BEARING CAPACITY
OF SUBSOIL FOR CONSTRUCTION
OF EMBANKMENT & RE WALL
AND NECESSITY OF GROUND IMPROVEMENT TECHNIQUE

EMBANKMENT AT CH. KM. 60+121 [DESIGN]

Subsoil is characterized by a stiff silty clay layer at top upto 8m depth.

Determination of Bearing Capacity

Based on the subsoil condition, use design cohesion C = 0.65 kg/sqcm & $\Phi = 0°$

Corresponding $N_c = 5.14$

Now, ultimate bearing capacity of top soil = CN_c = 6.50 x 5.14 = 33.41 t/sqm

Height of embankment to be constructed = 6.00m

So, stress increase on soil = 6.00 x 2.00 = 12.00 t/sqm

Factor of safety = 33.41 / 12.00 = 2.78 > 2.50….Hence safe.

Hence the virgin soil is safe from bearing capacity point of view due to construction of 6m high Embankment.

RE WALL AT CH. KM. 67+556 [DESIGN]

Subsoil is characterized by a medium dense silty sand layer at top upto 8m depth.

Average corrected N within the zone of influence = 22

Use cohesion c = 0.00 kg/sqcm and Φ value is restricted to 31 degree

Considering the General Shear (For $\Phi = 36°$)

Cohesion, C = 0.00 t/sqm

Using ϕ = 36 degree, the bearing capacity factors are:

$N_c = 50.59$
$N_q = 37.75$
$N_\gamma = 56.31$

Use,

Depth of Foundation = D_f = 0.30 M (Below Existing Ground Level)
Width of Foundation = B = 10 M (Assumed)
Length of Foundation = L = 50 M

Overburden Pressure = q =0.300 (Depth) x 0.90 (Submerged density) = 0.27 t/sqm (Assuming the ground water table is flushing with the ground level)

The Shape factors are [IS:6403 - 1981]

$S_c = 1.04$ $S_q = 1.04$ $S_\gamma = 0.92$

The Depth factors are [IS:6403 - 1981]

$D_c = 1.01$ $D_q = 1.01$ $D_\gamma = 1.01$

Computed Net Ultimate Bearing Capacity = 244.89 t/sqm

Considering Local Shear Failure (For $\Phi = 28°$)

$\Phi = 28°$, $\Phi' = \tan^{-1}$ (2/3 x tan 28°) = 19°

Computed Net Ultimate Bearing Capacity = 20.83 t/sqm

Therefore, interpolated Bearing Capacity for $\Phi = 31°$
= [20.83 + {(244.89 – 20.83) / (36-28)} x (31-28)] = 104.85 t/sqm

Height of embankment to be constructed = 14.00m

So, stress increase on soil = 14.00 x 2.00 = 28.00 t/sqm

Factor of safety = 104.85 / 28.00 = 3.74 > 2.50….Hence safe.

Hence the virgin soil is safe from bearing capacity point of view due to construction of 14m high RE Wall.

EMBANKMENT AT CH. KM. 75+994 [DESIGN]

Subsoil is characterized by a stiff to very silty clay layer at top upto 20m depth.

Determination of Bearing Capacity

Based on the subsoil condition, use design cohesion C = 1.00 kg/sqcm & $\Phi = 0°$

Corresponding $N_c = 5.14$

Now, ultimate bearing capacity of top soil = CN_c = 10.00 x 5.14 = 51.40 t/sqm

Height of embankment to be constructed = 8.00m

So, stress increase on soil = 8.00 x 2.00 = 16.00 t/sqm

Factor of safety = 51.40 / 16.00 = 3.21 > 2.50….Hence safe.

Hence the virgin soil is safe from bearing capacity point of view due to construction of 8m high Embankment.

Based on the same approach the other embankments/ RE walls for different chainages are analysed and the results are summarized as follows.

SL. No.	Chainage (CH. KM.)	Height of Structure (m)	Available Factor of safety	Remarks
1	60+121	6	> 2.50	--
2	61+848	8	> 2.50	--
3	67+363	14	> 2.50	--
4	75+994	8	> 2.50	--