Bharat Heavy Electricals Limited
(A Govt. Of India Undertaking)

Project Engineering Management

Ref. No. PE/PG/SG5/E-4415/14-03
Enquiry No.: PE/PG/SG5/E-4415/14
Date: 13/06/2014

2X660 MW SURATGARH STPS, STAGE-V
STATION LIGHTING SYSTEM

CORRIGENDA/ADDENDA-3

Dear Sirs,

Pre-Bid queries were received from bidders and same are enclosed herewith (along with BHEL's reply) for your information and n.a. please

Thanking you,
Yours faithfully,
For and on behalf of BHEL

13.6.14

ROHIT JUNEJA
(ENGINEER/Project Group-II-1)

ROHIT JUNEJA
ENGINEER/PG-II-1,
BHEL/PS-PEM
POWER PROJECT ENGINEERING INSTITUTE,
PLOT NO. 25, SECTOR - 16A, NOIDA (UP)
(OFF) 0120-4368848.

Regd. Office:
BHEL House
Siri Fort
New Delhi-110049

Bharat Heavy Electricals Limited
(A Govt. Of India Undertaking)

Project Engineering Management

Ref. No. PE/PG/SG5/E-4415/14-03
Enquiry No.: PE/PG/SG5/E-4415/14
Date: 13/06/2014

2X660 MW SURATGARH STPS, STAGE-V
STATION LIGHTING SYSTEM

PRE-BID QUERIES

Sr. No.	Bidder's Query	BHEL Reply
1	Cable Lying in Buried trenches – Please clarify the soil type i.e. soft soil or hard soil/rock.	Kindly Refer Attached extract of soil investigation report

13.6.14

ROHIT JUNEJA
ENGINEER/PG-II-1,
BHEL/PS-PEM
POWER PROJECT ENGINEERING INSTITUTE,
PLOT NO. 25, SECTOR - 16A, NOIDA (UP)
(OFF) 0120-4368848.

Regd. Office:
BHEL House
Siri Fort
New Delhi-110049

Job No: 3048

ADDITIONAL GEOTECHNICAL INVESTIGATION REPORT FOR CHIMNEY, POWER HOUSE, BOILER & MILL BUNKER AREA – 2 X 660 MW, SURATGARH SCTPS, UNIT 7 & 8, RAJASTHAN.

Clients :

M/s. Bharat Heavy Electricals Ltd.
Power Sector: Eastern Region
DJ - 9/1, Salt Lake City,
Kolkata – 700 091.

Geotechnical Consultants :

C. E. Testing Company Pvt. Limited
AN IS / ISO : 9001 – 2008 COMPANY
124A, N.S.C. BOSE ROAD : Kolkata - 700 092
Phones : 2428-6221 - 24 Fax : (033) 2428-6220
Email : cetest@vsnl.com

July – 2013

ADDITIONAL GEOTECHNICAL INVESTIGATION REPORT FOR CHIMNEY, POWER HOUSE, BOILER & MILL BUNKER AREA - 2 X 660 MW, SURATGARH SCTPS, UNIT 7 & 8, RAJASTHAN.

1. INTRODUCTION:

M/s. Rajasthan Rajya Vidyut Utpadan Nigam Limited has proposed the construction of 2 x 660 MW Suratgarh SCTPS, Unit 7 & 8 in Rajasthan & the job was awarded to **M/s. Bharat Heavy Electricals Limited**. For designing of Foundation Structures coming under this project, it was necessary to conduct a Detailed Geotechnical Investigation Work and **M/s Bharat Heavy Electricals Limited**, in turn awarded the job to **M/s. C. E. Testing Company Pvt. Ltd., Kolkata.**

The scope of the work comprises of 28 nos. boreholes. The boreholes of 150 mm in diameter in soil were advanced by Shell and Auger method. In rock, rotary core drilling of "NX" size was adopted. The scope also included conducting Standard Penetration Tests, collecting disturbed samples at regular intervals for identification and logging purposes, collecting undisturbed tube samples at suitable intervals or at change of strata whichever is earlier, collecting rock core samples and testing these in the laboratory.

This Report is based on 9 nos. boreholes at Chimney, Power House, Boiler & Mill Bunker area (BH-94, 97 to 104 only).

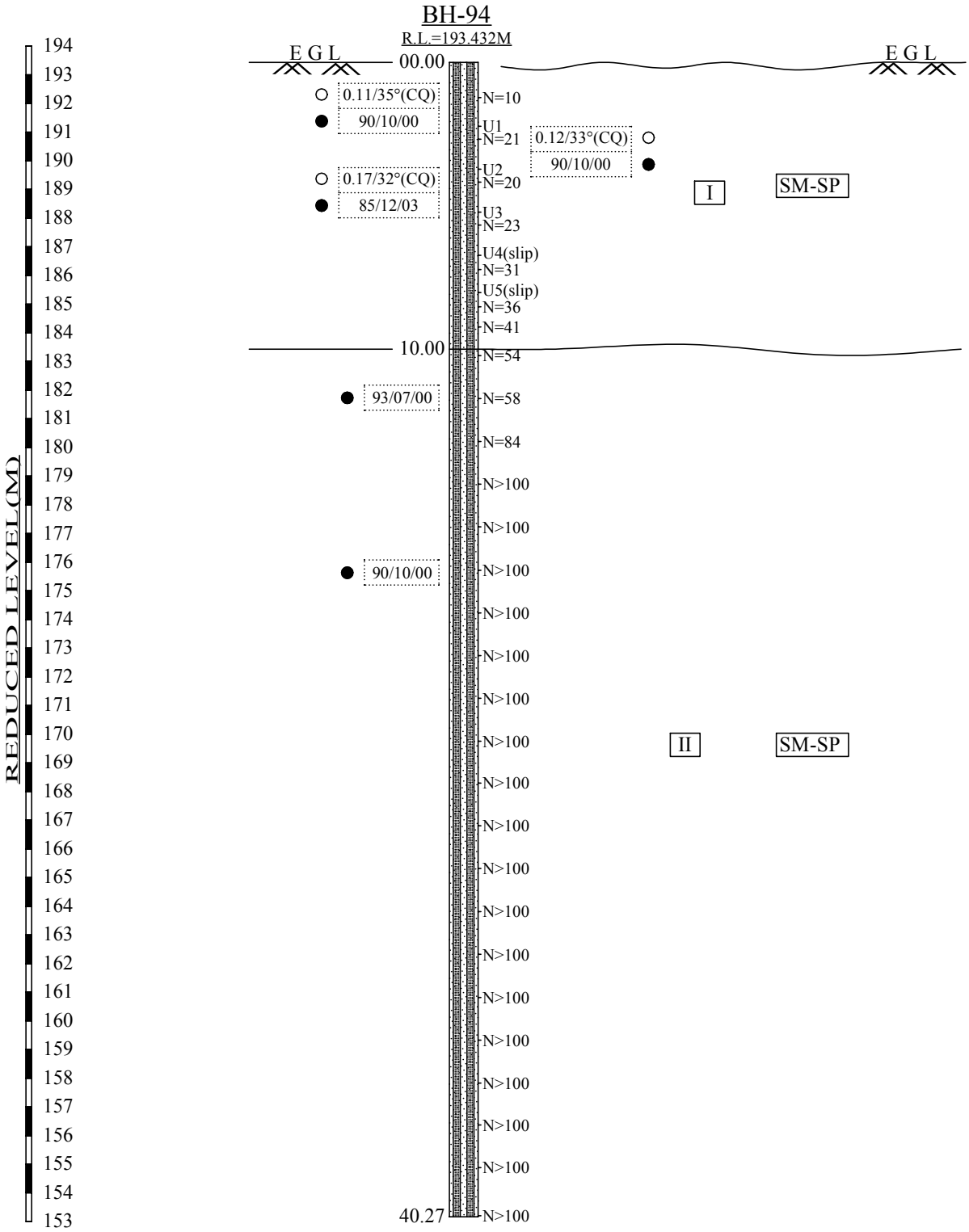
Considering the nature of the subsoil as revealed from field tests shallow foundation is recommended.

2. FIELD INVESTIGATION & SUBSOIL PROPERTIES:

Boring has been carried out by Shell and Auger method using full-length flush jointed casings. The bore holes are 150 mm diameter. Undisturbed tube samples have been collected from the soil deposits and Standard Penetration Tests have also been conducted as per standard norms.

The subsoils in general are of good quality. The subsoil is characterised by a medium dense to dense silty sand layer. Underlying the above, a very dense, silty sand layer was struck and that continues upto the terminating depth of all the boreholes.

Project : Geotech. Inv. Work for 2 x 660 MW Suratgarh SCTPS, Unit 7 & 8, Rajasthan.			CETEST
Job No : 3048	Created by : Chandrani	Created on : 06 / 07 / 2013	Sheet No:



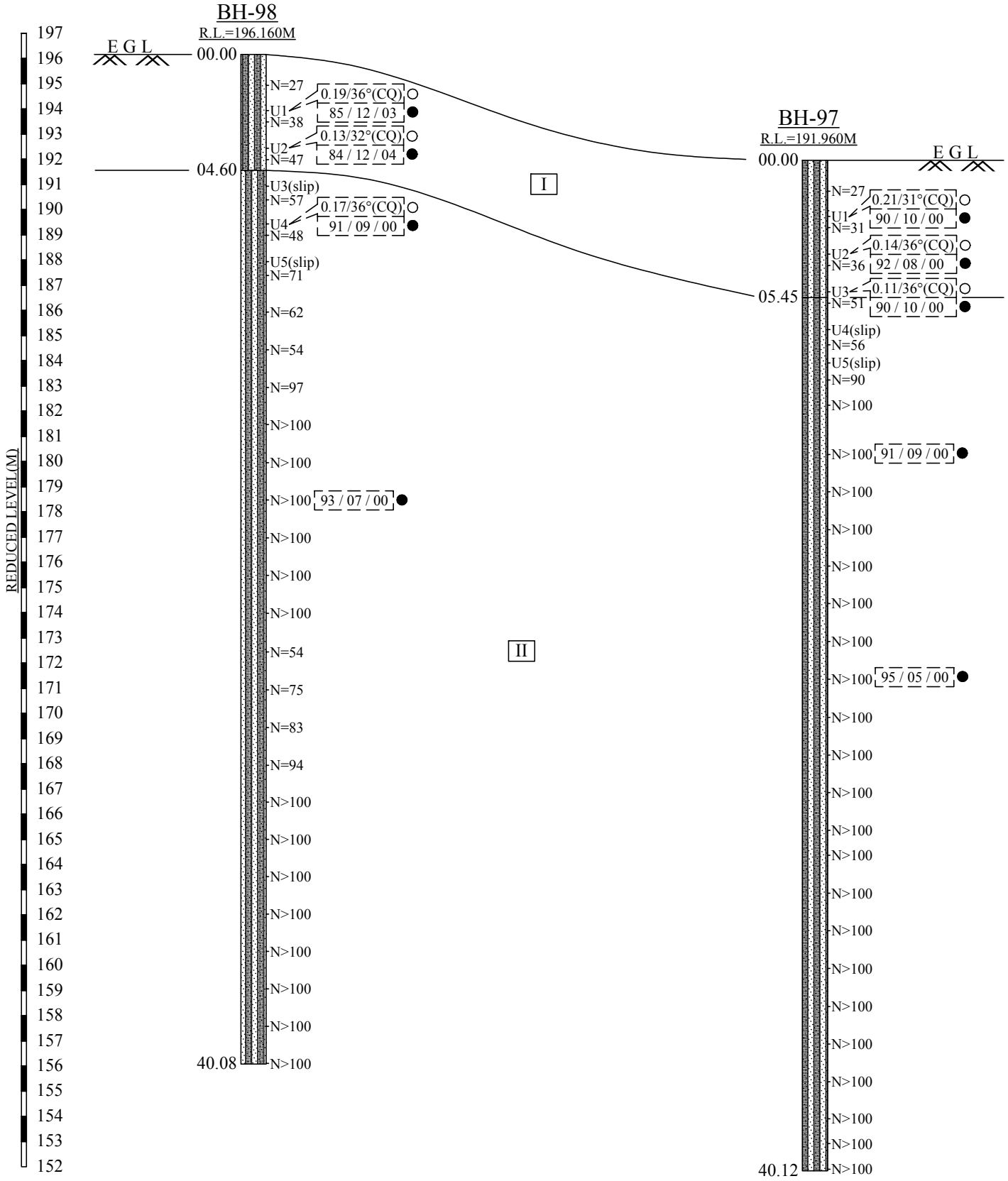
I → Medium dense, greyish brown / yellowish brown, silty fine sand. Obs. mica & sand pieces.

II → Very dense, greyish brown to yellowish brown, silty fine sand with sand stone pieces. Obs. mica.

U means `UDS'
N means `N' value
○ C / Ø values
● Sand/Silt/Clay %

FIG. 2.01: GENERALISED SOIL PROFILE

Project : Geotech. Inv. Work for 2 x 660 MW Suratgarh SCTPS, Unit 7 & 8, Rajasthan.			CETEST
Job No : 3048	Created by : Chandrani	Created on : 06 / 07 / 2013	Sheet No:



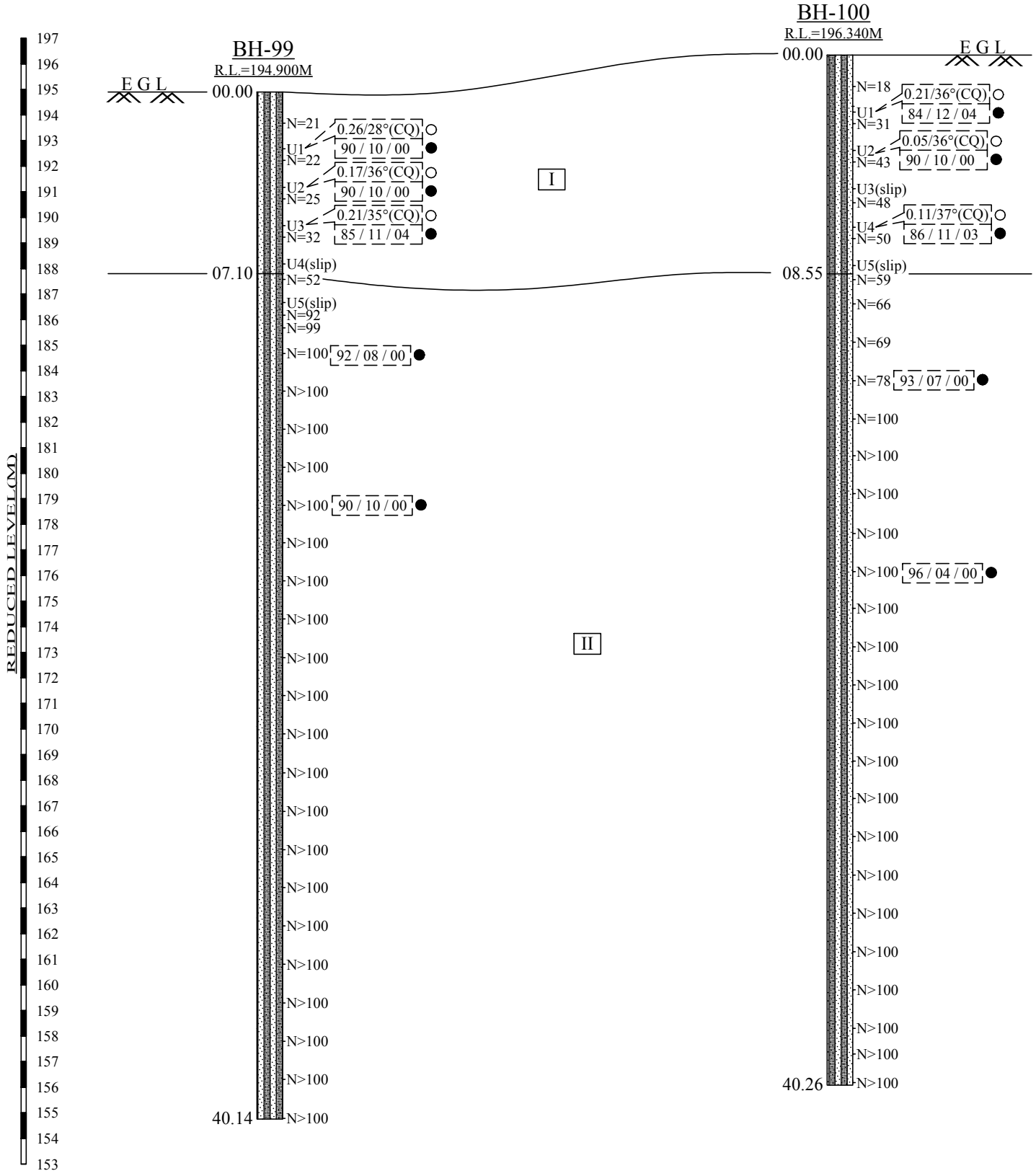
I → Medium dense to dense, greyish brown / yellowish brown, silty fine sand. Obs. mica & sand pieces.

II → Very dense, greyish brown to yellowish brown, silty fine sand with sand stone pieces. Obs. mica.

U means `UDS'
N means `N' value
○ C / Ø values
● Sand/Silt/Clay %

FIG. 2.02 : GENERALISED SOIL PROFILE

Project : Geotech. Inv. Work for 2 x 660 MW Suratgarh SCTPS, Unit 7 & 8, Rajasthan.			CETEST
Job No : 3048	Created by : Chandrani	Created on : 06 / 07 / 2013	Sheet No:



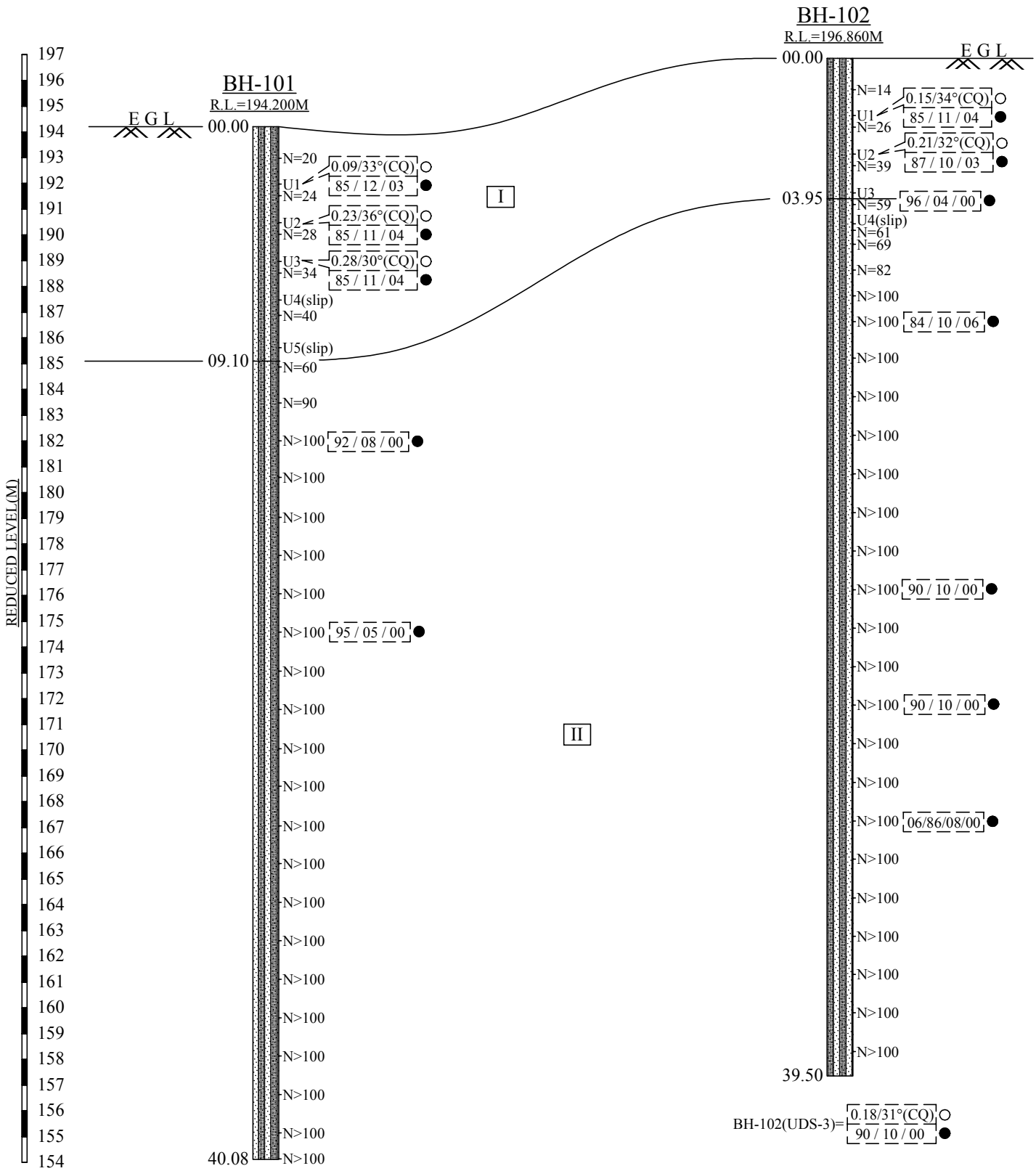
I → Medium dense to dense, greyish brown / yellowish brown, silty fine sand. Obs. mica & sand pieces.

II → Very dense, greyish brown to yellowish brown, silty fine sand with sand stone pieces. Obs. mica.

U means `UDS'
N means `N' value
○ C / Ø values
● Sand/Silt/Clay %

FIG. 2.03 : GENERALISED SOIL PROFILE

Project : Geotech. Inv. Work for 2 x 660 MW Suratgarh SCTPS, Unit 7 & 8, Rajasthan.			CETEST
Job No : 3048	Created by : Chandrani	Created on : 06 / 07 / 2013	Sheet No:



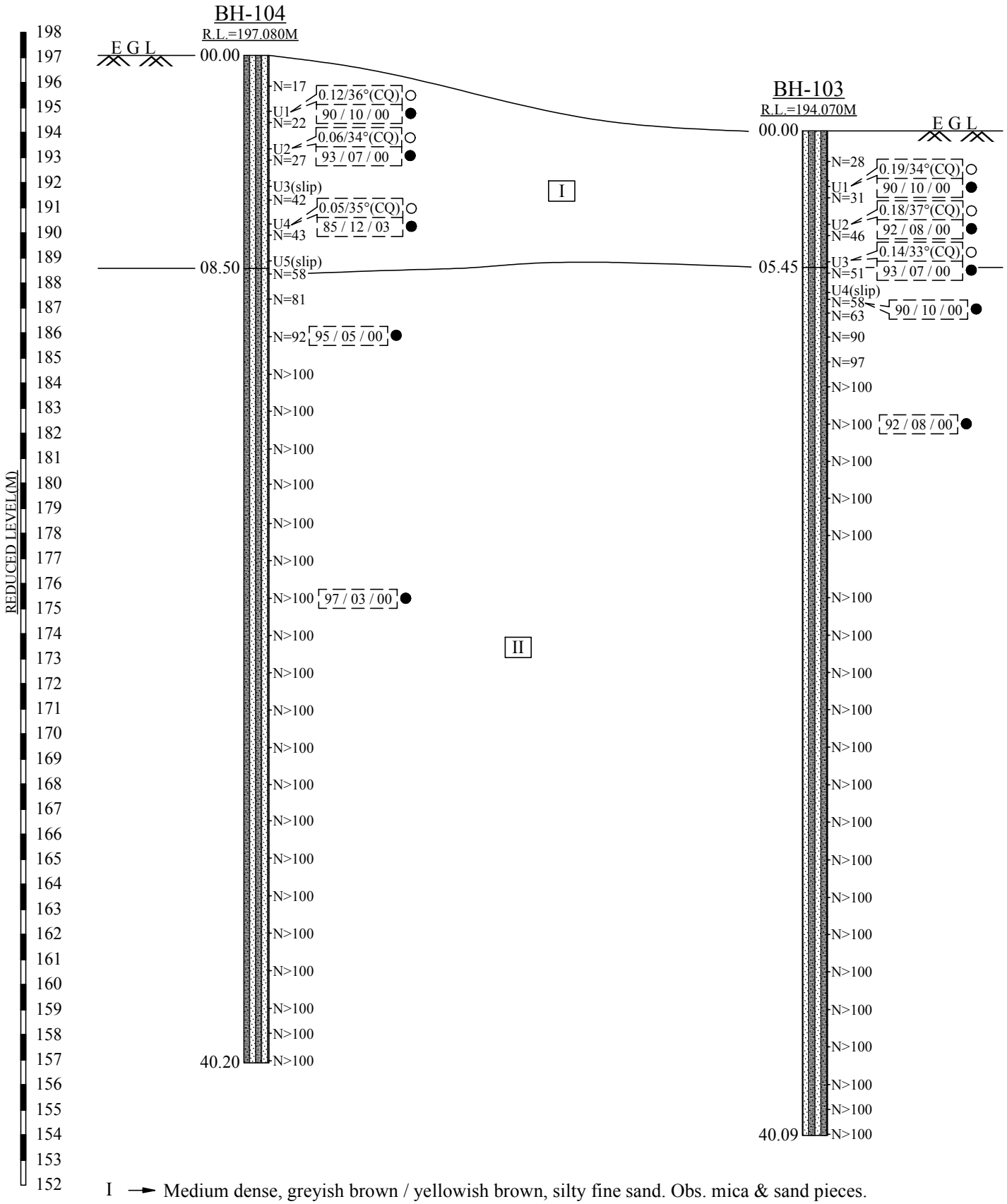
I → Medium dense to dense, greyish brown / yellowish brown, silty fine sand. Obs. mica & sand pieces.

II → Very dense, greyish brown to yellowish brown, silty fine sand with sand stone pieces. Obs. mica.

U means `UDS'
N means `N' value
○ C / Ø values
● Gravels/Sand/Silt/Clay %

FIG. 2.04 : GENERALISED SOIL PROFILE

Project : Geotech. Inv. Work for 2 x 660 MW Suratgarh SCTPS, Unit 7 & 8, Rajasthan.			CETEST
Job No : 3048	Created by : Chandrani	Created on : 06 / 07 / 2013	Sheet No:



I → Medium dense, greyish brown / yellowish brown, silty fine sand. Obs. mica & sand pieces.

II → Very dense, greyish brown to yellowish brown, silty fine sand with sand stone pieces. Obs. mica.

U means `UDS'
N means `N' value
○ C / Ø values
● Sand/Silt/Clay %

FIG. 2.05 : GENERALISED SOIL PROFILE

CORRECTION FOR STANDARD PENETRATION TEST VALUES

Bore Hole No:	Starting Depth (M)	Ending Depth (M)	Average Depth (M)	Field 'N' Values	Cor. 'N' for Overburden Pressure	Reduced Level (M)	Stratum
BH94	1.00	1.45	1.23	10	14	192.21	I
BH94	2.45	2.90	2.68	21	25	190.76	I
BH94	3.95	4.40	4.18	20	21	189.26	I
BH94	5.45	5.90	5.68	23	23	187.76	I
BH94	7.00	7.45	7.23	31	28	186.21	I
BH94	8.30	8.75	8.53	36	31	184.91	I
BH94	9.00	9.45	9.23	41	34	184.21	I
BH94	10.00	10.45	10.23	54	43	183.21	II
BH94	11.50	11.95	11.73	58	44	181.71	II
BH94	13.00	13.45	13.23	84	60	180.21	II
BH94	14.50	14.92	14.71	>100	68	178.72	II
BH94	16.00	16.41	16.21	>100	68	177.23	II
BH94	17.50	17.93	17.72	>100	68	175.72	II
BH94	19.00	19.41	19.21	>100	68	174.23	II
BH94	20.50	20.89	20.70	>100	68	172.74	II
BH94	22.00	22.37	22.19	>100	68	171.25	II
BH94	23.50	23.85	23.68	>100	68	169.76	II
BH94	25.00	25.28	25.14	>100	68	168.29	II
BH94	26.50	26.76	26.63	>100	68	166.80	II
BH94	28.00	28.24	28.12	>100	68	165.31	II
BH94	29.50	29.75	29.63	>100	68	163.81	II
BH94	31.00	31.23	31.12	>100	68	162.32	II
BH94	32.50	32.74	32.62	>100	68	160.81	II
BH94	34.00	34.22	34.11	>100	68	159.32	II
BH94	35.50	35.71	35.61	>100	68	157.83	II
BH94	37.00	37.13	37.07	>100	68	156.37	II
BH94	38.50	38.60	38.55	>100	68	154.88	II
BH94	40.19	40.27	40.23	>100	68	153.20	II
BH97	1.00	1.45	1.23	27	39	190.74	I
BH97	2.45	2.90	2.68	31	37	189.29	I
BH97	3.95	4.40	4.18	36	39	187.79	I
BH97	5.45	5.90	5.68	51	50	186.29	II
BH97	7.10	7.55	7.33	56	50	184.64	II
BH97	8.50	8.95	8.73	90	76	183.24	II
BH97	9.50	9.95	9.73	100	81	182.24	II
BH97	11.50	11.86	11.68	>100	81	180.28	II
BH97	13.00	13.32	13.16	>100	81	178.80	II
BH97	14.50	14.83	14.67	>100	81	177.30	II
BH97	16.00	16.23	16.12	>100	81	175.85	II
BH97	17.50	17.70	17.60	>100	81	174.36	II
BH97	19.00	19.22	19.11	>100	81	172.85	II
BH97	20.50	20.70	20.60	>100	81	171.36	II
BH97	22.00	22.24	22.12	>100	81	169.84	II
BH97	23.50	23.73	23.62	>100	81	168.35	II
BH97	25.00	25.21	25.11	>100	81	166.86	II
BH97	26.50	26.70	26.60	>100	81	165.36	II
BH97	27.50	27.69	27.60	>100	81	164.37	II
BH97	29.00	29.20	29.10	>100	81	162.86	II

CORRECTION FOR STANDARD PENETRATION TEST VALUES

Bore Hole No:	Starting Depth (M)	Ending Depth (M)	Average Depth (M)	Field 'N' Values	Cor. 'N' for Overburden Pressure	Reduced Level (M)	Stratum
BH97	30.50	30.68	30.59	>100	81	161.37	II
BH97	32.00	32.17	32.09	>100	81	159.88	II
BH97	33.50	33.70	33.60	>100	81	158.36	II
BH97	35.00	35.18	35.09	>100	81	156.87	II
BH97	36.50	36.67	36.59	>100	81	155.38	II
BH97	38.00	38.12	38.06	>100	81	153.90	II
BH97	39.00	39.09	39.05	>100	81	152.92	II
BH97	40.00	40.12	40.06	>100	81	151.90	II
BH98	1.00	1.45	1.23	27	39	194.94	I
BH98	2.45	2.90	2.68	38	46	193.49	I
BH98	3.95	4.40	4.18	47	50	191.99	I
BH98	5.55	6.00	5.78	57	56	190.39	II
BH98	6.95	7.40	7.18	48	43	188.99	II
BH98	8.55	9.00	8.78	71	60	187.39	II
BH98	10.00	10.45	10.23	62	50	185.94	II
BH98	11.50	11.95	11.73	54	41	184.44	II
BH98	13.00	13.45	13.23	97	70	182.94	II
BH98	14.50	14.89	14.70	>100	68	181.47	II
BH98	16.00	16.41	16.21	>100	68	179.96	II
BH98	17.50	17.88	17.69	>100	68	178.47	II
BH98	19.00	19.39	19.20	>100	68	176.97	II
BH98	20.50	20.87	20.69	>100	68	175.48	II
BH98	22.00	22.38	22.19	>100	68	173.97	II
BH98	23.50	23.95	23.73	54	27	172.44	II
BH98	25.00	25.45	25.23	75	37	170.94	II
BH98	26.50	26.95	26.73	83	39	169.44	II
BH98	28.00	28.45	28.23	94	42	167.94	II
BH98	29.50	29.87	29.69	>100	68	166.48	II
BH98	31.00	31.32	31.16	>100	68	165.00	II
BH98	32.50	32.78	32.64	>100	68	163.52	II
BH98	34.00	34.26	34.13	>100	68	162.03	II
BH98	35.50	35.72	35.61	>100	68	160.55	II
BH98	37.00	37.20	37.10	>100	68	159.06	II
BH98	38.50	38.67	38.59	>100	68	157.58	II
BH98	40.04	40.08	40.06	>100	68	156.10	II
BH99	1.00	1.45	1.23	21	31	193.68	I
BH99	2.45	2.90	2.68	22	26	192.23	I
BH99	3.95	4.40	4.18	25	27	190.73	I
BH99	5.45	5.90	5.68	32	31	189.23	I
BH99	7.10	7.55	7.33	52	47	187.58	II
BH99	8.50	8.95	8.73	92	78	186.18	II
BH99	9.00	9.45	9.23	99	82	185.68	II
BH99	10.00	10.45	10.23	100	80	184.68	II
BH99	11.50	11.88	11.69	>100	80	183.21	II
BH99	13.00	13.36	13.18	>100	80	181.72	II
BH99	14.50	14.84	14.67	>100	80	180.23	II

CORRECTION FOR STANDARD PENETRATION TEST VALUES

Bore Hole No:	Starting Depth (M)	Ending Depth (M)	Average Depth (M)	Field 'N' Values	Cor. 'N' for Overburden Pressure	Reduced Level (M)	Stratum
BH99	16.00	16.32	16.16	>100	80	178.74	II
BH99	17.50	17.74	17.62	>100	80	177.28	II
BH99	19.00	19.21	19.11	>100	80	175.80	II
BH99	20.50	20.70	20.60	>100	80	174.30	II
BH99	22.00	22.23	22.12	>100	80	172.79	II
BH99	23.50	23.69	23.60	>100	80	171.31	II
BH99	25.00	25.18	25.09	>100	80	169.81	II
BH99	26.50	26.72	26.61	>100	80	168.29	II
BH99	28.00	28.24	28.12	>100	80	166.78	II
BH99	29.50	29.73	29.62	>100	80	165.29	II
BH99	31.00	31.20	31.10	>100	80	163.80	II
BH99	32.50	32.68	32.59	>100	80	162.31	II
BH99	34.00	34.19	34.10	>100	80	160.81	II
BH99	35.50	35.72	35.61	>100	80	159.29	II
BH99	37.00	37.21	37.11	>100	80	157.80	II
BH99	38.50	38.69	38.60	>100	80	156.31	II
BH99	40.10	40.14	40.12	>100	80	154.78	II
BH100	1.00	1.45	1.23	18	26	195.12	I
BH100	2.45	2.90	2.68	31	37	193.67	I
BH100	3.95	4.40	4.18	43	46	192.17	I
BH100	5.55	6.00	5.78	48	47	190.57	I
BH100	6.95	7.40	7.18	50	45	189.17	I
BH100	8.55	9.00	8.78	59	50	187.57	II
BH100	9.50	9.95	9.73	66	54	186.62	II
BH100	11.00	11.45	11.23	69	53	185.12	II
BH100	12.50	12.95	12.73	78	57	183.62	II
BH100	14.00	14.45	14.23	100	70	182.12	II
BH100	15.50	15.82	15.66	>100	70	180.68	II
BH100	17.00	17.28	17.14	>100	70	179.20	II
BH100	18.50	18.90	18.70	>100	70	177.64	II
BH100	20.00	20.37	20.19	>100	70	176.16	II
BH100	21.50	21.75	21.63	>100	70	174.72	II
BH100	23.00	23.26	23.13	>100	70	173.21	II
BH100	24.50	24.73	24.62	>100	70	171.73	II
BH100	26.00	26.21	26.11	>100	70	170.24	II
BH100	27.50	27.68	27.59	>100	70	168.75	II
BH100	29.00	29.11	29.06	>100	70	167.29	II
BH100	30.50	30.59	30.55	>100	70	165.80	II
BH100	32.00	32.10	32.05	>100	70	164.29	II
BH100	33.50	33.58	33.54	>100	70	162.80	II
BH100	35.00	35.09	35.05	>100	70	161.30	II
BH100	36.50	36.57	36.54	>100	70	159.81	II
BH100	38.00	38.07	38.04	>100	70	158.31	II
BH100	39.00	39.08	39.04	>100	70	157.30	II
BH100	40.06	40.26	40.16	>100	70	156.18	II
BH101	1.00	1.45	1.23	20	29	192.98	I
BH101	2.45	2.90	2.68	24	29	191.53	I

CORRECTION FOR STANDARD PENETRATION TEST VALUES

Bore Hole No:	Starting Depth (M)	Ending Depth (M)	Average Depth (M)	Field 'N' Values	Cor. 'N' for Overburden Pressure	Reduced Level (M)	Stratum
BH101	3.95	4.40	4.18	28	30	190.03	I
BH101	5.45	5.90	5.68	34	33	188.53	I
BH101	7.10	7.55	7.33	40	36	186.88	I
BH101	9.10	9.55	9.33	60	50	184.88	II
BH101	10.50	10.95	10.73	90	71	183.48	II
BH101	12.00	12.38	12.19	>100	75	182.01	II
BH101	13.50	13.71	13.61	>100	75	180.60	II
BH101	15.00	15.32	15.16	>100	75	179.04	II
BH101	16.50	16.78	16.64	>100	75	177.56	II
BH101	18.00	18.25	18.13	>100	75	176.08	II
BH101	19.50	19.74	19.62	>100	75	174.58	II
BH101	21.00	21.26	21.13	>100	75	173.07	II
BH101	22.50	22.73	22.62	>100	75	171.59	II
BH101	24.00	24.28	24.14	>100	75	170.06	II
BH101	25.50	25.70	25.60	>100	75	168.60	II
BH101	27.00	27.27	27.14	>100	75	167.07	II
BH101	28.50	28.70	28.60	>100	75	165.60	II
BH101	30.00	30.21	30.11	>100	75	164.10	II
BH101	31.50	31.69	31.60	>100	75	162.61	II
BH101	33.00	33.18	33.09	>100	75	161.11	II
BH101	34.50	34.67	34.59	>100	75	159.62	II
BH101	36.00	36.14	36.07	>100	75	158.13	II
BH101	37.50	37.63	37.57	>100	75	156.64	II
BH101	39.00	39.11	39.06	>100	75	155.15	II
BH101	40.05	40.08	40.07	>100	75	154.14	II
BH102	1.00	1.45	1.23	14	20	195.64	I
BH102	2.45	2.90	2.68	26	31	194.19	I
BH102	3.95	4.40	4.18	39	42	192.69	I
BH102	5.45	5.90	5.68	59	58	191.19	II
BH102	6.45	6.90	6.68	61	57	190.19	II
BH102	7.00	7.45	7.23	69	62	189.64	II
BH102	8.00	8.45	8.23	82	71	188.64	II
BH102	9.00	9.45	9.23	96	80	187.64	II
BH102	10.00	10.45	10.23	96	77	186.64	II
BH102	11.50	11.78	11.64	>100	76	185.22	II
BH102	13.00	13.27	13.14	>100	76	183.73	II
BH102	14.50	14.77	14.64	>100	76	182.23	II
BH102	16.00	16.26	16.13	>100	76	180.73	II
BH102	17.50	17.77	17.64	>100	76	179.23	II
BH102	19.00	19.25	19.13	>100	76	177.74	II
BH102	20.50	20.76	20.63	>100	76	176.23	II
BH102	22.00	22.25	22.13	>100	76	174.74	II
BH102	23.50	23.74	23.62	>100	76	173.24	II
BH102	25.00	25.22	25.11	>100	76	171.75	II
BH102	26.50	26.71	26.61	>100	76	170.26	II
BH102	28.00	28.23	28.12	>100	76	168.75	II
BH102	29.50	29.72	29.61	>100	76	167.25	II
BH102	31.00	31.18	31.09	>100	76	165.77	II

CORRECTION FOR STANDARD PENETRATION TEST VALUES

Bore Hole No:	Starting Depth (M)	Ending Depth (M)	Average Depth (M)	Field 'N' Values	Cor. 'N' for Overburden Pressure	Reduced Level (M)	Stratum
BH102	32.50	32.69	32.60	>100	76	164.27	II
BH102	34.00	34.17	34.09	>100	76	162.78	II
BH102	35.50	35.63	35.57	>100	76	161.30	II
BH102	37.00	37.10	37.05	>100	76	159.81	II
BH102	38.50	38.61	38.56	>100	76	158.31	II
BH103	1.00	1.45	1.23	28	41	192.85	I
BH103	2.45	2.90	2.68	31	37	191.40	I
BH103	3.95	4.40	4.18	46	49	189.90	I
BH103	5.45	5.90	5.68	51	50	188.40	II
BH103	6.50	6.95	6.73	58	54	187.35	II
BH103	7.05	7.50	7.28	63	57	186.80	II
BH103	8.00	8.45	8.23	90	78	185.85	II
BH103	9.00	9.45	9.23	97	81	184.85	II
BH103	10.00	10.42	10.21	>100	80	183.86	II
BH103	11.50	11.90	11.70	>100	80	182.37	II
BH103	13.00	13.38	13.19	>100	80	180.88	II
BH103	14.50	14.82	14.66	>100	80	179.41	II
BH103	16.00	16.29	16.15	>100	80	177.93	II
BH103	18.50	18.76	18.63	>100	80	175.44	II
BH103	20.00	20.25	20.13	>100	80	173.95	II
BH103	21.50	21.74	21.62	>100	80	172.45	II
BH103	23.00	23.19	23.10	>100	80	170.98	II
BH103	24.50	24.68	24.59	>100	80	169.48	II
BH103	26.00	26.19	26.10	>100	80	167.98	II
BH103	27.50	27.67	27.59	>100	80	166.49	II
BH103	29.00	29.18	29.09	>100	80	164.98	II
BH103	30.50	30.68	30.59	>100	80	163.48	II
BH103	32.00	32.14	32.07	>100	80	162.00	II
BH103	33.50	33.62	33.56	>100	80	160.51	II
BH103	35.00	35.13	35.07	>100	80	159.01	II
BH103	36.50	36.61	36.56	>100	80	157.52	II
BH103	38.00	38.12	38.06	>100	80	156.01	II
BH103	39.00	39.10	39.05	>100	80	155.02	II
BH103	40.00	40.09	40.05	>100	80	154.03	II
BH104	1.00	1.45	1.23	17	25	195.86	I
BH104	2.45	2.90	2.68	22	26	194.41	I
BH104	3.95	4.40	4.18	27	29	192.91	I
BH104	5.55	6.00	5.78	42	41	191.31	I
BH104	6.95	7.40	7.18	43	39	189.91	I
BH104	8.50	8.95	8.73	58	49	188.36	II
BH104	9.50	9.95	9.73	81	66	187.36	II
BH104	11.00	11.45	11.23	92	71	185.86	II
BH104	12.50	12.95	12.73	>100	73	184.36	II
BH104	14.00	14.40	14.20	>100	73	182.88	II
BH104	15.50	15.91	15.71	>100	73	181.38	II

CORRECTION FOR STANDARD PENETRATION TEST VALUES

Bore Hole No:	Starting Depth (M)	Ending Depth (M)	Average Depth (M)	Field 'N' Values	Cor. 'N' for Overburden Pressure	Reduced Level (M)	Stratum
BH104	17.00	17.23	17.12	>100	73	179.97	II
BH104	18.50	18.86	18.68	>100	73	178.40	II
BH104	20.00	20.32	20.16	>100	73	176.92	II
BH104	21.50	21.83	21.67	>100	73	175.42	II
BH104	23.00	23.29	23.15	>100	73	173.94	II
BH104	24.50	24.77	24.64	>100	73	172.45	II
BH104	26.00	26.25	26.13	>100	73	170.96	II
BH104	27.50	27.74	27.62	>100	73	169.46	II
BH104	29.00	29.20	29.10	>100	73	167.98	II
BH104	30.50	30.58	30.54	>100	73	166.54	II
BH104	32.00	32.07	32.04	>100	73	165.05	II
BH104	33.50	33.57	33.54	>100	73	163.55	II
BH104	35.00	35.06	35.03	>100	73	162.05	II
BH104	36.50	36.54	36.52	>100	73	160.56	II
BH104	38.00	38.06	38.03	>100	73	159.05	II
BH104	39.00	39.05	39.03	>100	73	158.06	II
BH104	40.05	40.20	40.13	>100	73	156.96	II

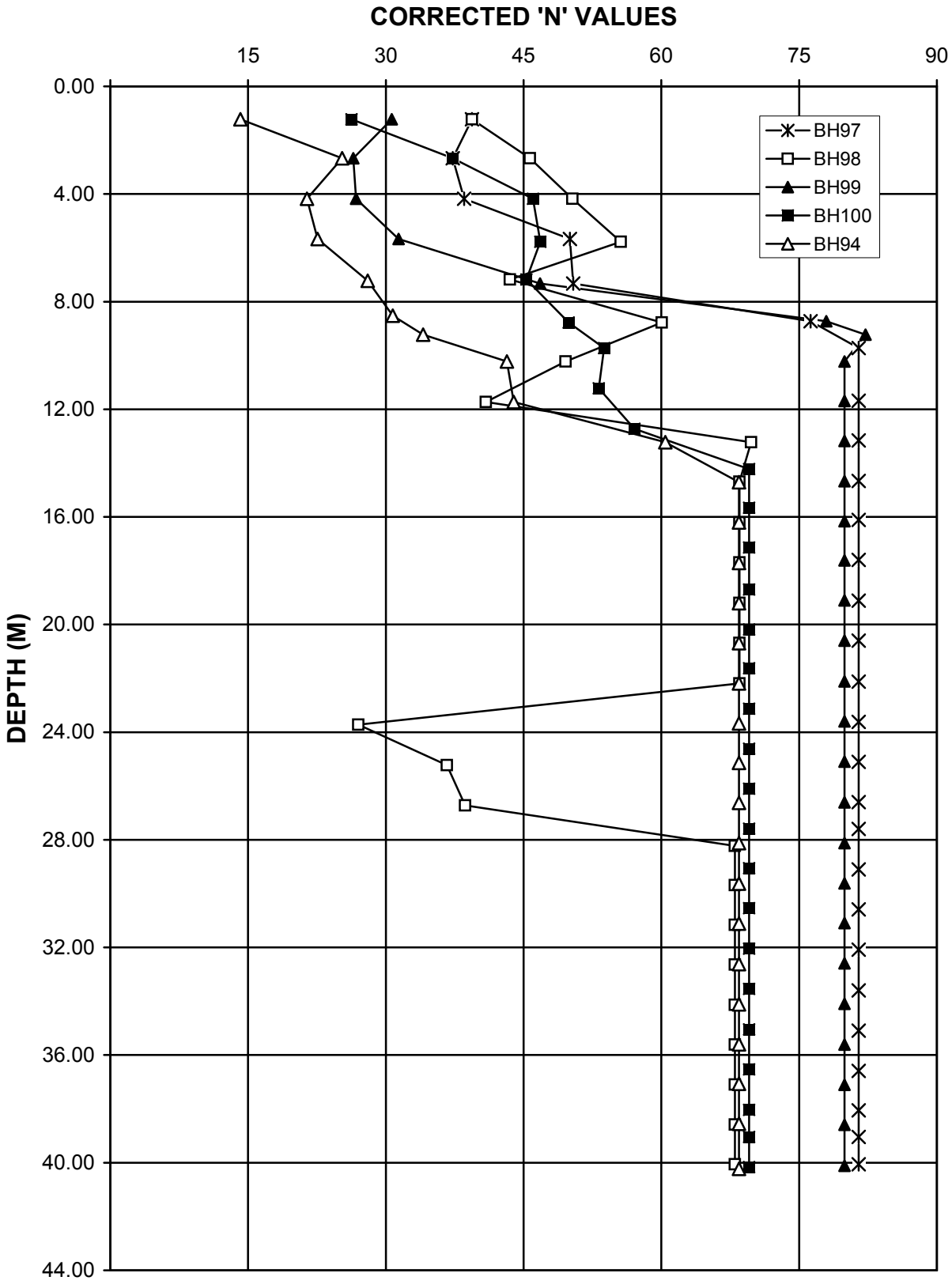


FIG. 3.1 CORRECTED 'N' Vs DEPTH PLOT

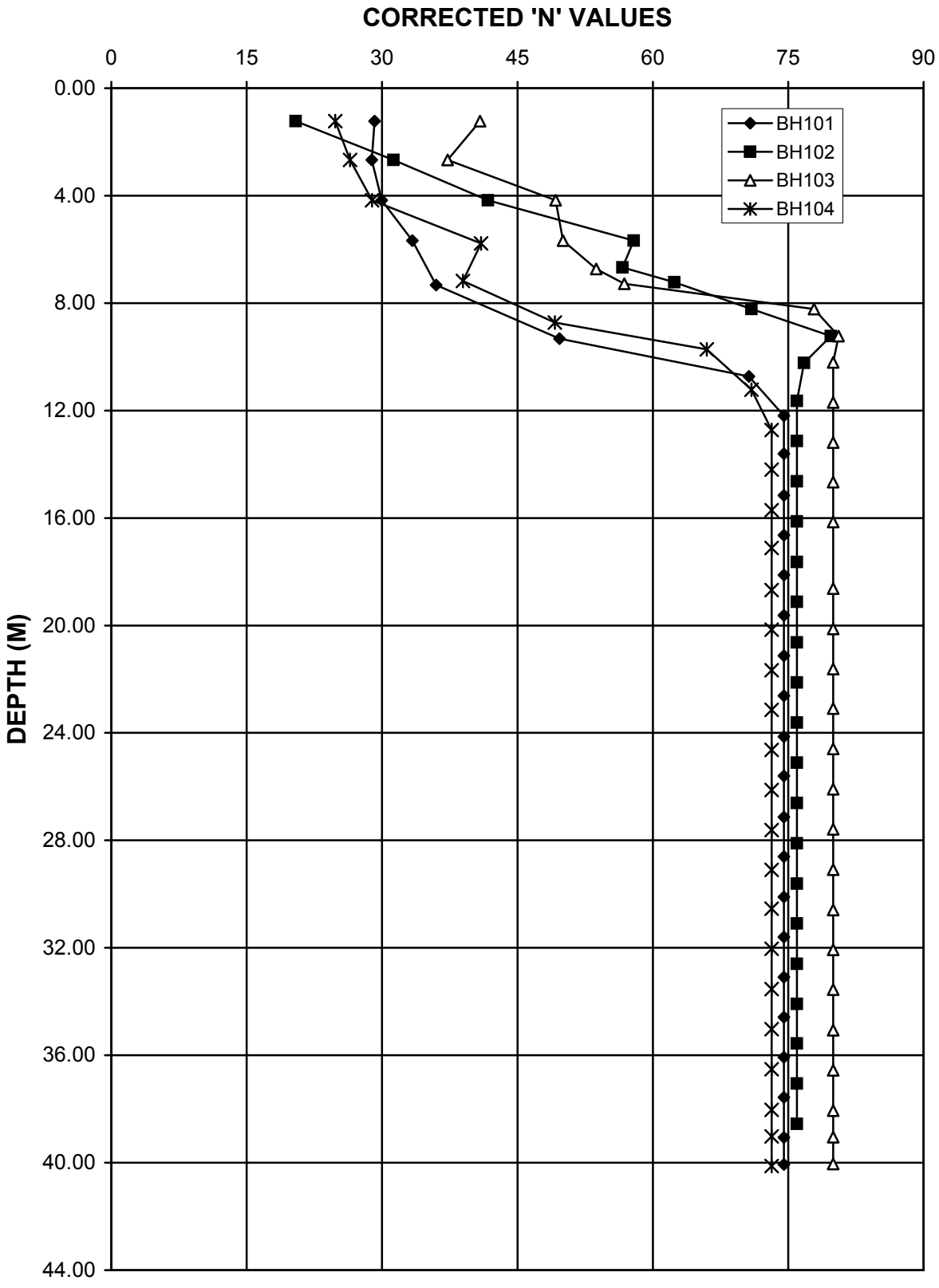


FIG. 3.2 CORRECTED 'N' Vs DEPTH PLOT

A list of the bore holes with the Co-ordinates, reduced level and standing water level are presented in tabular form below.

Location	BH No.	Co-ordinates (M)			Terminating Depth (m)	Depth of Water Table (m)
		E	N	G.L.		
Chimney, Power House, Boiler & Mill Bunker Area	BH-94	658.000	(-)3744.000	193.432	40.27	Not Found
	BH-97	860.000	(-)3834.000	191.960	40.12	Not Found
	BH-98	853.000	(-)3656.000	196.160	40.08	Not Found
	BH-99	864.000	(-)3800.000	194.900	40.14	Not Found
	BH-100	868.000	(-)3697.000	196.340	40.26	Not Found
	BH-101	930.000	(-)3805.000	194.200	40.05	Not Found
	BH-102	933.000	(-)3708.000	196.860	39.50	Not Found
	BH-103	941.000	(-)3776.000	194.070	40.09	Not Found
	BH-104	930.000	(-)3663.000	197.080	40.20	Not Found

3. SUB-SOIL STRATIFICATIONS:

The subsoils in general are of good quality. The subsoil is characterised by a medium dense to dense silty sand layer. Underlying the above, a very dense, silty sand layer was struck and that continues upto the terminating depth of all the boreholes. The description of each layer along with its average properties is presented below.

3.1. STRATUM – I :

The soil in this layer consists of medium dense to dense, greyish brown / yellowish brown, silty fine sand. Mica and sand pieces have also been observed in this layer. The average soil properties of this layer so found from routine laboratory tests on some 'UDS' as well as SPT samples are presented below.

Bulk Density, gms/cc	1.91	Specific gravity	2.66
Dry Density, gms/cc	1.65		
Natural Water Content, %	16	**GRAIN SIZE**	
DRSH-CQ:		Sand %	88
Cohesion kg/sqcm	0.16	Silt %	10
Friction angle °	34	Clay %	02

3.2. STRATUM – II :

This layer continues upto the terminating depth of all the boreholes and the soil in this layer is characterized by very dense, greyish brown to yellowish brown, silty fine sand with sand stone pieces & mica. The soil properties of this layer so found from routine laboratory tests on an 'UDS' and some SPT samples are presented below.

Bulk Density, gms/cc	1.93	Specific gravity	2.68
Dry Density, gms/cc	1.71		
Natural Water Content, %	13	**GRAIN SIZE**	
DRSH-CQ:		Sand %	92
Cohesion kg/sqcm	0.17	Silt %	08
Friction angle °	36	Clay %	00

4. DISCUSSION:

Considering the nature of the subsoil and the type of structures to be constructed at the present site, it is suggested to go for open foundation. The foundation may be placed at a depth of 1.00m or more below FGL depending on structural requirement and foundation location.

The determination of bearing capacity is presented in the following section.

4.1. FOUNDATION AROUND CHIMNEY AREA:

Let us place the foundation at 2.00m below FGL (FGL = 193.00M).

Founding level falls inside Stratum-I.

Average Corrected "N" = 22, corresponding ϕ = 34° (as per IS 6403)

Again, The average fine content of the stratum-I is 12%

So, as per Meyerhof, granular soil with fine content more than 5%,

$\phi = 25 + 0.15D_r = 25 + 0.15 \times 53$ (D_r = 53% for corrected "N" = 22)

$= 32.95°$

Again, from laboratory Direct shear tests, average C = 0.16 kg/sqcm & Φ = 34°

Considering all the above, neglecting cohesion value, use design Φ = 32°

Calculation of Safe Bearing Capacity:

Use depth of foundation = 2.00M below FGL & size of footing = 6m x 6m

The Net Ultimate Bearing Capacity is given as:

$$q_{nu} = C.N_c.S_c.D_c + q\,(N_q-1)S_q.D_q. + 0.5\gamma.B.N_\gamma.S_\gamma.D_\gamma.W'$$

Where,

N_c, N_q and N_γ are bearing capacity factors,
S_c, S_q and S_γ are shape factors,
D_c, D_q and D_γ are depth factors,

And C = Cohesion
q = Effective Overburden pressure,
B = Width of foundation,
γ = Bulk density and
W' = Water Table correction factor = 1.00