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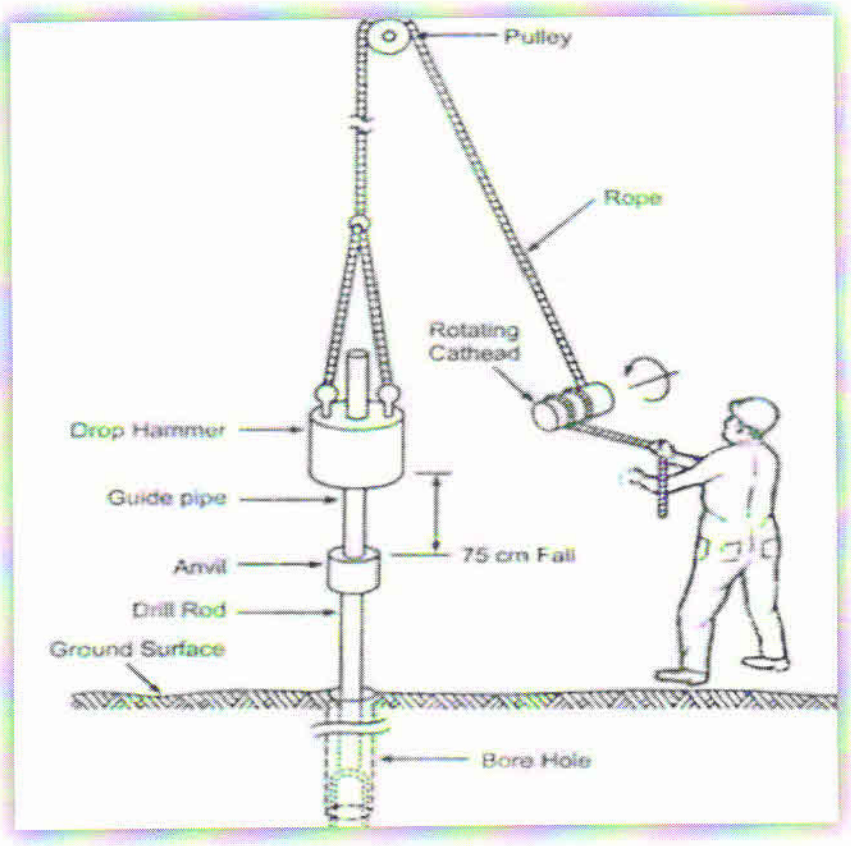
Geotechnical & Material Testing Facility



PROJECT

Soil Investigation in KV AFS for Vocational Lab, Sambra, Belgaum.

PROJECT No: 022

Garrison Engineer(AF) ,Sambra, Belgaum

TRIDENT LABORATORIES ★ RATNAGIRI ★

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National Accreditation Board for Testing and Calibration Laboratories

NABL

CERTIFICATE OF ACCREDITATION

TRIDENT LABORATORIES

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

PLOT NO D-20, MIDC, MIRJOLE, RATNAGIRI, MAHARASHTRA, INDIA

in the field of

TESTING

Certificate Number: TC-13098

Issue Date: 16/02/2024 Valid Until: 15/02/2026

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Entity: TRIDENT LABORATORIES

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

TRIDENT LABORATORIES

Geotechnical & Material Testing Facility

PROJECT NO : 022 **DATE : 15.06.2024**

PROJECT SUMMARY

- Work awarded vide Contract No GEMC-511687741186383 Dated 28.05.2024 for carrying out Topographic Survey and Soil Investigation at:
  KV AFS, (For Vocational Lab) at Sambra, Belgaum
- Following types of activities were conducted
  a) Topographic Survey.
  b) Soil Investigation by Drilling Bore / SPT test, UDS and Core.
- The details of Client

Office Zone	GE,AFS,Sambra, Belgaum
Organisation	Indian Army
Department	Department of Military Affairs
Ministry	Ministry of Defence
Type	Central Government

- The activities were conducted between 31.05.2024 and 04.06.2024
- The Report is submitted and the works completed today on

For **TRIDENT LABORATORIES.**

TRIDENT LABORATORIES RATNAGIRI

CEO & Technical Manager

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ABBREVIATION

SBC	:	Safe Bearing Capacity
SBP	:	Safe Bearing Pressure
SPT	:	Standard Penetration Tests
BH	:	Borehole
A	:	Area of footing
B	:	Width of footing
C	:	Cohesion intercept
D_f	:	Depth of footing
e	:	Void ratio
e_o	:	Initial Void Ratio
F	:	Factor safety
G	:	Gravitation Force, Specific gravity
H	:	Height/Thickness of Layer
K	:	Earth pressure coefficient
L	:	Length of footing
N	:	Observed SPT N value
N′	:	Overburden corrected SPT N value
N″	:	Corrected SPT N value
P	:	Load Intensity
P_o		Initial Load Intensity
q_{nu}	:	Net ultimate bearing capacity
q_{ns}	:	Net safe bearing capacity
q	:	Overburden pressure.
R	:	Relative Density of soil
W′	:	Water table correction factor
γ	:	Bulk Unit weight
γ'	:	Effective Unit Weight
F	:	Factor of safety
S_c, S_γ, S_q	:	Shape Factors
d_c, d_q, d_γ	:	Depth Factors

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CONTENTS

1. **Introduction** 1

1.1 Project Description 1

1.2 Purposes/objective of study 1

1.3 Scope of geotechnical investigation 1

2. **Field Investigation** 1

2.1 Borehole Drilling 1

2.2 Ground Water Table 2

3. **Laboratory Test** 3

4. **Site Condition** 3

4.1 Site Description 3

4.2 Site Stratigraphy 3

5. **Design Parameter** 3

5.1 Bearing Capacity Analysis 3

5.2 Bearing Capacity on Rock 4

5.3 Load carrying capacity analysis for Pile 5

5.4 Settlement Analysis 5

6. **Recommendation ,Conclusion and discussion** 9

7. **Referernces** 10

ANNEXURE

Annexure 1 Satellite View 12

Annexure 2 Bore log Data Sheet 11

Annexure 3 Result Sheet 13

Annexure 4 Site Investigation Photograph 15

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i_c, i_q, i_γ	:	Inclination Factors
N_c, N_q, N_γ	:	Bearing Capacity Factors
N'_c, N'_q, N'_γ	:	Corrected Bearing Capacity Factors
α	:	Inclination of the load to the vertical in degree
Ø	:	Angle of internal friction
GW, GP, GM, GC	:	Well Graded, Poorly Graded, Silty, Clayey Gravel with respectively
SW, SP, SM, SC	:	Well Graded, Poorly Graded, Silty, Clayey Sand with respectively
ML, MI, MH	:	Low, Intermediate, Highly Plastic Silt with respectively
CL, CI, CH	:	Low, Intermediate, Highly Plastic Clay with respectively
DS	:	Disturbed sample
UDS	:	Undisturbed sample
UCS	:	Unconfined compressive strength
DUU	:	Direct shear test in Unconsolidated undrained condition
TRX	:	Triaxial shear test in Unconsolidated undrained condition
RQD	:	Rock Quality Designation
q_c	:	Unconfined compressive strength of rock
S_i	:	Immediate settlement
S_c	:	Consolidation settlement
S_t	:	Total Settlement
Δp	:	Load increment
I_f	:	Influence factor for immediate settlement
C_c	:	Consolidation Index
P_c	:	Pre- Consolidation pressure

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1. INTRODUCTION

1.1 Project Description

Trident Laboratories has carried out the geotechnical investigation for the proposed project. At the time of our field investigations, the boreholes have been drilled from the ground level.

The complete geotechnical investigation work was undertaken to obtain required sub surface information to define nature and behaviour of soil, under application of loads of proposed structure A satellite view showing the locations of our field investigation is illustrated Annexure 1.

1.2 Purposes/objective of study

[1]The purpose of site exploration is to provide reliable, specific and details information about the soil and ground water condition of their site which may be required for a safe economic design and execution of the engineering work.

1.3 Scope of Geotechnical Investigation

1. Determine the nature of soil at the site and its stratification.
2. Determined the depth and nature of bedrock if and when encounter.
3. Obtaining disturbed and undisturbed soil/rock samples for visual identification and appropriate laboratory test.
4. Nature of each stratum and engineering properties of soil and rock which may affect design and mode of construction of proposed structures and their foundations.
5. Location of ground water and possible corrosive effects of soil and water on foundation materials.
6. Observing drainage condition from and into the site.
7. Performing some in situ field tests per site condition
8. Field Investigation

2.1Borehole Drilling

The boreholes were progressed using a mechanized shell to the specified depth. The borehole diameter was 150 mm. Where caving of the borehole occurred, 150 mm diameter casing was used to keep the borehole stable. The work was in general accordance with IS: 1892-1979.

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Standard Penetration Tests (SPT) was conducted in the boreholes at 1.5 m depth intervals. The test was performed by connecting a split spoon sampler to rods and driving it by 45 cm using a 63.5 kg hammer falling freely from a height of 75 cm. The tests were conducted in accordance with IS: 2131-1986. And undisturbed samples were collected by attaching 75 mm diameter thin walled 'Shelby' tubes. The tubes were sealed with wax at both ends.

Standard split spoon sampler was used for conducting Standard Penetration Test and were conducted in boreholes to obtain SPT 'N' values at 1.0 to 1.5 m intervals. The number of blows required to drive each 15cm penetration is recorded. The first 15cm of drive considered as seating drive. The total blows required for the second and third 15cm penetration is termed as a penetration resistance - N value. Recorded SPT N value was first corrected due to overburden (Overburden correction) for cohesion less soil and second correction (Diltency correction) apply if, the stratum consists of fine sand and silt below water table for values of N' greater than 15.

Refusal is defined as an SPT value exceeding 100 blows for 30 cm or less penetration of the split-spoon sampler; or 25 blows for 2.5 cm or less penetration of the split-spoon sampler. Where refusal (N>100) to further penetration of the split spoon sampler is encountered in the first 15 cm seating penetration itself, SPT test could not be completed and "Ref" is indicated in the bore logs, along with the penetration achieved.

2.2Ground Water Table

The groundwater table, is the level at which water is found in the ground within soil or rock. It is the boundary between the unsaturated zone, where the pores and spaces in the soil or rock are filled with air and some water, and the saturated zone, where the pores and spaces are completely filled with water.

The groundwater table can vary in depth depending on factors such as the amount of precipitation, the topography of the area, the type of soil or rock, and the rate of water withdrawal. It is an important factor in understanding the ground water level changes according to seasons caused by changes in precipitation between seasons and years.

Groundwater level was measured in the boreholes 24 hours after drilling and sampling was completed. The groundwater table was recorded up to the investigated depth in borehole during subsoil exploration work carried out in the month of December 2023.

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3. LABORATORY TEST

Laboratory tests were conducted on selected soil, to determine their physical and engineering properties. The testing procedures were in accordance with current applicable IS specifications.

Table 1 Following test were conducted on selected soil

Name of test	Relevant IS Code
Bulk Density	By calculation
Natural Moisture Content	IS: 2720 (Part-2)-1973, RA-2020
Grain Size Analysis	IS: 2720 (Part-4)-1985, RA-2020
Specific Gravity	IS: 2720 (Part-3)-1980, RA-2021
Liquid and plastic limits	IS: 2720 (Part-5)-1985, RA-2020
Unconfined compression test	IS: 2720 (Part-10)-1993, RA-2020
Unconsolidated undrained tri axial shear test	IS: 2720 (Part-11)-1993, RA-2021
Unconsolidated undrained direct shear test	IS: 2720 (Part-13)-1986, RA-2021

4.SITE CONDITION

4.1Site Description

The project site is located near Belgaum in Karnataka. The site is surrounding nearby hilly terrain.

4.2Site Stratigraphy

The soil at the site is alluvial in nature. The stratigraphy encountered at the site generalized stratum as described in Annexures

5.DESIGN PARAMETER

5.1Bearing Capacity Analysis

Bearing capacity analysis for raft/Square foundation has been done in general accordance with IS: 6403-1981. The bearing capacity equation used is as follows:

$$q_{net\ safe} = \frac{1}{F}[CN_cS_cd_ci_c + q(N_q - 1)S_qd_qi_q + 0.5B\gamma N_\gamma S_\gamma d_\gamma i_\gamma W']$$

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Appropriate values have been substituted into the bearing capacity equation given above to compute the safe net bearing capacity. The values have been checked to determine the settlement of the foundation under the safe bearing pressure. The allowable bearing pressure has been taken as the lower of the two values computed from the bearing capacity *shear failure criterion as well as that computed from the tolerable settlement criterion.

Notes: *Shear Failure Criterion:

Sr. No.	Mode of Shear Failure	Angle of internal friction, (Ø)	Void ratio, (e)	SPT – N value
1	General shear failure	(Ø) > 36°	(e) < 0.55	N value > 30
2	Mix shear failure	29° < (Ø) < 36°	0.55 < (e) < 0.75	10 < N value < 30
3	Local shear failure	(Ø) < 29°	(e) > 0.75	N value < 10

5.2 Bearing Capacity on Rock

A-Typical Calculation for Allowable Bearing Pressure (As per IS 12070 - 1987) based on Core Strength

Calculation for Permissible Bearing Pressure of Rock

Safe Bearing Pressure (Gross) (qs) = Nj * qc

Where Nj = Empirical coefficient depending upon spacing of discontinuities.

Type of Discontinuity	Nj
Very Wide	0.40
Wide	0.25
Moderately	0.10

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5.3 Load carrying capacity analysis for Pile

Ultimate point bearing capacity

Following equation has been used for Computation of Ultimate Point Bearing (Re);
Re = K_{sp} x q_c x d_f x A_b

Ultimate skin friction capacity

Following equation has been used for Computation of Ultimate Skin Friction (Raf);
Raf = A_s x C_{us}

5.4 Settlement Analysis

Settlement analysis for open / raft foundations has been performed based on the SPT values in accordance with Clause 9.1.4 of IS 8009 (Part 1)-1976 Fig.9 and the consolidation test. The value of SBC is calculated only for symmetric static loading conditions. The inclined and dynamic loading condition has not considered while computing the safe bearing capacity

The total settlement is computed as summation of immediate and secondary settlement.

$$\textbf{Total settlement } S_T = S_i + S_c$$

1) Elastic Deformation or immediate settlement of foundation soil:

$$\textbf{Immediate settlement } S_i = \mathrm{pB}\frac{(1-\mu^2)I_f}{E}$$

2) Primary consolidation of foundation soil resulting from the expulsion of pore water, Secondary Compression of foundation soil; and Creep of the foundation soil:

$$\textbf{Consolidation settlement } S_c = \frac{H_t}{(1+e_0)} C_c \log_{10}\frac{(p_0+\Delta p)}{p_0}$$

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6.1 Safe Bearing Capacity Calculations

By General (Local) Shear Failure

Sample Calculation Bore Hole A (Depth 2.5. Mtr & Footing Size 2.0x2.0 Mtr)

Net Safe Bearing Capacity q net =	CNcScdcic + q(nq-1)Sqdqiq + 0.5BySydyiyW'			
Bore Hole No	A		Shape Factor Sc	1.3
Depth of Footing Df	2.5	M	Shape Factor Sq	1.2
Cohesion C	0.25	Kg/cm²	Shape Factor Sy	0.8
Angle of internal Friction ϕ	19.5	°	Bearing Capacity factors	
Void ratio e			Nc	14.44
Specific Gravity Gs	2.66		Nq	6.15
Density of Water	1	gm/cc	Ny	5.11
Bulk Density of Soil y	1.83	gm/cc	Depth Factors	
Type (Shape) of footing	Square		dc	1.14
Length of Footing L	2	M	dq	1.07
Width of Footing B	2	M	dy	1.07
Depth of Water Table W		M	Inclination Factors	
Effect of Water Table W'	0.5		ic	1
Over Burden Pressure q	4.575	Kg/M²	iq	1
Factor of Safety FOS	2.5		iy	1
	5.35		30.25	0.78

Net Safe Bearing Capacity q net =	14.55	T/m²

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Sample Calculation Bore Hole B (Depth 2.5. Mtr & Footing Size 2.00x2.00 Mtr)

Net Safe Bearing Capacity q net =	**CNcScdcic + q(nq-1)Sqdqiq + 0.5BySyNydyiyW'**			
Bore Hole No	B		Shape Factor Sc	1.3
Depth of Footing Df	2.5	M	Shape Factor Sq	1.2
Cohesion C	0.28	Kg/cm²	Shape Factor Sy	0.8
Angle of internal Friction ϕ	22.6	°	Bearing Capacity factors	
Void ratio e			Nc	17.91
Specific Gravity Gs	2.66		Nq	8.61
Density of Water	1	gm/cc	Ny	8.25
Bulk Density of Soil y	1.87	gm/cc	Depth Factors	
Type (Shape) of footing	Square		dc	1.14
Length of Footing L	2	M	dq	1.07
Width of Footing B	2	M	dy	1.07
Depth of Water Table W		M	Inclination Factors	
Effect of Water Table W'	0.5		ic	1
Over Burden Pressure q	4.675	Kg/M²	iq	1
Factor of Safety FOS	3		iy	1

q =	7.43	45.68	6.60

Net Safe Bearing Capacity q net =	**19.91**	**T/m²**	q/FOS

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Table 2 Recommendation Net Safe Bearing Capacity

For Bore Hole Location : Bore A
By Local Shear Failure Method

S.No	Footing Size M x M	Footing Depth D Mtr	Net Safe Bearing Capacity q net Tn/M²
1	1.5 x 1.5	2.00	12.06
		2.50	14.48
		3.00	16.90
2	2.0 x 2.0	2.00	12.13
		2.50	14.55
		3.00	16.97
3	2.5 x 2.5	2.00	12.21
		2.50	14.55
		3.00	17.05

For Bore Hole Location : Bore B
By General Shear Failure Method

S.No	Footing Size M x M	Footing Depth D Mtr	Net Safe Bearing Capacity q net Tn/M²
1	1.50 x 1.50	2.00	16.31
		2.50	19.35
		3.00	22.40
2	2.00 x 2.00	2.00	16.86
		2.50	19.91
		3.00	22.95
3	2.50 x 2.50	2.00	17.41
		2.50	20.46
		3.00	23.50

The Net Safe Bearing Capacity of Soil Shall be taken from Bore Hole A

At other depths the SBC can be calculated by linear Interpolation*

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Conclusion and discussion

A suitable foundation for any structure should have an adequate factor of safety against exceeding the bearing capacity of the supporting soils. Also, the vertical movements due to compression of the soils should be within tolerable limits for the structure. We consider that foundations designed in accordance with the recommendations herein will satisfy these criteria.

1. Subsurface investigation work was carried out by M/s. Trident Laboratories. Between 31th May and 4th of June 2024. The said locations of Bore Holes were decided by representative of GE(AF) Sambra Belgaum. The samples were taken to laboratory for testing and calculation of SBC.
2. At the time of our field investigations, at site Bore Holes were drilled up to 7.00 m depth below the Existing Ground Level.
3. For the soil/rock condition at site, shear failure condition for bearing capacity calculation consider based on angle of internal friction, void ratio, and SPT N values Core compressive strength & water table consider for critical condition at G.L.
4. The recommended SBC has been taken as lower of the two values computed from local shear failure criteria as well as that computed from the SPT Test.
5. **SBC is Calculated as per weak bore data condition BH A**
6. The factor of safety 3.0 has been considered.
7. For any other size and depth of footing bearing capacity of soil can be calculated by linear Interpolation.
8. Depth of Foundation should be carried as per IS 1904:1986- Reaffirmed 2006.
9. If groundwater is encountered during foundation excavations, dewatering would be required.
10. All loose soils/rock should be removed and the exposed foundation bearing surface should be compacted properly using rammers / rollers.
11. General guidelines pertaining to temporary excavation slopes, foundation level preparation as per IS 3764: 1992 (Reaffirmed 2002) & IS 14680: 1999 (Reaffirmed 2004) and chemicals attack on foundation concrete are as per IS: 456-2000.
12. Subsurface conditions encountered during construction may vary somewhat from the conditions encountered during the site investigation. In case significant variations are encountered during construction, we request to be notified so that our engineers may review the recommendations in this report in light of these variations.

If there is any query in the report, let us know within one month, as the samples are stored for one month. Analysis and recommendations are based only on the data collected from borehole made at the site.

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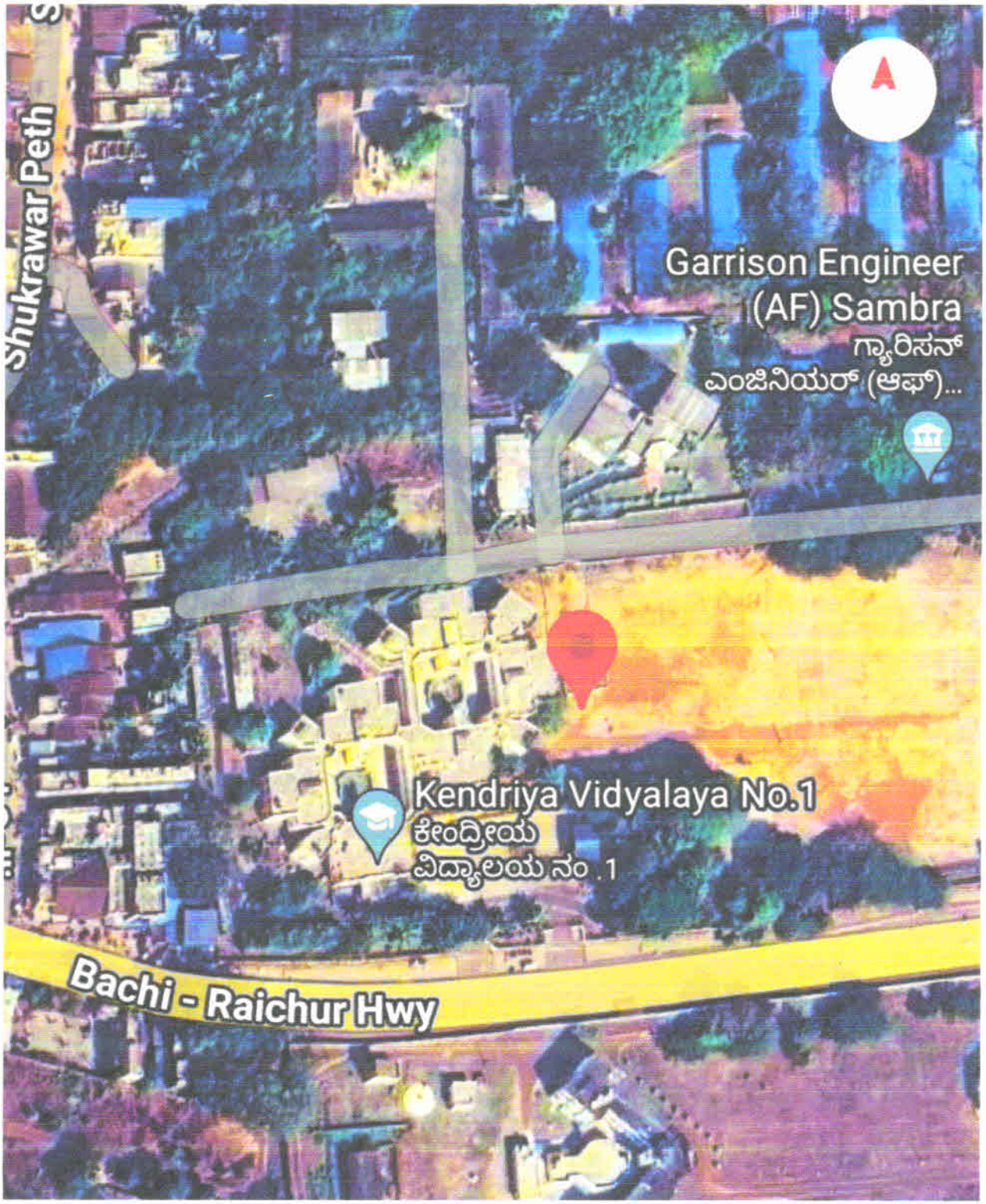
7. REFERERNCES

1) Foundation Analysis and Design, J.E. Bowles, McGraw Hill Publication, 5th Edition, 1996.
2) Braja M. Das, Principles of Geotechnical Engineering, 9th Edition
3) Foundation Design Manual, N. V. Nayak, 5th Edition, 1996.
4) IS 1498-1970-Classification and Identification of Soils for General Engineering Purposes.
5) IS 1892-1979 - Code of practice for Sub-surface investigation for foundations.
6) IS 2131-1981- Method for Standard penetration test for soils.
7) IS 6403-1981- Code of Practice for Determination of bearing capacity of Shallow Foundations.
8) IS 2911: 2010 Design and construction of pile foundation & IRC 78:2014.
9) IS-9143-1979- Method for the determination of unconfined compressive strength of rock materials.
10) IS 1904-1986- Code of Practice for Design and construction of foundations in soils.
11) IS 8009-(Part-1 & 2)1976- Code of Practice for Calculation of settlement of foundations.
12) Government of India Ministry of Water Resources Central Ground Water Board-Surat.

Annexure

Annexure 1 Satellite View of Plot



Plot : KV AFS , SAMBRA , BELGAUM.

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Annexure 2 Bore log Data Sheet

BORE LOG DATA

	Bore Hole No. : A	Dia of Bore (mm) : 100/150
	Type of Boring : Machine Drilling	Start Date : 31.05.2024
	Water Table (m) : -	End Date : 03.06.2024
	Bore Co-Ordinate : As per location Map	
Location :Kendriya Vidhyalay, Air Force Station Sambra, Belgaum		

Depth (m)	Thickness (m)	GWT (m)	Visual Description of Strata	Legend	IS Classification	Type of Sampling	Observed N Value	Core Recovery (%)	RQD (%)	Remark
G.L - 1.50	4.5		Reddish plastic clayey sand		SC	DS	-	-	-	-
1.50-3.00					SC	SPT	14	-	-	-
3.00-4.50					SC	SPT	16	-	-	-
4.50-6.00	2.5		Reddish dense clayey sand		SC	DS	-	-	-	-
6.00-7.00					SC	DS	-	-	-	-
7.50	Termination Depth									

Abbreviation

DS- Disturb Sample

UDS - Undisturbed Sample

SPT- Standard Penetration Test

GWT-Ground Water Table

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CA NO:GE(AF)/SAM/TOK-36 OF 2024-25

BORE LOG DATA

	Bore Hole No. : B	Dia of Bore (mm) : 100/150
	Type of Boring : Machine Drilling	Start Date : 31.05.2024
	Water Table (m) : -	End Date : 03.06.2024
	Bore Co-Ordinate : As per location Map	
Location :Kendriya Vidhyalay, Air Force Station Sambra, Belgaum		

Depth (m)	Thickness (m)	GWT (m)	Visual Description of Strata	Legend	IS Classification	Type of Sampling	Observed N Value	Core Recovery (%)	RQD (%)	Remark
G.L - 1.50	4.5		Reddish plastic clayey sand		SC	DS	-	-	-	-
1.50-3.00					SC	SPT	15	-	-	-
3.00-4.50					SC	SPT	17	-	-	-
4.50-6.00	2.5		Reddish dense clayey sand		SC	DS	-	-	-	-
6.00-7.00					SC	DS	-	-	-	-
7.50	Termination Depth									

Abbreviation

DS- Disturb Sample

UDS - Undisturbed Sample

SPT- Standard Penetration Test

GWT-Ground Water Table

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SOIL EXPLORATION DATA

Location :Kendriya Vidhyalay, Air Force Station Sambra, Belgaum	Project Co-Ordinate	0	
Bore Hole No. : A	Diameter of Bore : 100/150 mm		
Project No. :	Type of Boring : Machine Drilling		
Water Table(m) : -	Depth of Bore : 7.50 m		
Date of Started/Completed : 03.06.2024 To 10.06.2024			

DEPTH (m)	TYPE OF SAMPLE	OBSERVED N VALUE	SOIL DESCRIPTION	LEGEND	PARTICLE SIZE ANALYSIS %				ATTERBERG LIMITS %			I.S.CLASSIFICATION	LAB/FIELD BULK DENSITY (g/cc)	FIELD DRY DENSITY (g/cc)	MOISTURE CONTENT (%)	SPECIFIC GRAVITY (G)	SHEAR PARAMETERS			FREE SWELL INDEX (%)	COMPRESSION INDEX (C_c)	CORE COMPRESSIVE STRENGTH(N/mm^2)
					GRAVEL	SAND	SILT	CLAY	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX						TYPE OF TEST	COHESION (kg/cm^2)	ANGLE OF INTERNAL FRICTION, Ø°			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
G.L - 1.50	DS	-	Reddish plastic clayey sand		8	55	37		42	23	19	SC	-	-	12.8	-	-	-	-	15	-	-
1.50-3.00	SPT	14			11	55	34		38	18	20	SC	1.83	1.48	23.5	2.65	DUU	0.25	19.5	18	-	-
3.00-4.50	SPT	16			14	65	21		35	17	18	SC	1.84	1.50	22.5	2.68	-	0.25	19.5	18	-	-
4.50-6.00	DS	-	Reddish dense clayey sand		10	68	22		38	19	19	SC	1.83	1.49	22.1	2.71	-	0.23	21.6	17.5	-	-
6.00-7.00	DS	-			9	70	21		34	16	18	SC	1.85	1.47	22.0	2.69	-	0.22	20.5	17	-	-
7.50	Termination Depth																					

Abbreviation :

UDS: Undisturbed Samples NP.: Non Plastic SPT: Standard Penetration Test UCS: Unconfined compressive strength

DS: Disturbed samples DUU.: Direct Shear Test TRX: Triaxial Shear Test

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SOIL EXPLORATION DATA

Location :Kendriya Vidhyalay, Air Force Station Sambra, Belgaum	Project Co-Ordinate: As per location Map	0	
Bore Hole No. : B	Diameter of Bore : 100/150 mm		
Project No. :	Type of Boring : Machine Drilling		
Water Table(m) : -	Depth of Bore : 7.50 m		
Date of Started/Completed : 03.06.2024	To 10.06.2024		

DEPTH (m)	TYPE OF SAMPLE	OBSERVED N VALUE	SOIL DESCRIPTION	LEGEND	PARTICLE SIZE ANALYSIS %				ATTERBERG LIMITS %			I.S.CLASSIFICATION	LAB/FIELD BULK DENSITY (g/cc)	FIELD DRY DENSITY (g/cc)	MOISTURE CONTENT (%)	SPECIFIC GRAVITY (G)	SHEAR PARAMETERS			FREE SWELL INDEX (%)	COMPRESSION INDEX (C_c)	CORE COMPRESSIVE STRENGTH(N/mm^2)
					GRAVEL	SAND	SILT	CLAY	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX						TYPE OF TEST	COHESION (kg/cm^2)	ANGLE OF INTERNAL FRICTION, Ø°			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
G.L - 1.50	DS	-	Reddish plastic clayey sand		6	45	49		38	19	19	SC	-	-	14.8	-	-	-	-	15	-	-
1.50-3.00	SPT	15			3	57	40		39	18	21	SC	1.87	1.53	22.6	2.64	DUU	0.28	22.6	20	-	-
3.00-4.50	SPT	17			8	45	47		41	17	24	SC	1.85	1.51	21.6	2.56	-	0.26	22.8	19.5	-	-
4.50-6.00	DS	-	Reddish dense clayey sand		7	52	41		36	16	20	SC	1.85	1.52	22.1	2.66	-	0.28	22.3	19	-	-
6.00-7.00	DS	-			6	51	43		35	17	18	SC	1.86	1.54	19.5	2.45	-	0.28	21.5	19.5	-	-
7.50	Termination Depth																					

Abbreviation :

UDS: Undisturbed Samples NP.: Non Plastic SPT: Standard Penetration Test UCS: Unconfined compressive strength

DS: Disturbed samples DUU.: Direct Shear Test TRX: Triaxial Shear Test

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Annexure 3 Site Investigation Photograph

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Sample at 1.5 Mtr. Reddish Plastic Clayey Sand

Sample at 3.00 Mtr. and 4.5 Mtr. Reddish Dense Clayey Sand

Vinayak Kamble

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Project No. 22