FINAL REPORT

ON

GEO-TECHNICAL INVESTIGATION

FOR

PREPARATION OF MASTER PLAN AND DPR OF PALYUL PEMA TSOKEY LING MONESTARY

AT

SALLERI, SOLUKHUMBU, NEPAL

OCTOBER 2024

PREPARED BY: AGNI BORING AND SOIL TEST PVT. LTD.

CONSULTANT: GREEN DESIGN SOLUTION PVT. LTD., BANESHWOR, KATHMANDU

SUBMITTED TO: PALYUL PEMA TSOKEY LING MONESTARY

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1. INTRODUCTION

This report presents the result of geotechnical investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary at Salleri, Solukhumbu, Nepal. The investigation characterizes the subsurface conditions and develops the necessary requirement for the proposed safe bearing capacity of the foundation.

The soil investigation work was carried out on Kartik of 2081. The total quantity of soil investigation included three (3) trial pits, each of 3.0m as per understanding and requirement. The scope of work of present contract includes the following:

- Exploration of the subsurface conditions at various locations of proposed foundation sites and conduct requisite in-situ tests.
- Limited laboratory testing of representative samples obtained during the field investigation to evaluate relevant engineering parameters of the subsurface soils.
- Engineering analyses and Preparation of this report includes:
    - Trial pit logs
    - Results of in situ and laboratory test
    - Assessment of bearing capacity
    - Recommendations of foundation type and depth

2. COLLECTION AND REVIEW OF AVAILABLE DATA

Site conditions, topographical and geological characteristic of the project area was grasped sufficiently through collecting and reviewing previously conducted soil investigation reports of nearby corridors, topographical map and geological map. Information stored in the form of maps, tables and published papers are collected from various sources.

3. PLANNING OF WORKS

Work schedule, location of the trail pits and other project specific issues were identified on mutual understanding between Client's representative and soil investigating team during a desk study and field visit. Immediately after finalization of foundations at site, soil investigation team finalized the location of trial pits and revised methodology depending upon the changes on environment, geological and local conditions.

4. GEO-TECHNICAL EXPLORATION

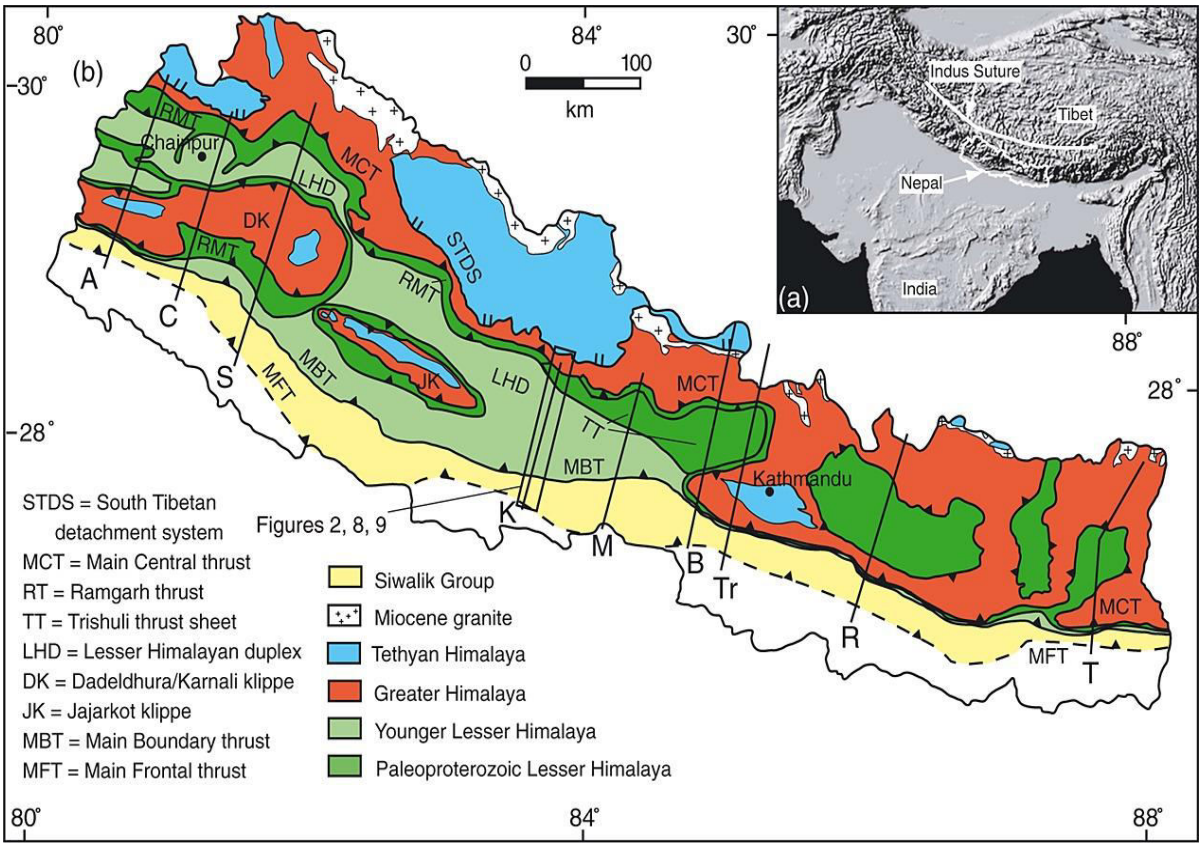

Figure 1: Geological map of Nepal

Geological condition/stratum at the test site is important aspect to determine the depth, size and types of foundation. Trial pits can define the characteristic and strength of soil and rock in both unstable and stable zones. Ground water table, cavities and changes in strata are major aspect of soil investigation.

The proposed location lies on light greyish silt with traces of clay followed by light greyish/brownish silt with few gravel, fine sand and traces of clay at greater depths. Safety mechanisms were developed for technical team & workers.

4.1.Trial Pit

Three trial pits were excavated of 1.5m length, 1.5m width and 3m depth.

4.2.Sampling

Samples were collected from the trial pit whenever there was change in strata. Changes in strata can be differentiated by soil composition, colour of soil, level of ground water table.

4.3.Field Observation

4.3.1. Ground water table monitoring

Water Table is defined as underground border between the grounds in which all spaces are filled with water and the ground above in which the spaces contain some air. The level of the water table tends to follow the shape of the overlying ground surface, rising under hills and dipping in valleys, but with a gentler slope than the ground. The level of the water table also varies with the climate, rising during rainy periods and falling during dry season. Ground water table during the excavation of the pit was not encountered so it water table at the site lies at not less than 3.0m from the natural ground level.

4.4.Laboratory Testing, Interpretations and Determination of Design Parameters

Disturbed and undisturbed samples are tested to get the physical characteristics and mechanical properties. To identify the properties, laboratory soil tests were performed.

4.4.1. Tests for determination of index properties

Standard laboratory tests were carried out to characterize the soil strata. The laboratory tests included the following: Grain Size Analysis, Natural Moisture Content, Bulk Density, and Specific Gravity. Depending upon the type of soil and the scope of works, type and number of the laboratory tests were determined in consultation with the Geotechnical Engineer. All the requisite laboratory tests were carried out in accordance with IS standard specifications mentioned as follows: Moisture Content-IS 2720: Part 2: 1973: Part 2; Grain Size Analysis-IS 2720: Part 4: 1985: Part I; Bulk Density Determination, Specific Gravity-IS 2720: Part 3: Sec 1: 1980: Part 3.

A. Grain Size Analysis

Equipment required:

- Set of sieves- 4.75mm, 2.36mm, 2mm, 1mm, 0.600mm, 0.425mm, 0.300mm, 0.150mm, 0.090mm, 0.075mm.
- Drying Oven
- Sieve shaker (Can do manually if unavailable)
- Plate/Tray
- Weighing Machine

- Hydrometer if clay present

Figure 2: Sieve Analysis

Procedure:

- The soil sample was sieved through a set of sieves to obtain grain size analysis as per IS 2720-4 (1985).
- 1kg of soil sample was taken and passed through 20mm of IS sieve in a tray weight of the sample was noted.
- Soil specimen was dried in drying oven for 24 hours.
- The sieves were arranged according to size
- Dried specimen was passed from tray to arranged sets of sieves.
- Sieve was shaken manually or to pass the soil from top to lower sieve.
- Retained soil sample at each sieve was weighed noted.
- Particle size distribution curve was plotted with the recorded data.

From the weight retained in individual sieve and cumulative weight retained, % passing from each sieve can be calculated form which the gradation curve is obtained. We can also then classify the soil as clay, silt, sand, gravel or any combination of these.

$$\text{Percentage retained} = \frac{\text{Weight retained on sieve}}{\text{Total weight of sample}} * 100$$

Percentage passing (%) = 100% - Cumulative percent retained

B. Specific Gravity

Figure 3: Specific Gravity Test

Equipment required:

- 4.75mm IS sieve
- Weighing machine
- Pycnometer
- Stirring rod
- Thermometer

Procedure-

- Specific gravity of the sample was determined following IS 2720-3-1 (1980).
- The dry weight of pycnometer was weighed.
- Some soil sample was taken and oven dried for 24 hours.
- The oven dried sample was sieved through 4.75mm IS sieve and 60gm of the dried sample

was taken.

- The soil was placed inside the pycnometer.
- After weighing, water was poured inside the pycnometer.
- The pycnometer was left as it is for 24 hours and the temperature of the pycnometer after 24 hours was measured and noted.
- The adjustment of temperature was done by adding hot or cold water according to the temperature of the water inside the pycnometer.
- The specific gravity was calculated with the various weights recorded of the soil, water and soil-water mix.
- At least three experiments were conducted which gave three values and average value of specific gravity was calculated.

Calculation:

$$\text{Specific Gravity} = \frac{W1 * G_w}{W1 - W3 + W2}$$

W1 = Weight of soil

W2 = Weight of pycnometer + Weight of water

W3 = Weight of pycnometer + Weight of water + Weight of soil

G_w = Specific Gravity of water

4.4.2. Mechanical Tests

Generally, some sets of soil samples were selected assuming similar in situ layers and conducted laboratory tests from each trial pits in order to discern the shear related strengths and stress-strain responses of soils. All the laboratory tests were numbered sequentially. The test number and the prefix were used as test and specimen identifiers.

A. Direct Shear Test

Direct shear tests were conducted on disturbed samples collected from the trial pits. Some of the samples obtained from the trial pits was used to carry out direct shear test. The samples were carefully extruded from the sampling tubes and molded using standard moulds of 6.0 x

6.0 cm^2 cross-sectional areas and trimmed to 2.5 cm high. Solid metal plates were placed on both surfaces of the samples to prevent the dissipation of pore water during shearing. The direct shear equipment is mechanically-operated, and shearing applied at constant strain rate. If the samples are cohesive they will be sheared at a relatively fast rate (duration of tests less than 10 minutes) to maintain un-drained condition. The samples were sheared at three different normal stresses.

5. SEISMICITY

Many earth scientists believe that longitudinally the entire 2,400 km long Himalayan arc can be segmented into different individual parts (200-300 km) which periodically break and move separately and produce mega earthquake (catastrophic earthquake) in the Himalayan region. From east to west, the great earthquake of Assam, India (1950), Shilong, India (1897), Nepal-Bihar, India (1934) and Kangra, India (1905) are the mega-earthquakes of the last century produced by the movements in different parts of the Himalayan arc, all with magnitude around 8.0.

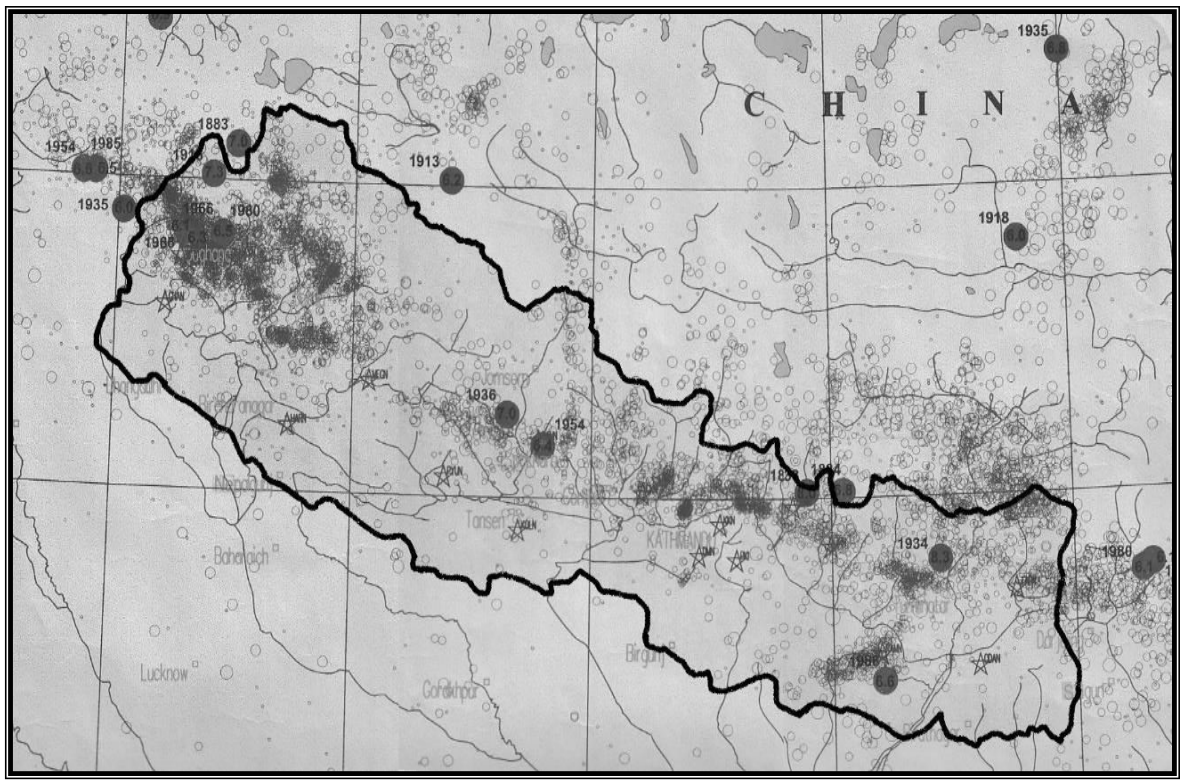

Figure 4: Historical events of Earthquakes (Source: Microseismic epicenter map of Nepal Himalaya and adjoining region, 1997 published by DoMG, GON).

When a sector of the Himalaya moves and produces earthquakes, it will take some time (from decades to century) to repeat the event at the same place. Nepal is prone to an earthquake of minor or major magnitude. Records of earthquakes since 1253 indicate that Nepal was hit by 16 major earthquakes - the 1833 (magnitude 7.9) and 1934(magnitude 8.3) are two of these which have occurred at an interval of 100 years. Statically, the earthquake occurrence data of the last century shows that in average Nepal was hit by a big earthquake in every 12 years

(Nakarmi, 1997).

Statistics shows that 1934 earthquake was the severest for Kathmandu valley where significant damages to the lives and properties were observed. Recently devastating earthquake in April 25th, 2015 causing significant damages to life and properties of the people. The frequency and intensity of earthquakes are found at the weakness of the crust such as major faults and major bends. Location of Nepal in the Himalaya along with major tectonic boundary and various longitudinal zones of the Himalaya is shown in Fig.5.

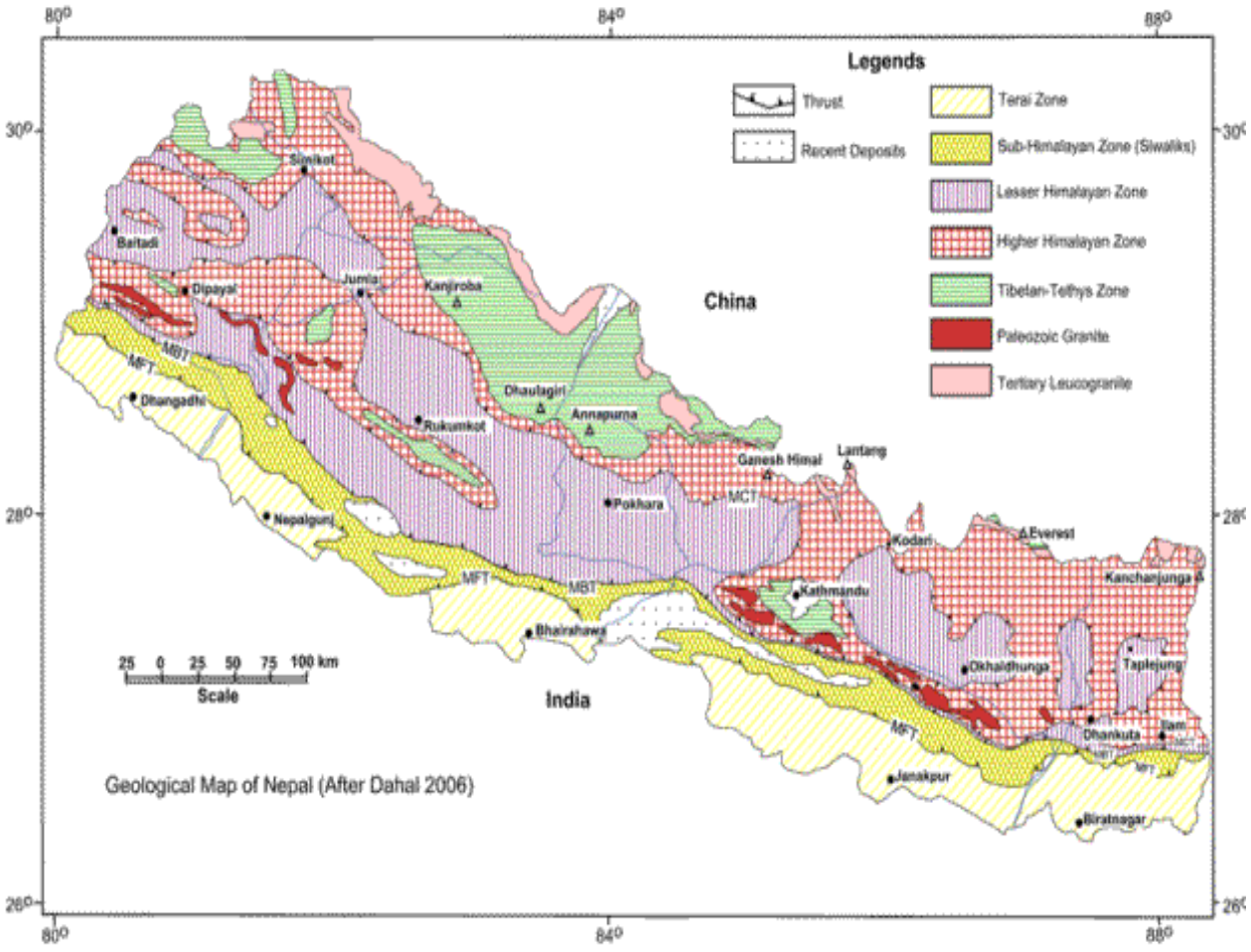

Figure 5: Geological map of Nepal (Dahal, 2006)

To counteract earthquake effect, due consideration has to be taken in the structural design of structures as per seismic design as provided by Building Code of Nepal. The project area is located in the area having Seismic Zoning Factor, Z = 1 according to the Seismic Hazard Map of Nepal prepared by National Seismological center, Departments of Mines and

Geology, Nepal.

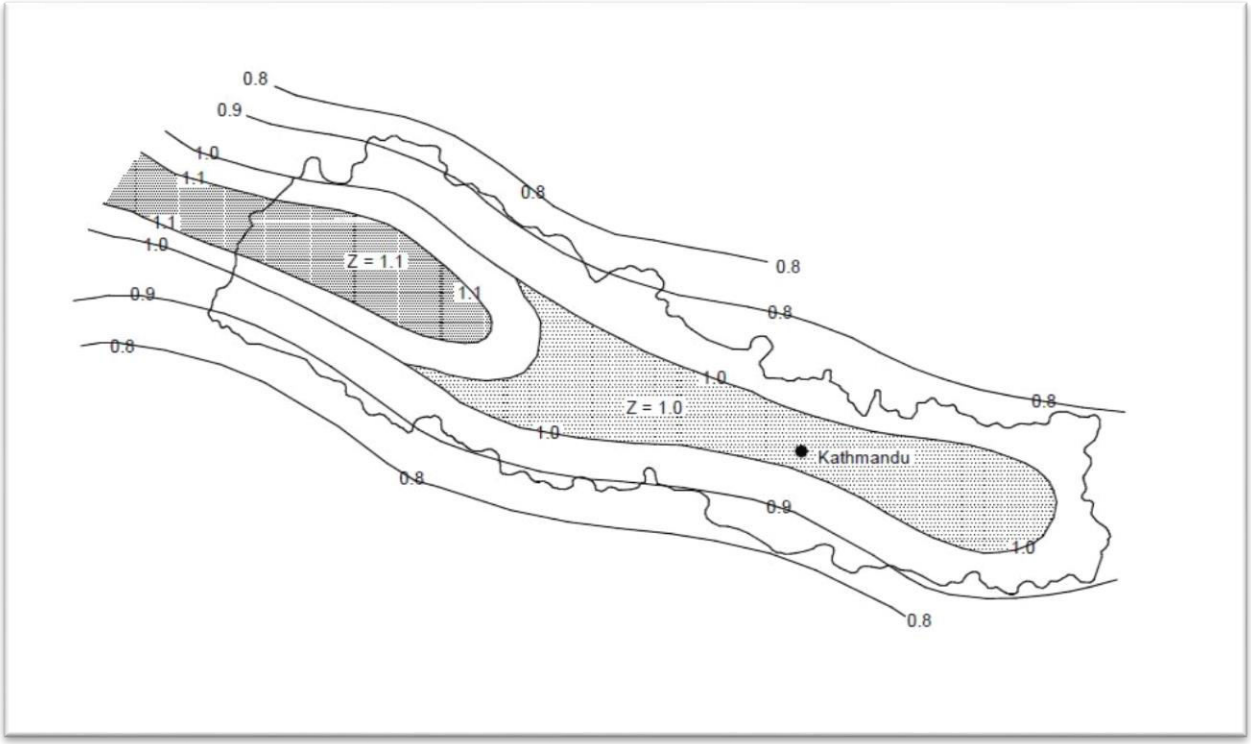

Fig. 7: Seismic Zoning Factor, Z

6. ANALYSIS OF ALLOWABLE BEARING PRESSURE

The allowable bearing pressure (qa) is the maximum pressure that can be imposed on the foundation soil taking into consideration the ultimate bearing capacity of the soil and the tolerable settlement of the structure. Analysis to determine the ultimate bearing capacity and the pressure corresponding to a specified maximum settlement were performed and the minimum pressure obtained from the two analyses were adopted as the allowable bearing pressure.

6.1. Allowable Bearing Capacity from Shear Failure Criteria

The bearing capacity analysis has been carried out for foundation soil. The bearing capacity analysis was carried out based on the results of SPT N-value. The so adopted N-value is the average value beneath each point between level of the base of the footing and the depth equal to 2 times the width of the foundation. In computing the average any individual value more than 50 percent greater than the average was neglected, but the values for all loose seams if encountered was included. (IS 6403:1981) The well-known Indian Standard (IS 6403:1981) has

been used to compute bearing capacity of soil on the basis of shear failure criteria. Different depths and widths of foundation are used in the analysis.

$$q_a = \left[cN_c s_c d_c i_c \; + \; q(N_q - 1)s_q d_q i_q + 0.5B\gamma N_\gamma s_\gamma d_\gamma i_\gamma W'\right]/FOS$$

Where: q_a = net allowable bearing pressure, t/m^2,

C = cohesion in t/m^2

N_c, N_q, N_γ = Bearing capacity factors

s_c, s_q, s_γ = Shape factors,

d_c, d_q, d_γ= Depths factors,

i_c, i_q, i_γ = Inclination factors

q = Effective surcharge at the base level of foundation in t/m^2

B = Width of footing in m,

γ = Bulk unit weight of soil sample in t/m^3

W' = Correction factor for location of water table

The values of N_c, N_q and N_γ may be obtained from the table below:

Table 1: Bearing Capacity Factor

Angle of friction Ø (degree)	N_c	N_q	N_Γ
0	5.14	1	0
5	6.49	1.57	0.45
10	8.35	2.47	1.22
15	10.98	3.94	2.65
20	14.83	6.4	5.39
25	20.72	10.66	10.88
30	30.14	18.4	22.4
35	46.12	33.3	48.03
40	75.31	64.2	109.41
45	138.88	134.88	271.76
50	266.89	319.07	762.89

The values of s_c, s_q, s_γ may be obtained from Table 2.

Table 2: Shape Factors

Shape of Footing	S_c	S_q	S_γ
Square	As per IS 6403:1981 recommendation		

The depth factors shall be as

d_c,= 1+0.2 $D_f/B\sqrt{N_Ø}$

d_q,= $d_ſ$ = 1 for Ø<10°

d_q,= $d_Ɣ$= 1+0.1 $D_f/B\sqrt{N_Ø}$ for Ø>10°

The inclination factor shall be as under

i_c =i_q = $(1-α/90)^2$

$i_Ɣ$ = $(1-α/Ø)^2$

W' (effect of water table)

If water table is likely to permanently remains at or below a depth of (D_f+B) beneath the ground level surrounding the footing then W' = 1.

If the water table is located at depth $D_f$or likely to rise to the base of the footing or above then the value of W' shall be taken as 0.5.

If the water table is likely to permanently got located at depth $D_f<D_w<(D_f+B)$, then the value of W' be obtained by linear interpolation.

6.2. Permissible Settlement

Permissible settlement has been selected considering IS 1904 (1968). In our analysis, for isolated footing, permissible settlement of 25mm is used and for raft foundation, permissible settlement of 40mm is used.

Table 3: Permissible Settlement

	Isolated Footing		Raft foundation	
	Clay	Sand	Clay	Sand
Maximum Settlement, mm	75	50	100	75

6.3. Determination of Subgrade Modulus

The modulus of subgrade reaction is a conceptual relationship between pressure and deflection. It is defined as the ratio between the soil pressure and the corresponding settlement. Subgrade Reaction Modulus (Ks) required for design of open foundation in different trial pit areas at different depths can be calculated from formula below:

Subgrade Reaction Modulus in kN/m^3= Allowable bearing Capacity at that depth in kN/m^2* Factor of Safety/ Permissible Deflection in m.

General Assumption

- Each stratum was considered as a combination of different heterogeneous layer, so maximum thickness considered for unique soil properties was limited to 1.5 m otherwise as tested.
- In between two tested samples, properties of soil in middle sections were interpolated as relevancy of data.

Design data were interpolated between semi empirical data form field test and lab test results. Some of input and output data were refined as per relevancy with correlated data.

Bearing Capacity of soil (Shear criteria) - IS 6403 (1981)

Project: Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary
Client: Palyul Pema Tsokey Ling
Location: Salleri, Solukhumbu
Width of Foundation (B): 3.00 m
Length of Foundation (L) 3.00 m

Depth of water table : 0.00 m

Depth of Footing, m	Angle of Internal friction (Φ)	Cohesion	Unit weight of soil, kN/m^3	Effective surcharge at base of footing, kN/m^2	Nphi	Nc	Nq	Ny	Sc	Sq	Sy	dc	dq	dy	Water Table correction	Net Ultimate bearing Capacity (q_{nu}), kN/m^2	Net safe bearing Capacity (q_{ns}), kN/m^2	Settlement Criteria	Allowable Bearing Capacity (kN/m^2)
1.00	27	3	17.20	7.39	0.07	25.43	14.53	16.64	1.30	1.20	0.80	1.02	1.01	1.01	0.50	411.94	137.31	266.27	137.31
1.50	27	3	17.20	11.09	0.07	25.43	14.53	16.64	1.30	1.20	0.80	1.03	1.01	1.01	0.50	474.97	158.32	279.46	158.32
2.00	27	3	17.20	14.78	0.07	25.43	14.53	16.64	1.30	1.20	0.80	1.03	1.02	1.02	0.50	538.52	179.51	292.66	179.51
2.50	27	3	17.20	18.48	0.07	25.43	14.53	16.64	1.30	1.20	0.80	1.04	1.02	1.02	0.50	602.58	200.86	305.85	200.86
3.00	27	3	17.20	22.17	0.07	25.43	14.53	16.64	1.30	1.20	0.80	1.05	1.03	1.03	0.50	667.17	222.39	319.04	222.39
3.50	27	3	17.20	25.87	0.07	25.43	14.53	16.64	1.30	1.20	0.80	1.06	1.03	1.03	0.50	732.27	244.09	319.04	244.09
4.00	27	3	17.20	29.56	0.07	25.43	14.53	16.64	1.30	1.20	0.80	1.07	1.03	1.03	0.50	797.90	265.97	319.04	265.97
4.50	27	3	17.20	33.26	0.07	25.43	14.53	16.64	1.30	1.20	0.80	1.08	1.04	1.04	0.50	864.04	288.01	319.04	288.01
5.00	27	3	17.20	36.95	0.07	25.43	14.53	16.64	1.30	1.20	0.80	1.09	1.04	1.04	0.50	930.70	310.23	319.04	310.23
5.50	27	3	17.20	40.65	0.07	25.43	14.53	16.64	1.30	1.20	0.80	1.10	1.05	1.05	0.50	997.87	332.62	319.04	319.04

ALLOWABLE BEARING CAPACITY OF FOUNDATION AT PROPOSED SITE						
Depth of footing, m	Gross Allowable Bearing Capacity, kN/m^2	Net Allowable Bearing Capacity, kN/m^2	Gross Allowable Bearing Capacity, kN/m^2	Net Allowable Bearing Capacity, kN/m^2	Gross Allowable Bearing Capacity, kN/m^2	Net Allowable Bearing Capacity, kN/m^2
	Width of Square Footing, m		Width of Square Footing, m		Width of Square Footing, m	
	1.5		2.0		2.5	
1	126.9	109.7	135.9	118.7	145.2	128.0
1.5	157.3	131.5	165.9	140.1	174.9	149.1
2	188.0	153.6	196.2	161.8	204.9	170.5
2.5	219.1	176.1	226.7	183.7	235.1	192.1
3	250.5	198.9	257.5	205.9	265.5	213.9
	Width of Square Footing, m		Width of Square Footing, m		Width of Square Footing, m	
	3.0		3.5		4.0	
1	154.5	137.3	163.9	146.7	173.3	156.1
1.5	184.1	158.3	193.4	167.6	202.8	177.0
2	213.9	179.5	223.1	188.7	232.3	197.9
2.5	243.9	200.9	252.9	209.9	262.0	219.0
3	274.0	222.4	282.8	231.2	291.8	240.2
	Width of Square Footing, m		Width of Square Footing, m		Width of Square Footing, m	
	5.0		6.0		7.0	
1	192.3	175.1	211.2	194.0	230.3	213.1
1.5	221.6	195.8	240.5	214.7	259.4	233.6
2	251.0	216.6	269.8	235.4	288.7	254.3
2.5	280.5	237.5	299.2	256.2	318.0	275.0
3	310.1	258.5	328.7	277.1	347.4	295.8

7. CONCLUSION AND RECOMMENDATION

Based on the analysis, the following recommendations are made.

- Isolated footing was analyzed for allowable bearing capacity at various depths for 25mm permissible settlement. Raft foundation was analyzed for allowable bearing capacity at various depths for 40mm permissible settlement. Designer have to consider appropriate values and capacities on different foundation as there is changes on soil strata, which may cause differential settlement in long run.

  ❖ Refer Page 15 – for more details

- Subgrade Reaction Modulus (Ks) required for design of open foundation in different trial pit areas at different depths can be calculated from formula below:
  Subgrade Reaction Modulus in kN/m^3= Allowable bearing Capacity at that depth in kN/m^2* Factor of Safety/ Permissible Deflection in m.
  For example, at depth 1.5m and size 3 m * 3 m of foundation size, subgrade reaction modulus = 158.3*3/ (0.025) = 18996 kN/m^3
- The slope of the excavation should be maintained at about 45° to prevent the slope from collapsing during excavation or construction period.
- The foundation Design Engineer needs not strictly follow the depth and dimension of foundation selected in the bearing capacity analysis of this report. Designer is free to select any other foundation dimension and depth depending upon the load of the structure. Allowable bearing capacity depends on many variables such as adopted allowable settlement, type of foundation, size and depth of foundation, importance of structure, cost of the project, topographical, hydrological characteristics of river etc. Therefore once the size and depth of the foundation is finalized the calculation may need to be refined during design phase based on the parameters obtained from this investigation.

Important Notes;

- The recommendations and discussions presented in this report are based on the sub-surface conditions encountered during the site work at the time of investigation and on the result of the field and laboratory testing on samples obtained from three trial pits.

There may be, however, conditions pertaining to the site which have not been into account due to the limitation in geotechnical exploration.

- If filling ground is observed during the construction, the foundation should be placed below the filling ground to reduce the uneven settlements.
- It is recommended that proper and efficient surface drainage be provided at the location of the structures both during and after construction. Surface water should be directed away from the edges of the excavation.

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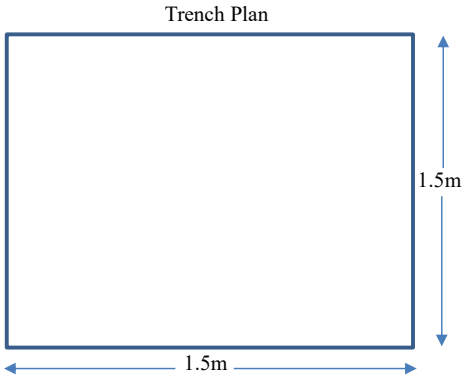
APPENDIX

BOREHOLE LOG DATA

TRIAL PIT LOG

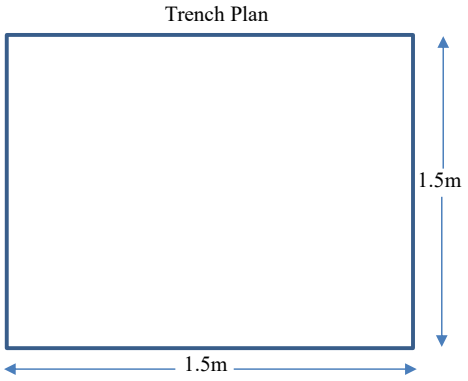
Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary
Hole No.:- 1
Client : Palyul Pema Tsokey Ling
Ground water: Not encountered
Location : Salleri, Solukhumbu
Consultant : Green Design Solution Pvt. Ltd., Baneshwor, Kathmandu
Prepared by : Agni Boring and Soil Test Pvt. Ltd.

Soil Description	Symbol	Depth, m
Light greyish silt with traces of clay		- 0.5
Light greyish silt with few gravel, fine sand and traces of clay		- 1.0 - 1.5 - 2.0
Light brownish silt with few gravel, fine sand and traces of clay		- 2.5 - 3.0



Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary
Hole No.:- 2
Client : Palyul Pema Tsokey Ling
Ground water: Not encountered
Location : Salleri, Solukhumbu
Consultant : Green Design Solution Pvt. Ltd., Baneshwor, Kathmandu
Prepared by : Agni Boring and Soil Test Pvt. Ltd.

Soil Description	Symbol	Depth, m
Light greyish silt with traces of clay		- 0.5
Light greyish silt with few gravel, fine sand and traces of clay		- 1.0 - 1.5 - 2.0
Light brownish silt with few gravel, fine sand and traces of clay		- 2.5 - 3.0



Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary
Hole No.:- 3
Client : Palyul Pema Tsokey Ling
Ground water: Not encountered
Location : Salleri, Solukhumbu
Consultant : Green Design Solution Pvt. Ltd., Baneshwor, Kathmandu
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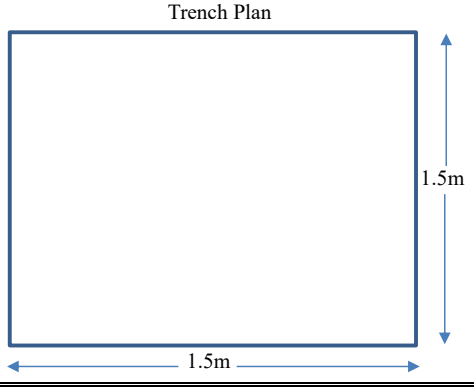
Light greyish silt with few gravel, fine sand and traces of clay		- 1.0 - 1.5 - 2.0
Light brownish silt with few gravel, fine sand and traces of clay		- 2.5 - 3.0



LABORATORY TEST DATA

BULK DENSITY DETERMINATION

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary
Client : Palyul Pema Tsokey Ling
Prepared by : Agni Boring and Soil Test Pvt. Ltd.

Depth, m	Weight of mould+wet sample, gm	Weight of mould, gm	Weight of sample, gm	Volume, cm^3	Bulk Density, gm/cm^3
Trail Pit-1					
0-0.5	1005.5	431	574.5	333.28	1.72
0.5-2.0	1193	431.6	761.4	439.64	1.73
2.0-3.0	1217.5	431.5	786.0	436.1	1.80
Trial Pit-2					
0-0.5	988.7	420.2	568.5	330.6	1.72
0.5-2.0	1177.62	428.5	749.1	436.8	1.72
2.0-3.0	1186.55	430	756.6	432.5	1.75
Trial Pit-3					
0-0.5	1022.4	464.7	557.7	322.4	1.73
0.5-2.0	1156.5	482.5	674.0	385.4	1.75
2.0-3.0	1322.4	500.2	822.2	458.7	1.79

NATURAL MOISTURE CONTENT

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary
Client : Palyul Pema Tsokey Ling
Prepared by : Agni Boring and Soil Test Pvt. Ltd.

Depth, m	Wt. of Cont. + Wet Soil (gm)	Wt. of Cont. + Dry Soil (gm)	Wt. of Water (gm)	Wt. of Empty Container (gm)	Wt. of Dry Soil (gm)	Moisture Content (%)
Trial Pit-1						
0-0.5	712.00	641.00	71.00	74.60	566.40	12.54
0.5-2.0	825.00	742.00	83.00	73.00	669.00	12.41
2.0-3.0	668.00	602.00	66.00	70.40	531.60	12.42
Trial Pit-2						
0-0.5	732.20	650.10	82.10	76.50	573.60	14.31
0.5-2.0	848.50	746.50	102.00	75.20	671.30	15.19
2.0-3.0	691.00	606.10	84.90	70.50	535.60	15.85
Trial Pit-3						
0-0.5	714.50	647.80	66.70	75.20	572.60	11.65
0.5-2.0	830.50	745.80	84.70	71.20	674.60	12.56
2.0-3.0	673.50	597.80	75.70	75.40	522.40	14.49

SPECIFIC GRAVITY TEST

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary

Client : Palyul Pema Tsokey Ling

Prepared by : Agni Boring and Soil Test Pvt. Ltd.

		BH-1			BH-2			BH-3		
Depth, m		0-0.5	0.5-2.0	2.0-3.0	0-0.5	0.5-2.0	2.0-3.0	0-0.5	0.5-2.0	2.0-3.0
Wt. Pycnometer + Water + Soil	gm	216.62	217.15	217.34	216.60	217.05	217.27	216.75	217.15	216.80
Temperature	°C	27	27	27	26	26	26	27	27	27
Wt. Pycnometer + Water	gm	185.5	185.9	186.1	185.5	185.9	186.1	185.6	186	185.6
Wt. Pycnometer + Dry Soil	gm	31.12	31.25	31.24	37.17	37.47	37.13	31.15	31.15	31.2
Wt. Soil	gm	50	50	50	50	50	50	50	50	50
Specific Gravity of Water		0.9965	0.9965	0.9965	0.9968	0.9968	0.9968	0.9965	0.9965	0.9965
Specific Gravity of Soil		**2.639**	**2.657**	**2.656**	**2.637**	**2.644**	**2.647**	**2.643**	**2.643**	**2.650**

GRAIN SIZE ANALYSIS

Test Metho : IS: 2720 (Part 4) - 1985

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary

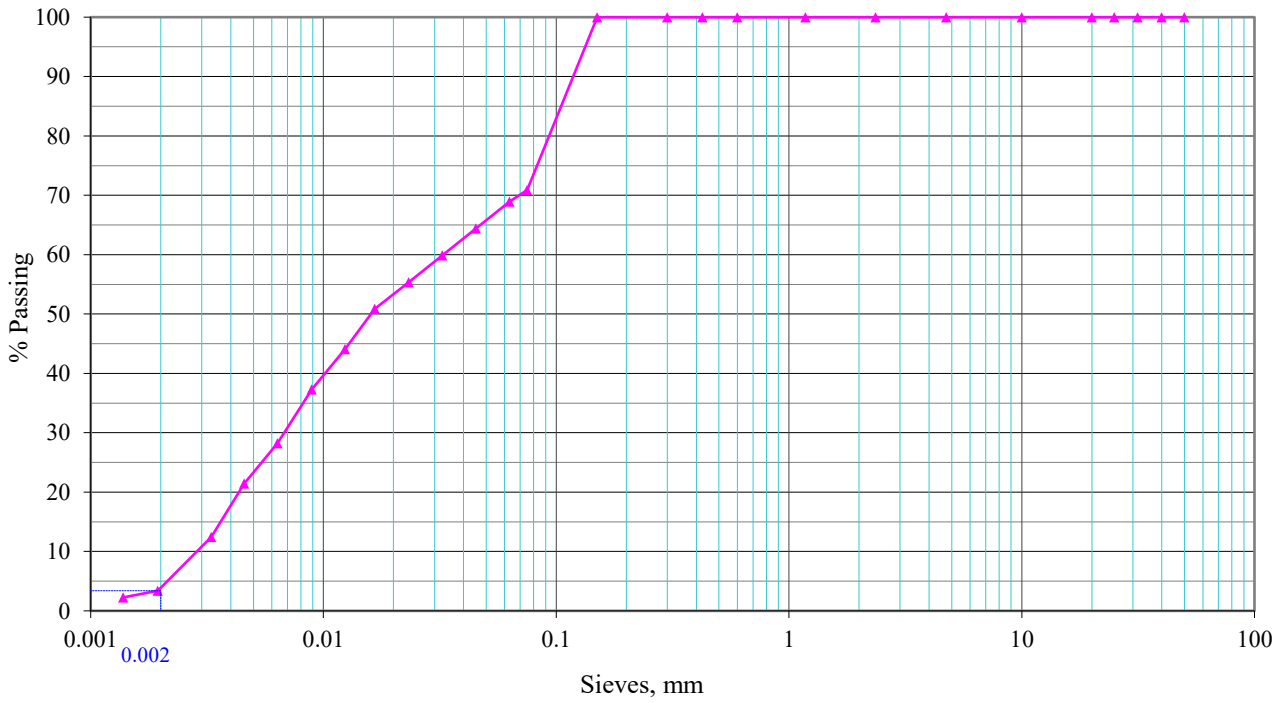
Borehole: **BH-1**

Client : Palyul Pema Tsokey Ling

Prepared by : Agni Boring and Soil Test Pvt. Ltd.

Depth m: 0-0.5

Sieve	% Passing
50.000 mm	100.00
40.000 mm	100.00
31.500 mm	100.00
25.000 mm	100.00
20.000 mm	100.00
10.000 mm	100.00
4.750 mm	100.00
2.360 mm	100.00
1.180 mm	100.00
0.600 mm	100.00
0.425 mm	100.00
0.300 mm	100.00
0.150 mm	100.00
0.075 mm	70.89
0.063 mm	68.94
0.045 mm	64.42
0.032 mm	59.90
0.023 mm	55.38
0.017 mm	50.86
0.012 mm	44.07
0.009 mm	37.29
0.006 mm	28.25
0.005 mm	21.47
0.003 mm	12.43
0.002 mm	3.39
0.001 mm	2.26



CLAY	SILT	SAND	GRAVEL
3.4 %	67.50 %	29.1 %	0.0 %

GRAIN SIZE ANALYSIS

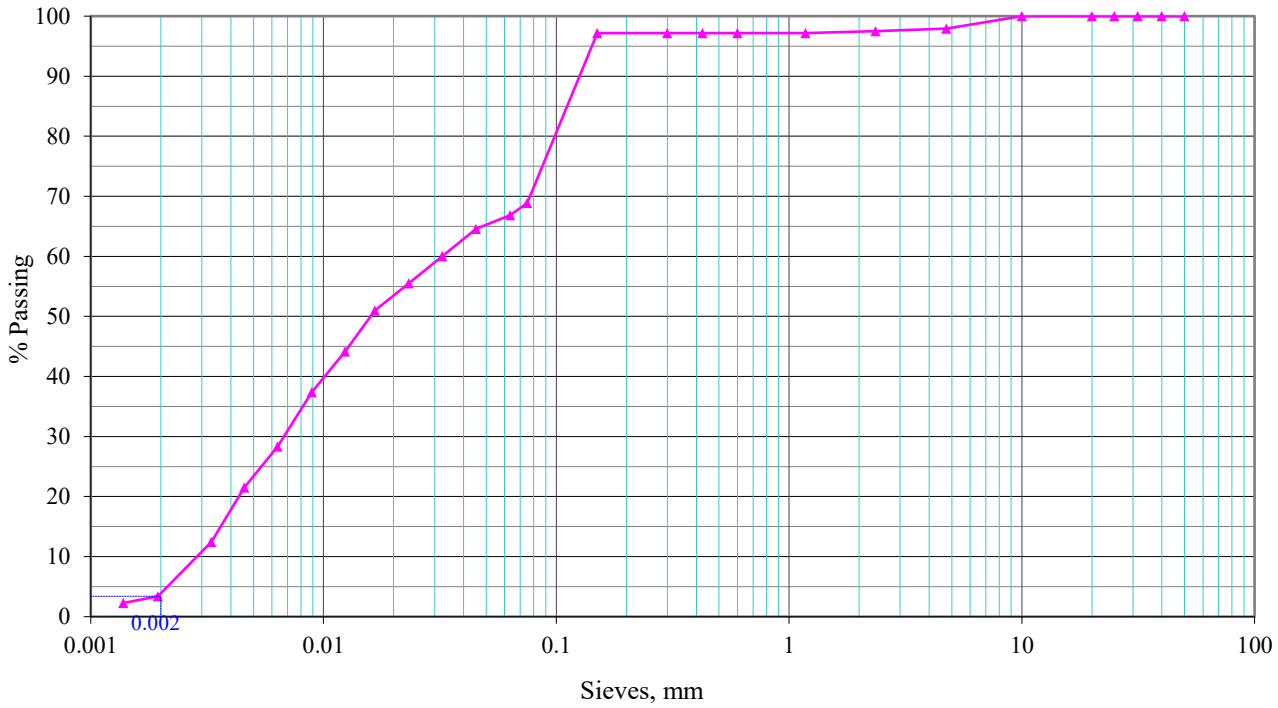
Test Metho : IS: 2720 (Part 4) - 1985

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Borehole: **BH-1**

Client : Palyul Pema Tsokey Ling

Prepared by : Agni Boring and Soil Test Pvt. Ltd. Depth m: 0.5-2.0

Sieve	% Passing
50.000 mm	100.00
40.000 mm	100.00
31.500 mm	100.00
25.000 mm	100.00
20.000 mm	100.00
10.000 mm	100.00
4.750 mm	97.94
2.360 mm	97.48
1.180 mm	97.18
0.600 mm	97.18
0.425 mm	97.18
0.300 mm	97.18
0.150 mm	97.18
0.075 mm	68.89
0.063 mm	66.83
0.045 mm	64.57
0.032 mm	60.04
0.023 mm	55.51
0.017 mm	50.98
0.012 mm	44.18
0.009 mm	37.38
0.006 mm	28.32
0.005 mm	21.52
0.003 mm	12.46
0.002 mm	3.40
0.001 mm	2.27



CLAY	SILT	SAND	GRAVEL
3.4 %	65.49 %	29.1 %	2.1 %

GRAIN SIZE ANALYSIS

Test Metho : IS: 2720 (Part 4) - 1985

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling

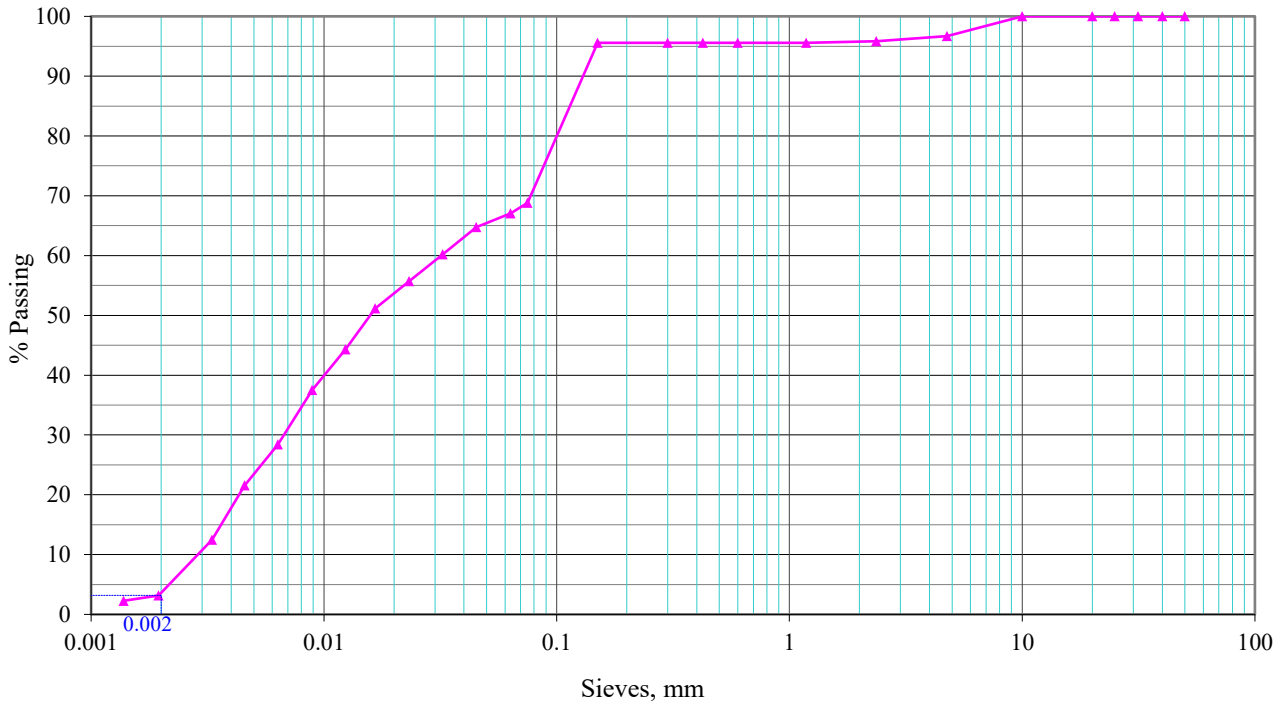
Borehole: **BH-1**

Client : Palyul Pema Tsokey Ling

Prepared by : Agni Boring and Soil Test Pvt. Ltd.

Depth m: 2.0-3.0

Sieve	% Passing
50.000 mm	100.00
40.000 mm	100.00
31.500 mm	100.00
25.000 mm	100.00
20.000 mm	100.00
10.000 mm	100.00
4.750 mm	96.69
2.360 mm	95.85
1.180 mm	95.54
0.600 mm	95.54
0.425 mm	95.54
0.300 mm	95.54
0.150 mm	95.54
0.075 mm	68.81
0.063 mm	67.05
0.045 mm	64.78
0.032 mm	60.23
0.023 mm	55.68
0.017 mm	51.14
0.012 mm	44.32
0.009 mm	37.50
0.006 mm	28.41
0.005 mm	21.59
0.003 mm	12.50
0.002 mm	3.18
0.001 mm	2.27



CLAY	SILT	SAND	GRAVEL
3.2 %	65.63 %	27.9 %	3.3 %

GRAIN SIZE ANALYSIS

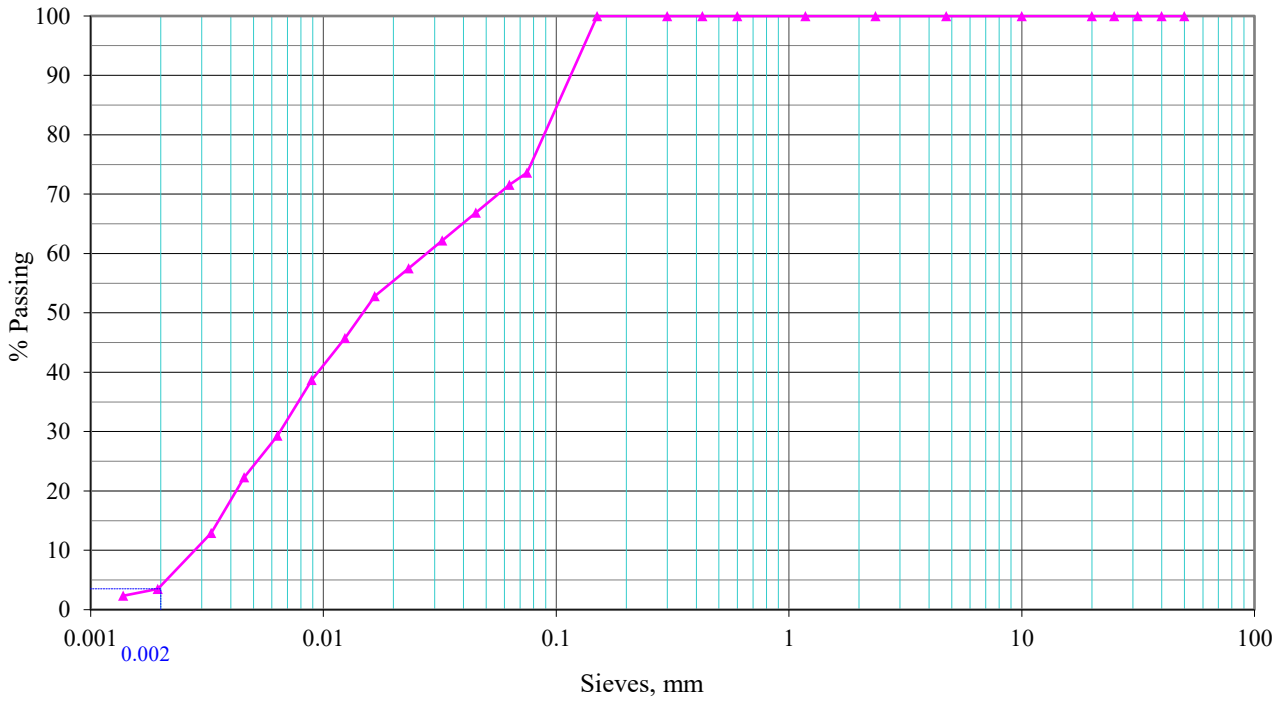
Test Metho : IS: 2720 (Part 4) - 1985

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Borehole: **BH-2**

Client : Palyul Pema Tsokey Ling

Prepared by : Agni Boring and Soil Test Pvt. Ltd. Depth m: 0-0.5

Sieve	% Passing
50.000 mm	100.00
40.000 mm	100.00
31.500 mm	100.00
25.000 mm	100.00
20.000 mm	100.00
10.000 mm	100.00
4.750 mm	100.00
2.360 mm	100.00
1.180 mm	100.00
0.600 mm	100.00
0.425 mm	100.00
0.300 mm	100.00
0.150 mm	100.00
0.075 mm	73.60
0.063 mm	71.58
0.045 mm	66.88
0.032 mm	62.19
0.023 mm	57.50
0.017 mm	52.80
0.012 mm	45.76
0.009 mm	38.72
0.006 mm	29.33
0.005 mm	22.29
0.003 mm	12.91
0.002 mm	3.52
0.001 mm	2.35



CLAY	SILT	SAND	GRAVEL
3.5 %	70.08 %	26.4 %	0.0 %

GRAIN SIZE ANALYSIS

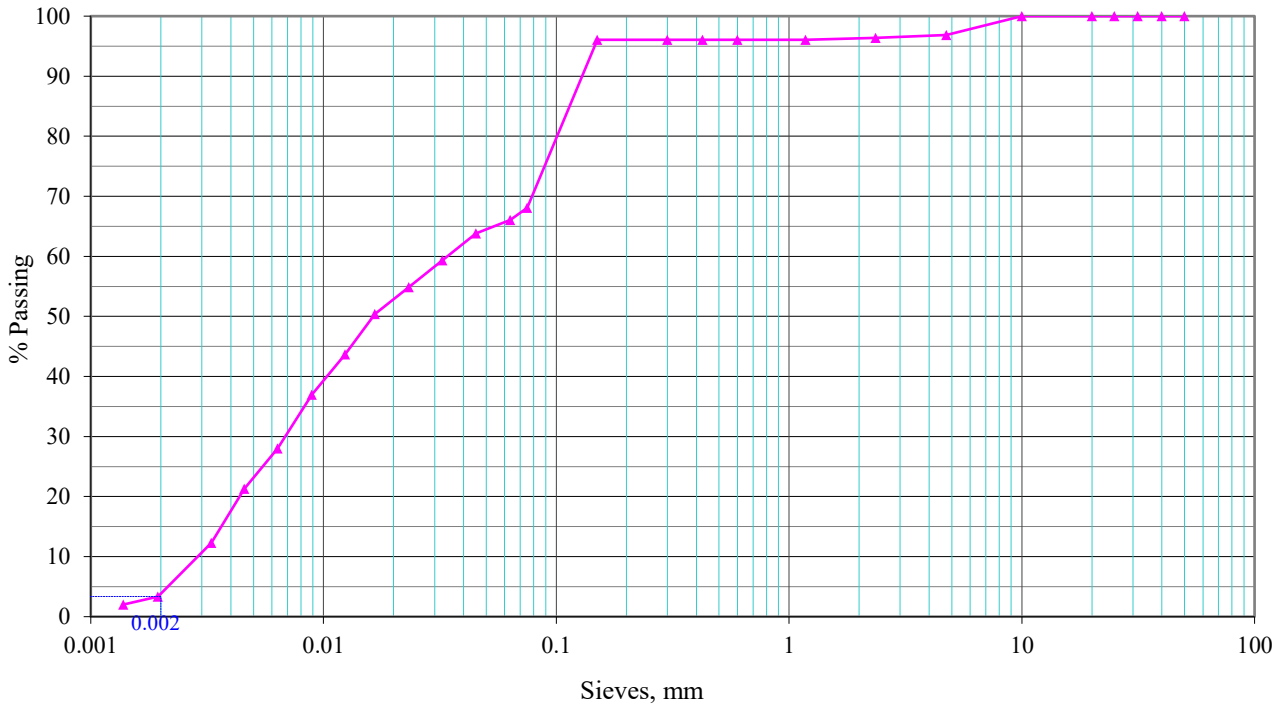
Test Metho : IS: 2720 (Part 4) - 1985

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Borehole: **BH-2**

Client : Palyul Pema Tsokey Ling

Prepared by : Agni Boring and Soil Test Pvt. Ltd. Depth m: 0.5-2.0

Sieve	% Passing
50.000 mm	100.00
40.000 mm	100.00
31.500 mm	100.00
25.000 mm	100.00
20.000 mm	100.00
10.000 mm	100.00
4.750 mm	96.83
2.360 mm	96.38
1.180 mm	96.08
0.600 mm	96.08
0.425 mm	96.08
0.300 mm	96.08
0.150 mm	96.08
0.075 mm	68.11
0.063 mm	66.08
0.045 mm	63.84
0.032 mm	59.36
0.023 mm	54.88
0.017 mm	50.40
0.012 mm	43.68
0.009 mm	36.96
0.006 mm	28.00
0.005 mm	21.28
0.003 mm	12.32
0.002 mm	3.36
0.001 mm	2.02



CLAY	SILT	SAND	GRAVEL
3.4 %	64.75 %	28.7 %	3.2 %

GRAIN SIZE ANALYSIS

Test Metho : IS: 2720 (Part 4) - 1985

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling

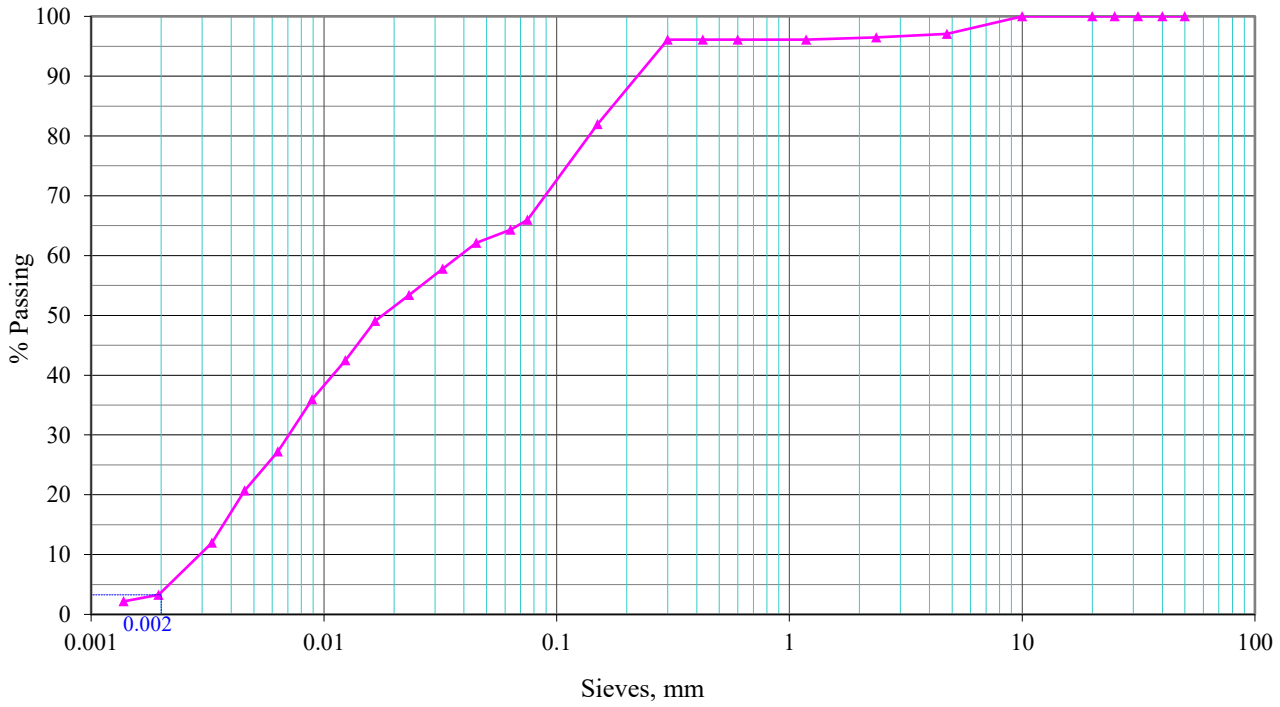
Borehole: **BH-2**

Client : Palyul Pema Tsokey Ling

Prepared by : Agni Boring and Soil Test Pvt. Ltd.

Depth m: 2.0-3.0

Sieve	% Passing
50.000 mm	100.00
40.000 mm	100.00
31.500 mm	100.00
25.000 mm	100.00
20.000 mm	100.00
10.000 mm	100.00
4.750 mm	97.05
2.360 mm	96.46
1.180 mm	96.10
0.600 mm	96.10
0.425 mm	96.10
0.300 mm	96.10
0.150 mm	82.01
0.075 mm	66.00
0.063 mm	64.31
0.045 mm	62.13
0.032 mm	57.77
0.023 mm	53.41
0.017 mm	49.05
0.012 mm	42.51
0.009 mm	35.97
0.006 mm	27.25
0.005 mm	20.71
0.003 mm	11.99
0.002 mm	3.27
0.001 mm	2.18



CLAY	SILT	SAND	GRAVEL
3.3 %	62.73 %	31.1 %	2.9 %

GRAIN SIZE ANALYSIS

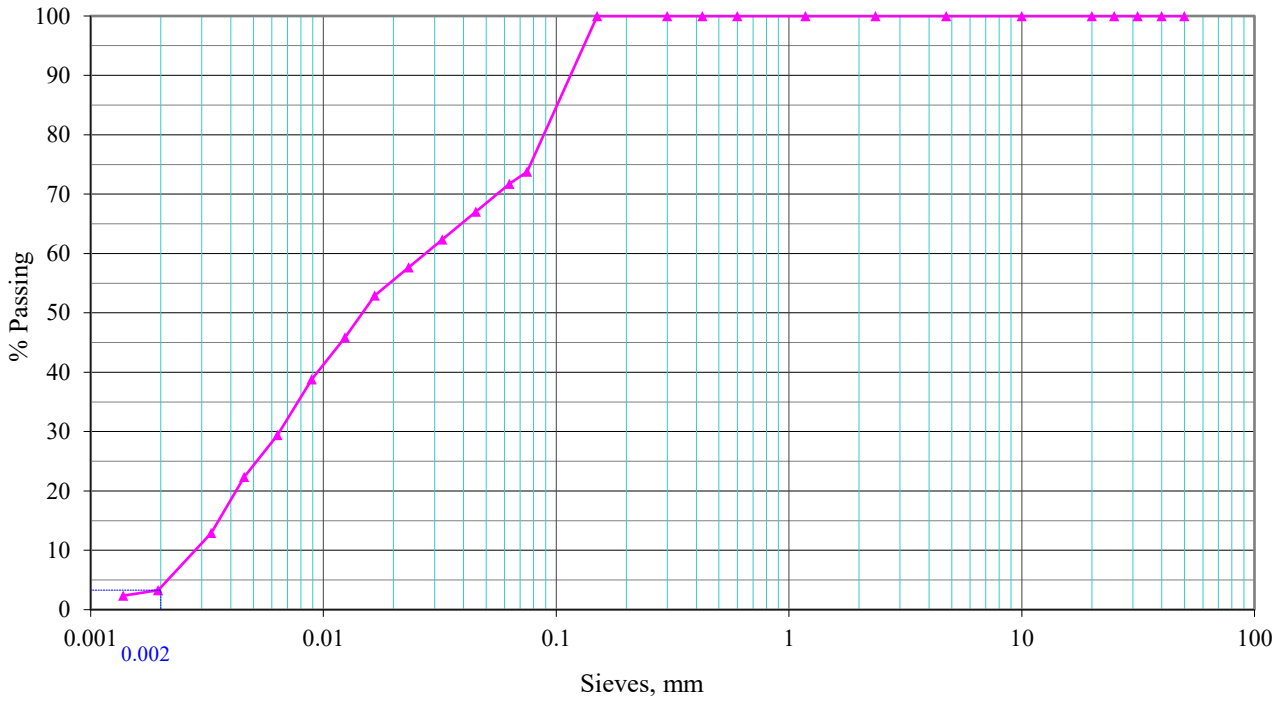
Test Metho : IS: 2720 (Part 4) - 1985

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Borehole: **BH-3**

Client : Palyul Pema Tsokey Ling

Prepared by : Agni Boring and Soil Test Pvt. Ltd. Depth m: 0-0.5

Sieve	% Passing
50.000 mm	100.00
40.000 mm	100.00
31.500 mm	100.00
25.000 mm	100.00
20.000 mm	100.00
10.000 mm	100.00
4.750 mm	100.00
2.360 mm	100.00
1.180 mm	100.00
0.600 mm	100.00
0.425 mm	100.00
0.300 mm	100.00
0.150 mm	100.00
0.075 mm	73.80
0.063 mm	71.76
0.045 mm	67.06
0.032 mm	62.35
0.023 mm	57.65
0.017 mm	52.94
0.012 mm	45.88
0.009 mm	38.82
0.006 mm	29.41
0.005 mm	22.35
0.003 mm	12.94
0.002 mm	3.29
0.001 mm	2.35



CLAY	SILT	SAND	GRAVEL
3.3 %	70.50 %	26.2 %	0.0 %

GRAIN SIZE ANALYSIS

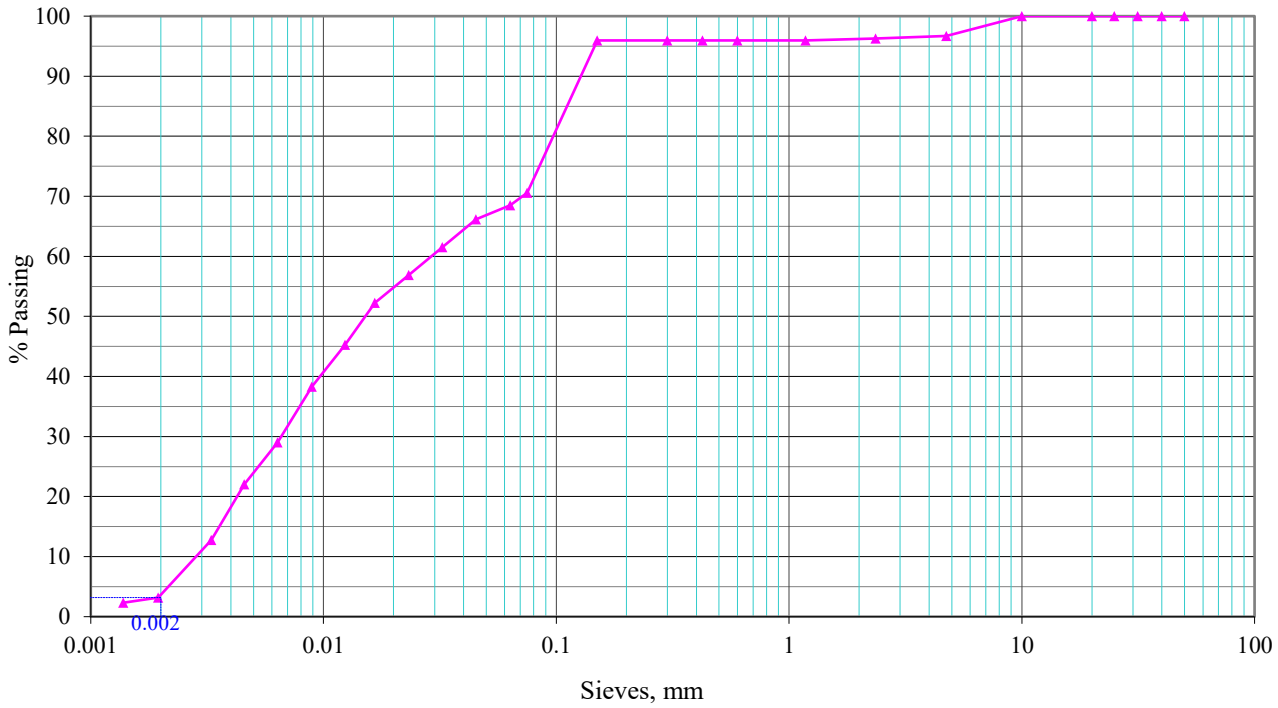
Test Metho : IS: 2720 (Part 4) - 1985

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Borehole: **BH-3**

Client : Palyul Pema Tsokey Ling

Prepared by : Agni Boring and Soil Test Pvt. Ltd. Depth m: 0.5-2.0

Sieve	% Passing
50.000 mm	100.00
40.000 mm	100.00
31.500 mm	100.00
25.000 mm	100.00
20.000 mm	100.00
10.000 mm	100.00
4.750 mm	96.72
2.360 mm	96.25
1.180 mm	95.94
0.600 mm	95.94
0.425 mm	95.94
0.300 mm	95.94
0.150 mm	95.94
0.075 mm	70.61
0.063 mm	68.51
0.045 mm	66.18
0.032 mm	61.54
0.023 mm	56.89
0.017 mm	52.25
0.012 mm	45.28
0.009 mm	38.32
0.006 mm	29.03
0.005 mm	22.06
0.003 mm	12.77
0.002 mm	3.18
0.001 mm	2.32



CLAY	SILT	SAND	GRAVEL
3.2 %	67.43 %	26.1 %	3.3 %

GRAIN SIZE ANALYSIS

Test Metho : IS: 2720 (Part 4) - 1985

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling

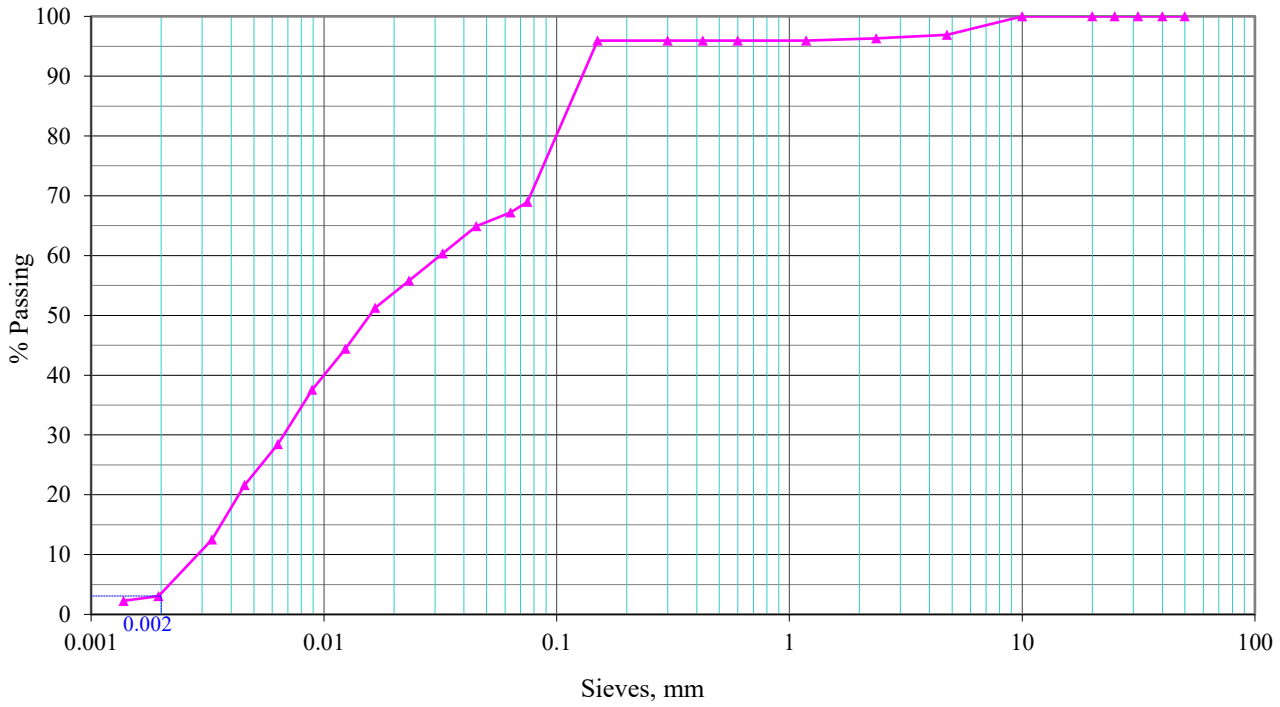
Borehole: **BH-3**

Client : Palyul Pema Tsokey Ling

Prepared by : Agni Boring and Soil Test Pvt. Ltd.

Depth m: 2.0-3.0

Sieve	% Passing
50.000 mm	100.00
40.000 mm	100.00
31.500 mm	100.00
25.000 mm	100.00
20.000 mm	100.00
10.000 mm	100.00
4.750 mm	96.92
2.360 mm	96.30
1.180 mm	95.92
0.600 mm	95.92
0.425 mm	95.92
0.300 mm	95.92
0.150 mm	95.92
0.075 mm	68.97
0.063 mm	67.20
0.045 mm	64.92
0.032 mm	60.37
0.023 mm	55.81
0.017 mm	51.25
0.012 mm	44.42
0.009 mm	37.59
0.006 mm	28.47
0.005 mm	21.64
0.003 mm	12.53
0.002 mm	3.08
0.001 mm	2.28



CLAY	SILT	SAND	GRAVEL
3.1 %	65.89 %	28.0 %	3.1 %

DIRECT SHEAR TEST

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary

Client : Palyul Pema Tsokey Ling

Location : Salleri, Solukhumbu

Consultant : Green Design Solution Pvt. Ltd., Baneshwor, Kathmandu

Prepared by : Agni Boring and Soil Test Pvt. Ltd.

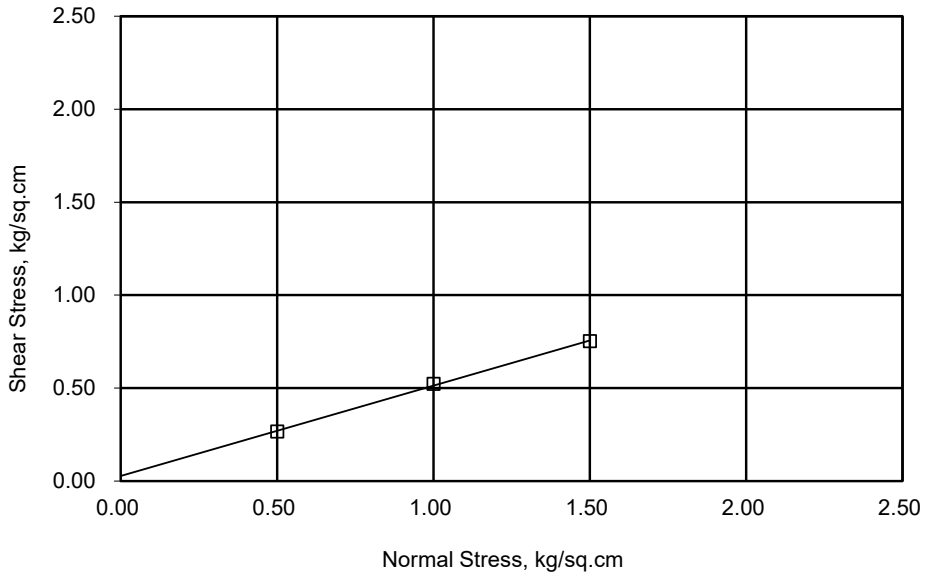
Depth (m) : 2.0m

Testing Method IS : 2720 Part 13

SDT	Test No. 1		Test No. 2		Test No. 3	
	Normal Stress 0.5 kg/cm²		Normal Stress 1.0 kg/cm²		Normal Stress 1.5 kg/cm²	
cm	PRDRg	SST kg/cm²	PRDRg	SST kg/cm²	PRDRg	SST kg/cm²
0.50	6	0.055	8	0.073	11	0.101
1.00	12	0.110	15	0.138	20	0.183
1.50	19	0.174	25	0.229	30	0.275
2.00	24	0.220	33	0.303	42	0.385
2.50	28	0.257	40	0.367	52	0.477
3.00	29	0.266	52	0.477	67	0.614
3.50	28	0.257	55	0.504	70	0.642
4.00			57	0.523	78	0.715
4.50					82	0.752
6.00					80	0.733

SDT = Shear Displacement; PRDRg = Proving Ring Dial Reading; SST = Shear Stress

ϕ =	27°
C=	0.03



DIRECT SHEAR TEST

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary

Client : Palyul Pema Tsokey Ling

Consultant : Green Design Solution Pvt. Ltd., Baneshwor, Kathmandu

Prepared by : Agni Boring and Soil Test Pvt. Ltd.

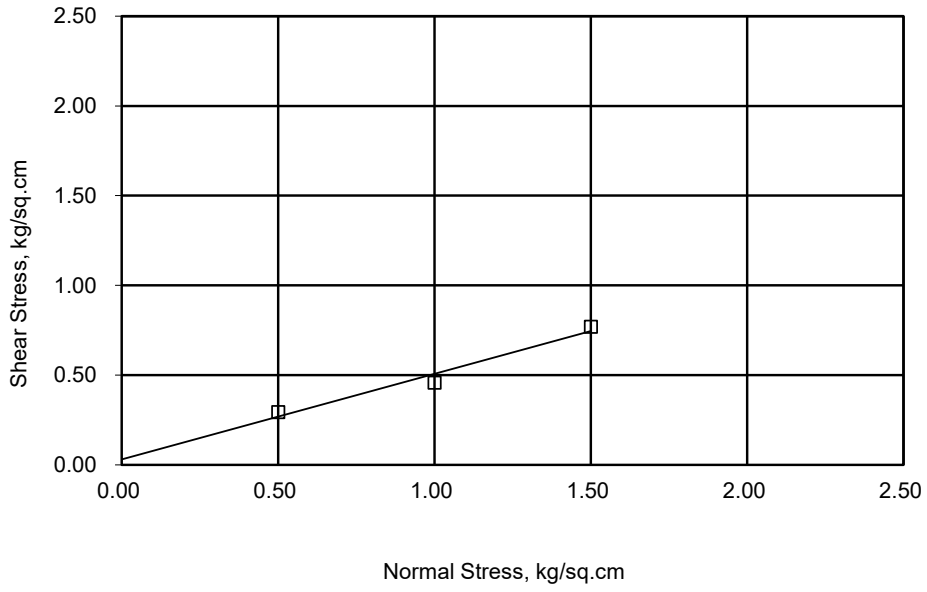
Depth (m) : 2.0m

Testing Method IS : 2720 Part 13

SDT cm	Test No. 1 Normal Stress 0.5 kg/cm²		Test No. 2 Normal Stress 1.0 kg/cm²		Test No. 3 Normal Stress 1.5 kg/cm²	
	PRDRg	SST kg/cm²	PRDRg	SST kg/cm²	PRDRg	SST kg/cm²
0.50	7	0.064	9	0.083	13	0.119
1.00	14	0.128	19	0.174	25	0.229
1.50	21	0.193	28	0.257	37	0.339
2.00	27	0.248	34	0.312	50	0.458
2.50	32	0.293	39	0.358	62	0.568
3.00	30	0.275	42	0.385	74	0.678
3.50			50	0.458	82	0.752
4.00			47	0.431	84	0.770
4.50					81	0.743
6.00						

SDT = Shear Displacement; PRDRg = Proving Ring Dial Reading; SST = Shear Stress

ϕ =	27°
C=	0.03



DIRECT SHEAR TEST

Project : Geotechnical Investigation for Preparation of Master Plan and DPR of Palyul Pema Tsokey Ling Monestary

Client : Palyul Pema Tsokey Ling

Consultant : Green Design Solution Pvt. Ltd., Baneshwor, Kathmandu

Prepared by : Agni Boring and Soil Test Pvt. Ltd.

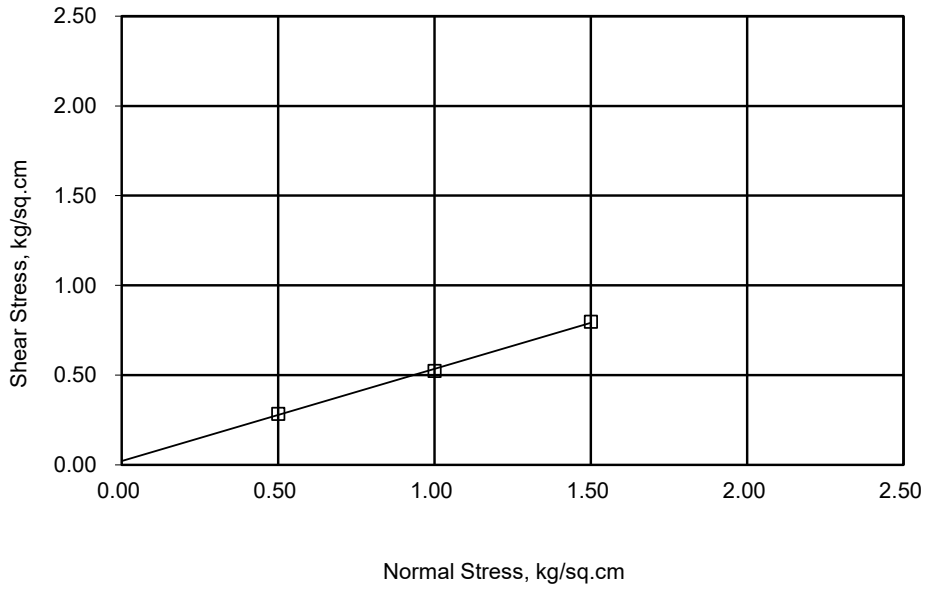
Depth (m) : 2.0m

Testing Method IS : 2720 Part 13

SDT cm	Test No. 1 Normal Stress 0.5 kg/cm²		Test No. 2 Normal Stress 1.0 kg/cm²		Test No. 3 Normal Stress 1.5 kg/cm²	
	PRDRg	SST kg/cm²	PRDRg	SST kg/cm²	PRDRg	SST kg/cm²
0.50	6	0.055	8	0.073	10	0.092
1.00	12	0.110	17	0.156	21	0.193
1.50	19	0.174	25	0.229	32	0.293
2.00	26	0.238	33	0.303	43	0.394
2.50	29	0.266	42	0.385	53	0.486
3.00	31	0.284	52	0.477	62	0.568
3.50	30	0.275	57	0.523	72	0.660
4.00				0.000	83	0.761
4.50				0.000	87	0.798
6.00						

SDT = Shear Displacement; PRDRg = Proving Ring Dial Reading; SST = Shear Stress

ϕ =	28°
C=	0.02



PHOTOGRAPHS

Figure 1: Trial Pit-1

Figure 2: Trial Pit-2

Figure 3: Trial Pit-3

Figure 4: Proposed site