GEOLOGICAL INVESTIGATION FOR THE DIVERSION OF 14489 HECTARE OF FOREST LAND IN FAVOUR OF HPPWD FOR C/O ROAD FROM PATYAR GHATRU VIA SITIRI JAYAN BERTI NALLAH KM 0/00 TO KM 3/600 WITHIN THE JURISDICTION OF SHIMLA , H.P.

SUBMITTED TO :-
THE ASSISTANT ENGINEER,
H.P.PWD SUB DIVISION,
DHAMI

BY:-

GEOTECH ENGINEERS AND CONSULTANTS
(A H.P. Govt. Appproved & An ISO 9001-2015 Certified Material Testing Laboratory)
MARIA NIWAS, BELOW BCS, NEAR SANJAY GANDHI PUBLIC SCHOOL NEW SHIMLA-171009 (H.P)
Mob No-8894700939

Table of Contents

Geotech Engineers and Consultants

(A H.P. Government Approved & an ISO 9001-2015 ISO 14001-2015 and OHSAS 18001-2007 Certified Material Testing Laboratory)
Maria Niwas, Below BCS Near Sanjay Gandhi Public School, New Shimla-171009 (H.P.)
Mobile No. : 098161-53281, 088947-00939
E-mail ID : geotechconsultants09@gmail.com
Web : www.geotechconsultants.co.in

Services Available :

- Soil Investigation for Buildings, Bridges, Towers, Irrigation Structures, etc. by S.P.T., D.C.P.T. and Plate Load.
- Boring of Soil/ Rock upto the depth of 50 Mtr for Bridges, Building, Towers, Tunnels etc.
- Design Mix of Concrete for any Grade, Job mix of G.S.B., W.M.M., B.M.,S.D.B.C. etc.
- Assessment of Road Crust/Overlays Thickness by Lab CBR and Benkelman Beam Deflection Techniques.
- Physical Tests of Aggregate, Sand, Stones, Cement Concrete Cubes, Bitumen required for Buildings, Towers, Storage tanks and also tests required for PMGSY, NABARD, National Highways, World Bank Roads etc in the Laboratory/field.
- Non Destructive Concrete Hammer test, Core cutting of flexible pavement and R.C.C. structure, Soil Resistivity test for Towers, Sub-station etc.

Ref. No.GEC-524 Date 25.11.2024

GEOLOGICAL INVESTIGATION FOR THE DIVERSION OF 14489 HECTARE OF FOREST LAND IN FAVOUR OF HPPWD FOR C/O ROAD FROM PATYAR GHATRU VIA SITIRI JAYAN BERTI NALLAH KM 0/00 TO KM 3/600 WITHIN THE JURISDICTION OF SHIMLA , H.P.

1. INTRODUCTION:-

1.1 Foundation engineering is the art of selecting designing and constructing the element that transfer the weight of a structure to the under lying soil/ rock. To know the nature and consistency of the sub-soil, geotechnical typical engineering properties of soil of various groups is valuable for the computation of bearing capacity.

1.2 The laboratory tests of soil was conducted by Geotech Engineers and Consultants, Maria Niwas, New Shimla on behalf of The Assistant Engineer,H.P.PWD Sub Division Dhami to evaluate the Safe bearing capacity of Soil.

2. SCOPE OF WORK:-

2.1 Two number soil samples were supplied by the client, excavated at a depth of 1.5 mtr to the laboratory for further analysis in the laboratory to know the preliminary geo-technical information in respect of soil strata encountered in the test pits at the proposed site.

2.2 GRADATION ANALYSIS OF SOIL:-

The gradation analysis of soil were performed as per IS: 2720-Part III-1970 to work out the percentage composition of gravels, sand and fines (silt/clay).

The gradation analysis of soil revealed that the percentage composition of gravels, sand and fines (silt/clay) were found to vary from 57.4 % to 61.3 %, 20.4 % to 22.8 % and 18.3 % to 19.8 % respectively.

2.3 INDEX PROPERTIES OF SOIL:-

The index properties of soil has been done as per Code IS: 2720-Part V-1970 for calculating the plasticitty index of soil.

The index properties of soil revealed that the liquid limits varies from 18 % to 19% with non-plastic in character.

2.4 COMPACTION PROPERTIES OF SOIL:-

The compaction properties of soil has been done as per IS: 2720-Part VII-1965 to know the compaction characteristic of the soil in the excavated test pits.

The field compaction revealed that the field moisture content and bulk density of soil were observed to be 4.0 % to 4.6 % and 1.95 gm/cc to 1.98 gm/cc respectively. However, at Proctor compaction the value of OMC and MDD were found to vary from 8.0 % to 8.5 % and 1.99 gm/cc to 2.01 gm/cc respectively.

3. IDENTIFICATION AND CLASSIFICATION OF SOIL :-

The identificatiion and classification of soil has been done as per code IS: 1498-1970.

The gradation analysis and index properties of soil held that the soil- strata was identified as that of the coarse grained soil of group symbol GM. The group symbol GM represented silty gravels, poorly graded gravels-sand-silt mixtures.

4. FOUNDATION ANALYSIS:-

Bearing capacity has been evaluated keeping in view of the foundation will be safe against shear failure. The value of angle of shearing resistance Ø in Test Pit No.I and II were found to be 32.5 ° & 33.0° respectively and C-value is 0.0 kg/cm^2 in both cases by conducting the Direct shear test on the sample supplied to the laboratory and is further used for calculating the bearing capacity of soil as per IS: 6403:1981

The following equation has been used for calculating the safe bearing capacity of soil i.e. 32.5°

$$q_u = q(N'_q-1)\, Sq\, dq\, iq + 0.5 \times B \times \gamma \times N'\gamma \times S\gamma \times d\gamma \times i\gamma \times w'$$

Where:

q_u =Net ultimate bearing capacity

Ø = angle of shear resistance

q = Effective surcharge

B = Width of footing

γ = density

N'_q, $N'\gamma$ = Bearing capacity factors, local shear factor

S_c,S_q, $S\gamma$ = Shape factor

d_c,d_q, $d\gamma$ = Depth factor

i_c,i_q, $i\gamma$ = inclination factors

W' = Water table factor

For Strip footing :

$\phi = 32.5°$, $N'q = 9.06$ $N'\gamma = 8.82$,

$iq = iy = 1.0$ (Vertical load), $w'=1$

$Sq= 1.0$, $S\gamma= 1.0$ $\gamma= 1.95$ gm/cc

Assumed, Depth of footing, Df = 1.5 mtr Width of footing, B = 1.8 mtr.

$dq = d\gamma = 1 + 0.1\ Df/B \tan(45+\emptyset/2) = 1.15$

$q(ult) = 2.93 \times (9.06-1) \times 1.0 \times 1.15 \times 1.0 + 0.5 \times 1.8 \times 1.95 \times 8.82 \times 1.0 \times 1.15 \times 1.0 \times 1.0$

$= 27.16 + 17.80 = 44.96\ t/m^2$

With F.O.S. = 2.5

q(safe) =17.98 t/m²

5. RECOMMENDATIONS :-

5.1 A factor of safety 2.5 is recommended by Bureau of Indian Standards. So a factor of safety 2.5 is recommended to be adopted for the safe and economic foundation design of the Const. of road from Patyar Ghatru via Sitiri Jayan Berti Nallah Km 0/00 to Km 3/600 within the jurisdiction of Shimla Forest Diversion , Distt Shimla as its periphery falls in Seismic Zone No. IV.

5.2 The safe bearing capacity of soil 'qs' were found to be 17.98 t/mt² and 19.04 t/mt² for Test Pit No.I and II respectively.

So, keeping in view the structure consideration, the minimum value of safe bearing capacity **17.98 t/mt²** may be adopted for the construction of said structure.

5.3 Proper designed retaining wall/ breast walls of suitable height may be provided along the periphery of the said structure.

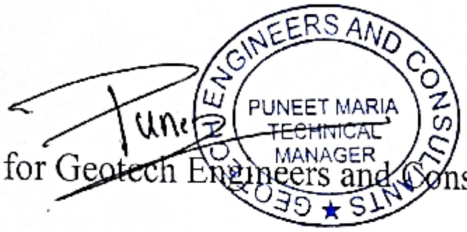
5.4 No where the foundation may be allowed to rest on overburden/ loose filing while constructing the structure.

5.5 These values do not take into the effect of under earthquake loading which may be considered by the Design Engineer at their own level while designing the said structure

5.6 The above said values of safe bearing capacity may hold good only for the soil samples supplied by the client from the site to laboratory. However, if any significant

change is noticed during actual excavation of foundations the soil consultants may be consulted for further opinion.

5.7 The surface soil water would require suitable drainage work along the periphery of the structure to prevent the tendency of water in filtration due to the seepage of water due to rain etc in the foundation.



for Geotech Engineers and Consultants