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Organisation Chain :	Indian Institute of Technology Ropar
Tender ID :	2025_IITRP_865637_1
Tender Ref No :	IITRPR/EE/T/42
Tender Title :	Design, Supply and Construction of 500 Seater Hostel G plus 2 using Precast LGSF Technology in IIT Ropar on EPC Turnkey basis
Corrigendum Type :	Technical Bid

Corrigendum Document Details

Corr.No.	Corrigendum Title	Corrigendum Description	Published Date	Document Name	Doc Size(in KB)
1	Corrigendum 1	Design, Supply and Construction of 500 Seater Hostel G plus 2 3 Seater using Precast LGSF Technology in IIT Ropar on Turnkey Basis	28-Jun-2025 11:06 AM	Corrigendum1.pdf	5064.38

Government eProcurement System

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Published Corrigendum Details

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Corrigendum Type :	Other

Corrigendum Document Details

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1	Corrigendum 1	Design Supply and Construction of 500 Seater Hostel G plus 2 3 Seater using Precast LGSF Technology in IIT Ropar on Turnkey Basis	28-Jun-2025 11:20 AM	Desktop.rar	4411.46

भारतीय प्रौद्योगिकी संस्थान रोपड़
INDIAN INSTITUTE OF TECHNOLOGY ROPAR
रूपनगर, पंजाब-140001/ Rupnagar, Punjab-140001
e-mail: Email – jr.enm@iitrpr.ac.in, Phone No. - 01881-235108

Date: 28-06-2025

CORRIGENDUM & ADDENDUM I

The RFP for the work **"DESIGN, SUPPLY AND CONSTRUCTION OF 500 SEATER HOSTEL (G+2, 3 Seater) USING PRECAST/LGSF IN IIT ROPAR ON TURNKEY BASIS"** (NIT No. IITRPR/EE/T/24/42, Tender ID: 2025_IITRP_865637_1) was uploaded on CPP Portal on 23.06.2025 with the last date for bid submission as 07.07.2025. On the basis of pre-bid meeting held on 24.06.2025, following amendments are made in the RFP:

Sr.no	Reference	Existing Clause	Modified as
1	Page No. 11, Clause No. 3	The Bidding Documents include the draft Agreement for Designing and Construction of 500 Seater Hostel (G+2, 3 seater) [which is enclosed/ which will be provided to the Bidders]. **Subject to the provisions of Clause 2.1.3,** the aforesaid documents and any addenda issued subsequent to this RFP Document, will be deemed to form part of the Bidding Documents.	The Bidding Documents for Designing, supply and Construction of 500 Seater Hostel (G+2, 3 seater) and any Corrigendum and Addendum issued subsequent to this RFP Document, will be deemed to form part of the Bidding Documents.
2	Page No. 62, SCHEDULE OF QUANTITIES	Page No. 62, Financial Quote	**The modified Format of Financial Bid is attached as Annexure I.**
3	Page No. 15, Annexure 4	The indicative soil investigative report is enclosed for reference. However, the responsibility of soil investigation is in the scope of the agency and nothing extra shall be paid on the account.	The indicative soil investigation report is enclosed for reference. However, the responsibility of soil investigation is in the scope of the agency and nothing extra shall be paid on this account. **The soil investigation report is attached as Annexure III.**
4		NIL	Provision for a 6 meter wide fire tender path around the building and all fire safety measures shall be

			designed in accordance with applicable codes, standards and fire norms of the State Government of Punjab. The Comprehensive fire safety provisions include fire detection and alarm systems, emergency exit signage, fire-fighting equipment, fire-resistant construction, and smoke control shall be incorporated into the building design. The complete fire safety plan, including the fire tender access and all related safety measures, shall be submitted for review and approval by the relevant statutory authority prior to construction and occupancy. The fire exit doors shall be constructed of galvanized steel or cold-rolled steel to ensure durability and compliance with fire safety standards/norms. The required fire-resistance rating for the hostel building shall be in accordance with the applicable fire safety codes and regulations.
5		NIL	The HVAC system shall be designed as a dual-mode (heating and cooling) facility with a minimum total load capacity of VRV/VRF 250 TR (Tons of Refrigeration). The unit should have 10% redundancy of design AC load.
6		NIL	The centralized RO facility shall be installed and provided in the hostel premises. SS distribution line should be laid upto water cooler points.
7		NIL	All staircases are to be finished using Kota stone for both treads and risers, in accordance with the approved design and quality standards. Required grooves to be provided.
8		NIL	Providing and installation of 32 mm medium weight curtain rods made from Grade 202 stainless steel, including brackets, finials, and all necessary fittings, to be provided above the windows in every room.

9		NIL	The top roof and wet areas shall be subjected to water proofing. The treatment to be adopted is PU+membrane (EPDM) waterproofing membrane. The waterproofing methodology must be approved by the relevant authority before it is implemented. IS Code (IS 2645:2003), Central Public Works Department (CPWD) guidelines shall be followed.
10		NIL	A mock-up sample of a single room, incorporating all civil and electrical fixtures, shall be constructed in full and submitted to IIT Ropar for approval. This approved mock-up will serve as the standard for replication in subsequent construction. Initally, a 3D rendered view of the mock-up room, illustrating all fixtures and fittings, shall be prepared. All sample materials and workmanship shall be inspected and approved by IIT Ropar prior to commencement of the related construction activities.
11		NIL	The roof shall be designed to achieve a U-value of 0.15 $W/m^2 \cdot K$, ensuring adequate thermal insulation performance in accordance with applicable building energy codes and standards.
12		NIL	All windows shall be of 3 track uPVC frame with glazed panel and wire mesh shutters, ensuring durability and low maintenance. The doors for the hostel rooms shall be flush doors, while doors for washrooms shall be of uPVC, suitable for wet area applications.
13		NIL	Drawings of existing services in the vicinity of the hostel—namely electrical, storm water drainage, sewerage system, water supply, fire fighting, and OFC (Optical Fibre Cable) network—are enclosed as annexures to facilitate understanding of the interface between internal services and the existing external utility network. It shall be the

			responsibility of the contractor to physically inspect and verify the existing utilities at the site prior to commencement of related works. The drawings are attached as **Annexure II** for reference.
14		NIL	Passive IT infrastructure components proposed for the hostel building—including but not limited to networking equipment, data cabling, access control systems, CCTV cameras,, fire alarm systems, and communication panels—shall be clearly specified and submitted for approval. All components shall be of reputed make, conforming to relevant industry standards and approved by the Institute prior to procurement and installation.
15		NIL	The chajja (sunshade/overhang) of U valve as per ECSBC norms and shall be provided to ensure protection against rain and direct sunlight, while also contributing to the architectural aesthetics of the structure. The dimensions, material specifications, and structural support for the chajja shall be detailed in the architectural and structural drawings, in accordance with applicable building codes IS 456, IS 875 and shall be approved by IIT Ropar.
16		NIL	The top roof shall be a deck slab designed for water storage, fire storage tanks and other services etc. These tanks shall be clearly identified and distinctly marked in the layout plan for construction.
17		NIL	The location for two lifts shall be earmarked in the layout plan. The shafts for the two lifts shall be constructed for SITC of 02 number of 15 passenger lifts.

18		NIL	**Order of Preference:** Should there be any difference or discrepancy between the description of items as given in the schedule of quantities, particular specifications for individual items of work (including special condition) and IS Codes etc. the following order of preference shall be observed. i) Description of items as given in the Schedule of quantities. ii) Particular specifications. iii) Additional & Special Conditions. iv) CPWD Specifications including correction slips issued upto the last date of uploading / submission of tender. v) Working drawings. vi) Indian Standards Specifications of BIS. vii) ASTM, BS or other foreign origin code mentioned in tender documents. viii) Manufacturer's specifications and as decided by the Engineer-in-charge.
19		NIL	**All Heights, Lifts, Leads and Depths** Unless otherwise provided in the Schedule of quantities or in CPWD specifications or in tender document, the rates tendered by the contractor shall be all inclusive and shall apply to all heights, lifts, leads and depths of the building and nothing extra shall be payable to him on this account.
20		NIL	Obtaining statutory approvals to obtain Occupancy Certificate from local government body / authority.
21		NIL	Minimum Grade of concrete:- M30 Minimum Grade of Steel:- Fe 500D
22		NIL	Expansion joint as per design and specification.
23		NIL	Entrance door: Aluminium with Glass.

24		NIL	Hostel room door: 35 mm flush door, SS 4 hinges, sliding door bolt stopper, tower bolt, frame-WPC.
25		NIL	Washrom: Frame WPC- shutter WPC
26		NIL	Flooring: (a) Rooms vitrified 600 x 600 (b) Corridor 600 x 600 mm Anti Skid GVT. (c) Entrance - Granite. (d) Toilets- 400 x 400 anti skid GVT (e) Lift wall cladding- Granite 18 mm
27		NIL	Plinth Protection: M 15
28		NIL	Water Supply:- CPVC Soil waste- unplasticised PVC
29		ON page NO. 50 under approved make list	CAT 6A: RNM, Molex, Systemax
30		Nil	In each room, 03 LAN points to be provided.
31		Nil	All LAN points to be on UPS except in rooms.
32		Add under scope of work	SITC of 02 numbers lifts i.e. Supply, Installation, Testing and Commission of 15 (Fifteen) passenger (1020 kg) lifts with machine room type and gearless having contract speed of 1.0 metre per second serving different floor in the lift shaft as per detailed specifications as speed-1.0 MPS, Floor-2 as per drawings,, Stops & opening - as per drawing & opening on same side, Controller - AC variable voltage & variable frequency, Automatic rescue device complete with dry maintenance free batteries as required, Operation - Microprocessor based single automatic push button simplex selective collective with / without attendant, Power - 415V, phase, 50 Hz, 4 wires system, Type of doors - Car: power operated, centre opening horizontal sliding in stainless steel hairline finish with texture, Landing doors: Power operated, centre opening horizontal sliding in stainless steel hairline finish with texture, A hand rail not less than 600mm long at 900mm above floor level to be fixed adjacent to control

			panel in the lift, Voice announcement system in the car to announce the position of the elevator in the hoistway as the car passes or stops at a floor served by the elevator of the OEM with 03 years defect liability period. Make: OTIS, KONE, SCHINDLER.
		NIL	Design, Supply, Testing and Commissioning of heat pump system as per OEM specifications for the hostel. Make - Stiebel Eltron, AO Smith, Racold, Mitsubishi Electric.

The Corrigendum & Addendum shall form a part of the Contract. Other terms & conditions remain the same.

2.8.16

Joint Registrar
(E&M Section)

FINANCIAL BID

Name of work: "DESIGN, SUPPLY AND CONSTRUCTION OF 500 SEATER HOSTEL (G+2, 3 Seater) USING PRECAST/LGSF TECHNOLOGY IN IIT ROPAR ON TURNKEY BASIS"

Technology to be used: Precast/LGSF (Tick whichever is applicable)

S. No.	Description of Item	Quantity	Unit	Rate in figures	Rate in words	Amount Rs.
1	Design, Supply and Construction of 500 Seater Hostel (G+2) 3 seater using Precast/LGSF Technology in IIT Ropar on EPC Turnkey basis as per the scope of work, drawings and directions of Competent Authority including all tools, tackles, manpower, materials, machinery, working at all heights, GST, etc. with 3 years Defect Liability Period. Nothing to be paid extra. Excluding 1a and 1b scope mentioned below.	1	L.S.			
1a	Extra for Design, Supply, Installation, Testing and Commissioning of VRV/VRF system system with three years Defect Liability period.	1	L.S.			
1b	Extra for Passive Components of Information Technology, Centralised UPS for each LAN port, CCTV with three years Defect Liability period.	1	L.S.			
1c	Extra for SITC of 02 numbers lifts i.e. Supply, Installation, Testing and Commission of 15 (Fifteen) passenger (1020 kg) lifts with machine room type and gearless having contract speed of 1.0 metre per second serving different floor in the lift shaft as per detailed specifications as speed-1.0 MPS, Floor-2 as per drawings, Stops & opening - as per drawing & opening on same side, Controller - AC variable voltage & variable frequency, Automatic rescue device complete with dry maintenance free batteries as required, Operation - Microprocessor based single automatic push button simplex selective collective with / without attendent, Power - 415V, phase, 50 Hz, 4 wires system, Type of	2	Nos.			

	doors - Car: power operated, centre opening horizontal sliding in stainless steel hairline finish with texture, Landing doors: Power operated, centre opening horizontal sliding in stainless steel hairline finish with texture, A hand rail not less than 600mm long at 900mm above floor level to be fixed adjacent to control panel in the lift, Voice announcement system in the car to announce the position of the elevator in the hoistway as the car passes or stops at a floor served by the elevator of the OEM with 03 years defect liability period. Make: OTIS, KONE, SCHINDLER.					
2	Extra for Operation & Maintenance as per the tender document including scope of work, material/manpower, civil, electrical, mechanical, plumbing, VRV/VRF system etc. taxes, GST all included. Nothing to be paid extra.					
	For 4th year with material	1	L.S.			
	For 5th year with material	1	L.S.			
	Grand Total					

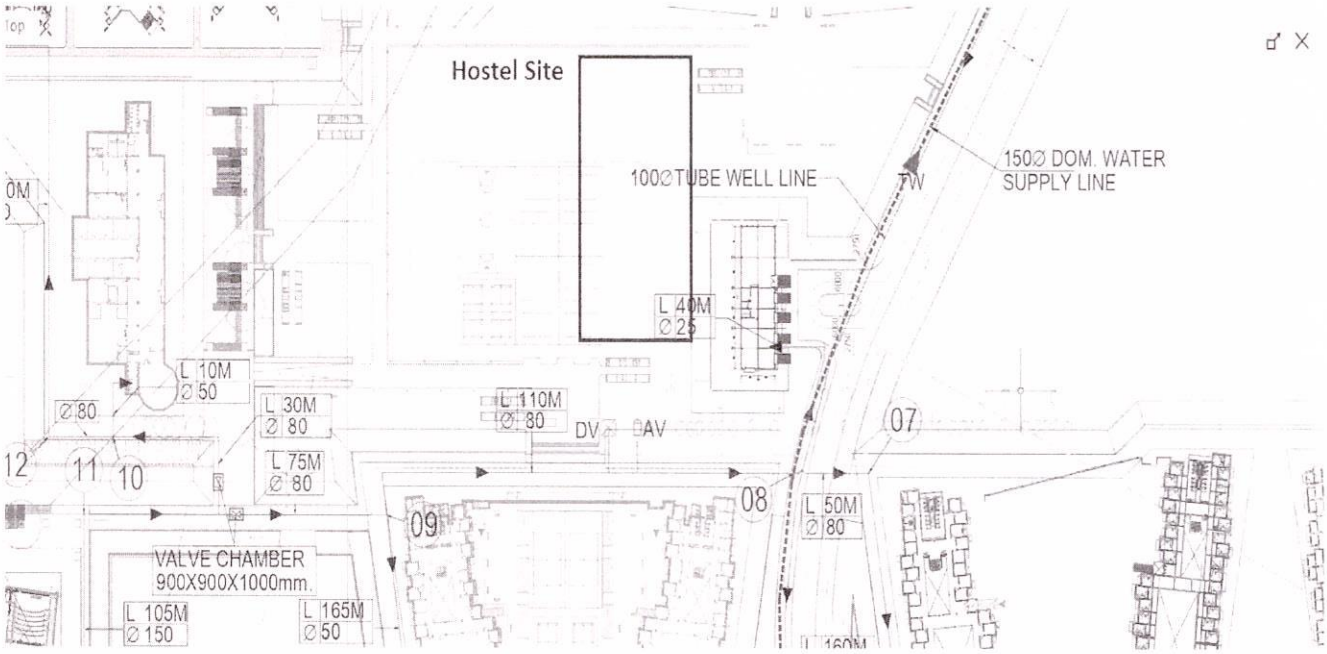
Note: Criteria for evaluation will be the grand total of all the above. The Institute reserves the right to award the work for Operation and Maintenance mentioned at point 2 above after the completion of the Defect Liability Period.

(Signatures and Seal of the bidder)

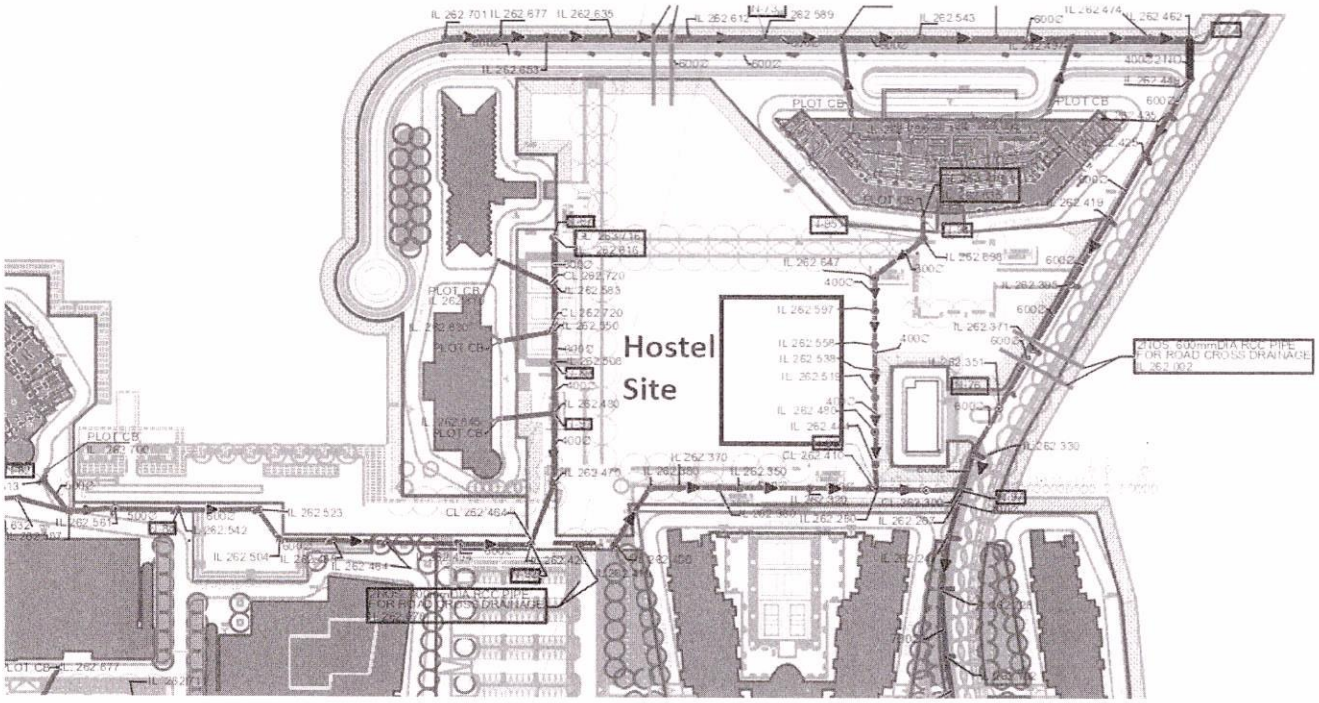
Annexure II

Indicative External Services Network

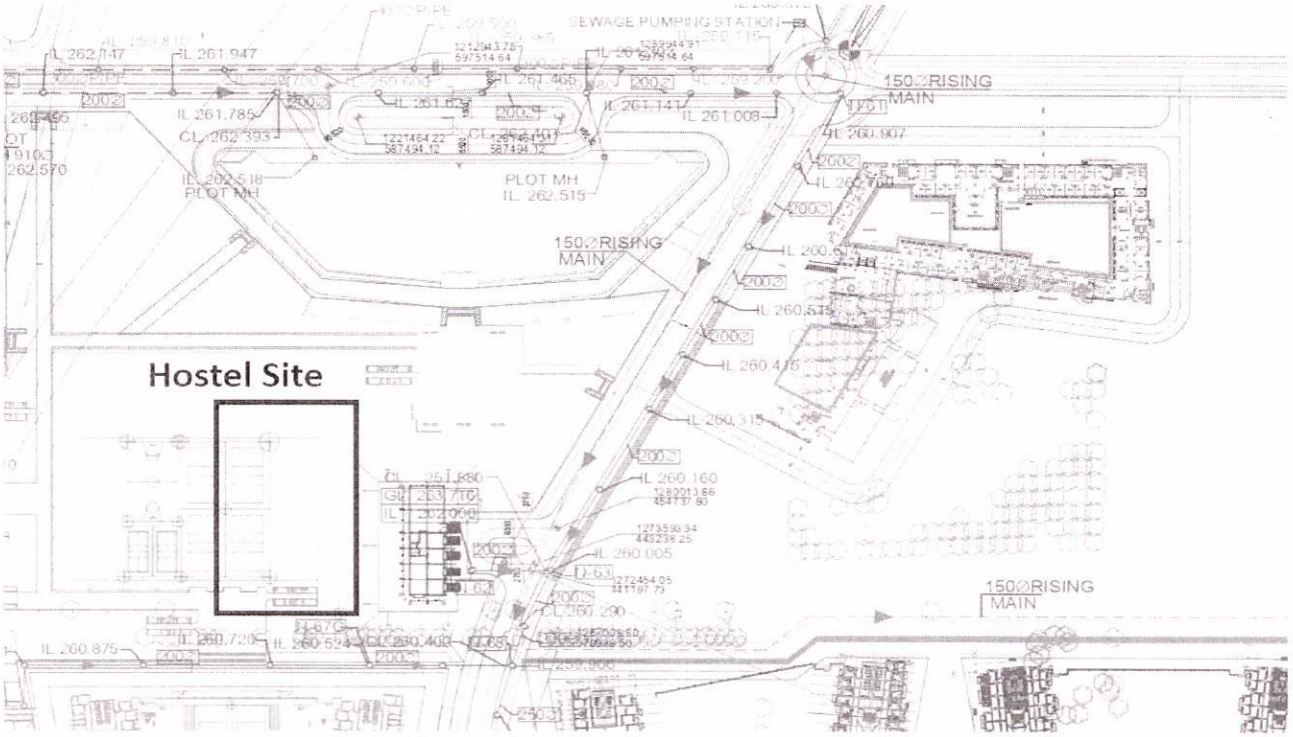
1. Water Distribution line: (Represented with Blue Colour solid line)



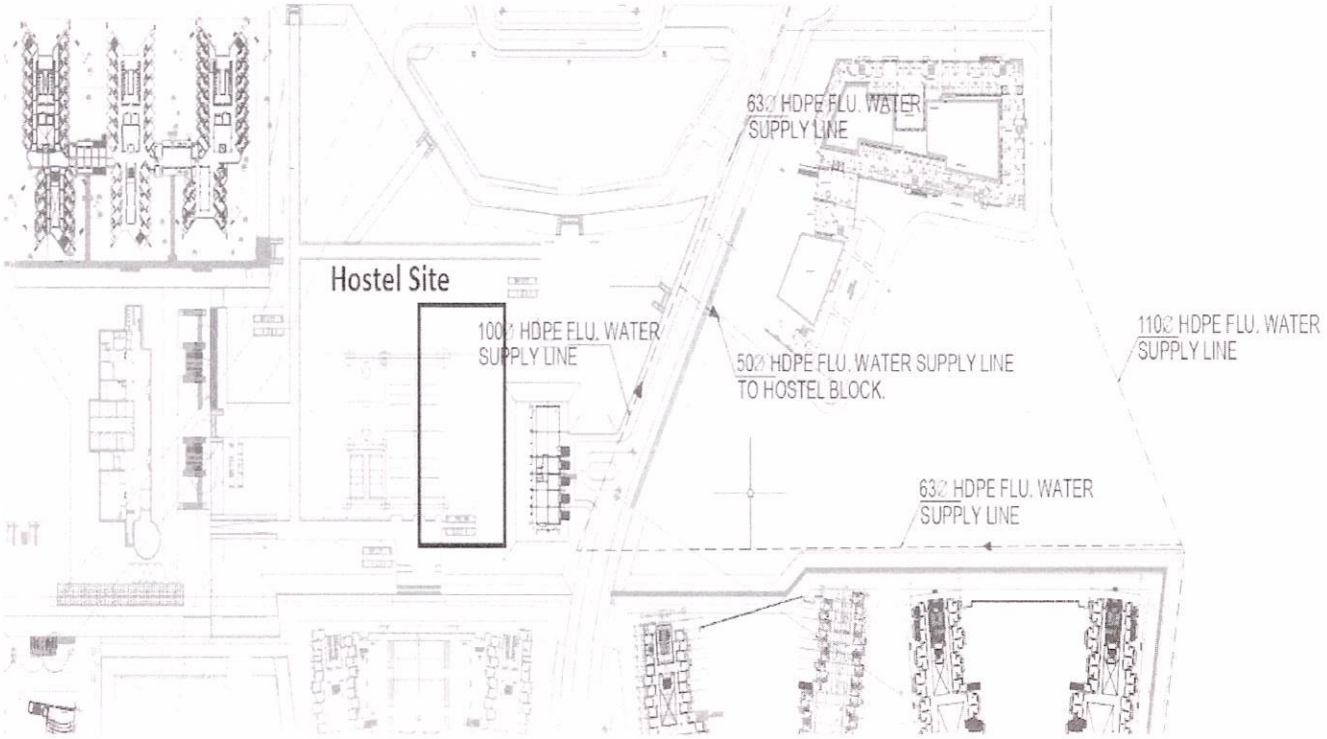
2. Storm Drain Line: (Represented with Blue Colour solid line)



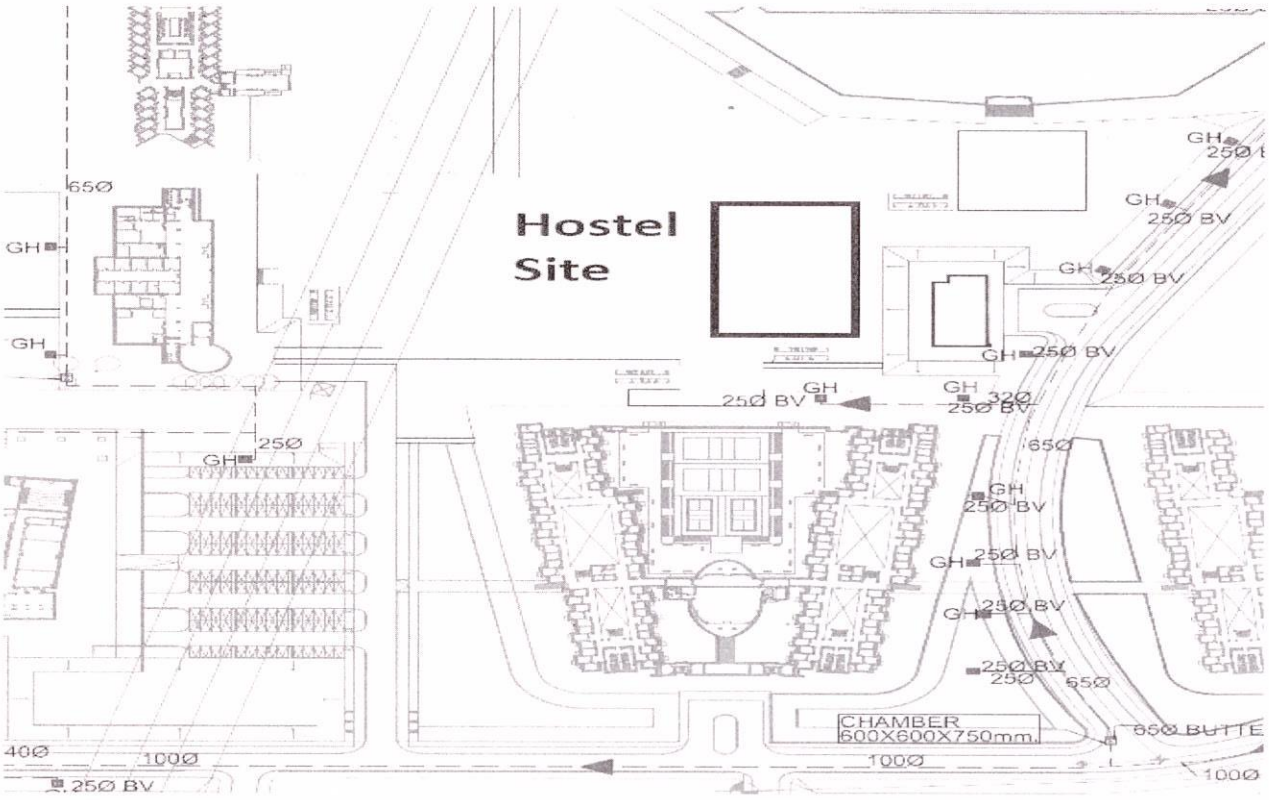
3. Sewerage Line: (Represented with Orange Colour solid line)



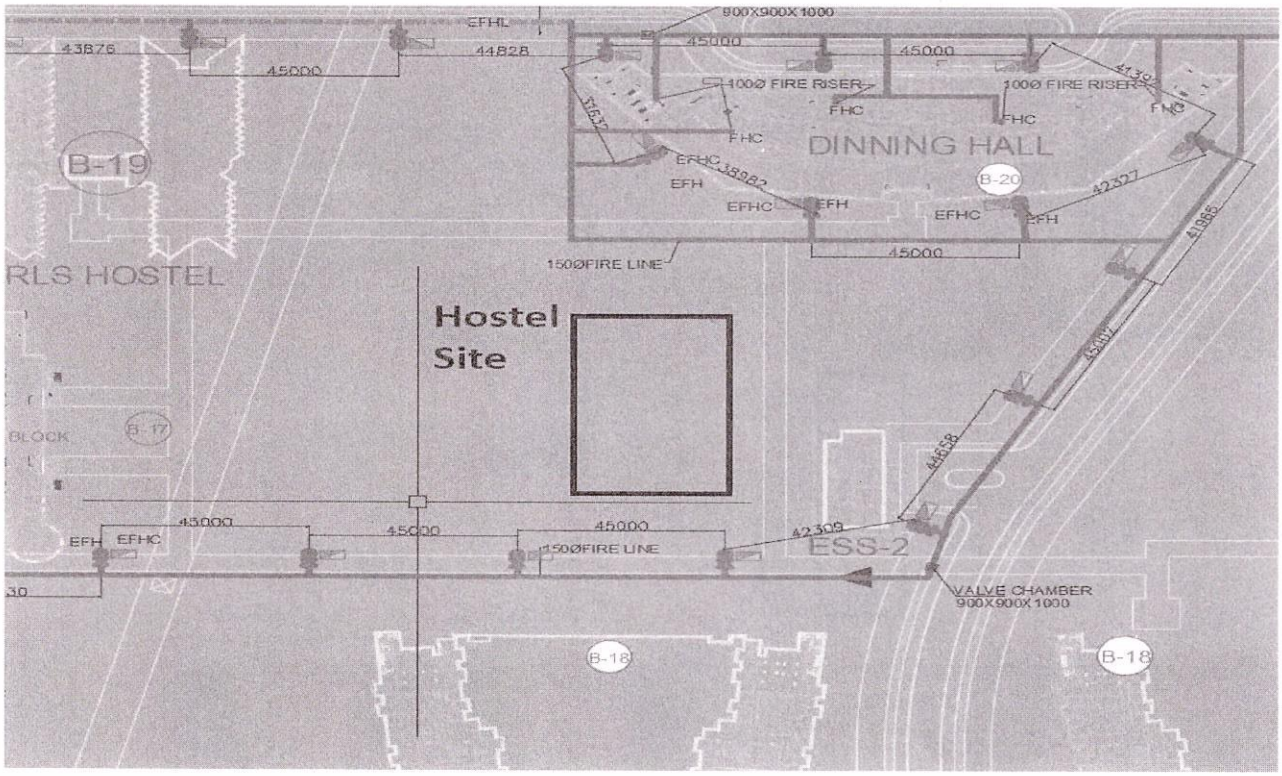
4. Flushing Line: (Represented with Blue Colour dotted line)



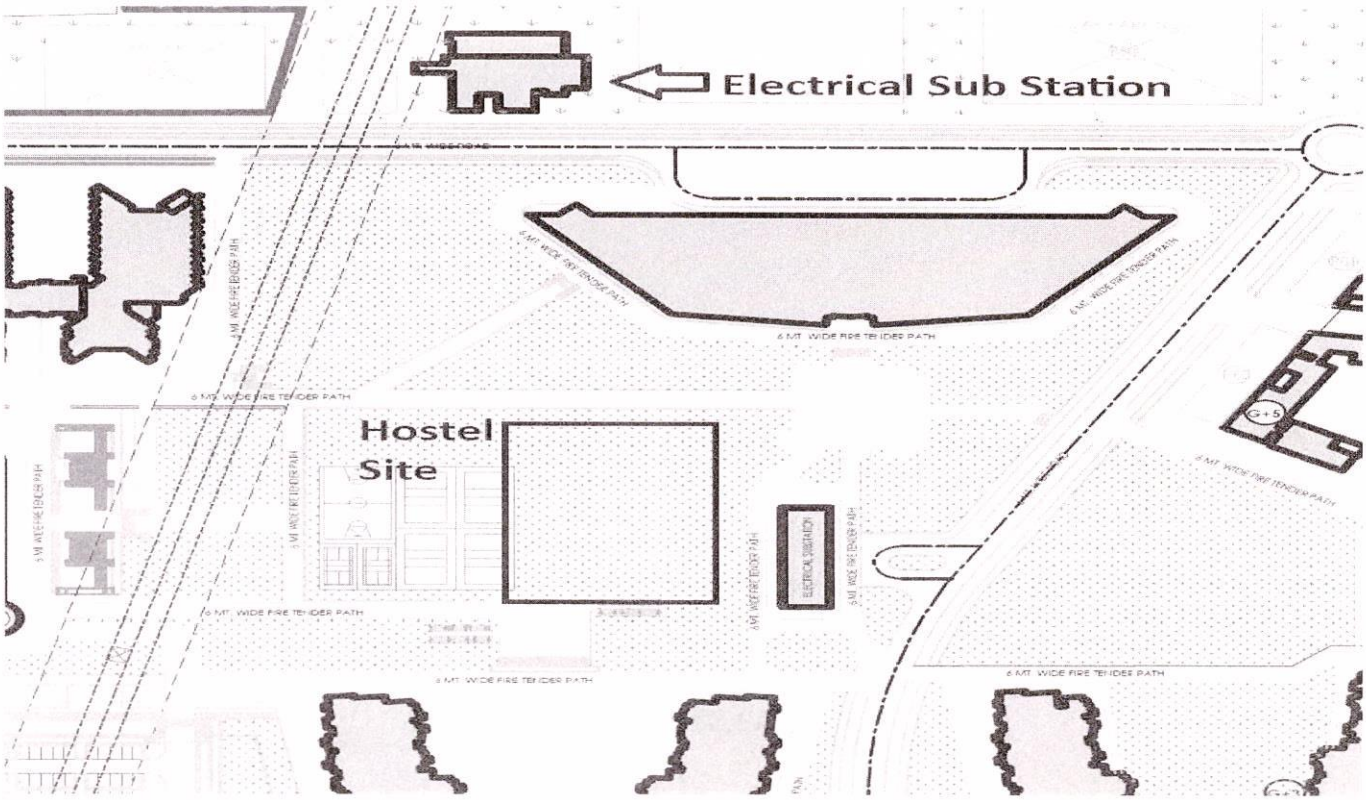
5. Garden Hydrant Line: (Represented with Blue Colour dotted line)



6. Fire Hydrant Line: (Represented with Red Colour solid line)



7. ESS Location:



SOIL INVESTIGATION REPORT

REPORT NO.: - RLS/2025-26/IIT/016 **DATED: - 20.05.2025**

INDIAN INSTITUTE OF TECHNOLOGY, ROPAR

GEOTECHNICAL INVESTIGATION FOR PROPOSED HOSTEL BUILDING PROJECT AT IIT ROPAR, PUNJAB

GEOTECHNICAL INVESTIGATION

RADHE LAB SOLUTION PVT. LTD.

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GSTIN: 02AALCR7656P1ZN

Table of Contents

List of Illustrations

1. INTRODUCTION

1.1. Project Description

This soil investigation work, whose results are being presented herewith, has been carried out for Proposed Hostel Building Project at IIT Ropar, Punjab. We understand that the proposed project shall consists of Ground + 3 storeys without basement. Borehole locations were shown to us by the client representative.

M/s. Radhe Lab Solutions Pvt. Ltd has been appointed as Geotechnical Consultant to study and confirm the subsoil conditions and to establish the various soil parameters and its behaviour, to assess the general stability of site proposed for deep excavation.

1.2. Purpose & Scope

The current study has been carried out at the site in order to:

a) determine the general nature of the subsurface strata at the site;

b) retrieve the subsurface samples for determination of index and engineering properties; and

c) assess geotechnical parameters of the subsurface strata at the site for foundation recommendations.

The scope of work includes the following:

(i) Mobilization of men and equipment at site for carrying out the investigation including shifting at all test locations & demobilization after completion of work.

(ii) Drilling five (5) exploratory boreholes to the specified depth including collection of sub-surface samples;

(iii) Conducting Standard Penetration Test (SPT) to obtain data on in-situ penetration resistance;

(iv) Collecting undisturbed soil samples at specified depth intervals;

(v) Laboratory testing of retrieved samples to determine the index and engineering properties of the sub-surface strata;

(vi) Geotechnical analysis using the available field and laboratory test data;

(vii) Preparation of geotechnical recommendations for foundation design and construction; and

(viii) Preparation and submission of this report in triplicate

2. FIELD EXPLORATION

2.1. Soil Boring

150 mm diameter boreholes were advanced using shell & Auger rig at the specified locations and depths. Casing wherever required was used to stabilise the borehole. The work was carried out as per the provisions laid in IS: 1892-1979.

2.2. Standard Penetration Test

Standard penetration tests were carried out by using a split spoon sampler with a drive shoe and drive head fitted with a non-return valve. The tests were carried out at every 1.5 m depth interval and at the soil-rock interface. The work was carried out as per the provisions laid in IS: 1892-1979.

Standard split spoon sampler was attached to the lower end of 'A' drill rods and was driven in the bore hole using a 63.5 kg hammer falling freely from a height of 75 cm. The sampler was driven for 45 cm as per IS specifications & the number of blows required for each 15 cm penetration were recorded.

The number of blows for the first 15 cm penetration (*also known as the seating drive*) was not taken into account. The number of blows for the next 30 cm penetration was designated as SPT 'N' value. Wherever total penetration was less than 45 cm, the number of blows & the depth penetrated is incorporated in the respective borehole log profiles.

2.3. Collection of Samples

Undisturbed samples were collected at specified depth intervals using a 3 inch thin walled tube sampler. The samples were then sealed with wax on both ends and transported to our laboratory for further testing. Disturbed samples obtained from the split spoon sampler after carrying out the standard penetration tests were collected in polythene bags of suitable size.

2.4. Groundwater

The measured water levels as recorded in the completed boreholes are presented on the individual borehole logs.

3. LABORATORY TESTS

Laboratory tests were carried out on the retrieved samples in order to determine the index and engineering properties. The testing procedures were in accordance with current applicable IS specifications.

The following tests were conducted on selected soil samples recovered from the boreholes:

Laboratory Tests on Soil Samples	IS Code
Bulk Density	-
Natural Moisture Content	IS : 2720 (Part-2)-1973
Specific Gravity	IS : 2720 (Part-3)-1980
Grain Size Analysis	IS : 2720 (Part-4)-1985
Liquid Limit and Plastic Limit	IS : 2720 (Part-5)-1985, RA-2010
Unconsolidated Undrained Triaxial Shear Test	IS : 2720 (Part-11)-1993, RA-2007
Consolidated Drained Direct Shear Test	IS : 2720 (Part-13)-1986, RA-2010

RADHE LAB SOLUTION PVT. LTD.

4. GENERALISED SUB-SURFACE CONDITIONS

4.1. Stratigraphy

Based on the five (5) exploratory boreholes drilled at the project site, a heterogeneous fill material was met at the site to about 1.2-1.5 m depth below EGL. Below fill, clayey silt was met to about 1.5-2.5 m depth and underlain by silty sand / fine sand to the final explored depth of 10.45 m below EGL.

The field SPT N-values range from 8 to 14 to about 2.5 m depth and range from 5 to 11 to about 7.5 m depth below EGL, indicating loose to medium dense strata condition. Further, SPT N-values range from 16 to 21 to the final explored depth of 10.45 m below EGL.

The field and laboratory test results are presented on the individual borehole logs on Plates 2 to 6. A summary of the borehole logs is illustrated on Plate 7. Plots of field and corrected SPT values versus depth are presented on Sheet No. 8 & 9, respectively.

4.2. Groundwater

Based on our measurements in the completed boreholes, groundwater was met at 4.9~5.1 m depth below EGL during the period of our field investigation (May, 2025). Fluctuations may occur in the measured water levels due to seasonal variations in rainfall and surface evaporation rates as well as the level of water in nearby water bodies.

4.3. Seismicity

According to Fig.1 of IS: 1893 (Part:1)-2016 showing seismic zones, the proposed site falls in earthquake Zone-IV.

5. LIQUEFACTION SUSCEPTIBILITY ASSESSMENT

5.1. General

As per IS: 1893-2016, liquefaction is defined as a state in which the shear strength of primarily saturated cohesionless soils become negligible during earthquake shaking. In this condition, the soil tends to behave like a fluid mass.

Depending on the degree of susceptibility to liquefaction, of the subsoil at the site, in the event of an earthquake, the structure may either not be affected as no liquefaction occurs, or may undergo large settlements due to partial liquefaction, or else there may be a complete loss of the shear strength of the soil leading to a collapse of the super structure.

5.2. Design Parameters

The following design parameters have been used for detailed liquefaction analysis:

- Design Earthquake Zone = IV
- Design Magnitude of Earthquake (Mw) = 6.7
- Peak Horizontal Acceleration (PGA) = 0.24 g
- Design GW Depth = 1.0 m (at Ground Level)
- Magnitude Scaling Factor = 1.334

5.3. Assessment as per IS code

The following points are noted for the soils encountered at the site, with reference to the liquefaction susceptibility assessment:

1. According to Fig.1 of IS: 1893 (Part1)-2016 showing seismic zones the proposed site falls in earthquake Zone-IV.

2. For project sites located in Zone-III, IV & V saturated sands with corrected SPT (N') values less than 15 up to 5 m depth and less than 25 below 10 m depth may liquefy in the event of an earthquake.

3. As mentioned in Section 4.2, groundwater was met at 4.9~5.1 m depth below EGL during the period of our field investigation (May, 2025).

4. Based on the available borehole data, the SPT values in the sand strata is lower than the limits prescribed in IS: 1893 (Part-1) - 2016 for liquefaction potential. The clayey silt layers are not likely to liquefy due to the high fines content and plasticity.

5. The results of liquefaction susceptibility analysis are also tabulated below for easy reference.

Borehole Designation	Results of Liquefaction Susceptibility Analysis
BH-1	Liquefaction potential in between 4.5 to 10 m depth
BH-2	Liquefaction potential in between 3 to 10.5 m depth
BH-3	Liquefaction potential in between 4.5 to 10.5 m depth
BH-4	Liquefaction potential in between 3.0 to 10.5 m depth
BH-5	Liquefaction potential in between 4.5 to 10.5 m depth

According to Fig.1 of IS: 1893 (Part-1)-2016 showing seismic zones, the project site falls under Zone-IV. The design for seismic forces should be done considering the project site in Zone-IV.

6. GEOTECHNICAL ANALYSIS

6.1. Foundation Type & Depth

The selection of an appropriate foundation type for the proposed structure depends primarily on the loading intensity at the foundation level and the configuration of structural loading points.

Based on the geotechnical investigation carried out, including field and laboratory test results from five (5) boreholes drilled up to 10 m depth below existing ground level (EGL), we have assessed the subsurface conditions and present the following observations:

- **Subsurface Conditions:**

As detailed in Section 4.1, the subsurface profile generally consists of loose to medium dense sand strata extending to the maximum explored depth of 10 m below EGL. Standard Penetration Test (SPT) N-values across this depth range from 5 to 21, indicating loose to medium dense strata conditions.

- **Groundwater Conditions:**

As reported in Section 4.2, the groundwater table was encountered at depths ranging from approximately 4.9-5.1 m below EGL during the time of investigation. This elevated groundwater condition further influences the stability and bearing characteristics of shallow foundations.

- **Liquefaction Potential:**

According to the liquefaction assessment described in Section 5.3, the encountered sand strata up to 10 m depth below EGL is prone to liquefaction under seismic loading. This poses a significant risk to the stability and performance of shallow foundation systems during a seismic event.

Considering the above findings, **open or raft foundation systems are not deemed feasible** for the proposed structure due to the presence of loose to medium dense strata, high groundwater table, and the pronounced potential for liquefaction up to the explored depth. These conditions render shallow foundations unreliable and unsafe under both static and seismic loading conditions.

Given the geotechnical constraints at the site, we recommend the adoption of a **pile foundation system** as a feasible and appropriate foundation scheme. Pile foundations can transfer the structural loads to deeper, more competent soil strata, thereby bypassing the problematic upper layers susceptible to liquefaction and settlement.

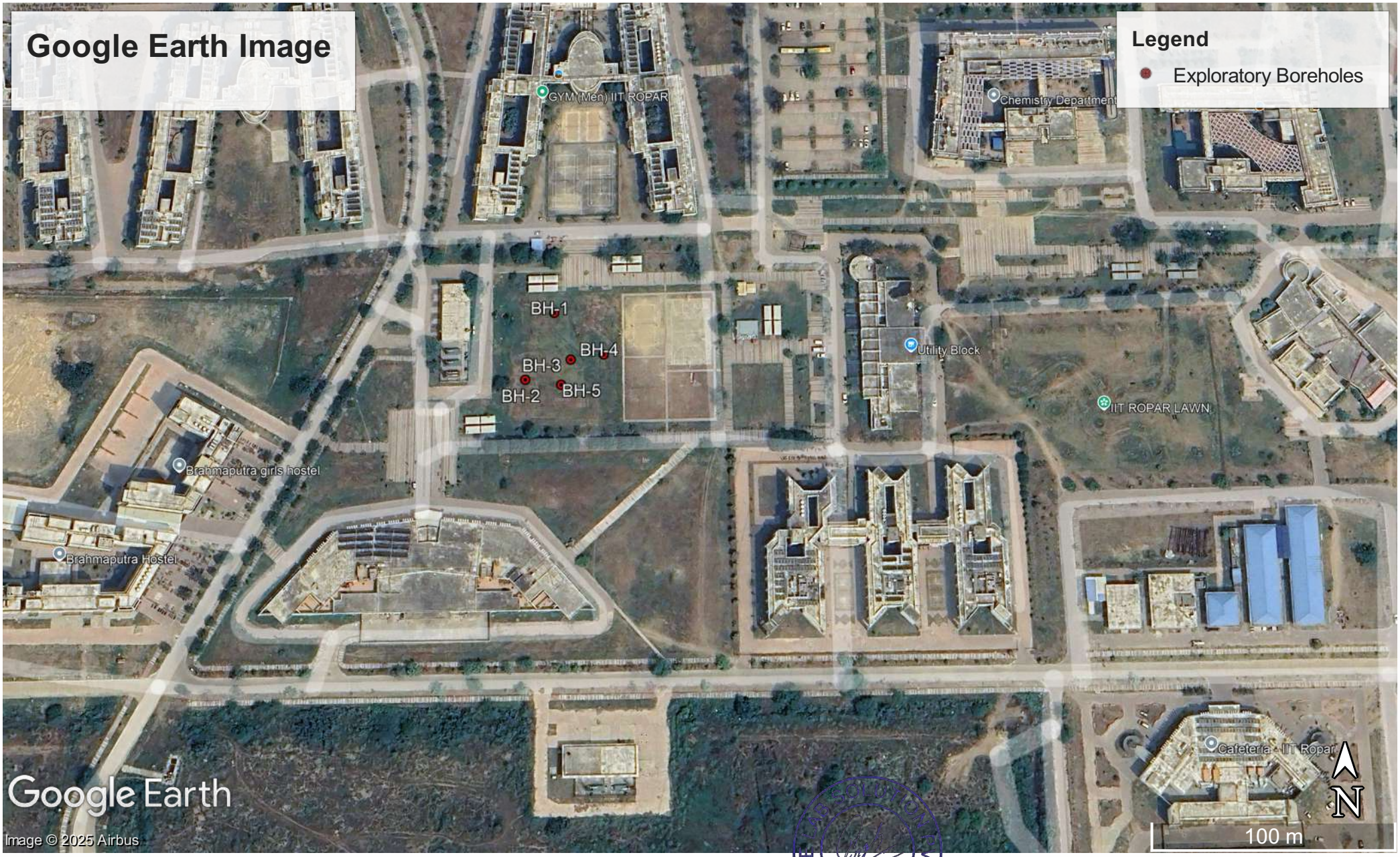
To refine the design parameters and ensure adequate pile capacity, **we strongly recommend conducting additional subsurface investigations** comprising **2 to 3 boreholes to a minimum depth of 20 m below EGL**. This will help delineate the bottom extent of the liquefiable zone and identify suitable bearing strata for end-bearing or friction piles.

7. LIMITATIONS AND UNIFORMITY OF SUBSURFACE CONDITIONS

The subsurface conditions may change with time due to man-made and natural phenomenon such as on-site and nearby construction activities, earthquakes, floods, scour and groundwater fluctuations. Construction decisions must consider any changes in site conditions, regulatory provisions, technology or economic conditions subsequent to the investigation.

If significant strata changes occur or any changes in the nature or design of the project are made, we should be allowed to review this report and provide additional recommendations, if any.

We strive to perform our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed in the area; no warranty is expressed or implied.


Google Earth Image
Legend
Exploratory Boreholes
GYM (Men) IIT ROPAR
Chemistry Department
BH-1
BH-4
BH-3
BH-2
BH-5
Utility Block
IIT ROPAR LAWN
Brahmaputra girls hostel
Brahmaputra Hostel
Cafeteria - IIT Ropar
Google Earth
Image © 2025 Airbus
N
100 m

PROJECT: PROPOSED HOSTEL BUILDING PROJECT AT IIT ROPAR, PUNJAB

BOREHOLE ID : BH- 1 **TERMINATION DEPTH :** 10.5 m **CO-ORDINATES :** 640240 mE, 3426964 mN **START DATE :** 08 May 2025

WATER TABLE : 5.0 m **LOCATION :** **REDUCED LEVEL :** - **END DATE :** 08 May 2025

Field SPT N Value / Corrected SPT Value N | (N'/N'')	Reduced Level, m	Depth Below EGL, m		Sample Type	Symbol	Strata Description	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm3	Dry Density gms/cm^3	Moisture Content %	Shear Test Results: Test Type	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
		0.00	0.50	DS		Medium Dense Fill Material (1.3 m)														
						Firm to stiff Clayey Silt of medium plasticity (CI) (1.5 m)														
14 | 19'		1.50	1.95	SPT		Loose to Medium Dense Silty Sand (SM)	5	74	21	0										
		2.25	2.55	UDS		with traces of gravels								2.63	1.88	1.68	11.7	DST	0.0	28.5
18 | 21'		3.00	3.45	SPT							22.8	NP								
5 | 5'		4.50	4.95	SPT			2	80	18	0										
		5.25	5.55	UDS											1.86	1.61	15.5	DST	0.0	29.0
9 | 9'		6.00	6.45	SPT		(7.5 m)					22.8	NP								
16 | 15''		7.50	7.95	SPT		Medium Dense Fine Sand (SP-SM)	1	90	9	0										
		8.25	8.55	UDS		with traces of gravels								2.64	1.87	1.68	11.6	DST	0.0	30.0
17 | 15''		9.00	9.45	SPT																
19 | 16''		10.00	10.45	SPT		(10.5 m)														

RADHE LAB SOLUTION PVT. LTD.

DST - Direct Sheat test, UU - Unconsolidated Undrained Test, SPT - Standard Penetration Test, DS- Disturbed Sample, UDS - Undisturbed Sample, Refusal (N>100)

PROJECT:	PROPOSED HOSTEL BUILDING PROJECT AT IIT ROPAR, PUNJAB																					
BOREHOLE ID :	BH- 2	TERMINATION DEPTH :	10.5 m	CO-ORDINATES :	640228 mE, 3426935 mN	START DATE :	08 May 2025															
WATER TABLE :	5.0 m	LOCATION :		REDUCED LEVEL :	-	END DATE :	08 May 2025															

Field SPT N Value / Corrected SPT Value N | (N'/N'')	Reduced Level, m	Depth Below EGL, m		Sample Type	Symbol	Strata Description	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm3	Dry Density gms/cm^3	Moisture Content %	Shear Test Results: Test Type	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
		0.00	0.50	DS		Loose Fill Material (1.2 m)														
8 | 8		1.50	1.95	SPT		Stiff Clayey Silt of medium plasticity (CI) (2.0 m)	0	10	68	22	42.3	23.0	19.3							
		2.25	2.55	UDS		Loose Silty Sand (SM) with traces of gravels									1.82	1.62	12.3	DST	0.0	27.8
8 | 9'		3.00	3.45	SPT			2	77	21	0				2.64						
9 | 9'		4.50	4.95	SPT							22.8	NP								
		5.25	5.55	UDS		(6.0 m)									1.84	1.61	14.3			
18 | 16''		6.00	6.45	SPT		Medium Dense Fine Sand (SP-SM) with traces of gravels	4	87	9	0										
19 | 16''		7.50	7.95	SPT																
		8.25	8.55	UDS										2.63	1.91	1.68	13.8	DST	0.0	29.9
21 | 17''		9.00	9.45	SPT			0	89	11	0										
21 | 17''		10.00	10.45	SPT		(10.5 m)														

RADHE LAB SOLUTION PVT. LTD.

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PROJECT:	PROPOSED HOSTEL BUILDING PROJECT AT IIT ROPAR, PUNJAB																					
BOREHOLE ID :	BH- 3	**TERMINATION DEPTH :**	10.5 m	**CO-ORDINATES :**	640248 mE, 3426944 mN	**START DATE :**	08 May 2025															
WATER TABLE :	4.9 m	**LOCATION :**		**REDUCED LEVEL :**	-	**END DATE :**	08 May 2025															

Field SPT N Value / Corrected SPT Value N | (N'/N'')	Reduced Level, m	Depth Below EGL, m		Sample Type	Symbol	Strata Description	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm3	Dry Density gms/cm^3	Moisture Content %	Shear Test Results			
							Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Test Type	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
		0.00	0.50	DS		Loose Fill Material (1.3 m)															
8 | 8		1.50	1.95	SPT		Stiff Clayey Silt of medium plasticity (CI) (2.0 m)	0	12	67	21	40.7	24.9	15.8								
		2.25	2.55	UDS		Loose to Medium Dense Silty Sand (SM) with gravels									1.82	1.61	13.0	DST	0.0	27.4	
7 | 8'		3.00	3.45	SPT			5	69	26	0											
6 | 6'		4.50	4.95	SPT							23.9	NP		2.65							
		5.25	5.55	UDS											1.83	1.58	15.8	DST	0.0	28.1	
11 | 11'		6.00	6.45	SPT		(7.5 m)	7	73	20	0											
16 | 15''		7.50	7.95	SPT		Medium Dense Fine Sand (SP-SM)	0	90	10	0											
		8.25	8.55	UDS											1.88	1.68	11.8	DST	0.0	30.2	
18 | 16''		9.00	9.45	SPT										2.64							
19 | 16''		10.00	10.45	SPT		(10.5 m)															

RADHE LAB SOLUTION PVT. LTD.

DST - Direct Sheat test, UU - Unconsolidated Undrained Test, SPT - Standard Penetration Test, DS- Disturbed Sample, UDS - Undisturbed Sample, Refusal (N>100)

PROJECT: PROPOSED HOSTEL BUILDING PROJECT AT IIT ROPAR, PUNJAB

BOREHOLE ID : BH- 4 **TERMINATION DEPTH :** 10.5 m **CO-ORDINATES :** 640262 mE, 3426946 mN **START DATE :** 08 May 2025

WATER TABLE : 4.9 m **LOCATION :** **REDUCED LEVEL :** - **END DATE :** 08 May 2025

Field SPT N Value / Corrected SPT Value N | (N'/N")	Reduced Level, m	Depth Below EGL, m		Sample Type	Symbol	Strata Description	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm3	Dry Density gms/cm^3	Moisture Content %	Shear Test Results: Test Type	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
		0.00	0.50	DS		Medium Dense Fill Material (1.5 m)														
10 | 10		1.50	1.95	SPT		Stiff Clayey Silt of medium plasticity (CI) (2.0 m)	0	14	68	18	41.4	23.1	18.3							
		2.25	2.55	UDS		Loose to Medium Dense Silty Sand (SM) with traces of gravels									1.84	1.63	12.7	DST	0.0	28.2
13 | 15'		3.00	3.45	SPT			2	74	24	0										
8 | 8'		4.50	4.95	SPT							24.0	NP								
		5.25	5.55	UDS		(6.0 m)								2.64	1.86	1.62	15.1			
14 | 14'		6.00	6.45	SPT		Medium Dense Fine Sand (SP-SM) with traces of gravels	3	91	6	0										
17 | 16''		7.50	7.95	SPT																
		8.25	8.55	UDS										2.63	1.89	1.68	12.4	DST	0.0	30.5
18 | 16''		9.00	9.45	SPT			4	88	8	0										
21 | 17''		10.00	10.45	SPT		(10.5 m)														

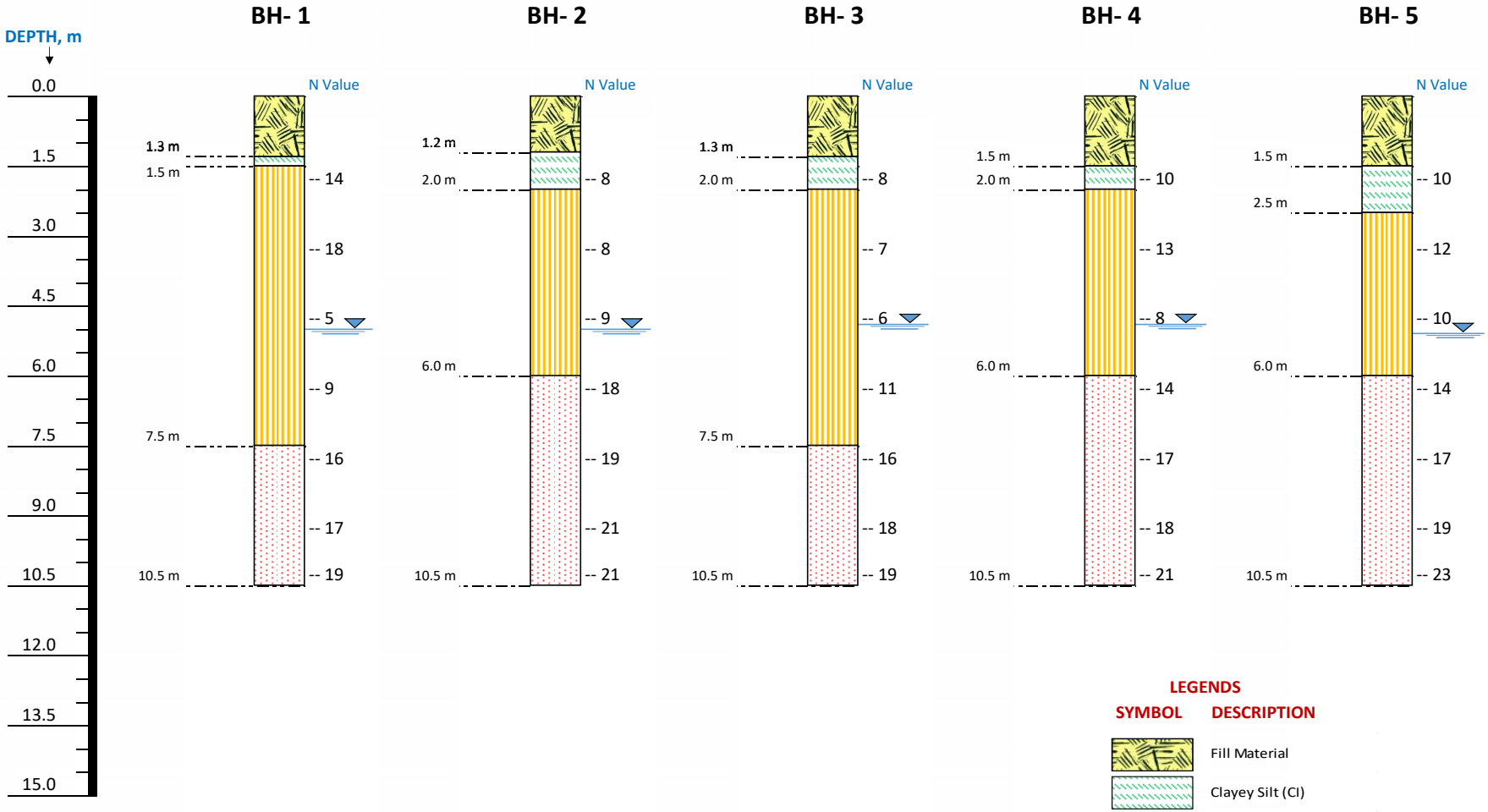
RADHE LAB SOLUTION PVT. LTD.

DST - Direct Sheat test, UU - Unconsolidated Undrained Test, SPT - Standard Penetration Test, DS- Disturbed Sample, UDS - Undisturbed Sample, Refusal (N>100)

PROJECT:	PROPOSED HOSTEL BUILDING PROJECT AT IIT ROPAR, PUNJAB																						
BOREHOLE ID :	BH- 5		TERMINATION DEPTH :	10.5 m			CO-ORDINATES :	640244 mE, 3426933 mN			START DATE :	08 May 2025											
WATER TABLE :	5.1 m		LOCATION :				REDUCED LEVEL :	-			END DATE :	08 May 2025											
Field SPT N Value / Corrected SPT Value N | (N'/N")	Reduced Level, m	Depth Below EGL, m		Sample Type	Symbol	Strata Description	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm3	Dry Density gms/cm^3	Moisture Content %	Shear Test Results					
							Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Test Type	Cohesion Intercept Kg/cm^2	Angle of Internal Friction			
		0.00	0.50	DS		Medium Dense Fill Material (1.5 m)																	
10 | 10		1.50	1.95	SPT		Stiff Clayey Silt	2	14	66	18													
		2.25	2.55	UDS		of medium plasticity (CI) (2.5 m)					41.8	22.7	19.1	2.71	1.84	1.60	14.9	UUT	0.6	6			
12 | 14'		3.00	3.45	SPT		Medium Dense Silty Sand (SM) with gravels	5	69	26	0													
10 | 10'		4.50	4.95	SPT							24.4	NP											
		5.25	5.55	UDS		(6.0 m)									1.86	1.61	15.8	DST	0.0	29.5			
14 | 14'		6.00	6.45	SPT		Medium Dense Fine Sand (SP-SM) with traces of gravels	0	93	7	0													
17 | 15''		7.50	7.95	SPT										2.65									
		8.25	8.55	UDS											1.89	1.68	12.4	DST	0.0	30.0			
19 | 16''		9.00	9.45	SPT			5	86	9	0													
23 | 18''		10.00	10.45	SPT		(10.5 m)																	

RADHE LAB SOLUTION PVT. LTD.

DST - Direct Sheat test, UU - Unconsolidated Undrained Test, SPT - Standard Penetration Test, DS- Disturbed Sample, UDS - Undisturbed Sample, Refusal (N>100)



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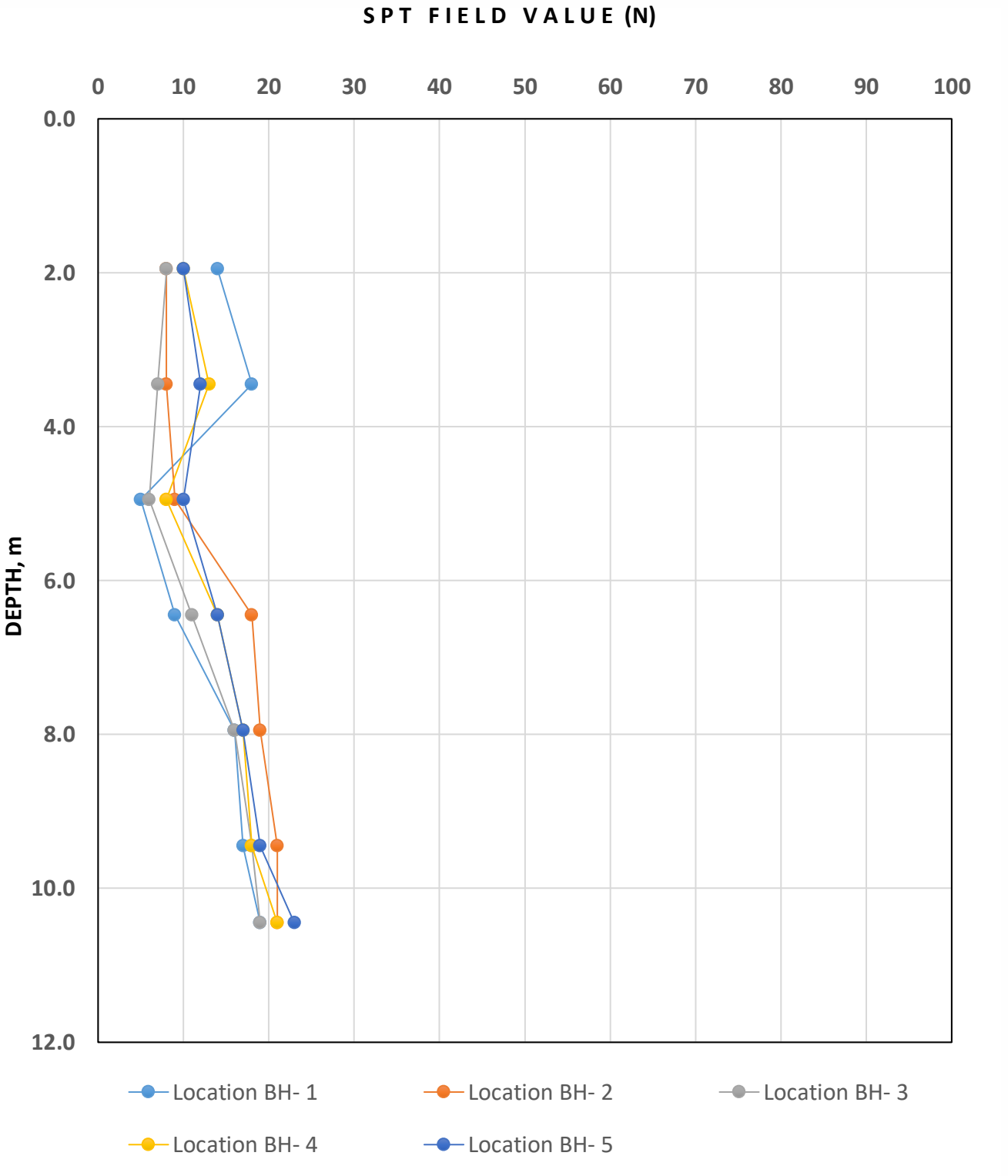
Summary of Borehole Profiles

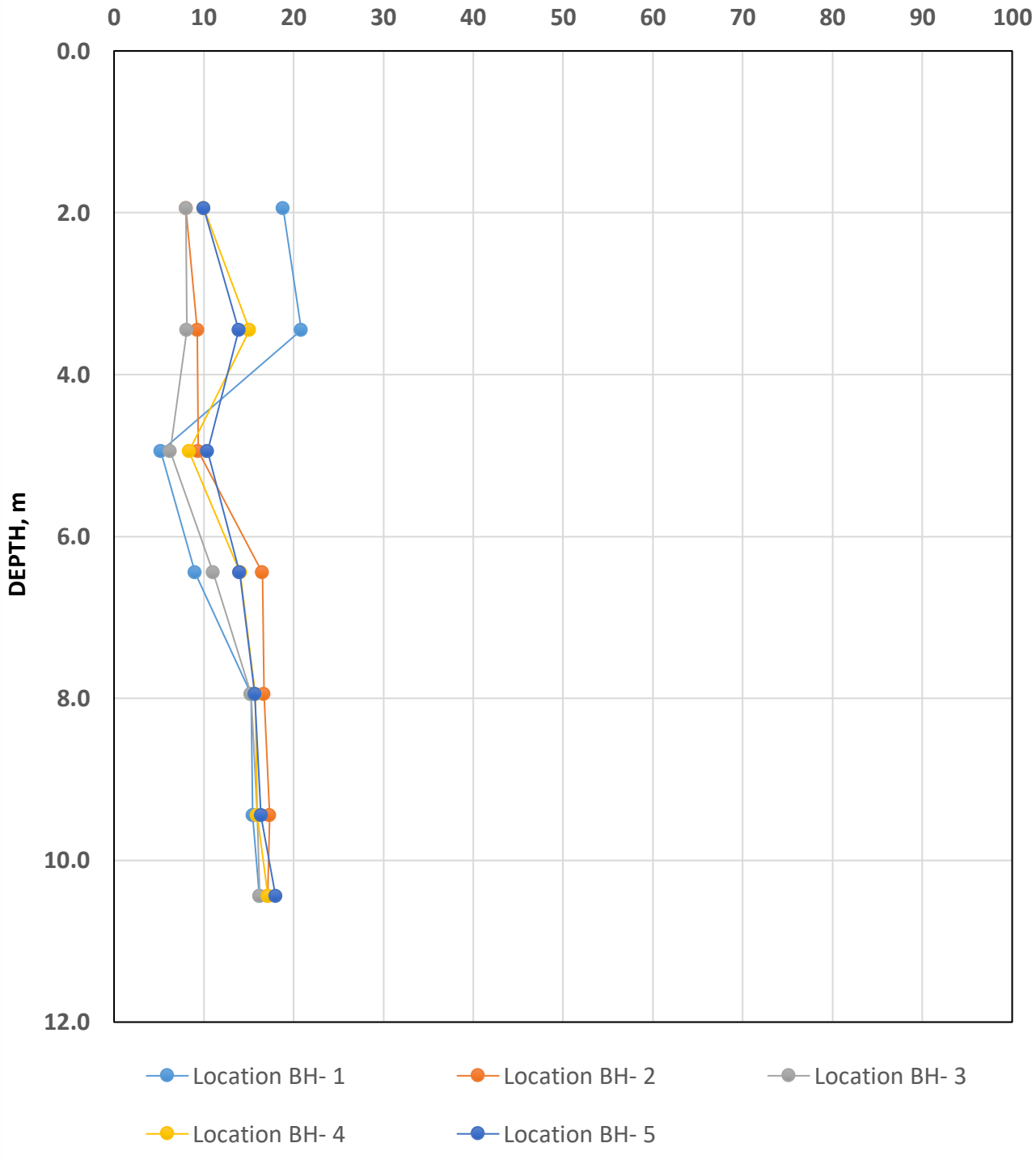
STANDARD PENETRATION TEST



Standard Penetration Test Results (Field Values)

RADHE LAB SOLUTION PVT. LTD.

STANDARD PENETRATION TEST

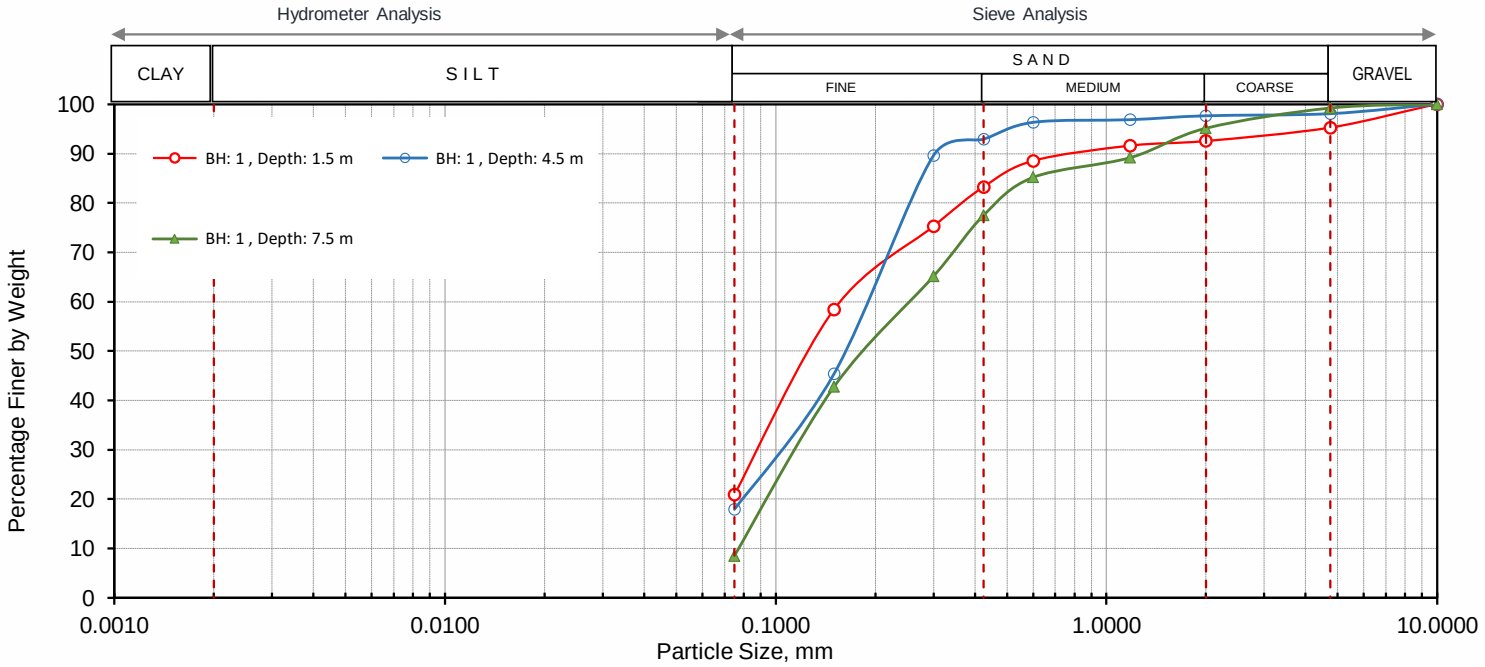


Standard Penetration Test Results (Corrected Values)

RADHE LAB SOLUTION PVT. LTD.

GRAIN SIZE ANALYSIS

IS : 2720 (Part 4) - 1985, RA-2020



GRAIN SIZE DISTRIBUTION CURVE

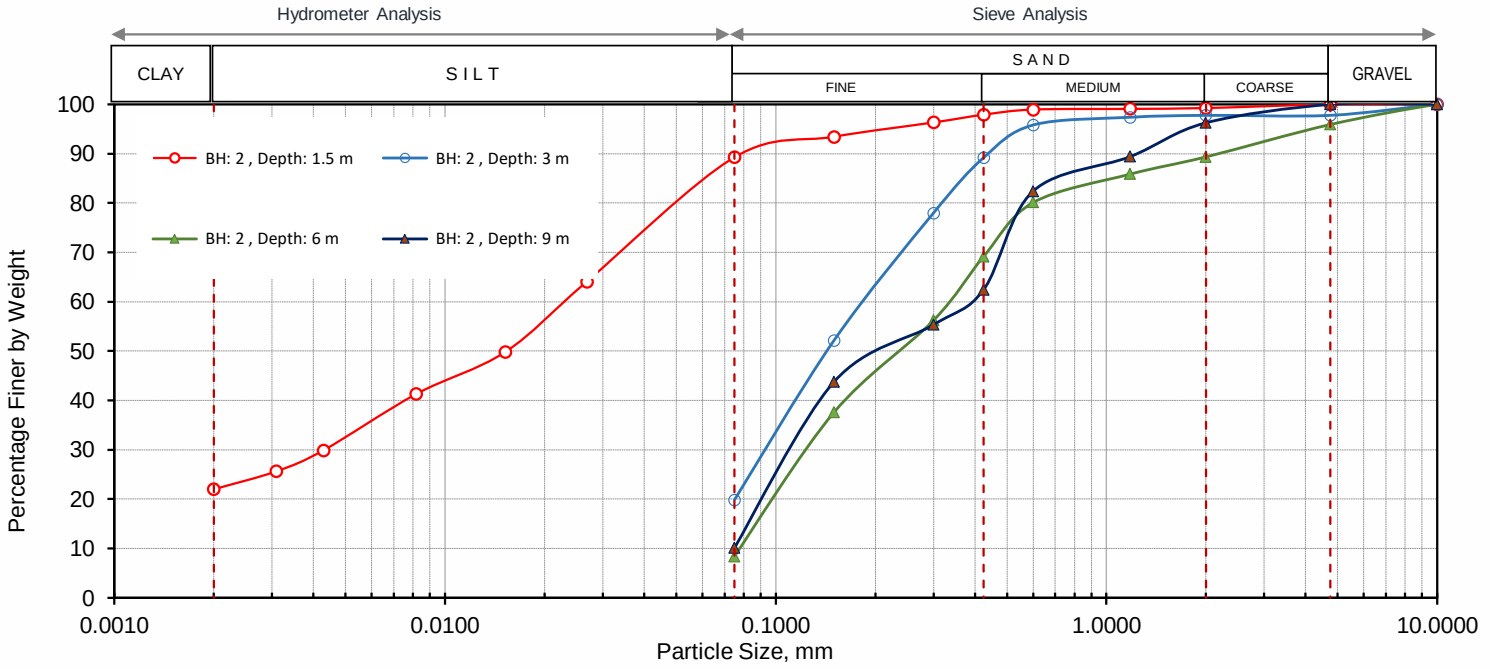
Sample Details			Test Results								
Location / Borehole	Depth, m	Sample Description	Gravel %	Sand %	Silt %	Clay %	D_{60}	D_{30}	D_{10}	C_u	C_c
BH: 1	1.50	Silty Sand (SM) with gravels	5	74	21	0	0.164	0.093	--	--	--
BH: 1	4.50	Silty Sand (SM) with traces of gravels	2	80	18	0	0.200	0.108	--	--	--
BH: 1	7.50	Fine sand (SP-SM) with traces of gravels	1	90	9	0	0.265	0.122	0.078	3.4	0.72

RADHE LAB SOLUTION PVT. LTD.

C_u - Coefficient of Uniformity, C_c - Coefficient of Gradation

GRAIN SIZE ANALYSIS

IS : 2720 (Part 4) - 1985, RA-2020



GRAIN SIZE DISTRIBUTION CURVE

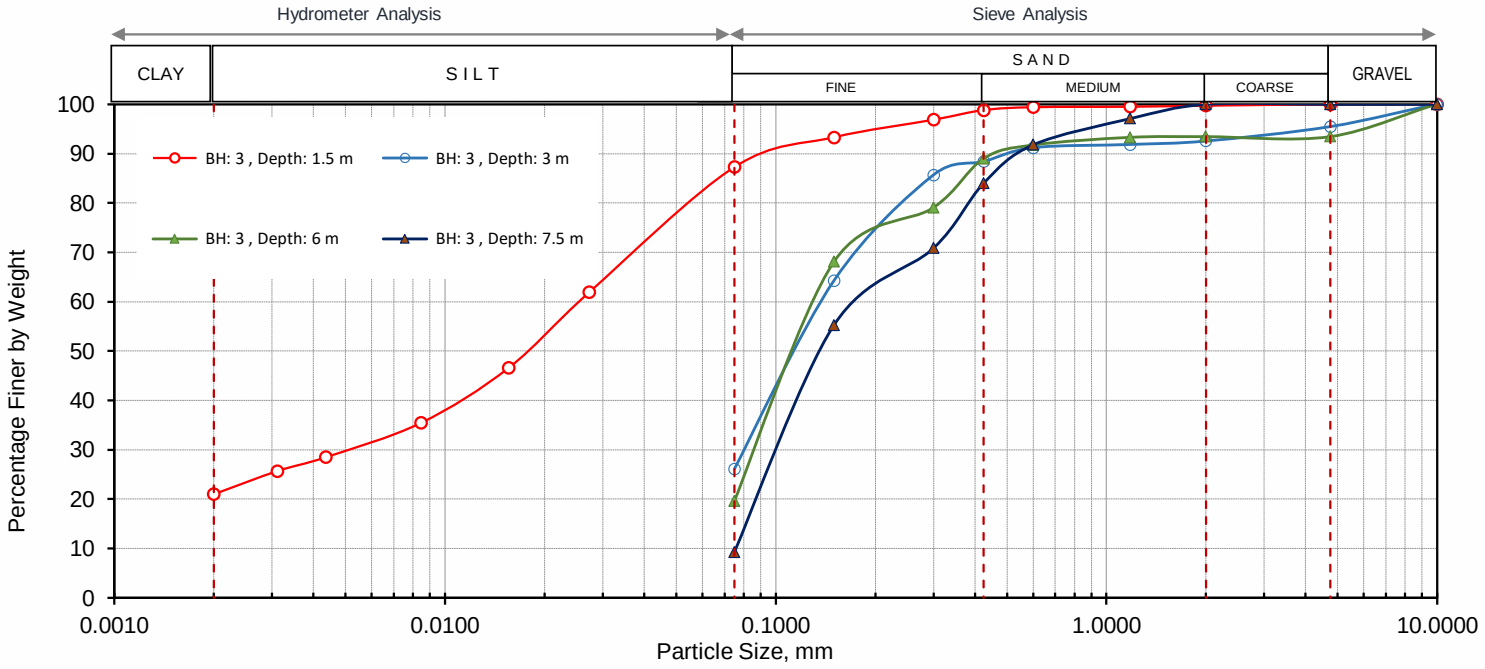
RADHE LAB SOLUTION PVT. LTD.

Sample Details			Test Results								
Location / Borehole	Depth, m	Sample Description	Gravel %	Sand %	Silt %	Clay %	D_{60}	D_{30}	D_{10}	C_u	C_c
BH: 2	1.50	Clayey Silt (CI)	0	10	68	22	0.024	0.004	--	--	--
BH: 2	3.00	Silty Sand (SM) with traces of gravels	2	77	21	0	0.195	0.099	--	--	--
BH: 2	6.00	Fine sand (SP-SM) with traces of gravels	4	87	9	0	0.336	0.130	0.079	4.3	0.64
BH: 2	9.00	Fine sand (SP-SM)	0	89	11	0	0.382	0.119	--	--	--

C_u - Coefficient of Uniformity, C_c - Coefficient of Gradation

GRAIN SIZE ANALYSIS

IS : 2720 (Part 4) - 1985, RA-2020



GRAIN SIZE DISTRIBUTION CURVE

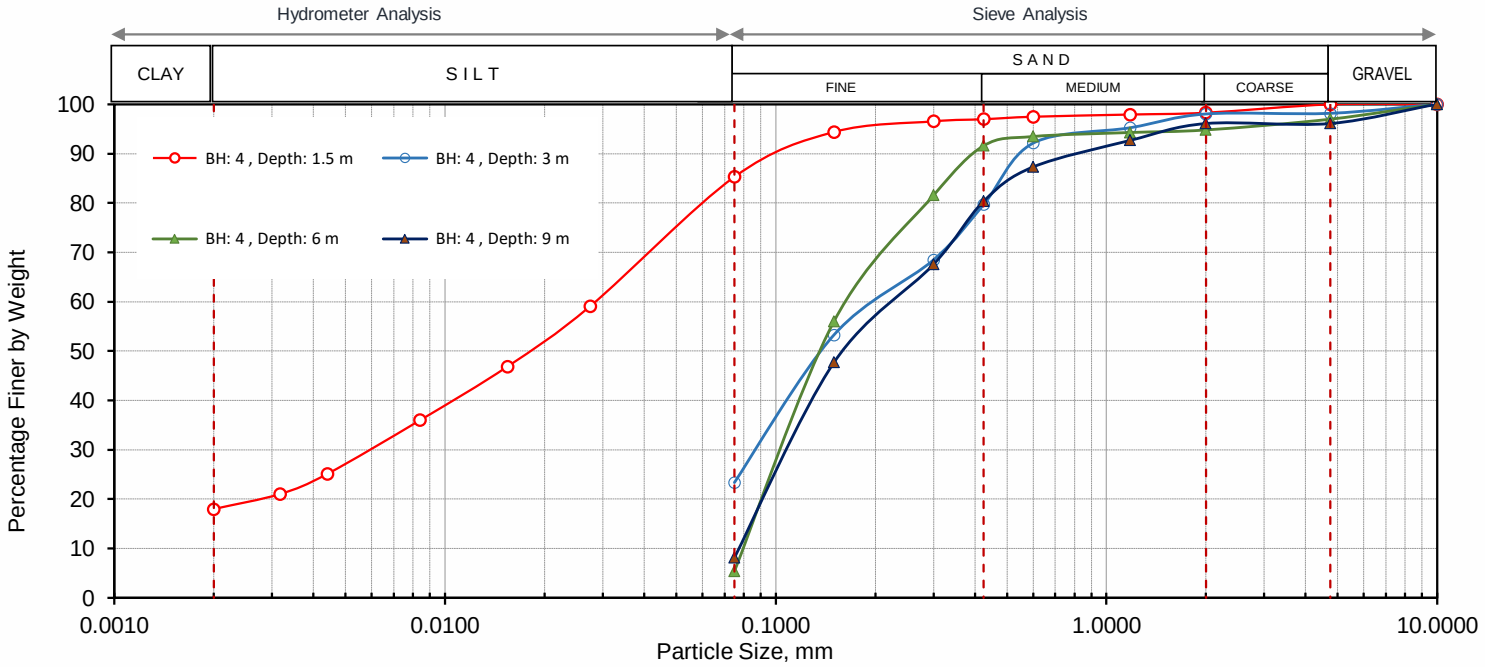
RADHE LAB SOLUTION PVT. LTD.

Sample Details			Test Results								
Location / Borehole	Depth, m	Sample Description	Gravel %	Sand %	Silt %	Clay %	D_{60}	D_{30}	D_{10}	C_u	C_c
BH: 3	1.50	Clayey Silt (CI)	0	12	67	21	0.026	0.005	--	--	--
BH: 3	3.00	Silty Sand (SM) with gravels	5	69	26	0	0.142	0.083	--	--	--
BH: 3	6.00	Silty Sand (SM) with gravels	7	73	20	0	0.137	0.091	--	--	--
BH: 3	7.50	Fine sand (SP-SM)	0	90	10	0	0.195	0.109	0.076	2.6	0.79

C_u - Coefficient of Uniformity, C_c - Coefficient of Gradation

GRAIN SIZE ANALYSIS

IS : 2720 (Part 4) - 1985, RA-2020



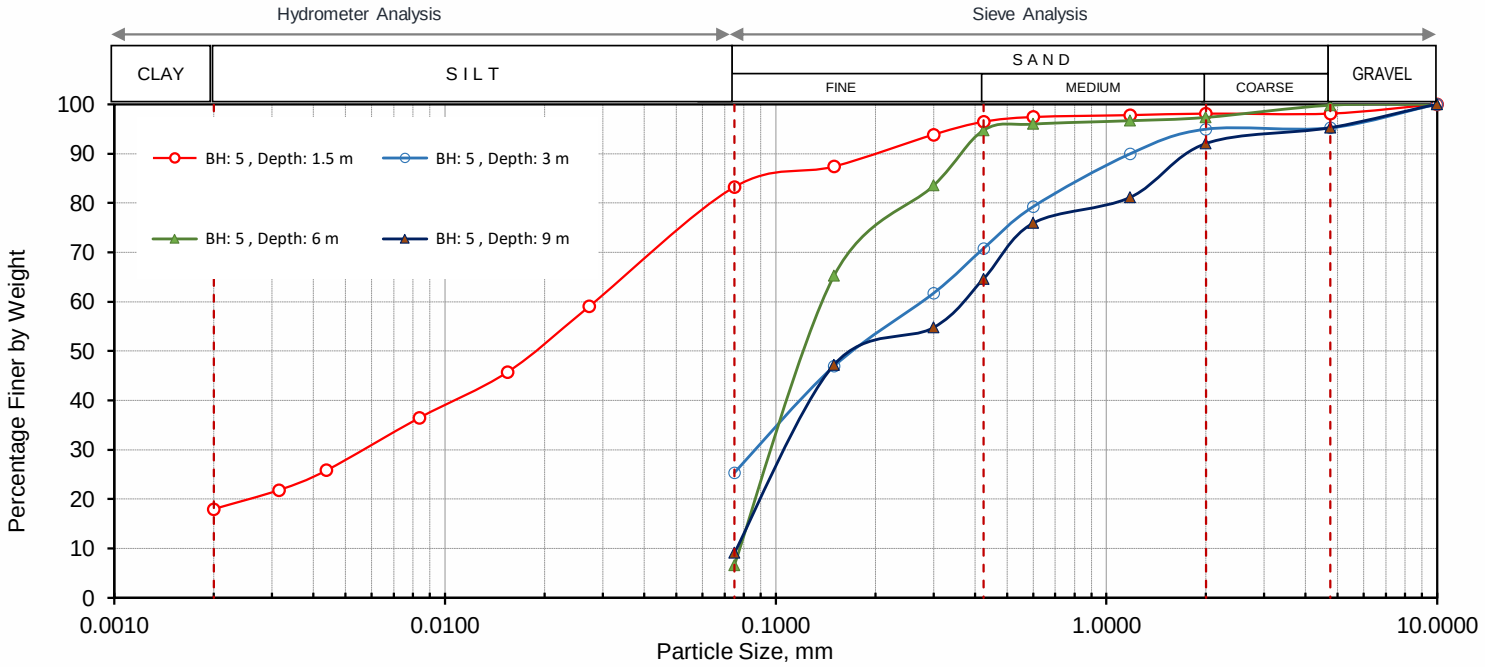
GRAIN SIZE DISTRIBUTION CURVE

Sample Details			Test Results								
Location / Borehole	Depth, m	Sample Description	Gravel %	Sand %	Silt %	Clay %	D_{60}	D_{30}	D_{10}	C_u	C_c
BH: 4	1.50	Clayey Silt (CI)	0	14	68	18	0.029	0.006	--	--	--
BH: 4	3.00	Silty Sand (SM) with traces of gravels	2	74	24	0	0.216	0.092	--	--	--
BH: 4	6.00	Fine sand (SP-SM) with traces of gravels	3	91	6	0	0.173	0.111	0.082	2.1	0.88
BH: 4	9.00	Fine sand (SP-SM) with traces of gravels	4	88	8	0	0.243	0.116	0.079	3.1	0.71

C_u - Coefficient of Uniformity, C_c - Coefficient of Gradation

GRAIN SIZE ANALYSIS

IS : 2720 (Part 4) - 1985, RA-2020

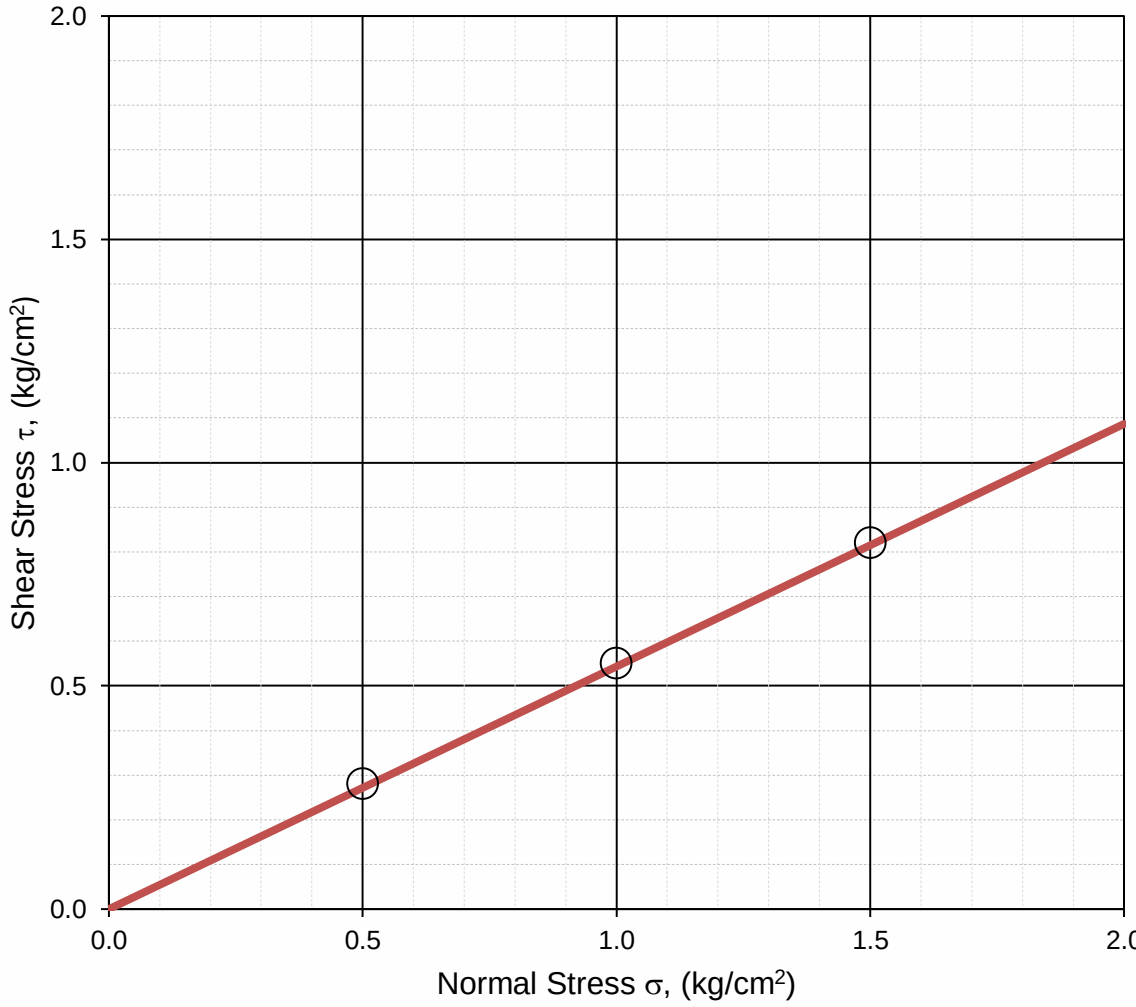


GRAIN SIZE DISTRIBUTION CURVE

RADHE LAB SOLUTION PVT. LTD.

Sample Details			Test Results								
Location / Borehole	Depth, m	Sample Description	Gravel %	Sand %	Silt %	Clay %	D_{60}	D_{30}	D_{10}	C_u	C_c
BH: 5	1.50	Clayey Silt (CI) with traces of gravels	2	14	66	18	0.029	0.006	--	--	--
BH: 5	3.00	Silty Sand (SM) with gravels	5	69	26	0	0.282	0.091	--	--	--
BH: 5	6.00	Fine sand (SP-SM)	0	93	7	0	0.143	0.105	0.079	1.8	0.97
BH: 5	9.00	Fine sand (SP-SM) with gravels	5	86	9	0	0.366	0.116	0.077	4.8	0.48

C_u - Coefficient of Uniformity, C_c - Coefficient of Gradation



RADHE LAB SOLUTION PVT. LTD.

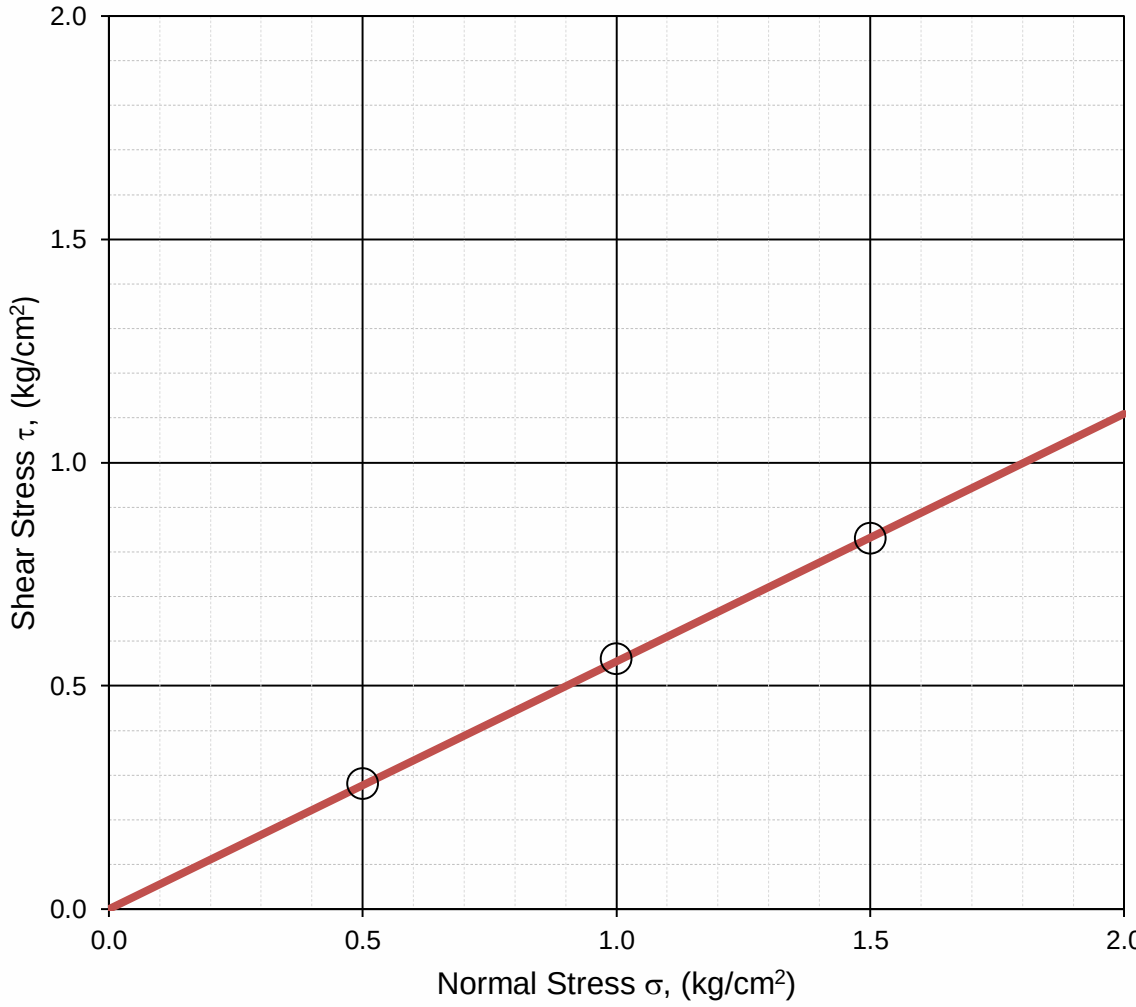
DETAILS

Location / Borehole No.	=	BH-1
Sample Depth, m	=	2.25
Sample Description	=	Silty Sand (SM)

RESULT

Cohesion Intercept, c (kg/cm²)	**=**	**0**
Angle of Internal Friction, ø (degrees)	**=**	**28.5**

CONSOLIDATED DRAINED DIRECT SHEAR TEST



RADHE LAB SOLUTION PVT. LTD.

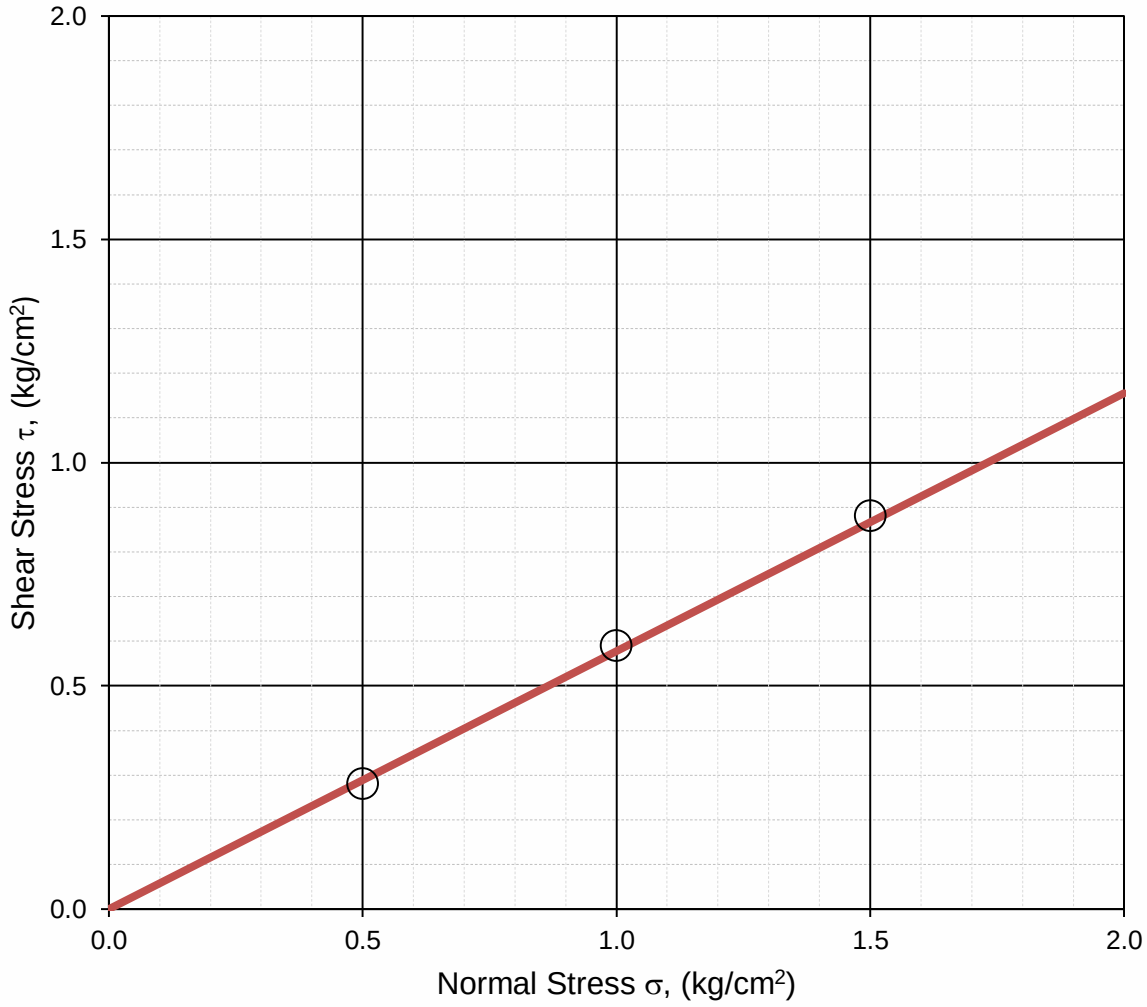
DETAILS

Location / Borehole No.	=	BH-1
Sample Depth, m	=	5.25
Sample Description	=	Silty Sand (SM)

RESULT

Cohesion Intercept, c (kg/cm²)	=	**0**
Angle of Internal Friction, ø (degrees)	=	**29**

CONSOLIDATED DRAINED DIRECT SHEAR TEST



RADHE LAB SOLUTION PVT. LTD.

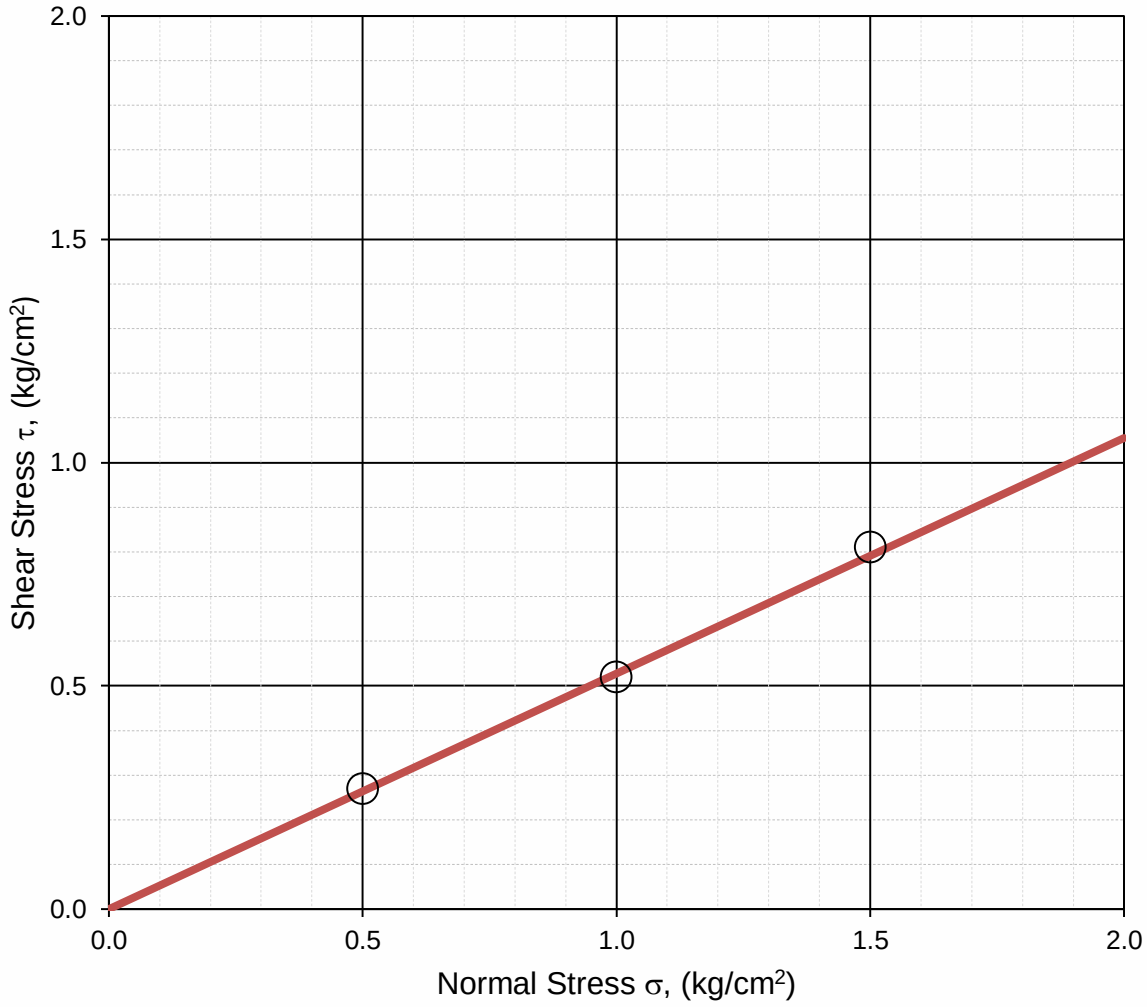
DETAILS

Location / Borehole No.	=	BH-1
Sample Depth, m	=	8.25
Sample Description	=	Fine sand (SP-SM)

RESULT

Cohesion Intercept, c (kg/cm²)	=	**0**
Angle of Internal Friction, ø (degrees)	=	**30**

CONSOLIDATED DRAINED DIRECT SHEAR TEST



RADHE LAB SOLUTION PVT. LTD.

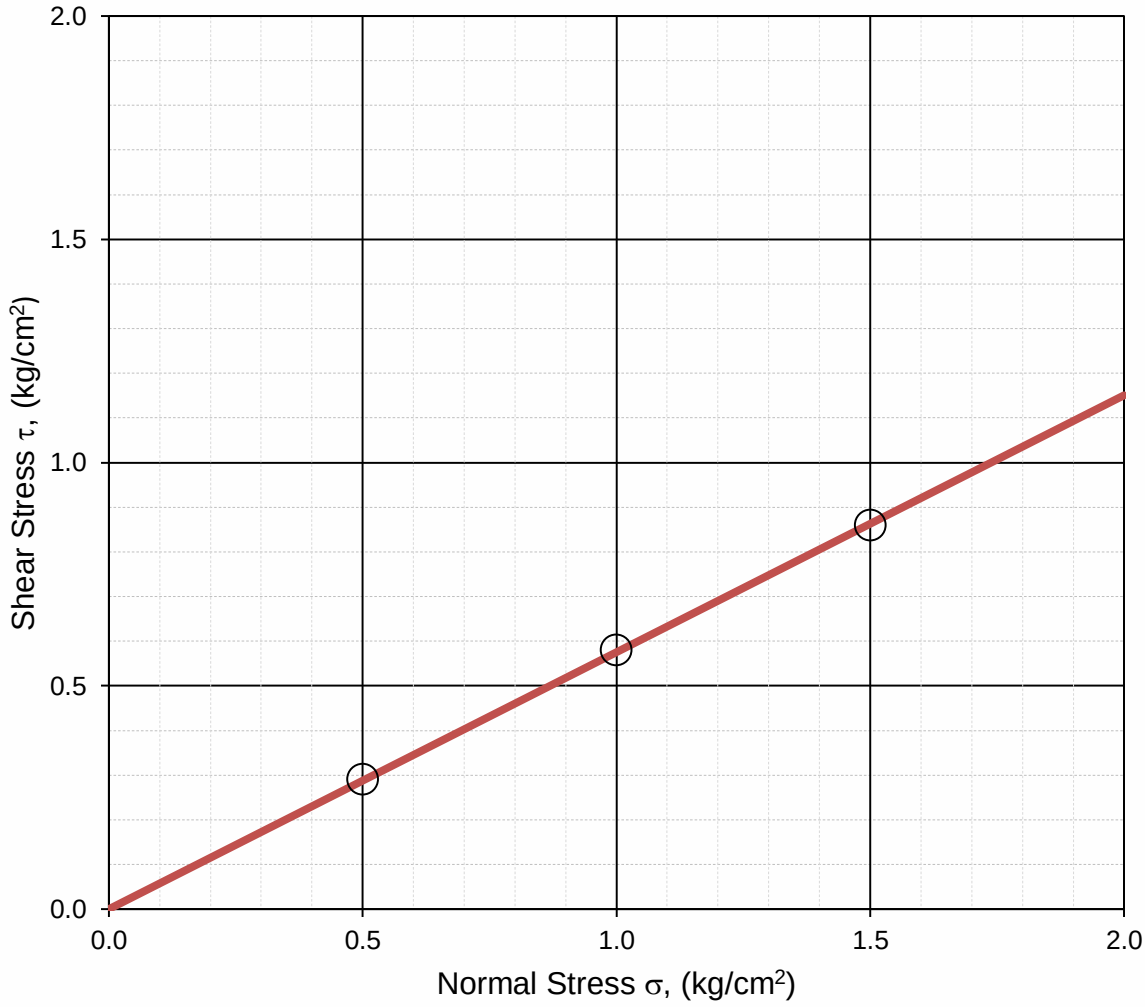
DETAILS

Location / Borehole No.	=	BH-2
Sample Depth, m	=	2.25
Sample Description	=	Silty Sand (SM)

RESULT

Cohesion Intercept, c (kg/cm²)	=	**0**
Angle of Internal Friction, ø (degrees)	=	**27.8**

CONSOLIDATED DRAINED DIRECT SHEAR TEST



RADHE LAB SOLUTION PVT. LTD.

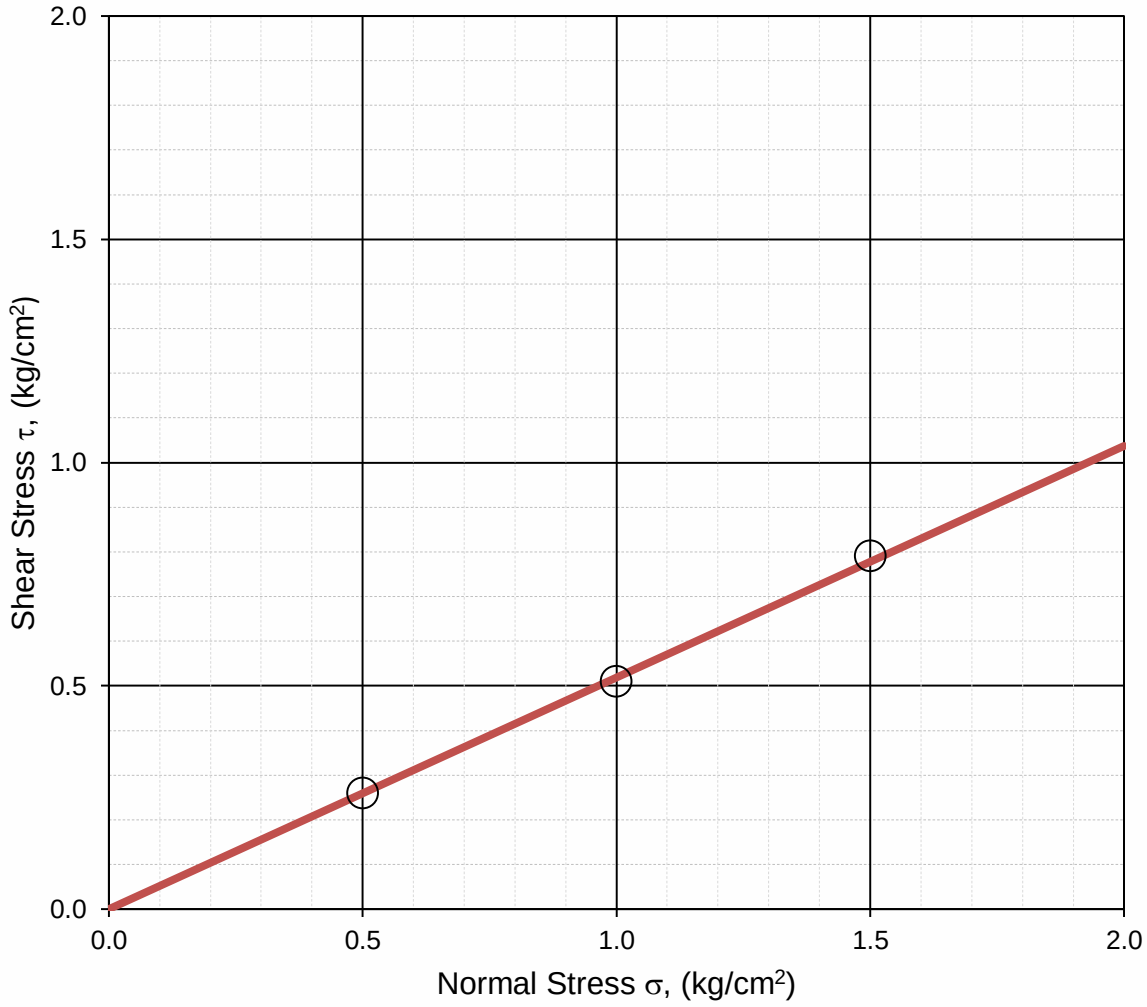
DETAILS

Location / Borehole No.	=	BH-2
Sample Depth, m	=	8.25
Sample Description	=	Fine sand (SP-SM)

RESULT

Cohesion Intercept, c (kg/cm²)	=	**0**
Angle of Internal Friction, ø (degrees)	=	**29.9**

CONSOLIDATED DRAINED DIRECT SHEAR TEST



RADHE LAB SOLUTION PVT. LTD.

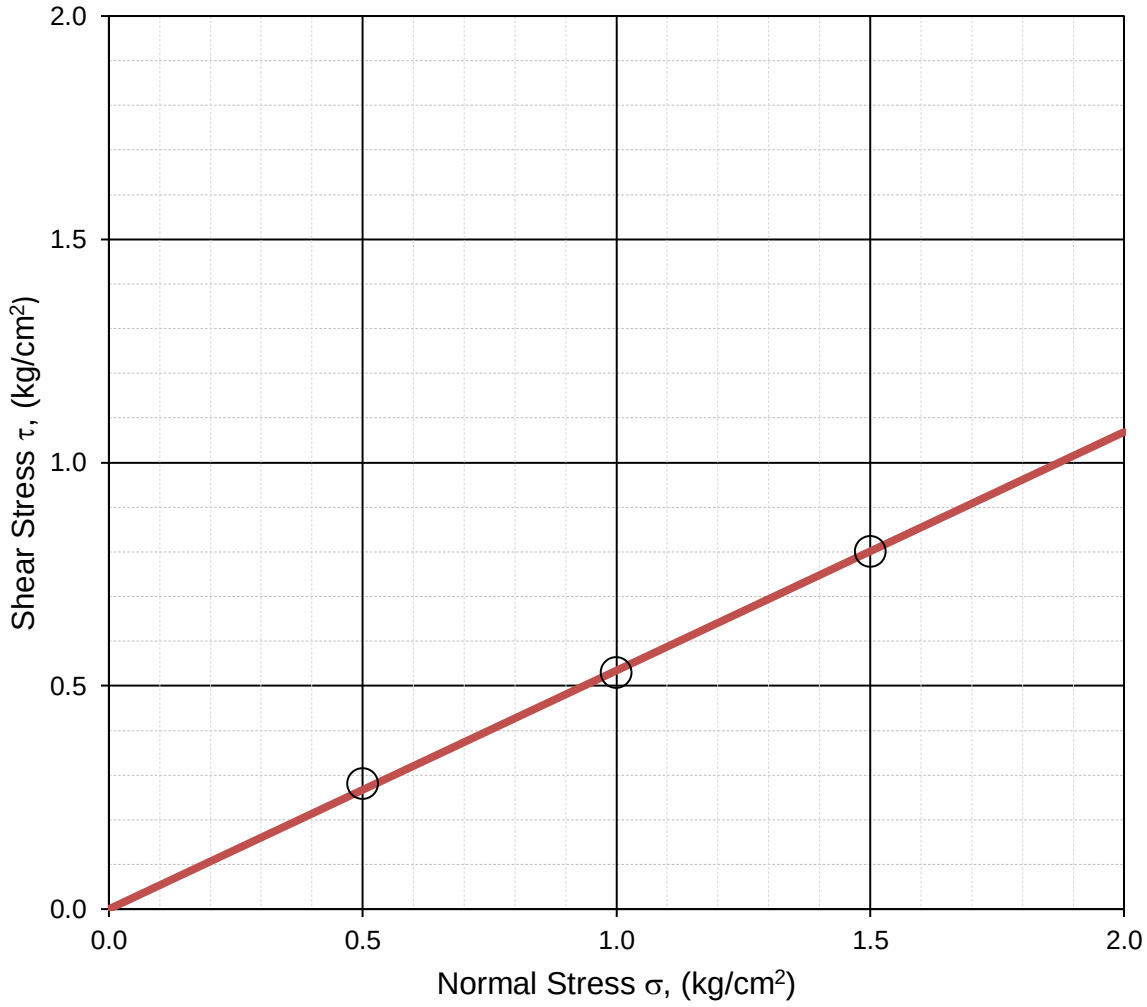
DETAILS

Location / Borehole No.	=	BH-3
Sample Depth, m	=	2.25
Sample Description	=	Silty Sand (SM)

RESULT

Cohesion Intercept, c (kg/cm²)	=	**0**
Angle of Internal Friction, ø (degrees)	=	**27.4**

CONSOLIDATED DRAINED DIRECT SHEAR TEST



DETAILS

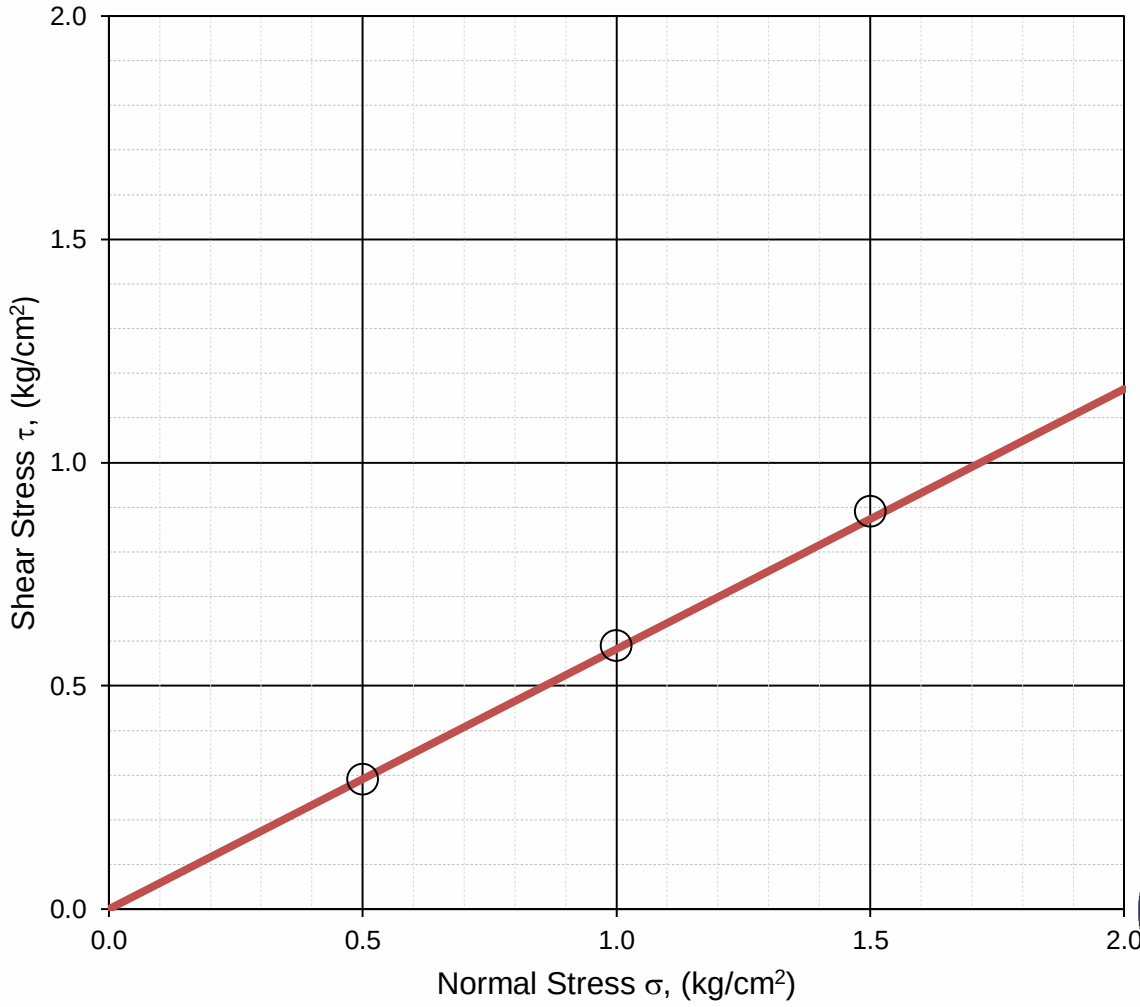
Location / Borehole No.	=	BH-3
Sample Depth, m	=	5.25
Sample Description	=	Silty Sand (SM)

RESULT

Cohesion Intercept, c (kg/cm²)	=	**0**
Angle of Internal Friction, ø (degrees)	=	**28.1**

RADHE LAB SOLUTION PVT. LTD.

CONSOLIDATED DRAINED DIRECT SHEAR TEST



RADHE LAB SOLUTION PVT. LTD.

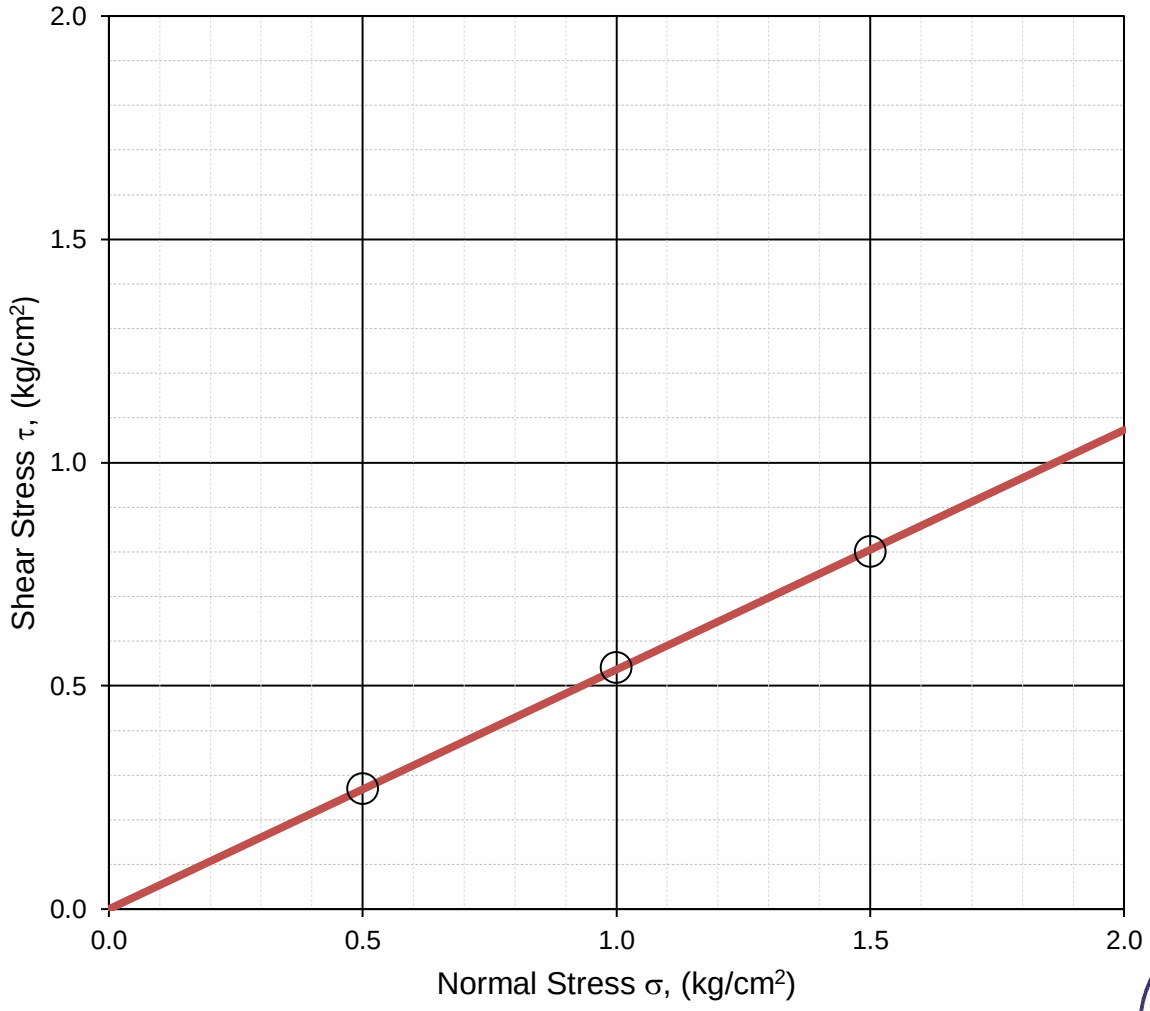
DETAILS

Location / Borehole No.	=	BH-3
Sample Depth, m	=	8.25
Sample Description	=	Fine sand (SP-SM)

RESULT

Cohesion Intercept, c (kg/cm²)	=	**0**
Angle of Internal Friction, ø (degrees)	=	**30.2**

CONSOLIDATED DRAINED DIRECT SHEAR TEST



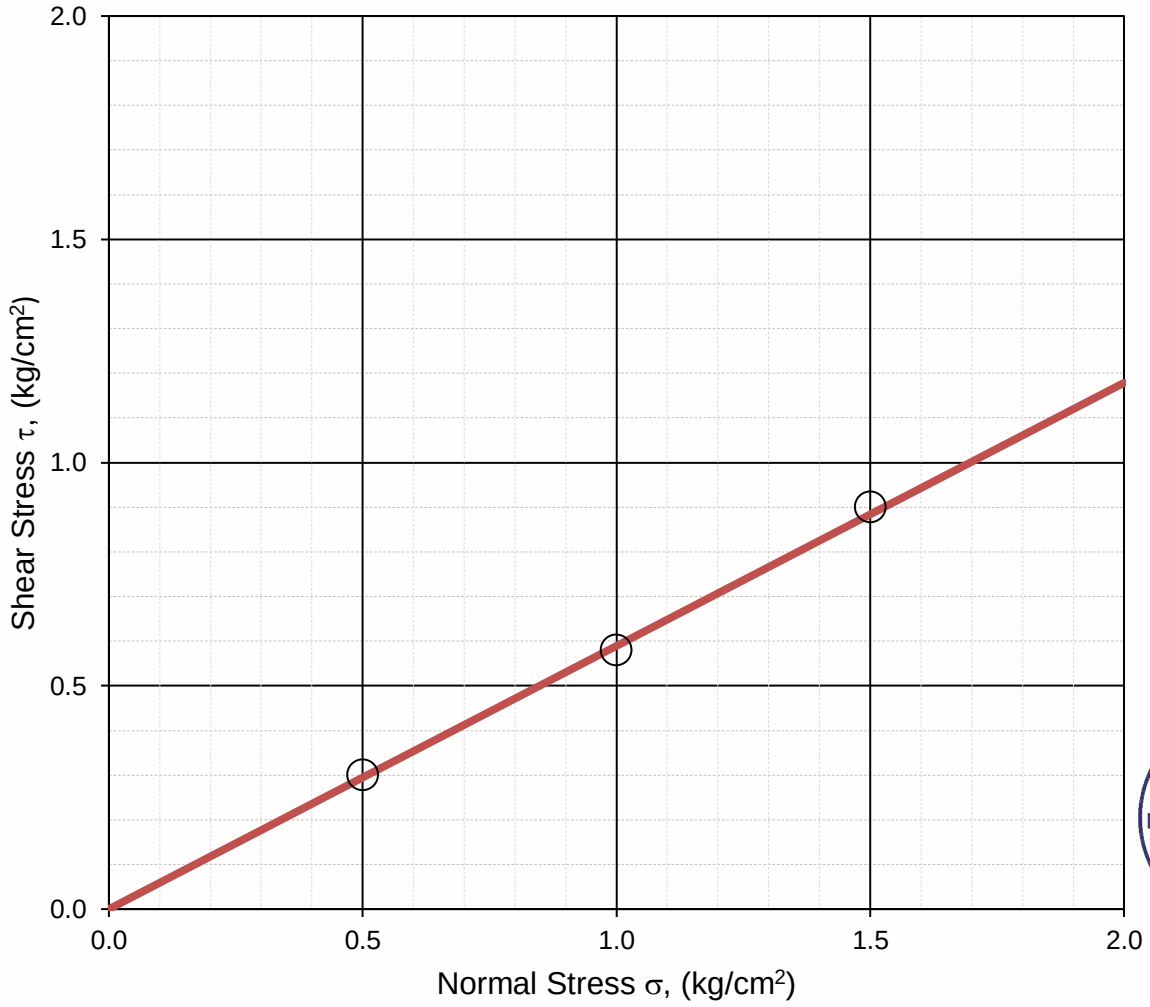
DETAILS

Location / Borehole No.	=	BH-4
Sample Depth, m	=	2.25
Sample Description	=	Silty Sand (SM)

RESULT

Cohesion Intercept, c (kg/cm²)	=	**0**
Angle of Internal Friction, ø (degrees)	=	**28.2**

CONSOLIDATED DRAINED DIRECT SHEAR TEST



RADHE LAB SOLUTION PVT. LTD.

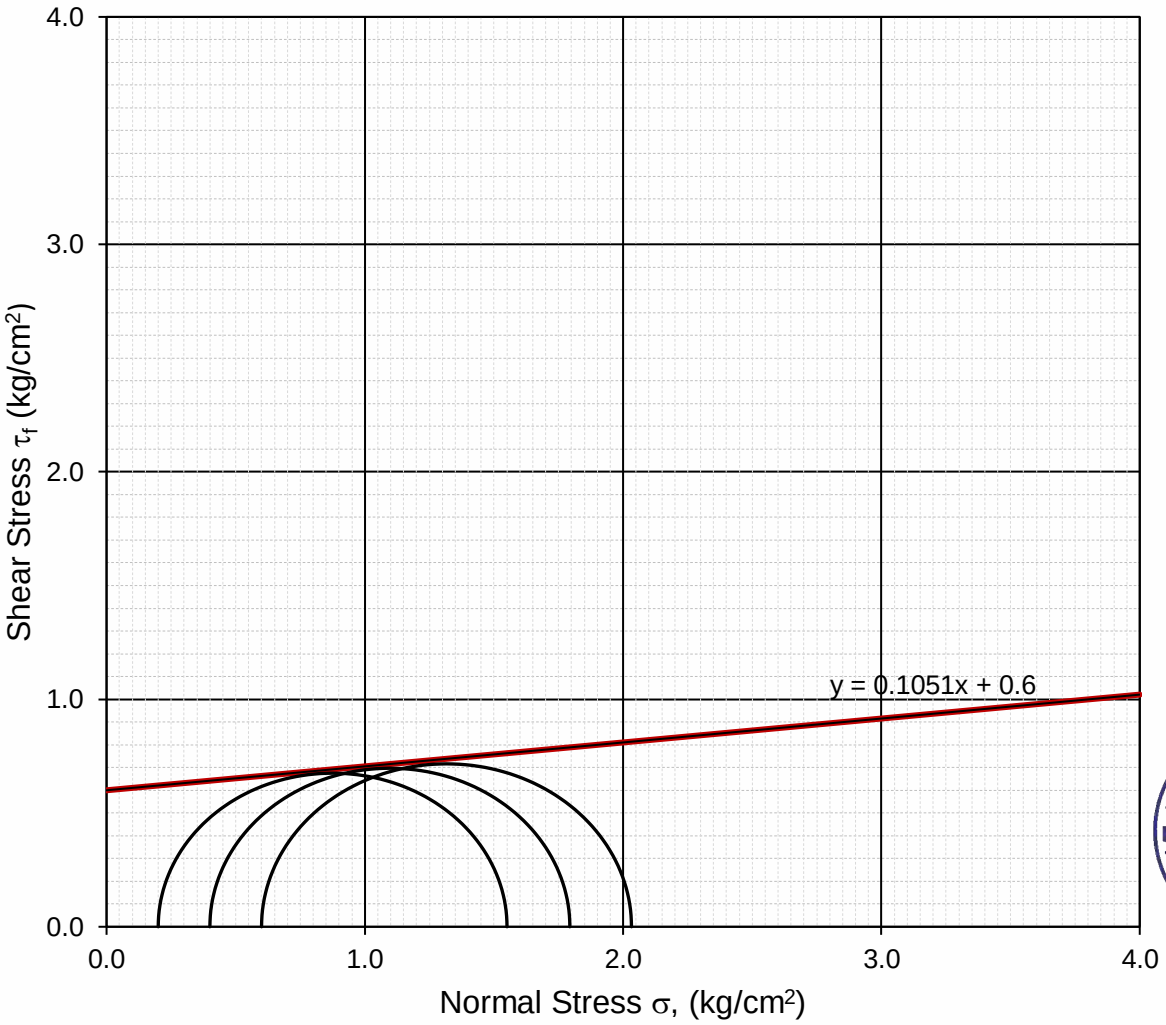
DETAILS

Location / Borehole No.	=	BH-4
Sample Depth, m	=	8.25
Sample Description	=	Fine sand (SP-SM)

RESULT

Cohesion Intercept, c (kg/cm²)	=	**0**
Angle of Internal Friction, ø (degrees)	=	**30.5**

CONSOLIDATED DRAINED DIRECT SHEAR TEST



RADHE LAB SOLUTION PVT. LTD.

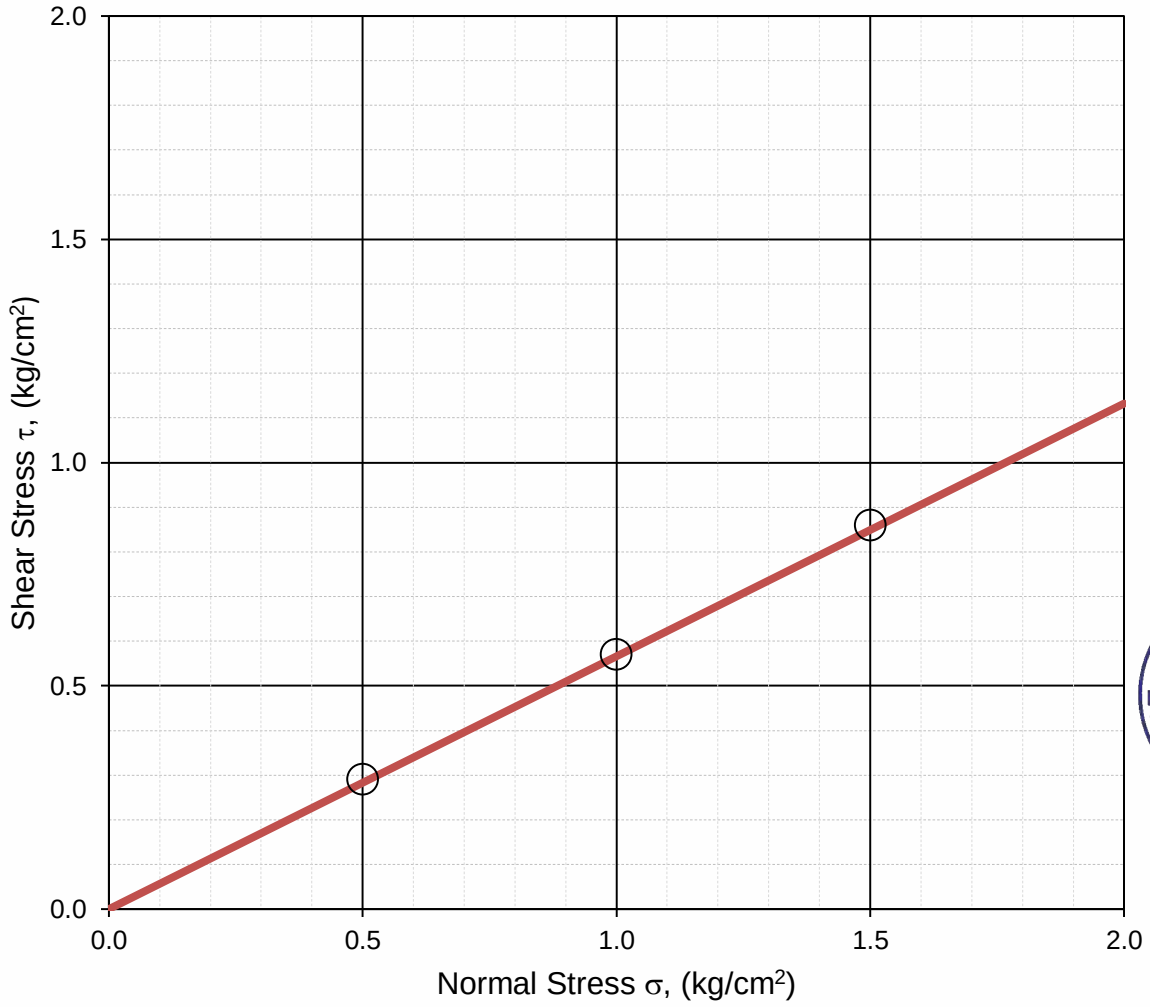
DETAILS

Location / Borehole No.	=	BH-5
Sample Depth, m	=	2.25
Sample Description	=	Clayey Silt (Cl)

RESULT

Cohesion Intercept, c (kg/cm^2)	=	**0.6**
Angle of Internal Friction, ø (degrees)	=	**6**

UNCONSOLIDATION UNDRAINED TRIAXIAL TEST



RADHE LAB SOLUTION PVT. LTD.

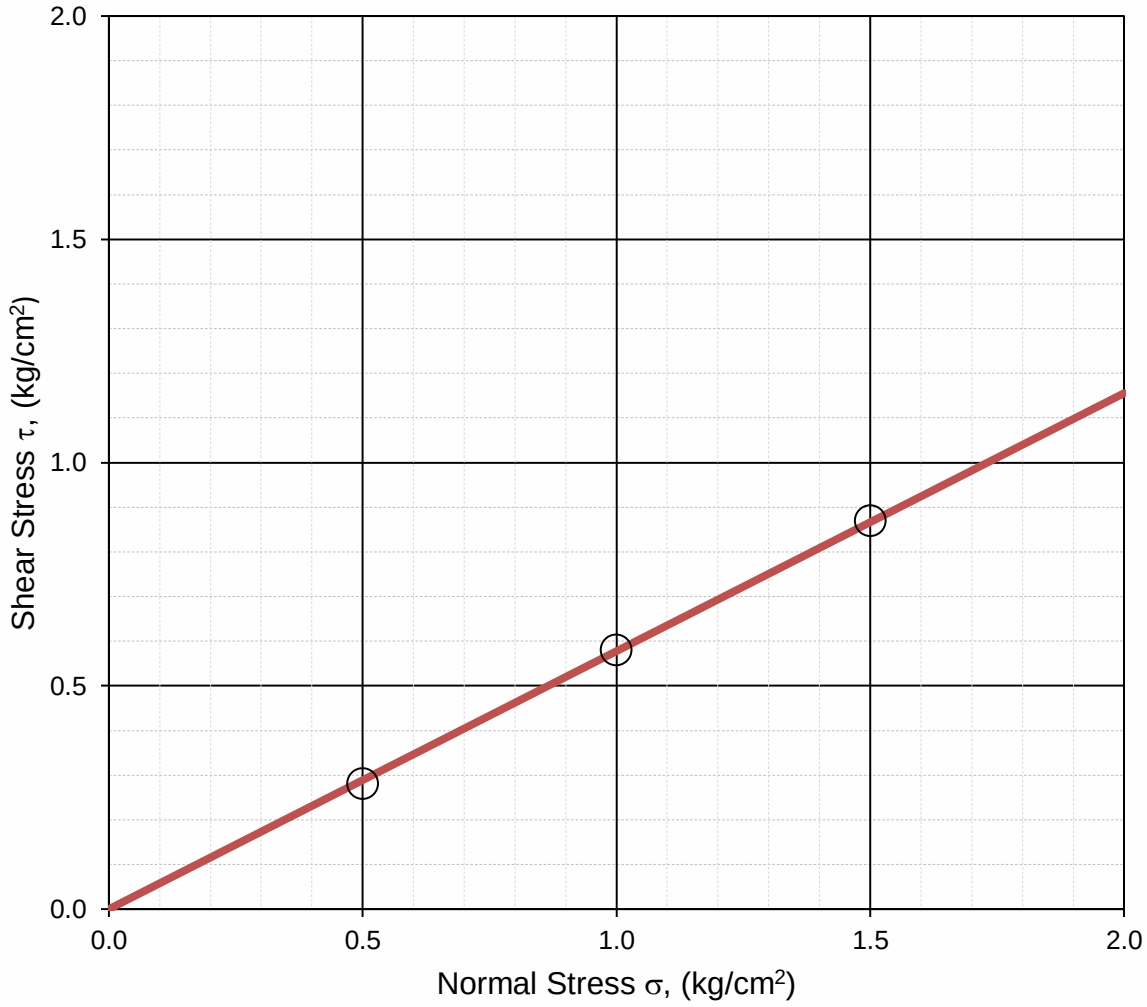
DETAILS

Location / Borehole No.	=	BH-5
Sample Depth, m	=	5.25
Sample Description	=	Silty Sand (SM)

RESULT

Cohesion Intercept, c (kg/cm²)	**=**	**0**
Angle of Internal Friction, ø (degrees)	**=**	**29.5**

CONSOLIDATED DRAINED DIRECT SHEAR TEST



RADHE LAB SOLUTION PVT. LTD.

DETAILS

Location / Borehole No.	=	BH-5
Sample Depth, m	=	8.25
Sample Description	=	Fine sand (SP-SM)

RESULT

Cohesion Intercept, c (kg/cm²)	=	**0**
Angle of Internal Friction, ø (degrees)	=	**30**

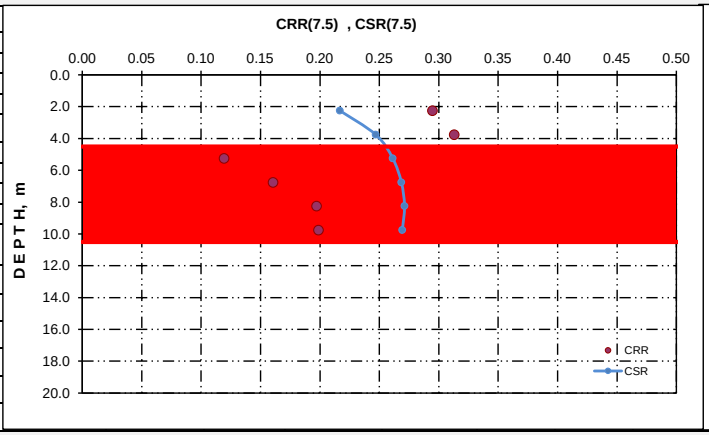
CONSOLIDATED DRAINED DIRECT SHEAR TEST

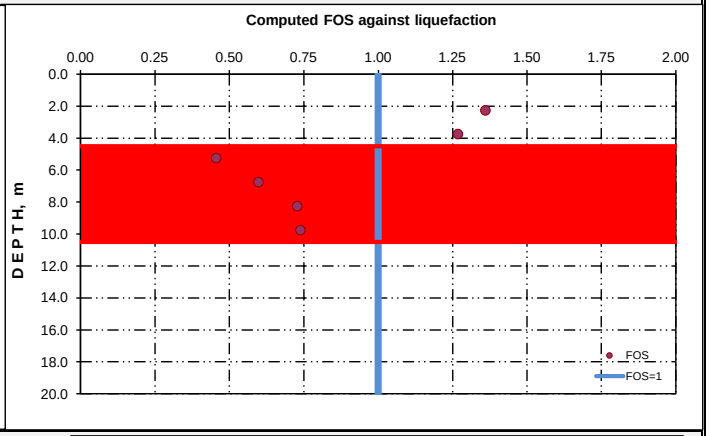
Liquefaction Susceptibility Assessment (based on SPT-N value)

Analysis in accordance with IS 1893 (Part 1) : 2016 ANNEX F (Clause 3.12 & 6.3.5.3)

Borehole No.	**1**	**Site Levels**	
		Existing Ground Level, EGL (m):	
Location	**IIT Ropar**	Actual GW Depth (m):	5.0
		Design GW Depth (m):	1.0
Structure	**Hostel Building**	Design GW Level (m):	1.0
		Design Earthquake	
Existing Ground Level	**N/A**	Seismic Zone:	IV
		Earthquake Magnitude:	6.7
Surcharge Load (T/m^2)	**0.0**	PGA (g):	0.24
		Factor of Safety (FS):	1.0

Boring Details			**Bulk Density Profile**	
Sampler with liner?	N	Depth, m		γ_b
Hammer Used: Donut hammer with rope and pulley	M	From	To	T/m^3
		0.0	1.3	1.60
Hammer Type Correction (C_{HT}) :	0.75	1.3	1.5	1.70
Borehole Diameter (mm):	150	1.5	7.5	1.86
Borehole Diameter Correction (C_{BD}) :	1.05	7.5	10.0	1.87





Calculations

N/A : Not Applicable (as in the case of unsaturated soils)
NL : Not Liquefiable, e.g. if (N1)60,cs>30, PI>15%, or Fines Content>50%

Layer	Soil Description	Depth to Top of Layer (m)	Layer Thickness (m)	Depth to Middle of Layer (m)	Unit weight (T/m^3)	Total Overburden Pressure at Middle of Layer based on actual GWT (T/m^2)	Effective Stress at Middle of Layer, based on design GWT (T/m^2)	Effective Stress at Middle of Layer, based on actual GWT (T/m^2)	N_m	Fines Content (%)	Overburden Correction Factor C_N	Correction for rod length C_{RL}	Sampler Correction C_{SS}	α	β	$(N1)_{60CS}$	$CRR_{7.5}$	Stress Reduction Factor (r_d)	CSR	Magnitude Scaling Factor	CRR	Computed FOS against liquefaction
1	CI	0.0	1.5	0.8	1.60	1.20	1.20	1.20	12	80	1.70	0.75	1.2	5.00	1.20	22	N/A	0.99	N/A	1.334	N/A	N/A
2	SM	1.5	1.5	2.3	1.86	4.19	2.96	4.19	14	21	1.55	0.75	1.2	3.78	1.09	20	0.22	0.98	0.22	1.334	0.29	1.36
3	SM	3.0	1.5	3.8	1.86	6.98	4.28	6.98	18	21	1.20	0.80	1.2	3.78	1.09	21	0.23	0.97	0.25	1.334	0.31	1.27
4	SM	4.5	1.5	5.3	1.86	9.77	5.60	9.77	5	18	1.01	0.85	1.1	3.23	1.07	7	0.09	0.96	0.26	1.334	0.12	**0.46**
5	SM	6.0	1.5	6.8	1.86	12.56	6.91	10.84	9	18	0.96	0.95	1.1	3.23	1.07	11	0.12	0.95	0.27	1.334	0.16	**0.60**
6	SP-SM	7.5	1.5	8.3	1.87	15.43	8.32	12.24	16	9	0.90	0.95	1.2	0.56	1.02	14	0.15	0.94	0.27	1.334	0.20	**0.73**
7	SP-SM	9.0	1.5	9.8	1.87	18.23	9.65	13.57	17	9	0.86	0.95	1.2	0.56	1.02	14	0.15	0.91	0.27	1.334	0.20	**0.74**
8	SP-SM	10.0							19	9												

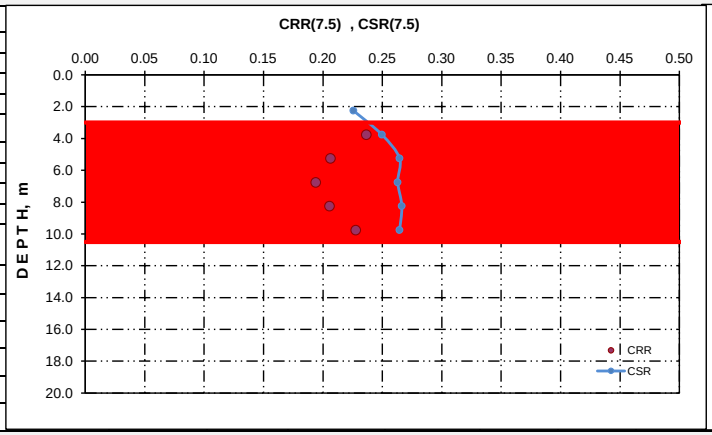
Conclusion: **Liquefaction susceptibility between 4.5 and 10.5 m depths**

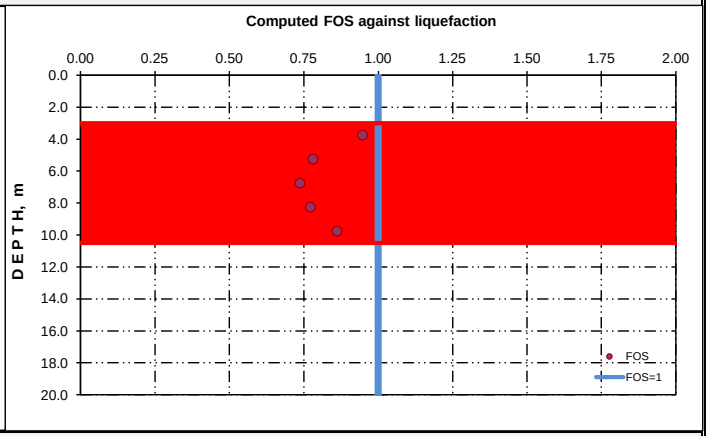
Liquefaction Susceptibility Assessment (based on SPT-N value)

Analysis in accordance with IS 1893 (Part 1) : 2016 ANNEX F (Clause 3.12 & 6.3.5.3)

Borehole No.	**2**	**Site Levels**	
		Existing Ground Level, EGL (m):	
Location	**IIT Ropar**	Actual GW Depth (m):	5.0
		Design GW Depth (m):	1.0
Structure	**Hostel Building**	Design GW Level (m):	1.0
		Design Earthquake	
Existing Ground Level	**N/A**	Seismic Zone:	IV
		Earthquake Magnitude:	6.7
Surcharge Load (T/m^2)	**0.0**	PGA (g):	0.24
		Factor of Safety (FS):	1.0

Boring Details		**Bulk Density Profile**		
Sampler with liner?	N	Depth, m		γ_b
Hammer Used: Donut hammer with rope and pulley	M	From	To	T/m^3
		0.0	1.2	1.60
Hammer Type Correction (C_{HT}) :	0.75	1.2	2.0	1.70
Borehole Diameter (mm):	150	2.0	6.0	1.83
Borehole Diameter Correction (C_{BD}) :	1.05	6.0	10.0	1.91





Calculations

N/A : Not Applicable (as in the case of unsaturated soils)
NL : Not Liquefiable, e.g. if (N1)60,cs>30, PI>15%, or Fines Content>50%

Layer	Soil Description	Depth to Top of Layer (m)	Layer Thickness (m)	Depth to Middle of Layer (m)	Unit weight (T/m^3)	Total Overburden Pressure at Middle of Layer based on actual GWT (T/m^2)	Effective Stress at Middle of Layer, based on design GWT (T/m^2)	Effective Stress at Middle of Layer, based on actual GWT (T/m^2)	N_m	Fines Content (%)	Overburden Correction Factor C_N	Correction for rod length C_{RL}	Sampler Correction C_{SS}	α	β	$(N1)_{60CS}$	$CRR_{7.5}$	Stress Reduction Factor (r_d)	CSR	Magnitude Scaling Factor	CRR	Computed FOS against liquefaction
1	CI	0.0	1.5	0.8	1.60	1.20	1.20	1.20	12	90	1.70	0.75	1.2	5.00	1.20	22	N/A	0.99	N/A	1.334	N/A	N/A
2	CI	1.5	1.5	2.3	1.70	3.83	2.60	3.83	14	90	1.62	0.75	1.2	5.00	1.20	24	NL	0.98	0.23	1.334	NL	NL
3	SM	3.0	1.5	3.8	1.83	6.86	4.16	6.86	13	21	1.21	0.80	1.2	3.78	1.09	17	0.18	0.97	0.25	1.334	0.24	**0.95**
4	SM	4.5	1.5	5.3	1.83	9.61	5.44	9.61	12	21	1.02	0.85	1.2	3.78	1.09	14	0.15	0.96	0.26	1.334	0.21	**0.78**
5	SP-SM	6.0	1.5	6.8	1.91	12.89	7.25	11.18	15	9	0.95	0.95	1.2	0.56	1.02	14	0.15	0.95	0.26	1.334	0.19	**0.74**
6	SP-SM	7.5	1.5	8.3	1.91	15.76	8.65	12.57	17	9	0.89	0.95	1.2	0.56	1.02	14	0.15	0.94	0.27	1.334	0.21	**0.77**
7	SP-SM	9.0	1.5	9.8	1.91	18.62	10.04	13.96	19	11	0.85	0.95	1.2	1.21	1.03	16	0.17	0.91	0.26	1.334	0.23	**0.86**
8	SP-SM	10.0							18	11												

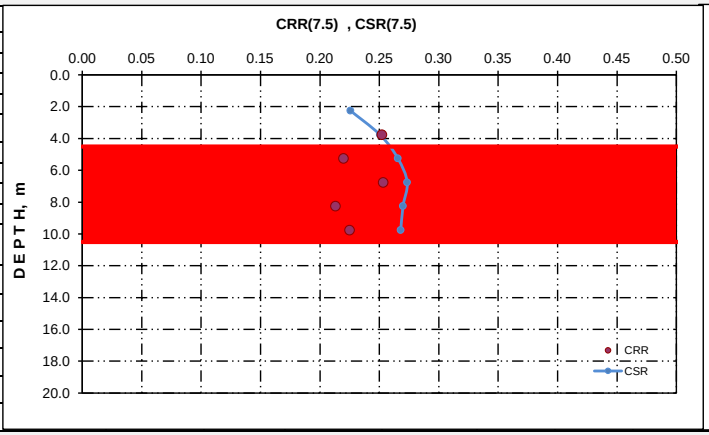
Conclusion: **Liquefaction susceptibility between 3 and 10.5 m depths**

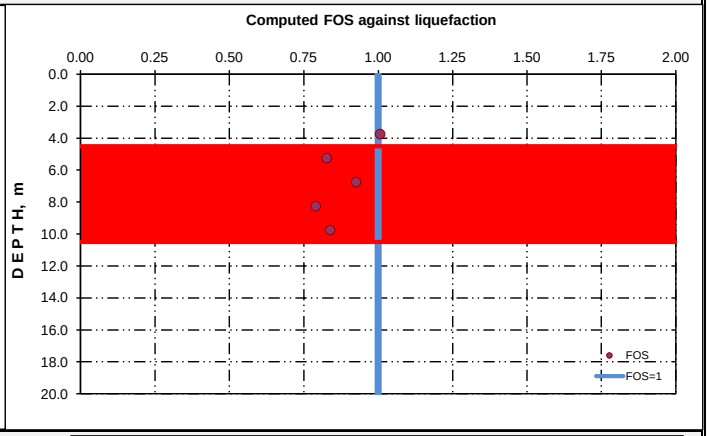
Liquefaction Susceptibility Assessment (based on SPT-N value)

Analysis in accordance with IS 1893 (Part 1) : 2016 ANNEX F (Clause 3.12 & 6.3.5.3)

Borehole No.	**3**	**Site Levels**	
		Existing Ground Level, EGL (m):	
Location	**IIT Ropar**	Actual GW Depth (m):	4.9
		Design GW Depth (m):	1.0
Structure	**Hostel Building**	Design GW Level (m):	1.0
		Design Earthquake	
Existing Ground Level	**N/A**	Seismic Zone:	IV
		Earthquake Magnitude:	6.7
Surcharge Load (T/m^2)	**0.0**	PGA (g):	0.24
		Factor of Safety (FS):	1.0

Boring Details			**Bulk Density Profile**	
Sampler with liner?	N	Depth, m		γ_b
Hammer Used: Donut hammer with rope and pulley	M	From	To	T/m^3
		0.0	1.3	1.60
Hammer Type Correction (C_{HT}) :	0.75	1.3	2.0	1.70
Borehole Diameter (mm):	150	2.0	7.5	1.82
Borehole Diameter Correction (C_{BD}) :	1.05	7.5	10.0	1.88

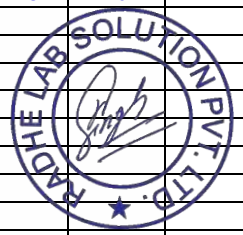




Calculations

N/A : Not Applicable (as in the case of unsaturated soils)
NL : Not Liquefiable, e.g. if (N1)60,cs>30, PI>15%, or Fines Content>50%

Layer	Soil Description	Depth to Top of Layer (m)	Layer Thickness (m)	Depth to Middle of Layer (m)	Unit weight (T/m^3)	Total Overburden Pressure at Middle of Layer based on actual GWT (T/m^2)	Effective Stress at Middle of Layer, based on design GWT (T/m^2)	Effective Stress at Middle of Layer, based on actual GWT (T/m^2)	N_m	Fines Content (%)	Overburden Correction Factor C_N	Correction for rod length C_{RL}	Sampler Correction C_{SS}	α	β	$(N1)_{60CS}$	$CRR_{7.5}$	Stress Reduction Factor (r_d)	CSR	Magnitude Scaling Factor	CRR	Computed FOS against liquefaction
1	CI	0.0	1.5	0.8	1.60	1.20	1.20	1.20	12	88	1.70	0.75	1.2	5.00	1.20	22	N/A	0.99	N/A	1.334	N/A	N/A
2	CI	1.5	1.5	2.3	1.70	3.83	2.60	3.83	14	88	1.62	0.75	1.2	5.00	1.20	24	NL	0.98	0.23	1.334	NL	NL
3	SM	3.0	1.5	3.8	1.82	6.83	4.13	6.83	13	26	1.21	0.80	1.2	4.39	1.12	18	0.19	0.97	0.25	1.334	0.25	1.01
4	SM	4.5	1.5	5.3	1.82	9.56	5.39	9.56	12	26	1.02	0.85	1.2	4.39	1.12	15	0.16	0.96	0.27	1.334	0.22	**0.83**
5	SM	6.0	1.5	6.8	1.82	12.29	6.64	10.47	15	20	0.98	0.95	1.2	3.61	1.08	18	0.19	0.95	0.27	1.334	0.25	**0.93**
6	SP-SM	7.5	1.5	8.3	1.88	15.51	8.40	12.22	17	10	0.90	0.95	1.2	0.87	1.02	15	0.16	0.94	0.27	1.334	0.21	**0.79**
7	SP-SM	9.0	1.5	9.8	1.88	18.33	9.75	13.57	19	10	0.86	0.95	1.2	0.87	1.02	16	0.17	0.91	0.27	1.334	0.22	**0.84**
8	SP-SM	10.0							18	10												



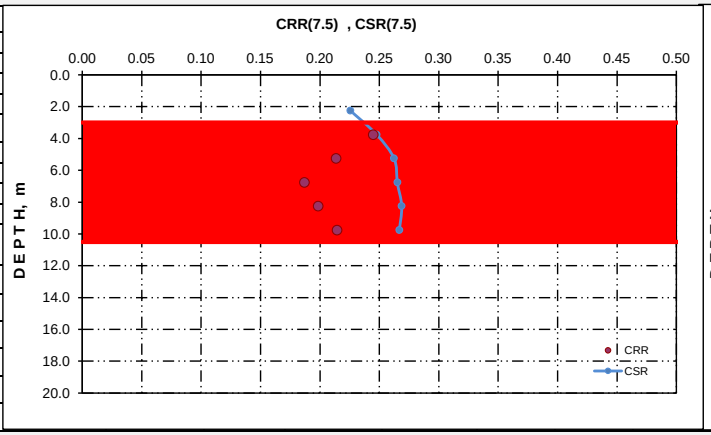
Conclusion: **Liquefaction susceptibility between 4.5 and 10.5 m depths**

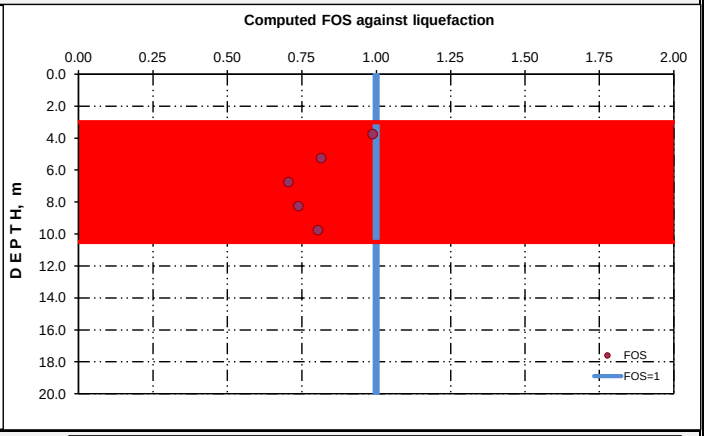
Liquefaction Susceptibility Assessment (based on SPT-N value)

Analysis in accordance with IS 1893 (Part 1) : 2016 ANNEX F (Clause 3.12 & 6.3.5.3)

		Site Levels	
Borehole No.	**4**	Existing Ground Level, EGL (m):	
Location	**IIT Ropar**	Actual GW Depth (m):	4.9
		Design GW Depth (m):	1.0
Structure	**Hostel Building**	Design GW Level (m):	1.0
		Design Earthquake	
Existing Ground Level	**N/A**	Seismic Zone:	IV
		Earthquake Magnitude:	6.7
Surcharge Load (T/m^2)	**0.0**	PGA (g):	0.24
		Factor of Safety (FS):	1.0

Boring Details		**Bulk Density Profile**		
Sampler with liner?	N	Depth, m		γ_b
Hammer Used: Donut hammer with rope and pulley	M	From	To	T/m^3
		0.0	1.5	1.60
Hammer Type Correction (C_{HT}) :	0.75	1.5	2.0	1.70
Borehole Diameter (mm):	150	2.0	6.0	1.85
Borehole Diameter Correction (C_{BD}) :	1.05	6.0	10.0	1.89

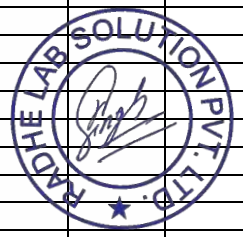




Calculations

N/A : Not Applicable (as in the case of unsaturated soils)
NL : Not Liquefiable, e.g. if (N1)60,cs>30, PI>15%, or Fines Content>50%

Layer	Soil Description	Depth to Top of Layer (m)	Layer Thickness (m)	Depth to Middle of Layer (m)	Unit weight (T/m^3)	Total Overburden Pressure at Middle of Layer based on actual GWT (T/m^2)	Effective Stress at Middle of Layer, based on design GWT (T/m^2)	Effective Stress at Middle of Layer, based on actual GWT (T/m^2)	N_m	Fines Content (%)	Overburden Correction Factor C_N	Correction for rod length C_{RL}	Sampler Correction C_{SS}	α	β	$(N1)_{60CS}$	$CRR_{7.5}$	Stress Reduction Factor (r_d)	CSR	Magnitude Scaling Factor	CRR	Computed FOS against liquefaction
1	CI	0.0	1.5	0.8	1.60	1.20	1.20	1.20	12	86	1.70	0.75	1.2	5.00	1.20	22	N/A	0.99	N/A	1.334	N/A	N/A
2	CI	1.5	1.5	2.3	1.70	3.83	2.60	3.83	14	86	1.62	0.75	1.2	5.00	1.20	24	NL	0.98	0.23	1.334	NL	NL
3	SM	3.0	1.5	3.8	1.85	6.94	4.24	6.94	13	24	1.20	0.80	1.2	4.18	1.11	17	0.18	0.97	0.25	1.334	0.24	**0.99**
4	SM	4.5	1.5	5.3	1.85	9.71	5.54	9.71	12	24	1.01	0.85	1.2	4.18	1.11	15	0.16	0.96	0.26	1.334	0.21	**0.81**
5	SP-SM	6.0	1.5	6.8	1.89	12.76	7.12	10.94	15	6	0.96	0.95	1.2	0.03	1.00	13	0.14	0.95	0.27	1.334	0.19	**0.71**
6	SP-SM	7.5	1.5	8.3	1.89	15.59	8.48	12.31	17	6	0.90	0.95	1.2	0.03	1.00	14	0.15	0.94	0.27	1.334	0.20	**0.74**
7	SP-SM	9.0	1.5	9.8	1.89	18.43	9.84	13.67	19	8	0.86	0.95	1.2	0.30	1.01	15	0.16	0.91	0.27	1.334	0.21	**0.80**
8	SP-SM	10.0							18	8												



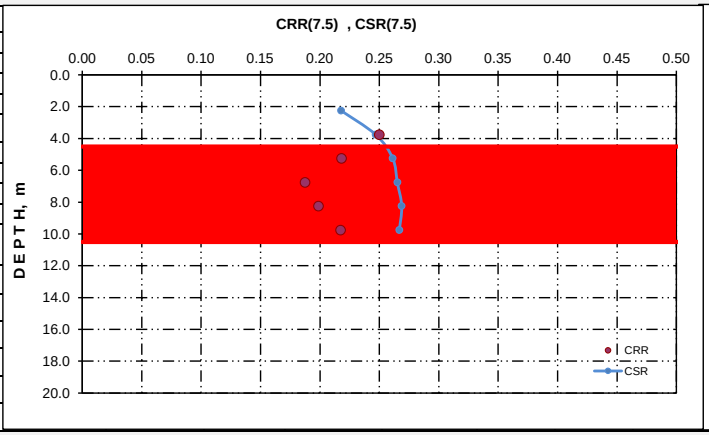
Conclusion: **Liquefaction susceptibility between 3 and 10.5 m depths**

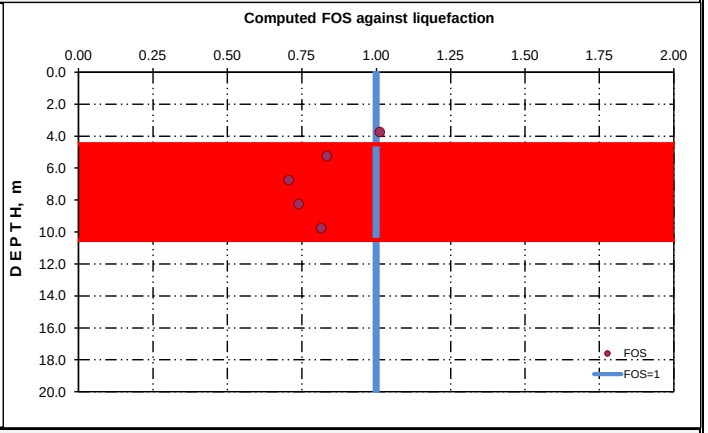
Liquefaction Susceptibility Assessment (based on SPT-N value)

Analysis in accordance with IS 1893 (Part 1) : 2016 ANNEX F (Clause 3.12 & 6.3.5.3)

Borehole No.	**5**	**Site Levels**	
		Existing Ground Level, EGL (m):	
Location	**IIT Ropar**	Actual GW Depth (m):	5.1
		Design GW Depth (m):	1.0
Structure	**Hostel Building**	Design GW Level (m):	1.0
		Design Earthquake	
Existing Ground Level	**N/A**	Seismic Zone:	IV
		Earthquake Magnitude:	6.7
Surcharge Load (T/m²)	**0.0**	PGA (g):	0.24
		Factor of Safety (FS):	1.0

Boring Details			**Bulk Density Profile**	
Sampler with liner?	N	Depth, m		γ_b
Hammer Used:	Donut hammer with rope and pulley	From	To	T/m³
	M	0.0	1.5	1.60
Hammer Type Correction (C_{HT}) :	0.75	1.5	2.5	1.84
Borehole Diameter (mm):	150	2.5	6.0	1.86
Borehole Diameter Correction (C_{BD}) :	1.05	6.0	10.0	1.89

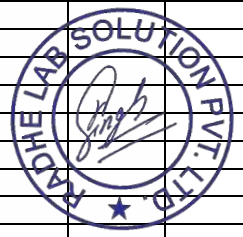




Calculations

N/A : Not Applicable (as in the case of unsaturated soils)
NL : Not Liquefiable, e.g. if (N1)60,cs>30, PI>15%, or Fines Content>50%

Layer	Soil Description	Depth to Top of Layer (m)	Layer Thickness (m)	Depth to Middle of Layer (m)	Unit weight (T/m³)	Total Overburden Pressure at Middle of Layer based on actual GWT (T/m²)	Effective Stress at Middle of Layer, based on design GWT (T/m²)	Effective Stress at Middle of Layer, based on actual GWT (T/m²)	N_m	Fines Content (%)	Overburden Correction Factor C_N	Correction for rod length C_{RL}	Sampler Correction C_{SS}	α	β	$(N1)_{60CS}$	$CRR_{7.5}$	Stress Reduction Factor (r_d)	CSR	Magnitude Scaling Factor	CRR	Computed FOS against liquefaction
1	CI	0.0	1.5	0.8	1.60	1.20	1.20	1.20	12	84	1.70	0.75	1.2	5.00	1.20	22	N/A	0.99	N/A	1.334	N/A	N/A
2	CI	1.5	1.5	2.3	1.84	4.14	2.91	4.14	14	84	1.55	0.75	1.2	5.00	1.20	24	NL	0.98	0.22	1.334	NL	NL
3	SM	3.0	1.5	3.8	1.86	6.98	4.28	6.98	13	26	1.20	0.80	1.2	4.39	1.12	18	0.19	0.97	0.25	1.334	0.25	1.01
4	SM	4.5	1.5	5.3	1.86	9.77	5.60	9.77	12	26	1.01	0.85	1.2	4.39	1.12	15	0.16	0.96	0.26	1.334	0.22	**0.83**
5	SP-SM	6.0	1.5	6.8	1.89	12.76	7.12	11.14	15	7	0.95	0.95	1.2	0.12	1.01	13	0.14	0.95	0.27	1.334	0.19	**0.71**
6	SP-SM	7.5	1.5	8.3	1.89	15.59	8.48	12.50	17	7	0.89	0.95	1.2	0.12	1.01	14	0.15	0.94	0.27	1.334	0.20	**0.74**
7	SP-SM	9.0	1.5	9.8	1.89	18.43	9.84	13.87	19	9	0.85	0.95	1.2	0.56	1.02	15	0.16	0.91	0.27	1.334	0.22	**0.81**
8	SP-SM	10.0							18	9												



Conclusion: **Liquefaction susceptibility between 4.5 and 10.5 m depths**

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SITE PHOTOGRAPHS