Arki Techno Consultants (India) Pvt. Ltd

ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

GRAIN SIZE ANALYSIS OF SOIL AS PER IS 2720 (P- 4)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	30.0m	Tested by	:	D.Mohanty

Weight of oven dried sample before washing (gm) :- 100.00

Weight of oven dried sample after washing (gm) :- 27.79

Sieve Size mm	Individual Weight Retained in gm.	Individual Wt. Retained In %	Cummulative Wt Retained In %	Cummulative Wt Passing In %
75	0	0.00	0.00	100.00
50	0	0.00	0.00	100.00
37.5	0	0.00	0.00	100.00
19	0	0.00	0.00	100.00
4.75	7.98	7.98	7.98	92.02
2.00	9.84	9.84	17.82	82.18
0.425	6.75	6.75	24.57	75.43
0.075	3.22	3.22	27.79	72.21
Total	100.00			

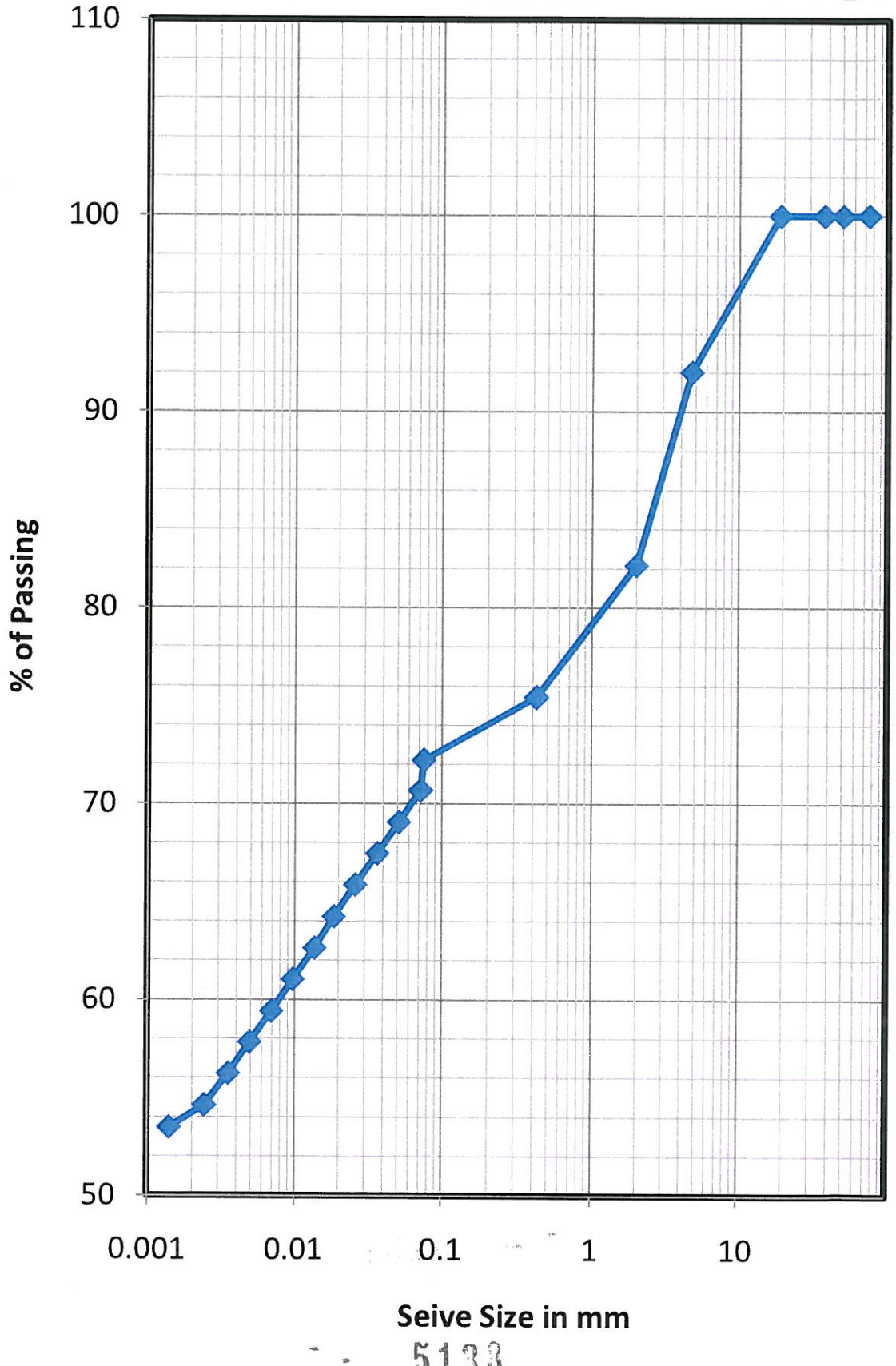
Gravel Content (%)= **7.98**

Sand Content (%) = 19.81 **Silt and clay %** 72.21

Remarks :-

5137

Grain Size Distribution Curve
BH-8,D-30.0m



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ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

GRAIN SIZE ANALYSIS OF SOIL AS PER IS 2720 (P- 4)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	36.0m	Tested by	:	D.Mohanty

Weight of oven dried sample before washing (gm) :- 100.00

Weight of oven dried sample after washing (gm) :- 90.36

Sieve Size mm	Individual Weight Retained in gm.	Individual Wt. Retained In %	Cummulative Wt Retained In %	Cummulative Wt Passing In %
75	0	0.00	0.00	100.00
50	0	0.00	0.00	100.00
37.5	0	0.00	0.00	100.00
19	0	0.00	0.00	100.00
4.75	13.22	13.22	13.22	86.78
2.00	32.84	32.84	46.06	53.94
0.425	27.45	27.45	73.51	26.49
0.075	16.85	16.85	90.36	9.64
Total	100.00			

Gravel Content (%)= **13.22**

Sand Content (%) = 77.14 **Silt and clay %** 9.64

Remarks :-

5139

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ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

GRAIN SIZE ANALYSIS OF SOIL AS PER IS 2720 (P- 4)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	42.0m	Tested by	:	D.Mohanty

Weight of oven dried sample before washing (gm) :- 100.00

Weight of oven dried sample after washing (gm) :- 83.39

Sieve Size mm	Individual Weight Retained in gm.	Individual Wt. Retained In %	Cummulative Wt Retained In %	Cummulative Wt Passing In %
75	0	0.00	0.00	100.00
50	0	0.00	0.00	100.00
37.5	0	0.00	0.00	100.00
19	0	0.00	0.00	100.00
4.75	1.66	1.66	1.66	98.34
2.00	32.98	32.98	34.64	65.36
0.425	28.46	28.46	63.10	36.90
0.075	20.29	20.29	83.39	16.61
Total	100.00			

Gravel Content (%)= **1.66**

Sand Content (%) = 81.73 **Silt and clay %** 16.61

Remarks :-

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ARKI TECHNO CONSULTANTS (INDIA) PVT LTD

N 3/91, IRC Village, Bhubaneswar

GRAIN SIZE ANALYSIS OF SOIL - HYDROMETER METHOD

Client : DFCC

Project Name : G.I For 3 Nos. Important Bridges

Type of Sample : SPT

Location : BH-8(Yamuna River- Ambala)

Sampled by : Binayak Swain

Depth : 30.0m

Date of Testing : 21.05.2013

Tested by : D.Mohanty

(I)	Percentage of 75 micron passing (from sieve analysis)		72.21
(II)	Mass of dry soil passing 2mm sieve taken (gm)		50
(III)	Mass of dry soil retained on 75micron sieve (gm)		13.9
(IV)	Mass of dry soil passing 75 micron Wh (gm)		36.1
(V)	Specific gravity of soil grains, Gs		2.65
(VI)	Top Meniscus reading on hydrometer stem		2.0
(VII)	Bottom meniscus reading on hydrometer stem		2.5
(VIII)	Meniscuss correction, Cm = + [(VII) - (VI)]		0.5
a	Hydrometer No	1	
	Volume of Hydrometer V (cm3)	50	
	Height of bulb (h) in cm	16.5	
b	Sedimentation Jar No	1	
	Cross sectional area of jar (A) in cm2	35.714	

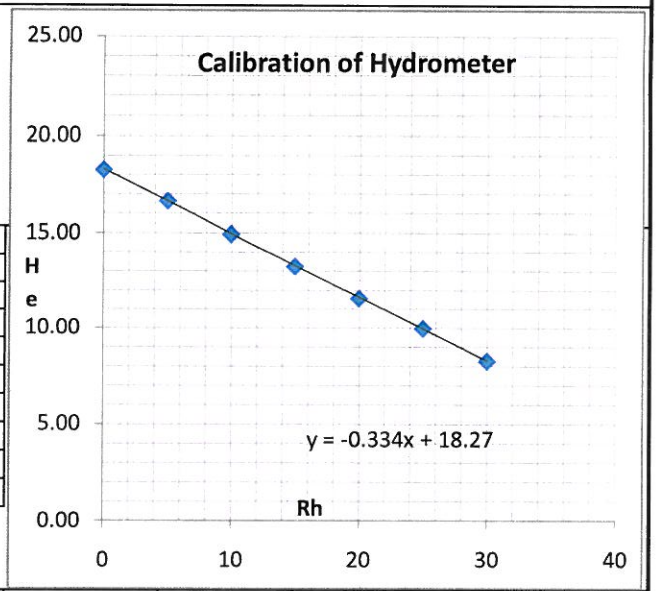
CALIBRATION OF HYDROMETER

(Rh)	H (cm)	He (cm)
30	0.7	8.25
25	2.4	9.95
20	4.0	11.55
15	5.7	13.25
10	7.4	14.95
5	9.1	16.65
0	10.7	18.25
-5	12.4	19.95

Rh = hydrometer Reading

H = height corresponding to Rh

He = Effective height = H + 0.5*(h -V/A)



Time	Elapsed Time (min)	Hydrometer Reading (Rh)	Temperature (o C)	Composite Correction +/- C	Effective depth h (cm)	Rc1 = Rh + Cm	Sqrt (h/t)	Viscosity (gm/cm2)	Factor M	Particle 'C' (cm) (8) x (10)	Rc2 = Rh + C (3) + (5)	Factor N	% Finner w.r.t Wd F (12) x (13)	% Finner w.r.t total mass (14) x (I)/100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10.30	0.5	24.00	29	-2.0	10.25	24.50	0.585	0.000008341	0.012314796	0.00719968	22.00	4.448	97.86	70.67
	1	23.50	29	-2.0	10.42	24.00	0.417	0.000008341	0.012314796	0.00513223	21.50	4.448	95.64	69.06
	2	23.00	29	-2.0	10.59	23.50	0.297	0.000008341	0.012314796	0.00365800	21.00	4.448	93.41	67.45
	4	22.50	29	-2.0	10.76	23.00	0.212	0.000008341	0.012314796	0.00260691	20.50	4.448	91.19	65.85
	8	22.00	29	-2.0	10.92	22.50	0.151	0.000008341	0.012314796	0.00185762	20.00	4.448	88.97	64.24
	15	21.50	29	-2.0	11.09	22.00	0.111	0.000008341	0.012314796	0.00136695	19.50	4.448	86.74	62.64
	30	21.00	29	-2.0	11.26	21.50	0.079	0.000008341	0.012314796	0.00097383	19.00	4.448	84.52	61.03
	60	20.50	29	-2.0	11.42	21.00	0.056	0.000008341	0.012314796	0.00069369	18.50	4.448	82.29	59.42
	120	20.00	29	-2.0	11.59	20.50	0.040	0.000008341	0.012314796	0.00049409	18.00	4.448	80.07	57.82
	240	19.50	29	-2.0	11.76	20.00	0.029	0.000008341	0.012314796	0.00035188	17.50	4.448	77.85	56.21
	480	19.00	32	-2.0	11.92	19.50	0.020	0.000007821	0.011924722	0.00024264	17.00	4.448	75.62	54.61
	1440	18.64	32	-2.0	12.04	19.14	0.012	0.000007821	0.011924722	0.000140787	16.64	4.448	74.03	53.46

Arki Techno Consultants (India) Pvt.Ltd

ARKITECHNO

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

IS : 2720 (Part -5)

Client : DFCC

Project Name : G.I For 3 Nos. Important Bridges

Type of Sample : SPT

Location : BH-8(Yamuna River-Ambala)

Depth : 1.5m

Date Of Testing : 20.05.2013

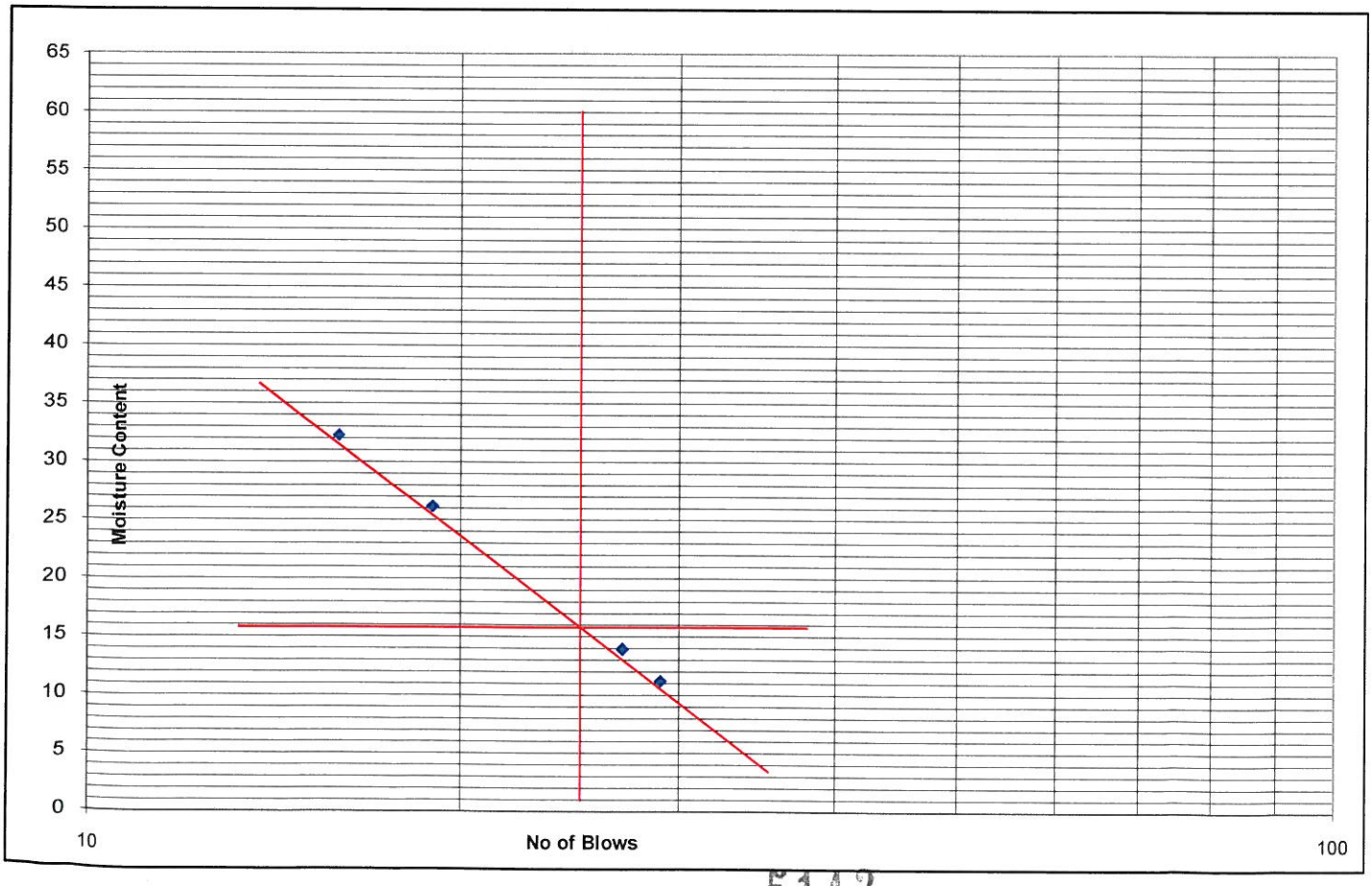
Sampled by : Binayak Swain

Tested by : D.Mohanty

Number of Blows	29	27	16	19	Plastic Limit	
Container No.	R1	R2	R3	R4		
Container Weight (gm) (W1)	35.41	36.62	34.15	33.52		
Container + Wt. of wet soil (gm) (W2)	82.59	96.20	102.65	101.32		
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25		
Wt. Of water (gm) (W2-W1)-(W3-W1)	4.76	7.29	16.71	14.07		
Wt. of oven dry soil (gm) (W3-W1)	42.43	52.30	51.79	53.73		
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**11.21**	**13.93**	**32.26**	**26.18**		

Result Summary

Liquid Limit (WL)	16	%
Plastic Limit (Wp)	NP	
Plasticity Index (Ip)	_	



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N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

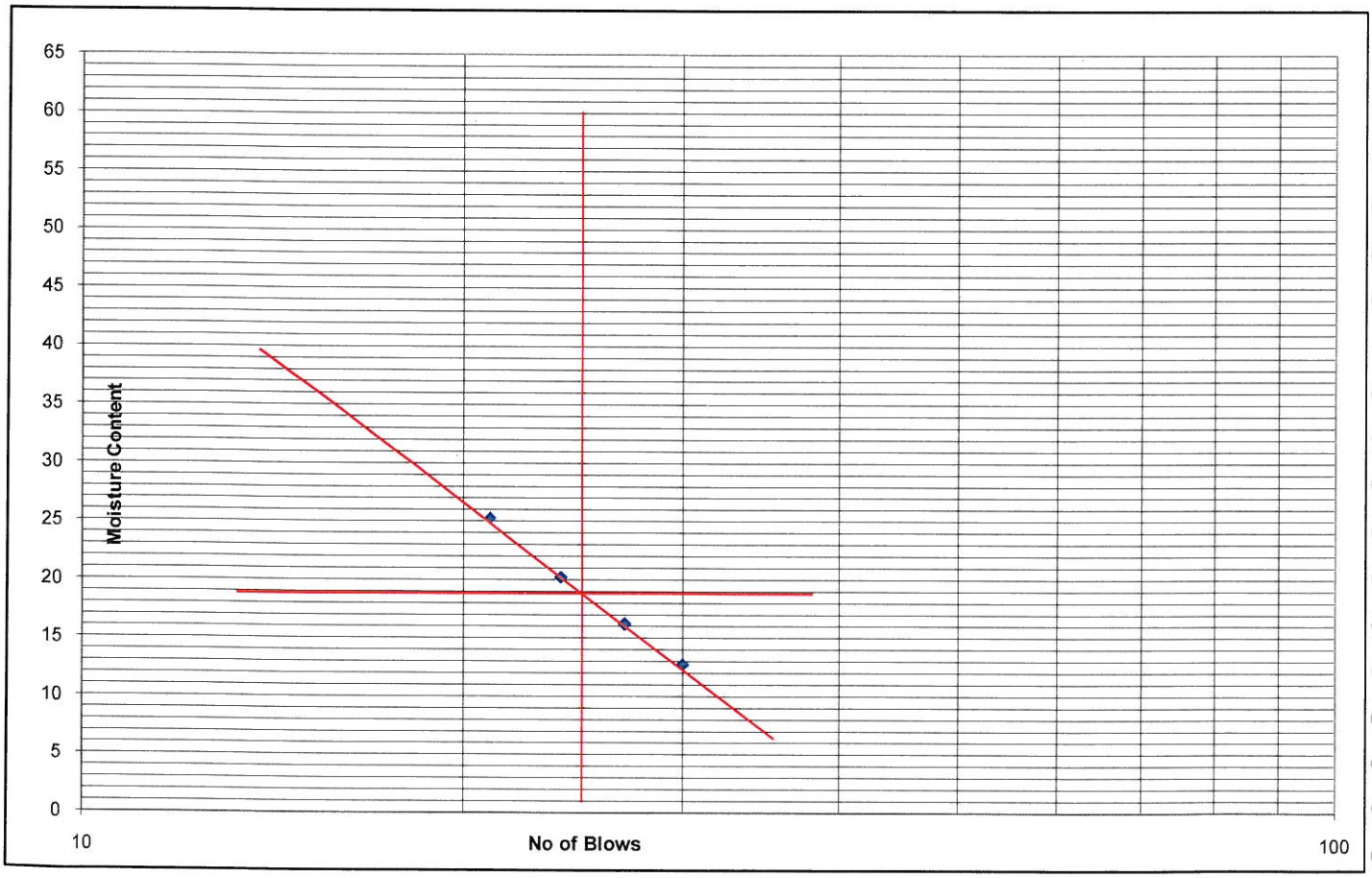
IS : 2720 (Part -5)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	3.0m	Tested by	:	D.Mohanty

Number of Blows	30	27	24	21	Plastic Limit	
Container No.	W1	W2	W3	W4		
Container Weight (gm) (W1)	32.52	34.15	33.63	35.58		
Container + Wt. of wet soil (gm) (W2)	83.62	97.79	96.52	100.32		
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25		
Wt. Of water (gm) (W2-W1)-(W3-W1)	5.78	8.88	10.57	13.07		
Wt. of oven dry soil (gm) (W3-W1)	45.32	54.77	52.31	51.67		
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**12.75**	**16.21**	**20.21**	**25.29**		

Result Summary

Liquid Limit (WL)	19	%
Plastic Limit (Wp)	NP	
Plasticity Index (Ip)	_	



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Arki Techno Consultants (India) Pvt.Ltd

ARKITECHNO

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

IS : 2720 (Part -5)

Client : DFCC

Project Name : G.I For 3 Nos. Important Bridges

Type of Sample : SPT — Date Of Testing : 20.05.2013

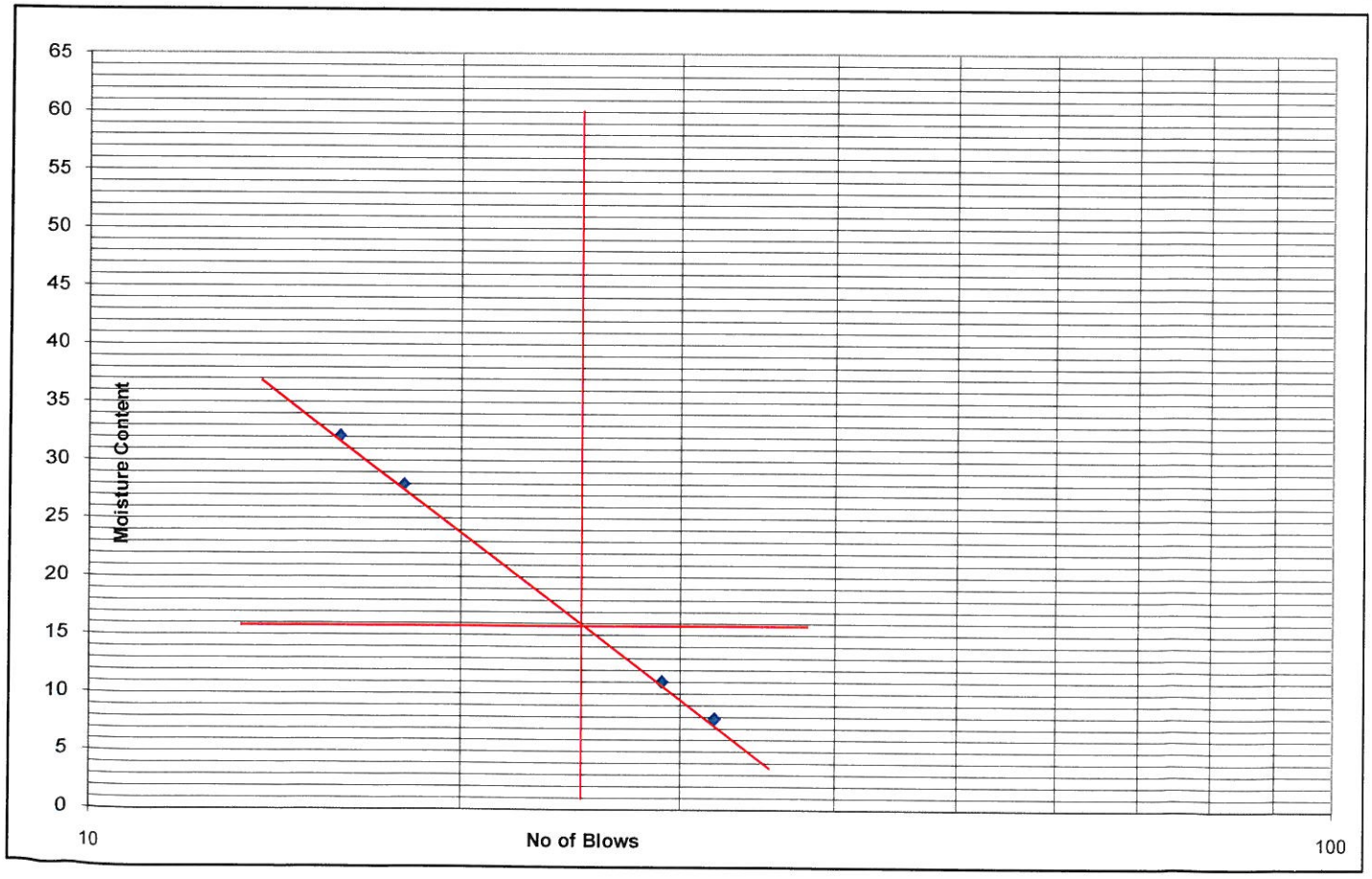
Location : BH-8(Yamuna River-Ambala) — Sampled by : Binayak Swain

Depth : 4.5m — Tested by : D.Mohanty

Number of Blows	32	29	18	16	Plastic Limit	
Container No.	D1	D2	D3	D4		
Container Weight (gm) (W1)	31.25	32.42	33.65	34.47		
Container + Wt. of wet soil (gm) (W2)	81.50	95.15	100.57	104.19		
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25		
Wt. Of water (gm) (W2-W1)-(W3-W1)	3.66	6.23	14.63	16.94		
Wt. of oven dry soil (gm) (W3-W1)	46.59	56.50	52.29	52.78		
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**7.85**	**11.03**	**27.98**	**32.09**		

Result Summary

Liquid Limit (WL)	16	%
Plastic Limit (Wp)	NP	
Plasticity Index (Ip)	_	



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ARKITECHNO

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

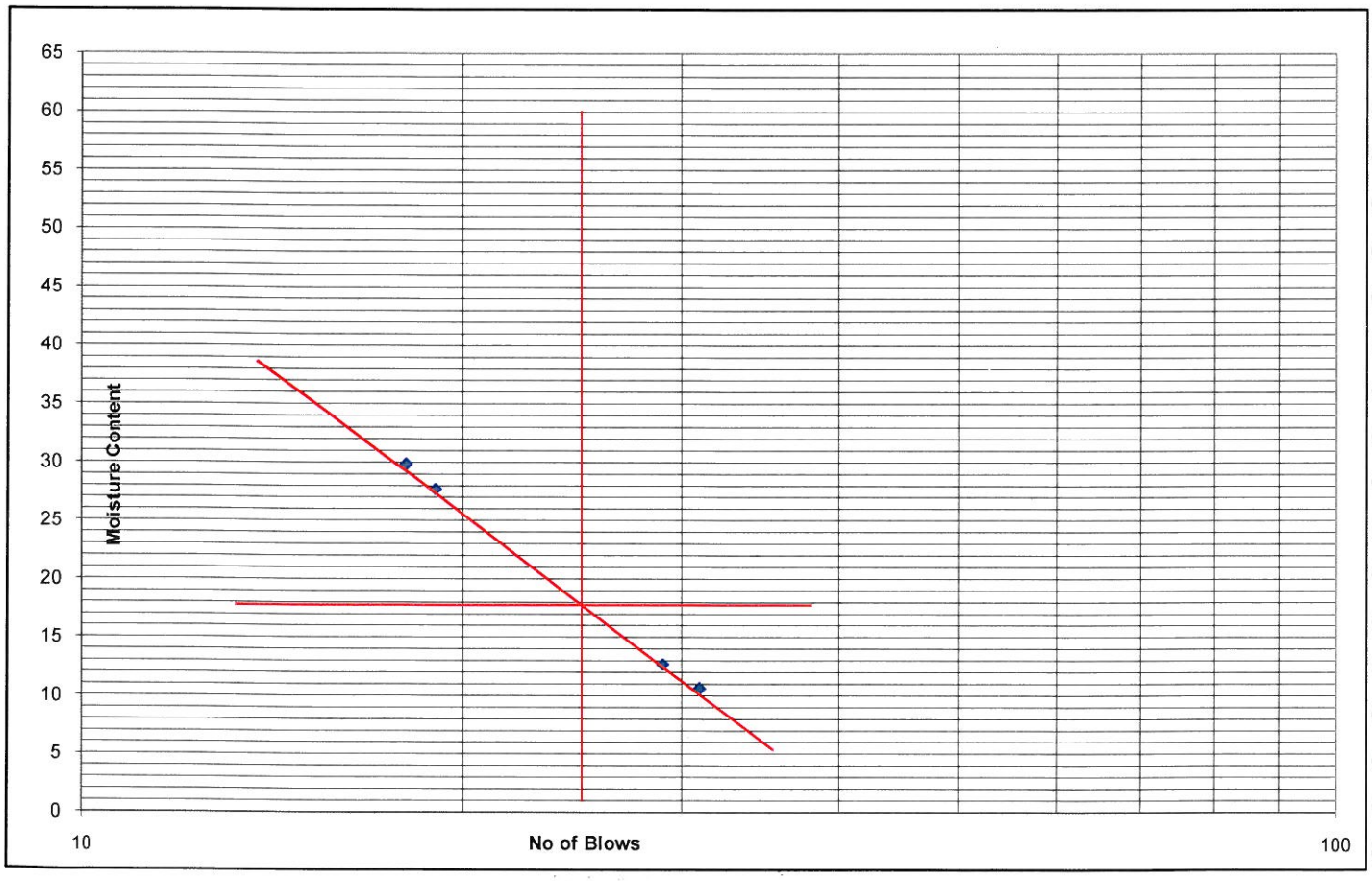
IS : 2720 (Part -5)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	10.5m	Tested by	:	D.Mohanty

Number of Blows	31	29	19	18	Plastic Limit	
Container No.	C7	C8	C9	C10		
Container Weight (gm) (W1)	32.58	37.21	33.14	35.42		
Container + Wt. of wet soil (gm) (W2)	82.64	95.49	100.57	102.71		
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25		
Wt. Of water (gm) (W2-W1)-(W3-W1)	4.81	6.57	14.63	15.45		
Wt. of oven dry soil (gm) (W3-W1)	45.26	51.71	52.80	51.83		
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**10.62**	**12.71**	**27.71**	**29.81**		

Result Summary

Liquid Limit (WL)	18	%
Plastic Limit (Wp)	NP	
Plasticity Index (Ip)	–	



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ARKITECHNO

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

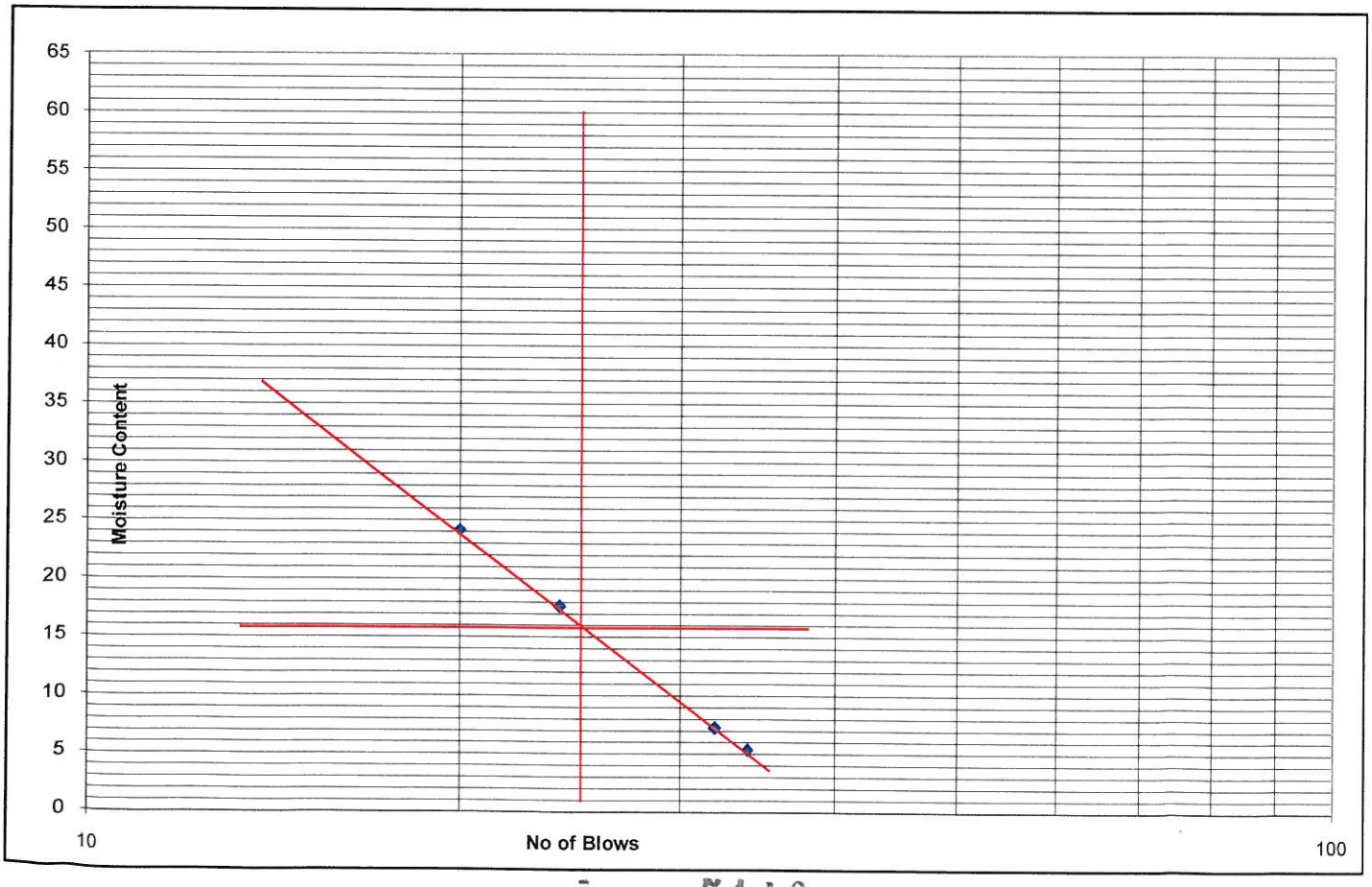
IS : 2720 (Part -5)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	12.0m	Tested by	:	D.Mohanty

Number of Blows	34	32	24	20	Plastic Limit	
Container No.	F1	F2	F3	F4		
Container Weight (gm) (W1)	30.25	33.24	34.18	32.74		
Container + Wt. of wet soil (gm) (W2)	80.40	92.98	95.08	100.44		
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25		
Wt. Of water (gm) (W2-W1)-(W3-W1)	2.57	4.06	9.14	13.18		
Wt. of oven dry soil (gm) (W3-W1)	47.59	55.68	51.76	54.51		
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**5.39**	**7.29**	**17.65**	**24.18**		

Result Summary

Liquid Limit (WL)	16	%
Plastic Limit (Wp)	NP	
Plasticity Index (Ip)	–	



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ARKITECHNO

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

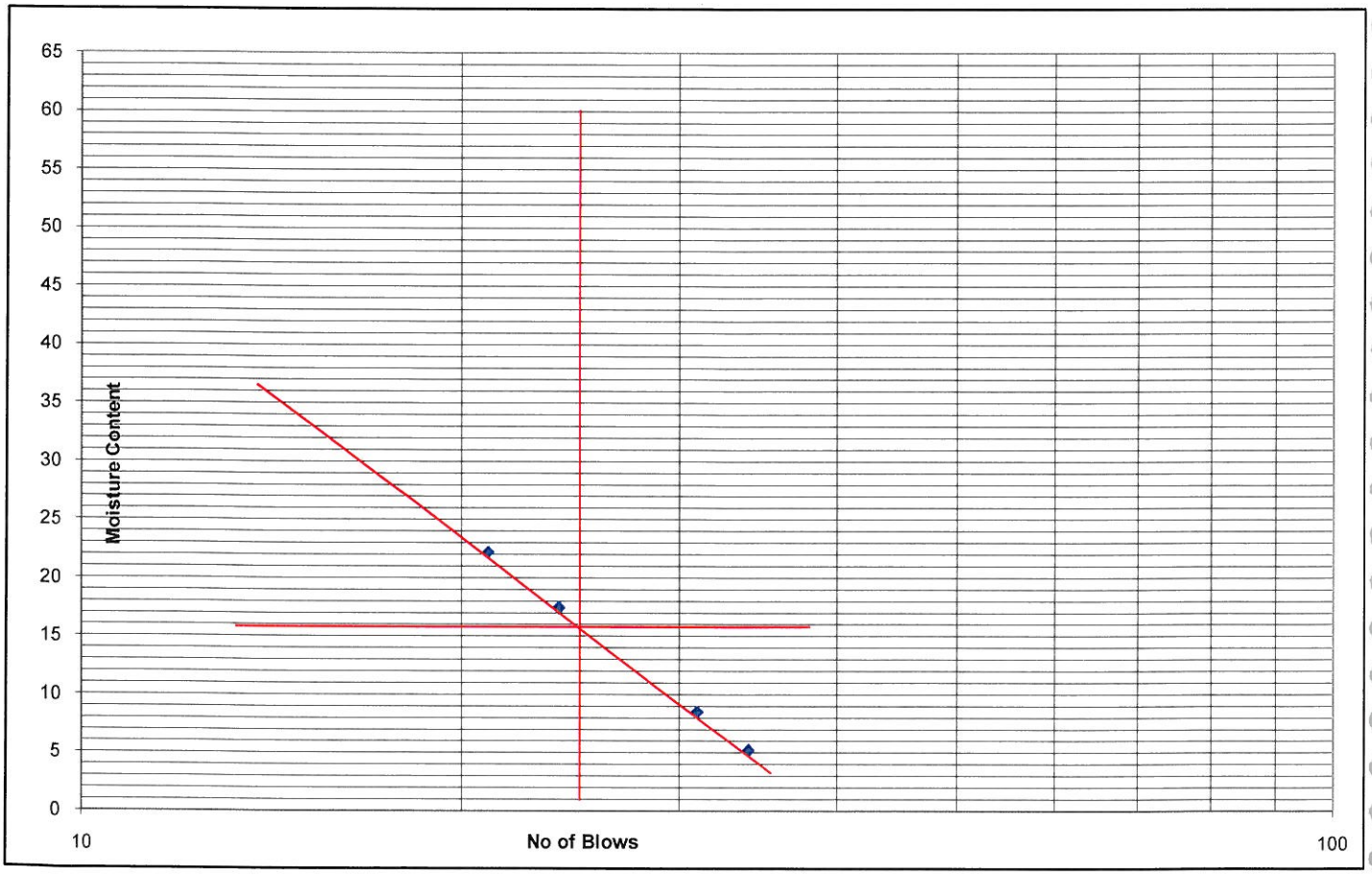
IS : 2720 (Part -5)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	18.0m	Tested by	:	D.Mohanty

Number of Blows	34	31	24	21	Plastic Limit	
Container No.	E1	E2	E3	E4		
Container Weight (gm) (W1)	32.26	3.41	34.58	33.29		
Container + Wt. of wet soil (gm) (W2)	80.21	96.20	94.89	99.24		
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25		
Wt. Of water (gm) (W2-W1)-(W3-W1)	2.37	7.29	8.95	11.99		
Wt. of oven dry soil (gm) (W3-W1)	45.58	85.51	51.36	53.96		
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**5.21**	**8.52**	**17.42**	**22.21**		

Result Summary

Liquid Limit (WL)	16	%
Plastic Limit (Wp)	NP	
Plasticity Index (Ip)	_	



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ARKITECHNO

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

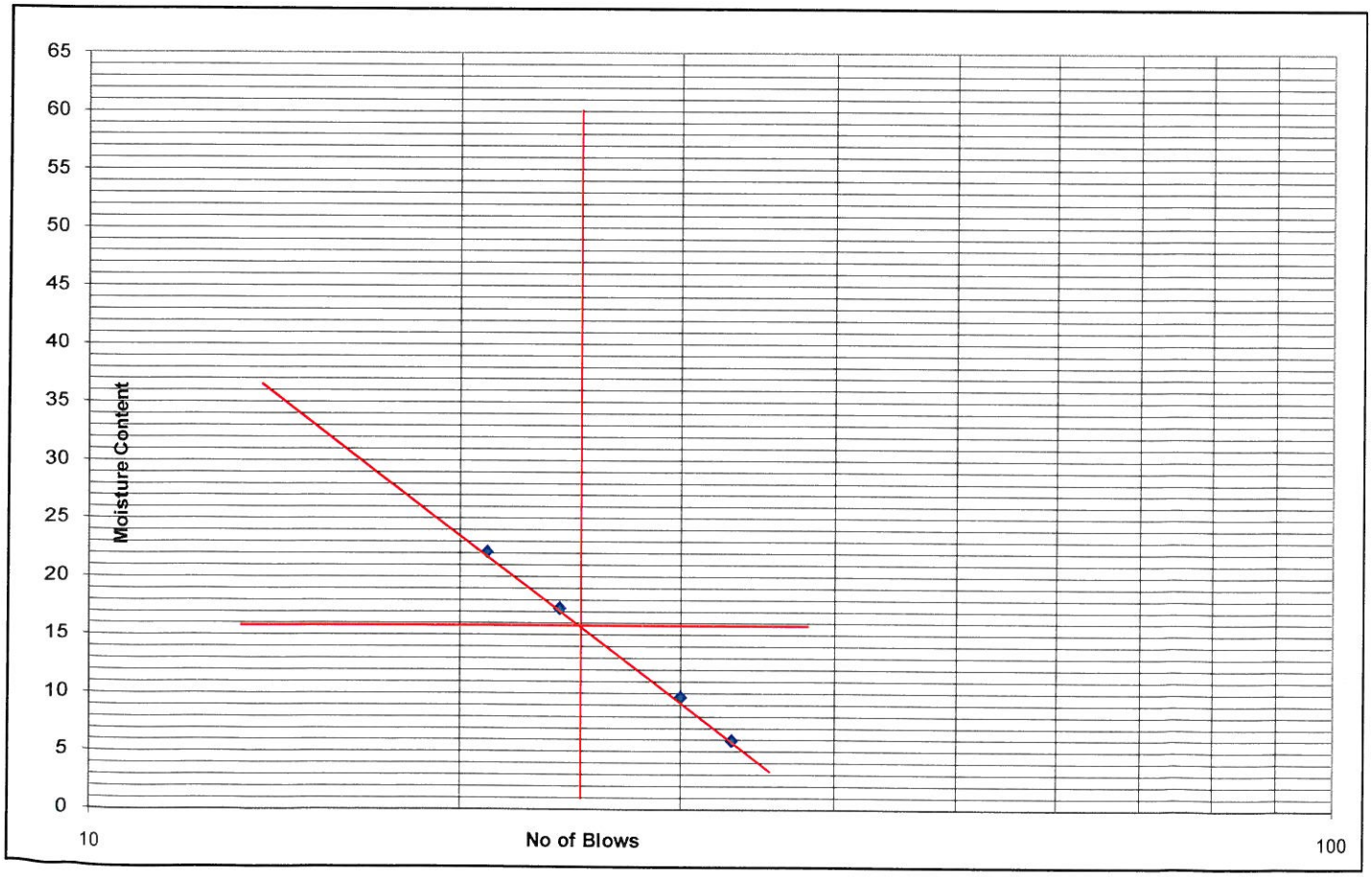
IS : 2720 (Part -5)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	21.0m	Tested by	:	D.Mohanty

Number of Blows	33	30	24	21	Plastic Limit	
Container No.	T1	T2	T3	T4		
Container Weight (gm) (W1)	36.63	35.12	34.18	32.95		
Container + Wt. of wet soil (gm) (W2)	80.29	94.11	94.89	99.24		
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25		
Wt. Of water (gm) (W2-W1)-(W3-W1)	2.46	5.19	8.95	11.99		
Wt. of oven dry soil (gm) (W3-W1)	41.21	53.80	51.76	54.30		
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**5.96**	**9.65**	**17.29**	**22.07**		

Result Summary

Liquid Limit (WL)	16	%
Plastic Limit (Wp)	NP	
Plasticity Index (Ip)	–	



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ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

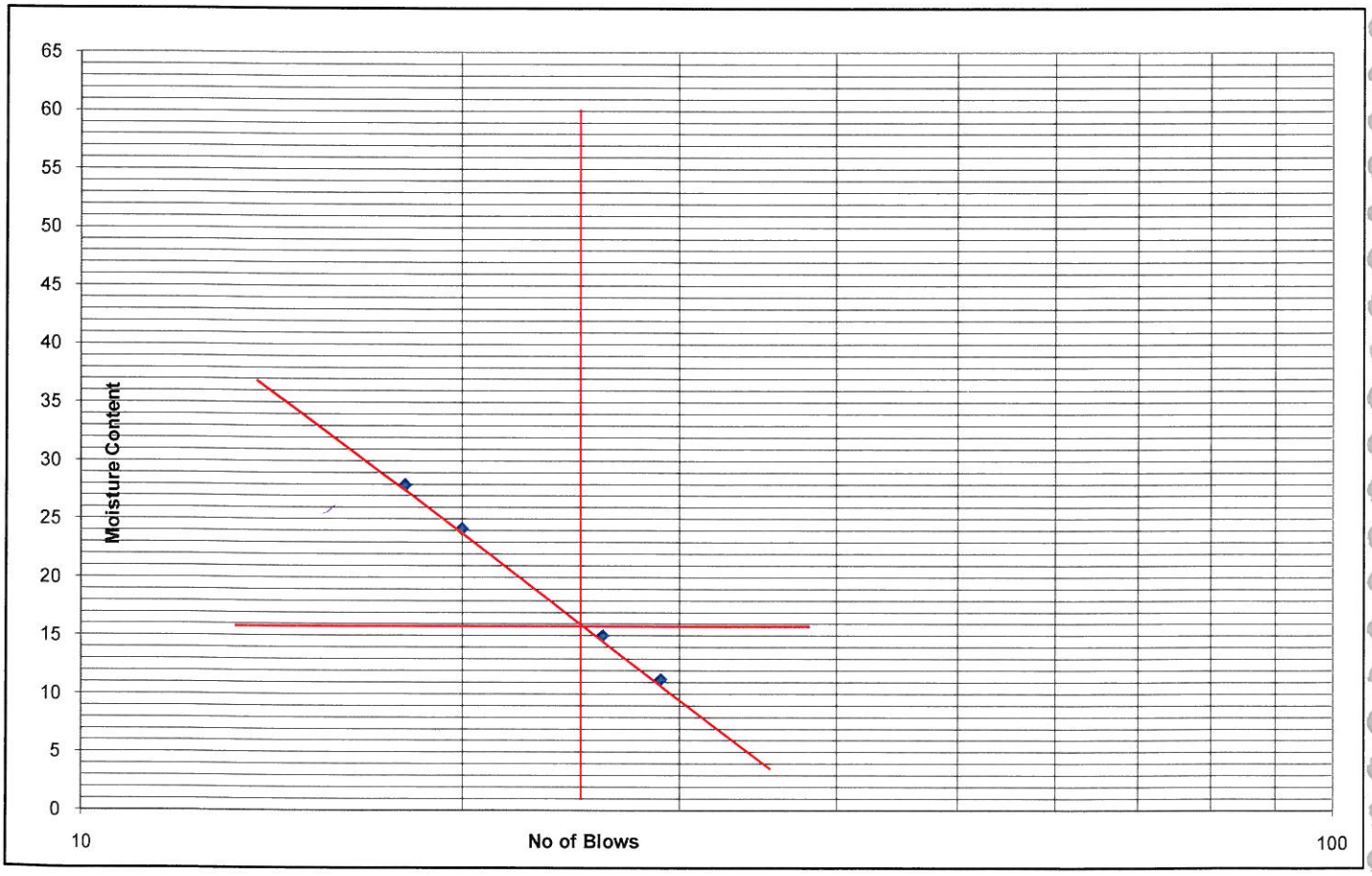
IS : 2720 (Part -5)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	24.0m	Tested by	:	D.Mohanty

Number of Blows	26	29	18	20	Plastic Limit	
Container No.	H1	H2	H3	H4		
Container Weight (gm) (W1)	31.45	32.28	35.85	33.65		
Container + Wt. of wet soil (gm) (W2)	84.81	95.31	99.92	100.20		
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25		
Wt. Of water (gm) (W2-W1)-(W3-W1)	6.97	6.39	13.98	12.95		
Wt. of oven dry soil (gm) (W3-W1)	46.39	56.64	50.09	53.60		
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**15.02**	**11.28**	**27.91**	**24.15**		

Result Summary

Liquid Limit (WL)	16	%
Plastic Limit (Wp)	NP	
Plasticity Index (Ip)	_	



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N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

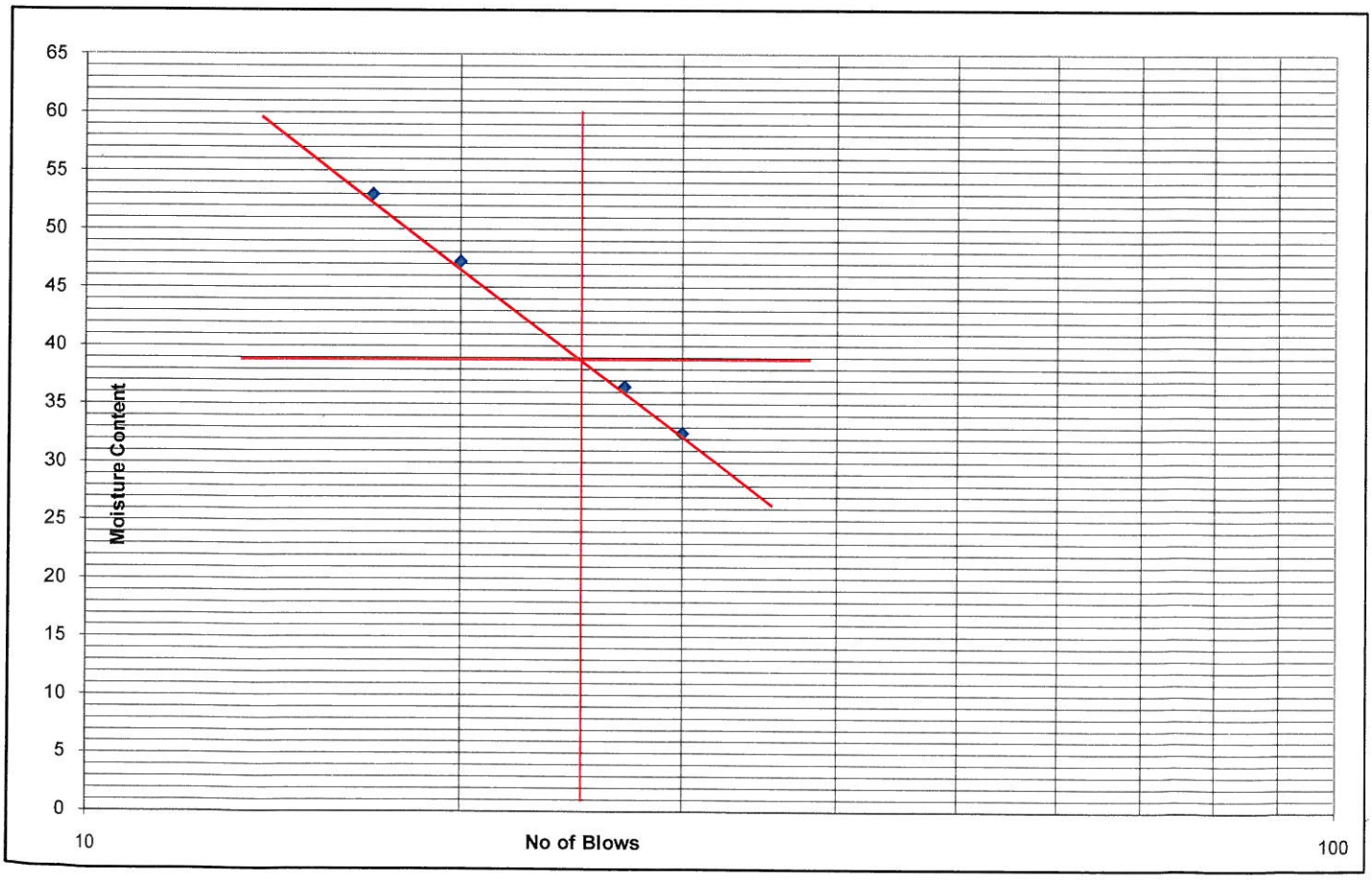
IS : 2720 (Part -5)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	30.0m	Tested by	:	D.Mohanty

Number of Blows	30	27	20	17	Plastic Limit	
Container No.	A1	A2	A3	A4	A5	A6
Container Weight (gm) (W1)	31.25	32.36	34.74	35.59	30.17	33.33
Container + Wt. of wet soil (gm) (W2)	92.98	109.53	110.12	114.61	86.54	99.11
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25	77.84	88.92
Wt. Of water (gm) (W2-W1)-(W3-W1)	15.15	20.62	24.17	27.36	8.70	10.19
Wt. of oven dry soil (gm) (W3-W1)	46.59	56.56	51.20	51.66	47.67	55.59
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**32.51**	**36.45**	**47.21**	**52.95**	**18.25**	**18.34**

Result Summary

Liquid Limit (WL)	39	%
Plastic Limit (Wp)	18	%
Plasticity Index (Ip)	21	%



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Arki Techno Consultants (India) Pvt.Ltd

ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

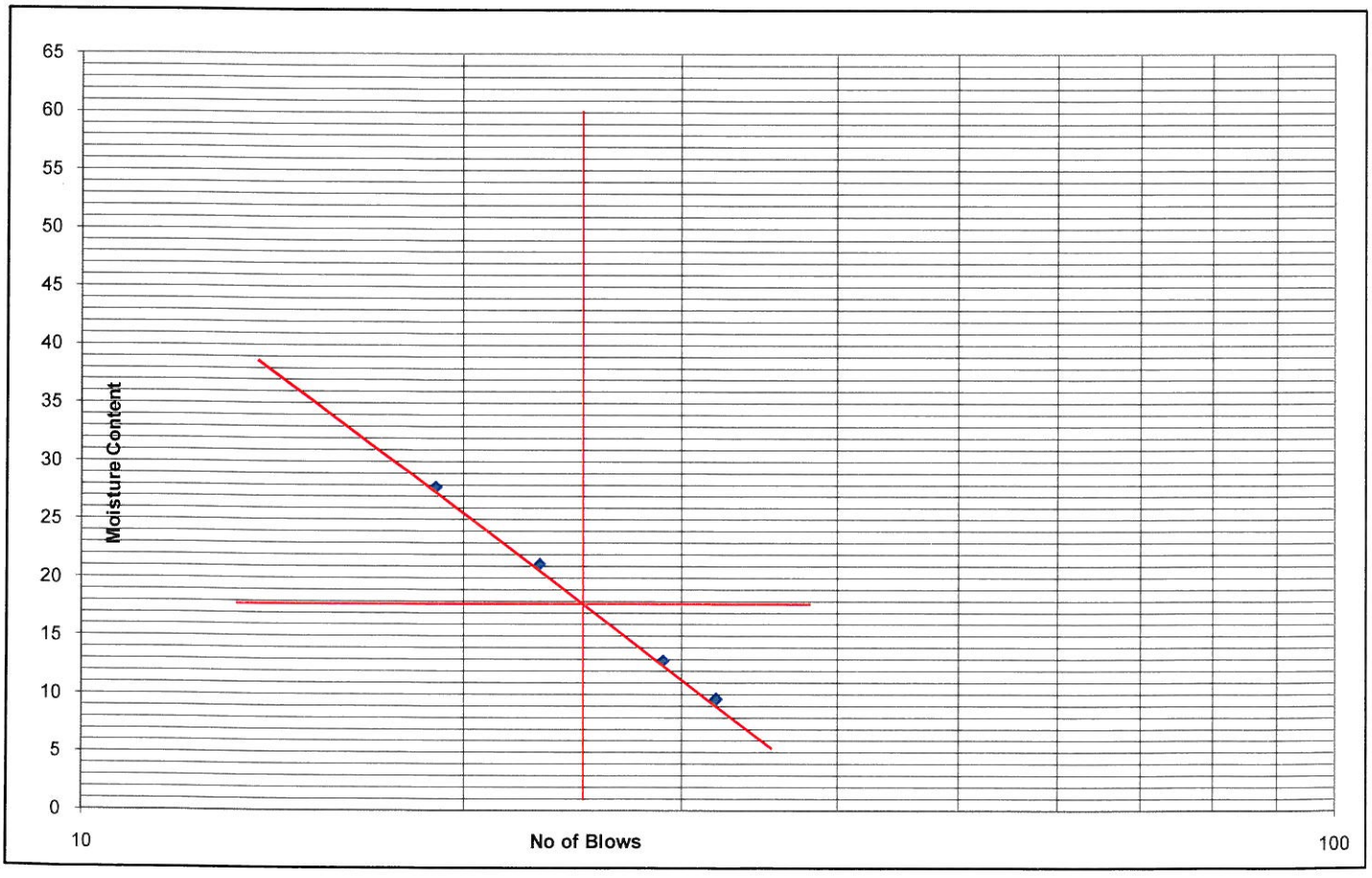
IS : 2720 (Part -5)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	36.0m	Tested by	:	D.Mohanty

Number of Blows	32	29	23	19	Plastic Limit	
Container No.	Y1	Y2	Y3	Y4		
Container Weight (gm) (W1)	33.36	32.45	31.85	30.27		
Container + Wt. of wet soil (gm) (W2)	82.11	96.20	97.42	103.10		
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25		
Wt. Of water (gm) (W2-W1)-(W3-W1)	4.27	7.29	11.47	15.85		
Wt. of oven dry soil (gm) (W3-W1)	44.48	56.47	54.09	56.98		
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**9.61**	**12.90**	**21.21**	**27.81**		

Result Summary

Liquid Limit (WL)	18	%
Plastic Limit (Wp)	NP	
Plasticity Index (Ip)	_	



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Arki Techno Consultants (India) Pvt.Ltd

ARKITECHNO

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF LIQUID LIMIT AND PLASTIC LIMIT

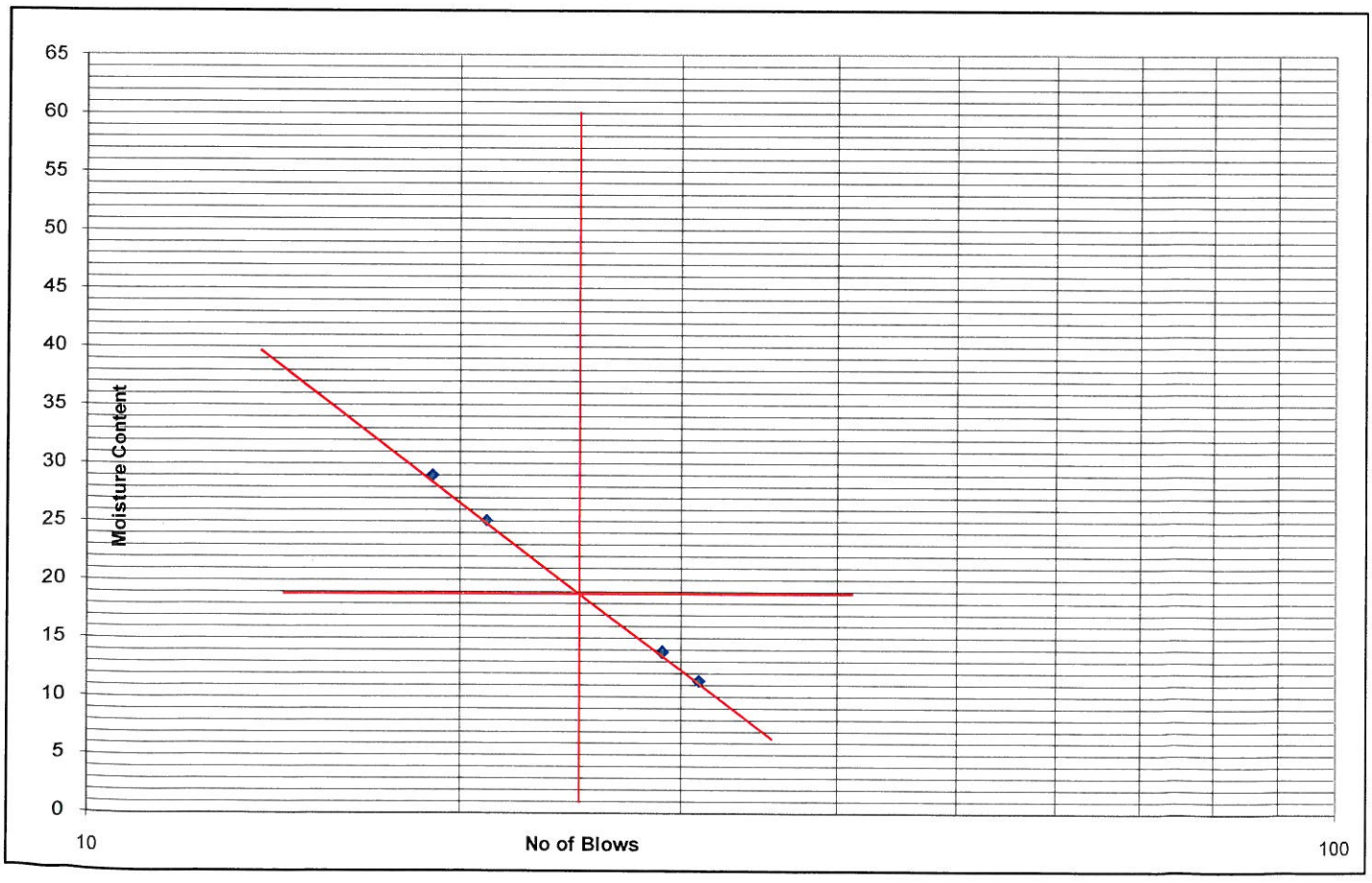
IS : 2720 (Part -5)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	42.0m	Tested by	:	D.Mohanty

Number of Blows	29	31	21	19	Plastic Limit	
Container No.	X1	X2	X3	X4		
Container Weight (gm) (W1)	36.63	37.52	35.26	34.51		
Container + Wt. of wet soil (gm) (W2)	83.55	94.76	98.67	102.54		
Wt of Container + Wt. of oven dry soil (gm) (W3)	77.84	88.92	85.94	87.25		
Wt. Of water (gm) (W2-W1)-(W3-W1)	5.71	5.84	12.73	15.29		
Wt. of oven dry soil (gm) (W3-W1)	41.21	51.40	50.68	52.74		
Moisture Content (%)= [(W2-W1)-(W3-W1)]/(W3-W1) X 100	**13.85**	**11.37**	**25.12**	**28.98**		

Result Summary

Liquid Limit (WL)	19	%
Plastic Limit (Wp)	NP	
Plasticity Index (Ip)	–	



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Arki Techno Consultants (India) Pvt.Ltd

ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

DIFFERENTIAL FREE SWELL INDEX OF SOIL (D.F.S.)

AS PER IS: 2720 (PART - 40)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges	Date Of Testing	:	20.05.2013
Type of Sample	:	SPT	Tested by	:	D.Mohanty
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	30.0m	Weight of Sample	:	10gm

SAMPLE NO.	VOLUME IN KEROSIN OIL Vk	VOLUME IN WATER Vd	SWELL (Vd-Vk)	SWELL INDEX = (Vd-Vk)/ (Vk)*100 (%)	AVERAGE SWELL %	SPECIFIC LIMIT
1	10	12.0	2.00	20	15	50%
2	10	11.5	1.50	15		
3	10	11.0	1.00	10		

Remarks:

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ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF SPECIFIC GRAVITY BY DENSITY BOTTLE METHOD AS PER IS : 2386 (Part -2)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	1.5m	Tested by	:	D.Mohanty

Sl. No.	Observations	1	Remarks
1	Weight of density bottle W1 in gm	31.52	
2	Weight of bottle with dry soil in W2 gm	36.31	
3	Weight of bottle with soil and water W3 in gm	135.52	
4	Weight of bottle full of water W4 in gm	133.82	
5	Weight of dry soil (W2-W1)in gm	4.79	
6	Weight of equal volume of water(W2 - W1) - (W3 - W4) in gm	3.09	
7	Specific Gravity G = (5) / (6)	1.55	

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ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF SPECIFIC GRAVITY BY DENSITY BOTTLE METHOD AS PER IS : 2386 (Part -2)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	6.0m	Tested by	:	D.Mohanty

Sl. No.	Observations	1	Remarks
1	Weight of density bottle W1 in gm	31.52	
2	Weight of bottle with dry soil in W2 gm	35.26	
3	Weight of bottle with soil and water W3 in gm	134.10	
4	Weight of bottle full of water W4 in gm	132.76	
5	Weight of dry soil (W2-W1)in gm	3.74	
6	Weight of equal volume of water(W2 - W1) - (W3 - W4) in gm	2.40	
7	Specific Gravity G = (5) / (6)	1.56	

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ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF SPECIFIC GRAVITY BY DENSITY BOTTLE METHOD AS PER IS : 2386 (Part -2)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	12.0m	Tested by	:	D.Mohanty

Sl. No.	Observations	1	Remarks
1	Weight of density bottle W1 in gm	31.52	
2	Weight of bottle with dry soil in W2 gm	36.42	
3	Weight of bottle with soil and water W3 in gm	135.22	
4	Weight of bottle full of water W4 in gm	133.36	
5	Weight of dry soil (W2-W1)in gm	4.90	
6	Weight of equal volume of water(W2 - W1) - (W3 - W4) in gm	3.05	
7	Specific Gravity G = (5) / (6)	1.61	

51[illegible]

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ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF SPECIFIC GRAVITY BY DENSITY BOTTLE METHOD AS PER IS : 2386 (Part -2)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	18.0m	Tested by	:	D.Mohanty

Sl. No.	Observations	1	Remarks
1	Weight of density bottle W1 in gm	31.52	
2	Weight of bottle with dry soil in W2 gm	35.41	
3	Weight of bottle with soil and water W3 in gm	134.26	
4	Weight of bottle full of water W4 in gm	132.79	
5	Weight of dry soil (W2-W1)in gm	3.89	
6	Weight of equal volume of water(W2 - W1) - (W3 - W4) in gm	2.42	
7	Specific Gravity G = (5) / (6)	1.61	

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ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF SPECIFIC GRAVITY BY DENSITY BOTTLE METHOD AS PER IS : 2386 (Part -2)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	27.0m	Tested by	:	D.Mohanty

Sl. No.	Observations	1	Remarks
1	Weight of density bottle W1 in gm	31.52	
2	Weight of bottle with dry soil in W2 gm	36.24	
3	Weight of bottle with soil and water W3 in gm	135.42	
4	Weight of bottle full of water W4 in gm	133.69	
5	Weight of dry soil (W2-W1)in gm	4.72	
6	Weight of equal volume of water(W2 - W1) - (W3 - W4) in gm	2.99	
7	Specific Gravity G = (5) / (6)	1.58	

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Arki Techno Consultants (India) Pvt.Ltd

ARKITECHNO CONSULTANTS (INDIA) PVT. LTD.

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF SPECIFIC GRAVITY BY DENSITY BOTTLE METHOD AS PER IS : 2386 (Part -2)

Client	:	DFCC			
Project Name	:	G.I For 3 Nos. Important Bridges			
Type of Sample	:	SPT	Date Of Testing	:	20.05.2013
Location	:	BH-8(Yamuna River-Ambala)	Sampled by	:	Binayak Swain
Depth	:	42.0m	Tested by	:	D.Mohanty

Sl. No.	Observations	1	Remarks
1	Weight of density bottle W1 in gm	31.52	
2	Weight of bottle with dry soil in W2 gm	35.41	
3	Weight of bottle with soil and water W3 in gm	135.29	
4	Weight of bottle full of water W4 in gm	133.90	
5	Weight of dry soil (W2-W1)in gm	3.89	
6	Weight of equal volume of water(W2 - W1) - (W3 - W4) in gm	2.50	
7	Specific Gravity G = (5) / (6)	1.56	

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ARKI TECHNO CONSULTANTS (I) PVT. LTD.

ARKITECHNO

N 3/91, IRC Village, Bhubaneswar

DETERMINATION OF BULK DENSITY & MOISTURE CONTENT OF SOIL SAMPLE

Client : DFCC

Project Name : G.I For 3 Nos. Important Bridges

Location : BH-8(Yamuna River-Ambala)

Sl No.	BH No.	Depth in m	Type of Sample	Date of Testing	Weight of Container in gm	Diameter of Sample in cm	Length of Sample in cm	Volume of Sample in cc	Weight of Container + Wet Soil in gm	Weight of Container + Dry soil in gm	Weight of Dry soil in gm	Weight of water in gm	Moisture Content in %	Bulk Density in gm/cc	Dry Density in gm/cc
1	BH-8(Yamuna River-Ambala)	1.5	SPT	20.05.2013	62.34	3.8	7	79.39	212.39	201.94	139.60	10.44	7.48	1.89	1.76
3		4.5	SPT	20.05.2013	60.71	3.8	7	79.39	204.41	192.64	131.93	11.77	8.92	1.81	1.66
5		10.5	SPT	20.05.2013	60.77	3.8	7	79.39	208.44	199.53	138.76	8.91	6.42	1.86	1.75
6		12.0	SPT	20.05.2013	64.84	3.8	7	79.39	214.89	204.59	139.75	10.30	7.37	1.89	1.76
7		15.0	SPT	20.05.2013	65.31	3.8	7	79.39	215.36	204.23	138.92	11.13	8.01	1.89	1.75
8		21.0	SPT	20.05.2013	60.5	3.8	7	79.39	216.10	205.69	145.19	10.41	7.17	1.96	1.83
9		27.0	SPT	20.05.2013	61.31	3.8	7	79.39	218.50	208.37	147.06	10.13	6.89	1.98	1.85
10		30.0	SPT	20.05.2013	62.29	3.8	7	79.39	219.48	194.47	132.18	25.01	18.92	1.98	1.66
11		42.0	SPT	20.05.2013	62.29	3.8	7	79.39	219.48	206.73	144.44	12.75	8.83	1.98	1.82

Appendix -IV

(Test Results of Dr.Ghuman and Gupta Geotech Consultants)

डेडीकेटेड फ्रेट कोरीडोर

DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LIMITED
(A Govt. Of India Enterprise)
Old Railway Colony (Near Anand Market), Ambala Cantt-133001.
Telefax: 0171-2612412

No: UMB/EN/Tender/GI

Date: 27.12.2013

M/S Arkitechno Consultants (India) Pvt. Ltd.
Plot No. N-3/91, IRC Village,
Nayapalli, Bhubanswar-751015

SUB: Conducting Geotechnical Investigation; preparation of GAD(General Arrangement Drawings), preparation of bill of quantities for 3 Nos. important bridges (Namely on Yamuna River, Markanda River and Tangri River) between Talheri Buzurg- Sanewal section in c/w construction of Eastern Dedicated Freight Corridor.

Ref: This Office letter no. UMB/EN/Tender/GI Dated: 13.11.2013.

In reference to above meeting between representative of DFCCIL and Arkitechno Consultants (India) Pvt. Ltd was held on dated 28.11.2013 in Chamber of Dy.CPM/Engg/DFCCIL, Ambala. It was decided jointly that sample from two new bore holes would be taken by Arkitechno Consultants (India) Pvt. Ltd. and these will be get tested from independent laboratory for verification of silt factor for all three rivers. The expenditure for the above testing will be born by Arkitechno Consultants (India) Pvt. Ltd.

Now samples have been taken by Arkitechno Consultants (India) Pvt. Ltd. These sample have been sent to Dr Ghuman & Gupta Geotech consultants Chandigarh for testing. The details of sample is given as below:-

1.	Yamuna River-	Pier-3	5 nos
		Pier-5	5 Nos
2.	Markanda River-	Pier-1	5 Nos
		Pier-3	5 Nos
3.	Tangri River-	Pier-1	4 Nos
		Pier-2	4 Nos

The correspondence address of Dr Ghuman & Gupta Geotech Consultants, SCO-64-65, Basement, Sector-17A, Chandigarh (0172-2707211). So that testing can done early in the interest of work.

This information is being sent to you for further necessary action please.

(Nehaluddin)
Asst. Project Manager
DFCCIL, Ambala Cantt.

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A TEAM IN PURSUIT OF EXCELLENCE

CHD 2707211 (O)
CHD 2706465 (O)
Telefax 4653641 (O)
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gggc

Dr. GHUMAN AND GUPTA GEOTECH CONSULTANTS

Test House Headed By Dr. M. S. Ghuman
Ph.D. (Geotechnical Engg.) Roorkee
Ex. Prof. & Head of Civil Engg., Pb. Engineering College, Chd. cum
Director, Technical Education (U.T.) Chandigarh

Office cum Laboratory
S.C.O. 64 - 65 (Basement)
Sector 17-A, Chandigarh
&
F-81, Phase VII,
Industrial Focal Point, Mohali (Pb.)

Experts for :

* Test House Approved by PUDA, PWSSB, PPHC, HPHC, MES, C-DOT, CPWD, LIC, AIRFORCE Airport Authority of India.

* Soil investigations for Buildings, Bridges, OHRs, Earth Dams, Irrigations Structures, Towers, Roads, Industrial Buildings etc.
* Evaluation of Dynamic Elastic Properties and Analysis of Machine Foundations and Soil Stabilization Problems.
* Plain Table Surveying, Levelling, Contouring and Demarcation.
* Physical and Chemical Testing of Cement, Chemical Analysis of Mortar and Concrete, Cube, Mix Design of Cement Concrete, Coarse and Fine Aggregates, Bricks, Marble, Kota Stone, Glazed Tiles, Terrazo Tiles, Water, Particle Board, Flush Door Shutters, G.I. Pipes, Barbed Wire, Coatings, Steel Sections, CBR, MDD and DBD of Compacted Earth, Non Destructive Concrete hammer test, Roof Deflection test, Highway Bitumionous Mix Design and Cement Concrete Pavements etc.

Ref.No.GGGC/D-5172/2013-2014 Dated : 06.02.2014

Assistant Project Manager/Engg-II.
DFCCIL. Ambala Cantt.

SUBJECT : DETERMINATION OF THE SILT FACTORS OF SOIL SAMPLES SUPPLIED IN LAB. FOR THREE RIVER NAMELY YAMUNA, MARKANDA AND TANGRI.

Sample Particular : Twenty seven soil samples for the bridges of Yamuna, Markanda and Tangri were supplied in the laboratory for calculation of silt factors.

TEST RESULTS

Sr. No.	Description of Samples	Depth	Silt Factors
1.	Tangri, Pier-1, Type Clay Silt	2.0 m	0.82
2.	Tangri, Pier-1, Type Silty Sand	4.0 m	0.89
3	Tangri, Pier-1, Type Silty Sand	6.0 m	0.71
4.	Tangri, Pier-1, Type Fine Sand	7.0 m	0.79
5.	Tangri, Pier-2	2.0 m	1.14
6.	Tangri, Pier-2	2.0 m	0.73
7	Tangri, Pier-2	4.0 m	0.92
8.	Tangri, Pier-2	8.0 m	0.80
9.	Tangri, Pier-2	10.0 m	0.84
10.	Markanda Pier-1, Type Fine Sand	1.0 m	0.72
11.	Markanda Pier-1, Type Fine Sand	3.0 m	0.86
12.	Markanda Pier-1, Type Fine Sand	5.0 m	0.96
13.	Markanda Pier-1, Type Fine Sand	7.0 m	1.13
14.	Markanda Pier-3, Type Silty Clay	1.0 m	1.12

Contd.2/p..

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A TEAM IN PURSUIT OF EXCELLENCE

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gggc

Dr. GHUMAN AND GUPTA GEOTECH CONSULTANTS

Test House Headed By Dr. M. S. Ghuman
Ph.D. (Geotechnical Engg.) Roorkee
Ex. Prof. & Head of Civil Engg., Pb. Engineering College, Chd. cum
Director, Technical Education (U.T.) Chandigarh

Experts for :

Office cum Laboratory
S.C.O. 64 - 65 (Basement)
Sector 17-A, Chandigarh
&
F-81, Phase VII,
Industrial Focal Point, Mohali (Pb.)

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* Soil investigations for Buildings, Bridges, OHRs, Earth Dams, Irrigations Structures, Towers, Roads, Industrial Buildings etc.
* Evaluation of Dynamic Elastic Properties and Analysis of Machine Foundations and Soil Stabilization Problems.
* Plain Table Surveying, Levelling, Contouring and Demarcation.
* Physical and Chemical Testing of Cement, Chemical Analysis of Mortar and Concrete, Cube, Mix Design of Cement Concrete, Coarse and Fine Aggregates, Bricks, Marble, Kota Stone, Glazed Tiles, Terrazo Tiles, Water, Particle Board, Flush Door Shutters, G.I. Pipes, Barbed Wire, Coatings, Steel Sections, CBR, MDD and DBD of Compacted Earth, Non Destructive Concrete hammer test, Roof Deflection test, Highway Bitumionous Mix Design and Cement Concrete Pavements etc.

TEST RESULTS

Sr. No.	Description of Samples	Depth	Silt Factors
15.	Markanda Pier-3, Type Silty Clay	3.0 m	0.64
16.	Markanda Pier-3, Type Fine Sand	5.0 m	0.97
17.	Markanda Pier-3, Type Fine Sand	7.0 m	0.95
18.	Yamuna Pier-3, Type Fine Sand	2.0 m	0.92
19.	Yamuna Pier-3, Type Fine Sand	4.0 m	0.92
20.	Yamuna Pier-3, Type Fine Sand	6.0 m	0.73
21.	Yamuna Pier-3, Type Fine Sand	8.0 m	0.86
22.	Yamuna Pier-3, Type Fine Sand	10.0 m	0.92
23.	Yamuna Pier-5, Type Fine Sand	2.0 m	0.71
24.	Yamuna Pier-5, Type Fine Sand	4.0 m	0.85
25.	Yamuna Pier-5, Type Fine Sand	6.0 m	0.75
26.	Yamuna Pier-5, Type Fine Sand	8.0 m	0.80
27.	Yamuna Pier-5, Type Fine Sand	10.0 m	1.28

Er. RANJIV K. GUPTA
B.E. (CIVIL) (HONS.) (LMIGS), MIE
DIRECTOR CUM
CONSULTING ENGINEER (GGGC)

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Table : 1 Tangri, Pier-1, Depth = 2.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	1.6	1.42
0.600-0.300	0.450	26.0	11.70
0.300-0.150	0.225	17.6	3.96
0.150-0.075	0.1125	35.8	4.03
0.075 and below	0.0375	19.0	0.71
		100	21.82

$$d_m = \frac{21.82}{100} = 0.2182$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2182} = 0.82$

Table : 2 Tangri, Pier-1, Depth = 4.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
10-4.75	7.375	0.0	0.00
4.75-2.36	3.555	0.4	1.42
2.36-1.18	1.770	0.6	1.06
1.18-0.600	0.890	4.0	3.56
0.600-0.300	0.450	12.4	5.58
0.300-0.150	0.225	49.4	11.12
0.150-0.075	0.1125	20.8	2.34
0.075 and below	0.0375	12.4	0.47
		100	25.55

$$d_m = \frac{25.55}{100} = 0.2555$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2555} = 0.89$

Table : 3 Tangri, Pier-1, Depth = 6.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.0	0.00
0.600-0.300	0.450	3.2	1.44
0.300-0.150	0.225	42.2	9.50
0.150-0.075	0.1125	42.0	4.73
0.075 and below	0.0375	12.6	0.47
		100	16.14

$$d_m = \frac{16.14}{100} = 0.1614$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.1614} = 0.71$

Table : 4 Tangri, Pier-1, Depth = 7.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.2	0.35
1.18-0.600	0.890	0.4	0.36
0.600-0.300	0.450	2.6	1.17
0.300-0.150	0.225	67.6	15.21
0.150-0.075	0.1125	25.2	2.84
0.075 and below	0.0375	4.0	0.15
		100	20.08

$$d_m = \frac{20.08}{100} = 0.2008$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2008} = 0.79$

Table : 5 Tangri, Pier-2, Depth = 2.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	32.6	29.01
0.600-0.300	0.450	15.6	7.02
0.300-0.150	0.225	12.8	2.88
0.150-0.075	0.1125	23.6	2.66
0.075 and below	0.0375	15.4	0.58
		100	42.15

$$d_m = \frac{42.15}{100} = 0.4215$$

Silt Factor = f = $1.76\sqrt{d_m}$ = $1.76\sqrt{0.4215}$ = 1.14

Table : 6 Tangri, Pier-2, Depth = 2.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.0	0.00
0.600-0.300	0.450	0.4	0.18
0.300-0.150	0.225	52.8	11.88
0.150-0.075	0.1125	42.0	4.73
0.075 and below	0.0375	4.8	0.18
		100	16.97

$$d_m = \frac{16.97}{100} = 0.1697$$

Silt Factor = f = $1.76\sqrt{d_m}$ = $1.76\sqrt{0.1697}$ = 0.73

Table : 7 Tangri, Pier-2, Depth = 4.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
20-16	18.0	0.0	0.00
16-12.5	14.25	0.0	0.00
12.5-10	11.25	0.0	0.00
10-4.75	7.375	0.8	5.90
4.75-2.36	3.555	2.0	7.11
2.36-1.18	1.770	1.0	1.77
1.18-0.600	0.890	3.4	3.03
0.600-0.300	0.450	1.6	0.72
0.300-0.150	0.225	12.0	2.70
0.150-0.075	0.1125	37.8	4.25
0.075 and below	0.0375	41.4	1.55
		100	27.03

$$d_m = \frac{27.03}{100} = 0.2703$$

Silt Factor = f = $1.76\sqrt{d_m}$ = $1.76\sqrt{0.2703}$ = 0.92

Table : 8 Tangri, Pier-2, Depth = 8.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.0	0.00
0.600-0.300	0.450	6.2	2.79
0.300-0.150	0.225	67.4	15.17
0.150-0.075	0.1125	25.0	2.81
0.075 and below	0.0375	1.4	0.05
		100	20.82

$$d_m = \frac{20.82}{100} = 0.2082$$

Silt Factor = f = $1.76\sqrt{d_m}$ = $1.76\sqrt{0.2082}$ = 0.80

Table : 9 Tangri, Pier-2, Depth = 10.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	1.0	0.89
0.600-0.300	0.450	6.6	2.97
0.300-0.150	0.225	75.0	16.88
0.150-0.075	0.1125	15.4	1.73
0.075 and below	0.0375	2.0	0.08
		100	22.55

$$d_m = \frac{22.55}{100} = 0.84$$

Silt Factor = f = $1.76\sqrt{d_m}$ = $1.76\sqrt{0.2255}$ = 0.84

Table : 10 Markanda Pier-1, Depth = 1.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.0	0.00
0.600-0.300	0.450	7.2	3.24
0.300-0.150	0.225	31.0	6.98
0.150-0.075	0.1125	57.8	6.50
0.075 and below	0.0375	4.0	0.15
		100	16.87

$$d_m = \frac{16.87}{100} = 0.1687$$

Silt Factor = f = $1.76\sqrt{d_m}$ = $1.76\sqrt{0.1687}$ = 0.72

Table : 11 Markanda Pier-1, Depth = 3.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.0	0.00
0.600-0.300	0.450	14.4	6.48
0.300-0.150	0.225	71.4	16.07
0.150-0.075	0.1125	12.0	1.35
0.075 and below	0.0375	2.2	0.08
		100	23.98

$$d_m = \frac{23.98}{100} = 0.2398$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2398} = 0.86$

Table : 12 Markanda Pier-1, Depth = 5.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	2.6	4.60
1.18-0.600	0.890	2.0	1.78
0.600-0.300	0.450	16.0	7.20
0.300-0.150	0.225	64.8	14.58
0.150-0.075	0.1125	12.8	1.44
0.075 and below	0.0375	1.8	0.07
		100	29.67

$$d_m = \frac{29.67}{100} = 0.2967$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2967} = 0.96$

Table : 13 Markanda Pier-1, Depth = 7.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.00
10-4.75	7.375	0.0	0.00
4.75-2.36	3.555	1.6	5.69
2.36-1.18	1.770	7.8	13.81
1.18-0.600	0.890	3.0	2.67
0.600-0.300	0.450	9.6	4.32
0.300-0.150	0.225	56.6	12.74
0.150-0.075	0.1125	15.6	1.76
0.075 and below	0.0375	5.8	0.22
		100	41.21

$$d_m = \frac{41.21}{100} = 0.4121$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.4121} = 1.13$

Table : 14 Markanda Pier-3, Depth = 1.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	14.0	24.78
1.18-0.600	0.890	5.8	5.16
0.600-0.300	0.450	7.2	3.24
0.300-0.150	0.225	12.4	2.79
0.150-0.075	0.1125	30.6	3.44
0.075 and below	0.0375	30.0	1.13
		100	40.54

$$d_m = \frac{40.54}{100} = 0.4054$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.4054} = 1.12$

Table : 15 Markanda Pier-3, Depth = 3.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.0	0.00
0.600-0.300	0.450	1.0	0.45
0.300-0.150	0.225	23.6	5.31
0.150-0.075	0.1125	59.4	6.68
0.075 and below	0.0375	16.0	0.60
		100	13.04

$$d_m = \frac{13.04}{100} = 0.1304$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.1304} = 0.64$

Table : 16 Markanda Pier-3, Depth = 5.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	2.4	4.25
1.18-0.600	0.890	4.6	4.09
0.600-0.300	0.450	17.2	7.74
0.300-0.150	0.225	55.4	12.47
0.150-0.075	0.1125	16.6	1.87
0.075 and below	0.0375	3.8	0.14
		100	30.56

$$d_m = \frac{30.56}{100} = 0.3056$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.3056} = 0.97$

Table : 17 Markanda Pier-3, Depth = 7.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	2.6	4.60
1.18-0.600	0.890	1.6	1.42
0.600-0.300	0.450	19.0	8.55
0.300-0.150	0.225	54.0	12.15
0.150-0.075	0.1125	16.8	1.89
0.075 and below	0.0375	6.0	0.23
		100	28.84

$$d_m = \frac{28.84}{100} = 0.2884$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2884} = 0.95$

Table : 18 Yamuna Pier-3, Depth = 2.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.00
10-4.75	7.375	0.0	0.00
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.1	0.09
0.600-0.300	0.450	24.0	10.80
0.300-0.150	0.225	68.4	15.39
0.150-0.075	0.1125	6.1	0.69
0.075 and below	0.0375	1.4	0.05
		100	27.02

$$d_m = \frac{27.02}{100} = 0.2702$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2702} = 0.92$

Table : 19 Yamuna Pier-3, Depth = 4.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.00
10-4.75	7.375	0.0	0.00
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.2	1.18
0.600-0.300	0.450	28.4	12.78
0.300-0.150	0.225	59.0	13.28
0.150-0.075	0.1125	9.4	1.06
0.075 and below	0.0375	3.0	0.11
		100	27.41

$$d_m = \frac{27.41}{100} = 0.2741$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2741} = 0.92$

Table : 20 Yamuna Pier-3, Depth = 6.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.00
10-4.75	7.375	0.0	0.00
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.8	0.71
0.600-0.300	0.450	12.8	5.76
0.300-0.150	0.225	30.8	6.93
0.150-0.075	0.1125	25.0	2.81
0.075 and below	0.0375	30.6	1.15
		100	17.36

$$d_m = \frac{17.36}{100} = 0.1736$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.1736} = 0.73$

Table : 21 Yamuna Pier-3, Depth = 8.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.00
10-4.75	7.375	0.0	0.00
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.0	0.00
0.600-0.300	0.450	18.4	8.28
0.300-0.150	0.225	61.4	13.82
0.150-0.075	0.1125	15.2	1.71
0.075 and below	0.0375	5.0	0.19
		100	24.00

$$d_m = \frac{24.00}{100} = 0.2400$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2400} = 0.86$

Table : 22 Yamuna Pier-3, Depth = 10.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.00
10-4.75	7.375	0.0	0.00
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.6	0.53
0.600-0.300	0.450	27.2	12.24
0.300-0.150	0.225	58.6	13.19
0.150-0.075	0.1125	12.2	1.37
0.075 and below	0.0375	1.4	0.05
		100	27.38

$$d_m = \frac{27.38}{100} = 0.2738$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2738} = 0.92$

Table : 23 Yamuna Pier-5, Depth = 2.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.00
10-4.75	7.375	0.0	0.00
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	0.2	0.18
0.600-0.300	0.450	8.4	3.78
0.300-0.150	0.225	35.6	8.01
0.150-0.075	0.1125	31.8	3.58
0.075 and below	0.0375	24.0	0.90
		100	16.45

$$d_m = \frac{16.45}{100} = 0.1645$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.1645} = 0.71$

Table : 24 Yamuna Pier-5, Depth = 4.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.00
10-4.75	7.375	0.0	0.00
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	5.6	4.98
0.600-0.300	0.450	14.8	6.66
0.300-0.150	0.225	30.4	6.84
0.150-0.075	0.1125	38.0	4.28
0.075 and below	0.0375	11.2	0.42
		100	23.18

$$d_m = \frac{23.18}{100} = 0.2318$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2318} = 0.85$

Table : 25 Yamuna Pier-5, Depth = 6.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.00
10-4.75	7.375	0.0	0.00
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.1	0.18
1.18-0.600	0.890	3.0	2.67
0.600-0.300	0.450	4.4	1.98
0.300-0.150	0.225	38.6	8.69
0.150-0.075	0.1125	35.0	3.94
0.075 and below	0.0375	18.9	0.71
		100	18.17

$$d_m = \frac{18.17}{100} = 0.1817$$

Silt Factor = $f = 1.76 \sqrt{dm} = 1.76 \sqrt{0.1817} = 0.75$

Table : 26 Yamuna Pier-5, Depth = 8.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.0
10-4.75	7.375	0.0	0.0
4.75-2.36	3.555	0.0	0.0
2.36-1.18	1.770	0.0	0.0
1.18-0.600	0.890	1.0	0.89
0.600-0.300	0.450	13.8	6.21
0.300-0.150	0.225	41.2	9.27
0.150-0.075	0.1125	34.0	3.83
0.075 and below	0.0375	10.0	0.38
		100	20.58

$$d_m = \frac{20.58}{100} = 0.2058$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.2058} = 0.80$

Table : 27 Yamuna Pier-5, Depth = 10.0 m

Size size (mm) (1)	Avge. Sieve Size (mm) (2)	%age Weight retained on lower sieve size (3)	Product of columns (2 & 3)
12.5-10	11.25	0.0	0.00
10-4.75	7.375	3.6	26.55
4.75-2.36	3.555	0.0	0.00
2.36-1.18	1.770	0.0	0.00
1.18-0.600	0.890	3.6	3.20
0.600-0.300	0.450	24.2	10.89
0.300-0.150	0.225	46.0	10.35
0.150-0.075	0.1125	18.6	2.09
0.075 and below	0.0375	4.0	0.15
		100	53.23

$$d_m = \frac{53.23}{100} = 0.5323$$

Silt Factor = $f = 1.76 \sqrt{d_m} = 1.76 \sqrt{0.5323} = 1.28$

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Appendix-A		
YAMUNA RIVER		
Bore Hole No	**Depth (m)**	**Silt Factor**
BH-1(A2)	1.5	2.26
	3.0	2.39
	4.5	2.35
	6.0	2.33
	10.5	2.33
BH-2(P4)	1.5	2.15
	3.0	2.15
	4.5	2.16
	6.0	2.19
	7.5	2.18
	12.0	2.34
BH-3(P5)	1.5	2.24
	3.0	2.24
	4.5	2.28
	6.0	2.25
	9.0	2.35
	10.5	2.38

BH-4(A1)	1.5	2.28
	3.0	2.32
	4.5	2.28
	6.0	2.29
	7.5	2.39
	10.5	2.36
BH-5(P6)	1.5	2.19
	3.0	2.22
	4.5	2.2
	6.0	2.22
	9.0	2.18
BH-6(P3)	1.5	2.19
	3.0	2.19
	4.5	2.22
	6.0	2.2
BH-7(P2)	1.5	2.22
	3.0	2.2
	4.5	2.21
	6.0	2.17
	9.0	2.17
	12.0	2.32
BH-8(P1)	1.5	2.22
	3.0	2.17
	4.5	2.21
	6.0	2.18
	10.5	2.29

APPENDIX-B		
YAMUNA RIVER		
Bore Hole No	**Depth (m)**	**Silt Factor**
BH-1(A2)	1.5	2.26
BH-2(P4)	1.5	2.15
BH-3(P5)	1.5	2.24
BH-4(A1)	1.5	2.28
BH-5(P6)	1.5	2.19
BH-6(P3)	1.5	2.19
BH-7(P2)	1.5	2.22
BH-8(P1)	1.5	2.22