

FINAL REPORT

GEOTECHNICAL/SUB-SOIL INVESTIGATION WORK

FOR A CONSTRUCTION OF RESIDENTIAL BUILDING –EWS-II (P+14 FLOOR)IN

PACKAGE NO.:48) FP NO.:131, TP NO.:64 (NORTH WEST ZONE)

MOJE.: TRAGAD,

TA.:CITY, DIS. :AHMEDABAD. , STATE:GUJARAT

REPORT NO. : 2112/EI-795/S-154/21

MONTH & YEAR : DECEMBER, 2021

SUBMITTED TO,

**THE ADDITIONAL CITY ENGINEER (HOUSING PROJECT)
5TH FLOOR, C-BLOCK,SARDAR PATEL BHAVAN
AHMEDABAD MUNICIPAL CORPORATION
AHMEDABAD
PREPARED BY**

**THE GUJARAT INSTITUTE OF CIVIL ENGINEERS AND ARCHITECTS,
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CO-CHAIRMAN

CONVINER

LABORATORY COMMITTEE

Date :14/12/2021

To,

The Additional City Engineer (Housing Project)

Sub.: Report for the soil investigation work for EWS-II building (P+G+14Floor) in Tragad (Package No.:48) , at

FP No.:131 TP No.:64,(North West Zone) , Moje.:-Tragad

We have conducted the soil investigation work at above mentioned site

.Alongwith this letter we are submitting the soil report for the same along with the SBC analysis.

Please call us for further information and clarification.

Thanking You,

For, **GICEA**

Material Testing & N.G.Patel Soil Testing Laboratory,

Authorised Signatory,

Encl.

1.Two copy of Report

2.One report in soft copy

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[1] INTRODUCTION :

The Additional City Engineer (Housing Project), proposes geotechnical investigation work for a Building for Tragad(Package No.:48) site (Plinth+G+14floor) in FP No.:131, TP No.:64(Tragad), Moje.: Tragad, Dist :Ahmedabad. in Gujarat state.

The purpose of the investigations was to determine the sub soil stratification of the soil, geotechnical information & safe bearing capacity of the soil, so as to provide information that will assist the structural engineers in the design of the foundations with and the relevant works.

The Job was carried out under the guidance and supervision of the soil personnel of **G.I.C.E.A Laboratory,Ahmedabad**, and client's engineer.

[2] FIELD WORK :

- 1) Drilling One nos. of 150 mm dia borehole with casing whenever required up to maximum depth of 20 m from ground level.
- 2) Carryout standard penetration test at regular interval alternate to undisturbed sampling
- 3) Collecting disturbed soil samples at regular interval as per the stratification of soil ,recording depth at which soil changes.
- 4) Collecting undisturbed samples (UDS) at regular interval alternate to SP Test or continuous UD samples at regular interval if subsoil is cohesive.

[2.1] Borehole Drilling :

Drilling of 150 mm dia borehole was carried out by tractor mounted rotary drilling method above water table. Water was added while drilling but stopped at enough height above the test level to avoid disturbance. Drilling below water table was made by percussion drilling method casing is required to be lowered if holes do not retain its shape. Care is taken to maintain ground water table during drilling and particularly before testing or sampling levels. In no case casing is allowed to advance below the bottom of borehole. Chiselling is carried out if required while drilling .The Location of borehole was decided with due consideration of Client/Consultant of the project

(2.2) Collection of Samples:

Undisturbed soil samples in 70mm Ø shelby tubes were collected in the thin walled sampling tubes in accordance with IS: 2132-1981 at regular interval for finding shear parameters, field density, moisture content etc. of soil. The sampling tube was connected to the rod by jarring link in case of 38mm Ø tubes. A' drill rods were connected by suitable adaptor with ball check valve. Before lowering the sampler, the borehole was cleaned properly and sampling tubes were lightly oiled from inner and outer side.

Sampling tube was pushed into the borehole by pressure hammering as per the soil stiffness. The sampling tubes were waxed immediately after removal.

In case of medium to coarse grained, non-cohesive sand samples, where sampling is unsuccessful, Standard Penetration Tests was carried out after cleaning the borehole.

However, disturbed soil samples from shell or split spoon samplers were also collected in polythene bags with proper labels during drilling for finding index properties of the soil.

[2.3] Standard Penetration Test :

The standard penetration tests were performed in accordance with IS: 2131:1981 using the standard split spoon sampler & 63.5Kg hammer at the desired intervals. Before testing, the borehole was cleaned properly and Split spoon sampler was centrally seated in the borehole. In case of SPT to be conducted below water table, care was taken to keep casing position above the borehole depth. The water level in borehole is maintained above or at least at the water table.

A standard hammer of 63.5 kg is dropped from a height of 75 cms. And the no. of Blows for penetration of sampler for 0-15, 15-30 and 30-45 cms were noted in table no.3. Standard penetration test value N_s is considered for last 30 cm penetration, For non plastic silts and fine sands N_s value is corrected for effective overburden pressure and dilatancy. Correction is applied for tests conducted below water table.

[3] LABORATORY WORK

Following laboratory tests were carried out on the samples collected from the site.

1. Water content on selected samples from SPT
2. Field density, Moisture content and dry density of undisturbed samples.
3. Grain size Analysis of SPT samples, UD samples and disturbed samples covering each soil strata.
4. Atterberg's Limit for samples
5. Specific gravity Test for samples as per 3.
6. Shrinkage Limit / Free Swell / Differential Swell test for selected samples of expansive soil
7. Test for shear properties of selected samples.
8. Unconfined compressive Strength on saturated cohesive soil
9. Triaxial Shear test under UU/CU condition with or without pore pressure measurement as per in situ conditions. Normally soft cohesive saturated samples will be consolidated at average overburden pressure.

The common practice adopted in the field and laboratory testing by & large are as per I S code indicated . Results of the laboratory tests performed on various soil samples are presented in the form of table at the end of report.

[4 .0] PHYSICAL PROPERTIES:-

The moisture cans collected from SPT samplers from the field are weighed and placed in oven for drying to determine natural moisture content(NMC). Results are tabulated in table-3

UDS are extracted using screw type extractor and samples were prepared as per the required size of the test. Weight and volume of the samples were noted before extracting from tubes. Average bulk density is calculated and samples were placed in oven to get the field moisture content for computing the dry density. Results are tabulated in table 4.

Specific gravity with specific gravity bottle/pycnometer is calculated as per IS 2720. Results were tabulated in table 4. Saturation of sample in % is also calculated which is a useful data for deciding the condition of triaxial shear test.

Grain size analysis is made by IS sieves of sizes 4.75mm, 2.00mm, 1.00mm, 0.425mm, 0.25mm and 0.075mm. For coarse grained soil a graph of particle size v/s cumulative % finer is plotted. For fine grained soil wet analysis is made on plummet balance. Results are tabulated in table 5

Liquid limit and Plastic Limit tests are carried out with distilled water as per IS 2720 part – 5. The samples are tested at a minimum of 24 hours after the addition of water. Liquid limit is done on Casagrande standards with occasional checking by Cone penetration method.

The soil samples showing high plasticity were checked for swelling and shrinkage. Firstly for rough estimate, free swell test is carried out as per IS 2720 part – 40. Shrinkage limit test is carried out as per IS 2720 part 6.

[5.0] SHEAR PROPERTIES:-

Shear tests were carried out by three methods.

- 1) Unconfined compressive strength as per IS 2720 part-10 for the saturated plastic soil
- 2) Triaxial shear test is to be carried out on samples of size 38mm dia and 76 mm in height on motorized 30 speed load frame. The confining pressure is applied to the cell by oil water constant pressure system. The tests are carried out for the three conditions
 - a) Unconsolidated Undrained (UU) test without pore water pressure measurement as per IS 2720 part 1
 - b) Consolidated Undrained (CU) test without pore water pressure measurement as per IS 2720 part 11

The condition is decided on type of sample and water table condition or designer's specifications.

- c) Direct/box shear test on noncohesive medium to coarse sandy soil as per IS 2720 part 13. The graph for triaxial shear test is plotted by modified method.

[6.0] SOIL STRATIFICATIONS.:

[6.1] BOREHOLE: BH-1

(6.1.1) Layer No. 1

This layer from 0.30 m ,1.5mtr&3.00 m depth is observed to consist of

Brownish to yellowish brown colored sandy clayey/ silty claye soil with low plasticity . The grain size analysis and consistency limits indicate the layer as CL. The grain size analysis shows variation in % of silt and clay is from 61% to 73% ; in sand is from 24% to 38% and gravels is from 01% to 06%. The variation in liquid limit is from 29% to 31% and that plasticity index is form 08% to 10%.

(6.1.2) Layer No. 2

This layer from 4.5 m depth is observed to consist of

yellowish brown colored Yellowish brown fine sand and little portion clay mix with non plasticity. The grain size analysis and consistency limits indicate the layer as ML. The grain size analysis shows variation in % of silt and clay is from 68% ; in sand is from 26% and gravels is from 06%. The variation in liquid limit is from 29% and no plasticity index 8% .

(6.1.3) Layer No. 3

This layer from 06.00 m ,7.5m & 9.0 m depth is observed to consist of

yellowish brown colored sand, clayey/ silty claye soil with non . The grain size analysis and consistency limits indicate the layer as SM. The grain size analysis shows variation in % of silt and clay is from 21% to 28% ; in sand is from 68% to 77% and gravels is from 01% to 04%. There is no liquid limit and plasticity index.

(6.1.4) Layer No. 4

This layer from 10.50 m & 12.0 depth is observed to consist of brown colored clay sand and little portion silt mix with Low Plasticity soil. The grain size analysis and consistency limits indicate the layer as SC. The grain size analysis shows variation in % of silt and clay is from 32% to 38% ; in sand is from 56% to 62% and gravels is from 06%. The variation in liquid limit is from 30% to 31% and plasticity index is 11% to 12% .

(6.1.5) Layer No. 5

This layer from 13.50 m & 15.00 m depth is observed to consist of

Brownish to yellowish brown colored sandy clayey/ silty claye soil with low plasticity . The grain size analysis and consistency limits indicate the layer as CL. The grain size analysis shows variation in % of silt and clay is from 53% to 55% ; in sand is from 40% to 46% and gravels is from 01% to 05%. The variation in liquid limit is from 29% to 30% and that plasticity index is form 10%.

(6.1.6) Layer No. 6

This layer from 16.00 m to 20.0 m depth is observed to consist of

yellowish brown colored sand, clayey/ silty claye soil with non . The grain size analysis and consistency limits indicate the layer as SM. The grain size analysis shows variation in % of silt and clay is from 26% to 43% ; in sand is from 52% to 74% and gravels is from 00% to 05%. There is no liquid limit and plasticity index.

[7] GROUND WATER TABLE :

Ground water level was not observed in the borehole to 20.00 m depth below GL at the time of investigation. (Decemeber-2021).

8] CONCLUSIONS & RECOMMENDATION:

(8.1) The site for proposed soil investigation work at Tragad general is observed to consist of silty /clayey fine sandy / poor graded ,non- low plasticity soil up to 20.00 m depth of termination.

Ground water level was not observed in the borehole to 20.00 m depth below GL at the time of investigation. (Decemembr-2020).

(8.2) The net safe bearing capacity of open foundation having width varying from 1.5 to 2.0 m at 1.50 m to 2.50 m depth below GL is recommended in following paras considering 50 mm maximum permissible settlement and in natural condition of soil. For indivisual depth and size of footing please refer table on page no.11 of this report.

(8.3) The top soil is not having swelling potential and hence is suitable to be used for back / Plinth filling purpose.

(8.4) The results of the laboratory tests are incorporated in the form of table at the later part of the report.

(8.5) In site location do plat load is perfect result for on site.

For,G.I.C.E.A.,

Material Testing & N.G.Patel Soil Testing Laboratory,

Authorised Signatory

Project : 2112-ei-795-tp-64-tragad - FP NO.:131, TP No.:64

Calculation for Safe Bearing Capacity

Design Data :

Foundation Type	: Square Footing
Width of Footing	: 1.50 m
Depth of Footing	: 1.50 m
Failure Mode	: Mixed Shear Failure
Shape and Depth Factors	: To be considered
Load inclination	: 0.00 Deg
Water Table	: Not Seen at Drilling time
Factor of Safety	: 2.50

Calculations :

Ultimate Bearing Capacity (for Mixed Shear Failure) q'_d

$$\begin{aligned} &= 0.67 c N'_c s_c d_c i_c + q (N'_q - 1) s_q d_q i_q + \frac{1}{2} B \gamma N'_\gamma s_\gamma d_\gamma i_\gamma \\ &= 0.67 \times 0.19 \times 9.47 \times 1.3 \times 1.272 \times 1 + 0.2565 \times (3.1 - 1) \times 1.2 \times 1.136 \times 1 + 0.5 \times 150 \times 0.00171 \times 1.84 \times 0.8 \times \\ &1.136 \times 1 \\ &= 1.993 + 0.734 + 0.214 \\ &= 2.941 \text{ Kg/cm}^2 \\ &= 29.41 \text{ T/m}^2 \end{aligned}$$

Where

c	= Cohesion = 0.19 kgf/cm ²
q	= Effective surcharge at base of fdn = 0.2565 kgf/cm ²
B	= Width of footing = 150 cm
γ	= Bulk unit weight of foundation soil = 0.00171 Kgf/cm ³
W'	= Correction factor for location of water table = 1
ϕ	= Angle of shearing resistance of soil in degrees = 17.4
N'_c	= Bearing Capacity Factor = 9.47
N'_q	= Bearing Capacity Factor = 3.10
N'_γ	= Bearing Capacity Factor = 1.84
s_c	= Shape factor = 1.3
s_q	= Shape factor = 1.2
s_γ	= Shape factor = 0.8
d_c	= Depth Factor = 1.272
d_q	= Depth Factor = 1.136
d_γ	= Depth Factor = 1.136
i_c	= Inclination Factor = 1
i_q	= Inclination Factor = 1
i_γ	= Inclination Factor = 1

Safe Bearing Capacity

$$= 11.76 \text{ T/m}^2 \text{ [Considering a Safety Factor of 2.5]}$$

Project : 2112-ei-795-tp-64-tragad - FP NO.:131, TP No.:64

ALLOWABLE NET SAFE BEARING CAPACITY

Sr.	Width	Depth	Surcharge	W'	Shape F	Shape F	Shape F	Depth F	Depth F	Depth F	Incl F.	Incl F.	Incl F.	q _{safe}	Settlement
No	(m)	(m)	Kg/cm ³		s _c	s _q	s _γ	d _c	d _q	d _γ	i _c	i _q	i _γ	T/m ²	mm
1	1.50	1.50	0.26	1.00	1.30	1.20	0.80	1.27	1.14	1.14	1.00	1.00	1.00	11.76	12.0
2	1.50	2.00	0.34	1.00	1.30	1.20	0.80	1.36	1.18	1.18	1.00	1.00	1.00	13.51	11.0
3	1.50	2.50	0.43	1.00	1.30	1.20	0.80	1.45	1.23	1.23	1.00	1.00	1.00	15.33	11.1
4	1.50	3.00	0.51	1.00	1.30	1.20	0.80	1.55	1.27	1.27	1.00	1.00	1.00	17.22	10.4
5	2.00	1.50	0.26	1.00	1.30	1.20	0.80	1.20	1.10	1.10	1.00	1.00	1.00	11.5	12.2
6	2.00	2.00	0.34	1.00	1.30	1.20	0.80	1.27	1.14	1.14	1.00	1.00	1.00	13.03	11.2
7	2.00	2.50	0.43	1.00	1.30	1.20	0.80	1.34	1.17	1.17	1.00	1.00	1.00	14.62	11.3
8	2.00	3.00	0.51	1.00	1.30	1.20	0.80	1.41	1.20	1.20	1.00	1.00	1.00	16.26	10.7
9	2.50	1.50	0.26	1.00	1.30	1.20	0.80	1.16	1.08	1.08	1.00	1.00	1.00	11.45	12.4
10	2.50	2.00	0.34	1.00	1.30	1.20	0.80	1.22	1.11	1.11	1.00	1.00	1.00	12.86	11.4
11	2.50	2.50	0.43	1.00	1.30	1.20	0.80	1.27	1.14	1.14	1.00	1.00	1.00	14.3	11.6
12	2.50	3.00	0.51	1.00	1.30	1.20	0.80	1.33	1.16	1.16	1.00	1.00	1.00	15.8	10.9

For,,G.I.C.E.A.,

Material Testing & N.G.Patel Soil Testing Laboratory,

Authorised Signatory

CLASSIFICATIONS:

GW: Well graded gravels, gravel sand mixture or no fines

GP : Poorly graded gravels or gravels sand mixture, little or no fines

GM: Silty gravels, poorly graded gravel-sand-silt mixtures

GC : Clayey gravels, poorly graded gravels-sand-clay mixtures

SW : Well graded sands, gravelly sands, little or no fines

SP : Poorly graded sands or gravelly sands; little or no fines

SC : Claye sands, poorly graded sand-clay mixture

SM: Silty sands, poorly graded sand-silt mixture

ML: Inorganic silt and very fine sands, silty or clayey fine sands or clayey silt with non to low plasticity

CL: Inorganic clays, gravelly clays, sandy clays, silty clays, lean clays of low plasticity

OL: Organic silts and organic silty clay of low plasticity

MI: Inorganic silts, silty or clayey fine sands or clayey silts of medium plasticity

CI: Inorganic clays, gravelly clays, sandy clays, silty clays, lean clays of medium plasticity

OI : Organic silts and silty clay of medium plasticity

MH: Inorganic silt of high compressibility, micaceous or diatomaceous fine sandy or silty soils, elastic silts

CH: Inorganic clays of high plasticity, fat clays

OH: Organic clays of medium to high plasticity

Pt.: Peat and other highly organic soil with very high compressibility

ABBREVIATIONS

DS : Disturbed Soil Sample

UDS : Undisturbed Soil Sample

SPT : Standard Penetration Test

SBC : Safe Bearing Capacity

NP : Non Plastic

DST : Direct Shear Test

LL : Liquid Limit

PL : Plastic Limits

PI : Plasticity Index

***** : Remolded Sample

Ref. : Refusal

GENERAL TERMS AND CONDITIONS

- 1.** The test are carried out under certain laboratory condition and parameter
- 2.** Results given in this report refers only to the material supplied to the laboratory.
- 3.** The test report do not indicate the quality of the product or usage of product or suitability of the product or material.
- 4.** This test report does not indicate the sampling criterion for testing the samples..
- 5.** Any site testing or supervision is to be done separately.
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Permission of the testing agency shall be deemed to be an infringement.
- 8 .** The report/results are not to be used for publicity.
- 9.** Location of bore, nos of bore and depth of bore decided by client.

For, G.I.C.E.A.,

MATERIAL TESTING & N.G.PATEL SOIL TESTING LABORATORY

Authorized Signatory

TABLE - 1

FIELD PROGRAMME OF TESTS

Project : FP NO.:131, TP No.:64

Project No. 2112-ei-795-tp-64-tragad

Owner : Add City Engineer Housing Projects

Bore Hole No.

1

Location of Bore Hole : Tragad

: RL of Ground Level (mt):

Depth in mts.	Visual Soil Description	Field Tests		Remarks
00.30	Brownish to yellowish brown clay fine sand little portion silt mix with low plasticity	SPT	DS	
01.50				
03.00			UDS	
04.50	Yellowish brown fine sand and silt mix non to low plasticity	SPT		
06.00			UDS	
07.50	Yellowish brown fine sand and little portion clay mix with non plasticity	SPT		
09.00			UDS	
10.50				
12.00	Yellowishbrown clay ,fine sand and little portion silt with low plasticity	SPT		
13.50			UDS	
15.00	Yellowish brown clay/silt fine sand mix with low plasticity	SPT		
16.50			UDS	
18.00				
20.00	Yellowish brown fine sand and little portion clay mix with non plasticity	SPT		
			UDS	

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GICEA-2112-EI-795-EWS-FP-131-TP-64

TABLE - 2
RESULTS OF STANDARD PENETRATION TEST

Project : FP NO.:131, TP No.:64
Owner : Add City Engineer Housing Projects

Project No. :
2112-ej-795-tp-64-tragad
Bore Hole No. : 1

Depth in mts.	No. of Blows for Penetration			Ns (Blows /300 mm)	Nc(Corrected value of Ns)	N. M. C. (in %)
	0 - 150 mm	150 - 300 mm	300 - 450 mm			
0.30						8.11
1.50	04	06	08	14	14	10.50
3.00						11.38
4.50	07	11	21	32	32	11.73
6.00						5.78
7.50	09	18	23	41	36	12.04
9.00						10.84
10.50	12	18	24	42	42	13.31
12.00						14.87
13.50	19	26	39	65	65	13.31
15.00						12.68
16.50	15	21	34	55	33	17.65
18.00						13.52
20.00	18	24	40	64	34	18.34

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TABLE - 4**INSITU DENSITY, MOISTURE CONTENT, DRY DENSITY & SPECIFIC GRAVITY**

Project : FP NO.:131, TP No.:64

Project No.:fp-64-tragad

Owner : Add City Engineer Housing Projects

Bore Hole No. : 1

Depth Sample (mts.)	Bulk Density in gms/cc	Natural Moisture Content (%)	Dry Density in gms/cc	Specific Gravity	Saturation
0.30		8.11			
1.50		10.50			
3.00	1.71	11.38	1.54	2.64	
4.50		11.73			
6.00	1.72	5.78	1.62	2.65	0.24
7.50		12.04			
9.00	1.81	10.84	1.63	2.65	0.46
10.50		13.31			
12.00	1.89	14.87	1.65	2.66	0.64
13.50		13.31			
15.00	1.92	12.68	1.70		
16.50		17.65			
18.00	1.96	13.52	1.73		
20.00		18.34			

TABLE - 3
PARTICLE SIZE DISTRIBUTION

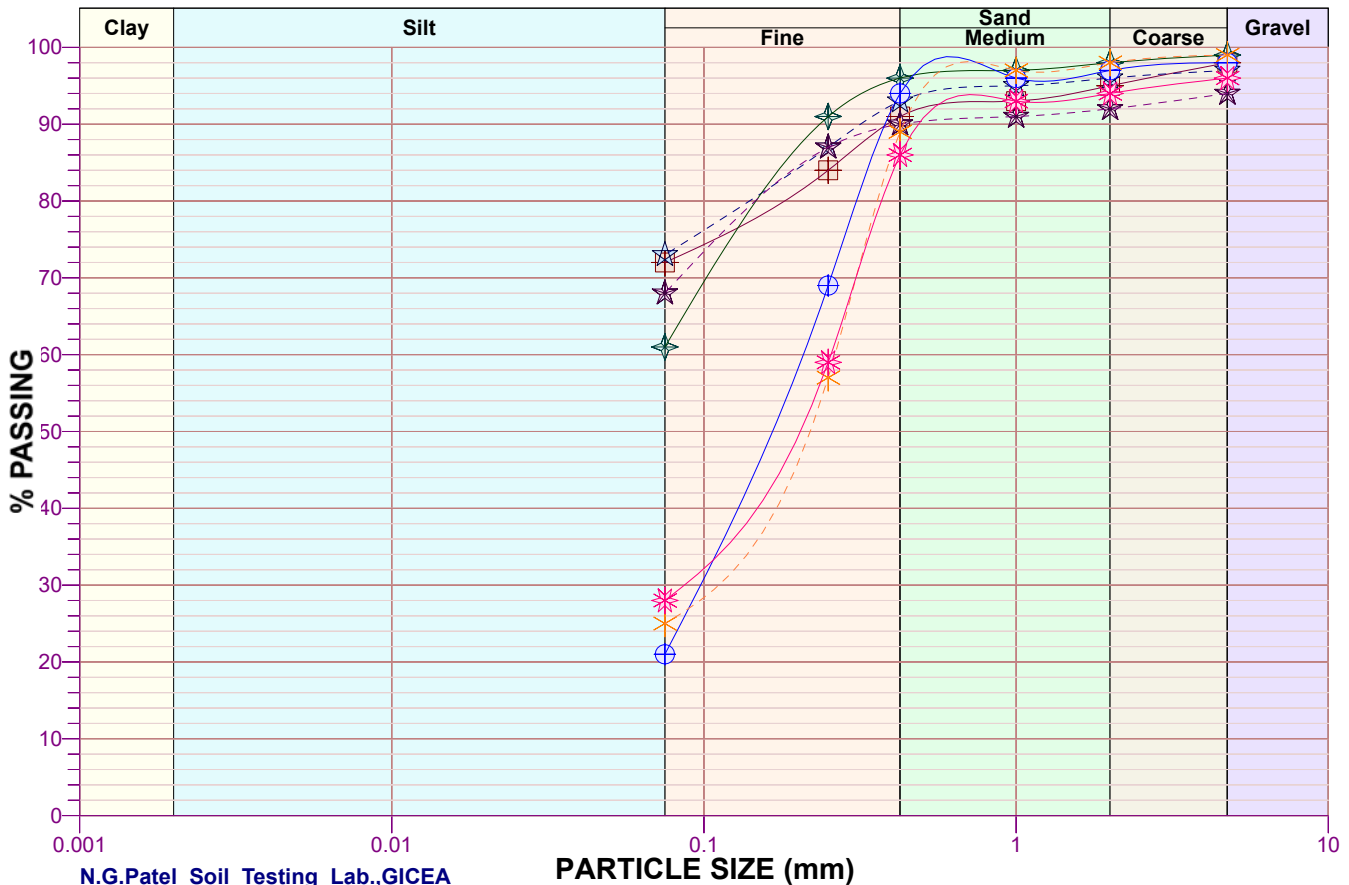
Project : FP NO.:131, TP No.:64

Project No.: 2112-ei-795-tp-64-tragad

Owner : Add City Engineer Housing Projects

Bore Hole No. : 1

Depth Type of Sample		Soil Strata	Gravel in % (>4.75 mm)	Sand in %			Silt in % + Clay in %
				Coarse (4.75 - 2 mm)	Medium (2mm - 425 μ)	Fine (425 - 75 μ)	
0.30/D	★ ★ ★	0.30 to 4.50	2	3	4	19	72
1.50/S	⊕ ⊕ ⊕	0.30 to 4.50	3	1	3	20	73
3.00/U	✱ ✱ ✱	0.30 to 4.50	1	1	2	35	61
4.50/S	✱ ✱ ✱	4.50 to 6.00	6	2	2	22	68
6.00/U		6.00 to 10.50	2	1	3	73	21
7.50/S		6.00 to 10.50	1	1	9	64	25
9.00/U		6.00 to 10.50	4	2	8	58	28



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TABLE - 3
PARTICLE SIZE DISTRIBUTION

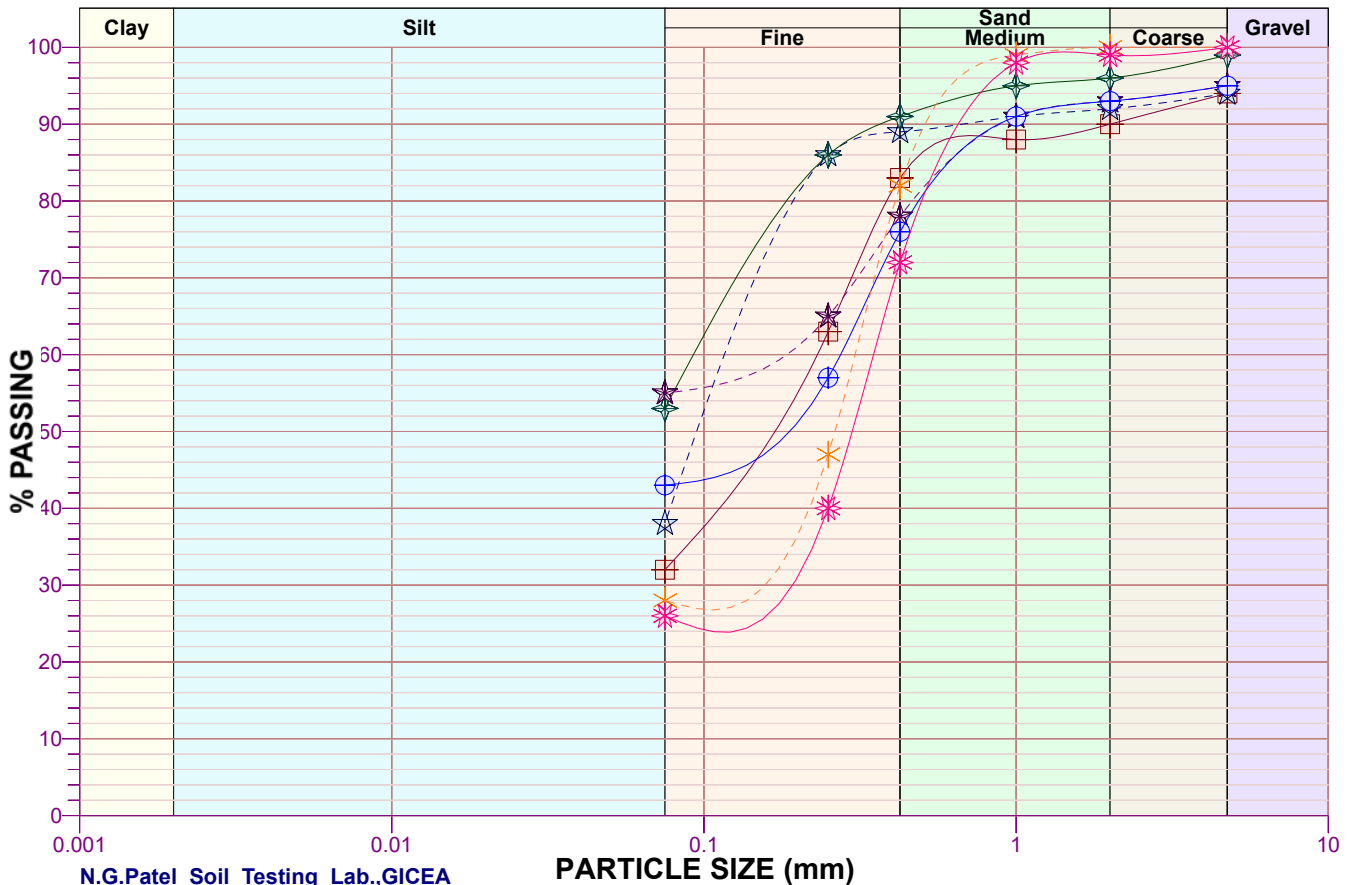
Project : FP NO.:131, TP No.:64

Project No.: 2112-ei-795-tp-64-tragad

Owner : Add City Engineer Housing Projects

Bore Hole No. : 1

Depth Type of Sample		Soil Strata	Gravel in % (>4.75 mm)	Sand in %			Silt in % + Clay in %
				Coarse (4.75 - 2 mm)	Medium (2mm - 425μ)	Fine (425 - 75 μ)	
10.50/S	★ ★ ★	10.50 to 13.50	6	4	7	51	32
12.00/U	⊕ ⊕ ⊕	10.50 to 13.50	6	2	3	51	38
13.50/S	✱ ✱ ✱	13.50 to 16.50	1	3	5	38	53
15.00/U	✱ ✱ ✱	13.50 to 16.50	5	2	15	23	55
16.50/S		16.50 to 20.00	5	2	17	33	43
18.00/U		16.50 to 20.00	0	0	18	54	28
20.00/S		16.50 to 20.00	0	1	27	46	26



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TABLE - 3
PARTICLE SIZE DISTRIBUTION

Project : FP NO.:131, TP No.:64

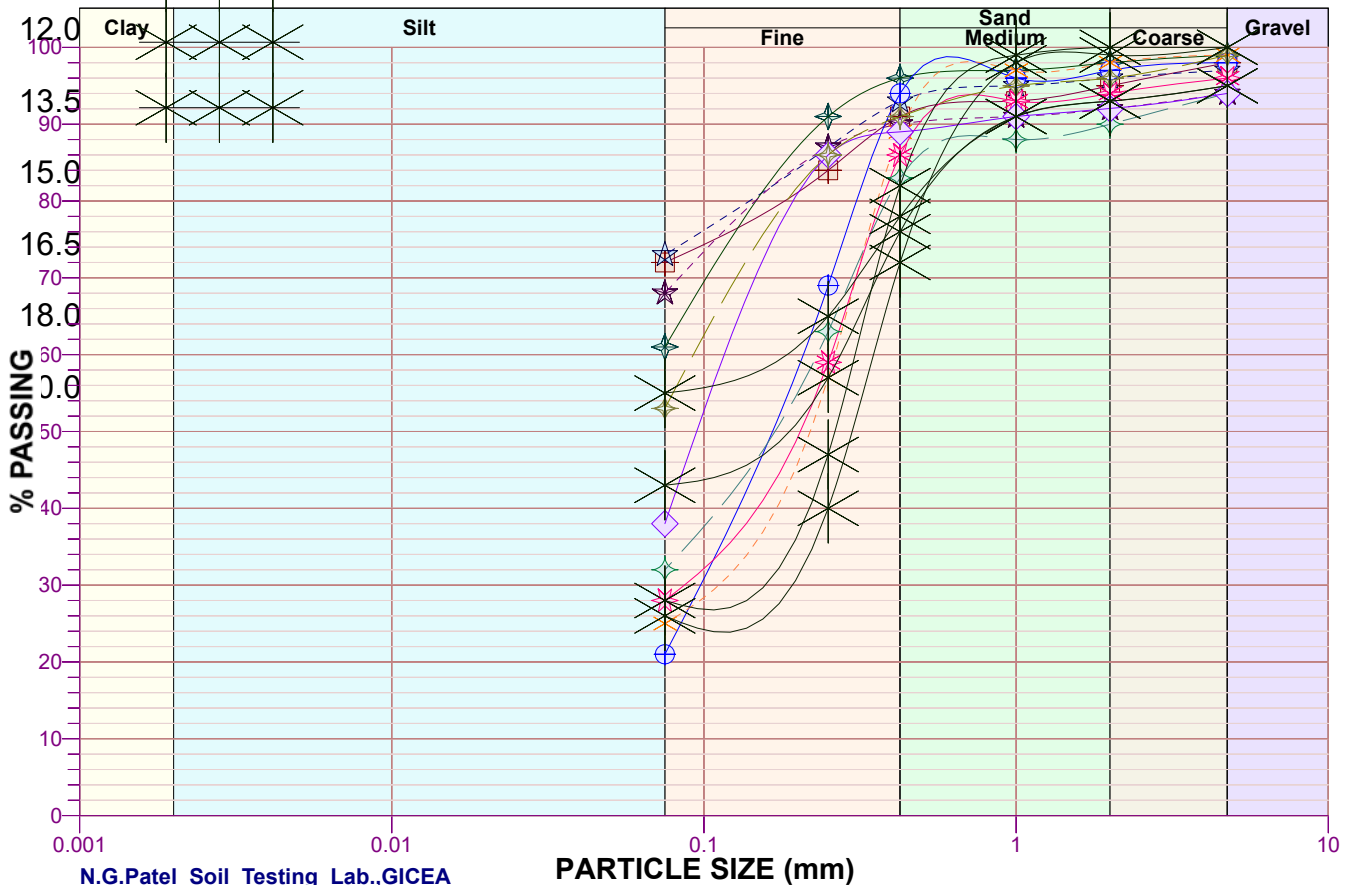
Project No.: 2112-ei-795-tp-64-tragad

Owner : Add City Engineer Housing Projects

Bore Hole No. :

1

Depth Type of Sample		Soil Strata	Gravel in % (>4.75 mm)	Sand in %			Silt in % + Clay in %
				Coarse (4.75 - 2 mm)	Medium (2mm - 425μ)	Fine (425 - 75 μ)	
0.30/D	★ ★ ★	0.30 to 4.50	2	3	4	19	72
1.50/S	⊕ ⊕ ⊕	0.30 to 4.50	3	1	3	20	73
3.00/U	✱ ✱ ✱	0.30 to 4.50	1	1	2	35	61
4.50/S	✱ ✱ ✱	4.50 to 6.00	6	2	2	22	68
6.00/U	◆ ◆ ◆	6.00 to 10.50	2	1	3	73	21
7.50/S	◆ ◆ ◆	6.00 to 10.50	1	1	9	64	25
9.00/U	✱ ✱ ✱	6.00 to 10.50	4	2	8	58	28
10.50/S	✱ ✱ ✱	10.50 to 13.50	6	4	7	51	32



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SUMMARY OF GEOTECHNICAL EXPLORATIONS

Project No. :2112-ei-795-tp-64-tragad					Bore Hole Started on :06-12-21					Depth of Water Table :Below Termination Level																											
Bore Hole No. :1					Bore Hole Completed on :06-12-21					R. L. of Ground Level :																											
Method of Drilling :ROTARY DRILLING					Diameter of Bore Hole :150 mm					Location of Bore Hole :Tragad																											
Depth in metres	I. S. Classification	Visual Soil Description	Field Test /Samples		Ns No. of Blows per 300 mm	Rock Property C.R. % RQD %	Natural Moist. Content (in %)	Density (in gms/cc)		Specific Gravity	Particle Size Analysis			Atterberg Limits			Shrinkage Lim. %	Free Swell Indx %	Shear Property			Compressibility Property															
			SPT VST	UDS DS				Bulk	Dry		Gr. %	Sn %	Silt+ Clay	LL %	PL %	PI %			Test Type	C (Kg/cm²)	Ø in Deg.	Pressure Range in Kg/cm²	Mv in 10 ⁻⁴ cm²/Kg	Cv in 10 ⁻⁴ cm²/sec													
00.30	CL	Brownish to yellowish brown clay fine sand little portion silt mix with low plasticity	SPT	DS	14			8.11				2	26	72	31	22	9																				
01.50																																					
03.00				UDS																															23	TUU	0.19
04.50	CL	Yellowish brown fine sand and silt mix non to low plasticity	SPT		32			11.73				6	26	68	29	21	8																				
06.00	SM	Yellowish brown fine sand and little portion clay mix with non plasticity	UDS				5.78	1.72	1.62	2.65	2	77	21		-	-									Duu	0.003	1.0°										
07.50			SPT		41			12.04				1	74	25		-	-																				
09.00			UDS					10.84	1.81	1.63	2.65	4	68	28		-	-		Duu	0.003	1.6°																
10.50	SC	Yellowishbrown clay ,fine sand and little portion silt with low plasticity	SPT		42			13.31				6	62	32	31	19	12																				
12.00			UDS					14.87	1.89	1.65	2.66	6	56	38	30	19	11									Duu	0.06	27.2°									
13.50	CL	Yellowish brown clay/silt fine sand mix with low plasticity	SPT		65			13.31				1	46	53	29	19	10																				
15.00			UDS					12.68	1.92	1.70		5	40	55	30	20	10																				
16.50			SPT		55			17.65				5	52	43		-	-																				
18.00	SM	Yellowish brown fine sand and little portion clay mix with non plasticity	UDS					13.52	1.96	1.73		0	72	28		-	-																				
20.00			SPT		64			18.34				0	74	26		-	-																				
SPT - Standard Penetration Test			DS - Disturbed Sample			Gr - Gravel Sand			LL - Liquid Limit			PI - Plasticity Index			Cv - Coeff. of Consolidation			Mv - Coeff. of Volume Change			C.R. - Core Recovery			RQD - Rock Quality Designation													
UDS - Undisturbed Sample			VST - Vane Shear Test			Sn - Sand			PL - Plastic Limit			C, Ø - Shear Parameters																									

SPT - Standard Penetration Test DS - Disturbed Sample Gr - Gravel LL - Liquid Limit PI - Plasticity Index Cv - Coeff. of Consolidation C.R. - Core Recovery
 UDS - Undisturbed Sample VST - Vane Shear Test Sn - Sand PL - Plastic Limit C, Ø - Shear Parameters Mv - Coeff. of Volume Change RQD - Rock Quality Designation

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