

## **Patran Transmission Company Limited (PTCL)**

### **Amendment- III (Clarifications / Replies to the Pre-bid Queries)**

10.07.2023

**Subject: Clarifications on NIT Dated 15/06/2023 for selection of Bidder for Augmentation of Transformation Capacity by 1x500 MVA, 400/220 kV ICT (3rd) at 400/220 kV Patran (GIS) S/s along with GIS duct (at 400 kV and 220 kV) in new diameter of ICT-Tie Line on LSTK basis.**

Sl. No.	Name of the Document	Clause no.	Existing Provision	Suggested texts for amendments	Rationale for the Clarification/ Amendments	PTCL Response
1	02 Section-II ITB	33.3.1	Within twenty-eight (28) days after receipt of the Notification of Award, the successful Bidder shall furnish the performance security for 10% (Ten percent) of the Contract Price plus additional performance securities, if any,	Within twenty-eight (28) days after receipt of the Notification of Award, the successful Bidder shall furnish the performance security for <b>3% (Three percent)</b> of the Contract Price.	Various central government bodies like Northern railway consider 3% CPBG. Hence request you to consider 3% in place of 10%.	The provision of Clause 33.1 of Section-II (ITB) of Volume-I of Bidding Documents shall remain unchanged.
2	05 Section-V SCC	GCC 1.1(ii) & GCC 24.1	Duration in months from the effective date of Contract is 10 months	Duration in months from the effective date of Contract is 15 months.	Delivery of major items is around 10-12 months from drawing approval. Hence, project completion period must be min. 15 months.	The Time for Completion of Project from the effective date of Contract shall remain 10 months.
3	04 Section-IV GCC	Appendix-2: Price Adjustment	The prices shall remain firm and fixed during the currency of the contract.	The prices shall remain firm and fixed during the currency of the contract except power transformer on latest IEEMA PV formula with base date as May-2023	Due to volatile market condition, prices of high value items must be on PV basis.	As this is a short duration project on LSTK basis, the provisions of Appendix-2: Price Adjustment of Section-IV (GCC) of Volume-I of Bidding Document will remain unchanged.
4	Technical Specifications of civil works	2.0 Geotechnical Investigation	Not any	Please provide values of SBT to be considered for execution of project	-	Soil Report enclosed as Annexure-I for Existing PEB/Switchyard location for reference purpose only. However Bidders are advised to visit the location and evaluate the soil strata for present Scope of Work and consider the soil parameters

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						accordingly for Foundation Design.
5	Technical specifications of civil works	3.1 Road	Not any	Please confirm whether road to be constructed from third (new) power transformer to boundary side and along with boundary side.		Provisions of Clause 3.R of Volume-II of Technical Specification for Substation - Electrical Works aptly cover the requirement for the roads. If the present Scope of Work requires the dismantling of the existing roads and the construction of new roads to maintain the switchyard road connectivity, it shall be in the scope of the Contractor. The detail of the new road layout after accommodating the Scope of Work shall be decided during the detailed engineering. Bidders can visit the Patran (GIS) S/s to evaluate the requirement and quantum of construction of roads, drains, etc.
6	Technical specification for electrical works	3.J AC & DC Power Supplies	The availability of modules/feeders in LTDB required for the present scope of work has to be ascertained by the bidders during their site visit. Based on the site visit, existing facilities shall be augmented as further required. In case of utilizing the existing vacant LT modules, MCCB shall be provided.	Please confirm whether existing LTDB is suitable for present scope of work or we need to supply new panels.		A few vacant modules without MCB/MCCB are available in the existing LTDB panel. Provisions in Clause 3.J of Volume-II of Technical Specification for Substation - Electrical Works aptly covers the requirement for LT feeders. Bidders have to ascertain the requirement of AC and DC feeders and accordingly ensure that requirements are met for the present Scope of Work. In case the existing LTDB panels don't have enough modules/feeders required for present Scope of Work, the Contractor will extend the existing LTDB panels with modules and MCCB.

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7	Technical specifications of civil works	10.1 GIS Building/ Hall	Not any	Please confirm whether building shall be extended for present scope of bays or how many future bays to be considered for extension of GIS Hall		The GIS Building/Hall shall be extended only for present Scope of Work.
8	Technical specification for electrical works	List of approved makes for OEM	PEB Structure: 1. E-Pack Polymers 2. Everest 3. Phenix 4. Zamil 5. Kirby 6. BNAL 7. Moonwalk	We have sent enquiry to approved vendors but not received any offer from them, please confirm whether we can propose another vendor for the same.		Contractor can propose the vendors apart from the approved vendor list with all the credentials, previous work orders, performance certificates etc. for PTCL approval during the detailed engineering. However, PTCL reserves the right to accept or reject the vendor based on the quality and technical requirements.
9	General	GCC 9.2/Appendix-2	The prices shall remain firm and fixed during the currency of the Contract	<p>Prices are variable as per IEEMA. The base date shall be one month prior to technical bid opening.</p> <p>The bidder shall quote base prices for the Ex-Works price component of the equipment/materials (Transformer, Reactor &amp; Insulating Oil, CVT, SA, PVC/XLPE insulated Power &amp; Control Cables), the complete equipment procured as spares (Transformer, CVT, SA, PVC/XLPE insulated Power &amp; Control Cables), Substation Structures and installation (including civil works) price component of the equipment/materials. These price components for certain equipment/ materials, as specified, shall be subject to price adjustment to reflect changes in the cost of labour and material</p>		Please refer to reply at Sl. No. 3 above in this regard.

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				components as per the provisions given in Appendix-A		
10	General	BDS ITB 13.1 and 13.2	The Bidder shall furnish as part of its bid, a Bid Security of INR 5 lakh (5 lakh Only) for an initial period of 180 days.	We request you to please waive off the Earnest money deposit (EMD) BG.		<p>The Bids shall be submitted in Hard Copy only as detailed in Sl. No. 8 of Section - III (BDS) of Volume-I of the Bidding Documents.</p> <p>Revised Provisions of: Sl. No 7 of Section - III (BDS) of Volume-I of the Bidding Documents:</p> <p>Supplementing ITB Clause 13</p> <p>Bid Security shall not be applicable in this Project. All Bidders shall submit as part of their Bid, a duly signed Bid Securing Declaration attached as Annexure-II. This will form a part of 'Other Bid Forms' of Volume-III of Bidding Documents.</p> <p>In the Bidding Documents wherever there is a provision of submission of Bid Security, it shall be replaced with Bid Securing Declaration. Subsequently Bid Security Form as provided in 'Other Bid Forms' of Volume-III of Bidding Documents shall be read as 'Deleted'.</p>
11		06-Section - VI Forms and Procedures 'Appendix 1(A) Terms & Procedures of Payment for		We request you to allow us Progressive payment for Supply of Transformer and GIS on Prorata basis -Progressive payment of Eighty Percent (80%) of the Ex-Works, 100% for Taxes and Freight & Insurance after receipt of material at Site, issue of		The Payment terms of the Contract shall remain the same.



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		Supply of Goods (Volume-I, GCC)		MRN/ MRHOV and certification from Employer.		
12	General	Vol-II Technical Specifications	-	Equipment specifications are not present with the tender documents. We understand that, PGCIL specification to be followed which are available as on June'2023. Kindly confirm that bidder's understanding is correct.		Complete technical specification is provided with the Bidding Documents. Bidders to follow the same along with CEA regulations amended from time to time.
13	General	Vol-II Drawings	-	Design of earthing shall be for 50kg or 70kg body weight. Kindly confirm. Also provide the GIS Building earthing layout plan.		Existing Main Mat shall be extended for the present Scope of Work related to switchyard and the GIS halls. However Bidders are advised to visit the Patran (GIS) S/s and ascertain the requirement and make them acquaint as per the requirement for the present Scope of Work.
14	General	Vol-II Drawings	-	Earthing shall be considered only for present area and does not include future area, as shown in the layout as per fencing area.		Bidders are advised to refer to the Volume-II Drawings 'Tentative Plan Layout for Augmentation at Patran'. No future area has been earmarked for any kind of work under the present Scope of Work.
15	General-Electrical	Vol-II Technical Specifications		Please provide the Existing GIS technical specification, drawings with Make and Model		Technical Specification for GIS work is covered in Clause 3.E of Volume-II of Technical Specification of Substation - Electrical Works with all the applicable standards. Existing Make of GIS is ABB. Other details such as GTP, if required, shall be shared with the Contractor during the detailed engineering.
16	General-Electrical	Vol-II Technical Specifications		Please provide the Existing specification of CRP SAS, Transformer, VMS for integration with Make and Model		Technical Specification for CRP, SAS, Transformer, VMS etc. are covered in Clause 3. of Volume-II of Technical Specification of Substation - Electrical Works with all the applicable standards.

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						Existing Make of CRP-SAS, Transformer and VMS is ABB, ABB and Delcom respectively.
17	General-Electrical	Vol-II Technical Specifications		Spare feeders are available in ACDB, DCDB existing panel. Hence, we are not considering any extension in present scope		Please refer to reply at Sl. No. 6 above in this regard.
18	General-Mechanical	Vol-II Technical Specifications		We are considering HVWS system for FF protection of transformer. Understand that common oil collection pit for connecting all the transformer soak pit is not available. Please clarify the scope of this if it is to be considered in bidder scope.		Confirmed. It shall be as per the provisions laid in Clause 10.5.5 of Volume-II of Technical Specification of Substation - Civil Works. Specification for the soak pit and remote oil collecting pit and the same shall be followed by the Bidders.
19	General-Electrical	Vol-II Technical Specifications		Creepage distance details are not available. Please confirm the creepage to be considered.		Bidders are requested to refer to Clause 3.A of Volume-II of Technical Specification of Substation - Electrical Works.
20	General-Electrical	Vol-II Technical Specifications		Existing lighting panel for illumination have spare feeders to cater present scope. Please confirm our understanding		Bidders are advised to visit Patran (GIS) S/s to understand the availability of spare feeders in the existing AC/DC and Main/Emergency Lighting Panels. In case the existing LTDB panels don't have enough modules/feeders required for present Scope of Work, the Contractor will extend the existing LTDB panels with modules and MCCB.
21	General-Electrical	Vol-II Technical Specifications		Battery and charger scope is not envisaged under present scope. Please confirm our understanding		Bidders are requested to refer to Clause 3.J of Volume-II of Technical Specification of Substation - Electrical Works.
22	General-Electrical	Vol-II Technical Specifications		Spare ports are available in communication panel. Hence, we are not considering any extension in present scope. Please confirm our understanding		We do not envisage any requirement of extension of PLCC or FOTE communication under the present Scope of Work. However, Bidders are advised to refer to Volume-II 'Technical

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						Specification for Substation - Electrical Works' and 'Scope of Work' to understand the requirements for this proposed augmentation.
23	General			Any repairing related to existing building structures or electrical work is not in bidder scope.		The Contractor has to construct the works as required for present Scope of Work. However, any damages caused to existing facilities due to present Scope of Work, the Contractor will rectify the same without any extra cost to PTCL.
24	General-Civil			Please provide the existing GIS PEB Building drawings for extension		Bidders are requested to refer to Volume-II Drawings 'Indicative Drawing - Civil Works'
25	General-Mechanical	Vol-II Technical Specifications		We are considering HVWS system for FF protection of transformer. Understand that common oil collection pit for connecting all the transformer soak pit is not available. Please clarify the scope of this if it is to be considered in bidder scope.		Please refer to reply at Sl. No. 18 above in this regard.
26	General-Mechanical			As per site visit, we understand that new EOT crane for the extension of building is required due to center column at the extension side of building. Please confirm our understanding.		It shall be the responsibility of the Contractor to suitably extend the existing EOT crane girder after removing the Center column at the extension side of the building. However, new PEB extension shall be connected to existing column and alignment of EOT crane movement shall be taken care by the Contractor.
27	General-Mechanical			We understand that existing AHU can cater the present scope of extension. AHU is not in bidder scope for the extended part of building only AHU duct extension is required. Please confirm our understanding.		Bidders are requested to refer to Clause 3.N of Volume-II of Technical Specification of Substation - Electrical Works. New AHU system for extended part of both GIS halls under the

Sl. No.	Name of the Document	Clause no.	Existing Provision	Suggested texts for amendments	Rationale for the Clarification/ Amendments	PTCL Response
						present Scope of Work shall be provided by the Contractor
28	Scope of Supply	1	420kV, 3150 A, 50 kA, SF6 GIS ICT feeder bay module 420kV, 3150 A, 50 kA, SF6 GIS Tie Bay module(without PIR with CSD) 420 kV, 3150 A, 50 kA, SF6 GIS Line feeder bay module (without PIR with CSD)	We would like to inform that, the requirement for PIR or CSD is not mentioned in ICT feeder bay, hence we have not considered and we would like to provide spring-type mechanism CB for all bays.  We would also like to inform that, our 420kV GIS is type tested for 63kA short circuit withstand current.  Kindly confirm & accept the same.		Bidders are requested to refer to Clause 3.E ii of Volume-II of Technical Specification of Substation - Electrical Works which clarifies the requirement of CSD and operating mechanism in the 400kV GIS circuit breakers. Same shall be followed without any deviation.
29	400kV Termination	4	400kV, 3150A, SF6/Air bushing for connection of GIS to AIS-3Nos	We would like to inform that, we understand that in line side end cover to be provided with no terminations and GAB only in the trafo side.  Kindly confirm the same.		SF6 to Air bushings are only needed for the 400/220kV transformer bays. The line bay of the 400kV GIS dia shall be terminated outside the GIS hall with suitable interface. Bidders are requested to refer to the Clause 3.E of Volume-II of the Technical Specification of Substation - Electrical Works.
30	Additional Document required			we would like to inform that, the following would require: a. 220kV overall layout with dimensions along with the AutoCAD file of the present scope of supply. b. 400kV overall layout with dimension along with the AutoCAD file of the present scope of supply. c. Endbus bar dimension for interface module to be designed. GIS Manufacturer to consider sufficient standard space if		a. & b. The Contractor shall prepare the AutoCAD drawings based on the drawings provided in Volume-II Drawings of the Bidding Documents. c. It is the responsibility of the Contractor to verify the end bus details from the site and design the interface and the GIS along with the building dimension accordingly.

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				dimensions are not supplied.  Kindly confirm & provide the same.		
31	TS_original RFP CB mechanism type with PIR	B 6.0	The circuit breaker controlling 420kV & 220kV lines wherever required shall be provided with pre insertion closing resistor of about 400ohms with 8 ms insertion time. The short line fault capacity shall be same as the rated capacity and this is proposed to be achieved without use of opening resistors.	We would like to inform that, in 245kV GIS PIR is not applicable, and in 420kV GIS we have not considered the PIR. We have considered the spring-type mechanism for CB.  Kindly confirm the same.		Bidders are requested to refer to Clause 3.E ii of Volume-II of Technical Specification of Substation - Electrical Works which clarifies the requirement of CSD or PIR and operating mechanism in the GIS circuit breakers. Same shall be followed without any deviation.
32	TS_original RFP Earth Swiches	B 7.0	All earth switches shall be of motor-operated type	We would like to inform that, the maintenance earthing switches are motor type while fast earthing switches are of the motor with spring type operating mechanism.  Kindly accept the same.		The ES shall be provided as per the Technical Specification and the applicable standards along with details of the existing system in place.
33	Eniromental parameters			We would like to inform that, we have not received the parameters like altitude, seismic level , ambient temperature, etc.  Kindly provide the same.		Bidders are requested to refer to the Clause 4.3 of Volume-II of Scope of Work.
34	CT Data			We would like to inform you that we have not received the present supply scope GIS CT data, we have only received the existing GIS CT data. Hence we have considered that data from the present scope. As per the feasibility point, we have considered duly distributed CT for the 400kV diagonal.		Bidders are requested to refer to the Clause 3.E iv of Volume-II of the Technical Specification of Substation - Electrical Works.

Sl. No.	Name of the Document	Clause no.	Existing Provision	Suggested texts for amendments	Rationale for the Clarification/ Amendments	PTCL Response
				Kindly confirm & accept the same.		
35	Earth Switches & HES			<p>We would like to inform that, we have considered the following as per standard manufacturing: 400kV: highspeed earthing switches(HES) in the line side of the line bay &amp; maintenance earthing switches in the line side of the trafo side. 220kV: highspeed earthing switches(HES) in the line side of the ICT bay.</p> <p>Kindly accept the same.</p>		Bidders are requested to refer to the Clause 3.E iii of Volume-II of the Technical Specification of Substation - Electrical Works.
36	Bays Name			<p>We would like to inform that, 400kV &amp; 220kV GIS bays name is not mentioned for the present scope. Therefore, we have considered as per our standard. Kindly provide or confirm the same.</p>		The nomenclature for naming of bays shall be discussed during detailed engineering.
37	Delivery of Transformer and GIS			<p>We are not able to confirm the transformer Supply as per 10 months completion schedule .All the transformer suppliers denied to supply in 10 months due to factory loading. So transformer schedule as per Tender(10 Months) is not possible to delivery the product at site.</p> <p>Please increase the project duration to 18 months.</p>		Please refer to reply at Sl. No. 2 above in this regard.

**Patran Transmission Company Limited**



## **ANNEXURE - 1**

**REPORT ON SOIL INVESTIGATION  
FOR 400/220 KV GIS SUB-STATION  
AT  
PATRAN, DISTT.-PATIALA  
IN PUNJAB**

**SUBMITTED TO  
M/S TECHNO ELECTRIC AND ENGINEERING CO. LTD.  
KOLKATA**

**JUNE-2015**

**SUBMITTED BY  
SANGUINE GEOTECH PVT. LTD.  
TUGLAKABAD EXTENSION  
NEW DELHI – 110 019  
PH:011-26052881.**

**SANGUINE GEOTECH PVT. LTD.**



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## 1.0 INTRODUCTION

M/s Techno Electric and Engineering Co. Ltd., Kolkata is planning to construct 400/220 KV GIS Sub-station at **Patran**, Distt.-Patiala in Punjab. The work of sub-soil investigation has been carried out under supervision of M/s Techno Electric staff. The work of sub-soil investigation has been awarded to M/s Sanguine Geotech Pvt. Ltd., New Delhi by M/s Techno Electric and Engineering Co. Ltd., Kolkata.

The proposed structures is the 400/220 KV GIS Sub-station at **Patran**, Distt.-Patiala in Punjab. The different functional units to be installed for this sub-station may be power transformers, current transformers, voltage transformers, disconnectors, surge arresters, circuit breakers, earthing transformers etc.



## 2. SCOPE OF WORK

In order to establish the sub-soil characteristics at the area marked for construction of the 400/220 KV GIS sub-station, the entire investigation program had been divided into field and laboratory tests leading to preparation of comprehensive report on the recommendations for foundation types and the corresponding design bearing capacity values for the foundations of the different functional units to be installed at the site.

As mentioned within the framework of this job contract, the field investigations comprised of the following:-

- i) Boring of six (06) no. of bore holes of 150mm dia. up to 10.0 m depth below ground level or up to refusal, whichever occurs earlier.
- ii) Collection of representative disturbed and undisturbed soil samples, 100mm in diameter, from the exploratory bore holes for detailed laboratory analysis.
- ii) Carrying out standard penetration tests as per IS:2131 – 1981 in each bore hole and subsequently preparation of penetration charts depth-wise for each bore hole.
- iv) Conducting two (2) no. of plate load tests on the location marked in drawing.
- v) Conducting six (6) no. of trial pits on the location marked in drawing.
- vi) Conducting eight (8) no. of resistivity test on the location marked in drawing.

**SANGUINE GEOTECH PVT. LTD.**



The laboratory tests part of this job contract comprised of the following:-

- i) Grain size analysis
  - a) Sieve analysis
  - b) Hydrometer analysis
- ii) Liquid limit, plastic limit
- iii) Specific gravity
- iv) Natural moisture content
- v) Bulk density and dry density
- vi) Unconfined compression tests
- vii) Unconsolidated undrained tests
- viii) Direct shear tests on granular soil samples
- ix) Consolidation tests
- x) CBR tests



### **3.0 FIELD INVESTIGATION METHODOLOGY**

#### **3.1 DRILLING OF BOREHOLE**

Boreholes of 150mm diameter were drilled by using shell and auger method upto the depth of 10m as per IS:1892 at proposed site location. The location plan of borehole is shown and details of the soil type, type of sample collected and SPT 'N'-value are shown in Table-01 to Table-06 in their respective laboratory test results.

#### **3.2 COLLECTION OF UNDISTURBED SOIL SAMPLES**

Undisturbed soil samples have been collected from each boreholes at interval of 3.0m in thin wall sampling tubes of 45cm long with area ratio less than of 10%. All undisturbed soil samples were collected by open drive tube sampler as per IS:2132 and the tube so recovered with samples, after removal of loose disturbed soil, were sealed by wax from both end to protect against the loss of moisture. After sealing, the sampling tubes were marked for testing of sample for various parameters.

#### **3.3 STANDARD PENETRATION TEST**

Standard Penetration tests have been conducted as per IS:2131 in each borehole at interval of 1.50m at the change of strata, whichever encountered earlier. The penetration resistance (SPT) is expressed as number of blows required for 30 cm. On a rigid steel head and standard "A" rod attachment. The bottom of borehole have been cleaned and water level maintained at outside water level before commencement of test. Also seating number of blows of 150mm were recorded before recording actual SPT 'N' for 30 cm penetration. On removal of sampler, the soil entrapped in the sampler is taken out and the representative disturbed soil sample is preserved in polythene bags to avoid any loss of fines and marked for identification.



#### 4.0 LABORATORY TESTING

1. The laboratory test was carried out progressively during the field work after sufficient number of samples have reached the laboratory in order that the test results of the initial bore holes can be made use of in planning the later stages of the field investigation and quantum of laboratory test.
2. All samples brought from field, whether disturbed or undisturbed was extracted/prepared and examined by competent technical personnel, and the test was carried out as per the procedures laid out in the latest edition of the relevant I.S. Codes.

The following laboratory tests have been carried out

- i) Grain size analysis
  - a) Sieve analysis
  - b) Hydrometer analysis
- ii) Liquid limit, plastic limit
- iii) Specific gravity
- iv) Natural moisture content
- v) Bulk density and dry density
- vi) Unconfined compression tests
- vii) Direct shear tests on granular soil samples
- viii) Unconsolidation undrained triaxial shear tests
- ix) CBR tests
- x) Chemical tests of soil

All the above tests were conducted as per the provisions laid down in the relevant IS Code of practice. The test results for all the samples tested have been tabulated in proper format; please refer Table No.01 to 13.



## **5.0 LITHOLOGY**

Six boreholes conducted at site reveals that the entire stratum consists of three Lithounits (layers), namely Lithounit-X, Lithounit-Y and Lithounit-Z.

### **LITHOUNIT-X**

Lithounit-X is light brown sandy silt with gravels starting from GL to different depth in different Boreholes. For exact depth, refer Table-01 to 06. It is classified as CL showing low-plastic in nature. Standard penetration test conducted in the boreholes indicate that the strata are stiff to very stiff to hard in nature. The Specific gravity is found from 2.66 to 2.67.

### **LITHOUNIT-Y**

Lithounit-Y is light brown clayey silt with gravels starting from different depth in different Boreholes. For exact depth, refer Table-01 to 06. It is classified as MI showing medium-plastic in nature. Standard penetration test conducted in the boreholes indicate that the strata are medium to stiff in nature. The Specific gravity is found to be 2.68.

### **LITHOUNIT-Z**

Lithounit-Z is gray sand starting from different depth in different Boreholes. For exact depth, refer Table-01 to 06. It is classified as SP-SM/SP showing non-plastic in nature. Standard penetration test conducted in the boreholes indicate that the strata are medium dense in nature. The Specific gravity is found from 2.62 to 2.64.

## **6.0 ANALYSIS AND DISCUSSIONS OF TEST RESULTS**

Six boreholes and six trial pit are conducted at site and disturbed/undisturbed soil samples have been collected for laboratory testing. Standard Penetration Test has been carried out as per I.S. standard. On the field investigation data, it is found that soil is medium to stiff to very stiff to medium dense in nature.



## 6.1 GENERAL

A suitable foundation for any structure should satisfy two basic criteria. Firstly, the soils should have adequate shear strength to support the superimposed loads so that there is an adequate safety factors against the bearing capacity. Secondly, the settlement of the soils including immediate elastic settlement and long terms consolidations settlement should be within the tolerable limits for the structure. The net allowable bearing pressure on the foundations should be taken as the lower of the two values obtained from these two criteria.

## 6.2 FOUNDATIONS TYPE

In general, light to medium loaded structure may bear on open shallow footings. Heavily loaded structure may bear on raft foundation.

## 6.3 ALTERNATIVE FOUNDATION SCHEMES

Considering the above nature of soils and load coming through the proposed structure, we suggest the Isolated/Raft foundation of different sizes at different depth as per the suitability of designer.

Detailed recommendation of this scheme is given in the following sections. The designer may select the appropriate foundation scheme based on the loading condition, economic consideration & ease of construction.

## 6.4 OPEN FOUNDATION

### 6.4.1 SHEAR CONSIDERATION

#### At 1.0m Depth from EGL

$$C = 5.0 \text{ T/M}^2, \phi = 5^\circ, \phi^1 = 3.35^\circ, N_c^1 = 6.04, N_q^1 = 1.382, N_r^1 = 0.3015,$$

$$r = 1.70 \text{ T/M}^3, S_c = 1.3, S_q = 1.2, S_r = 0.8, w = 1, \text{ FOS} = 2.50.$$

$$\begin{aligned} Q_u &= 2/3 \times 5.0 \times 6.04 \times 1.3 + 1.7 \times 1.0 \times 0.382 \times 1.2 + 0.5 B \times 1.7 \times 0.3015 \times 0.8 \times 1 \\ &= 26.95 + 0.205 B \end{aligned}$$

$$q_a (\text{for } 1\text{m} \times 1\text{m}) = 10.86 \text{ T/M}^2$$

$$q_a (\text{for } 2\text{m} \times 2\text{m}) = 10.94 \text{ T/M}^2$$

$$q_a (\text{for } 3\text{m} \times 3\text{m}) = 11.03 \text{ T/M}^2$$

$$q_a (\text{for } 6\text{m} \times 6\text{m}) = 11.27 \text{ T/M}^2$$



#### At 1.50m Depth from EGL

$$Q_u = 27.34 + 0.205 B$$

$$q_a \text{ (for 1mx1m)} = 11.01 \text{ T/M}^2$$

$$q_a \text{ (for 2mx2m)} = 11.10 \text{ T/M}^2$$

$$q_a \text{ (for 3mx3m)} = 11.18 \text{ T/M}^2$$

$$q_a \text{ (for 6mx6m)} = 11.43 \text{ T/M}^2$$

#### At 2.0m Depth from EGL

$$C = 5.0 \text{ T/M}^2, \phi = 6^\circ, \phi^1 = 4^\circ, N_c^1 = 6.22, N_q^1 = 1.456, N_r^1 = 0.36,$$

$$r = 1.70 \text{ T/M}^3, S_c = 1.3, S_q = 1.2, S_r = 0.8, \text{FOS} = 3.0.$$

$$Q_u = 2/3 \times 5.0 \times 6.22 \times 1.3 + 1.7 \times 2.0 \times 0.456 \times 1.2 + 0.5 B \times 1.7 \times 0.36 \times 0.8 \times 1$$
$$= 28.81 + 0.245 B$$

$$q_a \text{ (for 1mx1m)} = 11.62 \text{ T/M}^2$$

$$q_a \text{ (for 2mx2m)} = 11.72 \text{ T/M}^2$$

$$q_a \text{ (for 3mx3m)} = 11.82 \text{ T/M}^2$$

$$q_a \text{ (for 6mx6m)} = 12.11 \text{ T/M}^2$$

#### At 3.0m Depth from EGL

$$Q_u = 29.74 + 0.245 B$$

$$q_a \text{ (for 1mx1m)} = 12.00 \text{ T/M}^2$$

$$q_a \text{ (for 2mx2m)} = 12.09 \text{ T/M}^2$$

$$q_a \text{ (for 3mx3m)} = 12.19 \text{ T/M}^2$$

$$q_a \text{ (for 6mx6m)} = 12.48 \text{ T/M}^2$$

### 6.4.2 SETTLEMENT CONSIDERATION

Net safe bearing capacity on settlement criteria is calculated as per IS: 8009 (PART-1) –1976. The total settlement for isolated footing is taken as 50 mm & for raft foundation as 75mm. For Cohesive soil, This settlement may be increased by 25mm.





### At 1.0m Depth from EGL

#### For 1mx1m

We have divided the influence zone in the layer of 3m. Total depth of influence=2B=2m from depth of footing.

#### Ist Layer

$$P_o = 1.70 \times 2.0 = 3.40 \text{ T/M}^2.$$

$$B/Z = 0.5/1 = 0.5, \text{ So } \Delta P = 0.083 \times 4 \times 10.86 = 3.60 \text{ T/M}^2. \text{ (Fig-18)}$$

$$C_c = 0.098 \text{ \& } e_o = 0.763$$

$$S_c = C_c H / (1 + e_o) \log_{10} \{ (P + \Delta P) / P \}$$

$$S_c = 0.098 \times 2000 / 1.763 \log_{10} \{ (3.40 + 3.60) / 3.40 \}$$

$$= 34.86 \text{ mm.}$$

$$\text{Total settlement} = 34.86 \times 0.73 = 25.45 \text{ mm} < 50 \text{ mm} / 75 \text{ mm.}$$

Depth factor-0.73 & rigidity factor-1.0 has been taken into account.

### At 2.0m Depth from EGL

#### For 1mx1m

We have divided the influence zone in the layer of 3m. Total depth of influence=2B=2m from depth of footing.

#### Ist Layer

$$P_o = 1.70 \times 2.0 + 1.70 \times 0.5 = 4.25 \text{ T/M}^2.$$

$$B/Z = 0.5/0.5 = 1, \text{ So } \Delta P = 0.161 \times 4 \times 11.62 = 7.48 \text{ T/M}^2. \text{ (Fig-18)}$$

$$C_c = 0.098 \text{ \& } e_o = 0.763$$

$$S_c = C_c H / (1 + e_o) \log_{10} \{ (P + \Delta P) / P \}$$

$$S_c = 0.098 \times 1000 / 1.763 \log_{10} \{ (4.25 + 7.48) / 4.25 \}$$

$$= 24.50 \text{ mm.}$$



#### II Layer

$$P_o = 1.70 \times 2.0 + 1.70 \times 1.5 = 5.95 \text{ T/M}^2.$$

$$B/Z = 0.5/1.5 = 0.33, \text{ So } \Delta P = 0.042 \times 4 \times 11.62 = 1.95 \text{ T/M}^2. \text{ (Fig-18)}$$

$$C_c = 0.098 \text{ \& } e_o = 0.763$$

$$S_c = C_c H / (1 + e_o) \log_{10} \{ (P + \Delta P) / P \}$$

$$\begin{aligned} S_c &= 0.098 \times 1000 / 1.763 \log_{10} \{ (5.95 + 1.95) / 5.95 \} \\ &= 6.84 \text{ mm.} \end{aligned}$$

$$\text{Total settlement} = 31.34 \times 0.63 = 19.74 \text{ mm} < 50 \text{ mm} / 75 \text{ mm}$$

Depth factor-0.63 & rigidity factor-1.0 has been taken into account.

Similarly, net safe bearing capacity for different depth & different sizes have been calculated and found safe.

#### **6.4.3 PLATE LOAD CONSIDERATION**

Based upon Plate Load tests, SBC is calculated as given below:

##### At 2.50m epth

$$\text{PLT-01, SBC} = 18.40 \text{ T/M}^2$$

$$\text{PLT-02, SBC} = 16.00 \text{ T/M}^2$$



## **7.0 CONCLUSIONS AND RECOMMENDATIONS**

Based on field and laboratory investigations, following recommendations can be made:

1. The strata is medium to stiff to very stiff to medium dense in nature. For detail, please refer Table-01 to Table-06.
2. The stratum consists of three lithounits., Lithounit-X, Lthounit-Y and Lthounit-Z. The detailed lithology is explained in article 5.0.

3. It is suggested that the net allowable bearing capacity for Isolated footings may be taken as the table given below:

NET ALLOWABLE BEARING CAPACITY IN T/M<sup>2</sup>

Depth from EGL (m)	1mx1m	2mx2m	3mx3m
1.00	10.00	10.00	10.00
1.50	11.00	11.00	11.00
2.00	11.50	11.50	11.50
3.00	12.00	12.00	12.00

- For bearing capacity at intermediate depth, please do the interpolation.

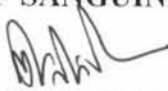
4. The net allowable bearing capacity of combined or raft foundation may be taken as given below:

NET SAFE BEARING CAPACITY IN T/M<sup>2</sup>

Depth from EGL ( m)	5mx5m	6mx6m
1.00	10.50	10.50
1.50	11.25	11.25
2.00	11.75	11.75
3.00	12.25	12.25


5. The bulk density should be taken as 1.70 T/M<sup>3</sup>.
6. Water table has not encountered from EGL during the boring. So, effect of water table on foundation has been ignored.
7. For ERT, Refer Table-14 to Table-21.
8. CBR value may be taken as 5.70 kg/cm<sup>3</sup> for design purposes.

For SANGUINE GEOTECH PVT. LTD.


  
**M. K. SINGH.**  
(M.E, Geotech)




**SANGUINE GEOTECH PVT. LTD.**


 SOIL PROFILE				PROJECT: 400/220 KV GIS A.A AT PATRAN.										B.H.NO:01			TERMINATION		TABLE: 01					
														Water Level: Nil.			Depth:10.0m.							
N -VALUE	Depth(M)	Sample	SOIL DESCRIPTION	SPT-PLOT						SIEVE ANALYSIS					Limits		Natural Density	Moisture content, %	Shear Test			Consolidation Test		
				0	10	20	30	40	50	Sp. Gr.	Gravel, %	Sand, %	Silt, %	Clay, %	L.L, %	P.L, %			Confining Pressure Kg/cm2	Cohesion Kg/cms2	Angle of internal friction	cc	e0	
	0	DS-1	Light brown sandy silt -1.50m-											27.1	18.4									
7	1.5	SPT-1	Light brown clayey silt																					
	2.5	UDS-1	with gravels							2.68	3	14	56	27	40.6	27.5	1.77	15.5	UUT	0.5	6	0.096	0.752	
12	3	SPT-2	-4.50m-																					
15	4.5	SPT-3	Light brown sandy silt																					
	5.5	UDS-2	with gravels -6.0m-								6	28	51	15	29.1	19.6	1.83	17.2	UCT	0.65				
17	6	SPT-4	L.B clayey silt with gravels-7.15m-												38.8	25.8								
22	7.5	SPT-5	Gray sand																					
	8.5	UDS-3	-do-							2.62	0	96	4	0	N	P	1.89	16.4	DST	0	34			
25	9	SPT-6																						
26	10	SPT-7	-do-																					
								UUT	UNCONSOLIDATED UNDRAINED TRIAXIAL TEST															
								DST	DRAINED DIRECT SHEAR TEST															
								UCT	UNCONFINED COMPRESION TEST															


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 SOIL PROFILE				PROJECT: 400/220 KV GIS A.A AT PATRAN.				B.H.NO:02				TERMINATION		TABLE: 02										
								Water Level: Nil.				Depth:10.0m.												
N-VALUE	Depth(M)	Sample	SOIL DESCRIPTION	SPT-PLOT						Sp. Gr.	SIEVE ANALYSIS				Limits		Natural Density	Moisture content, %	Shear Test			Consolidation Test		
				0	10	20	30	40	50		Gravel, %	Sand, %	Silt, %	Clay, %	L.L, %	P.L, %			Confining Pressure Kg/cm2	Cohesion Kg/cms2	Angle of internal friction	cc	e0	
	0	DS-1	Light brown sandy silt																					
8	1.5	SPT-1	with gravels																					
	2.5	UDS-1	-3.0m-							2.66	4	32	52	12	26.6	17.5	14.1	1.75	UUT	0.5	7			
11	3	SPT-2	Light brown clayey silt												40	26.1								
13	4.5	SPT-3	with gravels -5.0m-																					
	5.5	UDS-2	L.B sandy silt with gravels -6.50m-							2.67	2	29	55	14	28.1	18.9	1.84	16.6	UUT	0.6	6			
17	6	SPT-4	Gray sand																					
20	7.5	SPT-5	-do-																					
	8.5	UDS-3								2.63	0	92	8	0	N	P	1.87	15.8	DST	0	33			
23	9	SPT-6																						
25	10	SPT-7	-do-																					
										UUT	UNCONSOLIDATED UNDRAINED TRIAXIAL TEST													
										DST	DRAINED DIRECT SHEAR TEST													
										UCT	UNCONFINED COMPRESION TEST													


 SOIL PROFILE				PROJECT: 400/220 KV GIS A.A AT PATRAN.						B.H.NO:03			TERMINATION		TABLE: 03								
										Water Level: Nil.			Depth:10.0m.										
N -VALUE	Depth(M)	Sample	SOIL DESCRIPTION	SPT-PLOT						SIEVE ANALYSIS					Limits		Natural Density	Moisture content, %	Shear Test			Consolidation Test	
				0	10	20	30	40	50	Sp. Gr.	Gravel, %	Sand, %	Silt, %	Clay, %	L.L, %	P.L, %			Confining Pressure Kg/cm2	Cohesion Kg/cms2	Angle of internal friction	cc	e0
	0	DS-1	Light brown sandy silt -1.50m-											25.5	16.9								
7	1.5	SPT-1	Light brown clayey silt																				
	2.5	UDS-1	with gravels						2.68	2	10	59	29	41.7	28.4	1.76	15.7	UUT	0.5	6	0.098	0.763	
11	3	SPT-2	-3.50m-																				
15	4.5	SPT-3	Light brown sandy silt																				
	5.5	UDS-2	with gravels -6.50m-						2.66	5	30	52	13	27.1	18.2	1.85	16.6	UCT	0.64				
17	6	SPT-4	Gray sand																				
19	7.5	SPT-5	-do-																				
	8.5	UDS-3							2.62	0	97	3	0	N	P	1.88	15.8	DST	0	32			
22	9	SPT-6	-do-																				
26	10	SPT-7																					
									UUT	UNCONSOLIDATED UNDRAINED TRIAXIAL TEST													
									DST	DRAINED DIRECT SHEAR TEST													
									UCT	UNCONFINED COMPRESSION TEST													

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 SOIL PROFILE				PROJECT: 400/220 KV GIS A.A AT PATRAN.						B.H.NO:04				TERMINATION		TABLE: 04						
										Water Level: Nil.				Depth:10.0m.								
N -VALUE	Depth(M)	Sample	SOIL DESCRIPTION	SPT-PLOT						SIEVE ANALYSIS				Limits		Natural Density	Moisture content,%	Shear Test			Consolidation Test	
				0	10	20	30	40	50	Sp. Gr.	Gravel, %	Sand, %	Silt, %	Clay, %	L.L, %			P.L, %	Confining Pressure Kg/cm2	Cohesion Kg/cms2	Angle of internal friction	cc
	0	DS-1	Light brown sandy silt												26.3	17.5						
8	1.5	SPT-1	with gravels -2.50m-																			
	2.5	UDS-1	Light brown clayey silt						2.68	1	14	58	27	40.8	27.5	1.78	16.3	UUT	0.5	7	0.097	0.751
13	3	SPT-2	with gravels -3.50m-																			
9	4.5	SPT-3	Light brown sandy silt																			
	5.5	UDS-2	with gravels -6.0m-							4	30	51	15	29.7	19.5	1.87	17	UUT	0.6	6		
21	6	SPT-4	Gray sand																			
22	7.5	SPT-5	-do-																			
	8.5	UDS-3							2.62	0	95	5	0	N	P	1.9	16.1	DST	0	34		
23	9	SPT-6	-do-																			
27	10	SPT-7																				
									UUT	UNCONSOLIDATED UNDRAINED TRIAXIAL TEST												
									DST	DRAINED DIRECT SHEAR TEST												
									UCT	UNCONFINED COMPRESION TEST												

 SOIL PROFILE				PROJECT: 400/220 KV GIS A.A AT PATRAN.						B.H.NO:05				TERMINATION		TABLE: 05						
										Water Level: Nil.				Depth:10.0m.								
N -VALUE	Depth(M)	Sample	SOIL DESCRIPTION	SPT-PLOT						SIEVE ANALYSIS				Limits		Natural Density	Moisture content, %	Shear Test			Consolidation Test	
				0	10	20	30	40	50	Sp. Gr.	Gravel, %	Sand, %	Silt, %	Clay, %	L.L, %			P.L, %	Confining Pressure Kg/cm2	Cohesion Kg/cms2	Angle of internal friction	cc
	0	DS-1	Light brown sandy silt -1.50m-											25.8	16.9							
7	1.5	SPT-1	Light brown clayey silt																			
	2.5	UDS-1	with gravels						2.68	3	15	57	25	38.7	26.2	1.77	16.5	UUT	0.5	6	0.098	0.763
10	3	SPT-2	-4.0m-																			
14	4.5	SPT-3	Light brown sandy silt																			
	5.5	UDS-2	with gravels -6.0m-						2.66	5	31	51	13	27.3	18.4	1.86	17.2	UCT	0.66			
19	6	SPT-4	Gray sand																			
21	7.5	SPT-5	-do-																			
	8.5	UDS-3							2.62	0	94	6	0	N	P	1.9	16.4	DST	0	33		
24	9	SPT-6																				
27	10	SPT-7	-do-																			
									UUT	UNCONSOLIDATED UNDRAINED TRIAXIAL TEST												
									DST	DRAINED DIRECT SHEAR TEST												
									UCT	UNCONFINED COMPRESSION TEST												



 SOIL PROFILE				PROJECT: 400/220 KV GIS A.A AT PATRAN.						B.H.NO:06				TERMINATION		TABLE: 06						
										Water Level: Nil.				Depth:10.0m.								
N - VALUE	Depth(M)	Sample	SOIL DESCRIPTION	SPT-PLOT						SIEVE ANALYSIS				Limits		Natural Density	Moisture content,%	Shear Test			Consolidation Test	
				0	10	20	30	40	50	Sp. Gr.	Gravel, %	Sand, %	Silt, %	Clay, %	L.L, %			P.L, %	Confining Pressure Kg/cm2	Cohesion Kg/cms2	Angle of internal friction	cc
	0	DS-1	Light brown sandy silt																			
8	1.5	SPT-1	with gravels																			
	2.5	UDS-1	-3.0m-							2.67	1	27	57	15	30.6	19.5	1.79	15.6	UUT	0.55	6	
13	3	SPT-2	L.B clayey silt with gravels-4.50m-												37.2	25.8						
15	4.5	SPT-3	Light brown sandy silt																			
	5.5	UDS-2	with gravels -6.0m-							2.66	3	32	51	14	27.8	18.9	1.84	17.1	UCT	0.68		
16	6	SPT-4	L.B clayey silt with gravels-7.25m-																			
23	7.5	SPT-5	Gray sand																			
	8.5	UDS-3	-do-							2.64	0	97	3	0	N	P	1.89	16.4	DST	0	33	
24	9	SPT-6																				
27	10	SPT-7	-do-																			
										UUT	UNCONSOLIDATED UNDRAINED TRIAXIAL TEST											
										DST	DRAINED DIRECT SHEAR TEST											
										UCT	UNCONFINED COMPRESION TEST											

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**TABLE-13**

**CHEMICAL TEST RESULTS OF SOIL**

B.H.No.	DEPTH (M)	SULPHATE CONTENT(%)	CHLORIDE CONTENT (%)	pH VALUE
01	2.50	0.132	0.084	8.4
03	5.50	0.125	0.072	8.2
05	2.50	0.129	0.088	8.3

**CBR RESULTS**

CBR.No.	CBR Value at 2.5mm	CBR Value at 5.0mm	CBR Value
01	6.0	5.9	6.0
02	5.7	5.5	5.7
03	6.3	6.1	6.3

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TABLE NO: 14  
ELECTRICAL RESISTIVITY TEST - 01  
400/220KV GIS PATRAN

S.NO.	DIRECTION	SPACING	METER READING (OHM)	RESISTIVITY (OHM-M)
1	EW	0.5	7.3	22.922
		1	4	25.12
		2	1.8	22.608
		3	1.1	20.724
		4	1	25.12
		5	0.8	25.12
		6	0.6	22.608
		8	0.5	25.12
		10	0.4	25.12
2	NE-SW	0.5	7.5	23.55
		1	3.6	22.608
		2	1.8	22.608
		3	1	18.84
		4	0.9	22.608
		5	0.8	25.12
		6	0.6	22.608
		8	0.6	30.144
		10	0.5	31.4
3	NS	0.5	7.9	24.806
		1	4	25.12
		2	1.9	23.864
		3	1.3	24.492
		4	0.9	22.608
		5	0.8	25.12
		6	0.7	26.376
		8	0.6	30.144
		10	0.5	31.4
4	NW-SE	0.5	9.2	28.888
		1	3.7	23.236
		2	1.9	23.864
		3	1.3	24.492
		4	1.1	27.632
		5	0.9	28.26
		6	0.8	30.144
		8	0.7	35.168
		10	0.6	37.68



TABLE NO:- 15  
ELECTRICAL RESISTIVITY TEST - 02  
400/220KV GIS PATRAN

S.NO.	DIRECTION	SPACING	METER READING (OHM)	RESISTIVITY (OHM-M)
1	EW	0.5	5.2	16.328
		1	2.6	16.328
		2	1.4	17.584
		3	1.1	20.724
		4	1	25.12
		5	0.8	25.12
		6	0.7	26.376
		8	0.6	30.144
		10	0.5	31.4
2	NE-SW	0.5	7.9	24.806
		1	3.4	21.352
		2	1.6	20.096
		3	0.8	15.072
		4	0.8	20.096
		5	0.7	21.98
		6	0.6	22.608
		8	0.6	30.144
		10	0.5	31.4
3	NS	0.5	8.4	26.376
		1	2.9	18.212
		2	1.1	13.816
		3	0.9	16.956
		4	0.7	17.584
		5	0.6	18.84
		6	0.6	22.608
		8	0.5	25.12
		10	0.5	31.4
4	NW-SE	0.5	7.8	24.492
		1	2.7	16.956
		2	1.8	22.608
		3	1.1	20.724
		4	0.9	22.608
		5	0.8	25.12
		6	0.8	30.144
		8	0.6	30.144
		10	0.5	31.4



TABLE NO: 16  
ELECTRICAL RESISTIVITY TEST - 03  
400/220KV GIS PATRAN

S.NO.	DIRECTION	SPACING	METER READING (OHM)	RESISTIVITY (OHM-M)
1	EW	0.5	5.2	16.328
		1	2.1	13.188
		2	1.1	13.816
		3	0.7	13.188
		4	0.5	12.56
		5	0.3	9.42
		6	0.3	11.304
		8	0.4	20.096
		10	0.2	12.56
2	NE-SW	0.5	5.5	17.27
		1	2	12.56
		2	0.9	11.304
		3	0.7	13.188
		4	0.5	12.56
		5	0.6	18.84
		6	0.5	18.84
		8	0.4	20.096
		10	0.5	31.4
3	NS	0.5	6.8	21.352
		1	1.8	11.304
		2	1.4	17.584
		3	0.7	13.188
		4	0.7	17.584
		5	0.7	21.98
		6	0.6	22.608
		8	0.6	30.144
		10	0.6	37.68
4	NW-SE	0.5	4.1	12.874
		1	1.3	8.164
		2	1.1	13.816
		3	0.7	13.188
		4	0.6	15.072
		5	0.6	18.84
		6	0.4	15.072
		8	0.4	20.096
		10	0.5	31.4



TABLE NO: 17  
ELECTRICAL RESISTIVITY TEST - 04  
400/220KV GIS PATRAN

S.NO.	DIRECTION	SPACING	METER READING (OHM)	RESISTIVITY (OHM-M)
1	EW	0.5	8.7	27.318
		1	2.8	17.584
		2	1.1	13.816
		3	0.9	16.956
		4	0.8	20.096
		5	0.6	18.84
		6	0.6	22.608
		8	0.5	25.12
		10	0.4	25.12
2	NE-SW	0.5	9	28.26
		1	3.1	19.468
		2	1.3	16.328
		3	0.9	16.956
		4	0.7	17.584
		5	0.7	21.98
		6	0.6	22.608
		8	0.5	25.12
		10	0.4	25.12
3	NS	0.5	8.6	27.004
		1	3.8	23.864
		2	1.4	17.584
		3	1	18.84
		4	0.8	20.096
		5	0.7	21.98
		6	0.6	22.608
		8	0.6	30.144
		10	0.5	31.4
4	NW-SE	0.5	9.2	28.888
		1	3.4	21.352
		2	1.6	20.096
		3	1.2	22.608
		4	0.9	22.608
		5	0.8	25.12
		6	0.7	26.376
		8	0.7	35.168
		10	0.5	31.4



TABLE NO: 18  
ELECTRICAL RESISTIVITY TEST - 05  
400/220KV GIS PATRAN

S.NO.	DIRECTION	SPACING	METER READING (OHM)	RESISTIVITY (OHM-M)
1	EW	0.5	8.2	25.748
		1	2.7	16.956
		2	1.5	18.84
		3	1.1	20.724
		4	0.9	22.608
		5	0.8	25.12
		6	0.6	22.608
		8	0.5	25.12
		10	0.5	31.4
2	NE-SW	0.5	7.7	24.178
		1	3.4	21.352
		2	1.8	22.608
		3	1.1	20.724
		4	0.7	17.584
		5	0.6	18.84
		6	0.6	22.608
		8	0.4	20.096
		10	0.4	25.12
3	NS	0.5	8.3	26.062
		1	3.8	23.864
		2	1.9	23.864
		3	1.4	26.376
		4	0.8	20.096
		5	0.7	21.98
		6	0.5	18.84
		8	0.4	20.096
		10	0.4	25.12
4	NW-SE	0.5	9	28.26
		1	2.6	16.328
		2	1.8	22.608
		3	1.2	22.608
		4	1	25.12
		5	0.8	25.12
		6	0.6	22.608
		8	0.5	25.12
		10	0.5	31.4



**TABLE NO: 19**  
**ELECTRICAL RESISTIVITY TEST - 06**  
**400/220KV GIS PATRAN**

S.NO.	DIRECTION	SPACING	METER READING (OHM)	RESISTIVITY (OHM-M)
1	EW	0.5	7.8	24.492
		1	3.3	20.724
		2	1.6	20.096
		3	1	18.84
		4	0.7	17.584
		5	0.6	18.84
		6	0.6	22.608
		8	0.5	25.12
		10	0.5	31.4
2	NE-SW	0.5	7.7	24.178
		1	3.3	20.724
		2	1.6	20.096
		3	1	18.84
		4	0.8	20.096
		5	0.7	21.98
		6	0.6	22.608
		8	0.5	25.12
		10	0.4	25.12
3	NS	0.5	8.3	26.062
		1	3	18.84
		2	1.5	18.84
		3	0.9	16.956
		4	0.7	17.584
		5	0.5	15.7
		6	0.4	15.072
		8	0.6	30.144
		10	0.5	31.4
4	NW-SE	0.5	6.9	21.666
		1	2.7	16.956
		2	1.8	22.608
		3	1.2	22.608
		4	0.7	17.584
		5	0.5	15.7
		6	0.5	18.84
		8	0.6	30.144
		10	0.4	25.12



TABLE NO: 20  
ELECTRICAL RESISTIVITY TEST - 07  
400/220KV GIS PATRAN

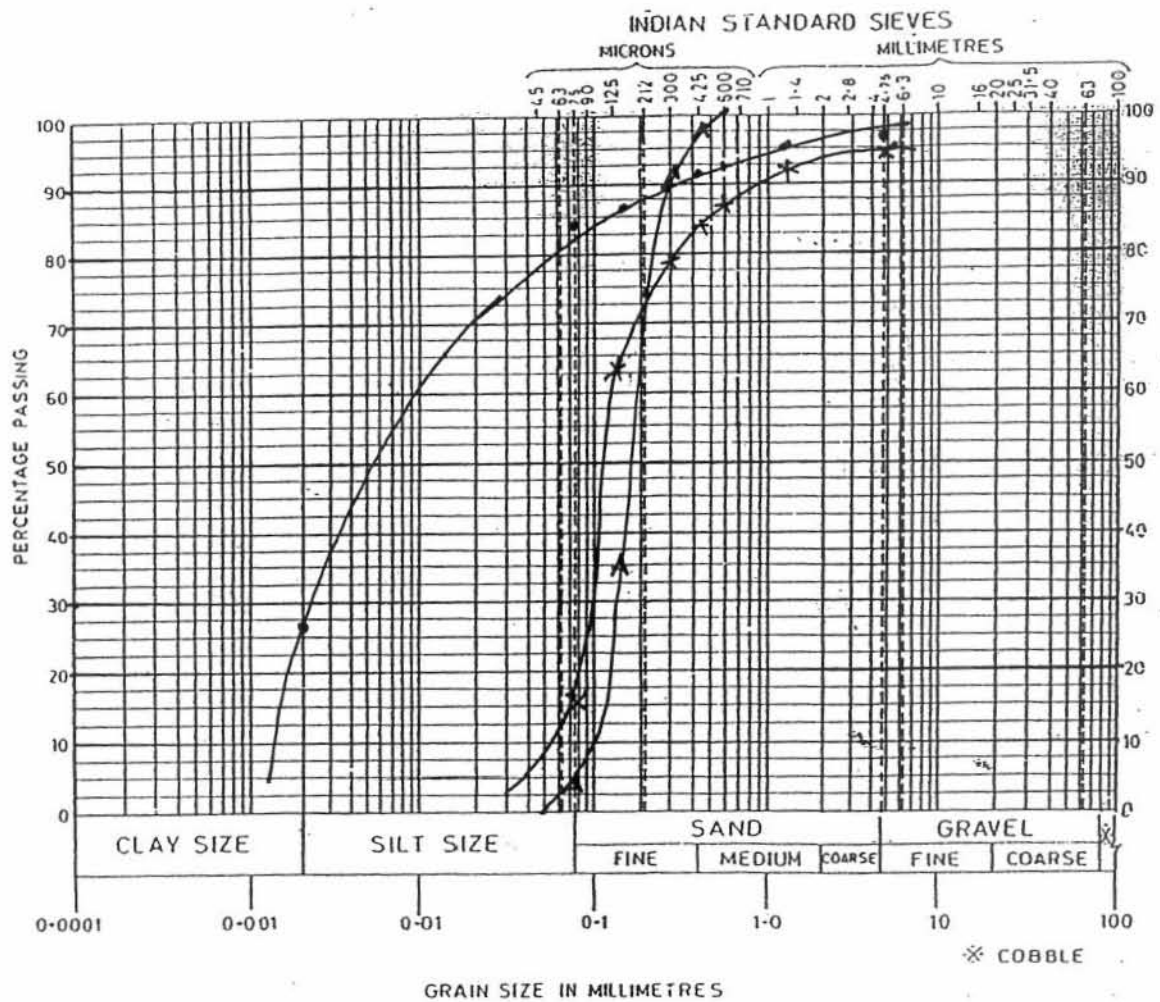
S.NO.	DIRECTION	SPACING	METER READING (OHM)	RESISTIVITY (OHM-M)
1	EW	0.5	7.1	22.294
		1	3.4	21.352
		2	1.4	17.584
		3	0.8	15.072
		4	0.6	15.072
		5	0.5	15.7
		6	0.5	18.84
		8	0.5	25.12
		10	0.5	31.4
2	NE-SW	0.5	6.9	21.666
		1	2.6	16.328
		2	1.4	17.584
		3	0.9	16.956
		4	0.6	15.072
		5	0.5	15.7
		6	0.4	15.072
		8	0.3	15.072
		10	0.3	18.84
3	NS	0.5	6.9	21.666
		1	2.7	16.956
		2	1.8	22.608
		3	1.2	22.608
		4	0.9	22.608
		5	0.7	21.98
		6	0.6	22.608
		8	0.5	25.12
		10	0.4	25.12
4	NW-SE	0.5	6.1	19.154
		1	2.1	13.188
		2	1.3	16.328
		3	1	18.84
		4	0.6	15.072
		5	0.8	25.12
		6	0.6	22.608
		8	0.5	25.12
		10	0.5	31.4



TABLE NO: 21  
ELECTRICAL RESISTIVITY TEST - 08  
400/220KV GIS PATRAN

S.NO.	DIRECTION	SPACING	METER READING (OHM)	RESISTIVITY (OHM-M)
1	EW	0.5	7	21.98
		1	3	18.84
		2	1.3	16.328
		3	1	18.84
		4	0.9	22.608
		5	0.6	18.84
		6	0.6	22.608
		8	0.5	25.12
		10	0.5	31.4
2	NE-SW	0.5	8.3	26.062
		1	3	18.84
		2	1.6	20.096
		3	1.1	20.724
		4	0.9	22.608
		5	0.8	25.12
		6	0.7	26.376
		8	0.6	30.144
		10	0.5	31.4
3	NS	0.5	6.8	21.352
		1	3	18.84
		2	1.5	18.84
		3	1.1	20.724
		4	0.9	22.608
		5	0.7	21.98
		6	0.6	22.608
		8	0.6	30.144
		10	0.6	37.68
4	NW-SE	0.5	7.5	23.55
		1	2.5	15.7
		2	1.6	20.096
		3	1.2	22.608
		4	1	25.12
		5	0.9	28.26
		6	0.7	26.376
		8	0.6	30.144
		10	0.6	37.68

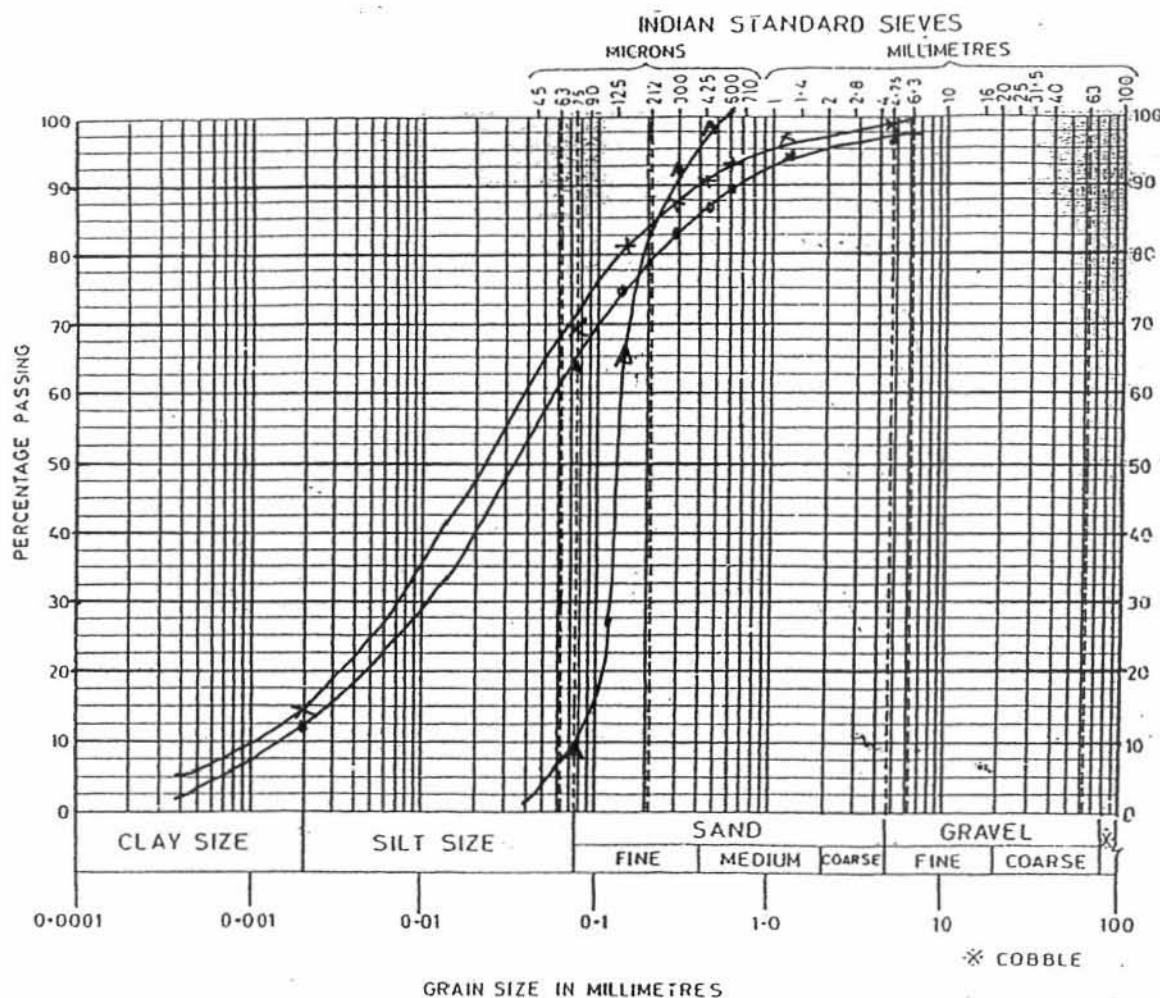




LOCATION	DEPTH	SYMBOL	CLASSIFI CATION	GRAVELS (%)	SAND (%)	SILT (%)	CLAY (%)
01	2.5	—●—	MD	3	14	56	27
	5.5	*—*	CL	6	28	51	15
	8.5	▲—▲	SP	0	96	4	0

### GRAIN SIZE ANALYSIS

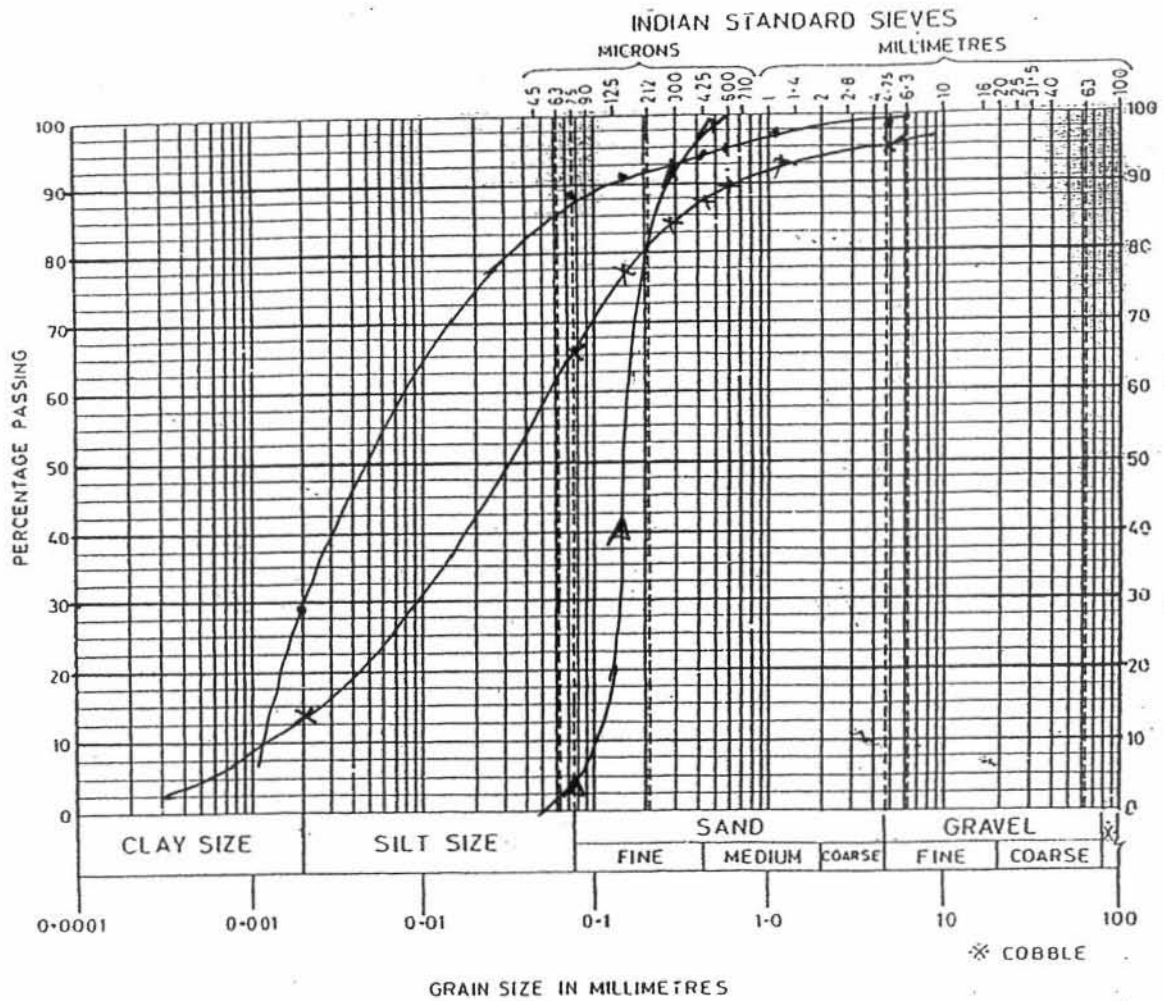
FIG. NO: 01



LOCATION	DEPTH	SYMBOL	CLASSIFICATION	GRAVELS (%)	SAND (%)	SILT (%)	CLAY (%)
02	2.5	—●—	CL	4	32	52	12
	5.5	*—*	CL	2	29	55	14
	8.5	▲—▲	SP-SM	0	92	8	0

GRAIN SIZE ANALYSIS

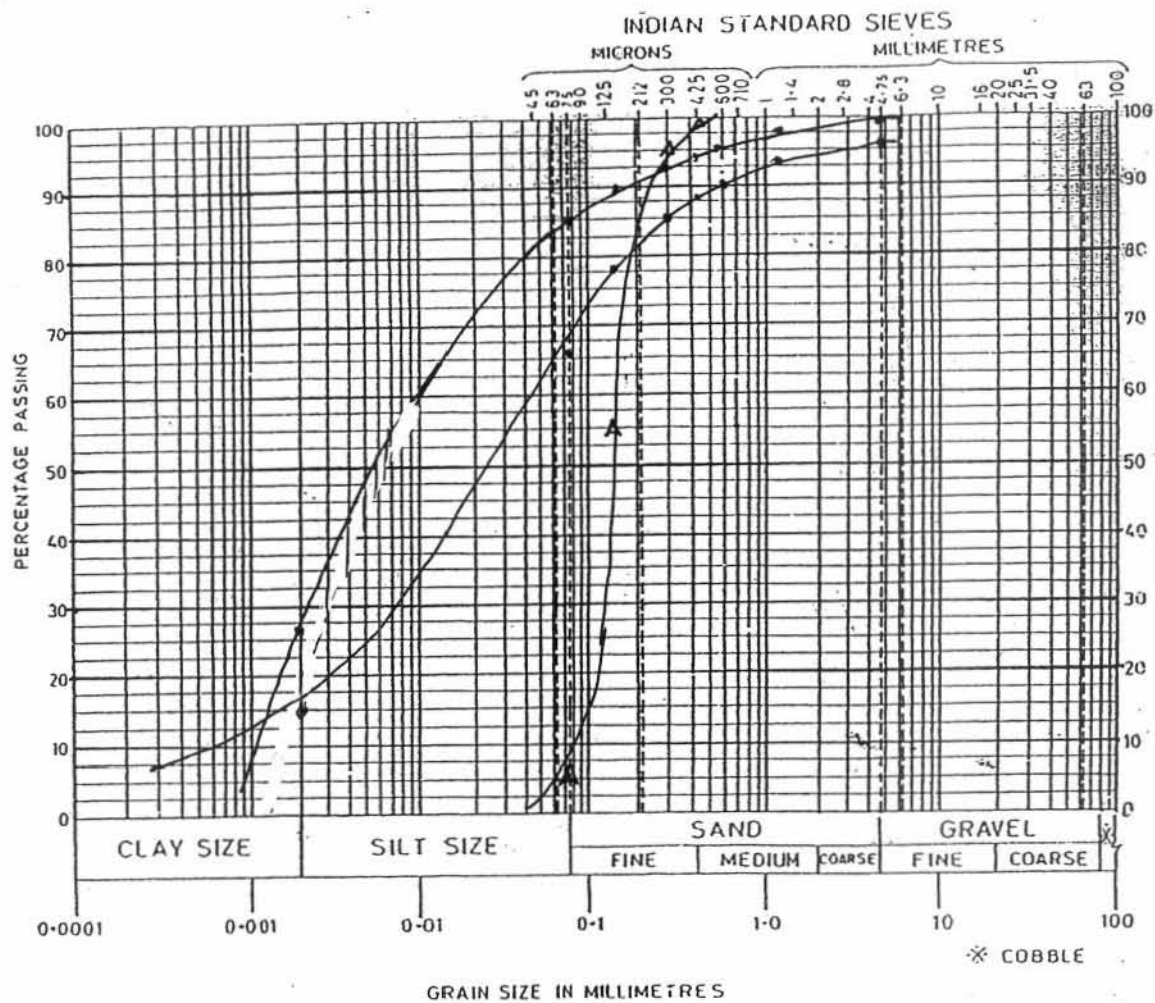
FIG. NO: 02



LOCATION	DEPTH	SYMBOL	CLASSIFICATION	GRAVELS (%)	SAND (%)	SILT (%)	CLAY (%)
03	2.5	—●—	MI	2	10	59	29
	5.5	*—*	CL	5	30	52	13
	8.5	▲—▲	SP	0	97	3	0

### GRAIN SIZE ANALYSIS

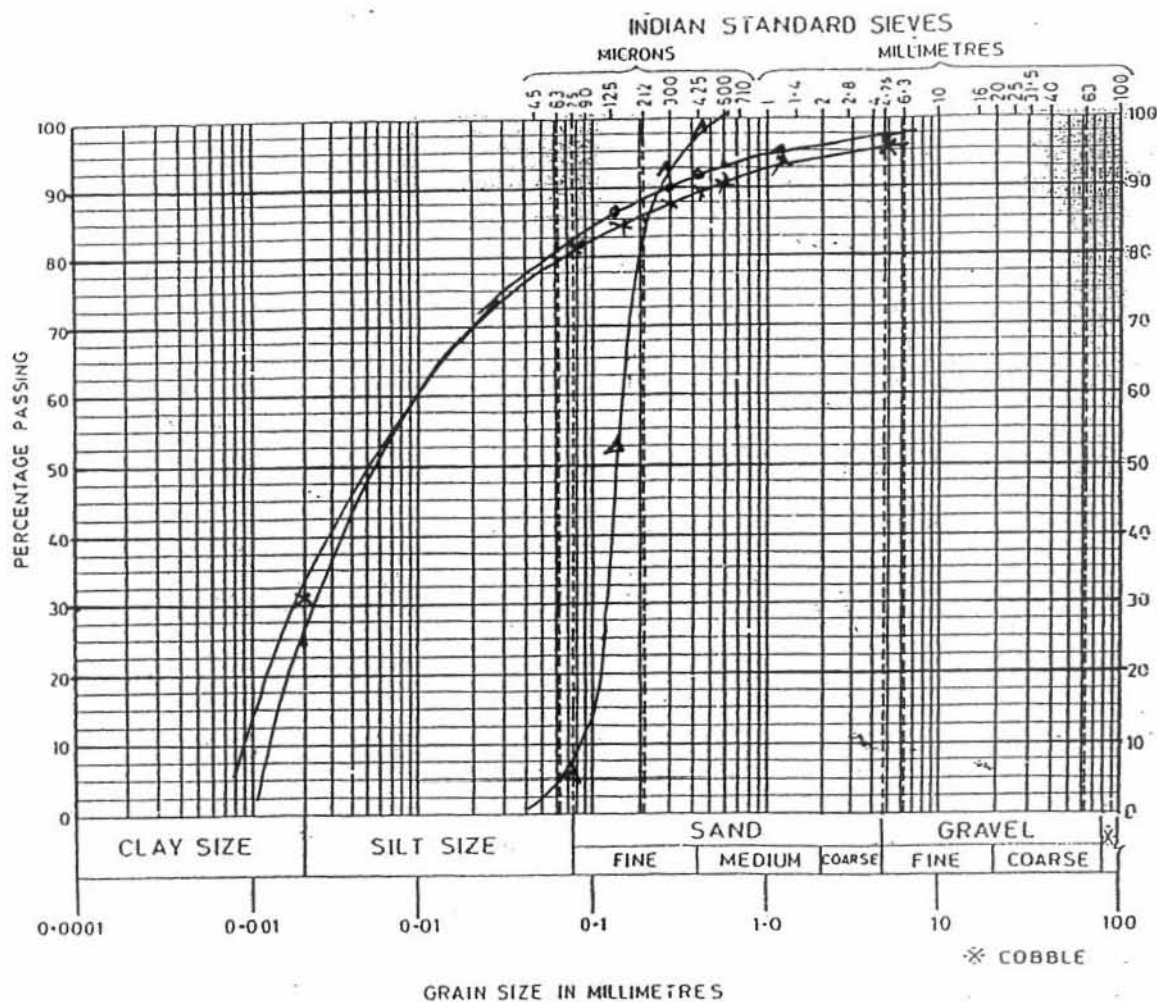
FIG. NO: 03



LOCATION	DEPTH	SYMBOL	CLASSIFICATION	GRAVELS (%)	SAND (%)	SILT (%)	CLAY (%)
04	2.5	—●—	MP	1	14	58	27
	5.5	*—*	CL	4	30	51	15
	8.5	▲—▲	SP-SM	0	95	5	0

GRAIN SIZE ANALYSIS

FIG. NO: 04

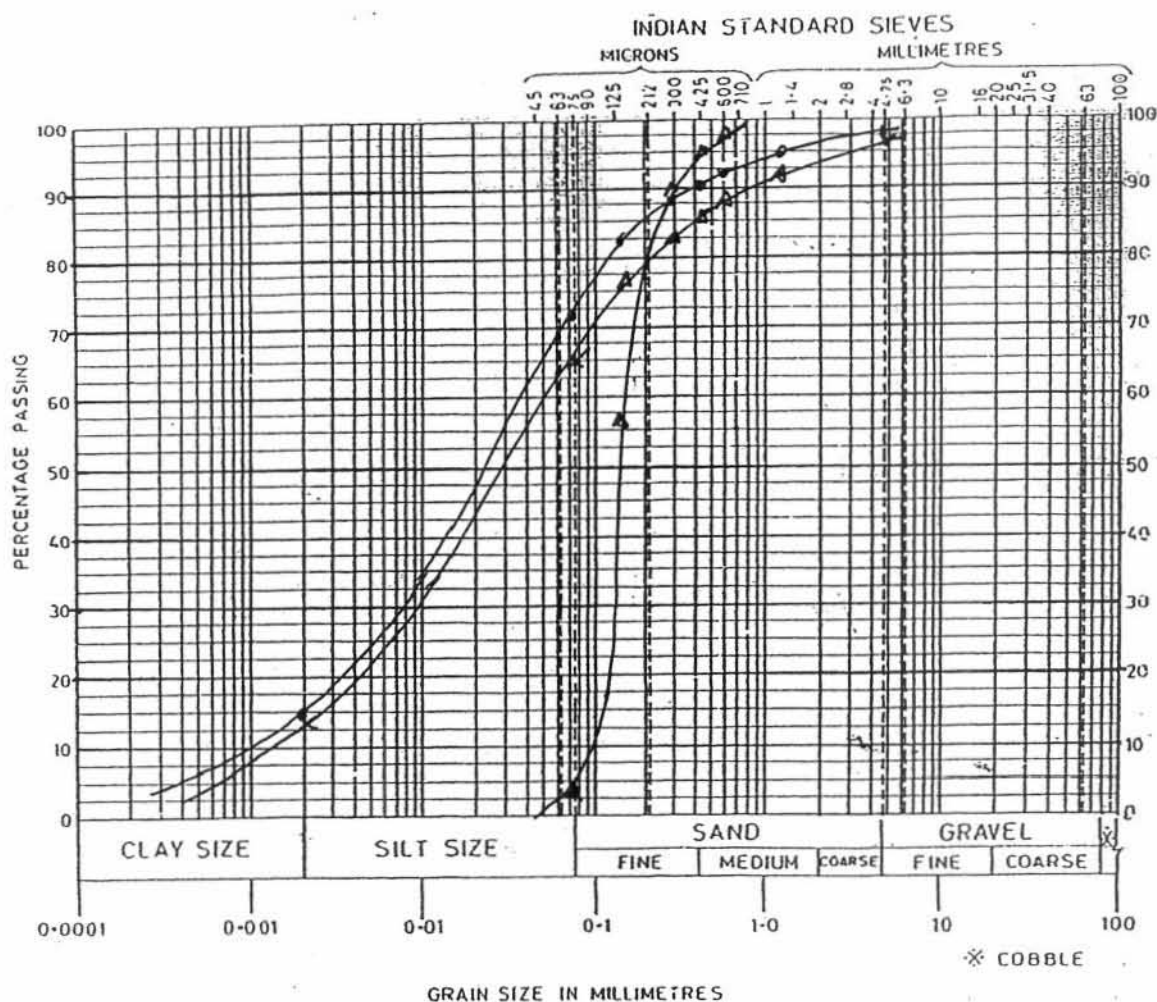


LOCATION	DEPTH	SYMBOL	CLASSIFI CATION	GRAVELS (%)	SAND (%)	SILT (%)	CLAY (%)
05	2.5	—●—	MI	3	15	57	25
	5.5	*—*	MI	5	31	51	31
	8.5	▲—▲	SP-SM	0	94	6	0

### GRAIN SIZE ANALYSIS

FIG. NO: 05





LOCATION	DEPTH	SYMBOL	CLASSIFICATION	GRAVELS (%)	SAND (%)	SILT (%)	CLAY (%)
06	2.5	—●—	CL	1	27	57	15
	5.5	*—*	CL	3	32	51	14
	8.5	▲—▲	Sp	0	97	3	0

GRAIN SIZE ANALYSIS

FIG. NO: 06



B.H.No.: 01

SAMPLE: 008-01

TYPE OF TEST : UUT.

C: 0.5 kg/cm<sup>2</sup>

$\phi$ : 6 Degree.

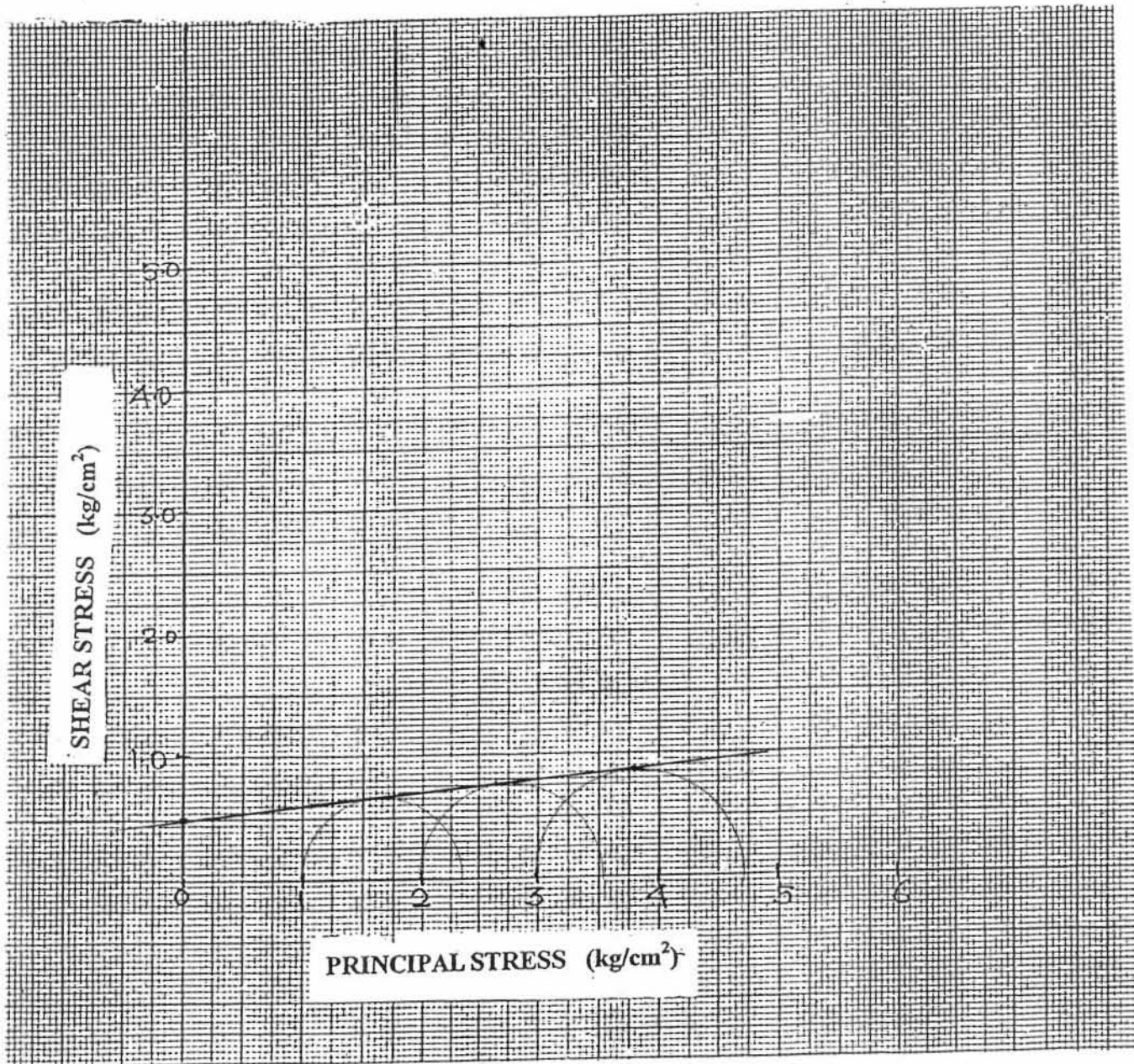


FIG. NO: 07

SANGUINE GEOTECH PVT. LTD.



B.H.No.: 02

SAMPLE: UN5-01

TYPE OF TEST : UUT.

$C: 0.5 \text{ kg/cm}^2$

$\phi: 7 \text{ Degree.}$

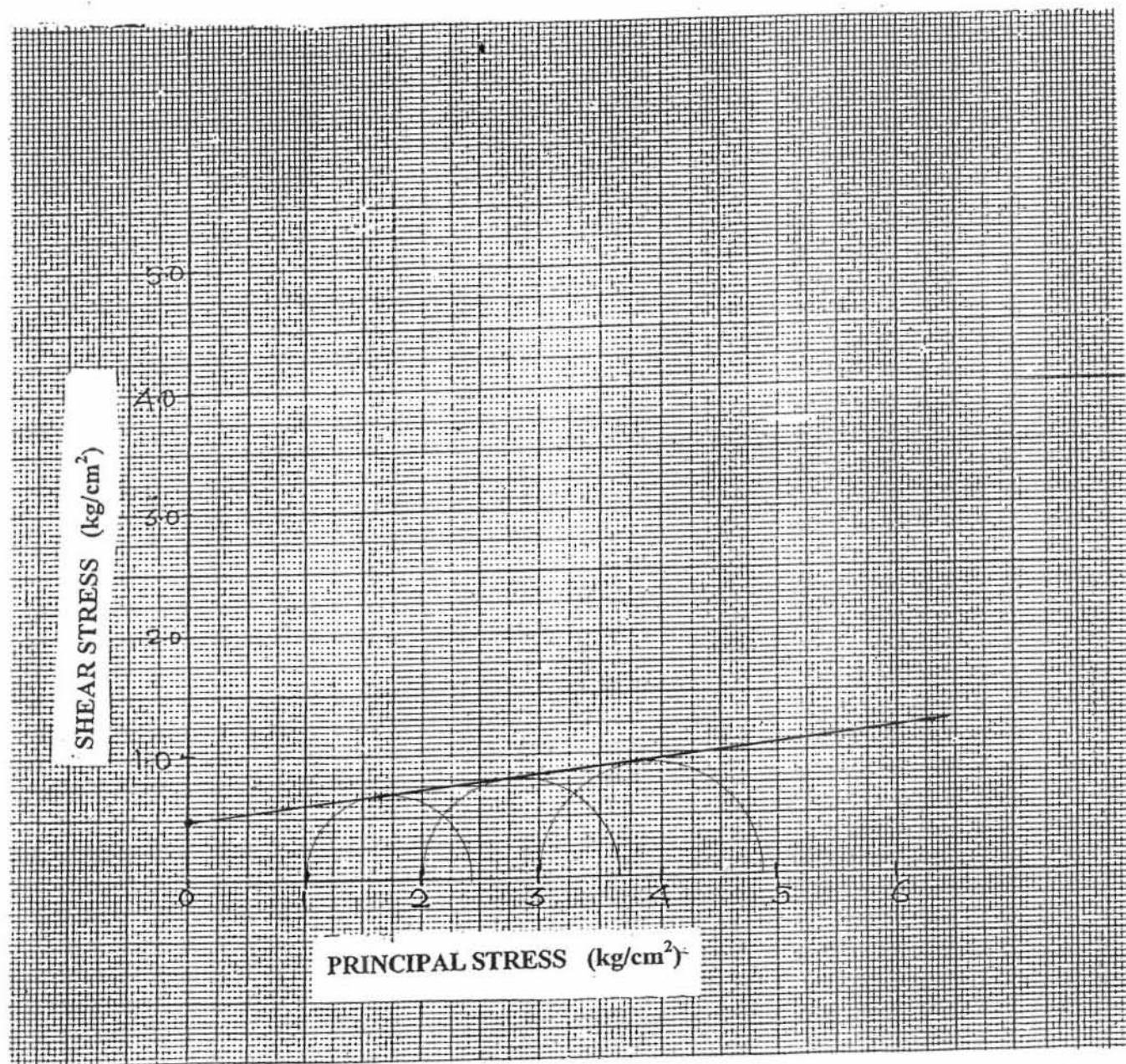


FIG. NO: 08

SANGUINE GEOTECH PVT. LTD.





B.H.No.: 03

SAMPLE: UDS-01

TYPE OF TEST : UUT.

$C: 0.5 \text{ kg/cm}^2$

$\phi: 6 \text{ Degree.}$

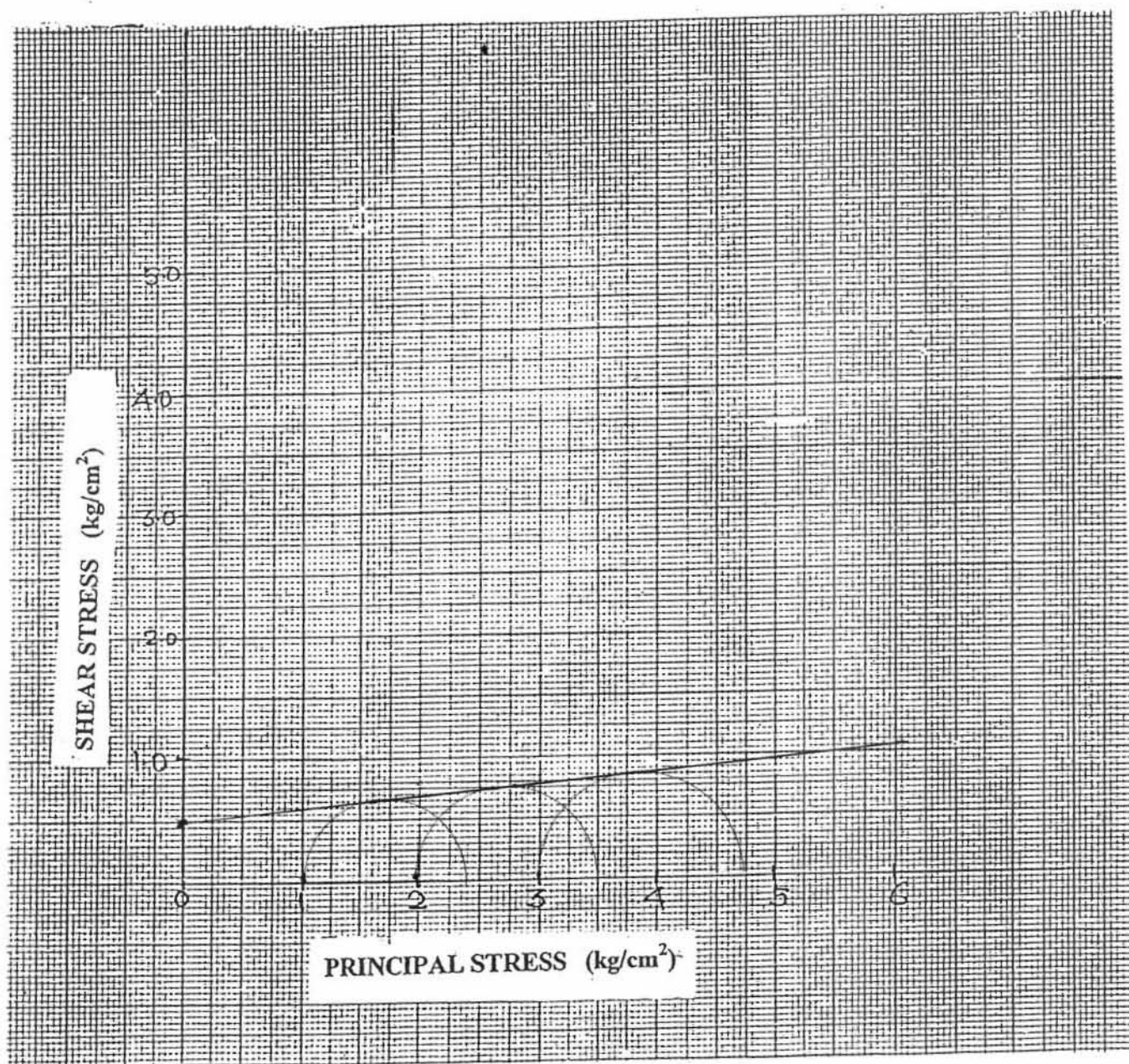


FIG. NO: 09

SANGUINE GEOTECH PVT. LTD.



B.H.No.: 04

SAMPLE: UD5-01

TYPE OF TEST : UUT.

$C: 0.5 \text{ kg/cm}^2$

$\phi: 7 \text{ Degree.}$

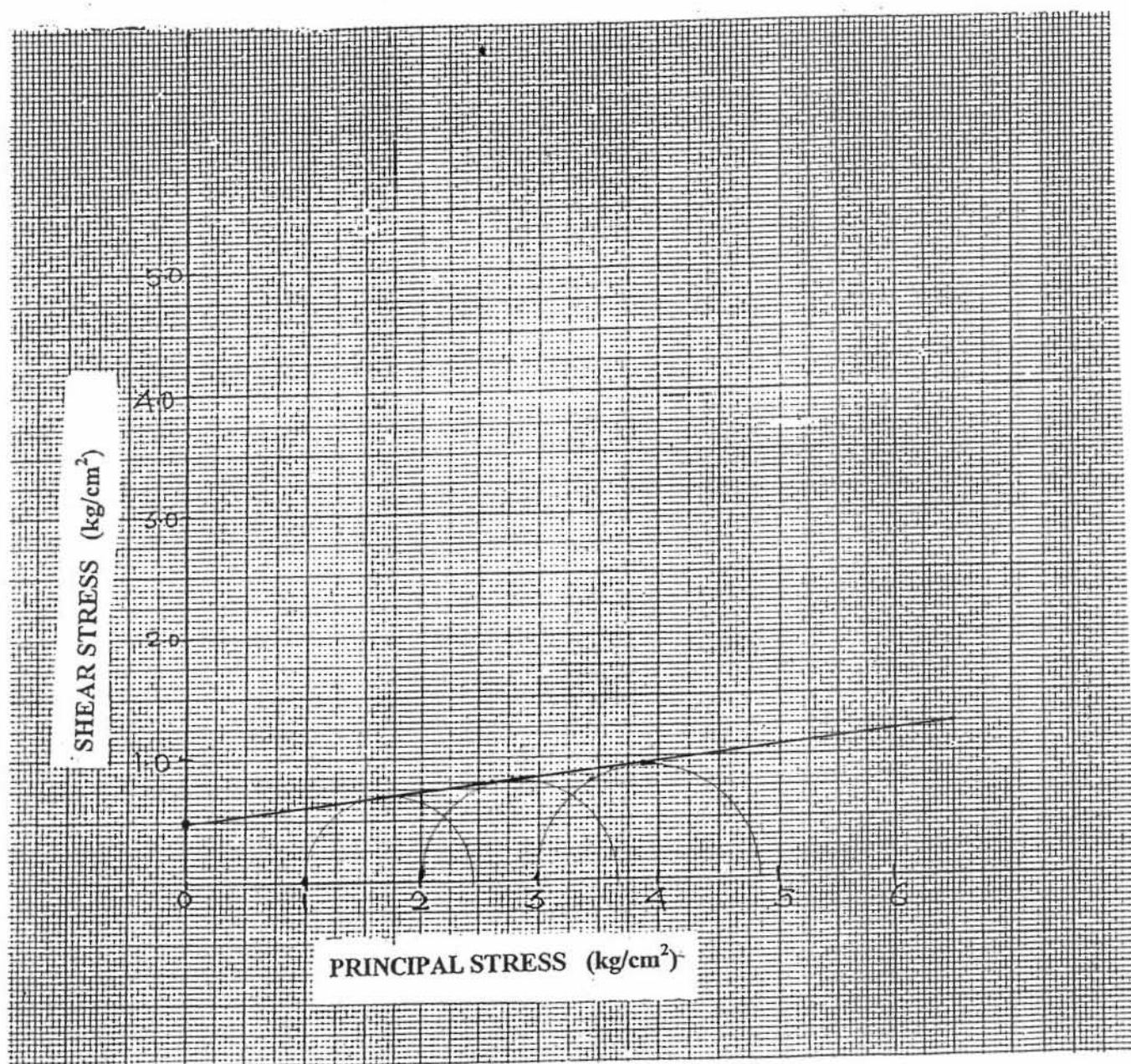


FIG. NO: 10

SANGUINE GEOTECH PVT. LTD.





B.H.No.: 05

SAMPLE: 00801

TYPE OF TEST : UUT.

C: 0.5 kg/cm<sup>2</sup>

$\phi$ : 6 Degree.

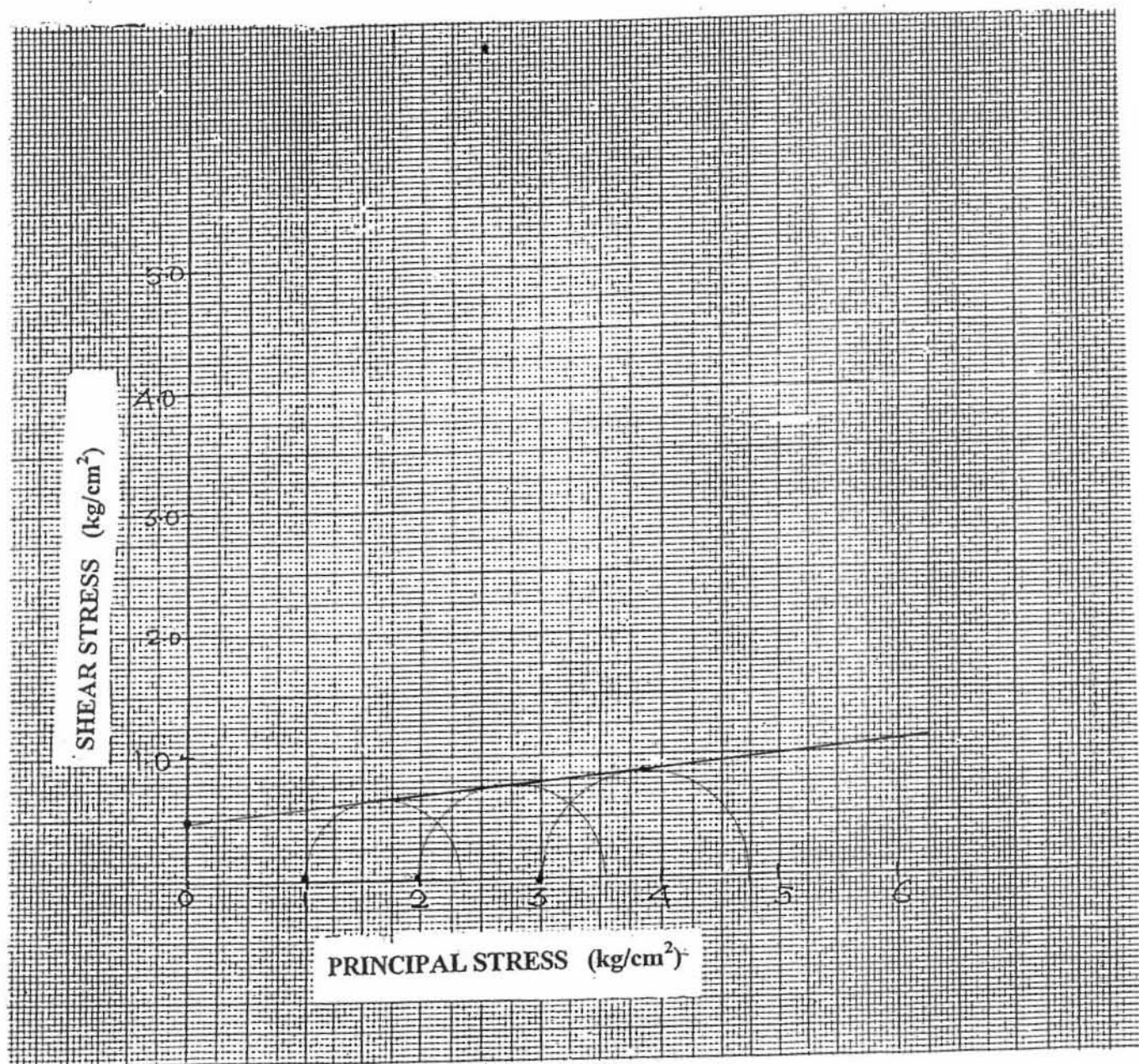


FIG. NO: 11

SANGUINE GEOTECH PVT. LTD.



B.H.No.: 06

SAMPLE: 0080\

TYPE OF TEST : UUT.

$C: 0.55 \text{ kg/cm}^2$

$\phi: 6 \text{ Degree.}$

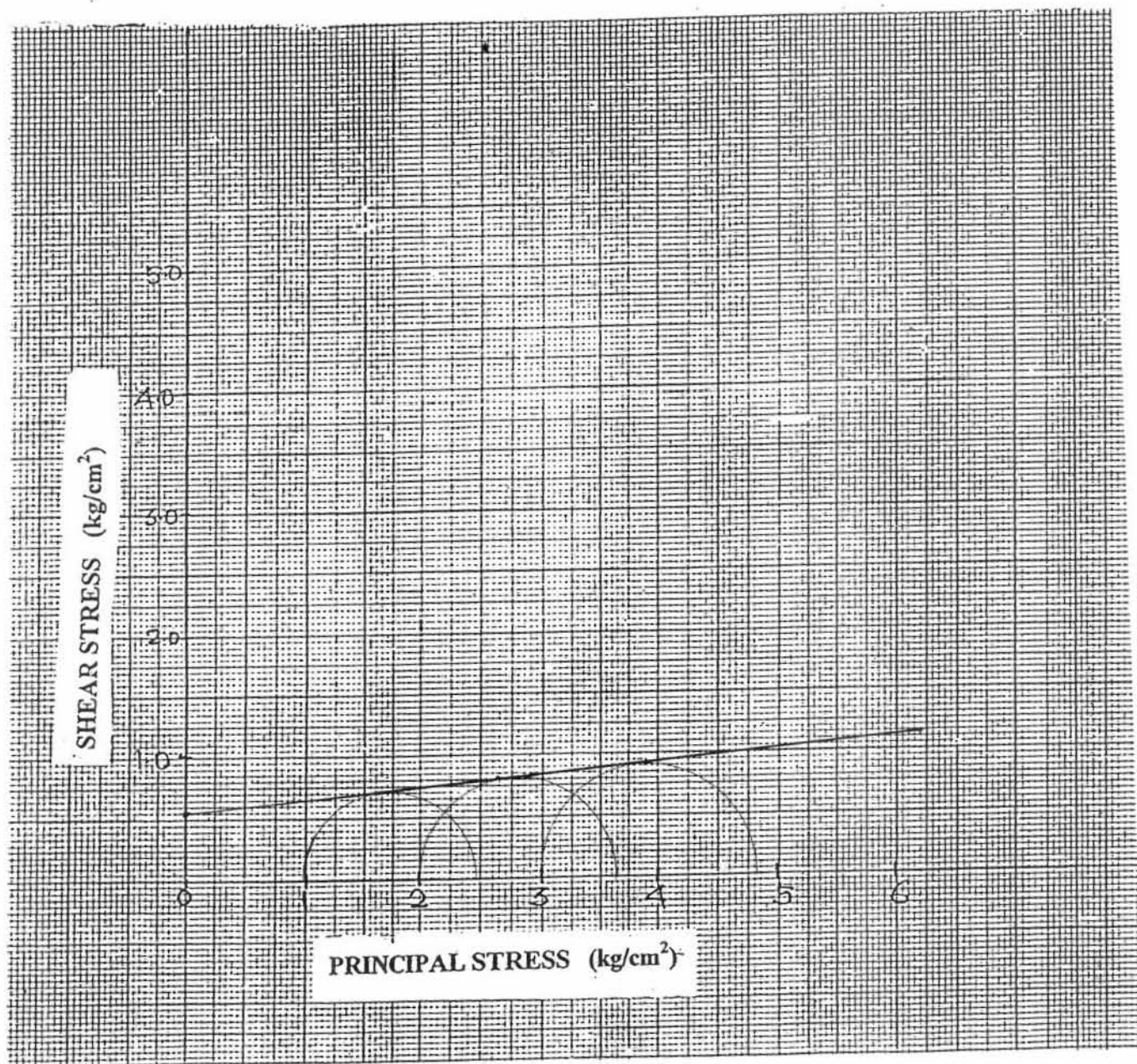
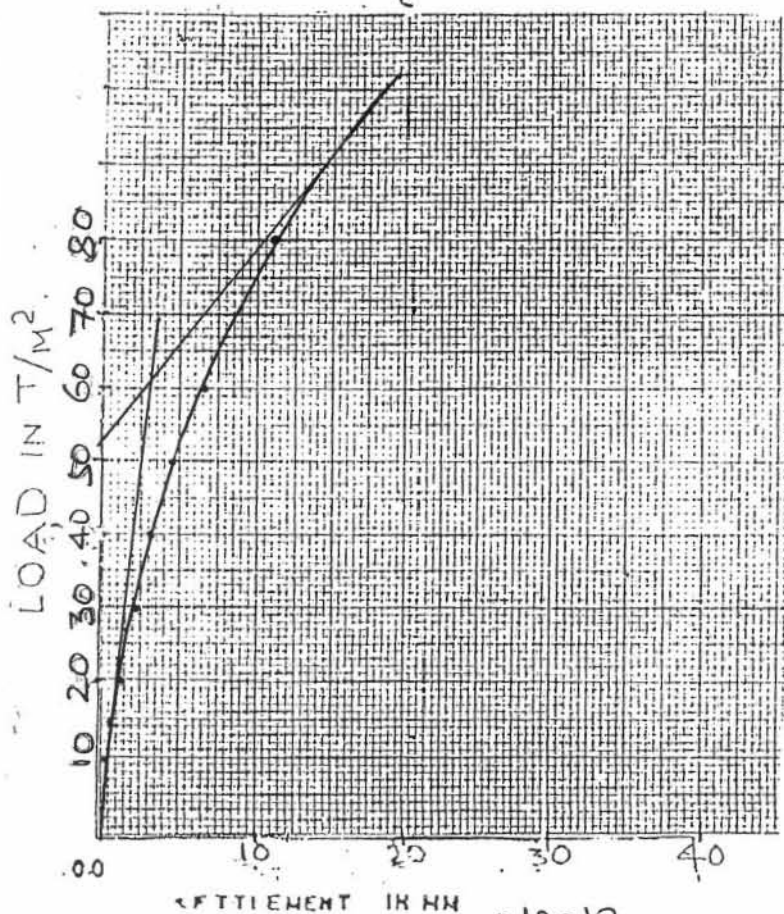
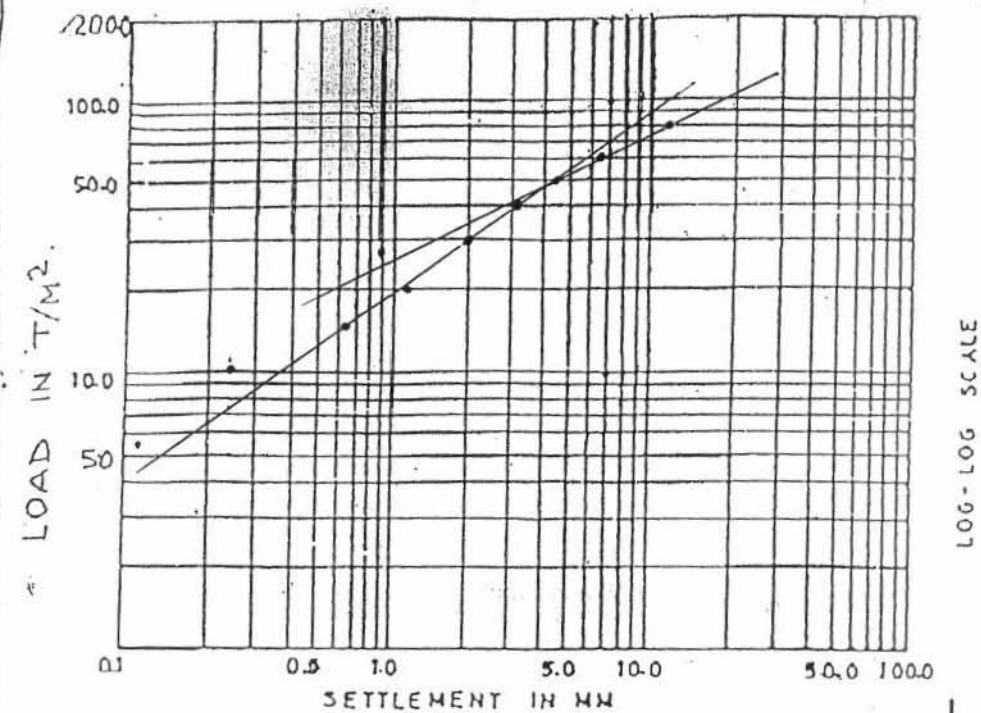


FIG. NO: 12

SANGUINE GEOTECH PVT. LTD.

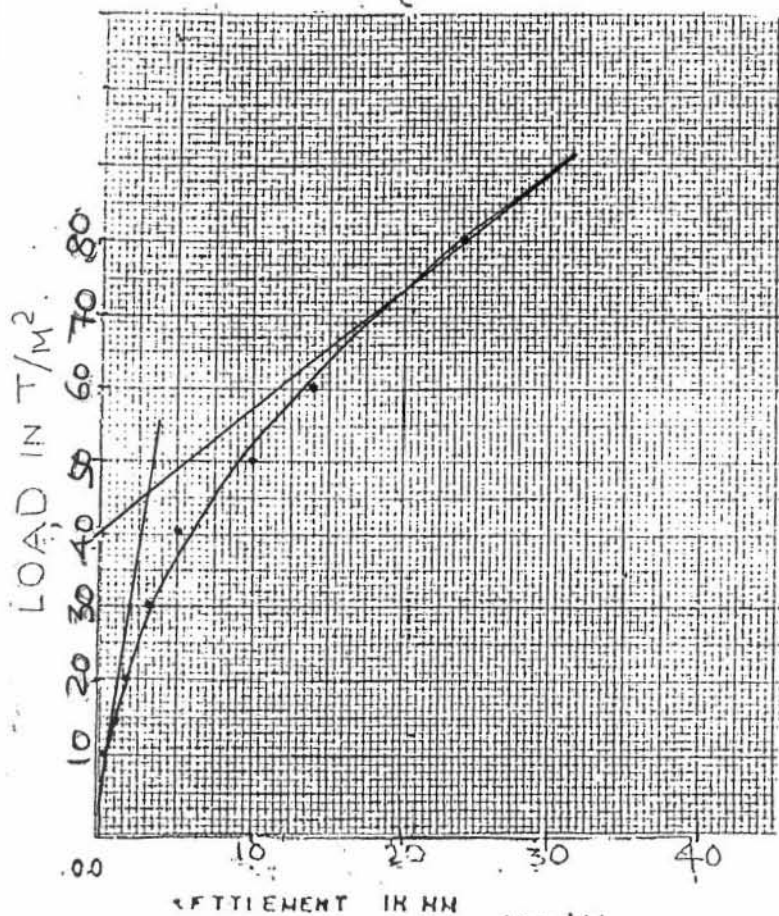
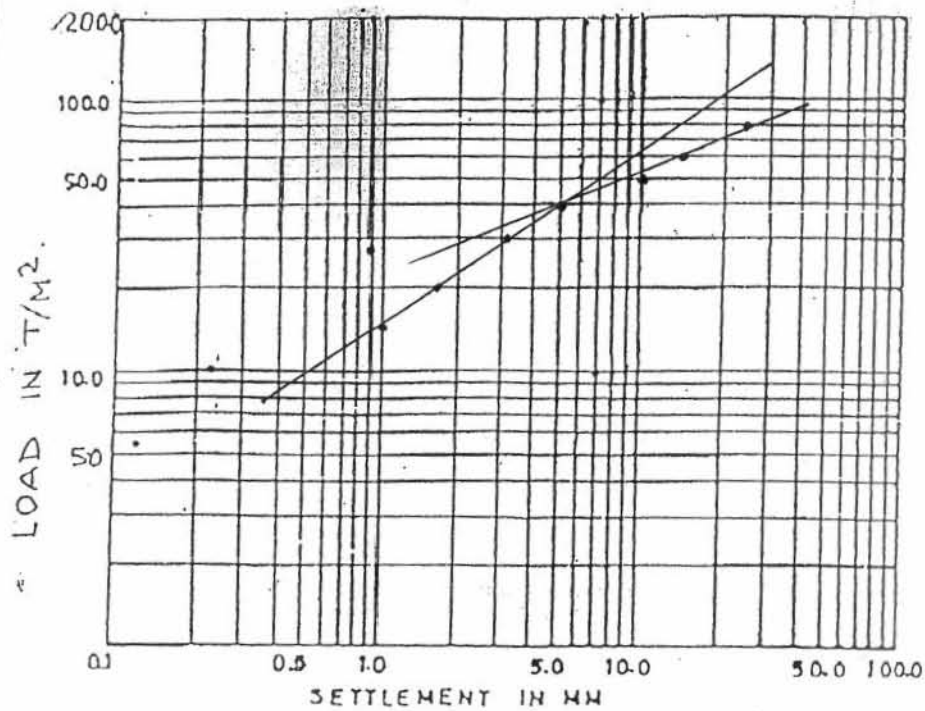


$$q_a = \frac{46}{2.5} = 18.4 \text{ T/M}^2$$

PLATE LOAD TEST-01

Depth = 2.0 M.





$$q_a = \frac{40}{2.5} = 16.0 \text{ T/M}^2$$

PLATE LOAD TEST - 02

Depth = 2.0M.



C.B.R. NO.-01 (LAB)

Penetration (mm)	CBR Value Soaked
2.5	6.0
5.0	5.9

LOAD ON PISTON (Kg/cm<sup>2</sup>)

12

10

8

6

4

2

0

2

4

6

8

10

12

14

PENETRATION (mm)

FIG. NO:

FIG. NO: 15

-47-



C.B.R. NO.- 02 (LAB)

Penetration (mm)	CBR Value Soaked
2.5	5.7
5.0	5.5

LOAD ON PISTON ( $\text{Kg/cm}^2$ )

10

8

6

4

2

0

2

4

6

8

10

12

14

PENETRATION (mm)

FIG. NO:

FIG-NO: 16

-48-





C.B.R. NO.- 03 (LAB)

Penetration (mm)	CBR Value Soaked
2.5	6.3
5.5	6.1

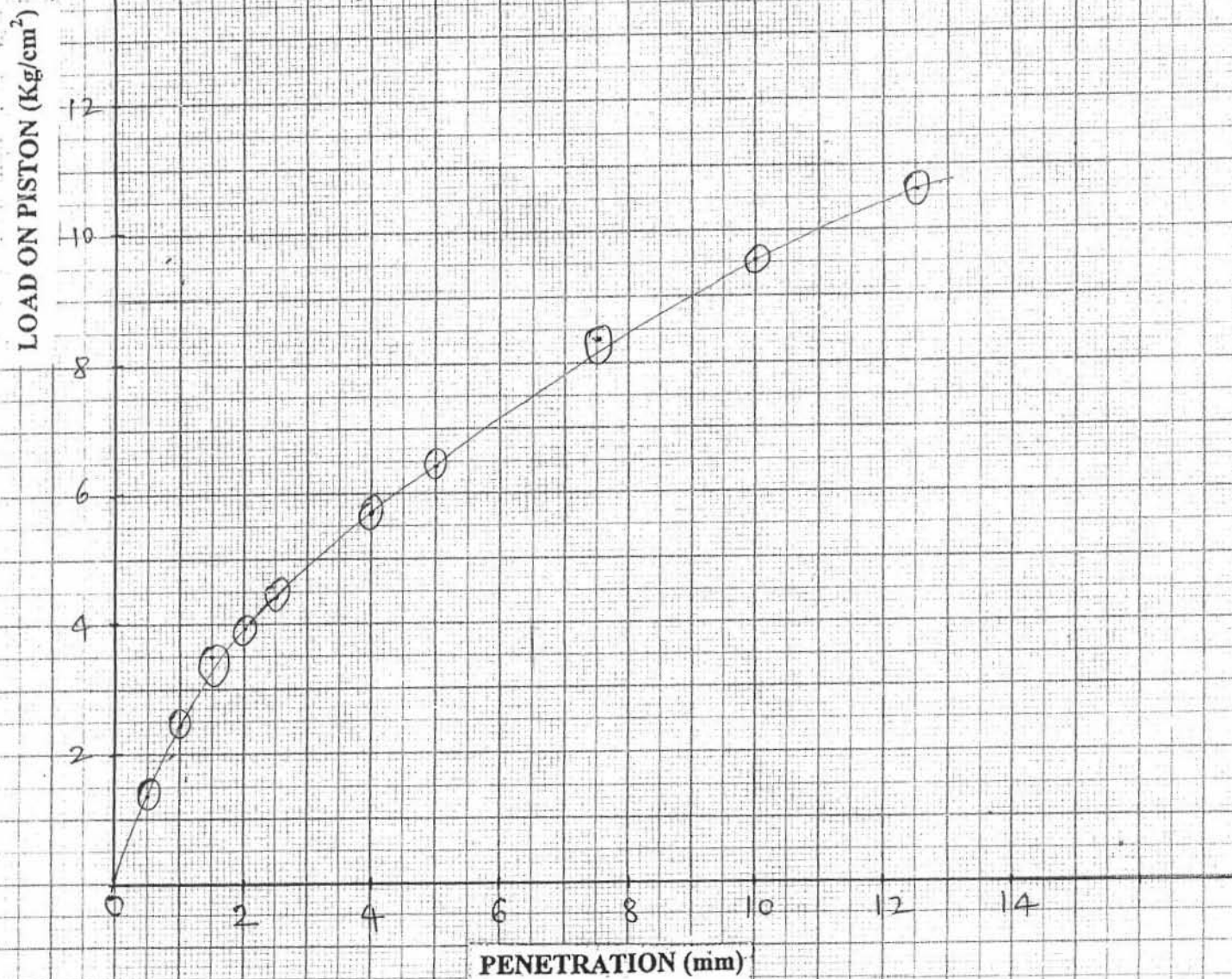
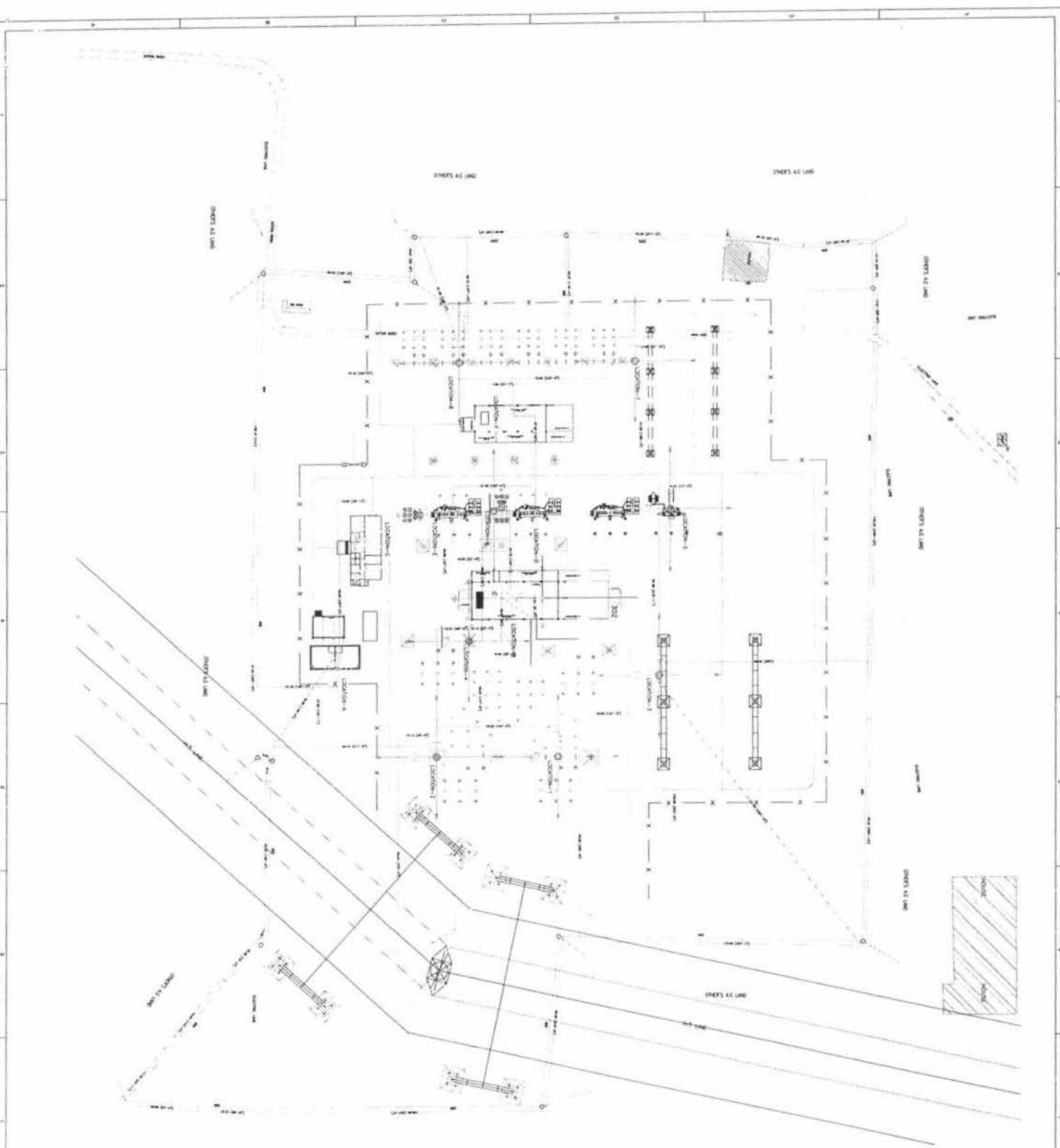


FIG. NO:

FIG. NO: 17



OWNER		PATRAN TRANSMISSION COMPANY LIMITED
CONTRACTOR		TECHNO ELECTRIC & ENGG. CO. LTD. ENGINEERS & CONSTRUCTORS KOLKATA, INDIA
NOA NO.		PTCL-PATRAN/KOL/14-15/CA-13 DTD 01.02.2014
PROJECT		TRANSMISSION SYSTEM FOR PATRAN 400 KV S/S.
SUB-STATION		400 / 220 KV GIS SUBSTATION AT PATRAN
DRG. TITLE		SOIL RESISTIVITY & BORE HOLE TEST LOCATION
DRG. NO.		0701PA_PTRN_SWYD_E_DRG_42_014
SCALE :		N.T.S
JOB NO. :		0701PA
SHEET :		1 OF 1



INDEX OF SOIL RESISTIVITY TEST

SL. NO	TYPE OF TEST	COORDINATE	DEPTH	RESISTIVITY
1	LOCATION-1	11.17	1.0	11.17
2	LOCATION-2	11.18	1.0	11.18
3	LOCATION-3	11.19	1.0	11.19
4	LOCATION-4	11.20	1.0	11.20
5	LOCATION-5	11.21	1.0	11.21
6	LOCATION-6	11.22	1.0	11.22
7	LOCATION-7	11.23	1.0	11.23
8	LOCATION-8	11.24	1.0	11.24

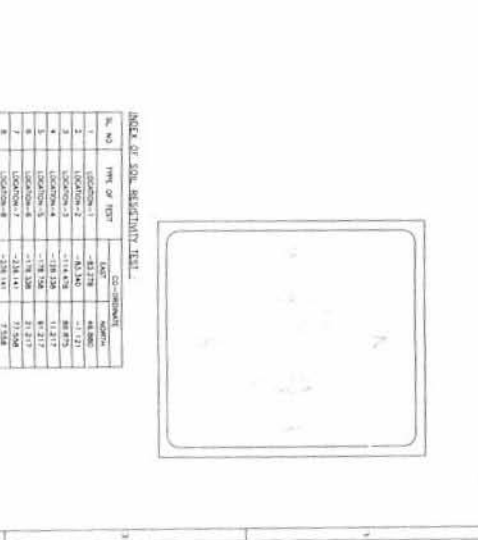
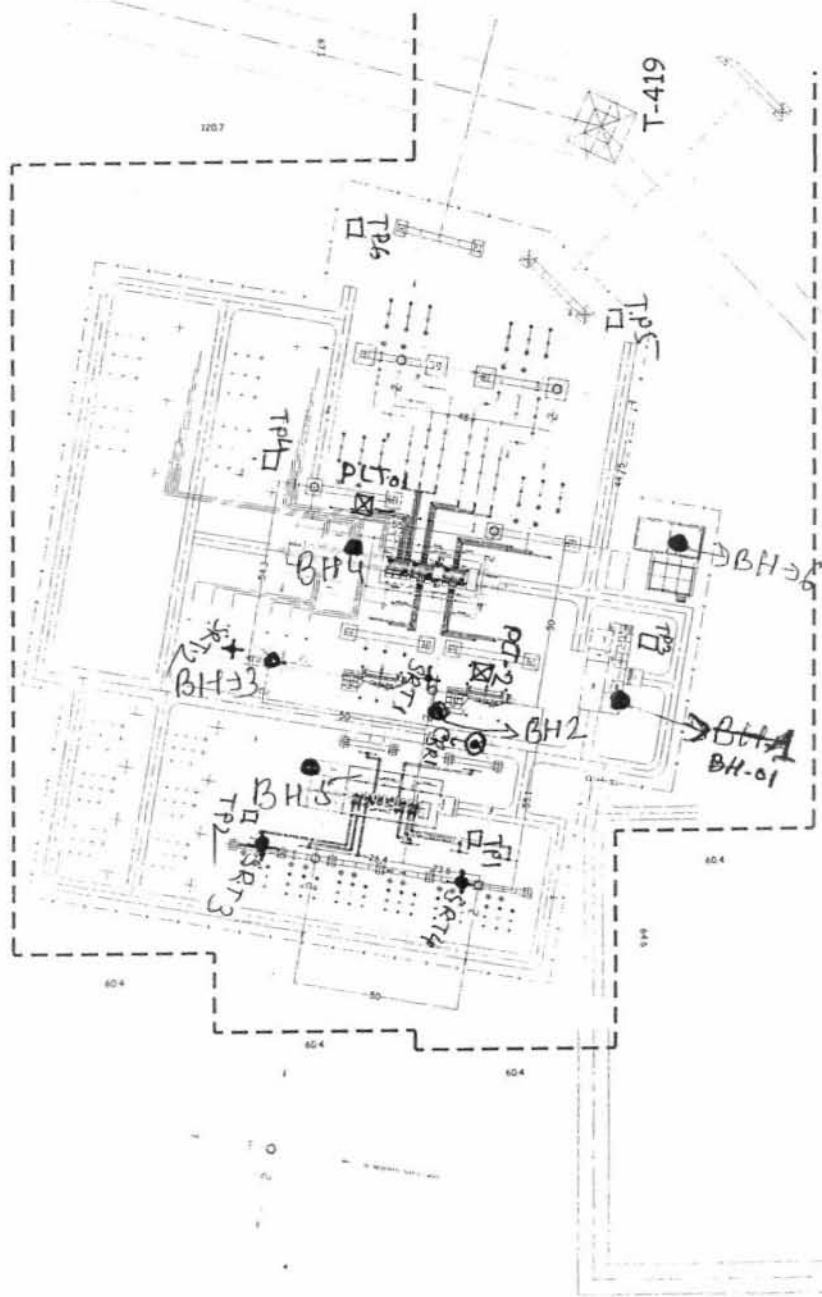


FIG-NO: 18





**Bid-Securing Declaration**

*[To be provided on Company Letterhead]*

Date:

**Design, engineering, supply, testing at manufacturer's works, transportation, unloading and delivery at site including insurance & storage, all associated civil works including PEB (Extension of existing GIS Hall PEB with protection & communication panels room for 220kV and 400kV respectively), transformer oil collecting pit, dismantling and diversion of internal roads, erection, testing and commissioning at site along with all equipments, fittings, accessories, foundation bolts (if any) cables and Mandatory Spare Parts and Condition Monitoring Instruments for Augmentation of Transformation capacity at Patran (GIS) S/s on LSTK basis.**

To: *[insert Name and Address of Employer]*

We, *[insert name of the Bidder]* understand that, according to bid conditions, Bids must be supported by a Bid-Securing Declaration.

We the Bidder hereby declare that, if we are in breach of any of our obligation(s) under the bidding conditions as brought out below, our bid for the Project shall be considered as non-responsive:

- (1) If we withdraw our bid during the period of bid validity specified by us in the Bid Form; or
- (2) In the event of us being a successful Bidder, if we fail within the specified time limit
  - (i) To sign the Contract Agreement, in accordance with ITB Clause 32, or
  - (ii) To furnish the required Performance Security, in accordance with ITB Clause 33.or
- (3) In any other case specifically provided for in ITB.

Name of the Bidder \_\_\_\_\_

Name of the person duly authorized to sign the Bid on behalf of the Bidder \_\_\_\_\_

Title of the person signing the Bid \_\_\_\_\_

Signature of the person named above \_\_\_\_\_

Date signed \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_