GEO TECHNICAL INVESTIGATION REPORT

Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth, Kadmath, Kalpeni Islands in Lakshadweep

Name of Client

M/s Cochin Port Authority

Report Prepared by

MCSH

Name of Island

Kalpeni

Report No:

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1 INTRODUCTION

M/s Manglam Consultancy Services Hyderabad is a NABL accredited Laboratory that provides Civil Engineering Laboratory Test Services, Project Management Consultancy Services, and Offshore & Onshore Geotechnical Investigations.

M/s Cochin Port Authority, has appointed M/s Manglam Consultancy Services Hyderabad to carry out geotechnical investigations for the proposed construction of the above said project. This report deals with the analysis of laboratory test results for the encountered soil profile.

2 OBJECTIVES OF SOIL INVESTIGATION

The purpose and objectives of soil investigation was to obtain the reliable information regarding sub surface conditions at the site to evaluate the soil parameters which are required for design and suitability of foundation for the proposed structures. The knowledge of general geotechnical subsoil characteristics, compressibility and information about ground water table is an essential requirement for the geotechnical engineer, which would assist the designer to design the type of foundation system.

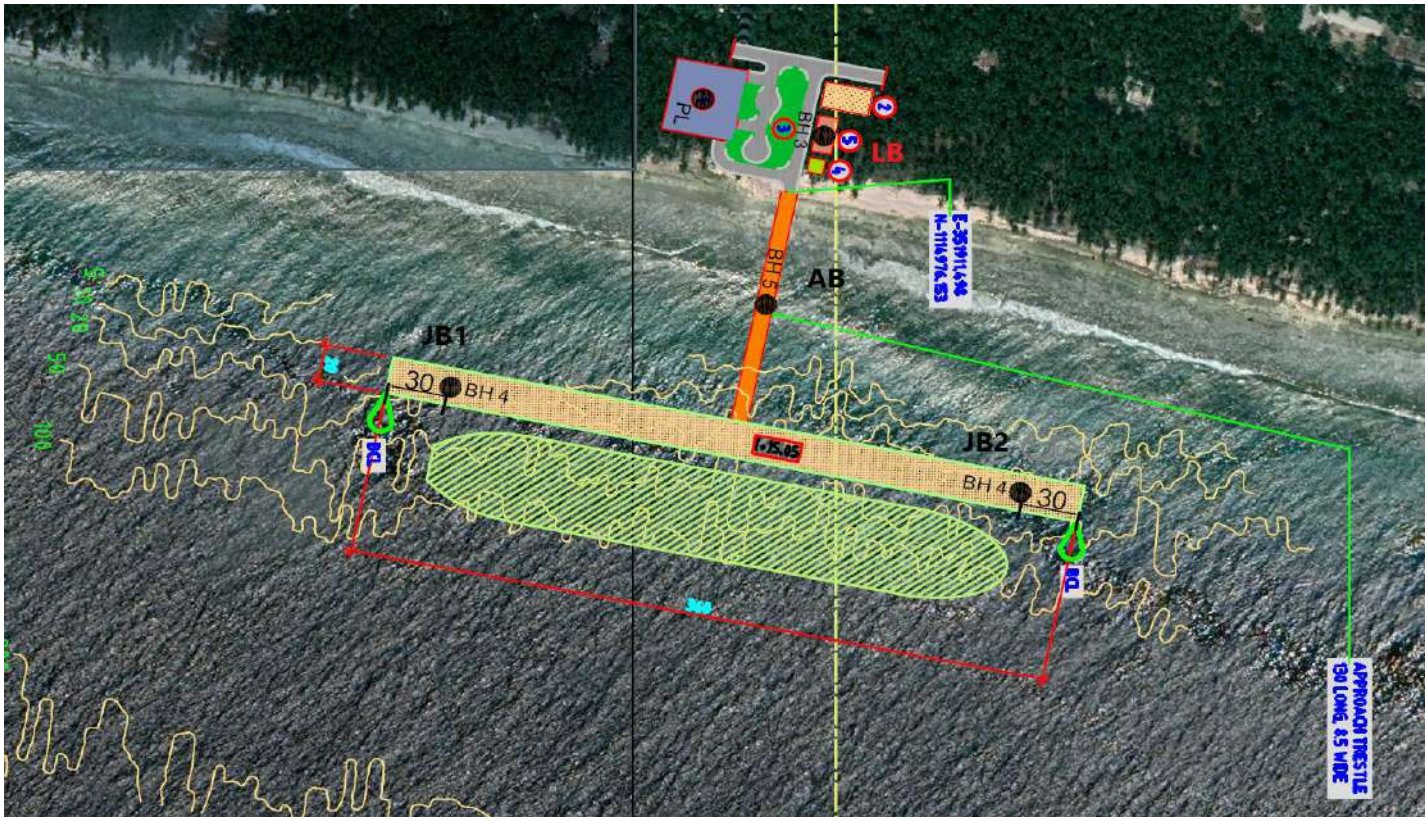
3 SCOPE OF THE WORK

The scope of work for the project was limited to the following:

- Mobilization and demobilization of equipment and personnel to the project site and setting up the equipment and carrying out the field investigation.
- Drilling a borehole of 100mm diameter in all types of soil up to a depth by using shell/auger/ rotary drilling at specified location mentioned as per the work order.
- Conducting standard penetration test at regular depth intervals of 3.00m or at the change of strata whichever is occurs at earlier and collect each SPT samples for further testing.
- Collection of the undisturbed soil samples at the change of the strata.
- Collection of the disturbed soil samples at depths were failed to collect undisturbed soil samples.
- Recording the depth of ground water table (If observed).

- Conducting all necessary and relevant laboratory test on representative soil samples limited to following:
    - Natural moisture content
    - Grain Size Distribution
    - Liquid and Plastic limit
    - Specific gravity
    - Bulk and Dry density
    - Consolidation Test
    - Unconfined Compression Test
    - Triaxial Shear Test / Direct shear test
- Evaluating Safe Bearing Capacity of open foundation as per latest IS codes.
- Submission of soil testing report including interpretation of test results, rock mass rating and suggesting recommendations for safe bearing capacity of open foundation.

4 FIELD INVESTIGATION



Kalpeni Eastern

Kalpeni Western

The location coordinates are presented in table below.

Table 4.1: Details of Boreholes

BH No	Depth of borehole (m)	Positioned Coordinates		Structure	Location	Ground Water table
		Easting (m)	Northing (m)			
BH-LB	25.0	351858	1114962.9	Land	Eastern Land	1.2
BH – JB1	30.0	352009.59	1114808.67	Jetty Head	Eastern Marine	-
BH – JB2	30.0	352071.62	1115084.91	Jetty Head		-
BH-AB	20.0	351973.08	1114963.04	Approach Trestle		-
BH-LB	25.0	351829.08	1115331.67	Land	Western Land	1.0
BH-AB	20.0	351616.49	1115455.44	Approach Trestle	Western Marine	-
BH-JB	20.0	351677.38	1115455.19	Jetty Head		-
BH-CB	8.50	351525.42	1115517.26	Approach Channel		-
BH-CB1	8.50	351434.09	1115517.63			-
BH-CB2	8.50	351558.15	1116070.1			-
BH-CB3	8.50	351681.83	1116530.4			-
BH-CB4	8.50	351775.19	1117021.55			-
BH-CB5	8.50	351807.67	1117512.95			-
BH-CB6	8.50	351718.26	1117974.13			-
BH-CB7	8.50	351507.09	1118435.82			-
BH-CB8	8.50	351295.79	1118866.79			-
BH-CB9	8.50	351084.63	1119328.49			-
BH-CB10	8.50	350873.35	1119759.46			-
BH-CB11	8.50	350601.07	1120159.98			-

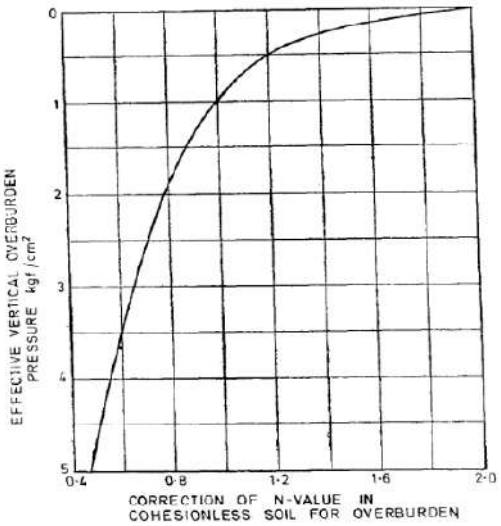
- The testing equipment and personnel for carrying out the requisite field works were mobilized to the site. These were shifted from one test location to another location during fieldwork and demobilized after satisfactory completion of entire field work.
- The prescribed boreholes of 100mm diameter in soil stratum were drilled at the proposed site using rotary drilling machine in accordance with IS: 1892 - 1976.

4.1 DRILLING IN SOIL

- Standard penetration tests were conducted in all boreholes at regular intervals of 3.0m. For this, bore was cleaned up to the desired depth where the SPT test was to conduct. Standard split spoon sampler was attached to lower end of 'A' size drill rods and driven into borehole by means of a standard hammer of 63.5 kg falling freely from a height of 75 cm. The sampler was driven 45cm into soil by blows of this hammer and the numbers of blow required for each 15 cm penetration were recorded. Blows required for first 15cm penetration are not considered for N value as it is considered as seating drive. The number of blows for last 30 cm penetration is designated as SPT 'N' values. 'Refusal' for SPT is stated when less than 15 cm penetration is received in 50 blows.
- Soil samples obtained from standard split spoon sampler for all above standard penetration tests were collected in the polythene bags of suitable size. These samples were properly sealed, labelled, recorded and carefully transported to the laboratory for further testing.

4.1.1 STANDARD PENETRATION TEST

The result of these tests for the boreholes have been calculated and plotted as Penetration Resistance (P.R.) Curves for observed penetration resistance (N-Values) as well as corrected penetration resistance (N-Values) in Log of each borehole. The observed values of 'N' have been corrected for overburden pressure by using the following graph given in IS: 2131 – 1981.



Where,

N

$=$ observed value for penetration resistance in no. of blows per 30cm penetration of sampler.

$N' =$ Value of Penetration resistance corrected for overburden pressure.

$p =$ Effective Overburden Pressure in $^{kg}/_{cm^2}$

N values have also been corrected for water table wherever applicable.

4.2 DRILLING IN ROCK

- Drilling was advanced by rotary core drilling method using double tube core barrels as per the guidelines of IS: 6926-1996. A core barrel and Nx sized bits are used for drilling and recovering rock cores. Recovered rock cores were numbered serially and preserved in good quality sturdy wooden core boxes as specified in IS: 4078-1980.
- The percent recovery and Rock Quality Designation (RQD) was measured for each core run. The percent recovery is defined as the percent ratio of the cumulative length of core sample recovered to the total length of the core run. The Rock Quality Designation (RQD) is defined as the ratio of the cumulative length of core pieces 10 cm or longer to the total length of the core run, expressed as percentage. The Rock Mass Rating (RMR), an engineering parameter that assists in assessing the rock quality and behaviour is also presented on the individual rock profiles.

- Rock classification in terms of weathering and state of fractures and strength is carried out in the following manner. Tabulations given in below explain it briefly.

Table 4.2.1: SCALE OF WEATHERING GRADES OF ROCK MASS (IS 4464)

Terms	Description	Grade	Geologist Interpretation
Fresh	No visible sign of rock material weathering; Perhaps slight discoloration on major discontinuity surfaces.	I	CR > 90 %
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discoloured by weathering.	II	CR between 70 % to 90 %
Moderately Weathered	Less than half of the rock material is decomposed or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as core stones.	III	CR between 51 % to 70 %
Highly Weathered	More than half of the rock material is decomposed or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as core stones	IV	CR between 11 % to 50 %
Completely Weathered	All rock material is decomposed and / or disintegrated to soil. The original mass structure is still largely intact.	V	CR between zero to 10 %
Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.	VI	CR = Zero % But N > 50

- It should be understood that all grades of weathering may not be seen in a given rock mass and that in some cases a particular grade may be present to a very small extent. Distribution of the various weathering grades of rock material in the rock mass may be related to the porosity of the rock material and the presence of open discontinuities of all types in the rock mass.

5 LABORATORY TESTS

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

Soil Samples

Grain size distribution analysis	IS:2720 (PART -4)
Hydrometer Analysis	IS:2720 (PART -4)
Atterberg limits	IS 2720 (Part 5)
Specific gravity	IS 2720 (Part 3, Sec.1 & 2)
Natural moisture content	IS 2720 (Part 2)
Bulk and Dry density	IS 2720 (Part 29)
Triaxial unconsolidated undrained (UU) test	IS 2720 (Part 11)
Unconfined Compressive Strength	IS 2720 (Part 10)
Consolidation test	IS 2720 (Part 15)

Rock Cores

Unconfined compression test	IS 9143
Point load index test	IS 8764

Grain size distribution Hydrometer Analysis

Classification tests performed on granular soil samples were directed towards determining grain size. In these cases, IS: 2720(Part IV) - 1985 is used to determine the quantity of material passing the No. 200 (75-µm) sieve, the boundary between sands and fines (silts and clays). The portion of fines (silt and clay) in a specimen is determined by washing the material through the No. 200 (75 micron) sieve, and computing the percentage by weight passing. Sieve analyses are performed on selected cohesionless samples to determine their grain size distribution. Results for grain size distribution analyses are presented on a semi-logarithmic plot with grain size versus percent passing by weight finer than the grain size. The hydrometer test is used to determine the grain size distribution of fine-grained materials by a sedimentation method. The test procedures adopted are described in detail in IS: 2720(Part IV) – 1985.

Atterberg limits

The liquid limit (LL) and plastic limit (PL) of a soil mass are collectively termed the Atterberg's limits. The liquid limit is defined as the moisture content, in percentage, at which the soil transitions from a plastic state to a semi-liquid state. The plastic limit is defined as the moisture content, in percent, at which the soil transitions from a semi-solid state to a plastic state. Test procedures for obtaining the liquid and plastic limits are detailed in IS: 2720 (Part V)-1985

Specific gravity

Specific gravity (Gs) test is performed as part of the specialized laboratory testing program on selected samples recovered from the boring. Specific gravity is defined as the unit weight of soil solids divided by the unit weight of water. Specific gravity measurements of the soil particles are performed according to the procedures detailed in IS 2720: Part III (Sec 1&2)

Bulk density & Dry density

Dry density and Bulk density of soil strata were obtained using Shelby tubes in accordance with IS 2720 (Part XXIX)-1975, Bulk density is the oven-dry weight of soil per unit of volume at field moisture capacity. Determination of density for the fine -grained natural or compacted soils free from aggregates using a core-cutter.

Natural moisture content

Water or moisture content (w) is determined from measured total and dry weights of a specimen taken from recovered soil samples. Measurements are performed in accordance with the procedures as per the code IS: 2720: Part-XXII: 1973

Triaxial unconsolidated undrained (UU) test

UU Triaxial tests (IS: 2720 P-XI 1993) were carried out in remoulded soil samples unless undisturbed soil sample is available at a particular depth. The remoulded soil sample can be prepared for testing by reworking the failed / disturbed test specimen. Original site condition was recreated by taking a quantity of soil with respect to field bulk density and field water content. The representative soil sample is filled in a split mould (38mm D) with gentle compression by fingers or a plunger as to achieve the field density. The testing procedure is similar to the testing on undisturbed soil samples

Consolidation Test

The Consolidation properties of soil were determined by vertical drainage both to top and bottom surfaces. Volume change after every stress application is recorded at intervals of 0, ½, 1, 4, 9, 16, 25,

36, 49, 64min 1½, 2, 4, 8 and 24 hours. The consolidation test was conducted on two (2) soil sample in accordance with the method of IS:2720 (PART-15).

Point Load Lump Strength Index Test

This test shall be conducted on lump pieces of rock material. Point load lump strength index (/L) is

Calculated by the formula

$$I_L = \frac{p}{(DW)^{1.5}\sqrt{D_{50}}}$$

P = peak load in N at failure,

(DW) = the minimum cross-sectional area passing through point loads in mm^2

I_L =point load lump strength index in MPa,

D_{50} =standard size of lump (50 mm),

D =distance between point loads in mm,

W =average width of minimum cross-sectional area in mm.

UNCONFINED COPRESSIVE STRENGTH

This standard covers the method for determination of unconfined compressive strength of a rock sample in the form of specimens of regular geometry. Test procedures for obtaining the Unconfined Compressive Strength of Rock are detailed in IS: 9143-1979.

6 DESCRIPTION OF BOREHOLES

Based on the details obtained from the field and laboratory test results performed by M/S. Manglam Consultancy Services Hyderabad, the sub soil stratum is classified as under:

Eastern land:

BH-LB:

The stratum of the borehole BH-LB consists of Loose Coral Sand from 0.0 m to 1.95 m, Silty Sand from 1.95 m to 2.40 m, Medium Coral Sand from 2.40 m to 9.00 m, Soft Rock from 9.00 m to 10.50 m, Dense Coral Sand from 10.50 m to 10.95 m, Soft Rock from 10.95 m to 13.95 m, Very Dense Coral Sand from 13.95 m to 14.00 m, Soft Rock from 14.00 m to 17.00 m, Very Dense Coral Sand from 17.00 m to 17.04 m, Soft Rock from 17.04 m, to 20.04 m, Very Dense Coral Sand from 20.04 m to 20.07 m, Soft Rock from 20.07 m to 25.32 m and Very Dense

Coral Sand from 25.32 m to 25.34 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

Eastern Marine:

BH-JB1:

The stratum of the borehole BH-JB1 consists of Medium Dense Coral Sand from 0.0 m to 4.35 m, Dense Coral Sand from 4.35 m to 14.40 m, Soft Rock from 14.40m, to 18.90 m, Very Dense Coral Sand from 18.90 m to 30.02 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-JB2:

The stratum of the borehole BH-JB2 consists of Coral Sand from 0.0 m to 14.40m, Soft Rock from 14.40 m to 18.90m, Dense Coral Sand from 18.90 m to 23.85 m, Very Dense Coral Sand from 23.85 m to 30.30 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-AB:

The stratum of the borehole BH-AB consists of Medium Dense Coral Sand from 0.0 m to 1.20 m, Soft Rock from 1.20 m to 1.95 m, Coral Sand from 1.95 m to 2.40 m, Soft Rock from 2.40 m to 3.90 m, Medium Dense Coral Sand from 3.90 m to 4.35 m, Soft Rock from 5.55 m to 7.05 m, Dense Coral Sand from 7.05 m to 7.50 m, Soft Rock from 7.50 m to 9.00 m, Dense Coral Sand from 9.00 m to 10.95 m, Soft Rock from 10.95 m to 13.95 m, Very Dense Coral Sand from 13.95 m to 20.07 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

Western Land:

BH-LB:

The stratum of the borehole BH-03 consists of Medium Dense Coral Sand from 0.0 m to 5.10 m, Silty Sand from 5.10 m to 5.55 m, Medium Dense Coral Sand from 5.55 m to 9.00 m, Soft Rock from 9.00 m to 10.50 m, Medium Dense Coral Sand from 10.50 m to 10.95 m, Soft Rock from 10.95 m to 13.95 m, Medium Dense Coral Sand from 13.95 m to 14.40 m, Soft Rock from 14.40 m to 17.40 m, Very Dense Coral Sand from 17.40 m to 17.51 m, Soft Rock from 17.51 m to 20.51 m, Very Dense Coral Sand from 20.51 m to 25.59 m, Soft Rock from

20.59 m to 25.09 m, Very Dense Coral Sand from 25.09 m to 25.14 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

Western Marine:

BH-AB:

The stratum of the borehole BH-AB consists of Medium Dense Coral Sand from 0.0 m to 1.20 m, Dense Coral Sand from 1.20 m to 7.50 m, Soft Rock from 7.50 m to 10.50 m, Dense Coral Sand from 10.50 m to 10.95 m, Soft Rock from 10.95 m to 13.95 m, Very Dense Coral Sand from 13.95 m to 14.05 m, Soft Rock from 14.05 m to 17.02 m, Very Dense Coral Sand from 17.02 m to 17.10 m, Soft Rock from 17.10 m to 20.10 m and Very Dense Coral Sand from 20.10 m to 20.14 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-JB:

The stratum of the borehole BH-JB consists of Loose Coral Sand from 0.0 m to 1.20 m, Medium Dense Coral Sand from 1.20 m to 7.50 m, Dense Coral Sand from 7.50 m to 10.95 m, Soft Rock from 10.95 m to 13.95 m, Very Dense Coral Sand from 13.95 m to 14.00 m, Soft Rock from 14.0 m to 17.00 m, Very Dense Coral Sand from 17.00 m to 17.08 m, Soft Rock from 17.08 m to 20.08 m and Very Dense Coral Sand from 20.08 m to 20.14 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB:

The stratum of the borehole BH-CB consists of Medium Dense Coral Sand from 0.0 m to 5.55 m, Soft Rock from 5.55 m to 7.05 m, Medium Dense Coral Sand from 7.05 m to 7.50 m and Dense Coral Sand from 7.50 m to 8.70 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB1:

The stratum of the borehole BH-CB1 consists of Medium Dense Coral Sand from 0.0 m to 7.50 m, Soft Rock from 7.50 m to 8.25 m, Dense Coral Sand from 8.25 m to 8.70 m. Actual

stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB2:

The stratum of the borehole BH-CB2 consists of Medium Dense Coral Sand from 0.0 m to 1.20 m, Dense Coral Sand from 1.20 m to 7.50 m, Soft Rock from 7.50 m to 8.25 m and Dense Coral Sand from 8.25 m to 8.70 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB3:

The stratum of the borehole BH-CB3 consists of Coral Sand from 0.0 m to 7.50 m, Soft Rock from 7.50 m to 8.25 m and Coral Sand from 8.25 m to 8.70 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB4:

The stratum of the borehole BH-CB4 consists of Coral Sand from 0.0 m to 4.35 m, and Dense Coral Sand from 4.35 m to 8.70 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB5:

The stratum of the borehole BH-CB5 consists of Loose Coral Sand from 0.0 m to 1.20 m, Medium Dense Coral Sand from 1.20 m to 7.50 m, Soft Rock from 7.50 m to 8.25 m and Medium Dense Coral Sand from 8.25 m to 8.70 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB6:

The stratum of the borehole BH-CB6 consists of Loose Coral Sand from 0.0 m to 1.20 m, Medium Dense Coral Sand from 1.20 m to 5.55 m, Soft Rock from 5.55 m to 7.05 m and Medium Dense Coral Sand from 7.05 m to 7.50 m, Soft Rock from 7.50 m to 8.25 m and Medium Dense Coral Sand from 8.25 m to 8.70 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB7:

The stratum of the borehole BH-CB7 consists of Coral Sand from 0.0 m to 5.55 m, Soft Rock from 5.55 m to 7.05 m and Coral Sand from 7.05 m to 7.50 m, Soft Rock from 7.50 m to

8.25 m and Coral Sand from 8.25 m to 8.70 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB8:

The stratum of the borehole BH-CB8 consists of Loose Coral Sand from 0.0 m to 1.20 m, Medium Dense Coral Sand from 1.20 m to 7.50 m, Soft Rock from 7.50m to 8.25m and Medium Dense Coral Sand from 8.25 m to 8.70m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB9:

The stratum of the borehole BH-CB9 consists of Loose Coral Sand from 0.0 m to 1.20 m, Medium Dense Coral Sand from 1.20m to 5.55m, Soft Rock from 5.55 m to 7.05 m, Medium Dense Coral Sand from 7.05 m to 7.50 m, Soft Rock from 7.50 m to 8.25 m and Medium Dense Coral Sand from 8.25 m to 8.70 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB10:

The stratum of the borehole BH-CB10 consists of Loose Coral Sand from 0.0 m to 5.55m, Soft Rock from 5.55 m to 7.05 m, Medium Dense Coral Sand from 7.05 m to 7.50 m, Soft Rock from 7.50 m to 8.25 m and Medium Dense Coral Sand from 8.25 m to 8.70 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

BH-CB11:

The stratum of the borehole BH-CB11 consists of Medium Dense Coral Sand from 0.0 m to 7.50 m and Dense Coral Sand from 7.50 m to 8.70 m. Actual stratum of each borehole and the results laboratory tests on Soil & Rock samples are presented in Soil profile sheet.

6.1 PILE FOUNDING CRITERIA FOR SOFT ROCK

The net allowable Load on the Pile for soft/weathered rock is computed as per IS: 2911 Part 1/Sec 2. The allowable load on the pile, Q_a, in kN, by this approach, is given by

$$Q_a = C_{u_1} N_c \frac{\pi B^2}{4 F_s} + \alpha C_{u_2} \frac{\pi B L}{F_s}$$

Where,

$C_{u1} = Shear\ strength\ of\ rock\ below\ the\ base\ of\ the\ pile, in\ kN/m2$

$N_c = Bearing\ capacity\ factor\ taken\ as\ 9;$

$F_s = factor\ of\ safety\ usually\ taken\ as\ 3;$

$\alpha\ = 0.9\ (recommended\ value);$

$C_{u1} = average\ shear\ strength\ of\ rock\ in\ the\ socketed\ length\ of\ pile, in\ kN/m2$

$B = minimum\ width\ of\ pile\ shaft\ (diameter\ in\ case\ of\ circular\ piles), in\ m.$

$L = socket\ length\ of\ pile, in\ m$

7 COMPUTATION OF BEARING CAPACITY OF OPEN FOUNDATION

A properly designed foundation must satisfy the following basic requirements:

- Foundation must be safe against the shear failure of the supporting soil.
- The settlement of foundation must be within permissible limit.

The bearing capacities have been determined separately to satisfy both the above-mentioned requirements and the smaller of the two values has been recommended as the allowable bearing capacity.

7.1 BEARING CAPACITY FROM SHEAR CONSIDERATIONS

In shear, a foundation can fail in any of the three different ways viz.

I. Local shear failure
II. General shear failure
III. In between the above two

The local Shear Failure is assumed to occur for ϕ less than 28.0° & general shear failure for ϕ>36° & between these limiting values of ϕ, average values for local & general shear failure can be determined. In this case bearing capacity for shear failure consideration has been determined.

Adopting a square foundation and taking the depths below O.G.L. and using Eq. below as per IS:6403-1981 “Determination of Bearing Capacity of Shallow Foundation” the bearing capacity has been determined.

$$q_a = \frac{1}{F}\left[C\, N_C\, S_C\, d_C\, i_C + q(N_q - 1)\, S_q\, d_q i_q + 0.5\, B\, \Upsilon\, N_\Upsilon\, S_\Upsilon\, d_\Upsilon\, i_\Upsilon W^1 \right] + \Upsilon\, D_f$$

Where,

$q_a = Allowable\ Safe\ Bearing\ Capacity$

$F = Factor\ of\ Safety\ taken\ as\ 2.5$

$C = Cohesion$

$q = Effective\ Overburden\ Pressure$

$B = Width\ of\ Footing$

$\Upsilon = Unit\ weight$

$N_C\ ,\ N_q,\ N_\Upsilon = Modified\ Bearing\ Capacity\ Factors$

$S_C\ ,\ S_q\ , S_\Upsilon = Shape\ Factors$

$d_C, d_q, d_\Upsilon = Depth\ Factors$

7.2 BEARING CAPACITY FROM SETTLEMENT CRITERIA

The net allowable Bearing Capacity based on the maximum settlement of foundation has been computed as per IS: 8009. The calculated bearing capacity is based on corrected N values or penetration resistance values.

The foundation should not settle or deflect to an extent causing damage to structure or impair its usefulness. The bearing capacity calculation for foundation shall be governed by IS 1904-1986, IS 6403-1981, and I.S. 8009-1981 (Part-I & II) - 1976 based on available information regarding the proposed design have been done.

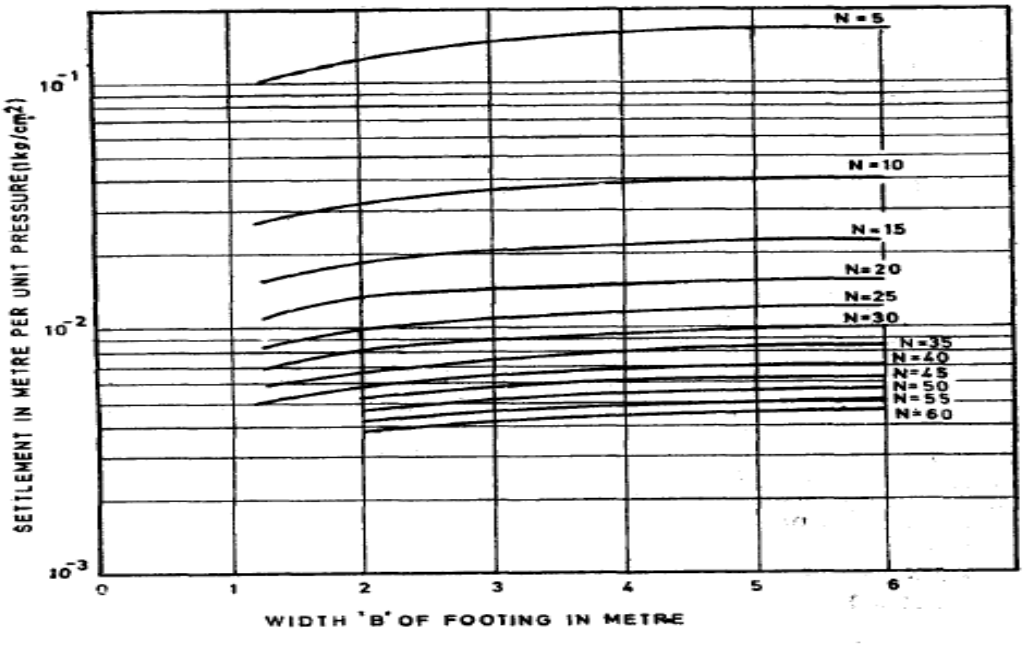


Fig. 7.2.1 Settlement per unit pressure from Standard Penetration Resistance

7.3 LAB TEST RESULTS

Table 7.3.1 Lab Test Results and design Parameters

S.No	Field Reference	Types of samples	Depth w r to CD (m)	Bulk Density g/cc	Moisture Content %	Dry Density g/cc	Gradation Analysis			Consistency Limit			IS Classification	Shear Strength Test		Design Shear Strength Parameters
							%Gravel	%sand	%Fines	Liquid limit	plastic limit	plastic index		C	ϕ	ϕ
1	BH-LB (EASTERN LAND)	SPT-1	2.89 to 2.44	1.92	9.90	1.75	13.1	76.4	10.5	NP	NP	NP	SW-SM	0.0	30.1	29.0
		UD-1	1.69 to 1.24	1.96	9.50	1.79	14.0	74.5	11.4	NP	NP	NP	SM	0.0	30.5	-
		SPT-2	-0.26 to -0.71	1.99	9.30	1.82	11.2	77.5	11.2	NP	NP	NP	SW-SM	0.0	32.7	32.0
		SPT-3	-3.41 to -3.86	2.01	8.80	1.85	10.1	78.8	11.1	NP	NP	NP	SW-SM	0.0	32.0	31.5
		SPT-4	-6.86 to -7.31	2.02	8.60	1.86	8.5	82.1	9.4	NP	NP	NP	SW-SM	0.0	32.6	32.0
		SPT-5	-10.31 to -10.36	2.05	8.40	1.89	13.1	63.7	23.2	NP	NP	NP	SW-SM	0.0	-	34.0
		SPT-6	-13.36 to -13.40	Refusal and No Sample Recovered												
		SPT-7	-16.40 to -16.43	Refusal and No Sample Recovered												
		SPT-8	-21.68 to -21.70	Refusal and No Sample Recovered												

MCSH	**Name of Work**	Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Andrott, Kadmath, Kalpeni Islands in Lakshadweep
	Client	Cochin Port Authority

S.No	Field Reference	Types of samples	Depth w r to CD (m)	Bulk Density g/cc	Moisture Content %	Dry Density g/cc	Gradation Analysis			Consistency Limit			IS Classification	Shear Strength Test		Design Shear Strength Parameters
							%Gravel	%sand	%Fines	Liquid limit	plastic limit	plastic index		C	ϕ	ϕ
1	BH-JB1 (Eastern Marine)	SPT-1	-8.45 to -8.90	1.96	10.50	1.77	5.9	84.4	9.7	NP	NP	NP	SW-SM	0.0	30.9	30.5
		UD-1	-9.65 to -10.10	Sample Slipped off												
		SPT-2	-11.60 to -12.05	1.97	10.00	1.79	4.5	84.1	11.4	NP	NP	NP	SW-SM	0.0	31.3	30.0
		UD-2	-12.80 to -13.25	Sample Slipped off												
		SPT-3	-14.75 to -15.20	1.99	9.60	1.82	7.1	82.0	10.9	NP	NP	NP	SW-SM	0.0	31.4	31.0
		SPT-4	-18.20 to -18.65	2.01	9.20	1.84	8.1	81.4	10.5	NP	NP	NP	SW-SM	0.0	31.0	31.5
		SPT-5	-21.65 to -22.10	2.02	8.70	1.86	9.5	79.5	11.0	NP	NP	NP	SW-SM	0.0	31.8	31.5
		SPT-6	-26.60 to -26.70	2.03	8.50	1.87	15.9	60.5	20.2	NP	NP	NP	SM	0.0	-	34.0
		SPT-7	-31.2 to -31.35	2.04	8.00	1.89	14.2	62.9	22.9	NP	NP	NP	SM	0.0	-	34.0
		SPT-8	-37.35 to -37.72	2.05	7.70	1.90	15.9	58.2	25.9	NP	NP	NP	SM	0.0	-	34.0
2	BH-JB2 (Eastern Marine)	SPT-1	-6.35 to -6.80	1.86	10.30	1.69	6.8	83.6	9.6	NP	NP	NP	SW-SM	0.0	31.3	30.0
		UD-1	-7.55 to -8.00	Sample Slipped off												
		SPT-2	-9.50 to -9.95	1.96	10.00	1.78	16.4	75.0	8.7	NP	NP	NP	SW-SM	0.0	31.0	30.5
		UD-2	-10.70 to -11.15	Sample Slipped off												
		SPT-3	-12.65 to -13.10	1.99	9.80	1.81	16.9	73.6	9.5	NP	NP	NP	SW-SM	0.0	31.2	32.5
		SPT-4	-16.10 to -16.55	1.93	9.50	1.76	11.6	77.9	10.5	NP	NP	NP	SW-SM	0.0	31.4	31.0
		SPT-5	-19.55 to -20.00	1.95	9.20	1.79	10.9	77.7	11.4	NP	NP	NP	SW-SM	0.0	32.1	31.5
		SPT-6	-24.50 to -24.95	1.97	9.00	1.81	29.2	59.0	11.8	NP	NP	NP	SW-SM	0.0	-	31.5
		SPT-7	-29.45 to -29.60	1.98	8.70	1.82	13.5	63.6	22.9	NP	NP	NP	SM	0.0	-	34.0
		SPT-8	-34.60 to -34.10	1.99	8.50	1.83	15.2	59.0	25.8	NP	NP	NP	SM	0.0	-	34.0
		SPT-9	-35.78 to -35.90	2.00	8.20	1.85	19.2	56.2	24.6	NP	NP	NP	SM	0.0	-	34.0
3	BH-AB (Eastern Marine)	SPT-1	-3.85 to -4.30	1.92	10.60	1.74	7.5	82.6	9.9	NP	NP	NP	SW-SM	0.0	31.4	30.0
		UD-1	-5.05 to -5.50	Sample Slipped off												
		SPT-2	-7.00 to -7.45	2.00	9.90	1.82	8.3	81.5	10.2	NP	NP	NP	SW-SM	0.0	31.9	31.0
		UD-2	-8.20 to -8.65	Sample Slipped off												

		SPT-3	-10.15 to -10.60	2.01	9.50	1.84	9.8	78.8	11.4	NP	NP	NP	SW-SM	0.0	33.0	32.0
		SPT-4	-13.60 to -14.05	2.05	9.00	1.88	13.8	76.4	9.8	NP	NP	NP	SW-SM	0.0	34.2	33.0
		SPT-5	-17.05 to -17.10	2.08	8.80	1.91	14.2	62.6	23.2	NP	NP	NP	SM	-	-	34.0
		SPT-6	-20.10 to -20.28	2.08	8.40	1.92	16.2	63.9	19.9	NP	NP	NP	SM	-	-	34.0
		SPT-7	-23.28 to -23.52	2.10	8.20	1.94	13.9	60.9	25.2	NP	NP	NP	SM	-	-	34.0

S.No	Field Reference	Types of samples	Depth w r to CD (m)	Bulk Density g/cc	Moisture Content %	Dry Density g/cc	Gradation Analysis			Consistency Limit			IS Classification	Shear Strength Test		Design Shear Strength Parameters
							%Gravel	%sand	%Fines	Liquid limit	plastic limit	plastic index		C	ϕ	ϕ
1	BH-LB (WESTERN LAND)	SPT-1	1.84 - 1.39	1.89	10.00	1.72	15.2	73.5	11.3	NP	NP	NP	SW-SM	0.0	32.0	31.0
		SPT-2	-1.31 to -1.76	1.92	9.80	1.75	11.0	76.0	10.2	NP	NP	NP	SW-SM	0.0	32.1	31.0
		UD-2	-2.51 to -2.96	1.94	9.2	1.78	18.5	87.4	18.4	NP	NP	NP	SM	0.0	32.4	-
		SPT-3	-4.46 to -4.91	1.97	9.30	1.80	11.1	80.0	8.9	NP	NP	NP	SW-SM	0.0	31.0	30.5
		SPT-4	-7.91 to -8.36	1.98	9.20	1.81	9.5	78.7	11.8	NP	NP	NP	SW-SM	0.0	32.5	30.5
		SPT-5	-11.36 to -11.81	1.99	9.00	1.83	14.2	65.3	20.5	NP	NP	NP	SW-SM	0.0	32.3	31.0
		SPT-6	-14.81 to -14.92	2.02	8.70	1.86	13.5	62.4	24.1	NP	NP	NP	SW-SM	0.0	-	34.0
		SPT-7	-17.92 to -18.00	2.05	8.40	1.89	12.9	59.9	27.2	NP	NP	NP	SW-SM	0.0	-	34.0
		SPT-8	-22.50 to -22.55	2.06	8.00	1.91	18.4	56.5	25.1	NP	NP	NP	SW-SM	0.0	-	34.0

S.No	Field Reference	Types of samples	Depth w r to CD (m)	Bulk Density g/cc	Moisture Content %	Dry Density g/cc	Gradation Analysis			Consistency Limit			IS Classification	Shear Strength Test		Design Shear Strength Parameters
							%Gravel	%sand	%Fines	Liquid limit	plastic limit	plastic index		C	ϕ	ϕ
2	BH-JB (WESTERN Marine)	SPT-1	-1.55 to -2.00	1.69	8.90	1.55	2.2	86.4	15.8	NP	NP	NP	SW-SM	0.0	28.6	27.0
		UD-1	-2.75 to -3.20	Sample Slipped off												
		SPT-2	-4.70 to -5.15	1.87	8.00	1.73	2.9	86.9	14.2	NP	NP	NP	SW-SM	0.0	30.8	30.0
		UD-2	-5.90 to -6.32	Sample Slipped off												

		SPT-3	-7.85 to -8.30	1.93	7.80	1.79	6.1	85.1	11.6	NP	NP	NP	SW-SM	0.0	31.5	31.0
		SPT-4	-11.30 to -11.75	1.97	7.60	1.83	6.5	84.5	11.9	NP	NP	NP	SW-SM	0.0	32.7	32.0
		SPT-5	-14.75 to -14.80	2.00	7.30	1.86	2.4	89.5	11.5	NP	NP	NP	SW-SM	0.0	-	34.0
		SPT-6	-17.80 to -17.88	2.02	7.00	1.89	2.9	87.0	13.5	NP	NP	NP	SW-SM	0.0	-	34.0
		SPT-7	-20.88 to -20.94	2.04	6.80	1.91	4.7	85.4	13.7	NP	NP	NP	SW-SM	0.0	-	34.0
3	BH-AB (WESTERN Marine)	SPT-1	-1.65 to -2.10	1.94	10.80	1.75	1.5	87.7	10.8	NP	NP	NP	SW-SM	0.0	30.6	29.0
		UD-1	-3.30 to -4.80	Sample Slipped off												
		SPT-2	-4.80 to -5.25	1.96	10.30	1.78	1.0	91.6	7.4	NP	NP	NP	SW-SM	0.0	30.1	29.0
		UD-2	-6.00 to -6.45	Sample Slipped off												
		SPT-3	-7.95 to -8.40	1.98	9.00	1.82	0.9	88.2	10.9	NP	NP	NP	SW-SM	0.0	32.9	32.0
		SPT-4	-11.40 to -11.85	2.00	8.70	1.84	1.0	90.8	8.2	NP	NP	NP	SW-SM	0.0	33.8	33.0
		SPT-5	-14.85 to -14.95	2.01	8.20	1.86	1.1	88.2	10.7	NP	NP	NP	SW-SM	0.0	-	34.0
		SPT-6	-17.92 to -18.00	2.02	7.90	1.87	0.9	87.5	11.6	NP	NP	NP	SW-SM	0.0	-	34.0
		SPT-7	-21.00 to -21.04	2.03	7.20	1.89	1.0	90.2	11.1	NP	NP	NP	SW-SM	0.0	-	34.0
4	BH-CB (WESTERN Marine)	SPT-1	-2.55 to -3.00	1.85	7.80	1.72	2.5	87.7	9.8	NP	NP	NP	SW-SM	0.0	30.4	30.0
		UD-1	-3.75 to -4.20	Sample Slipped off												
		SPT-2	-5.70 to -6.15	1.89	6.90	1.77	3.0	88.3	8.6	NP	NP	NP	SW-SM	0.0	30.9	30.5
		UD-2	-6.90 to -7.35	Sample Slipped off												
		SPT-3	-8.85 to -9.30	1.91	6.50	1.79	2.5	88.0	9.5	NP	NP	NP	SW-SM	0.0	31.2	31.0
		SPT-4	-10.05 to -10.50	1.94	6.20	1.83	2.9	86.8	10.3	NP	NP	NP	SW-SM	0.0	31.6	31.5
5	BH-CB1 (WESTERN Marine)	SPT-1	-2.55 to -3.00	1.90	10.10	1.73	11.1	77.0	11.9	NP	NP	NP	SW-SM	0.0	31.2	30.5
		UD-1	-3.75 to -6.15	Sample Slipped off												
		SPT-2	-5.70 to -6.15	1.93	9.80	1.76	9.9	80.3	9.8	NP	NP	NP	SW-SM	0.0	32.3	31.0
		UD-2	-6.90 to -7.35	Sample Slipped off												
		SPT-3	-8.85 to -9.30	1.96	9.50	1.79	6.2	85.8	8.0	NP	NP	NP	SW-SM	0.0	31.2	31.0
		SPT-4	-10.05 to -10.50	1.99	9.20	1.82	12.6	78.6	8.8	NP	NP	NP	SW-SM	0.0	32.0	31.5
6	BH-CB2 (WESTERN Marine)	SPT-1	-2.65 to -3.10	1.95	10.00	1.77	8.7	81.5	9.8	NP	NP	NP	SW-SM	0.0	30.1	29.0
		UD-1	-3.85 to -4.30	Sample Slipped off												
		SPT-2	-5.80 to -6.25	1.99	9.50	1.82	11.6	77.1	11.3	NP	NP	NP	SW-SM	0.0	32.4	32.0
		UD-2	-7.00 to -7.45	Sample Slipped off												

		SPT-3	-8.95 to -9.40	1.99	8.90	1.83	7.6	81.8	10.6	NP	NP	NP	SW-SM	0.0	32.2	31.5
		SPT-4	-10.15 to -10.60	2.04	8.20	1.89	12.6	78.6	8.8	NP	NP	NP	SW-SM	0.0	31.9	32.0
7	BH-CB3 (WESTERN Marine)	SPT-1	-2.95 to -3.40	1.93	10.30	1.75	5.7	85.9	8.4	NP	NP	NP	SW-SM	0.0	30.2	29.0
		UD-1	-4.15 to -4.60	Sample Slipped off												
		SPT-2	--6.10 to -6.55	1.96	10.00	1.78	9.0	79.1	11.9	NP	NP	NP	SW-SM	0.0	30.8	30.0
		UD-2	-7.30 to -7.75	Sample Slipped off												
		SPT-3	-9.25 to -9.70	2.00	9.70	1.82	7.8	81.8	10.4	NP	NP	NP	SW-SM	0.0	31.4	31.0
		SPT-4	-10.45 to -10.90	2.03	9.30	1.86	10.1	80.5	9.4	NP	NP	NP	SW-SM	0.0	32.4	31.5
8	BH-CB4 (WESTERN Marine)	SPT-1	-3.05 to -3.50	1.97	10.00	1.79	5.8	82.6	11.6	NP	NP	NP	SW-SM	0.0	30.3	30.0
		UD-1	-4.25 to -4.70	Sample Slipped off												
		SPT-2	-6.20 to -6.65	2.00	9.80	1.82	6.7	83.0	10.3	NP	NP	NP	SW-SM	0.0	30.2	31.0
		UD-2	-7.40 to -7.85	Sample Slipped off												
		SPT-3	-9.35 to -9.80	2.05	9.60	1.87	6.2	83.1	10.7	NP	NP	NP	SW-SM	0.0	31.5	32.0
		SPT-4	-10.55 to -11.00	2.06	9.00	1.89	7.5	80.6	11.9	NP	NP	NP	SW-SM	0.0	33.4	32.0
9	BH-CB5 (WESTERN Marine)	SPT-1	-5.25 to -5.70	1.75	8.40	1.61	4.1	88.2	7.7	NP	NP	NP	SW-SM	0.0	29.0	28.0
		UD-1	-6.45 to -6.90	Sample Slipped off												
		SPT-2	-8.40 to -8.85	1.90	8.20	1.76	5.7	84.5	9.8	NP	NP	NP	SW-SM	0.0	30.4	29.5
		UD-2	-9.60 to -10.05	Sample Slipped off												
		SPT-3	-11.55 to -12.00	1.93	8.00	1.79	7.4	84.1	8.5	NP	NP	NP	SW-SM	0.0	31.0	30.0
		SPT-4	-12.75 to -13.20	1.95	7.70	1.81	7.5	81.8	10.2	NP	NP	NP	SW-SM	0.0	31.5	30.0
10	BH-CB6 (WESTERN Marine)	SPT-1	-5.65 to -6.10	1.72	8.60	1.58	4.8	87.7	7.5	NP	NP	NP	SW-SM	0.0	29.3	28.0
		UD-1	-6.85 to -7.30	Sample Slipped off												
		SPT-2	-8.80 to -9.25	1.80	8.20	1.66	3.6	84.8	11.6	NP	NP	NP	SW-SM	0.0	29.6	29.0
		UD-2	-10.00 to -10.45	Sample Slipped off												
		SPT-3	-11.95 to -12.40	1.89	7.90	1.75	2.1	86.8	11.1	NP	NP	NP	SW-SM	0.0	31.1	30.0
		SPT-4	-13.15 to -13.60	1.93	7.30	1.80	3.4	87.7	8.9	NP	NP	NP	SW-SM	0.0	30.8	30.0
11	BH-CB7 (WESTERN Marine)	SPT-1	-4.55 to -5.00	1.68	8.20	1.55	5.8	86.5	7.7	NP	NP	NP	SW-SM	0.0	28.2	27.0
		UD-1	-5.75 to -6.20	Sample Slipped off												
		SPT-2	-7.70 to -8.15	1.75	7.90	1.62	8.6	84.6	6.8	NP	NP	NP	SW-SM	0.0	30.0	29.0
		UD-2	-8.90 to -9.35	Sample Slipped off												

		SPT-3	-10.85 to -11.30	1.87	6.80	1.75	7.1	88.7	7.1	NP	NP	NP	SW-SM	0.0	31.8	31.0
		SPT-4	-12.05 to -12.50	1.94	6.50	1.82	8.9	86.4	8.9	NP	NP	NP	SW-SM	0.0	30.6	31.0
12	BH-CB8 (WESTERN Marine)	SPT-1	-5.05 to -5.50	1.71	8.00	1.58	6.2	84.1	9.7	NP	NP	NP	SW-SM	0.0	28.3	27.0
		UD-1	-6.25 to -6.70	Sample Slipped off												
		SPT-2	-8.20 to -8.65	1.76	7.80	1.63	7.3	83.5	9.2	NP	NP	NP	SW-SM	0.0	30.2	29.5
		UD-2	-9.40 to -9.85	Sample Slipped off												
		SPT-3	-11.35 to -11.80	1.84	7.50	1.71	7.6	82.2	10.2	NP	NP	NP	SW-SM	0.0	31.0	30.0
		SPT-4	-12.55 to -13.00	1.92	7.00	1.79	6.5	81.9	11.6	NP	NP	NP	SW-SM	0.0	31.3	30.5
13	BH-CB9 (WESTERN Marine)	SPT-1	-3.85 to -4.30	1.68	8.60	1.55	10.1	81.9	8.0	NP	NP	NP	SW-SM	0.0	29.5	28.0
		UD-1	-5.05 to -5.50	Sample Slipped off												
		SPT-2	-7.00 to -7.45	1.74	8.00	1.61	8.5	84.1	7.4	NP	NP	NP	SW-SM	0.0	29.8	29.0
		UD-2	-8.20 to -8.65	Sample Slipped off												
		SPT-3	-10.15 to -10.60	1.86	7.60	1.73	6.0	86.3	7.7	NP	NP	NP	SW-SM	0.0	30.0	29.5
		SPT-4	-11.35 to -11.80	1.91	7.20	1.78	6.6	81.8	11.6	NP	NP	NP	SW-SM	0.0	31.4	31.0
14	BH-CB10 (WESTERN Marine)	SPT-1	-3.95 to -4.40	1.69	8.50	1.56	6.5	85.4	8.1	NP	NP	NP	SW-SM	0.0	27.8	27.0
		UD-1	-5.15 to -5.60	Sample Slipped off												
		SPT-2	-7.10 to -7.55	1.72	8.20	1.59	6.7	82.7	10.6	NP	NP	NP	SW-SM	0.0	29.3	28.0
		UD-2	-8.30 to -8.75	Sample Slipped off												
		SPT-3	-10.25 to -10.70	1.86	7.80	1.73	6.2	86.0	7.8	NP	NP	NP	SW-SM	0.0	31.2	30.0
		SPT-4	-11.45 to -11.90	1.92	7.00	1.79	6.9	84.8	8.3	NP	NP	NP	SW-SM	0.0	31.5	31.0
15	BH-CB11 (WESTERN Marine)	SPT-1	-5.65 to -6.10	1.76	8.90	1.62	5.9	84.6	9.5	NP	NP	NP	SW-SM	0.0	30.0	29.5
		UD-1	-6.85 to -7.30	Sample Slipped off												
		SPT-2	-8.80 to -9.25	1.91	8.50	1.76	7.2	84.4	8.4	NP	NP	NP	SW-SM	0.0	30.2	31.0
		UD-2	-10.00 to -10.45	Sample Slipped off												
		SPT-3	-11.95 to -12.40	1.95	8.00	1.81	5.7	83.4	10.9	NP	NP	NP	SW-SM	0.0	32.9	31.0
		SPT-4	-13.15 to -13.60	1.99	7.60	1.85	7.4	81.1	11.5	NP	NP	NP	SW-SM	0.0	32.4	32.0

8 CONCLUSIONS AND RECOMMENDATIONS

Based on the laboratory test results performed by M/s. Manglam Consultancy Services Hyderabad, the conclusion and Recommendations are given below.

- Depending upon the field and laboratory test results below foundations are recommended.

Table 8.1.1 Recommendations on Type of Foundation

Location	**BH No**	**Type of Foundation**		**Structure name**
Eastern Land	BH -LB	-	**Pile**	Land
Eastern Marine	BH- JB1 BH JB2 BH-AB			Jetty head Approach Trestle
Western Land	BH -LB			Land
Western Marine	BH-AB, BH -JB			Approach Trestle, Jetty head
Western Marine	BH CB BH CB1 BH CB2 BH CB3 BH CB4 BH CB5 BH CB6 BH CB7 BH CB8 BH CB9 BH CB10 BH CB11	**Open**	-	Approach Channel

- Pile capacities for diameters of 750mm, 900 mm, 1000 mm, 1200mm and 1300 mm are determined per IS 2911 to ensure safe load transfer into the competent strata.

Table 8.1.2 Recommended Safe Bearing Capacity

S.NO.	BH No.	Location	Structure	Strata	Depth of Foundation (m)	Depth of Foundation w r to CD(m)	Recommended SBC (t/m2)	
							(2X2)	(3x3)
1	BH-CB	Kalpeni Western	Approach Channel	Medium Dense Coral Sand	0.75	-2.55	8.45	10.52
					1.95	-3.75	16.34	16.50
					3.90	-5.70	35.06	35.05
					5.10	-6.90	47.67	42.73
					7.05	-8.85	76.69	70.65
				Dense Coral Sand	8.25	-10.05	90.00	85.00
2	BH-CB1			Medium Dense Coral Sand	0.75	-2.55	9.61	11.96
					1.95	-3.75	18.43	20.25
					3.90	-5.70	39.35	39.30
					5.10	-6.90	53.50	51.48
					7.05	-8.85	75.00	70.00
				Dense Coral Sand	8.25	-10.05	75.00	70.00
3	BH-CB2			Medium Dense Coral Sand	0.75	-2.65	8.17	10.10
				Dense Coral Sand	1.95	-3.85	17.91	19.58
					3.90	-5.80	47.75	47.63
					5.10	-7.00	55.60	53.44
					7.05	-8.95	85.00	80.00
					8.25	-10.15	85.00	80.00
4	BH-CB3			Medium Dense Coral Sand	0.75	-2.95	8.06	9.98
					1.95	-4.15	17.59	19.26

					3.90	-6.10	34.49	34.36
				Dense Coral Sand	5.10	-7.30	51.09	49.10
					7.05	-9.25	83.87	77.09
					8.25	-10.45	85.00	80.00
5	BH-CB4			Medium Dense Coral Sand	0.75	-3.05	9.26	11.45
					1.95	-4.25	19.62	21.48
					3.90	-6.20	41.86	41.72
				Dense Coral Sand	5.10	-7.40	61.91	59.44
					7.05	-9.35	100.0	91.91
					8.25	-10.55	100.0	95.0
6	BH-CB5			Loose Coral Sand	0.75	-5.25	6.17	7.72
				Medium Dense Coral Sand	1.95	-6.45	13.99	15.41
					3.90	-8.40	31.08	31.04
					5.10	-9.60	42.61	41.00
					7.05	-11.55	55.00	50.00
					8.25	-12.75	55.00	50.00
7	BH-CB6			Loose Coral Sand	0.75	-5.65	6.01	7.53
				Medium Dense Coral Sand	1.95	-6.85	12.44	13.75
					3.90	-8.80	26.25	26.34
					5.10	-10.00	39.18	37.81
					7.05	-11.95	55.00	50.00
					8.25	-13.15	55.00	50.00
8	BH-CB7			Coral Sand	0.75	-4.55	5.15	6.46
					1.95	-5.75	11.03	12.25
					3.90	-7.70	24.83	24.97
					5.10	-8.90	39.01	37.71

					7.05	-10.85	73.72	67.98
					8.25	-12.05	75.00	70.00
9	BH-CB8			Loose Coral Sand	0.75	-5.05	5.29	6.63
				Medium Dense Coral Sand	1.95	-6.25	11.31	12.64
					3.90	-8.20	26.50	26.64
					5.10	-9.40	31.46	30.61
					7.05	-11.35	50.00	56.27
					8.25	-12.55	50.00	65.00
10	BH-CB9			Loose Coral Sand	0.75	-3.85	5.82	7.32
				Medium Dense Coral Sand	1.95	-5.05	11.90	13.19
					3.90	-7.00	24.56	24.71
					5.10	-8.20	35.88	34.68
					7.05	-10.15	50.00	50.00
					8.25	-11.35	50.00	50.00
11	BH-CB10			Loose Coral Sand	0.75	-3.95	5.22	6.55
					1.95	-5.15	11.03	12.25
					3.90	-7.10	21.56	21.72
					5.10	-8.30	36.29	35.06
				Medium Dense Coral Sand	7.05	-10.25	62.81	57.91
					8.25	-11.45	80.00	70.00
12	BH-CB11			Medium Dense Coral Sand	0.75	-5.65	7.42	9.28
					1.95	-6.85	16.03	17.64
					3.90	-8.80	38.47	38.47
					5.10	-10.00	52.97	50.99
					7.05	-11.95	75.00	74.11

				Dense Coral Sand	8.25	-13.15	75.00	100.0

Table 8.1.3 Pile Capacities of Western and Eastern Marine Boreholes

S. No.	BH No.	Depth w r to CD (m)	Diameter (m)	Pile Termination in Strata	Net Vertical Capacities (Tons)	Safe Uplift capacity (Tons)	Lateral Capacity (Tons)	Fixed End Moment (Ton-m)
1	BH-AB Western Approach Trestle	-18.0	0.9	Very Dense Coral Sand*	413.6	59.4	13.51	83.31
			1.0		510.6	73.3	16.08	104.6
			1.2		735.3	105.6	20.91	151.63
			1.3		863.0	123.9	24.04	182.24
2	BH-JB Western Jetty	-17.88	0.9	Very Dense Coral Sand*	370.8	53.9	10.79	69.87
			1.0		457.8	66.6	13.28	90.29
			1.2		659.2	95.9	19.52	143.9
			1.3		773.7	112.5	22.67	174.34
3	BH-JB1 Eastern Jetty	-26.60	0.9	Soft Rock	347.7	51.8	13.44	80.92
			1.0		429.3	63.9	16.35	103.63
			1.2		618.2	92.0	23.48	162.37
			1.3		725.5	108.0	27.58	198.38

	BH-JB2 Eastern Jetty	-24.50	0.9	Soft Rock	326.3	49.0	14.16	84.29
			1.0		402.9	60.5	17.44	108.87
			1.2		580.1	87.2	25.05	170.51
			1.3		680.9	102.3	28.76	204.71
	BH-AB Eastern Approach Trestle	-17.05	0.9	Soft Rock	309.4	44.8	27.83	107.34
			1.0		382.0	55.3	33.20	138.35
			1.2		550.1	79.6	46.85	220.71
			1.3		645.6	93.5	54.41	270.76

Note: Very Dense Coral Sand as it a refusal stratum (N>100) it is considered as weathered rock for estimation of Pile capacity.

Table 8.1.4 Pile Capacities of Western and Eastern Land Boreholes

S. No.	BH No.	Depth (m)	Diameter (m)	Pile Termination in Strata	Net Vertical Capacities (Tons)	Safe Uplift capacity (Tons)	Lateral Capacity (Tons)	Fixed End Moment (Ton-m)
1	BH-LB Western	-17.92	0.75	Soft Rock	270.2	40.1	6.96	46.12
			0.9		389.13	57.7	10.24	72.43
			1.0		480.41	71.2	12.66	93.39
			1.2		691.7	102.6	18.30	145.87

			1.3		811.8	120.4	21.32	176.46
2	BH-LB Eastern	-13.36	0.75	Soft Rock	287.32	41.2	9.16	51.22
			0.9		413.7	59.4	14.32	85.06
			1.0		510.7	73.3	17.85	110.85
			1.2		735.5	105.5	26.25	176.67
			1.3		863.2	123.8	30.84	215.77

Chemical results

Table 8.1.5 Chemical Results of Soil (LB)

Borehole No.	pH	Organic %	Sulphates %	Calcium carbonate %
BH-LB (Western land)	9.8	0.369	0.0058	98.0
BH-LB (Eastern land)	9.7	0.362	0.0052	93.0

Table 8.1.6 Chemical Results of Water (LB)

Borehole No.	pH	Total Salinity	Sulphates %	Chlorides %
BH-LB (Western land)	7.4	0.149	0.015	0.06
BH-LB (Eastern land)	7.5	0.138	0.018	0.07

Table 8.1.7 Chemical results of Water

Borehole No.	pH	Total Salinity %	Sulphates %	Chlorides %
BH-AB (Kalpeni Western)	7.6	6.535	0.0096	3.964

BH-JB (Kalpeni Western)	7.9	6.458	0.0083	3.758
BH-JB1 (Kalpeni Eastern)	6.9	6.235	0.0088	2.698
BH-JB2 (Kalpeni Eastern)	8.5	5.239	0.0095	2.189
BH-AB (Kalpeni Eastern)	6.3	5.985	0.0089	3.895

Table 8.1.7 Chemical results of Soil

Borehole No.	pH	Organic %	Sulphates %	Calcium carbonate %
BH-AB (Kalpeni Western)	8.5	0.35	0.0095	98.0
BH-JB (Kalpeni Western)	8.0	0.39	0.0093	83.0
BH-JB1 (Kalpeni Eastern)	7.8	0.44	0.0085	76.0
BH-JB2 (Kalpeni Eastern)	7.7	0.42	0.0090	89.0
BH-AB (Kalpeni Eastern)	8.3	0.33	0.0086	95.0

PLATE LOAD TEST REPORT

9 PLT FIELD INVESTIGATION METHOD

A test plate 450 mm X 450mm was used and it was placed at the proposed foundation level and subjected to incremental loading. Settlement at each increment of load was measured and Load-Settlement curves plotted. The bearing capacity and the settlement of the foundation were determined with the help of the load-settlement curves for the test plate. The tests were conducted as per IS: 1888-1982.

9.1 PROCEDURE

In the design of finished soil surface, design engineers need to know the bearing pressure of Surface of the soil. Plate bearing test is carried out in the field to serve this purpose. Results from the test can be used as design parameter or used to confirm the design assumption.

I. The test shall be carried out in general accordance with IS 1888-1982 'in-Situ Tests'.

II. A circular/square plate having a maximum diameter of 300 – 600 mm shall be used.

III. Protect the test area and the apparatus from moisture changes, sunlight and the effects of adverse weather as soon as the test level is exposed and throughout the test.

IV. The plate shall be placed on a thin layer (5mm thick) of clean dry sand to produce a level surface on which to bed the plate.

V. The centre of the plate shall be exactly match to the centre of the beam used to take the reaction and it shall be verified by plumb and bob arrangement.

VI. Set up the loading and deflection, measuring systems so that the load is applied to the plate without eccentricity and the deflection system is outside the zone of influence. During these operations a small seating load may be applied to the plate to enable adjustments to be made: this seating load shall be less than 0.07kg/Cm2.

VII. The load shall be applied in five increments. Settlement reading will be taken at 1.0, 2.25, 4, 6.25,9,16,25 and 60min and thereafter, until detectable movement of the plate has stopped, i.e. until the average settlement rate is less than 0.02mm per 1-minute interval.

The test is continued till a settlement of 25mm under normal circumstances or 50mm in special cases, such as dense gravel, gravel and sand mixture is reached or till failure occurs, whichever is earlier.

Alternately where settlement does not reach 25mm test should be continued to at least two times the estimated design pressure

IX. After the final test increment has been completed, the pressure in the hydraulic pump shall then be released and the settlement of the plate allowed to recover. When the recovery is essentially complete, the residual settlement value shall be recorded.

X. The load and settlement values recorded during the test are plotted on a simple graph with Load on X - axis and settlement on Y - axis

9.2 DETAILS FURNISHED

Table 9.2.1 Location and Test Details

Location	Coordinates	Depth of test location (m)	Width of Foundation (m)	Ultimate Load (T/m^2)
Kalpeni East	351859.73 E 1114932.10 N	1.2	2.0	60
Kalpeni West	351875.42 E 1115479.37 N	1.2	2.0	

9.3 INTERPRETATION OF RESULTS:

Test results are presented in the below table No.1

The Stress verse settlement curves are given in Annexure-I, and Site Photographs were given in Annexure- II

Bearing Capacity Computations

Safe bearing pressure for medium and dense sand could be read, corresponding to a settlement (S_p) which shall be calculated as under (S_f) taken as permissible settlement of footing:

$$S_f = S_p \times \{(B \times (B_p+0.3) / (B_p \times (B+0.3)\}^2$$

Where,

B = Width of footing in m.

B_p = Width of plate in m.

S_p = settlement of the test plate in m.

S_f = settlement of footing in m.

Table.9.3.1 Test Results

S.NO	Location	Depth of Test (m)	Settlement of the test plate in mm @ Ultimate Load	Settlement of the Footing in mm @ Ultimate Load	Ultimate Load (T/m^2)
1	Kalpeni East	1.2	14.05	29.09	60.T
2	Kalpeni West	1.2	15.42	32.47	60.T

9.4 RECOMMENDATIONS

S.NO		Ultimate load (T/M^2)	Obtained Plate settlement (mm)	allowable settlement (mm)	Calculated Foundation Settlement (mm)	Allowable settlement (mm)	Remarks
1	Kalpeni East	60.T	14.05	25.0	29.09	50.0	Safe
2	Kalpeni West	60.T	15.42		32.47		

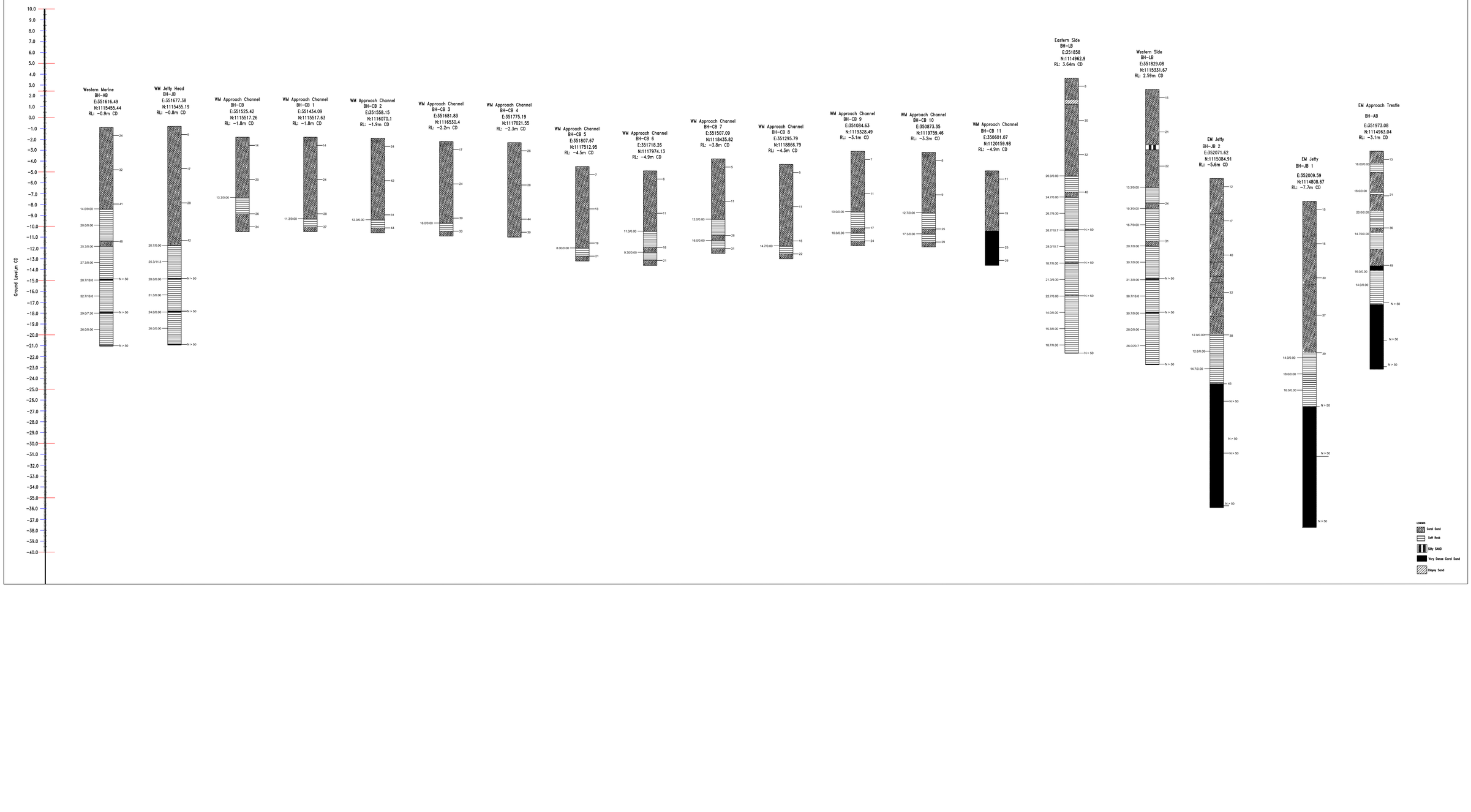
10 REFERENCES

- IS:12070-1987, Code of Practice for Design and Construction of Shallow Foundations on Rocks
- IS-1498, IS-2131, IS-1892 and various parts of IS-2720
- IS: 2720 (Part 1, 11, 111, IV, V, VI, X, Xl, Mil, XV, XXI, XXII, XXIII & XXXX)
- IS: 2720 (Part XVII, XXXVI, XII)
- IS: 6403 - 1981, 1892 - 1979, 1498- 1970, and 2131-1981
- IS: 8009 (Part -1)- 1976, (Part-Il) 1980.
- IS: 1904 - 1986.
- Foundation Design Manual, N. V. Nayak, 5th Edition, 1996
- Soil Mechanics and Foundation Engineering, K.R. Arora, Standard Publishers Distributors, Fourth Edition,1997.
- IS 13365 (Part 1) 2010 Quantitative Classification Systems of Rock Mass.
- IS 2911 Part -1/ Sec2 :2010 Design and Construction of Pile foundations.

ANNEXURE

- **BORELOG PROFILE**
- **LABORATORY TEST RESULTS**
- **FIELD PICTURES**
- **PLATE LOAD TEST RESULTS**

BOREHOLE PROFILE KALPENI



BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth, Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: BH-LB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Eastern Side	**Positioned Coordinates**	43P	351858	1114962.9
Land/Marine	: Land	**Drilling Period**	**From**		11-11-2024
Termination Depth (m).	: 25.0		**To**		13-11-2024
Ground Level wrt CD	3.64	**Water Table**	1.20m		

Depth (m)		Depth wrt CD		Sample Type	Sample No	Soil Log	Standard Penetration Test (SPT)				Strata Description	Total Core Recovery (%)	Length of core(>10 cm)	RQD %	Remarks
From	To	From	To				15 cm	30 cm	45 cm	N Value					
		0.00	3.64												
0.00	0.75	3.64	2.89	DS-1	S-1										
0.75	1.20	2.89	2.44	SPT-1	S-2		1	3	5	8	Loose Coral Sand				
1.20	1.95	2.44	1.69	DS-2	S-3										
1.95	2.40	1.69	1.24	UD-1	S-4						Silty sand				
2.40	3.90	1.24	-0.26	DS-3	S-5										
3.90	4.35	-0.26	-0.71	SPT-2	S-6		9	12	18	30					
4.35	5.10	-0.71	-1.46	DS-4	S-7										
5.10	5.55	-1.46	-1.91	UD-2	S-8						Medium Coral Sand				
5.55	7.05	-1.91	-3.41	DS-5	S-9										
7.05	7.50	-3.41	-3.86	SPT-3	S-10		8	13	19	32					
7.50	9.00	-3.86	-5.36	DS-6	S-11										
9.00	10.50	-5.36	-6.86	RCS-1	S-12						Soft Rock	20.0	-	0.0	
10.50	10.95	-6.86	-7.31	SPT-4	S-13		13	18	22	40	Dense Coral Sand				
10.95	12.45	-7.31	-8.81	RCS-2	S-14						Soft Rock	24.7	-	0.0	
12.45	13.95	-8.81	-10.31	RCS-3	S-15							26.7	14	9.3	
13.95	14.00	-10.31	-10.36	SPT-5	S-16		5cm/50; N>50				Very Dense Coral Sand				
14.00	15.50	-10.36	-11.86	RCS-4	S-17						Soft Rock	26.7	16	10.7	
15.50	17.00	-11.86	-13.36	RCS-5	S-18							28.0	16	10.7	
17.00	17.04	-13.36	-13.40	SPT-6	S-19		4cm/50; N>50				Very Dense Coral Sand				
17.04	18.54	-13.40	-14.90	RCS-6	S-20						Soft Rock	18.7	-		
18.54	20.04	-14.90	-16.40	RCS-7	S-21							21.3	14	9.3	
20.04	20.07	-16.40	-16.43	SPT-7	S-22		3cm/50; N>50				Very Dense Coral Sand				
20.07	21.57	-16.43	-17.93	RCS-8	S-23						Soft Rock	22.7	-	0.0	
21.57	23.07	-17.93	-19.43	RCS-9	S-24							14.0	-	0.0	
23.07	24.57	-19.43	-20.93	RCS-10	S-25							15.3	-	0.0	
24.57	25.32	-20.93	-21.68	RCS-11	S-26							18.7	-	0.0	
25.32	25.34	-21.68	-21.70	SPT-8	S-27		2cm/50; N>50				Very Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum		Coral Sand
CPT	Cone penetration test	**UDS**	Undistrubed Sample		Clay Sand
RQD	Rock Quality Designation	**RCS**	Rock Core Sample		Soft Rock
CR	Core Recovery	**DS**	Distubed Sample		Hard Rock
		Silty Sand			Very Dense Coral Sand

LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: LB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Eastern Side	**Proposed Coordinates :**	43P	351858	1114962.9
Land/Marine	: Land	**Drilling Period**	**From**	11-11-2024	
Termination Depth (m)	: 25.0		**TO**	13-11-2024	
CD Level	: 3.64				

Borehole No.	Sample Number	Depth w r to CD (m) From	Depth w r to CD (m) To	SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4) Gravel (%)	Sand (%)	Clay & Silt (%)	Atterberg limits (IS 2720 Part 5) Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Specific Gravity G	IS Classification	Bulk Density (gm/cc)	Moisture Content (%)	Dry Density (gm/cc)	Shear Strength Test C (t/m²)	Φ (deg)	Φ Design (deg)
		3.64																				
BH-LB		0.00	3.64																			
	DS-1	3.64	2.89																			
	SPT-1	2.89	2.44	8	15	15	Loose Coral Sand		13.1	76.4	10.5	NP	NP	NP	2.63	SW-SM	1.92	9.90	1.75	0.0	30.1	29.0
	DS-2	2.44	1.69																			
	UD-1	1.69	1.24				Silty sand		14.0	74.5	11.4	NP	NP	NP	2.65	SM	1.96	9.50	1.79	0.0	30.5	-
	DS-3	1.24	-0.26																			
	SPT-2	-0.26	-0.71	30	41	28			11.2	77.5	11.2	NP	NP	NP	2.55	SW-SM	1.99	9.30	1.82	0.0	32.7	32.0
	DS-4	-0.71	-1.46																			
	UD-2	-1.46	-1.91				Medium Coral Sand		Sample Slipped Off													
	DS-5	-1.91	-3.41																			
	SPT-3	-3.41	-3.86	32	36	25			10.1	78.8	11.1	NP	NP	NP	2.56	SW-SM	2.01	8.80	1.85	0.0	32.0	31.5
	DS-6	-3.86	-5.36																			

Borehole No.	Sample Number	Depth w r to CD (m) From	Depth w r to CD (m) To	Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
BH-LB	RCS-1	-5.36	-6.86		Soft Rock		5.4	20	0.0	-	-	-	

Borehole No.	Sample Number	Depth w r to CD (m) From	Depth w r to CD (m) To	SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4) Gravel (%)	Sand (%)	Clay & Silt (%)	Atterberg limits (IS 2720 Part 5) Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Specific Gravity G	IS Classification	Bulk Density (gm/cc)	Moisture Content (%)	Dry Density (gm/cc)	Shear Strength Test C (t/m²)	Φ (deg)	Φ Design (deg)
BH-LB	SPT-4	-6.86	-7.31	40	39	27	Dense Coral Sand		8.5	82.1	9.4	NP	NP	NP	2.59	SW-SM	2.02	8.60	1.86	0.0	32.6	32.0

Borehole No.	Sample Number	Depth w r to CD (m)		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-LB	RCS-2	-7.31	-8.81	37	Soft Rock		5.4	24.7	0.0	-	-	2.5	-
	RCS-3	-8.81	-10.31	40			5.4	26.7	9.3	-	-	-	15.9

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ Design
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-LB	SPT-5	-10.31	-10.36	>50	60	38	Very Dense Coral Sand		13.1	63.7	23.2	NP	NP	NP	2.68	SM	2.05	8.40	1.89	-	-	34.0

Borehole No.	Sample Number	Depth w r to CD (m)		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-LB	RCS-4	-10.36	-11.86	40	Soft Rock		5.4	26.7	10.7	-	-	-	18.2
	RCS-5	-11.86	-13.36	42			5.4	28.0	10.7	-	-	-	18.5

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ Design
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-LB	SPT-6	-13.36	-13.40	>50	60	38	Very Dense Coral Sand		Refusal and No Sample Recovered													

Borehole No.	Sample Number	Depth w r to CD (m)		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-LB	RCS-6	-13.40	-14.90	28	Soft Rock		5.4	18.7	0.0	-	-	2.0	
	RCS-7	-14.90	-16.40	32			5.4	21.3	9.3	-	-	-	15.9

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-LB	SPT-7	-16.40	-16.43	>50	60	38	Very Dense Coral Sand		Refusal and No Sample Recovered													

Borehole No.	Sample Number	Depth w r to CD (m)		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-LB	RCS-8	-16.43	-17.94	34	Soft Rock		5.4	22.7	0.0	-	-	2.5	
	RCS-9	-17.94	-19.43	21			5.4	14.0	0.0	-	-	1.5	
	RCS-10	-19.43	-20.93	23			5.4	15.3	0.0	-	-	1.8	
	RCS-11	-20.93	-21.68	28			5.4	18.7	0.0	-	-	2.3	

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-LB	SPT-8	-21.68	-21.70	>50	60	38	Very Dense Coral Sand		Refusal and No Sample Recovered													

For Manglam Consultancy Services Hyderabad

Tested by

Authorized Signatory

BH-LB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.75 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	0.75	m
Length of Pile		=	16.00	m
Depth of Pile from Ground Level		=	17.00	m
Self Weight of the Pile		=	98.97	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	1000.00	KN/m^2
	N_c	=	9.00	
	B	=	0.75	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1325.4**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	1000.00	kN/m^2
	L	=	2.25	*m*
	α		0.90	*m*
	B	=	0.75	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**1590.4**	*kN*
Allowable Load On The Pile	Q_a	=	**2915.8**	***kN***
Allowable Load On The Pile	Q_a	=	**297.4**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**2816.82**	***kN***
			287.32	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1212.3	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	404.1	*kN*
		=	**41.2**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-LB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.9 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	0.90	m
Length of Pile		=	16.00	m
Depth of Pile from Ground Level		=	17.00	m
Self Weight of the Pile		=	142.52	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	1000.00	KN/m^2
	N_c	=	9.00	
	B	=	0.90	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1908.5**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	1000.00	kN/m^2
	L	=	2.70	*m*
	α		0.90	*m*
	B	=	0.90	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2290.2**	*kN*
Allowable Load On The Pile	Q_a	=	**4198.7**	***kN***
Allowable Load On The Pile	Q_a	=	**428.3**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**4056.22**	***kN***
			413.73	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1745.7	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	581.9	*kN*
		=	**59.4**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-LB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.0 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.00	m
Length of Pile		=	16.00	m
Depth of Pile from Ground Level		=	17.00	m
Self Weight of the Pile		=	175.95	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	1000.00	KN/m^2
	N_c	=	9.00	
	B	=	1.00	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**2356.2**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	1000.00	kN/m^2
	L	=	3.00	*m*
	α		0.90	*m*
	B	=	1.00	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2827.4**	*kN*
Allowable Load On The Pile	Q_a	=	**5183.6**	***kN***
Allowable Load On The Pile	Q_a	=	**528.7**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**5007.68**	***kN***
			510.78	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	2155.2	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	718.4	*kN*
		=	**73.3**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-LB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.2 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.20	m
Length of Pile		=	16.00	m
Depth of Pile from Ground Level		=	17.00	m
Self Weight of the Pile		=	253.37	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	1000.00	KN/m^2
	N_c	=	9.00	
	B	=	1.20	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**3392.9**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	1000.00	kN/m^2
	L	=	3.60	*m*
	α		0.90	*m*
	B	=	1.20	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**4071.5**	*kN*
Allowable Load On The Pile	Q_a	=	**7464.4**	***kN***
Allowable Load On The Pile	Q_a	=	**761.4**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**7211.05**	***kN***
			735.53	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	3103.4	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	1034.5	*kN*
		=	**105.5**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-LB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.3 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.30	m
Length of Pile		=	16.00	m
Depth of Pile from Ground Level		=	17.00	m
Self Weight of the Pile		=	297.36	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	1000.00	KN/m^2
	N_c	=	9.00	
	B	=	1.30	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**3982.0**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	1000.00	kN/m^2
	L	=	3.90	*m*
	α		0.90	*m*
	B	=	1.30	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**4778.4**	*kN*
Allowable Load On The Pile	Q_a	=	**8760.3**	***kN***
Allowable Load On The Pile	Q_a	=	**893.6**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**8462.97**	***kN***
			863.22	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	3642.2	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	1214.1	*kN*
		=	**123.8**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-LB	**Lateral Load Capacity (Dia 0.75 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	0.75	m	
Length of Pile	=	16.00	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.27	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.01553	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	2.69	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4R**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.91	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	5.14	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	7.50	mm	
Allowable pile head deflection at cutoff level	=	22.79	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**9.16**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**51.22**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of

BH-LB	**Lateral Load Capacity (Dia 0.9 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	0.90	m	
Length of Pile	=	16.00	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.03221	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.03	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4R**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.92	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	5.83	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	9.00	mm	
Allowable pile head deflection at cutoff level	=	20.58	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**14.32**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**85.06**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of

BH-LB	**Lateral Load Capacity (Dia 1.00 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.00	m	
Length of Pile	=	16.00	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.04909	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.30	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4R**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.93	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	6.37	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	10.00	mm	
Allowable pile head deflection at cutoff level	=	19.25	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**17.85**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**110.85**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of

BH-LB	**Lateral Load Capacity (Dia 1.20 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.20	m	
Length of Pile	=	16.00	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.10179	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.82	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4R**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.94	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	7.41	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	12.00	mm	
Allowable pile head deflection at cutoff level	=	17.37	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**26.25**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**176.67**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of

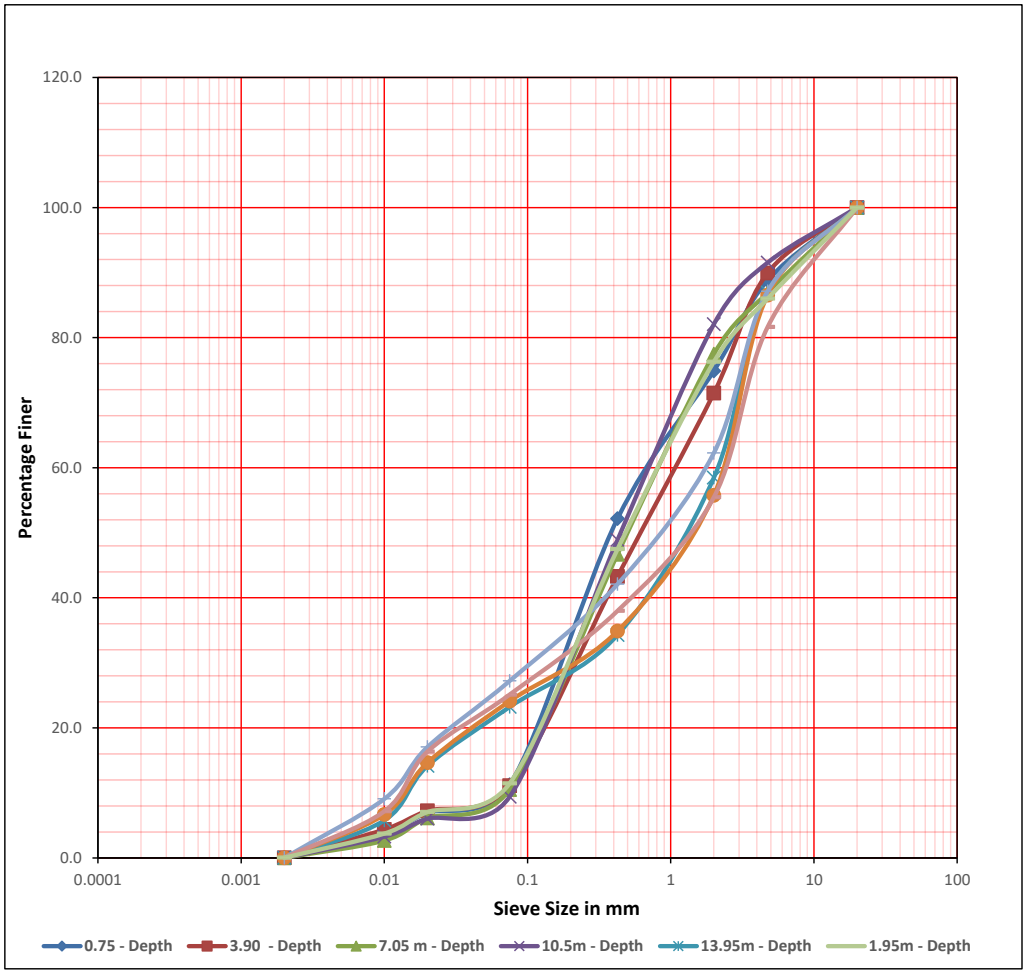
BH-LB	**Lateral Load Capacity (Dia 1.30 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.30	m	
Length of Pile	=	16.00	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.14020	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	4.07	m	
Behaviour of Pile based on embedment length	=	**Intermediate**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.95	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	7.94	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	13.00	mm	
Allowable pile head deflection at cutoff level	=	16.64	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**30.84**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**215.77**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

GRAIN SIZE ANALYSIS

BH-LB



DEPTH	CLAY	SILT			SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	COARSE
0.75	0.0	2.7	3.5	4.4	36.2	30.8	9.5	13.1	0.0
1.95	0.0	3.7	3.3	4.4	36.0	28.8	9.7	14.0	0.0
3.90	0.0	3.7	3.2	4.3	40.9	22.7	13.9	11.2	0.0
7.05	0.0	4.4	2.9	3.9	32.2	28.2	18.5	10.1	0.0
10.50	0.0	3.3	2.8	3.4	39.5	33.2	9.5	8.5	0.0
13.95	0.0	5.8	8.4	9.1	11.1	24.2	28.5	13.1	0.0

BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: JB1				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Eastern Side	**Positioned Coordinates**	43P	352009.59	1114808.67
Land/Marine	: Marine	**Drilling Period**	**From**		26-11-2024
Termination Depth (m).	: 30.0		**To**		01-12-2024
Bed Level wrt CD	-7.70	**Structure**	: Jetty Head		

Depth (m) wrt Seabed		Depth of seabed wrt CD		Sample Type	Sample No	Soil Log	Standard Penetration Test (SPT)				Strata Description	Total Core Recovery (%)	Length of core(>10 cm)	RQD %	Remarks
From	To	From	To				15 cm	30 cm	45 cm	N Value					
			-7.70								Water				
0.00	0.75	-7.70	-8.45	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	-8.45	-8.90	SPT-1	S-2		7	9	6	15					
1.20	1.95	-8.90	-9.65	DS-2	S-3										
1.95	2.40	-9.65	-10.10	UD-1	S-4										
2.40	3.90	-10.10	-11.60	DS-3	S-5										
3.90	4.35	-11.60	-12.05	SPT-2	S-6		11	7	8	15					
4.35	5.10	-12.05	-12.80	DS-4	S-7						Dense Coral Sand				
5.10	5.55	-12.80	-13.25	UD-2	S-8										
5.55	7.05	-13.25	-14.75	DS-5	S-10										
7.05	7.50	-14.75	-15.20	SPT-3	S-11		14	12	18	30					
7.50	9.00	-15.20	-16.70	DS-6	S-12										
9.00	10.50	-16.70	-18.20	DS-7	S-13										
10.50	10.95	-18.20	-18.65	SPT-4	S-14		13	16	21	37					
10.95	12.45	-18.65	-20.15	DS-8	S-15										
12.45	13.95	-20.15	-21.65	DS-9	S-16										
13.95	14.40	-21.65	-22.10	SPT-5	S-17		18	21	18	39					
14.40	15.90	-22.10	-23.60	RCS-1	S-18						Soft Rock	14.0		0.0	
15.90	17.40	-23.60	-25.10	RCS-2	S-19							18.0		0.0	
17.40	18.90	-25.10	-26.60	RCS-3	S-20							16.0		0.0	
18.90	19.00	-26.60	-26.70	SPT-6	S-21		10cm/50; N>50				Very Dense Coral Sand				
19.00	20.50	-26.70	-28.20	DS-10	S-22										
20.50	22.00	-28.20	-29.70	DS-11	S-20										
22.00	23.50	-29.70	-31.20	DS-12	S-21										
23.50	23.65	-31.20	-31.35	SPT-7	S-22		15cm/50; N>50								
23.65	25.15	-31.35	-32.85	DS-13	S-23										
25.15	26.65	-32.85	-34.35	DS-14	S-24										
26.65	28.15	-34.35	-35.85	DS-15	S-25										
28.15	29.65	-35.85	-37.35	DS-16	S-26										
29.65	30.02	-37.35	-37.72	SPT-8	S-27		32cm/50; N>50								

SPT Standard penetration test
CPT Cone penetration test
RQD Rock Quality Designation
CR Core Recovery

CD Chart Datum
UDS Undistrubed Sample
RCS Rock Core Sample
DS Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand

LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: JB1				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Eastern Side	**Proposed Coordinates :**	43P	352009.59	1114808.67
Land/Marine	: Marine	**Drilling Period**	**From**	26-11-2024	
Termination Depth (m).	: 30.0		**TO**	01-12-2024	
CD Level	-7.70	**Structure**	: Jetty Head		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	C	Φ	Φ Design
		-7.70							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-JB1			-7.70				Water															
	DS-1	-7.70	-8.45				Medium Dense Coral Sand															
	SPT-1	-8.45	-8.90	15	28	21			5.9	84.4	9.7	28.5	NP	NP	2.58	SW-SM	1.96	10.50	1.77	0.0	30.9	30.5
	DS-2	-8.90	-9.65																			
	UD-1	-9.65	-10.10						Sample Slipped off													
	DS-3	-10.10	-11.60																			
	SPT-2	-11.60	-12.05	15	20	18			4.5	84.1	11.4	29.0	NP	NP	2.63	SW-SM	1.97	10.00	1.79	0.0	31.3	30.0
	DS-4	-12.05	-12.80																			
	UD-2	-12.80	-13.25						Sample Slipped off													
	DS-5	-13.25	-14.75																			
	SPT-3	-14.75	-15.20	30	34	24			7.1	82.0	10.9	29.3	NP	NP	2.59	SW-SM	1.99	9.60	1.82	0.0	31.4	31.0
	DS-6	-15.20	-16.70				Dense Coral Sand															
	DS-7	-16.70	-18.20																			
	SPT-4	-18.20	-18.65	37	36	26			8.1	81.4	10.5	29.3	NP	NP	2.57	SW-SM	2.01	9.20	1.84	0.0	31.0	31.5
	DS-8	-18.65	-20.15																			
	DS-9	-20.15	-21.65																			
	SPT-5	-21.65	-22.10	39	35	25			9.5	79.5	11.0	29.3	NP	NP	2.61	SW-SM	2.02	8.70	1.86	0.0	31.8	31.5

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-JB1	RCS-1	-22.10	-23.60	21	Soft Rock		5.4	14.0	0.0	-	-	1.8	-
	RCS-2	-23.60	-25.10	27			5.4	18.0	0.0	-	-	1.9	-
	RCS-3	-25.10	-26.60	24			5.4	16.0	0.0	-	-	2.1	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ Design
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-JB1	SPT-6	-26.60	-26.70	>50	60	38	Very Dense Coral Sand		15.9	60.5	20.2	31.9	NP	NP	2.65	SM	2.03	8.50	1.87	-	-	34.0
	DS-10	-26.70	-28.20																			
	DS-11	-28.20	-29.70																			
	DS-12	-29.70	-31.20																			
	SPT-7	-31.20	-31.35	>50	60	38			14.2	62.9	22.9	33.0	NP	NP	2.67	SM	2.04	8.00	1.89	-	-	34.0
	DS-13	-31.35	-32.85																			
	DS-14	-32.85	-34.35																			
	DS-15	-34.35	-35.85																			
	DS-16	-35.85	-37.35																			
	SPT-8	-37.35	-37.72	>50	60	38			15.9	58.2	25.9	32.2	NP	NP	2.69	SM	2.05	7.70	1.90	-	-	34.0

For Manglam Consultancy Services Hyderabad

Tested by

Authorized Signatory

BH-JB1	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.9 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	0.90	m
Length of Pile		=	17.90	m
Depth of Pile from Ground Level		=	18.90	m
Self Weight of the Pile		=	159.45	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	850.00	KN/m^2
	N_c	=	9.00	
	B	=	0.90	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1622.2**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	850.00	kN/m^2
	L	=	2.70	*m*
	α		0.90	*m*
	B	=	0.90	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**1946.7**	*kN*
Allowable Load On The Pile	Q_a	=	**3568.9**	***kN***
Allowable Load On The Pile	Q_a	=	**364.0**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**3409.48**	***kN***
			347.77	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1522.1	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	507.4	*kN*
		=	**51.8**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB1	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.0 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.00	m
Length of Pile		=	17.90	m
Depth of Pile from Ground Level		=	18.90	m
Self Weight of the Pile		=	196.85	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	850.00	KN/m^2
	N_c	=	9.00	
	B	=	1.00	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**2002.8**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	850.00	kN/m^2
	L	=	3.00	*m*
	α		0.90	*m*
	B	=	1.00	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2403.3**	*kN*
Allowable Load On The Pile	Q_a	=	**4406.1**	***kN***
Allowable Load On The Pile	Q_a	=	**449.4**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**4209.24**	***kN***
			429.34	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1879.2	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	626.4	*kN*
		=	**63.9**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB1	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.2m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.20	m
Length of Pile		=	17.90	m
Depth of Pile from Ground Level		=	18.90	m
Self Weight of the Pile		=	283.46	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	850.00	KN/m^2
	N_c	=	9.00	
	B	=	1.20	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**2884.0**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	850.00	kN/m^2
	L	=	3.60	*m*
	α		0.90	*m*
	B	=	1.20	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**3460.8**	*kN*
Allowable Load On The Pile	Q_a	=	**6344.8**	***kN***
Allowable Load On The Pile	Q_a	=	**647.2**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**6061.30**	***kN***
			618.25	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	2706.0	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	902.0	*kN*
		=	**92.0**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB1	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.3 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.30	m
Length of Pile		=	17.90	m
Depth of Pile from Ground Level		=	18.90	m
Self Weight of the Pile		=	332.67	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	850.00	KN/m^2
	N_c	=	9.00	
	B	=	1.30	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**3384.7**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	850.00	kN/m^2
	L	=	3.90	*m*
	α		0.90	*m*
	B	=	1.30	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**4061.6**	*kN*
Allowable Load On The Pile	Q_a	=	**7446.3**	***kN***
Allowable Load On The Pile	Q_a	=	**759.5**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**7113.61**	***kN***
			725.59	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	3175.8	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	1058.6	*kN*
		=	**108.0**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB1	**Lateral Load Capacity (Dia 0.9 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	0.90	m	
Length of Pile	=	17.90	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.38	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.03221	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.09	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.94	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	6.00	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	9.00	mm	
Allowable pile head deflection at cutoff level	=	20.14	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**13.44**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**80.92**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-JB1	**Lateral Load Capacity (Dia 1.0 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.00	m	
Length of Pile	=	17.90	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.38	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.04909	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.36	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.97	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	6.62	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	10.00	mm	
Allowable pile head deflection at cutoff level	=	18.73	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**16.35**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**103.63**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-JB1	**Lateral Load Capacity (Dia 1.2 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.20	m	
Length of Pile	=	17.90	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.38	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.10179	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.89	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	2.00	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	7.78	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	12.00	mm	
Allowable pile head deflection at cutoff level	=	16.85	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**23.48**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**162.37**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

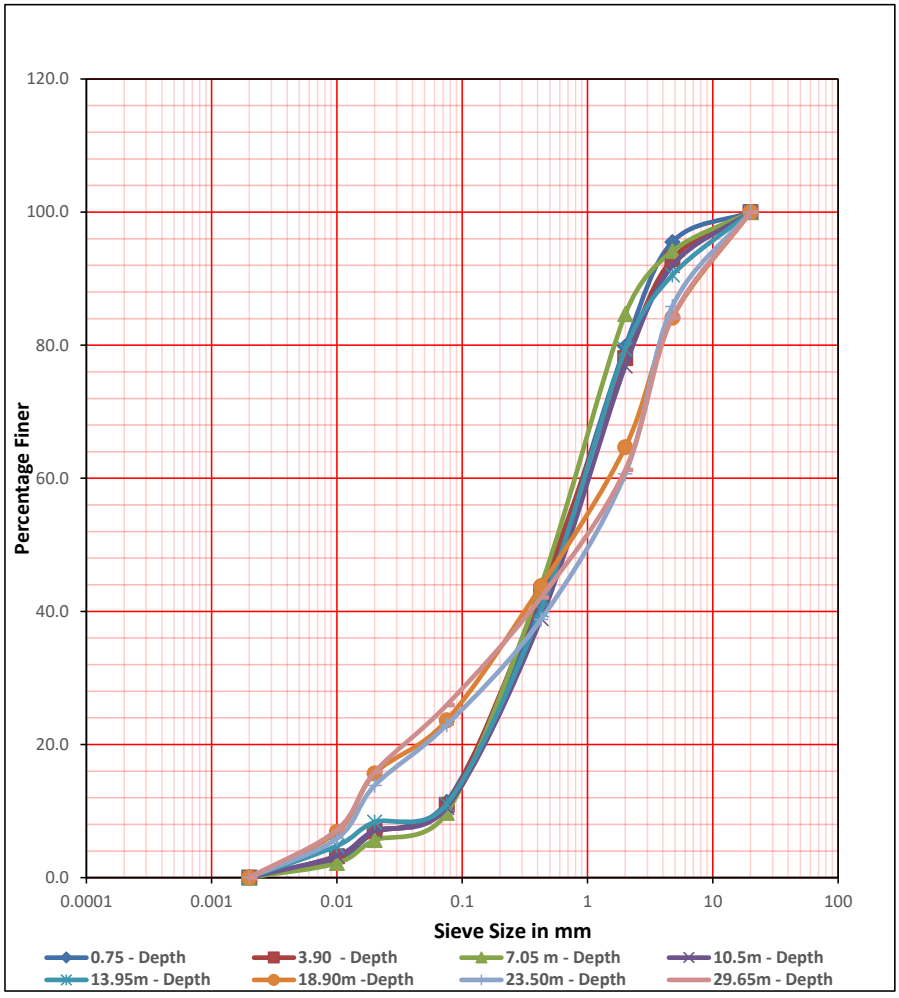
BH-JB1	**Lateral Load Capacity (Dia 1.3 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.30	m	
Length of Pile	=	17.90	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.38	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.14020	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	4.15	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	2.01	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	8.34	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	13.00	mm	
Allowable pile head deflection at cutoff level	=	16.18	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**27.58**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**198.38**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

GRAIN SIZE ANALYSIS

BH-JB1



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	9.7	34.2	40.8	9.5	5.9	0.0
3.90	11.4	30.5	37.9	15.7	4.5	0.0
7.05	10.9	32.1	35.1	14.9	7.1	0.0
10.50	10.5	28.4	38.0	15.1	8.1	0.0
13.95	11.0	29.2	39.2	11.2	9.5	0.0
18.90	23.6	20.2	20.9	19.5	15.9	0.0
20.08	22.9	15.9	21.9	25.2	14.2	0.0
29.65	25.9	16.2	19.2	22.9	15.9	0.0

BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: JB2				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Eastern Side	**Positioned Coordinates**	43P	352071.62	1115084.91
Land/Marine	: Marine	**Drilling Period**	**From**		07-12-2024
Termination Depth (m).	: 30.0		**To**		12-12-2024
Bed Level wrt CD	-5.60	**Structure**	: Jetty Head		

Depth (m) wrt Seabed		Depth of seabed wrt CD		Sample Type	Sample No	Soil Log	Standard Penetration Test (SPT)				Strata Description	Total Core Recovery (%)	Length of core(>10 cm)	RQD %	Remarks
From	To	From	To				15 cm	30 cm	45 cm	N Value					
			-5.60								Water				
0.00	0.75	-5.60	-6.35	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	-6.35	-6.80	SPT-1	S-2		6	7	5	12					
1.20	1.95	-6.80	-7.55	RCS-1	S-3						Soft Rock	8.7		0.0	
1.95	2.40	-7.55	-8.00	UD-1	S-4						Medium Dense Coral Sand				
2.40	3.90	-8.00	-9.50	DS-2	S-5										
3.90	4.35	-9.50	-9.95	SPT-2	S-6		11	8	9	17					
4.35	5.10	-9.95	-10.70	DS-3	S-7						Dense Coral Sand				
5.10	5.55	-10.70	-11.15	UD-2	S-8										
5.55	7.05	-11.15	-12.65	DS-4	S-10										
7.05	7.50	-12.65	-13.10	SPT-3	S-11		13	19	21	40					
7.50	9.00	-13.10	-14.60	DS-5	S-12										
9.00	10.50	-14.60	-16.10	DS-6	S-13										
10.50	10.95	-16.10	-16.55	SPT-4	S-14		17	11	21	32					
10.95	12.45	-16.55	-18.05	RCS-2	S-15						Soft Rock	20.0		0.0	
12.45	13.95	-18.05	-19.55	DS-7	S-16						Dense Coral Sand				
13.95	14.40	-19.55	-20.00	SPT-5	S-17		15	26	12	38					
14.40	15.90	-20.00	-21.50	RCS-3	S-18						Soft Rock	12.0		0.0	
15.90	17.40	-21.50	-23.00	RCS-4	S-19							12.6		0.0	
17.40	18.90	-23.00	-24.50	RCS-5	S-20							14.7		0.0	
18.90	19.35	-24.50	-24.95	SPT-6	S-21		26	17	28	45	Dense Coral Sand				
19.35	20.85	-24.95	-26.45	DS-8	S-22						Very Dense Coral Sand				
20.85	22.35	-26.45	-27.95	DS-9	S-20										
22.35	23.85	-27.95	-29.45	DS-10	S-21										
23.85	24.00	-29.45	-29.60	SPT-7	S-22		15cm/50; N>50								
24.00	25.50	-29.60	-31.10	DS-11	S-23										
25.50	27.00	-31.10	-32.60	DS-12	S-24										
27.00	28.50	-32.60	-34.10	DS-13	S-25										
28.50	28.68	-34.10	-34.28	SPT-8	S-26		18cm/50; N>50								
28.68	30.18	-34.28	-35.78	DS-14	S-27										
30.18	30.30	-35.78	-35.90	SPT-9	S-28		12cm/50; N>50								

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand

LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: JB2				
CLIENT	: Cochin Port Authority	**Zone**	**Easting**	**Northing**	
Location	: Kalpeni Eastern Side	**Proposed Coordinates :**	43P	352071.62	1115084.91
Land/Marine	: Marine	**Drilling Period**	**From**	07-12-2024	
Termination Depth (m).	: 30.0		**TO**	12-12-2024	
CD Level	**-5.60**	**Structure**	: Jetty Head		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ Design
		-5.60							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
			-5.60				Water															
BH-JB2	DS-1	-5.60	-6.35				Medium Dense Coral Sand															
	SPT-1	-6.35	-6.80	12	22	19			6.8	83.6	9.6	NP	NP	NP	2.58	SW-SM	1.86	10.30	1.69	0.0	31.3	30.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-JB2	RCS-1	-6.80	-7.55	13.0	Soft Rock		5.4	8.7	0.0	-	-	1.2	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ Design
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-JB2	UD-1	-7.55	-8.00				Medium Dense Coral Sand		Sample Slipped off													
	DS-2	-8.00	-9.50																			
	SPT-2	-9.50	-9.95	17	26	20			16.4	75.0	8.7	NP	NP	NP	2.59	SW-SM	1.96	10.00	1.78	0.0	31.0	30.5
	DS-3	-9.95	-10.70				Dense Coral Sand															
	UD-2	-10.70	-11.15						Sample Slipped off													
	DS-4	-11.15	-12.65																			-
	SPT-3	-12.65	-13.10	40	46	31			16.9	73.6	9.5	NP	NP	NP	2.6	SW-SM	1.99	9.80	1.81	0.0	31.2	32.5
	DS-5	-13.10	-14.60																			
	DS-6	-14.60	-16.10																			
	SPT-4	-16.10	-16.55	32	32	24			11.6	77.9	10.5	NP	NP	NP	2.55	SW-SM	1.93	9.50	1.76	0.0	31.4	31.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-JB2	RCS-2	-16.55	-18.05	30.00	Soft Rock		5.4	20	0.0	-	-	2.1	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ Design
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-JB2	DS-7	-18.05	-19.55				Dense Coral Sand															
	SPT-5	-19.55	-20.00	38	35	25			10.9	77.7	11.4	NP	NP	NP	2.57	SW-SM	1.95	9.20	1.79	0.0	32.1	31.5

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-JB2	RCS-3	-20.00	-21.50	18	Soft Rock		5.4	12.0	0.0	-	-	1.8	-
	RCS-4	-21.50	-23.00	18.9			5.4	12.6	0.0	-	-	1.9	-
	RCS-5	-21.50	-24.50	22			5.4	14.7	0.0	-	-	2.2	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ Design
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-JB2	SPT-6	-24.50	-24.95	45	37	26	Dense Coral Sand		29.2	59.0	11.8	NP	NP	NP	2.63	SW-SM	1.97	9.00	1.81	-	-	31.5
	DS-8	-24.95	-26.45				Very Dense Coral Sand															
	DS-9	-26.45	-27.95																			
	DS-10	-27.95	-29.45																			
	SPT-7	-29.45	-29.60	>50	60	38			13.5	63.6	22.9	NP	NP	NP	2.65	SM	1.98	8.70	1.82	-	-	34.0
	DS-11	-29.60	-31.10																			
	DS-12	-31.10	-32.60																			
	DS-13	-32.60	-34.60																			
	SPT-8	-34.60	-34.10	>50	60	38			15.2	59.0	25.8	NP	NP	NP	2.68	SM	1.99	8.50	1.83	-	-	34.0
	DS-14	-34.10	-35.78																			
	SPT-9	-35.78	-35.90	>50	60	38			19.2	56.2	24.6	NP	NP	NP	2.63	SM	2.00	8.20	1.85	-	-	34.0

For Manglam Consultancy Services Hyderabad

Tested by

Authorized Signatory

BH-JB2	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.9 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	0.90	m
Length of Pile		=	17.90	m
Depth of Pile from Ground Level		=	18.90	m
Self Weight of the Pile		=	159.45	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	800.00	KN/m^2
	N_c	=	9.00	
	B	=	0.90	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1526.8**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	800.00	kN/m^2
	L	=	2.70	*m*
	α		0.90	*m*
	B	=	0.90	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**1832.2**	*kN*
Allowable Load On The Pile	Q_a	=	**3359.0**	***kN***
Allowable Load On The Pile	Q_a	=	**342.6**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**3199.55**	***kN***
			326.35	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1442.0	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	480.7	*kN*
		=	**49.0**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB2	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.0 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.00	m
Length of Pile		=	17.90	m
Depth of Pile from Ground Level		=	18.90	m
Self Weight of the Pile		=	196.85	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	800.00	KN/m^2
	N_c	=	9.00	
	B	=	1.00	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1885.0**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	800.00	kN/m^2
	L	=	3.00	*m*
	α		0.90	*m*
	B	=	1.00	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2261.9**	*kN*
Allowable Load On The Pile	Q_a	=	**4146.9**	***kN***
Allowable Load On The Pile	Q_a	=	**423.0**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**3950.06**	***kN***
			402.91	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1780.2	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	593.4	*kN*
		=	**60.5**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB2	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.2 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.20	m
Length of Pile		=	17.90	m
Depth of Pile from Ground Level		=	18.90	m
Self Weight of the Pile		=	283.46	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	800.00	KN/m^2
	N_c	=	9.00	
	B	=	1.20	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**2714.3**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	800.00	kN/m^2
	L	=	3.60	*m*
	α		0.90	*m*
	B	=	1.20	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**3257.2**	*kN*
Allowable Load On The Pile	Q_a	=	**5971.5**	***kN***
Allowable Load On The Pile	Q_a	=	**609.1**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**5688.08**	***kN***
			580.18	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	2563.5	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	854.5	*kN*
		=	**87.2**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB2	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.3 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.30	m
Length of Pile		=	17.90	m
Depth of Pile from Ground Level		=	18.90	m
Self Weight of the Pile		=	332.67	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	800.00	KN/m^2
	N_c	=	9.00	
	B	=	1.30	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**3185.6**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	800.00	kN/m^2
	L	=	3.90	*m*
	α		0.90	*m*
	B	=	1.30	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**3822.7**	*kN*
Allowable Load On The Pile	Q_a	=	**7008.3**	***kN***
Allowable Load On The Pile	Q_a	=	**714.8**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**6675.59**	***kN***
			680.91	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	3008.6	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	1002.9	*kN*
		=	**102.3**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB2	**Lateral Load Capacity (Dia 0.9 m)**			
Sea bed Level w. r. to CD	=	5.60		
Cut off Level	=	1.00	m	
Diameter of Pile	=	0.90	m	
Length of Pile	=	17.90	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.03221	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.03	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.93	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	5.86	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	9.00	mm	
Allowable pile head deflection at cutoff level	=	20.50	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**14.16**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**84.29**	**Ton-m**	

Note:
Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-JB2	**Lateral Load Capacity (Dia 1.0 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.00	m	
Length of Pile	=	17.90	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.04909	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.30	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.95	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	6.44	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	10.00	mm	
Allowable pile head deflection at cutoff level	=	19.11	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**17.44**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**108.87**	**Ton-m**	

Note:
Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-JB2	**Lateral Load Capacity (Dia 1.2 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.20	m	
Length of Pile	=	17.90	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.10179	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.82	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.98	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	7.56	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	12.00	mm	
Allowable pile head deflection at cutoff level	=	17.15	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**25.05**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**170.51**	**Ton-m**	

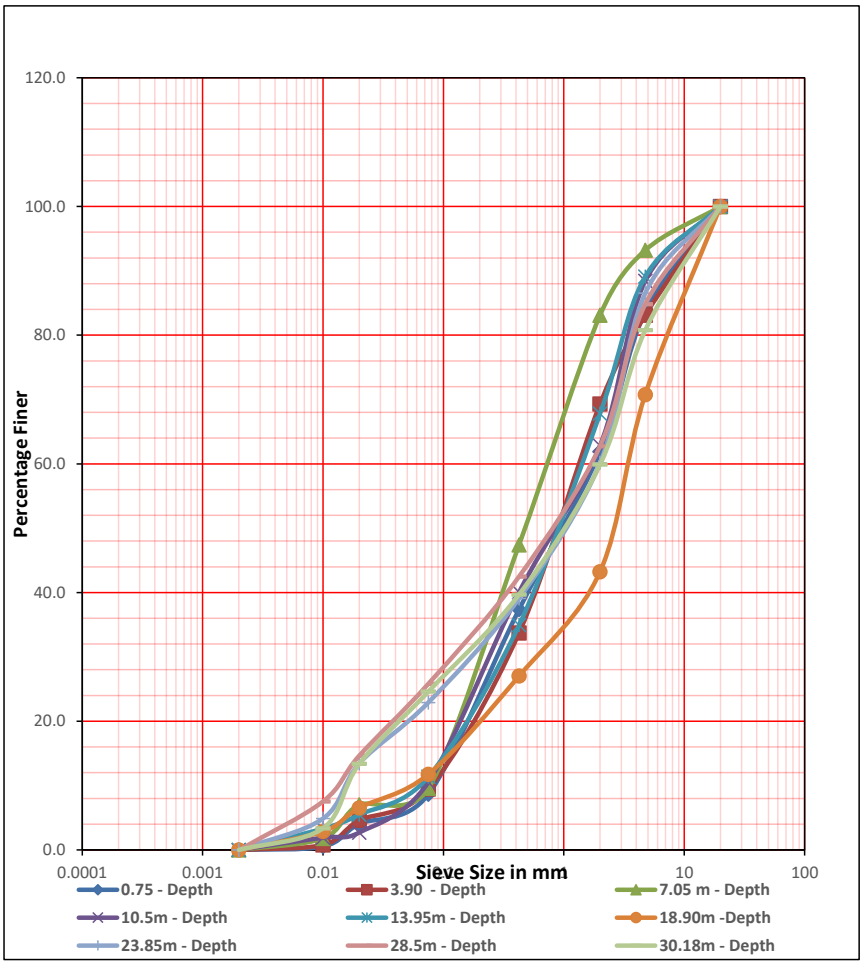
Note:
Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-JB2	**Lateral Load Capacity (Dia 1.3 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.30	m	
Length of Pile	=	17.90	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.14020	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	4.07	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.05	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	2.01	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	8.19	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	13.00	mm	
Allowable pile head deflection at cutoff level	=	16.35	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**28.76**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**204.71**	**Ton-m**	

Note:
Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

GRAIN SIZE ANALYSIS

BH-JB2



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	9.6	37.8	35.7	10.1	6.8	0.0
3.90	8.7	28.7	24.5	21.7	16.4	0.0
7.05	9.5	24.3	35.6	13.8	16.9	0.0
10.50	10.5	29.5	22.8	25.6	11.6	0.0
13.95	11.4	23.6	32.9	21.3	10.9	0.0
18.90	11.8	15.3	16.2	27.5	29.2	0.0
23.85	22.9	16.2	21.1	26.4	13.5	0.0
28.50	25.8	16.7	20.3	22.1	15.2	0.0
30.18	24.6	15.1	20.2	20.9	19.2	0.0

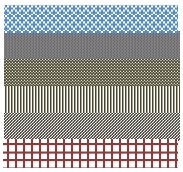
BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: AB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Eastern Side	**Positioned Coordinates**	43P	351973.08	1114963.04
Land/Marine	: Marine	**Drilling Period**	**From**		17-12-2024
Termination Depth (m).	: 20.0		**To**		20-12-2024
Bed Level wrt CD	-3.10	**Structure**	: Approach Trestle		

Depth (m) wrt Seabed		Depth of seabed wrt CD		Sample Type	Sample No	Soil Log	Standard Penetration Test (SPT)				Strata Description	Total Core Recovery (%)	Length of core(>10 cm)	RQD %	Remarks
From	To	From	To				15 cm	30 cm	45 cm	N Value					
			-3.10								Water				
0.00	0.75	-3.10	-3.85	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	-3.85	-4.30	SPT-1	S-2		4	7	6	13					
1.20	1.95	-4.30	-5.05	RCS-1	S-3						Soft Rock	16.6	-	0.0	
1.95	2.40	-5.05	-5.50	UD-1	S-4						Coral Sand				
2.40	3.90	-5.50	-7.00	RCS-2	S-5						Soft Rock	16.0	-	0.0	
3.90	4.35	-7.00	-7.45	SPT-2	S-6		11	5	16	21	Medium Dense Coral Sand				
4.35	5.10	-7.45	-8.20	DS-2	S-7										
5.10	5.55	-8.20	-8.65	UD-2	S-8										
5.55	7.05	-8.65	-10.15	RCS-3	S-10						Soft Rock	20.0	-	0.0	
7.05	7.50	-10.15	-10.60	SPT-3	S-11		8	14	22	36	Dense Coral Sand				
7.50	9.00	-10.60	-12.10	RCS-4	S-12						Soft Rock	14.7	-	0.0	
9.00	10.50	-12.10	-13.60	DS-3	S-13						Dense Coral Sand				
10.50	10.95	-13.60	-14.05	SPT-4	S-14		11	28	21	49					
10.95	12.45	-14.05	-15.55	RCS-5	S-15						Soft Rock	16.0	-	0.0	
12.45	13.95	-15.55	-17.05	RCS-6	S-16							15.3	-	0.0	
13.95	14.00	-17.05	-17.10	SPT-5	S-17		5cm/50; N>50				Very Dense Coral Sand				
14.00	15.50	-17.10	-18.60	DS-4	S-18										
15.50	17.00	-18.60	-20.10	DS-5	S-19										
17.00	17.18	-20.10	-20.28	SPT-6	S-20		18cm/50; N>50								
17.18	18.68	-20.28	-21.78	DS-6	S-21										
18.68	20.18	-21.78	-23.28	DS-7	S-22										
20.18	20.42	-23.28	-23.52	SPT-7	S-20		24cm/50; N>50								

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: AB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Eastern Side	**Proposed Coordinates :**	43P	351973.08	1114963.04
Land/Marine	: Marine	**Drilling Period**	**From**	17-12-2024	
Termination Depth (m).	: 20.0		**TO**	20-12-2024	
CD Level	**-3.10**	**Structure**	: Approach Trestle		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ Design
		-3.10							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-AB			-3.10				Water															
	DS-1	-3.10	-3.85				Medium Dense Coral Sand															
	SPT-1	-3.85	-4.30	13	24	19			7.5	82.6	9.9	NP	NP	NP	2.59	SW-SM	1.92	10.60	1.74	0.0	31.4	30.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	Core Recovery %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-05	RCS-1	-4.30	-5.05	25.00	Soft Rock		4.4	16.7	0.0	0.0	-	-	1.5

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ Design
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-AB	UD-1	-5.05	-5.50				Coral Sand		Sample Slipped off													

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	Core Recovery %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-AB	RCS-2	-5.50	-7.00	24.00	Soft Rock		5.4	16	0.0	0.0	-	1.5	

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{Design}
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-AB	SPT-2	-7.00	-7.45	21	29	22	Medium Dense Coral Sand		8.3	81.5	10.2	NP	NP	NP	2.58	SW-SM	2.00	9.90	1.82	0.0	31.9	31.0
	DS-2	-7.45	-8.20																			
	UD-2	-8.20	-8.65						Sample Slipped off													

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	Core Recovery %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-05	RCS-3	-8.65	-10.15	30	Soft Rock		5.4	20	0.0	0.0	-	1.5	

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{Design}
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-AB	SPT-3	-10.15	-10.60	36	42	28	Dense Coral Sand		9.8	78.8	11.4	NP	NP	NP	2.62	SW-SM	2.01	9.50	1.84	0.0	33.0	32.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	Core Recovery %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-05	RCS-4	-10.60	-12.10	22	Soft Rock		5.4	14.7	0.0	0.0	-	1.9	

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{Design}
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-05	DS-3	-12.10	-13.60				Dense Coral Sand															
	SPT-4	-13.60	-14.05	49	49	32			13.8	76.4	9.8	NP	NP	NP	2.63	SW-SM	2.05	9.00	1.88	0.0	34.2	33.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	Core Recovery %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-05	RCS-5	-14.05	-15.55	24	Soft Rock		5.4	16	0.0	0.0	-	1.2	1.2
	RCS-6	-15.55	-17.05	23			5.4	15.3	0.0	0.0	-	1.4	1.4

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ Design
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-05	SPT-5	-17.05	-17.10	>50	60	38	Very Dense Coral Sand		14.2	62.6	23.2	NP	NP	NP	2.65	SM	2.08	8.80	1.91	-	-	34.0
	DS-4	-17.10	-18.60																			
	DS-5	-18.60	-20.10																			
	SPT-6	-20.10	-20.28	>50	60	38			16.2	63.9	19.9	NP	NP	NP	2.67	SM	2.08	8.40	1.92	-	-	34.0
	DS-6	-20.28	-21.78																			
	DS-7	-21.78	-23.28																			
	SPT-7	-23.28	-23.52	>50	60	38			13.9	60.9	25.2	NP	NP	NP	2.69	SM	2.10	8.20	1.94	-	-	34.0

For Manglam Consultancy Services Hyderabad

Tested by

Authorized Signatory

BH-AB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.9 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	0.90	m
Length of Pile		=	12.95	m
Depth of Pile from Ground Level		=	13.95	m
Self Weight of the Pile		=	115.35	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	750.00	KN/m^2
	N_c	=	9.00	
	B	=	0.90	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1431.4**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	750.00	kN/m^2
	L	=	2.70	*m*
	α		0.90	*m*
	B	=	0.90	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**1717.7**	*kN*
Allowable Load On The Pile	Q_a	=	**3149.1**	***kN***
Allowable Load On The Pile	Q_a	=	**321.2**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**3033.70**	***kN***
			309.44	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1317.7	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	439.2	*kN*
		=	**44.8**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-AB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.0 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.00	m
Length of Pile		=	12.95	m
Depth of Pile from Ground Level		=	13.95	m
Self Weight of the Pile		=	142.41	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	750.00	KN/m^2
	N_c	=	9.00	
	B	=	1.00	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1767.1**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	750.00	kN/m^2
	L	=	3.00	*m*
	α		0.90	*m*
	B	=	1.00	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2120.6**	*kN*
Allowable Load On The Pile	Q_a	=	**3887.7**	***kN***
Allowable Load On The Pile	Q_a	=	**396.5**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**3745.31**	***kN***
			382.02	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1626.8	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	542.3	*kN*
		=	**55.3**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-AB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.2 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.20	m
Length of Pile		=	12.95	m
Depth of Pile from Ground Level		=	13.95	m
Self Weight of the Pile		=	205.07	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	750.00	KN/m^2
	N_c	=	9.00	
	B	=	1.20	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**2544.7**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	750.00	kN/m^2
	L	=	3.60	*m*
	α		0.90	*m*
	B	=	1.20	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**3053.6**	*kN*
Allowable Load On The Pile	Q_a	=	**5598.3**	***kN***
Allowable Load On The Pile	Q_a	=	**571.0**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**5393.25**	***kN***
			550.11	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	2342.6	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	780.9	*kN*
		=	**79.6**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-AB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.3 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.30	m
Length of Pile		=	12.95	m
Depth of Pile from Ground Level		=	13.95	m
Self Weight of the Pile		=	240.67	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	750.00	KN/m^2
	N_c	=	9.00	
	B	=	1.30	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**2986.5**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	750.00	kN/m^2
	L	=	3.90	*m*
	α		0.90	*m*
	B	=	1.30	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**3583.8**	*kN*
Allowable Load On The Pile	Q_a	=	**6570.2**	***kN***
Allowable Load On The Pile	Q_a	=	**670.2**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**6329.57**	***kN***
			645.62	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	2749.3	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	916.4	*kN*
		=	**93.5**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-AB	**Lateral Load Capacity (Dia 0.9 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	0.90	m	
Length of Pile	=	12.95	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.03221	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.03	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	1.40	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	2.08	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	6.31	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	9.00	mm	
Allowable pile head deflection at cutoff level	=	10.95	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**27.83**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**107.34**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of

BH-AB	**Lateral Load Capacity (Dia 1.0 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.00	m	
Length of Pile	=	12.95	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.04909	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.30	m	
Behaviour of Pile based on embedment length	=	**Intermediate**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	1.40	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	2.10	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	6.93	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	10.00	mm	
Allowable pile head deflection at cutoff level	=	10.81	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**33.20**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**138.35**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of

BH-AB	**Lateral Load Capacity (Dia 1.2 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.20	m	
Length of Pile	=	12.95	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.10179	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.82	m	
Behaviour of Pile based on embedment length	=	**Intermediate**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	1.40	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	2.10	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	8.02	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	12.00	mm	
Allowable pile head deflection at cutoff level	=	10.63	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**46.85**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**220.71**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of

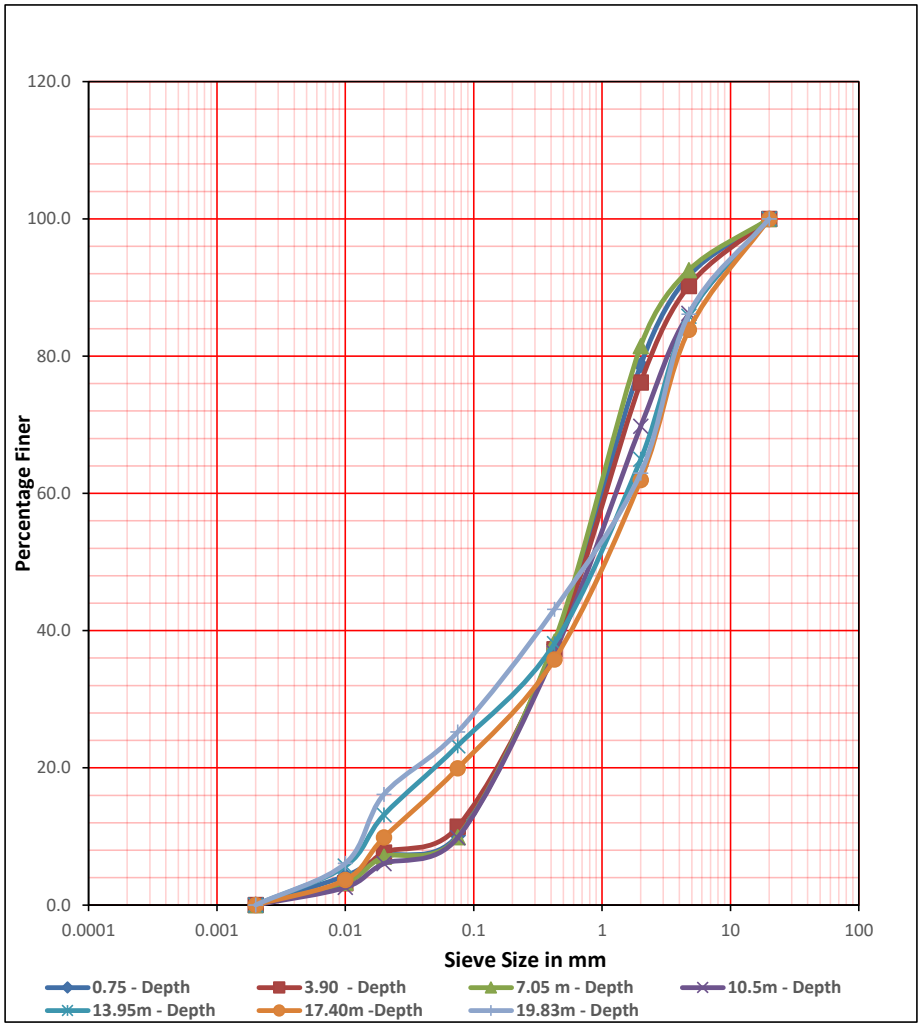
BH-AB	**Lateral Load Capacity (Dia 1.3 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.30	m	
Length of Pile	=	12.95	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.70	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.14020	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	4.07	m	
Behaviour of Pile based on embedment length	=	**Intermediate**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	1.40	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	2.10	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	8.55	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	13.00	mm	
Allowable pile head deflection at cutoff level	=	10.57	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**54.41**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**270.76**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of

GRAIN SIZE ANALYSIS

BH-AB



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	9.9	28.5	43.1	11.1	7.5	0.0
3.90	10.2	27.8	40.7	13.0	8.3	0.0
7.05	11.4	25.9	38.9	14.1	9.8	0.0
10.50	9.8	26.9	33.1	16.5	13.8	0.0
13.95	23.2	14.9	26.9	20.9	14.2	0.0
17.40	19.9	15.9	26.2	21.9	16.2	0.0
19.83	25.2	17.9	19.9	23.2	13.9	0.0

BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth, Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: LB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351829.08	1115331.67
Land/Marine	: Land	**Drilling Period**	**From**		07-11-2024
Termination Depth (m)	: 25.0		**To**		09-11-2024
Ground Level wrt CD	2.59	**Water table**	1.0m		

Depth (m)		**Depth wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
		0.00	2.59												
0.00	0.75	2.59	1.84	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	1.84	1.39	SPT-1	S-2		5	8	7	15					
1.20	1.95	1.39	0.64	DS-2	S-3										
1.95	2.40	0.64	0.19	UD-1	S-4										
2.40	3.90	0.19	-1.31	DS-3	S-5										
3.90	4.35	-1.31	-1.76	SPT-2	S-6		8	9	12	21					
4.35	5.10	-1.76	-2.51	DS-4	S-7										
5.10	5.55	-2.51	-2.96	UD-2	S-8						Silty Sand				
5.55	7.05	-2.96	-4.46	DS-5	S-9						Medium Dense Coral Sand				
7.05	7.50	-4.46	-4.91	SPT-3	S-10		11	9	13	22					
7.50	9.00	-4.91	-6.41	DS-6	S-11										
9.00	10.50	-6.41	-7.91	RCS-1	S-12						Soft Rock	13.3	-	0.0	
10.50	10.95	-7.91	-8.36	SPT-4	S-13		7	8	16	24	Medium Dense Coral Sand				
10.95	12.45	-8.36	-9.86	RCS-2	S-14						Soft Rock	19.3	-	0.0	
12.45	13.95	-9.86	-11.36	RCS-3	S-15							16.7	-	0.0	
13.95	14.40	-11.36	-11.81	SPT-5	S-16		11	13	18	31	Medium Dense Coral Sand				
14.40	15.90	-11.81	-13.31	RCS-4	S-17						Soft Rock	20.7	-	0.0	
15.90	17.40	-13.31	-14.81	RCS-5	S-18							30.7	-	0.0	
17.40	17.51	-14.81	-14.92	SPT-6	S-19		11cm/50; N>50				Very Dense Coral Sand				
17.51	19.01	-14.92	-16.42	RCS-6	S-20						Soft Rock	21.3	-	0.0	
19.01	20.51	-16.42	-17.92	RCS-7	S-21							38.7	10+14	16.0	
20.51	20.59	-17.92	-18.00	SPT-7	S-22		8cm/50; N>50				Very Dense Coral Sand				
20.59	22.09	-18.00	-19.50	RCS-8	S-23						Soft Rock	30.7	-	0.0	
22.09	23.59	-19.50	-21.00	RCS-9	S-24							28.0	-	0.0	
23.59	25.09	-21.00	-22.50	RCS-10	S-25							26.0	16+15	20.7	
25.09	25.14	-22.50	-22.55	SPT-8	S-26		5cm/50; N>50				Very Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum		Coral Sand
CPT	Cone penetration test	**UDS**	Undistrubed Sample		Clay
RQD	Rock Quality Designation	**RCS**	Rock Core Sample		Soft Rock
CR	Core Recovery	**DS**	Distubed Sample		Hard Rock
		Silty Sand		Very Dense Coral Sand	

LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: LB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates :**	43P	351829.08	1115331.67
Land/Marine	: Land	**Drilling Period**	**From**	07-11-2024	
Termination Depth (m).	: 25.0		**TO**	09-11-2024	
CD Level	: 2.59				

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	$Φ_{design}$
		2.59							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-LB		0.00	2.59																			
	DS-1	2.59	1.84																			
	SPT-1	1.84	1.39	15	28	21			15.2	73.5	11.3	NP	NP	NP	2.63	SW-SM	1.89	10.00	1.72	0.0	32.0	31.0
	DS-2	1.39	0.64				Medium Dense Coral Sand															
	UD-1	0.64	0.19						Sample Slipped Off													
	DS-3	0.19	-1.31																			
	SPT-2	-1.31	-1.76	21	29	22			11.0	76.0	10.2	NP	NP	NP	2.59	SW-SM	1.92	9.80	1.75	0.0	32.1	31.0
	DS-4	-1.76	-2.51																			
	UD-2	-2.51	-2.96				Silty Sand		18.5	87.4	18.4	NP	NP	NP	2.65	SM	1.94	9.2	1.78	0.0	32.4	-
	DS-5	-2.96	-4.46				Medium Dense Coral Sand															
	SPT-3	-4.46	-4.91	22	25	20			11.1	80.0	8.9	NP	NP	NP	2.60	SW-SM	1.97	9.30	1.80	0.0	31.0	30.5
	DS-6	-4.91	-6.41																			

Borehole No.	Sample Number	Depth w r to CD (m)		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-LB	RCS-1	-6.41	-7.91	20	Soft Rock		5.4	13.3	0.0	-	-	0.56	12.32

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	$Φ_{design}$
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-LB	SPT-4	-7.91	-8.36	24	24	20	Medium Dense Coral Sand		9.5	78.7	11.8	NP	NP	NP	2.65	SW-SM	1.98	9.20	1.81	0.0	32.5	30.5

Borehole No.	Sample Number	Depth w r to CD (m)		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-LB	RCS-2	-8.36	-9.86	29	Soft Rock		5.4	19.3	0.0	-	-	1.54	33.88
	RCS-3	-9.86	-11.36	25			5.4	16.7	0.0	-	-	1.08	23.76

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	$Φ_{design}$
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-LB	SPT-5	-11.36	-11.81	31	28	21	Medium Dense Coral Sand		14.2	65.3	20.5	NP	NP	NP	2.55	SW-SM	1.99	9.00	1.83	0.0	32.3	31.0

Borehole No.	Sample Number	Depth w r to CD (m)		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-LB	RCS-4	-11.81	-13.31	31	Soft Rock		5.4	20.7	0.0	-	-	1.56	-
	RCS-5	-13.31	-14.81	46			5.4	30.7	0.0	-	-	2.15	-

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	$Φ_{design}$
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-LB	SPT-6	-14.81	-14.92	>50	60	38	Very Dense Coral Sand		13.5	62.4	24.1	NP	NP	NP	2.63	SW-SM	2.02	8.70	1.86	-	-	34.0

Borehole No.	Sample Number	Depth w r to CD (m)		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-LB	RCS-6	-14.92	-16.42	32	Soft Rock		5.4	21.3	0.0	-	-	2.11	-
	RCS-7	-16.42	-17.92	58			5.4	38.7	16.0	-	-	-	13.2

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ_{design}
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m^2)	(deg)	(deg)
BH-LB	SPT-7	-17.92	-18.00	>50	60	38	Very Dense Coral Sand		12.9	59.9	27.2	NP	NP	NP	2.68	SW-SM	2.05	8.40	1.89	-	-	34.0

Borehole No.	Sample Number	Depth w r to CD (m)		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-LB	RCS-8	-18.00	-19.50	46	Soft Rock		5.4	30.7	0.0	-	-	1.09	-
	RCS-9	-19.50	-21.00	42			5.4	28.0	0.0	-	-	2.17	-
	RCS-10	-19.50	-22.50	39			5.4	26.0	20.7	-	-	-	13.5

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ_{design}
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m^2)	(deg)	(deg)
BH-LB	SPT-8	-22.50	-22.55	>50	60	38	Very Dense Coral Sand		18.4	56.5	25.1	NP	NP	NP	2.67	SW-SM	2.06	8.00	1.91	-	-	34.0

For Manglam Consultancy Services Hyderabad

Tested by

Authorized Signatory

BH-LB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.75 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	0.75	m
Length of Pile		=	19.51	m
Depth of Pile from Ground Level		=	20.51	m
Self Weight of the Pile		=	120.69	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	950.00	KN/m^2
	N_c	=	9.00	
	B	=	0.75	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1259.1**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	950.00	kN/m^2
	L	=	2.25	*m*
	α		0.90	*m*
	B	=	0.75	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**1510.9**	*kN*
Allowable Load On The Pile	Q_a	=	**2770.0**	***kN***
Allowable Load On The Pile	Q_a	=	**282.5**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**2649.32**	***kN***
			270.23	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1178.3	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	392.8	*kN*
		=	**40.1**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-LB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.9 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	0.90	m
Length of Pile		=	19.51	m
Depth of Pile from Ground Level		=	20.51	m
Self Weight of the Pile		=	173.79	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	950.00	KN/m^2
	N_c	=	9.00	
	B	=	0.90	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1813.1**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	950.00	kN/m^2
	L	=	2.70	*m*
	α		0.90	*m*
	B	=	0.90	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2175.7**	*kN*
Allowable Load On The Pile	Q_a	=	**3988.8**	***kN***
Allowable Load On The Pile	Q_a	=	**406.9**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**3815.01**	***kN***
			389.13	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1696.8	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	565.6	*kN*
		=	**57.7**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-LB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.0 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.00	m
Length of Pile		=	19.51	m
Depth of Pile from Ground Level		=	20.51	m
Self Weight of the Pile		=	214.55	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	950.00	KN/m^2
	N_c	=	9.00	
	B	=	1.00	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**2238.4**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	950.00	kN/m^2
	L	=	3.00	*m*
	α		0.90	*m*
	B	=	1.00	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2686.1**	*kN*
Allowable Load On The Pile	Q_a	=	**4924.4**	***kN***
Allowable Load On The Pile	Q_a	=	**502.3**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**4709.90**	***kN***
			480.41	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	2094.8	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	698.3	*kN*
		=	**71.2**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-LB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.2 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.20	m
Length of Pile		=	19.51	m
Depth of Pile from Ground Level		=	20.51	m
Self Weight of the Pile		=	308.95	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	950.00	KN/m^2
	N_c	=	9.00	
	B	=	1.20	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**3223.3**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	950.00	kN/m^2
	L	=	3.60	*m*
	α		0.90	*m*
	B	=	1.20	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**3867.9**	*kN*
Allowable Load On The Pile	Q_a	=	**7091.2**	***kN***
Allowable Load On The Pile	Q_a	=	**723.3**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**6782.25**	***kN***
			691.79	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	3016.5	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	1005.5	*kN*
		=	**102.6**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-LB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.3 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.30	m
Length of Pile		=	19.51	m
Depth of Pile from Ground Level		=	20.51	m
Self Weight of the Pile		=	362.59	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 4 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	950.00	KN/m^2
	N_c	=	9.00	
	B	=	1.30	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**3782.9**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	950.00	kN/m^2
	L	=	3.90	*m*
	α		0.90	*m*
	B	=	1.30	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**4539.4**	*kN*
Allowable Load On The Pile	Q_a	=	**8322.3**	***kN***
Allowable Load On The Pile	Q_a	=	**848.9**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**7959.72**	***kN***
			811.89	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	3540.2	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	1180.1	*kN*
		=	**120.4**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-LB	**Lateral Load Capacity (Dia 0.75 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	0.75	m	
Length of Pile	=	19.51	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	2.69	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.01553	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	2.80	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	8.00	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.88	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	5.26	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	7.50	mm	
Allowable pile head deflection at cutoff level	=	28.82	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**6.96**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**46.12**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-LB	**Lateral Load Capacity (Dia 0.9 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	0.90	m	
Length of Pile	=	19.59	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	2.69	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.03221	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.23	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	8.00	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.90	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	6.15	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	9.00	mm	
Allowable pile head deflection at cutoff level	=	24.86	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**10.24**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**72.43**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-LB	**Lateral Load Capacity (Dia 1.00 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.00	m	
Length of Pile	=	19.59	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	2.69	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.04909	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{EI}{\eta_h}}$				
Stiffness Factor, T	=	3.52	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	8.00	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.92	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	6.76	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	10.00	mm	
Allowable pile head deflection at cutoff level	=	22.88	mm	(for fixed head pile)
Deflection = $\frac{H(e+z_f)^3}{12EI} \times 10^3$ mm			(for fixed head pile)	
Lateral Load Capacity, H	=	**12.66**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**93.39**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-LB	**Lateral Load Capacity (Dia 1.2 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.20	m	
Length of Pile	=	19.59	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	2.69	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.10179	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	4.07	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	8.00	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.95	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	7.94	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	12.00	mm	
Allowable pile head deflection at cutoff level	=	20.11	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**18.30**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**145.87**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

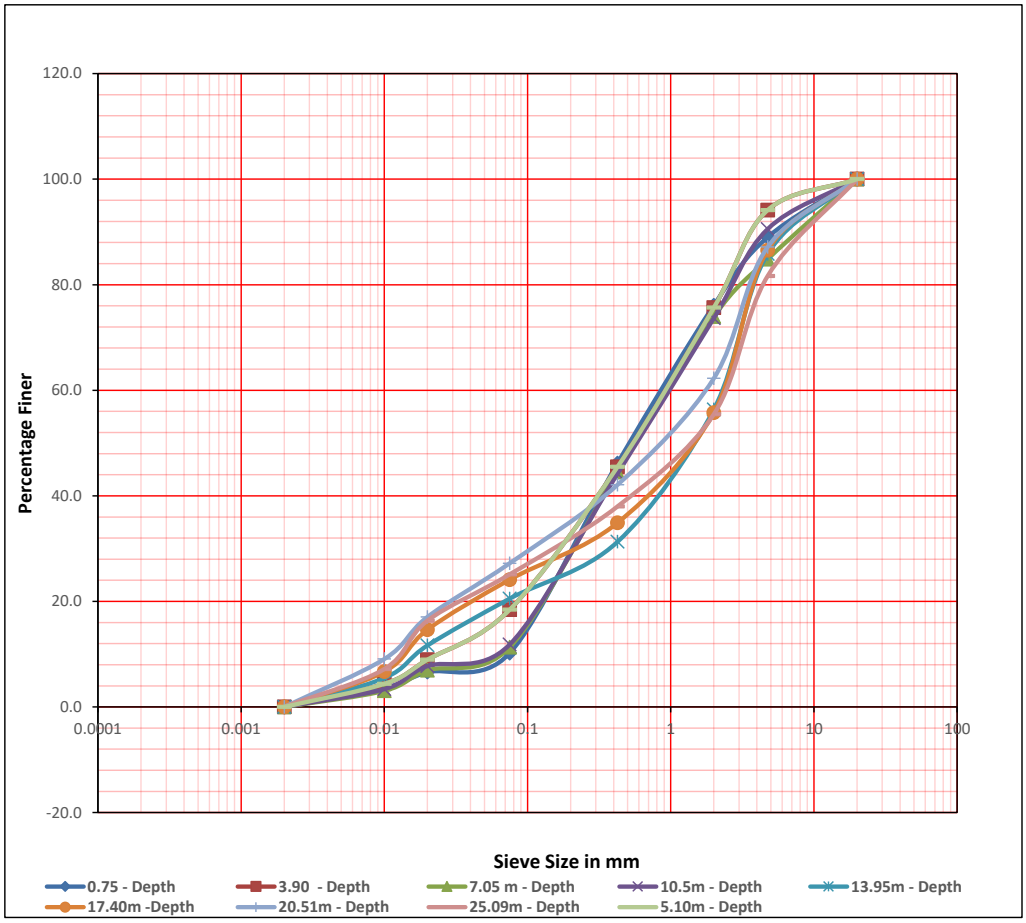
BH-LB	**Lateral Load Capacity (Dia 1.3 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.30	m	
Length of Pile	=	19.59	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	2.69	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.14020	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	4.34	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	8.00	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.97	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	8.55	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	13.00	mm	
Allowable pile head deflection at cutoff level	=	19.05	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**21.32**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**176.46**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

GRAIN SIZE ANALYSIS

BH-LB



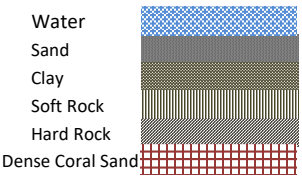
DEPTH	CLAY	SILT			SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	COARSE
0.75	0.0	3.1	3.9	4.4	33.2	29.5	10.9	15.2	0.0
3.90	0.0	3.6	3.0	3.6	36.0	27.1	12.9	11.0	0.0
5.10	0.0	4.4	4.6	9.5	27.1	30.2	30.2	18.5	0.0
7.05	0.0	2.4	3.5	3.1	30.8	29.2	20.1	11.1	0.0
10.50	0.0	3.4	4.4	4.1	32.4	29.5	16.9	9.5	0.0
13.95	0.0	5.5	6.2	8.9	10.8	25.1	29.5	14.2	0.0
17.40	0.0	6.7	8.0	9.5	10.8	20.9	30.8	13.5	0.0
20.51	0.0	9.1	8.0	10.2	14.9	20.2	24.9	12.9	0.0
25.09	0.0	7.2	9.2	8.8	12.9	17.5	26.2	18.4	0.0

BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: BH-AB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351616.49	1115455.44
Land/marine	: Marine	**Drilling Period**	**From**		14-11-2024
Termination Depth (m).	: 20.0		**To**		15-11-2024
Bed Level wrt CD	-0.90	**Structure**	: Approach Trestle		

Depth (m) wrt Seabed		Depth of seabed wrt CD		Sample Type	Sample No	Soil Log	Standard Penetration Test (SPT)				Strata Description	Total Core Recovery (%)	Length of core(>10 cm)	RQD %	Remarks
From	To	From	To				15 cm	30 cm	45 cm	N Value					
			-0.90								Water				
0.00	0.75	-0.90	-1.65	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	-1.65	-2.10	SPT-1	S-2		8	11	13	24					
1.20	1.95	-2.10	-2.85	DS-2	S-3						Dense Coral Sand				
1.95	2.40	-2.85	-3.30	UD-1	S-4										
2.40	3.90	-3.30	-4.80	DS-3	S-5										
3.90	4.35	-4.80	-5.25	SPT-2	S-6		7	14	18	32					
4.35	5.10	-5.25	-6.00	DS-4	S-7										
5.10	5.55	-6.00	-6.45	UD-2	S-8										
5.55	7.05	-6.45	-7.95	DS-5	S-10										
7.05	7.50	-7.95	-8.40	SPT-3	S-11		11	17	24	41					
7.50	9.00	-8.40	-9.90	RCS-1	S-12						Soft Rock	14.0			
9.00	10.50	-9.90	-11.40	RCS-2	S-13							20.0			
10.50	10.95	-11.40	-11.85	SPT-4	S-14		13	27	21	48	Dense Coral Sand				
10.95	12.45	-11.85	-13.35	RCS-3	S-15						Soft Rock	25.3			
12.45	13.95	-13.35	-14.85	RCS-4	S-16							27.3			
13.95	14.02	-14.85	-14.92	SPT-5	S-17		7cm/50; N>50				Very Dense Coral Sand				
14.02	15.52	-14.92	-16.42	RCS-5	S-18						Soft Rock	28.7	27.0	18.0	
15.52	17.02	-16.42	-17.92	RCS-6	S-19							32.7	24.0	16.0	
17.02	17.10	-17.92	-18.00	SPT-6	S-20		8cm/50; N>50				Very Dense Coral Sand				
17.10	18.60	-18.00	-19.50	RCS-7	S-21						Soft Rock	29.0	11.0	7.3	
18.60	20.10	-19.50	-21.00	RCS-8	S-22							26.0		0.0	
20.10	20.14	-21.00	-21.04	SPT-7	S-20		4cm/50; N>50				Very Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: AB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western side	**Proposed Coordinates :**	43P	351616.49	1115455.44
Land/Marine	: Marine	**Drilling Period**	**From**	14-11-2024	
Termination Depth (m).	: 20.0		**TO**	15-11-2024	
CD Level	**-0.9**	**Structure**	Approach Trestle		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{design}
		-0.9							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-AB			-0.90				Water															
	DS-1	-0.90	-1.65				Medium Dense Coral Sand															
	SPT-1	-1.65	-2.10	24	44	30			1.5	87.7	10.8	NP	NP	NP	2.63	SW-SM	1.94	10.80	1.75	0.0	30.6	29.0
	DS-2	-2.10	-2.85				Dense Coral Sand															
	UD-1	-2.85	-3.30						Sample Slipped off													
	DS-3	-3.30	-4.80																			
	SPT-2	-4.80	-5.25	32	44	29			1.0	91.6	7.4	NP	NP	NP	2.65	SW-SM	1.96	10.30	1.78	0.0	30.1	29.0
	DS-4	-5.25	-6.00																			
	UD-2	-6.00	-6.45						Sample Slipped off													
	DS-5	-6.45	-7.95																			
	SPT-3	-7.95	-8.40	41	46	30			0.9	88.2	10.9	NP	NP	NP	2.58	SW-SM	1.98	9.00	1.82	0.0	32.9	32.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-AB	RCS-1	-8.40	-9.90	21	Soft Rock		5.4	14	0.0	-	-	1.09	
	RCS-2	-9.90	-11.40	30			5.4	20	0.0	-	-	1.3	

Borehole No.	Sample Number	Depth w r to CD (m)		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{design}
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-AB	SPT-4	-11.40	-11.85	48	47	31	Dense Coral Sand		1.0	90.8	8.2	NP	NP	NP	2.59	SW-SM	2.00	8.70	1.84	0.0	33.8	33.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-AB	RCS-3	-11.85	-13.35	38	Soft Rock		5.4	25.3	0.0	-	-	1.62	-
	RCS-4	-13.35	-14.85	41			5.4	27.3	0.0	-	-	0.59	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{design}
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-AB	SPT-5	-14.85	-14.95	>50	60	38	Very Dense Coral Sand		1.1	88.2	10.7	NP	NP	NP	2.63	SW-SM	2.01	8.20	1.86	-	-	34.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-AB	RCS-5	-14.95	-16.42	43	Soft Rock		5.4	28.7	18.0	-	-	-	15.3
	RCS-6	-16.42	-17.92	49			5.4	32.7	16.0	-	-	-	13.9

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{design}
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-AB	SPT-6	-17.92	-18.00	>50	60	38	Very Dense Coral Sand		0.9	87.5	11.6	NP	NP	NP	2.69	SW-SM	2.02	7.90	1.87	-	-	34.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-AB	RCS-7	-18.00	-19.50	43	Soft Rock		5.4	29.0	7.33	-	-	-	10.6
	RCS-8	-19.50	-21.00	39			5.4	26.0	0.0	-	-	1.26	

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{design}
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-AB	SPT-7	-21.00	-21.04	>50	60	38	Very Dense Coral Sand		1.0	90.2	11.1	NP	NP	NP	2.67	SW-SM	2.03	7.20	1.89	-	-	34.0

For Manglam Consultancy Services Hyderabad

Tested by

Authorized Signatory

BH-AB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.9 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	0.90	m
Length of Pile		=	16.10	m
Depth of Pile from Ground Level		=	17.10	m
Self Weight of the Pile		=	143.41	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	1000.00	KN/m^2
	N_c	=	9.00	
	B	=	0.90	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1908.5**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	1000.00	kN/m^2
	L	=	2.70	*m*
	α		0.90	*m*
	B	=	0.90	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2290.2**	*kN*
Allowable Load On The Pile	Q_a	=	**4198.7**	***kN***
Allowable Load On The Pile	Q_a	=	**428.3**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**4055.33**	***kN***
			413.64	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1746.6	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	582.2	*kN*
		=	**59.4**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-AB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -1.0 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.00	m
Length of Pile		=	16.10	m
Depth of Pile from Ground Level		=	17.10	m
Self Weight of the Pile		=	177.05	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	1000.00	KN/m^2
	N_c	=	9.00	
	B	=	1.00	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**2356.2**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	1000.00	kN/m^2
	L	=	3.00	*m*
	α		0.90	*m*
	B	=	1.00	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2827.4**	*kN*
Allowable Load On The Pile	Q_a	=	**5183.6**	***kN***
Allowable Load On The Pile	Q_a	=	**528.7**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**5006.58**	***kN***
			510.67	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	2156.3	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	718.8	*kN*
		=	**73.3**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-AB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA-1.2 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.20	m
Length of Pile		=	16.10	m
Depth of Pile from Ground Level		=	17.10	m
Self Weight of the Pile		=	254.95	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	1000.00	KN/m^2
	N_c	=	9.00	
	B	=	1.20	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**3392.9**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	1000.00	kN/m^2
	L	=	3.60	*m*
	α		0.90	*m*
	B	=	1.20	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**4071.5**	*kN*
Allowable Load On The Pile	Q_a	=	**7464.4**	***kN***
Allowable Load On The Pile	Q_a	=	**761.4**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**7209.47**	***kN***
			735.37	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	3105.0	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	1035.0	*kN*
		=	**105.6**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-AB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA-1.3 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.30	m
Length of Pile		=	16.10	m
Depth of Pile from Ground Level		=	17.10	m
Self Weight of the Pile		=	299.22	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	1000.00	KN/m^2
	N_c	=	9.00	
	B	=	1.30	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**3982.0**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	1000.00	kN/m^2
	L	=	3.90	*m*
	α		0.90	*m*
	B	=	1.30	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**4778.4**	*kN*
Allowable Load On The Pile	Q_a	=	**8760.3**	***kN***
Allowable Load On The Pile	Q_a	=	**893.6**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**8461.11**	***kN***
			863.03	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	3644.1	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	1214.7	*kN*
		=	**123.9**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-AB	**Lateral Load Capacity (Dia 0.9 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	0.90	m	
Length of Pile	=	16.10	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.48	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.03221	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.07	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.50	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.90	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	5.84	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	9.00	mm	
Allowable pile head deflection at cutoff level	=	21.75	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\,\mathbf{x\,10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**13.51**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**83.31**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-AB	**Lateral Load Capacity (Dia 1.0 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.00	m	
Length of Pile	=	16.10	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.48	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.04909	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.34	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.50	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.95	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	6.52	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	10.00	mm	
Allowable pile head deflection at cutoff level	=	19.96	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\,\mathbf{x\,10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**16.08**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**104.66**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-AB	**Lateral Load Capacity (Dia 1.2 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.20	m	
Length of Pile	=	16.10	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.48	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.10179	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.87	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.50	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	2.07	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	8.01	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	12.00	mm	
Allowable pile head deflection at cutoff level	=	17.31	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**20.91**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**151.63**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

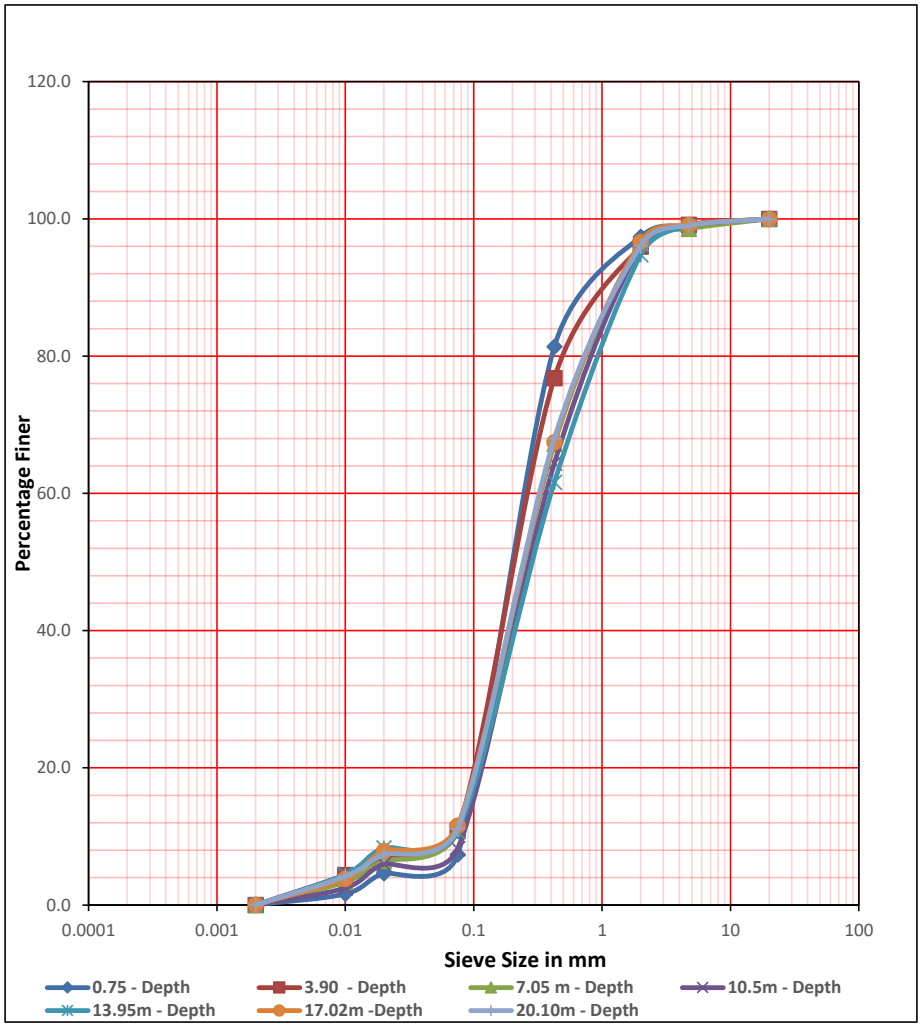
BH-AB	**Lateral Load Capacity (Dia 1.3 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.30	m	
Length of Pile	=	16.10	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	3.48	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.14020	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	4.12	m	
Behaviour of Pile based on embedment length	=	**Intermediate**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.50	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	2.10	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	8.66	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	13.00	mm	
Allowable pile head deflection at cutoff level	=	16.50	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\,\mathbf{x\,10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**24.04**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**182.24**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

GRAIN SIZE ANALYSIS

BH-AB



DEPTH	CLAY & CLAY	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	10.8	56.4	29.2	2.2	1.5	0.0
3.90	7.4	74.0	16.0	1.6	1.0	0.0
7.05	10.9	65.9	19.2	3.2	0.9	0.0
10.50	8.2	56.2	31.7	3.0	1.0	0.0
13.95	10.7	50.9	33.2	4.2	1.1	0.0
17.00	11.6	55.9	29.2	2.5	0.9	0.0
20.08	11.1	56.9	28.1	3.0	1.0	0.0

BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: BH-JB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351677.38	1115455.19
Land/Marine	: Marine	**Drilling Period**	**From**		11-11-2024
Termination Depth (m).	: 20.0		**To**		13-11-2024
Bed Level wrt CD	-0.80	**Structure**	: Jetty Head		

Depth (m) wrt Seabed		Depth of seabed wrt CD		Sample Type	Sample No	Soil Log	Standard Penetration Test (SPT)				Strata Description	Total Core Recovery (%)	Length of core(>10 cm)	RQD %	Remarks
From	To	From	To				15 cm	30 cm	45 cm	N Value					
			-0.80								Water				
0.00	0.75	-0.80	-1.55	DS-1	S-1						Loose Coral Sand				
0.75	1.20	-1.55	-2.00	SPT-1	S-2		1	2	4	6					
1.20	1.95	-2.00	-2.75	DS-2	S-3						Medium Dense Coral Sand				
1.95	2.40	-2.75	-3.20	UD-1	S-4										
2.40	3.90	-3.20	-4.70	DS-3	S-5										
3.90	4.35	-4.70	-5.15	SPT-2	S-6		4	7	10	17					
4.35	5.10	-5.15	-5.90	DS-4	S-7										
5.10	5.55	-5.90	-6.35	UD-2	S-8										
5.55	7.05	-6.35	-7.85	DS-5	S-10										
7.05	7.50	-7.85	-8.30	SPT-3	S-11		6	12	16	28					
7.50	9.00	-8.30	-9.80	DS-6	S-12						Dense Coral Sand				
9.00	10.50	-9.80	-11.30	DS-7	S-13										
10.50	10.95	-11.30	-11.75	SPT-4	S-14		12	18	24	42					
10.95	12.45	-11.75	-13.25	RCS-1	S-15						Soft Rock	20.7	-	0.0	
12.45	13.95	-13.25	-14.75	RCS-2	S-16							25.3	17.0	11.3	
13.95	14.00	-14.75	-14.80	SPT-5	S-17		5cm/50; N>50				Very Dense Coral Sand				
14.00	15.50	-14.80	-16.30	RCS-3	S-18						Soft Rock	28.0	-	0.0	
15.50	17.00	-16.30	-17.80	RCS-4	S-19							31.3	-	0.0	
17.00	17.08	-17.80	-17.88	SPT-6	S-20		8cm/50; N>50				Very Dense Coral Sand				
17.08	18.58	-17.88	-19.38	RCS-5	S-21						Soft Rock	24.0	-	0.0	
18.58	20.08	-19.38	-20.88	RCS-6	S-22							26.0	-	0.0	
20.08	20.14	-20.88	-20.94	SPT-7	S-20		6cm/50; N>50				Very Dense Coral Sand				

SPT Standard penetration test
CPT Cone penetration test
RQD Rock Quality Designation
CR Core Recovery

CD Chart Datum
UDS Undistrubed Sample
RCS Rock Core Sample
DS Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand

LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: JB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates**	43P	351677.38	1115455.19
Land/Marine	: Marine	**Drilling Period**	**From**	11-11-2024	
Termination Depth (m).	: 20.0		**TO**	13-11-2024	
CD Level	**-0.8**	**Structure**	Jetty Head		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ_{design}
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-0.80							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH -JB			-0.80				Water															
	DS-1	-0.80	-1.55				Loose Coral Sand															
	SPT-1	-1.55	-2.00	6	11	11			2.2	86.4	15.8	NP	NP	NP	2.55	SW-SM	1.69	8.90	1.55	0.0	28.6	27.0
	DS-2	-2.00	-2.75				Medium Dense Coral Sand															
	UD-1	-2.75	-3.20						Sample Slipped off													
	DS-3	-3.20	-4.70																			
	SPT-2	-4.70	-5.15	17	26	20			2.9	86.9	14.2	NP	NP	NP	2.58	SW-SM	1.87	8.00	1.73	0.0	30.8	30.0
	DS-4	-5.15	-5.90																			
	UD-2	-5.90	-6.32						Sample Slipped off													
	DS-5	-6.32	-7.85																			
	SPT-3	-7.85	-8.30	28	31	23			6.1	85.1	11.6	NP	NP	NP	2.60	SW-SM	1.93	7.80	1.79	0.0	31.5	31.0
	DS-6	-8.30	-9.80				Dense Coral Sand															
	DS-7	-9.80	-11.30																			
	SPT-4	-11.30	-11.75	42	42	29			6.5	84.5	11.9	NP	NP	NP	2.65	SW-SM	1.97	7.60	1.83	0.0	32.7	32.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH -JB	RCS-1	-11.75	-13.25	31	Soft Rock		5.4	20.7	0.0	-	-	1.2	
	RCS-2	-13.25	-14.75	38			5.4	25.3	11.3	-	-	-	15.3

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	$Φ_{design}$
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH -JB	SPT-5	-14.75	-14.80	>50	60	38	Very Dense Coral Sand		2.4	89.5	11.5	NP	NP	NP	2.63	SW-SM	2.00	7.30	1.86	0.0	-	34.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH -JB	RCS-3	-14.80	-16.30	42	Soft Rock		5.4	28.0	0.0		-	2.5	-
	RCS-4	-16.30	-17.80	47			5.4	31.3	0.0		-	1.8	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	$Φ_{design}$
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH -JB	SPT-6	-17.80	-17.88	>50	60	38	Very Dense Coral Sand		2.9	87.0	13.5	NP	NP	NP	2.67	SW-SM	2.02	7.00	1.89	0.0	-	34.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH -JB	RCS-5	-17.88	-19.38	24	Soft Rock		5.4	24.0	0.0	-	-	2.4	-
	RCS-6	-19.38	-20.88	39			5.4	26.0	0.0	-	-	1.7	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{design}
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH -JB	SPT-7	-20.88	-20.94	>50	60	38	Very Dense Coral Sand		4.7	85.4	13.7	NP	NP	NP	2.58	SW-SM	2.04	6.80	1.91	0.0	-	34.0

For Manglam Consultancy Services Hyderabad

Tested by

Authorized Signatory

BH-JB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.9 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	0.90	m
Length of Pile		=	16.08	m
Depth of Pile from Ground Level		=	17.08	m
Self Weight of the Pile		=	143.23	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	900.00	KN/m^2
	N_c	=	9.00	
	B	=	0.90	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**1717.7**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	900.00	kN/m^2
	L	=	2.70	*m*
	α		0.90	*m*
	B	=	0.90	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2061.2**	*kN*
Allowable Load On The Pile	Q_a	=	**3778.9**	***kN***
Allowable Load On The Pile	Q_a	=	**385.4**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**3635.63**	***kN***
			370.83	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1586.1	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	528.7	*kN*
		=	**53.9**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.9 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.00	m
Length of Pile		=	16.08	m
Depth of Pile from Ground Level		=	17.08	m
Self Weight of the Pile		=	176.83	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	900.00	KN/m^2
	N_c	=	9.00	
	B	=	1.00	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**2120.6**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	900.00	kN/m^2
	L	=	3.00	*m*
	α		0.90	*m*
	B	=	1.00	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**2544.7**	*kN*
Allowable Load On The Pile	Q_a	=	**4665.3**	***kN***
Allowable Load On The Pile	Q_a	=	**475.9**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**4488.43**	***kN***
			457.82	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	1958.1	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	652.7	*kN*
		=	**66.6**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.9 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.20	m
Length of Pile		=	16.08	m
Depth of Pile from Ground Level		=	17.08	m
Self Weight of the Pile		=	254.64	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	900.00	KN/m^2
	N_c	=	9.00	
	B	=	1.20	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**3053.6**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	900.00	kN/m^2
	L	=	3.60	*m*
	α		0.90	*m*
	B	=	1.20	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**3664.4**	*kN*
Allowable Load On The Pile	Q_a	=	**6718.0**	***kN***
Allowable Load On The Pile	Q_a	=	**685.2**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**6463.34**	***kN***
			659.26	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	2819.7	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	939.9	*kN*
		=	**95.9**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB	PILE FOUNDING CRITERIA FOR SOFT ROCK (DIA -0.9 m)			
Cut off Level		=	1.00	m
Diameter of Pile		=	1.30	m
Length of Pile		=	16.08	m
Depth of Pile from Ground Level		=	17.08	m
Self Weight of the Pile		=	298.85	kN
Base Resistance of Pile		=	$C_{u1}N_c\ \pi B^2/4F_s$	
Skin Friction Resistance of Pile(Rock)		=	$\alpha\ C_{u2}N_c\ \pi BL/F_s$	
The allowable load on the Pile can be Calculated using the following equation as per IS 2911 : PART 1 SEC 2 : 2010				
Q_a	=	Base Resistance of Pile + Skin Friction Resistance of Pile		
Base Resistance of Pile				
	C_{u1}	=	900.00	KN/m^2
	N_c	=	9.00	
	B	=	1.30	m
	Fs	=	3.00	m
Base Resistance of the Pile		=	**3583.8**	*kN*
Skin Friction Resistance of Pile				
	C_{u2}	=	900.00	kN/m^2
	L	=	3.90	*m*
	α		0.90	*m*
	B	=	1.30	m
	Fs	=	3.00	m
Skin Friction Resistance of Pile		=	**4300.5**	*kN*
Allowable Load On The Pile	Q_a	=	**7884.3**	***kN***
Allowable Load On The Pile	Q_a	=	**804.2**	***ton***
Factor of Safety		=	3.00	
Net Capacity of Pile		=	**7585.45**	***kN***
			773.72	***ton***
Reduction Factor		=	0.7	
Uplift Capacity		=	3309.2	*kN*
Factor of Safety		=	3.00	
Safe Uplift Capacity		=	1103.1	*kN*
		=	**112.5**	***Ton***

Note:

1) Assumed SPT N value along socket and below the pile tip is >100

2) Since it is a weathered Rock, shear strength is considered from Fig.3 from IS 2911.

3) The design should be supplemented by in-situ pile load testing to confirm the actual pile capacity.

BH-JB	**Lateral Load Capacity (Dia 0.9 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	0.90	m	
Length of Pile	=	16.08	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	2.40	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.03221	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.31	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.50	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.95	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	6.45	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	9.00	mm	
Allowable pile head deflection at cutoff level	=	20.11	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**10.79**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**69.87**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-JB	**Lateral Load Capacity (Dia 1.0 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.00	m	
Length of Pile	=	16.08	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	2.40	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.04909	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	3.60	m	
Behaviour of Pile based on embedment length	=	**Long (Flexible) Pile since L≥4T**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.50	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.97	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	7.09	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	10.00	mm	
Allowable pile head deflection at cutoff level	=	18.77	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\,\mathbf{x\,10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**13.28**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**90.29**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

BH-JB	**Lateral Load Capacity (Dia 1.2 m)**			
Sea bed Level w. r. to CD	=	0.800		
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.20	m	
Length of Pile	=	16.08	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	2.40	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.10179	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	4.17	m	
Behaviour of Pile based on embedment length	=	**Intermediate**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.50	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	1.98	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	8.25	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	12.00	mm	
Allowable pile head deflection at cutoff level	=	16.99	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**19.52**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**143.96**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

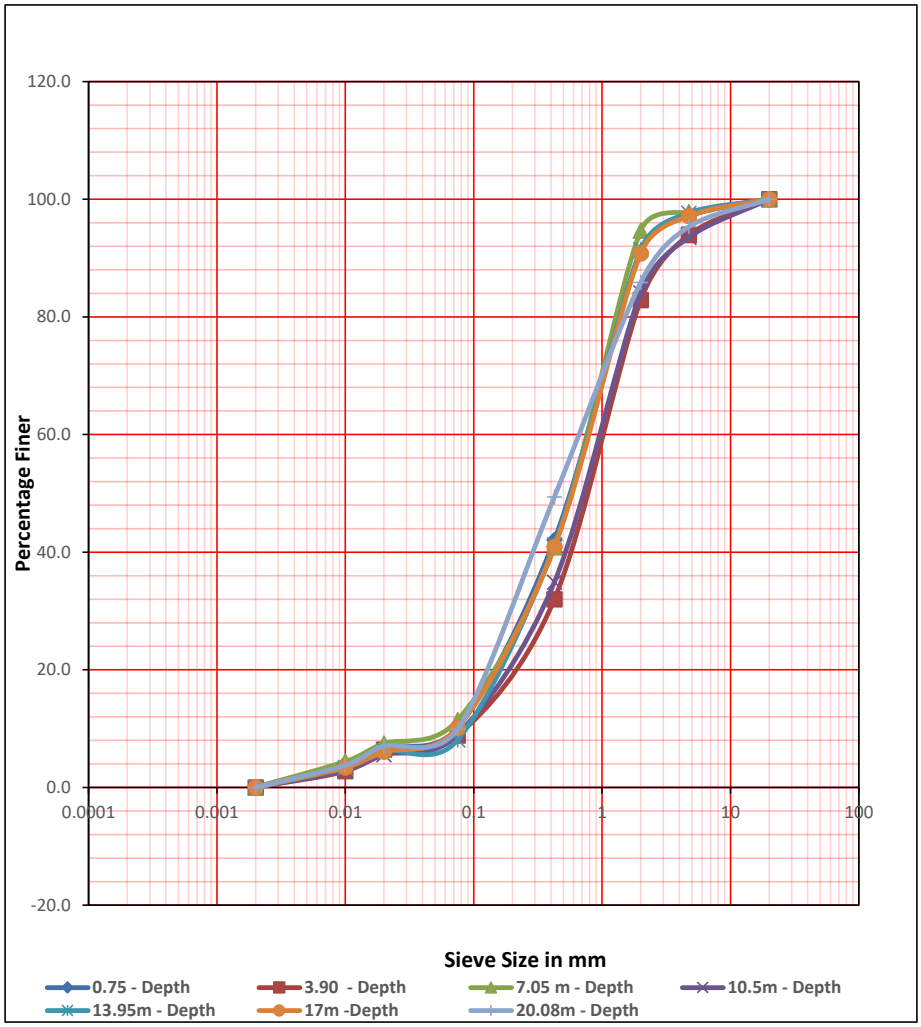
BH-JB	**Lateral Load Capacity (Dia 1.3 m)**			
Cut off Level	=	1.00	m	
Diameter of Pile	=	1.30	m	
Length of Pile	=	16.08	m	
Grade of Concrete for Pile Material	=	M35		
Young's Modulus of Pile Material, E	=	29580.4	MPa	(as per IS:456)
The Ultimate Load Capacity of Pile can be Calculated using the following equation as per IS:2911				
Modulus of Subgrade reaction, ηh	=	2.40	MN/m^3	
Moment of Inertia of Pile Cross-section	=	0.14020	m^4	
Stiffness Factor, T = $\sqrt[5]{\frac{E\,I}{\eta_h}}$				
Stiffness Factor, T	=	4.44	m	
Behaviour of Pile based on embedment length	=	**Intermediate**		
Considering the lateral loading to be applied at the ground level and fixed pile head condition.				
Cantilever Length from COL to scour level, L_1 (or) e	=	6.50	m	
From Fig.4 of Appendix C of IS:2911, L_f/T	=	2.00	(for fixed head pile)	
Depth of Fixity, L_f (or) z_f	=	8.88	m	(for fixed head pile)
Limiting the Pile Head Deflection as 1% of the Pile Diameter				
Deflection, y (1% of the Pile Diameter) at scour level	=	13.00	mm	
Allowable pile head deflection at cutoff level	=	16.25	mm	(for fixed head pile)
Deflection = $\frac{H\left(e+z_f\right)^3}{12\,E\,I}\ \mathbf{x\ 10^3\ mm}$			(for fixed head pile)	
Lateral Load Capacity, H	=	**22.67**	**Ton**	(for fixed head pile)
Fixed End Moment, M_F	=	**174.34**	**Ton-m**	

Note:

Because of limited information on the horizontal subgrade modulus of soil, it is suggested that the adequacy of design should be checked by an actual field load test.

GRAIN SIZE ANALYSIS

BH-JB



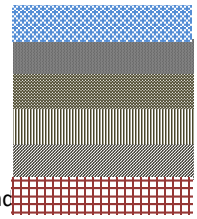
DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	11.5	29.4	53.8	3.2	2.2	0.0
3.90	10.2	31.9	49.0	6.0	2.9	0.0
7.05	8.8	23.2	50.9	11.1	6.1	0.0
10.50	9.0	25.9	49.2	9.5	6.5	0.0
13.95	8.1	33.2	50.2	6.2	2.4	0.0
17.00	10.1	30.8	49.9	6.4	2.9	0.0
20.08	9.9	39.5	36.5	9.5	4.7	0.0

BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351525.42	1115517.26
Land /Marine	: Marine	**Drilling Period**	**From**		16-11-2024
Termination Depth (m).	: 8.50		**To**		16-11-2024
Bed Level wrt CD	-1.8	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-1.80								Water				
0.00	0.75	-1.80	-2.55	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	-2.55	-3.00	SPT-1	S-2		5	6	8	14					
1.20	1.95	-3.00	-3.75	DS-2	S-3										
1.95	2.40	-3.75	-4.20	UD-1	S-4										
2.40	3.90	-4.20	-5.70	DS-3	S-5										
3.90	4.35	-5.70	-6.15	SPT-2	S-6		7	11	9	20					
4.35	5.10	-6.15	-6.90	DS-4	S-7										
5.10	5.55	-6.90	-7.35	UD-2	S-8										
5.55	7.05	-7.35	-8.85	RC-1	S-9						Soft Rock	13.3	-	0.0	
7.05	7.50	-8.85	-9.30	SPT-3	S-10		12	9	17	26	Medium Dense Coral Sand				
7.50	8.25	-9.30	-10.05	DS-5	S-11						Dense Coral Sand				
8.25	8.70	-10.05	-10.50	SPT-4	S-12		13	16	18	34					

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshdweep				
BH Number	: CB				
CLIENT	: Cochin Port of Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates :**	43P	351525.42	1115517.26
Land/Marine	: Marine	**Drilling Period**	**From**		16-11-2024
Termination Depth (m).	: 8.5		**TO**		16-11-2024
CD Level	-1.8	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	$Φ_{Design}$
		-1.80							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB			-1.80				Water															
	DS-1	-1.80	-2.55																			
	SPT-1	-2.55	-3.00	14	26	20			2.5	87.7	9.8	NP	NP	NP	2.65	SW-SM	1.85	7.80	1.72	0.0	30.4	30.0
	DS-2	-3.00	-3.75																			
	UD-1	-3.75	-4.20				Medium Dense Coral Sand		Sample Slipped off													
	DS-3	-4.20	-5.70																			
	SPT-2	-5.70	-6.15	20	26	21			3.0	88.3	8.7	NP	NP	NP	2.61	SW-SM	1.89	6.90	1.77	0.0	30.9	30.5
	DS-4	-6.15	-6.90																			
	UD-2	-6.90	-7.35						Sample Slipped off													

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB	RCS-4	-7.35	-8.85	20.00	Soft Rock		5.4	13.3	0.0	0.0	-	1.2	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{Design}
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB	SPT-3	-8.85	-9.30	26	30	23	Medium Dense Coral Sand		2.5	88.0	9.5	NP	NP	NP	2.58	SW-SM	1.91	6.50	1.79	0.0	31.2	31.0
	DS-5	-9.30	-10.05				Dense Coral Sand															
	SPT-4	-10.05	-10.50	34	37	26			2.9	86.8	10.3	NP	NP	NP	2.67	SW-SM	1.94	6.20	1.83	0.0	31.6	31.5

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB				Type of Foundation = Isolated , Square														Water Table Correction factor=0.5			
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.85	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.13	1.06	1.06	1.30	1.20	0.80	10.32	31.94	8.45
1.95	2.0	2.0	1.87	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.34	1.17	1.17	1.30	1.20	0.80	20.70	60.99	16.34
3.90	2.0	2.0	1.89	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.68	1.34	1.34	1.30	1.20	0.80	44.18	131.12	35.06
5.10	2.0	2.0	1.90	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.89	1.45	1.45	1.30	1.20	0.80	60.45	177.90	47.67
7.05	2.0	2.0	1.91	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	2.25	1.62	1.62	1.30	1.20	0.80	95.76	287.70	76.69
8.25	2.0	2.0	1.94	0.00	0.00	31.5	22.2	34.93	22.87	30.09	17.45	8.29	7.83	2.47	1.74	1.74	1.30	1.20	0.80	128.86	395.35	104.84

Note: The Safe Bearing Capacity Value is Restricted To 90.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

BH- CB			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	14	20	8.45	17.0	0.5	0.88	0.8	5.06
2.0	2.0	3.90	Square	20	21	35.06	16.0	0.5	0.63	0.8	14.14
2.0	2.0	7.05	Square	26	23	76.69	14.0	0.5	0.58	0.8	24.91
2.0	2.0	8.25	Square	34	26	90.00	12.0	0.5	0.55	0.8	23.76

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB				Type of Foundation = Isolated , Square														Water Table Correction factor=0.5			
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.85	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.09	1.04	1.04	1.30	1.20	0.80	12.65	39.95	10.52
1.95	3.0	3.0	1.78	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.23	1.11	1.11	1.30	1.20	0.80	20.56	61.95	16.50
3.90	3.0	3.0	1.89	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.45	1.23	1.23	1.30	1.20	0.80	43.67	131.59	35.05
5.10	3.0	3.0	1.83	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.59	1.30	1.30	1.30	1.20	0.80	53.60	160.06	42.73
7.05	3.0	3.0	1.91	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.83	1.42	1.42	1.30	1.20	0.80	87.50	265.74	70.65
8.25	3.0	3.0	1.94	0.00	0.00	31.5	22.2	34.93	22.87	30.09	17.45	8.29	7.83	1.98	1.49	1.49	1.30	1.20	0.80	115.18	356.89	94.41

Note: The Safe Bearing Capacity Value is Restricted To 85.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

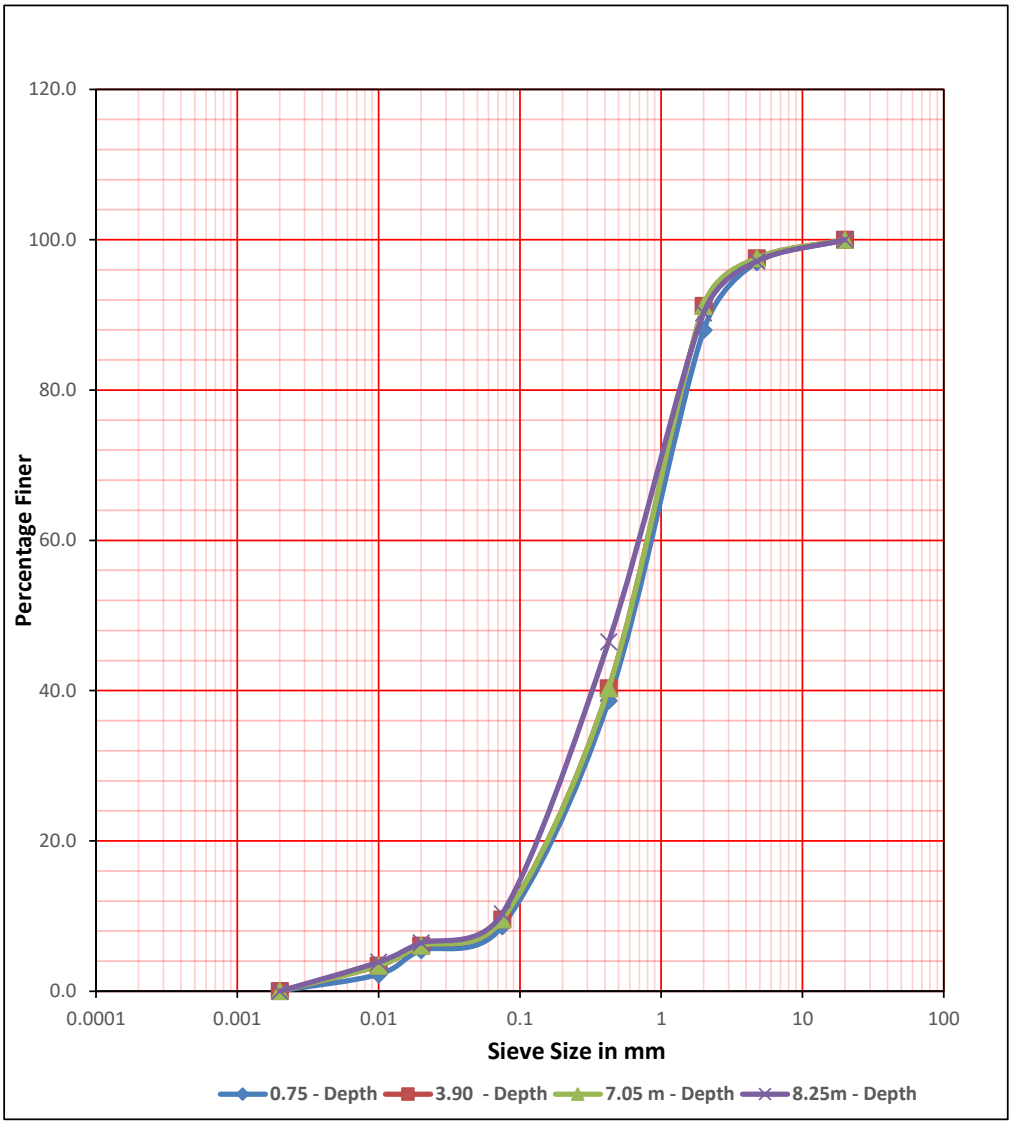
BH- CB			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	14	20	10.52	17.0	0.5	0.92	0.8	6.58
3.0	3.0	3.90	Square	20	21	35.05	16.0	0.5	0.67	0.8	15.03
3.0	3.0	7.05	Square	26	23	70.65	14.0	0.5	0.60	0.8	23.74
3.0	3.0	8.25	Square	34	26	85.00	12.0	0.5	0.60	0.8	24.48

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	9.8	33.8	50.8	3.2	2.5	0.0
3.90	8.7	30.0	49.3	9.0	3.0	0.0
7.05	9.5	30.8	50.9	6.4	2.5	0.0
8.25	10.3	36.2	43.8	6.9	2.9	0.0

BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB1				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351434.09	1115517.63
Land/Marine	: Marine	**Drilling Period**	**From**		17-11-2024
Termination Depth (m).	: 8.50		**To**		17-11-2024
Bed Level wrt CD	-1.80	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-1.80								Water				
0.00	0.75	-1.80	-2.55	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	-2.55	-3.00	SPT-1	S-2		4	5	9	14					
1.20	1.95	-3.00	-3.75	DS-2	S-3										
1.95	2.40	-3.75	-4.20	UD-1	S-4										
2.40	3.90	-4.20	-5.70	DS-3	S-5										
3.90	4.35	-5.70	-6.15	SPT-2	S-6		7	11	13	24					
4.35	5.10	-6.15	-6.90	DS-4	S-7										
5.10	5.55	-6.90	-7.35	UD-2	S-8										
5.55	7.05	-7.35	-8.85	DS-5	S-9										
7.05	7.50	-8.85	-9.30	SPT-3	S-10		9	7	21	28					
7.50	8.25	-9.30	-10.05	RCS-1	S-11						Soft Rock	11.3	-	0.0	
8.25	8.70	-10.05	-10.50	SPT-4	S-12		16	14	23	37	Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand

LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep		
BH Number	: CB1		
CLIENT	: Cochin Port Authority	**Zone**	**Easting** / **Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates**	43P / 351434.09 / 1115517.63
Land/Marine	: Marine	**Drilling Period** **From**	17-11-2024
Termination Depth (m).	: 8.5	**TO**	17-11-2024
CD Level	**-1.80**	**Structure**	: Approach Channel

Borehole No.	Sample Number	Depth of seabed wrt CD From	To	SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4) Gravel (%)	Sand (%)	Clay & Silt (%)	Atterberg limits (IS 2720 Part 5) Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Specific Gravity G	IS Classification	Bulk Density (gm/cc)	Moisture Content (%)	Dry Density (gm/cc)	Shear Strength Test C (t/m²)	Φ (deg)	Φ Design (deg)
		-1.80																				
BH-CB1			-1.80				Water																
	DS-1	-1.80	-2.55				Medium Desne Coral Sand																
	SPT-1	-2.55	-3.00	14	26	20			11.1	77.0	11.9	NP	NP	NP	2.60	SW-SM	1.90	10.10	1.73	0.0	31.2	30.5
	DS-2	-3.00	-3.75																			
	UD-1	-3.75	-4.20						Sample Slipped off													
	DS-3	-4.20	-5.70																			
	SPT-2	-5.70	-6.15	24	33	24			9.9	80.3	9.8	NP	NP	NP	2.59	SW-SM	1.93	9.80	1.76	0.0	32.3	31.0
	DS-4	-6.15	-6.90																			
	UD-2	-6.90	-7.35						Sample Slipped off													
	DS-5	-7.35	-8.85																			
	SPT-3	-8.85	-9.30	28	31	23			6.2	85.8	8.0	NP	NP	NP	2.58	SW-SM	1.96	9.50	1.79	0.0	31.2	31.0

Borehole No.	Sample Number	Depth of seabed wrt CD From	To	Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
BH-CB1	RCS-1	-9.30	-10.05	17.0	Soft Rock		5.4	11.3	0.0	0.0	-	1.5	

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	Φ_{Design}
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB1	SPT-4	-10.05	-10.50	37	40	27	Dense Coral Sand		12.6	78.6	8.8	NP	NP	NP	2.63	SW-SM	1.99	9.20	1.82	0.0	32.0	31.5

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB1 | **Type of Foundation = Isolated , Square** | **Water Table Correction factor=0.5**

Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.90	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.13	1.07	1.07	1.30	1.20	0.80	11.41	36.66	9.61
1.95	2.0	2.0	1.91	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.34	1.17	1.17	1.30	1.20	0.80	22.75	69.41	18.43
3.90	2.0	2.0	1.93	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.69	1.34	1.34	1.30	1.20	0.80	48.53	148.20	39.35
5.10	2.0	2.0	1.94	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.90	1.45	1.45	1.30	1.20	0.80	66.41	201.07	53.50
7.05	2.0	2.0	1.96	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	2.25	1.62	1.62	1.30	1.20	0.80	101.15	303.68	80.97
8.25	2.0	2.0	1.99	0.00	0.00	31.5	22.2	34.93	22.87	30.09	17.45	8.29	7.83	2.47	1.74	1.74	1.30	1.20	0.80	134.61	412.81	109.48

Note: The Safe Bearing Capacity Value is Restricted To 75.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

BH-CB1			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	14	20	9.61	17.0	0.5	0.88	0.8	5.75
2.0	2.0	3.90	Square	24	24	39.35	14.0	0.5	0.63	0.8	13.88
2.0	2.0	7.05	Square	28	23	75.00	14.0	0.5	0.58	0.8	24.36
2.0	2.0	8.25	Square	37	27	75.00	11.0	0.5	0.55	0.8	18.15

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB1				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.90	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.09	1.04	1.04	1.30	1.20	0.80	13.95	45.83	11.96
1.95	3.0	3.0	1.91	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.23	1.11	1.11	1.30	1.20	0.80	24.61	76.66	20.25
3.90	3.0	3.0	1.93	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.46	1.23	1.23	1.30	1.20	0.80	47.90	148.62	39.30
5.10	3.0	3.0	1.94	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.60	1.30	1.30	1.30	1.20	0.80	63.26	194.14	51.48
7.05	3.0	3.0	1.96	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.83	1.42	1.42	1.30	1.20	0.80	92.31	280.10	74.48
8.25	3.0	3.0	1.99	0.00	0.00	31.5	22.2	34.93	22.87	30.09	17.45	8.29	7.83	1.98	1.49	1.49	1.30	1.20	0.80	120.22	372.28	98.50

Note: The Safe Bearing Capacity Value is Restricted To 70.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

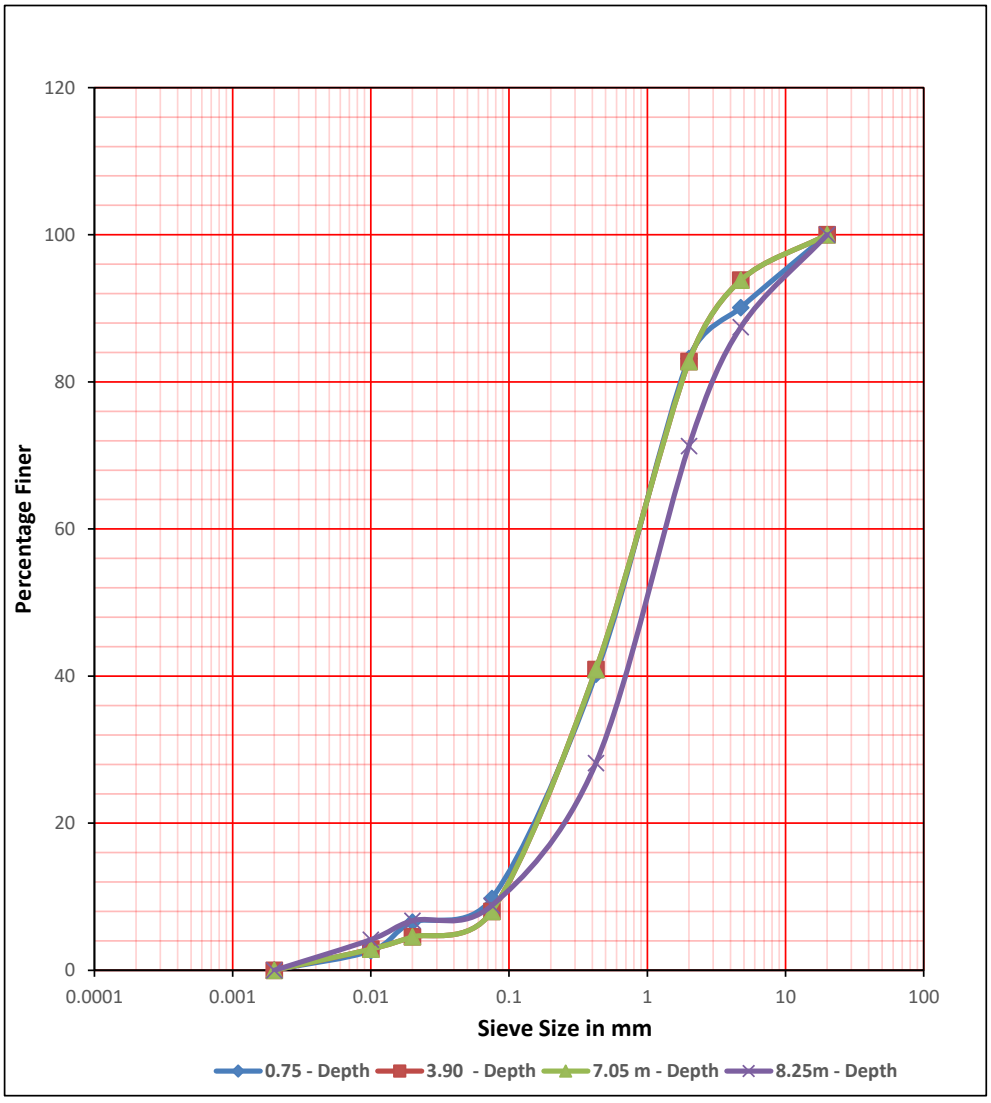
BH-CB1			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	14	20	11.96	17.0	0.5	0.93	0.8	7.56
3.0	3.0	3.90	Square	24	24	39.30	14.0	0.5	0.77	0.8	16.95
3.0	3.0	7.05	Square	28	23	70.00	14.0	0.5	0.60	0.8	23.52
3.0	3.0	8.25	Square	37	27	70.00	11.0	0.5	0.60	0.8	18.48

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB1



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	11.9	31.1	40.4	5.6	11.1	0.0
3.90	9.8	30.5	42.9	6.9	9.9	0.0
7.05	8.0	32.9	41.9	11.1	6.2	0.0
8.25	8.8	19.4	43.1	16.2	12.6	0.0

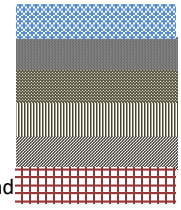
BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	:CB2				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western	**Positioned Coordinates**	43P	351558.15	1116070.1
Land/Marine	: Marine	**Drilling Period**	**From**		19-11-2024
Termination Depth (m).	: 8.50		**To**		19-11-2024
Bed Level wrt CD	-1.90	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-1.90								Water				
0.00	0.75	-1.90	-2.65	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	-2.65	-3.10	SPT-1	S-2		7	11	13	24					
1.20	1.95	-3.10	-3.85	DS-2	S-3						Dense Coral Sand				
1.95	2.40	-3.85	-4.30	UD-1	S-4										
2.40	3.90	-4.30	-5.80	DS-3	S-5										
3.90	4.35	-5.80	-6.25	SPT-2	S-6		14	18	24	42					
4.35	5.10	-6.25	-7.00	DS-4	S-7										
5.10	5.55	-7.00	-7.45	UD-2	S-8										
5.55	7.05	-7.45	-8.95	DS-5	S-9										
7.05	7.50	-8.95	-9.40	SPT-3	S-10		12	17	14	31					
7.50	8.25	-9.40	-10.15	RCS-1	S-11						Soft Rock	12.0		0.0	
8.25	8.70	-10.15	-10.60	SPT-4	S-12		18	21	23	44	Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB2				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates :**	43P	351558.15	1116070.1
Land/Marine	: Marine	**Drilling Period**	**From**	19-11-2024	
Termination Depth (m).	: 8.5		**TO**	19-11-2024	
CD Level	**-1.90**	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-1.90							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB2			-1.90				Water															
	DS-1	-1.90	-2.65				Medium Desne Coral Sand															
	SPT-1	-2.65	-3.10	24	44	30			8.7	81.5	9.8	NP	NP	NP	2.58	SW-SM	1.95	10.00	1.77	0.0	30.1	29.0
	DS-2	-3.10	-3.85																			
	UD-1	-3.85	-4.30						Sample Slipped off													
	DS-3	-4.30	-5.80																			
	SPT-2	-5.80	-6.25	42	57	36			11.6	77.1	11.3	NP	NP	NP	2.55	SW-SM	1.99	9.50	1.82	0.0	32.4	32.0
	DS-4	-6.25	-7.00																			
	UD-2	-7.00	-7.45						Sample Slipped off													
	DS-5	-7.45	-8.95																			
	SPT-3	-8.95	-9.40	31	35	25			7.6	81.8	10.6	NP	NP	NP	2.60	SW-SM	1.99	8.90	1.83	0.0	32.2	31.5

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB2	RCS-1	-9.40	-10.15	18.0	Soft Rock		5.4	12	0.0	0.0	-	1.3	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m^2)	(deg)	(deg)
BH-CB2	SPT-4	-10.15	-10.60	44	46	30	Desne Coral Sand		12.6	78.6	8.8	NP	NP	NP	2.65	SW-SM	2.04	8.20	1.89	0.0	31.9	32.0

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB2				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.95	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.13	1.06	1.06	1.30	1.20	0.80	9.83	31.02	8.17
1.95	2.0	2.0	1.97	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.34	1.17	1.17	1.30	1.20	0.80	22.73	66.80	17.91
3.90	2.0	2.0	1.99	0.00	0.00	32.0	22.6	36.53	24.36	32.65	17.91	8.63	8.26	1.70	1.35	1.35	1.30	1.20	0.80	56.82	181.92	47.75
5.10	2.0	2.0	1.98	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.90	1.45	1.45	1.30	1.20	0.80	69.05	208.95	55.60
7.05	2.0	2.0	1.99	0.00	0.00	31.5	22.2	34.93	22.87	30.09	17.45	8.29	7.83	2.26	1.63	1.63	1.30	1.20	0.80	109.99	338.41	89.68
8.25	2.0	2.0	2.04	0.00	0.00	32.0	22.6	36.53	24.36	32.65	17.91	8.63	8.26	2.49	1.74	1.74	1.30	1.20	0.80	149.44	468.09	123.51

Note: The Safe Bearing Capacity Value is Restricted To 85.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

BH-CB2			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	24	30	8.17	10.0	0.5	0.88	0.8	2.88
2.0	2.0	3.90	Square	42	36	47.75	8.0	0.5	0.58	0.8	8.86
2.0	2.0	7.05	Square	31	25	85.00	13.0	0.5	0.55	0.8	24.31
2.0	2.0	8.25	Square	44	30	85.00	10.0	0.5	0.55	0.8	18.70

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB2				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.95	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.08	1.04	1.04	1.30	1.20	0.80	11.95	38.56	10.10
1.95	3.0	3.0	1.97	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.23	1.11	1.11	1.30	1.20	0.80	24.51	73.40	19.58
3.90	3.0	3.0	1.99	0.00	0.00	32.0	22.6	36.53	24.36	32.65	17.91	8.63	8.26	1.47	1.23	1.23	1.30	1.20	0.80	55.96	182.21	47.63
5.10	3.0	3.0	1.98	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.60	1.30	1.30	1.30	1.20	0.80	65.71	201.49	53.44
7.05	3.0	3.0	1.99	0.00	0.00	31.5	22.2	34.93	22.87	30.09	17.45	8.29	7.83	1.84	1.42	1.42	1.30	1.20	0.80	100.25	311.86	82.42
8.25	3.0	3.0	2.04	0.00	0.00	32.0	22.6	36.53	24.36	32.65	17.91	8.63	8.26	1.99	1.50	1.50	1.30	1.20	0.80	133.24	421.50	110.95

Note: The Safe Bearing Capacity Value is Restricted To 80.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

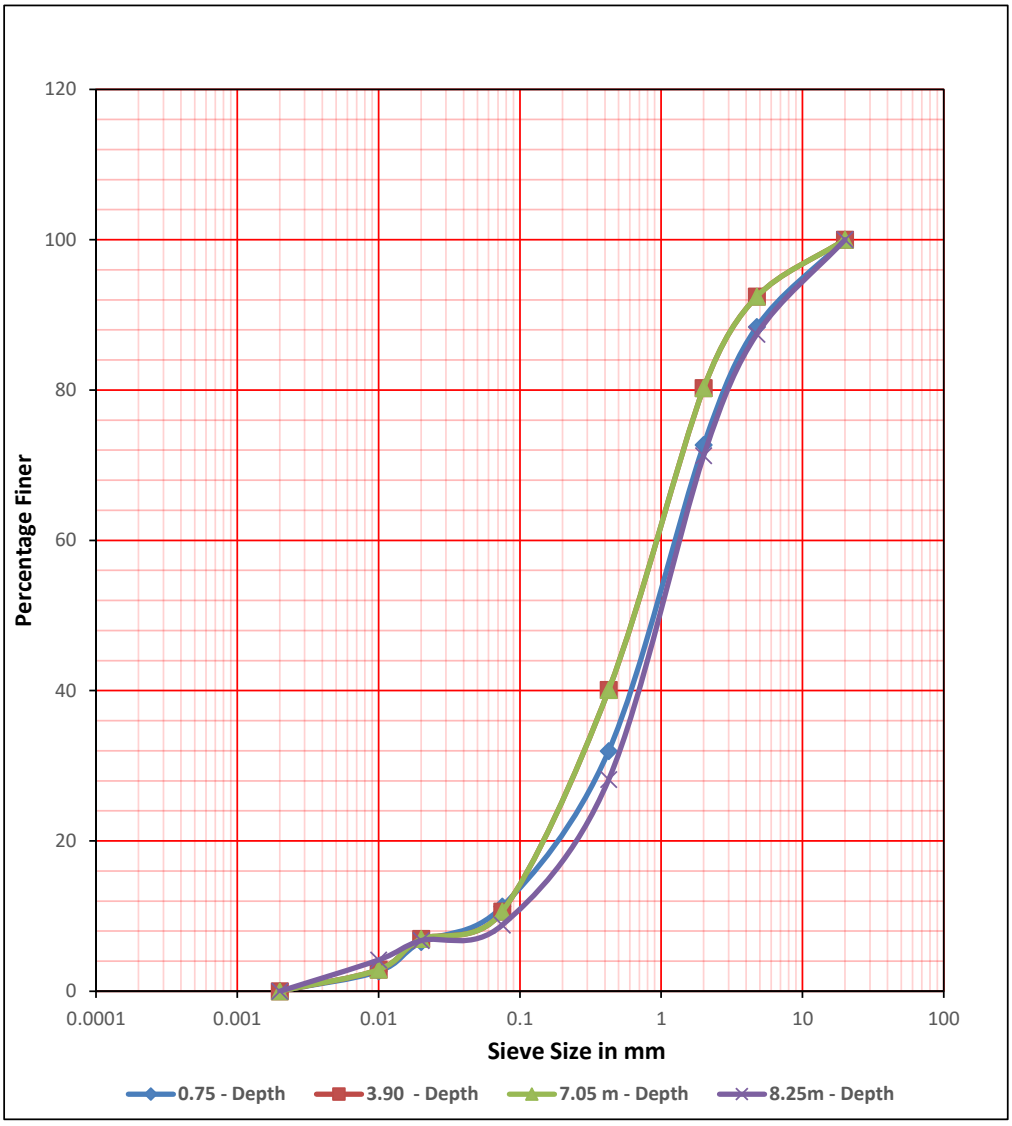
BH-CB2			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	24	30	10.10	10.0	0.5	0.93	0.8	3.76
3.0	3.0	3.90	Square	42	36	47.63	8.0	0.5	0.67	0.8	10.21
3.0	3.0	7.05	Square	31	25	80.00	13.0	0.5	0.60	0.8	24.96
3.0	3.0	8.25	Square	44	30	80.00	10.0	0.5	0.60	0.8	19.20

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB2



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	9.8	40.6	31.1	9.9	8.7	0.0
3.90	11.3	20.7	40.7	15.7	11.6	0.0
7.05	10.6	29.5	40.2	12.2	7.6	0.0
8.25	8.8	19.4	43.1	16.2	12.6	0.0

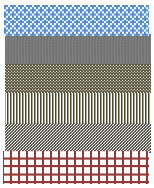
BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB3				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351681.83	1116530.4
Land/Marine	: Marine	**Drilling Period**	**From**		20-11-2024
Termination Depth (m).	: 8.50		**To**		20-11-2024
Bed Level wrt CD	-2.20	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-2.20								Water				
0.00	0.75	-2.20	-2.95	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	-2.95	-3.40	SPT-1	S-2		4	6	11	17					
1.20	1.95	-3.40	-4.15	DS-2	S-3										
1.95	2.40	-4.15	-4.60	UD-1	S-4										
2.40	3.90	-4.60	-6.10	DS-3	S-5										
3.90	4.35	-6.10	-6.55	SPT-2	S-6		7	11	13	24					
4.35	5.10	-6.55	-7.30	DS-4	S-7						Dense Coral Sand				
5.10	5.55	-7.30	-7.75	UD-2	S-8										
5.55	7.05	-7.75	-9.25	DS-5	S-9										
7.05	7.50	-9.25	-9.70	SPT-3	S-10		14	16	23	39					
7.50	8.25	-9.70	-10.45	RCS-1	S-11						Soft Rock	16.0		0.0	
8.25	8.70	-10.45	-10.90	SPT-4	S-12		17	12	21	33	Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	CB3				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates :**	43P	351681.83	1116530.4
Land/Marine	: Marine	**Drilling Period**	**From**	20-11-2024	
Termination Depth (m).	: 8.5		**TO**	20-11-2024	
CD Level	**-2.20**	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-2.20							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB3			-2.20				Water															
	DS-1	-2.20	-2.95				Medium Desne Coral Sand															
	SPT-1	-2.95	-3.40	17	31	23			5.7	85.9	8.4	NP	NP	NP	2.63	SW-SM	1.93	10.30	1.75	0.0	30.2	29.0
	DS-2	-3.40	-4.15																			
	UD-1	-4.15	-4.60						Sample Slipped off													
	DS-3	-4.60	-6.10																			
	SPT-2	-6.10	-6.55	24	33	24			9.0	79.1	11.9	NP	NP	NP	2.61	SW-SM	1.96	10.00	1.78	0.0	30.8	30.0
	DS-4	-6.55	-7.30				Dense Coral Sand															
	UD-2	-7.30	-7.75						Sample Slipped off													
	DS-5	-7.75	-9.25																			
	SPT-3	-9.25	-9.70	39	44	29			7.8	81.8	10.4	NP	NP	NP	2.57	SW-SM	2.00	9.70	1.82	0.0	31.4	31.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB3	RCS-1	-9.70	-10.45	24.0	Soft Rock		5.4	16	0.0	0.0	-	1.7	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m^2)	(deg)	(deg)
BH-CB3	SPT-4	-10.45	-10.90	33	34	25	Desne Coral Sand		10.1	80.5	9.4	NP	NP	NP	2.59	SW-SM	2.03	9.30	1.86	0.0	32.4	31.5

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB3				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.93	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.13	1.06	1.06	1.30	1.20	0.80	9.70	30.62	8.06
1.95	2.0	2.0	1.95	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.34	1.17	1.17	1.30	1.20	0.80	22.33	65.63	17.59
3.90	2.0	2.0	1.96	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.68	1.34	1.34	1.30	1.20	0.80	44.62	127.83	34.49
5.10	2.0	2.0	1.97	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.89	1.45	1.45	1.30	1.20	0.80	64.83	190.62	51.09
7.05	2.0	2.0	2.00	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	2.25	1.62	1.62	1.30	1.20	0.80	104.81	314.55	83.87
8.25	2.0	2.0	2.03	0.00	0.00	31.5	22.2	34.93	22.87	30.09	17.45	8.29	7.83	2.47	1.74	1.74	1.30	1.20	0.80	140.57	430.88	114.29

Note: The Safe Bearing Capacity Value is Restricted To 85.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

BH-CB3			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	17	23	8.06	14.0	0.5	0.88	0.8	3.97
2.0	2.0	3.90	Square	24	24	34.49	14.0	0.5	0.63	0.8	12.17
2.0	2.0	7.05	Square	39	29	83.87	10.0	0.5	0.58	0.8	19.46
2.0	2.0	8.25	Square	33	25	85.00	13.0	0.5	0.55	0.8	24.31

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB3				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.93	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.08	1.04	1.04	1.30	1.20	0.80	11.80	38.10	9.98
1.95	3.0	3.0	1.95	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.23	1.11	1.11	1.30	1.20	0.80	24.09	72.19	19.26
3.90	3.0	3.0	1.96	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.45	1.23	1.23	1.30	1.20	0.80	44.00	127.82	34.36
5.10	3.0	3.0	1.97	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.59	1.30	1.30	1.30	1.20	0.80	61.73	183.78	49.10
7.05	3.0	3.0	2.00	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.83	1.42	1.42	1.30	1.20	0.80	95.58	289.86	77.09
8.25	3.0	3.0	2.03	0.00	0.00	31.5	22.2	34.93	22.87	30.09	17.45	8.29	7.83	1.98	1.49	1.49	1.30	1.20	0.80	125.44	388.20	102.73

Note: The Safe Bearing Capacity Value is Restricted To 80.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

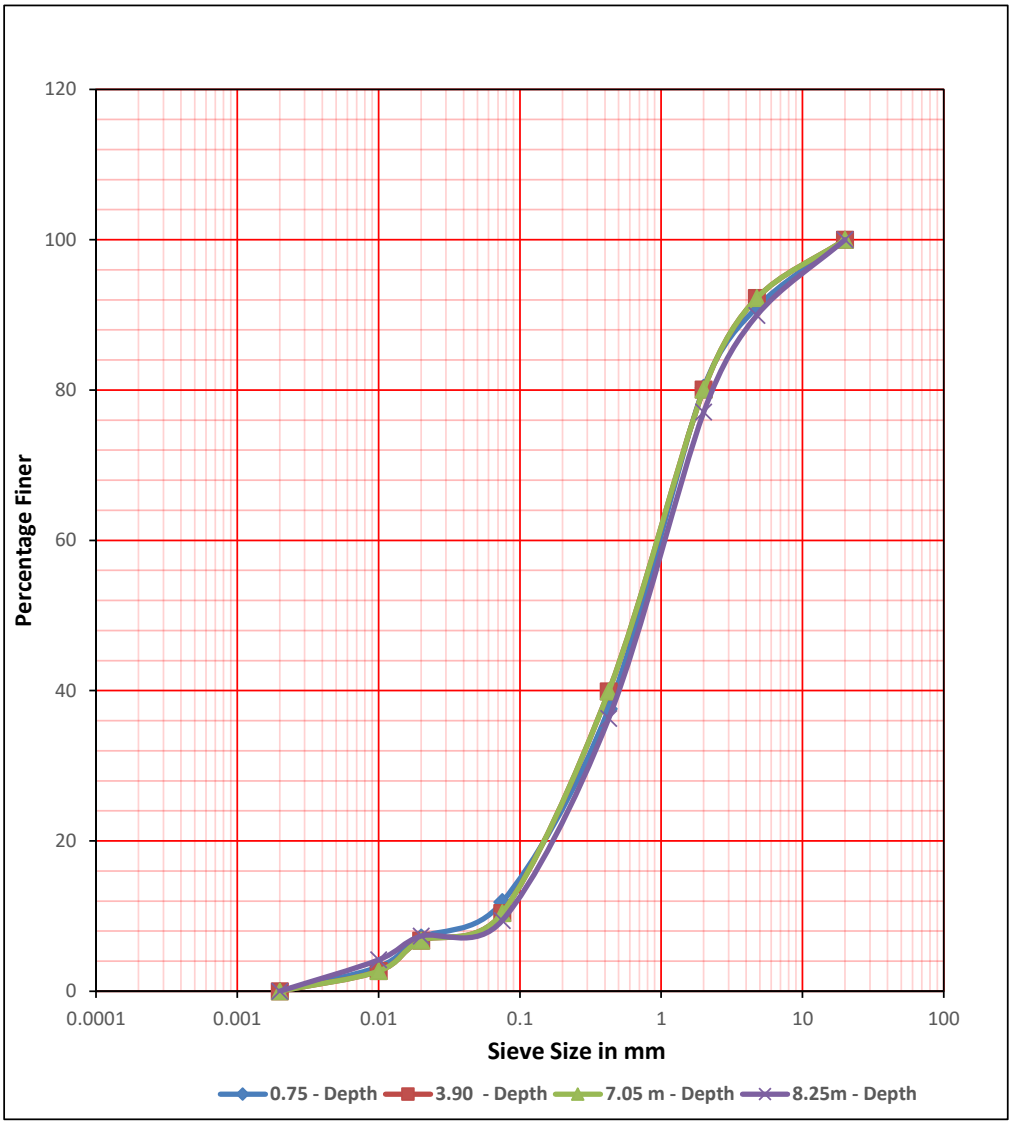
BH-CB3			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	17	23	9.98	14.0	0.5	0.88	0.8	4.92
3.0	3.0	3.90	Square	24	24	34.36	14.0	0.5	0.58	0.8	11.16
3.0	3.0	7.05	Square	39	29	77.09	10.0	0.5	0.55	0.8	16.96
3.0	3.0	8.25	Square	33	25	80.00	13.0	0.5	0.55	0.8	22.88

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB3



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	8.4	40.1	35.8	10.1	5.7	0.0
3.90	11.9	25.7	42.7	10.7	9.0	0.0
7.05	10.4	29.5	40.2	12.2	7.8	0.0
8.25	9.4	26.9	40.8	12.9	10.1	0.0

BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB4				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351775.19	1117021.55
Land/Marine	: Marine	**Drilling Period**	**From**		26-11-2024
Termination Depth (m).	: 8.50		**To**		26-11-2024
Bed Level wrt CD	-2.30	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-2.30								Water				
0.00	0.75	-2.30	-3.05	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	-3.05	-3.50	SPT-1	S-2		8	12	14	26					
1.20	1.95	-3.50	-4.25	DS-2	S-3										
1.95	2.40	-4.25	-4.70	UD-1	S-4										
2.40	3.90	-4.70	-6.20	DS-3	S-5										
3.90	4.35	-6.20	-6.65	SPT-2	S-6		14	16	12	28					
4.35	5.10	-6.65	-7.40	DS-4	S-7						Dense Coral Sand				
5.10	5.55	-7.40	-7.85	UD-2	S-8										
5.55	7.05	-7.85	-9.35	DS-5	S-9										
7.05	7.50	-9.35	-9.80	SPT-3	S-10		18	21	23	44					
7.50	8.25	-9.80	-10.55	DS-6	S-11										
8.25	8.70	-10.55	-11.00	SPT-4	S-12		17	18	21	39					

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand

LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	CB4				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates :**	43P	351775.19	1117021.55
Land/Marine	: Marine	**Drilling Period**	**From**	26-11-2024	
Termination Depth (m).	: 8.5		**TO**	26-11-2024	
CD Level	**-2.30**	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-2.30							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB4			-2.30				Water															
	DS-1	-2.30	-3.05				Medium Desne Coral Sand															
	SPT-1	-3.05	-3.50	26	48	31			5.8	82.6	11.6	NP	NP	NP	2.61	SW-SM	1.97	10.00	1.79	0.0	30.3	30.0
	DS-2	-3.50	-4.25																			
	UD-1	-4.25	-4.70						Sample Slipped off													
	DS-3	-4.70	-6.20																			
	SPT-2	-6.20	-6.65	28	38	27			6.7	83.0	10.3	NP	NP	NP	2.63	SW-SM	2.00	9.80	1.82	0.0	30.2	31.0
	DS-4	-6.65	-7.40				Dense Coral Sand															
	UD-2	-7.40	-7.85						Sample Slipped off													
	DS-5	-7.85	-9.35																			
	SPT-3	-9.35	-9.80	44	49	32			6.2	83.1	10.7	NP	NP	NP	2.59	SW-SM	2.04	9.60	1.87	0.0	31.5	32.0
	DS-6	-9.80	-10.55																			
	SPT-4	-10.55	-11.00	39	41	28			7.5	80.6	11.9	NP	NP	NP	2.57	SW-SM	2.05	9.00	1.89	0.0	33.4	32.0

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB4				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.97	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.13	1.06	1.06	1.30	1.20	0.80	11.34	34.95	9.26
1.95	2.0	2.0	1.98	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.34	1.17	1.17	1.30	1.20	0.80	24.25	73.85	19.62
3.90	2.0	2.0	2.00	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.69	1.34	1.34	1.30	1.20	0.80	51.67	157.63	41.86
5.10	2.0	2.0	2.02	0.00	0.00	31.5	22.2	34.93	22.87	30.09	17.45	8.29	7.83	1.91	1.46	1.46	1.30	1.20	0.80	75.46	234.07	61.91
7.05	2.0	2.0	2.04	0.00	0.00	32.0	22.6	36.53	24.36	32.65	17.91	8.63	8.26	2.27	1.64	1.64	1.30	1.20	0.80	120.83	379.82	100.13
8.25	2.0	2.0	2.05	0.00	0.00	32.0	22.6	36.53	24.36	32.65	17.91	8.63	8.26	2.49	1.74	1.74	1.30	1.20	0.80	150.13	470.23	124.07

Note: The Safe Bearing Capacity Value is Restricted To 100.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

BH-CB4			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	26	31	9.26	9.7	0.5	0.88	0.8	3.16
2.0	2.0	3.90	Square	28	27	41.86	11.0	0.5	0.63	0.8	11.60
2.0	2.0	7.05	Square	44	32	100.00	9.0	0.5	0.58	0.8	20.88
2.0	2.0	8.25	Square	39	28	100.00	11.0	0.5	0.55	0.8	24.20

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB4				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.97	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.09	1.04	1.04	1.30	1.20	0.80	13.80	43.44	11.45
1.95	3.0	3.0	1.98	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.23	1.11	1.11	1.30	1.20	0.80	26.15	81.27	21.48
3.90	3.0	3.0	2.00	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.46	1.23	1.23	1.30	1.20	0.80	50.90	157.69	41.72
5.10	3.0	3.0	2.02	0.00	0.00	31.5	22.2	34.93	22.87	30.09	17.45	8.29	7.83	1.61	1.30	1.30	1.30	1.20	0.80	71.71	225.50	59.44
7.05	3.0	3.0	2.04	0.00	0.00	32.0	22.6	36.53	24.36	32.65	17.91	8.63	8.26	1.85	1.42	1.42	1.30	1.20	0.80	109.97	349.58	91.91
8.25	3.0	3.0	2.05	0.00	0.00	32.0	22.6	36.53	24.36	32.65	17.91	8.63	8.26	1.99	1.50	1.50	1.30	1.20	0.80	133.84	423.38	111.45

Note: The Safe Bearing Capacity Value is Restricted To 95.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

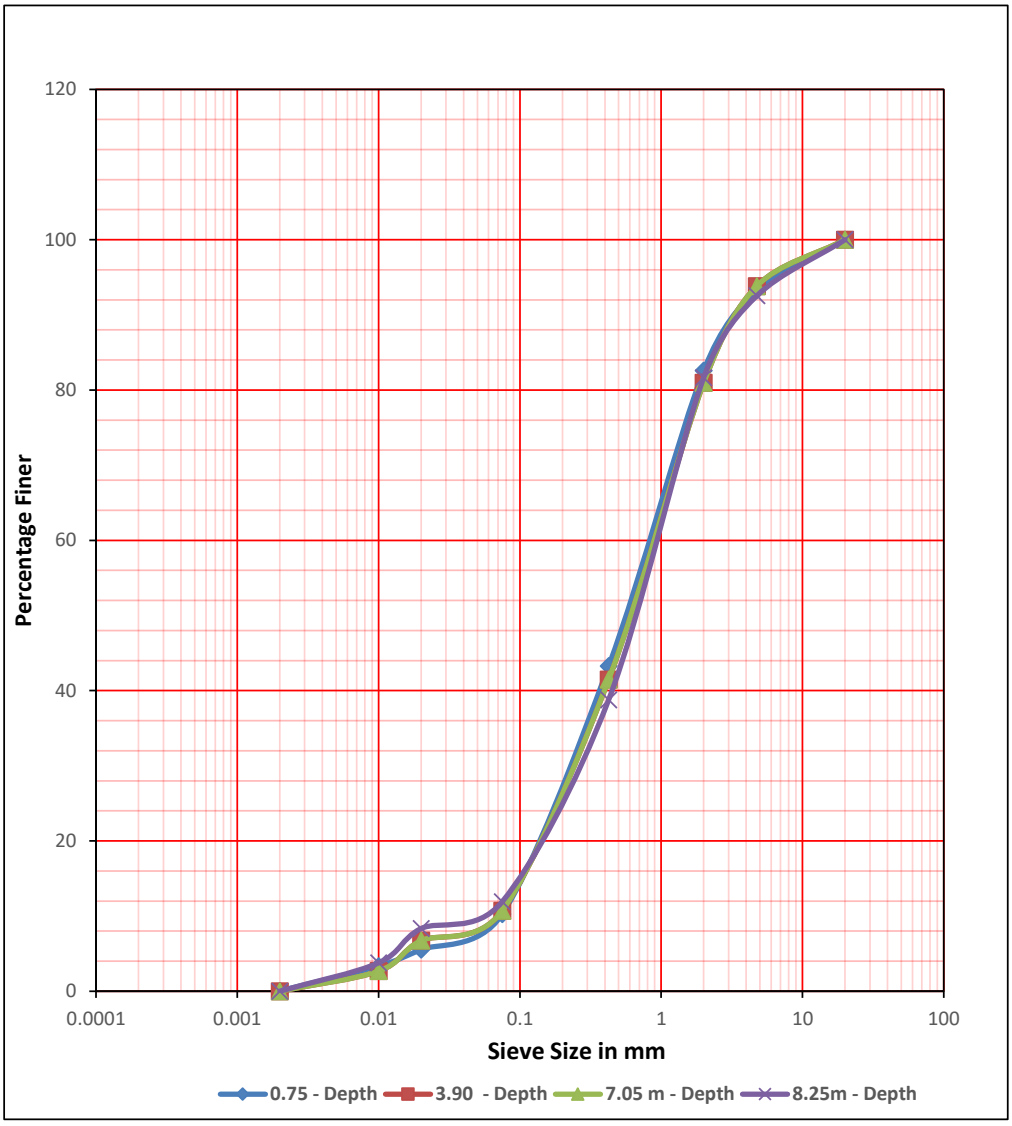
BH-CB4			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	26	31	11.45	9.7	0.5	0.88	0.8	3.91
3.0	3.0	3.90	Square	28	27	41.72	11.0	0.5	0.63	0.8	11.56
3.0	3.0	7.05	Square	44	32	91.91	9.0	0.5	0.58	0.8	19.19
3.0	3.0	8.25	Square	39	28	95.00	11.0	0.5	0.55	0.8	22.99

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB4



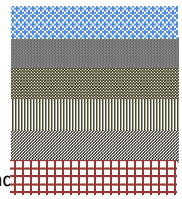
DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	11.6	37.1	35.7	9.9	5.8	0.0
3.90	10.3	33.0	39.3	10.7	6.7	0.0
7.05	10.7	30.8	39.5	12.9	6.2	0.0
8.25	11.9	26.9	42.9	10.9	7.5	0.0

BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB5				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western side	**Positioned Coordinates**	43P	351807.67	1117512.95
Land/Marine	: Marine	**Drilling Period**	**From**		21-11-2024
Termination Depth (m).	: 8.50		**To**		21-11-2024
Bed Level wrt CD	-4.50	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-4.50								Water				
0.00	0.75	-4.50	-5.25	DS-1	S-1						Loose Coral Sand				
0.75	1.20	-5.25	-5.70	SPT-1	S-2		2	3	4	7					
1.20	1.95	-5.70	-6.45	DS-2	S-3						Medium Dense Coral Sand				
1.95	2.40	-6.45	-6.90	UD-1	S-4										
2.40	3.90	-6.90	-8.40	DS-3	S-5										
3.90	4.35	-8.40	-8.85	SPT-2	S-6		4	6	7	13					
4.35	5.10	-8.85	-9.60	DS-4	S-7										
5.10	5.55	-9.60	-10.05	UD-2	S-8										
5.55	7.05	-10.05	-11.55	DS-5	S-9										
7.05	7.50	-11.55	-12.00	SPT-3	S-10		6	8	11	19					
7.50	8.25	-12.00	-12.75	RCS-1	S-11						Soft Rock	8.0		0.0	
8.25	8.70	-12.75	-13.20	SPT-4	S-12		7	9	12	21	Medium Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB5				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates :**	43P	351807.67	1117512.95
Land/Marine	: Marine	**Drilling Period**	**From**	21-11-2024	
Termination Depth (m).	: 8.5		**TO**	21-11-2024	
CD Level	**-4.50**	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-4.50							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB5			-4.50				Water															
	DS-1	-4.50	-5.25				Medium Desne Coral Sand															
	SPT-1	-5.25	-5.70	7	13	13			4.1	88.2	7.7	NP	NP	NP	2.60	SW-SM	1.75	8.40	1.61	0.0	29.0	28.0
	DS-2	-5.70	-6.45																			
	UD-1	-6.45	-6.90						Sample Slipped off													
	DS-3	-6.90	-8.40																			
	SPT-2	-8.40	-8.85	13	18	16			5.7	84.5	9.8	NP	NP	NP	2.55	SW-SM	1.90	8.20	1.76	0.0	30.4	29.5
	DS-4	-8.85	-9.60				Dense Coral Sand															
	UD-2	-9.60	-10.05						Sample Slipped off													
	DS-5	-10.05	-11.55																			
	SPT-3	-11.55	-12.00	19	21	18			7.4	84.1	8.5	NP	NP	NP	2.59	SW-SM	1.93	8.00	1.79	0.0	31.0	30.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB5	RCS-1	-12.00	-12.75	12.0	Soft Rock		5.4	8.0	0.0	0.0	-	1.1	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB5	SPT-4	-12.75	-13.20	21	23	19	Medium Dense Coral Sand		7.5	81.8	10.2	NP	NP	NP	2.63	SW-SM	1.95	7.70	1.81	0.0	31.5	30.0

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB5				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.75	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.12	1.06	1.06	1.30	1.20	0.80	7.48	23.39	6.17
1.95	2.0	2.0	1.82	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.33	1.17	1.17	1.30	1.20	0.80	17.45	52.50	13.99
3.90	2.0	2.0	1.90	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.67	1.33	1.33	1.30	1.20	0.80	39.92	115.49	31.08
5.10	2.0	2.0	1.92	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.87	1.44	1.44	1.30	1.20	0.80	55.04	158.00	42.61
7.05	2.0	2.0	1.93	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	2.22	1.61	1.61	1.30	1.20	0.80	88.21	249.14	67.47
8.25	2.0	2.0	1.95	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	2.43	1.71	1.71	1.30	1.20	0.80	110.20	310.33	84.11

Note: The Safe Bearing Capacity Value is Restricted To 55.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

BH-CB5			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	7	13	6.17	30.0	0.5	0.88	0.8	6.52
2.0	2.0	3.90	Square	13	16	31.08	22.0	0.5	0.63	0.8	17.23
2.0	2.0	7.05	Square	19	18	55.00	19.0	0.5	0.58	0.8	24.24
2.0	2.0	8.25	Square	21	19	55.00	18.0	0.5	0.55	0.8	21.78

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB5				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.75	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.08	1.04	1.04	1.30	1.20	0.80	9.20	29.40	7.72
1.95	3.0	3.0	1.82	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.22	1.11	1.11	1.30	1.20	0.80	18.93	58.14	15.41
3.90	3.0	3.0	1.90	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.45	1.22	1.22	1.30	1.20	0.80	39.44	115.74	31.04
5.10	3.0	3.0	1.92	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.58	1.29	1.29	1.30	1.20	0.80	52.50	152.51	41.00
7.05	3.0	3.0	1.93	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.81	1.41	1.41	1.30	1.20	0.80	80.62	229.84	62.09
8.25	3.0	3.0	1.95	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.95	1.48	1.48	1.30	1.20	0.80	98.66	280.11	75.76

Note: The Safe Bearing Capacity Value is Restricted To 50.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

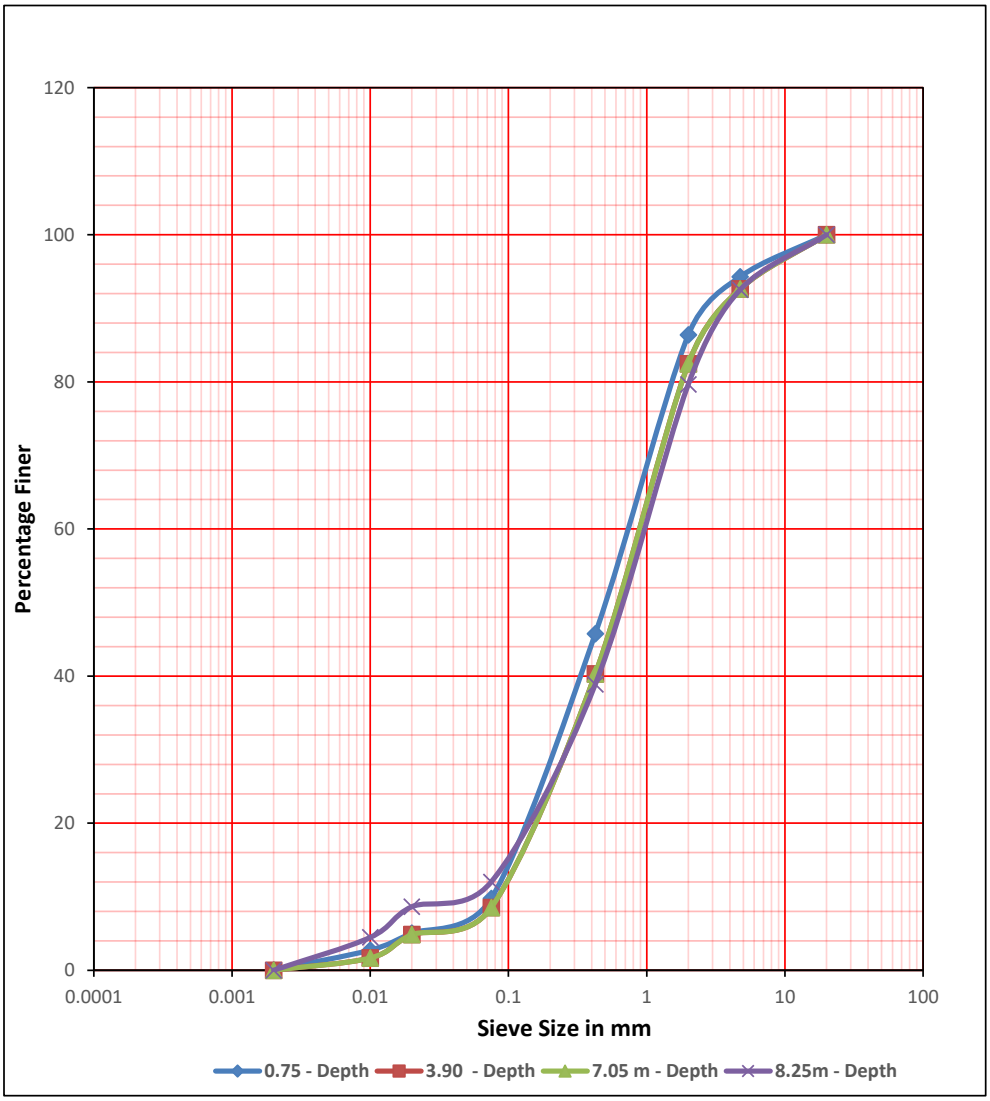
BH-CB5			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	7	13	7.72	30.0	0.5	0.88	0.8	8.15
3.0	3.0	3.90	Square	13	16	31.04	22.0	0.5	0.67	0.8	18.30
3.0	3.0	7.05	Square	19	18	50.00	19.0	0.5	0.60	0.8	22.80
3.0	3.0	8.25	Square	21	19	50.00	18.0	0.5	0.60	0.8	21.60

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB5



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	7.7	35.9	46.2	6.2	4.1	0.0
3.90	9.8	36.0	40.6	7.9	5.7	0.0
7.05	8.5	31.8	42.2	10.2	7.4	0.0
8.25	10.2	26.9	42.1	12.9	7.5	0.0

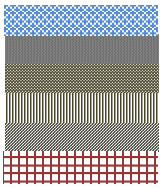
BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB6				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351718.26	1117974.13
Land/Marine	: Marine	**Drilling Period**	**From**		24-11-2024
Termination Depth (m).	: 8.50		**To**		24-11-2024
Bed Level wrt CD	-4.90	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-4.90								Water				
0.00	0.75	-4.90	-5.65	DS-1	S-1						Loose Coral Sand				
0.75	1.20	-5.65	-6.10	SPT-1	S-2		1	3	3	6					
1.20	1.95	-6.10	-6.85	DS-2	S-3						Medium Dense Coral Sand				
1.95	2.40	-6.85	-7.30	UD-1	S-4										
2.40	3.90	-7.30	-8.80	DS-3	S-5										
3.90	4.35	-8.80	-9.25	SPT-2	S-6		3	5	6	11					
4.35	5.10	-9.25	-10.00	DS-4	S-7										
5.10	5.55	-10.00	-10.45	UD-2	S-8										
5.55	7.05	-10.45	-11.95	RCS-1	S-9						Soft Rock	11.3		0.0	
7.05	7.50	-11.95	-12.40	SPT-3	S-10		5	7	11	18	Medium Dense Coral Sand				
7.50	8.25	-12.40	-13.15	RCS-2	S-11						Soft Rock	9.3		0.0	
8.25	8.70	-13.15	-13.60	SPT-4	S-12		6	9	12	21	Medium Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB6		**Zone**	**Easting**	**Northing**
CLIENT	: Cochin Port Authority	**Proposed Coordinates :**	43P	351718.26	1117974.13
Location	: Kalpeni Western Side		**From**	24-11-2024	
Land/Marine	: Marine	**Drilling Period**	**TO**	24-11-2024	
Termination Depth (m).	: 8.5				
CD Level	**-4.90**	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-4.90							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB6			-4.90				Water															
	DS-1	-4.90	-5.65				Loose Coral Sand															
	SPT-1	-5.65	-6.10	6	11	13			4.8	87.7	7.5	NP	NP	NP	2.55	SW-SM	1.72	8.60	1.58	0.0	29.3	28.0
	DS-2	-6.10	-6.85				Medium Dense Coral Sand															
	UD-1	-6.85	-7.30						Sample Slipped off													
	DS-3	-7.30	-8.80																			
	SPT-2	-8.80	-9.25	11	17	16			3.6	84.8	11.6	NP	NP	NP	2.63	SW-SM	1.80	8.20	1.66	0.0	29.6	29.0
	DS-4	-9.25	-10.00																			
	UD-2	-10.00	-10.45						Sample Slipped off													

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB6	RCS-1	-10.45	-11.95	17	Soft Rock		5.4	11.3	0.0	-	-	1.5	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB6	SPT-3	-11.95	-12.40	18	21	18	Medium Dense Coral Sand		2.1	86.8	11.1	NP	NP	NP	2.60	SW-SM	1.89	7.90	1.75	0.0	31.1	30.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB6	RCS-2	-12.40	-13.15	14	Soft Rock		5.4	9.3	0.0	0.0	-	1.3	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching				Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ_{Design}
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB6	SPT-4	-13.15	-13.60	21	23	19	Medium Dense Coral Sand		3.4	87.7	8.9	NP	NP	NP	2.57	SW-SM	1.93	7.30	1.80	0.0	30.8	30.0

For Manglam Consultancy Services Hyderabad

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB6				Type of Foundation = Isolated , Square														Water Table Correction factor=0.5			
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_γ	N_c'	N_q'	N_γ'	d_c	d_q	d_γ	s_c	s_q	s_γ	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.72	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.12	1.06	1.06	1.30	1.20	0.80	7.27	22.76	6.01
1.95	2.0	2.0	1.76	0.00	0.00	28.5	19.9	27.31	16.08	18.94	14.75	6.35	5.33	1.33	1.16	1.16	1.30	1.20	0.80	15.45	46.73	12.44
3.90	2.0	2.0	1.80	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.66	1.33	1.33	1.30	1.20	0.80	33.42	97.83	26.25
5.10	2.0	2.0	1.84	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.87	1.44	1.44	1.30	1.20	0.80	50.56	145.32	39.18
7.05	2.0	2.0	1.89	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	2.22	1.61	1.61	1.30	1.20	0.80	84.16	237.83	64.40
8.25	2.0	2.0	1.93	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	2.43	1.71	1.71	1.30	1.20	0.80	108.20	304.74	82.59

Note: The Safe Bearing Capacity Value is Restricted To 55.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

BH-CB6			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	6	13	6.01	30.0	0.5	0.88	0.8	6.34
2.0	2.0	3.90	Square	11	16	26.25	22.0	0.5	0.63	0.8	14.55
2.0	2.0	7.05	Square	18	18	55.00	19.0	0.5	0.58	0.8	24.24
2.0	2.0	8.25	Square	21	19	55.00	18.0	0.5	0.55	0.8	21.78

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB6				Type of Foundation = Isolated , Square														Water Table Correction factor=0.5				
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_γ	N_c'	N_q'	N_γ'	d_c	d_q	d_γ	s_c	s_q	s_γ	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.72	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.08	1.04	1.04	1.30	1.20	0.80	8.96	28.68	7.53
1.95	3.0	3.0	1.76	0.00	0.00	28.5	19.9	27.31	16.08	18.94	14.75	6.35	5.33	1.22	1.11	1.11	1.30	1.20	0.80	16.80	51.93	13.75
3.90	3.0	3.0	1.80	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.44	1.22	1.22	1.30	1.20	0.80	33.15	98.53	26.34
5.10	3.0	3.0	1.84	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.58	1.29	1.29	1.30	1.20	0.80	48.34	140.68	37.81
7.05	3.0	3.0	1.89	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.81	1.41	1.41	1.30	1.20	0.80	77.00	219.68	59.34
8.25	3.0	3.0	1.93	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.95	1.48	1.48	1.30	1.20	0.80	96.90	275.19	74.42

Note: The Safe Bearing Capacity Value is Restricted To 50.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

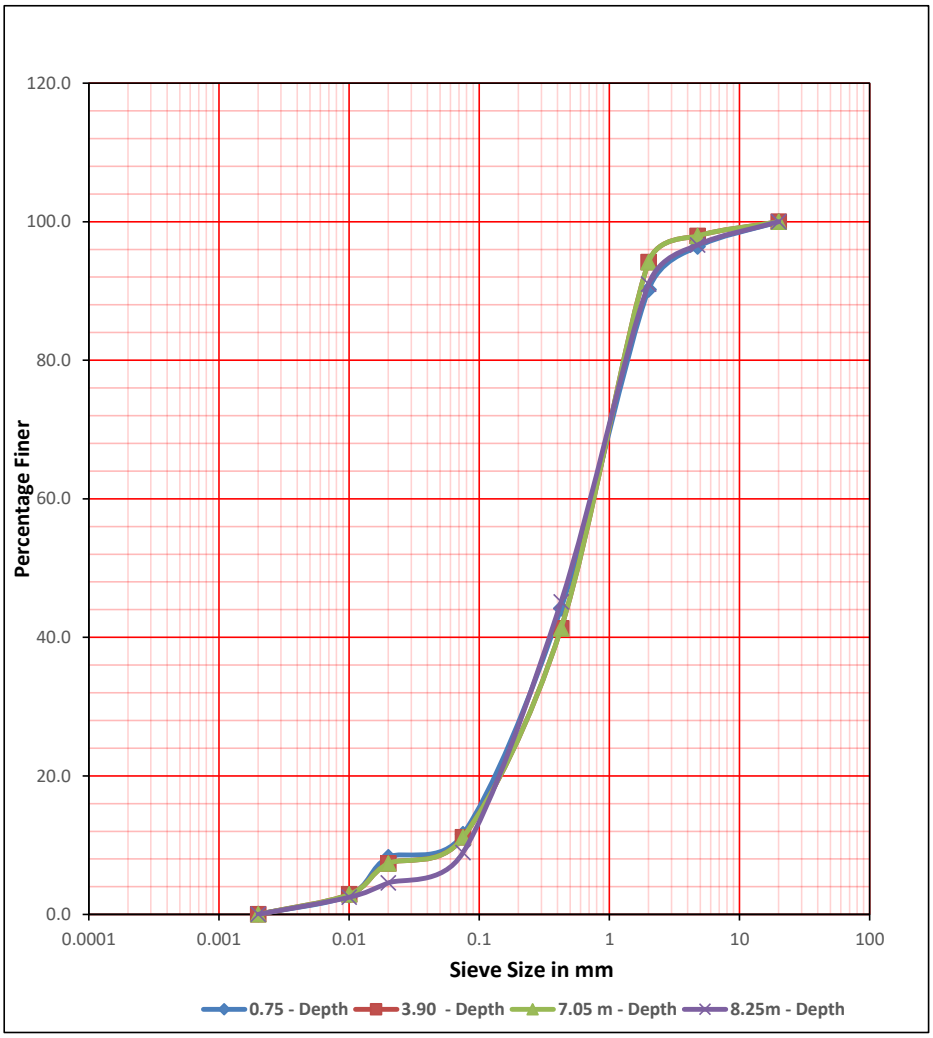
BH-CB6			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	6	13	7.53	30.0	0.5	0.93	0.8	8.40
3.0	3.0	3.90	Square	11	16	26.34	22.0	0.5	0.67	0.8	15.53
3.0	3.0	7.05	Square	18	18	50.00	19.0	0.5	0.60	0.8	22.80
3.0	3.0	8.25	Square	21	19	50.00	18.0	0.5	0.60	0.8	21.60

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB6



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	7.5	30.2	49.1	8.5	4.8	0.0
3.90	11.6	32.6	46.0	6.2	3.6	0.0
7.05	11.1	30.2	52.9	3.8	2.1	0.0
8.25	8.9	36.2	45.9	5.7	3.4	0.0

BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB7				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351507.09	1118435.82
Land/Marine	: Marine	**Drilling Period**	**From**		18-11-2024
Termination Depth (m).	: 8.50		**To**		18-11-2024
Bed Level wrt CD	-3.80	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-3.80								Water				
0.00	0.75	-3.80	-4.55	DS-1	S-1						Coral Sand				
0.75	1.20	-4.55	-5.00	SPT-1	S-2		1	2	3	5					
1.20	1.95	-5.00	-5.75	DS-2	S-3										
1.95	2.40	-5.75	-6.20	UD-1	S-4										
2.40	3.90	-6.20	-7.70	DS-3	S-5										
3.90	4.35	-7.70	-8.15	SPT-2	S-6		3	5	6	11					
4.35	5.10	-8.15	-8.90	DS-4	S-7										
5.10	5.55	-8.90	-9.35	UD-2	S-8										
5.55	7.05	-9.35	-10.85	RCS-1	S-9						Soft Rock	12.0		0.0	
7.05	7.50	-10.85	-11.30	SPT-3	S-10		8	12	16	28	Coral Sand				
7.50	8.25	-11.30	-12.05	RCS-2	S-11						Soft Rock	16.0		0.0	
8.25	8.70	-12.05	-12.50	SPT-4	S-12		12	14	17	31	Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand

LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB7				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates :**	43P	351507.09	1118435.82
Land/Marine	: Marine	**Drilling Period**	**From**	18-11-2024	
Termination Depth (m).	: 8.5		**TO**	18-11-2024	
CD Level	**-3.80**	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-3.80							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB7			-3.80				Water															
	DS-1	-3.80	-4.55				Loose Coral Sand															
	SPT-1	-4.55	-5.00	5	9	9			5.8	86.5	7.7	NP	NP	NP	2.63	SW-SM	1.68	8.20	1.55	0.0	28.2	27.0
	DS-2	-5.00	-5.75				Medium Dense Coral Sand															
	UD-1	-5.75	-6.20						Sample Slipped off													
	DS-3	-6.20	-7.70																			
	SPT-2	-7.70	-8.15	11	17	16			8.6	84.6	6.8	NP	NP	NP	2.60	SW-SM	1.75	7.90	1.62	0.0	30.0	29.0
	DS-4	-8.15	-8.90																			
	UD-2	-8.90	-9.35						Sample Slipped off													

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB7	RCS-1	-9.35	-10.85	18	Soft Rock		5.4	12.0	0.0	-	-	2.0	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB7	SPT-3	-10.85	-11.30	28	32	24	Medium Dense Coral Sand		4.2	88.7	7.1	NP	NP	NP	2.62	SW-SM	1.87	6.80	1.75	0.0	31.8	31.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB7	RCS-2	-11.30	-12.05	24	Soft Rock		5.4	16.0	0.0	0.0	-	1.3	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching				Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ_{Design}
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m^2)	(deg)	(deg)
BH-CB7	SPT-4	-12.05	-12.50	31	33	24	Medium Dense Coral Sand		4.7	86.4	8.9	NP	NP	NP	2.58	SW-SM	1.94	6.50	1.82	0.0	30.6	31.0

For Manglam Consultancy Services Hyderabad

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB7				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_γ	N_c'	N_q'	N_γ'	d_c	d_q	d_γ	s_c	s_q	s_γ	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.68	0.00	0.00	27.0	18.8	24.49	13.76	15.49	13.88	5.79	4.71	1.12	1.06	1.06	1.30	1.20	0.80	6.45	19.27	5.15
1.95	2.0	2.0	1.70	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.32	1.16	1.16	1.30	1.20	0.80	13.88	41.29	11.03
3.90	2.0	2.0	1.75	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.66	1.33	1.33	1.30	1.20	0.80	31.58	92.56	24.83
5.10	2.0	2.0	1.79	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.88	1.44	1.44	1.30	1.20	0.80	50.64	144.40	39.01
7.05	2.0	2.0	1.87	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	2.25	1.62	1.62	1.30	1.20	0.80	92.01	276.58	73.72
8.25	2.0	2.0	1.94	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	2.46	1.73	1.73	1.30	1.20	0.80	121.69	364.24	97.19

Note: The Safe Bearing Capacity Value is Restricted To 75.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

BH-CB7			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	5	9	5.15	58.0	0.5	0.88	0.8	10.50
2.0	2.0	3.90	Square	11	16	24.83	22.0	0.5	0.63	0.8	13.77
2.0	2.0	7.05	Square	28	24	73.72	14.0	0.5	0.58	0.8	23.94
2.0	2.0	8.25	Square	31	24	75.00	14.0	0.5	0.55	0.8	23.10

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB7				Type of Foundation = Isolated , Square															Water Table Correction factor=0.5		
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.68	0.00	0.00	27.0	18.8	24.49	13.76	15.49	13.88	5.79	4.71	1.08	1.04	1.04	1.30	1.20	0.80	7.97	24.31	6.46
1.95	3.0	3.0	1.70	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.22	1.11	1.11	1.30	1.20	0.80	15.17	46.08	12.25
3.90	3.0	3.0	1.75	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.44	1.22	1.22	1.30	1.20	0.80	31.39	93.47	24.97
5.10	3.0	3.0	1.79	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.59	1.29	1.29	1.30	1.20	0.80	48.50	140.04	37.71
7.05	3.0	3.0	1.87	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.83	1.42	1.42	1.30	1.20	0.80	84.15	255.75	67.98
8.25	3.0	3.0	1.94	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.97	1.49	1.49	1.30	1.20	0.80	108.85	328.90	87.55

Note: The Safe Bearing Capacity Value is Restricted To 70.0 t/m^2 as a safety factor.

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SETTLEMENT ANALYSIS

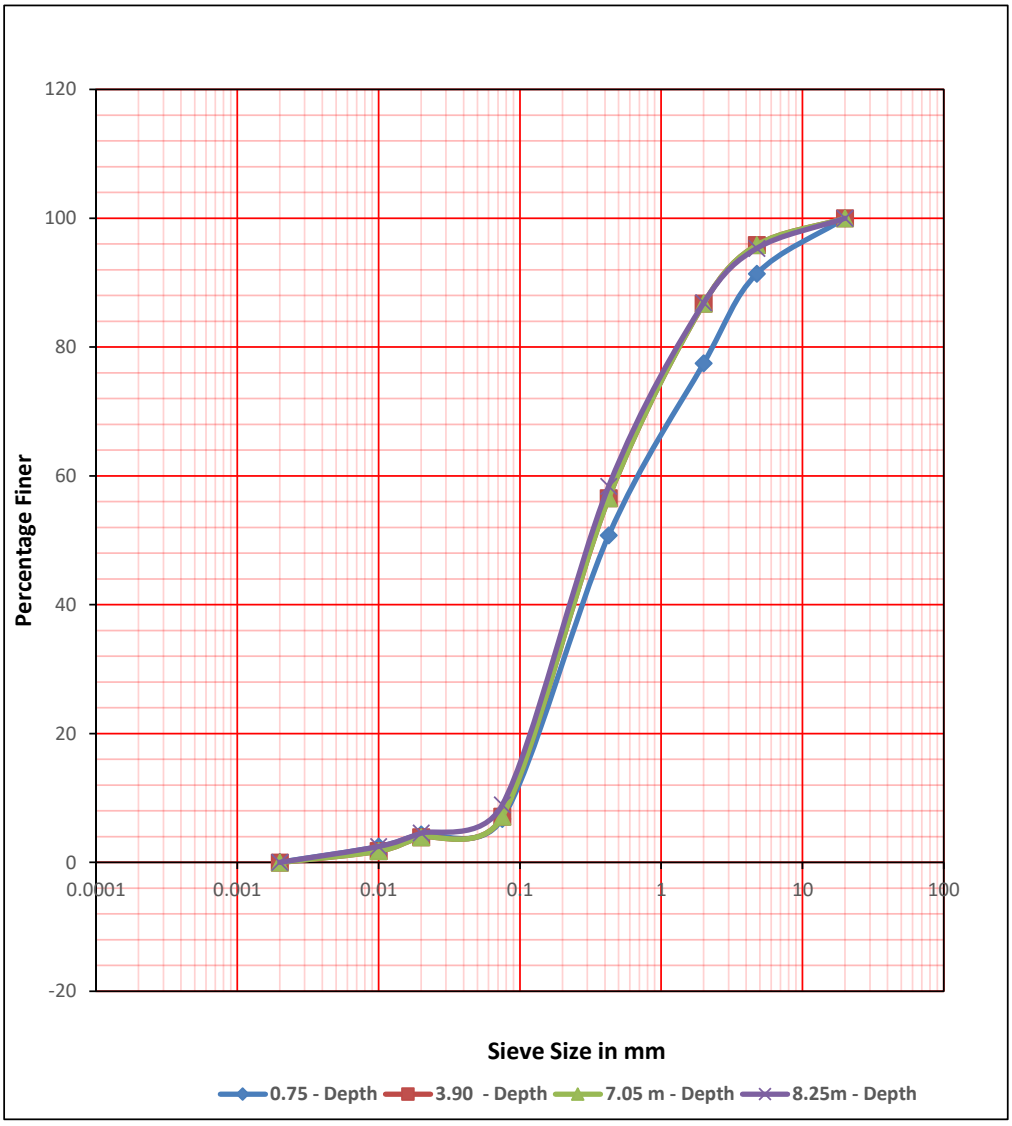
BH-CB7			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	5	9	6.46	58.0	0.5	0.93	0.8	13.93
3.0	3.0	3.90	Square	11	16	24.97	22.0	0.5	0.67	0.8	14.72
3.0	3.0	7.05	Square	28	24	67.98	14.0	0.5	0.60	0.8	22.84
3.0	3.0	8.25	Square	31	24	70.00	14.0	0.5	0.60	0.8	23.52

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB7



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	7.7	45.9	31.2	9.5	5.8	0.0
3.90	6.8	44.0	26.7	13.9	8.6	0.0
7.05	7.1	49.5	30.2	9.1	4.2	0.0
8.25	8.9	49.5	28.5	8.5	4.7	0.0

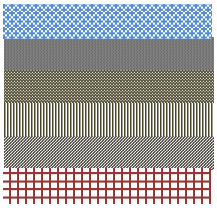
BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB8				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351295.79	1118866.79
Land/Marine	: Marine	**Drilling Period**	**From**		23-11-2024
Termination Depth (m).	: 8.50		**To**		23-11-2024
Bed Level wrt CD	-4.30	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-4.30								Water				
0.00	0.75	-4.30	-5.05	DS-1	S-1						Loose Coral Sand				
0.75	1.20	-5.05	-5.50	SPT-1	S-2		2	3	2	5					
1.20	1.95	-5.50	-6.25	DS-2	S-3						Medium Dense Coral Sand				
1.95	2.40	-6.25	-6.70	UD-1	S-4										
2.40	3.90	-6.70	-8.20	DS-3	S-5										
3.90	4.35	-8.20	-8.65	SPT-2	S-6		3	5	6	11					
4.35	5.10	-8.65	-9.40	DS-4	S-7										
5.10	5.55	-9.40	-9.85	UD-2	S-8										
5.55	7.05	-9.85	-11.35	DS-5	S-9										
7.05	7.50	-11.35	-11.80	SPT-3	S-10		5	7	8	15					
7.50	8.25	-11.80	-12.55	RCS-1	S-11						Soft Rock	14.7		0.0	
8.25	8.70	-12.55	-13.00	SPT-4	S-12		8	9	13	22	Medium Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	CB8				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kapeni Western Side	**Proposed Coordinates :**	43P	351295.79	1118866.79
Land/Marine	: Marine	**Drilling Period**	**From**	23-11-2024	
Termination Depth (m).	: 8.5		**TO**	23-11-2024	
CD Level	**-4.30**	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-4.30							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB8			-4.30				Water															
	DS-1	-4.30	-5.05				Loose Coral Sand															
	SPT-1	-5.05	-5.50	5	9	9			6.2	84.1	9.7	NP	NP	NP	2.59	SW-SM	1.71	8.00	1.58	0.0	28.3	27.0
	DS-2	-5.50	-6.25				Medium Dense Coral Sand															
	UD-1	-6.25	-6.70						Sample Slipped off													
	DS-3	-6.70	-8.20																			
	SPT-2	-8.20	-8.65	11	18	17			7.3	83.5	9.2	NP	NP	NP	2.69	SW-SM	1.76	7.80	1.63	0.0	30.2	29.5
	DS-4	-8.65	-9.40																			
	UD-2	-9.40	-9.85						Sample Slipped off													
	DS-5	-9.85	-11.35																			
	SPT-3	-11.35	-11.80	15	18	17			7.6	82.2	10.2	NP	NP	NP	2.60	SW-SM	1.84	7.50	1.71	0.0	31.0	30.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB8	RCS-1	-11.80	-12.55	22.0	Soft Rock		5.4	14.7	0.0	0.0	-	1.3	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ_{Design}
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m^2)	(deg)	(deg)
BH-CB8	SPT-4	-12.55	-13.00	22	26	20	Medium Dense Coral Sand		6.5	81.9	11.6	NP	NP	NP	2.63	SW-SM	1.92	7.00	1.79	0.0	31.3	30.5

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB8				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.71	0.00	0.00	27.0	18.8	24.49	13.76	15.49	13.88	5.79	4.71	1.12	1.06	1.06	1.30	1.20	0.80	6.64	19.82	5.29
1.95	2.0	2.0	1.63	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.33	1.17	1.17	1.30	1.20	0.80	14.02	42.51	11.31
3.90	2.0	2.0	1.76	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.67	1.33	1.33	1.30	1.20	0.80	33.95	98.54	26.50
5.10	2.0	2.0	1.66	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.87	1.44	1.44	1.30	1.20	0.80	40.48	116.80	31.46
7.05	2.0	2.0	1.84	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	2.22	1.61	1.61	1.30	1.20	0.80	79.66	225.26	60.98
8.25	2.0	2.0	1.92	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	2.44	1.72	1.72	1.30	1.20	0.80	112.58	327.64	88.04

Note: Safe bearing capacity is restricted to 50.0 t/m2 as a safety factor

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SETTLEMENT ANALYSIS

BH-CB8			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	5	9	5.29	58.0	0.5	0.88	0.8	10.81
2.0	2.0	3.90	Square	11	17	26.50	20.0	0.5	0.63	0.8	13.36
2.0	2.0	7.05	Square	15	17	50.00	20.0	0.5	0.58	0.8	23.20
2.0	2.0	8.25	Square	22	20	50.00	17.0	0.5	0.55	0.8	18.70

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB8				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.71	0.00	0.00	27.0	18.8	24.49	13.76	15.49	13.88	5.79	4.71	1.08	1.04	1.04	1.30	1.20	0.80	8.19	24.94	6.63
1.95	3.0	3.0	1.63	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.22	1.11	1.11	1.30	1.20	0.80	15.42	47.77	12.64
3.90	3.0	3.0	1.76	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.45	1.22	1.22	1.30	1.20	0.80	33.75	99.44	26.64
5.10	3.0	3.0	1.66	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.58	1.29	1.29	1.30	1.20	0.80	39.00	114.06	30.61
7.05	3.0	3.0	1.84	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.81	1.41	1.41	1.30	1.20	0.80	72.98	208.38	56.27
8.25	3.0	3.0	1.92	0.00	0.00	30.5	21.4	31.74	19.89	24.96	16.53	7.63	6.97	1.96	1.48	1.48	1.30	1.20	0.80	100.80	296.02	79.36

Note: Safe bearing capacity is restricted to 65.0 t/m2 as a safety factor

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SETTLEMENT ANALYSIS

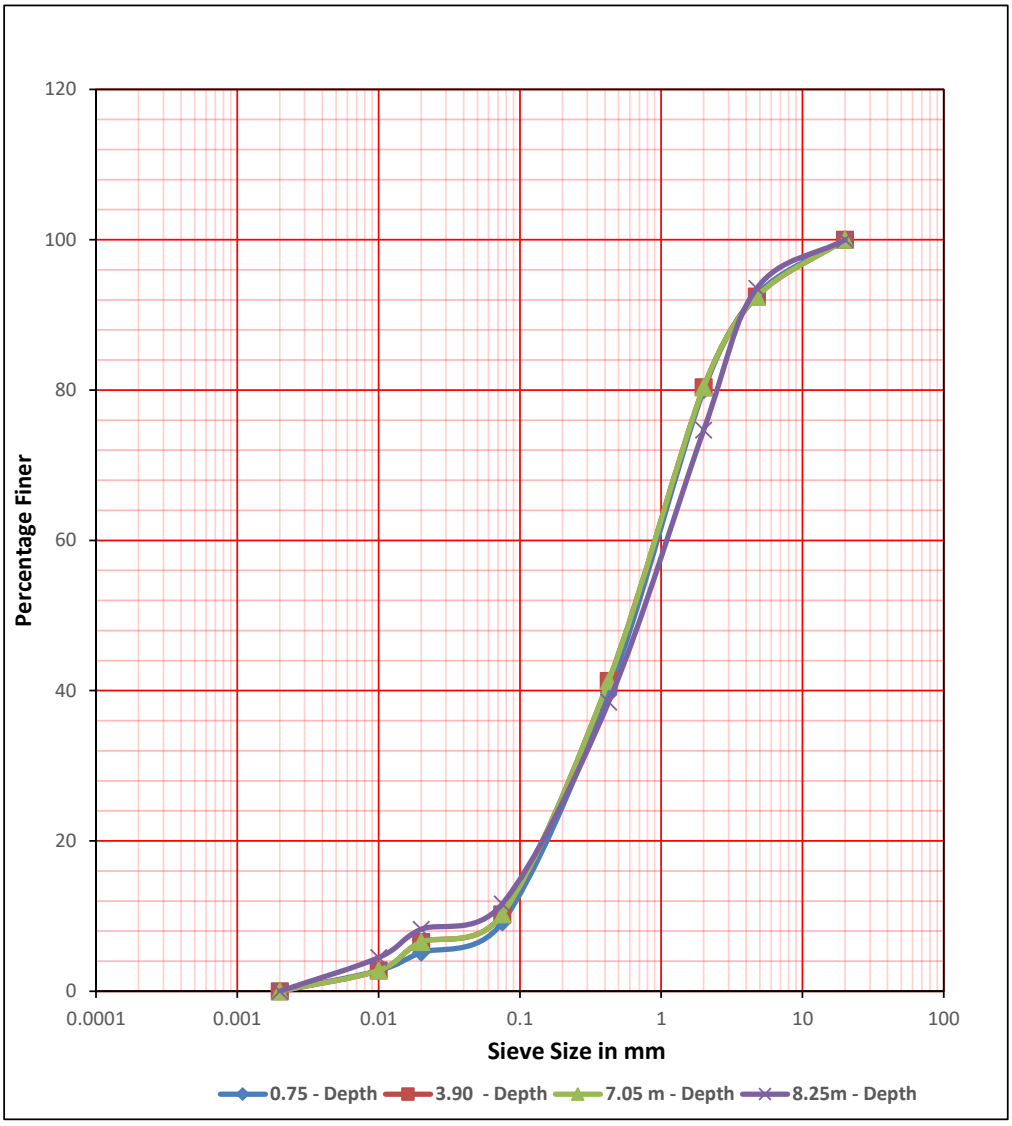
BH-CB8			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	5	9	6.63	58.0	0.5	0.88	0.8	13.53
3.0	3.0	3.90	Square	11	17	26.64	20.0	0.5	0.58	0.8	12.36
3.0	3.0	7.05	Square	15	17	56.27	20.0	0.5	0.55	0.8	24.76
3.0	3.0	8.25	Square	22	20	65.00	17.0	0.5	0.55	0.8	24.31

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB8



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	9.7	32.2	40.9	11.1	6.2	0.0
3.90	9.2	30.6	40.2	12.7	7.3	0.0
7.05	10.2	31.1	39.1	12.1	7.6	0.0
8.25	11.6	26.9	36.2	18.9	6.5	0.0

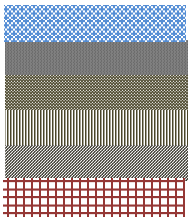
BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	:CB9				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	351084.63	1119328.49
Land/Marine	: Marine	**Drilling Period**	**From**		22-11-2024
Termination Depth (m).	: 8.50		**To**		22-11-2024
Bed Level wrt CD	-3.10	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-3.10								Water				
0.00	0.75	-3.10	-3.85	DS-1	S-1						Loose Coral Sand				
0.75	1.20	-3.85	-4.30	SPT-1	S-2		1	3	4	7					
1.20	1.95	-4.30	-5.05	DS-2	S-3						Medium Dense Coral Sand				
1.95	2.40	-5.05	-5.50	UD-1	S-4										
2.40	3.90	-5.50	-7.00	DS-3	S-5										
3.90	4.35	-7.00	-7.45	SPT-2	S-6		3	5	6	11					
4.35	5.10	-7.45	-8.20	DS-4	S-7										
5.10	5.55	-8.20	-8.65	UD-2	S-8										
5.55	7.05	-8.65	-10.15	RCS-1	S-9						Soft Rock	10.0	-	0.0	
7.05	7.50	-10.15	-10.60	SPT-3	S-10		5	8	9	17	Medium Dense Coral Sand				
7.50	8.25	-10.60	-11.35	RCS-2	S-11						Soft Rock	16.0	-	0.0	
8.25	8.70	-11.35	-11.80	SPT-4	S-12		8	11	13	24	Medium Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB9				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates :**	43P	351084.63	1119328.49
Land/Marine	: Marine	**Drilling Period**	**From**	22-11-2024	
Termination Depth (m).	: 8.5		**TO**	22-11-2024	
CD Level	**-3.10**	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-3.10							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB9			-3.10				Water															
	DS-1	-3.10	3.85				Loose Coral Sand															
	SPT-1	3.85	-4.30	7	13	13			10.1	81.9	8.0	NP	NP	NP	2.58	SW-SM	1.68	8.60	1.55	0.0	29.5	28.0
	DS-2	-4.30	-5.05				Medium Dense Coral Sand															
	UD-1	-5.05	-5.50						Sample Slipped off													
	DS-3	-5.50	-7.00																			
	SPT-2	-7.00	-7.45	11	17	16			8.5	84.1	7.4	NP	NP	NP	2.59	SW-SM	1.74	8.00	1.61	0.0	29.8	29.0
	DS-4	-7.45	-8.20																			
	UD-2	-8.20	-8.65						Sample Slipped off													

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB9	RCS-1	-8.65	-10.15	15	Soft Rock		5.4	10	0.0	-	-	1.4	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB9	SPT-3	-10.15	-10.60	17	20	17	Medium Dense Coral Sand		6.0	86.3	7.7	NP	NP	NP	2.60	SW-SM	1.86	7.60	1.73	0.0	30.0	29.5

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB9	RCS-2	-10.60	-11.35	24	Soft Rock		5.4	16	0.0	0.0	-	1.9	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Gravel	Sand	Clay & Silt	Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ_{Design}
		From	To									Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB9	SPT-4	-11.35	-11.80	24	27	21	Medium Dense Coral Sand		6.6	81.8	11.6	NP	NP	NP	2.56	SW-SM	1.91	7.20	1.78	0.0	31.4	31.0

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB9				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.68	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.12	1.06	1.06	1.30	1.20	0.80	7.04	22.07	5.82
1.95	2.0	2.0	1.72	0.00	0.00	28.5	19.9	27.31	16.08	18.94	14.75	6.35	5.33	1.33	1.16	1.16	1.30	1.20	0.80	14.76	44.74	11.90
3.90	2.0	2.0	1.74	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.66	1.33	1.33	1.30	1.20	0.80	31.23	91.56	24.56
5.10	2.0	2.0	1.81	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.87	1.43	1.43	1.30	1.20	0.80	45.97	133.45	35.88
7.05	2.0	2.0	1.86	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	2.21	1.60	1.60	1.30	1.20	0.80	77.09	219.80	59.38
8.25	2.0	2.0	1.91	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	2.46	1.73	1.73	1.30	1.20	0.80	117.95	353.15	94.22

Note : The Safe bearing capacity is restricted to 50 t/m2 as a safety factor

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SETTLEMENT ANALYSIS

BH-CB9			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	7	13	5.82	30.0	0.5	0.88	0.8	6.15
2.0	2.0	3.90	Square	11	16	24.56	22.0	0.5	0.63	0.8	13.61
2.0	2.0	7.05	Square	17	17	50.00	20.0	0.5	0.58	0.8	23.20
2.0	2.0	8.25	Square	24	21	50.00	16.0	0.5	0.55	0.8	17.60

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB9				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.68	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.08	1.04	1.04	1.30	1.20	0.80	8.70	27.88	7.32
1.95	3.0	3.0	1.72	0.00	0.00	28.5	19.9	27.31	16.08	18.94	14.75	6.35	5.33	1.22	1.11	1.11	1.30	1.20	0.80	16.11	49.87	13.19
3.90	3.0	3.0	1.74	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.44	1.22	1.22	1.30	1.20	0.80	31.06	92.50	24.71
5.10	3.0	3.0	1.81	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.58	1.29	1.29	1.30	1.20	0.80	44.00	129.38	34.68
7.05	3.0	3.0	1.86	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.81	1.40	1.40	1.30	1.20	0.80	70.60	203.29	54.78
8.25	3.0	3.0	1.91	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.97	1.49	1.49	1.30	1.20	0.80	105.57	319.13	84.94

Note : The Safe bearing capacity is restricted to 50 t/m2 as a safety factor

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SETTLEMENT ANALYSIS

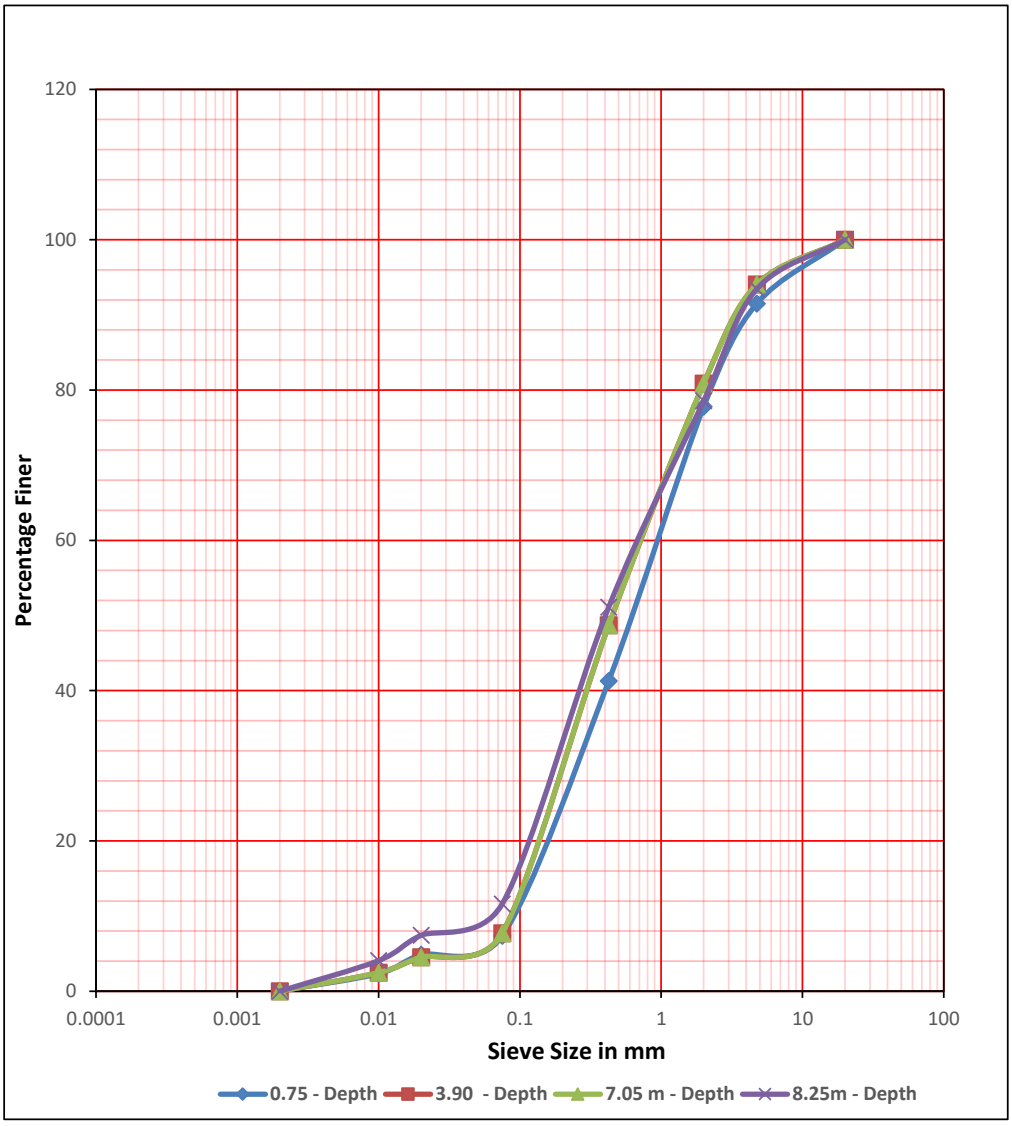
BH-CB9			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	7	13	7.32	30.0	0.5	0.93	0.8	8.16
3.0	3.0	3.90	Square	11	16	24.71	22.0	0.5	0.67	0.8	14.57
3.0	3.0	7.05	Square	17	17	50.00	20.0	0.5	0.60	0.8	24.00
3.0	3.0	8.25	Square	24	21	50.00	16.0	0.5	0.60	0.8	19.20

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB9



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	8.0	31.8	37.1	13.1	10.1	0.0
3.90	7.4	33.9	36.5	13.7	8.5	0.0
7.05	7.7	41.0	32.2	13.2	6.0	0.0
8.25	11.6	39.5	27.5	14.9	6.6	0.0

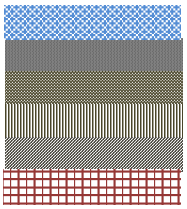
BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB10				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	350873.35	1119759.46
Land/Marine	: Marine	**Drilling Period**	**From**		25-11-2024
Termination Depth (m).	: 8.50		**To**		25-11-2024
Bed Level wrt CD	-3.20	Structure	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-3.20								Water				
0.00	0.75	-3.20	-3.95	DS-1	S-1						Loose Coral Sand				
0.75	1.20	-3.95	-4.40	SPT-1	S-2		1	2	4	6					
1.20	1.95	-4.40	-5.15	DS-2	S-3										
1.95	2.40	-5.15	-5.60	UD-1	S-4										
2.40	3.90	-5.60	-7.10	DS-3	S-5										
3.90	4.35	-7.10	-7.55	SPT-2	S-6		3	4	5	9					
4.35	5.10	-7.55	-8.30	DS-4	S-7										
5.10	5.55	-8.30	-8.75	UD-2	S-8										
5.55	7.05	-8.75	-10.25	RCS-1	S-9						Soft Rock	12.7	-	0.0	
7.05	7.50	-10.25	-10.70	SPT-3	S-10		8	11	14	25	Medium Dense Coral Sand				
7.50	8.25	-10.70	-11.45	RCS-2	S-11						Soft Rock	17.3	-	0.0	
8.25	8.70	-11.45	-11.90	SPT-4	S-12		12	13	16	29	Medium Dense Coral Sand				

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB10				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates :**	43P	350873.35	1119759.46
Land/Marine	: Marine	**Drilling Period**	**From**	25-11-2024	
Termination Depth (m).	: 8.5		**TO**	25-11-2024	
CD Level	**-3.20**	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-3.20							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB10			-3.20				Water															
	DS-1	-3.20	-3.95				Loose Coral Sand															
	SPT-1	-3.95	-4.40	6	11	11			6.5	85.4	8.1	NP	NP	NP	2.58	SW-SM	1.69	8.50	1.56	0.0	27.8	27.0
	DS-2	-4.40	-5.15				Medium Dense Coral Sand															
	UD-1	-5.15	-5.60						Sample Slipped off													
	DS-3	-5.60	-7.10																			
	SPT-2	-7.10	-7.55	9	14	14			6.7	82.7	10.6	NP	NP	NP	2.55	SW-SM	1.72	8.20	1.59	0.0	29.3	28.0
	DS-4	-7.55	-8.30																			
	UD-2	-8.30	-8.75						Sample Slipped off													

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB10	RCS-1	-8.75	-10.25	19	Soft Rock		5.4	12.67	0.0	-	-	1.9	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB10	SPT-3	-10.25	-10.70	25	29	22	Medium Dense Coral Sand		6.2	86.0	7.8	NP	NP	NP	2.63	SW-SM	1.86	7.80	1.73	0.0	31.2	30.0

Borehole No.	Sample Number	Depth of seabed wrt CD		Total Length of CR (cm)	Description	Hatching	Diameter (cm)	Core Recovery %	RQD %	Water Absorption (%)	Density (g/cc)	Point Load Index Strength (Mpa)	Uniaxial Compressive Strength (Mpa)
		From	To										
BH-CB10	RCS-2	-10.70	-11.45	26	Soft Rock		5.4	17.33	0.0	0.0	-	2.6	-

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N	N'	N''	Description	Hatching				Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ_{Design}
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
									(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB10	SPT-4	-11.45	-11.90	29	31	23	Medium Dense Coral Sand		6.9	84.8	8.3	NP	NP	NP	2.60	SW-SM	1.92	7.00	1.79	0.0	31.5	31.0

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB10 | **Type of Foundation = Isolated , Square** | **Water Table Correction factor=0.5**

Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.69	0.00	0.00	27.0	18.8	24.49	13.76	15.49	13.88	5.79	4.71	1.12	1.06	1.06	1.30	1.20	0.80	6.55	19.57	5.22
1.95	2.0	2.0	1.70	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.32	1.16	1.16	1.30	1.20	0.80	13.88	41.29	11.03
3.90	2.0	2.0	1.72	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.65	1.32	1.32	1.30	1.20	0.80	27.73	80.09	21.56
5.10	2.0	2.0	1.82	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.87	1.43	1.43	1.30	1.20	0.80	46.50	134.95	36.29
7.05	2.0	2.0	1.86	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	2.22	1.61	1.61	1.30	1.20	0.80	82.06	231.97	62.81
8.25	2.0	2.0	1.92	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	2.46	1.73	1.73	1.30	1.20	0.80	118.83	355.78	94.92

Note : Safe Bearing capacity is restricted to 80.0 t/m2 as a safety factor

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SETTLEMENT ANALYSIS

BH-CB10			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	6	11	5.22	36.0	0.5	0.88	0.8	6.62
2.0	2.0	3.90	Square	9	14	21.56	26.0	0.5	0.58	0.8	13.01
2.0	2.0	7.05	Square	25	22	62.81	14.0	0.5	0.55	0.8	19.34
2.0	2.0	8.25	Square	29	23	80.00	14.0	0.5	0.55	0.8	24.64

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH-CB10 | **Type of Foundation = Isolated , Square** | **Water Table Correction factor=0.5**

Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.69	0.00	0.00	27.0	18.8	24.49	13.76	15.49	13.88	5.79	4.71	1.08	1.04	1.04	1.30	1.20	0.80	8.09	24.65	6.55
1.95	3.0	3.0	1.70	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.22	1.11	1.11	1.30	1.20	0.80	15.17	46.08	12.25
3.90	3.0	3.0	1.72	0.00	0.00	28.0	19.5	26.37	15.30	17.79	14.46	6.16	5.13	1.43	1.22	1.22	1.30	1.20	0.80	27.61	81.00	21.72
5.10	3.0	3.0	1.82	0.00	0.00	29.0	20.3	28.26	16.85	20.10	15.16	6.64	5.70	1.58	1.29	1.29	1.30	1.20	0.80	44.49	130.79	35.06
7.05	3.0	3.0	1.86	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.81	1.41	1.41	1.30	1.20	0.80	75.13	214.41	57.91
8.25	3.0	3.0	1.92	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.97	1.49	1.49	1.30	1.20	0.80	106.34	321.44	85.56

Note : Safe Bearing capacity is restricted to 70.0 t/m2 as a safety factor

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SETTLEMENT ANALYSIS

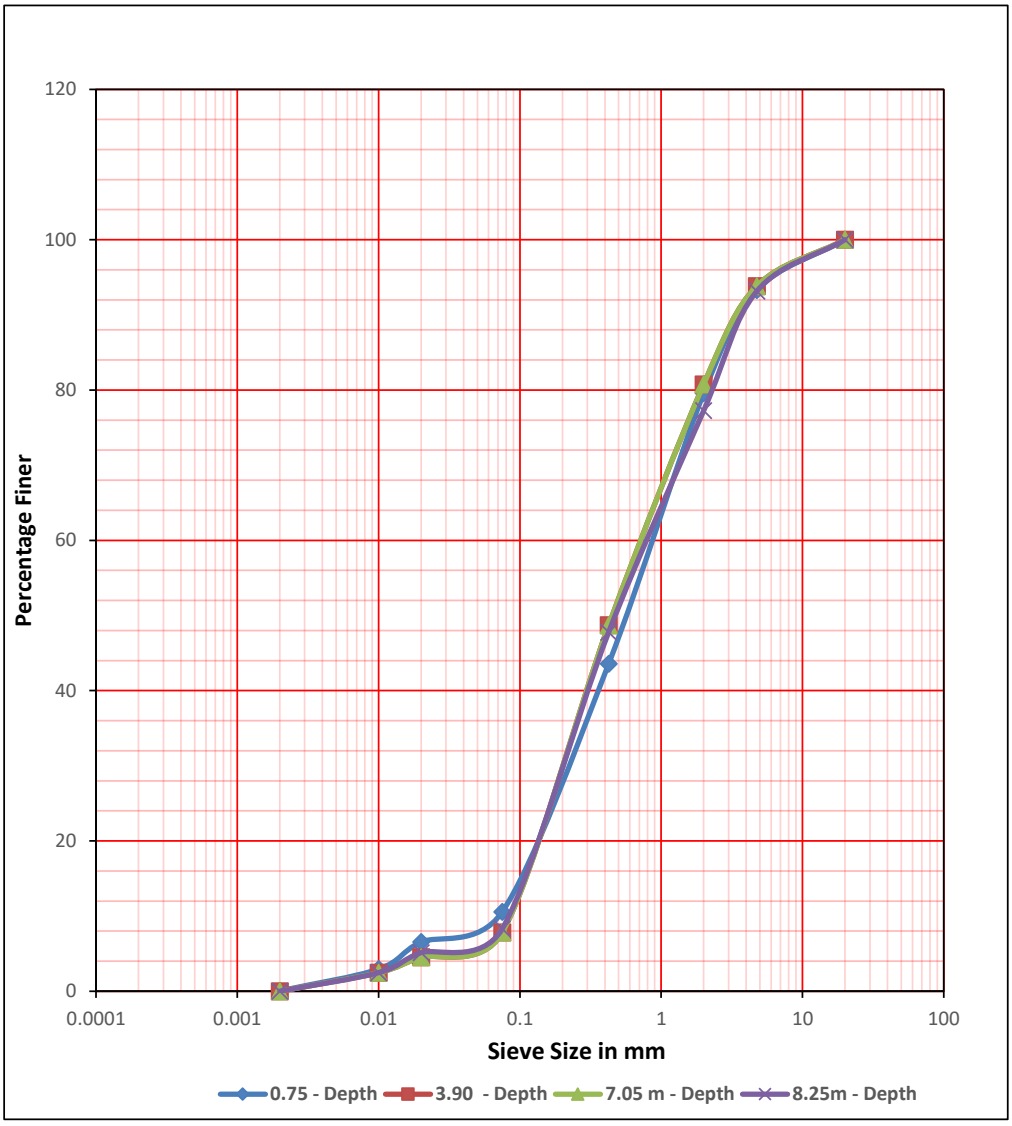
BH-CB10			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	6	11	6.55	36.0	0.5	0.93	0.8	8.77
3.0	3.0	3.90	Square	9	14	21.72	26.0	0.5	0.67	0.8	15.14
3.0	3.0	7.05	Square	25	22	57.91	14.0	0.5	0.60	0.8	19.46
3.0	3.0	8.25	Square	29	23	70.00	14.0	0.5	0.60	0.8	23.52

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH-CB10



DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	8.1	31.1	42.9	11.5	6.5	0.0
3.90	10.6	33.0	36.0	13.7	6.7	0.0
7.05	7.8	40.9	32.1	13.1	6.2	0.0
8.25	8.3	39.5	29.5	15.9	6.9	0.0

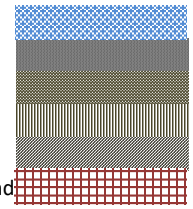
BORE LOG DATA SHEET

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	: CB11				
CLIENT	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Positioned Coordinates**	43P	350601.07	1120159.98
Land/Marine	: Marine	**Drilling Period**	**From**		28-11-2024
Termination Depth (m).	: 8.50		**To**		28-11-2024
Bed Level wrt CD	-4.90	**Structure**	: Approach Channel		

Depth (m) wrt Seabed		**Depth of seabed wrt CD**		**Sample Type**	**Sample No**	**Soil Log**	**Standard Penetration Test (SPT)**				**Strata Description**	**Total Core Recovery (%)**	**Length of core(>10 cm)**	**RQD %**	**Remarks**
From	**To**	**From**	**To**				**15 cm**	**30 cm**	**45 cm**	**N Value**					
			-4.90								Water				
0.00	0.75	-4.90	-5.65	DS-1	S-1						Medium Dense Coral Sand				
0.75	1.20	-5.65	-6.10	SPT-1	S-2		3	5	6	11					
1.20	1.95	-6.10	-6.85	DS-2	S-3										
1.95	2.40	-6.85	-7.30	UD-1	S-4										
2.40	3.90	-7.30	-8.80	DS-3	S-5										
3.90	4.35	-8.80	-9.25	SPT-2	S-6		7	11	8	19					
4.35	5.10	-9.25	-10.00	DS-4	S-7										
5.10	5.55	-10.00	-10.45	UD-2	S-8										
5.55	7.05	-10.45	-11.95	DS-5	S-9										
7.05	7.50	-11.95	-12.40	SPT-3	S-10		11	7	21	28					
7.50	8.25	-12.40	-13.15	DS-6	S-11						Dense Coral Sand				
8.25	8.70	-13.15	-13.60	SPT-4	S-12		14	12	26	38					

SPT	Standard penetration test	**CD**	Chart Datum
CPT	Cone penetration test	**UDS**	Undistrubed Sample
RQD	Rock Quality Designation	**RCS**	Rock Core Sample
CR	Core Recovery	**DS**	Distubed Sample

Water
Sand
Clay
Soft Rock
Hard Rock
Very Dense Coral Sand



LABORATORY TEST RESULTS

PROJECT NAME	: Geotechnical Investigation for proposed passenger Jetties and Associated Landside facilities at Androth Kadmath, Kalpeni Islands in Lakshadweep				
BH Number	CB11				
Client	: Cochin Port Authority		**Zone**	**Easting**	**Northing**
Location	: Kalpeni Western Side	**Proposed Coordinates :**	43P	350601.07	1120159.98
Land/Marine	: Marine	**Drilling Period**	**From**	28-11-2024	
Termination Depth (m).	: 8.5		**TO**	28-11-2024	
CD Level	**-4.90**	**Structure**	: Approach Channel		

Borehole No.	Sample Number	Depth of seabed wrt CD		SPT N value	N'	N''	Description	Hatching	Grain Size Analysis (IS 2720 Part 4)			Atterberg limits (IS 2720 Part 5)			Specific Gravity	IS Classification	Bulk Density	Moisture Content	Dry Density	Shear Strength Test		Φ Design
		From	To						Gravel	Sand	Clay & Silt	Liquid Limit	Plastic Limit	Plasticity Index						C	Φ	
		-4.90							(%)	(%)	(%)	(%)	(%)	(%)	G		(gm/cc)	(%)	(gm/cc)	(t/m²)	(deg)	(deg)
BH-CB11			-4.90				Water															
	DS-1	-4.90	-5.65				Medium Desne Coral Sand															
	SPT-1	-5.65	-6.10	11	20	18			5.9	84.6	9.5	NP	NP	NP	2.53	SW-SM	1.76	8.90	1.62	0.0	30.0	29.5
	DS-2	-6.10	-6.85																			
	UD-1	-6.85	-7.30						Sample Slipped off													
	DS-3	-7.30	-8.80																			
	SPT-2	-8.80	-9.25	19	26	20			7.2	84.4	8.4	NP	NP	NP	2.55	SW-SM	1.91	8.50	1.76	0.0	30.2	31.0
	DS-4	-9.25	-10.00																			
	UD-2	-10.00	-10.45						Sample Slipped off													
	DS-5	-10.45	-11.95																			
	SPT-3	-11.95	-12.40	28	31	23			5.7	83.4	10.9	NP	NP	NP	2.58	SW-SM	1.95	8.00	1.81	0.0	32.9	31.0
	DS-6	-12.40	-13.15				Dense Coral Sand															
	SPT-4	-13.15	-13.60	38	41	28			7.4	81.1	11.5	NP	NP	NP	2.63	SW-SM	1.99	7.60	1.85	0.0	32.4	32.0

For Manglam Consultancy Services Hyderabad

Tested by

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SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH - CB11				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	2.0	2.0	1.76	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.13	1.06	1.06	1.30	1.20	0.80	8.96	28.13	7.42
1.95	2.0	2.0	1.85	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.34	1.17	1.17	1.30	1.20	0.80	20.30	59.83	16.03
3.90	2.0	2.0	1.91	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.69	1.34	1.34	1.30	1.20	0.80	47.43	144.93	38.47
5.10	2.0	2.0	1.93	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.90	1.45	1.45	1.30	1.20	0.80	65.75	199.10	52.97
7.05	2.0	2.0	1.95	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	2.25	1.62	1.62	1.30	1.20	0.80	100.62	302.12	80.55
8.25	2.0	2.0	1.99	0.00	0.00	32.0	22.6	36.53	24.36	32.65	17.91	8.63	8.26	2.49	1.74	1.74	1.30	1.20	0.80	141.96	444.92	117.38

Note: Safe Bearing capacity is resticted to 75.0 t/m2 as a safety factor

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SETTLEMENT ANALYSIS

BH - CB11			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
2.0	2.0	0.75	Square	11	18	7.42	19.0	0.5	0.88	0.8	4.96
2.0	2.0	3.90	Square	19	20	38.47	17.0	0.5	0.63	0.8	16.48
2.0	2.0	7.05	Square	28	23	75.00	14.0	0.5	0.58	0.8	24.36
2.0	2.0	8.25	Square	38	28	75.00	11.0	0.5	0.55	0.8	18.15

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

SAFE BEARING CAPACITY ANLAYSIS BASED ON SHEAR CRITERIA (IS:6403-1981)

BH - CB11				Type of Foundation = Isolated , Square													Water Table Correction factor=0.5					
Depth of Foundation, m	Length of Footing, m	Width of Footing, m	Bulk Density of Soil, gm/cc	Cohesion c, t/m^2		Angle of Shearing Resistance ϕ, degree		Bearing Capacity Factors						Depth Factors			Shape Factors			Bearing Capacity (Local Shear Failure)	Bearing Capacity (General Shear Failure)	Net safe Bearing Capacity S.B.C (Net)=BC/FOS
								General Shear Failure			Local Shear Failure											
D	L	B	Y	c	c'	ϕ	ϕ'	N_c	N_q	N_Y	N_c'	N_q'	N_Y'	d_c	d_q	d_Y	s_c	s_q	s_Y	BC_1	BC_2	t/m^2
0.75	3.0	3.0	1.76	0.00	0.00	29.5	20.7	29.20	17.63	21.25	15.61	6.97	6.12	1.09	1.04	1.04	1.30	1.20	0.80	11.04	35.38	9.28
1.95	3.0	3.0	1.85	0.00	0.00	30.0	21.1	30.14	18.40	22.40	16.07	7.30	6.54	1.23	1.11	1.11	1.30	1.20	0.80	22.02	66.17	17.64
3.90	3.0	3.0	1.91	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.46	1.23	1.23	1.30	1.20	0.80	46.86	145.48	38.47
5.10	3.0	3.0	1.93	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.60	1.30	1.30	1.30	1.20	0.80	62.65	192.30	50.99
7.05	3.0	3.0	1.95	0.00	0.00	31.0	21.8	33.34	21.38	27.53	16.99	7.96	7.40	1.83	1.42	1.42	1.30	1.20	0.80	91.84	278.69	74.11
8.25	3.0	3.0	1.99	0.00	0.00	32.0	22.6	36.53	24.36	32.65	17.91	8.63	8.26	1.99	1.50	1.50	1.30	1.20	0.80	126.69	401.09	105.56

Note: Safe Bearing capacity is resticted to 100.0 t/m2 as a safety factor

For Manglam Consultancy Services Hyderabad

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SETTLEMENT ANALYSIS

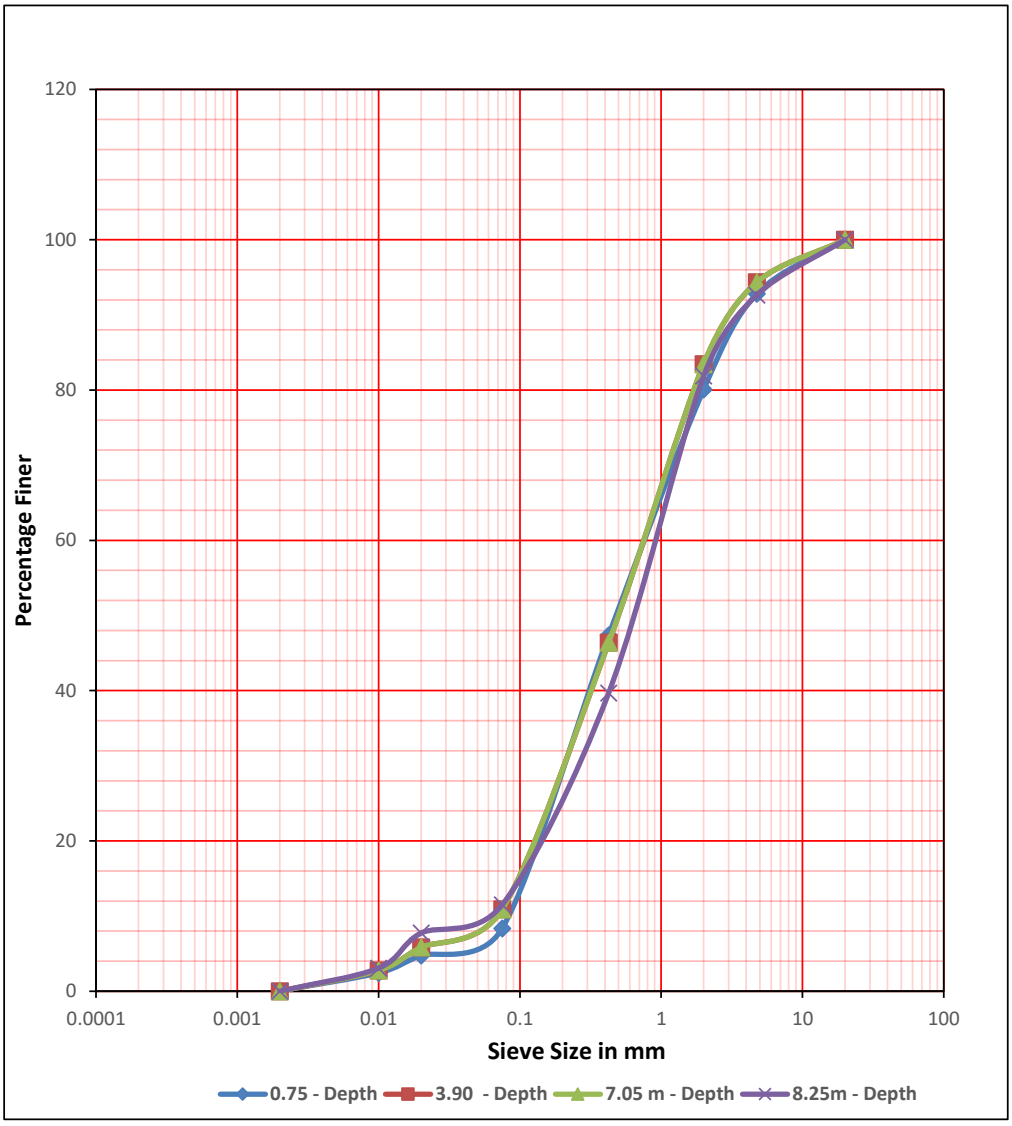
BH - CB11			Water Table Correction Factor = 0.5					Tolerable Total Settlement			
								Sands=25 mm		Clays=40 mm	
width of Foundation, m	Length of Foundation, m	Depth of Foundation, m	Shape	SPT N Value	Corrected N value	Net Allowable Bearing Pressure, t/m^2	Settlement @ $1kg/cm^2$ (as read off from Graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	Computed Settlement, mm
3.0	3.0	0.75	Square	11	18	9.28	19.0	0.5	0.88	0.8	6.21
3.0	3.0	3.90	Square	19	20	38.47	17.0	0.5	0.58	0.8	15.17
3.0	3.0	7.05	Square	28	23	74.11	14.0	0.5	0.55	0.8	22.83
3.0	3.0	8.25	Square	38	28	100.00	11.0	0.5	0.55	0.8	24.20

Note:

1. The settlement is calculated assuming that the full net safe bearing capacity is applied at the foundation level.
2. The corrected 'N'-value is restricted to 60 for settlement calculation as a safety factor.

GRAIN SIZE ANALYSIS

BH - CB11

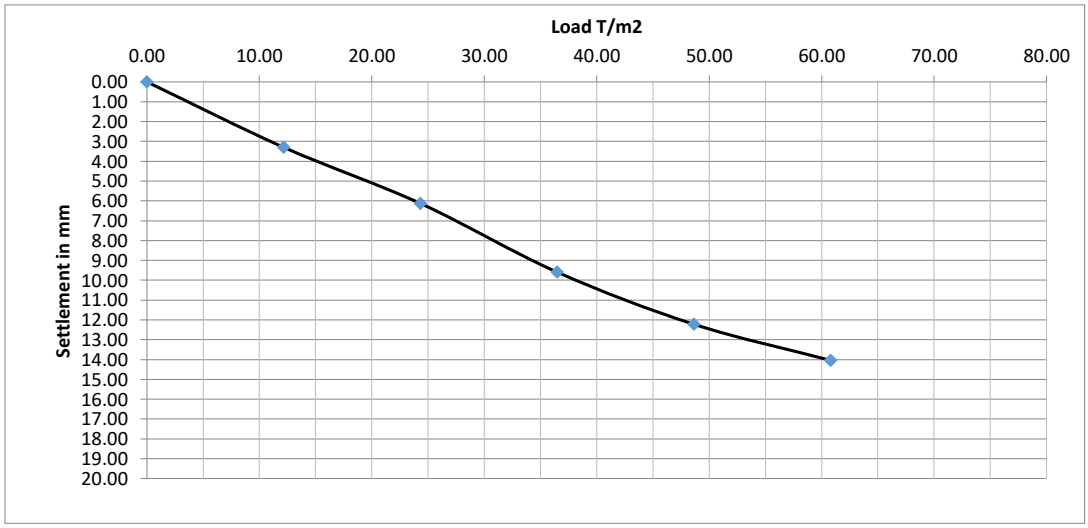


DEPTH	CLAY & SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
0.75	9.5	40.9	36.7	7.1	5.9	0.0
3.90	8.4	39.0	32.7	12.7	7.2	0.0
7.05	10.9	35.5	37.1	10.9	5.7	0.0
8.25	11.5	28.2	42.2	10.8	7.4	0.0

Plate Load Test Record

Name of Project	Kalpeni East				
Test Location	Point No.1			Hydraulic Jack details	Bearing palte Detailes
Depth of Test	1.2mtr			Capacity : 100 T	Size 450mm X450mm
Depth of GWT	Not encounterd			Ram Area : 153.94 cm2	Area 0.2025M^2
Reaction Load	Test Vehicle				Thickness 25mm
Moisture Content			Dial Gauge Reference of Range 25mm & L.C. 0.01mm		

Date of Testing	Pressure Gauge Reading (kg/cm^2)	Load in Ton	Load on Plate (T/m^2)	Dial Gauge Reading (mm)		Average Settlement (mm)
				DG1	DG2	
25.10.2024	0	0	0.00	0.00	0.00	0.00
	16	2.46	12.16	3.20	3.40	3.30
	32	4.93	24.33	5.97	6.29	6.13
	48	7.39	36.49	9.34	9.85	9.60
	64	9.85	48.65	11.93	12.52	12.23
	80	12.3152	60.82	13.78	14.31	14.05



$$S_f = S_p \times \{(B \times (B_p+0.3) / (B_p \times (B+0.3)\}^2$$

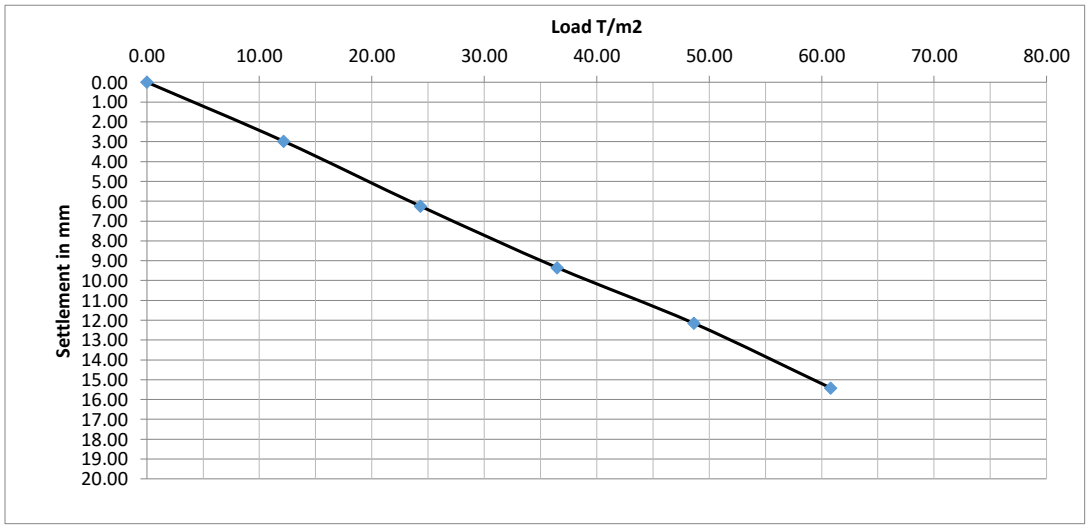
where

B = Width of footing in m	=	2 m	
B_p = Width of plate in m	=	0.45 m	
S_p = settlement of the test plate in m @ Ultimate Load	=	0.01405 m	14.05 mm
S_f = settlement of footing in m @ Ultimate Load	=	0.02951 m	29.09 mm

Plate Load Test Record

Name of Project	Kalpeni West				
Test Location	Point No.1			Hydraulic Jack details	Bearing palte Detailes
Depth of Test	1.2mtr			Capacity : 100 T	Size 450mm X450mm
Depth of GWT	Not encounterd			Ram Area : 153.94 cm2	Area 0.2025M^2
Reaction Load	Test Vehicle				Thickness 25mm
Moisture Content			Dial Gauge Reference of Range 25mm & L.C. 0.01mm		

Date of Testing	Pressure Gauge Reading (kg/cm^2)	Load in Ton	Load on Plate (T/m^2)	Dial Gauge Reading (mm)		Average Settlement (mm)
				DG1	DG2	
23.10.2024	0	0	0.00	0.00	0.00	0.00
	16	2.46	12.16	2.48	3.47	2.98
	32	4.93	24.33	6.14	6.36	6.25
	48	7.39	36.49	9.39	9.31	9.35
	64	9.85	48.65	11.95	12.37	12.16
	80	12.3152	60.82	15.38	15.46	15.42



$$S_f = S_p \times \{(B \times (B_p+0.3) / (B_p \times (B+0.3)\}^2$$

where

B = Width of footing in m	=	2 m	
B_p = Width of plate in m	=	0.45 m	
S_p = settlement of the test plate in m @ Ultimate Load	=	0.01546 m	15.46 mm
S_f = settlement of footing in m @ Ultimate Load	=	0.03247 m	32.47 mm

FIELD PICTURES

KALPENI WESTERN BH-LB

KALPENI EASTERN BH- LB

FIELD PICTURES

KALPENI WESTERN APPROACH TRESTLE BH-JB

KALPENI WESTERN JETTY HEAD BH-JB

KALPENI WESTERN APPROACH CHANNEL BH-CB

KALPENI WESTERN APPROACH CHANNEL BH-CB1

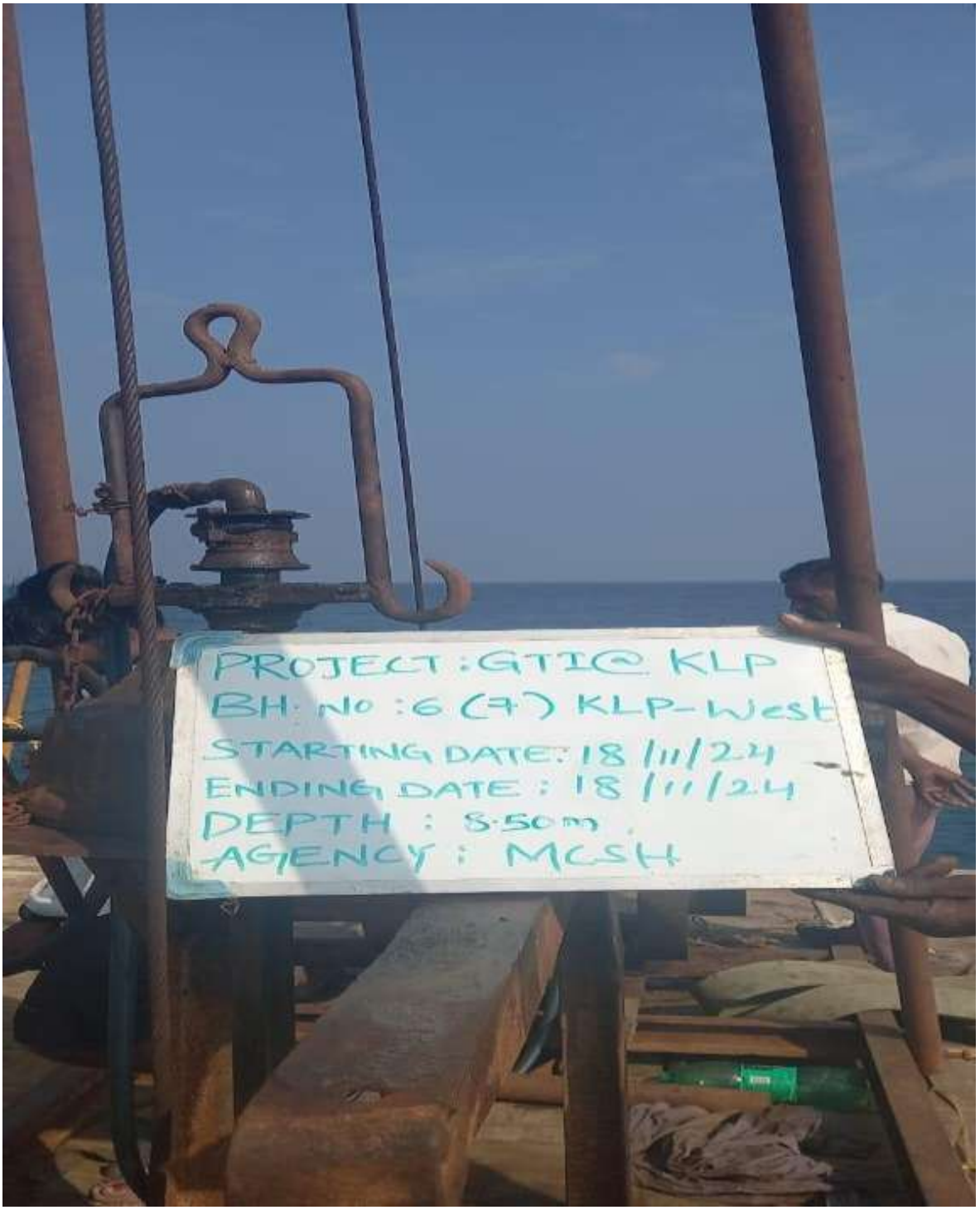
KALPENI WESTERN APPROACH CHANNEL BH-CB2

KALPENI WESTERN APPROACH CHANNEL BH-CB3

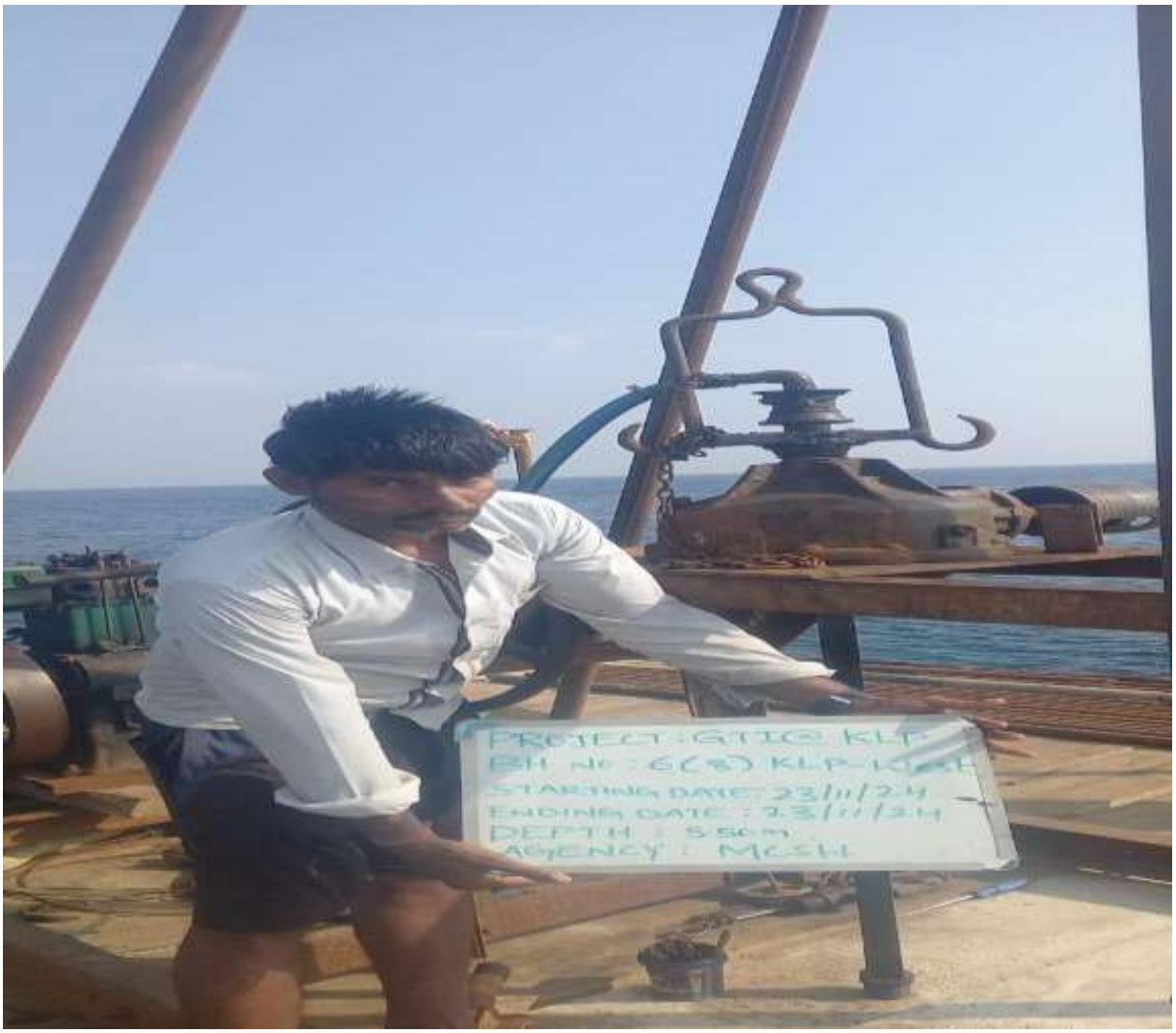
KALPENI WESTERN APPROACH CHANNEL BH-CB4

KALPENI WESTERN APPROACH CHANNEL BH-CB5

KALPENI WESTERN APPROACH CHANNEL BH-CB6



KALPENI WESTERN APPROACH CHANNEL BH-CB7



KALPENI WESTERN APPROACH CHANNEL BH-CB8

KALPENI WESTERN APPROACH CHANNEL BH-CB9

KALPENI WESTERN APPROACH CHANNEL BH-CB10

KALPENI WESTERN APPROACH CHANNL BH-CB11

KALPENI EASTERINE JETTY HEAD BH-JB1

KALPENI EASTERINE JETTY HEAD BH-JB2

Manglam Consultancy Services Hyderabad

PROJECT NAME: Geotechnical Investigations for proposed Jetty Sand Associated landslide facilities at Minicoy, Kadmath & Kalpeni Islands in Lakshadweep.

STRUCTURE NAME /NO : Eastern Jetty Kalpeni
BORE HOLE NO : BH-03 KLP East (Land)
CHAINAGE NO : 10°05'01"N 73°38'53"E
STARTING DATE : 11/11/24
ENDING DATE : 13/11/24
TOTAL DEPTH BORE (m) : 25m
WATER TABLE (m) :

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min. Mts
0.0	0.75		Coral Sand			DS-1												
0.75	1.20		Coral Sand			SPT-1	1	3	5	8								
1.20	1.95		Coral Sand			DS-2												
1.95	2.40		clayey Sand			UD-1												
2.40	3.90		Coral Sand			DS-3												
3.90	4.35		Coral Sand			SPT-2	9	12	18	30								
4.35	5.10		Coral Sand			DS-4												
5.10	5.55		Coral Sand			UD-2	[Slipped off]											
5.55	7.05		Coral Sand			DS-5												
7.05	7.50		SDR			SPT-3	8	13	19	32								
7.50	9.0		SDR			DS-6												
9.0	10.5		Soft Rock			RCS-1					30			20				
10.5	10.95		SDR			SPT-4	13	18	22	40								
10.95	12.45		Soft Rock			RCS-2					37			24.67				
12.45	13.95		Soft Rock			RCS-3					40	14	1	26.67	9.33			
13.95	14.0		Soft Rock			SPT-5	5cm	7	50	N								
14.0	15.50		Soft Rock			RCS-4					40	16	1	26.67	10.67			
15.20	17.0		Soft Rock			RCS-5					42	16	1	28	10.67			
17.0	17.04		Soft Rock			SPT-6	4cm	7	>50	N								
17.04	18.54		Soft Rock			RCS-6					28			18.67				

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Manglam Consultancy Services Hyderabad

PROJECT NAME	Geotechincal Investigations for proposed passenger Jetties & Associated landside facilities at Androth, Kadmath & Kalpeni Islands in Lakshdweep
STRUCTURE NAME /NO	: Eastern Jetty Kalpeni
BORE HOLE NO	: BH-03 East [Land]
CHAINAGE NO	: 10°05'01"N 73°38'53"E
STARTING DATE	: 11/11/24
ENDING DATE	: 13/11/24
TOTAL DEPTH BORE (m)	: 25 m
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type(DS/UDS/SPT)	SPT Blows 15	30	45	N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
18.54	20.04		Soft Rock			RCS-7					32	14	1	21.33	9.33			
20.04	20.07		Soft Rock			SPT-7	3cm		>50	N								
20.07	21.57		Soft Rock			RCS-8					34			22.67				
21.57	23.07		Soft Rock			RCS-9					21			14				
23.07	24.57		Soft Rock			RCS10					23			15.33				
24.57	25.32		Soft Rock			RCS-11					28			18.67				
25.32	25.34		Soft Rock			SPT-8	2cm		>50	N								

SITE ENGINEER

APPROVED SIGNATURE OF CLIENT

Manglam Consultancy Services Hyderabad

PROJECT NAME	Geotechnical Investigation for Proposed Passenger Jetties & associated Landside facilities at Androth, Kadmath and Kalpeni islands in Lakshadweep.
STRUCTURE NAME /NO	: Eastern Jetty, Kalpeni
BORE HOLE NO	: BH-04 (Marine)
CHAINAGE NO	: 10°4'56"N, 73°38'58"E
STARTING DATE	: 26/11/2024
ENDING DATE	: 01/12/2024
TOTAL DEPTH BORE (m)	: 30.00m
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0.0	0.75	0.75	Coral sand			DS-1												
0.75	1.20	0.45	Coral sand			SPT-1	7	9	6	15								
1.20	1.95	0.75	Coral sand			DS-2												
1.95	2.40	0.45	Coral sand			UD-1	(slipped off)											
2.40	3.90	1.50	Coral sand			DS-3												
3.90	4.35	0.45	Coral sand			SPT-2	11	7	8	15								
4.35	5.10	0.75	Coral sand			DS-4												
5.10	5.55	0.45	Coral sand			UD-2	(slipped off)											
5.55	7.05	1.50	Coral sand			DS-5												
7.05	7.50	0.45	Coral sand			SPT-3	14	12	18	30								
7.50	9.0	1.50	Coral sand			DS-6												
9.0	10.5	1.50	Coral sand			DS-7												
10.5	10.95	0.45	Coral sand			SPT-4	13	16	21	37								
10.95	12.45	1.50	Coral sand			DS-8												
12.45	13.95	1.50	Coral sand			DS-9												
13.95	14.40	0.45	SDR			SPT-5	18	21	18	39								
14.40	15.90	1.50	Soft Rock			RCS-1					21			14				
15.90	17.40	1.50	Soft Rock			RCS-2					27			18				
17.40	18.90	1.50	Soft Rock			RCS-3					24			16				
18.90	19.0	0.10	SDR			SPT-6	10cm	>50N										

SITE ENGINEER

APPROVED SIGNATURE OF CLIENT

Manglam Consultancy Services Hyderabad

PROJECT NAME	Geotechnical Investigation for Proposed Passenger Jetties & associated Landside facilities at Androth, Kadmath and Kalpeni islands in Lakshadweep.

STRUCTURE NAME /NO	: Eastern Jetty, Kalpeni
BORE HOLE NO	: BH-04 (Marine)
CHAINAGE NO	: 10°4'56"N, 73°38'58"E
STARTING DATE	: 26/11/2024
ENDING DATE	: 01/12/2024
TOTAL DEPTH BORE (m)	: 30.0M
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type(DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT Blows N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
19.0	20.50	1.50	Coarse sand			DS-10												
20.5	22.0	1.50	Coarse sand			DS-11												
22.0	23.50	1.50	Coarse sand			DS-12												
23.50	23.65	0.15	Coarse sand			SPT-7	15CM	> 50N										
23.65	25.15	1.50	Coarse sand			DS-13												
25.15	26.65	1.50	Coarse sand			DS-14												
26.65	28.15	1.50	Coarse sand			DS-15												
28.65	29.65	1.50	Coarse sand			DS-16												
29.65	30.02	0.32	Coarse sand			SPT-8	32CM	> 75N										

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PROJECT NAME	Geotechnical Investigation for Praposed passenger Jetties and associated landside facilities at Androth, Kadmath and Kalpeni islands in Lakshadweep.
STRUCTURE NAME /NO	: Eastern Jetty, Kalpeni
BORE HOLE NO	: BH-4(1) Marine.
CHAINAGE NO	: 10°5'5"N, 73°39'00"E
STARTING DATE	: 07/12/2024
ENDING DATE	: 12/12/2024
TOTAL DEPTH BORE (m)	: 30.0m
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT Blows N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0.0	0.75	0.75	Coral sand			DS-1												
0.75	1.20	0.45	Coral sand			SPT-1	6	7	5	12								
1.20	1.95	0.75	Soft Rock			RCS-1					13			8.66				
1.95	2.40	0.45	Coral sand			UD-1	[slipped off]											
2.40	3.90	1.50	Coral sand			DS-2												
3.90	4.35	0.45	Coral sand			SPT-2	11	8	9	17								
4.35	5.10	0.75	Coral sand			DS-3												
5.10	5.55	0.45	Coral sand			UD-2	[slipped off]											
5.55	7.05	1.50	Coral sand			DS-4												
7.05	7.50	0.45	Coral sand			SPT-3	13	19	21	40								
7.50	9.0	1.50	Coral sand			DS-5												
9.0	10.5	1.50	Coral sand			DS-6												
10.5	10.95	0.45	Coral sand			SPT-4	17	11	21	32								
10.95	12.45	1.50	Soft Rock			RCS-2					30			20				
12.45	13.95	1.50	Coral sand			DS-7												
13.95	14.40	0.45	Coral sand			SPT-5	15	26	12	38								
14.40	15.90	1.50	Soft Rock.			RCS-3					18			12				
15.90	17.40	1.50	Soft Rock			RCS-4												
17.40	18.90	1.50	Soft Rock			RCS-5					22			14.67				
18.90	19.35	0.45	SDR			SPT-6	26	17	28	45								

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PROJECT NAME	Geotechnical Investigation for Proposed Passenger Jetties and Associated Landside Facilities at Androth, Kadmath and Kalpeni islands in Lakshadweep
STRUCTURE NAME /NO	: Eastern Jetty, Kalpeni
BORE HOLE NO	: BH-4(1) Marine
CHAINAGE NO	: 10°5'5"N, 73°39'00"E
STARTING DATE	: 07/12/2024
ENDING DATE	: 12/12/2024
TOTAL DEPTH BORE (m)	: 30.0M
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type(DS/UDS/SPT)	SPT Blows 15	30	45	N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
19.35	20.85	1.50	Coarse sand			DS-8												
20.85	22.35	1.50	Coarse sand			DS-9												
22.35	23.85	1.50	Coarse sand			DS-10												
23.85	24.0	0.15	Coarse sand			SPT-7	15CM	>50N										
24.0	25.5	1.50	Coarse sand			DS-11												
25.5	27.0	1.50	Coarse sand			DS-12												
27.0	28.5	1.50	Coarse sand			DS-13												
28.5	28.68	0.18	Coarse sand			SPT-8	18CM	>50N										
28.68	30.18	1.50	Coarse sand			DS-14												
30.18	30.30	0.12	Coarse sand			SPT-9	12CM	>50N										

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STRUCTURE NAME /NO	: Eastern Jetty, Kalpeni
BORE HOLE NO	: BH-05 (Marine)
CHAINAGE NO	:
STARTING DATE	: 17/12/2024
ENDING DATE	: 20/12/2024
TOTAL DEPTH BORE (m)	: 20.00m
WATER TABLE (m)	:

PROJECT NAME: Geotechnical Investigation for Proposed Passenger Jetties and associated Landside facilities at Androth, Kadmath and Kalpeni islands in Lakshadweep.

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	30	45	N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0.0	0.75		Coral sand			DS-1												
0.75	1.20		Coral sand			SPT-1	4	7	6	13								
1.20	1.95		Soft Rock			DS-2					25			16.67				
1.95	2.40		Coral sand			UD-1	[slipped off]											
2.40	3.90		Soft Rock			RCS-2					24			16.0				
3.90	4.35		Coral sand			SPT-2	11	5	16	21								
4.35	5.10		Coral sand			DS-3												
5.10	5.55		Coral sand			UD-2	[slipped off]											
5.55	7.05		Soft Rock			RCS-3					30			20.0				
7.05	7.50		SDR			SPT-3	8	14	22	36								
7.50	9.0		Soft Rock			RCS-4					22			14.67				
9.0	10.50		SDR			DS-4												
10.50	10.95		SDR			SPT-4	11	28	21	49								
10.95	12.45		Soft Rock			RCS-5					24			16.0				
12.45	13.95		Soft Rock			RCS-6					23			15.33				
13.95	14.40		SDR			SPT-5	5cm/>50N											
14.40	15.90		Coral sand			DS-5												
15.90	17.40		Coral sand			DS-6												
17.40	17.58		Coral sand			SPT-6	18cm/>50N											
17.58	19.08		Coral sand			DS-7												

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STRUCTURE NAME /NO	: Eastern Jetty, Kalpeni
BORE HOLE NO	: BH-05 (Marine)
CHAINAGE NO	:
STARTING DATE	: 17/12/2024
ENDING DATE	: 20/12/2024
TOTAL DEPTH BORE (m)	: 20.0M
WATER TABLE (m)	:

PROJECT NAME: Geotechnical Investigation for Proposed passenger Jetties and associated landside facilities at Androth, Kadmath and Kalpeni islands in Lakshadweep.

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type(DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
19.08	19.83		Coral sand			DS-6												
19.83	20.07		Coral sand			SPT-7	24 CM		75	ON								

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PROJECT NAME	Geotechnical Investigation for Proposed passenger Jetties and associated Landside facilities at Androth, Kadmath and Kalpeni Islands in Lakshadweep.
STRUCTURE NAME /NO	: Western Jetty, Kalpeni
BORE HOLE NO	: BH-03 (KLP-W) Land B+I
CHAINAGE NO	: 10°5'13"N, 73° 38'52"E
STARTING DATE	: 07/11/2024
ENDING DATE	: 09/11/2024
TOTAL DEPTH BORE (m)	: 25.000
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type(DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT Blows N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0.0	0.75		Coral sand			DS-1												
0.75	1.20		coral sand			SPT-1	5	8	7	15								
1.20	1.95		Coral sand			DS-2												
1.95	2.40		Coral sand			UD-1	[Slipped off]											
2.40	3.90		SDR			DS-3												
3.90	4.35		SDR			SPT-2	8	9	12	21								
4.35	5.10		SDR			DS-4												
5.10	5.55		Silty Sand			UD-2												
5.55	7.05		SDR			DS-5												
7.05	7.50		SDR & clay			SPT-3	11	9	13	22								
7.50	9.0		SDR			DS-6												
9.0	10.50		Soft Rock			RCS-1					20			13.33				
10.50	10.95		SDR			SPT-4	7	8	16	24								
10.95	12.45		Soft Rock			RCS-2					29			19.33				
12.45	13.95		Soft Rock			RCS-3					25			16.67				
13.95	14.40		SDR			SPT-5	11	13	18	31								
14.40	15.90		Soft Rock			RCS-4					31			20.67				
15.90	17.40		Soft Rock			RCS-5					46			30.67				
17.40	17.51		SDR & Rock			SPT-6	11cm/>50			N								
17.51	19.01		Soft Rock			RCS-6					32			21.33				

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PROJECT NAME	Geotechnical Investigation for proposed passenger Jetties and associated Landside facilities at Androth, Kadmath and Kalpeni Islands in Lakshadweep
STRUCTURE NAME /NO	: Western Jetty, Kalpeni
BORE HOLE NO	: BH-03 (KLP-W) Land BH
CHAINAGE NO	: 10°5'13"N, 73°38'52"E
STARTING DATE	: 07/11/2024
ENDING DATE	: 09/11/2024
TOTAL DEPTH BORE (m)	: 25.0m
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
19.01	20.51		Soft Rock			RCS-7					58	10+14	2	38.67	160			
20.51	20.59		SDRt Rock			SPT-7	8cm	| >	50	N								
20.59	22.09		Soft Rock			RCS-8					46			30.67				
22.09	23.59		Soft Rock			RCS-9					42			28.00				
23.59	25.09		Soft Rock			RCS-10					39	16+15	2	26.00	20.67			
25.09	25.14		Soft Rock			SPT-8	5cm	| >	50	N								

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STRUCTURE NAME /NO	: Western Jetty Kalpeni
BORE HOLE NO	: BH-5
CHAINAGE NO	: 10°05'17"N 73°38'45"E
STARTING DATE	: 14/11/2024
ENDING DATE	: 15/11/2024
TOTAL DEPTH BORE (m)	: 20.0M
WATER TABLE (m)	:

PROJECT NAME: Geotechnical Investigation for Proposed Passenger Jetties and associated Landside facilities at Androth, Kadmath & Kalpeni islands in Lakshadweep.

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type(DS/UDS/SPT)	SPT Blows 15	30	45	N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0.0	0.75		Coral sand			DS-1												
0.75	1.20		coral sand			SPT-1	8	11	13	24								
1.20	1.95		coral sand			DS-2												
1.95	2.40		coral sand			UD-1	[slipped off]											
2.40	3.90		coral sand			DS-3												
3.90	4.35		coral sand			SPT-2	7	14	18	32								
4.35	5.10		Coral sand			DS-4												
5.10	5.55		Coral sand			UD-2												
5.55	7.05		Coral sand			DS-5												
7.05	7.50		SDR			SPT-3	11	17	24	41								
7.50	9.0		Soft Rock			RCS-1					21			14				
9.0	10.50		Soft Rock			RCS-2					30			20				
10.50	10.95		SDR			SPT-4	13	27	21	48								
10.95	12.45		Soft Rock			RCS-3					38			25.33				
12.45	13.95		Soft Rock			RCS-4					41			27.33				
13.95	14.02		Soft Rock			SPT-5	7cm/>50N											
14.02	15.52		Soft Rock			RCS-5					43	27		28.67	18			
15.52	17.02		Soft Rock			RCS-6					49	24		32.67	16			
17.02	17.10		Soft Rock			SPT-6	8cm/>50N											
17.40	18.60		Soft Rock			RCS-7						11			7.33			

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PROJECT NAME: Geotechnical Investigation for proposed Jetties and associated landslide facilities at androth Kadmath & Kalpeni Islands in Lakshadweep

STRUCTURE NAME /NO : Western Jetty Kalpeni
BORE HOLE NO : BH-5
CHAINAGE NO : 10°05'17"N 73°38'45"E
STARTING DATE : 14/11/24
ENDING DATE : 15/11/24
TOTAL DEPTH BORE (m) : 20.0 m
WATER TABLE (m) :

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT Blows N	Details of Rock Core: Total Length of core (cms)	≥10 Cm Core Pieces (cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
18.60	20.10		Soft Rock	.		RCS-8					39	.		26				
20.10	20.14		Soft Rock			SPT-7	4cm) >50N											

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PROJECT NAME: Geotechnical Investigations for proposed passanger Jetties & Associated Landslide facilities at Andrott, Kadmath & Kalpeni Islands in Lakshadweep

STRUCTURE NAME /NO : Western Jetty Kalpeni
BORE HOLE NO : BH-5(1) West (Marine)
CHAINAGE NO : 10°05'17"N 73°38'47"E
STARTING DATE : 11/11/24
ENDING DATE : 13/11/24
TOTAL DEPTH BORE (m) : 20 m.
WATER TABLE (m) :

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0.0	0.75		Coral Sand			DS1												
0.75	1.20		Coral Sand			SPT1	1	2	4	6								
1.20	1.95		Coral Sand			DS2												
1.95	2.4		Coral Sand			UD1	[Slipped Off]											
2.4	3.90		Coral Sand			DS3												
3.90	4.35		Coral Sand			SPT2	4	7	10	17								
4.35	5.10		Coral Sand			DS4												
5.10	5.55		Coral Sand			UD2	[Slipped Off]											
5.55	7.05		Coral Sand			DS5												
7.05	7.50		SDR			SPT3	6	12	16	28								
7.50	9.0		SDR			DS6												
9.0	10.5		SDR			DS7												
10.5	10.95		SDR			SPT4	12	18	24	42								
10.95	12.45		Soft Rock			RCS1					31			20.67				
12.45	13.95		Soft Rock			RCS2					38	17	1	25.33	11.33			
13.95	14.0		Soft Rock			SPT5	5cm	>50N										
14.0	15.5		Soft Rock			RCS3					42			28				
15.5	17.0		Soft Rock			RCS4					47			31.33				
17.0	17.08		Soft Rock			SPT6	8cm	>50N										
17.08	18.58		Soft Rock			RCS5					36			24				

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PROJECT NAME: Geotechnical Investigations for proposed passanger Jetties & Associated landside facilities at Androth, Kadmath & Kalpeni Islands in Lakshadweep.

STRUCTURE NAME /NO : Western Jetty Kalpeni
BORE HOLE NO : BH-5(1) West (Marine)
CHAINAGE NO : 10°05'17"N 73°38'47"E
STARTING DATE : 11/11/24
ENDING DATE : 13/11/24
TOTAL DEPTH BORE (m) : 20 m
WATER TABLE (m) :

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT Blows N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
18.08.2014			SOFT ROCK			RCS6					39			26.				
20.08.2014			SOFT ROCK			SPT 7-6 cm	>50 N											

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PROJECT NAME	Geotechnical Investigation for proposed passenger Jetties and associated Landside facilities at Andrath, Kadmath & Kalpeni islands in Lakshadweep.
STRUCTURE NAME /NO	: Western Jetty Kalpeni
BORE HOLE NO	: BH-6
CHAINAGE NO	: 10°05'19"N 73°38'42"E
STARTING DATE	: 16/11/2024
ENDING DATE	: 16/11/2024
TOTAL DEPTH BORE (m)	: 8.70 m
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Rec (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	30	45	N	DETAILS OF ROCK CORE Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0.0	0.75		Coral sand			DS-1												
0.75	1.20		Coral sand			SPT-1	5	6	8	14								
1.20	1.95		Coral sand			DS-2												
1.95	2.40		Coral sand			UD-1	[Slipped off]											
2.40	3.90		Coral sand			DS-3												
3.90	4.35		Coral sand			SPT-2	7	11	9	20								
4.35	5.10		coral sand			DS-4												
5.10	5.55		coral sand			UD-2	[Slipped off]											
5.55	7.05		Soft Rock			RCS-1					20			13.33				
7.05	7.50		SDR			SPT-3	12	9	17	26								
7.50	8.25		SDR			DS-5												
8.25	8.70		SDR			SPT-4	13	16	18	34								

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STRUCTURE NAME /NO	: Western Jetty Kalpeni
BORE HOLE NO	: BH-6(1)
CHAINAGE NO	: 10°05'19"N 73°38'39"E
STARTING DATE	: 17/11/2024
ENDING DATE	: 17/11/2024
TOTAL DEPTH BORE (m)	: 8.70m
WATER TABLE (m)	:

PROJECT NAME: Geotechnical Investigation for Proposed Passenger Jetties and associated Landside Facilities at Androth, Kadmath & Kalpeni Islands in Lakshadweep.

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT Blows N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0.0	0.75		Coral sand			DS-1												
0.75	1.20		Coral sand			SPT-1	4	5	9	14								
1.20	1.95		Coral sand			DS-2												
1.95	2.40		Coral sand			UD-1	[slipped off]											
2.40	3.90		Coral sand			DS-3												
3.90	4.35		Coral sand			SPT-2	7	11	13	24								
4.35	5.10		Coral sand			DS-4												
5.10	5.55		Coral sand			UD-2	[slipped off]											
5.55	7.05		Coral sand			DS-5												
7.05	7.50		SDR			SPT-3	9	7	21	28								
7.50	8.25		Soft Rock			RCS-1					17			11.33				
8.25	8.70		SDR			SPT-4	16	14	23	37								

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STRUCTURE NAME /NO	: Western Jetty Kalpeni
BORE HOLE NO	: BH - 6(2)
CHAINAGE NO	: 10°05'37" N 73°38'48" E
STARTING DATE	: 19/11/24
ENDING DATE	: 19/11/24
TOTAL DEPTH BORE (m)	: 8.50 m
WATER TABLE (m)	:

PROJECT NAME: Geotechnical Investigation for Proposed Passenger Jetties and associated Landside facilities at Androth, Kadmath & Kalpeni islands in Lakshadweep.

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows ≤5	SPT Blows 30	SPT Blows 45	SPT Blows N	DETAILS OF ROCK CORE: Total Length of core(cms)	DETAILS OF ROCK CORE: ≥10 Cm Core Pieces(cms)	DETAILS OF ROCK CORE: No. of Core pieces	DETAILS OF ROCK CORE: % of Core Recovery	DETAILS OF ROCK CORE: RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0.0	0.75		coral sand			DS-1												
0.75	1.20		coral sand			SPT-1	7	11	13	24								
1.20	1.95		coral sand			DS-2												
1.95	2.40		coral sand			UD-1	[slipped off]											
2.40	3.90		coral sand			DS-3												
3.90	4.35		coral sand			SPT-2	14	18	24	42								
4.35	5.10		coral sand			DS-4												
5.10	5.55		coral sand			UD-2	[slipped off]											
5.55	7.05		SDR			DS-5												
7.05	7.50		SDR			SPT-3	12	17	14	31								
7.50	8.25		Soft Rock			RCS-1					18			12				
8.25	8.70		SDR			SPT-4	18	21	23	44								

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STRUCTURE NAME /NO	: Western Jetty Kalpeni
BORE HOLE NO	: BH-6(3)
CHAINAGE NO	: 10°05'52" N 73°38'47" E
STARTING DATE	: 20/11/24
ENDING DATE	: 20/11/24
TOTAL DEPTH BORE (m)	: 8.50 m
WATER TABLE (m)	:

PROJECT NAME: Geotechnical Investigation for Proposed Passenger Jetties and associated Landside Facilities at Androth, Kadmath & Kalpeni Islands in Lakshadweep.

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0.0	0.75		Coral sand			DS-1												
0.75	1.20		Coral sand			SPT-1	4	6	11	17								
1.20	1.95		Coral sand			DS-2												
1.95	2.40		Coral sand			UD-1	[slipped off]											
2.40	3.90		Coral sand			DS-3												
3.90	4.35		Coral sand			SPT-2	7	11	13	24								
4.35	5.10		Coral sand			DS-4												
5.10	5.55		Coral sand			UD-2	[slipped off]											
5.55	7.05		Coral sand			DS-5												
7.05	7.50		SDR			SPT-3	14	16	23	39								
7.50	8.25		Soft Rock			RCS-1					24			16				
8.25	8.70		SDR			SPT-4	17	12	21	33								

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PROJECT NAME	Geotechnical Investigation for Proposed Passenger Jetties and associated Landside facilities at Androth, Kadmath & Kalpeni Islands in Lakshadweep
STRUCTURE NAME /NO	: Western Jetty Kalpeni
BORE HOLE NO	: BH-6(4)
CHAINAGE NO	: 10°06'08"N 73°38'50"E
STARTING DATE	: 26/11/24
ENDING DATE	: 26/11/24
TOTAL DEPTH BORE (m)	: 8.50 m
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	30	45	N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water loss	Water Color	Rate of Drill Min/Mts
0.0	0.75		Coral sand			DS-1												
0.75	1.20		Coral sand			SPT-1	8	12	14	26								
1.20	1.95		Coral sand			DS-2												
1.95	2.40		Coral sand			UD-1	[slipped off]											
2.40	3.90		coral sand			DS-3												
3.90	4.35		Coral sand			SPT-2	14	16	12	28								
4.35	5.10		Coral sand			DS-4												
5.10	5.55		Coral sand			UD-2	[slipped off]											
5.55	7.05		Coral sand			DS-5												
7.05	7.50		SDR			SPT-3	18	21	23	44								
7.50	8.25		SDR			DS-6												
8.25	8.70		SDR			SPT-4	17	18	21	39								

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PROJECT NAME	Geotechnical Investigations for proposed Jetties & Associated landside facilities at Androth, Kadmath & Kalpeni Islands in Lakshadweep
STRUCTURE NAME /NO	Western Jetty Kalpeni
BORE HOLE NO	BH-6(S)
CHAINAGE NO	10°06'24"N 73°38'51"E
STARTING DATE	21/11/24
ENDING DATE	21/11/24
TOTAL DEPTH BORE (m)	8.5m
WATER TABLE (m)	

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Leg of Bore (m)	Sampling Depth (m)	Sampling Type(DS/UDS/SPT)	SPT Blows 15	30	45	N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0	0.75		Coral sand			DS1												
0.75	1.20		Coral sand			SPT1	2	3	4	7								
1.20	1.95		Coral sand			DS2												
1.95	2.40		Coral sand			UD1	[Slipped off]											
2.40	3.90		Coral sand			DS3												
3.90	4.35		Coral sand			SPT2	4	6	7	13								
4.35	5.10		Coral sand			DS4												
5.10	5.55		Coral sand			UD2	[Slipped off]											
5.55	7.05		Coral sand			DS5												
7.05	7.50		Coral sand			SPT3	6	8	11	19								
7.50	8.25		Soft Rock			RCS1					12			8				
8.25	8.70		Soft Rock			SPT4	7	9	12	21								

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PROJECT NAME: Geotechnical Investigations proposed Jetties and Associated landslide Facilities at Androth, Kadmath & Kalpeni Islands in Lakshadweep

STRUCTURE NAME /NO : Western Jetty Kalpeni
BORE HOLE NO : BH-6(6)
CHAINAGE NO : 10°06'39" N 73°38'48" E
STARTING DATE : 24/11/24
ENDING DATE : 24/11/24
TOTAL DEPTH BORE (m) : 8.50m
WATER TABLE (m) :

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0	0.75		Coral Sand			DS1												
0.75	1.20		Coral Sand			SPT1	1	3	3	6								
1.20	1.95		Coral Sand			DS2												
1.95	2.40		Coral Sand			UP1	[Slipped off]											
2.40	3.90		Coral Sand			DS3												
3.90	4.35		Coral Sand			SPT2	3	5	6	11								
4.35	5.10		Coral Sand			DS4												
5.10	5.55		Coral Sand			UP2	[Slipped off]											
5.55	7.05		Soft ROCK			RCS1					17			11.33				
7.05	7.50		Soft ROCK			SPT3	5	7	11	18								
7.50	8.25		Soft ROCK			RCS2					14			9.33				
8.25	8.70		Soft ROCK			SPT4	6	9	12	21								

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STRUCTURE NAME /NO	: Western Jetty Kalpeni
BORE HOLE NO	: BH-6(7)
CHAINAGE NO	: 10°06'54"N 73°38'41"E
STARTING DATE	: 18/11/24
ENDING DATE	: 18/11/24
TOTAL DEPTH BORE (m)	: 85 m.
WATER TABLE (m)	:

PROJECT NAME: Geotechnical Investigations for proposed Jetties and Associated landslide facilities at Agatti, Kadmath & Kalpeni Islands at Lakshadweep

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type(DS/UDS/SPT)	SPT Blows 15	30	45	N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0	0.75		Coral Sand			DS1												
0.75	1.20		Coral Sand			SPT1	1	2	3	5								
1.20	1.95		Coral Sand			DS2												
1.95	2.40		Coral Sand			UP1	[Slipped off]											
2.40	3.90		Coral Sand			DS3												
3.90	4.35		Coral Sand			SPT2	3	5	6	11								
4.35	5.10		Coral Sand			DS4												
5.10	5.55		Coral Sand			UP2	[Slipped off]											
5.55	7.05		Soft Rock			RCS1					18			12				
7.05	7.50		Soft Rock			SPT3	8	12	16	28								
7.50	8.25		Soft ROCK			RCS2					24			16				
8.25	8.70		Soft ROCK			SPT4	12	14	17	31								

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PROJECT NAME: Geotechnical Investigations for proposed Jetties and Associated Landside facilities at Androth, Kadmath & Kalpeni Islands in Lakshdweep

STRUCTURE NAME /NO : Western Jetty Kalpeni
BORE HOLE NO : BH-6(B)
CHAINAGE NO : 10°04'08"N 73°38'34"E
STARTING DATE : 23/11/24
ENDING DATE : 23/11/24
TOTAL DEPTH BORE (m) : 8.5 m
WATER TABLE (m) :

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0	0.75		Coral Sand			DS1												
0.75	1.20		Coral Sand			SPT1	2	3	2	5								
1.20	1.95		Coral Sand			DS2												
1.95	2.40		Coral Sand			UD1	(Slipped off)											
2.40	3.90		Coral Sand			DS3												
3.90	4.35		Coral Sand			SPT2	3	5	6	11								
4.35	5.10		Coral Sand			DS4												
5.10	5.55		Coral Sand			UD2	(Slipped off)											
5.55	7.05		Coral Sand			DS5												
7.05	7.50		Coral Sand			SPT3	5	7	8	15								
7.50	8.25		Soft Rock			RCS1					22			14.67				
8.25	8.70		Soft Rock			SPT4	8	9	13	22								

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PROJECT NAME	Geotechincal Investigations for proposed Jetties & Associated landside facilities at Andrath, Kadmath & Kalpeni Islands in Lakshdweep
STRUCTURE NAME /NO	: Western Jetty Kalpeni
BORE HOLE NO	: BH-6(9)
CHAINAGE NO	: 10°07'23"N 73°38'27"E
STARTING DATE	: 22/11/24
ENDING DATE	: 22/11/24
TOTAL DEPTH BORE (m)	: 8.5 m
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type(DS/UDS/SPT)	SPT Blows 15	30	45	N	DETAILS OF ROCK CORE Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water lose	Water Color	Rate of Drill Min/Mts
0	0.75		Coral Sand			DS1												
0.75	1.20		Coral Sand			SPT1	1	3	4	7								
1.20	1.95		Coral Sand			DS2												
1.95	2.40		Coral Sand			UD1	(Slipped off)											
2.40	3.90		Coral Sand			DS3												
3.90	4.35		Coral Sand			SPT2	3	5	6	11								
4.35	5.10		Coral Sand			DS4												
5.10	5.55		Coral Sand			U.D2	(Slipped off)											
5.55	7.05		Soft Rock			RCS1					15			10				
7.05	7.50		Soft Rock			SPT3	5	8	9	17								
7.60	8.95		Soft Rock			RCS2					24			16				
8.25	8.70		Soft Rock			SPT4	8	11	13	24								

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PROJECT NAME	Geotechincal Investigations for proposed jetty and landslide facilities at Kadmath & Kalpeni Islands in Lakshdweep
STRUCTURE NAME /NO	: Western Jetty Kalpeni
BORE HOLE NO	: BH-6(40)
CHAINAGE NO	: 10°07'37"N 73°38'20"E
STARTING DATE	: 25/11/24
ENDING DATE	: 25/11/24
TOTAL DEPTH BORE (m)	: 8.50m
WATER TABLE (m)	:

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type(DS/UDS/SPT)	SPT Blows 15	30	45	N	DETAILS OF ROCK CORE: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water losc	Water Color	Rate of Drill Min/Mts
0	0.75		Coral Sand			DS1												
0.75	1.20		Coral Sand			SPT1	1	2	4	6								
1.20	1.95		Coral Sand			DS2												
1.95	2.40		Coral Sand			UP1	[Slipped Off]											
2.40	3.90		Coral Sand			DS3												
3.90	4.35		Coral Sand			SPT2	3	4	5	9								
4.35	5.10		Coral Sand			DS4												
5.10	5.55		Coral Sand			UP2	[Slipped off]											
5.55	7.05		Soft Rock			RCS1					19			12.67				
7.05	7.50		Soft Rock			SPT3	8	11	14	25								
7.50	8.25		Soft Rock			RCS2					26			17.33				
8.25	8.70		Soft Rock			SPT4	12	13	16	29								

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PROJECT NAME: Geotechnical Investigation for Proposed passenger Jetties and associated landside facilities at Kadmath & Kalpeni Islands in Lakshadweep.

STRUCTURE NAME /NO : Western Jetty Kalpeni
BORE HOLE NO : BH-6(II)
CHAINAGE NO :
STARTING DATE : 28/11/2024
ENDING DATE : 28/11/2024
TOTAL DEPTH BORE (m) : 8.50m
WATER TABLE (m) :

Depth (m) From	Depth (m) To	Length of Run (m)	Description	Log of Bore (m)	Sampling Depth (m)	Sampling Type (DS/UDS/SPT)	SPT Blows 15	SPT Blows 30	SPT Blows 45	SPT N	Details of Rock Core: Total Length of core(cms)	≥10 Cm Core Pieces(cms)	No. of Core pieces	% of Core Recovery	RQD %	Water loss	Water Color	Rate of Drill Min/Mts
0.0	0.75	0.75	Coral sand			DS-1												
0.75	1.20	0.45	coral sand			SPT-1	3	5	6	11								
1.20	1.95	0.75	Coral sand			DS-2												
1.95	2.40	0.45	Coral sand			UD-1	[slipped off]											
2.40	3.90	1.50	Coral sand			DS-3												
3.90	4.35	0.45	Coral sand			SPT-2	7	11	8	19								
4.35	5.10	0.75	Coral sand			DS-4												
5.10	5.55	0.45	Coral sand			UD-2												
5.55	7.05	1.50	SDR			DS-5												
7.05	7.50	0.45	SDR			SPT-3	11	7	21	28								
7.50	8.25	0.75	SDR			DS-6												
8.25	8.70	0.45	SDR			SPT-4	14	12	26	38								

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