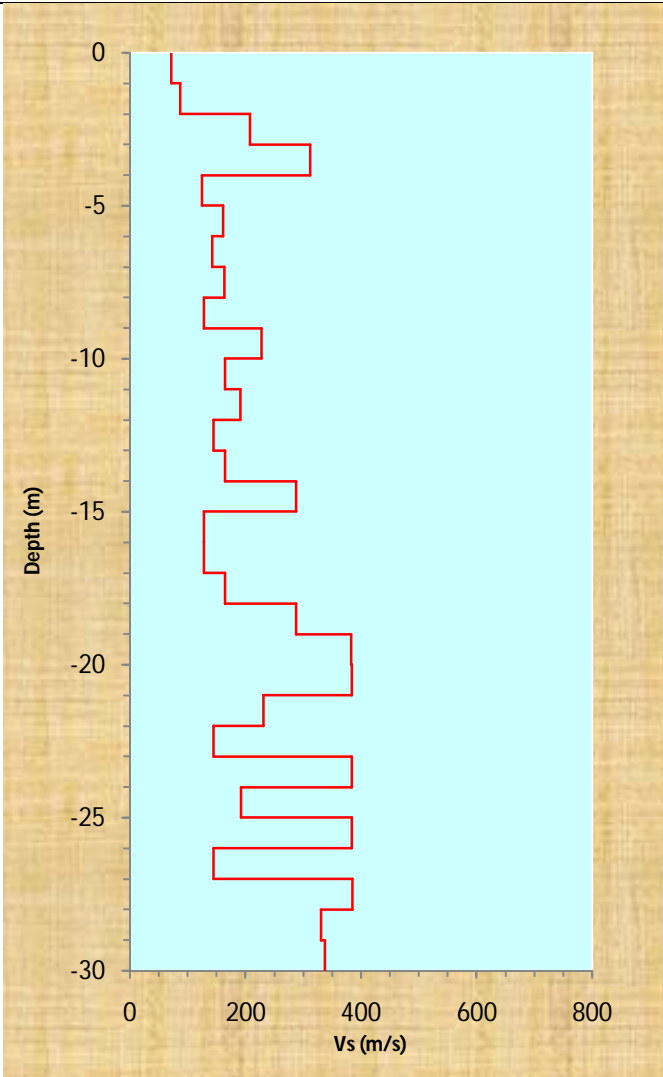
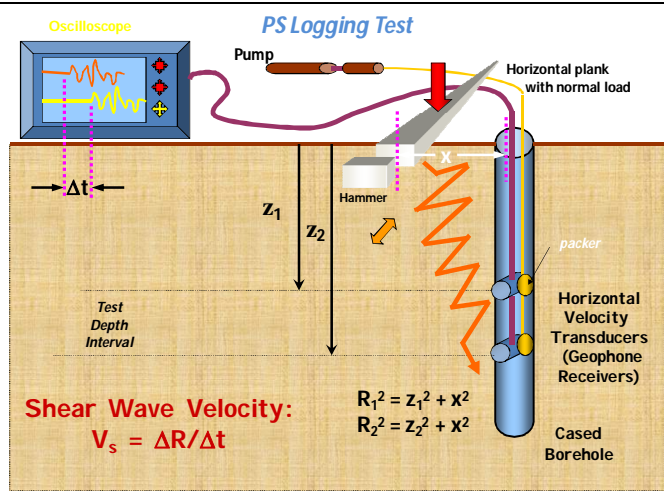

## CHAPTER 5: REFERENCES

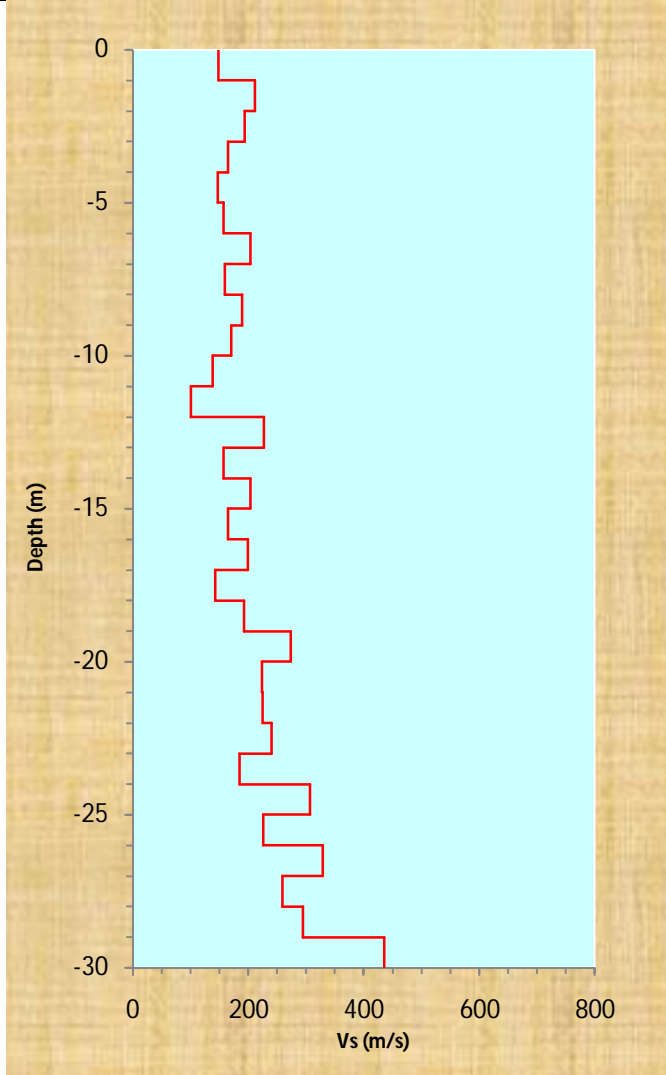
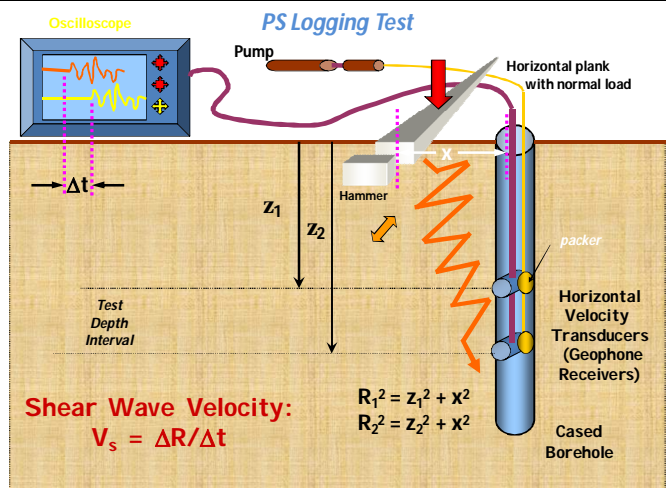

- i. Anbazhagan P, Sitharam TG. Mapping of average shear wave velocity for Bangalore region: a case study. *Journal of Environmental & Engineering Geophysics* 2008;13(2):69–84.
- ii. Anbazhagan P, Sitharam TG. Seismic microzonation of Bangalore. *Journal of Earth System Science* 2008; 117(S2):833–52.
- iii. Anbazhagan P, Sitharam TG. Spatial variability of the weathered and engineering bed rock using multichannel analysis of surface wave survey. *Pure and Applied Geophysics* 2009;166(3):409–28.
- iv. Auld, B., 1977, Cross-Hole and Down-Hole Vs by Mechanical Impulse, *Journal of Geotechnical Engineering Division, ASCE*, Vol. 103, No. GT12, pp. 1381-1398
- v. Kitsunezaki. C. ,N. Goto, Y. Kobayashi., T. Ikawa, M. Horike, T. Saito, T. Kurota, K. Yamane, and K. Okuzumi, 1990, Estimation of P- and S- wave velocities in Deep Soil Deposits for Evaluating Ground Vibrations in Earthquake, *SIZEN-SAIGAI-KAGAKU*,9-3,1-17 (in Japanese).
- vi. Ludwig, W.J., Nafe, J.E., and Drake, C.L., 1970, Seismic refraction, in *The Sea*, A.E. Maxwell (Editor), Vol. 4, Wiley-Interscience, New York, pp. 53-84
- vii. Miller RD, Xia J, Park CB, Ivanov J. Multichannel analysis of surface waves to map bedrock. *The Leading Edge* 1999;18(12):1392–6.
- viii. Okada, H., 2003, *The microtremor survey method*, Society of Exploration Geophysicist, Tulsa
- ix. Park CB, Miller RD, Xia J. Multi-channel analysis of surface waves. *Geophysics* 1999; 64(3):800–8.

## **Appendix A**

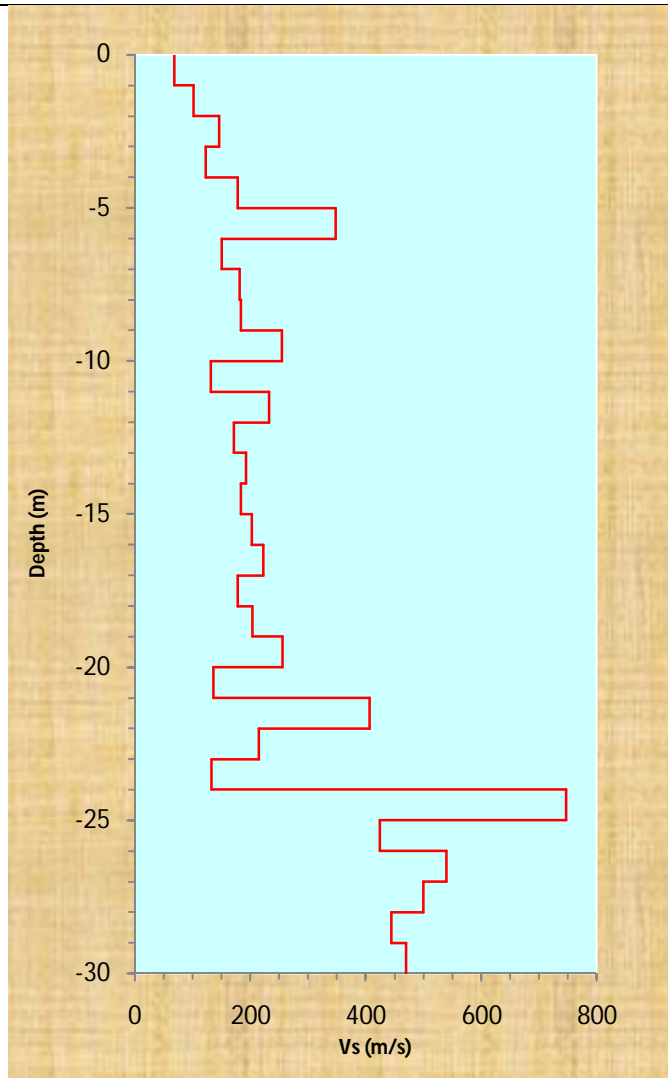
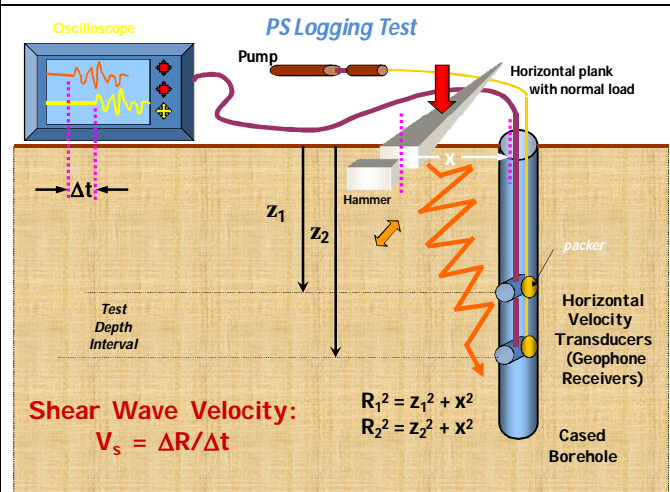

### Downhole Seismic Test (PS Logging) Results and Graphs

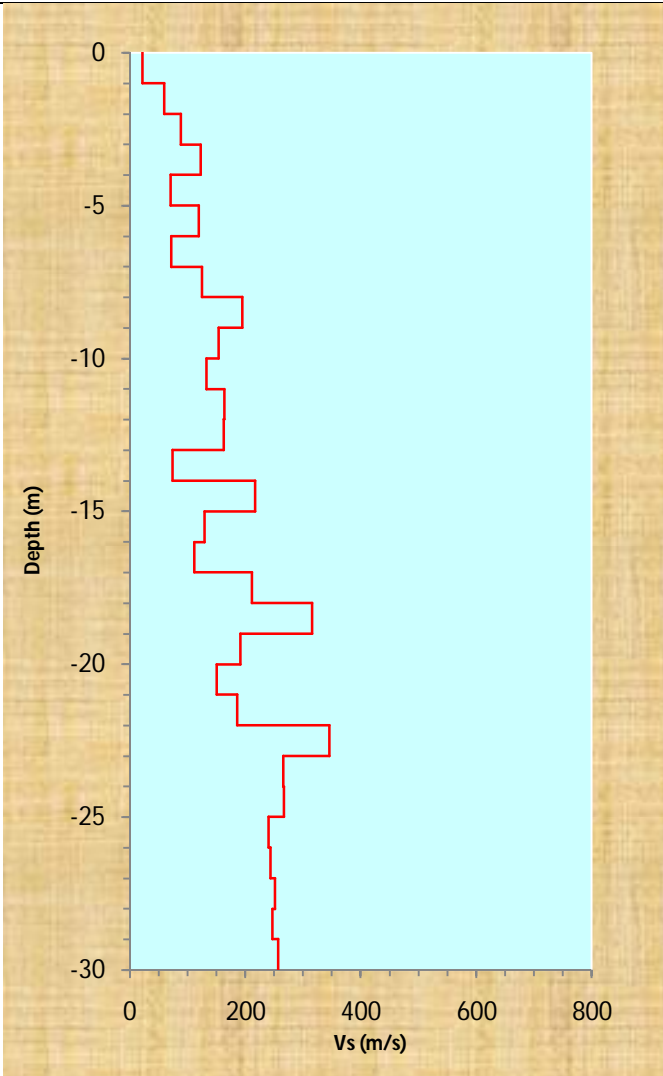
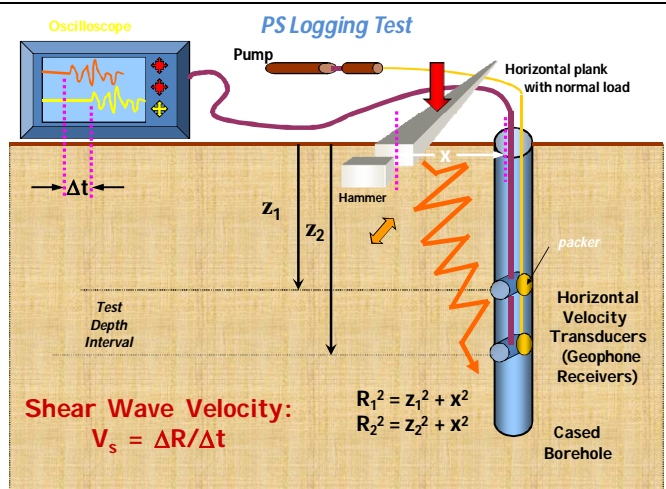



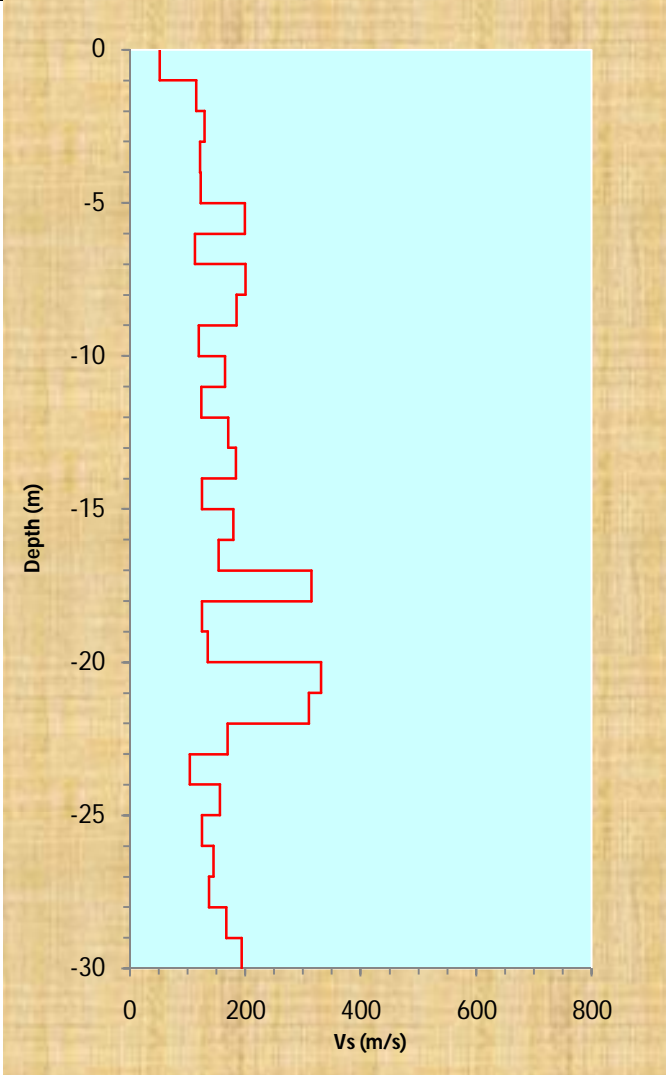
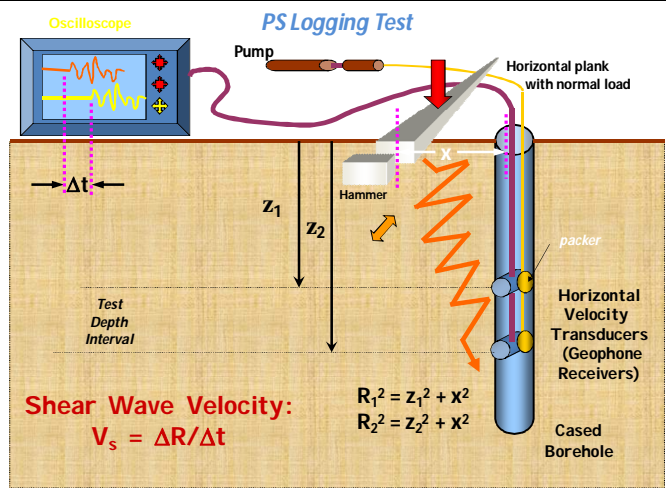

<b>Tested Date</b> : 7 January 2016 <b>Location</b> : Char Madhabdia Govt.Primary School, Char Madhabdia Bazar, Char Madhabdia Union <b>Test Id</b> : PS-1 (BH-04) <b>Coordinate</b> : Latitude 23.652707 Longitude 89.816911 <b>Operator</b> : The Olson Instruments Downhole Seismic system			<b>Source</b> : 7kg Sledge Hammer <b>Downhole Receiver</b> : Tri-axial Geophone <b>Recording Equipment</b> : Freedom Data PC <b>Borehole Information</b> : Grouted Cased <b>Casing Diameter</b> : 75mm PVC Casing	
Depth (m) Form EGL	S-wave Velocity	Graphical Representation of S-wave Velocity		Data Acquisition Procedure
-1	71			
-2	87			
-3	207			
-4	312			
-5	125			
-6	161			
-7	142			
-8	163			
-9	128			
-10	228			
-11	164			
-12	191			
-13	144			
-14	165			
-15	287			
-16	128			
-17	128			
-18	165			
-19	288			
-20	383			
-21	384			
-22	231			
-23	144			
-24	384			
-25	192			
-26	384			
-27	144			
-28	384			
-29	331			
-30	337			
<b>Average Vs 30m = 178m/sec</b>				 <p><b>Downhole Seismic Test Data Acquisition</b></p>

Tested Date : 7 January 2016 Location : 5 nos. Decreerchar, Munshitanggi Aftabuddin Madrasha, Decreerchar Union Test Id : PS-2 (BH-11) Coordinate : Latitude 23.61113 Longitude 89.86364 Operator : The Olson Instruments Downhole Seismic system			Source : 7kg Sledge Hammer Downhole Receiver : Tri-axial Geophone Recording Equipment : Freedom Data PC Borehole Information : Grouted Cased Casing Diameter : 75mm PVC Casing	
Depth (m) Form EGL	S-wave Velocity	Graphical Representation of S-wave Velocity		Data Acquisition Procedure
-1	148			 <p><b>Shear Wave Velocity:</b> <math>V_s = \Delta R / \Delta t</math></p> <p><math>R_1^2 = z_1^2 + x^2</math> <math>R_2^2 = z_2^2 + x^2</math></p>
-2	211			
-3	193			
-4	165			
-5	147			
-6	157			
-7	203			
-8	159			
-9	189			
-10	170			
-11	138			
-12	100			
-13	227			
-14	156			
-15	204			
-16	165			
-17	199			
-18	142			
-19	193			
-20	273			
-21	224			
-22	224			
-23	240			
-24	184			
-25	306			
-26	226			
-27	329			
-28	259			
-29	295			
-30	435			
Average Vs 30m = 191 m/sec				 <p>Downhole Seismic Test Data Acquisition</p>

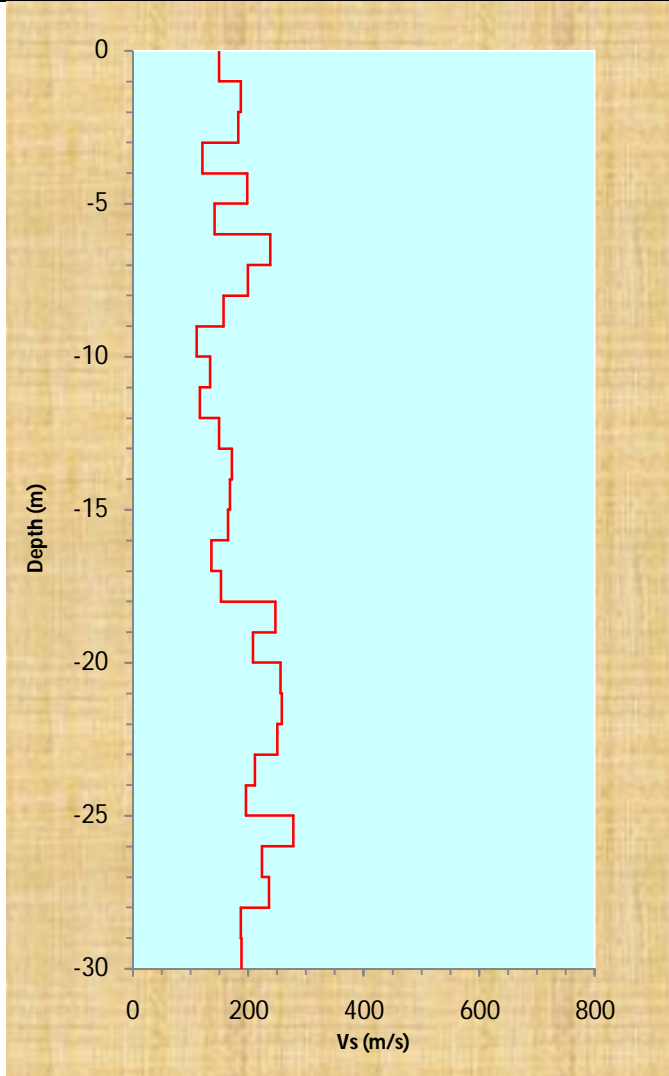
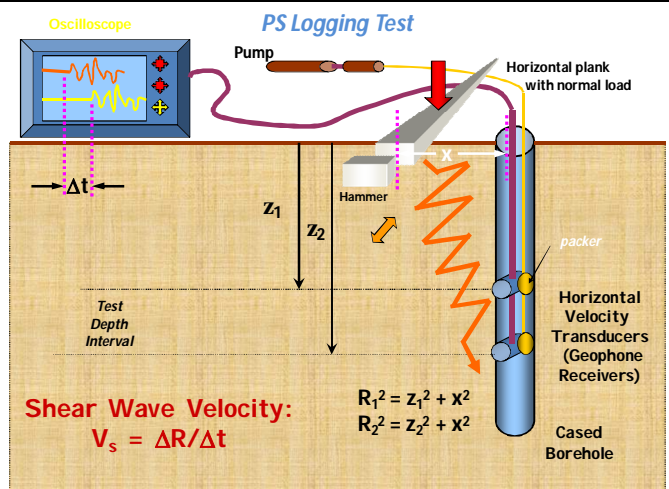



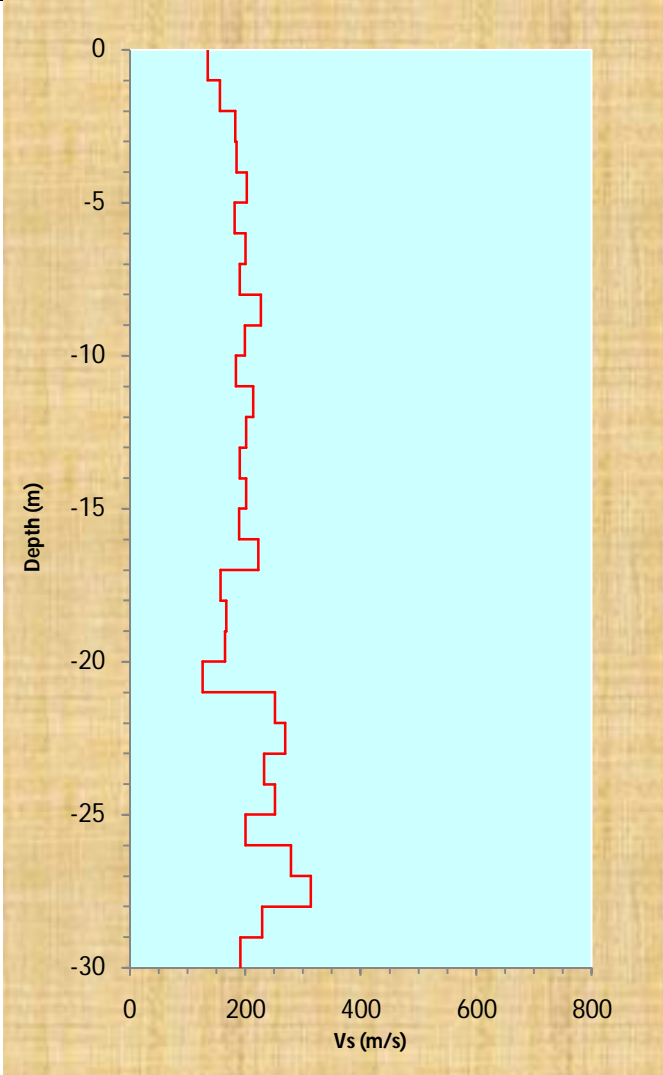
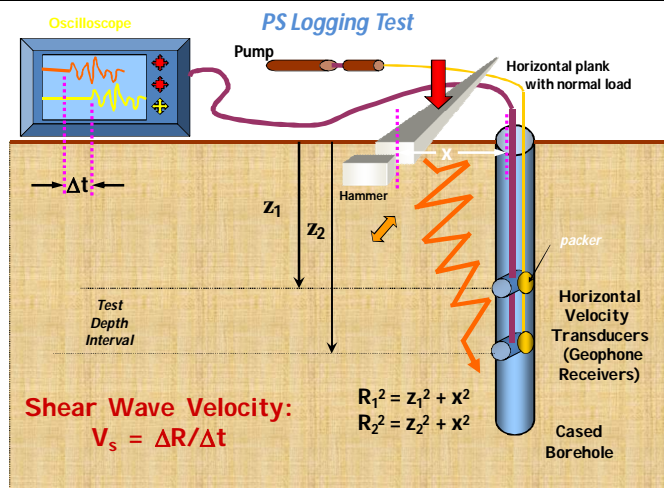

Tested Date : 6 January 2016			Source : 7kg Sledge Hammer	
Location : Faridpur Zilla School field, Faridpur Sadar			Downhole Receiver : Tri-axial Geophone	
Test Id : PS-3 (BH-13)			Recording Equipment : Freedom Data PC	
Coordinate : Latitude 23.60888 Longitude 89.84447			Borehole Information : Grouted Cased	
Operator : The Olson Instruments Downhole Seismic system			Casing Diameter : 75mm PVC Casing	
Depth (m) Form EGL	S-wave Velocity	Graphical Representation of S-wave Velocity		Data Acquisition Procedure
-1	68			
-2	102			
-3	146			
-4	123			
-5	178			
-6	348			
-7	150			
-8	181			
-9	184			
-10	255			
-11	131			
-12	232			
-13	171			
-14	192			
-15	184			
-16	203			
-17	222			
-18	178			
-19	203			
-20	256			
-21	136			
-22	406			
-23	215			
-24	133			
-25	746			
-26	424			
-27	539			
-28	500			
-29	445			
-30	469			
Average Vs 30m = 193m/sec				
Downhole Seismic Test Data Acquisition				

<b>Tested Date</b> : 5 January 2016 <b>Location</b> : Hadhokandi Govt. Primary School, Oposite side of River Research Institute, Kaijuri Union <b>Test Id</b> : PS-4 (BH-20) <b>Coordinate</b> : Latitude 23.58205 Longitude 89.83917 <b>Operator</b> : The Olson Instruments Downhole Seismic system			<b>Source</b> : 7kg Sledge Hammer <b>Downhole Receiver</b> : Tri-axial Geophone <b>Recording Equipment</b> : Freedom Data PC <b>Borehole Information</b> : Grouted Cased <b>Casing Diameter</b> : 75mm PVC Casing	
Depth (m) Form EGL	S-wave Velocity	Graphical Representation of S-wave Velocity		Data Acquisition Procedure
-1	22			 <p><b>PS Logging Test</b></p> <p>Oscilloscope</p> <p>Pump</p> <p>Horizontal plank with normal load</p> <p>Hammer</p> <p>Horizontal Velocity Transducers (Geophone Receivers)</p> <p>Cased Borehole</p> <p>Test Depth Interval</p> <p>Shear Wave Velocity: <math>V_s = \Delta R / \Delta t</math></p> <p><math>R_1^2 = z_1^2 + x^2</math> <math>R_2^2 = z_2^2 + x^2</math></p>
-2	59			
-3	88			
-4	122			
-5	70			
-6	119			
-7	71			
-8	124			
-9	195			
-10	154			
-11	132			
-12	164			
-13	163			
-14	74			
-15	217			
-16	129			
-17	111			
-18	211			
-19	315			
-20	191			
-21	151			
-22	186			
-23	345			
-24	265			
-25	267			
-26	240			
-27	244			
-28	252			
-29	247			
-30	257			
<b>Average Vs 30m = 120m/sec</b>				 <p><b>Downhole Seismic Test Data Acquisition</b></p>

<b>Tested Date</b> : 7 January 2016 <b>Location</b> : Technical Training Centre, Brahmonkanda, Sreeaungon, Faridpur Sadar <b>Test Id</b> : PS-5 (BH-22) <b>Coordinate</b> : Latitude 23.5869 Longitude 89.81373 <b>Operator</b> : The Olson Instruments Downhole Seismic system			<b>Source</b> : 7kg Sledge Hammer <b>Downhole Receiver</b> : Tri-axial Geophone <b>Recording Equipment</b> : Freedom Data PC <b>Borehole Information</b> : Grouted Cased <b>Casing Diameter</b> : 75mm PVC Casing	
<b>Depth (m) Form EGL</b>	<b>S-wave Velocity</b>	<b>Graphical Representation of S-wave Velocity</b>	<b>Data Acquisition Procedure</b>	
-1	51			
-2	115			
-3	129			
-4	121			
-5	122			
-6	199			
-7	112			
-8	200			
-9	185			
-10	119			
-11	165			
-12	124			
-13	171			
-14	184			
-15	125			
-16	179			
-17	154			
-18	314			
-19	124			
-20	135			
-21	331			
-22	310			
-23	170			
-24	104			
-25	156			
-26	124			
-27	145			
-28	137			
-29	167			
-30	193			
<b>Average Vs 30m = 142m/sec</b>			<b>Downhole Seismic Test Data Acquisition</b>	



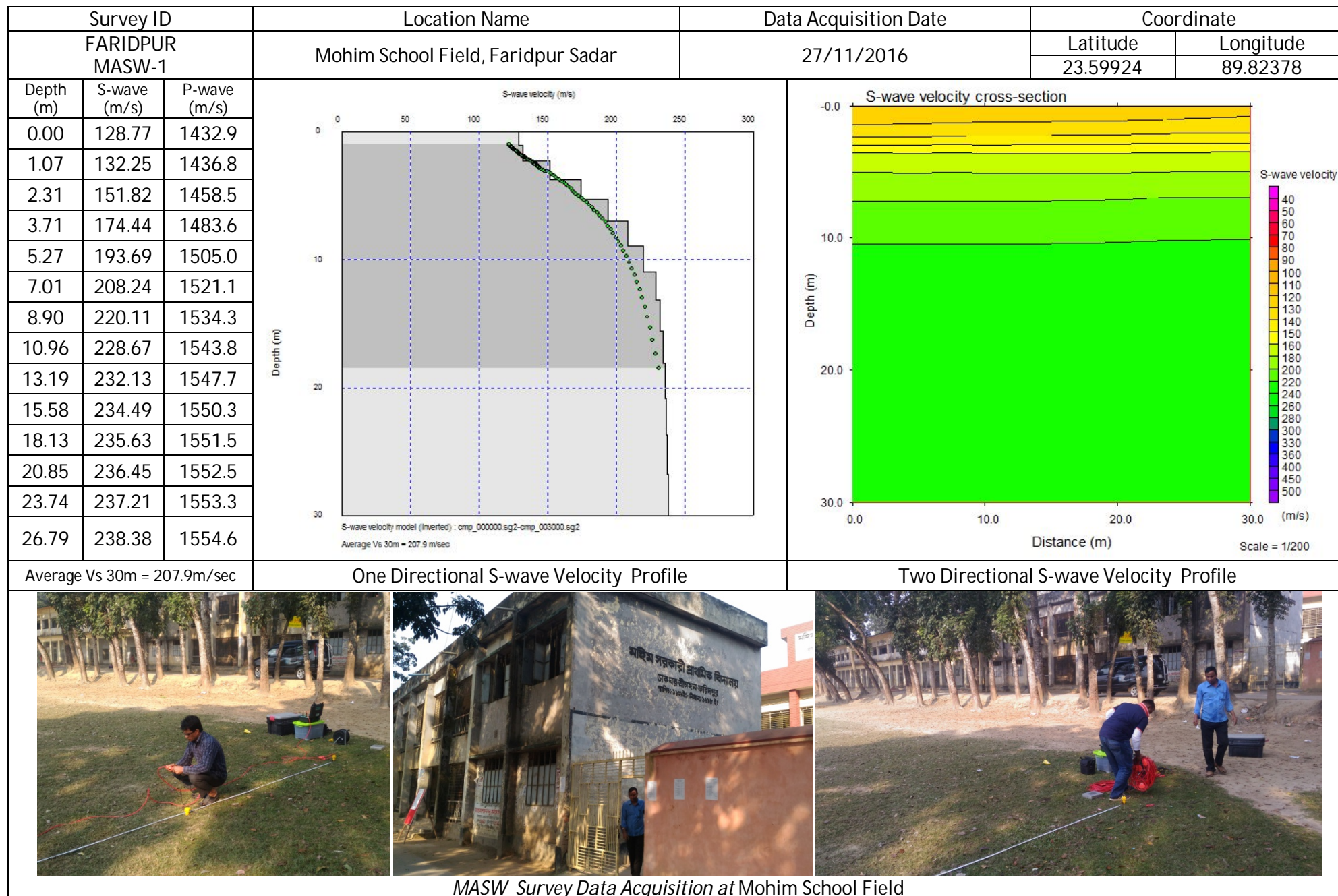
<b>Tested Date</b> : 7 January 2016 <b>Location</b> : Bakhunda College Field, Bakhunda, Greda Union <b>Test Id</b> : PS-6 (BH-27) <b>Coordinate</b> : Latitude 23.54565 Longitude 89.85487 <b>Operator</b> : The Olson Instruments Downhole Seismic system			<b>Source</b> : 7kg Sledge Hammer <b>Downhole Receiver</b> : Tri-axial Geophone <b>Recording Equipment</b> : Freedom Data PC <b>Borehole Information</b> : Grouted Cased <b>Casing Diameter</b> : 75mm PVC Casing	
<b>Depth (m) Form EGL</b>	<b>S-wave Velocity</b>	<b>Graphical Representation of S-wave Velocity</b>	<b>Data Acquisition Procedure</b>	
-1	149		 <p><b>PS Logging Test</b></p> <p>Oscilloscope</p> <p>Pump</p> <p>Horizontal plank with normal load</p> <p>Hammer</p> <p>Horizontal Velocity Transducers (Geophone Receivers)</p> <p>Cased Borehole</p> <p>Test Depth Interval</p> <p>Shear Wave Velocity:  <math>V_s = \Delta R / \Delta t</math> </p> <p> <math>R_1^2 = z_1^2 + x^2</math>  <math>R_2^2 = z_2^2 + x^2</math> </p>	
-2	187			
-3	183			
-4	121			
-5	197			
-6	141			
-7	238			
-8	199			
-9	157			
-10	110			
-11	134			
-12	116			
-13	150			
-14	171			
-15	168			
-16	164			
-17	135			
-18	152			
-19	247			
-20	208			
-21	256			
-22	258			
-23	250			
-24	211			
-25	196			
-26	278			
-27	224			
-28	235			
-29	187			
-30	188			
<b>Average Vs 30m = 175.7 m/sec</b>			 <p><b>Downhole Seismic Test Data Acquisition</b></p>	

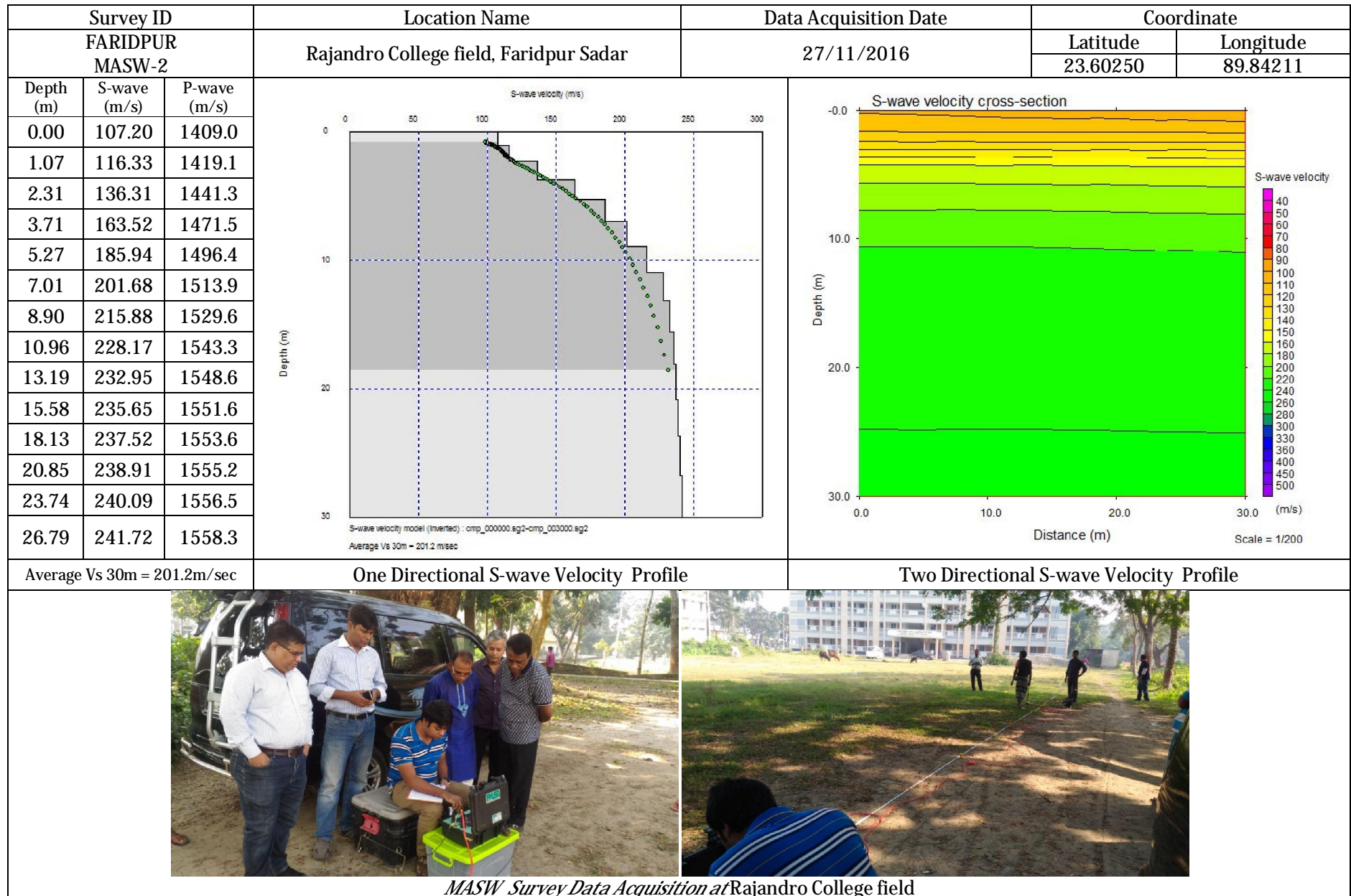
<b>Tested Date</b> : 6 January 2016 <b>Location</b> : Madhobpur Govt. Primary School, Mallikpur Bazar, Krishnanagar Union <b>Test Id</b> : PS-7 (BH-30) <b>Coordinate</b> : Latitude 23.53895 Longitude 89.73418 <b>Operator</b> : The Olson Instruments Downhole Seismic system			<b>Source</b> : 7kg Sledge Hammer <b>Downhole Receiver</b> : Tri-axial Geophone <b>Recording Equipment</b> : Freedom Data PC <b>Borehole Information</b> : Grouted Cased <b>Casing Diameter</b> : 75mm PVC Casing	
Depth (m) Form EGL	S-wave Velocity	Graphical Representation of S-wave Velocity		Data Acquisition Procedure
-1	135			 <p><b>Shear Wave Velocity:</b>  <math>V_s = \Delta R / \Delta t</math></p> <p> <math>R_1^2 = z_1^2 + x^2</math>  <math>R_2^2 = z_2^2 + x^2</math> </p>
-2	155			
-3	183			
-4	185			
-5	202			
-6	181			
-7	201			
-8	190			
-9	227			
-10	200			
-11	184			
-12	213			
-13	202			
-14	190			
-15	201			
-16	189			
-17	223			
-18	157			
-19	167			
-20	164			
-21	126			
-22	251			
-23	269			
-24	232			
-25	251			
-26	200			
-27	279			
-28	314			
-29	229			
-30	191			
<b>Average Vs 30m = 195.2 m/sec</b>				 <p>Downhole Seismic Test Data Acquisition</p>

## **Appendix B**

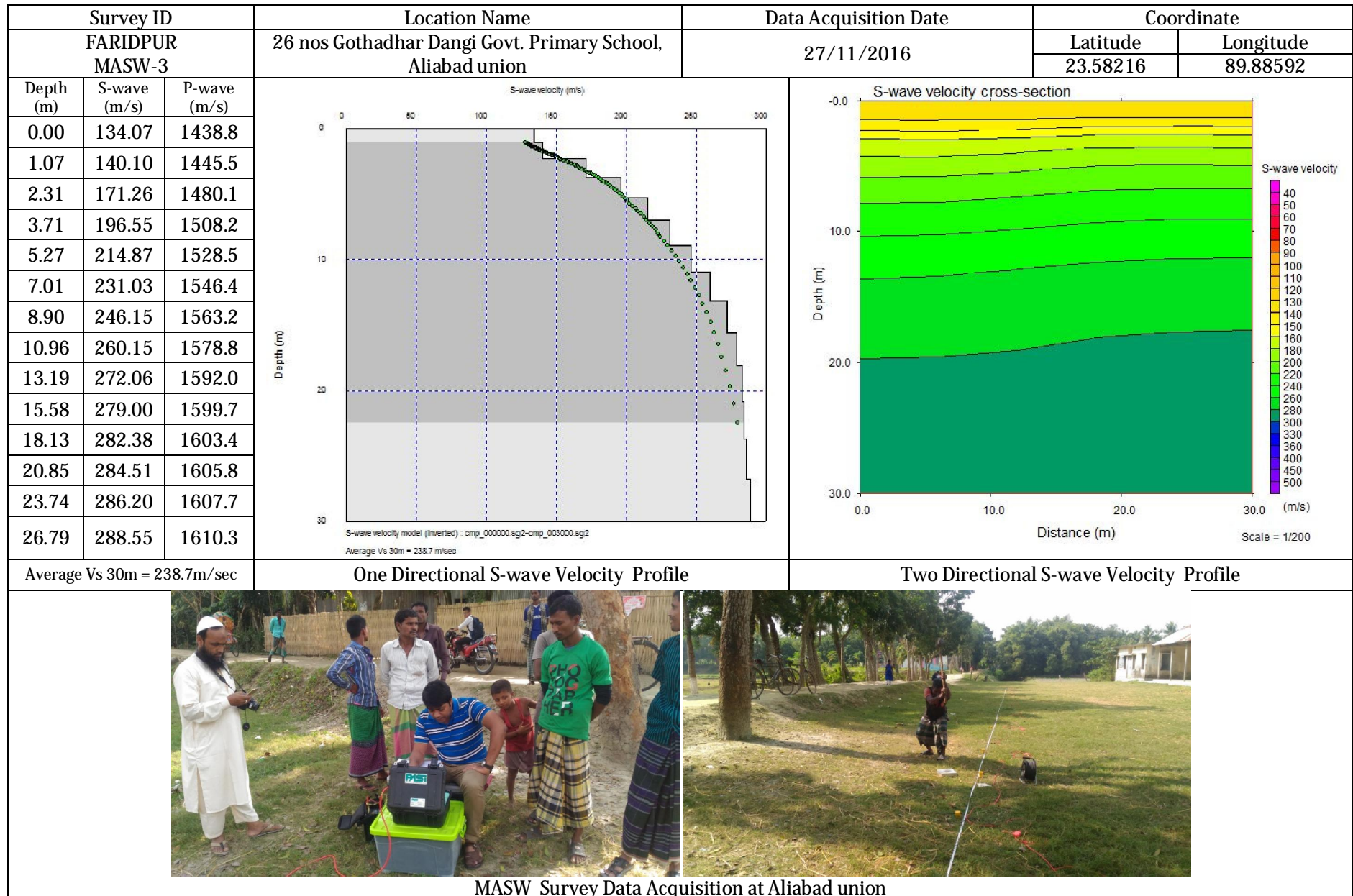
### Multi-channel Analysis of Surface Wave (MASW) Results and Graphs

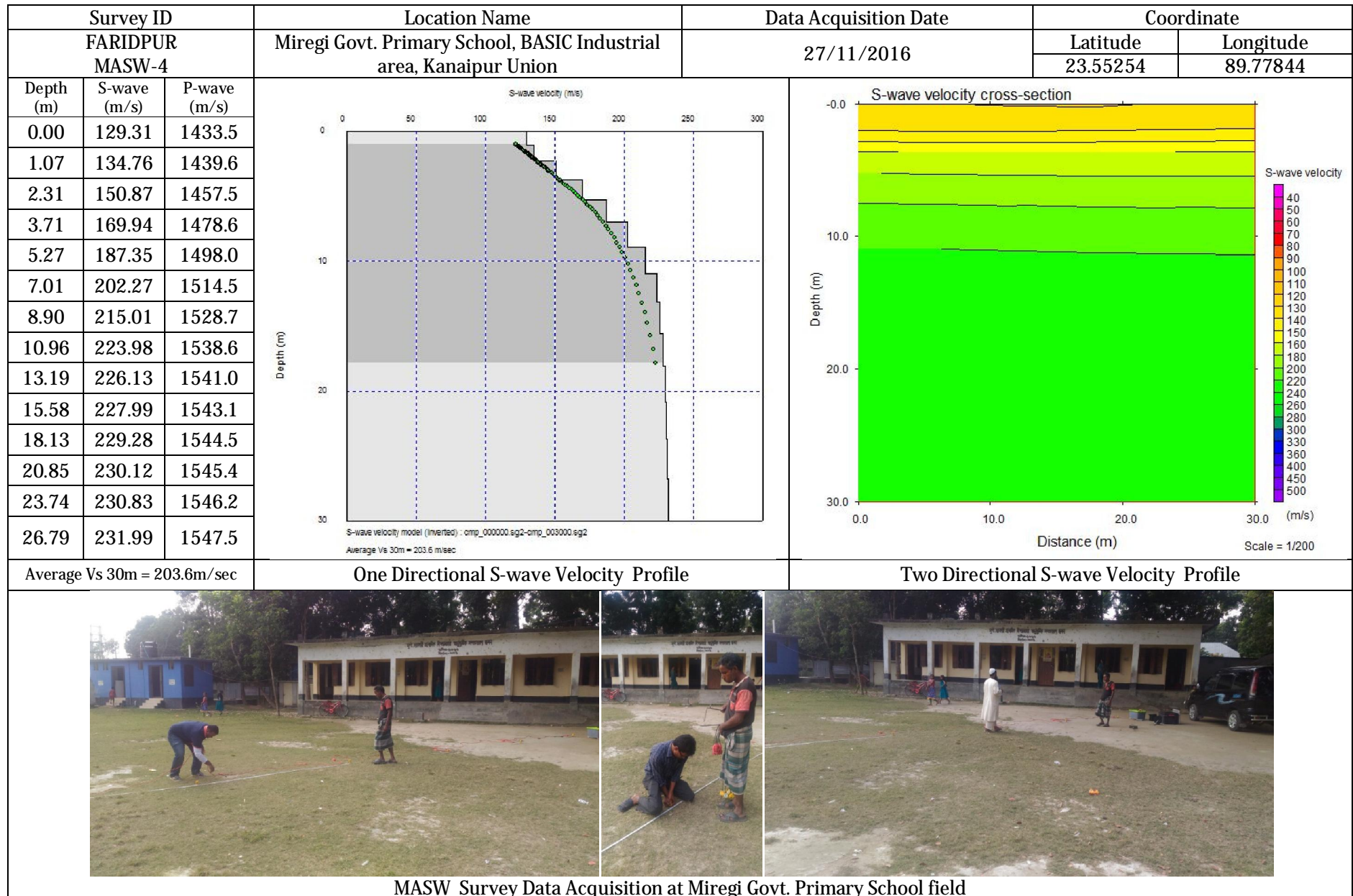




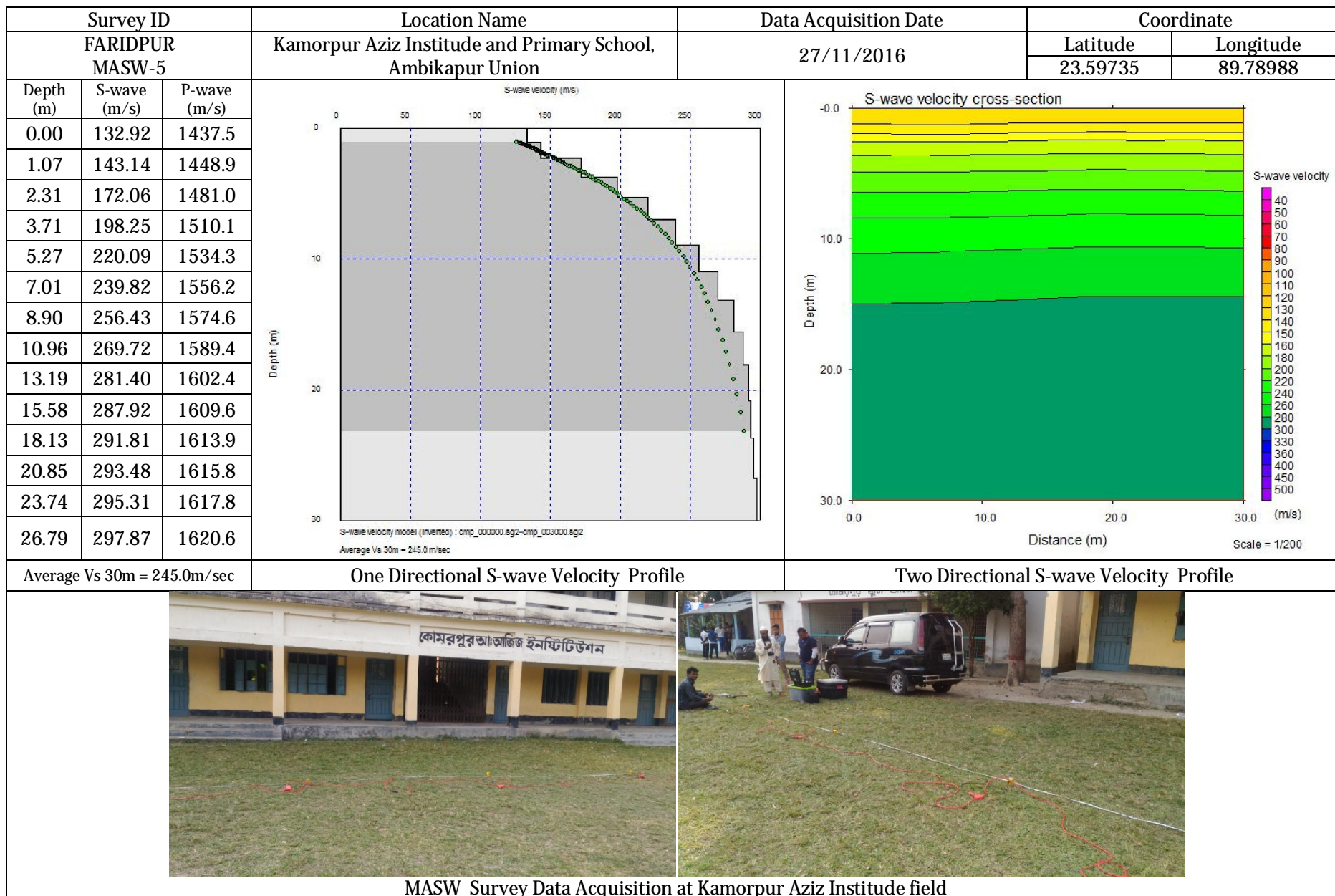


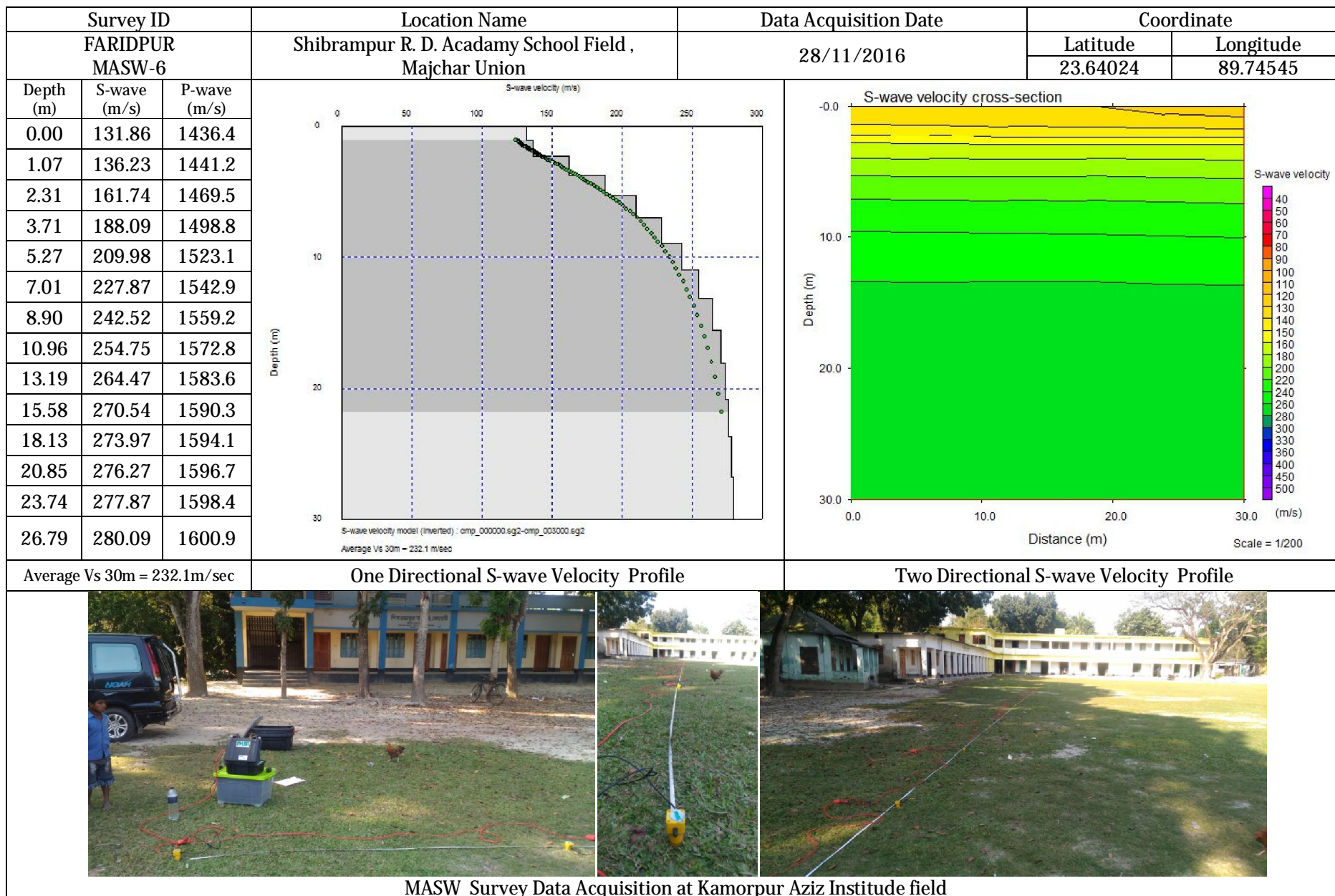






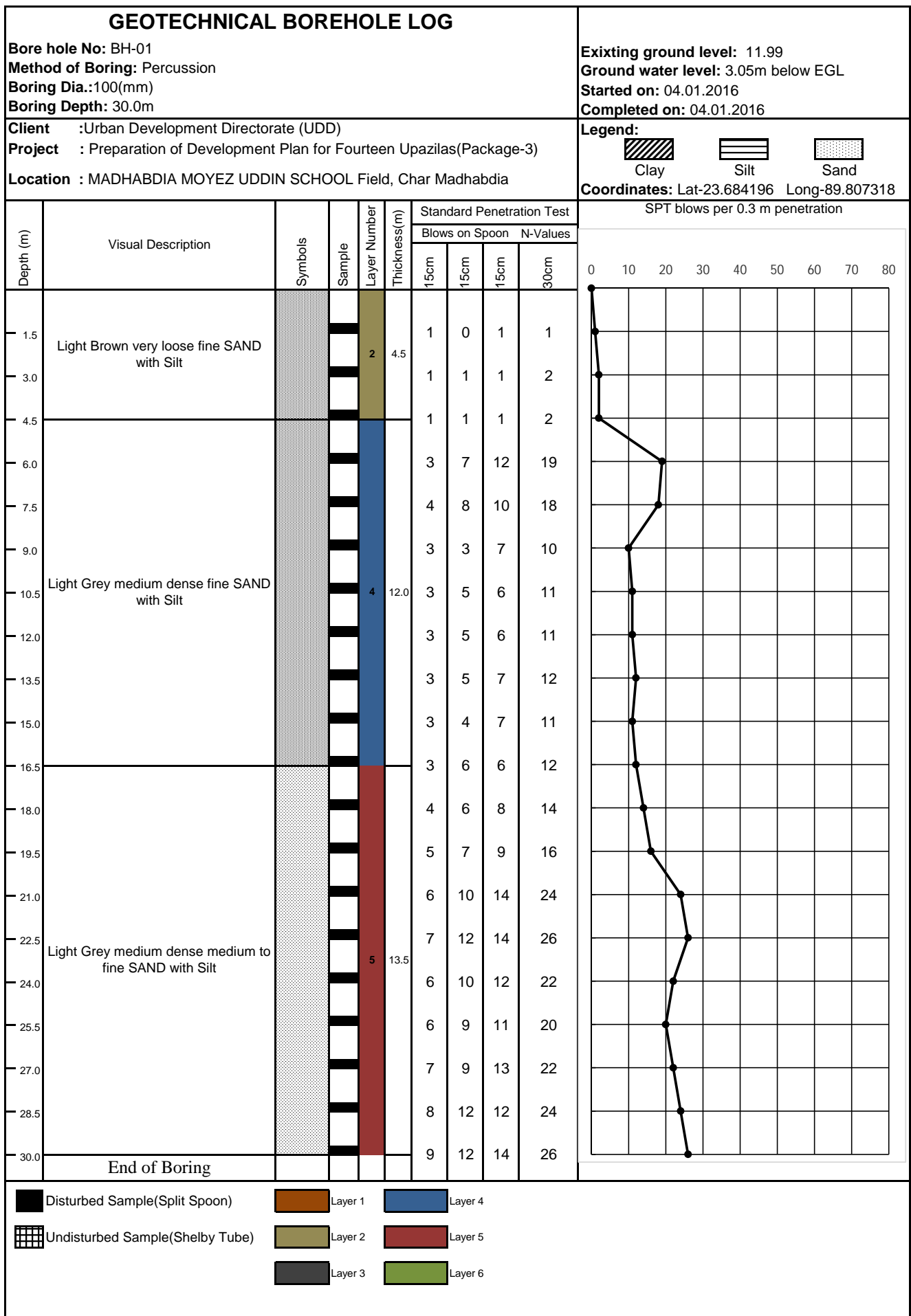




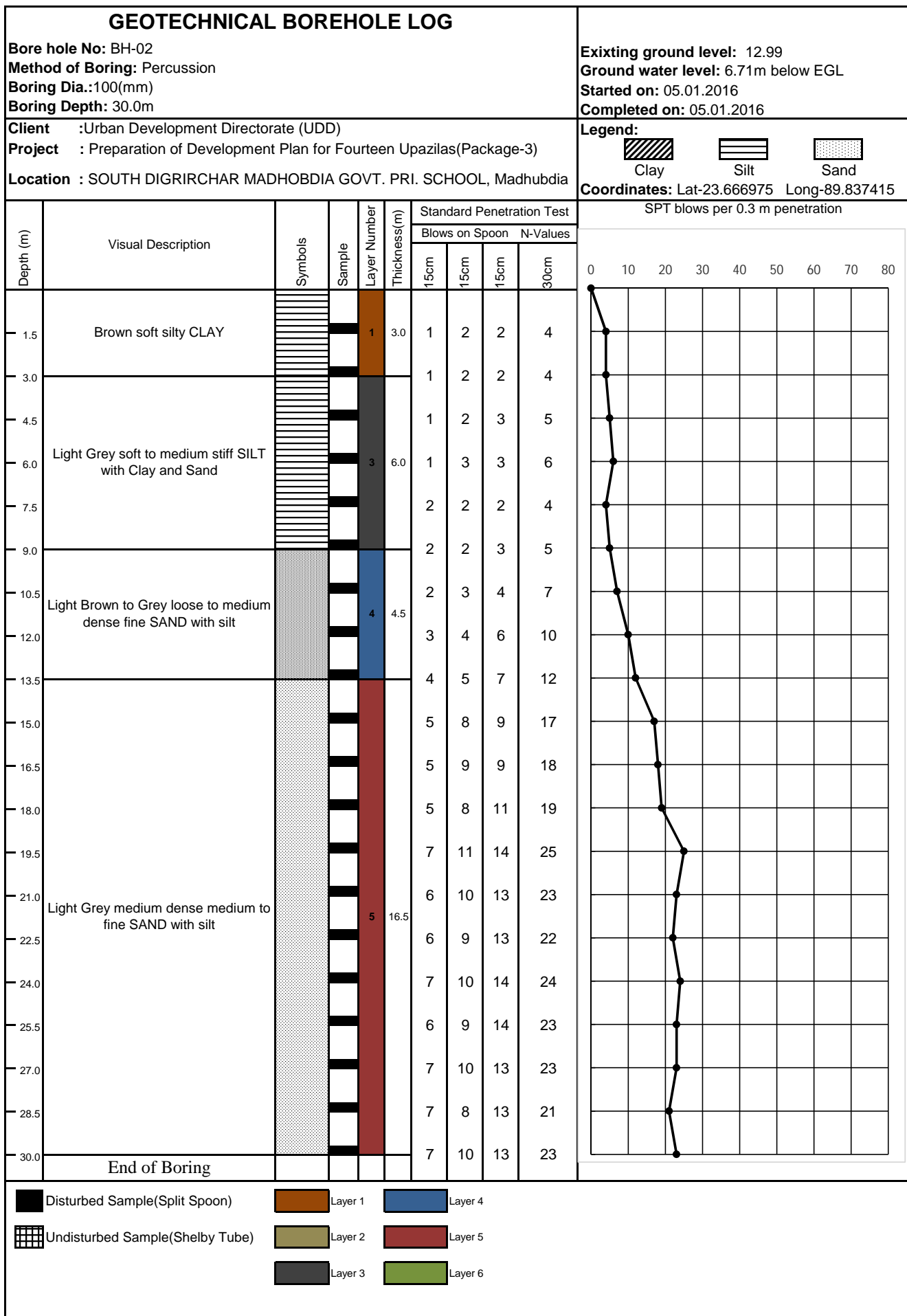


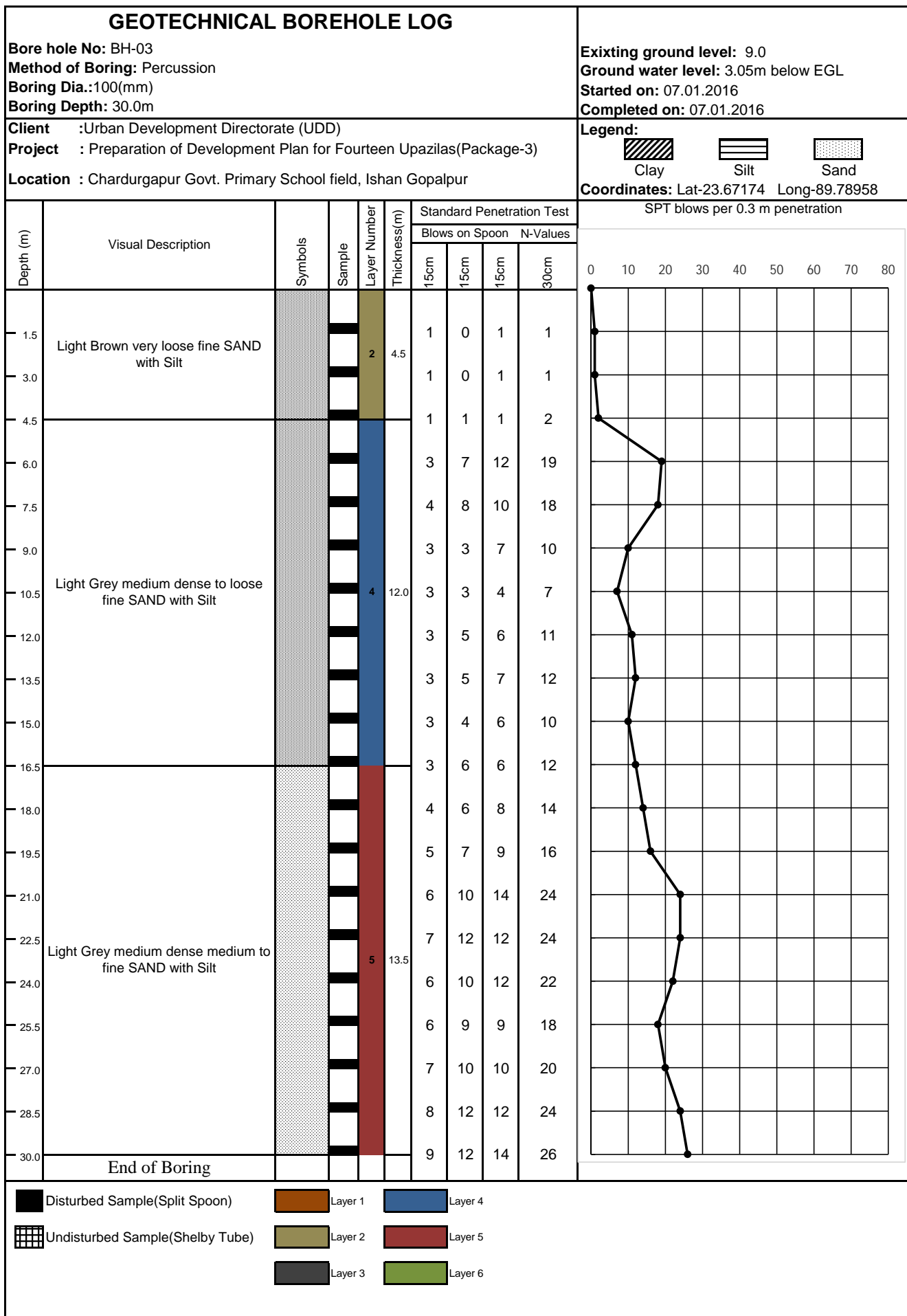
## **Appendix C**

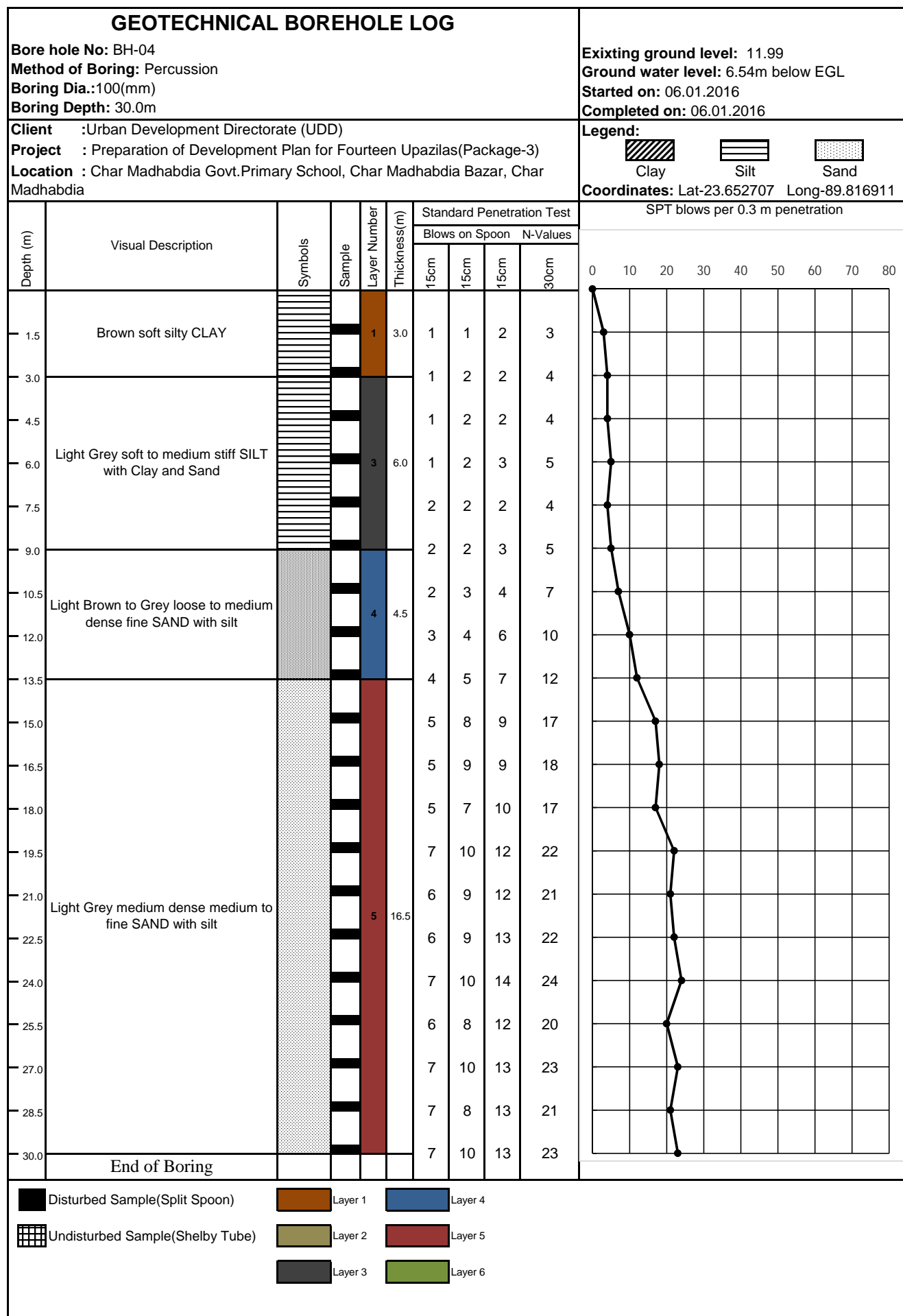
### Geotechnical Borehole Logs and Graphs

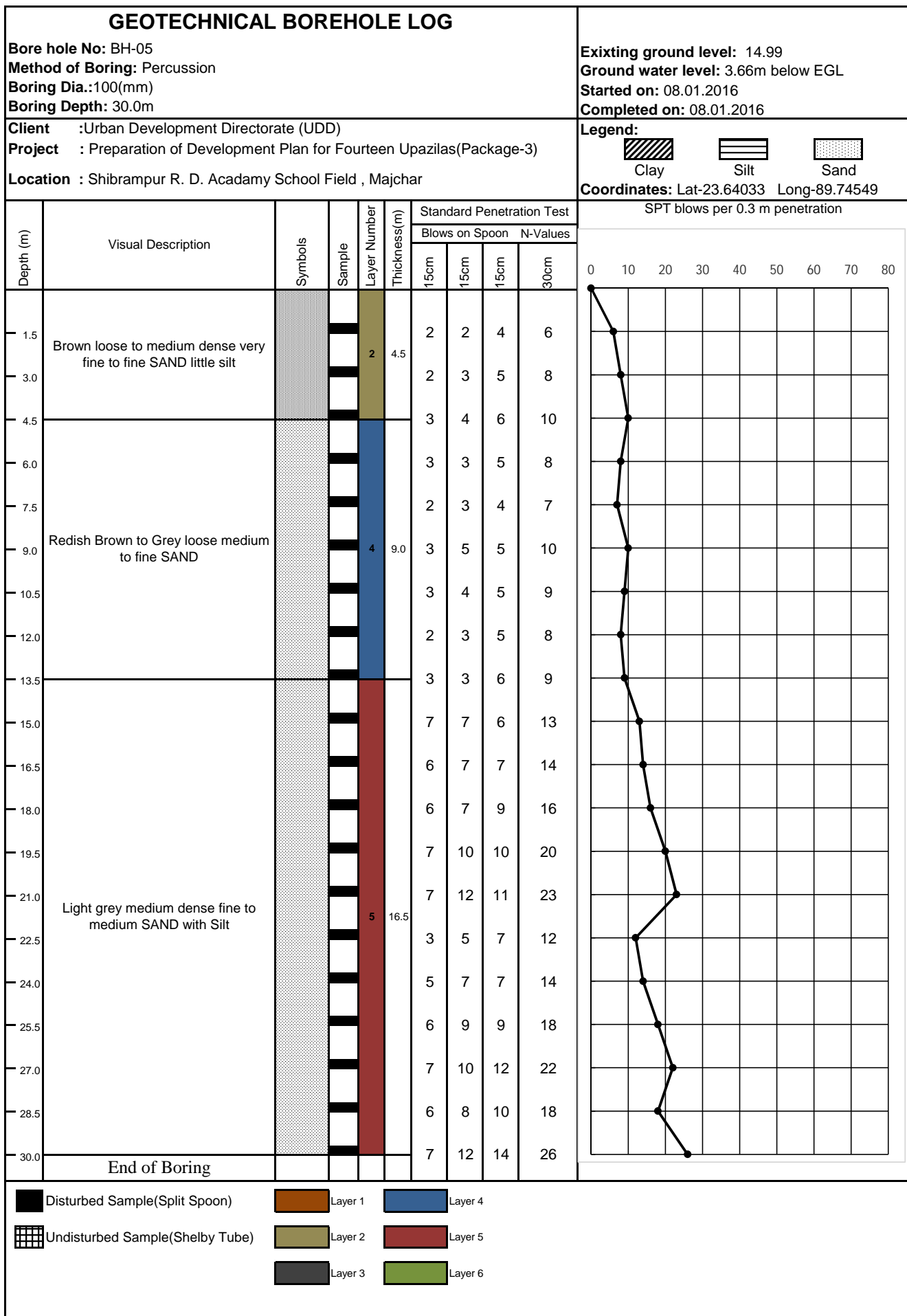


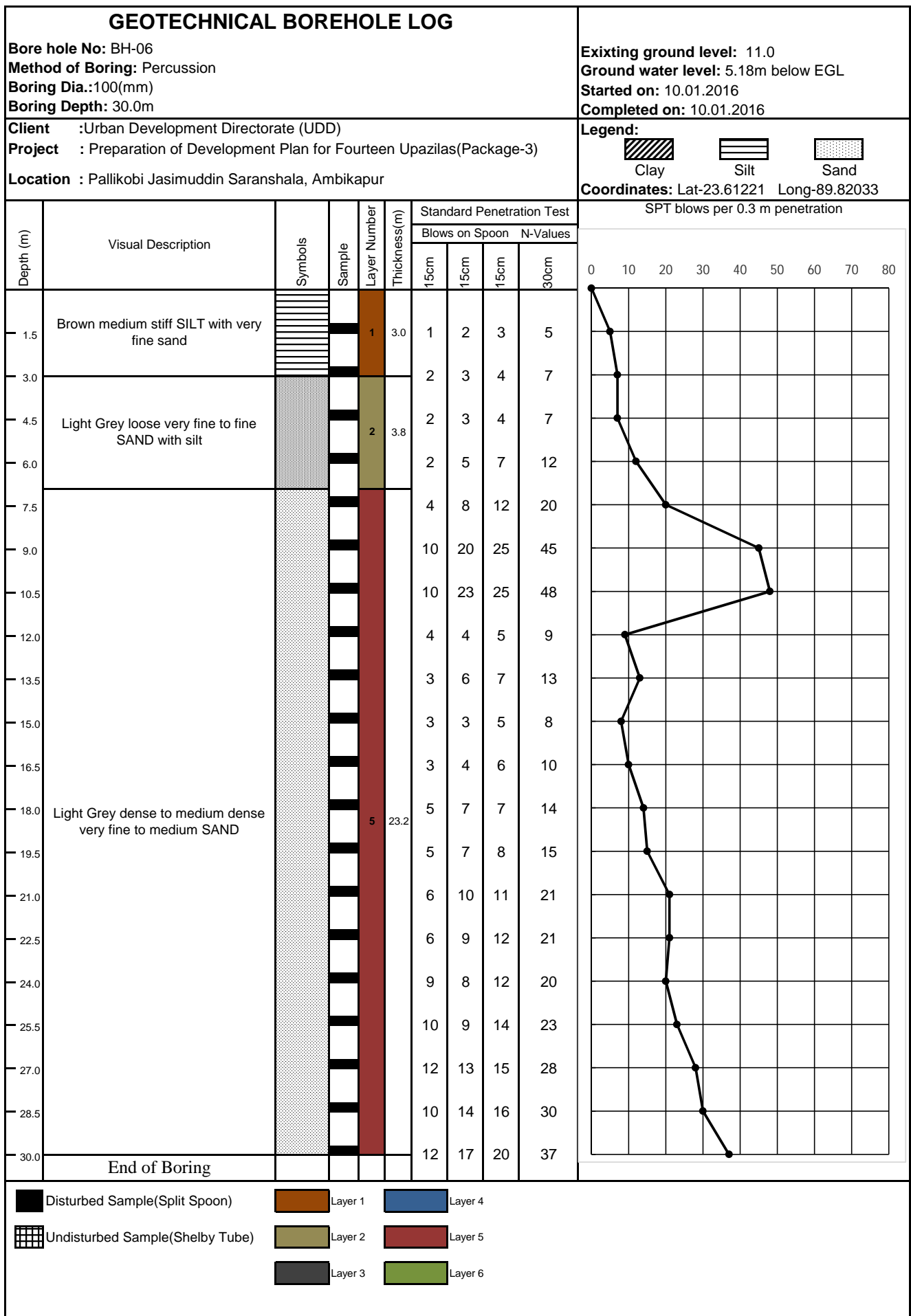


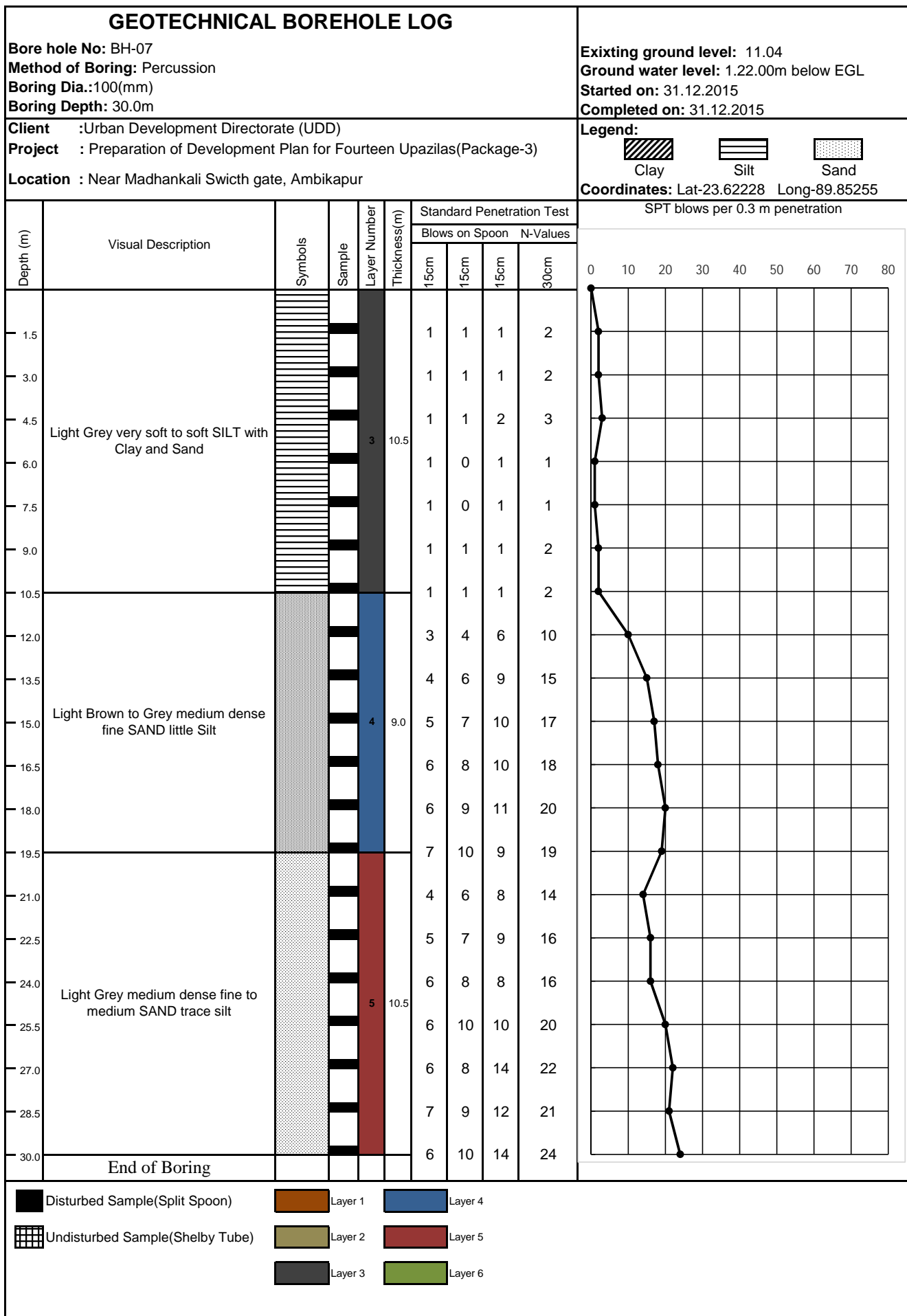


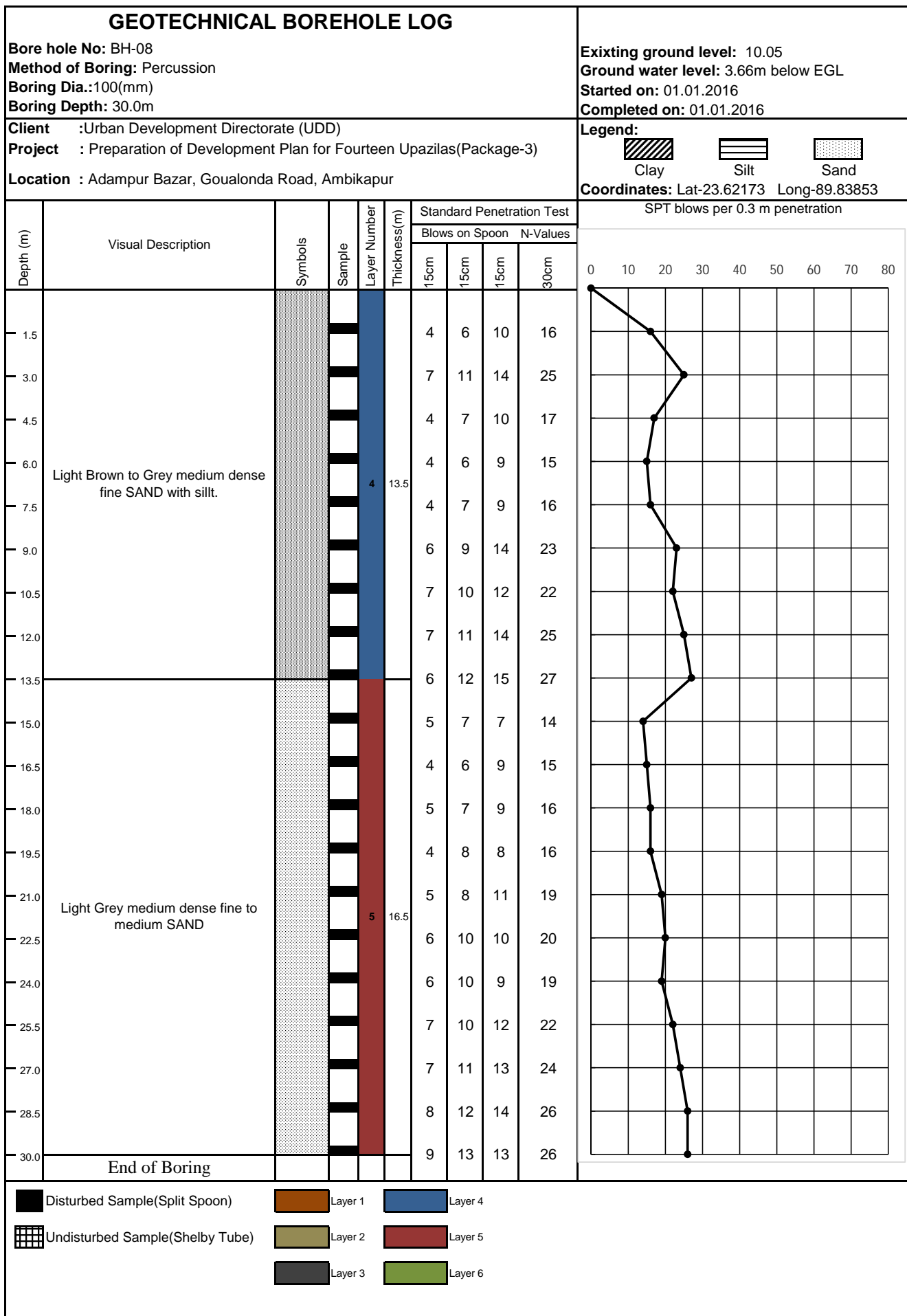


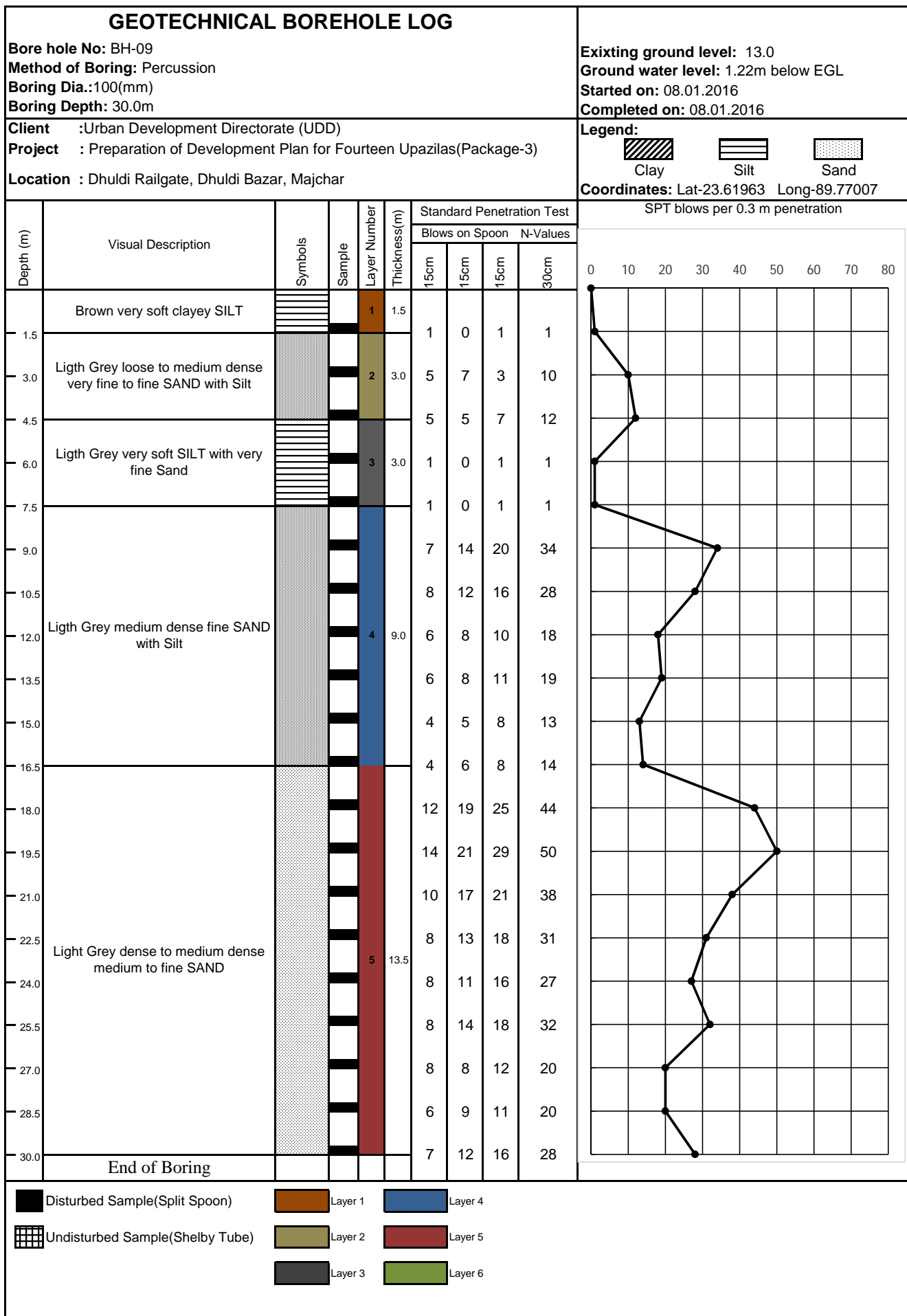




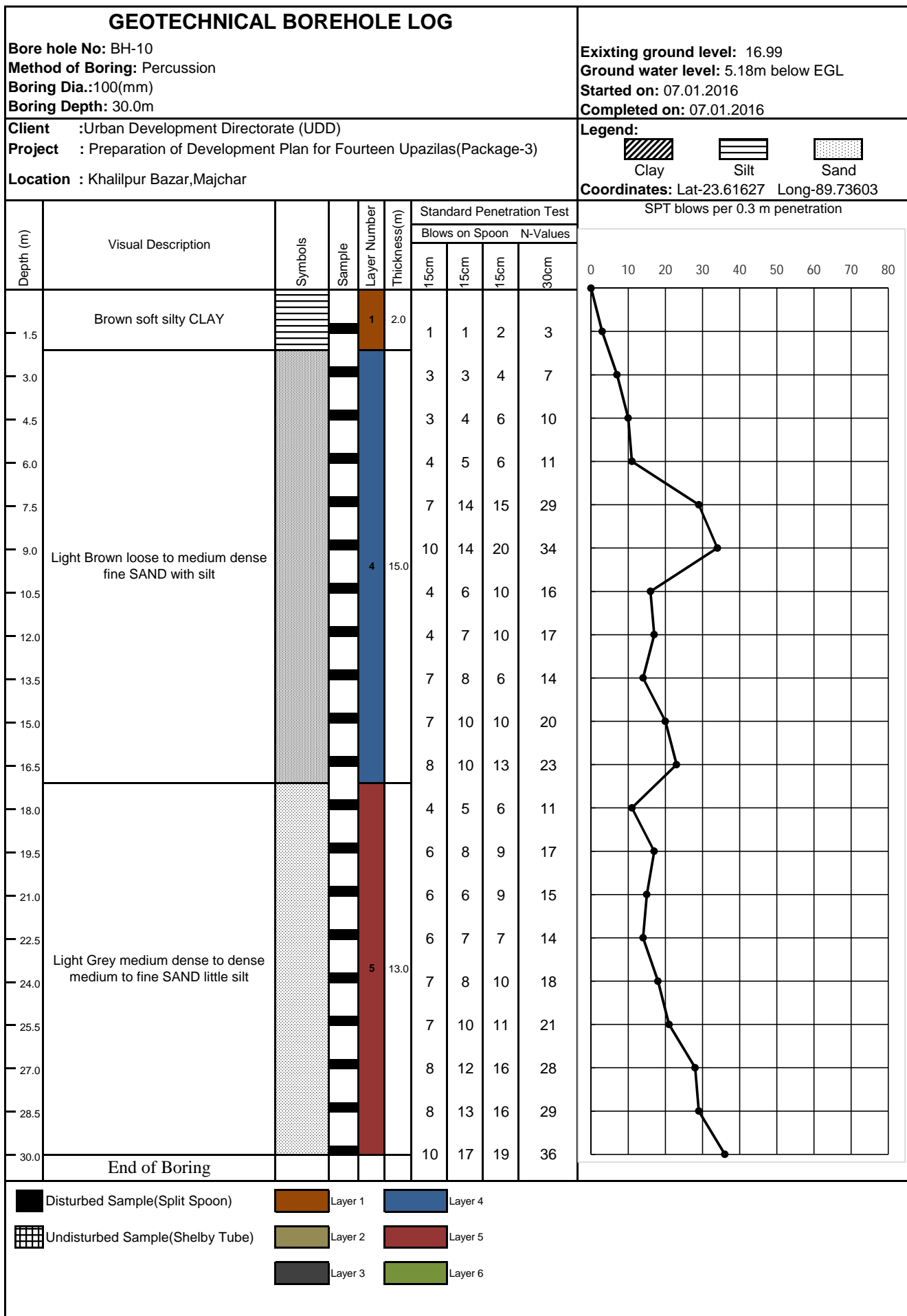


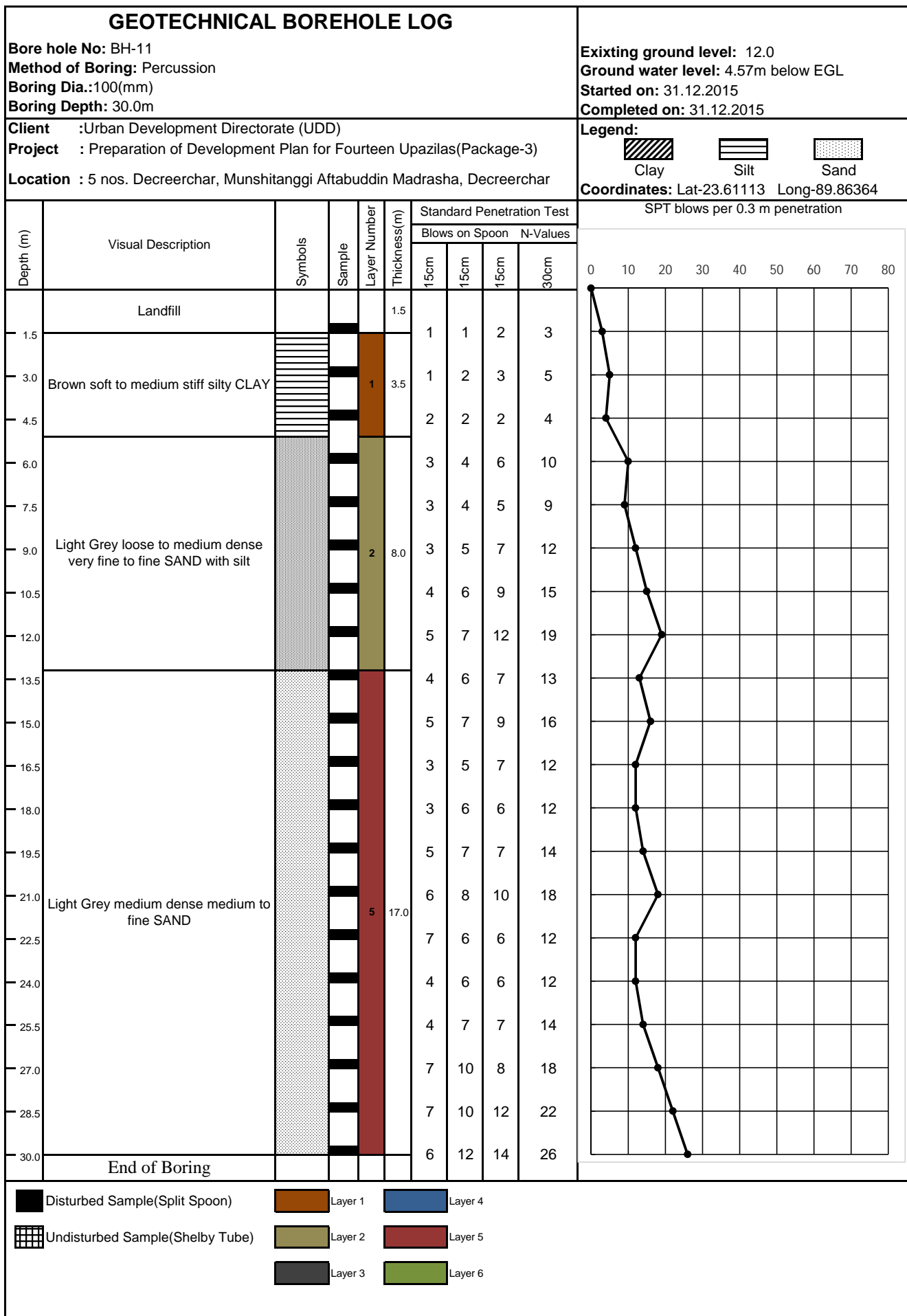


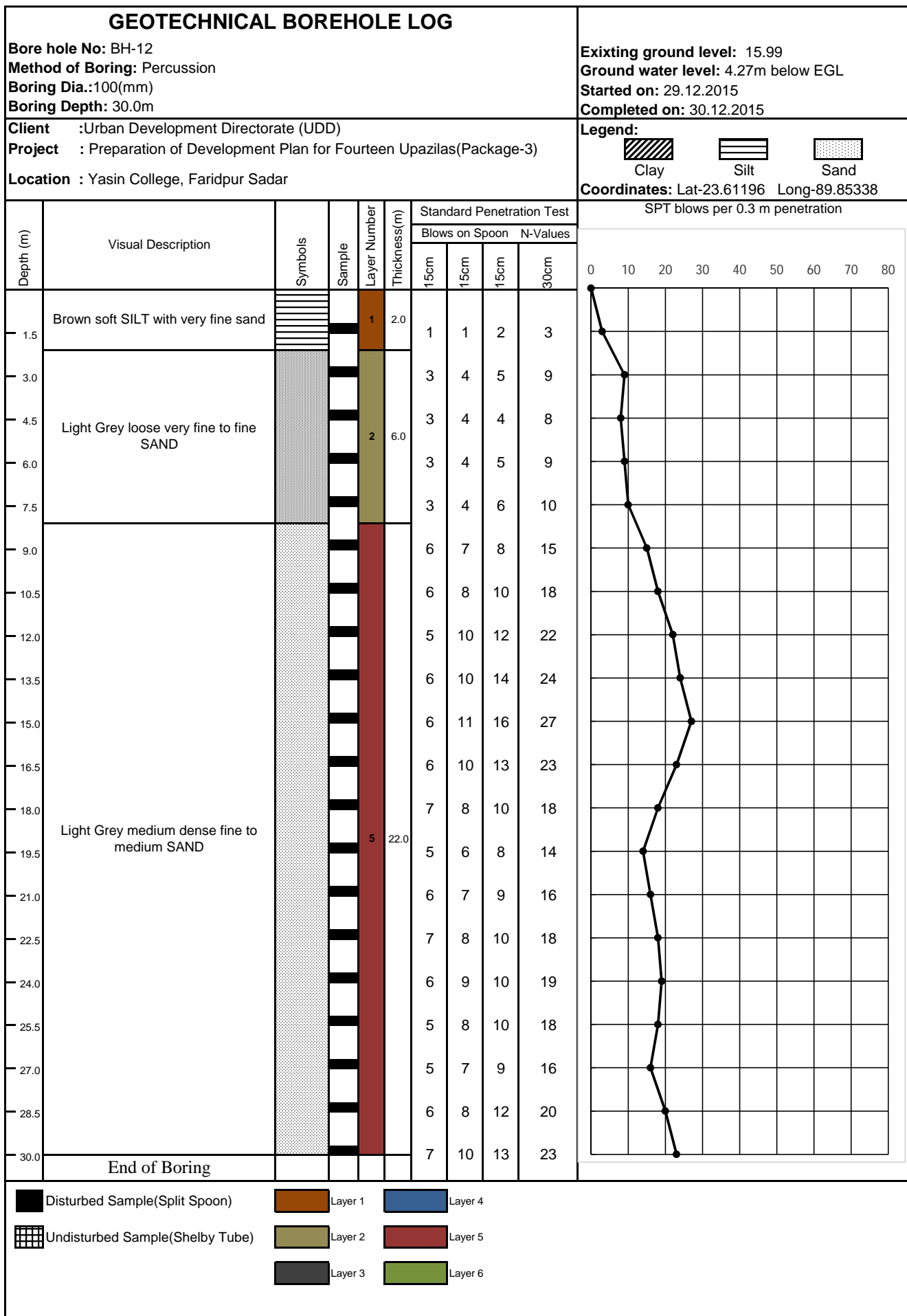


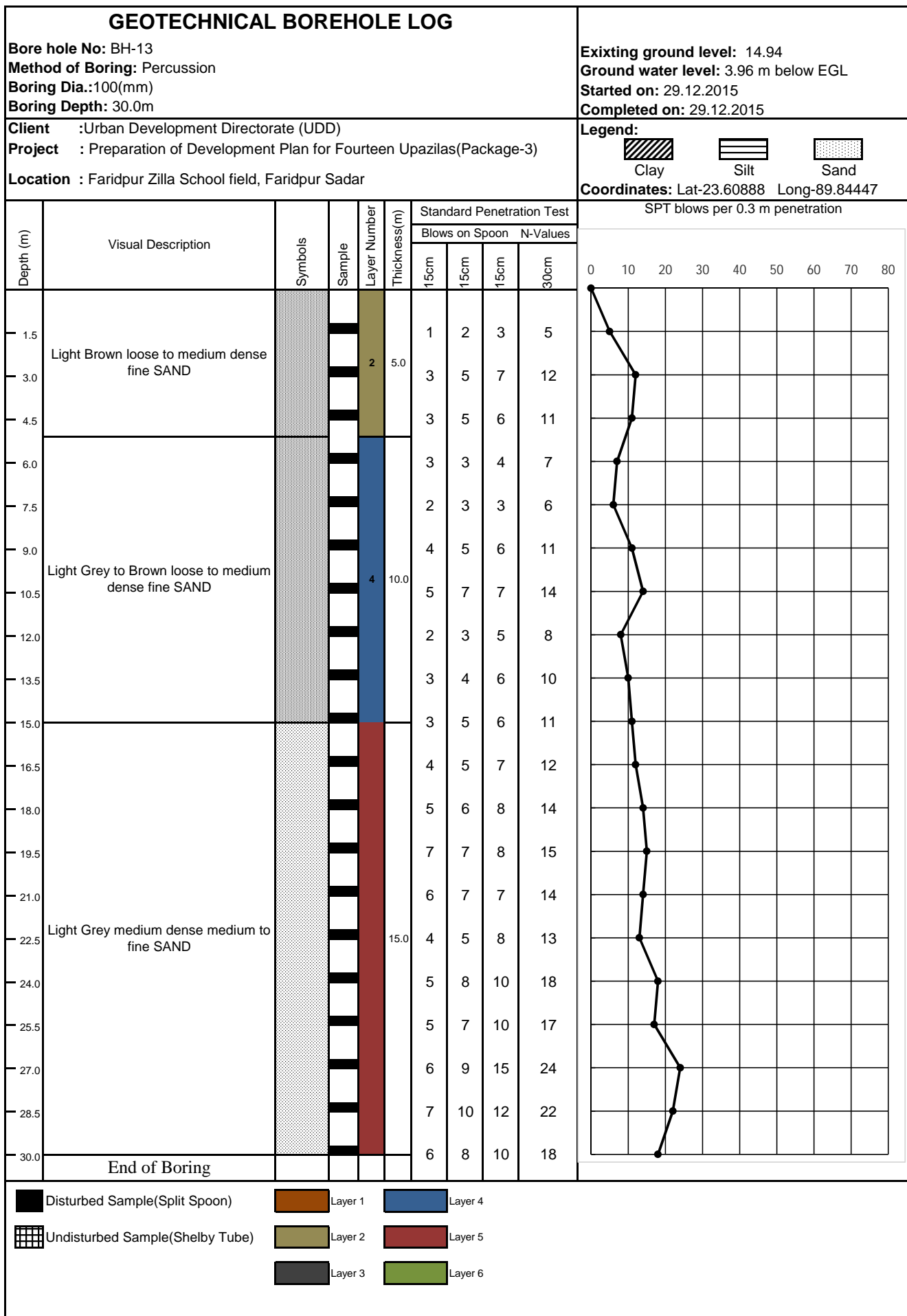


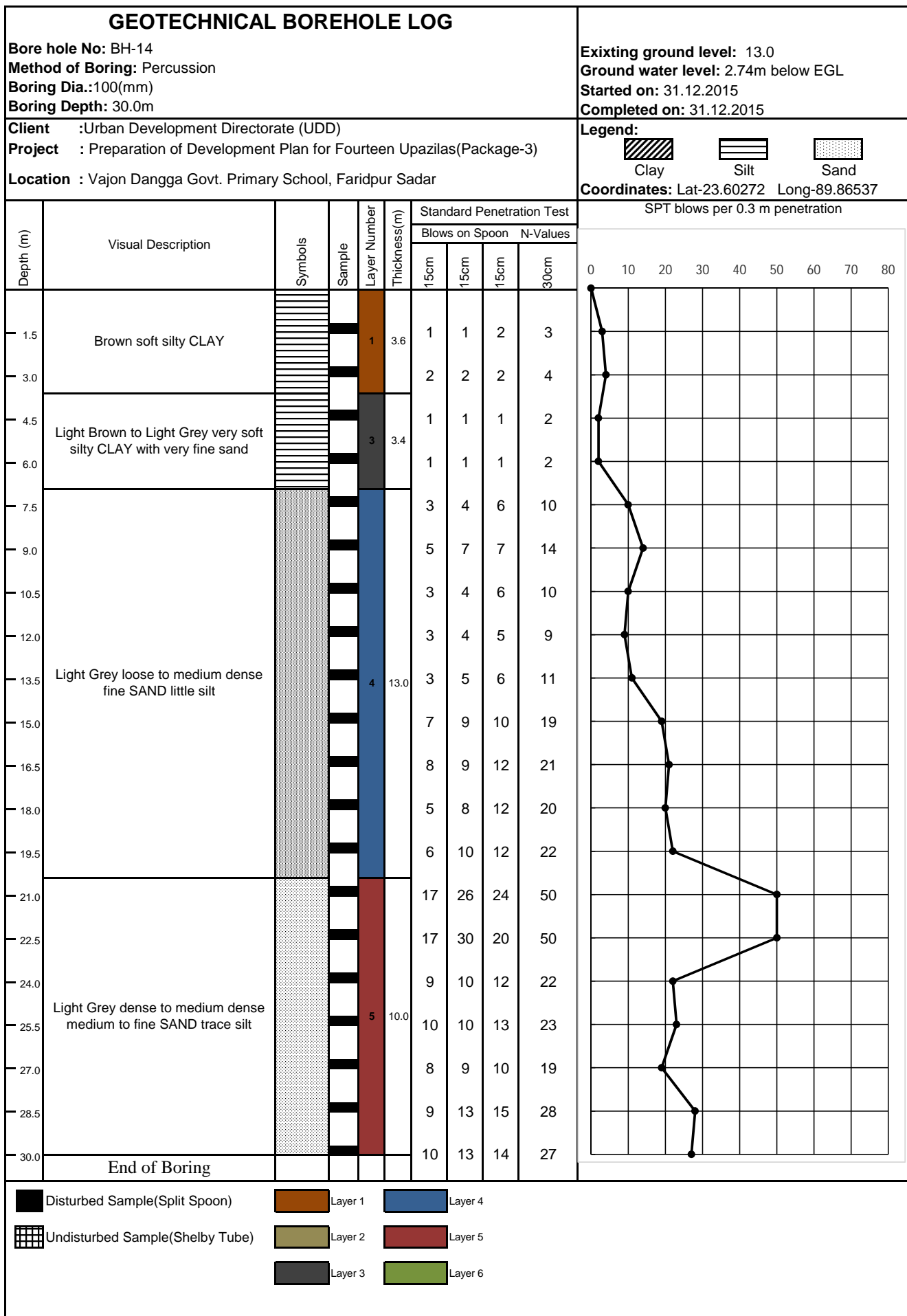


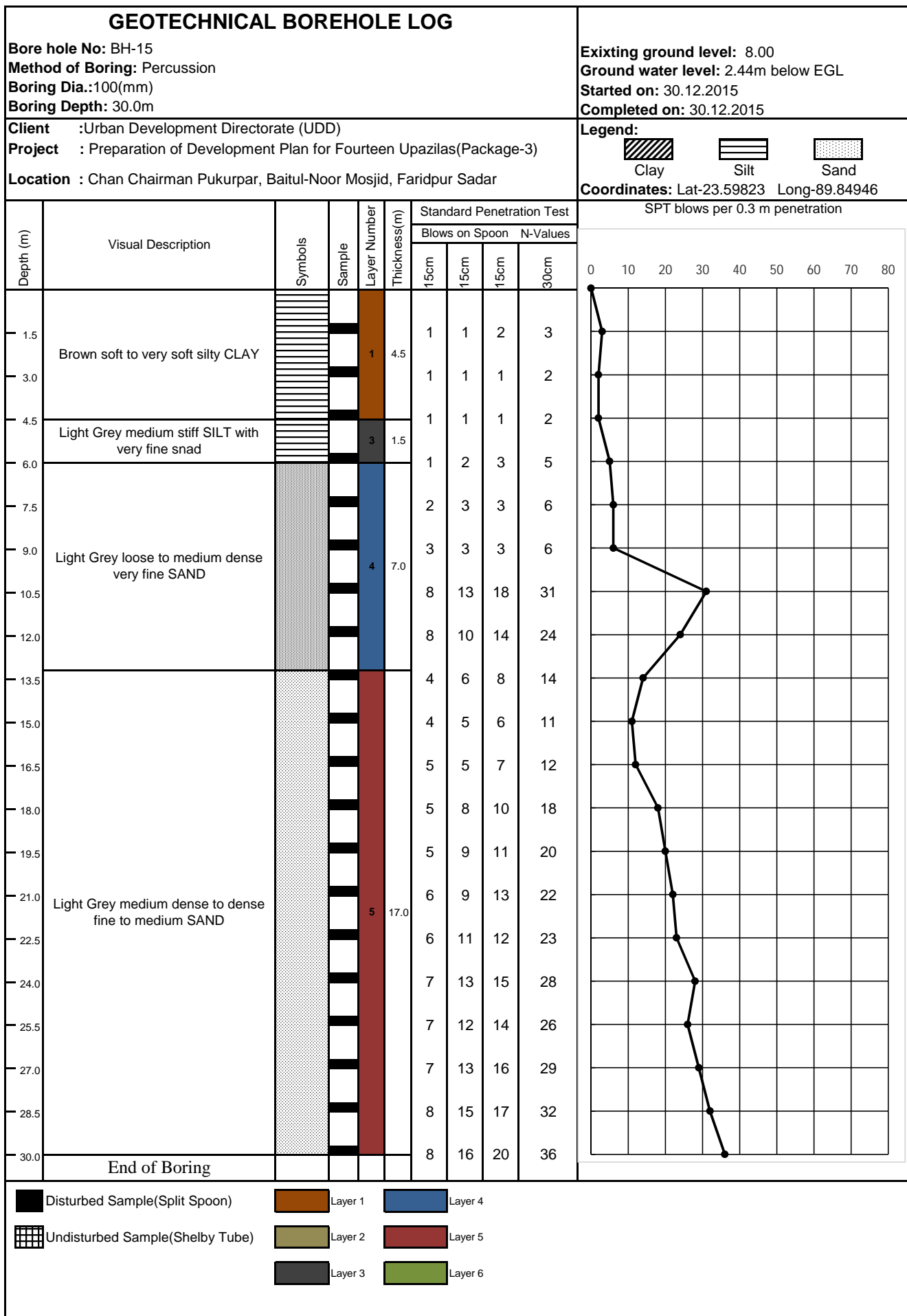


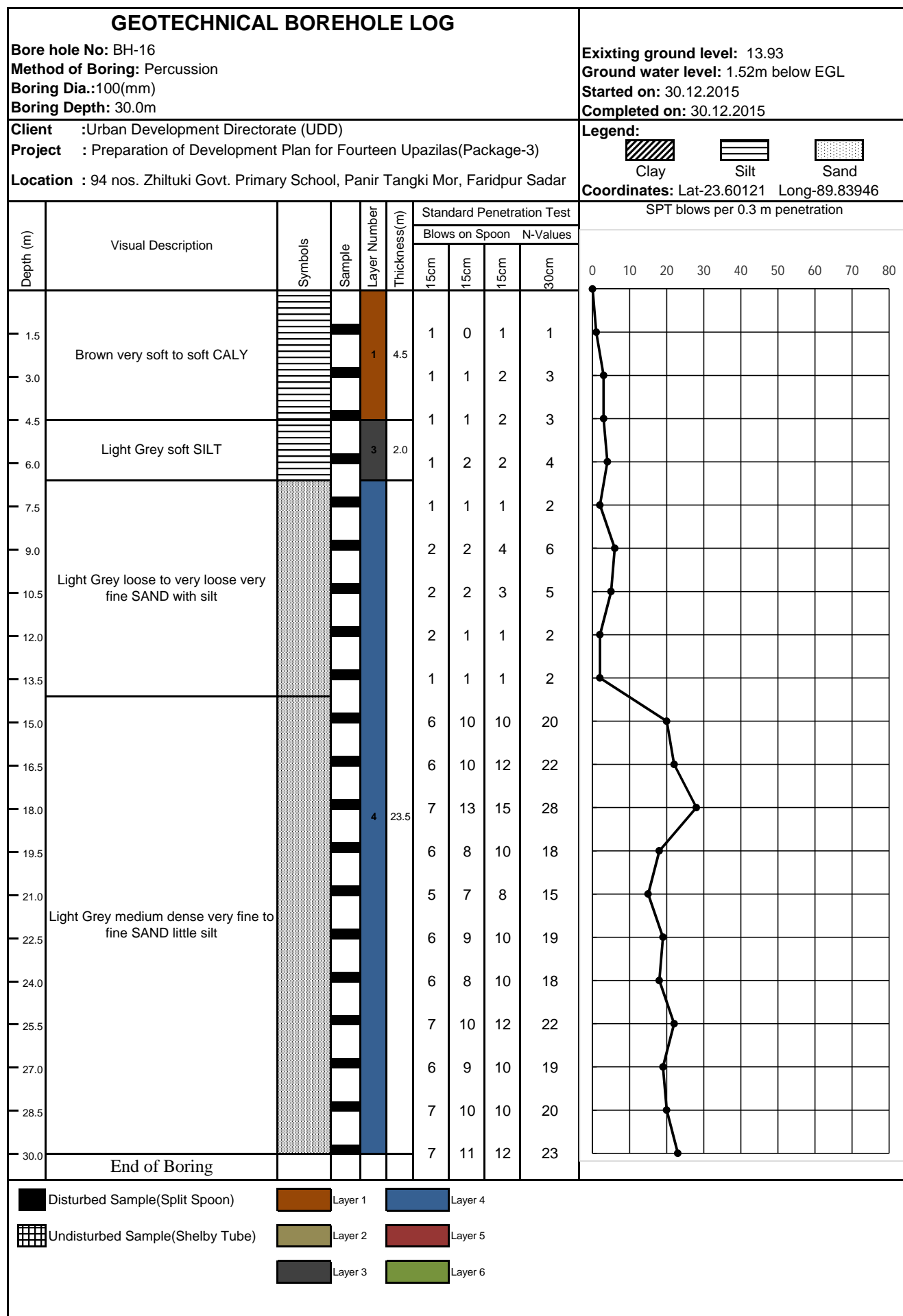


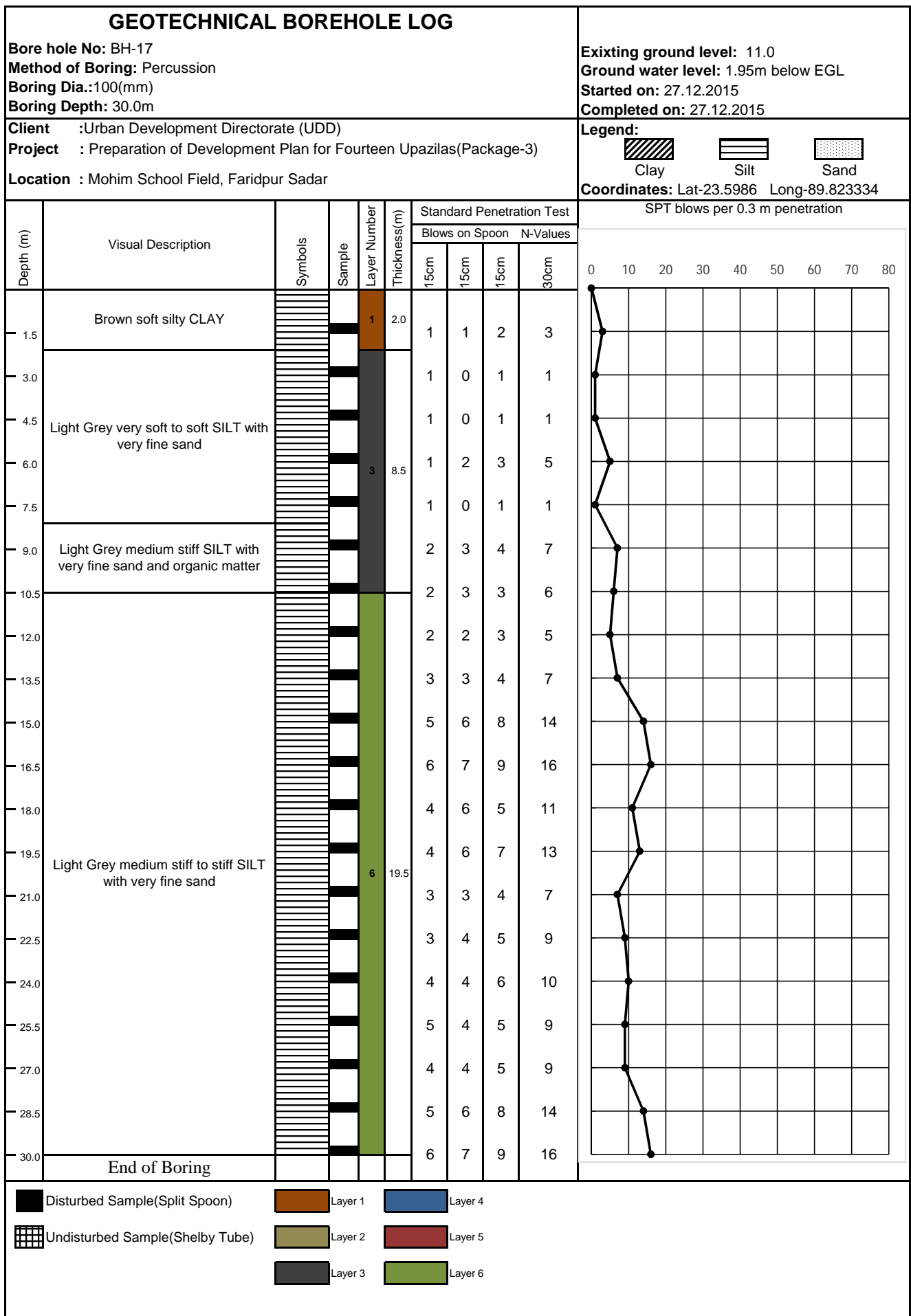




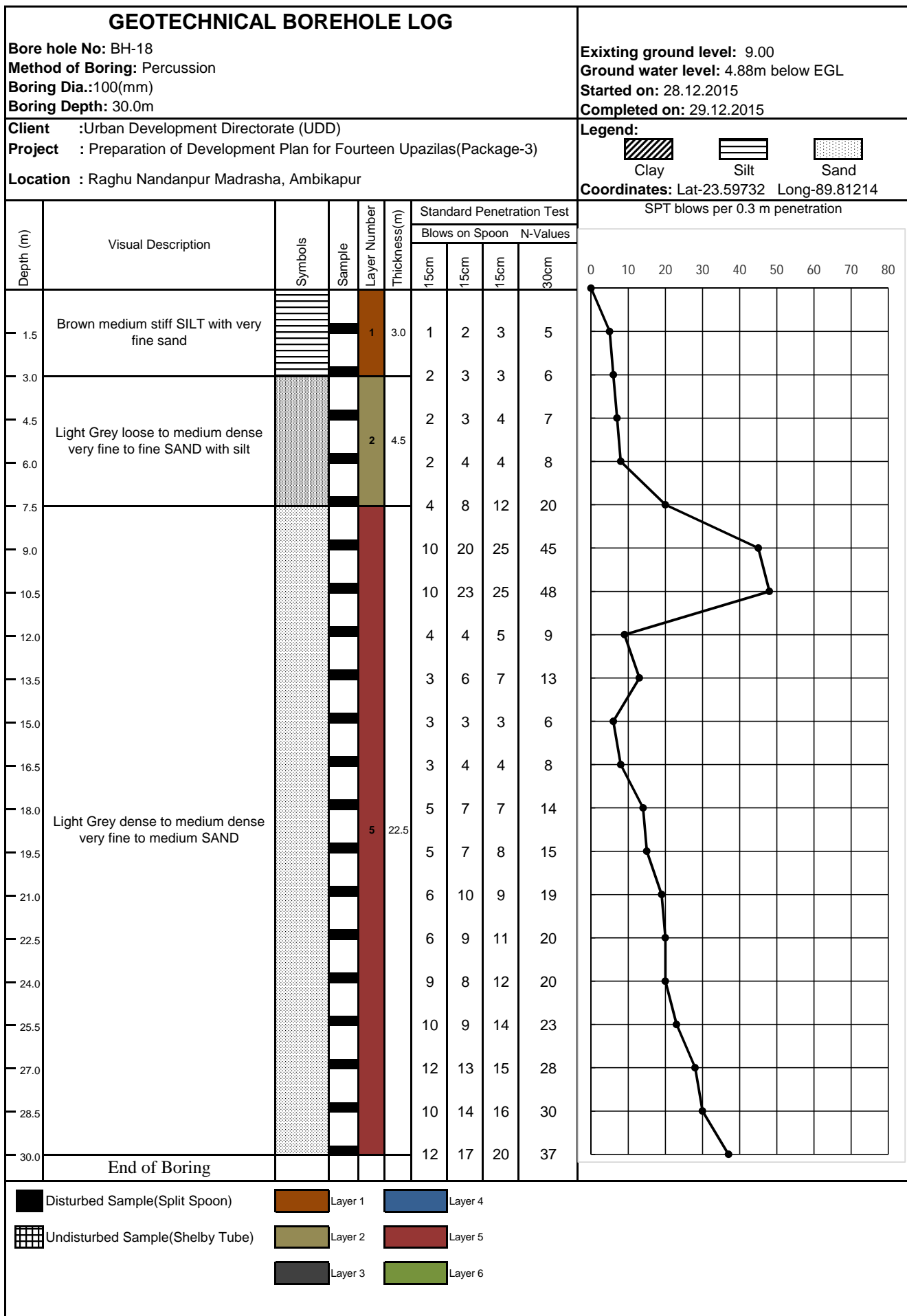


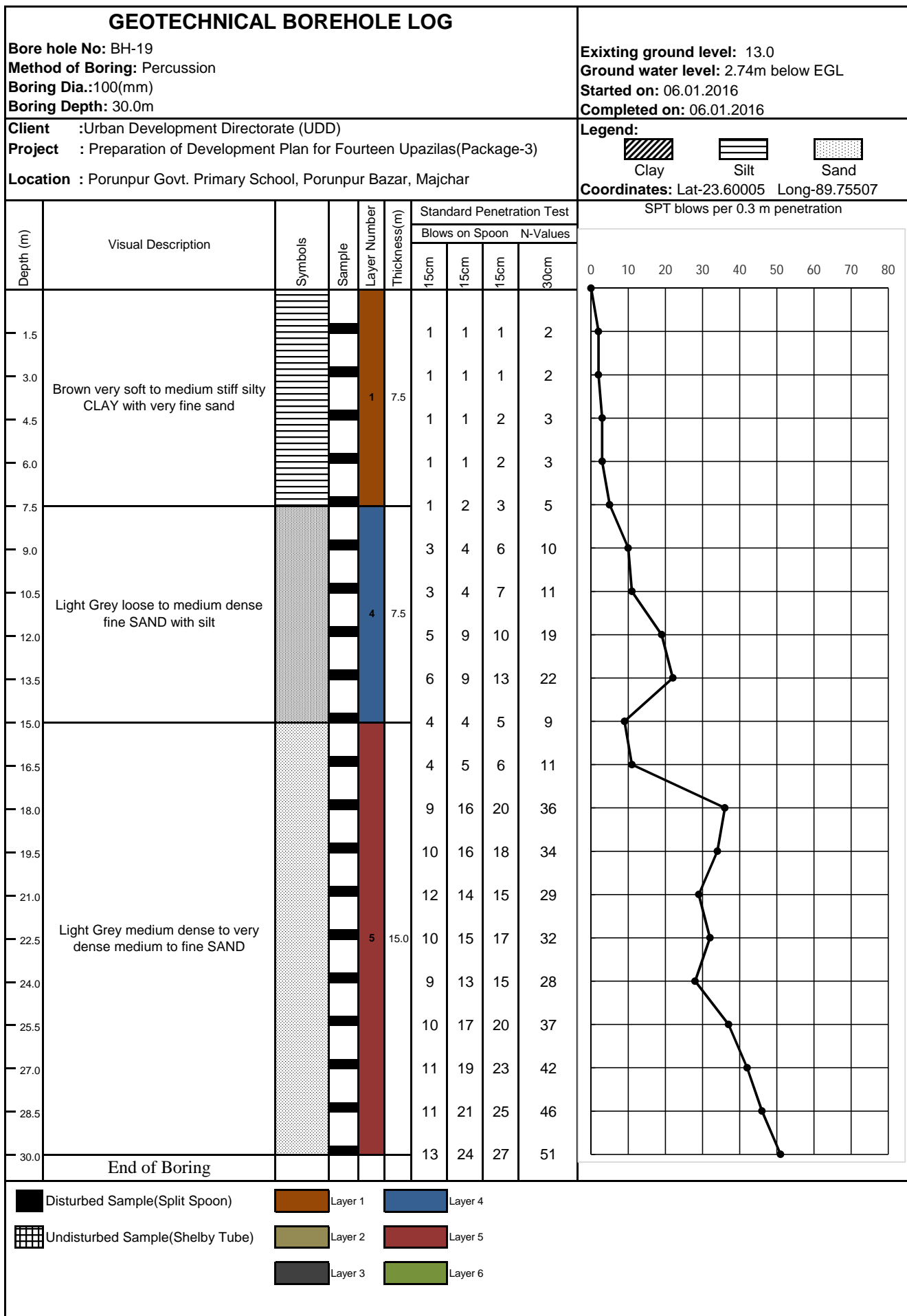


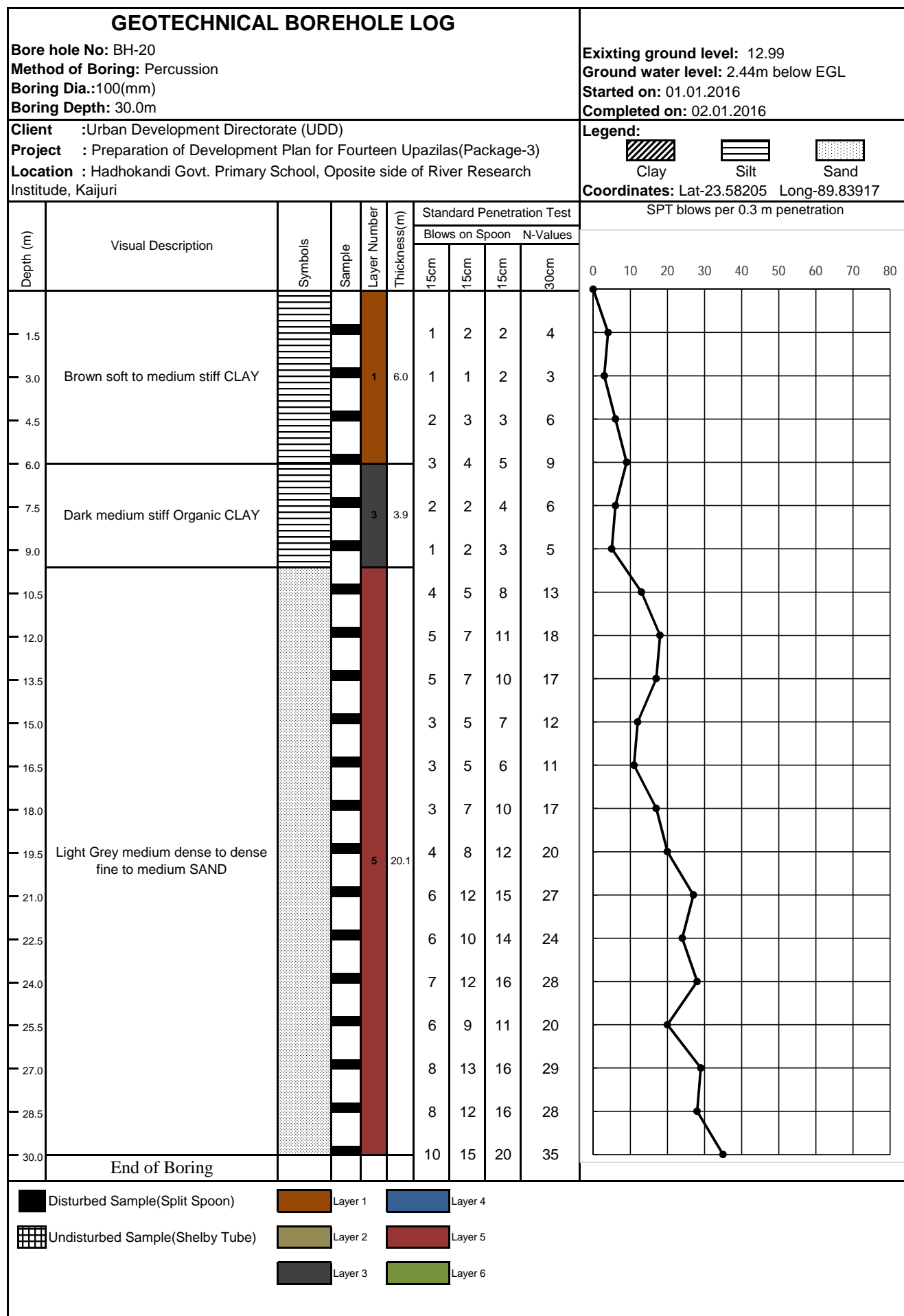


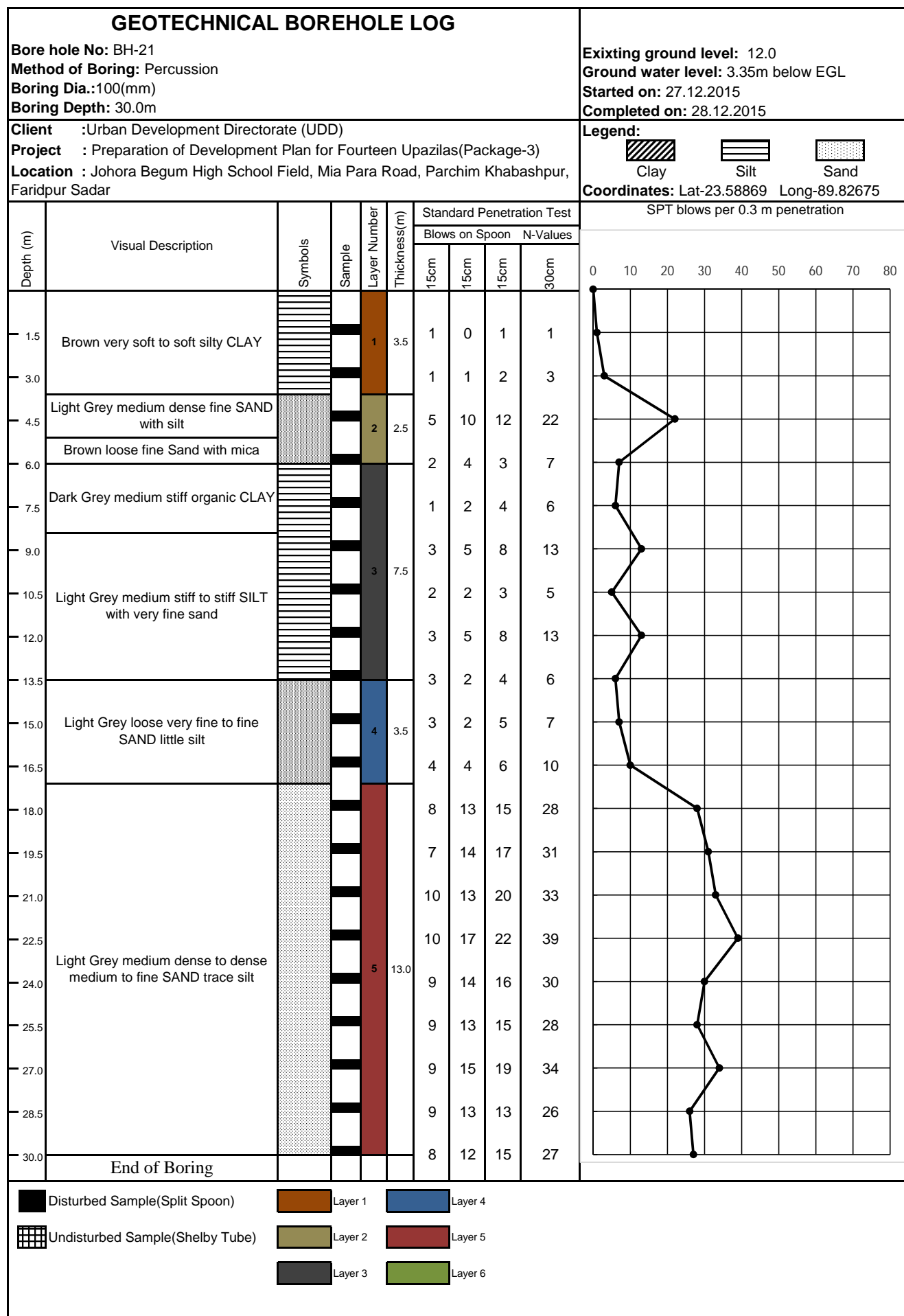


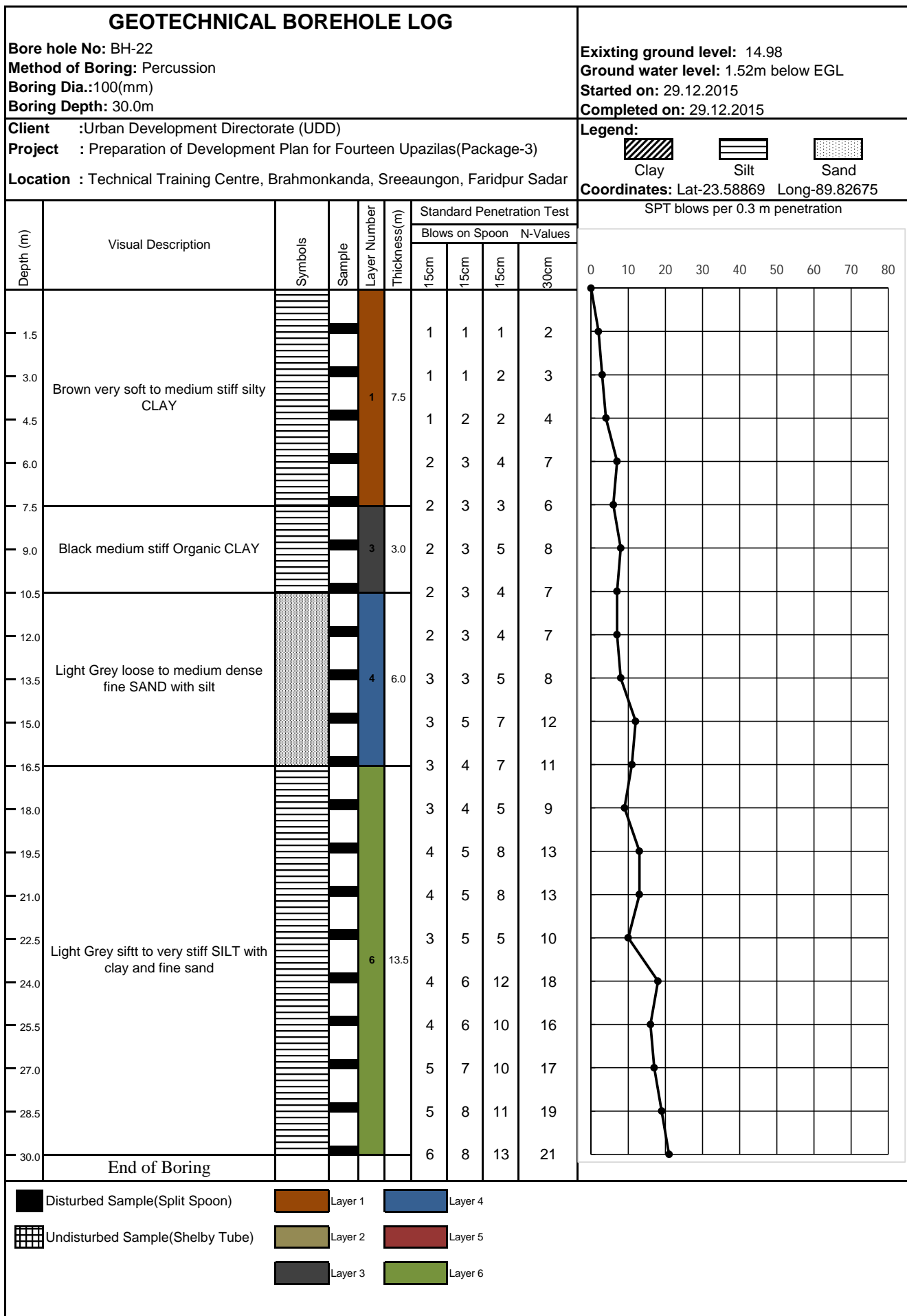


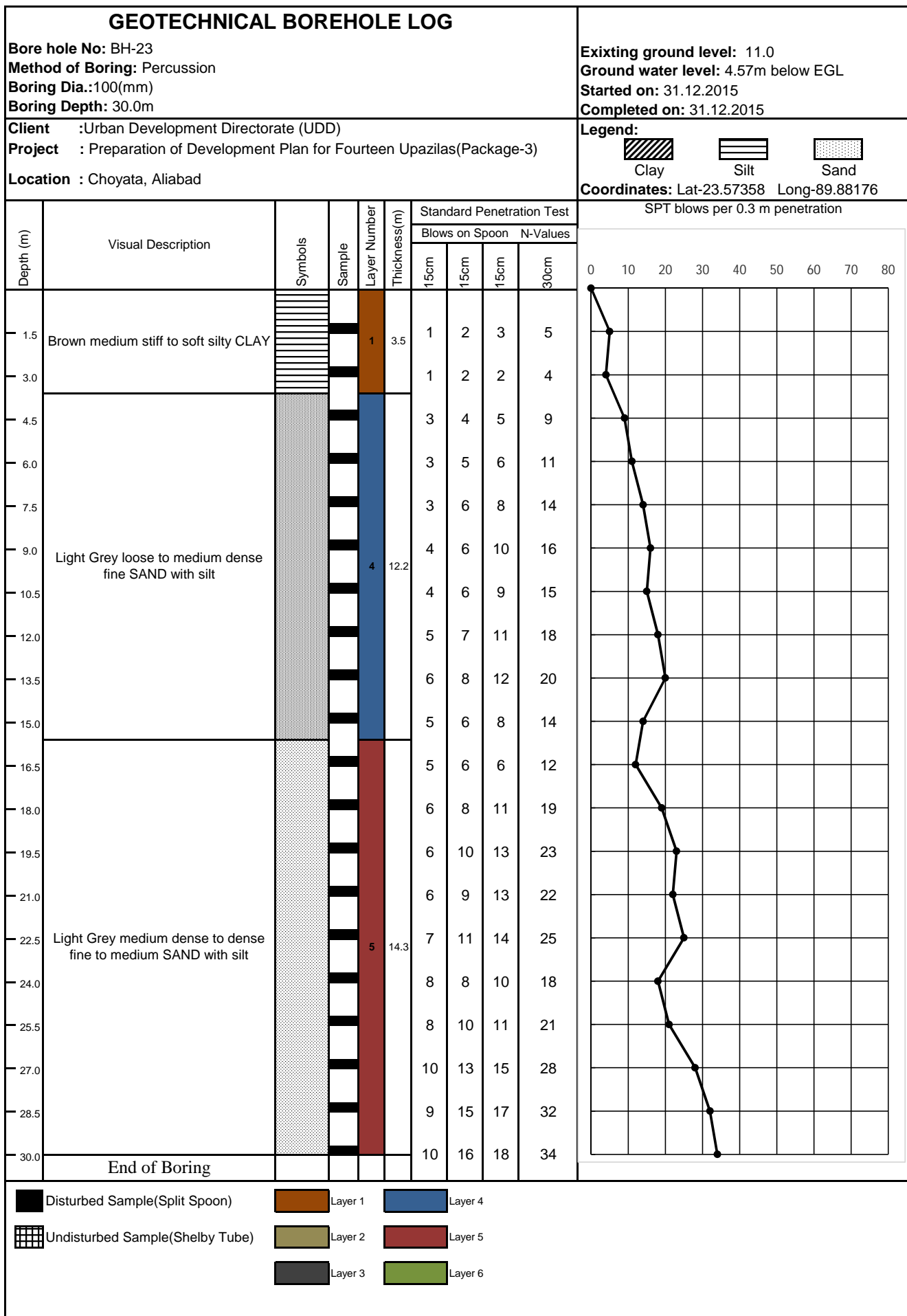


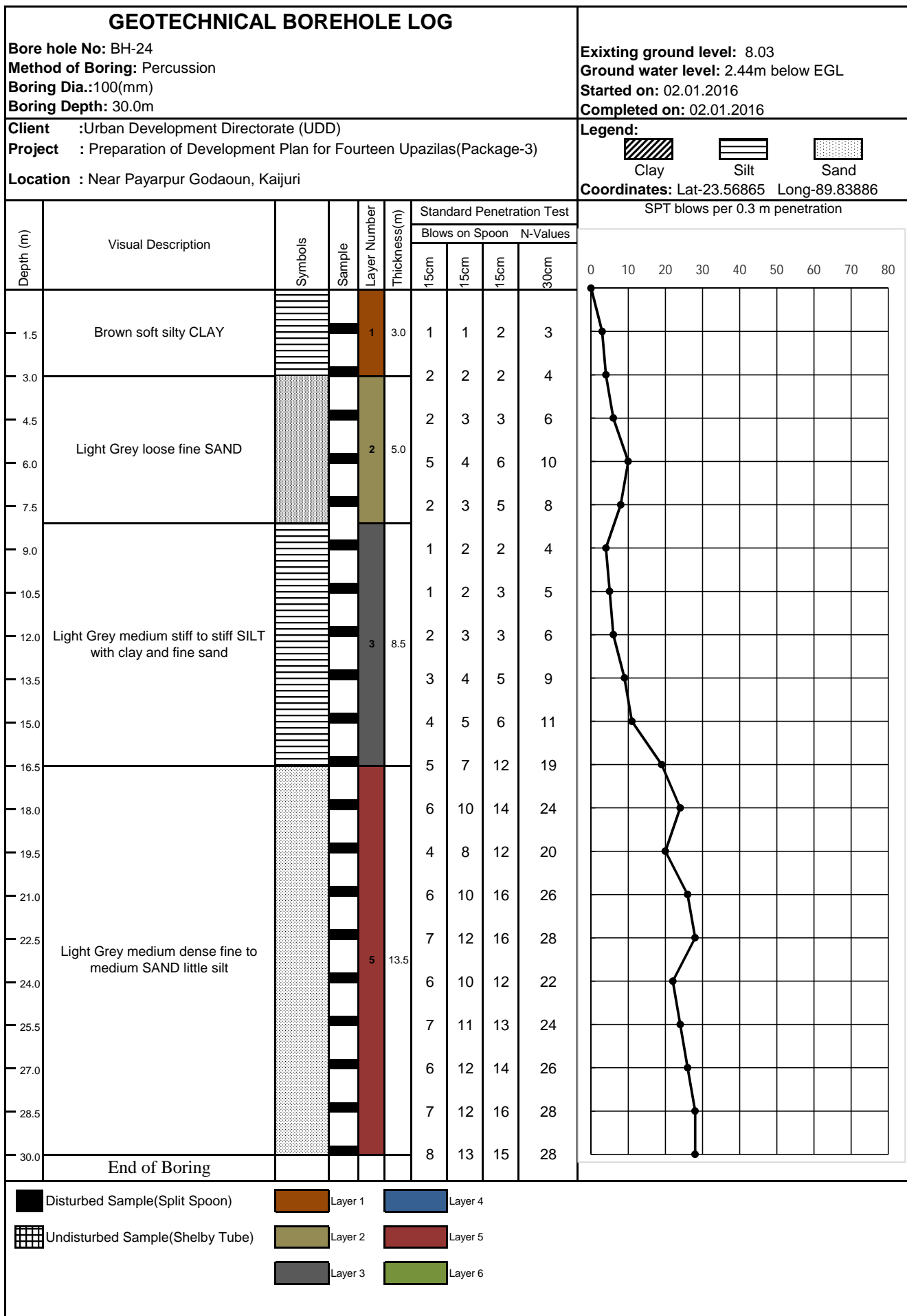


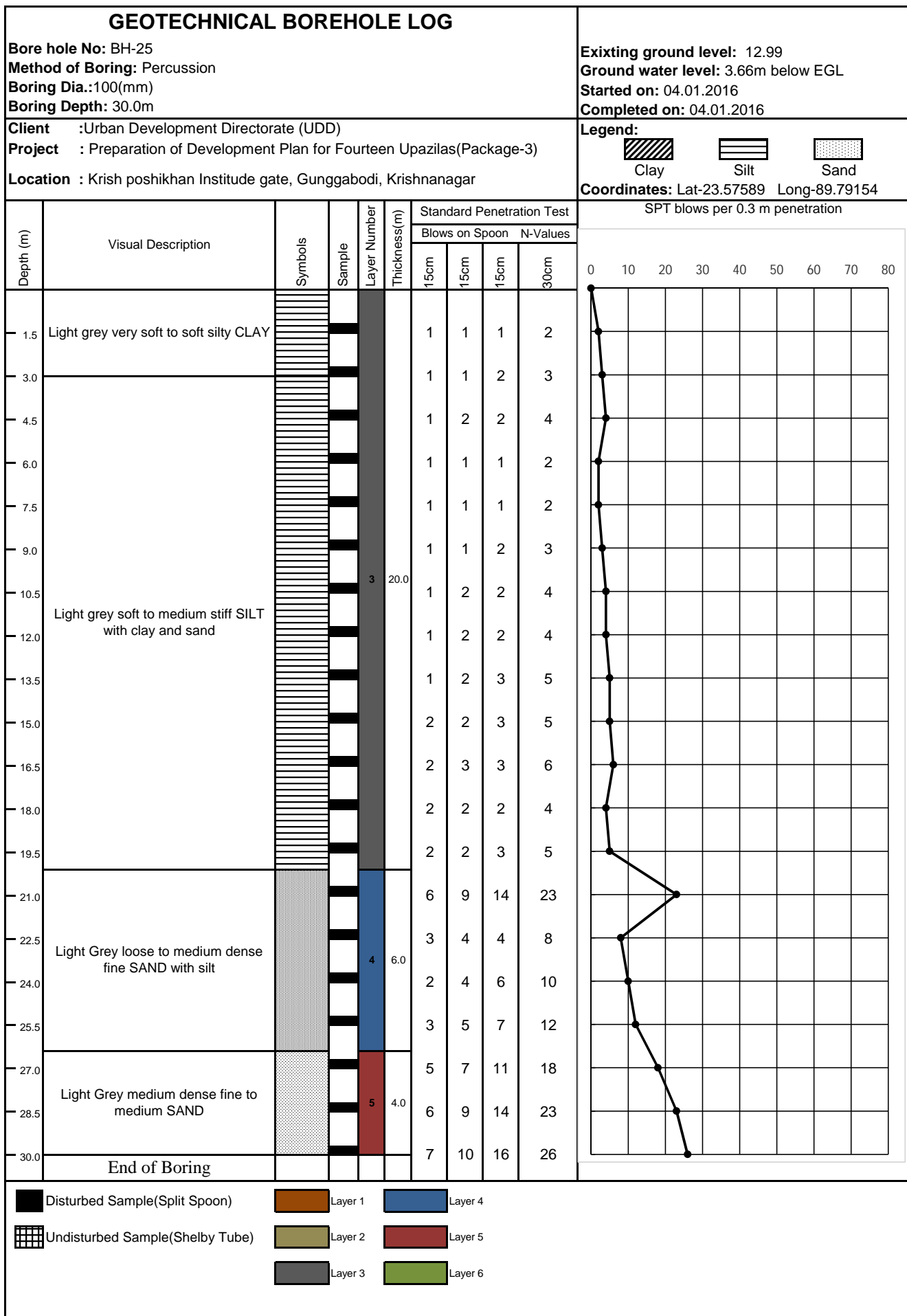




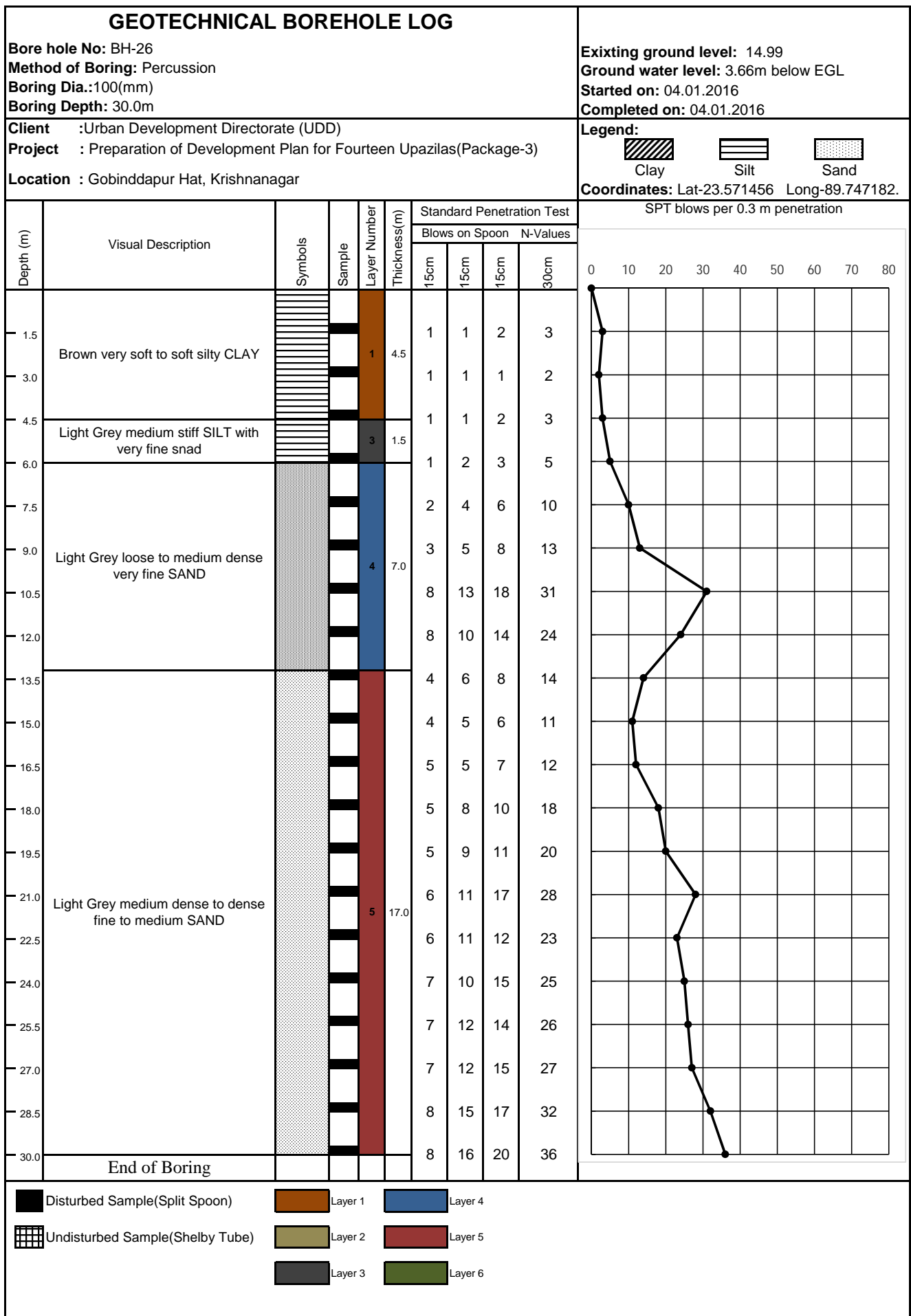


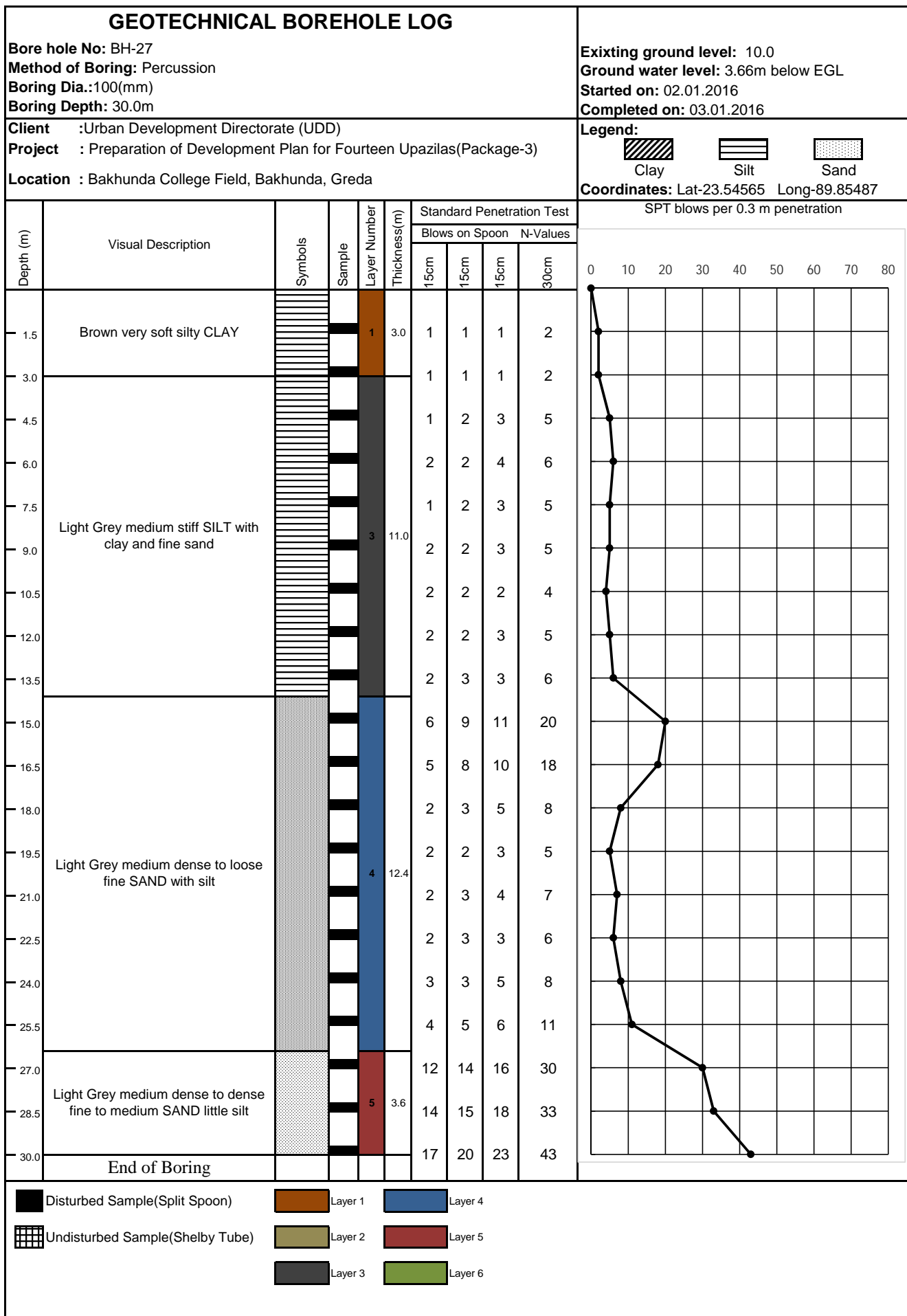


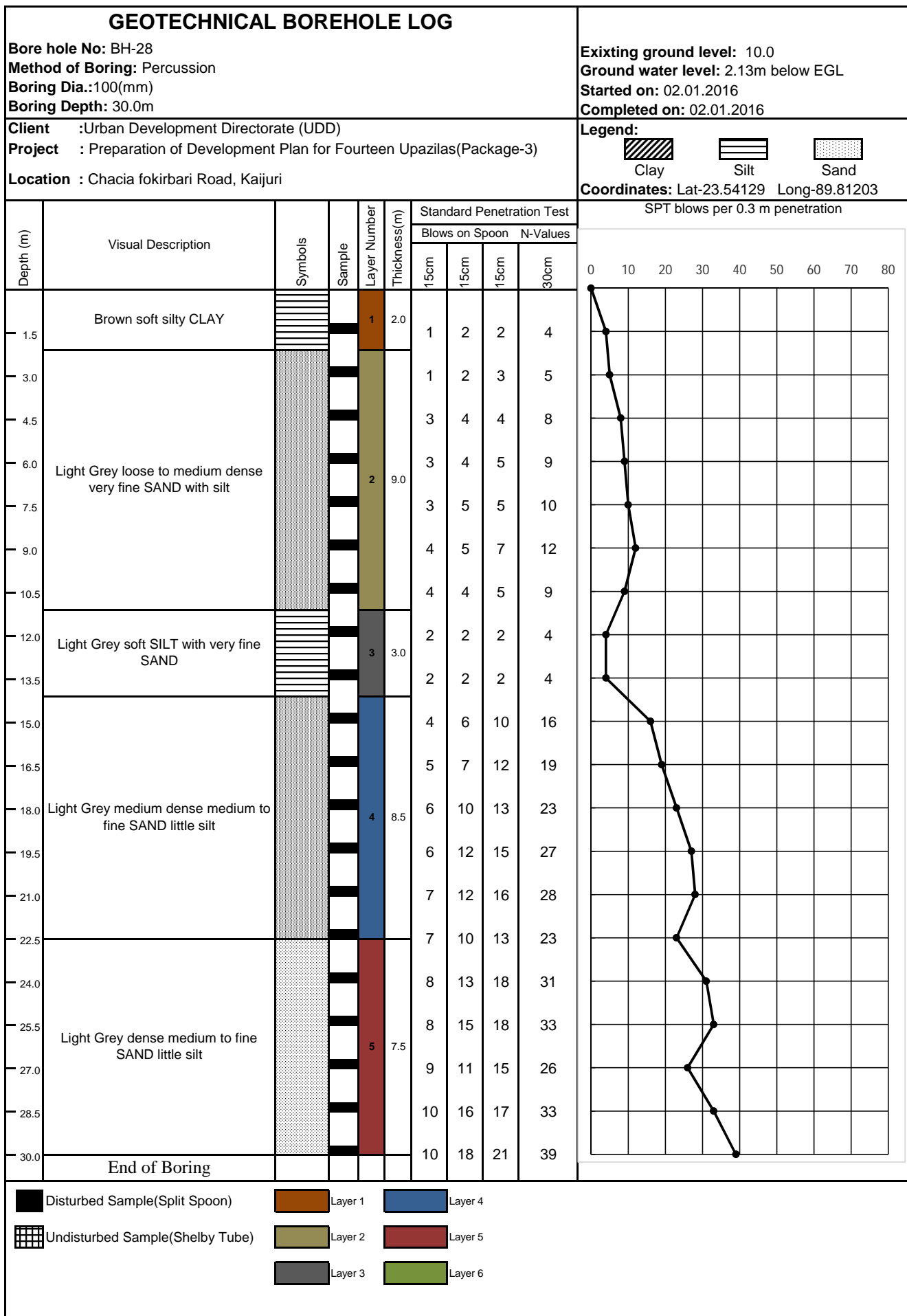


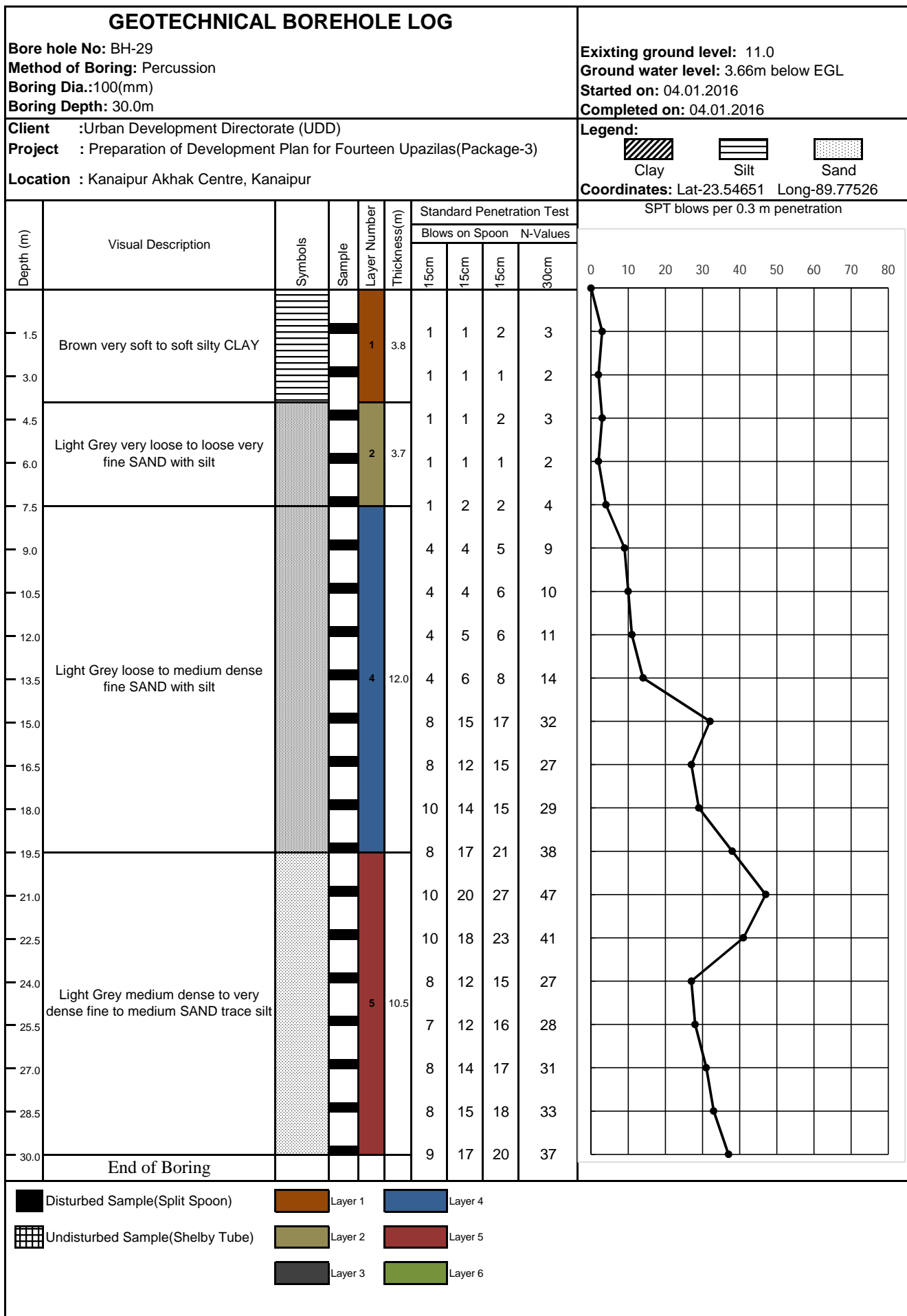


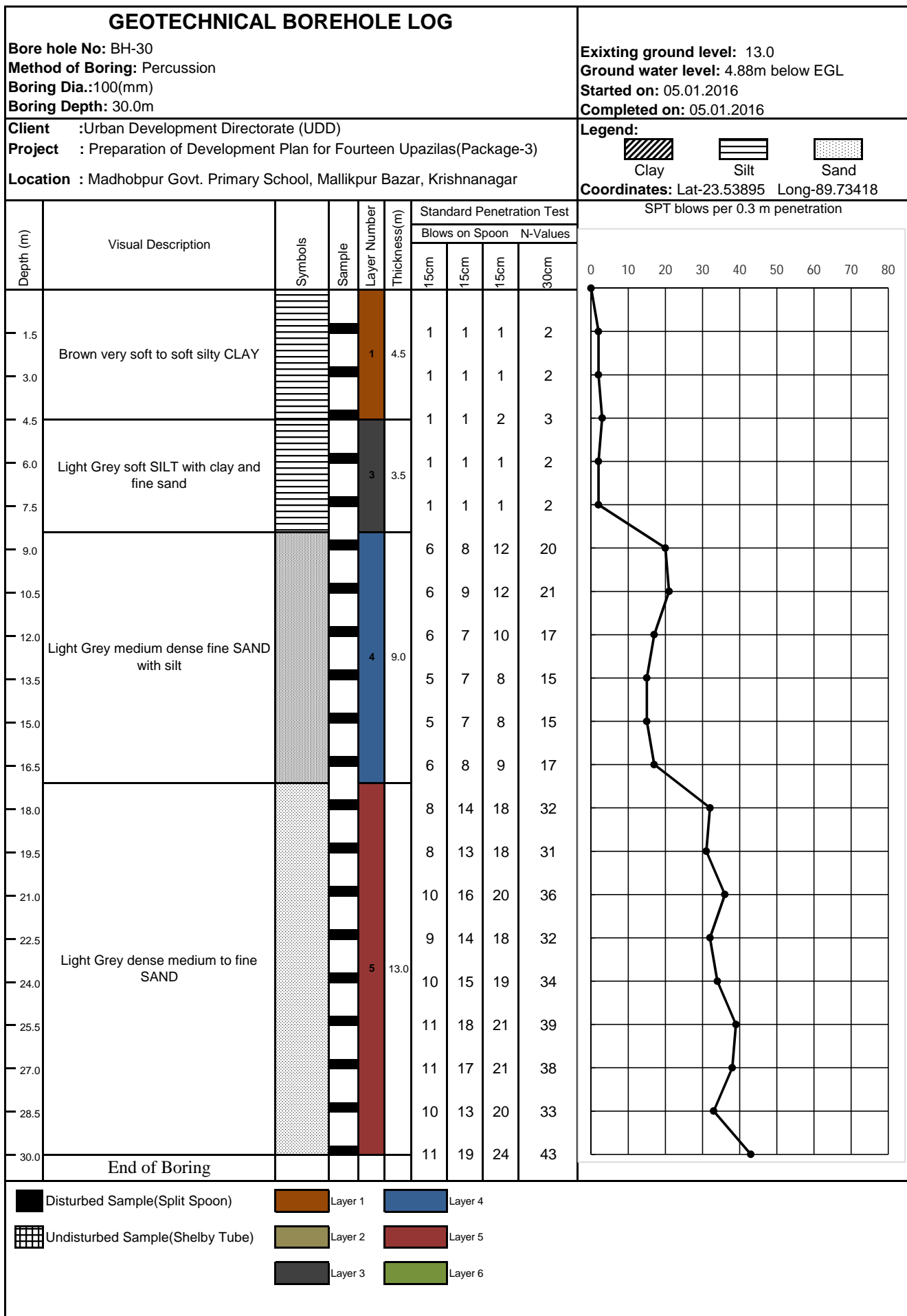


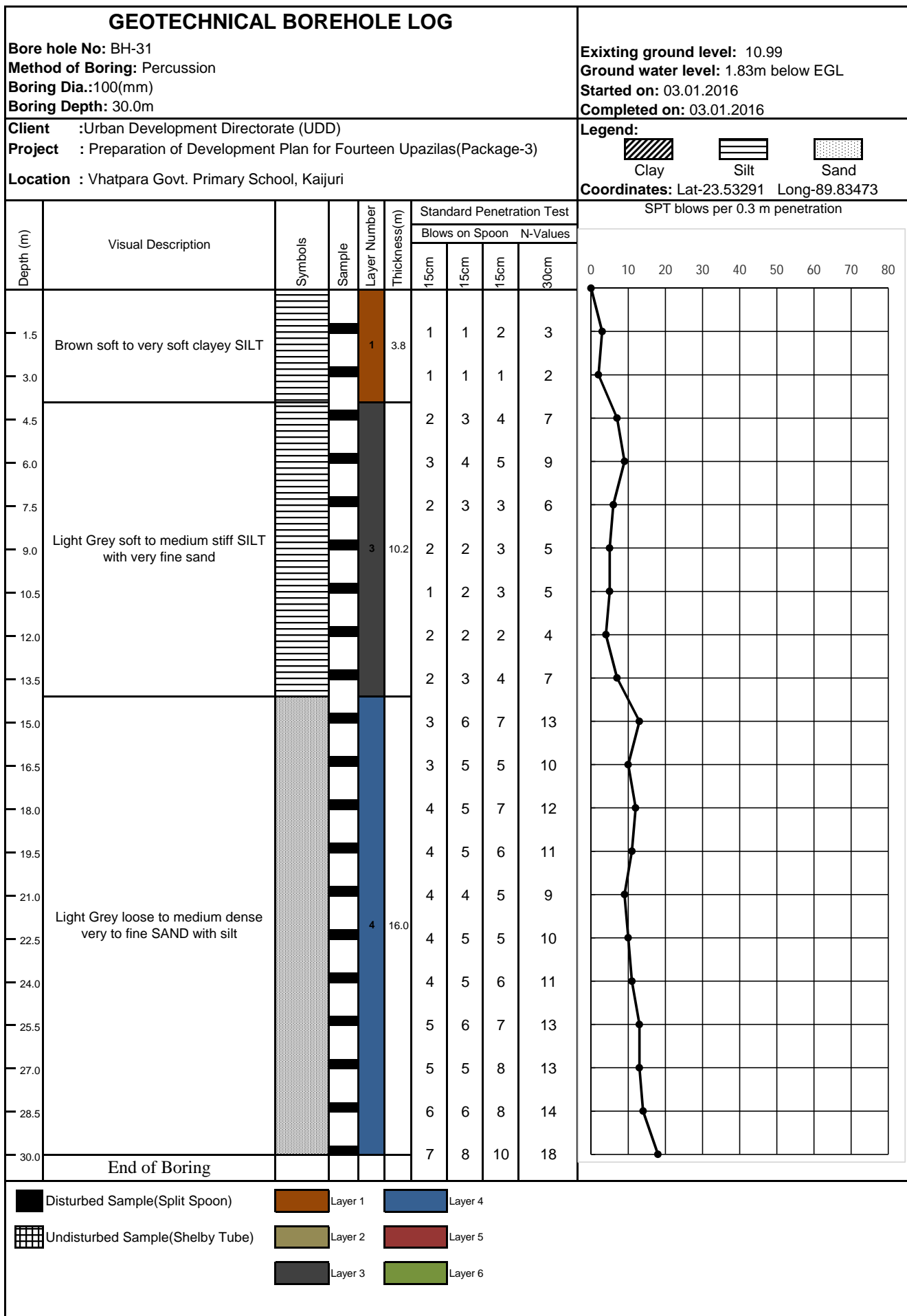


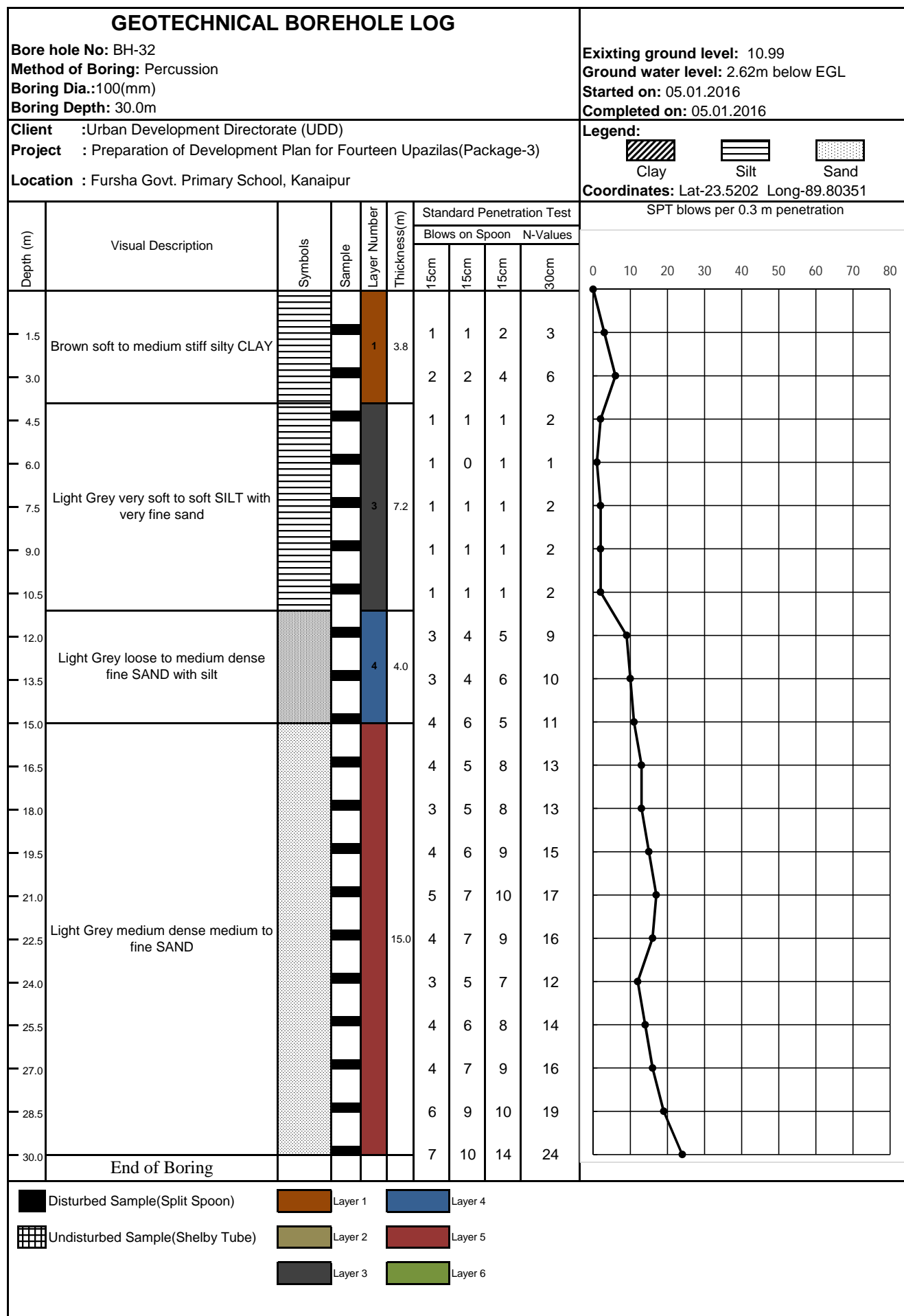


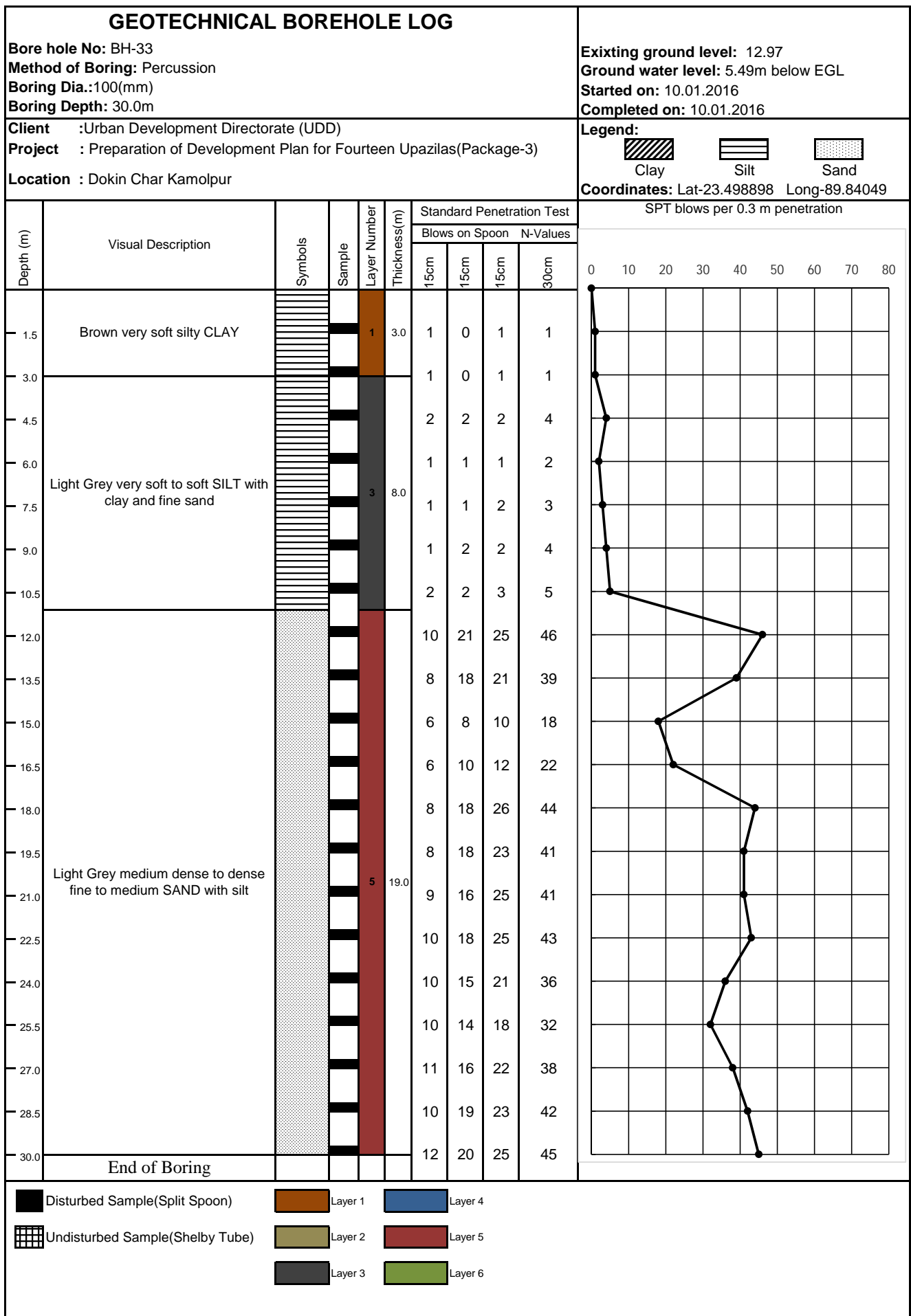




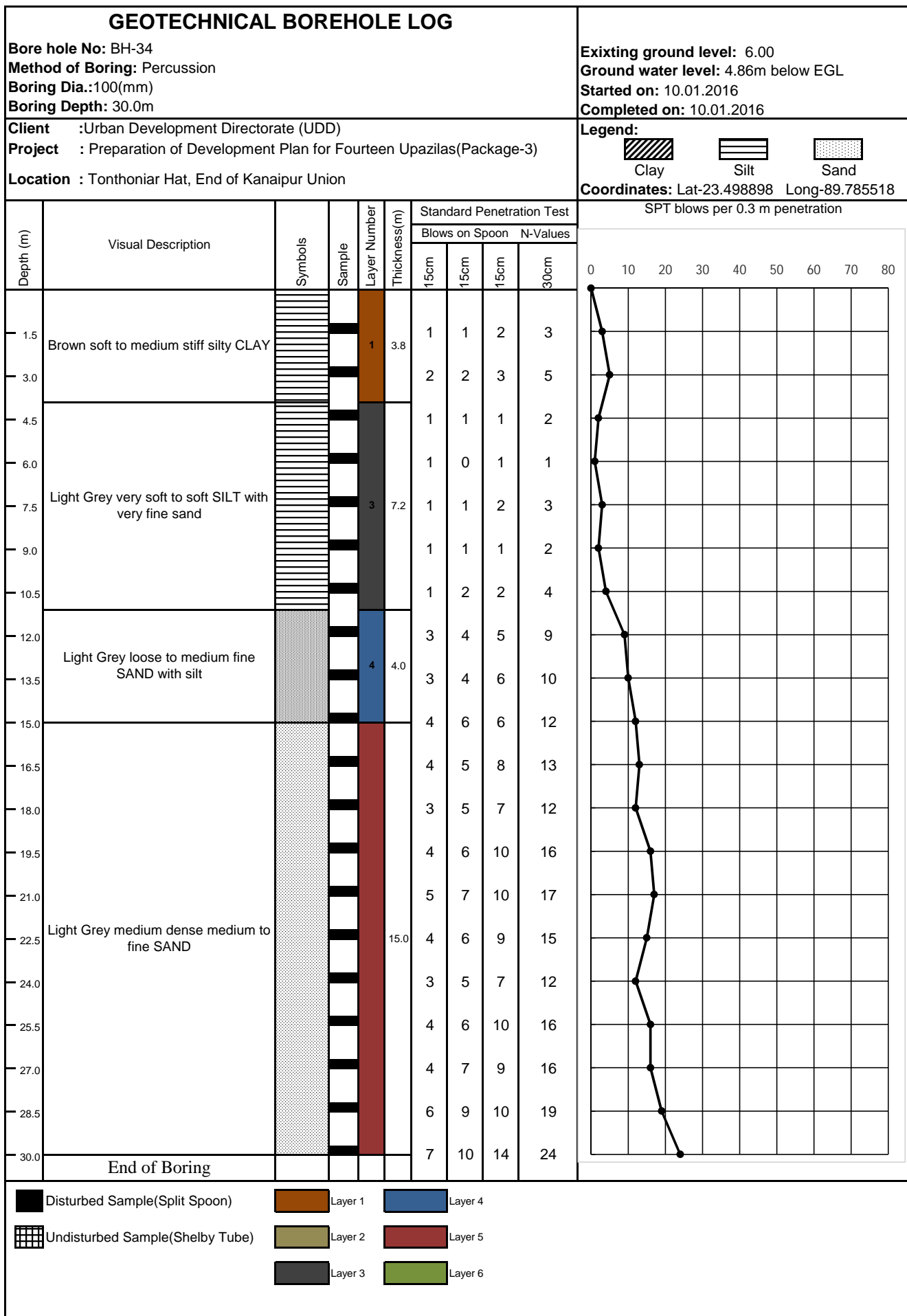


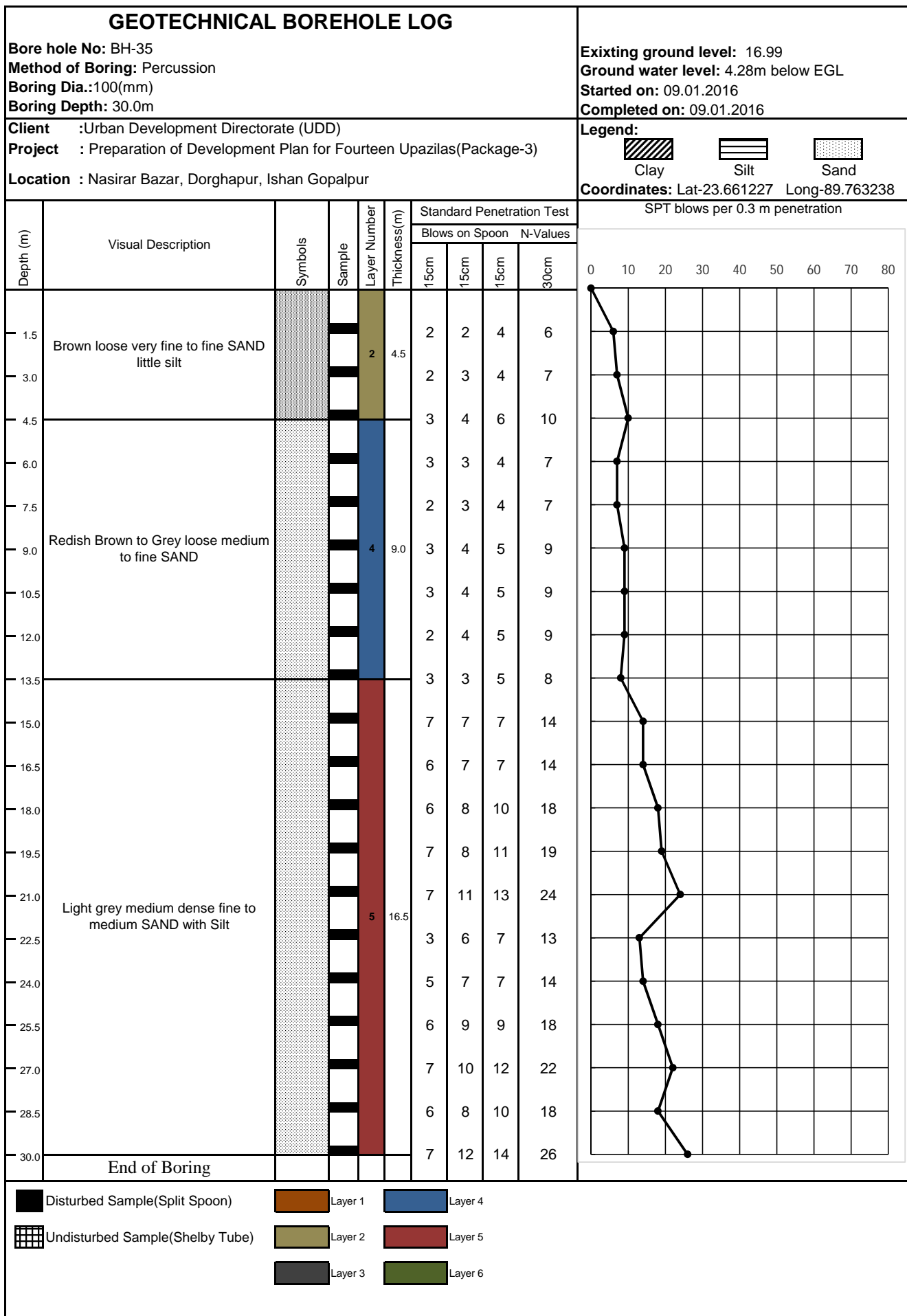


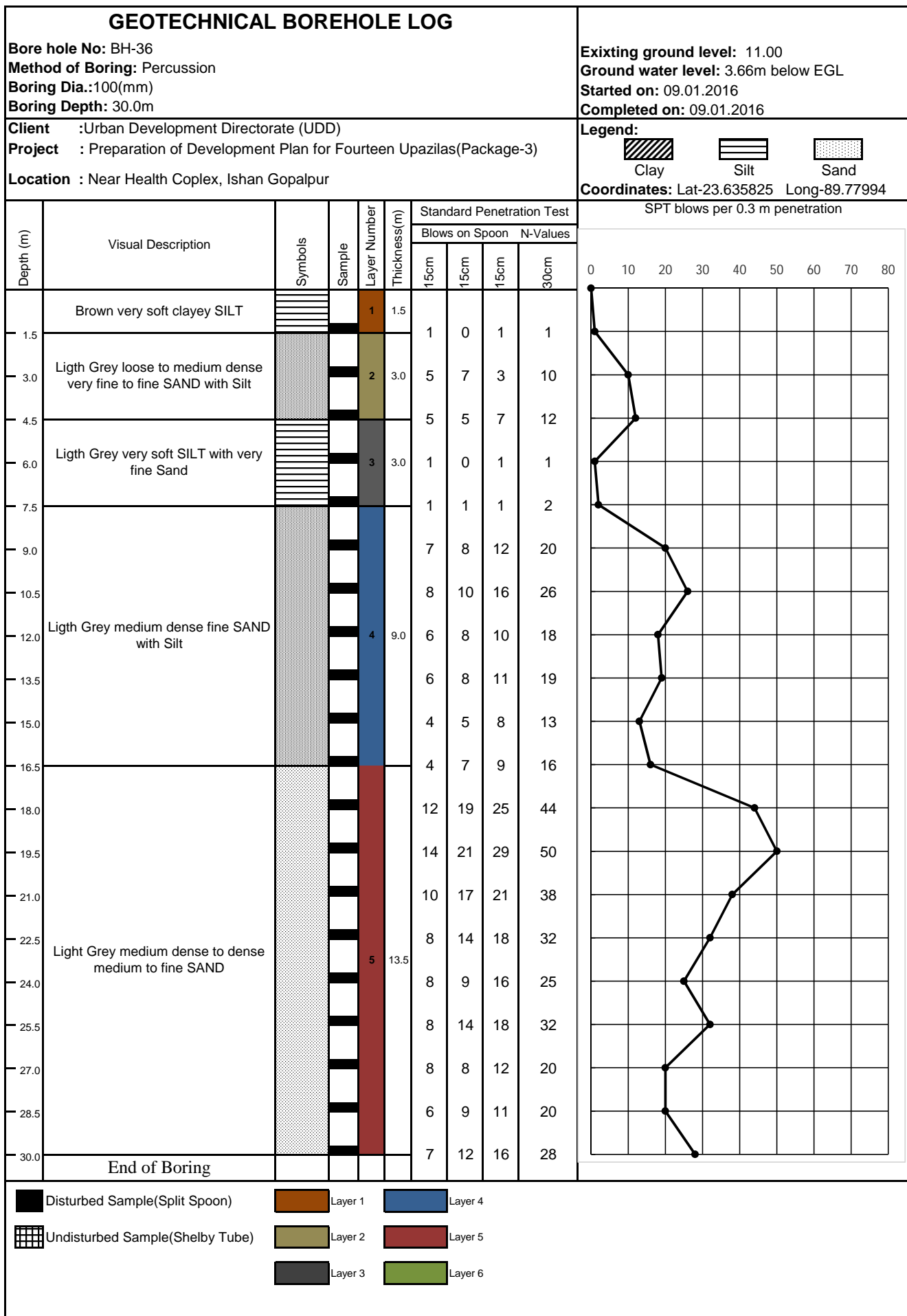


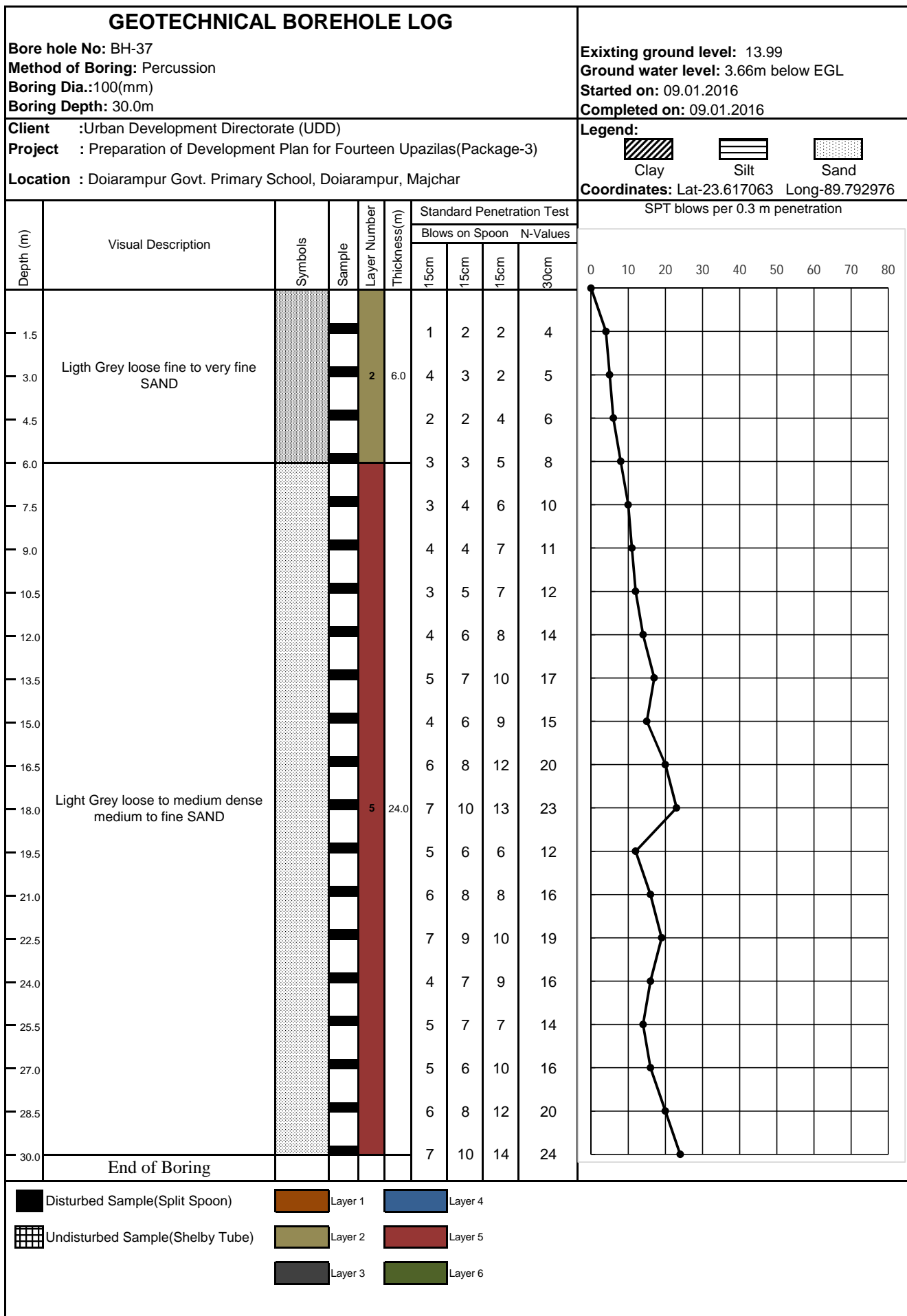












## **Appendix D**

### Geotechnical Laboratory Test Results and Graphs

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : MADHABDIA MOYEZ UDDIN SCHOOL Field, Char Madhabdia

Bore Hole No: BH-F01

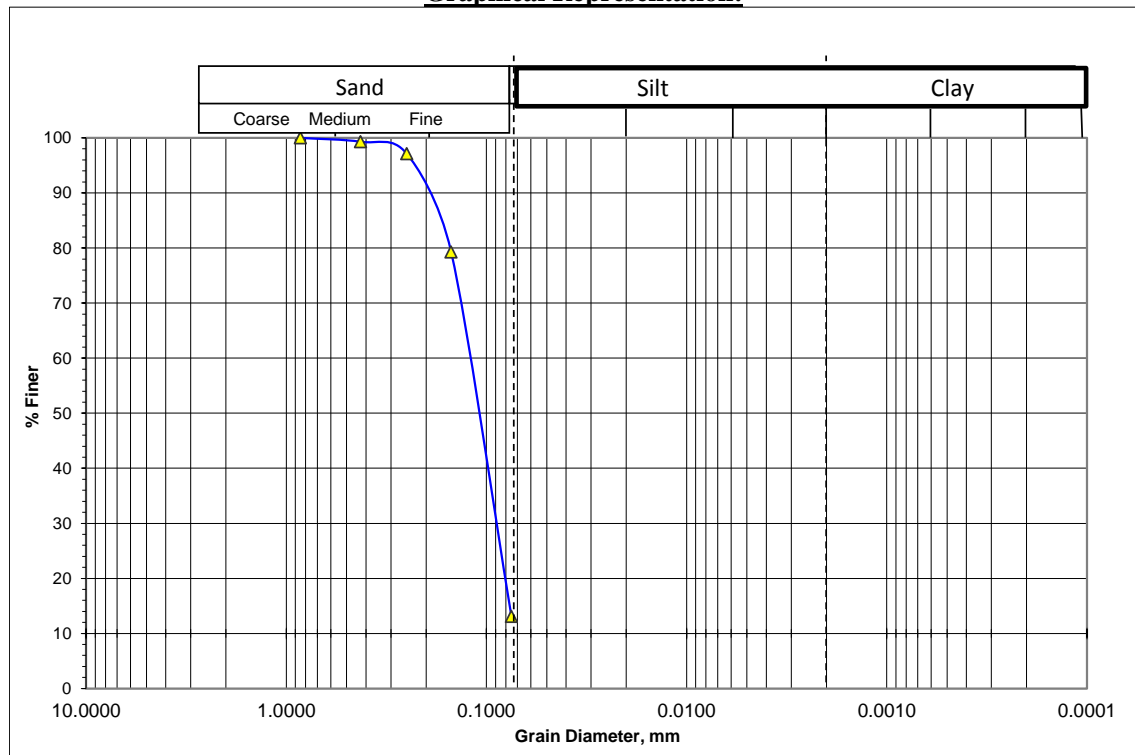
Sampled Date: 04/01/2016

Sample No : D-06

Test Date : 05/02/2016

Depth (m) : 9.0

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : MADHABDIA MOYEZ UDDIN SCHOOL Field, Char Madhabdia

Bore Hole No: BH-F01

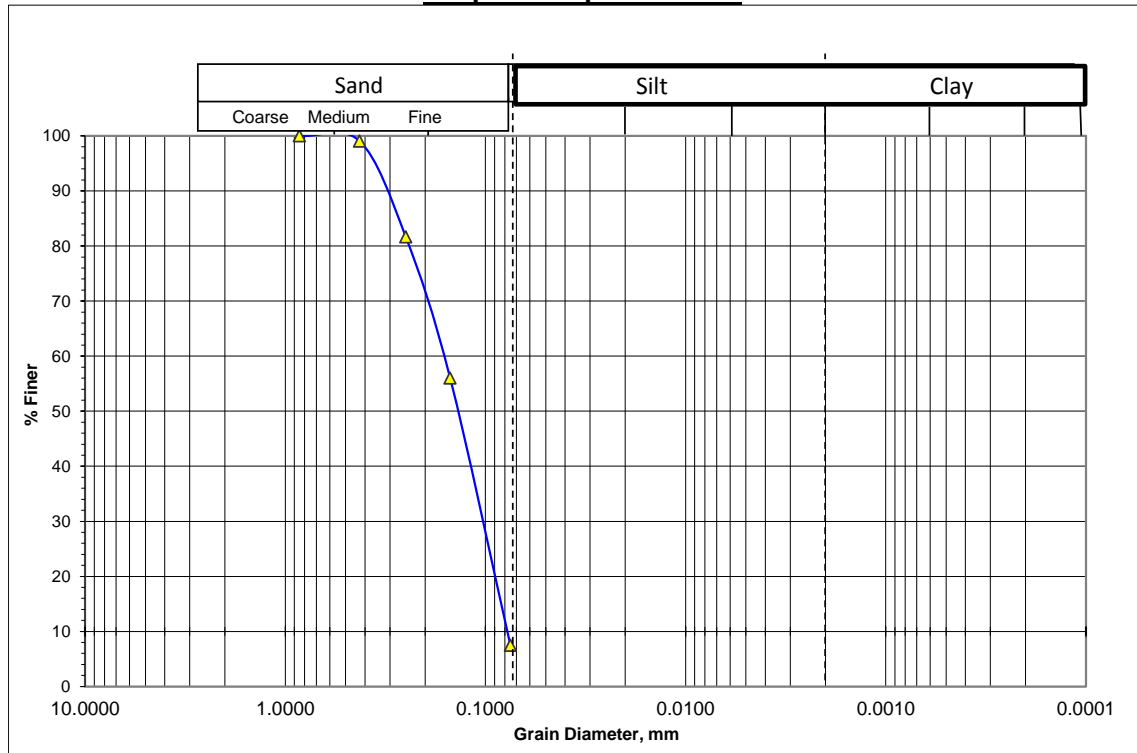
Sampled Date: 04/01/2016

Sample No : D-14

Test Date : 05/02/2016

Depth (m) : 21.0

#### Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter,  $D_{50} = 0.14$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.66$

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7





### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : SOUTH DIGRIRCHAR MADHOBDA GOVT. PRI. SCHOOL, Madhubdia

Bore Hole No: BH-F02

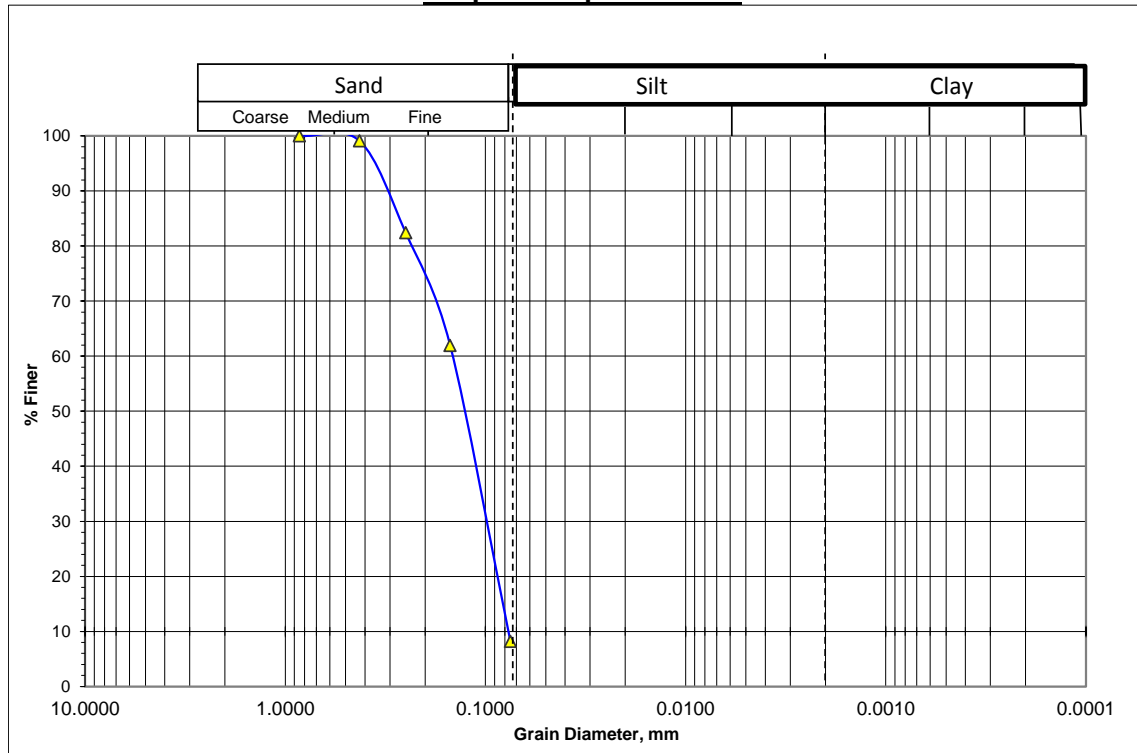
Sampled Date: 05/01/2016

Sample No : D-11

Test Date : 05/02/2016

Depth (m) : 16.5

#### Graphical Representation:



Fines or % of silt and clay = 8

Mean Diameter,  $D_{50}$  = 0.13 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 92

(0.005mm size) & (0.001mm size) = 8

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chardurgapur Govt. Primary School field, Ishan Gopalpur

Bore Hole No: BH-F03

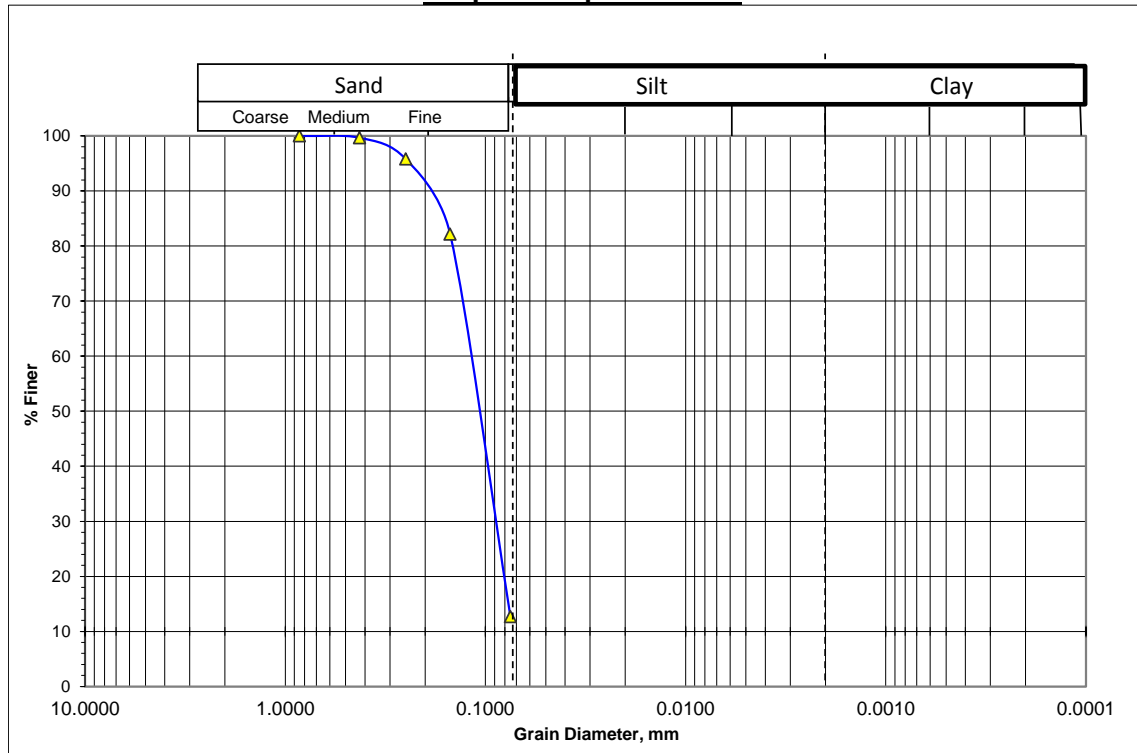
Sampled Date: 07/01/2016

Sample No : D-02

Test Date : 05/02/2016

Depth (m) : 3.0

#### Graphical Representation:



Fines or % of silt and clay = 12

Mean Diameter,  $D_{50} = 0.105$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.57$

% Particles (from the grain -size analysis graph

(0.075mm size) = 88

(0.005mm size) & (0.001mm size) = 12

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chardurgapur Govt. Primary School field, Ishan Gopalpur

Bore Hole No: BH-F03

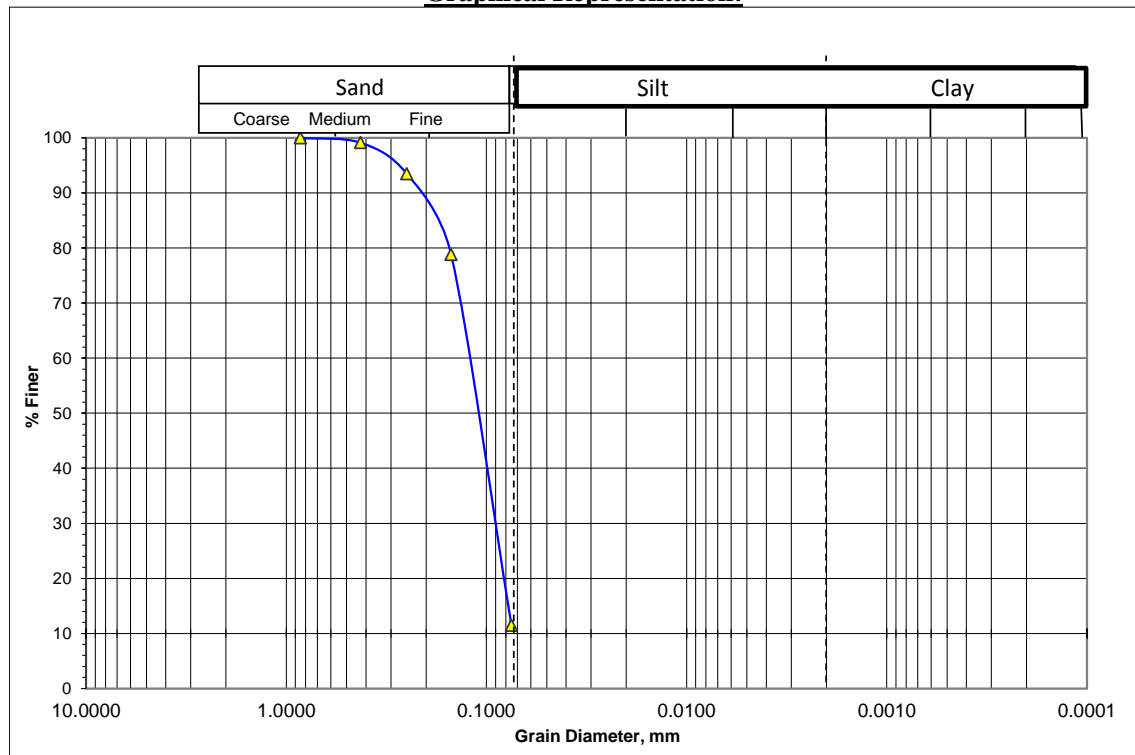
Sampled Date: 07/01/2016

Sample No : D-05

Test Date : 05/02/2016

Depth (m) : 7.5

#### Graphical Representation:



Fines or % of silt and clay = 11

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 89

(0.005mm size) & (0.001mm size) = 11

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chardurgapur Govt. Primary School field, Ishan Gopalpur

Bore Hole No: BH-F03

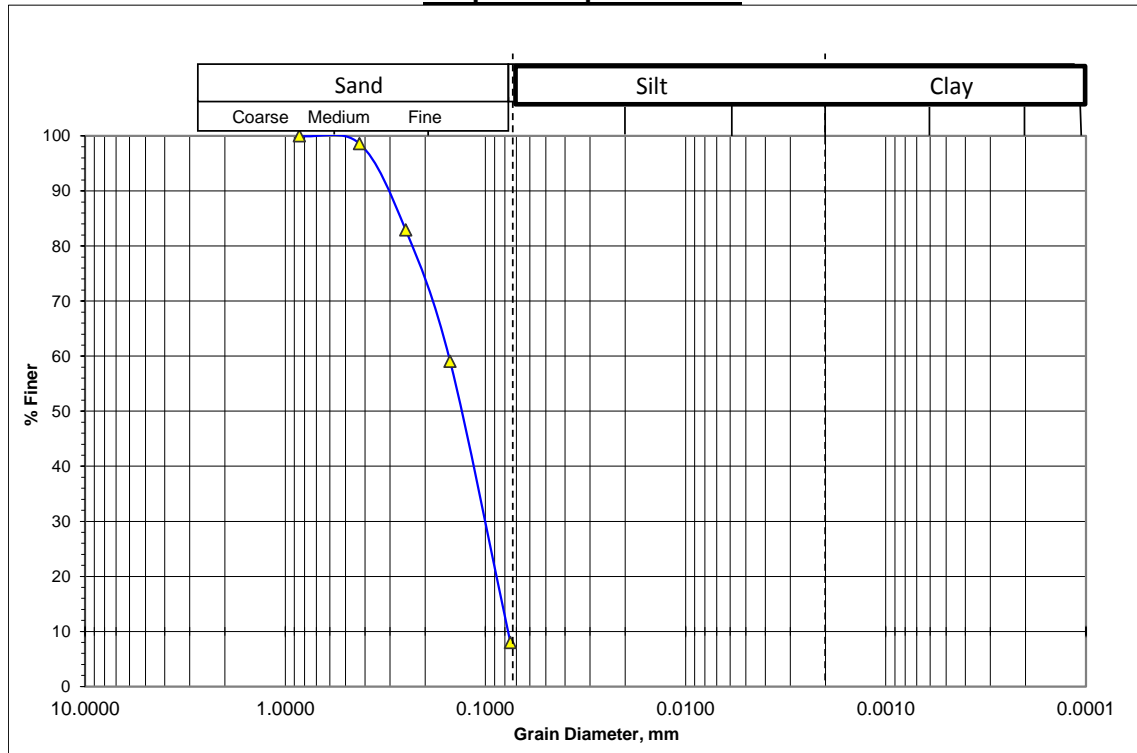
Sampled Date: 07/01/2016

Sample No : D-14

Test Date : 05/02/2016

Depth (m) : 21.0

#### Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter,  $D_{50} = 0.135$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.65$

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Char Madhabdia Govt.Primary School, Char Madhabdia Bazar, Char Madhabdia

Bore Hole No: BH-F04

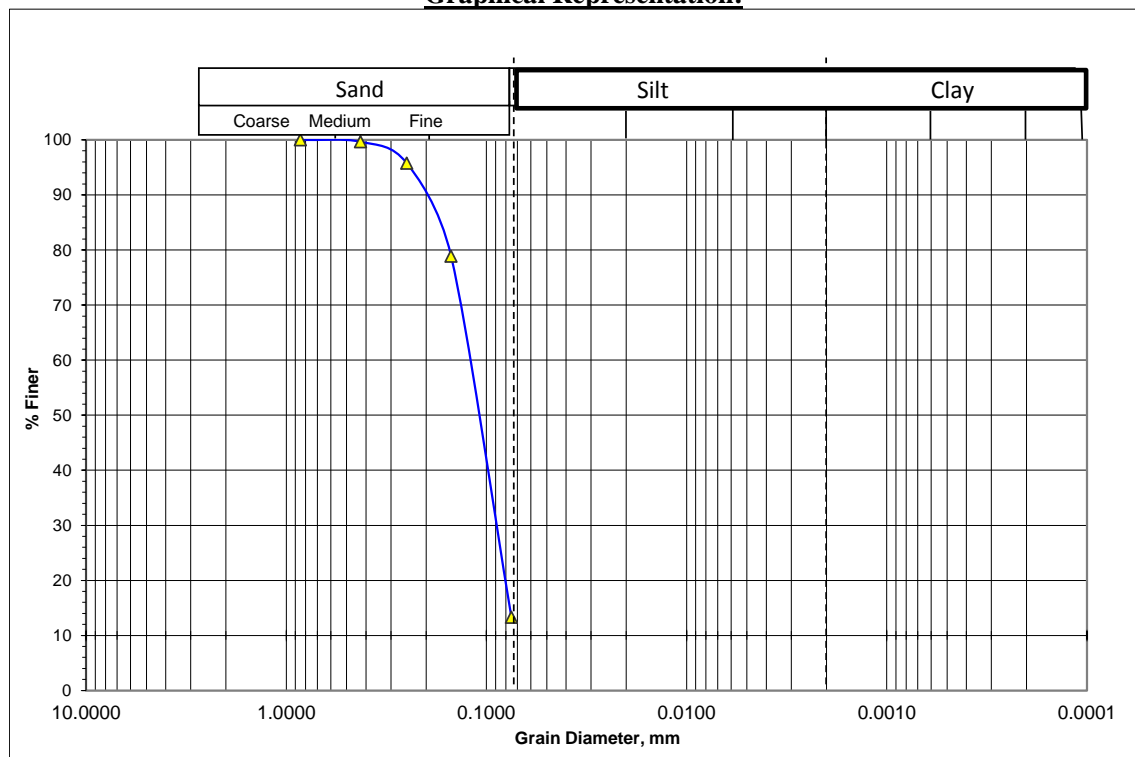
Sampled Date: 06/01/2016

Sample No : D-08

Test Date : 05/02/2016

Depth (m) : 12.0

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Char Madhabdia Govt.Primary School, Char Madhabdia Bazar, Char Madhabdia

Bore Hole No: BH-F04

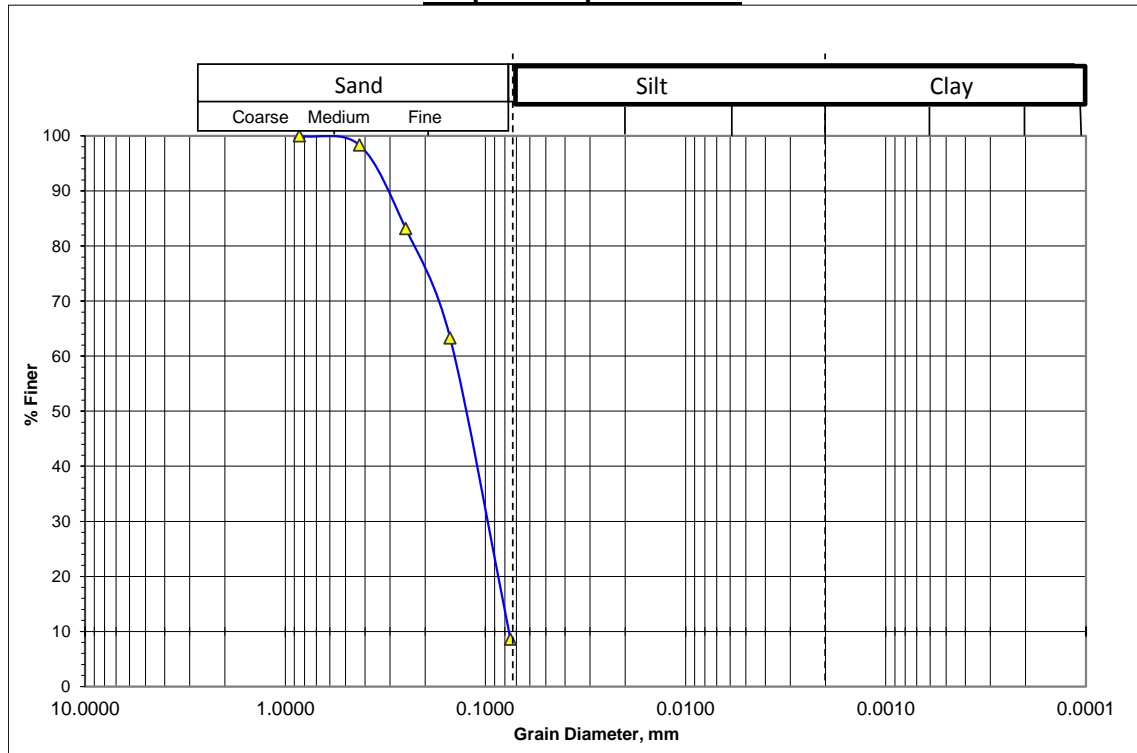
Sampled Date: 06/01/2016

Sample No : D-11

Test Date : 05/02/2016

Depth (m) : 16.5

#### Graphical Representation:



Fines or % of silt and clay = 8

Mean Diameter,  $D_{50} = 0.13$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 92

(0.005mm size) & (0.001mm size) = 8



### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Shibrampur R. D. Academy School Field , Majchar

Bore Hole No: BH-F05

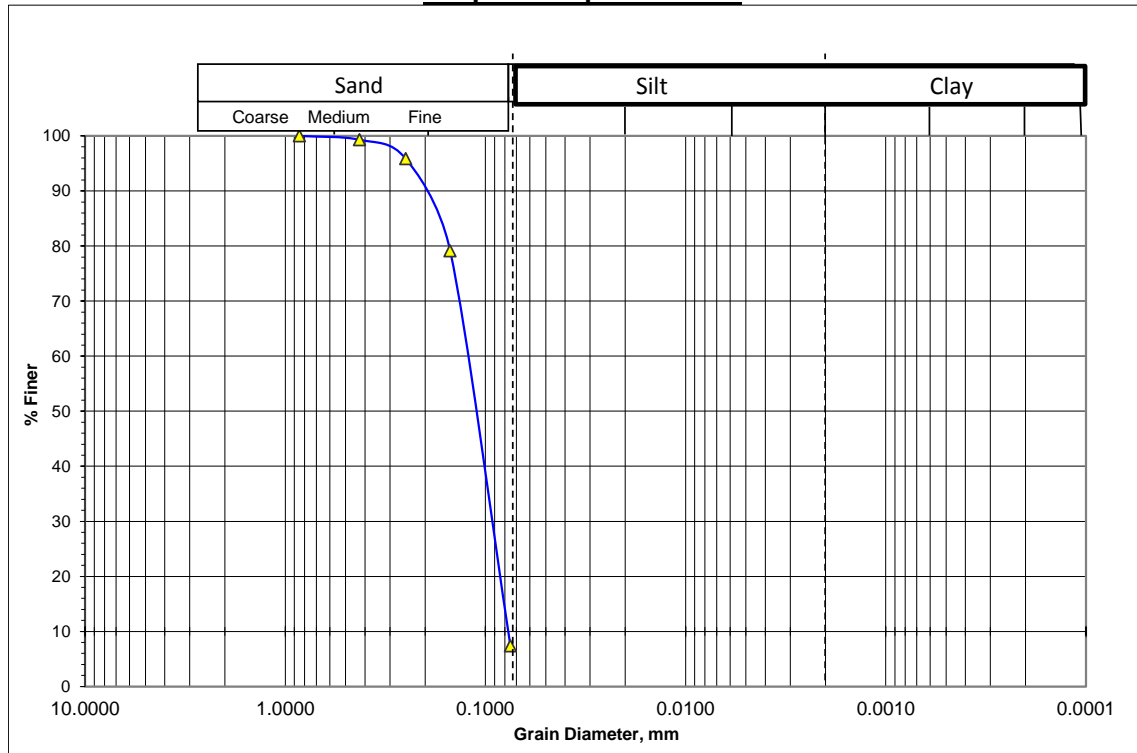
Sampled Date: 08/01/2016

Sample No : D-02

Test Date : 05/02/2016

Depth (m) : 3.0

#### Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter,  $D_{50}$  = 0.11 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.58

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Shibrampur R. D. Academy School Field , Majchar

Bore Hole No: BH-F05

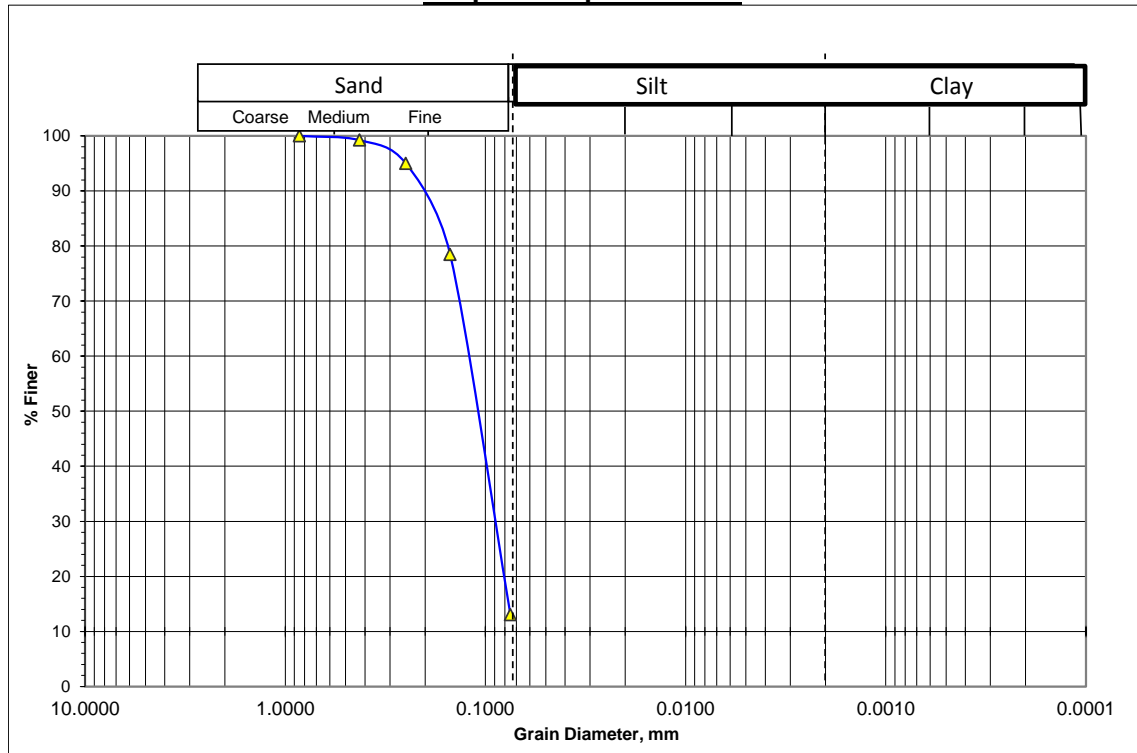
Sampled Date: 08/01/2016

Sample No : D-05

Test Date : 05/02/2016

Depth (m) : 7.5

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chardurgapur Govt. Primary School field, Ishan Gopalpur

Bore Hole No: BH-F03

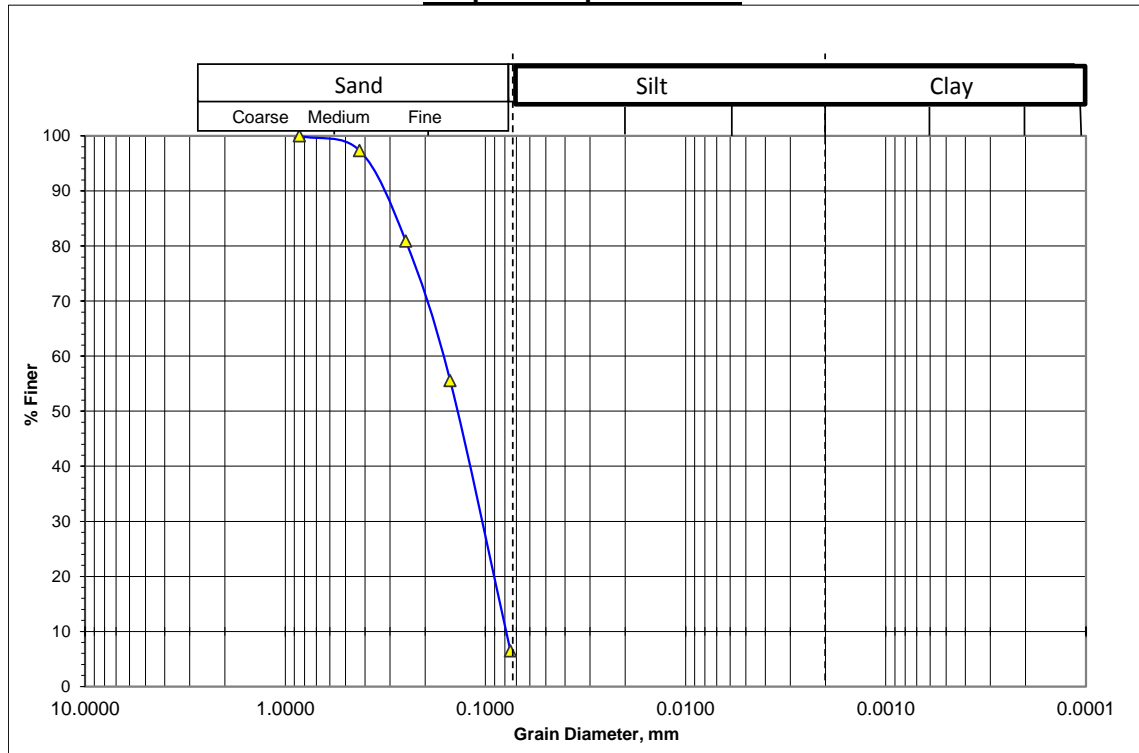
Sampled Date: 07/01/2016

Sample No : D-11

Test Date : 05/02/2016

Depth (m) : 16.5

#### Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter,  $D_{50} = 0.145$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.67$

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Pallikobi Jasimuddin Saranshala, Ambikapur

Bore Hole No: BH-F05

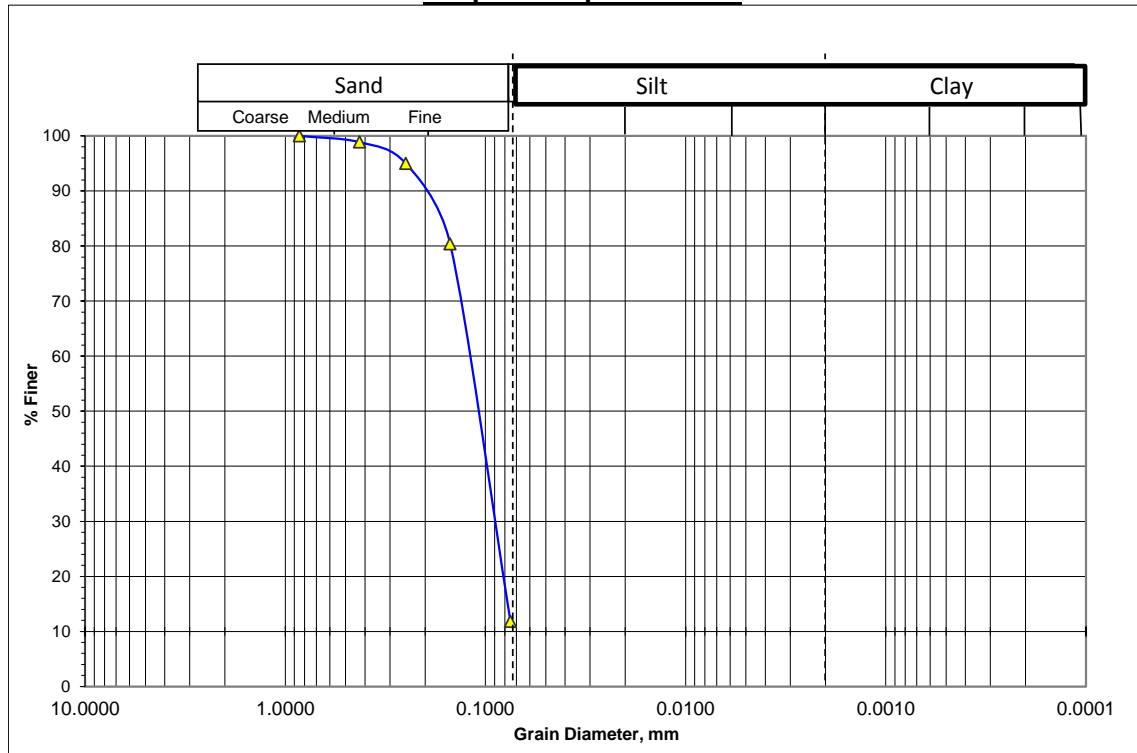
Sampled Date: 10/01/2016

Sample No : D-05

Test Date : 05/02/2016

Depth (m) : 7.5

#### Graphical Representation:



Fines or % of silt and clay = 12

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 88

(0.005mm size) & (0.001mm size) = 12

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Pallikobi Jasimuddin Saranshala, Ambikapur

Bore Hole No: BH-F05

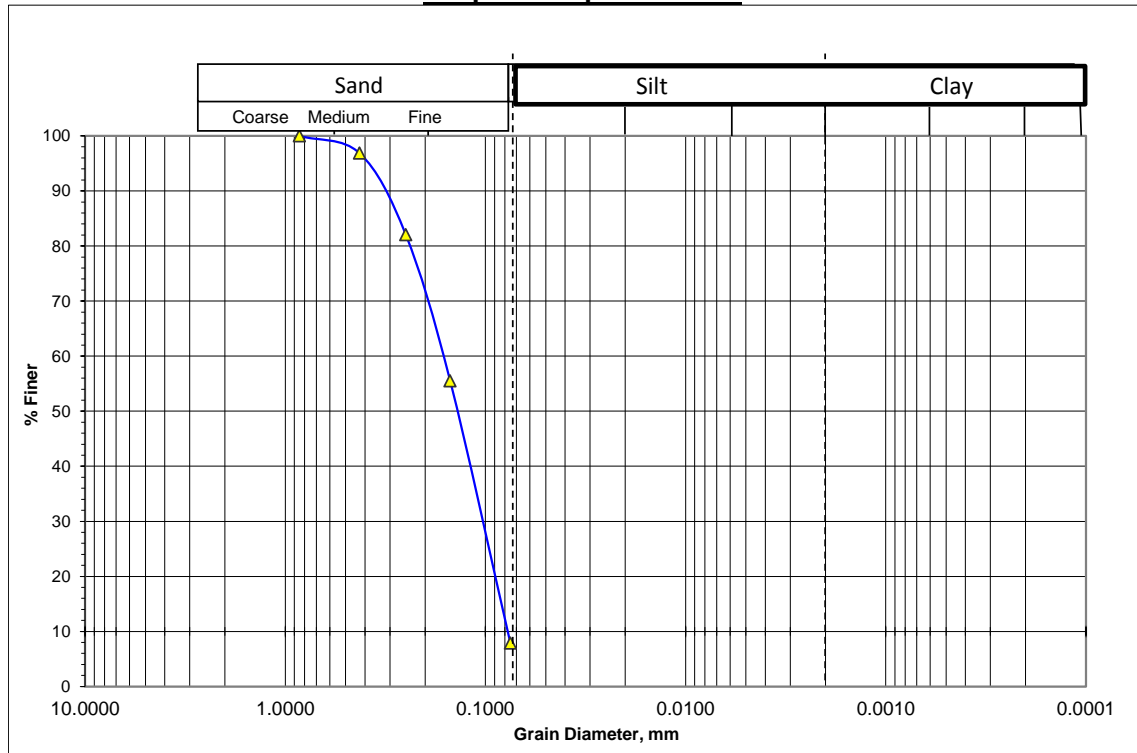
Sampled Date: 10/01/2016

Sample No : D-11

Test Date : 05/02/2016

Depth (m) : 16.5

#### Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter,  $D_{50} = 0.15$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.68$

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Madhankali Swith gate, Ambikapur

Bore Hole No: BH-F07

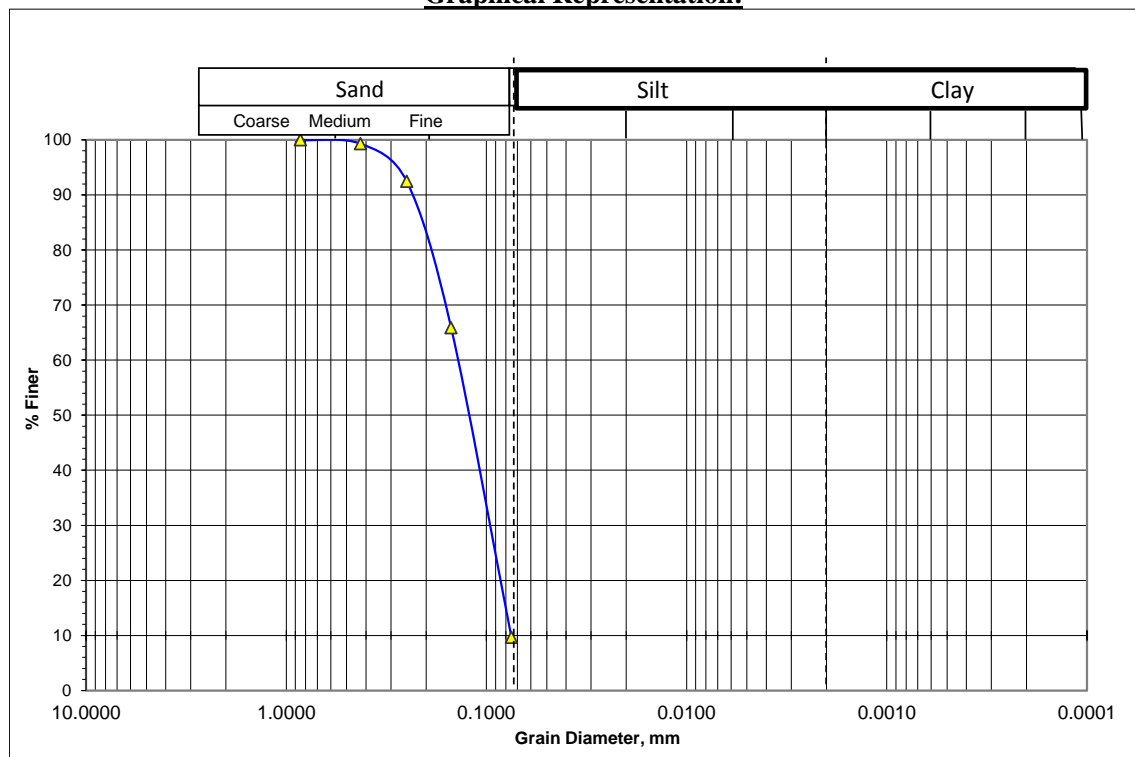
Sample Date: 31/12/2015

Sample No : D-09

Test Date : 05/02/2016

Depth (m) : 13.5

#### Graphical Representation:



Fines or % of silt and clay = 10

Mean Diameter,  $D_{50} = 0.13$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 90

(0.005mm size) & (0.001mm size) = 10

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Madhankali Swith gate, Ambikapur

Bore Hole No: BH-F07

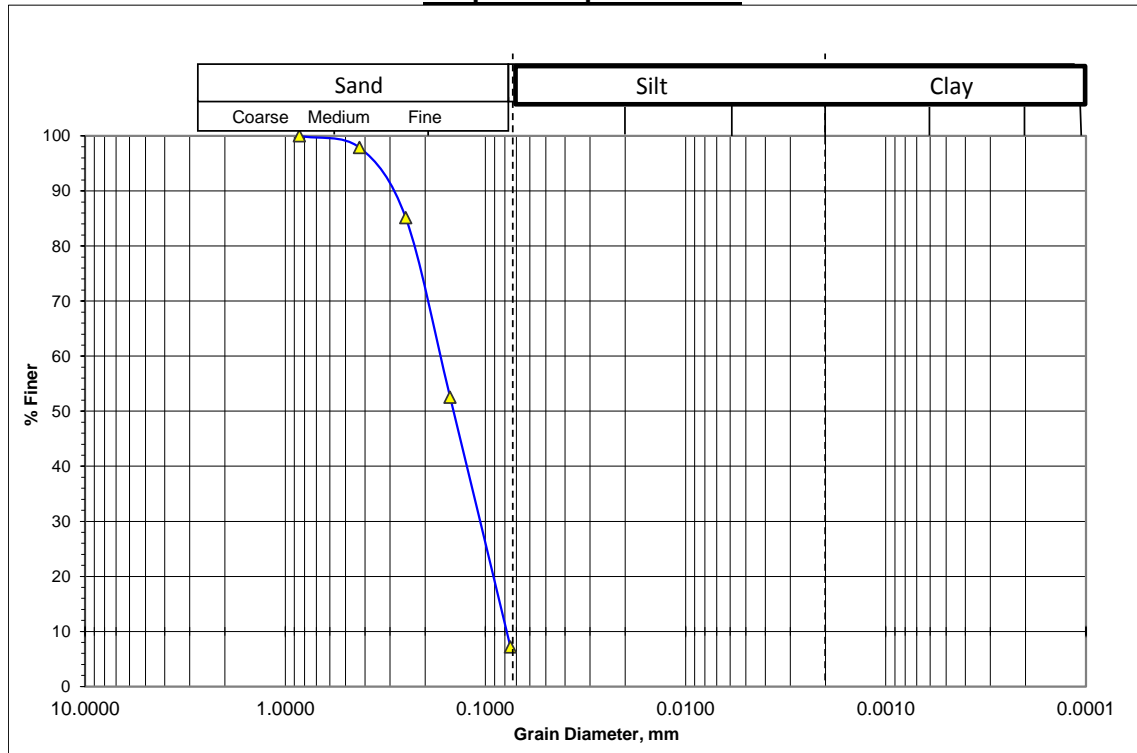
Sampled Date: 31/12/2015

Sample No : D-15

Test Date : 05/02/2016

Depth (m) : 22.5

#### Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter,  $D_{50} = 0.15$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.68$

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7



### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Adampur Bazar, Goulonda Road, Ambikapur

Bore Hole No: BH-F08

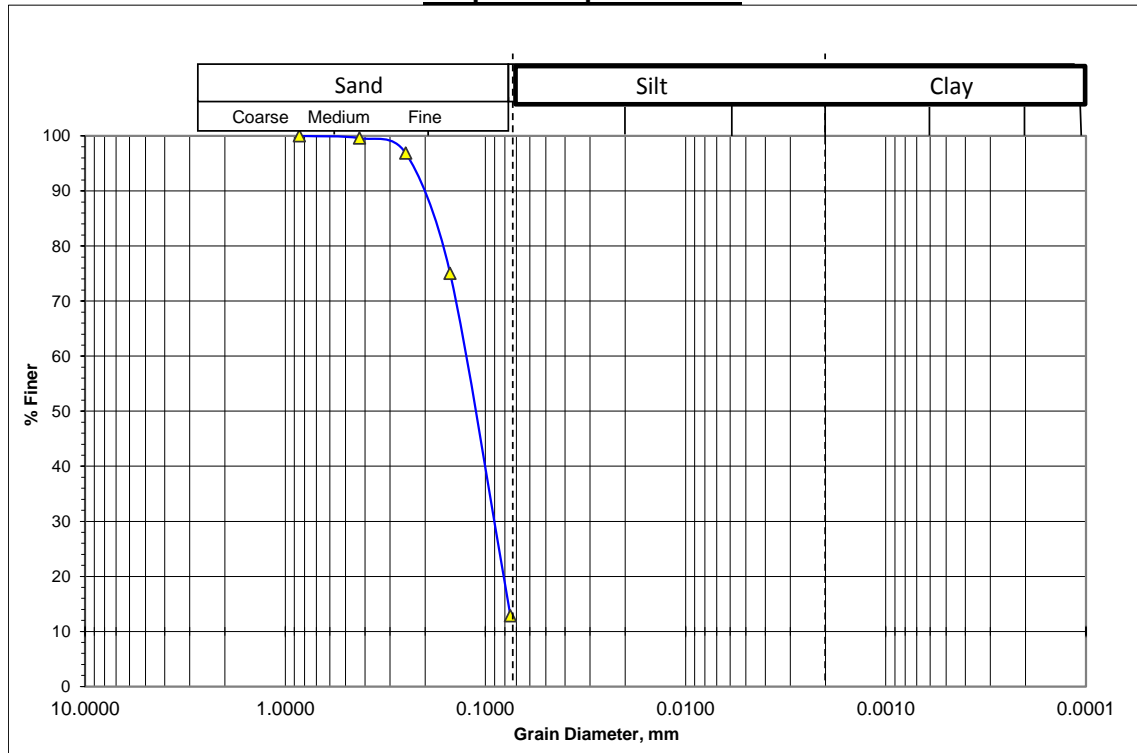
Sampled Date: 01/01/2016

Sample No : D-02

Test Date : 05/02/2016

Depth (m) : 3.0

#### Graphical Representation:



Fines or % of silt and clay = 12

Mean Diameter,  $D_{50} = 0.115$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.60$

% Particles (from the grain -size analysis graph

(0.075mm size) = 88

(0.005mm size) & (0.001mm size) = 12

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Adampur Bazar, Goualonda Road, Ambikapur

Bore Hole No: BH-F08

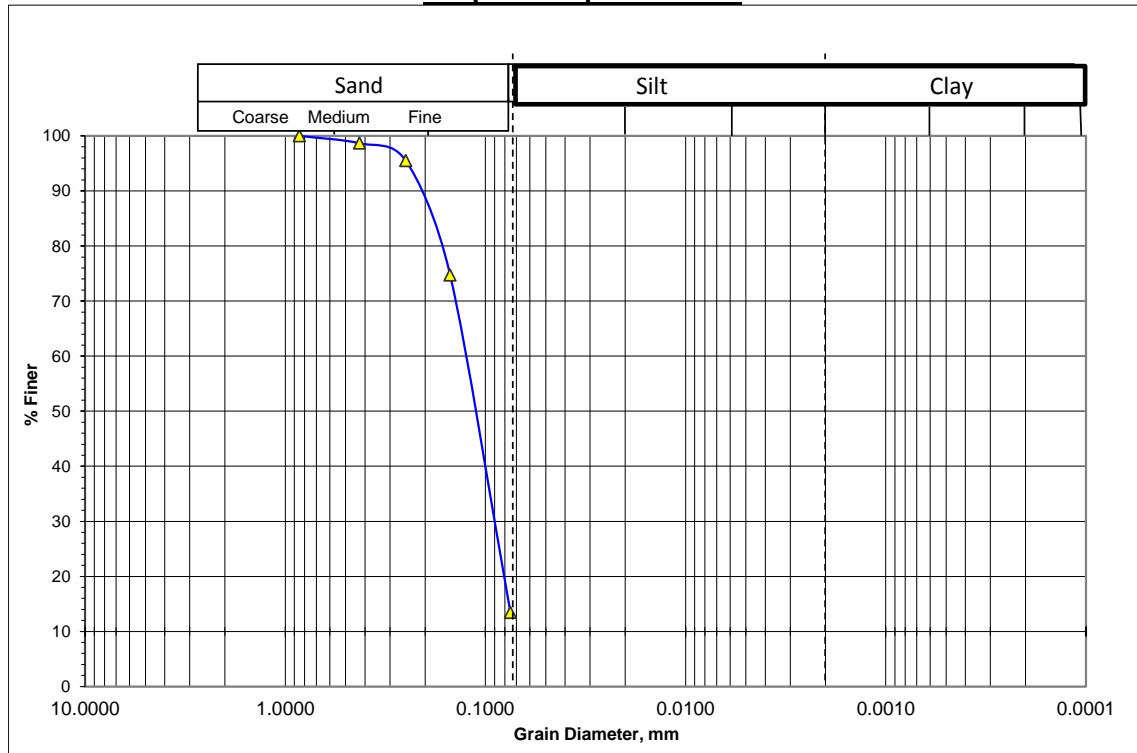
Sampled Date: 01/01/2016

Sample No : D-10

Test Date : 05/02/2016

Depth (m) : 15.0

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.12$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.61$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Adampur Bazar, Goualonda Road, Ambikapur

Bore Hole No: BH-F08

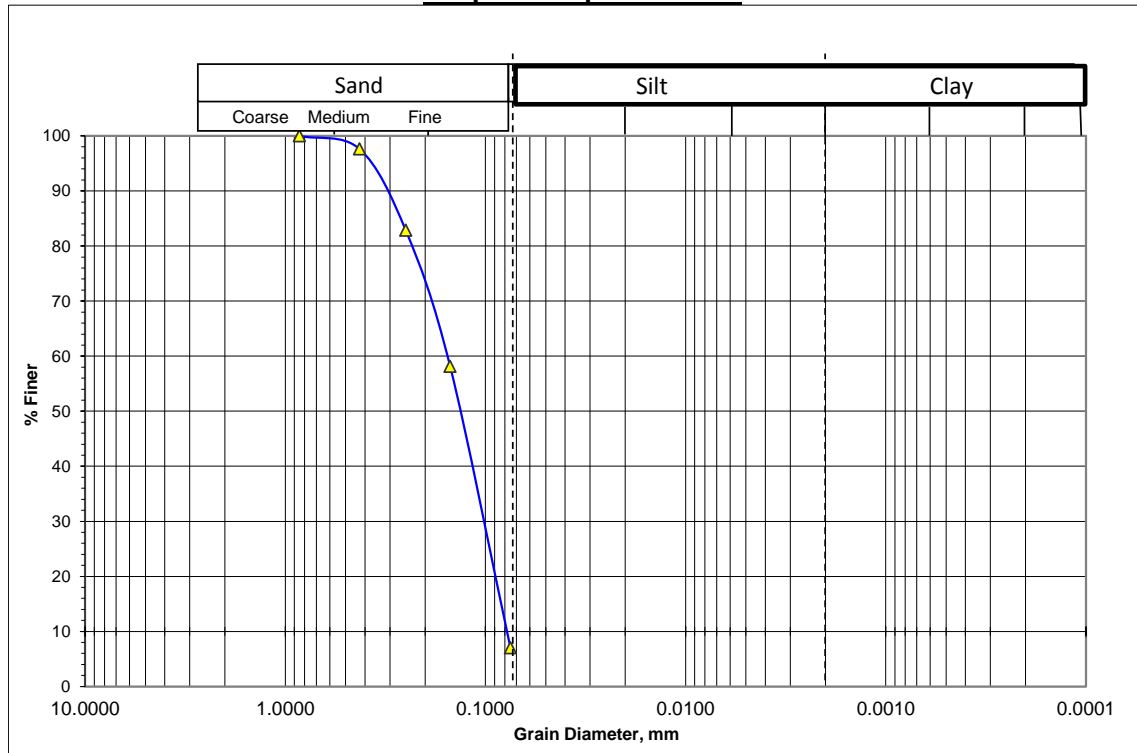
Sampled Date: 01/01/2016

Sample No : D-17

Test Date : 05/02/2016

Depth (m) : 25.5

#### Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter,  $D_{50}$  = 0.14 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.66

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Dhuldi Railgate, Dhuldi Bazar, Majchar

Bore Hole No: BH-F09

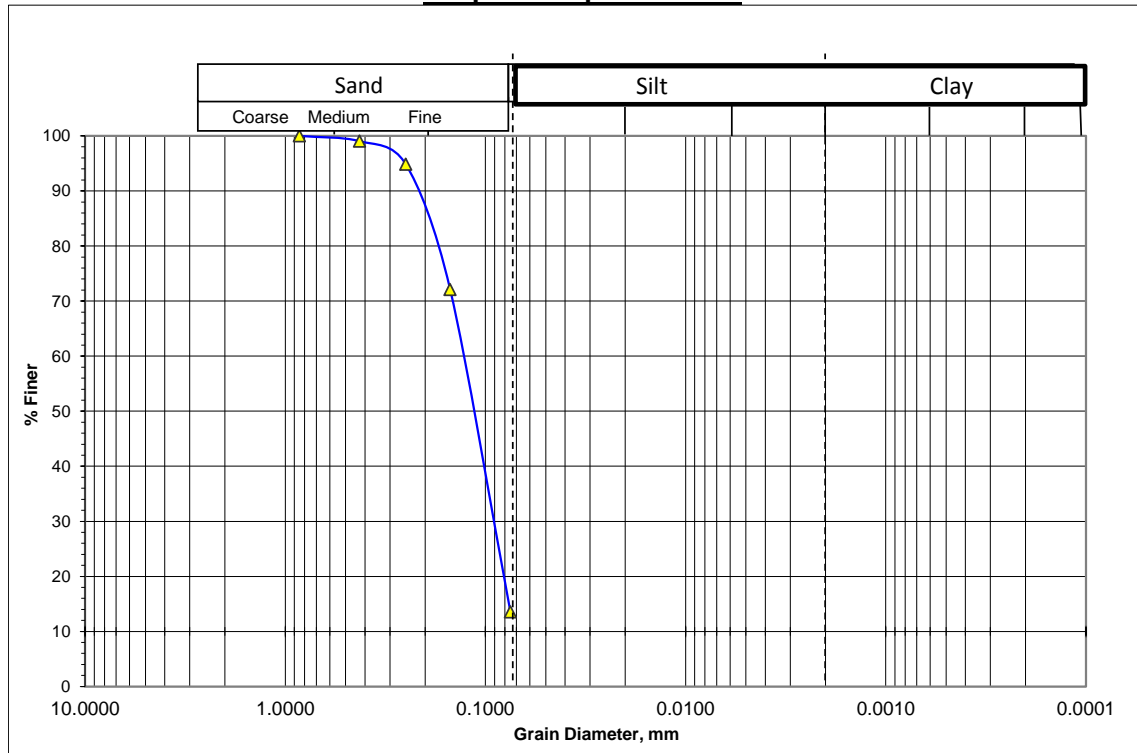
Sampled Date: 08/01/2016

Sample No : D-07

Test Date : 05/02/2016

Depth (m) : 10.5

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.12$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.61$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Dhuldi Railgate, Dhuldi Bazar, Majchar

Bore Hole No: BH-F09

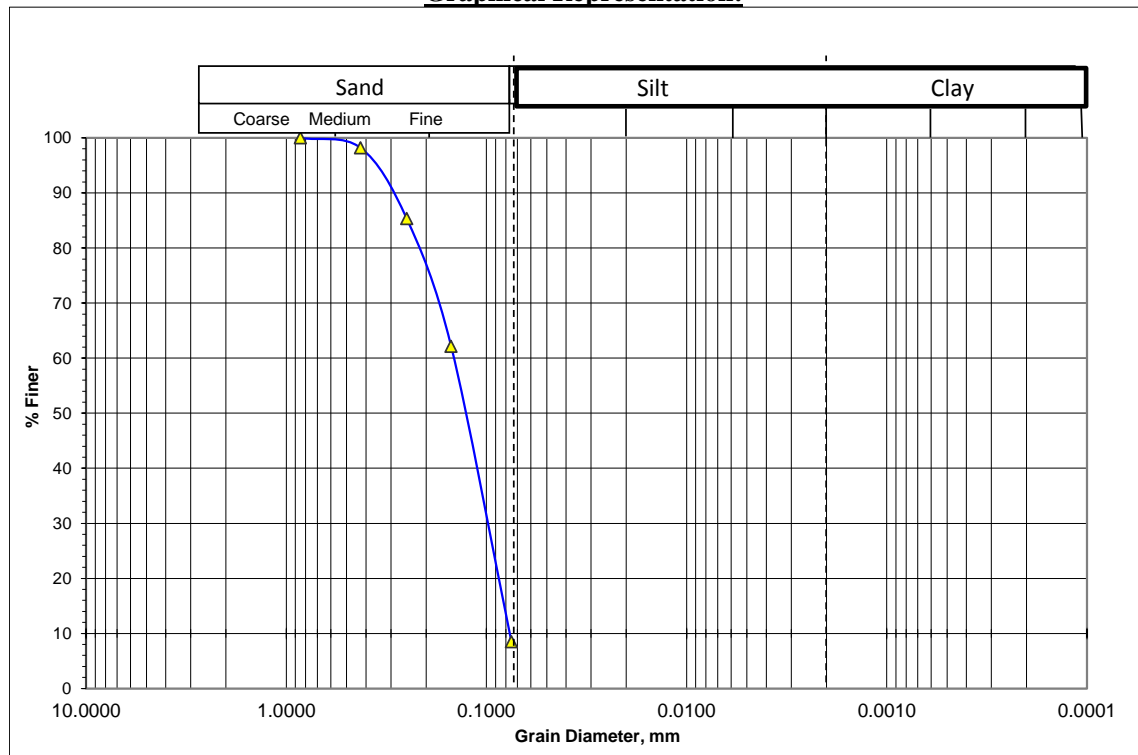
Sampled Date: 08/01/2016

Sample No : D-13

Test Date : 05/02/2016

Depth (m) : 19.5

#### Graphical Representation:



Fines or % of silt and clay = 8

Mean Diameter,  $D_{50} = 0.135$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.65$

% Particles (from the grain -size analysis graph

(0.075mm size) = 92

(0.005mm size) & (0.001mm size) = 8

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Khalilpur Bazar,Majchar

Bore Hole No: BH-F10

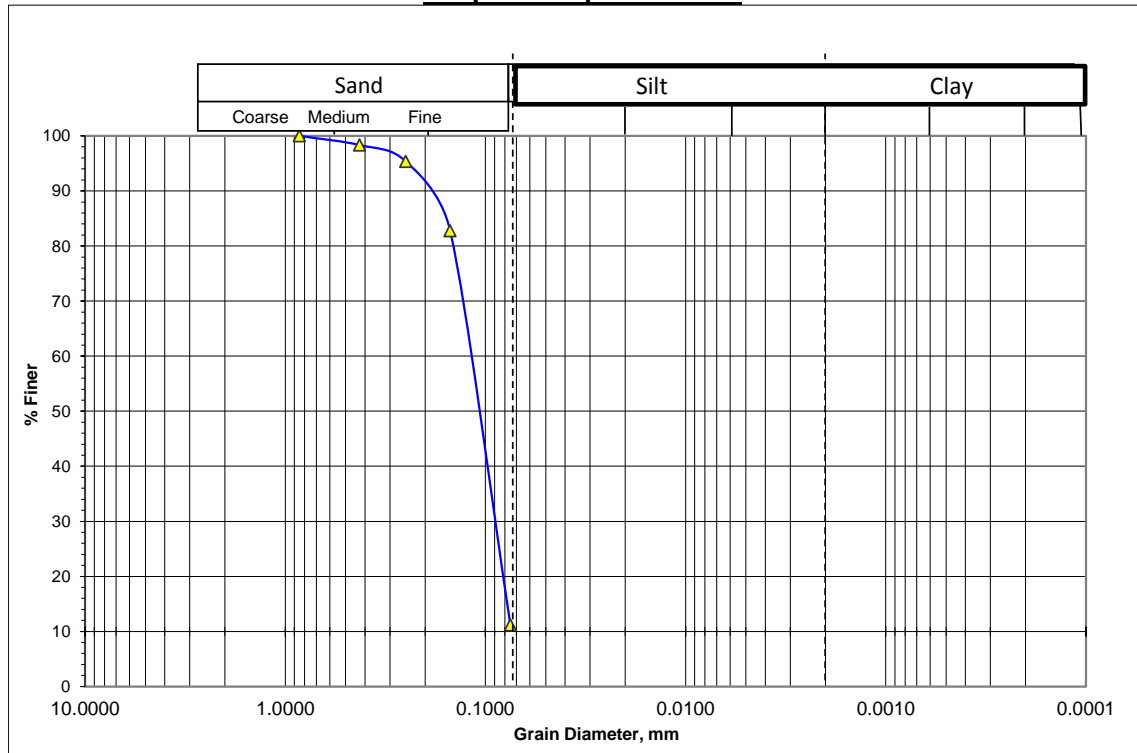
Sampled Date: 07/01/2016

Sample No : D-03

Test Date : 07/02/2016

Depth (m) : 4.5

#### Graphical Representation:



Fines or % of silt and clay = 11

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 89

(0.005mm size) & (0.001mm size) = 11

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Khalilpur Bazar,Majchar

Bore Hole No: BH-F10

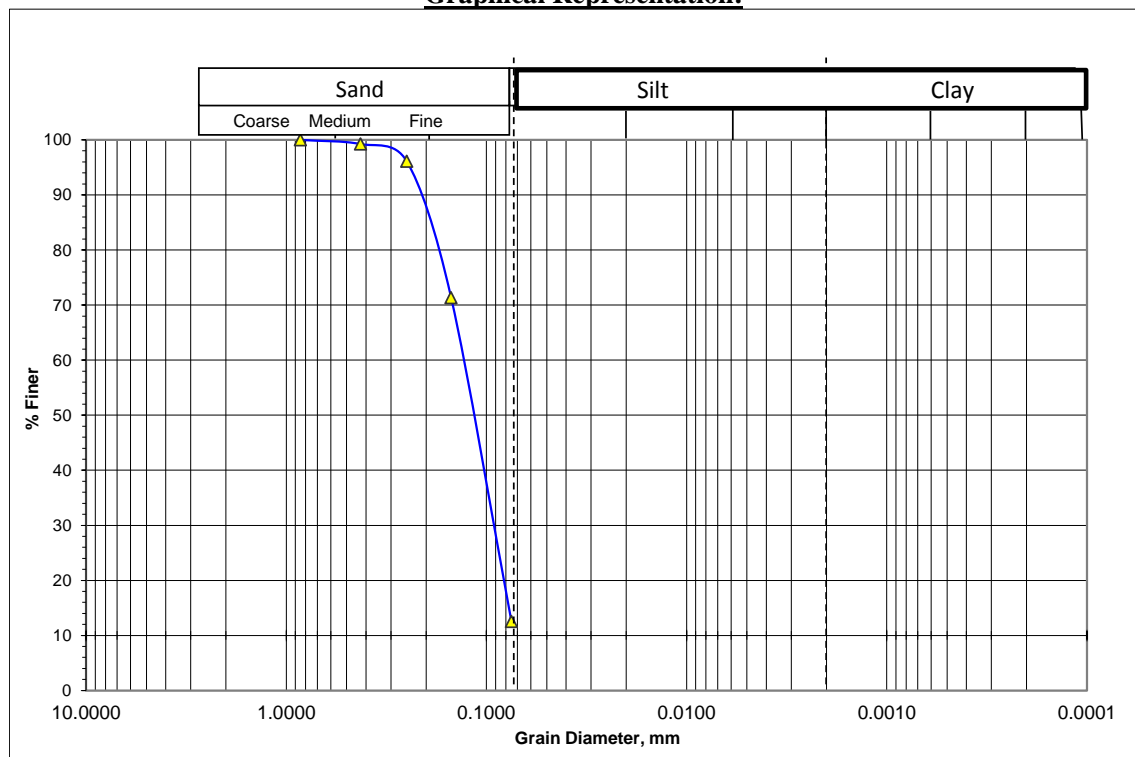
Sampled Date: 07/01/2016

Sample No : D-09

Test Date : 07/02/2016

Depth (m) : 13.5

#### Graphical Representation:



Fines or % of silt and clay = 12

Mean Diameter,  $D_{50}$  = 0.12 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.61

% Particles (from the grain -size analysis graph

(0.075mm size) = 88

(0.005mm size) & (0.001mm size) = 12



### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Khalilpur Bazar,Majchar

Bore Hole No: BH-F10

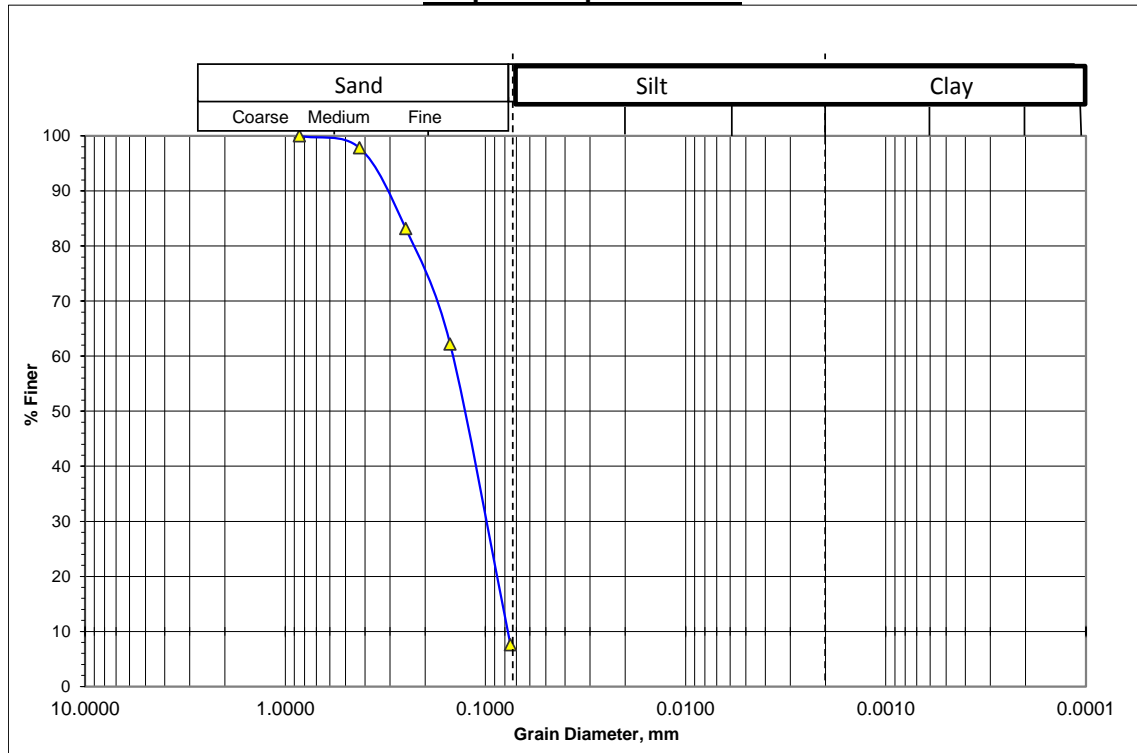
Sampled Date: 07/01/2016

Sample No : D-15

Test Date : 07/02/2016

Depth (m) : 22.5

#### Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter,  $D_{50}$  = 0.13 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.63

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : 5 nos. Decreerchar, Munshitanggi Aftabuddin Madrasha, Decreerchar

Bore Hole No: BH-F11

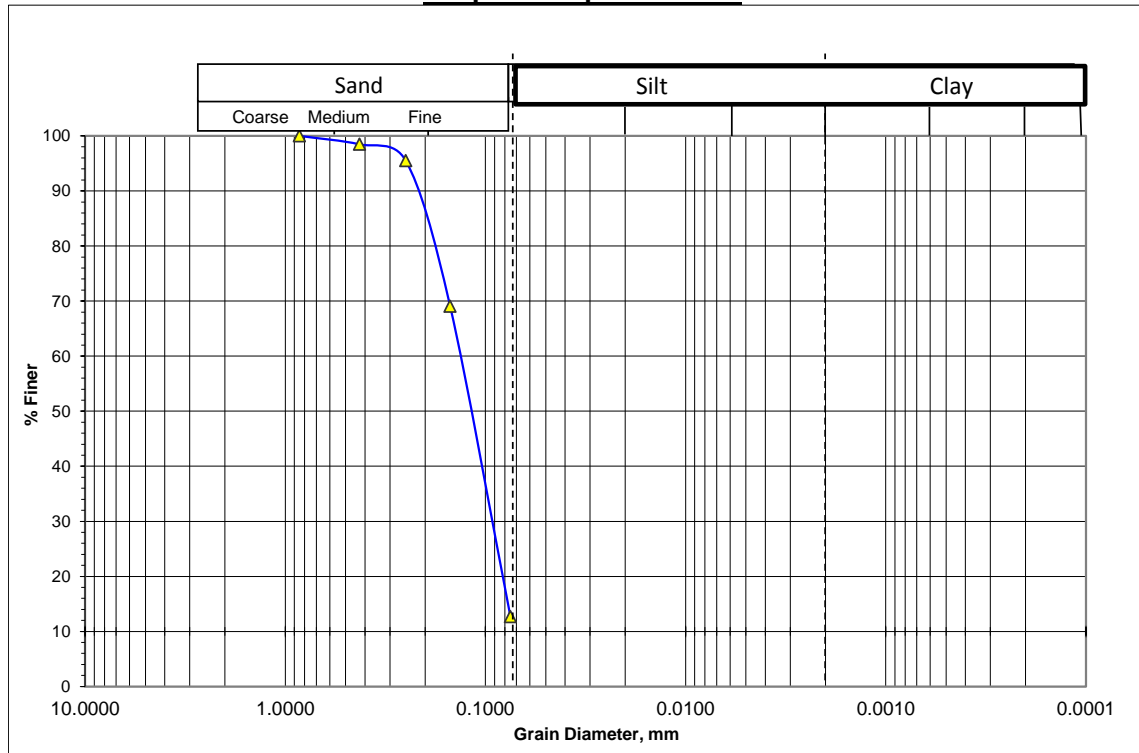
Sampled Date: 31/12/2015

Sample No : D-06

Test Date : 05/02/2016

Depth (m) : 9.0

#### Graphical Representation:



Fines or % of silt and clay = 12

Mean Diameter,  $D_{50} = 0.125$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.62$

% Particles (from the grain -size analysis graph

(0.075mm size) = 88

(0.005mm size) & (0.001mm size) = 12

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : 5 nos. Decreechar, Munshitanggi Aftabuddin Madrasha, Decreechar

Bore Hole No: BH-F11

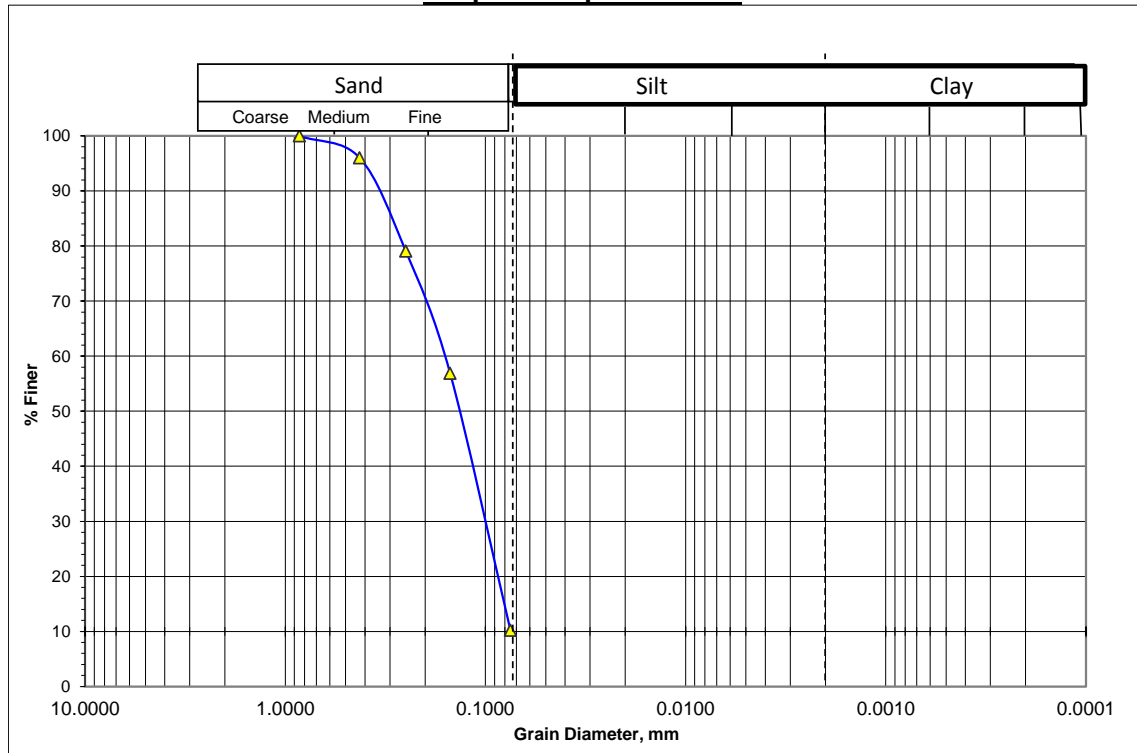
Sampled Date: 31/12/2015

Sample No : D-12

Test Date : 05/02/2016

Depth (m) : 18.0

#### Graphical Representation:



### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Yasin College, Faridpur Sadar

Bore Hole No: BH-F12

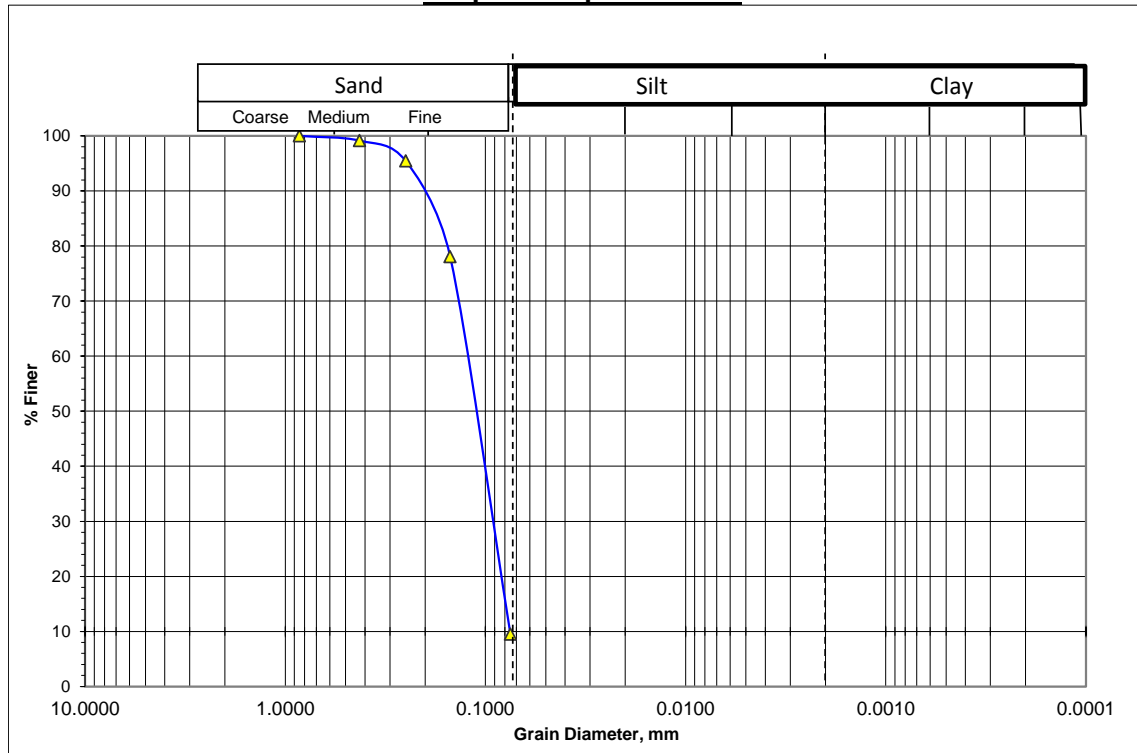
Sampled Date: 29/12/2015

Sample No : D-04

Test Date : 06/02/2016

Depth (m) : 6.0

#### Graphical Representation:



Fines or % of silt and clay = 9

Mean Diameter,  $D_{50} = 0.115$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.60$

% Particles (from the grain -size analysis graph

(0.075mm size) = 91

(0.005mm size) & (0.001mm size) = 9

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Yasin College, Faridpur Sadar

Bore Hole No: BH-F12

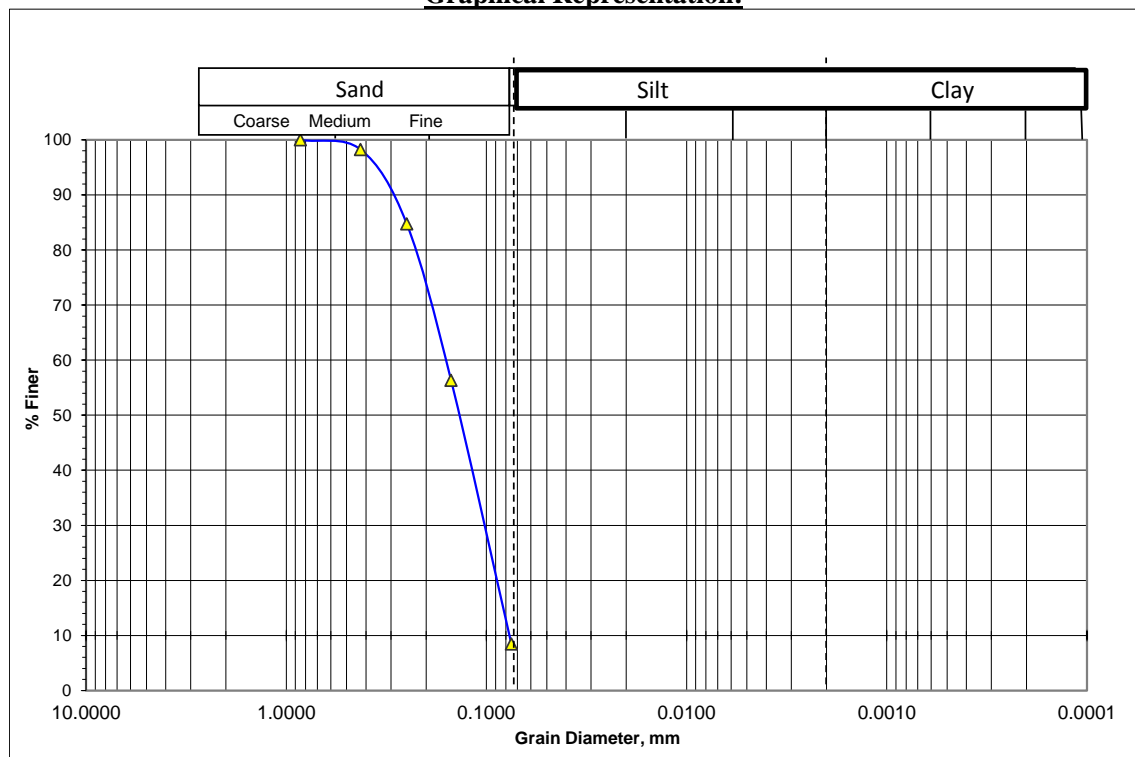
Sampled Date: 29/12/2015

Sample No : D-13

Test Date : 06/02/2016

Depth (m) : 19.5

#### Graphical Representation:



Fines or % of silt and clay = 8

Mean Diameter,  $D_{50} = 0.145$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.67$

% Particles (from the grain -size analysis graph

(0.075mm size) = 92

(0.005mm size) & (0.001mm size) = 8

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Faridpur Zilla School field, Faridpur Sadar

Bore Hole No: BH-F13

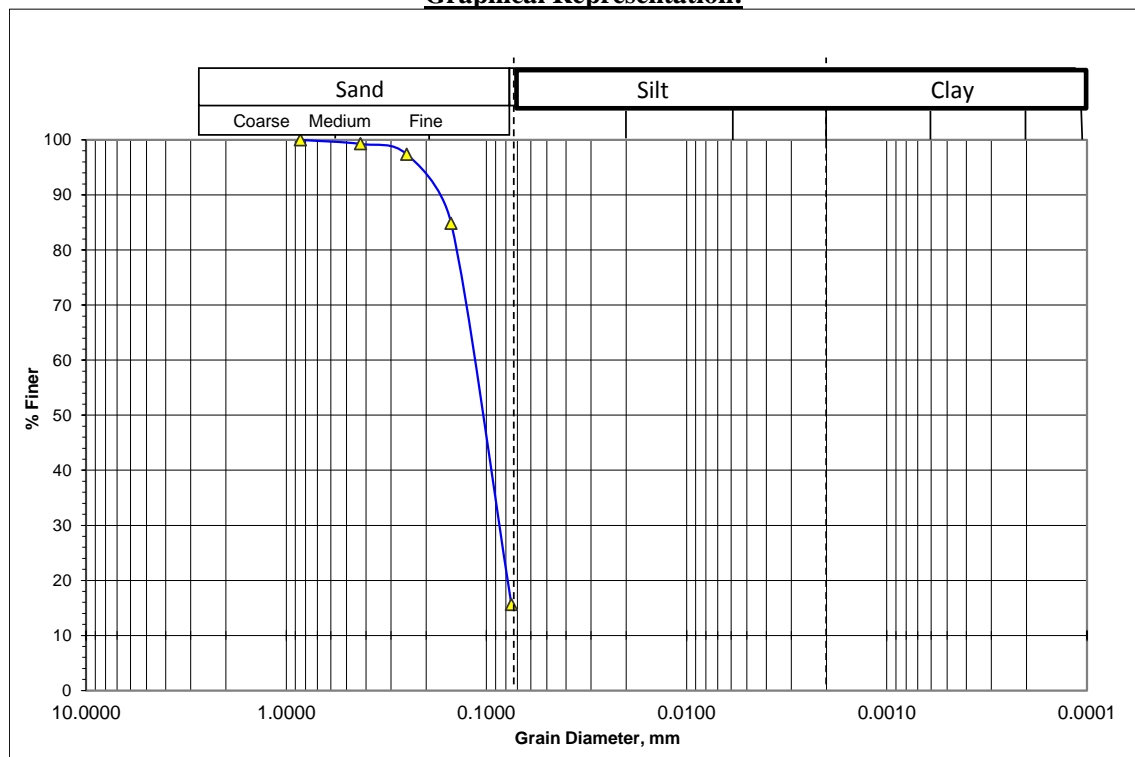
Sampled Date: 29/12/2015

Sample No : D-02

Test Date : 06/02/2016

Depth (m) : 3.0

#### Graphical Representation:



Fines or % of silt and clay = 15

Mean Diameter,  $D_{50}$  = 0.1 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.56$

% Particles (from the grain -size analysis graph

(0.075mm size) = 85

(0.005mm size) & (0.001mm size) = 15

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Faridpur Zilla School field, Faridpur Sadar

Bore Hole No: BH-F13

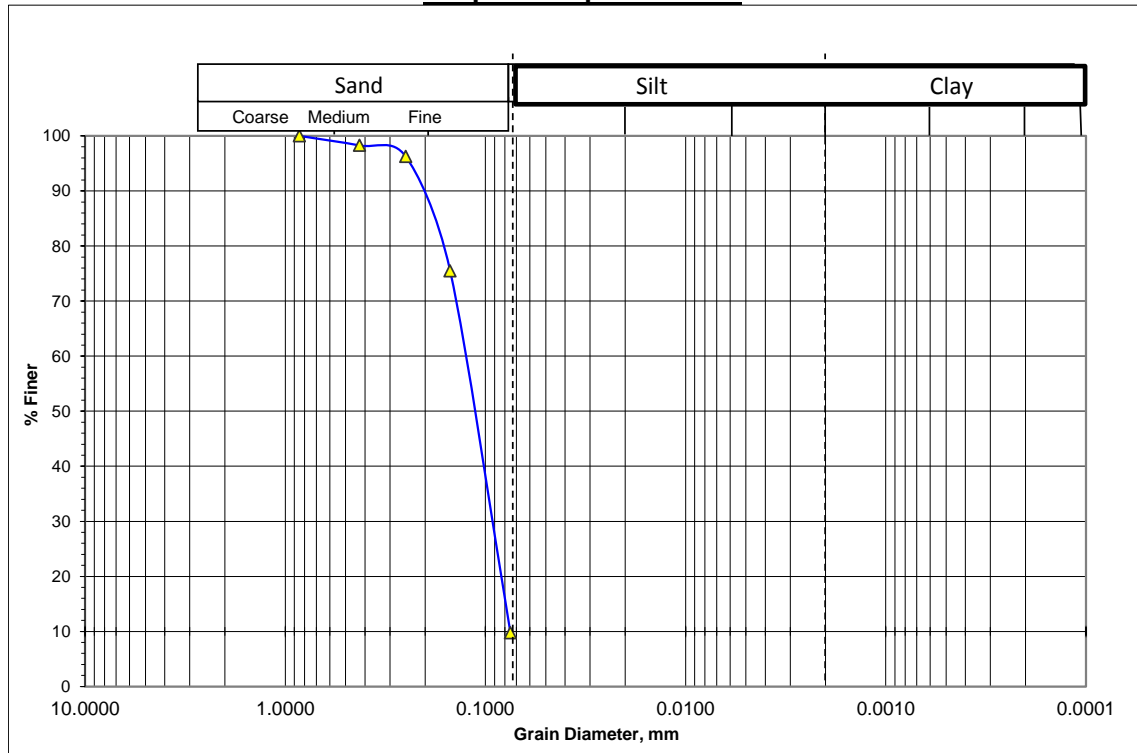
Sampled Date: 29/12/2015

Sample No : D-07

Test Date : 06/02/2016

Depth (m) : 10.5

#### Graphical Representation:



Fines or % of silt and clay = 9

Mean Diameter,  $D_{50}$  = 0.12 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.61

% Particles (from the grain -size analysis graph

(0.075mm size) = 91

(0.005mm size) & (0.001mm size) = 9

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Faridpur Zilla School field, Faridpur Sadar

Bore Hole No: BH-F13

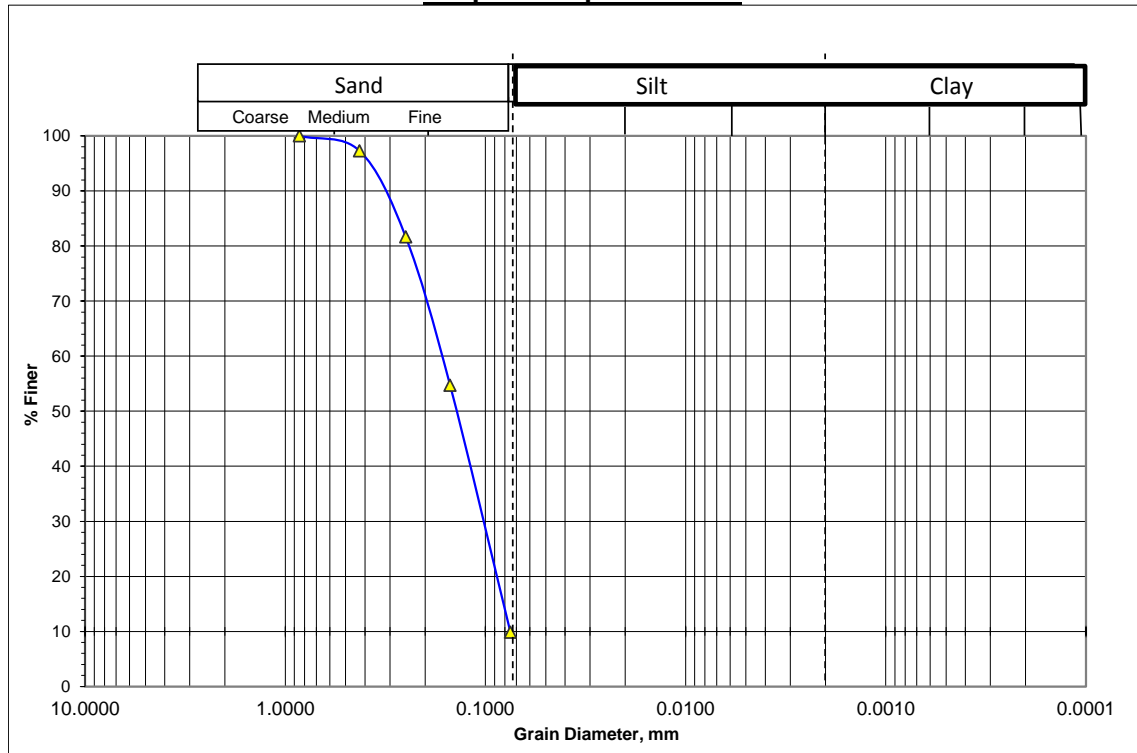
Sampled Date: 29/12/2015

Sample No : D-14

Test Date : 06/02/2016

Depth (m) : 21.0

#### Graphical Representation:



Fines or % of silt and clay = 9

Mean Diameter,  $D_{50}$  = 0.15 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.68

% Particles (from the grain -size analysis graph

(0.075mm size) = 91

(0.005mm size) & (0.001mm size) = 9



### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Vajon Dangga Govt. Primary School, Faridpur Sadar

Bore Hole No: BH-F14

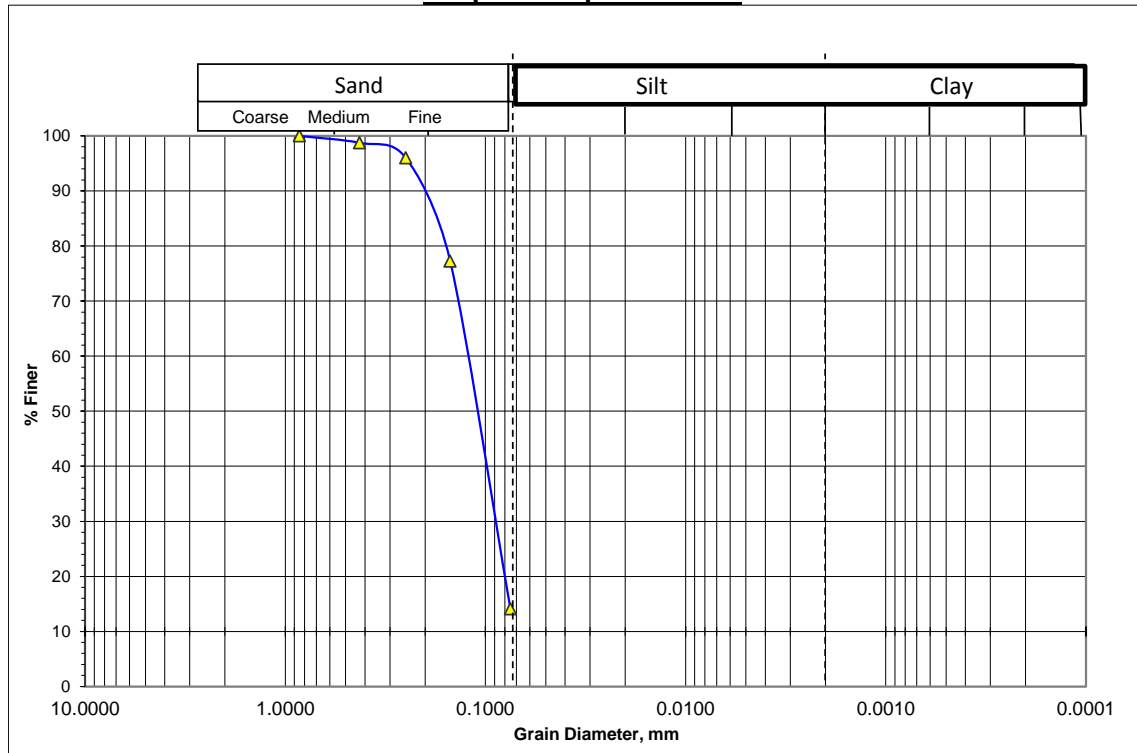
Sampled Date: 31/12/2015

Sample No : D-08

Test Date : 06/02/2016

Depth (m) : 12.0

#### Graphical Representation:



Fines or % of silt and clay = 14

Mean Diameter,  $D_{50} = 0.115$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.60$

% Particles (from the grain -size analysis graph

(0.075mm size) = 86

(0.005mm size) & (0.001mm size) = 14

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Vajon Dangga Govt. Primary School, Faridpur Sadar

Bore Hole No: BH-F14

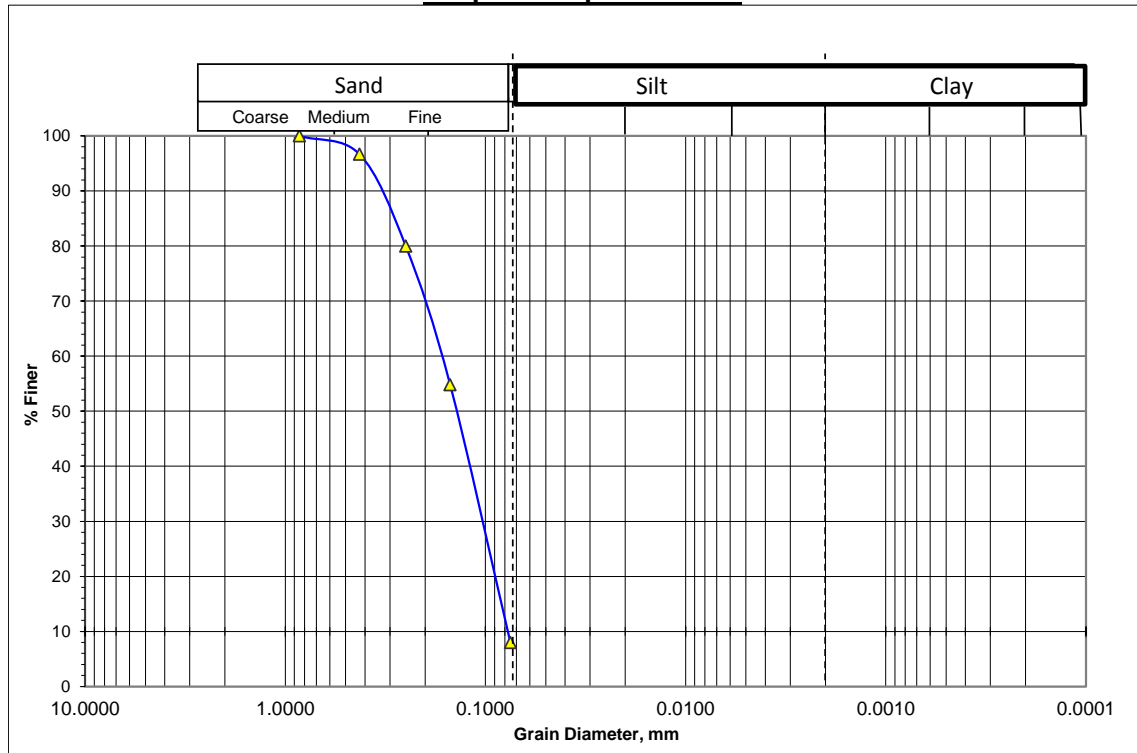
Sampled Date: 31/12/2015

Sample No : D-16

Test Date : 06/02/2016

Depth (m) : 24.0

#### Graphical Representation:



Fines or % of silt and clay = 8

Mean Diameter,  $D_{50} = 0.15$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.68$

% Particles (from the grain -size analysis graph

(0.075mm size) = 92

(0.005mm size) & (0.001mm size) = 8

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chan Chairman Pukurpar, Baitul-Noor Mosjid, Faridpur Sadar

Bore Hole No: BH-F15

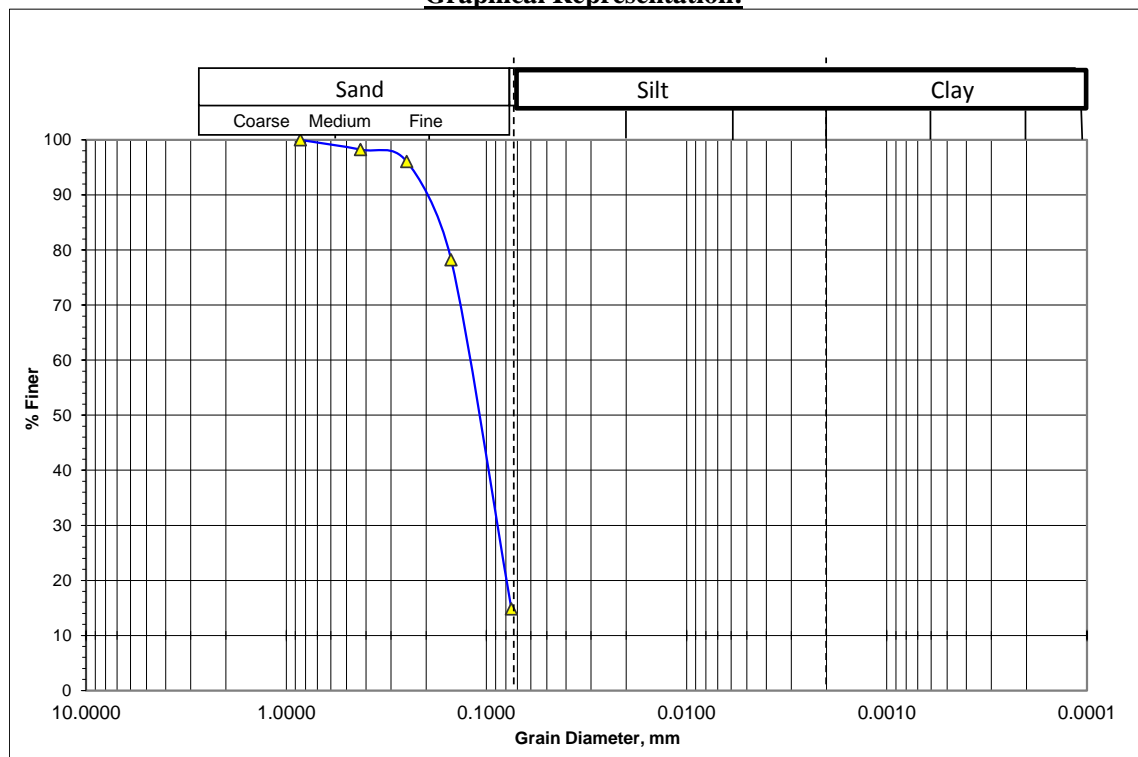
Sampled Date: 30/12/2015

Sample No : D-06

Test Date : 06/02/2016

Depth (m) : 9.0

#### Graphical Representation:



Fines or % of silt and clay = 14

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 86

(0.005mm size) & (0.001mm size) = 14

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chan Chairman Pukurpar, Baitul-Noor Mosjid, Faridpur Sadar

Bore Hole No: BH-F15

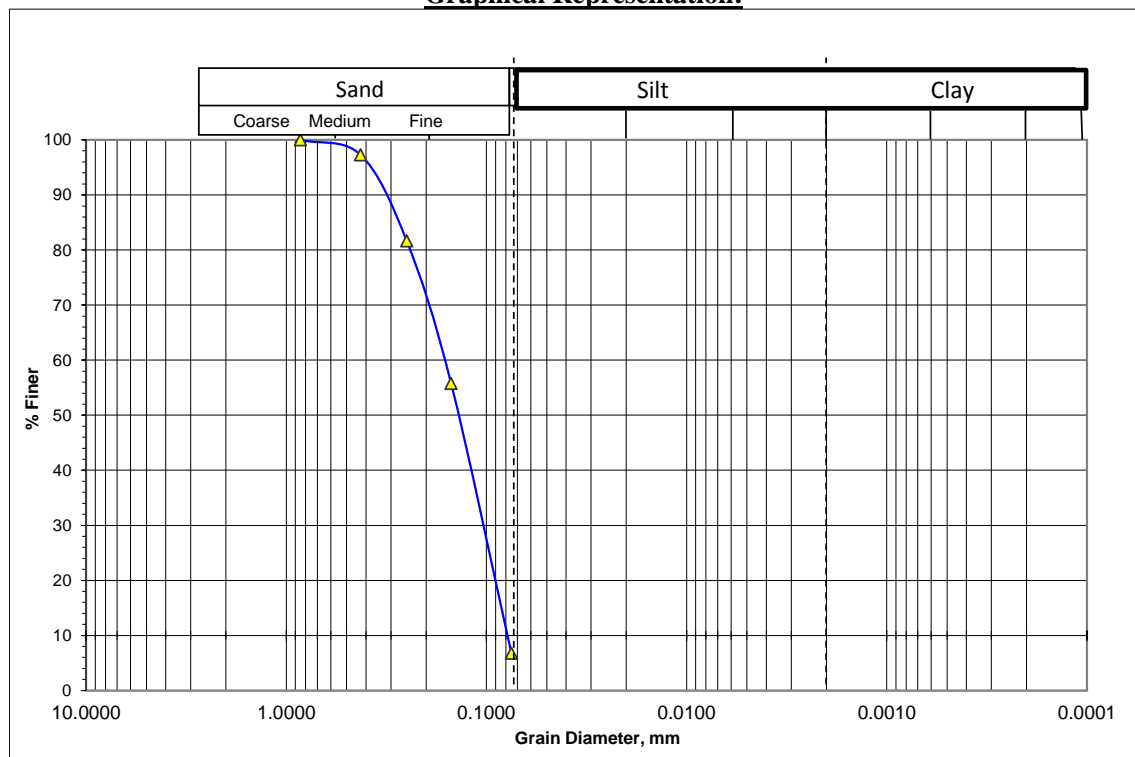
Sampled Date: 30/12/2015

Sample No : D-12

Test Date : 06/02/2016

Depth (m) : 18.0

#### Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter,  $D_{50} = 0.145$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.67$

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : 94 nos. Zhiltuki Govt. Primary School, Panir Tangki Mor, Faridpur Sadar

Bore Hole No: BH-F16

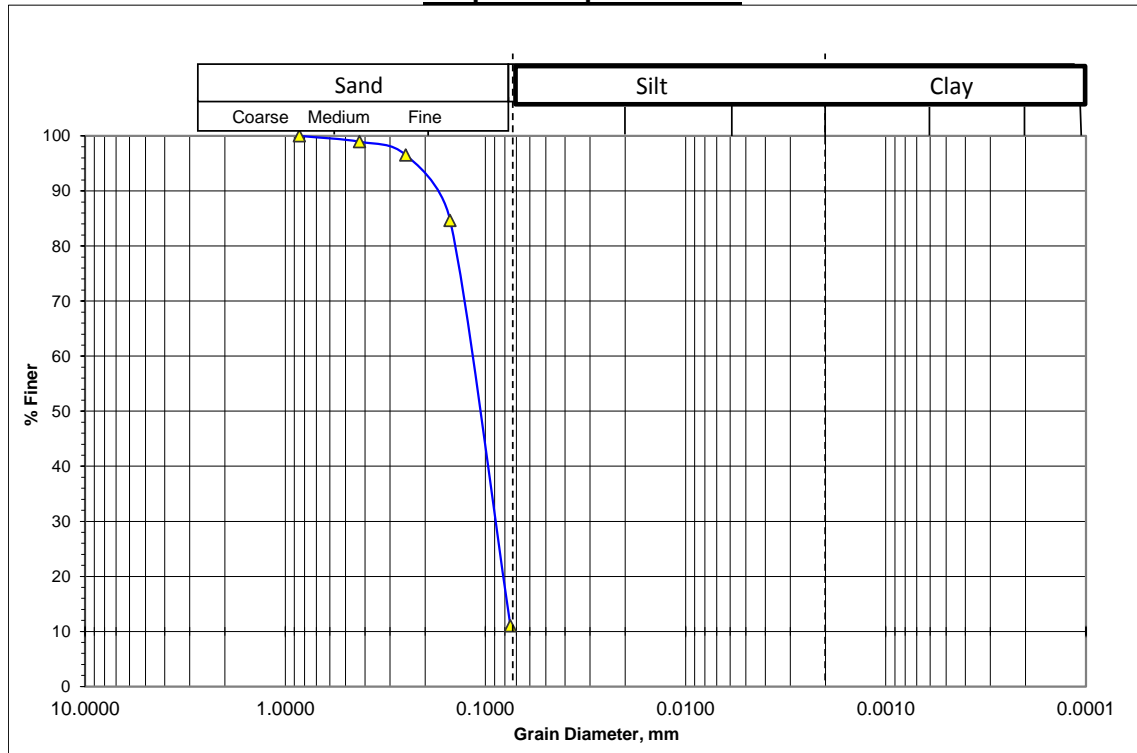
Sampled Date: 30/12/2015

Sample No : D-06

Test Date : 07/02/2016

Depth (m) : 9.0

#### Graphical Representation:



Fines or % of silt and clay = 11

Mean Diameter,  $D_{50} = 0.105$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.57$

% Particles (from the grain -size analysis graph

(0.075mm size) = 89

(0.005mm size) & (0.001mm size) = 11

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : 94 nos. Zhiltuki Govt. Primary School, Panir Tangki Mor, Faridpur Sadar

Bore Hole No: BH-F16

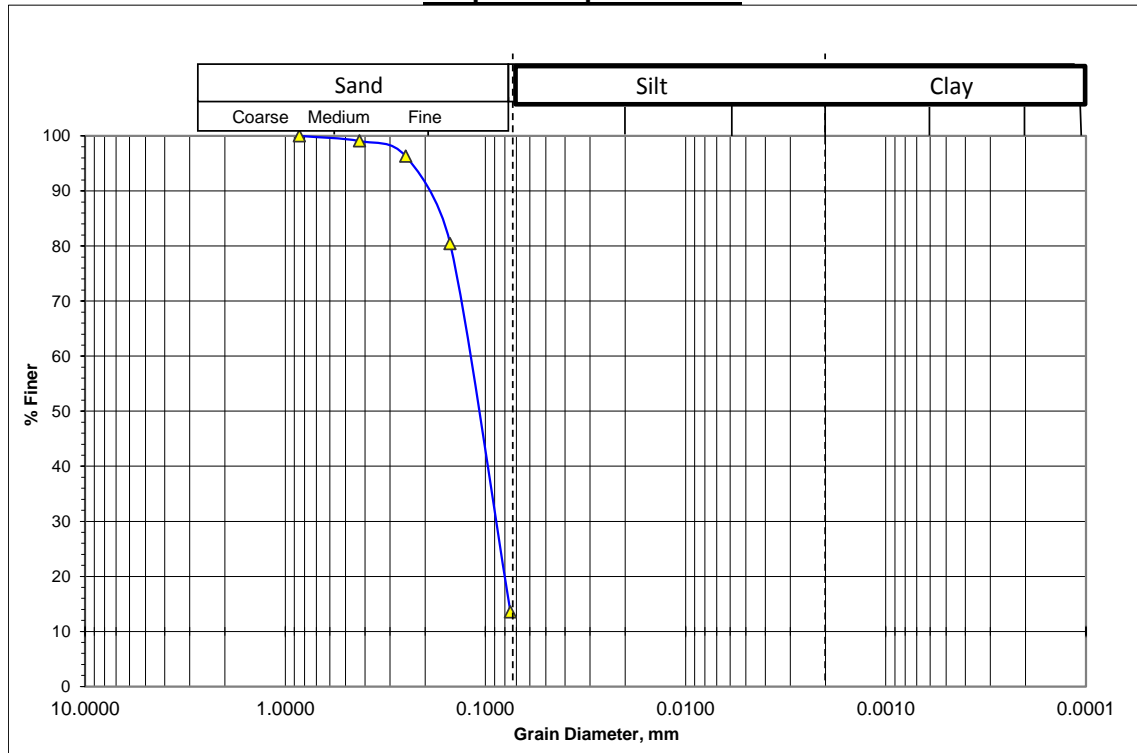
Sample Date: 30/12/2015

Sample No : D-15

Test Date : 07/02/2016

Depth (m) : 22.5

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Raghu Nandanpur Madrasha, Ambikapur

Bore Hole No: BH-F18

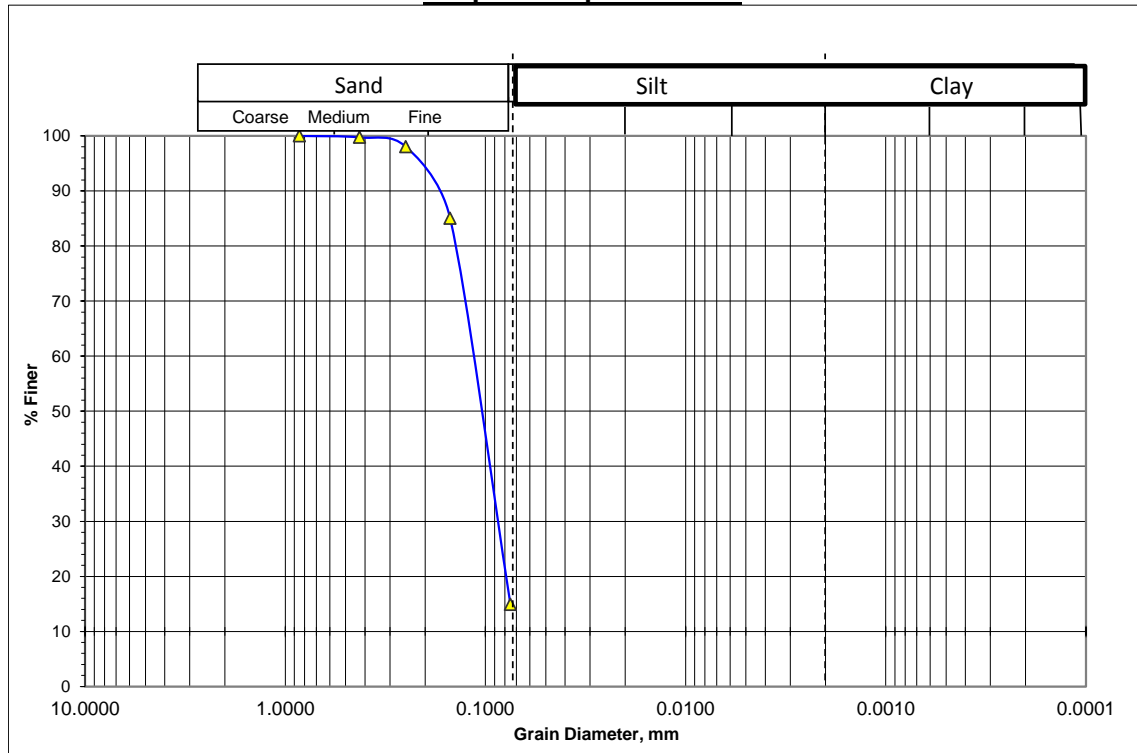
Sampled Date: 28/12/2015

Sample No : D-04

Test Date : 07/02/2016

Depth (m) : 6.0

#### Graphical Representation:



Fines or % of silt and clay = 14

Mean Diameter,  $D_{50} = 0.105$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.57$

% Particles (from the grain -size analysis graph

(0.075mm size) = 86

(0.005mm size) & (0.001mm size) = 14

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Raghu Nandanpur Madrasha, Ambikapur

Bore Hole No: BH-F18

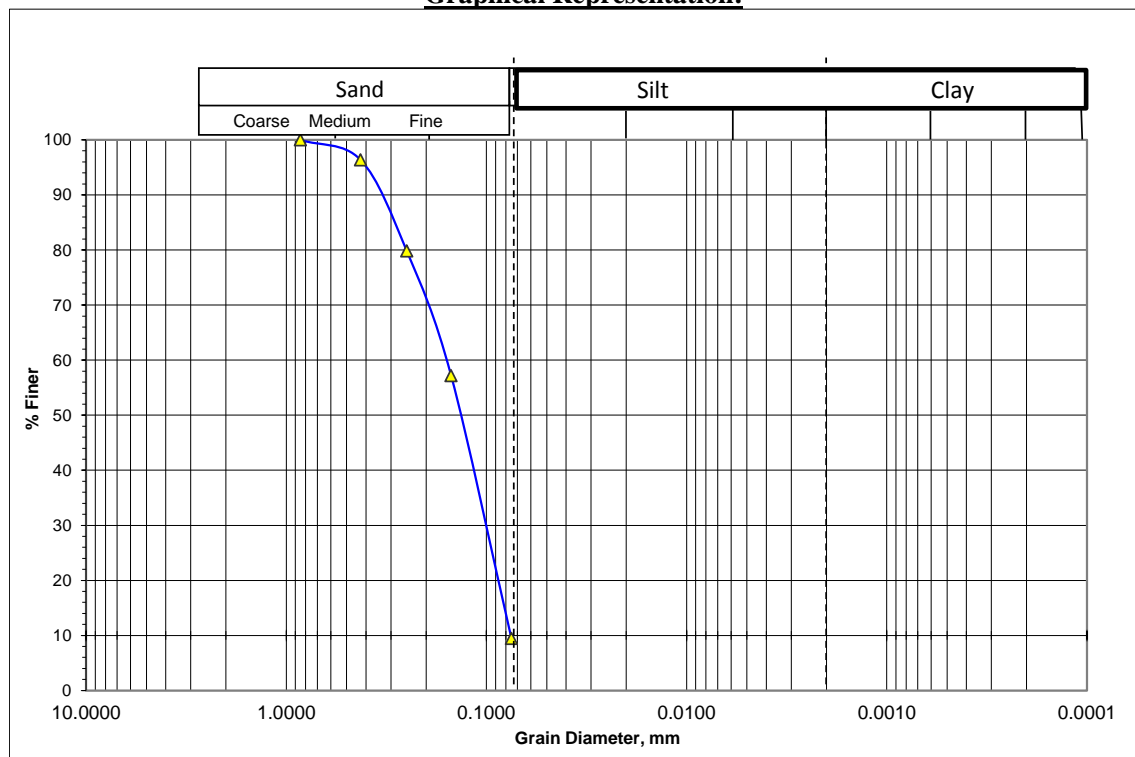
Sampled Date: 28/12/2015

Sample No : D-13

Test Date : 07/02/2016

Depth (m) : 19.5

#### Graphical Representation:



Fines or % of silt and clay = 9

Mean Diameter,  $D_{50} = 0.145$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.67$

% Particles (from the grain -size analysis graph

(0.075mm size) = 91

(0.005mm size) & (0.001mm size) = 9



### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Porunpur Govt. Primary School, Porunpur Bazar, Majchar

Bore Hole No: BH-F19

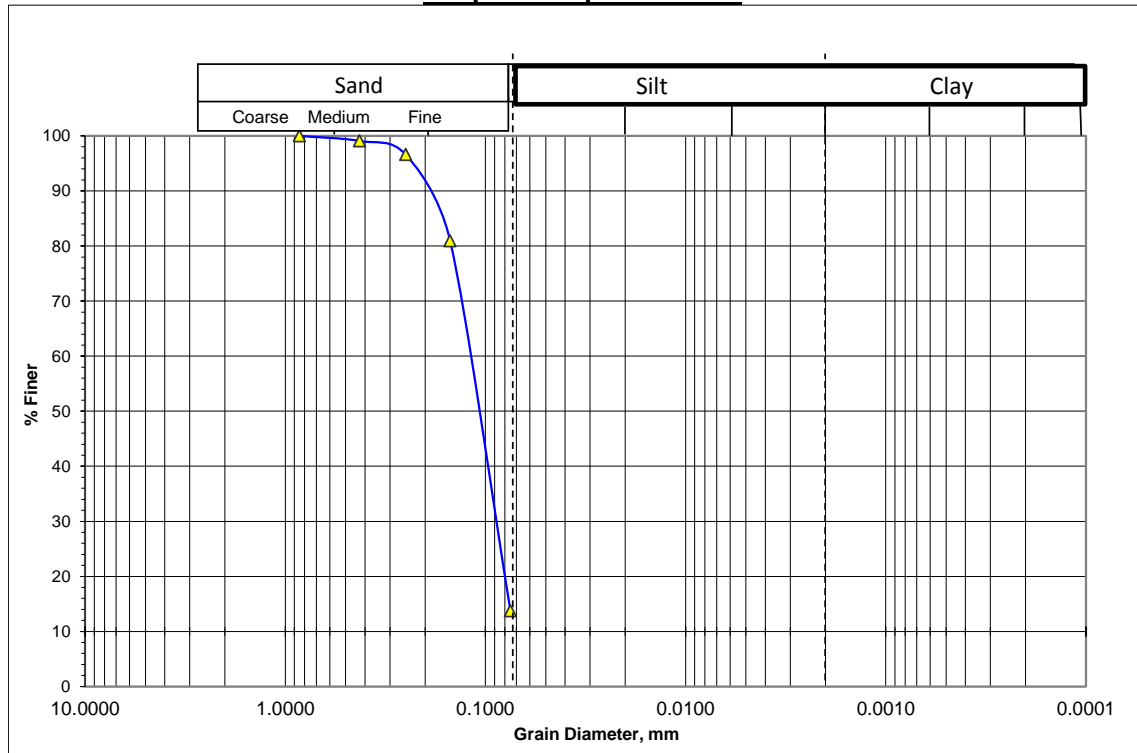
Sampled Date: 06/01/2016

Sample No : D-07

Test Date : 07/02/2016

Depth (m) : 10.5

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Porunpur Govt. Primary School, Porunpur Bazar, Majchar

Bore Hole No: BH-F19

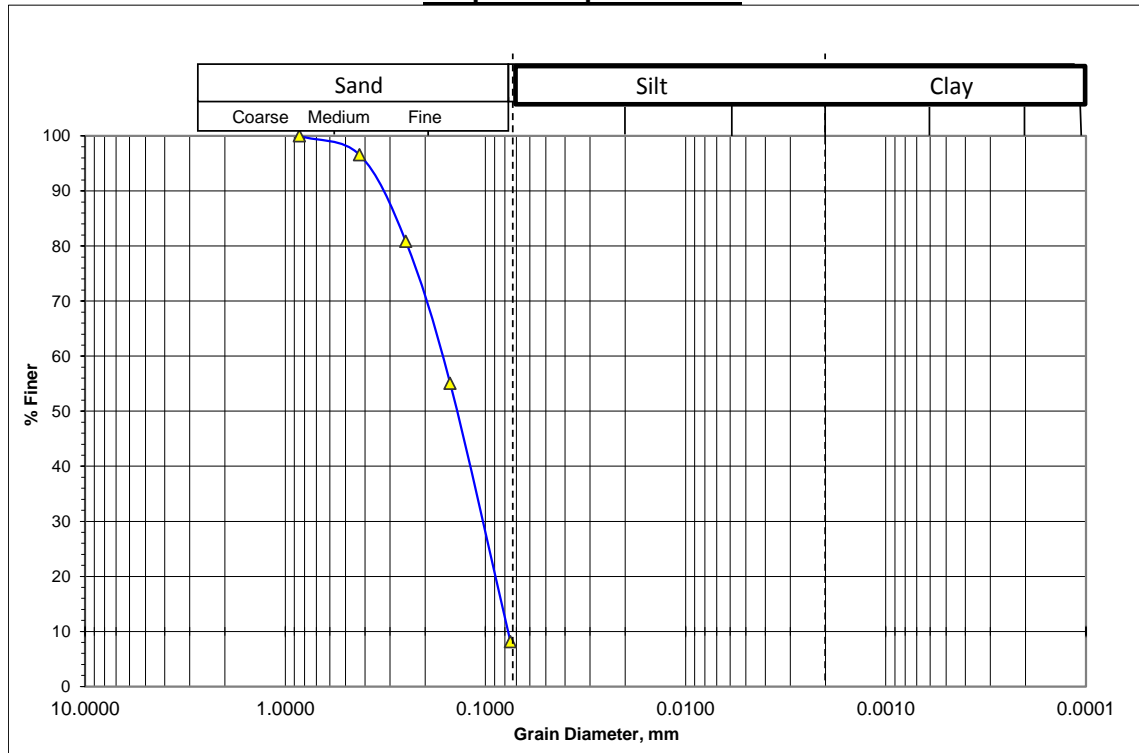
Sampled Date: 06/01/2016

Sample No : D-14

Test Date : 07/02/2016

Depth (m) : 21.0

#### Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter,  $D_{50}$  = 0.15 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.68

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Hadhokandi Govt. Primary School, River Research Institute, Kaijuri

Bore Hole No: BH-F20

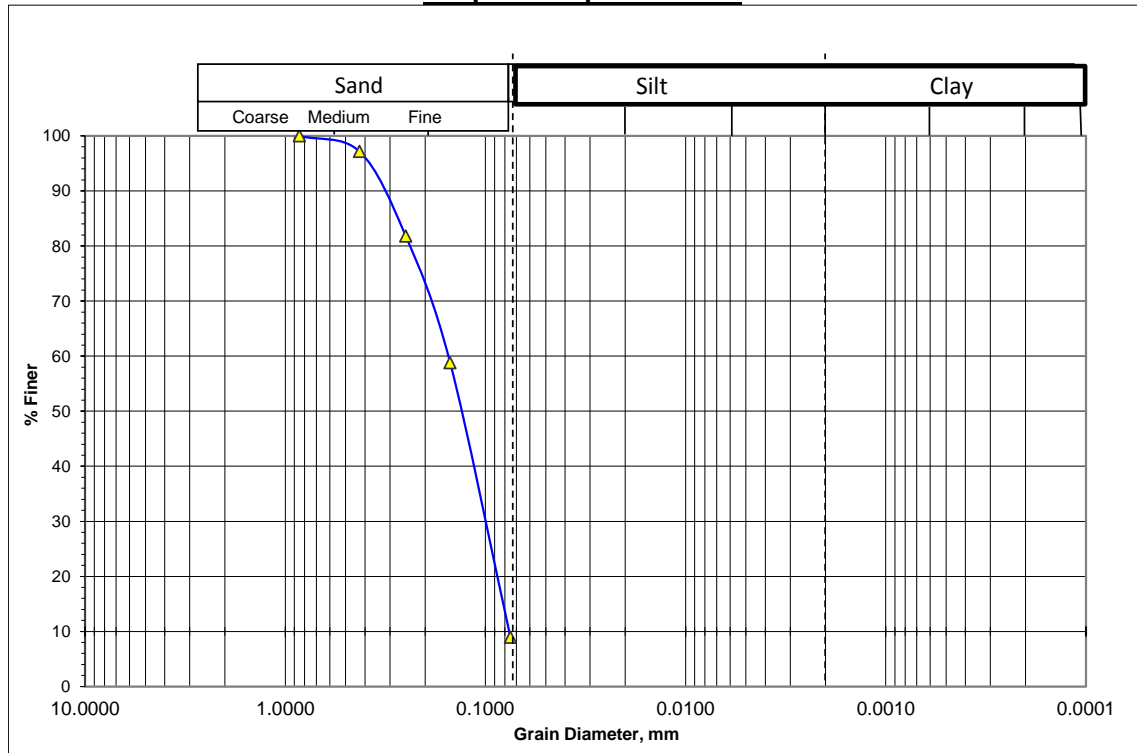
Sampled Date: 01/01/2016

Sample No : D-11

Test Date : 07/02/2016

Depth (m) : 16.5

#### Graphical Representation:



Fines or % of silt and clay = 8

Mean Diameter,  $D_{50} = 0.135$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.65$

% Particles (from the grain -size analysis graph

(0.075mm size) = 92

(0.005mm size) & (0.001mm size) = 8

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Johora Begum High School Field, Parchim Khabashpur, Faridpur Sadar

Bore Hole No: BH-F21

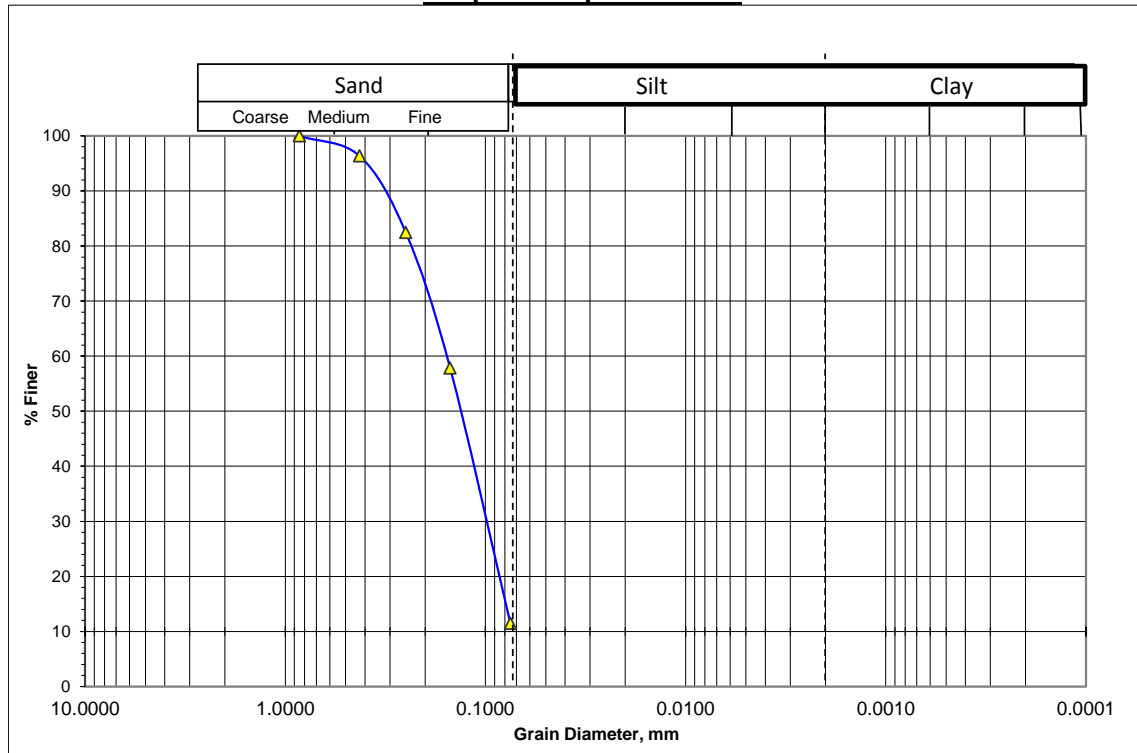
Sampled Date: 27/12/2015

Sample No : D-13

Test Date : 07/02/2016

Depth (m) : 19.5

#### Graphical Representation:



Fines or % of silt and clay = 11

Mean Diameter,  $D_{50} = 0.13$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 89

(0.005mm size) & (0.001mm size) = 11

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Technical Training Centre, Brahmonkanda, Sreeaungon, Faridpur Sadar

Bore Hole No: BH-F22

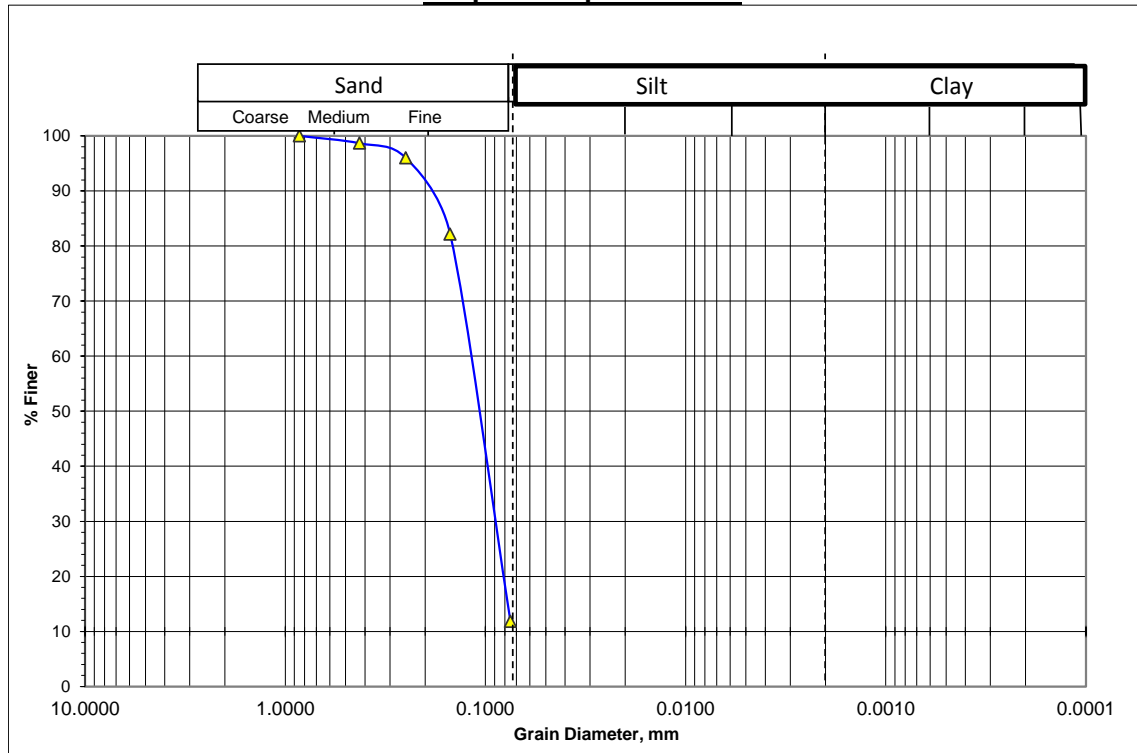
Sampled Date: 29/12/2015

Sample No : D-08

Test Date : 07/02/2016

Depth (m) : 12.0

#### Graphical Representation:



Fines or % of silt and clay = 12

Mean Diameter,  $D_{50} = 0.105$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.57$

% Particles (from the grain -size analysis graph

(0.075mm size) = 88

(0.005mm size) & (0.001mm size) = 12

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Choyata, Aliabad

Bore Hole No: BH-F23

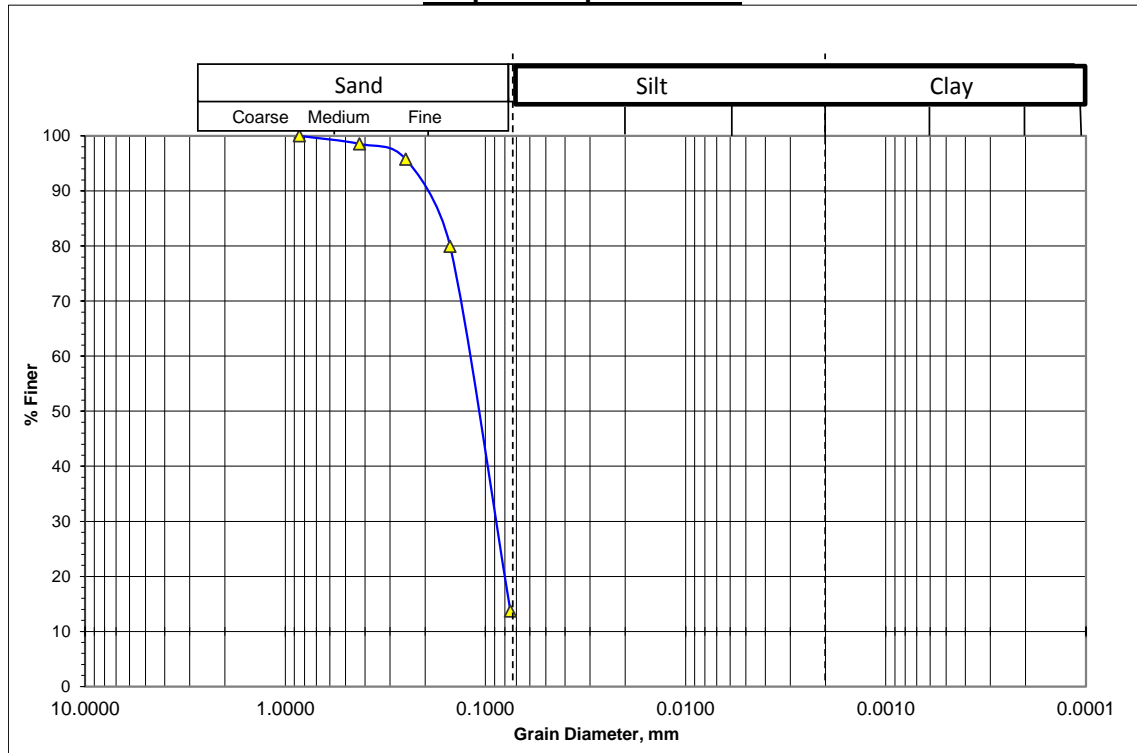
Sampled Date: 31/12/2015

Sample No : D-05

Test Date : 09/02/2016

Depth (m) : 7.5

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Choyata, Aliabad

Bore Hole No: BH-F23

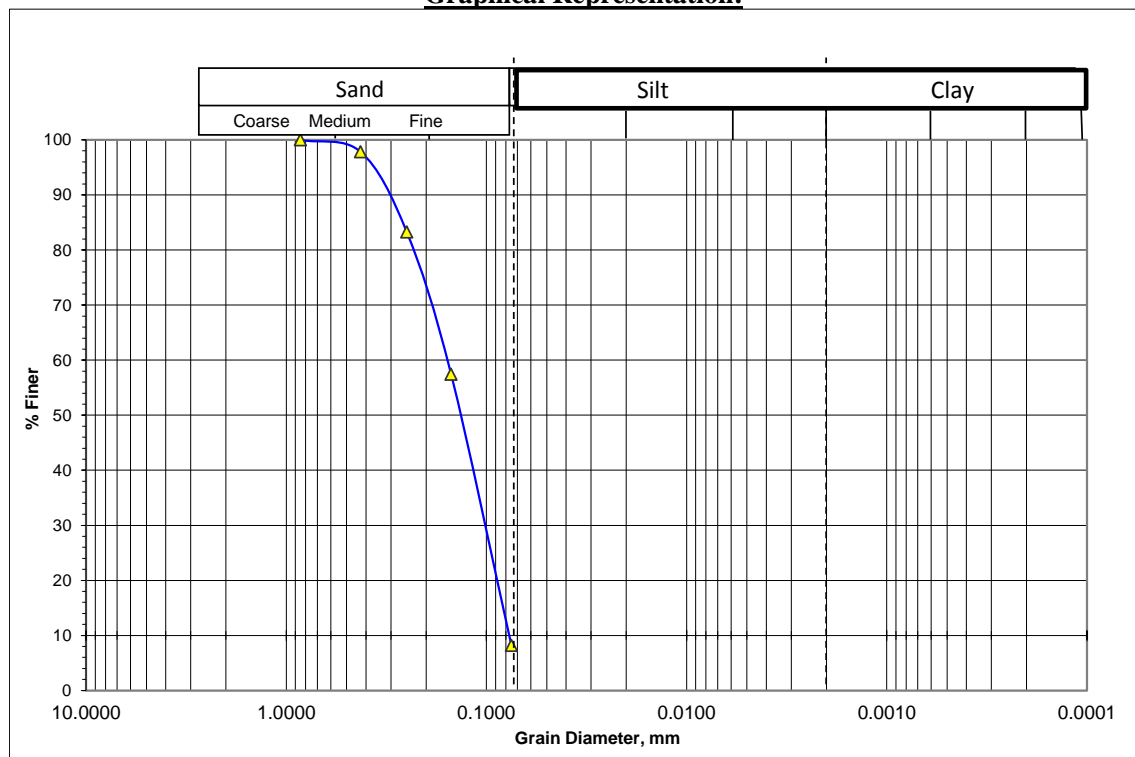
Sampled Date: 31/12/2015

Sample No : D-13

Test Date : 09/02/2016

Depth (m) : 19.5

#### Graphical Representation:



Fines or % of silt and clay = 8

Mean Diameter,  $D_{50}$  = 0.14 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.66

% Particles (from the grain -size analysis graph

(0.075mm size) = 92

(0.005mm size) & (0.001mm size) = 8





### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Payarpur Godaoun, Kaijuri

Bore Hole No: BH-F24

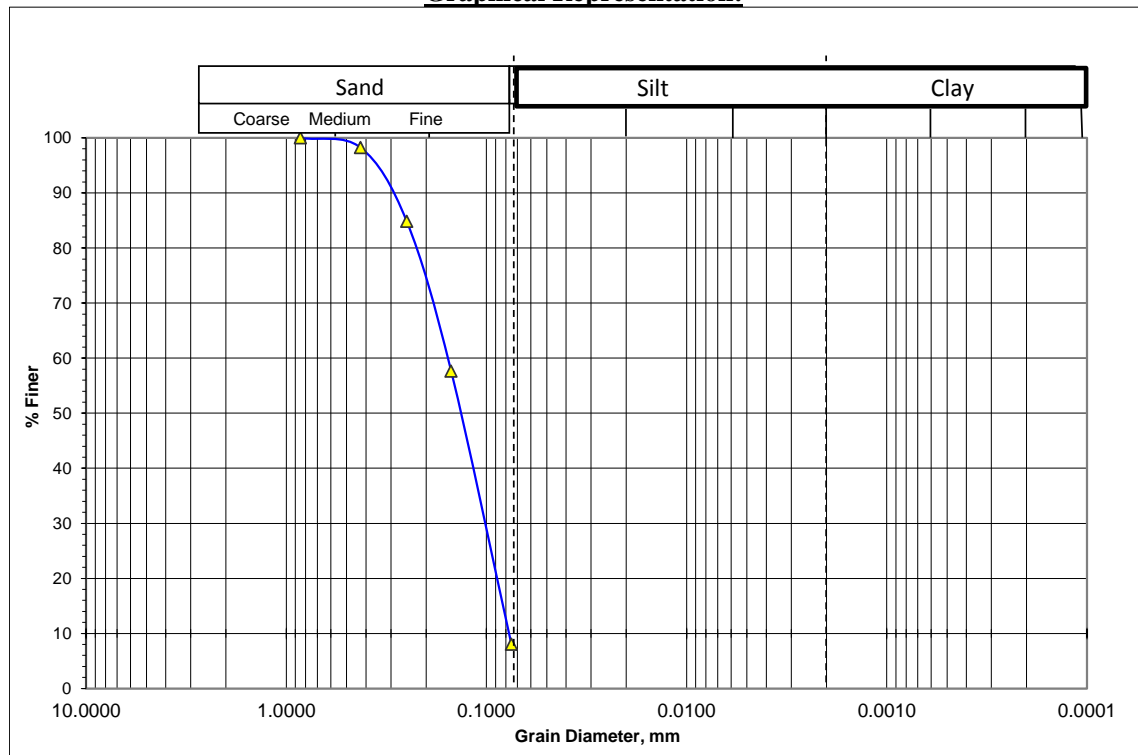
Sampled Date: 02/01/2016

Sample No : D-15

Test Date : 08/02/2016

Depth (m) : 22.5

#### Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter,  $D_{50} = 0.135$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.65$

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Krish poshikhan Institute gate, Gunggabodi, Krishnanagar

Bore Hole No: BH-F25

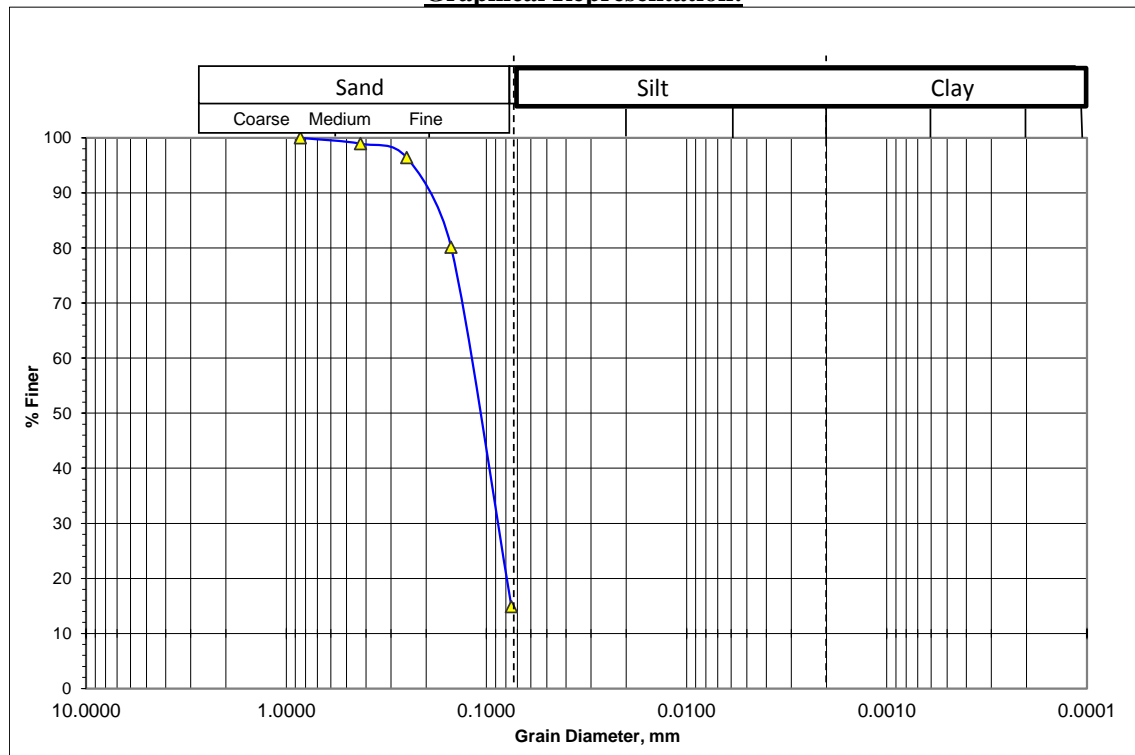
Sampled Date: 04/01/2016

Sample No : D-16

Test Date : 08/02/2016

Depth (m) : 24.0

#### Graphical Representation:



Fines or % of silt and clay = 14

Mean Diameter,  $D_{50} = 0.115$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.60$

% Particles (from the grain -size analysis graph

(0.075mm size) = 86

(0.005mm size) & (0.001mm size) = 14

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Gobinddapur Hat, Krishnanagar

Bore Hole No: BH-F26

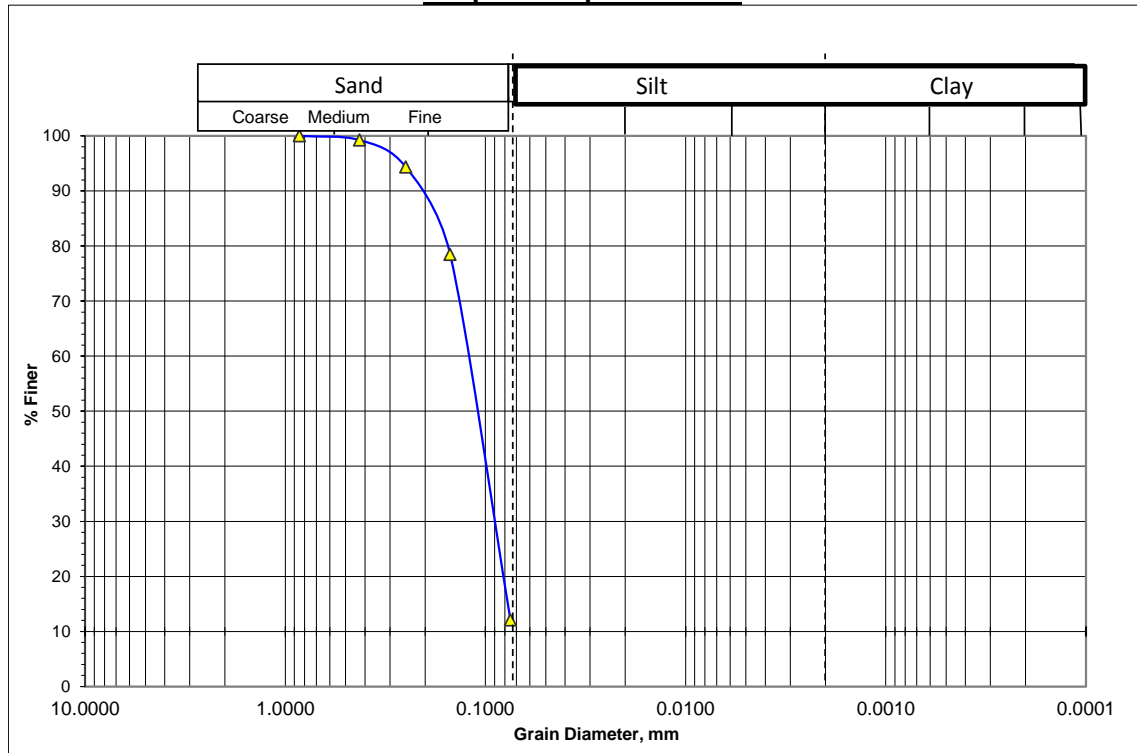
Sampled Date: 04/01/2016

Sample No : D-06

Test Date : 09/02/2016

Depth (m) : 9.0

#### Graphical Representation:



Fines or % of silt and clay = 12

Mean Diameter,  $D_{50} = 0.115$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.60$

% Particles (from the grain -size analysis graph

(0.075mm size) = 88

(0.005mm size) & (0.001mm size) = 12

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Gobinddapur Hat, Krishnanagar

Bore Hole No: BH-F26

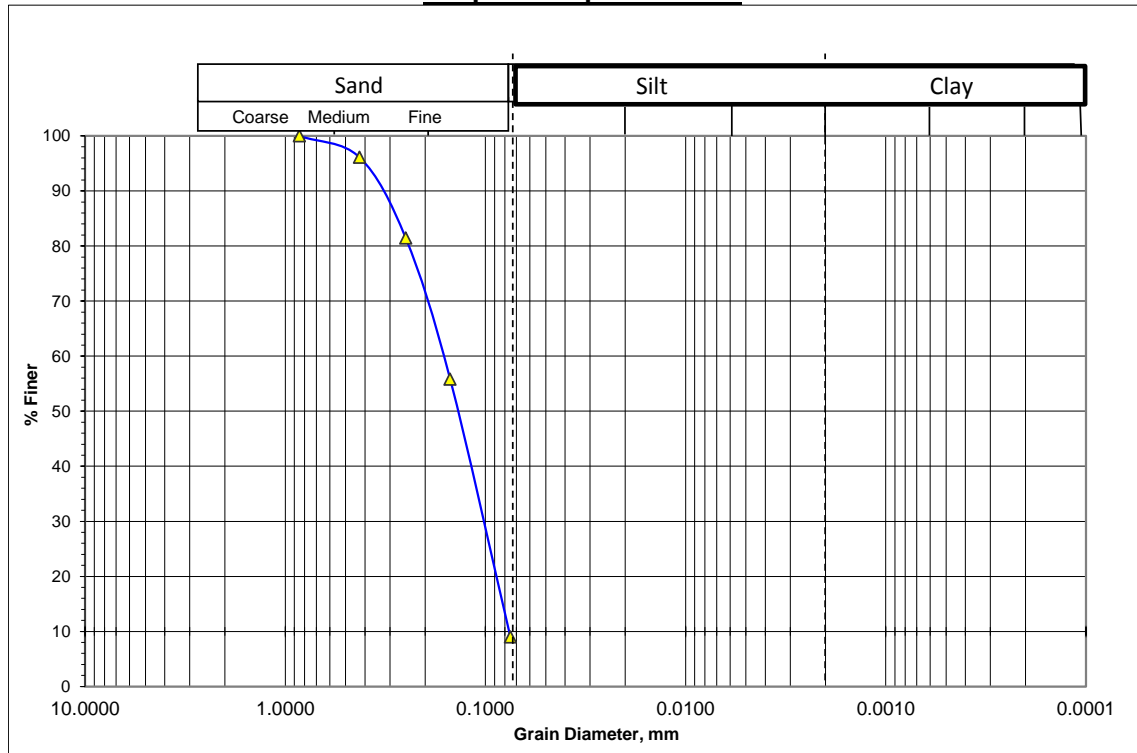
Sampled Date: 04/01/2016

Sample No : D-12

Test Date : 09/02/2016

Depth (m) : 18.0

#### Graphical Representation:



Fines or % of silt and clay = 9

Mean Diameter,  $D_{50} = 0.145$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.67$

% Particles (from the grain -size analysis graph

(0.075mm size) = 91

(0.005mm size) & (0.001mm size) = 9

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Bakhunda College Field, Bakhunda, Greda

Bore Hole No: BH-F27

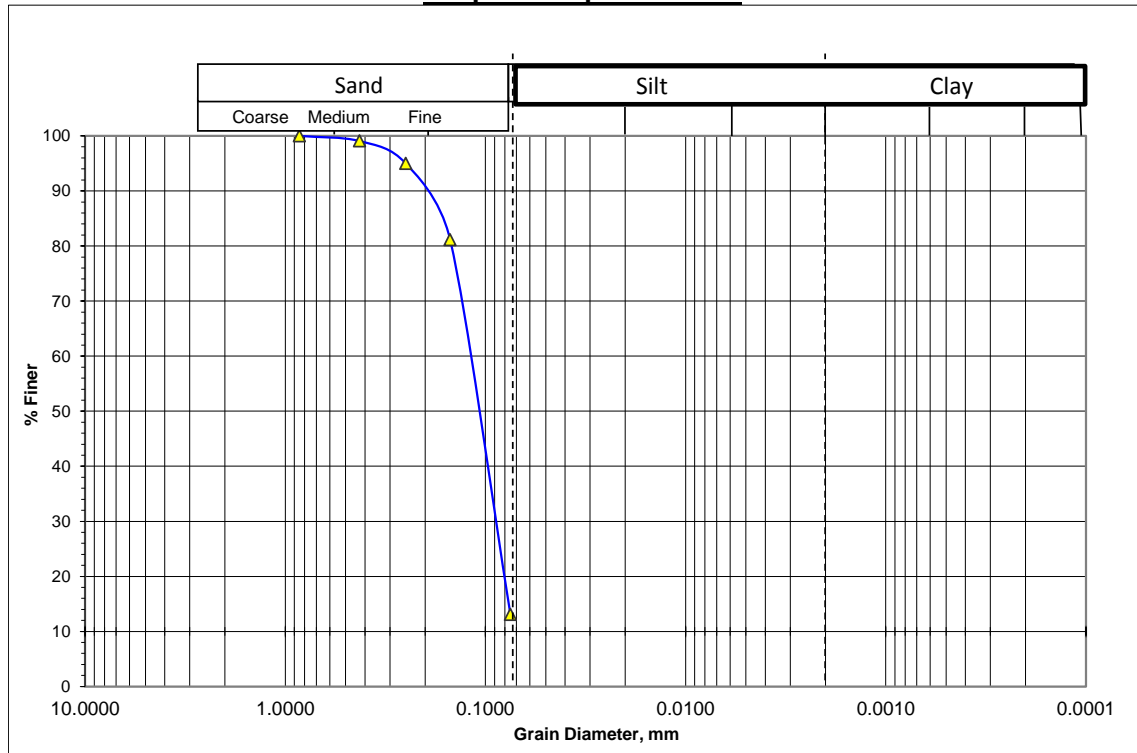
Sampled Date: 02/01/2016

Sample No : D-12

Test Date : 08/02/2016

Depth (m) : 18.0

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Bakhunda College Field, Bakhunda, Greda

Bore Hole No: BH-F27

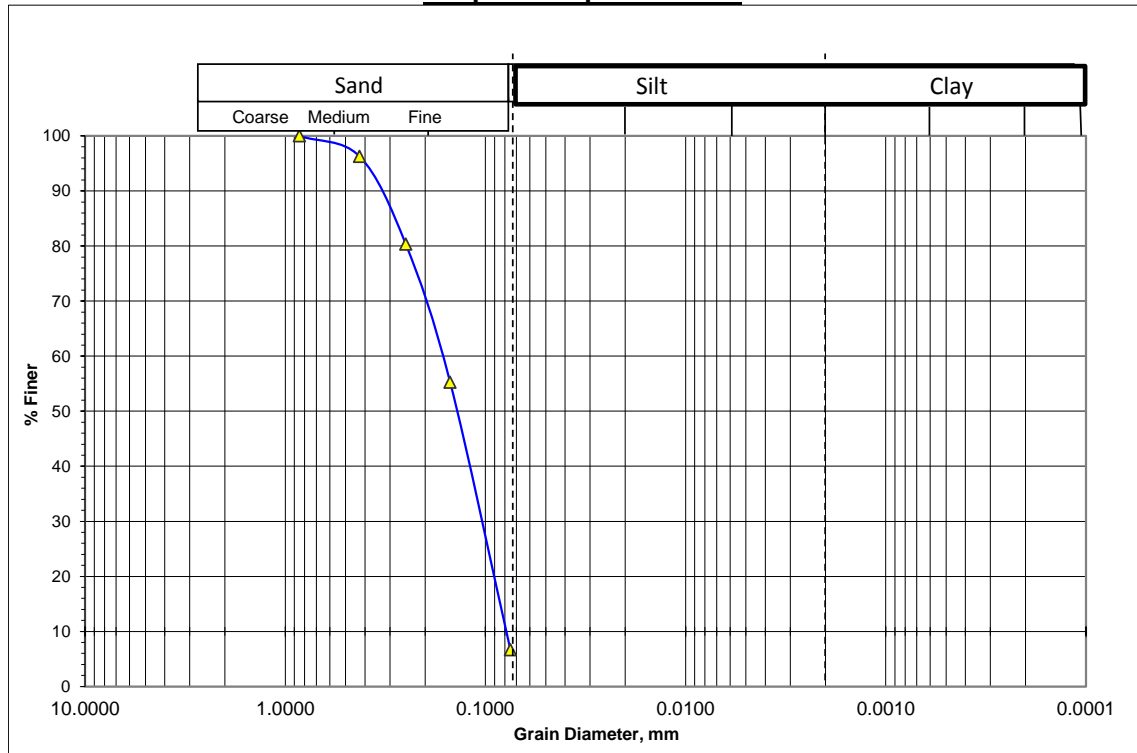
Sampled Date: 02/01/2016

Sample No : D-19

Test Date : 08/02/2016

Depth (m) : 28.5

#### Graphical Representation:



Fines or % of silt and clay = 6

Mean Diameter,  $D_{50}$  = 0.15 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.68

% Particles (from the grain -size analysis graph

(0.075mm size) = 94

(0.005mm size) & (0.001mm size) = 6

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chacia fokirbari Road, Kaijuri

Bore Hole No: BH-F28

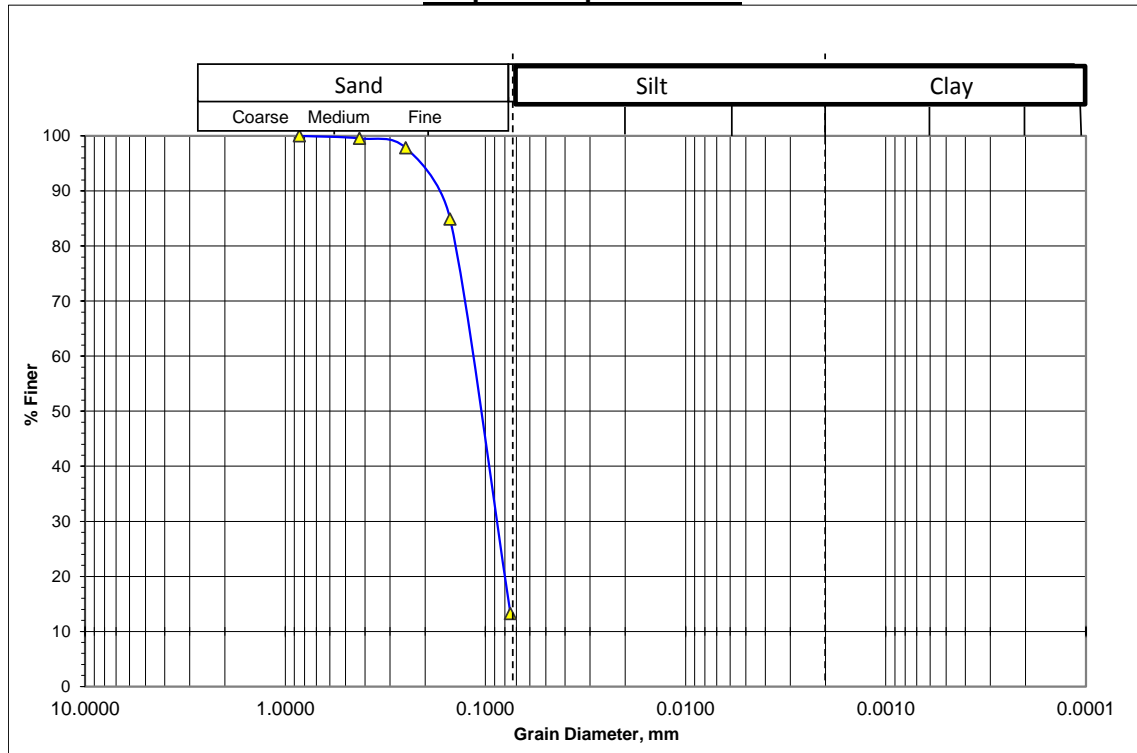
Sampled Date: 02/01/2016

Sample No : D-03

Test Date : 09/02/2016

Depth (m) : 4.5

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.105$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.57$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chacia fokirbari Road, Kaijuri

Bore Hole No: BH-F28

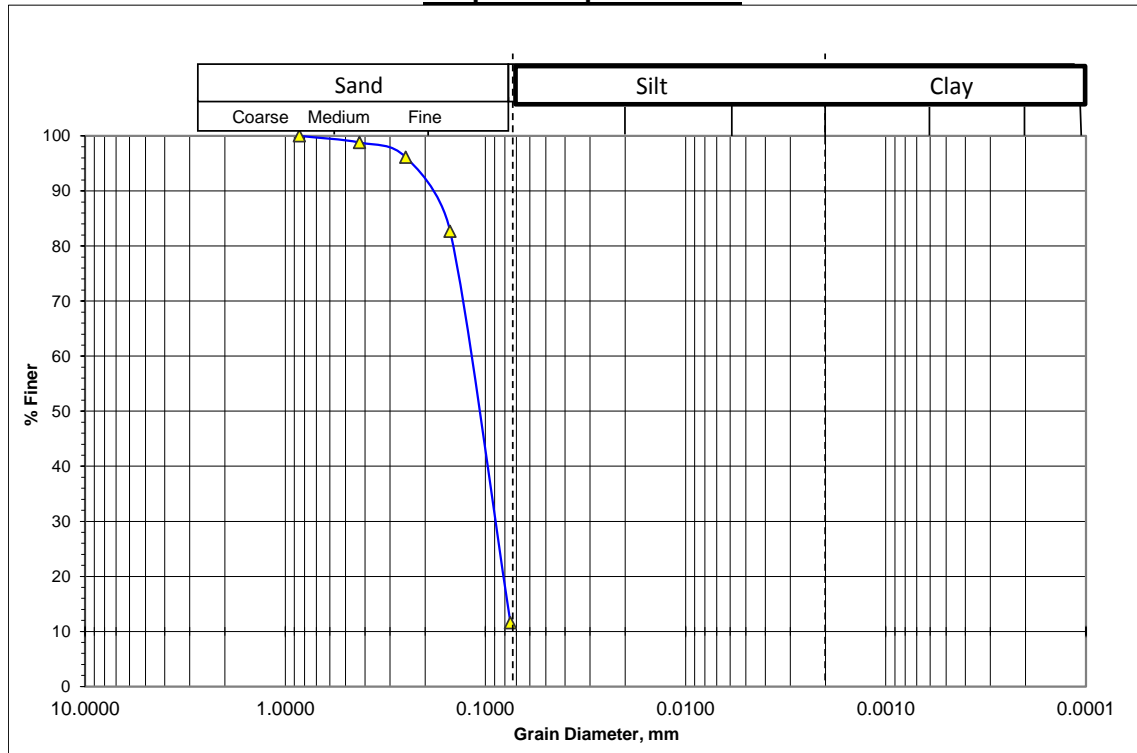
Sampled Date: 02/01/2016

Sample No : D-11

Test Date : 09/02/2016

Depth (m) : 16.5

#### Graphical Representation:



Fines or % of silt and clay = 11

Mean Diameter,  $D_{50} = 0.11$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 89

(0.005mm size) & (0.001mm size) = 11



### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chacia fokirbari Road, Kaijuri

Bore Hole No: BH-F28

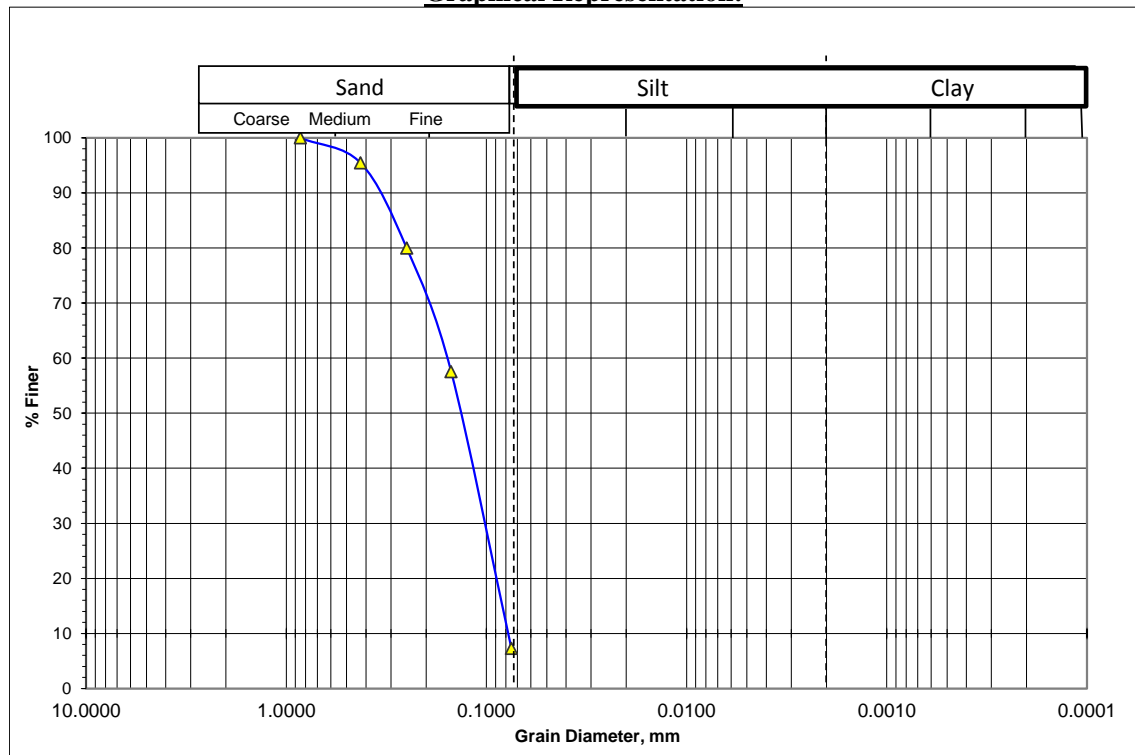
Sampled Date: 02/01/2016

Sample No : D-16

Test Date : 09/02/2016

Depth (m) : 24.0

#### Graphical Representation:



Fines or % of silt and clay = 7

Mean Diameter,  $D_{50} = 0.145$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.67$

% Particles (from the grain -size analysis graph

(0.075mm size) = 93

(0.005mm size) & (0.001mm size) = 7

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Kanaipur Akhak Centre, Kanaipur

Bore Hole No: BH-F29

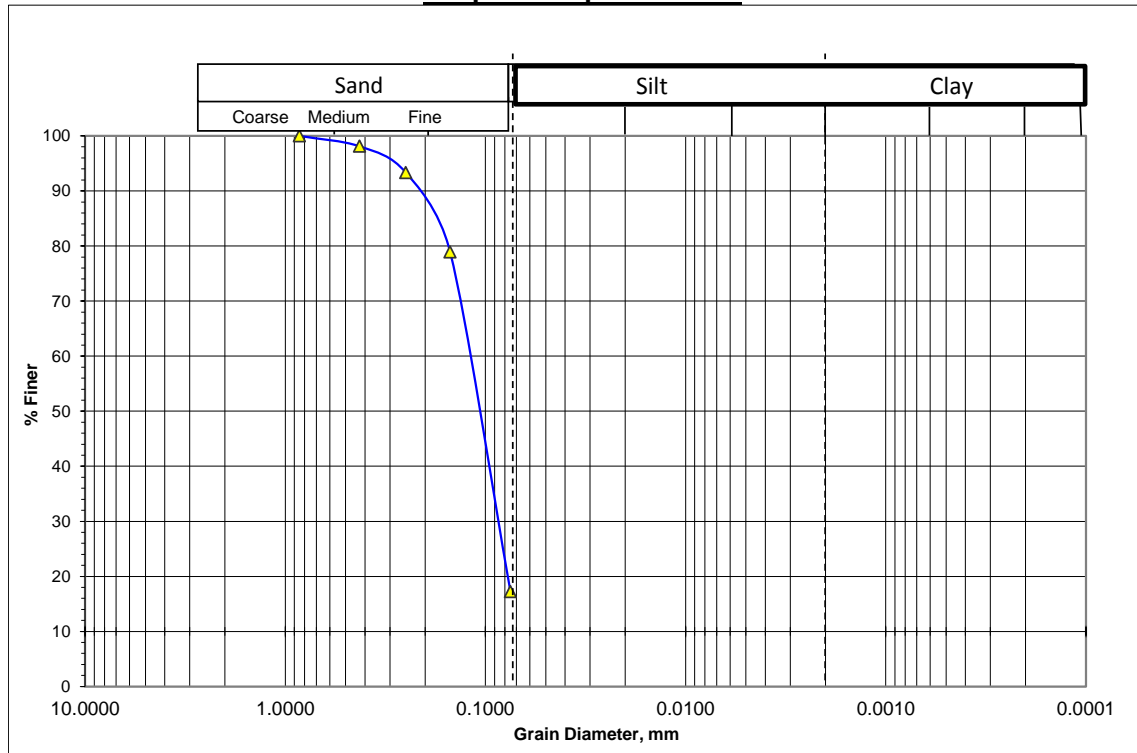
Sampled Date: 04/01/2016

Sample No : D-07

Test Date : 09/02/2016

Depth (m) : 10.5

#### Graphical Representation:



Fines or % of silt and clay = 17

Mean Diameter,  $D_{50} = 0.105$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.57$

% Particles (from the grain -size analysis graph

(0.075mm size) = 83

(0.005mm size) & (0.001mm size) = 17

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Kanaipur Akhak Centre, Kanaipur

Bore Hole No: BH-F29

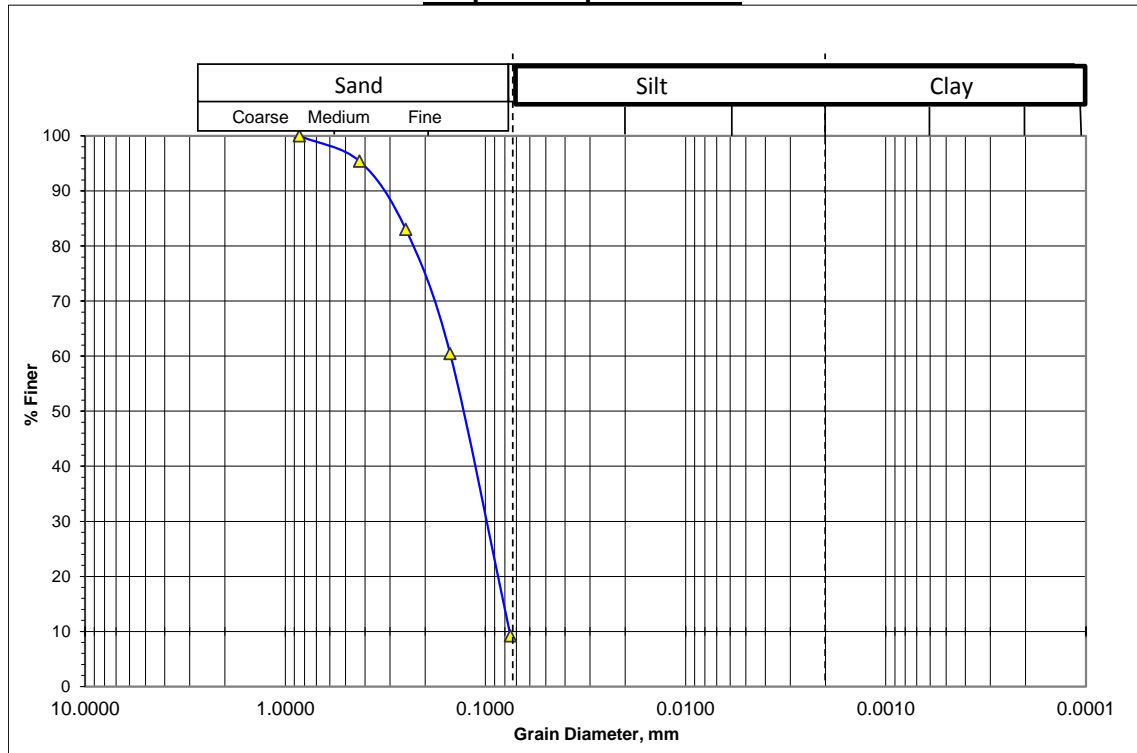
Sampled Date: 04/01/2016

Sample No : D-15

Test Date : 09/02/2016

Depth (m) : 22.5

#### Graphical Representation:



### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Madhobpur Govt. Primary School, Mallikpur Bazar, Krishnanagar

Bore Hole No: BH-F30

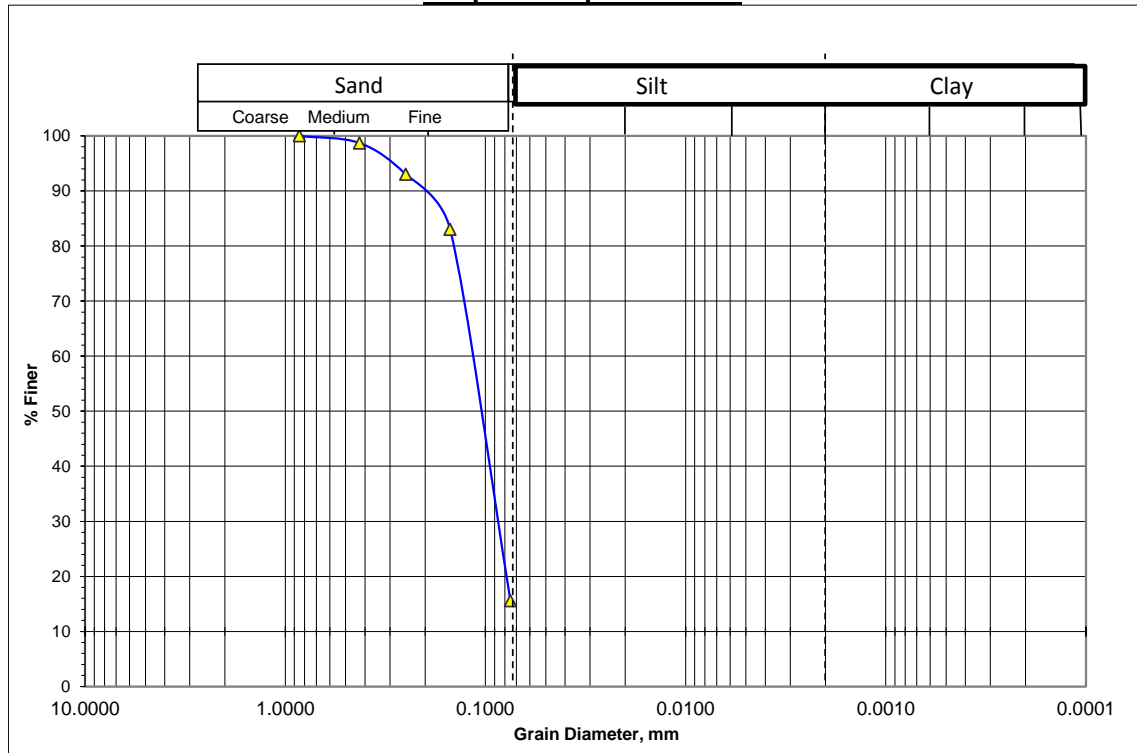
Sampled Date: 05/01/2016

Sample No : D-08

Test Date : 09/01/2016

Depth (m) : 12.0

#### Graphical Representation:



Fines or % of silt and clay = 15

Mean Diameter,  $D_{50}$  = 0.1 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.56$

% Particles (from the grain -size analysis graph

(0.075mm size) = 85

(0.005mm size) & (0.001mm size) = 15

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Madhobpur Govt. Primary School, Mallikpur Bazar, Krishnanagar

Bore Hole No: BH-F30

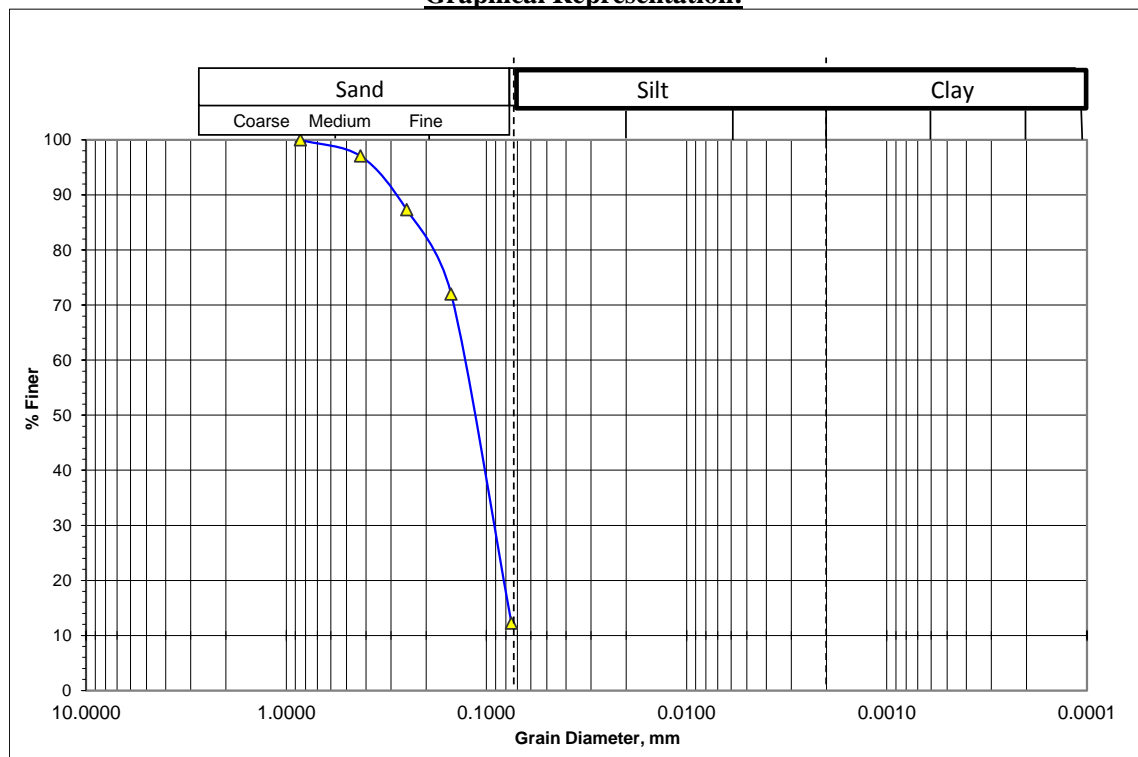
Sampled Date: 05/01/2016

Sample No : D-14

Test Date : 09/01/2016

Depth (m) : 21.0

#### Graphical Representation:



Fines or % of silt and clay = 12

Mean Diameter,  $D_{50}$  = 0.12 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.61

% Particles (from the grain -size analysis graph

(0.075mm size) = 88

(0.005mm size) & (0.001mm size) = 12

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Vhatpara Govt. Primary School, Kaijuri

Bore Hole No: BH-F31

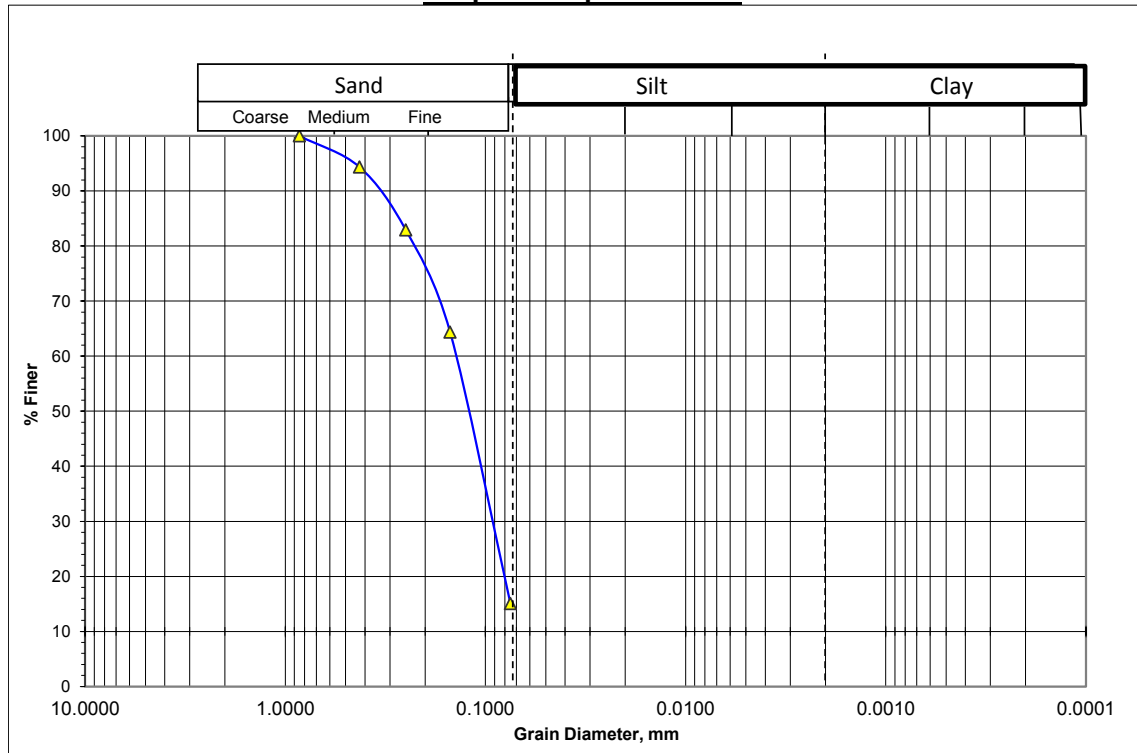
Sampled Date: 03/01/2016

Sample No : D-12

Test Date : 09/02/2016

Depth (m) : 18.0

#### Graphical Representation:



Fines or % of silt and clay = 15

Mean Diameter,  $D_{50} = 0.125$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.62$

% Particles (from the grain -size analysis graph

(0.075mm size) = 85

(0.005mm size) & (0.001mm size) = 15

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Vhatpara Govt. Primary School, Kaijuri

Bore Hole No: BH-F31

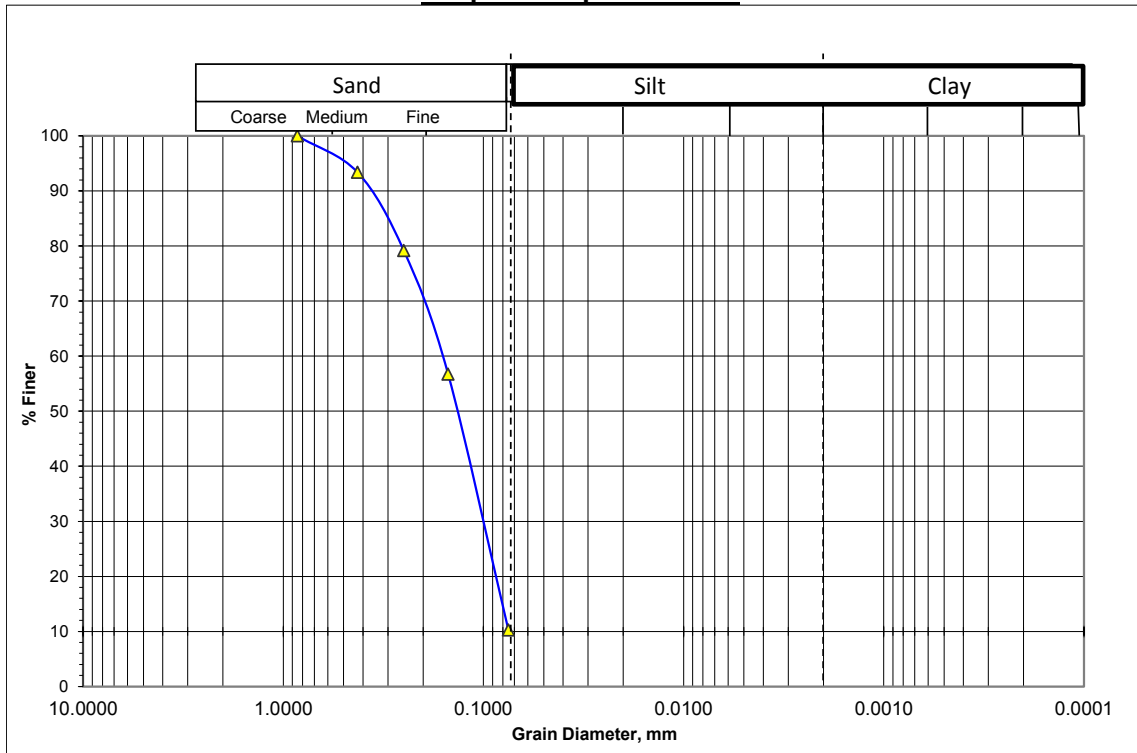
Sampled Date: 03/01/2016

Sample No : D-17

Test Date : 09/02/2016

Depth (m) : 25.5

#### Graphical Representation:



Fines or % of silt and clay = 10

Mean Diameter,  $D_{50} = 0.145$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.67$

% Particles (from the grain -size analysis graph

(0.075mm size) = 90

(0.005mm size) & (0.001mm size) = 10

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Fursha Govt. Primary School, Kanaipur

Bore Hole No: BH-F32

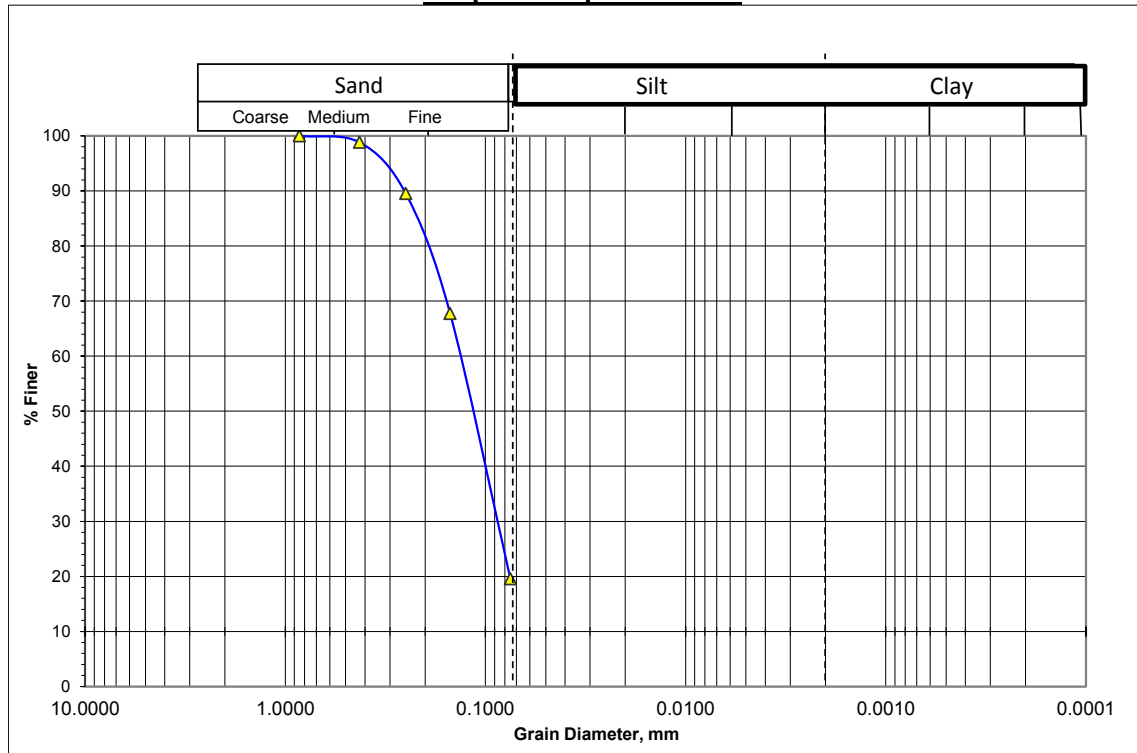
Sampled Date: 05/01/2016

Sample No : D-09

Test Date : 08/02/2016

Depth (m) : 13.5

#### Graphical Representation:



Fines or % of silt and clay = 20

Mean Diameter,  $D_{50}$  = 0.12 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.61$

% Particles (from the grain -size analysis graph

(0.075mm size) = 80

(0.005mm size) & (0.001mm size) = 20



### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Fursha Govt. Primary School, Kanaipur

Bore Hole No: BH-F32

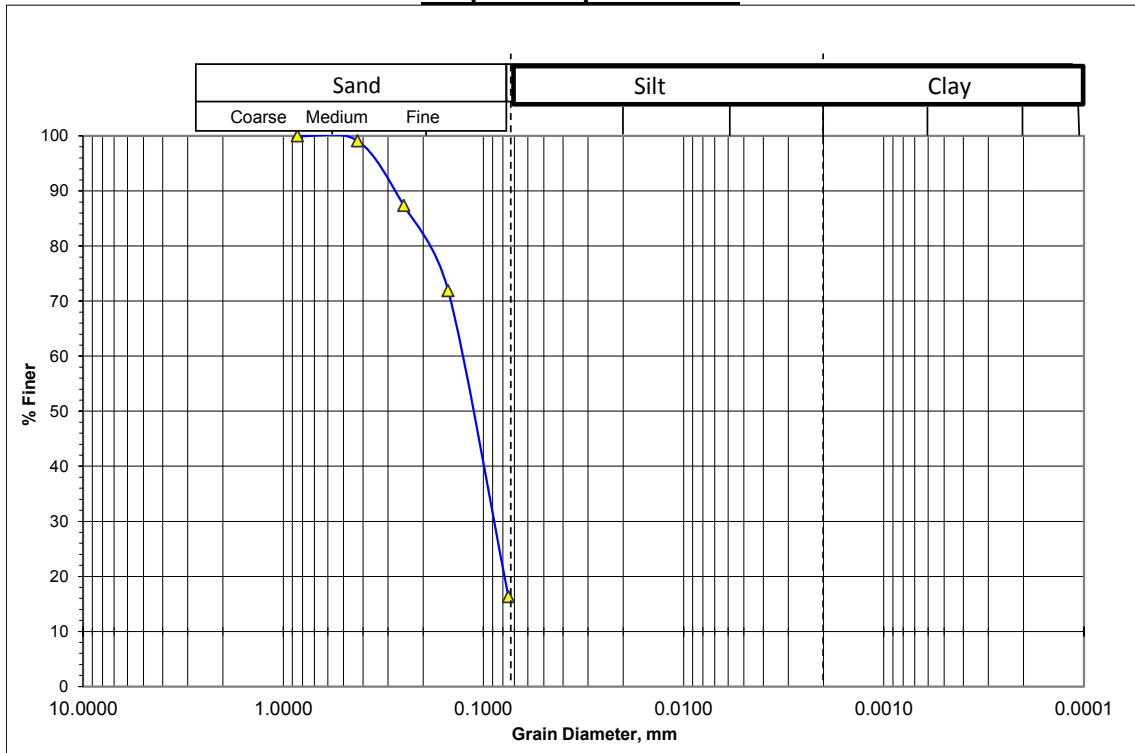
Sampled Date: 05/01/2016

Sample No : D-13

Test Date : 08/02/2016

Depth (m) : 19.5

#### Graphical Representation:



Fines or % of silt and clay = 15

Mean Diameter,  $D_{50} = 0.115$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.60$

% Particles (from the grain -size analysis graph

(0.075mm size) = 85

(0.005mm size) & (0.001mm size) = 15

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Dokin Char Kamolpur

Bore Hole No: BH-F33

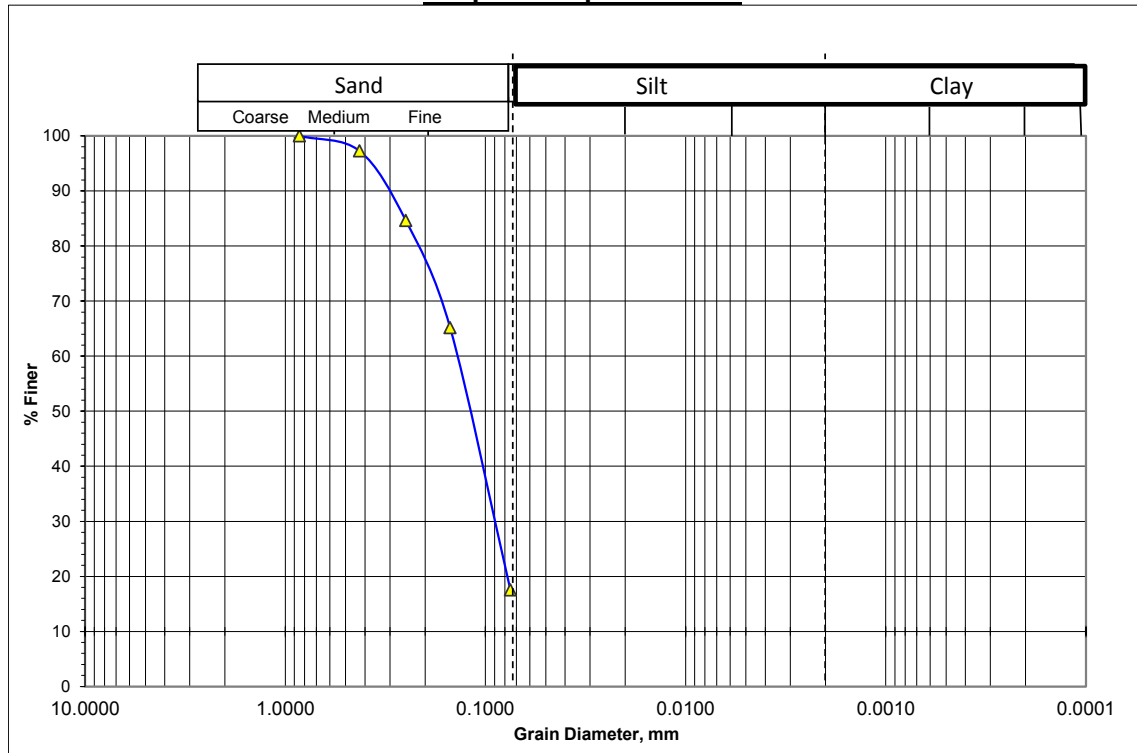
Sampled Date: 10/01/2016

Sample No : D-09

Test Date : 08/02/2016

Depth (m) : 13.5

#### Graphical Representation:



Fines or % of silt and clay = 17

Mean Diameter,  $D_{50} = 0.125$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.62$

% Particles (from the grain -size analysis graph

(0.075mm size) = 83

(0.005mm size) & (0.001mm size) = 17

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Dokin Char Kamolpur

Bore Hole No: BH-F33

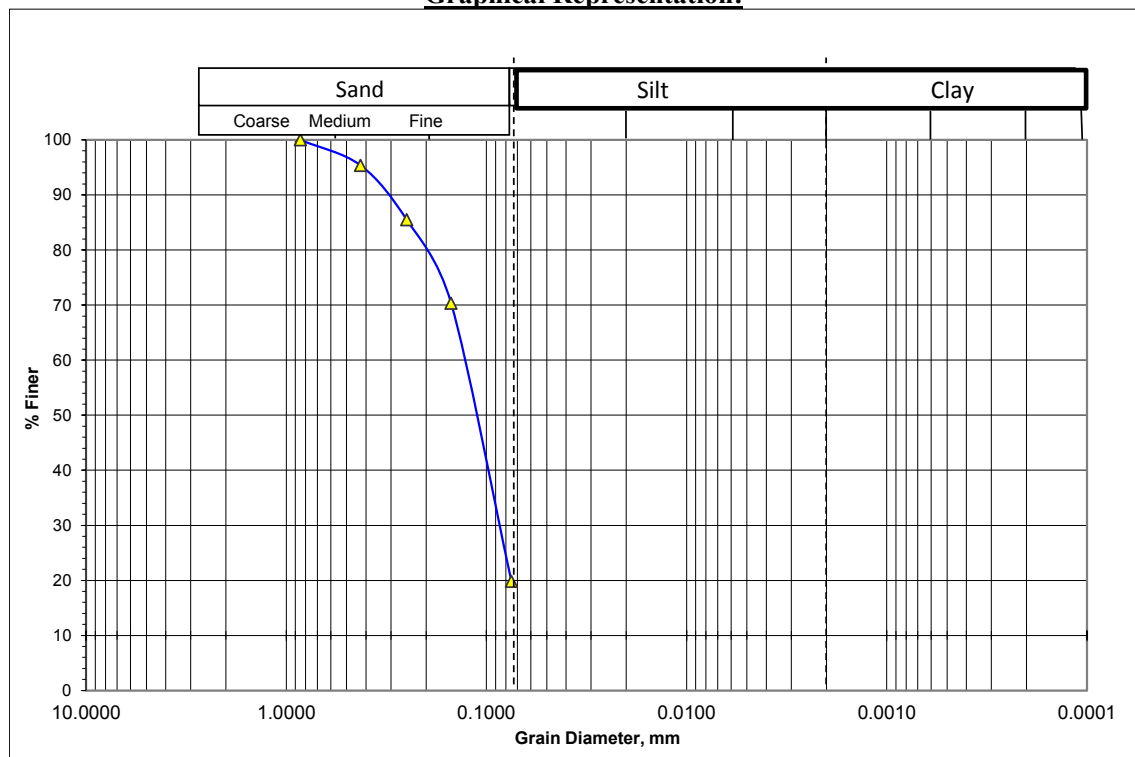
Sampled Date: 10/01/2016

Sample No : D-15

Test Date : 08/02/2016

Depth (m) : 22.5

#### Graphical Representation:



Fines or % of silt and clay = 20

Mean Diameter,  $D_{50} = 0.115$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.60$

% Particles (from the grain -size analysis graph

(0.075mm size) = 80

(0.005mm size) & (0.001mm size) = 20

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Tonthoniar Hat, End of Kanaipur Union

Bore Hole No: BH-F34

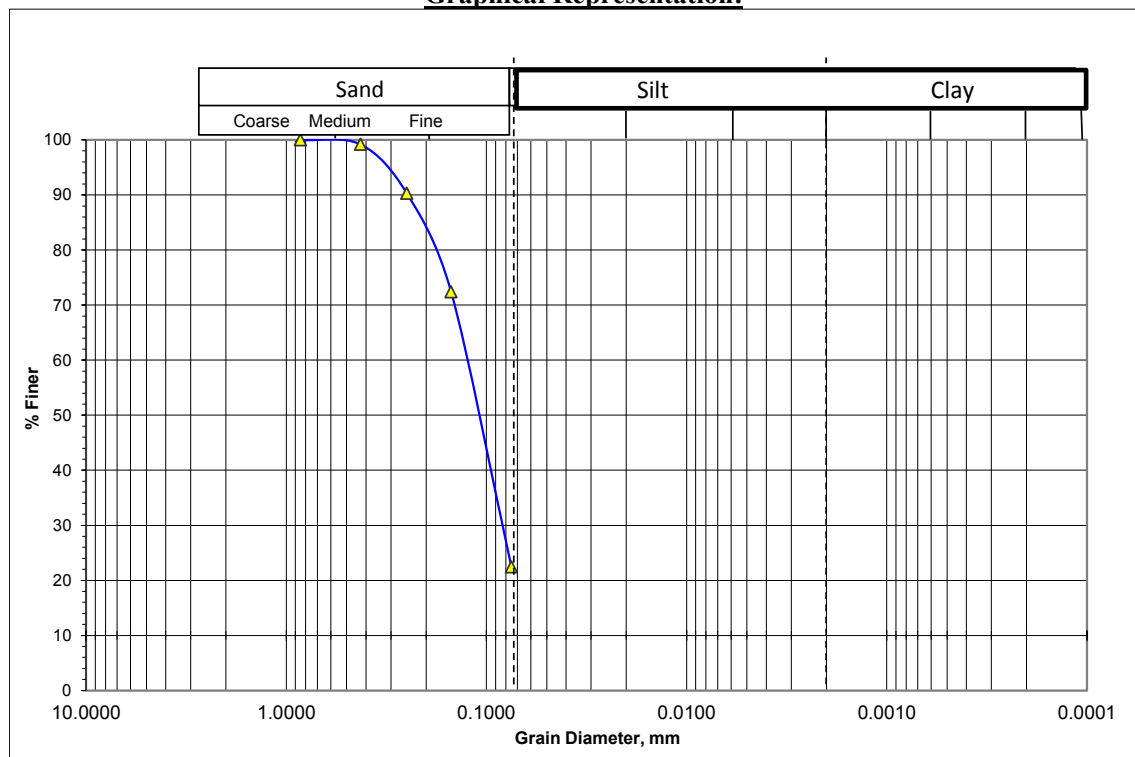
Sampled Date: 10/01/2016

Sample No : D-8

Test Date : 08/02/2016

Depth (m) : 12.0

#### Graphical Representation:



Fines or % of silt and clay = 22

Mean Diameter,  $D_{50}$  = 0.11 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.58$

% Particles (from the grain -size analysis graph

(0.075mm size) = 78

(0.005mm size) & (0.001mm size) = 22

Tested by : Md. Ashadullah

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Tonthoniar Hat, End of Kanaipur Union

Bore Hole No: BH-F34

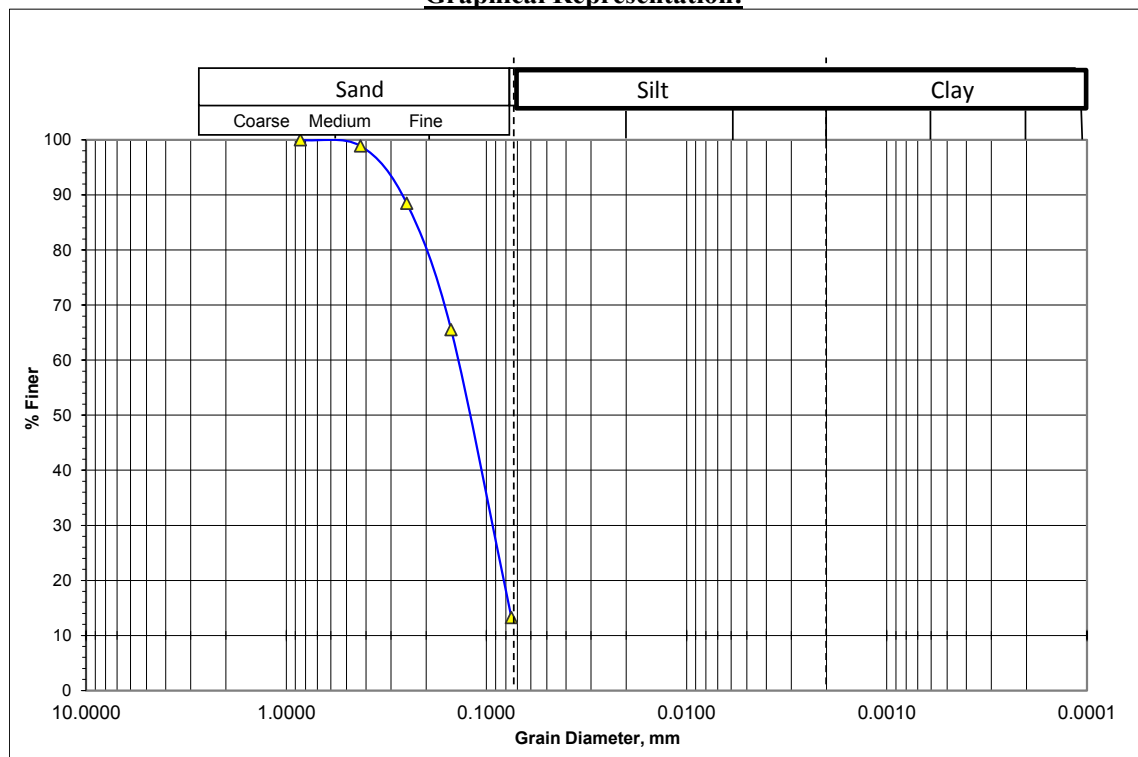
Sampled Date: 10/01/2016

Sample No : D-14

Test Date : 08/02/2016

Depth (m) : 21.0

#### Graphical Representation:



Fines or % of silt and clay = 13

Mean Diameter,  $D_{50} = 0.13$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.63$

% Particles (from the grain -size analysis graph

(0.075mm size) = 87

(0.005mm size) & (0.001mm size) = 13

## GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Nasirar Bazar, Dorghapur, Ishan Gopalpur

Bore Hole No: BH-F35

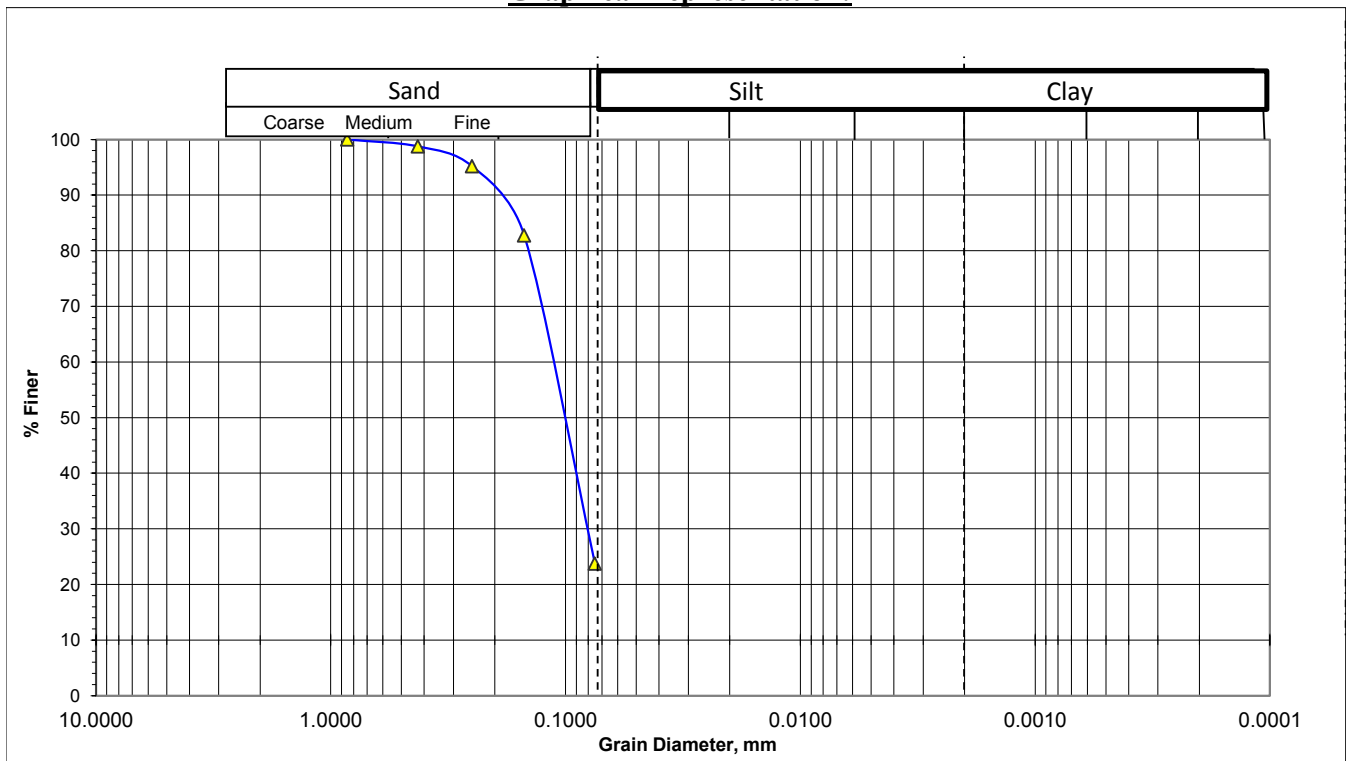
Sampled Date: 09/01/2016

Sample No : D-02

Test Date : 08/02/2016

Depth (m) : 3.0

### Graphical Representation:



Fines or % of silt and clay = 24

Mean Diameter,  $D_{50}$  = 0.1 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.56

% Particles (from the grain -size analysis graph).

(0.075mm size) = 76

(0.005mm size) & (0.001mm size) = 24

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Health Coplex, Ishan Gopalpur

Bore Hole No: BH-F36

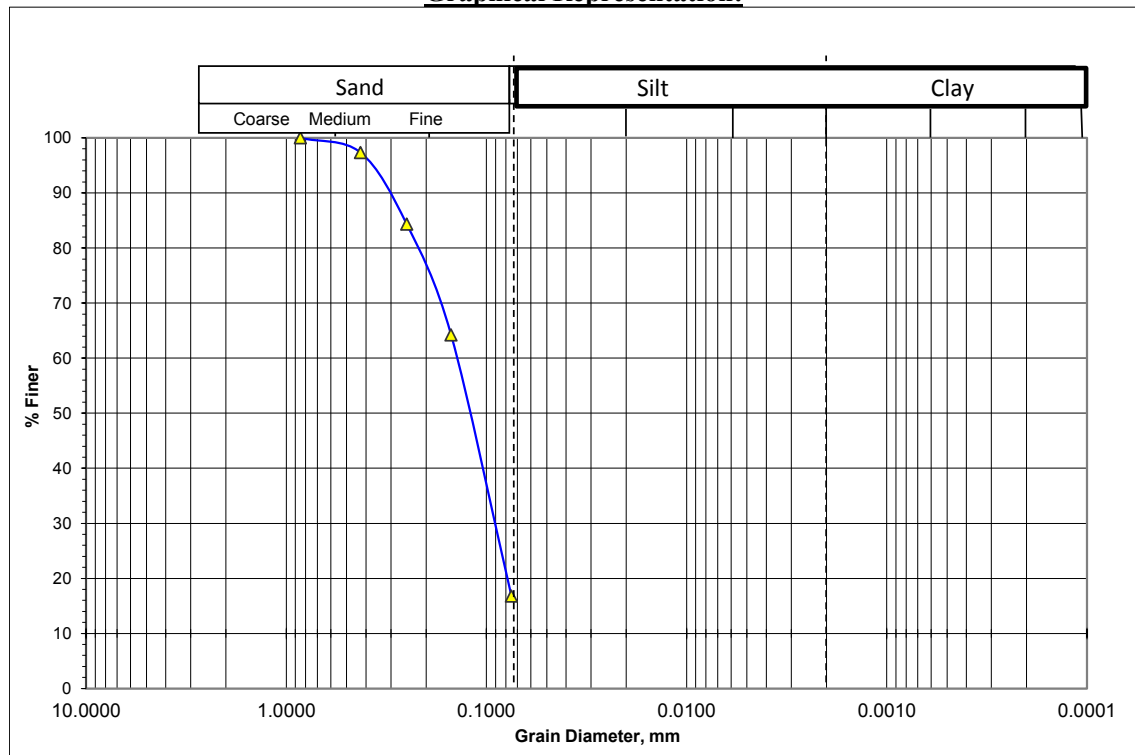
Sampled Date: 09/01/2016

Sample No : D-7

Test Date : 08/02/2016

Depth (m) : 10.5

#### Graphical Representation:



Fines or % of silt and clay = 17

Mean Diameter,  $D_{50} = 0.125$  mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.62$

% Particles (from the grain -size analysis graph

(0.075mm size) = 83

(0.005mm size) & (0.001mm size) = 17

Tested by : Md. Ashadullah

### GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Health Coplex, Ishan Gopalpur

Bore Hole No: BH-F36

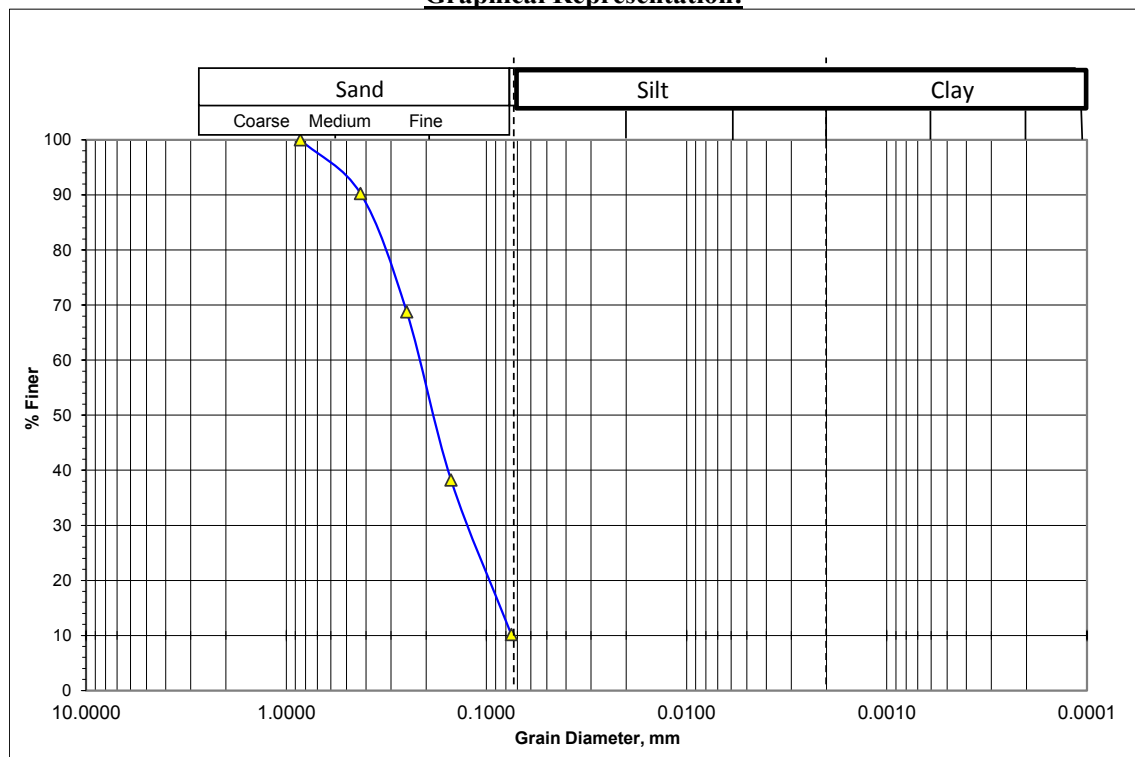
Sampled Date: 09/01/2016

Sample No : D-13

Test Date : 08/02/2016

Depth (m) : 19.5

#### Graphical Representation:



Fines or % of silt and clay = 10

Mean Diameter,  $D_{50}$  = 0.18 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.75$

% Particles (from the grain -size analysis graph

(0.075mm size) = 90

(0.005mm size) & (0.001mm size) = 10

Tested by : Md. Ashadullah



## GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Doiarampur Govt. Primary School, Doiarampur, Majchar

Bore Hole No: BH-F37

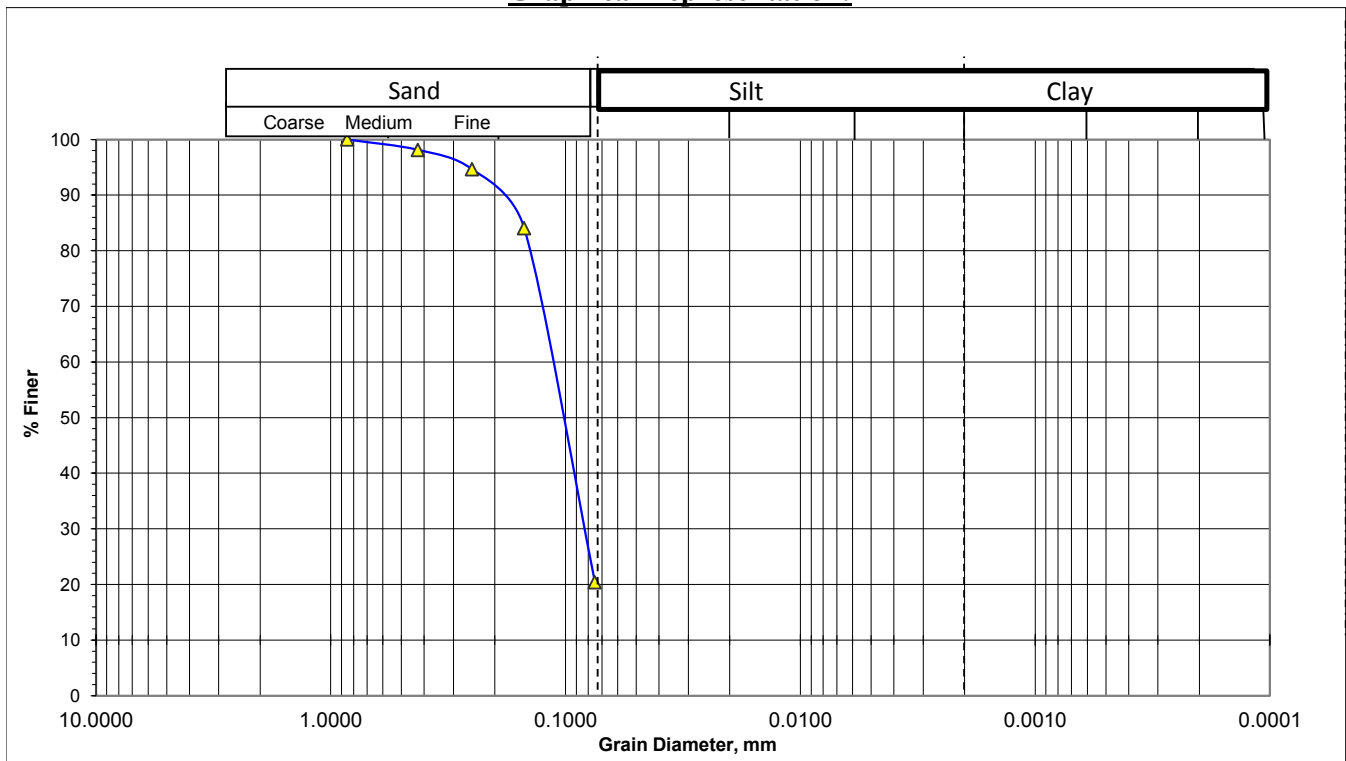
Sampled Date: 09/01/2016

Sample No : D-02

Test Date : 08/02/2016

Depth (m) : 3.0

### Graphical Representation:



Fines or % of silt and clay = 20

Mean Diameter,  $D_{50}$  = 0.1 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.56

% Particles (from the grain -size analysis graph).

(0.075mm size) = 80

(0.005mm size) & (0.001mm size) = 20

## GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Doiarampur Govt. Primary School, Doiarampur, Majchar

Bore Hole No: BH-F37

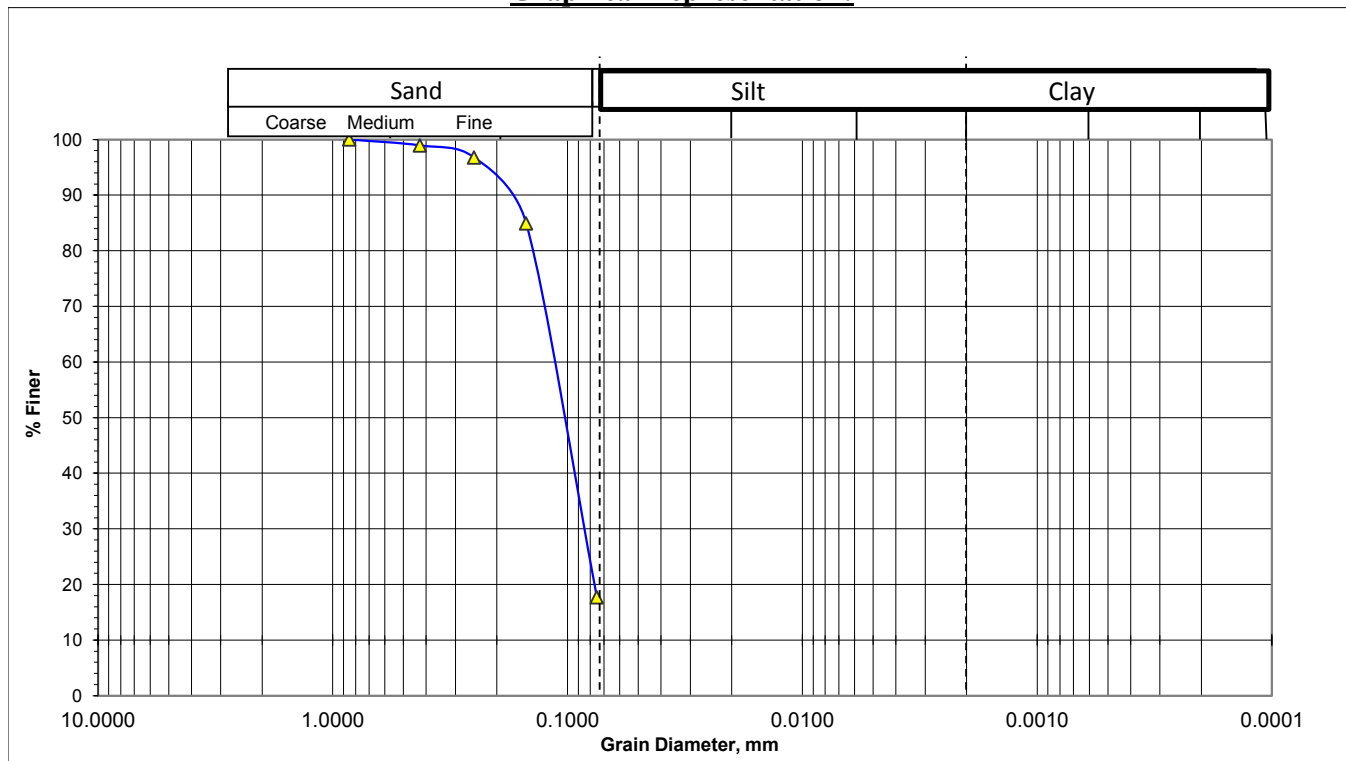
Sampled Date: 09/01/2016

Sample No : D-06

Test Date : 08/02/2016

Depth (m) : 9.0

### Graphical Representation:



Fines or % of silt and clay = 17

Mean Diameter,  $D_{50}$  = 0.1 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}} = 0.56$

% Particles (from the grain -size analysis graph).

(0.075mm size) = 83

(0.005mm size) & (0.001mm size) = 17

## GRAIN SIZE ANALYSIS (Mechanical) OF FINE AGGREGATE, SOIL ETC.

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Doiarampur Govt. Primary School, Doiarampur, Majchar

Bore Hole No: BH-F37

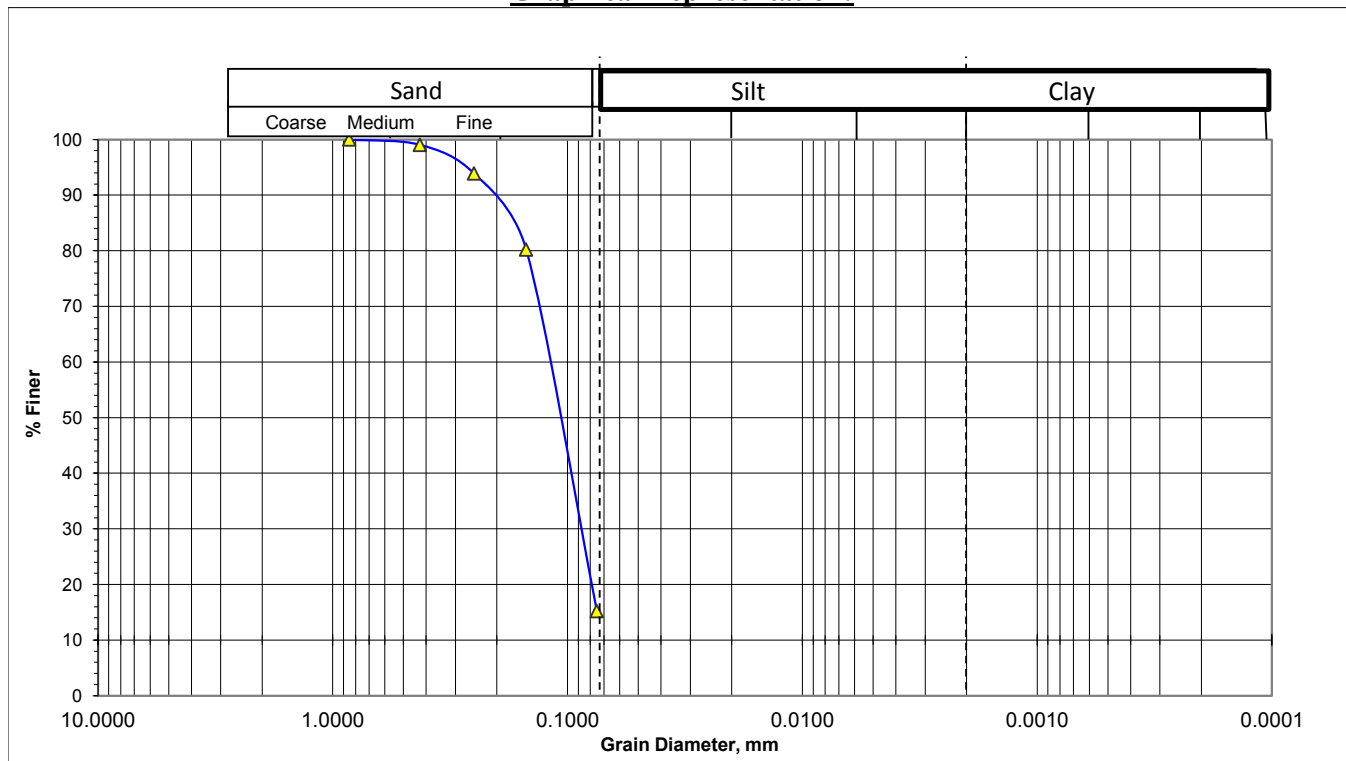
Sampled Date: 09/01/2016

Sample No : D-15

Test Date : 08/02/2016

Depth (m) : 22.5

### Graphical Representation:



Fines or % of silt and clay = 15

Mean Diameter,  $D_{50}$  = 0.11 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.58

% Particles (from the grain -size analysis graph).

(0.075mm size) = 85

(0.005mm size) & (0.001mm size) = 15

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Char Madhabdia Govt.Primary School, Char Madhabdia Bazar, Char Madhabdia

Bore Hole No : BH F04

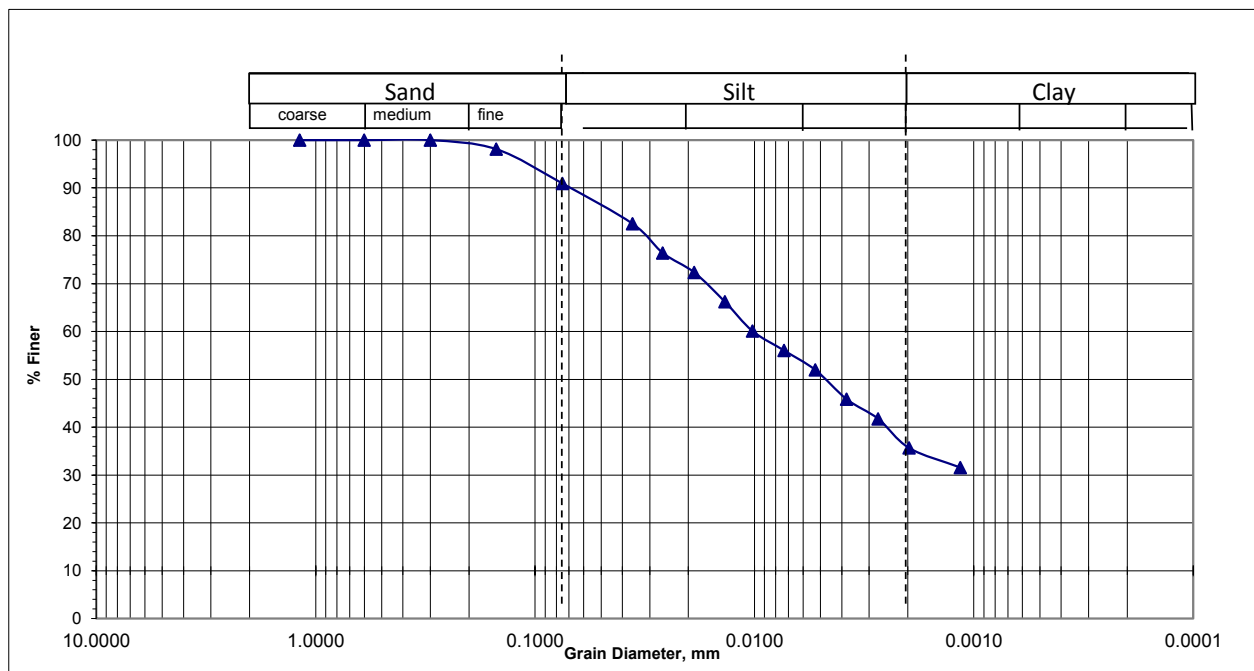
Sample No. D27

Sampled Date: 06/01/2016

Depth (m) : 40.5

Test Date : 04/06/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.005 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.12

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =9%, Silt (0.005mm size)= 55% & Clay (0.001mm size) = 36%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Pallikobi Jasimuddin Saranshala, Ambikapur

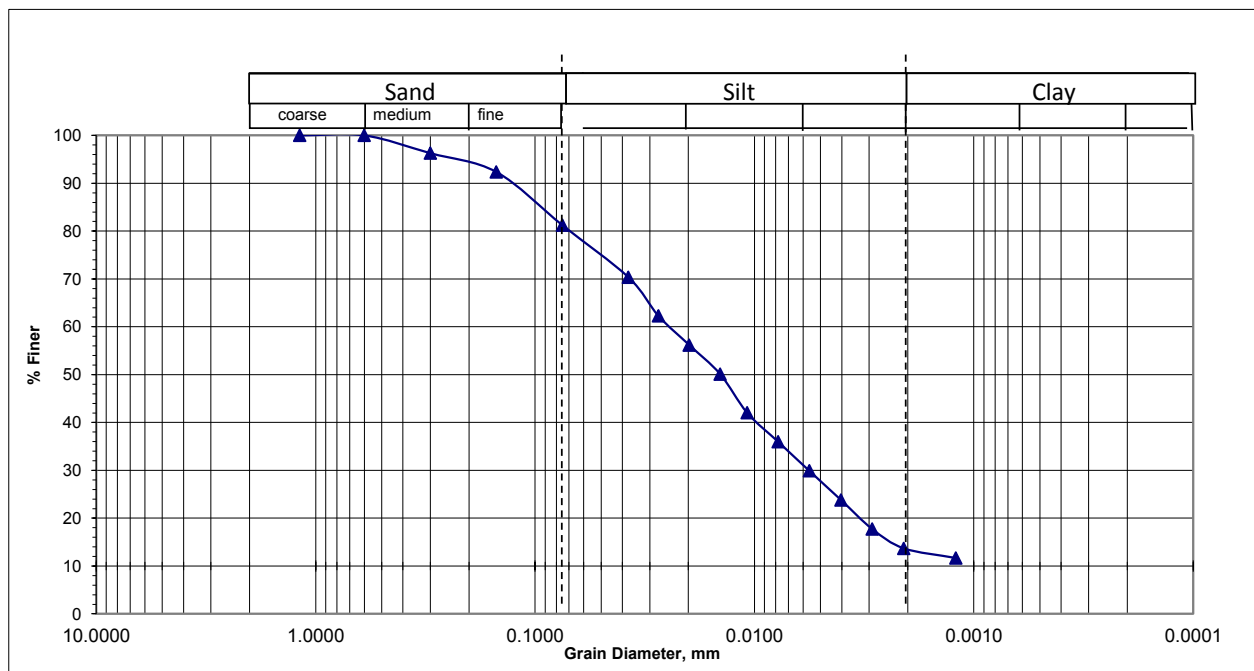
Bore Hole No : BH F06 Sample No. D2

Sampled Date: 10/01/2016

Depth (m) : 3.0

Test Date : 15/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.016 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.22

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =20%, Silt (0.005mm size)= 67% & Clay (0.001mm size) = 13%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Madhankali Swith gate, Ambikapur

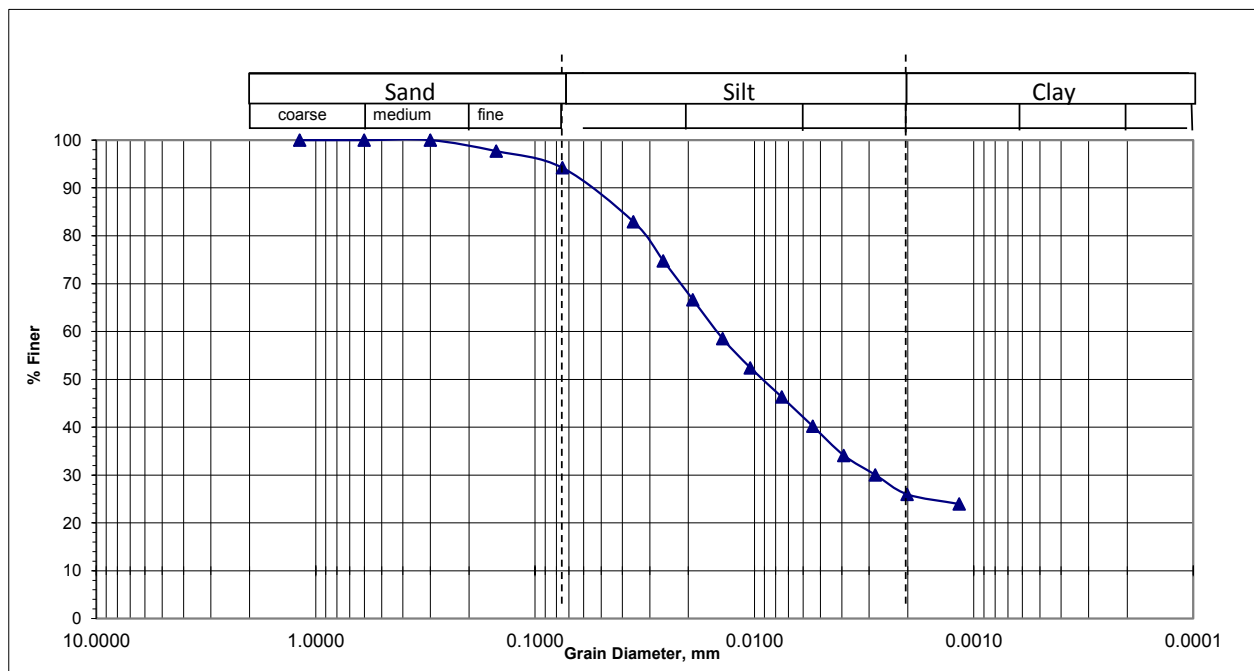
Bore Hole No : BH F07 Sample No. D3

Sampled Date: 31/12/2015

Depth (m) : 4.5

Test Date : 16/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.01 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.17

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 69% & Clay (0.001mm size) = 25%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Dhuldi Railgate, Dhuldi Bazar, Majchar

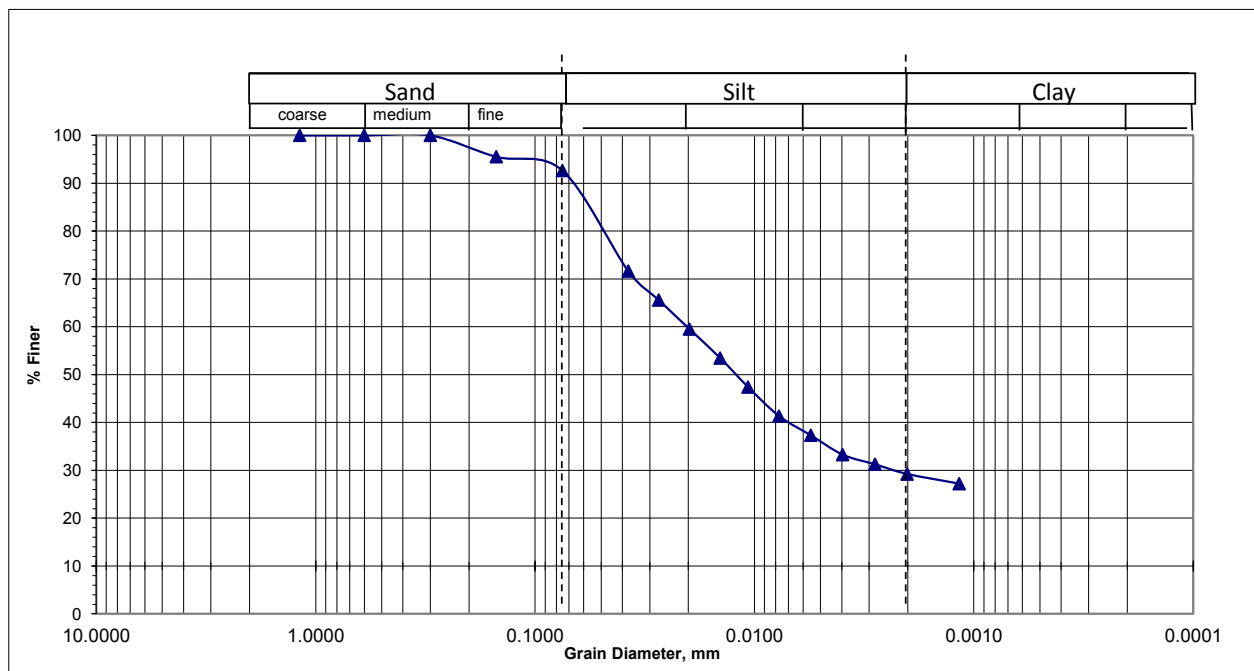
Bore Hole No : BH F09 Sample No. D4

Sampled Date: 08/01/2016

Depth (m) : 6.0

Test Date : 16/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.012 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.19

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =8%, Silt (0.005mm size)= 63% & Clay (0.001mm size) = 29%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : 5 nos. Decreerchar, Munshitanggi Aftabuddin Madrasha, Decreerchar

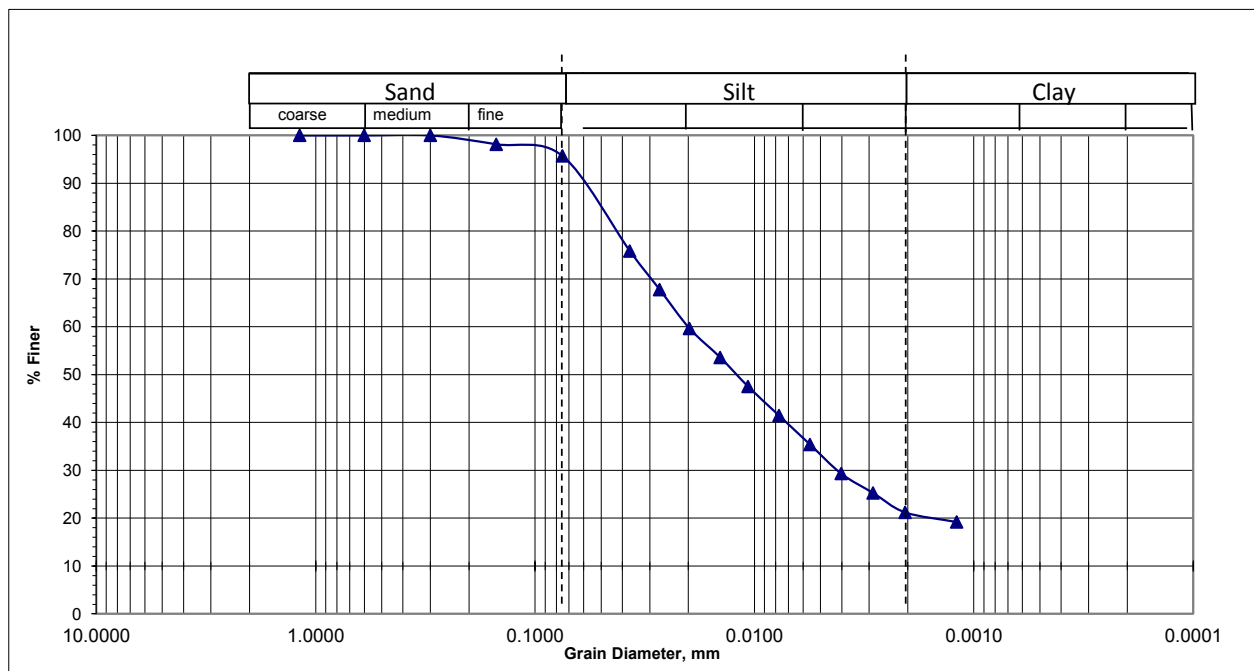
Bore Hole No : BH F11 Sample No. D3

Sampled Date: 31/12/2015

Depth (m) : 4.5

Test Date : 16/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.013 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.20

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =4%, Silt (0.005mm size)= 74% & Clay (0.001mm size) = 22%



### GRAIN SIZE ANALYSIS BY HYDROMETER

Client :Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Dokin Char Kamolpur

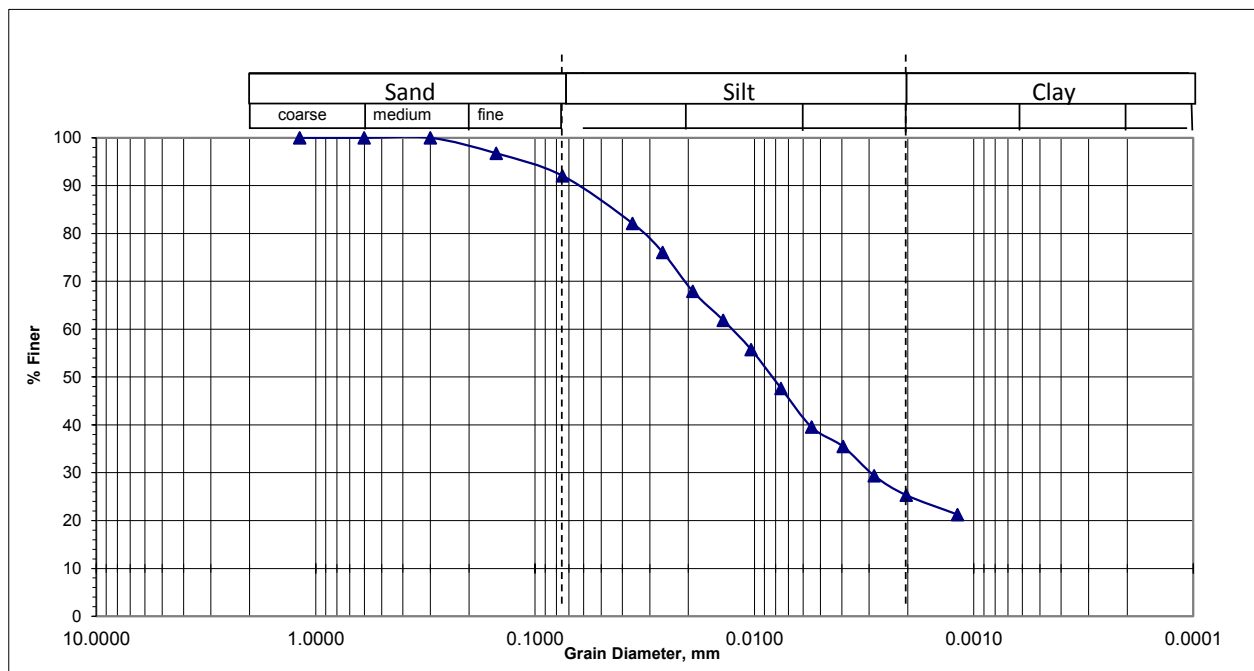
Bore Hole No : BH F33 Sample No. D4

Sampled Date: 10/01/2016

Depth (m) : 6.0

Test Date : 24/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.008 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.16

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =8%, Silt (0.005mm size)= 67% & Clay (0.001mm size) = 25%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Vajon Dangga Govt. Primary School, Faridpur Sadar

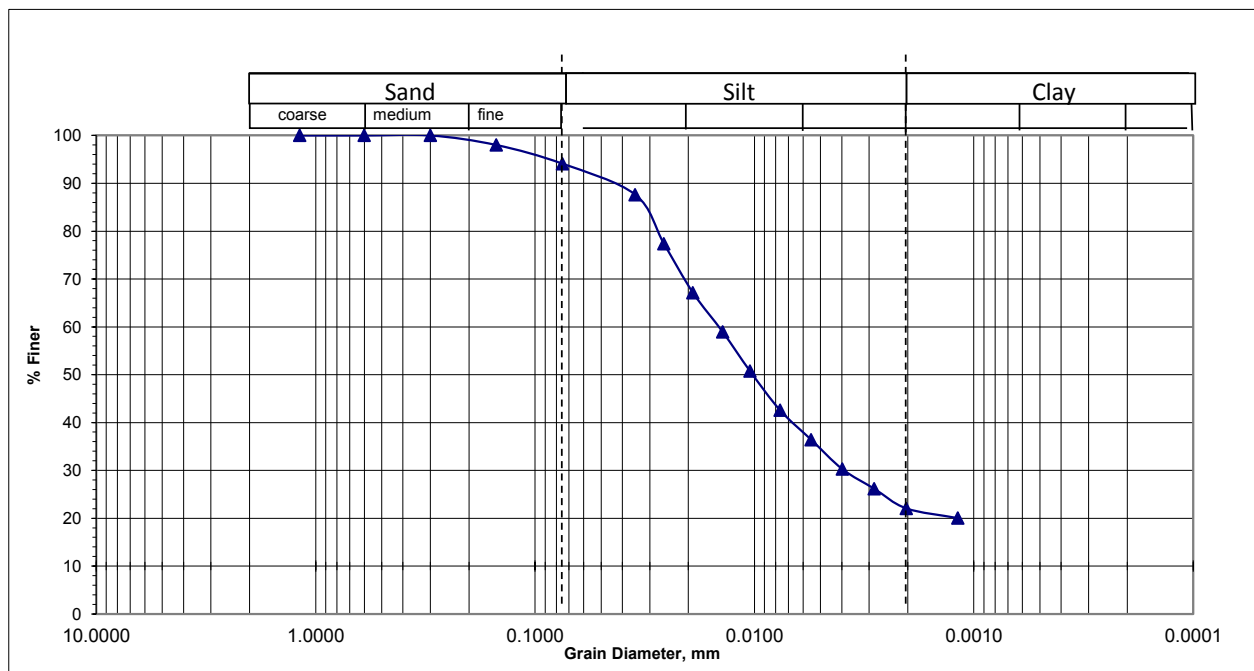
Bore Hole No : BH F14 Sample No. D3

Sampled Date: 31/12/2015

Depth (m) : 4.5

Test Date : 19/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.01 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.18

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =6%, Silt (0.005mm size)= 72% & Clay (0.001mm size) = 22%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Chan Chairman Pukurpar, Baitul-Noor Mosjid, Faridpur Sadar

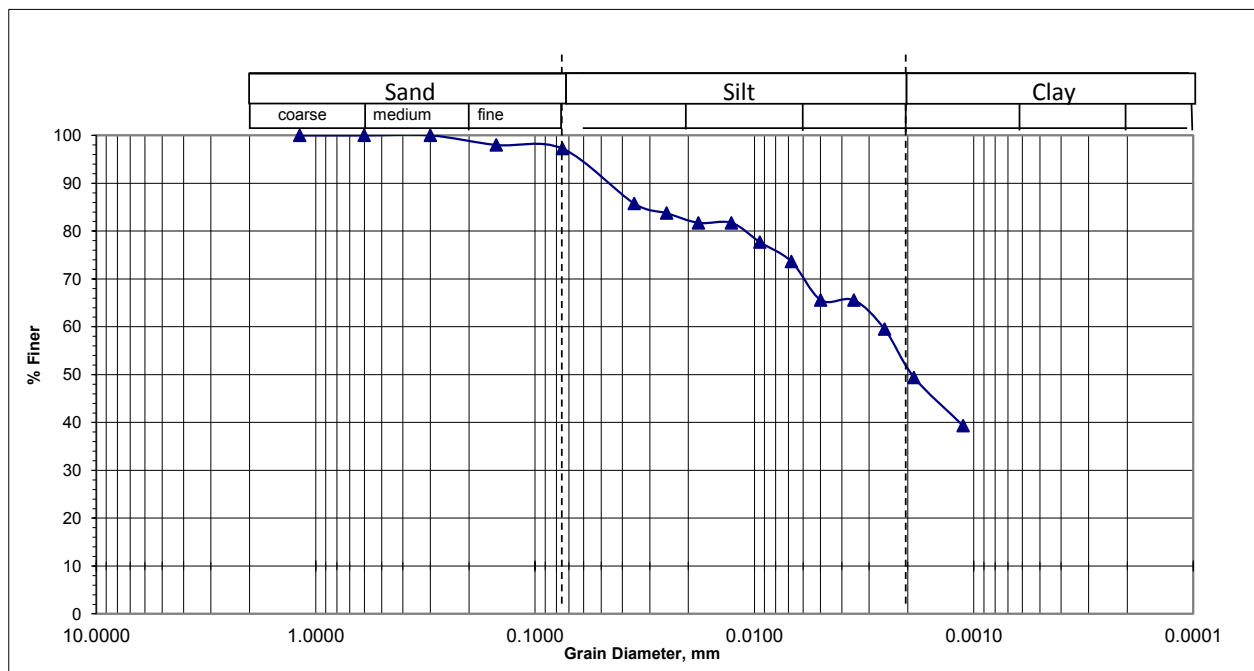
Bore Hole No : BH F15 Sample No. D2

Sampled Date: 30/12/2015

Depth (m) : 3.0

Test Date : 20/02/2016

#### Graphical Representation:



### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

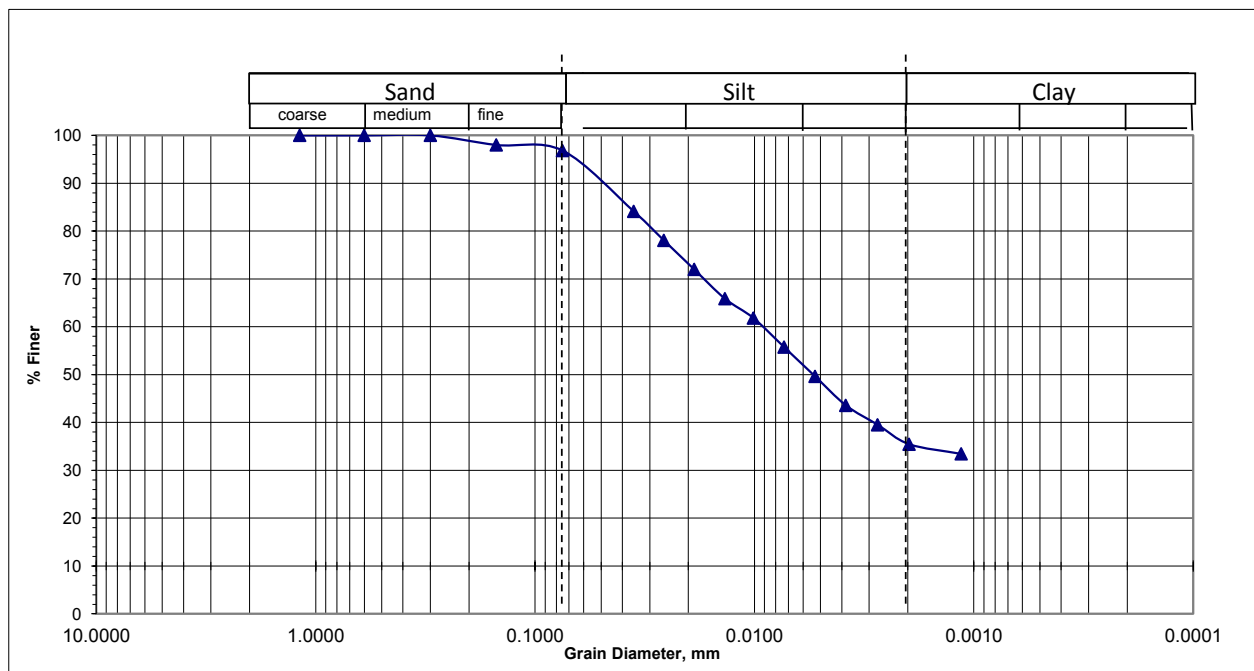
Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : 94 nos. Zhiltuki Govt. Primary School, Panir Tangki Mor, Faridpur Sadar

Bore Hole No : BH F16 Sample No. D2 Sampled Date: 30/12/2015

Depth (m) : 3.0 Test Date : 20/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.002 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.08

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =3%, Silt (0.005mm size)= 62% & Clay (0.001mm size) = 35%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Mohim School Field, Faridpur Sadar

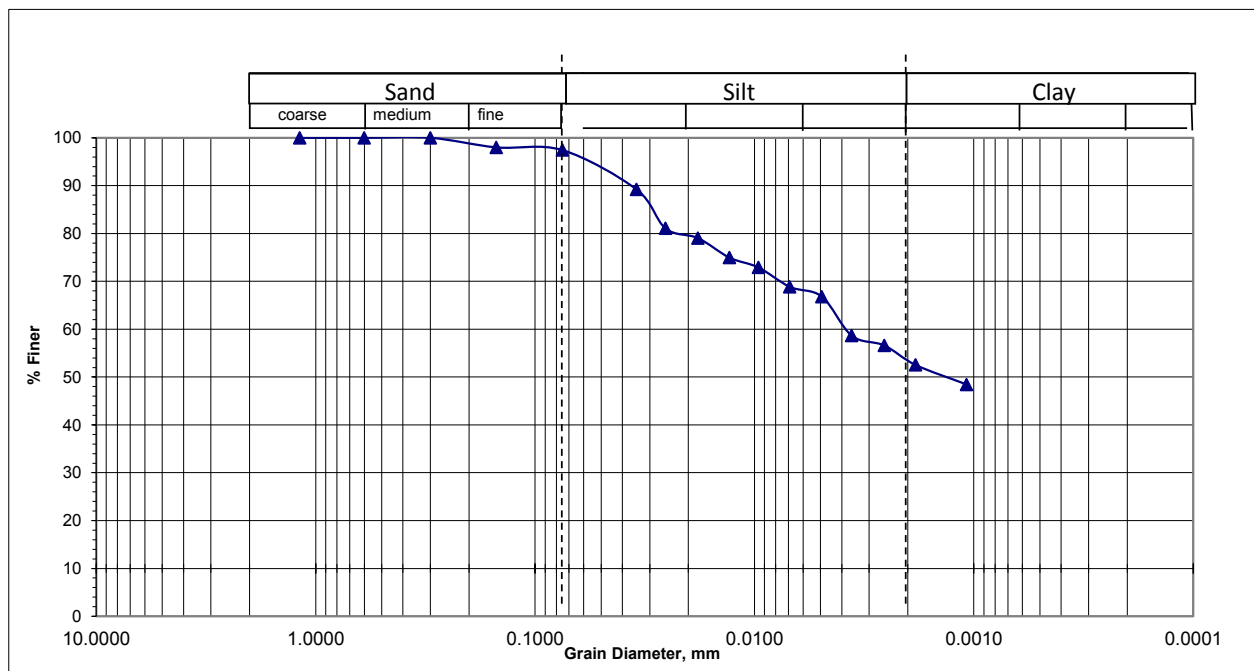
Bore Hole No : BH F17 Sample No. D1

Sampled Date: 27/12/2015

Depth (m) : 1.5

Test Date : 21/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.0015 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.07

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =3%, Silt (0.005mm size)= 43% & Clay (0.001mm size) = 54%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Mohim School Field, Faridpur Sadar

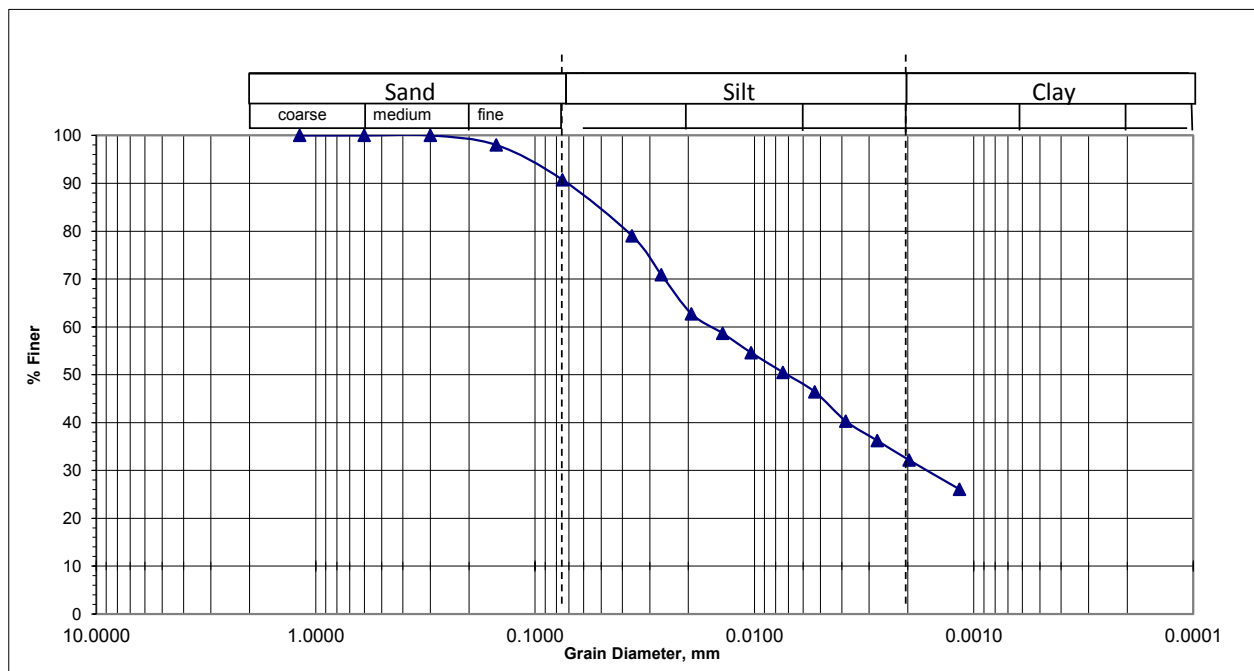
Bore Hole No : BH F17 Sample No. D3

Sampled Date: 27/12/2015

Depth (m) : 4.5

Test Date : 21/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.007 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.15

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =10%, Silt (0.005mm size)= 57% & Clay (0.001mm size) = 33%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Mohim School Field, Faridpur Sadar

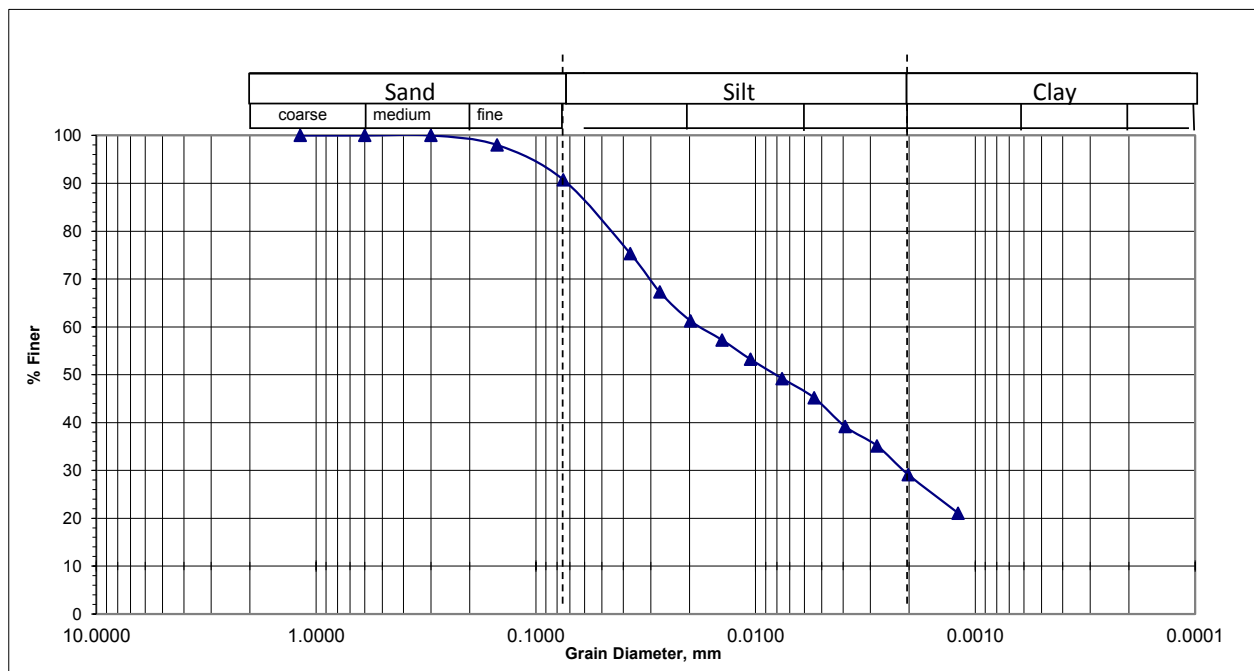
Bore Hole No : BH F17 Sample No. D10

Sampled Date: 27/12/2015

Depth (m) : 15.0

Test Date : 21/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.008 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.16

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =10%, Silt (0.005mm size)= 60% & Clay (0.001mm size) = 30%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Raghu Nandanpur Madrasha, Ambikapur

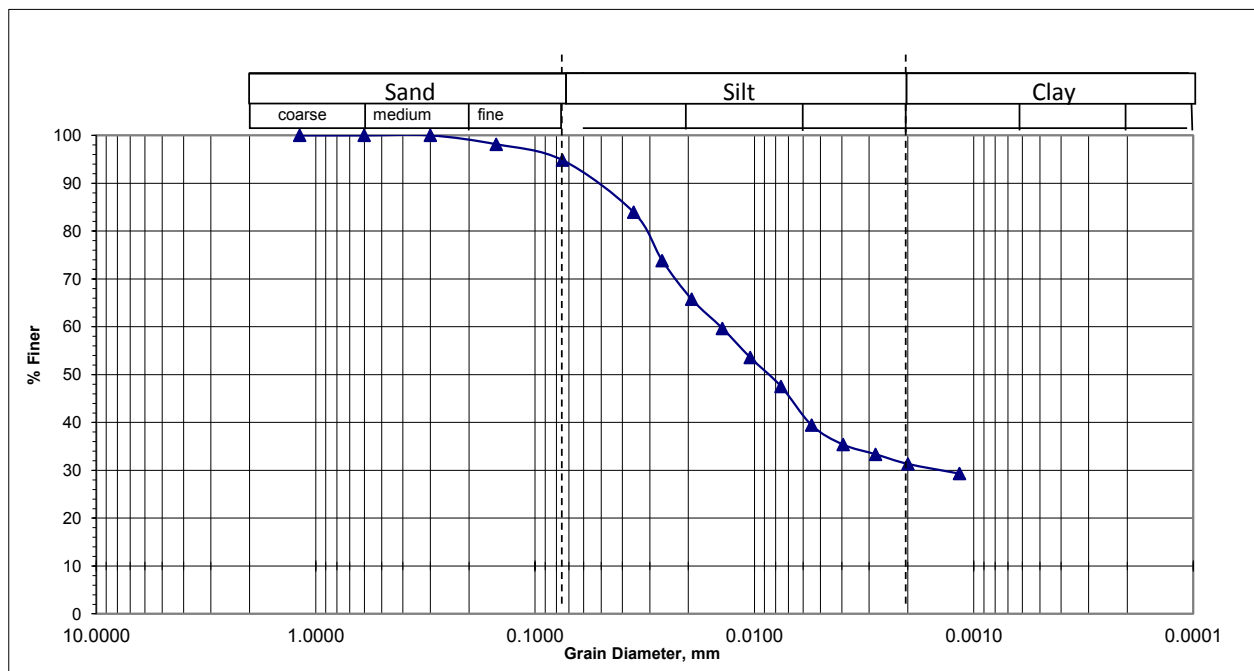
Bore Hole No : BH F18 Sample No. D2

Sampled Date: 28/12/2015

Depth (m) : 3.0

Test Date : 19/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.009 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.17

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)= 63% & Clay (0.001mm size) = 32%



### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Porunpur Govt. Primary School, Porunpur Bazar, Majchar

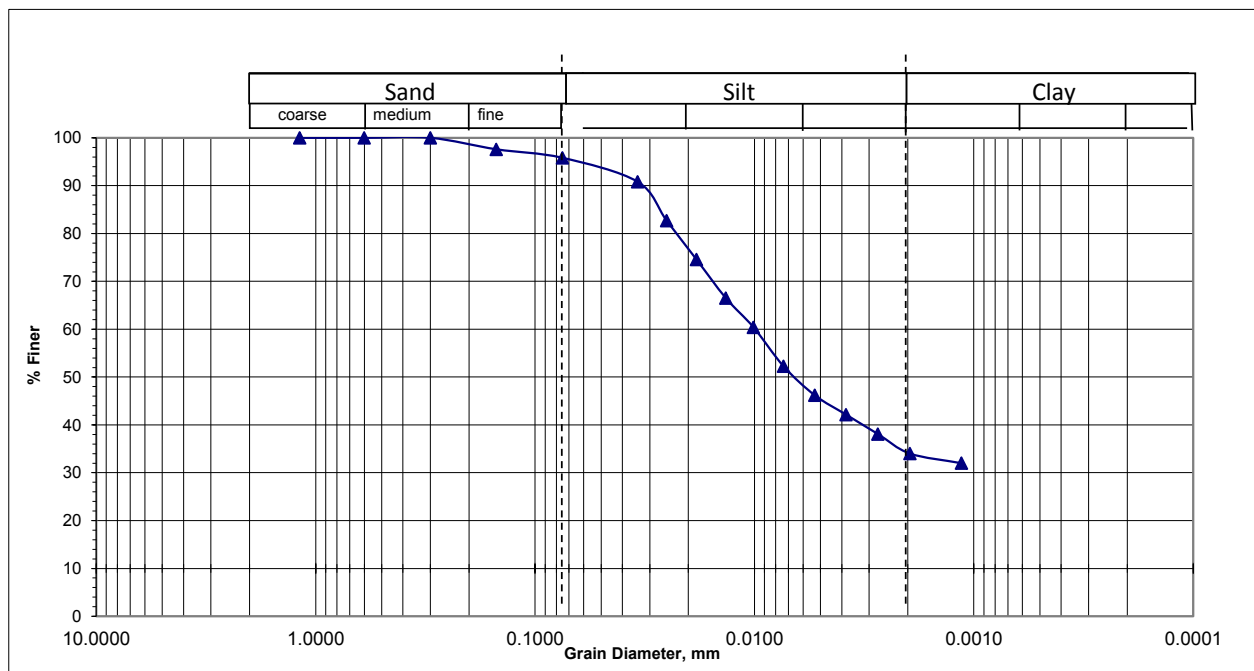
Bore Hole No : BH F19 Sample No. D2

Sampled Date: 06/01/2016

Depth (m) : 3.0

Test Date : 23/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.03 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.30

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)= 61% & Clay (0.001mm size) = 34%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Hadhokandi Govt. Primary School, River Research Institute, Kaijuri

Bore Hole No : BH F20

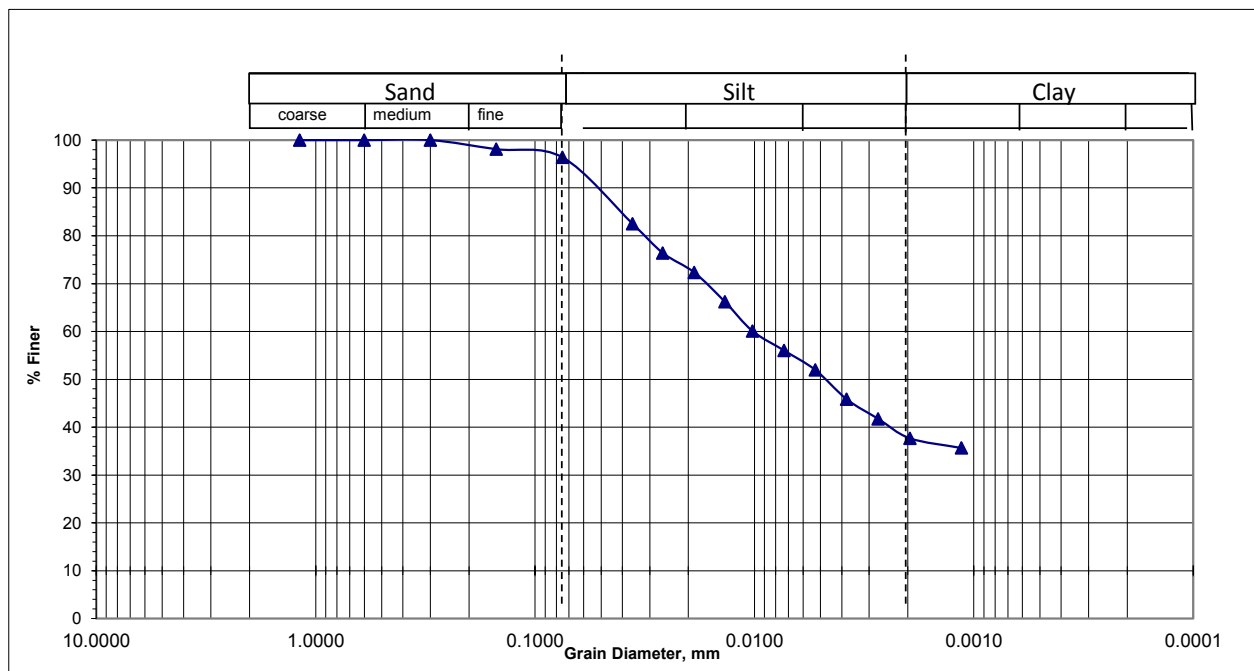
Sample No. D2

Sampled Date: 01/01/2016

Depth (m) : 3.0

Test Date : 22/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.005 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.12

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =4%, Silt (0.005mm size)= 58% & Clay (0.001mm size) = 38%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Hadhokandi Govt. Primary School, River Research Institute, Kaijuri

Bore Hole No : BH F20

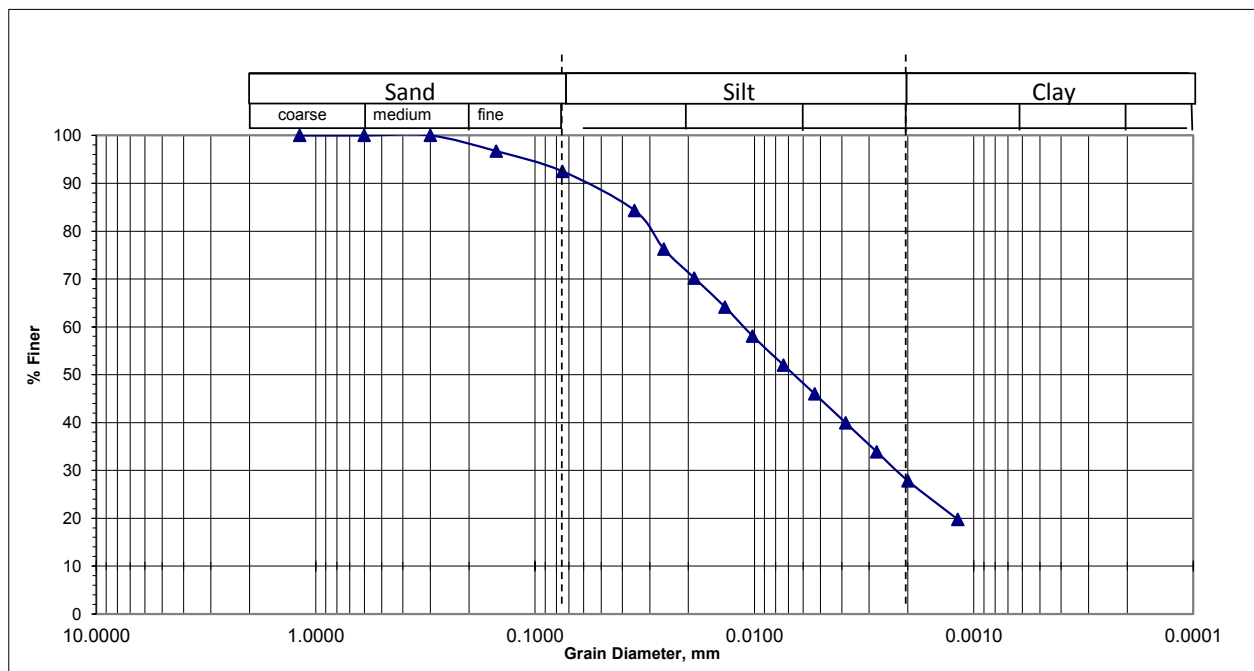
Sample No. D5

Sampled Date: 01/01/2016

Depth (m) : 7.5

Test Date : 22/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.007 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.15

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =8%, Silt (0.005mm size)= 65% & Clay (0.001mm size) =27%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

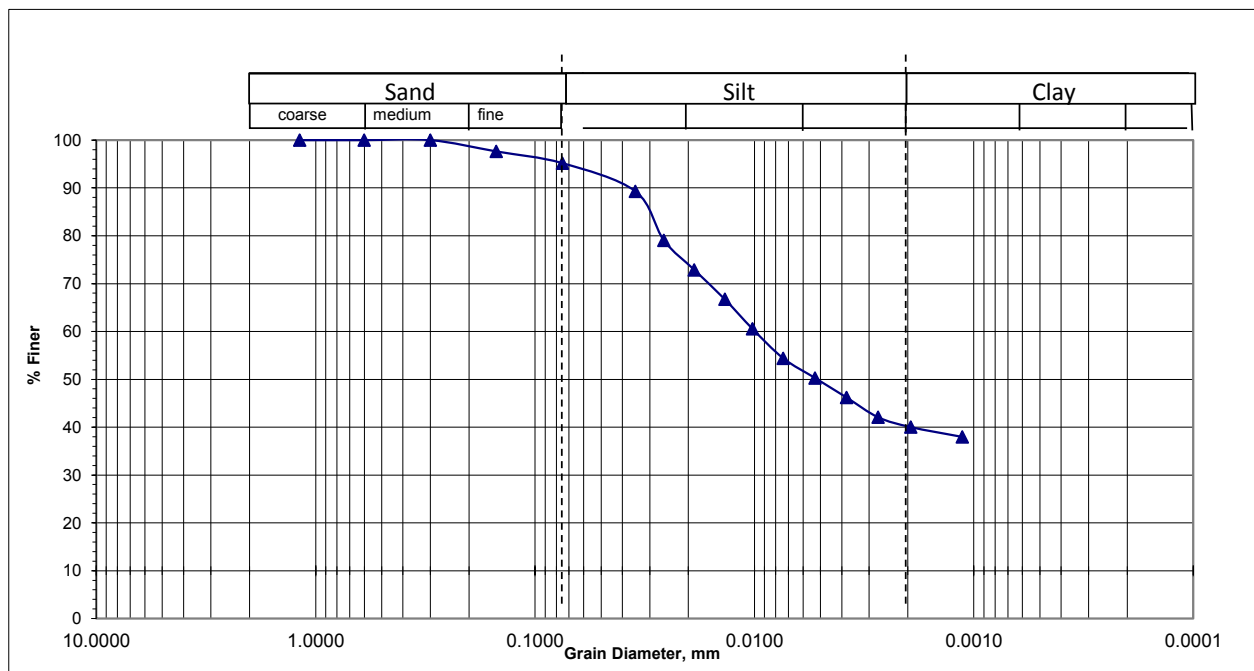
Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Johora Begum High School Field, Mia Para Road, Parchim Khabashpur, Faridpur Sadar

Bore Hole No : BH F21 Sample No. D3 Sampled Date: 27/12/2015

Depth (m) : 4.5 Test Date : 23/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.005 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.13

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)=55% & Clay (0.001mm size) = 40

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Johora Begum High School Field, Mia Para Road, Parchim Khabashpur, Faridpur Sadar

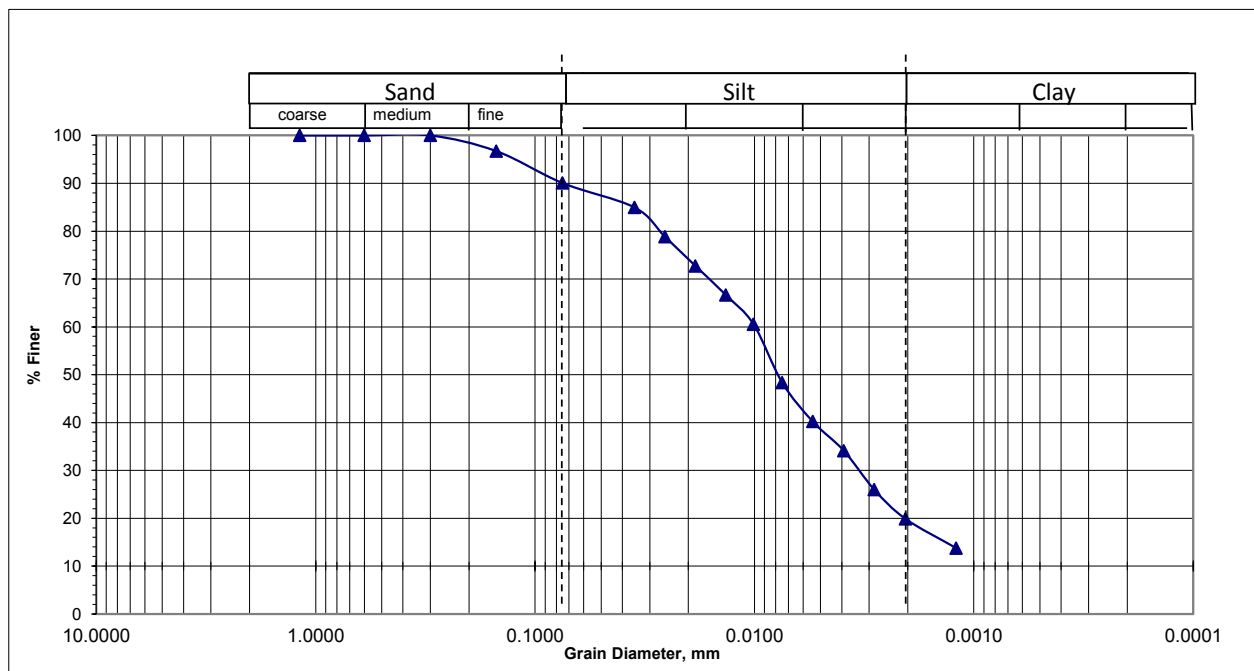
Bore Hole No : BH F21 Sample No. D6

Sampled Date: 27/12/2015

Depth (m) : 9.0

Test Date : 23/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.008 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.16

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =10%, Silt (0.005mm size)= 61% & Clay (0.001mm size) =19%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Payarpur Godaoun, Kaijuri

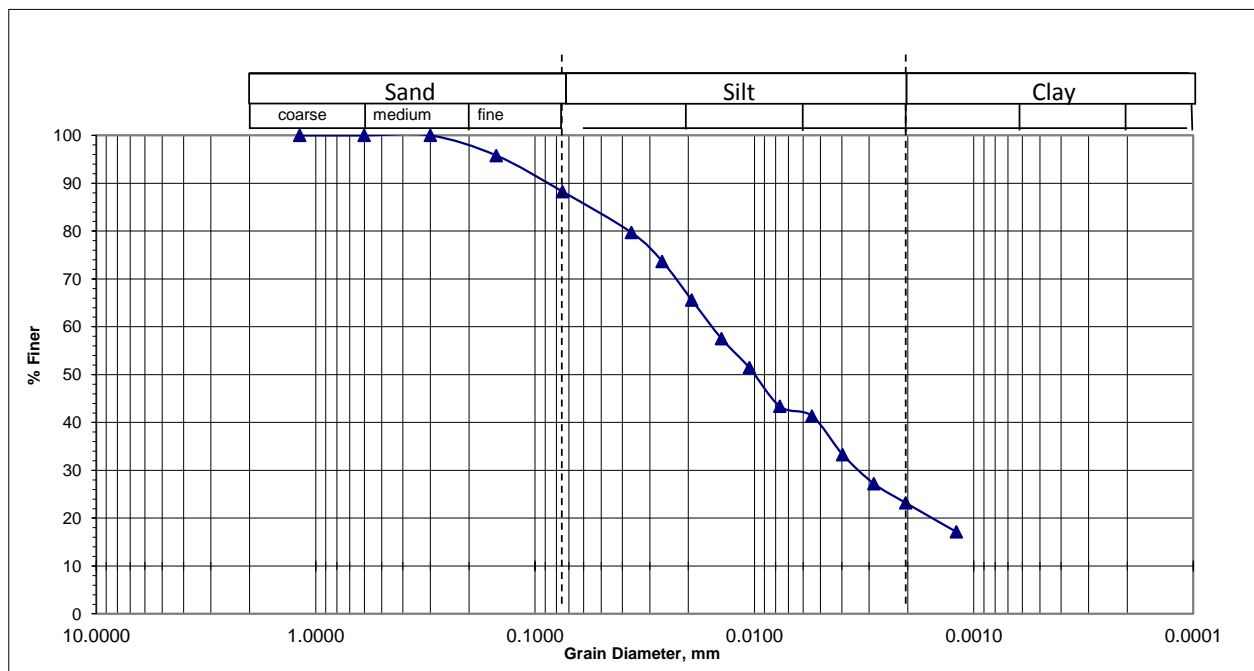
Bore Hole No : BH F24 Sample No. D7

Sampled Date: 02/01/2016

Depth (m) : 10.5

Test Date : 27/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.01 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.18

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =12%, Silt (0.005mm size)= 65% & Clay (0.001mm size) = 23%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Krish poshikhan Institute gate, Gunggabodi, Krishnanagar

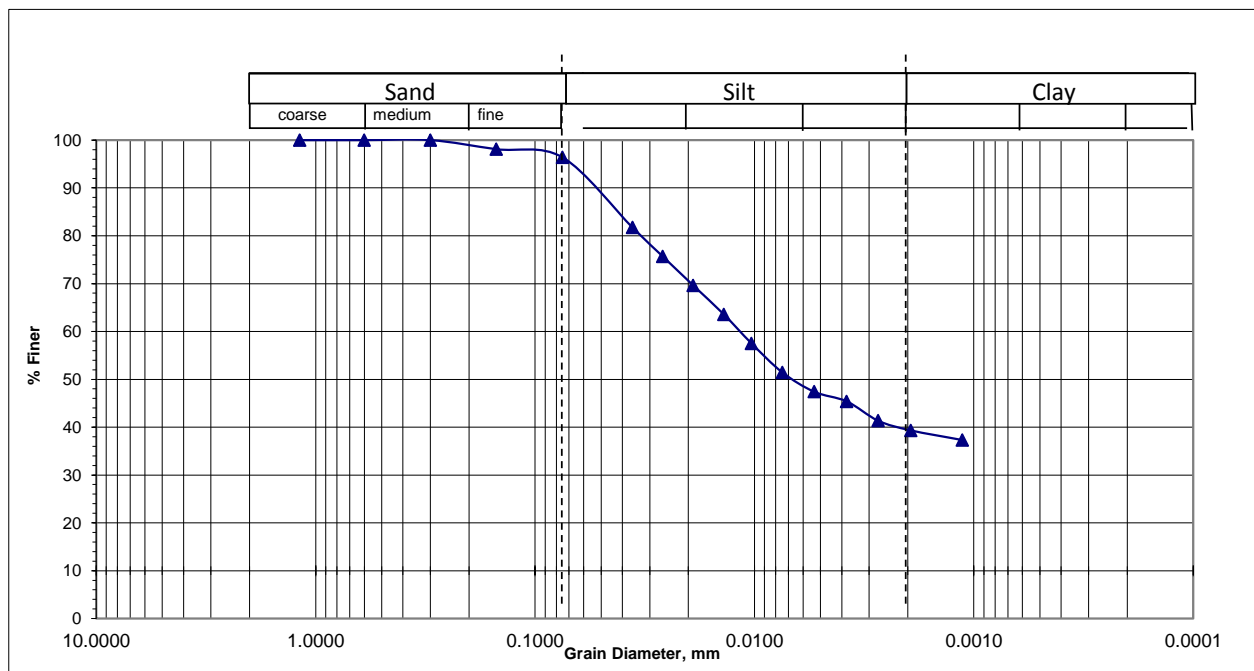
Bore Hole No : BH F205 Sample No. D2

Sampled Date: 04/01/2016

Depth (m) : 3.0

Test Date : 27/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.007 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.15

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =4%, Silt (0.005mm size)= 56% & Clay (0.001mm size) = 40%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Krish poshikhan Institute gate, Gunggabodi, Krishnanagar

Bore Hole No : BH F25

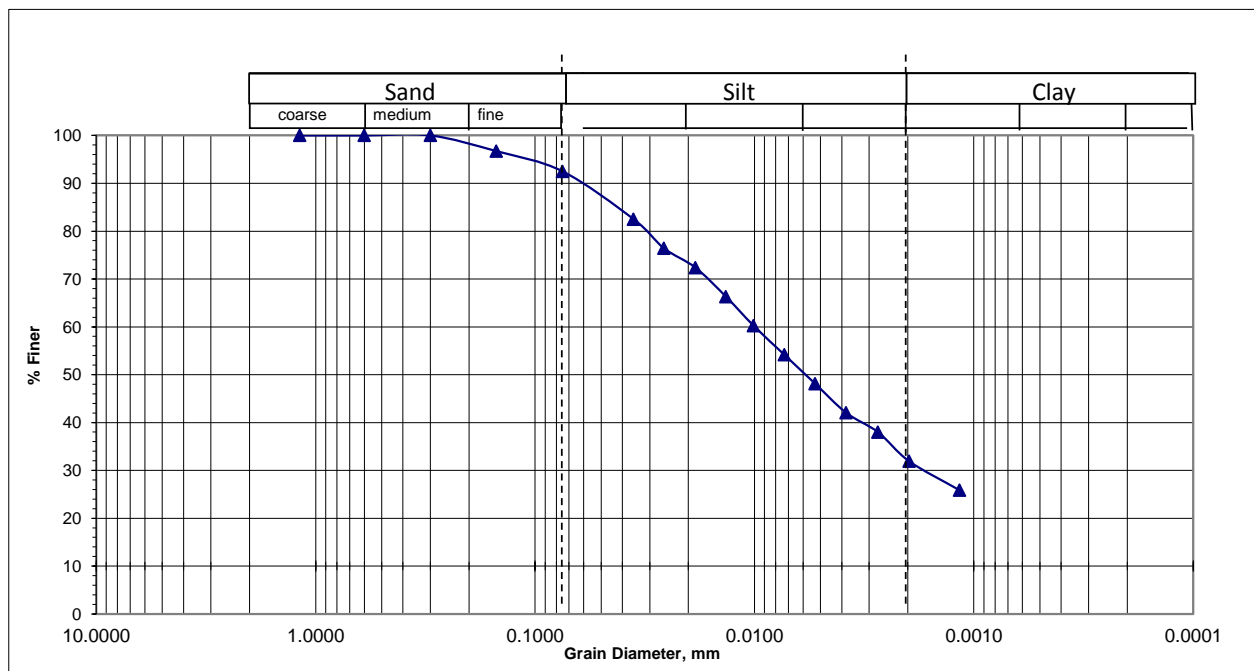
Sample No. D9

Sampled Date: 04/01/2016

Depth (m) : 13.5

Test Date : 27/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.006 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.14

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =8%, Silt (0.005mm size)= 60% & Clay (0.001mm size) =32%



### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Gobinddapur Hat, Krishnanagar

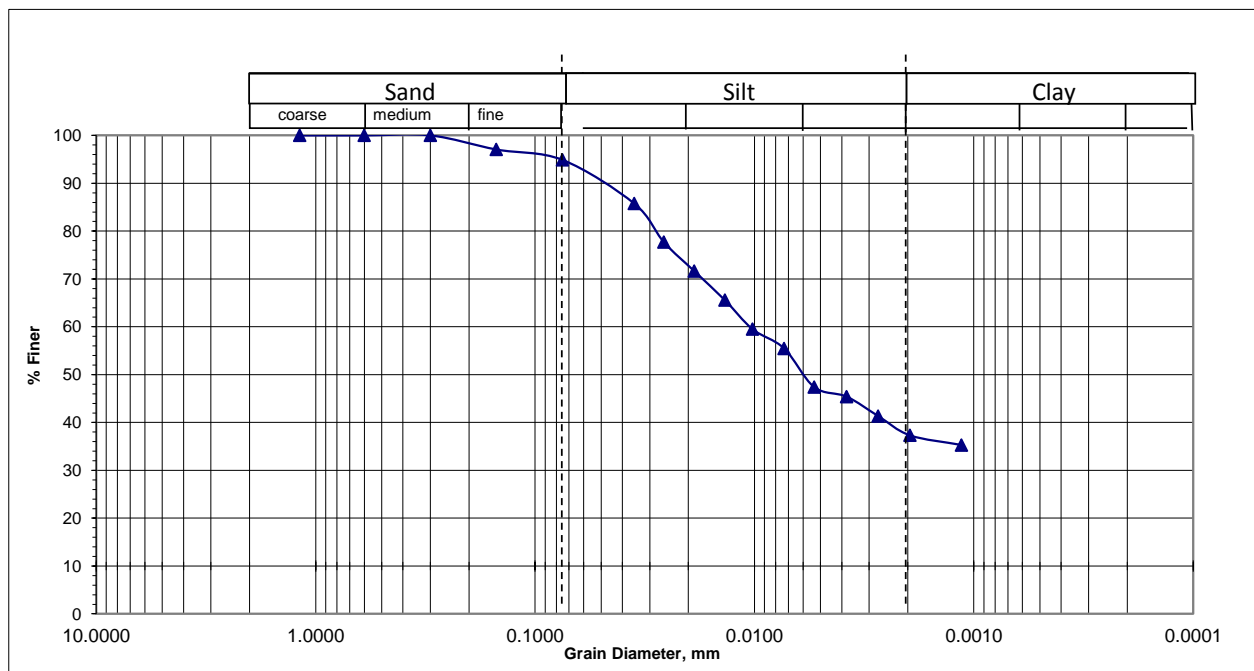
Bore Hole No : BH F26 Sample No. D2

Sampled Date: 04/01/2016

Depth (m) : 3.0

Test Date : 27/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.006 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.14

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =5%, Silt (0.005mm size)= 58% & Clay (0.001mm size) = 37%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Bakhunda College Field, Bakhunda, Greda

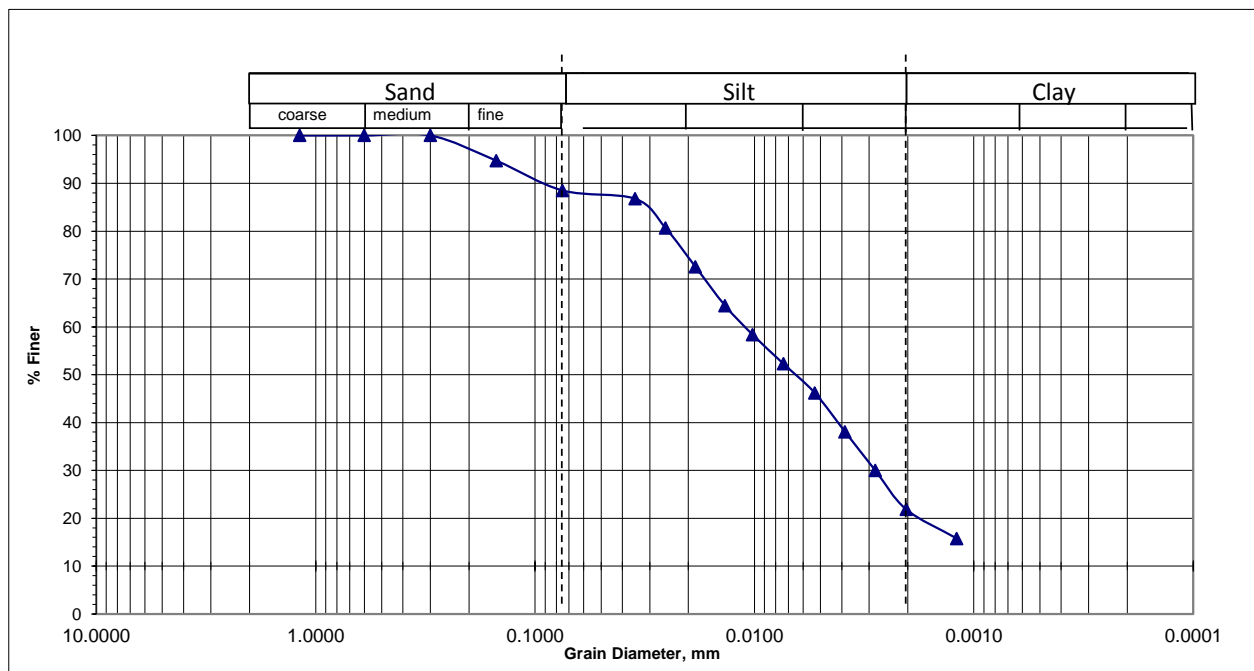
Bore Hole No : BH F27 Sample No. D5

Sampled Date: 02/01/2016

Depth (m) : 7.5

Test Date : 26/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.007 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.14

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =12%, Silt (0.005mm size)= 68% & Clay (0.001mm size) =20%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Kanaipur Akhak Centre, Kanaipur

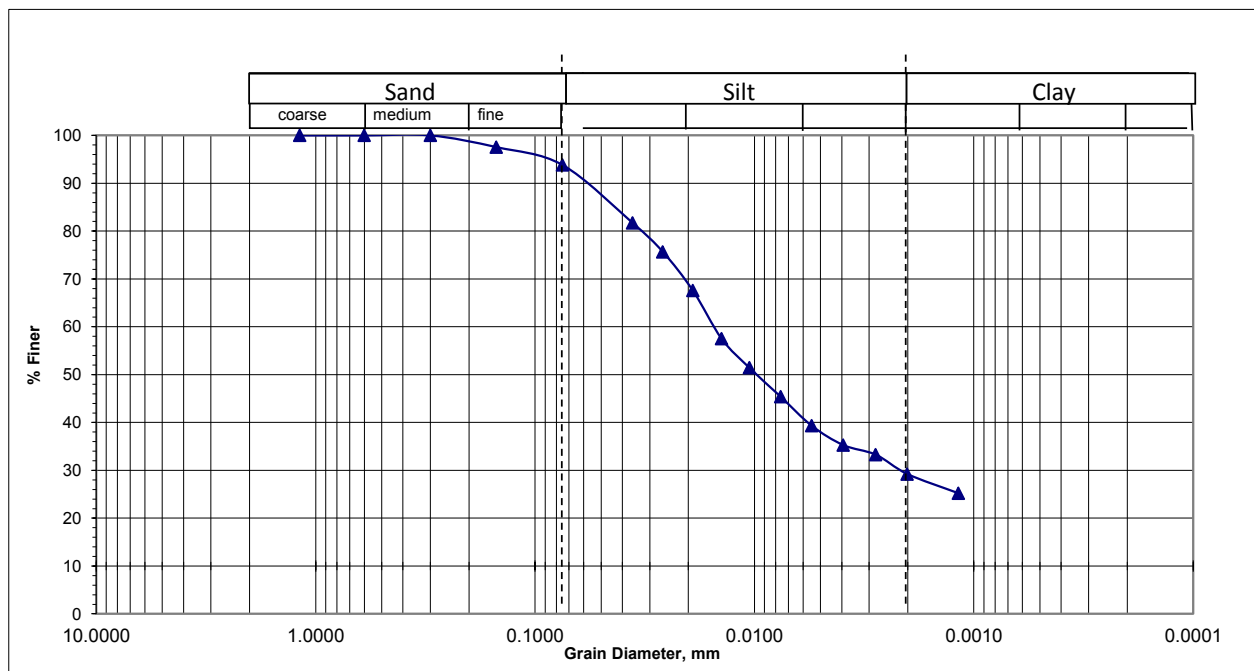
Bore Hole No : BH F29 Sample No. D2

Sampled Date: 04/01/2016

Depth (m) : 3.0

Test Date : 25/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.01 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.18

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =7%, Silt (0.005mm size)= 63% & Clay (0.001mm size) = 30%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Madhobpur Govt. Primary School, Mallikpur Bazar, Krishnanagar

Bore Hole No : BH F30

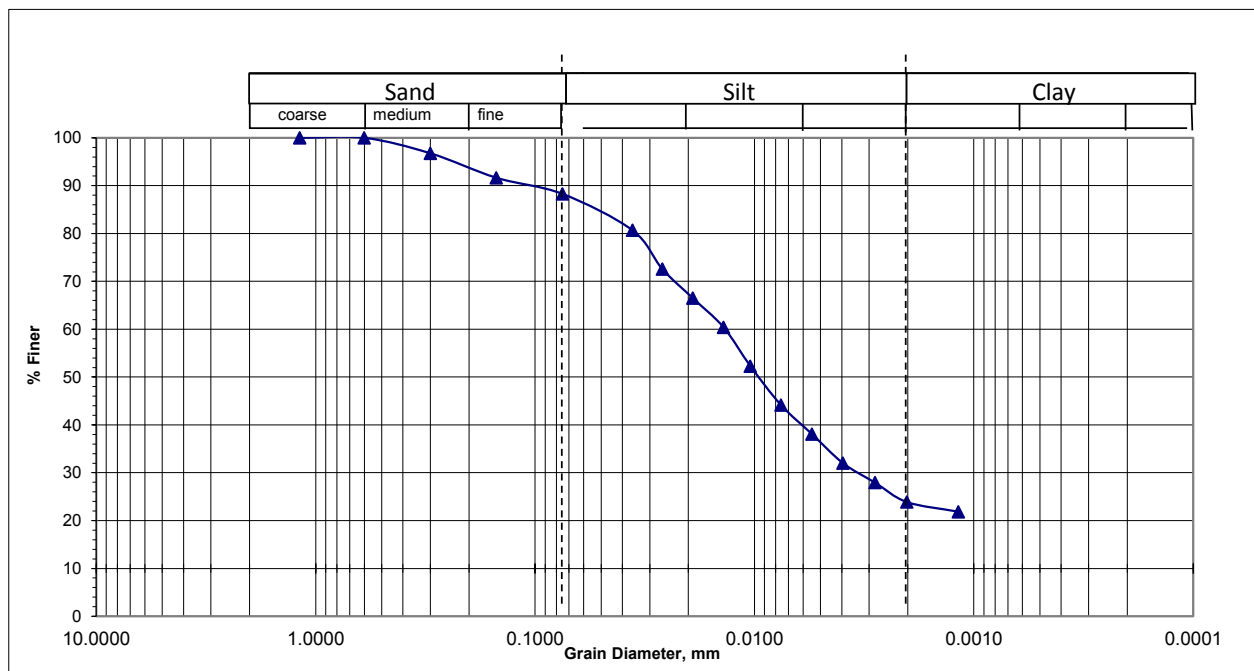
Sample No. D4

Sampled Date: 05/01/2016

Depth (m) : 6.0

Test Date : 25/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.012 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.19

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) = 12%, Silt (0.005mm size)= 65% & Clay (0.001mm size) = 23%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Vhatpara Govt. Primary School, Kaijuri

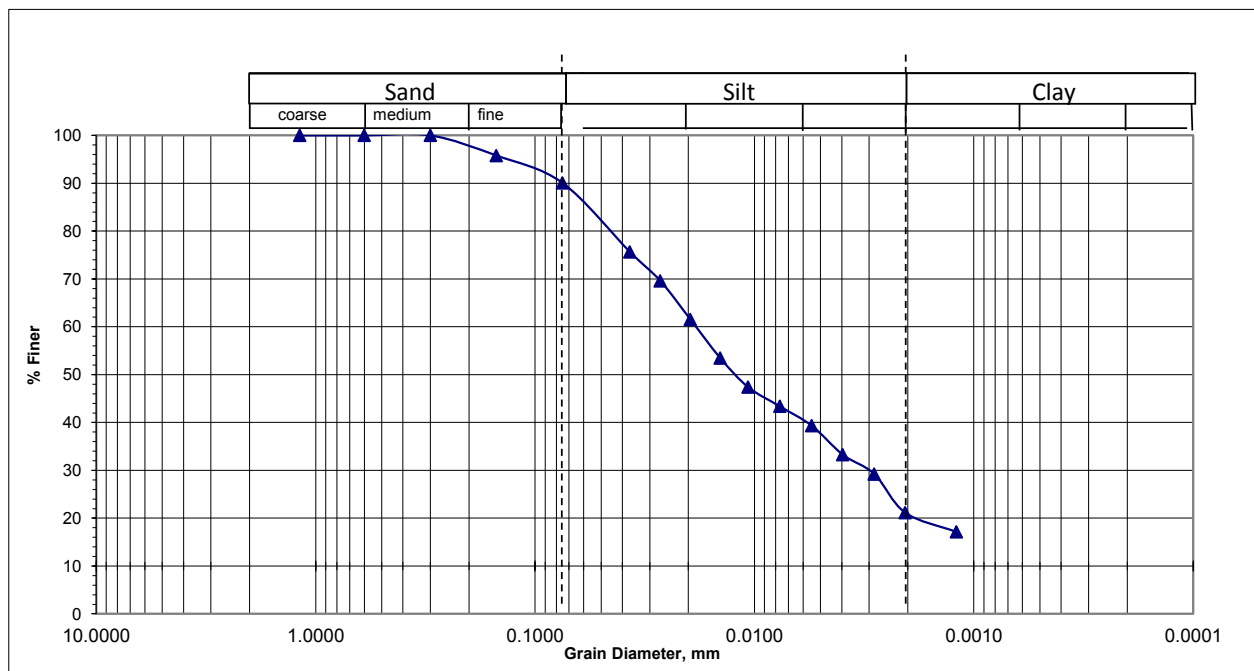
Bore Hole No : BH F31 Sample No. D4

Sampled Date: 03/01/2016

Depth (m) : 6.0

Test Date : 25/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.013 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.20

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =10%, Silt (0.005mm size)= 70% & Clay (0.001mm size) = 20%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Fursha Govt. Primary School, Kanaipur

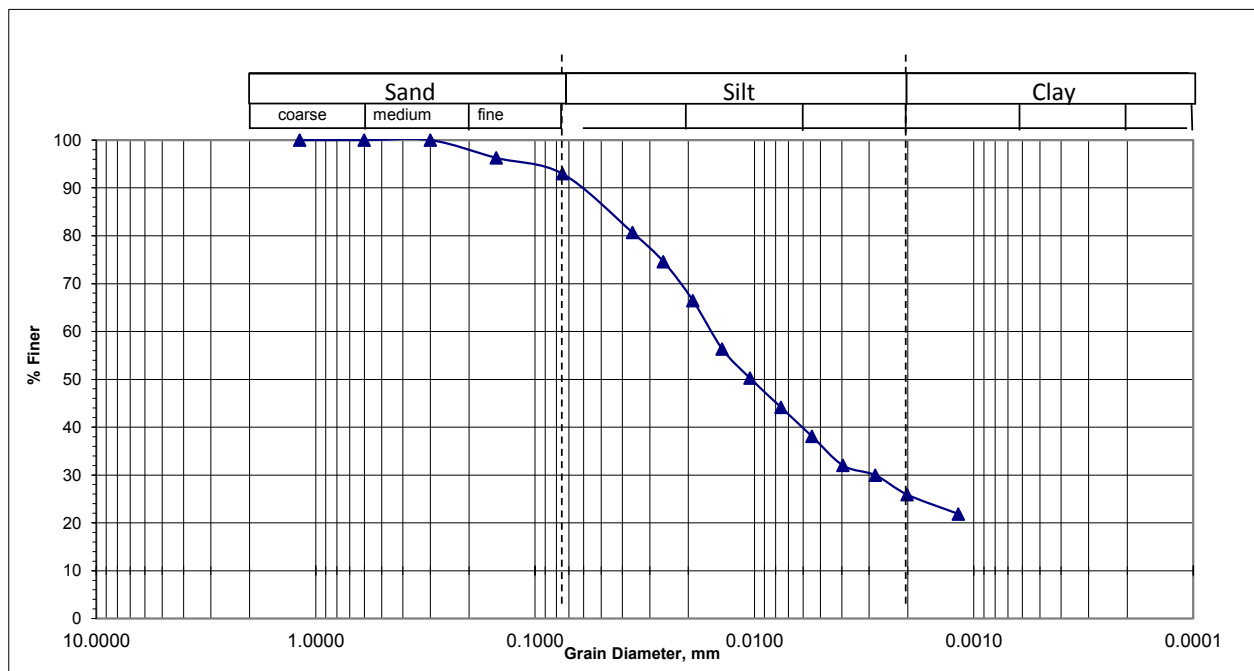
Bore Hole No : BH F32 Sample No. D4

Sampled Date: 05/01/2016

Depth (m) : 6.0

Test Date : 24/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.01 mm

Silt-Factor,  $f = 1.76 \times \sqrt{D_{50}}$  = 0.18

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =8%, Silt (0.005mm size)= 66% & Clay (0.001mm size) = 26%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Tonthoniar Hat, End of Kanaipur Union

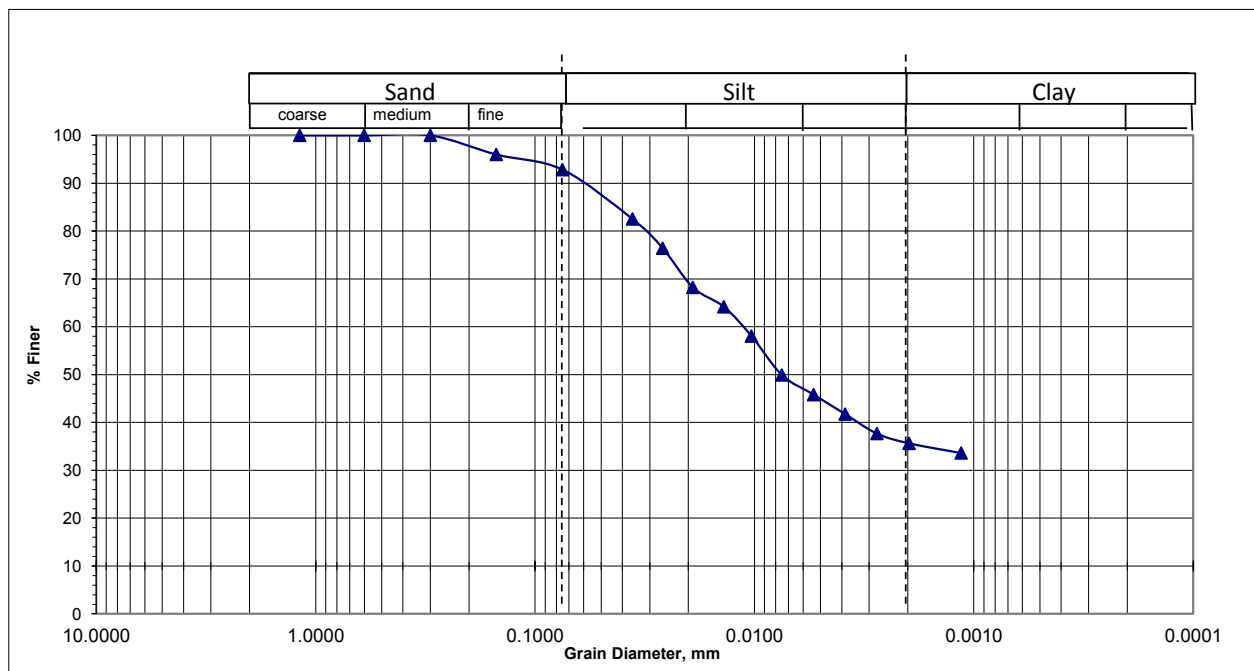
Bore Hole No : BH F34 Sample No. D2

Sampled Date: 10/01/2016

Depth (m) : 3.0

Test Date : 24/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.008 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.15

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =8%, Silt (0.005mm size)= 57% & Clay (0.001mm size) = 35%

### GRAIN SIZE ANALYSIS BY HYDROMETER

Client : Urban Development Directorate (UDD)

Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)

Project Location : Near Health Coplex, Ishan Gopalpur

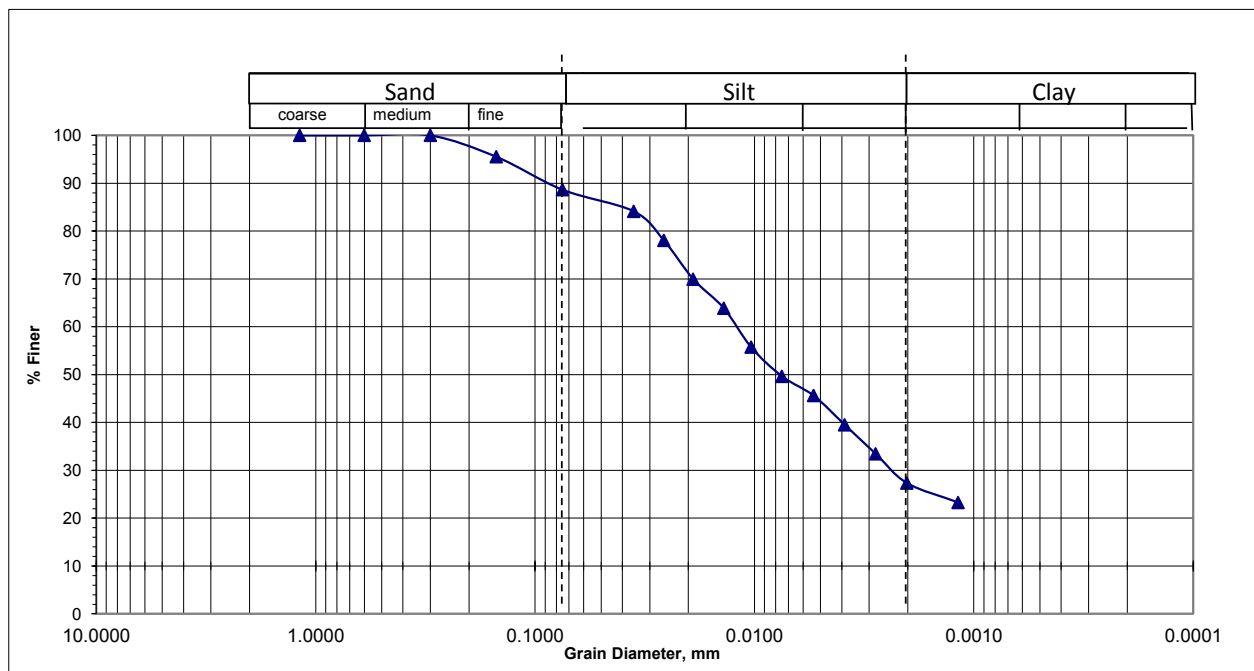
Bore Hole No : BH F36 Sample No. D4

Sampled Date: 09/01/2016

Depth (m) : 6.0

Test Date : 24/02/2016

#### Graphical Representation:



Mean Diameter,  $D_{50}$  = 0.008 mm

Silt-Factor,  $f = 1.76\sqrt{D_{50}}$  = 0.16

% Particles ( from the grain -size analysis graph).

Sand (0.075mm size) =12%, Silt (0.005mm size)= 61% & Clay (0.001mm size) = 27%



## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : SOUTH DIGRIRCHAR MADHOBDA GOVT. PRI. SCHOOL, Madhubdia**

Sample Information:

Sample Date: 5/1/2016

Test Date: 12/9/2016

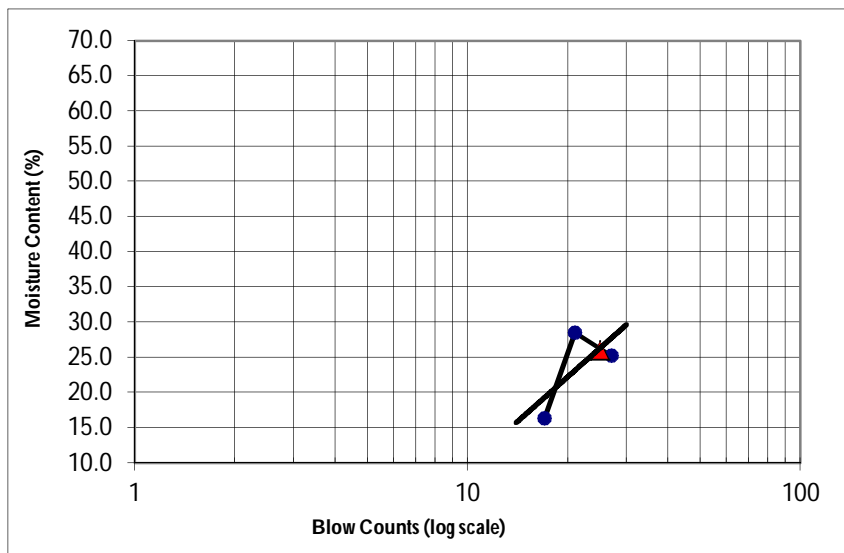
Boring Number BH-02

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C55	C66	C77	Cup Number	Ct103	Ct103
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	99.09	65.03	71.6	Weight of Wet Soil and Cup (g)	21.19	21.55
Weight of Dry Soil and Cup (g)	91.09	60.42	65.5	Weight of Dry Soil and Cup (g)	21.04	21.13
Moisure Content (%)	16.3	28.5	25.3	Moisure Content (%)	10.1	26.6
Blow Counts	17	21	27			

### Compilation of Test Results



Liquid Limit	26
Plastic Limit	18
Plasticity Index	8

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Char Madhabdia Govt.Primary School, Char Madhabdia Bazar, Char Madhabdia**

**Sample Information:**

Sample Date: 6/1/2016

Test Date: 12/9/2016

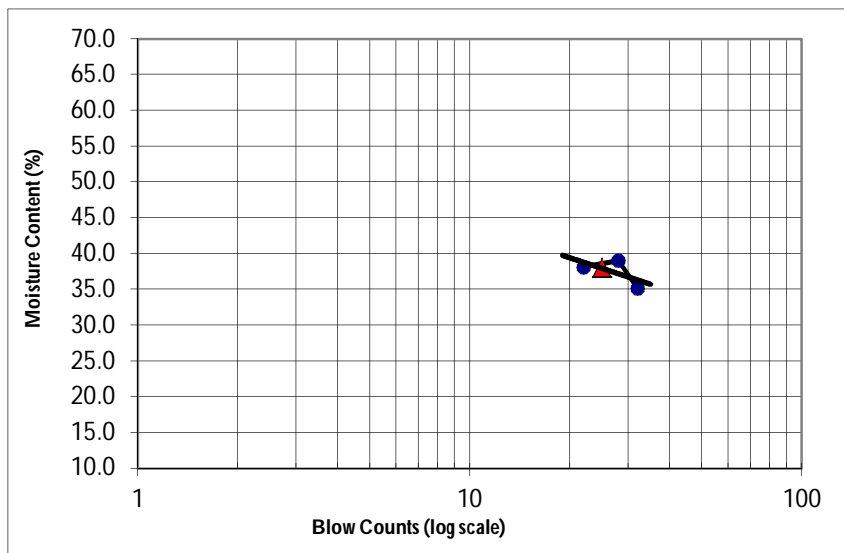
Boring Number BH-04

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C10	C14	C220	Cup Number	Ct302	Ct302
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	118.08	64.13	52.28	Weight of Wet Soil and Cup (g)	13.77	14.08
Weight of Dry Soil and Cup (g)	95.68	56.36	48.22	Weight of Dry Soil and Cup (g)	13.35	13.66
Moisure Content (%)	38.1	39.0	35.2	Moisure Content (%)	35.0	27.8
Blow Counts	22	28	32			

### Compilation of Test Results



Liquid Limit	38
Plastic Limit	31
Plasticity Index	7

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Khalilpur Bazar,Majchar**

Sample Information:

Sample Date: 7/1/2016

Test Date: 12/9/2016

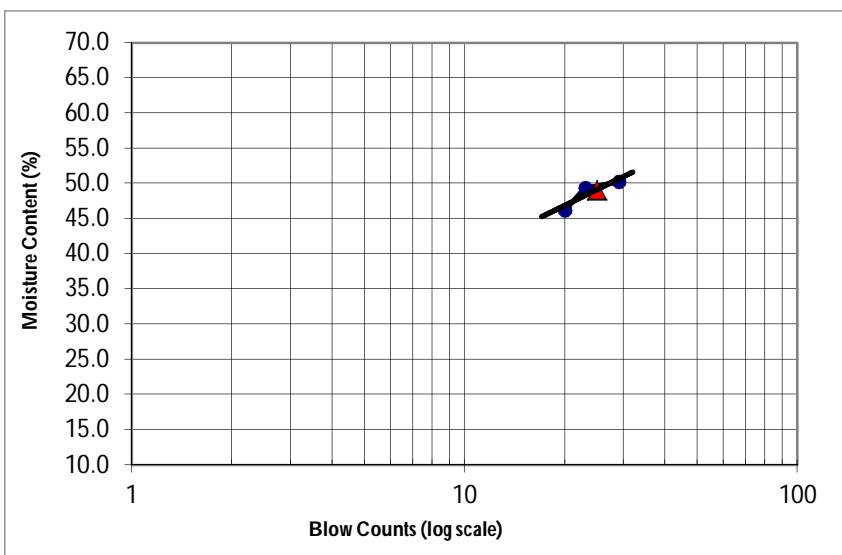
Boring Number BH-10

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C03	C08	C09	Cup Number	Ct111	Ct111
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	105.95	65.52	71.61	Weight of Wet Soil and Cup (g)	21.86	21.95
Weight of Dry Soil and Cup (g)	85.77	58.5	61.49	Weight of Dry Soil and Cup (g)	21.62	21.2
Moisure Content (%)	46.2	49.3	50.2	Moisure Content (%)	11.6	45.5
Blow Counts	20	23	29			

### Compilation of Test Results



Liquid Limit	49
Plastic Limit	29
Plasticity Index	20

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : 5 nos. Decreeerchar, Munshitanggi Aftabuddin Madrasha, Decreeerchar**

Sample Information:

Sample Date: 31/12/2015

Test Date: 12/9/2016

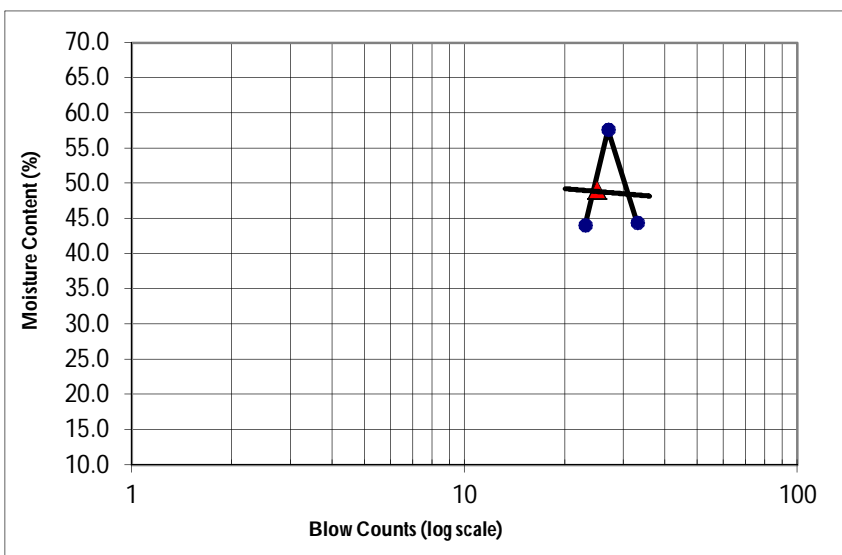
Boring Number BH-11

Sample Number D2

Depth of Sample(m) 3.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C01	C07	C11	Cup Number	Ct102	Ct102
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	117.18	69.43	55.37	Weight of Wet Soil and Cup (g)	14.45	14.38
Weight of Dry Soil and Cup (g)	92.65	57.37	49.62	Weight of Dry Soil and Cup (g)	13.85	13.56
Moisure Content (%)	44.0	57.6	44.4	Moisure Content (%)	35.3	58.2
Blow Counts	23	27	33			

### Compilation of Test Results



Liquid Limit	49
Plastic Limit	47
Plasticity Index	2

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Vajon Dangga Govt. Primary School, Faridpur Sadar**

Sample Information:

Sample Date: 31/12/2015

Test Date: 12/9/2016

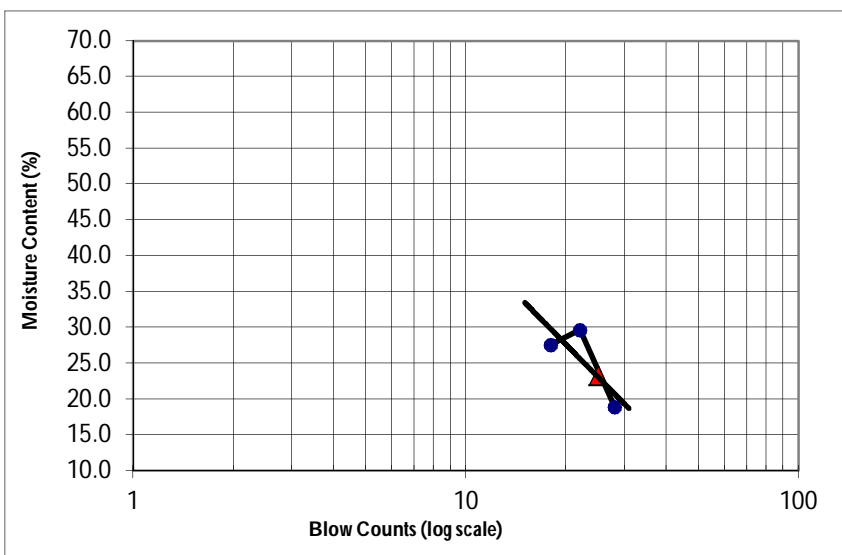
Boring Number BH-14

Sample Number D2

Depth of Sample(m) 3.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C44	C33	C88	Cup Number	Ct104	Ct104
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	100.89	70.53	73.63	Weight of Wet Soil and Cup (g)	21.86	21.65
Weight of Dry Soil and Cup (g)	88.19	64.52	68.5	Weight of Dry Soil and Cup (g)	21.54	21.23
Moisure Content (%)	27.6	29.7	18.9	Moisure Content (%)	16.1	25.0
Blow Counts	18	22	28			

Compilation of Test Results



Liquid Limit	23
Plastic Limit	21
Plasticity Index	3

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Chan Chairman Pukurpar, Baitul-Noor Mosjid, Faridpur Sadar**

Sample Information:

Sample Date: 30/12/2015

Test Date: 13/9/2016

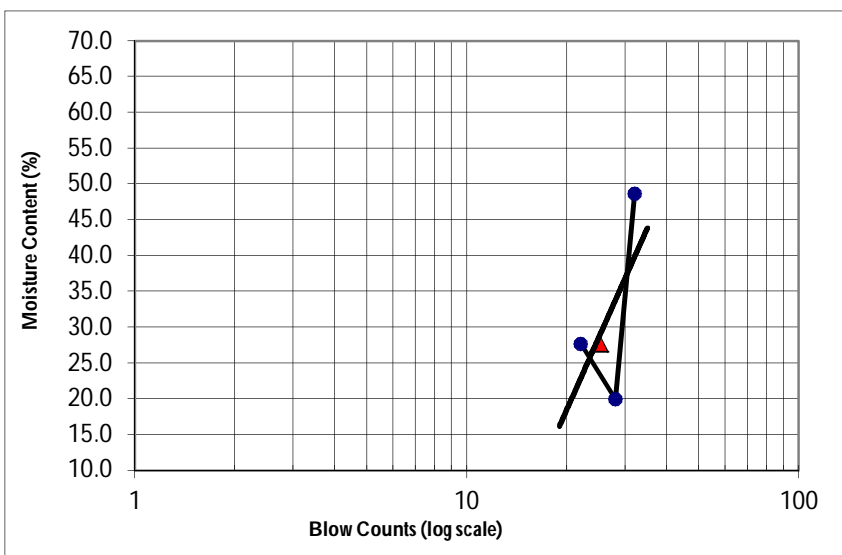
Boring Number BH-15

Sample Number D2

Depth of Sample(m) 3.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C10	C14	C220	Cup Number	Ct302	Ct302
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	117.08	65.13	61.28	Weight of Wet Soil and Cup (g)	13.77	14.18
Weight of Dry Soil and Cup (g)	99.68	60.36	53.22	Weight of Dry Soil and Cup (g)	13.3	13.96
Moisure Content (%)	27.7	19.9	48.7	Moisure Content (%)	40.9	12.2
Blow Counts	22	28	32			

Compilation of Test Results



Liquid Limit	28
Plastic Limit	27
Plasticity Index	1

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : 94 nos. Zhiltuki Govt. Primary School, Panir Tangki Mor, Faridpur Sadar**

Sample Information:

Sample Date: 30/12/2015

Test Date: 13/9/2016

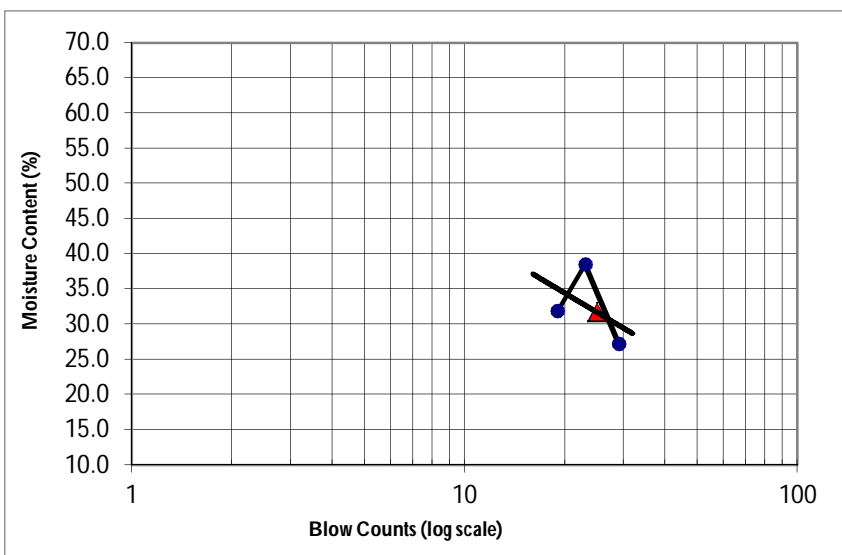
Boring Number BH-16

Sample Number D2

Depth of Sample(m) 3.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C03	C08	C09	Cup Number	Ct111	Ct111
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	104.95	69.52	74.61	Weight of Wet Soil and Cup (g)	21.86	21.85
Weight of Dry Soil and Cup (g)	89.77	62.5	67.49	Weight of Dry Soil and Cup (g)	21.52	21.39
Moisture Content (%)	31.9	38.5	27.2	Moisture Content (%)	17.3	25.0
Blow Counts	19	23	29			

### Compilation of Test Results



Liquid Limit	32
Plastic Limit	21
Plasticity Index	11

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Mohim School Field, Faridpur Sadar**

Sample Information:

Sample Date: 27/12/2015

Test Date: 13/9/2016

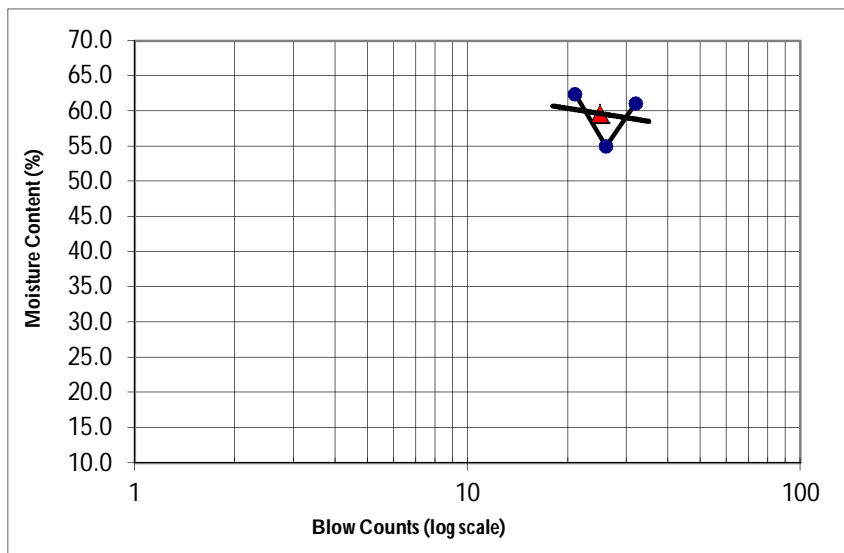
Boring Number BH-17

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C01	C07	C11	Cup Number	Ct102	Ct102
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	124.18	70.43	62.37	Weight of Wet Soil and Cup (g)	14.75	14.68
Weight of Dry Soil and Cup (g)	90.65	58.37	52.62	Weight of Dry Soil and Cup (g)	13.85	13.79
Moisure Content (%)	62.5	55.0	61.1	Moisure Content (%)	52.9	54.3
Blow Counts	21	26	32			

Compilation of Test Results



Liquid Limit	60
Plastic Limit	54
Plasticity Index	6



## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Hadhokandi Govt. Primary School, Oposite side of River Research Institute, Kaijuri**

Sample Information:

Sample Date: 1/1/2016

Test Date: 13/9/2016

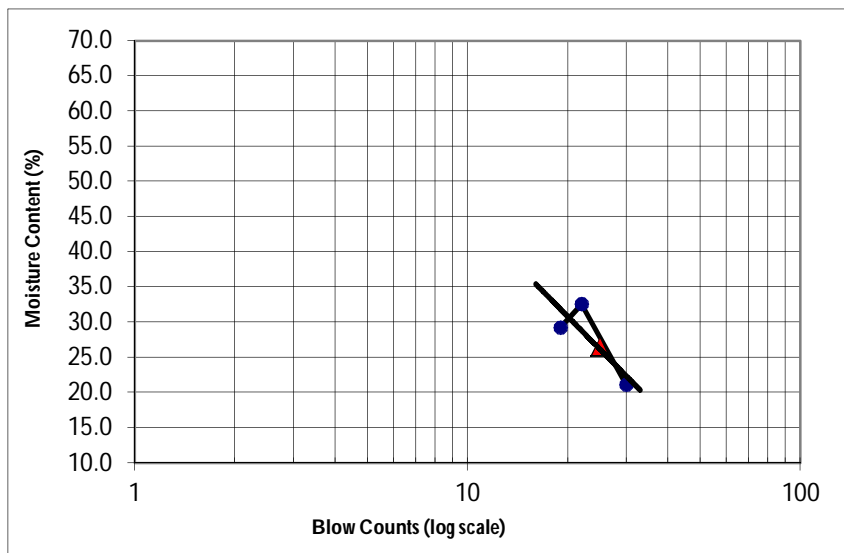
Boring Number BH-20

Sample Number D3

Depth of Sample(m) 4.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C55	C66	C77	Cup Number	Ct103	Ct103
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	95.09	63.03	70.6	Weight of Wet Soil and Cup (g)	21.66	21.55
Weight of Dry Soil and Cup (g)	83.09	58.42	65.5	Weight of Dry Soil and Cup (g)	21.39	21.29
Moisure Content (%)	29.3	32.6	21.1	Moisure Content (%)	14.7	14.9
Blow Counts	19	22	30			

### Compilation of Test Results



Liquid Limit	26
Plastic Limit	15
Plasticity Index	12

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Johora Begum High School Field, Parchim Khabashpur, Faridpur Sadar**

Sample Information:

Sample Date: 27/12/2015

Test Date: 13/9/2016

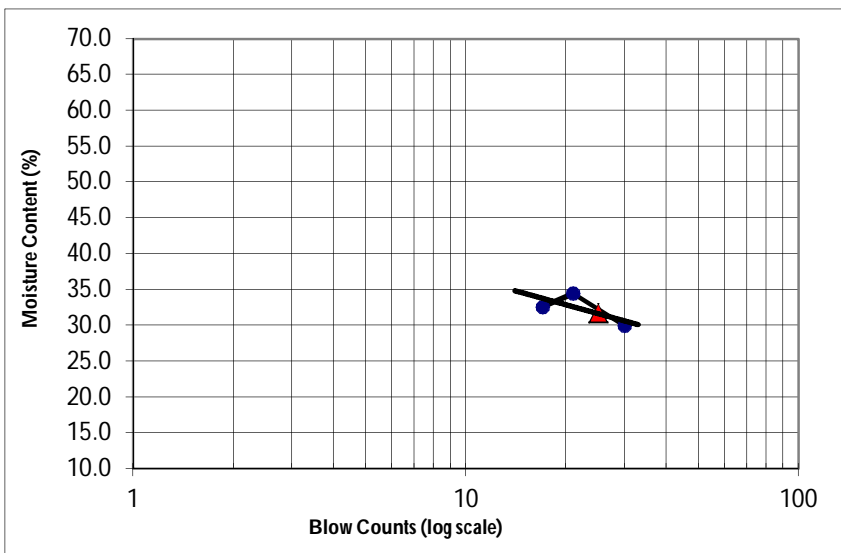
Boring Number BH-21

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C44	C33	C88	Cup Number	Ct104	Ct104
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	101.89	75.53	76.63	Weight of Wet Soil and Cup (g)	21.76	21.37
Weight of Dry Soil and Cup (g)	87.19	67.52	68.5	Weight of Dry Soil and Cup (g)	21.39	21.03
Moisture Content (%)	32.6	34.5	29.9	Moisture Content (%)	20.1	23.0
Blow Counts	17	21	30			

### Compilation of Test Results



Liquid Limit	32
Plastic Limit	22
Plasticity Index	10

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Krish poshikhan Institute gate, Gunggabodi, Krishnanagar**

Sample Information:

Sample Date: 4/1/2016

Test Date: 14/9/2016

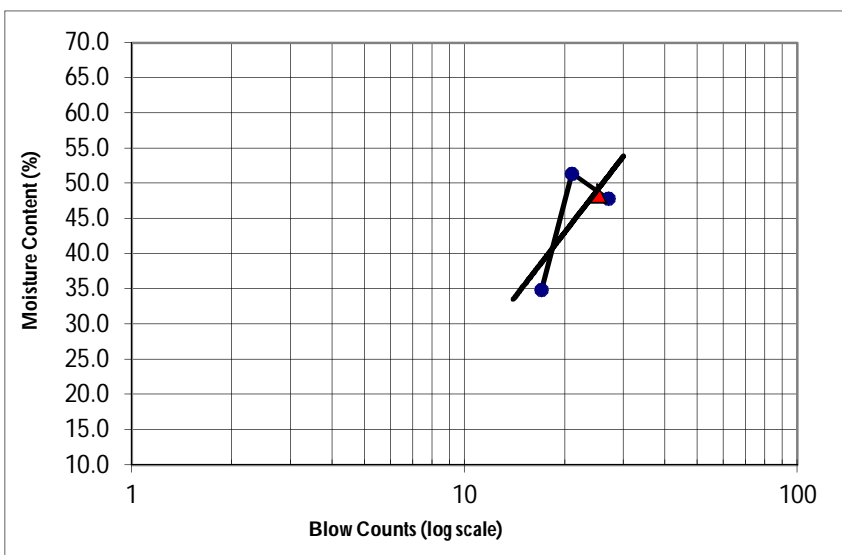
Boring Number BH-19

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C03	C08	C09	Cup Number	Ct111	Ct111
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	96.95	60.52	66.69	Weight of Wet Soil and Cup (g)	21.06	21.75
Weight of Dry Soil and Cup (g)	82.77	55	58.49	Weight of Dry Soil and Cup (g)	20.53	21.59
Moisure Content (%)	34.9	51.4	47.8	Moisure Content (%)	54.1	7.8
Blow Counts	17	21	27			

### Compilation of Test Results



Liquid Limit	49
Plastic Limit	31
Plasticity Index	18

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

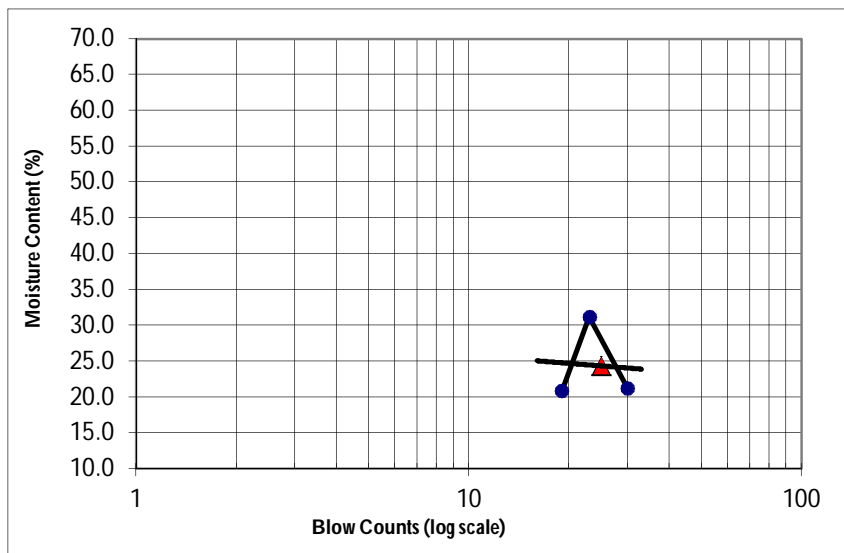
**Project Location : Technical Training Centre, Brahmonkanda, Sreeaungon, Faridpur Sadar**

Sample Information:

Sample Date: 29/12/2015  
Test Date: 14/9/2016  
Boring Number BH-22  
Sample Number D5  
Depth of Sample(m) 7.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C44	C33	C88	Cup Number	Ct104	Ct104
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	109.89	69.53	70.63	Weight of Wet Soil and Cup (g)	21.86	21.45
Weight of Dry Soil and Cup (g)	98.19	63.52	65.5	Weight of Dry Soil and Cup (g)	21.44	21.23
Moisure Content (%)	20.9	31.2	21.2	Moisure Content (%)	22.2	13.1
Blow Counts	19	23	30			

### Compilation of Test Results



Liquid Limit	24
Plastic Limit	18
Plasticity Index	7

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Choyata, Aliabad**

Sample Information:

Sample Date: 31/12/2016

Test Date: 14/9/2016

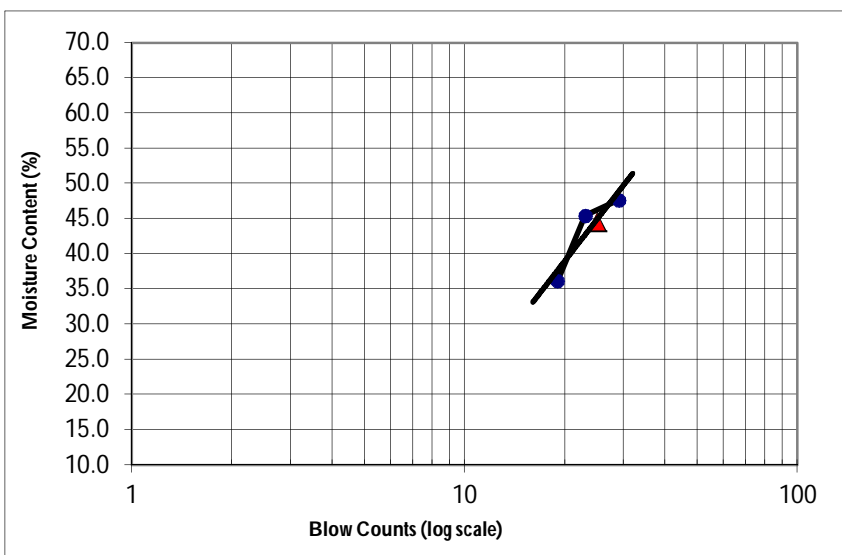
Boring Number BH-23

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C55	C66	C77	Cup Number	Ct103	Ct103
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	91.09	59.03	64.6	Weight of Wet Soil and Cup (g)	21.86	21.75
Weight of Dry Soil and Cup (g)	78.09	54.42	57.1	Weight of Dry Soil and Cup (g)	21.44	21.23
Moisure Content (%)	36.2	45.4	47.6	Moisure Content (%)	22.2	31.0
Blow Counts	19	23	29			

### Compilation of Test Results



Liquid Limit	45
Plastic Limit	27
Plasticity Index	18

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Near Payarpur Godaoun, Kaijuri**

Sample Information:

Sample Date: 2/1/2016

Test Date: 14/9/2016

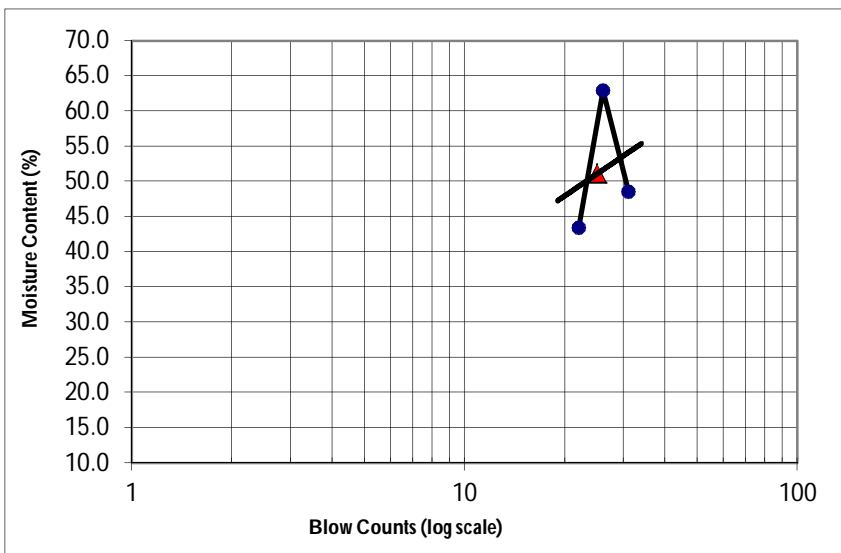
Boring Number BH-24

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C01	C07	C11	Cup Number	Ct102	Ct102
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	121.18	75.43	60.37	Weight of Wet Soil and Cup (g)	14.59	14.38
Weight of Dry Soil and Cup (g)	95.65	60.37	52.62	Weight of Dry Soil and Cup (g)	13.59	13.96
Moisure Content (%)	43.5	63.0	48.6	Moisure Content (%)	69.4	23.2
Blow Counts	22	26	31			

Compilation of Test Results



Liquid Limit	51
Plastic Limit	46
Plasticity Index	5

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Gobinddapur Hat, Krishnanagar**

Sample Information:

Sample Date: 4/1/2016

Test Date: 14/9/2016

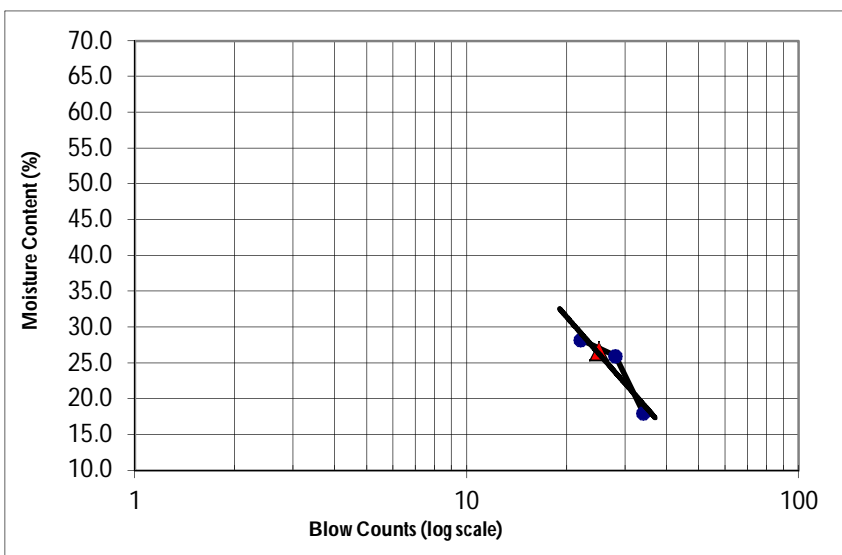
Boring Number BH-26

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C10	C14	C220	Cup Number	Ct302	Ct302
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	125.08	74.13	63.28	Weight of Wet Soil and Cup (g)	13.45	14.18
Weight of Dry Soil and Cup (g)	105.68	66.36	59.22	Weight of Dry Soil and Cup (g)	13.35	13.66
Moisure Content (%)	28.2	26.0	18.0	Moisure Content (%)	8.3	34.4
Blow Counts	22	28	34			

### Compilation of Test Results



Liquid Limit	27
Plastic Limit	21
Plasticity Index	6

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Bakhunda College Field, Bakhunda, Greda**

Sample Information:

Sample Date: 2/1/2016

Test Date: 15/9/2016

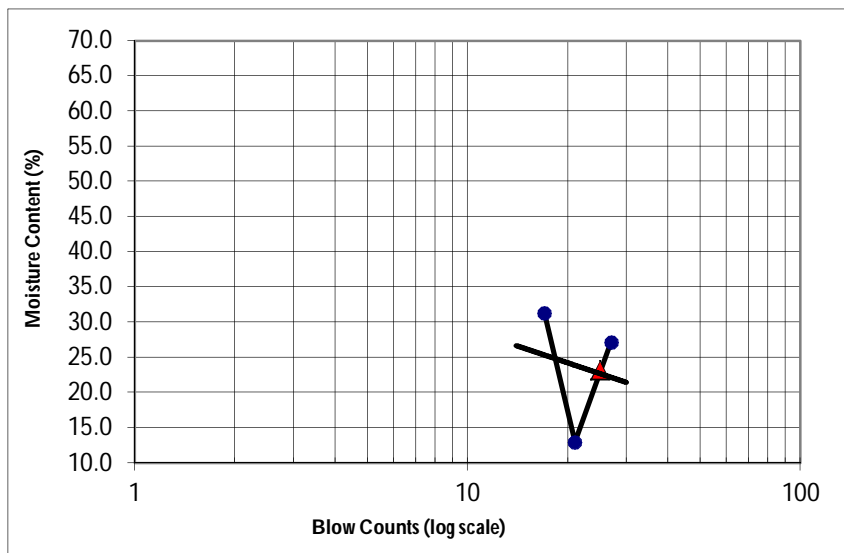
Boring Number BH-27

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C55	C66	C77	Cup Number	Ct103	Ct103
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	105.09	67.03	74.6	Weight of Wet Soil and Cup (g)	21.76	21.75
Weight of Dry Soil and Cup (g)	90.09	64.42	67.5	Weight of Dry Soil and Cup (g)	21.44	21.33
Moisure Content (%)	31.3	13.0	27.2	Moisure Content (%)	16.9	23.6
Blow Counts	17	21	27			

### Compilation of Test Results



Liquid Limit	23
Plastic Limit	20
Plasticity Index	3



## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Chacia fokirbari Road, Kaijuri**

Sample Information:

Sample Date: 2/1/2016

Test Date: 15/9/2016

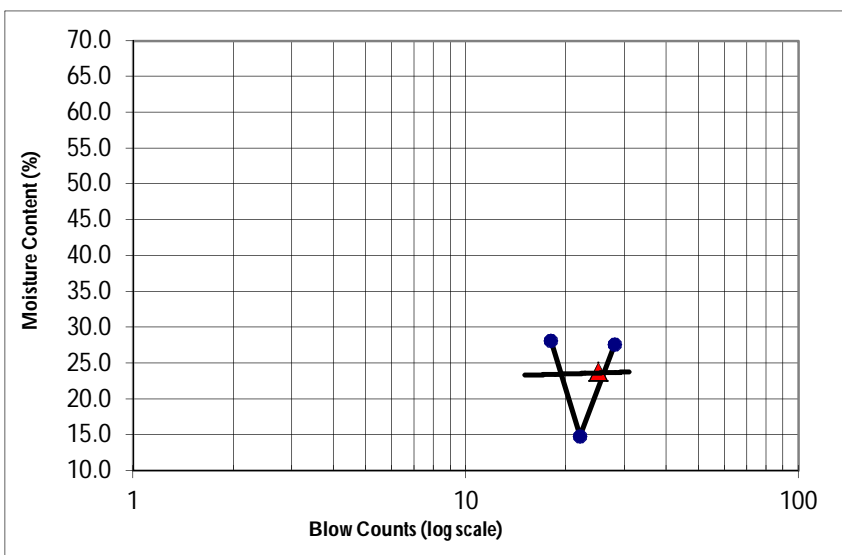
Boring Number BH-28

Sample Number D1

Depth of Sample(m) 1.5

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C44	C33	C88	Cup Number	Ct104	Ct104
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	99.89	67.53	69.63	Weight of Wet Soil and Cup (g)	21.96	21.63
Weight of Dry Soil and Cup (g)	87.19	64.52	63.5	Weight of Dry Soil and Cup (g)	21.51	21.33
Moisure Content (%)	28.2	14.9	27.7	Moisure Content (%)	23.0	16.9
Blow Counts	18	22	28			

Compilation of Test Results



Liquid Limit	24
Plastic Limit	20
Plasticity Index	4

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Kanaipur Akhak Centre, Kanaipur**

Sample Information:

Sample Date: 4/1/2016

Test Date: 15/9/2016

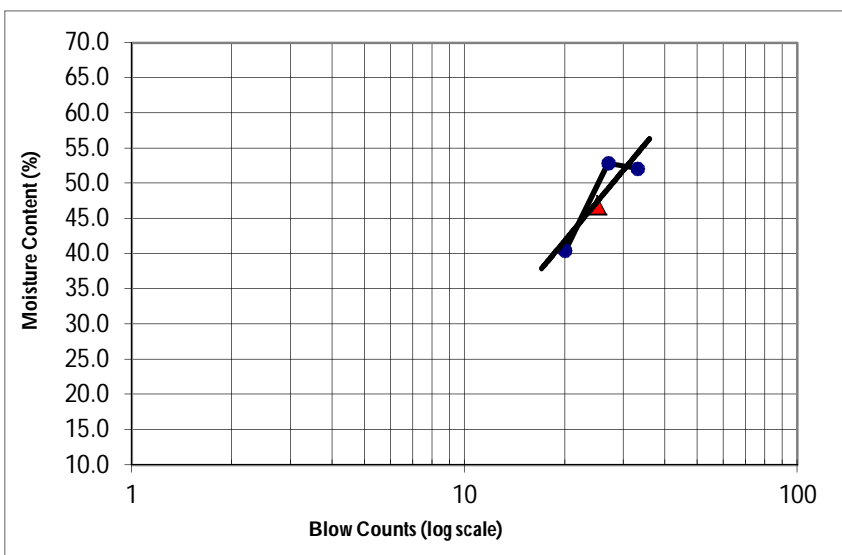
Boring Number BH-29

Sample Number D2

Depth of Sample(m) 3.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C01	C07	C11	Cup Number	Ct102	Ct102
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	115.18	68.43	56.37	Weight of Wet Soil and Cup (g)	14.61	14.39
Weight of Dry Soil and Cup (g)	92.65	57.37	49.62	Weight of Dry Soil and Cup (g)	13.85	13.76
Moisure Content (%)	40.5	52.9	52.1	Moisure Content (%)	44.7	39.1
Blow Counts	20	27	33			

Compilation of Test Results



Liquid Limit	47
Plastic Limit	42
Plasticity Index	5

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Madhobpur Govt. Primary School, Mallikpur Bazar, Krishnanagar**

Sample Information:

Sample Date: 5/1/2016

Test Date: 15/9/2016

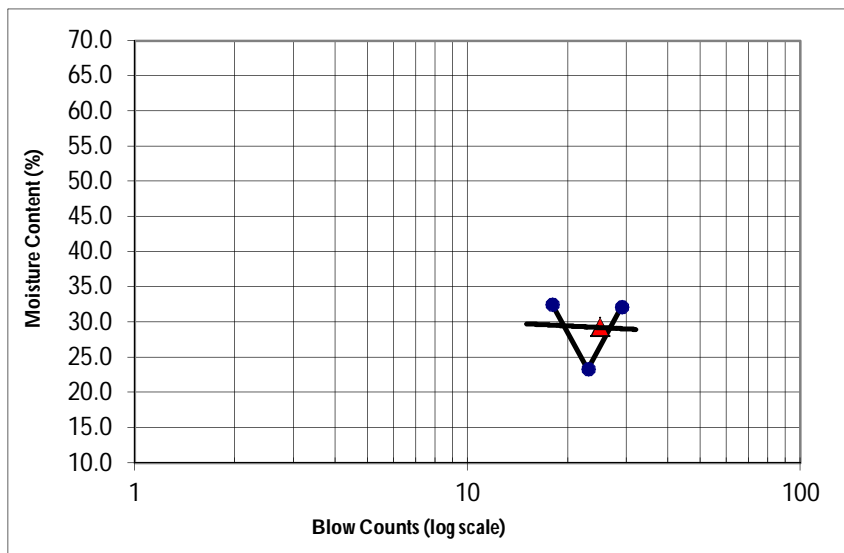
Boring Number BH-30

Sample Number D2

Depth of Sample(m) 3.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C03	C08	C09	Cup Number	Ct111	Ct111
Weight of Cup (g)	42.13	44.27	41.35	Weight of Cup (g)	19.55	19.55
Weight of Wet Soil and Cup (g)	99.95	65.52	70.61	Weight of Wet Soil and Cup (g)	21.96	21.95
Weight of Dry Soil and Cup (g)	85.77	61.5	63.49	Weight of Dry Soil and Cup (g)	21.62	21.26
Moisure Content (%)	32.5	23.3	32.2	Moisure Content (%)	16.4	40.4
Blow Counts	18	23	29			

### Compilation of Test Results



Liquid Limit	29
Plastic Limit	28
Plasticity Index	1

## Laboratory Test Results of Atterberg Limits of Soil (ASTM Designation:D4318)

**Client : Urban Development Directorate (UDD)**

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Project Location : Tonthoniar Hat, End of Kanaipur Union**

Sample Information:

Sample Date: 10/1/2016

Test Date: 15/9/2016

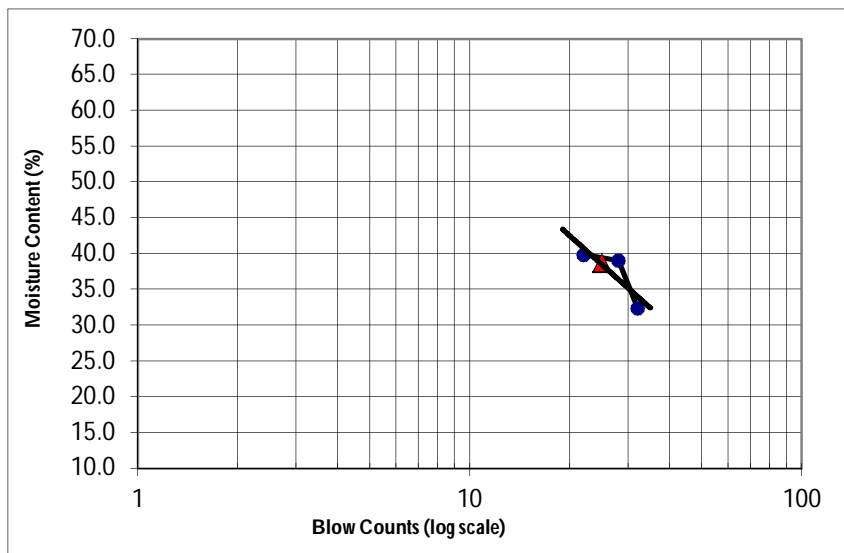
Boring Number BH-34

Sample Number D2

Depth of Sample(m) 3.0

Determination of Liquid Limit				Determination of Plastic Limit		
Cup Number	C10	C14	C220	Cup Number	Ct302	Ct302
Weight of Cup (g)	36.96	36.45	36.67	Weight of Cup (g)	12.15	12.15
Weight of Wet Soil and Cup (g)	119.08	64.13	53.28	Weight of Wet Soil and Cup (g)	13.77	14.08
Weight of Dry Soil and Cup (g)	95.68	56.36	49.22	Weight of Dry Soil and Cup (g)	13.35	13.76
Moisure Content (%)	39.9	39.0	32.4	Moisure Content (%)	35.0	19.9
Blow Counts	22	28	32			

Compilation of Test Results

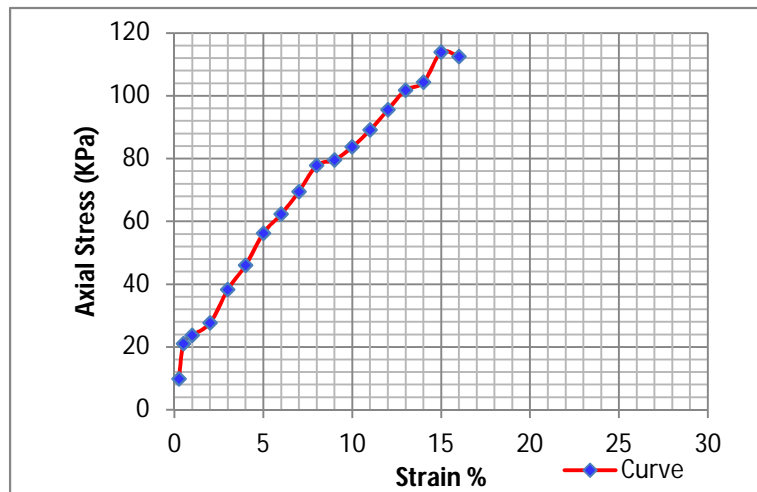


Liquid Limit	39
Plastic Limit	27
Plasticity Index	11

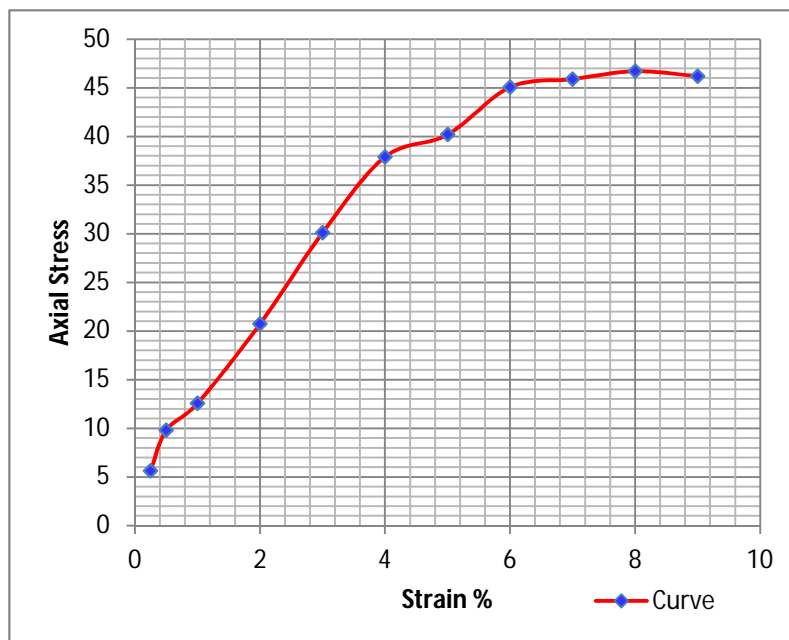
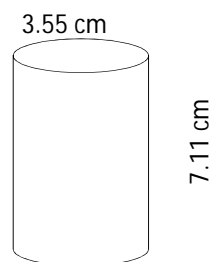
Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: SOUTH DIGRIRCHAR MADHOBDA GOVT. PRI. SCHOOL, Madhubdia & Char Madhabdia Govt.Primary School, Char Madhabdia Bazar, Char Madhabdia

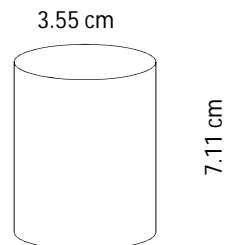
### UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-02
Sample No.	UD-1
Depth (m)	3.10 to 3.55
Description of soil	silty clay with sand
qu (Kpa)	113.85
% Strain	15.0
$\gamma_{wet}$ (gm/cc)	1.91
$\gamma_{Dry}$ (gm/cc)	1.44
% Moisture	32.34
Cohesion (Kpa)	56.93

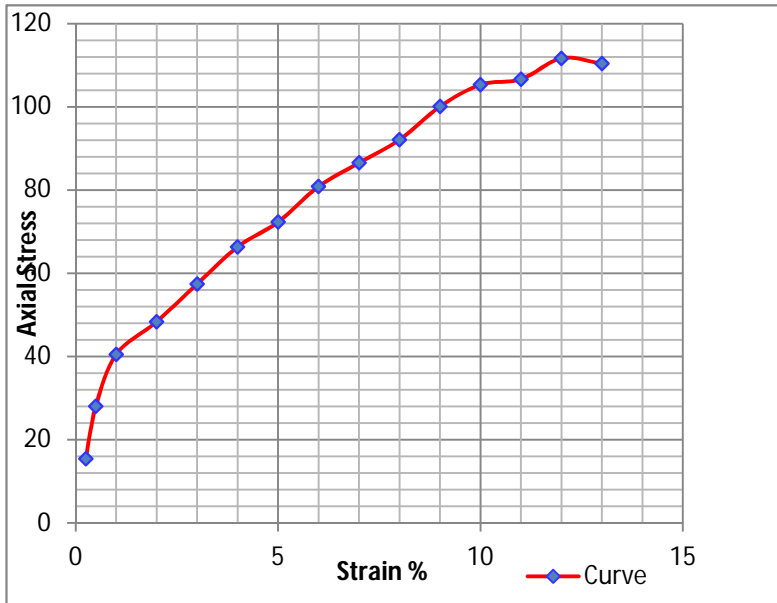


Bore hole No.	BH-04
Sample No.	UD-1
Depth (m)	2.10 to 2.55
Description of soil	Clay with Sand
qu (Kpa)	46.70
% Strain	8.0
$\gamma_{wet}$ (gm/cc)	2.19
$\gamma_{Dry}$ (gm/cc)	1.84
% Moisture	18.81
Cohesion (Kpa)	23.35

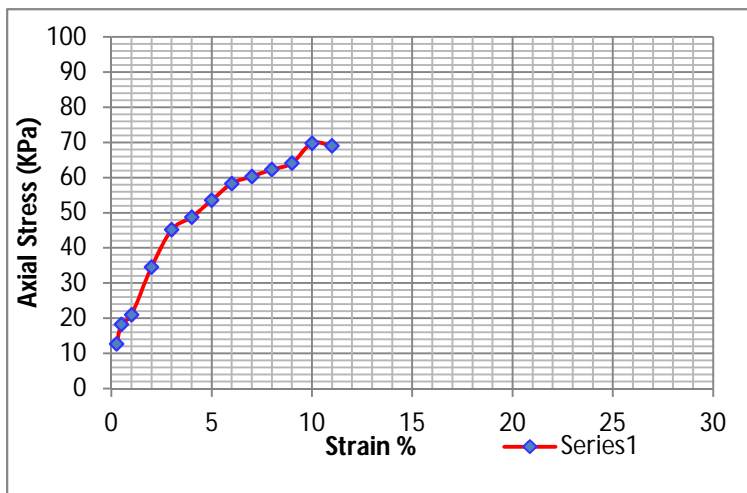
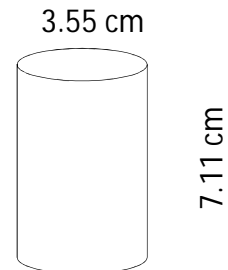


Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)  
Location: Near Madhankali Swith gate, Ambikapur & Dhuldi Railgate, Dhuldi Bazar, Majchar

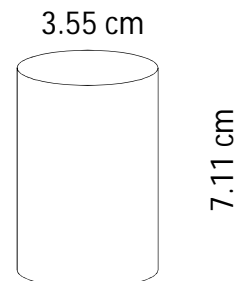
### UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-07
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silt with Clay and Sand
qu (Kpa)	111.67
% Strain	12.0
$\gamma_{wet}$ (gm/cc)	1.84
$\gamma_{Dry}$ (gm/cc)	1.49
% Moisture	23.54
Cohesion (Kpa)	55.83

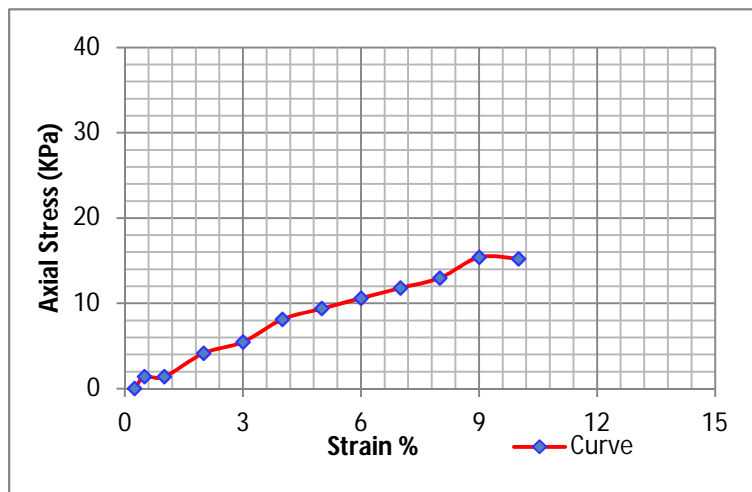


Bore hole No.	BH-09
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	SILT with Sand
qu (Kpa)	62.26
% Strain	8.0
$\gamma_{wet}$ (gm/cc)	2.20
$\gamma_{Dry}$ (gm/cc)	1.77
% Moisture	24.19
Cohesion (Kpa)	31.13

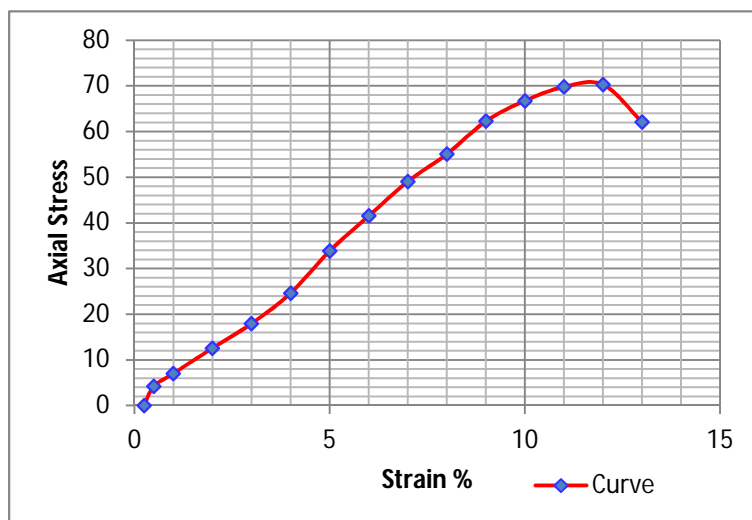
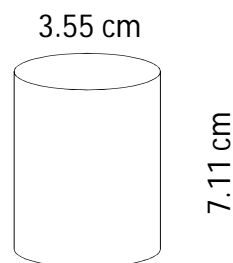


Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)  
Location: 5 nos. Decreerchar, Munshitanggi Aftabuddin Madrasha, Decreerchar  
& Vajon Dangga Govt. Primary School, Faridpur Sadar

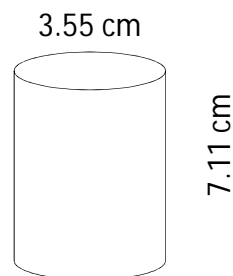
### UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-11
Sample No.	UD-1
Depth (m)	3.10 to 3.55
Description of soil	Silty Clay
qu (Kpa)	15.40
% Strain	9.0
$\gamma_{wet}$ (gm/cc)	1.39
$\gamma_{Dry}$ (gm/cc)	0.78
% Moisture	78.05
Cohesion (Kpa)	7.70



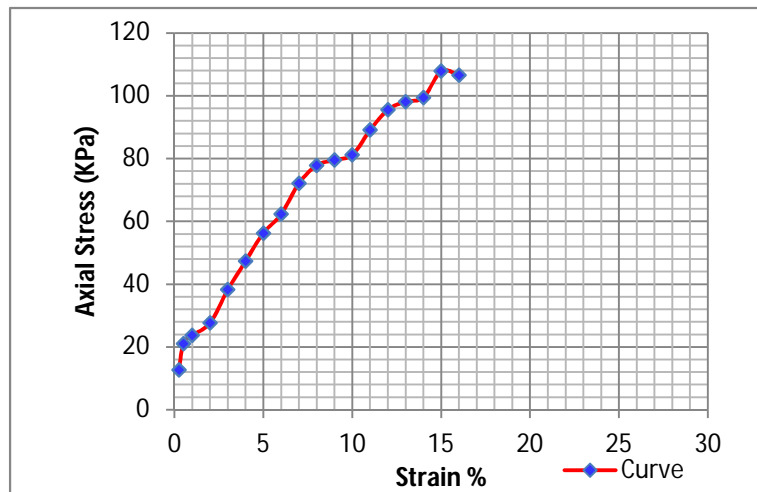
Bore hole No.	BH-14
Sample No.	UD-1
Depth (m)	4.40 to 4.85
Description of soil	Silty Clay
qu (Kpa)	40.20
% Strain	14.0
$\gamma_{wet}$ (gm/cc)	1.82
$\gamma_{Dry}$ (gm/cc)	1.36
% Moisture	33.59
Cohesion (Kpa)	20.10



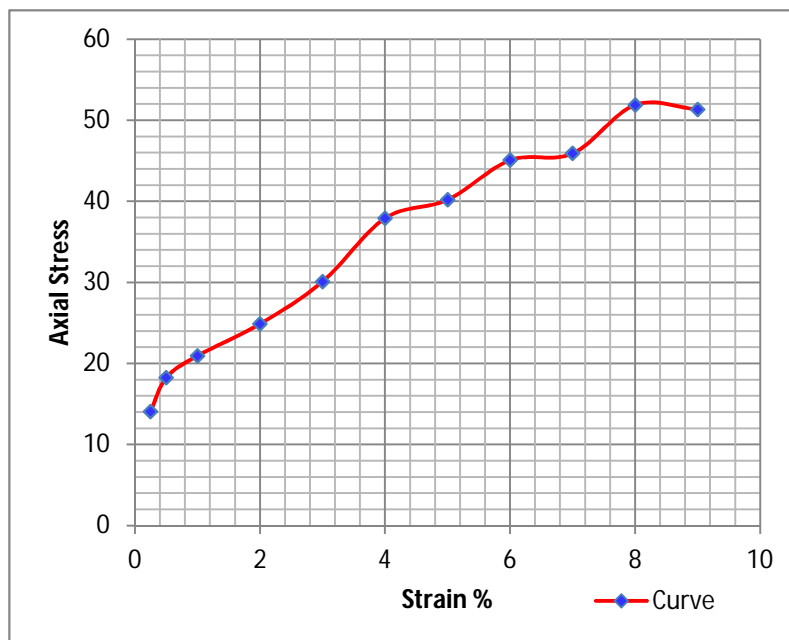
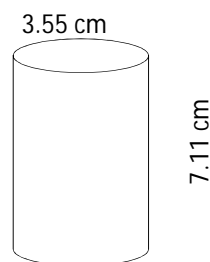
Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Chan Chairman Pukurpar, Baitul-Noor Mosjid, Faridpur Sadar &94 nos. Zhiltuki Govt. Primary School, Panir Tangki Mor, Faridpur Sadar

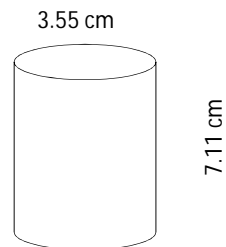
### UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-15
Sample No.	UD-1
Depth (m)	3.10 to 3.55
Description of soil	Silty Clay
qu (Kpa)	107.86
% Strain	15.0
$\gamma_{wet}$ (gm/cc)	2.01
$\gamma_{Dry}$ (gm/cc)	1.44
% Moisture	39.29
Cohesion (Kpa)	53.93



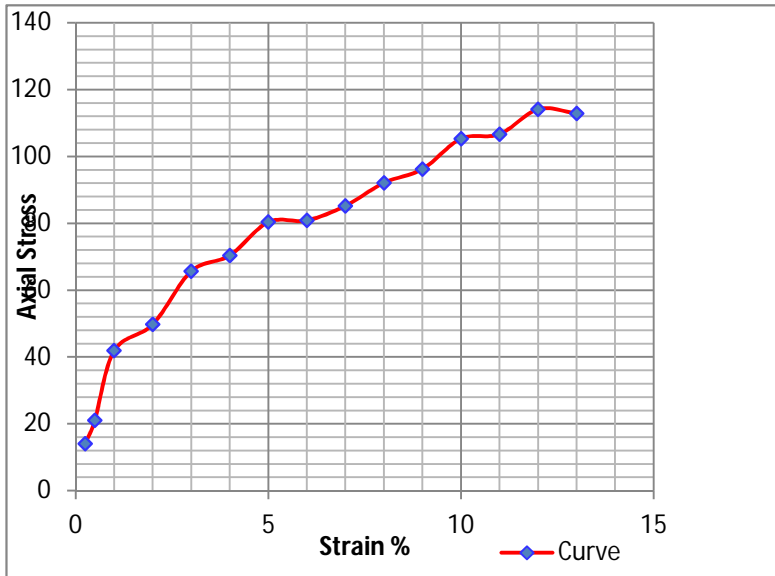
Bore hole No.	BH-16
Sample No.	UD-1
Depth (m)	3.10 to 3.55
Description of soil	Clay with Sand
qu (Kpa)	51.89
% Strain	8.0
$\gamma_{wet}$ (gm/cc)	2.12
$\gamma_{Dry}$ (gm/cc)	1.84
% Moisture	15.21
Cohesion (Kpa)	25.94



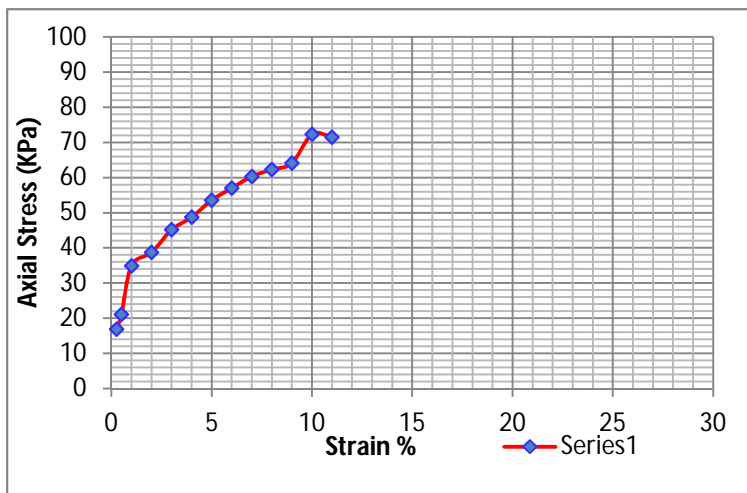
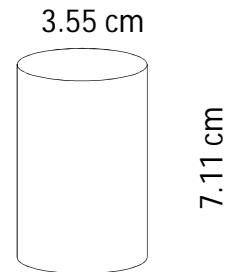


Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)  
Location: Mohim School Field, Faridpur Sadar & Raghu Nandanpur Madrasa, Ambikapur

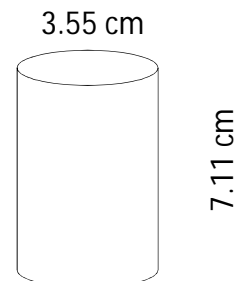
### UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-17
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silt With Sand
qu (Kpa)	114.15
% Strain	12.0
$\gamma_{wet}$ (gm/cc)	1.92
$\gamma_{Dry}$ (gm/cc)	1.52
% Moisture	26.46
Cohesion (Kpa)	57.08



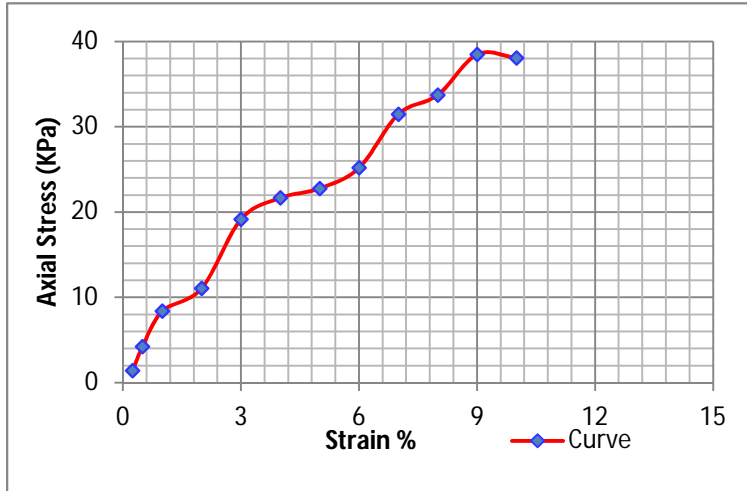
Bore hole No.	BH-18
Sample No.	UD-1
Depth (m)	2.10 to 2.55
Description of soil	SILT with Sand
qu (Kpa)	72.33
% Strain	10.0
$\gamma_{wet}$ (gm/cc)	2.20
$\gamma_{Dry}$ (gm/cc)	1.82
% Moisture	20.34
Cohesion (Kpa)	36.17



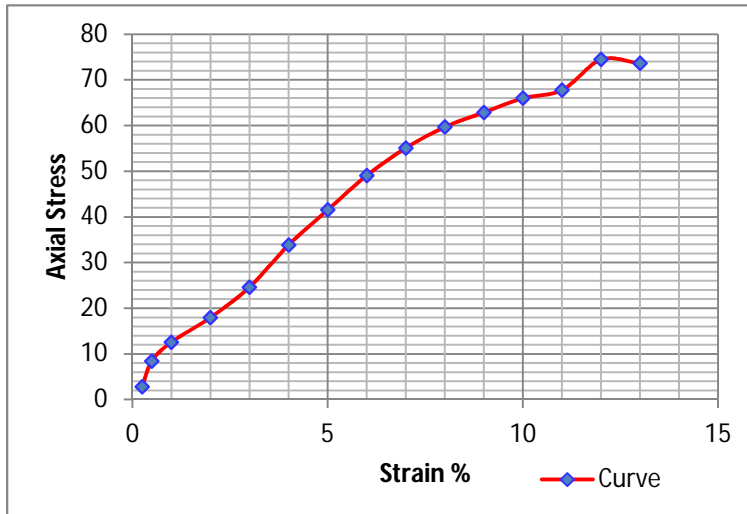
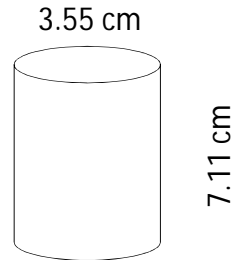
Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)

Location: Hadhokandi Govt. Primary School, Oposite side of River Research Institute, Kaijuri & Johora Begum High School Field, Mia Para Road, Parchim Khabashpur, Faridpur Sadar

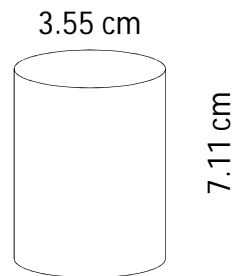
### UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-20
Sample No.	UD-1
Depth (m)	4.10 to 4.55
Description of soil	Clay
qu (Kpa)	38.49
% Strain	9.0
$\gamma_{wet}$ (gm/cc)	1.42
$\gamma_{Dry}$ (gm/cc)	1.11
% Moisture	27.93
Cohesion (Kpa)	19.25

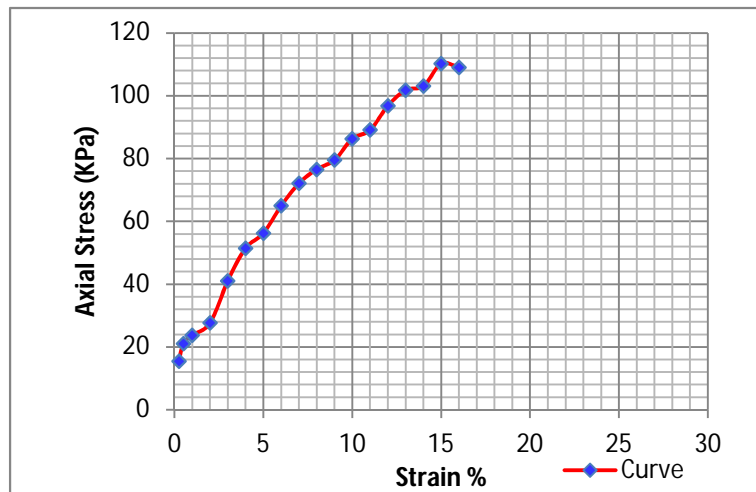


Bore hole No.	BH-21
Sample No.	UD-1
Depth (m)	2.10 to 2.55
Description of soil	Silty Clay
qu (Kpa)	40.20
% Strain	14.0
$\gamma_{wet}$ (gm/cc)	1.87
$\gamma_{Dry}$ (gm/cc)	0.51
% Moisture	267.79
Cohesion (Kpa)	20.10

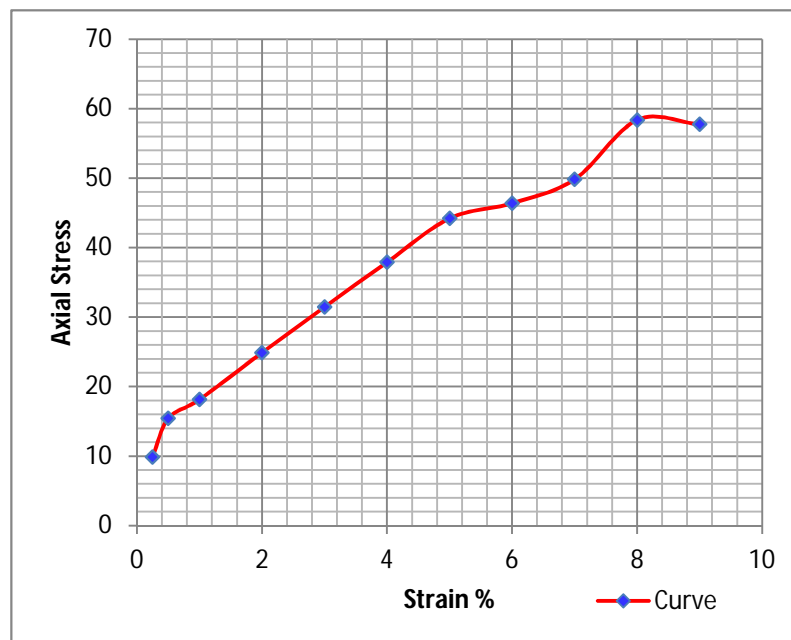
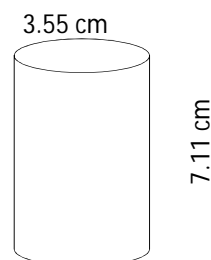


Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)  
Location: Technical Training Centre, Brahmonkanda, Sreeaungon, Faridpur Sadar  
& Choyata, Aliabad

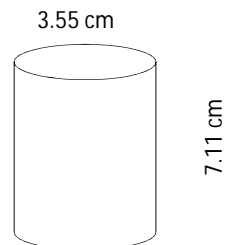
### UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-22
Sample No.	UD-1
Depth (m)	4.10 to 4.55
Description of soil	Silty Clay
qu (Kpa)	110.26
% Strain	15.0
$\gamma_{wet}$ (gm/cc)	2.02
$\gamma_{Dry}$ (gm/cc)	1.51
% Moisture	33.63
Cohesion (Kpa)	55.13

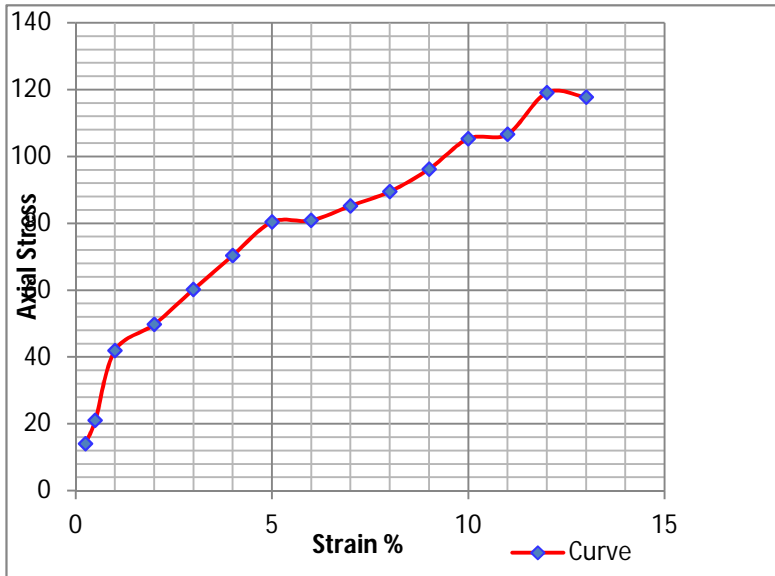


Bore hole No.	BH-23
Sample No.	UD-1
Depth (m)	3.10 to 3.55
Description of soil	Silty Clay
qu (Kpa)	58.37
% Strain	8.0
$\gamma_{wet}$ (gm/cc)	2.17
$\gamma_{Dry}$ (gm/cc)	1.93
% Moisture	12.34
Cohesion (Kpa)	29.19

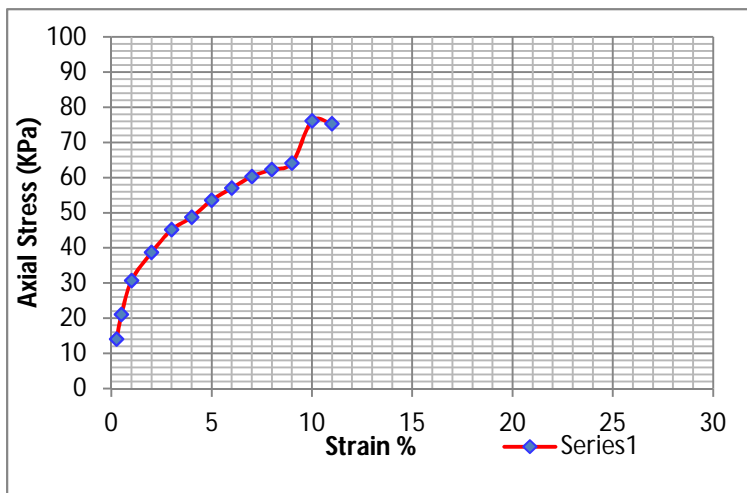
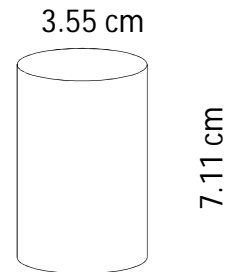


Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)  
Location: Near Payarpur Godaoun, Kaijuri & Krish poshikhan Institute gate, Gunggabodi, Krishnanagar

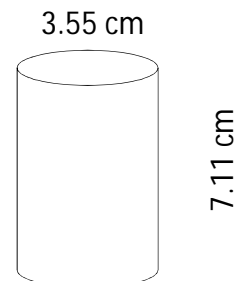
### UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-24
Sample No.	UD-1
Depth (m)	2.20 to 2.65
Description of soil	Silty Clay
qu (Kpa)	119.11
% Strain	12.0
$\gamma_{wet}$ (gm/cc)	1.94
$\gamma_{Dry}$ (gm/cc)	1.56
% Moisture	24.83
Cohesion (Kpa)	59.56

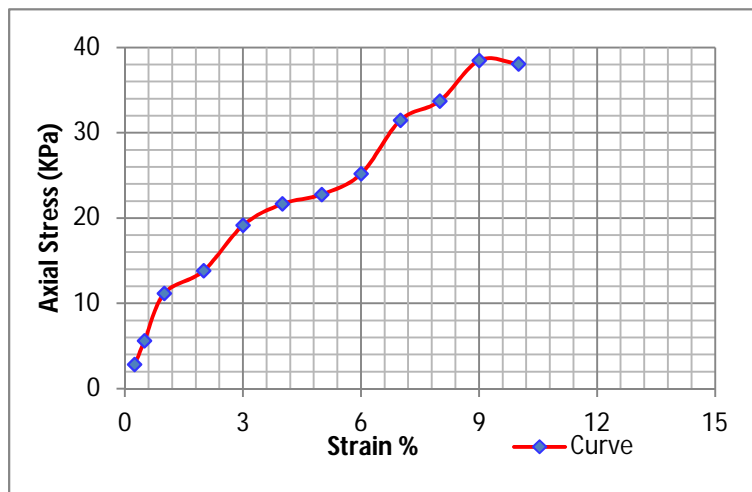


Bore hole No.	BH-25
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	SILT with Sand
qu (Kpa)	76.14
% Strain	10.0
$\gamma_{wet}$ (gm/cc)	2.29
$\gamma_{Dry}$ (gm/cc)	1.85
% Moisture	23.84
Cohesion (Kpa)	38.07



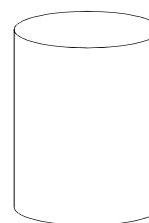
Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)  
Location: Gobinddapur Hat, Krishnanagar &Bakhunda College Field, Bakhunda, Greda

### UNCONFINED COMPRESSION STRENGTH TEST

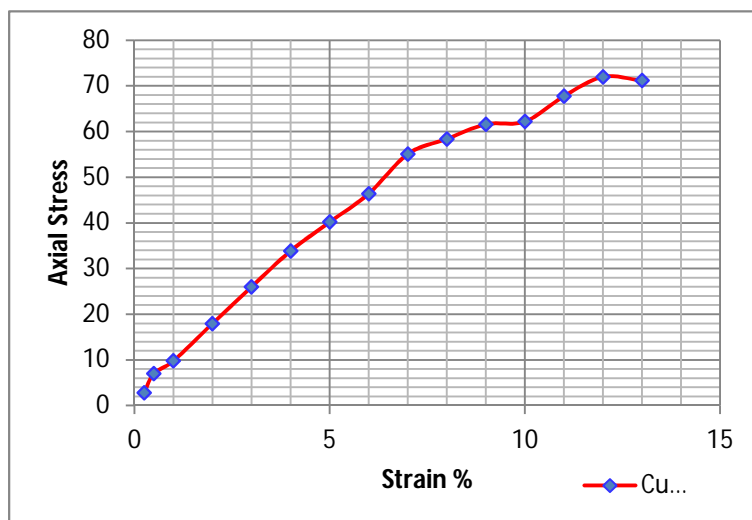


Bore hole No.	BH-26
Sample No.	UD-1
Depth (m)	3.20 to 3.65
Description of soil	Silty Clay
qu (Kpa)	38.49
% Strain	9.0
$\gamma_{wet}$ (gm/cc)	1.58
$\gamma_{Dry}$ (gm/cc)	1.20
% Moisture	31.86
Cohesion (Kpa)	19.25

3.55 cm

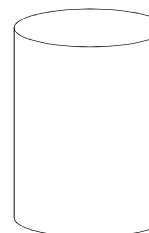


7.11 cm



Bore hole No.	BH-27
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silty with Clay & Sand
qu (Kpa)	40.20
% Strain	14.0
$\gamma_{wet}$ (gm/cc)	2.01
$\gamma_{Dry}$ (gm/cc)	1.40
% Moisture	44.20
Cohesion (Kpa)	20.10

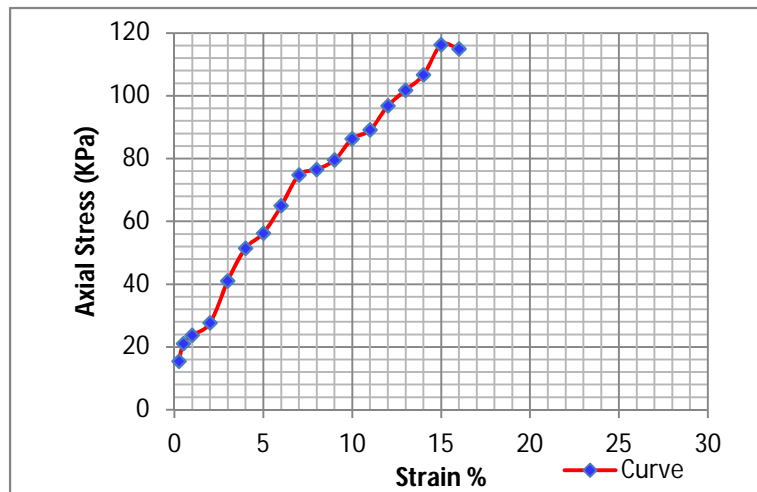
3.55 cm



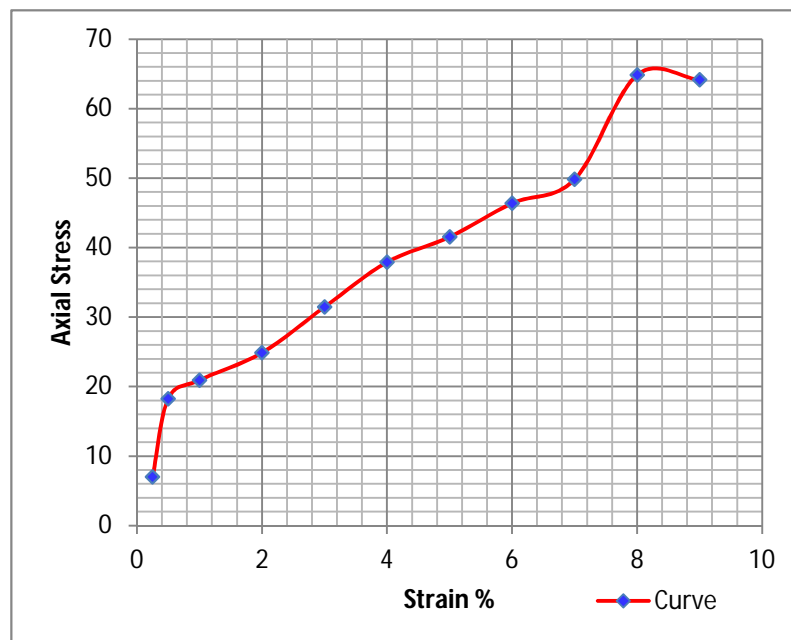
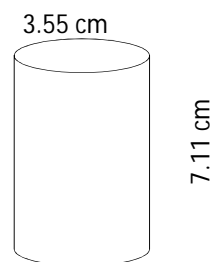
7.11 cm

Project :Preparation of Development Plan for Fourteen Upazilas(Package-3)  
Location: Madhobpur Govt. Primary School, Mallikpur Bazar, Krishnanagar  
& Tonthoniar Hat, End of Kanaipur Union

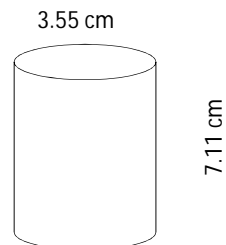
### UNCONFINED COMPRESSION STRENGTH TEST



Bore hole No.	BH-30
Sample No.	UD-1
Depth (m)	5.20 to 5.65
Description of soil	Clay With Sand
qu (Kpa)	116.25
% Strain	15.0
$\gamma_{wet}$ (gm/cc)	1.88
$\gamma_{Dry}$ (gm/cc)	1.43
% Moisture	31.67
Cohesion (Kpa)	58.13



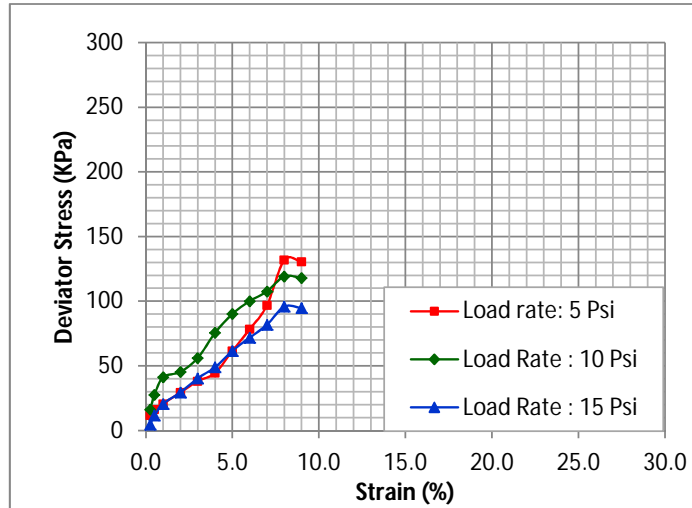
Bore hole No.	BH-34
Sample No.	UD-1
Depth (m)	5.10 to 5.55
Description of soil	Silt with Sand
qu (Kpa)	64.86
% Strain	8.0
$\gamma_{wet}$ (gm/cc)	2.02
$\gamma_{Dry}$ (gm/cc)	1.79
% Moisture	13.32
Cohesion (Kpa)	32.43



**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**  
**SOUTH DIGIRCHAR MADHOBDA GOVT. PRI. SCHOOL, Madhubdia**

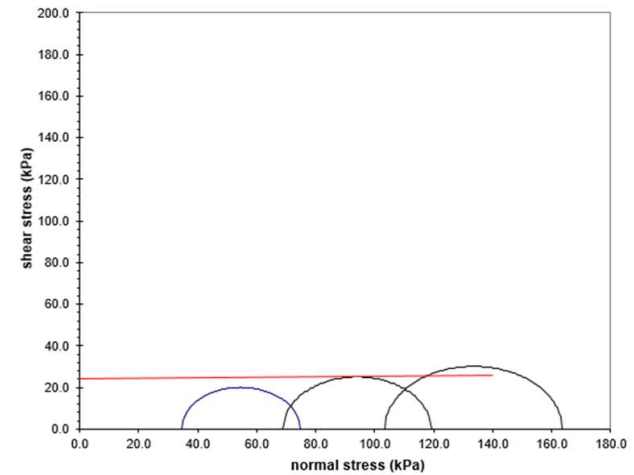
**Triaxial Compression Test**  
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	22.97	1.70
—◆—	27.57	1.67
—▲—	22.66	1.69

**MOHRS STRESS DIAGRAM**



Borehole No.	BH-02
Sample No.	UD-01
Depth (m)	5.10 to 5.55
Cohesion (KPa)	24
Angle of Friction (Degree)	0

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

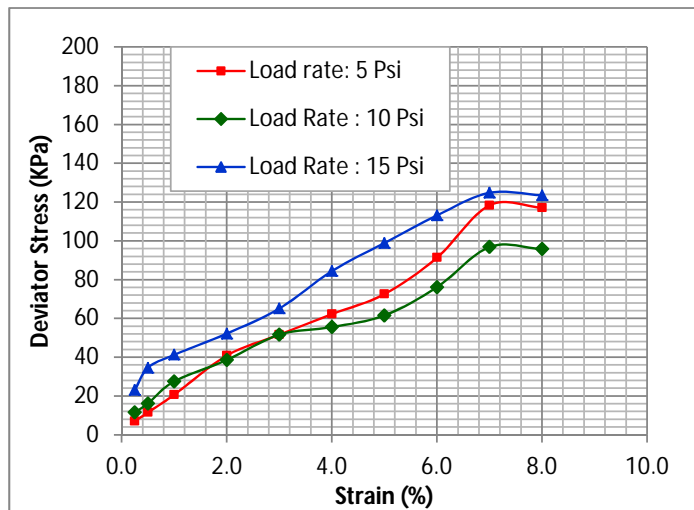
**Location: 31 Char Madhabdia Govt.Primary School, Char**

**Madhabdia Bazar, Char Madhabdia**

**Triaxial Compression Test**

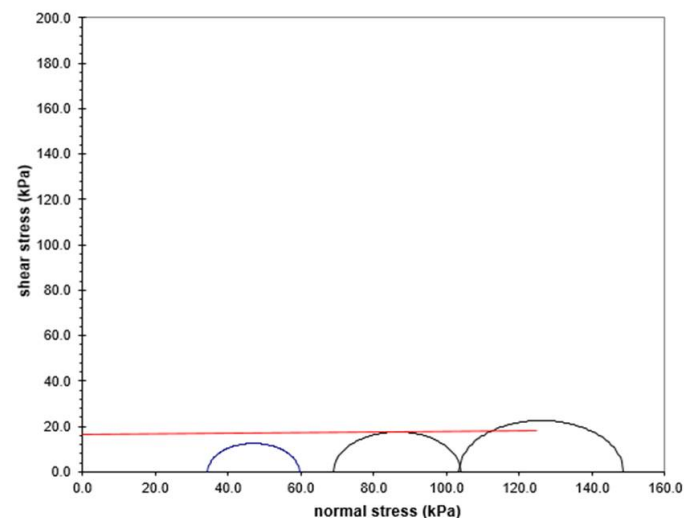
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	19.10	1.73
—◆—	19.60	1.76
—▲—	19.10	1.73

**MOHRS STRESS DIAGRAM**



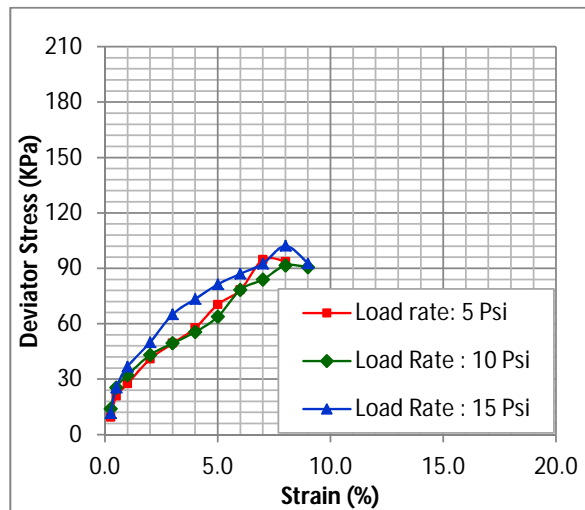
Borehole No.	BH-04
Sample No.	UD-01
Depth (m)	2.10 to 2.55
Cohesion (KPa)	17
Angle of Friction (degree)	0



**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**  
**Location: Near Madhankali Swith gate, Ambikapur**

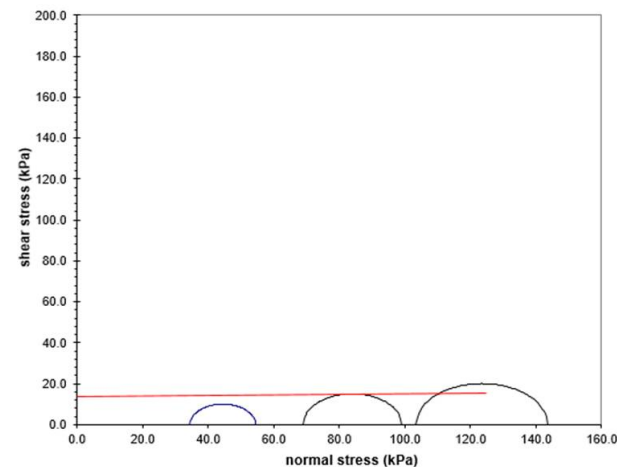
**Triaxial Compression Test**  
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	22.23	1.68
—◆—	23.61	1.60
—▲—	25.17	1.57

**MOHR'S STRESS DIAGRAM**



Borehole No.	BH-07
Sample No.	UD-01
Depth (m)	5.10 to 5.55
Cohesion (KPa)	15
Angle of Friction (degree)	0

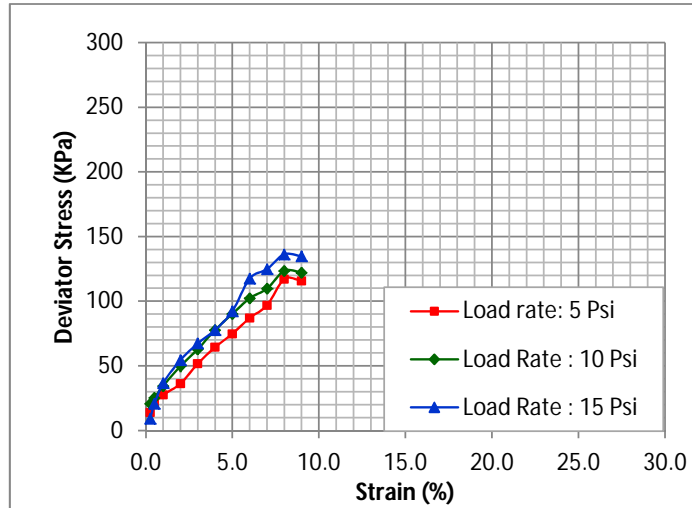
**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Location: Dhuldi Railgate, Dhuldi Bazar, Majchar**

**Triaxial Compression Test**

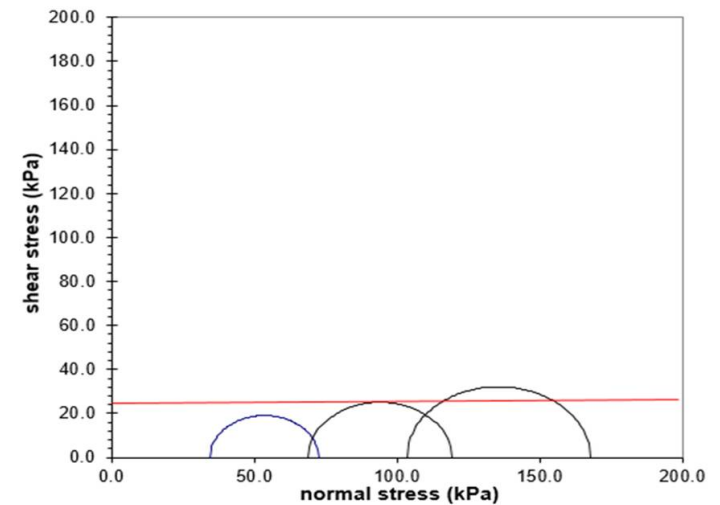
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	24.22	1.73
—◆—	27.09	1.71
—▲—	24.15	1.68

**MOHR'S STRESS DIAGRAM**



Borehole No.	BH-09
Sample No.	UD-01
Depth (m)	5.10 to 5.55
Cohesion (KPa)	25
Angle of Friction (Degree)	0

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

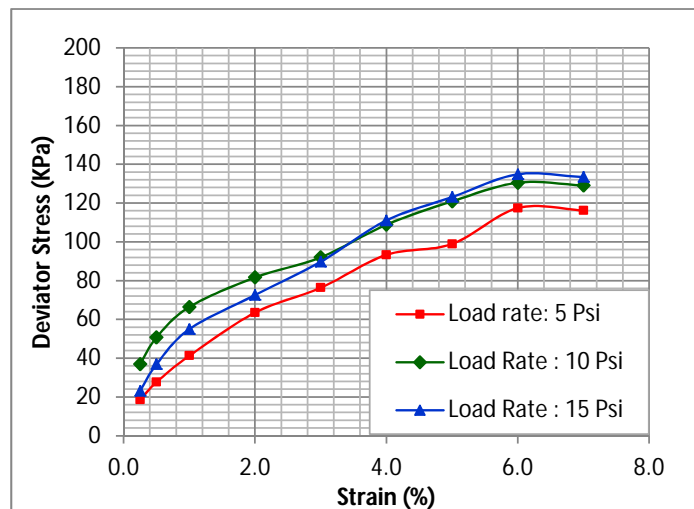
**Location: 5nos. Decreerchar, Munshitanggi**

**Aftabuddin Madrasha, Decreerchar**

**Triaxial Compression Test**

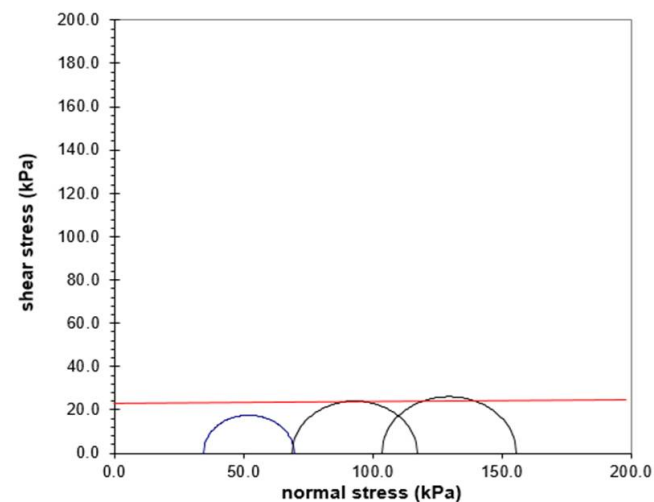
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	19.26	1.71
—◆—	19.10	1.73
—▲—	19.10	1.73

**MOHR'S STRESS DIAGRAM**



Borehole No.	BH-11
Sample No.	UD-01
Depth (m)	2.10 to 2.55
Cohesion (KPa)	23
Angle of Friction (degree)	0

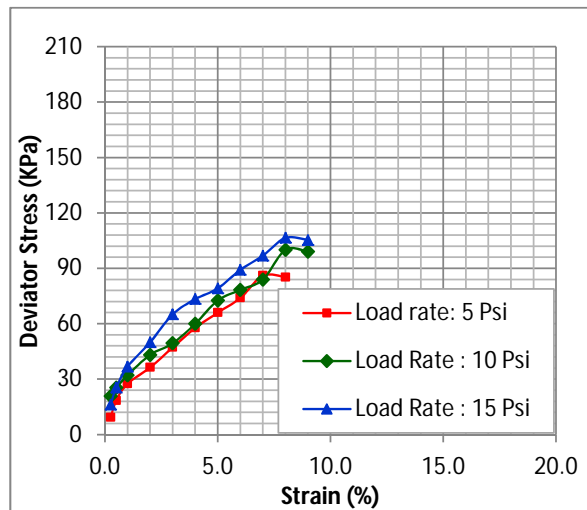
**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Location: Vajon Dangga Govt. Primary School, Faridpur**

**Triaxial Compression Test**

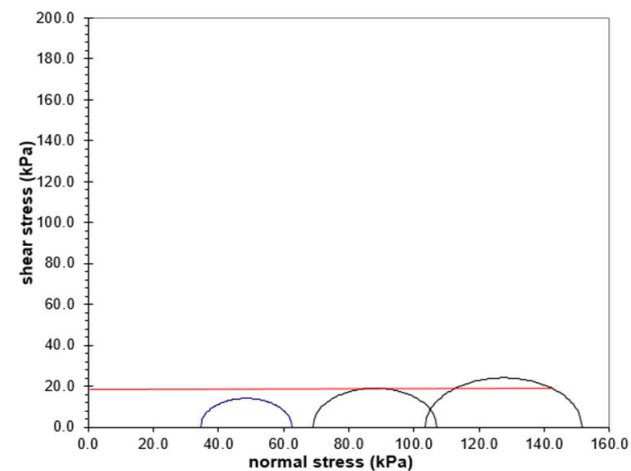
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	15.61	1.75
—◆—	23.76	1.66
—▲—	23.31	1.65

**MOHRS STRESS DIAGRAM**



Borehole No.	BH-14
Sample No.	UD-01
Depth (m)	4.40 to 4.85
Cohesion (KPa)	19
Angle of Friction (degree)	0

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-1)**

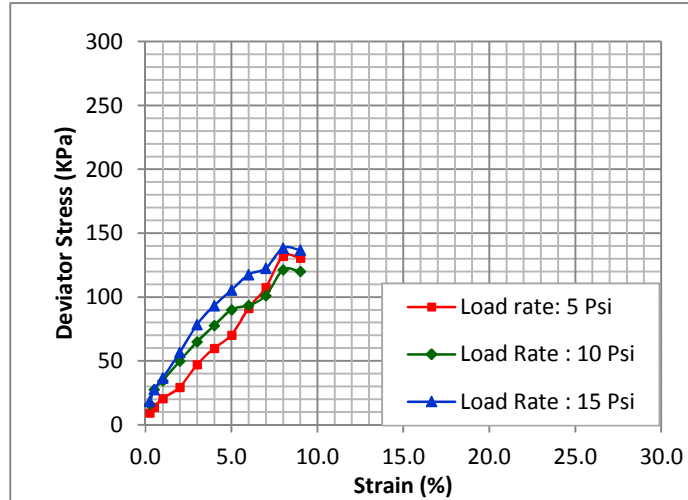
**Location:**

**Chan Chairman Pukurpar, Baitul-Noor Mosjid, Faridpur Sadar**

### Triaxial Compression Test

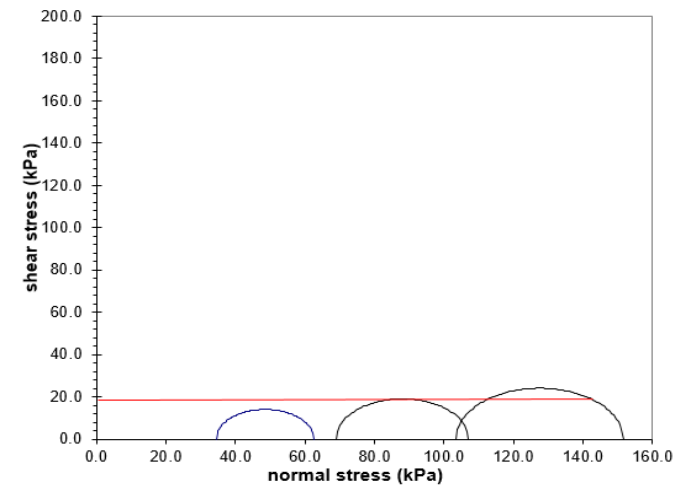
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	23.80	1.70
—◆—	22.12	1.71
—▲—	26.24	1.71

**MOHRS STRESS DIAGRAM**



Borehole No.	BH-15
Sample No.	UD-01
Depth (m)	5.10 to 5.55
Cohesion (KPa)	18
Angle of Friction (Degree)	0

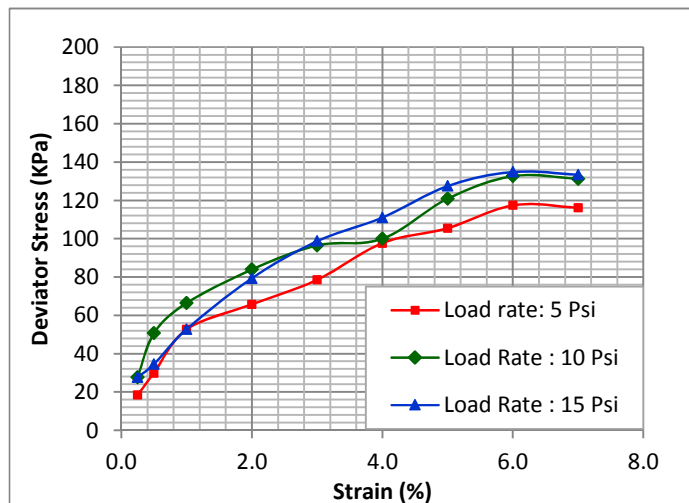
Project : Preparation of Development Plan for Fourteen Upazilas(Package-1)

Location: 94

nos. Zhiltuki Govt. Primary School, Panir Tangki Mor,  
Faridpur Sadar

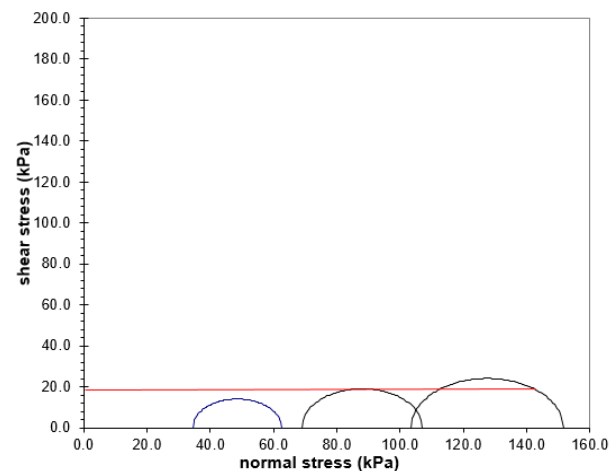
### Triaxial Compression Test ( Unconsolidated Undrained)

STRESS-STRAIN DIAGRAM



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	20.08	1.71
—◆—	22.00	1.63
—▲—	20.42	1.69

MOHRS STRESS DI

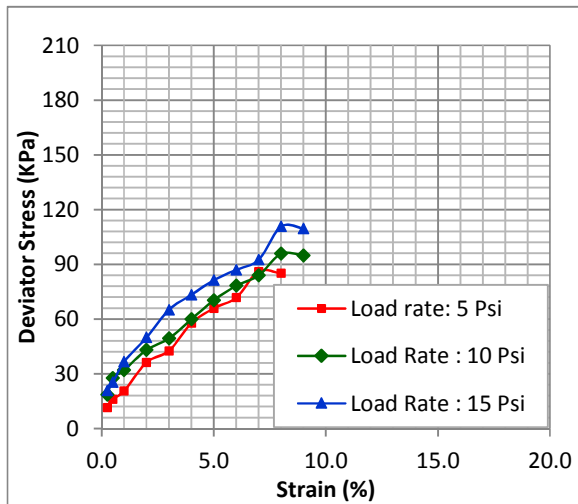


Borehole No.	BH-16
Sample No.	UD-01
Depth (m)	2.10 to 2.55
Cohesion (KPa)	18
Angle of Friction (degree)	0

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-1)**  
**Location: Mohim School Field, Faridpur Sadar**

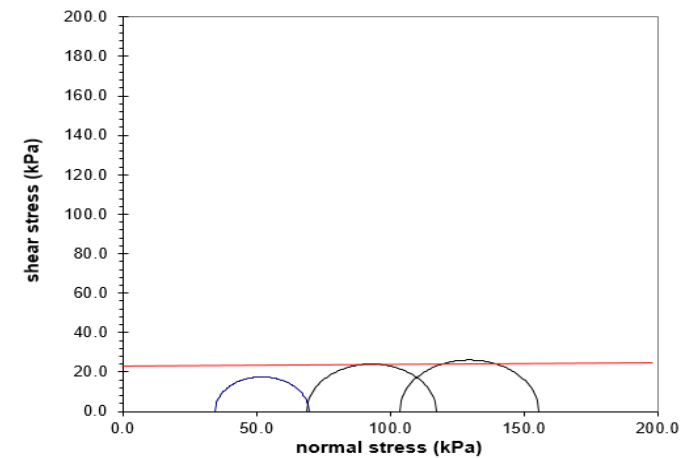
**Triaxial Compression Test**  
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	23.61	1.55
—◆—	21.21	1.66
—▲—	26.26	1.62

**MOHR'S STRESS DIAGRAM**



Borehole No.	BH-17
Sample No.	UD-01
Depth (m)	5.10 to 5.55
Cohesion (KPa)	23
Angle of Friction (degree)	0









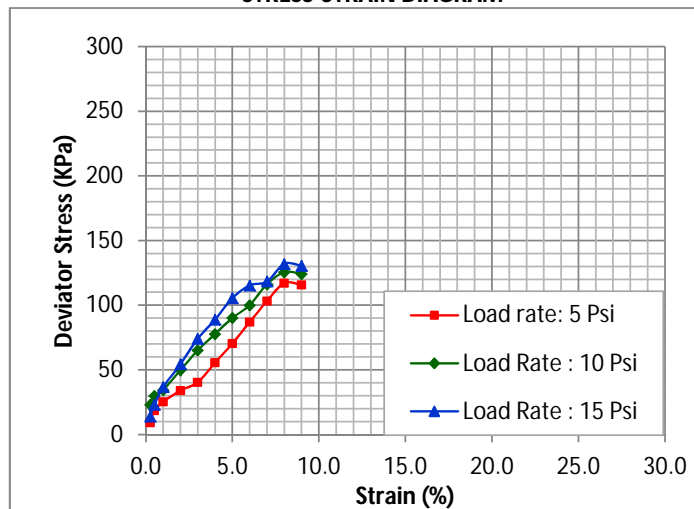
**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Location: Raghu Nandanpur Madrasa, Ambikapur**

**Triaxial Compression Test**

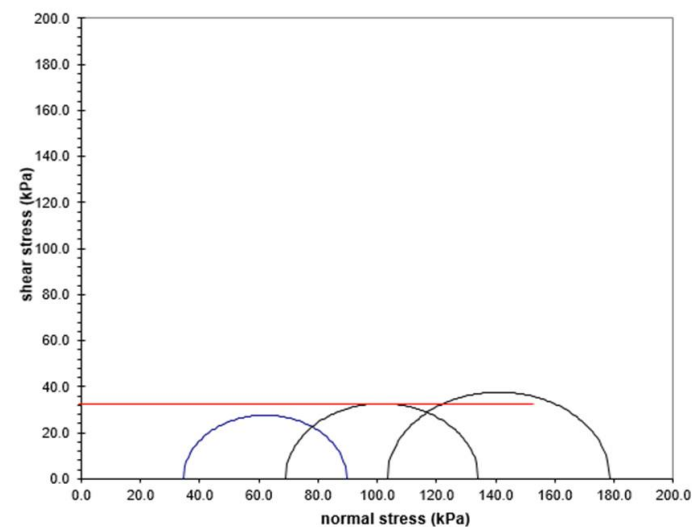
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	28.53	1.62
—◆—	-91.45	1.72
—▲—	21.27	1.71

**MOHR'S STRESS DIAGRAM**

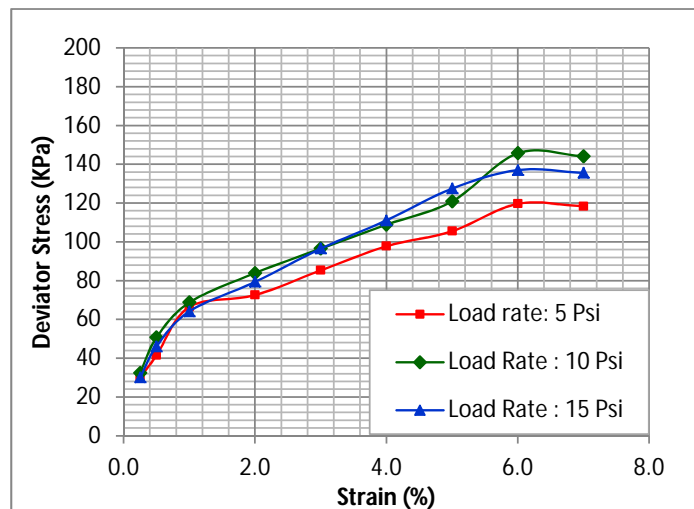


Borehole No.	BH-18
Sample No.	UD-01
Depth (m)	2.10 to 2.55
Cohesion (KPa)	32
Angle of Friction (Degree)	0

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**  
**Location: Hadhokandi Govt. Primary School, Oposite side of River Research Institute, Kaijuri**

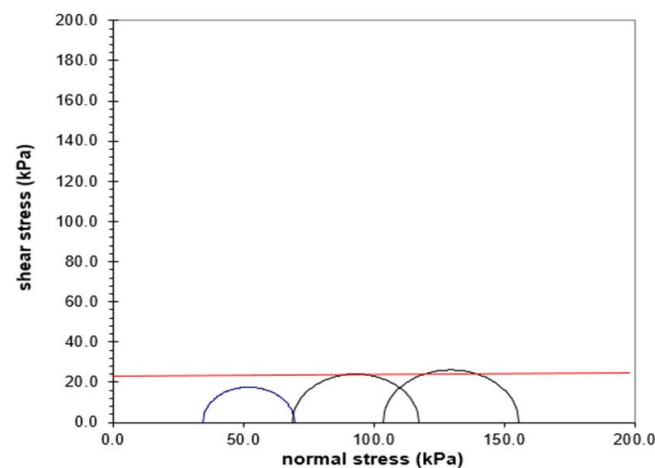
**Triaxial Compression Test**  
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	19.06	1.66
—◆—	23.94	1.62
—▲—	25.87	1.66

**MOHRS STRESS DIAGRAM**

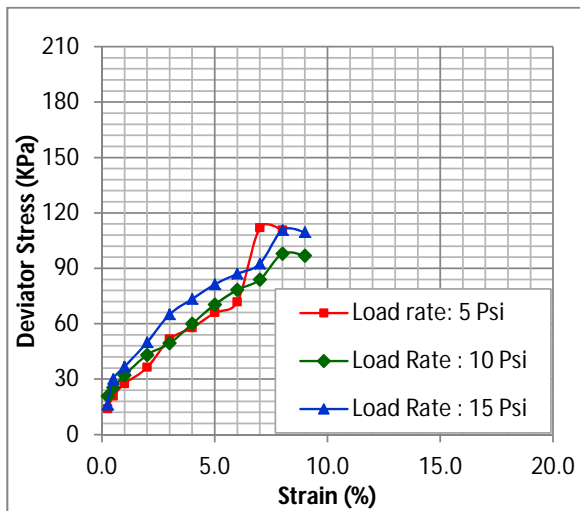


Borehole No.	BH-20
Sample No.	UD-01
Depth (m)	4.10 to 4.55
Cohesion (KPa)	23
Angle of Friction (degree)	0

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**  
**Location: Johora Begum High School Field, Mia Para Road**

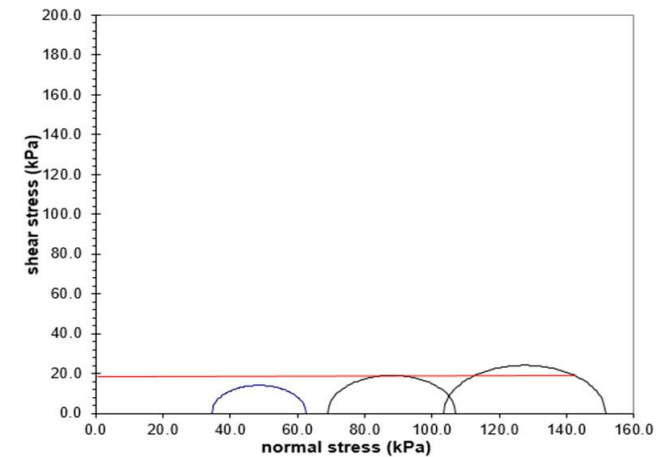
**Triaxial Compression Test**  
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	1.98	2.01
—◆—	28.13	1.60
—▲—	28.76	1.57

**MOHRS STRESS DIAGRAM**

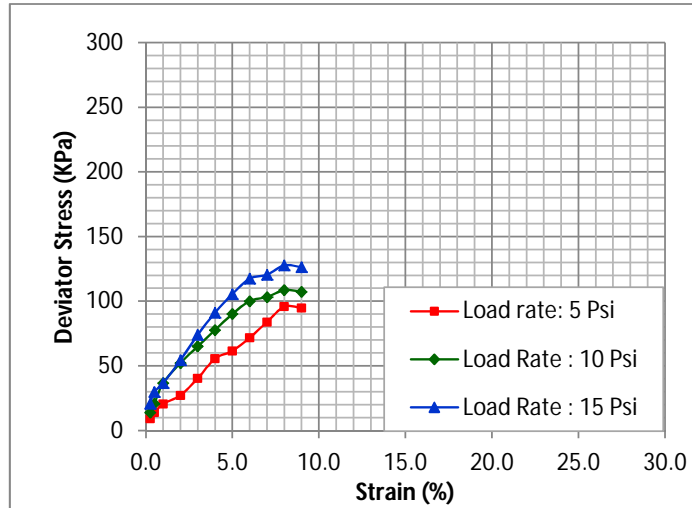


Borehole No.	BH-21
Sample No.	UD-01
Depth (m)	2.10 to 2.55
Cohesion (KPa)	17
Angle of Friction (degree)	0

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**  
**Location: Technical Training Centre, Brahmonkanda, Sreeaungon, Faridpur Sadar**

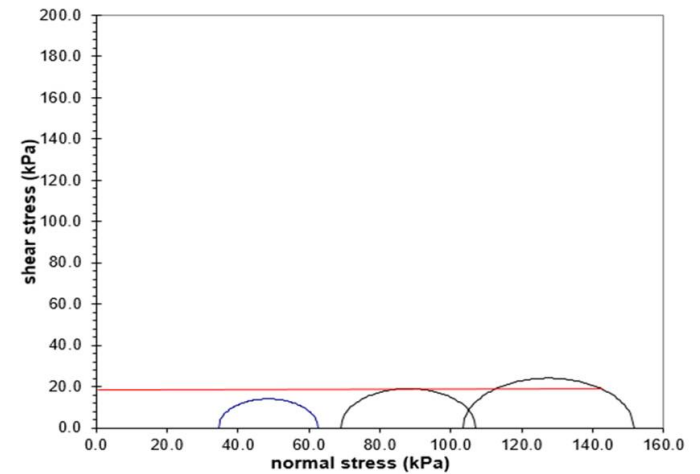
**Triaxial Compression Test**  
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	26.33	1.65
—◆—	25.86	1.68
—▲—	23.31	1.68

**MOHR'S STRESS DIAGRAM**



Borehole No.	BH-22
Sample No.	UD-01
Depth (m)	4.10 to 4.55
Cohesion (KPa)	17
Angle of Friction (Degree)	0

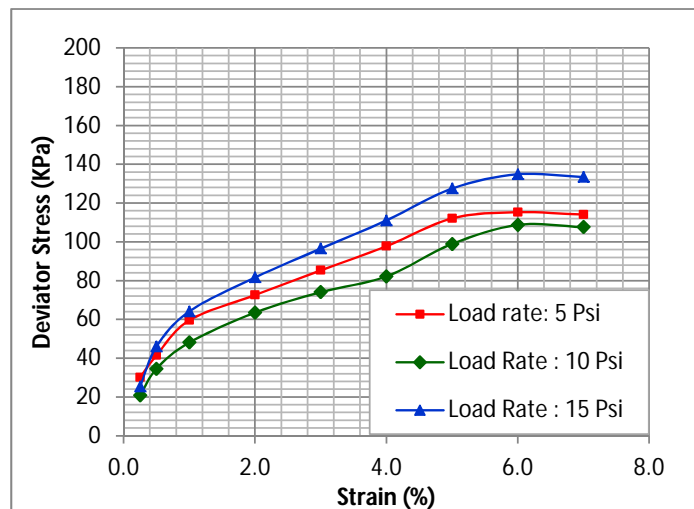
**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Location: Choyata, Aliabad**

**Triaxial Compression Test**

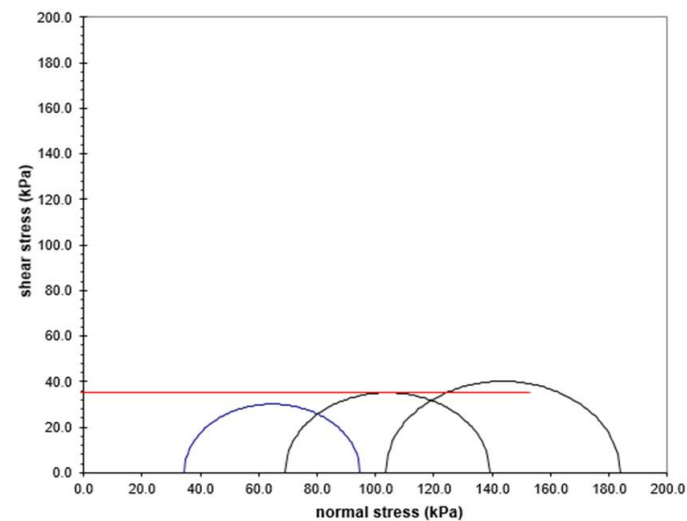
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	21.62	1.66
—◆—	29.34	1.56
—▲—	32.08	1.60

**MOHR'S STRESS DIAGRAM**

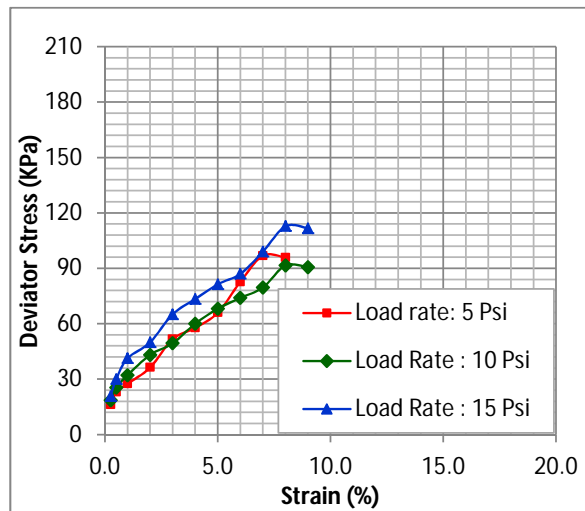


Borehole No.	BH-23
Sample No.	UD-01
Depth (m)	2.10 to 2.55
Cohesion (KPa)	35
Angle of Friction (degree)	0

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**  
**Location: Near Payarpur Godaoun, Kaijuri**

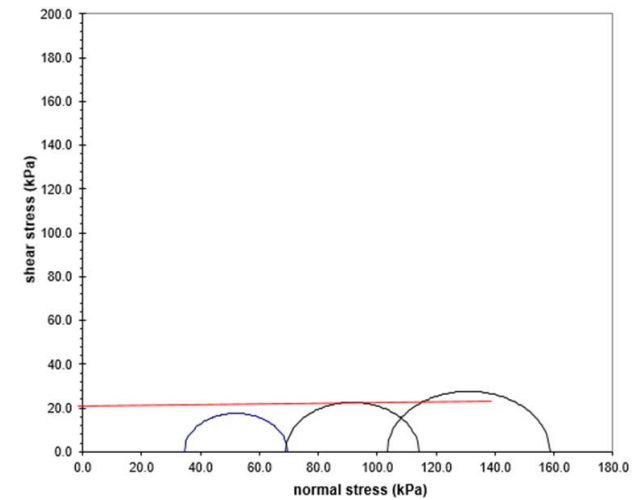
**Triaxial Compression Test**  
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	24.32	1.62
—◆—	30.63	1.52
—▲—	23.37	1.57

**MOHRS STRESS DIAGRAM**



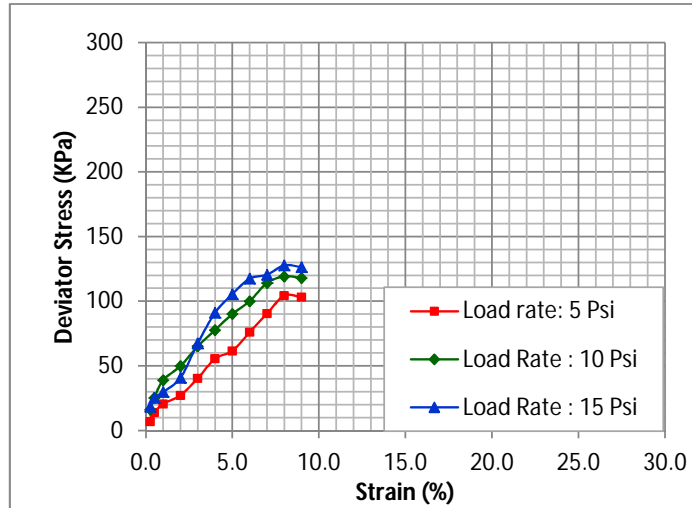
Borehole No.	BH-24
Sample No.	UD-01
Depth (m)	2.20 to 2.65
Cohesion (KPa)	21
Angle of Friction (degree)	0



**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**  
**Location: Krish poshikhan Institute gate, Gunggabodi, Krishnanagar**

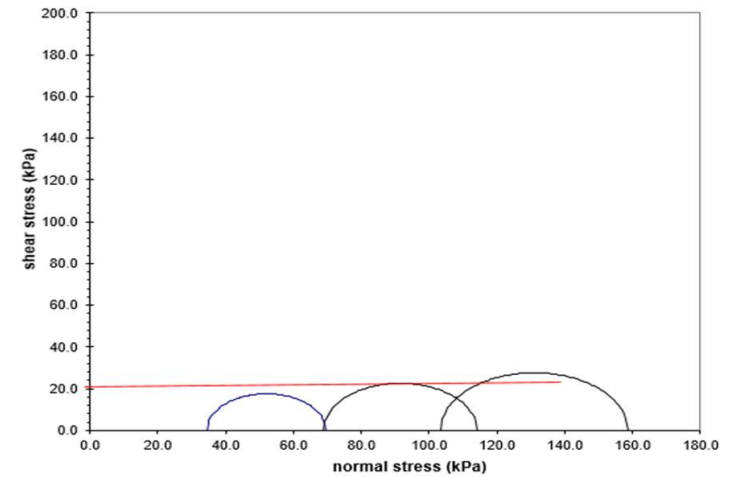
**Triaxial Compression Test**  
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	25.88	1.68
—◆—	23.14	1.69
—▲—	23.12	1.69

**MOHRS STRESS DIAGRAM**



Borehole No.	BH-25
Sample No.	UD-01
Depth (m)	5.10 to 5.55
Cohesion (KPa)	21
Angle of Friction (Degree)	0

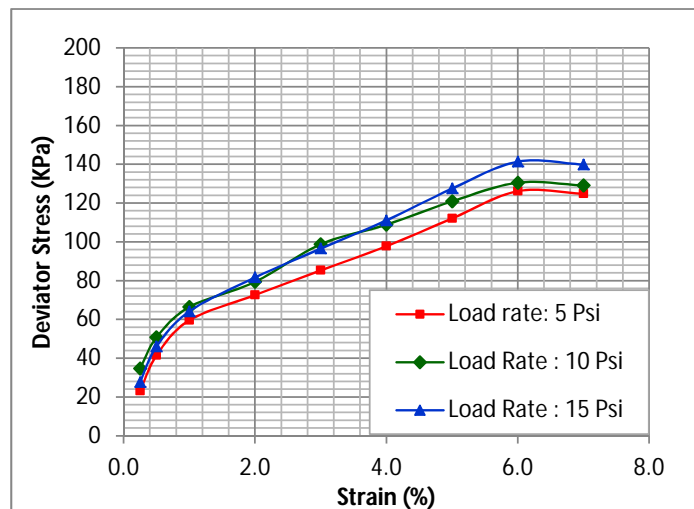
**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Location: Gobinddapur Hat, Krishnanagar**

**Triaxial Compression Test**

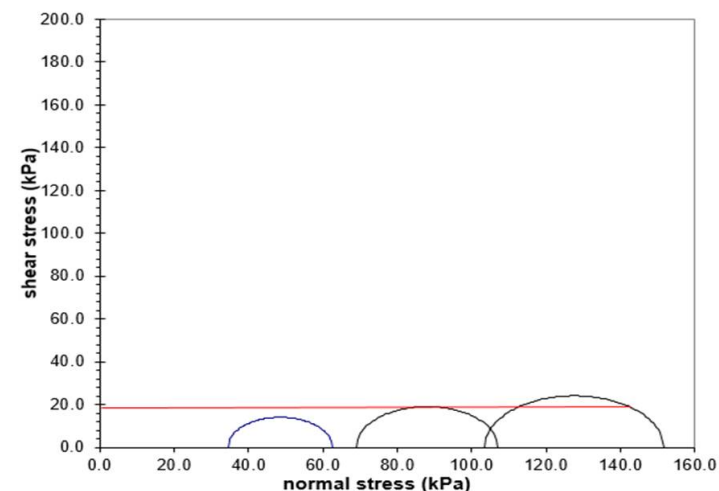
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	17.76	1.70
—◆—	27.59	1.66
—▲—	23.32	1.66

**MOHRS STRESS DIAGRAM**

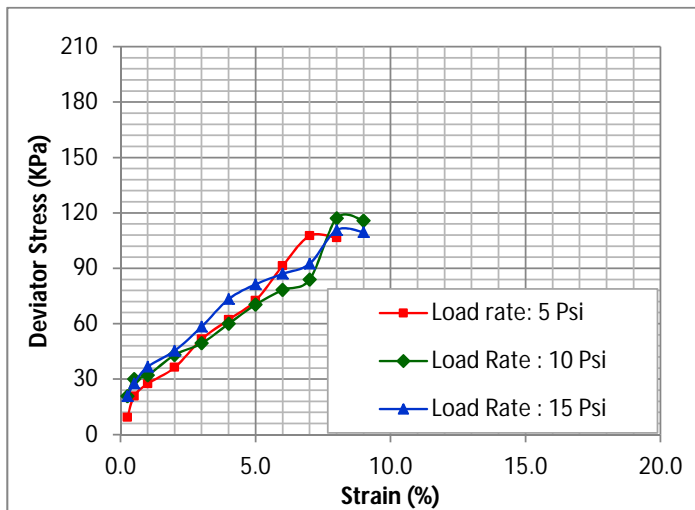


Borehole No.	BH-26
Sample No.	UD-01
Depth (m)	2.20 to 2.65
Cohesion (KPa)	18
Angle of Friction (degree)	0

**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**  
**Location: Bakhunda College Field, Bakhunda, Greda**

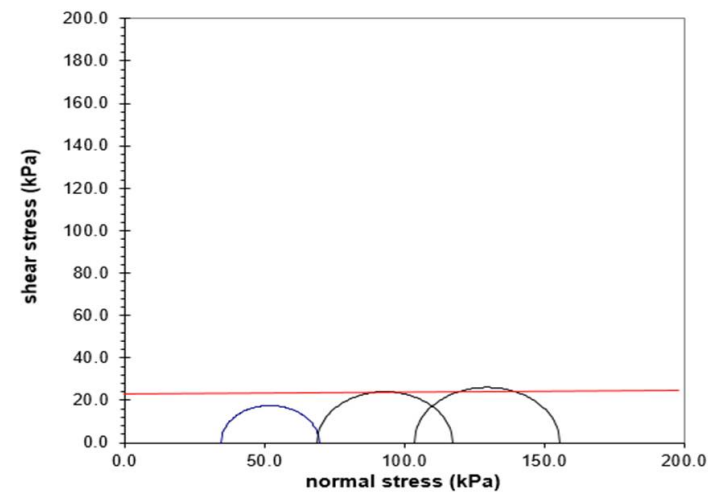
**Triaxial Compression Test**  
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	17.30	1.70
—◆—	27.74	1.57
—▲—	23.37	1.57

**MOHRS STRESS DIAGRAM**



Borehole No.	BH-27
Sample No.	UD-01
Depth (m)	5.10 to 5.55
Cohesion (KPa)	23
Angle of Friction (degree)	0

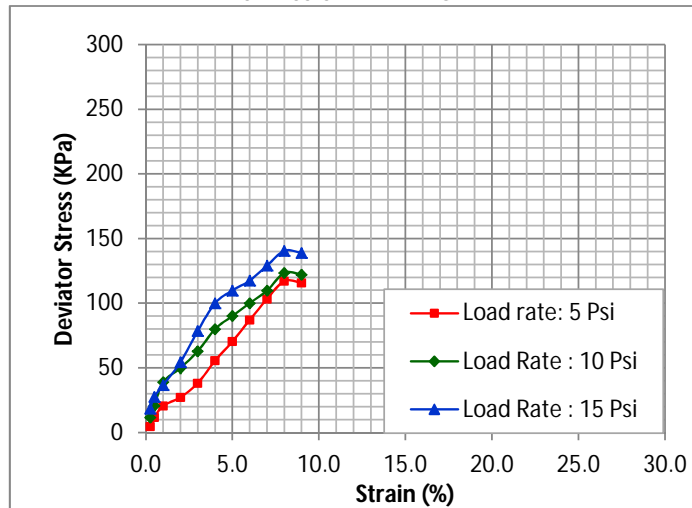
**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Location: Madhobpur Govt. Primary School, Mallikpur Bazar, Krishnanagar**

**Triaxial Compression Test**

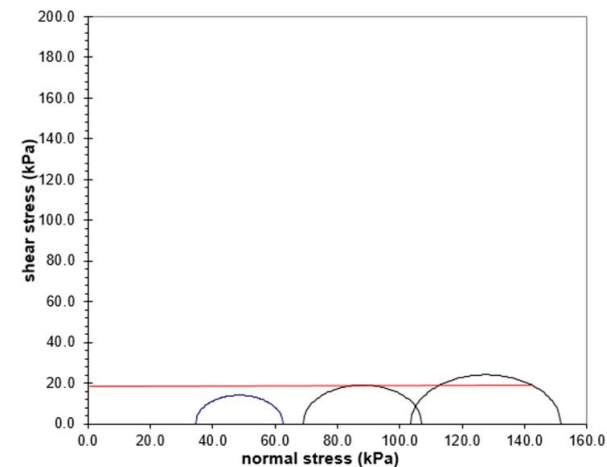
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	25.04	1.68
—◆—	22.12	1.71
—▲—	25.20	1.72

**MOHRS STRESS DIAGRAM**



Borehole No.	BH-30
Sample No.	UD-01
Depth (m)	5.20 to 5.65
Cohesion (KPa)	19
Angle of Friction (Degree)	0

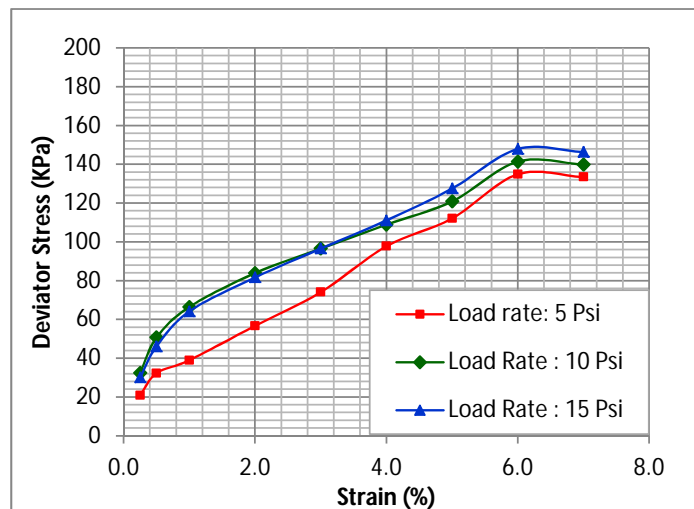
**Project : Preparation of Development Plan for Fourteen Upazilas(Package-3)**

**Location: Tonthoniar Hat, End of Kanaipur Union**

**Triaxial Compression Test**

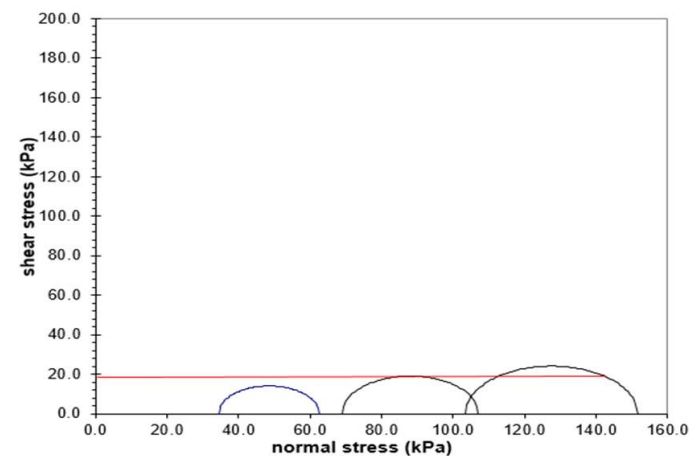
( Unconsolidated Undrained)

**STRESS-STRAIN DIAGRAM**



Symbol	Moisture Content (%)	Dry density (g/cc)
—■—	22.09	1.69
—◆—	19.10	1.73
—▲—	25.02	1.66

**MOHRS STRESS DIAGRAM**

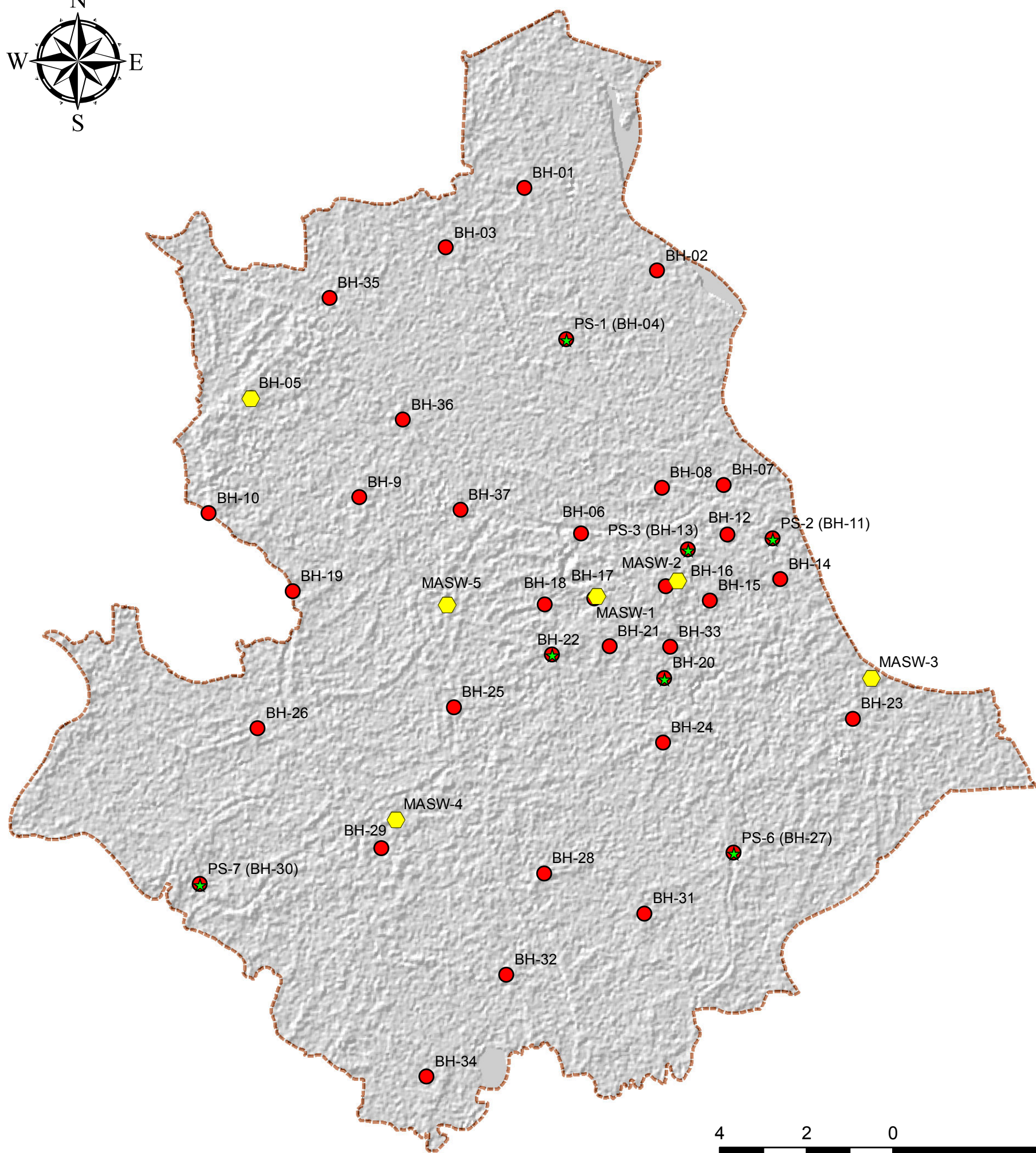
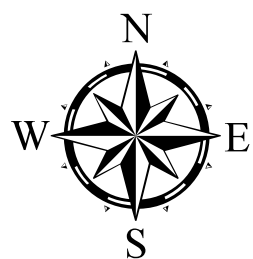


Borehole No.	BH-34
Sample No.	UD-01
Depth (m)	5.10 to 5.55
Cohesion (KPa)	18
Angle of Friction (degree)	0

## **Appendix E**

### **All Thematic Maps and Final Infrastructure Suitability Map**





## Geotechnical and Geophysical Test locations of Faridpur Sadar Upazila

### Legend

#### Work Locations

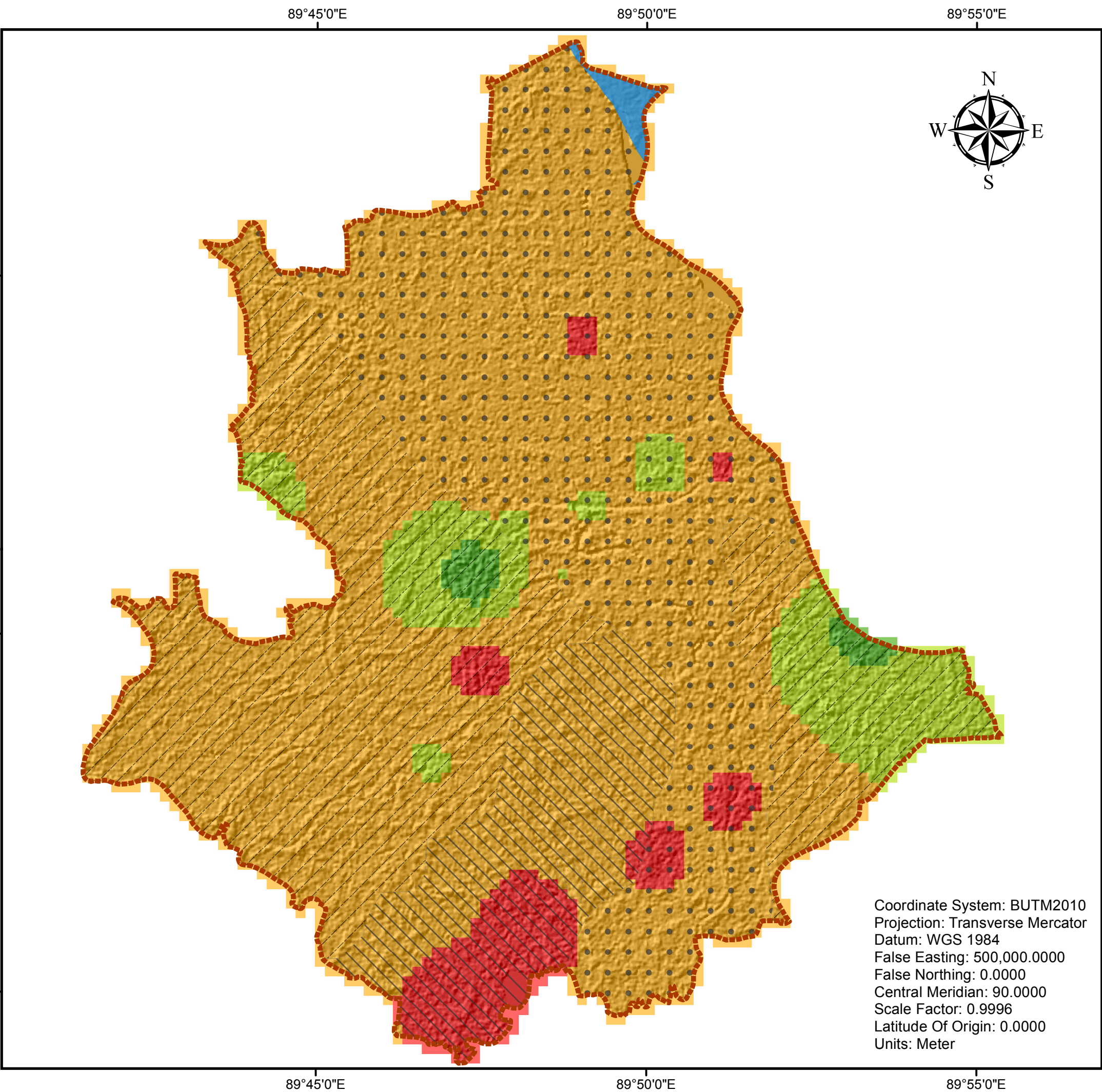
#### Geotechnical and Geophysical Test

- Standard Penetration Test (SPT) Drilling
- ⬡ Multi-channel Analysis of Surface Wave (MASW)
- ★ Downhole Seismic Test (PS Logging)
- Upazila Boundary

This map has been produced by plotting the co-ordinates of all the Geotechnical and Geophysical works which was acquired during field investigation. The drilling depth of those boroholes are up to 30m from the existing ground level (EGL).

Coordinate System: BUTM2010  
 Projection: Transverse Mercator  
 Datum: WGS 1984  
 False Easting: 500,000.0000  
 False Northing: 0.0000  
 Central Meridian: 90.0000  
 Scale Factor: 0.9996  
 Latitude Of Origin: 0.0000  
 Units: Meter





# Engineering Geological Map based on Avarage Shear wave Velocity (upto30m)

## Legend

Upazila Boundary

## Surface Geology Units

### Map Units

- Deltaic sand
- Deltaic silt
- Marsh clay and peat
- Water

## Soil Classification Type

- D3 - Medium Stiff to Stiff/Medium Dense to Dense Soil
- D4 - Medium Stiff/Medium Dense Soil
- D5 - Soft/Loose to Medium Stiff/Medium Dense Soil
- E- Very Soft to Soft/ Very Loose to Loose Soil

Site Class	Site class description	Shear wave velocity (m/sec)	
		Min	Max
A	<b>HARD ROCK</b> Eastern United States only	1500	
B	<b>ROCK</b>	760	1500
C	<b>VERY DENSE SOIL AND SOFT ROCK</b> Unstrained shear strength $u_s > 2000\text{psf}$ ( $u_s = 100\text{kPa}$ ) or $N = 50$ blows/ft	360	760
D	<b>STIFF SOILS</b> Stiff soil with undrained shear strength $1000\text{psf} = u_s = 2000\text{psf}$ ( $50\text{KPa} < u_s < 100\text{KPa}$ ) or $15 = N = 50$ blows/ft	180	360
E	<b>SOFT SOILS</b> Profile with more than 10 ft (3m) of soft clay defined as soil with plasticity index $PI > 20$ , moisture content $w > 40\%$ and undrained shear strength $u_s < 1000\text{psf}$ ( $50\text{kPa}$ ) ( $N = 15$ blows/ft)		180
F	<b>SOILS REQUIRING SITE SPECIFIC EVALUATIONS</b> 1. Soils vulnerable potential failures or collapse under seismic loading: e.g., liquefiable soils, quick and highly sensitive clays, collapse weakly connected soils. 2. Peats and/or highly organic clays: (10ft (3m) or thicker layer) 3. Very high plasticity clays: (25ft (8m) or thicker layer with plasticity index $> 75$ ) 4. Very thick soft/medium stiff clays: (120ft (36m) or thicker layer)		

Site class based on  $V_{s30}$  — according to NEHRP (National Earthquake Hazard Reduction Program, USA) provisions

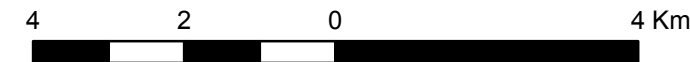
This map was produced by interpolating velocity of the soil layer in different Bore hole. Afterward it was classified by their velocity range according to a method provided by NEHRP (stands for National Earthquake Hazard Reduction Program, USA) Provisions but as most of the shear wave velocity of soil is within 168-244m/s the classification was modified as follows.

Ground Class	$V_{s30}$	Soil Type
C	360 - 760 m/sec	Very Dense/ Hard Soil and Soft rock
D1	300 - 360 m/sec	Stiff/ Dense to very dense/Hard Soil
D2	250 - 300 m/sec	Stiff/ Dense Soil
D3	220 - 250 m/sec	Medium Stiff to Stiff/ Medium Dense to Dense Soil
D4	200 - 220 m/sec	Medium Stiff/ Medium Dense Soil
D5	180 - 200 m/sec	Soft/Loose to Medium Stiff/ Medium Dense Soil
E	- 180 m/sec	Very Soft to Soft / Very Loose to Loose Soil

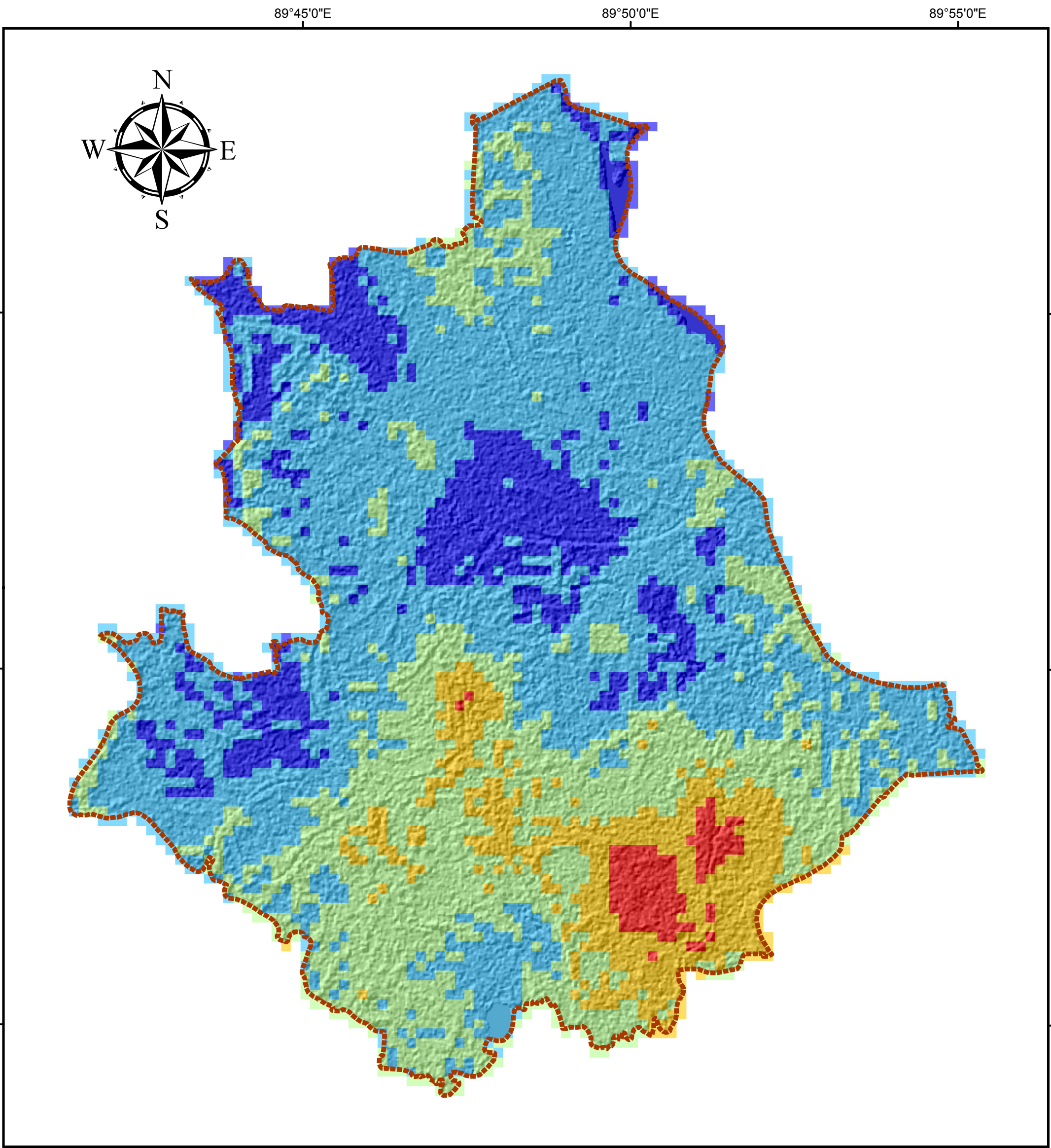
*Modified classification of the soils applied in this study*

### Scale:

1 centimeter = 1 kilometers












# Foundation Layer Recommendation Map

## Legend

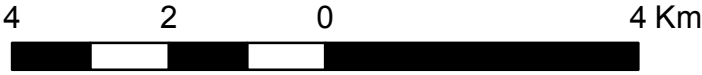
 Upazila Boundary

### Engineering Soil Layers

#### Foundation Depth (m) from EGL

-  1.54 - 10.00
-  10.01 - 15.00
-  15.01 - 20.00
-  20.01 - 25.00
-  25.01 - 35.23

1 centimeter = 0.97 kilometers



Coordinate System: BUTM2010  
Projection: Transverse Mercator  
Datum: WGS 1984  
False Easting: 500,000.0000  
False Northing: 0.0000  
Central Meridian: 90.0000  
Scale Factor: 0.9996  
Latitude Of Origin: 0.0000  
Units: Meter

#### Lithological description

Layer 1: Brown soft silty CLAY/clayey SILT

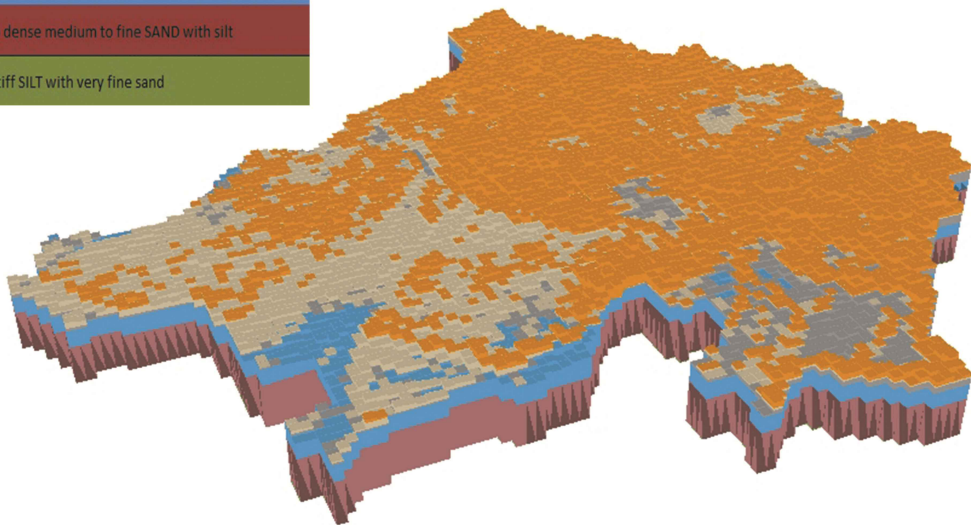
Layer 2: Gray loose/medium Dense very fine to fine SAND

Layer 3: Light Grey soft to medium stiff SILT with Clay and Sand

Layer 4: Light Brown to Grey loose to medium dense fine SAND with silt

Layer 5: Light Grey medium dense to dense medium to fine SAND with silt

Layer 6: Light Grey medium stiff to stiff SILT with very fine sand







23°40'0"N

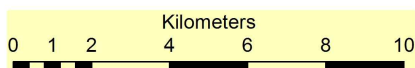
23°40'0"N

23°35'0"N

23°35'0"N

23°30'0"N

23°30'0"N



Coordinate System: WGS 1984 UTM Zone 46N  
 Projection: Transverse Mercator  
 Datum: WGS 1984  
 false easting: 500,000.0000  
 false northing: 0.0000  
 central meridian: 93.0000  
 scale factor: 0.9996  
 latitude of origin: 0.0000  
 Units: Meter

89°40'0"E

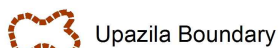
89°45'0"E

89°50'0"E

89°55'0"E

## Surface Geology of Faridpur Sadar Upazila

### Legend



Upazila Boundary

### Surface Geology Units

#### Map Unit



Deltaic sand



Deltaic silt



Marsh clay and peat



Water

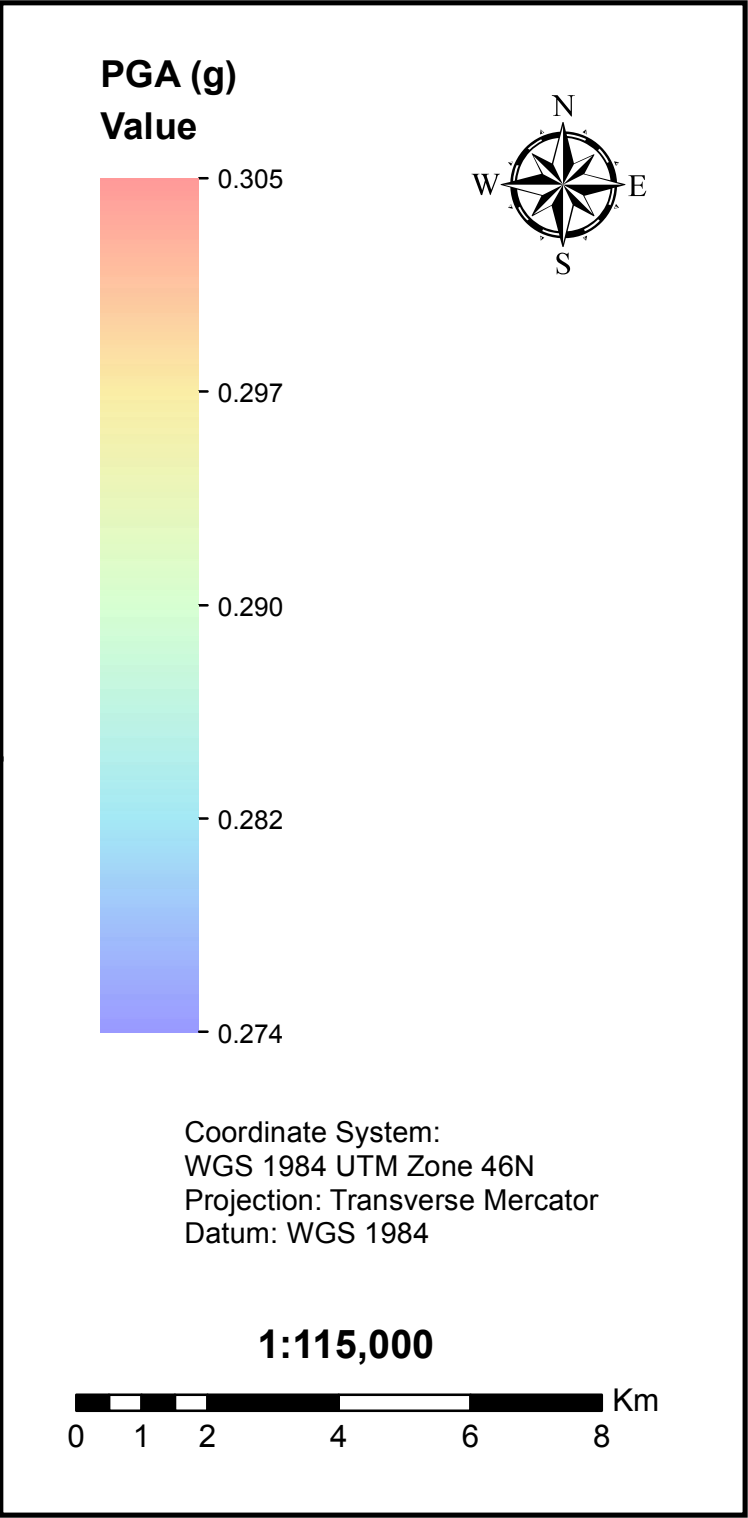
### Deltaic Sand and Deltaic Silt:

Deltaic sands accumulate in fluvial and tidal channels, distributary-mouth bars, beach ridges, barrier islands, and on delta-front platforms. It consists of sand, silt, clay and organic matters. The deposit may be sand or silt depending on the river water energy. Sands are particle sizes having 1/16 to 2 mm diameter. Sediment particles ranging from 0.004 to 0.06 mm (0.00016 to 0.0024 inch) in diameter irrespective of mineral type are called Silt. Silt is easily transported by moving currents but settles in still water. Hence river deposits are ideally rich in silty deposits. Energy content for silt deposition is slightly lower than sand body.

### Marshy Clay and Peat:

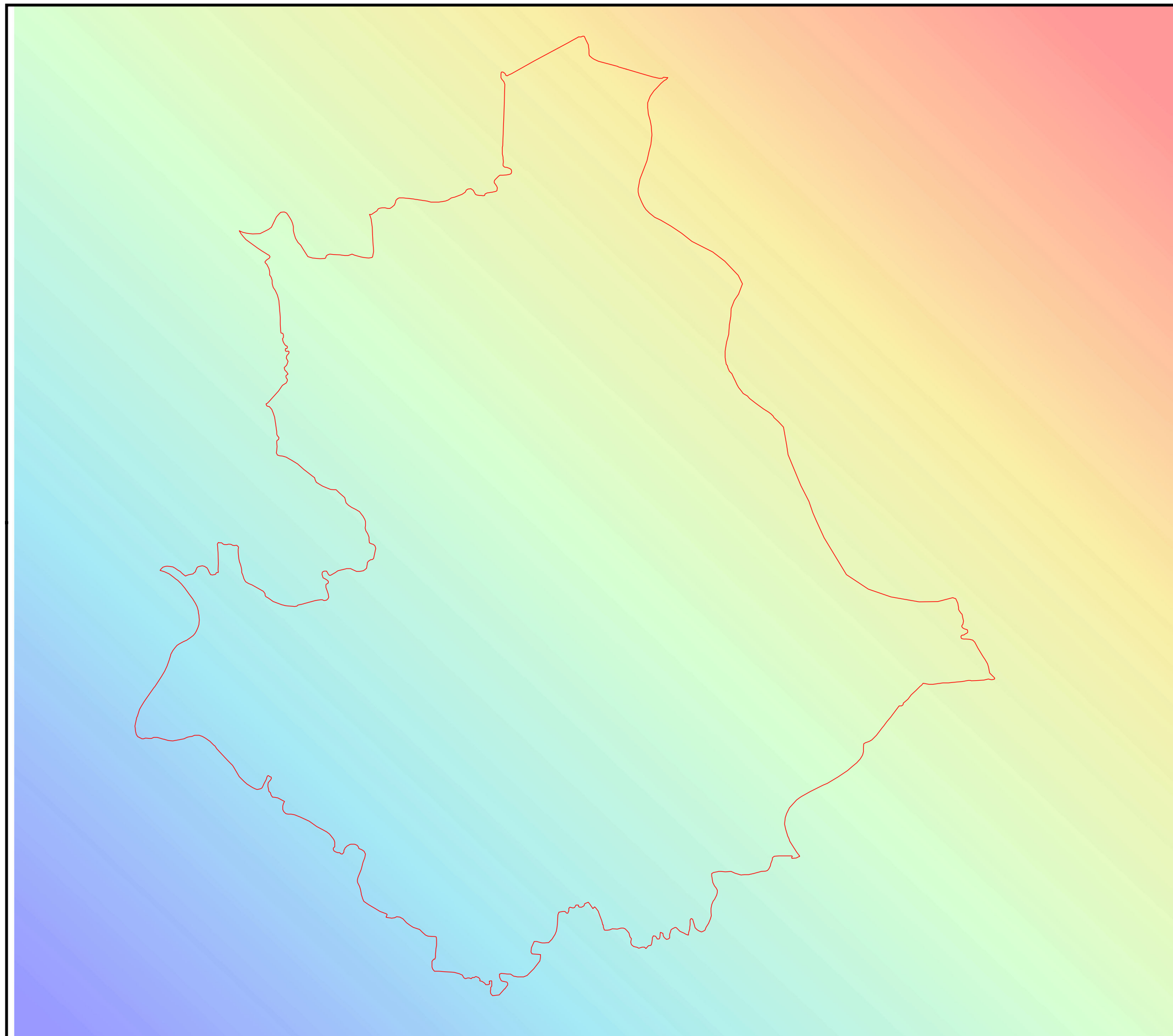
Peat soils and Marshy clays in the surface geology of the area is indication of swampy and humid environment of present active river plain deposits. In these soils, partially or wholly decomposed organic matters are present. These soils have a low infrastructure and of low quality on engineering value. Peat and muck layers are black to dark brown, strongly reduced, and neutral in reaction under persisting conditions. When these layers are allowed to dry, they become extensively acidic. The unit is seasonally flooded by both increased river water and rainwater hence, remains wet around this time. During the dry season where mineral topsoil is present they become dry. Under dry condition mineral top-soils are mainly grey or dark grey and become strongly acidic.

Peak Ground Acceleration (PGA) (g) at Engineering SeismicBaserock ( Vs30=760 m/sec )  
Corresponding to a Probabillity of Exceedance of 10% in 50 years



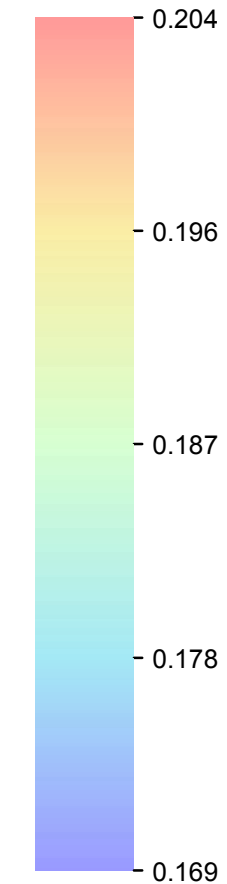
The probabilistic analysis was performed using the CRISIS2007 developed by Mario Ordaz et Al 2007), Engineering Institute National Autonomous University of Mexico (UNAM). This program calculates seismic hazard using the standard methodology for probabilistic seismic hazard analysis. Earthquake data of past hundred years and characteristics of tectonically active faults in and around Bangladesh were considered for this analysis.

# Spectral Acceleration (SA) (g) for 1 sec Structural period at Engineering Seismic Baserock (Vs30=760 m/sec) Corresponding to a Probabillity of Exceedance of 10% in 50 years



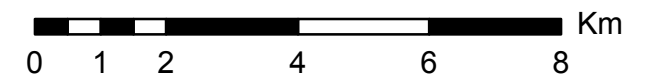
SA1 for 1sec (g)

Value



Coordinate System:  
WGS 1984 UTM Zone 46N  
Projection: Transverse Mercator  
Datum: WGS 1984

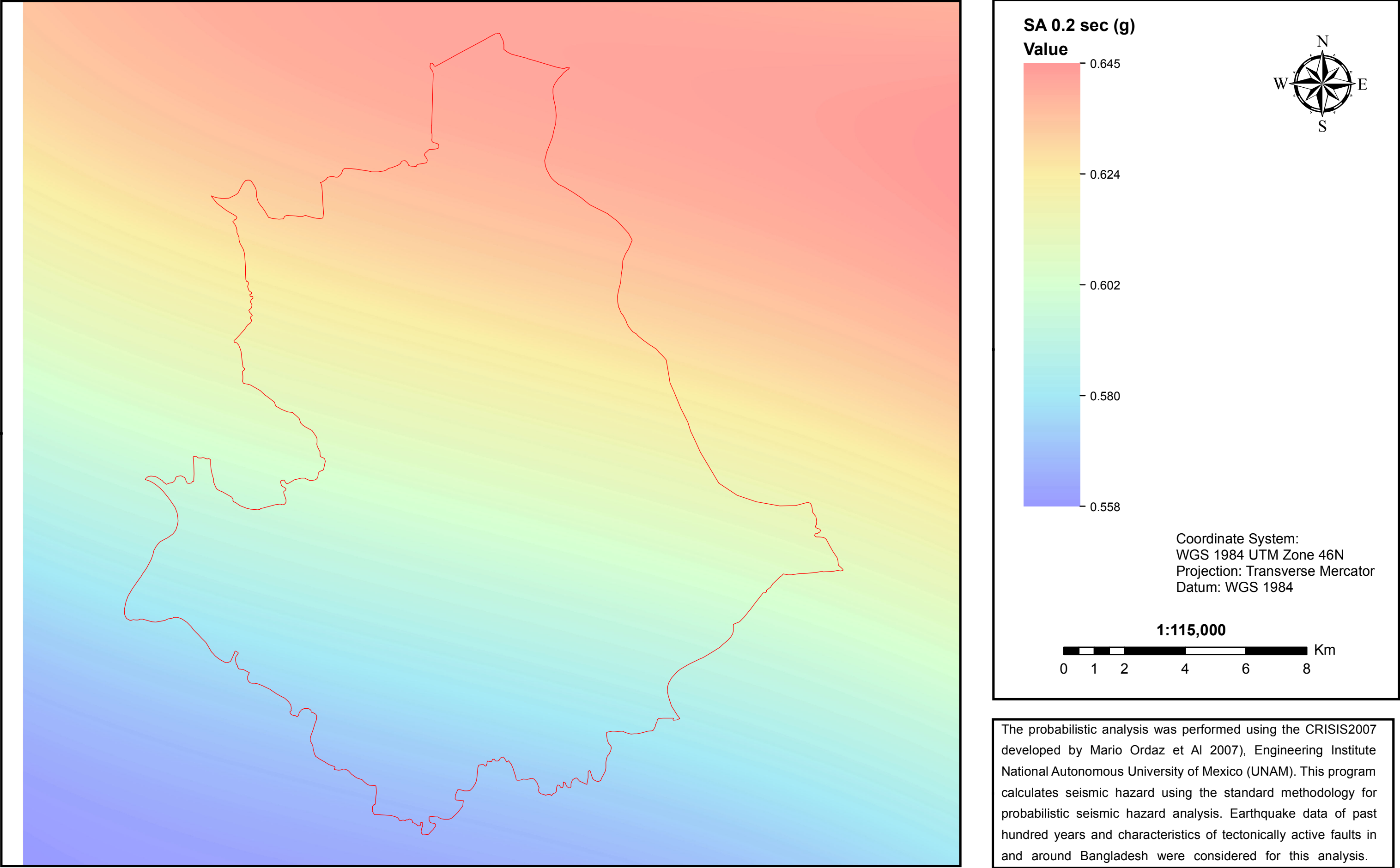
**1:115,000**

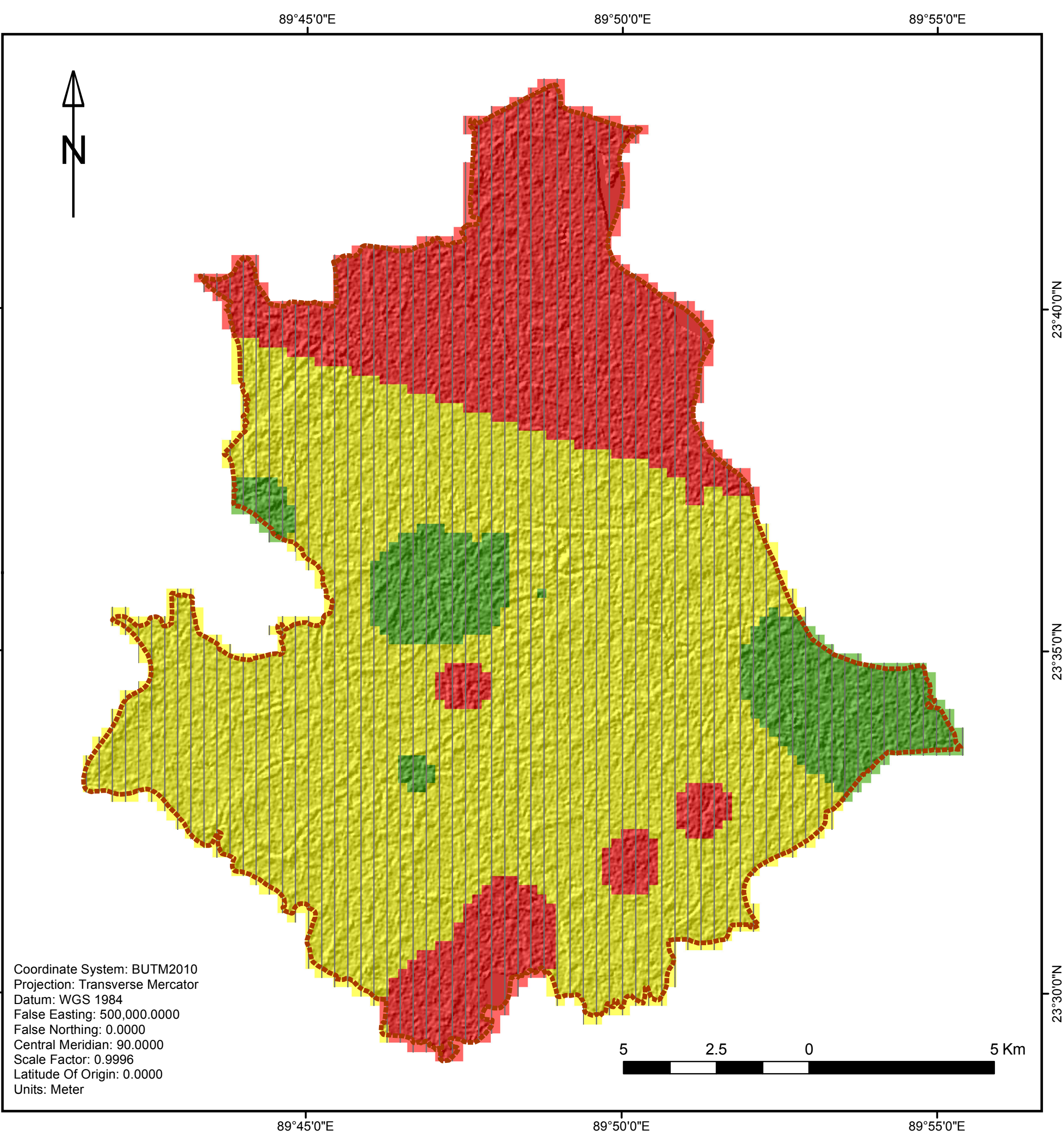


The probabilistic analysis was performed using the CRISIS2007 developed by Mario Ordaz et Al 2007), Engineering Institute National Autonomous University of Mexico (UNAM). This program calculates seismic hazard using the standard methodology for probabilistic seismic hazard analysis. Earthquake data of past hundred years and characteristics of tectonically active faults in and around Bangladesh were considered for this analysis.



**Spectral Acceleration (SA) (g) for 0.2 sec Structural period at Engineering Seismic Baserock (Vs30=760 m/sec) Corresponding to a Probability of Exceedance of 10% in 50 years**





# Peak Ground Acceleration (PGA) (g) at Engineering Seismic Ground Surface (Depth upto 30m) Corresponding to a Probability of Exceedance of 10% in 50 years

Upazila Boundary

**Provable Earthquake Intensity**  
 Intensity and Shaking  
 VIII, Severe

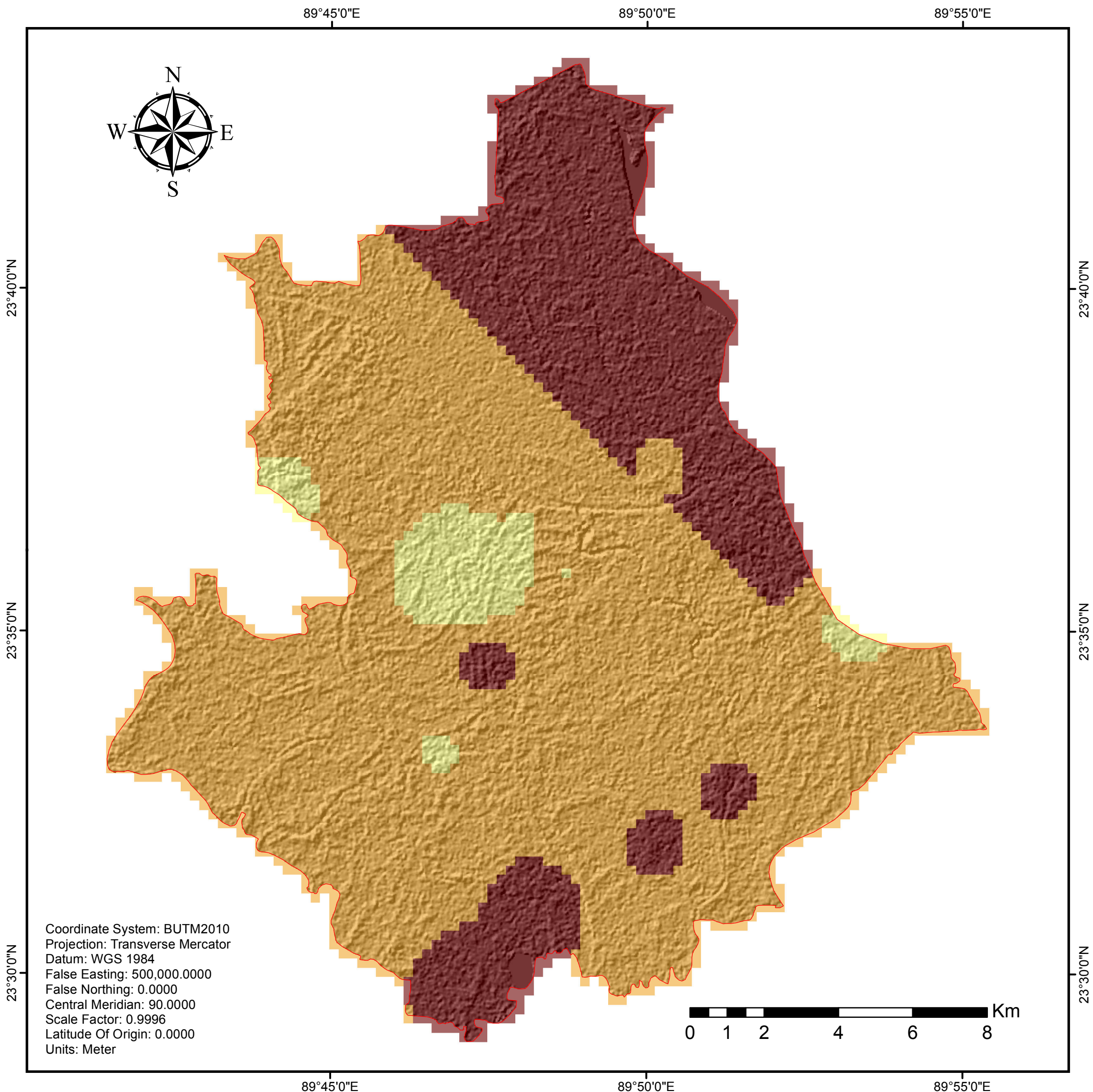
**Probabilities Seismic Hazard Assessment (PSHA)**  
**Earthquake Sensitivity with Peak Ground Acceleration (PGA)**

1st Degree Sensitive  
 2nd Degree Sensitive  
 3rd Degree Sensitive

This map was produced by multiplying PGA values with Amplification factors corresponded for different soil type. as the  $V_s$  is within 168-244m/s so soil was classified as (E,D5,D4,D3). thus the amplification factor was also modified. Spectral Acceleration (PGA) (g) at Engineering Ground Surface(Depth upto 30) corresponding to probability of exceedance of 10% in 50 year was count for each grid.

The soil amplification factors for PGA by NEHRP (National Earthquake Hazard Reduction Program) provisions





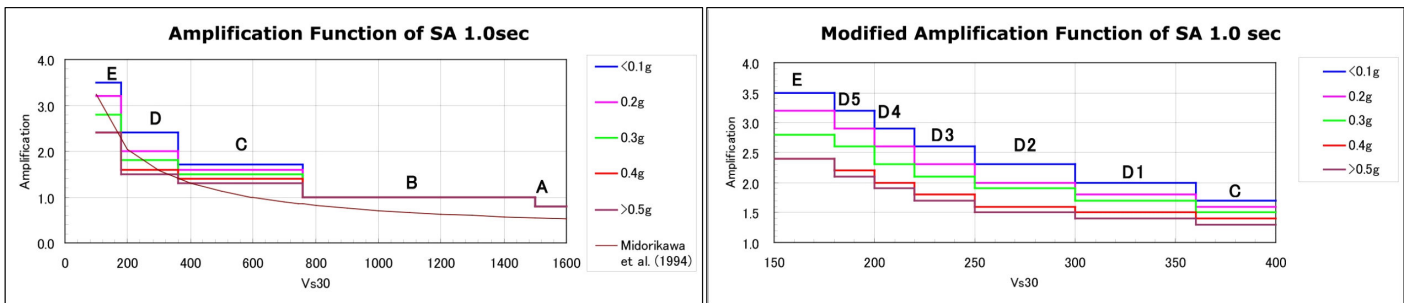
# **Spectral Acceleration (SA) (g) for 1 sec Structural period at Engineering Seismic Ground Surface (Depth upto 30m) Corresponding to a Probability of Exceedance of 10% in 50 years**

Upazila Boundary

**SA 1sec (g)**

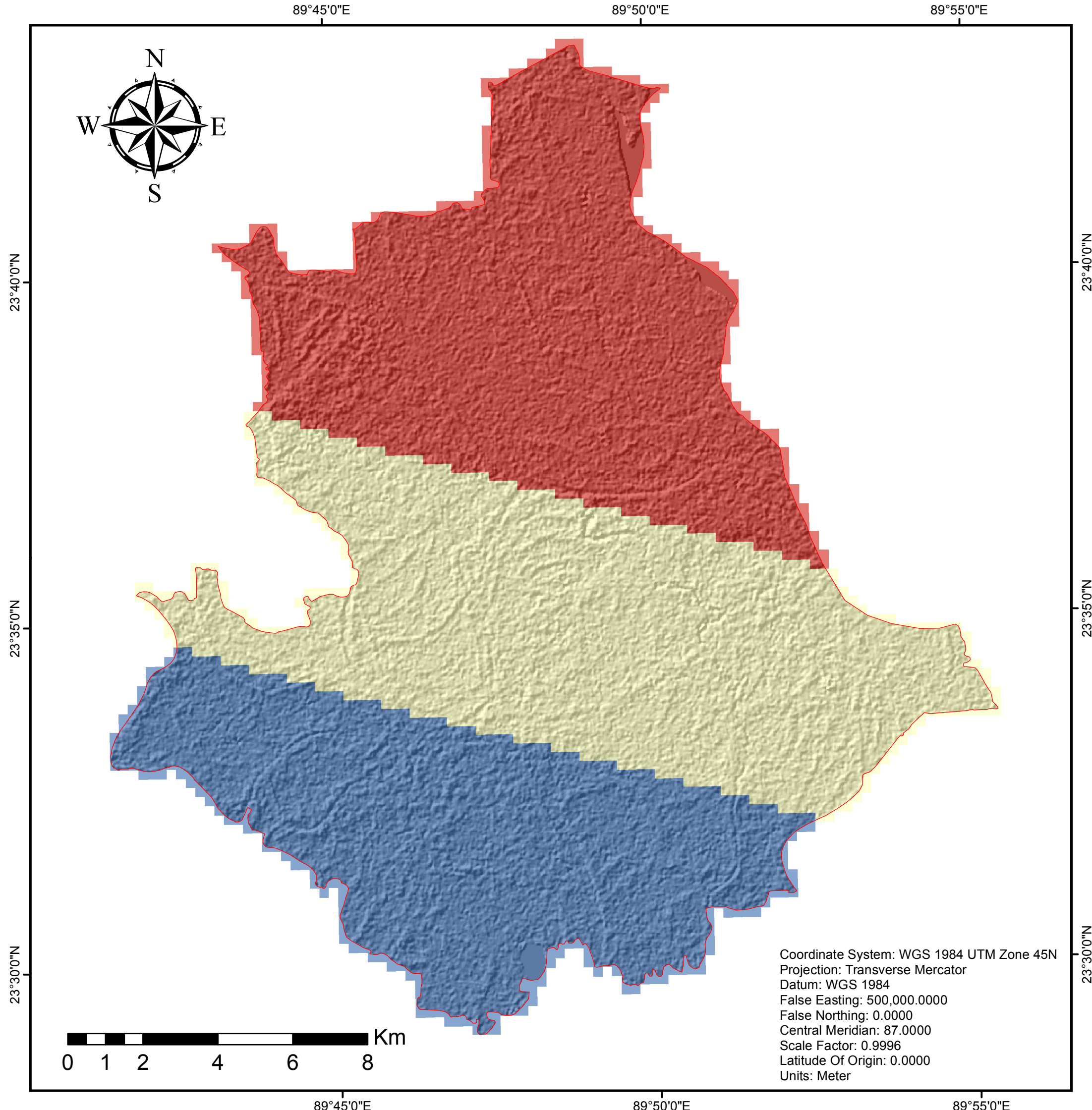
	0.4257 - 0.4871
	0.4872 - 0.5484
	0.5485 - 0.6098

This map was produced by multiplying SA values with Amplification factors corresponded for different soil type. as the Vs is within 168-244m/s so soil was classified as (E,D5,D4,D3). Thus the amplification factor was also modified. Spectral Acceleration (SA) (g) for 1 sec at Engineering Ground Surface(Depth upto 30)corresponding to probality of exceedance of 10% in 50 year was count for each grid.

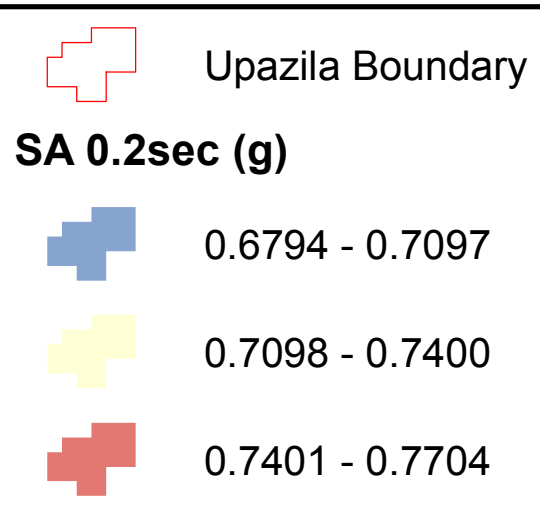


The soil amplification factors for PGA by NEHRP (National Earthquake Hazard Reduction Program) provisions

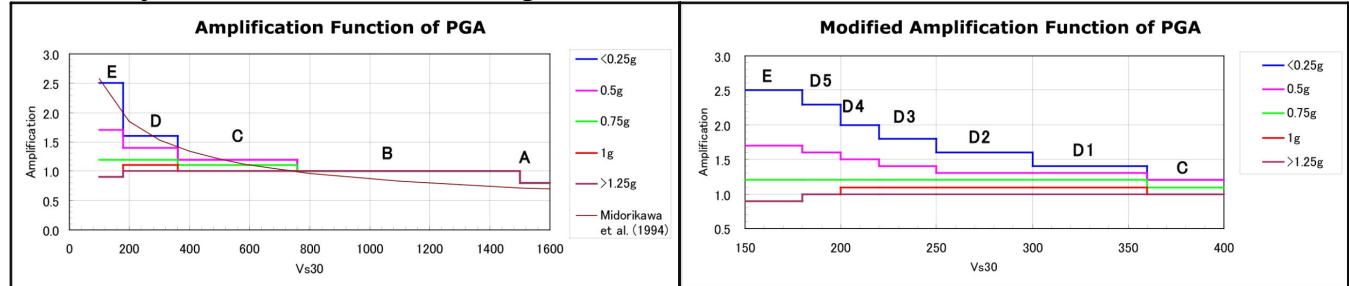




# **Spectral Acceleration (SA) (g) for 0.2 sec Structural period at Engineering Seismic Ground Surface (Depth upto 30m) Corresponding to a Probability of Exceedance of 10% in 50 years**

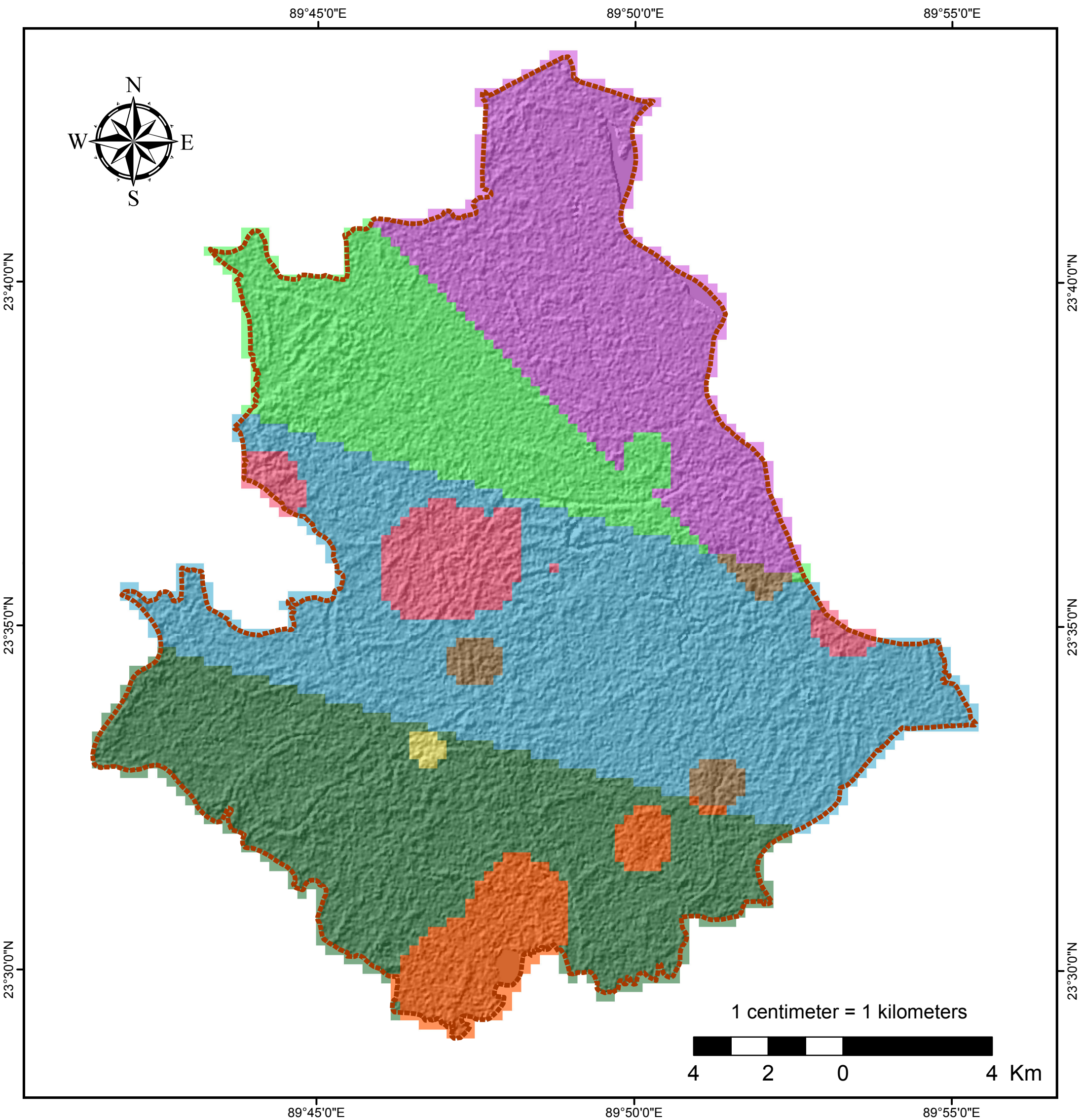


This map was produced by multiplying SA values with Amplification factors corresponded for different soil type. as the Vs is within 168-244m/s so soil was classified as (E,D5,D4,D3). Thus the amplification factor was also modified. Spectral Acceleration for 0.2 sec at Engineering Ground Surface(Depth upto 30) corresponding to probability of exceedance of 10% in 50 year was count for each grid.



The soil amplification factors for PGA by NEHRP (National Earthquake Hazard Reduction Program) provisions





# Building Height Recommendation Map of Faridpur Sadar Upazila

## Legend

Upazila Boundary

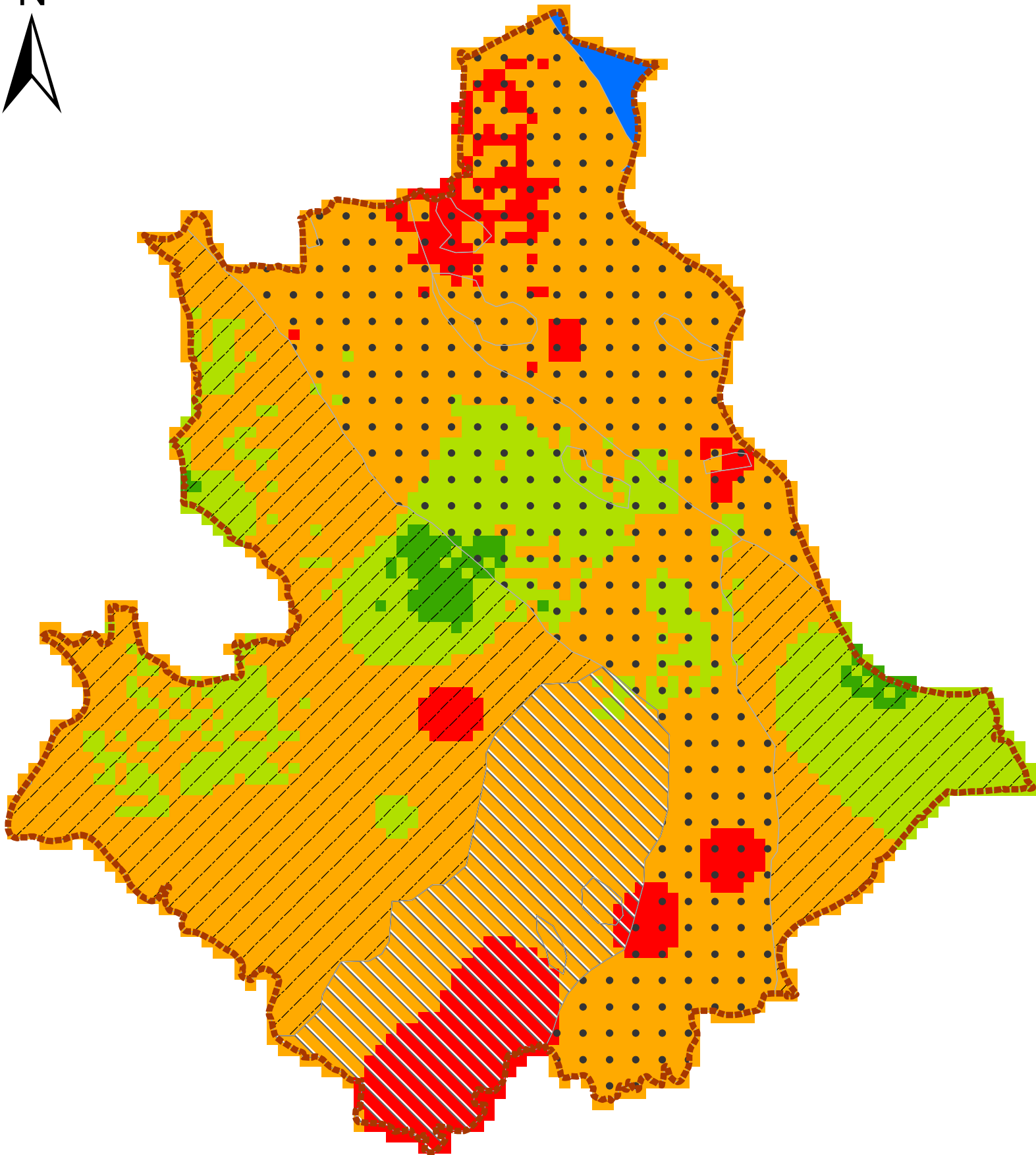
### Building Sensitivity

#### Low and High Rise Building

- 1st Degree Sensetive for Lowrise Building, 1st Degree Sensetive for Highrise Building
- 1st Degree Sensetive for Lowrise Building, 2nd Degree Sensetive for Highrise Building
- 2nd Degree Sensetive for Lowrise Building, 1st Degree Sensetive for Highrise Building
- 2nd Degree Sensetive for Lowrise Building, 2nd Degree Sensetive for Highrise Building
- 2nd Degree Sensetive for Lowrise Building, 3rd Degree Sensetive for Highrise Building
- 3rd Degree Sensetive for Lowrise Building, 1st Degree Sensetive for Highrise Building
- 3rd Degree Sensetive for Lowrise Building, 2nd Degree Sensetive for Highrise Building
- 3rd Degree Sensetive for Lowrise Building, 3rd Degree Sensetive for Highrise Building

Coordinate System: BUTM2010  
Projection: Transverse Mercator  
Datum: WGS 1984  
False Easting: 500,000.0000  
False Northing: 0.0000  
Central Meridian: 90.0000  
Scale Factor: 0.9996  
Latitude Of Origin: 0.0000  
Units: Meter

# Infrastructrure Suitability Map Faridpur Sadar Upazila



## Legend

Upazila Boundary

**Infrastructure Suitibility Class**

Very Good

Good

Moderate

Poor

**Surface Geology**

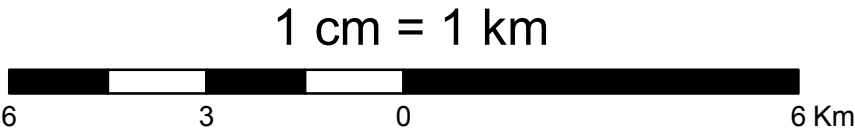
**Map Unit**

Deltaic sand

Deltaic silt

Marsh clay and peat

Water



Infrastructure Suitability	Infrastructure Foundation Suitability	Suggested Land Use Suitability
Very Good	4-6 story light infrastructure is suitable with a foundation depth of up to 2 m. Large and tail infrastructure requires pile foundation placed on Soil layer no 3 or 5.	Commercial area Residential area Industrial zone
Good	4-6 story light infrastructure is suitable in Madhupur Clay. General foundation depth is within 5 m, at places higher Large and tall infrastructure requires pile foundation placed on layer no 3 or 5	Commercial area Residential area Industrial zone
Moderate	4-6 story light infrastructure requires on-site subsoil investigation and proper foundation design. Deep pile foundation is needed for large and tail infrastructure	Industrial zone Residential area Commercial area Agricultural Zone Park and Recreation
Poor	Detail subsoil investigation and proper foundation design is required for all types of infrastructure, due to low bearing capacity with hazard potential.	Agricultural zone Flood flow zone Wetland Rural settlement Park and Recreation
Very Poor	Detail subsoil investigation for deep pile foundation is essential, due to very low bearing capacity and high hazard potential. Shallow foundation is not preferred.	Agricultural zone Flood flow zone Wetland Rural settlement Park and Recreation