Prospective EPC Contractors/Civil Structural agencies/ Solar Module structure manufacturing firms are requested to attend the Pre-tender vendor meet to find out alternate methods of foundation for Module Mounting Structure for installing Solar PV power plant over OB Dump at RG OC1. The firms are requested to participate in the Pre-Tender Vendor meet to be conducted on 28.01.2022 through Video Conference.

The interested firms are requested to send their Mail IDs to gm_solar@scclmines.com on or before 27.01.2022 to enable SCCL to send VC link.

Technical report for the installation of solar panels on OB Dump at RG OC-1, Ramagundam Area-3, submitted by NIT, Warangal is enclosed herewith.

Salient Features of RG OC1 OB Dump:

Project Location	:	Ramagundam OC1 OB dump 18°39’37.51”N, 79°32’20.73”E
Extent of land	:	100 acres.
Height of the OB dump	:	120 meters Approx. from NGL.
Size of over burden grain	:	From fines to pebbles & even boulders.
Wind Speed	:	44 m/sec.

TECHNICAL REPORT FOR THE INSTALLATION OF SOLAR PANELS ON OB DUMP AT RG OCP-I, RAMAGUNDAM AREA -III, S.C.C. Ltd.

Job No.3507

CONSULTANCY SERVICES
GEOTECHNICAL ENGINEERING DIVISION
DEPARTMENT OF CIVIL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY
WARANGAL – 506004
TELANGANA

Fax:0091-8712-2459547
Phone: 2469191,2469192,2469193. Extension: 2137 (BPL)

TECHNICAL REPORT FOR THE INSTALLATION OF SOLAR PANELS ON OB DUMP AT RG OCP-1, RAMAGUNDAM AREA - III, S.C.C. Ltd.

Job No. 3507

Introduction: It is proposed to install solar panels on OB dump at Ramagundam Area-III by S.C.C. Ltd. In this connection, the General Manager, RG-III Area, S.C.C. Ltd. requested the Geotechnical Engineering Division of NIT-Warangal to visit the site and give technical report to install the solar panels on OB dump which is filled up soil. Accordingly, Prof. V. Ramana Murty, faculty of geotechnical engineering visited the site on 14-3-2020 in order to have a physical idea of the strata condition. The soil exploration is carried out by S.C.C. Ltd. and the additional test results are supplemented by NIT-Warangal.

Laboratory Testing: The classification tests were done on the SPT split spoon samples; and classification and shear strength testing was carried out on UD samples collected from 2 m depth in open trial pits excavated over the proposed area.

Test Results: The results obtained from laboratory testing are presented in Tables-1 &2.

Calculation of Safe Bearing Capacity Based on Soil Parameters: The bearing capacity of OB dump soil bed is calculated using the following parameters.

Width of square footing, B = 0.8 m (assumed)

Depth of foundation, D = 1.8 m (below finished/final GL)

The soil properties of sample No. 8, i.e. $c' = 0$ and $\phi' = 28^0$ are used (lower range value for samples, Table-2)

Submerged unit weight of soil, $\gamma_{sub} = 1.0$ t/m^3

For $\phi = 28^0$, $N_c = 25.80$ $N_q = 14.72$ and $N_\gamma = 16.72$

The ultimate bearing capacity for fully submerged condition is calculated using the following equation:

$Q_u = 1.2\ cN_c + \gamma_{sub}\ D\ N_q + 0.40\ \gamma_{sub}\ B\ N\gamma$

$= 1.2 \times 0 \times 25.80 + 1.0 \times 1.8 \times 14.72 + 0.40 \times 1.0 \times 0.8 \times 16.72$

$= 0 + 26.49 + 5.35$

$= 31.84$ t/m^2

$Q_{safe} = Q_u/FS = 34.84/3 = 10.61$ t/m^2

Inference and Suggestions: The observation of open trial pits made over the proposed OB dump area indicates that the filled up material is of weathered sand stone and even the SPT samples up to about 5 m depth also indicate the presence of the same material. The physical observation of the open test / trial pits further indicates the presence of cobble and boulder size blocks within the crushed sand stone material.

The SPT N-values along the depth of exploration across the bore holes indicate the non-uniformity of compactness of OB dump material. The higher blow count at certain locations could be due to the presence of cobble/boulder size blocks of filled up material encountered below the driving split spoon sampler. The presence of several surface gullies and depressions formed due to rain water percolation indicates the presence of weak pockets within the OB dump material. The calculated SBC value based on lower range values of angle of internal friction is about 10 t/m^2. Based on these observations, the following recommendations are made.

1. The isolated footing foundation can be adopted for the solar panels. An allowable bearing capacity of 5 t/m^2 can be adopted to finalize the footing size based on the actual loading. The low value of bearing capacity is recommended for design in view of uncertain behaviour of filled up strata. In order to maintain the stability of footings in filled up soil bed, a minimum size of 0.80 m x 0.80 m can be adopted even when the actual loading condition requires lesser size footings.
2. The footings can be cast in rows and for each row of footings, a continuous foundation trench can be excavated up to 1.8 m depth below the finished level. The bottom of excavated trench is suggested to be compacted using a 7 t -10 t vibratory roller in order to ensure compact contact surface to the footings and minimize any looseness immediately below the footings.
3. After the bottom compaction of foundation trench by rolling, the footings can be cast and after curing them, the foundation trench can be backfilled as per standard procedure.
4. As per the above said process, the footings can be constructed in rows one after the other so that the work can be systematically carried out.
5. As the global stability of filled-up soils continues to adjust and readjust upon repeated wetting and drying over time, it is suggested to provide adequate surface drainage so that the amount of water infiltration would be limited and consequently the fill internal movements are under control. This is more relevant especially in case of pervious sand stone material.
6. As per the uplift capacity requirement, either the depth of foundation or the size of footing can be adjusted.

V. Ramana murty

(Dr. V. RAMANA MURTY)
Job Coordinator

Dr. V. RAMANA MURTY
Professor
Department. of Civil Engineering
NATIONAL INSTITUTE OF TECHNOLOGY
WARANGAL-506 004. TS, INDIA

Table-1 Properties of Filled-up OB dump soils along with N-values

At Bore hole – 1

Depth, m	Range of SPT-N-Values	Field dry density, g/cc	Field water content, %	Gradation			Atterberg Limits		IS Classification & type
				Gravel size,%	Sand,%	Fines,%	Liquid limit,%	Plastic limit, %	
0 – 4.30	23-100	1.66 -2.2	2.5 – 7.14	0	78	22	Non-plastic	NP	SM (weathered sand stone material)

At Bore hole – 2

Depth, m	SPT-N-Value	Field dry density, g/cc	Field water content, %	Gradation			Atterberg Limits		IS Classification & type
				Gravel size,%	Sand,%	Fines,%	Liquid limit,%	Plastic limit,%	
0 - 2.75	16-100	1.67-2.29	3.03 - 5	0	84	16	NP	NP	SM (weathered sand stone material)

At Bore hole – 3

Depth, m	SPT-N-Value	Field dry density, g/cc	Field water content, %	Gradation			Atterberg Limits		IS Classification & type
				Gravel size,%	Sand,%	Fines,%	Liquid limit,%	Plastic limit,%	
0 - 4.05	21 - 100	1.93 – 2.42	5.56 - 8	0	82	18	NP	NP	SM (weathered sand stone material)

At Bore hole – 4

Depth, m	SPT-N-Value	Field dry density, g/cc	Field water content, %	Gradation			Atterberg Limits		IS Classification
				Gravel size,%	Sand, %	Fines, %	Liquid limit,%	Plastic limit,%	
0.2 - 1.1	31-37	2.17-2.28	4.17-8	8	68	24	Non-plastic	NP	SM (weathered sand stone material)
1.1 - 1.55	18	1.18	7.46	29	56	15	NP	NP	SM(with coal mix)
1.55 - 5.15	6-34	1.44-1.81	3.75-4.59	18	67	15	NP	NP	SM

At Bore hole – 5

Depth, m	SPT-N-Value	Field dry density, g/cc	Field water content, %	Gradation			Atterberg Limits		IS Classification & type
				Gravel size,%	Sand, %	Fines, %	Liquid limit,%	Plastic limit,%	
0.2 - 1.5	51 - 90	2.04	3.6	29	57	14	NP	NP	SM
1.5 - 5.15	8 - 100	2.01-2.38	3.57-7.69	25	55	20	NP	NP	SM (weathered sand stone material with coal mix)

At Bore hole – 6

Depth, m	SPT-N-Value	Field dry density, g/cc	Field water content, %	Gradation			Atterberg Limits		IS Classification& type
				Gravel size,%	Sand,%	Fines,%	Liquid limit,%	Plastic limit,%	
0.2 - 4.7	13-100	2.44-2.84	2.86-6.35	14	69	17	NP	NP	SM (weathered sand stone material; with coal mix at 2 m depth)

At Bore hole – 7

Depth, m	SPT-N-Value	Field dry density, g/cc	Field water content, %	Gradation			Atterberg Limits		IS Classification &type
				Gravel size,%	Sand,%	Fines,%	Liquid limit,%	Plastic limit,%	
0.2 2.0	20 -99	2.09 - 2.6	3.51 - 6.52	8	72	20	NP	NP	SM (weathered sand stone material)
2.0 – 5.15	15 -39	2.22	2.2	5	78	17	NP	NP	SM

At Bore hole – 8

Depth, m	SPT-N-Value	Field dry density, g/cc	Field water content, %	Gradation			Atterberg Limits		IS Classification &type
				Gravel size,%	Sand, %	Fines, %	Liquid limit,%	Plastic limit,%	
0.2 0.65	66	2.35	4.95	17	67	16	NP	NP	SM (weathered sand stone material)
0.65 – 5.15	8 - 30	1.95-2.46	3.67-8.04	8	74	18	NP	NP	SM

At Bore hole – 9

Depth, m	SPT-N-Value	Field dry density, g/cc	Field water content, %	Gradation			Atterberg Limits		IS Classification &type
				Gravel size,%	Sand, %	Fines, %	Liquid limit,%	Plastic limit,%	
0 – 5.15	10 - 67	1.74 – 2.27	2.86 – 6.72	0	83	17	NP	NP	SM (weathered sand stone material)

At Bore hole – 10

Depth m	SPT-N-Value	Field dry density, g/cc	Field water content, %	Gradation			Atterberg Limits		IS Classification &type
				Gravel size,%	Sand, %	Fines, %	Liquid limit,%	Plastic limit,%	
0- 0.20	--	2.26	4.3	0	72	28	32	15	SC (desiccated red soil)
0.2 – 0.65	31	1.8	3.9	0	83	17	NP	NP	SM (weathered sand stone)
0.65 – 1.10	61	1.88	4.2	0	76	24	30	15	SC (red soil)
1.10 – 5.15	9 - 40	1.59 – 1.79	2.86 – 4.3	0	78	22	NP	NP	SM (weathered sand stone material with coal mix)

Note: The field dry density and water contents are calculated from intact portions of samples extracted from Split spoon sampler.

TABLE-2 Properties of undisturbed Soil Samples collected from test pits at RG-OCP-1

S.No.	Sample No.	Atterberg Limits		Gradation			IS Soil Classification	Field water content, %	Field dry density, g/cc	Shear Strength Parameters	
		Liquid limit, %	Plastic limit, %	Gravel size, %	Sand, %	Fines, %				Cohesion, c′, t/m^2	Angle of Internal Friction, ϕ'
1	2	3	4	5	6	7	8	9	10	11	12
1.	Sample-1	Non-plastic	NP	5	79	16	SM(silty sand)	6.51	1.74	0	32^0
2.	Sample-2	NP	NP	11	75	14	SM	5.8	1.78	0	33^0
3	Sample-3	NP	NP	12	69	19	SM	5.62	1.73	0	32^0
4	Sample-4	NP	NP	11	75	14	SM	6.14	1.69	0	31^0
5	Sample-5	NP	NP	3	58	39	SM	8.34	1.65	0	33^0
6	Sample-6	NP	NP	11	76	13	SM	4.73	1.90	0	37^0
7	Sample-7	NP	NP	3	81	16	SM	5.47	1.88	0	36^0
8	Sample-8	NP	NP	15	68	17	SM	5.62	1.33	0	28^0
9	Sample-9	NP	NP	16	70	14	SM	6.22	1.31	0	28^0
10	Sample-10	NP	NP	25	58	17	SM	5.58	1.33	0	29^0
11	Sample-11	NP	NP	7	78	15	SM	5.67	1.82	0	33^0
12	Sample-12	NP	NP	14	71	15	SM	5.79	1.85	0	35^0