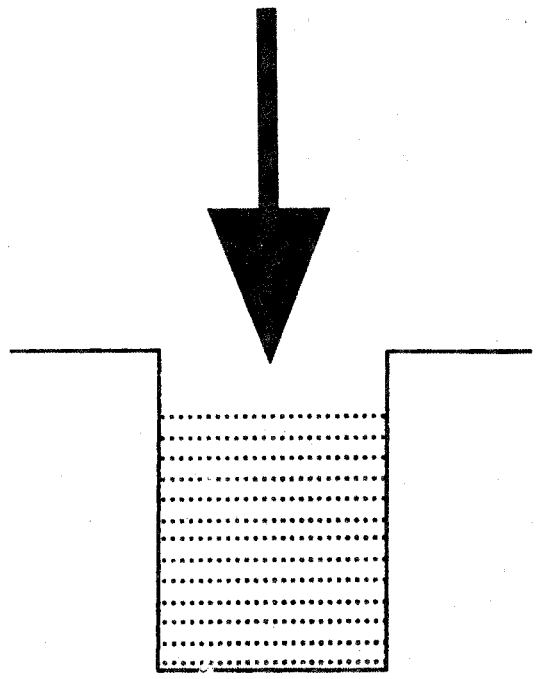
Geo- technical Report



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SITE : H. NO.- 372/1 CAL.-JESSORE ROAD, WARD NO - 8, P.S.- DUM DUM

A REPORT ON

SOIL INVESTIGATION FOR THE PROPOSED (G + IV) STORIED COMMERCIAL CUM RESIDENTIAL BUILDING AT J.L. NO.- 08, HOLDING NO.- 372/1 CAL.-JESSORE ROAD, C.S. KHATIAN NO.- 180, R.S. KHATIAN NO.- 529, WARD NO.- 08, L.R. KHATIAN NO.- 2258,608, C.S. DAG NO.- 114, L.R. DAG NO.- 273,272, R.S. NO.- 237, TOUZI NO.- 1070/2834, P.S.- DUM DUM, DIST.- 24PGS(N), UNDER SOUTH DUM DUM MUNICIPALITY

CLIENT : M/S. VAISHNOMATA CONSTRUCTIONS PVT. LTD.

SOIL INVESTIGATION ASSOCIATES:

ACUMEN GEO CONSULTANTS.

OFFICE: 2F, NABA ROY LANE, ALIPORE,

KOLKATA- 700 027.

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GENERAL

A sub-soil investigation work at H. NO.- 372/1 CAL.-JESSORE ROAD, WARD NO - 8, P.S.- DUM DUM. The order caring out the said investigation was taken immediately and supervised by the representative of the client.

THE SCOPE OF INVESTIGATION

It consists of two no. of bore holes 20M. & 10M. depth below E.G.L as shown in fig.1. The test location were shown by the client. Normal schedules of field and laboratory testing were carried out as per standard practice. All laboratory testing were carried out as per general requirement for the proposed structure

OBJECTS

The primary object of the soil investigation was :

1. To study the sub-soil characteristics in details by soil boring up to a maximum depth of 20.0M. Below G.L.

2. Carrying out in- situ testing within the bore holes as well as collection of un-disturbed soil samples.

3. Carrying out laboratory tests on un-disturbed soil samples.

4. Make recommendation for the suitable foundation system that may needed of the proposed Ground base tower as well as the economy. In arriving at the above, the investigation was schedule to include following :

1. Determination of maximum depth of fill if any.

2. Determination of water table as could be recorded during the period of field investigation

3. Suitability of various types of foundation design namely shallow foundations and deep foundation if needed.

4 Allowable bearing capacity of such shallow foundation.

5. Load carrying capacities of various types of deep foundation if needed.

6 Settlement characteristics of types of foundation design.

7. General technical observations, in connection with the field investigation and laboratory test results. An attempt is made, in this report to draw technical observed regarding the above, in addition to detailed field and laboratory findings

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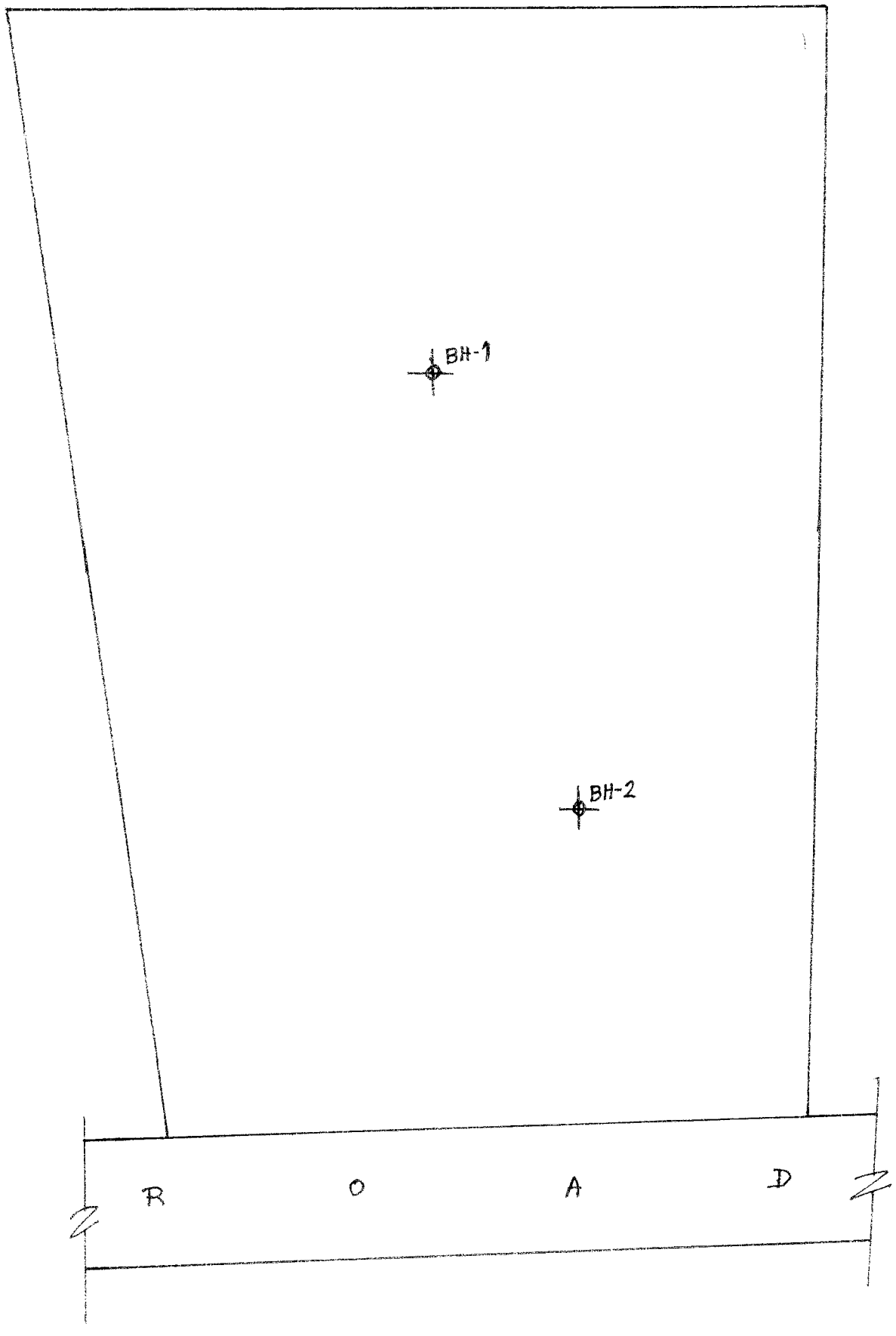

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THE FIELD WORK

The exploratory bore holes were sunk by hand auger, followed by betonies mud circulation. The initial diameter of the bore holes was 150mm. And flush jointed steel cashing were to prevent caving of the sub-soil inside bore holes during the operation.

During the period of boring operation, the disturbed soil samples were collected at a regular intervals and whenever the stratum change, these were collected from the cutting shoe of the un-disturbed samples as well as the same of SPT TESTS, and the SPTs split spoon samples. All these samples were labeled depth wise and were used in the preparation of bore holes the general identification and classification purpose as per IS : 1498 – 1970 and the laboratory tests on remolded conditions.

The un-disturbed samples were 100mm. Diameter x 400mm. Long. The un-disturbed samples were collected by slow hammering from cohesive and $c - \Phi$ soil, at an approximate intervals of 3.0M. and whenever stratum changed. However, when the stratum was thick sampling in similar soil was controlled by limited sampling on each bore hole to avoid the representation of laboratory test on similar soil. All the un-disturbed soil samples were labeled depth wise waxed at both ends and dispatched to laboratory for immediate testing.

The standard penetration tests (SPT) were conducted as per IS : 2131 – 1981 at regular intervals.

The penetration resistance commonly knows as 'N' value were recorded in the bore log data sheets and plotted depth wise as shown in fig.1.

The water table in the bore hole was recorded 24 hours after the completion of the field work of the respective bore holes.

All the laboratory tests carried out as per IS code.

THE LABORATORY TESTS.

All disturbed and un-disturbed soil samples were opened up in the laboratory for further identification and classification purpose and for the determination of laboratory test schedules.

The testing program was as follows :

1. Natural water content ;
2. Bulk density ;
3. Liquid limit and Plastic limit ;
4. Unconfined compression strength ;
5. Unconsolidated undrained triaxial ;
6. Specific gravity and void ratio ;
7. Hydrometer and sieve analysis ;
8. One dimensional consolidation test in oedometer.

All the above tests were carried out as per IS : 2720 respective parts, as applicable and as per standard practice of tests.
The test results were tabulated in test result sheets.

SOIL PROFILE & PROPERTIES

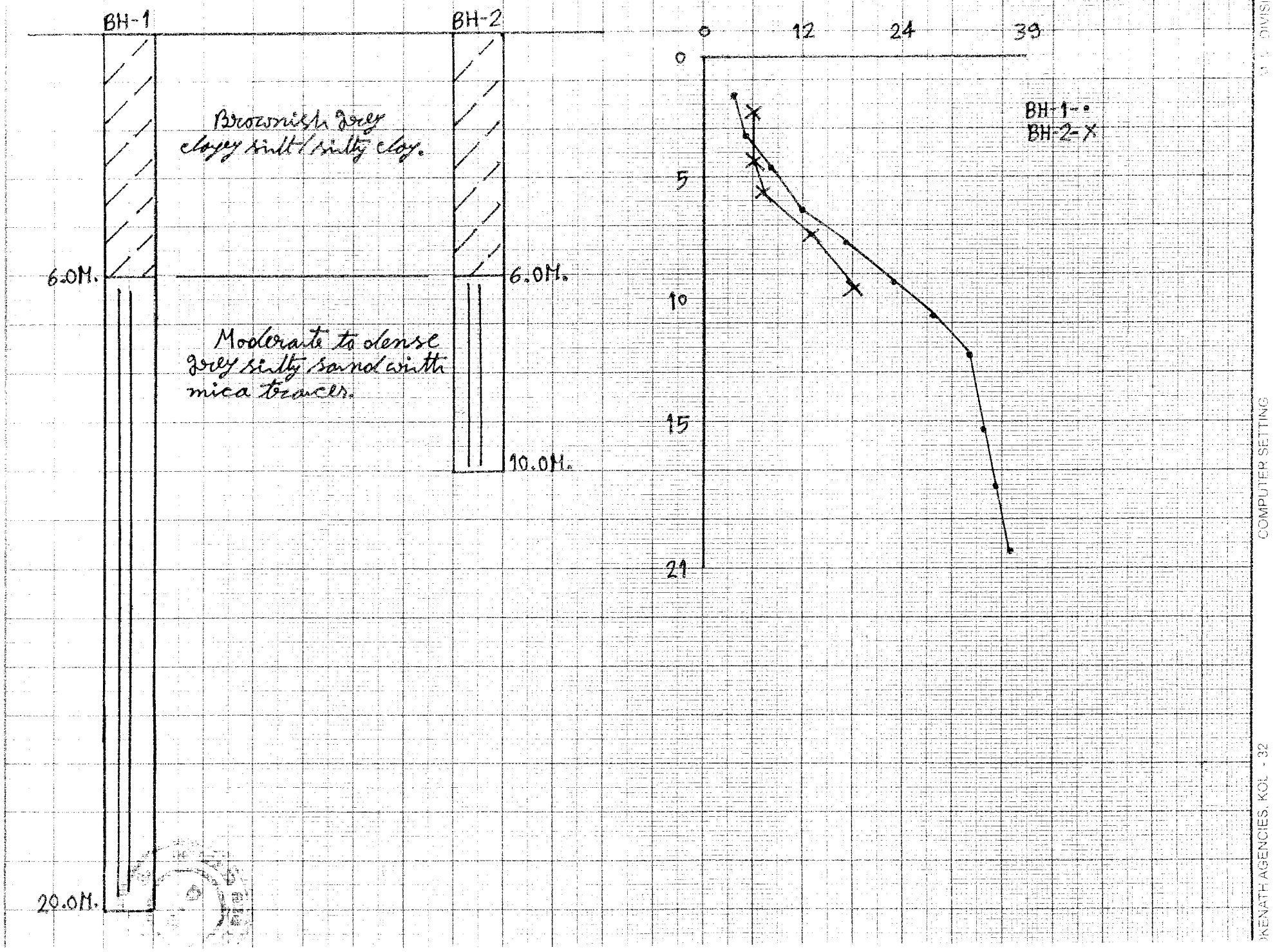
Sub-soil conditions as revealed from the 2 bore holes have been shown in the soil profile. Immediately below the G.L., there is a layer of brownish grey clayey silt/silty clay. Beyond 6.0M. Moderate to dense grey silty sand with mica traces extends upto the termination depth of 20.0M G.L.

The soil stratification appears to be more or less uniform over the entire area and the sequence of stratification is summarized shown below :

Stratum	Description	Avg Thickness(M)	Range of 'N' value
I	Brownish grey clayey silt/silty clay.	6.0	4 - 8
II	Moderate to dense grey silty sand with mica traces.	14.0	12 - 37

The average engineering properties of different strata related to the design of foundation have been arrived from field and laboratory test data as given below :

Stratum	Thickness (M.)	Bulk density (T/cu.M.)	NMC %	C (T/sq.M.)	Φ (deg)	Mv ($cm.^2/kg.$)
I	6.0	1.84	30	3.0	0	0.039



FOUNDATION CONSIDERATIONS & BEARING CAPACITY

The proposed construction would be a building. Accordingly the loading would be low to moderate which would depend also on column spacing for the proposed RCC framed structure. However, the foundation design would not only depends on the height and loading but also sub-soil condition. For the sub-soil condition the two necessary condition, are to be satisfied i.e. the soil should not fail in sheer and the settlement should be within permissible limit.

From the sub-soil condition it is revealed that the top most deposit of clay is adequately strong to support medium rise building. So shallow foundation in the form of individual/strip footing may be adopted in the building area at a depth of 1.2M. below G.L. Individual footing of size 2.0M. to 3.0M. founded at a depth 1.2M. below G.L. may be used according to the column spacing and planning of the building.

Net allowable bearing capacity for such footing have been calculated keeping the settlement within permissible limit of 7.5cm. and a factor of safety 2.5 as shown below.

Footing size (M. x M.)	**Allowable bearing capacity (T/M^2)**	**Settlement (mm.)**
2.0 x 2.0	9.6	42.1
2.5 x 2.5	9.3	50.0
3.0 x 3.0	9.1	53.4

shallow foundation in the form of 1.5M. to 2.5M. wide strip footing have also been investigated. Net allowable bearing capacity within the permissible settlement of 7.5cm and a factor of safety of 2.5 such footing have worked out and shown below.

Width of strip (M.)	**Allowable bearing capacity (T/M^2)**	**Settlement (mm.)**
1.5	7.7	46.8
2.0	7.4	60.0
2.5	7.2	70.1

SAMPLE CALCULATION

FOR NET SAFE BEARING CAPACITY & SETTLEMENT FOR SQUARE FOOTING OF 3.0M. x 3.0M. SIZE PLACED AT 1.2M. DEPTH.

Net ultimate bearing capacity as per IS: 6403 – 1981

$Qu = C.Nc.Sc.dc.Ic.$

Where, $C = 3.0T/M^2$ (undrained cohesive strength)

Nc = bearing capacity factor = 5.14

Sc = shape factor = 1.3 for square footing

Dc = depth factor = 1 + 0.35df/B where, df = depth of foundation = 1.2M.

B = width of footing

Ic = inclination factor = 1.0

Therefore, $Qu = 3.0 \times 5.14 \times 1.14 \times 1.3 = 22.8\ T/M^2$

ALLOWABLE BEARING CAPACITY

$qall = 22.8/2.5 = 9.1\ t/m^2$

Consolidation settlement

Thickness of layer below the footing susceptible to consolidation settlement

H1 =2B

Increment pressure due to foundation load at the mid depth of layer is

$\Delta P = 9.1 \times 3.0 \times 3.0/(6X6) = 2.285\ t/M^2$ (considering 2V 1H stress distribution)

Consolidation settlement sc = mv x ΔpxH

Sc1 = 0.0039 x 6.0 x 2.285 x 1000 = 53.4mm

CONCLUSION

For any other size of footings the permissible bearing capacity has to be calculated and the settlement has to be estimated and kept within the permissible limit.

If the column load varies considerably, it is suggested to provide tie beams to avoid \ differential settlement.

Medium size structure may be supported on shallow foundations.

There should be sufficient gaps in between two footings to avoid over stress among the adjacent footing.

Precaution should be taken for nearby existing structures.

Construction in stages is also advised.

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LABORATORY TESTS RESULT.

BH No.	Sam. depth	N. M. C.	Bulk Den-sity	LL %	PL %	Cu Kg / C m^2	C Kg/ Cm^2	Φ Deg.	Sp. Gra vity	e	C_c	C_c 1+e0	Sa nd	Si lt	Cl ay
I	2.5	30	1.84	42	20	-	.30	0	2.67	.80	.20	0.11	7	70	23
II	3.0	32	1.86	41	21	-	.32	0	2.68	.82	.21	0.11	6	72	22

BH-	depth	DESCRIPTION
I	2.5	Brownish grey clayey silt.
II	3.0	Brownish grey clayey silt.

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TYPE OF BORING/DRILLING : Auger/wash BORE HOLE NO. : 1
DIA OF BORING : 150mm. DATE STARTED :
GROUND WATER LEVEL : 1.3 M. DATE COMPLETED :

DEPTH OF BORING/CORI SG(M)		DESCRIPTION OF STRATA	STRATA THICKN-SS (M)	SAMPLE		SP T (N)
FROM	TO			TYPE	DEPTH(M)	
0.0	6.0	Brownish grey clayey silt/ silty clay.	6.0	DS-1	0.50	
				DS-2	1.00	
				SPT-1	1.50-2.10	4
				UDS-1	2.50-2.95	
				SPT-2	3.00-3.60	5
				SPT-3	4.50-5.10	8
6.0	20.0	Moderate to dense grey silty sand with mica traces.	14.0	SPT-4	6.00-6.60	12
				SPT-5	7.50-8.10	17
				SPT-6	9.00-9.60	23
				SPT-7	10.50-11.10	28
				SPT-8	12.00-12.60	32
				SPT-9	15.00-15.60	34
				Spt-10	17.50-18.10	35
				Spt-11	20.00-20.60	37

SITE : H. NO.- 372/1 CAL.-JESSORE ROAD. WARD NO.- 8. P.S.- DUM DUM

TYPE OF BORING/DRILLING : Auger/wash BORE HOLE NO. : 2
DIA OF BORING : 150mm. DATE STARTED :
GROUND WATER LEVEL : 1.3M. DATE COMPLETED :

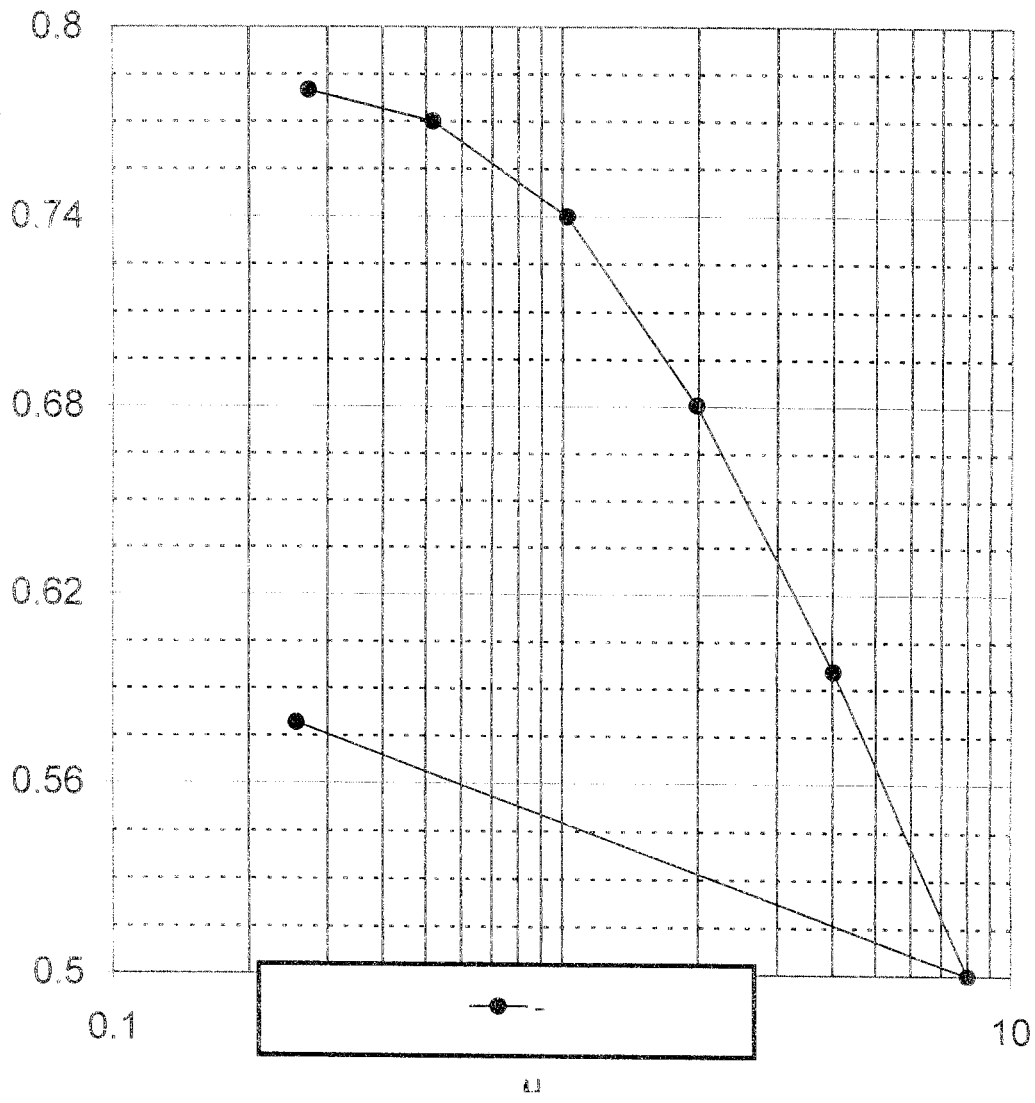
DEPTH OF BORING/CORI SG(M)		DESCRIPTION OF STRATA	STRATA THICKN-SS (M)	SAMPLE		SP T (N)
FROM	TO			TYPE	DEPTH(M)	
0.0	6.0	Brownish grey clayey silt/silty clay	6.0	DS-1 DS-2 SPT-1 UDS-1 SPT-2 SPT-3	0.50 1.00 2.00-2.60 3.00-3.45 4.00-4.60 5.50-6.10	 6 6 7
6.0	10.0	Moderate to dense grey silty sand with mica traces.	4.0	SPT-4 SPT-5	7.00-7.60 9.50-10.10	13 18

JESSORE ROAD

B.H.No.1 Depth 2.5M, e0 =0.80

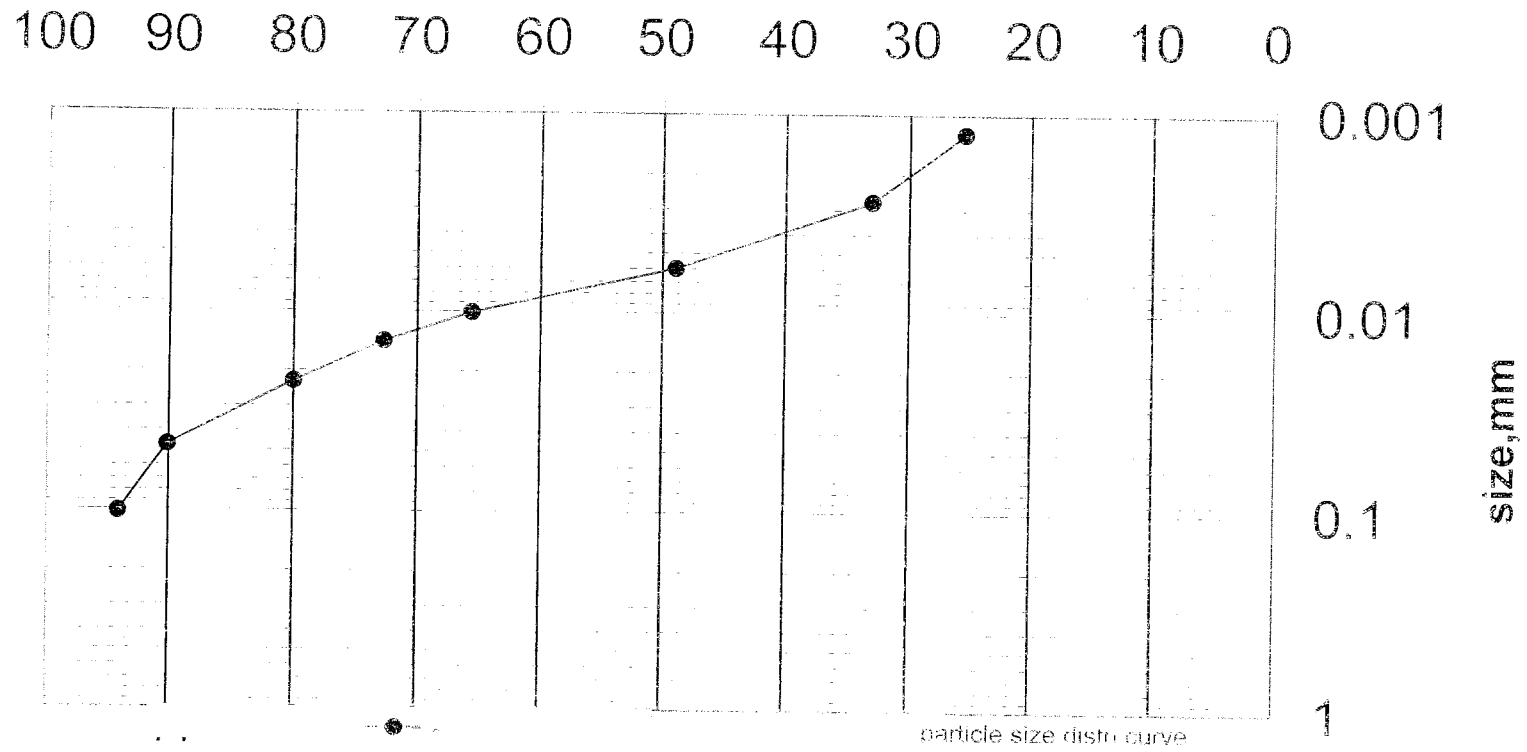
Pressure (kg/sq.cm) .

e vs logp curve



JESSORE ROAD

BH- 1 DEPTH- 2.5M, SAND- 7 % SILT-70 % CLAY 23%



particle size distribution curve