Doc No. 1718-081/TRB/FDPR/P2/S-6/REP-03

NATIONAL HIGHWAYS AND INFRASTRUCTURE DEVELOPMENT CORPORTION LIMITED
(MINISTRY OF ROAD TRANSPORT & HIGHWAYS)
GOVT. OF INDIA

Consultancy Services for Preparation of DPR for Development of Economic Corridors, Inter Corridors and Feeder Routes to Improve the Efficiency of Freight Movement in India under Bharatmala Pariyojana






Lot-1 : Package-II
(251.8 KM)

Section 6
Km 113+800 to Km 131+152

Final
Detailed Project Report

Volume – III
Material Report

June 2020
Revision : R0

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CHAPTER 1 INTRODUCTION

1.0 INTRODUCTION

1.1 Project Background

The National Highways & Infrastructure Development Corporation Limited has been constituted through an Act of Parliament for faster, economical and quality Road Construction work throughout India. The National Highways & Infrastructure Development Corporation Limited (NHIDCL) has been entrusted with the assignment of preparation of DPR for development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under BharatmalaPariyojana.

In view of the above work NHIDCL has appointed M/s Voyants Solutions Pvt. Ltd. to carry out the Feasibility Studies and Detailed Project Report including field investigations, road inventory, structure inventory, FWD test, road crust sample (trial pits), material investigation, secondary data collection and traffic survey (classified traffic volume count, O-D, intersection counts, axle load survey, animal/pedestrian crossing counts and speed-delay survey). The letter of invitation (LOI) has been issued vide memo no. NHIDCL/Bharatmala/DPR/Phase-I /Lot-1/2017, dated October 30, 2017, whereas, the letter of acceptance (LOA) has been issued vide letter no. NHIDCL/Bharatmala/DPR/Phase-I /Lot-1/Package II/2017/27, dated February 02, 2018. Letter of commencement (LOC) for the consultancy services was issued vide letter no. NHIDCL/Bharatmala/DPR/Phase-I /Lot-1/Package II/2017/80, dated April 13, 2018.

1.2 Project Road Description

The project road comprises 5 stretchesas mentioned in the RFP as mentioned below in **Table 1.1**

Table 1.1 : List of Road Segments as per RFP

Stretches	Description
Strech-1	Daboka – Manja (NH-29)
Strech-2	Manja- Lahorijan (NH-29)
Strech-3	Lahorijan – Khatkhati (NH-129)
Strech-4	Numaligar- Khatkhati (NH 129)
Strech-5	Khatkhati – Chumukademia (Dimapur Bypass)

Project location on state and district maps are presented on **Figure 1.1** and **1.2** respectively.

Different road segments are schematically presented in **Figure 1.3**.

Segment wise variation of lengths from RFP document is provided in **Table 1.2**.

Table 1.2 : Variation in Lengths of Different Segments from RFP Document

Stretches as per RFP	Node Reference	Description	RFP Length (km)	Ground Length (Km)	Remarks
1	A-B	Daboka - Manja	90	88.8	-
2	B-C	Manja - Lahorijan	38.8	29.3	Variation due to relocation of project end point from Dimapur Town to Start of Dimapur Bypass at Lahorijan
3	C-D	Lahorijan - Khatkhati	1	N/A *	Stretch already included in Dimapur Bypass (Under Construction)
4	E-D	Numaligarh – Khatkhati (NH-129)	99	99	Project road length considered along proposed Bypass of Nambor Wild Life Sanctuary
5	D-F	Khatkhati – Chumukedeima (Dimapur Bypass)	23	N/A *	Stretch already included in Dimapur Bypass (Under Construction)
Total			**251.8**	**217.1**	

As mentioned in the above section, the project road has 5 (Five) stretches. However after ground verification two road segments had been deletedas mentioned in **Table 1.2.** The details of three road segments are mentioned as below:

i) The Daboka – Manja stretch under Nagaon – Dimapur Economic Corridor starts at Daboka – Sutargaon More (26°6'56.85"N, 92°52'28.97"E) which is a junction of the project road i.e. NH-29 (Old NH-36) and Nagaon - Lumding/ Silchar road. The chainage of the start point is Km 39+500 of NH-29. The stretch runs along South-East direction and ends at the junction (Manja Market) of the Project Road with Manja – Diphu – Lumding Road at existing Km 128+300 of NH-29 (25°58'14.79"N, 93°26'14.79"E). The Length of the stretch is about 88.8 Km.

ii) The Manja – Lahorijan stretch under Nagaon – Dimapur Economic Corridor starts at existing Km 128+300 (25°58'14.79"N, 93°26'14.79"E) and ends at Lahorijan (25°55'15.60"N, 93°43'49.75"E), the outskirts of Dimapur. The end point is about 2 Km towards North from the City Tower (Junction of NH-29 and NH-129). The stretch passes mainly forest stretches and partly through the vicinity of Marat Wild Life Sanctuary. The Length of the stretch is about 40.1 Km.

iii) The Numaligarh – Khatkhati stretch under Numaligarh – Dimapur Economic Corridor starts at the Junction (26°37'51.90"N, 93°43'38.58"E) of NH-129 and NH-37 at Numaligarh and ends at Khatkhati (25°57'19.36"N, 93°44'8.86"E) about 7 Km towards North from the City Tower in Dimapur. The Length of the stretch is about 102 Km.

This report includes the road section as mentioned below from the **Stretch -1& 2 in Table 1.2**

Section-6: From Km 113+830 to Km 131+152 (near Manja)

CHAPTER 2 EXISTING PAVEMENT AND SUBGRADE INVESTIGATION

2.1 Sub-grade InvestigationMethodology (Test Pits)

The basic objective of the investigation was to form a database for characterization of existing pavement. The investigation was carried out by digging trial pits staggered left/right.

2.1.1 Large Pits (1m x 1m x 1m) and small Pit (0.5m x 0.5m x 0.5m)

Large Trial pits of size 1m x 1m x 1m and small trial pit size 0.5m x 0.5m x 0.5m were dug at the pavement shoulder interface, extending through the pavement layers down to the subgrade level. Pits were at least 300 mm within the carriageway. Pits were made in such a way that half of the pit remains within the carriageway and the other half (in the shoulder), ensuring minimum damage to the original pavement and disruption to the traffic. Large test pits are done on both sides of the project road were dug at the pavement shoulder interface extending through the pavement layers down to the sub-grade level

The following sequence of operation was followed for each large test pit:

- Manual excavation of 1.0 m x 1.0 x1.0 m and 0.5m x 0.5m x 0.5m pit down to subgrade level .The thickness of the different pavement layers were measured and type of material examined and logged from three sides.
- Field (in-situ) dry density using sand replacement method as per IS 2720: Part 28 was carried out at the subgrade level.
- Adequate sample in sealed polythene bag were collected for classification tests as per IS: 2720 (relevant parts)
  - Field moisture content
  - Grain size analysis
  - Atterberg limits

One sample of 40 kg was collected from the top 300 mm of subgrade for the following laboratory tests (as per IS:2720)

- Free swell index
- Moisture-Density test (heavy compaction)
- CBR (4 days soaked at three energy levels of 10, 35 and 65 blows)

After the completion of field tests and collection of samples, the pits were backfilled with the excavated materials and compacted suitably so as not to jeopardize the smooth movement of traffic of the existing road.

The existing pavement structure mostly comprises of three layers, namely bituminous layer, base course and sub-base course. During the present investigation the surfacing course is reported, on the whole, as bituminous course (BC). The base course comprises of stone ,gravel, cobble mix with clay mix with sand only and few stretch present in WBM mix . The sub-base course consists mainly occasional presence of sand layer along the stretches. Stretch I- The total thickness of the pavement varies from 745mm to 990mm. The thickness of the bituminous surfacing layer varies from 20 mm to 110 mm. The thickness of the baselayer ranges from 95to 270 mm.The thickness of the sub-base layer ranges from 86to 280 mm.

Stretch II- The total thickness of the pavement varies from 770 mm to 1090 mm. The thickness of the bituminous surfacing layer varies from 30 mm to 180 mm. The thickness of the base layer ranges from 95 to 320 mm.The thickness of the sub-base layer ranges from 70 to 271 mm.

2.1.2 Existing Pavement Composition (small Pit)

The existing pavement structure mostly comprises of two and three layers, namely bituminous layervaries from 20mm to 180 mm thick, base coursevaries from 95mm to 320 mmand sub-base coursevaries from 70mm to 280 mm thick.

Table: Summary of Existing Pavement Composition for Small Pit

S.NO	Side	Chainage (KM)	Crust Composition (mm)				Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	SUBGRADE	
Stretch-1 (NH-29)							
1	RHS	38+600	60	110	160	500	830
2	LHS	39+000	62	112	162	500	836
3	RHS	39+500	57	107	157	500	821
4	LHS	40+000	55	105	155	500	815
5	RHS	40+500	54	104	154	500	812
6	LHS	41+000	55	105	155	500	815
7	RHS	41+500	53	103	153	500	809
8	LHS	42+000	51	101	151	500	803
9	RHS	42+500	49	99	149	500	797
10	RHS	43+000	45	90	140	500	775
11	RHS	43+500	47	94	144	500	785
12	LHS	44+000	41	88	138	500	767

Table: Summary of Existing Pavement Composition for Small Pit

S.NO	Side	Chainage (KM)	Crust Composition (mm)				Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	SUBGRADE	
13	RHS	44+500	39	86	136	500	761
14	LHS	45+000	37	89	139	500	765
15	RHS	45+500	38	91	141	500	770
16	LHS	46+000	35	95	145	500	775
17	RHS	46+500	33	98	148	500	779
18	LHS	47+000	23	101	151	500	775
19	RHS	47+500	27	103	153	500	783
20	LHS	48+000	26	105	155	500	786
21	RHS	48+500	22	107	157	500	786
22	RHS	49+000	20	110	160	500	790
23	RHS	49+500	23	116	157	500	796
24	LHS	50+000	26	119	154	500	799
25	RHS	50+500	28	125	148	500	801
26	LHS	51+000	29	129	144	500	802
27	RHS	51+500	33	135	138	500	806
28	LHS	52+000	31	145	128	500	804
29	RHS	52+500	36	150	119	500	805
30	LHS	53+000	35	160	110	500	805
31	RHS	53+500	38	154	116	500	808
32	LHS	54+000	41	148	122	500	811
33	RHS	54+500	43	144	126	500	813
34	LHS	55+000	47	136	134	500	817
35	RHS	55+500	45	140	130	500	815
36	LHS	56+000	44	142	128	500	814
37	RHS	56+500	49	132	138	500	819
38	RHS	57+000	50	100	160	500	810
39	RHS	57+500	51	113	163	500	827
40	LHS	58+000	53	123	165	500	841
41	RHS	58+500	55	134	169	500	858
42	LHS	59+000	54	131	171	500	856
43	RHS	59+500	60	138	176	500	874

Table: Summary of Existing Pavement Composition for Small Pit

S.NO	Side	Chainage (KM)	Crust Composition (mm)				Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	SUBGRADE	
44	LHS	60+000	59	141	179	500	879
45	RHS	60+500	57	146	181	500	884
46	LHS	61+000	55	151	183	500	889
47	RHS	61+500	58	154	187	500	899
48	LHS	62+000	53	160	189	500	902
49	RHS	62+500	61	171	191	500	923
50	LHS	63+000	59	183	193	500	935
51	RHS	63+500	58	199	195	500	952
52	LHS	64+000	55	210	196	500	961
53	RHS	64+500	52	216	198	500	966
54	RHS	65+000	50	220	200	500	970
55	RHS	65+500	48	168	148	500	864
56	LHS	66+000	45	165	142	500	852
57	RHS	66+500	47	167	146	500	860
58	LHS	67+000	44	164	140	500	848
59	RHS	67+500	41	161	134	500	836
60	LHS	68+000	39	159	130	500	828
61	RHS	68+500	36	156	124	500	816
62	LHS	69+000	38	158	128	500	824
63	RHS	69+500	35	155	122	500	812
64	RHS	70+000	35	110	100	500	745
65	RHS	70+500	38	113	103	500	754
66	LHS	71+000	41	116	106	500	763
67	RHS	71+500	43	118	108	500	769
68	LHS	72+000	47	122	112	500	781
69	RHS	72+500	45	120	110	500	775
70	LHS	73+000	44	119	109	500	772
71	RHS	73+500	49	124	114	500	787
72	LHS	74+000	47	122	112	500	781
73	RHS	74+500	48	123	113	500	784
74	LHS	75+000	50	130	110	500	790

Table: Summary of Existing Pavement Composition for Small Pit

S.NO	Side	Chainage (KM)	Crust Composition (mm)				Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	SUBGRADE	
75	RHS	75+500	51	131	112	500	794
76	LHS	76+000	54	134	115	500	803
77	RHS	76+500	49	129	114	500	792
78	LHS	77+000	51	131	121	500	803
79	RHS	77+500	56	136	116	500	808
80	LHS	78+000	52	132	117	500	801
81	RHS	78+500	58	138	113	500	809
82	LHS	79+000	61	141	109	500	811
83	RHS	79+500	63	143	111	500	817
84	RHS	80+000	65	140	110	500	815
85	RHS	80+500	64	141	123	500	828
86	LHS	81+000	61	143	139	500	843
87	RHS	81+500	62	139	149	500	850
88	LHS	82+000	59	146	164	500	869
89	RHS	82+500	57	145	178	500	880
90	LHS	83+000	54	143	199	500	896
91	RHS	83+500	51	148	211	500	910
92	LHS	84+000	48	144	226	500	918
93	RHS	84+500	44	148	245	500	937
94	RHS	85+000	43	150	250	500	943
95	RHS	85+500	45	146	248	500	939
96	LHS	86+000	49	141	241	500	931
97	RHS	86+500	48	138	231	500	917
98	LHS	87+000	43	129	225	500	897
99	RHS	87+500	47	122	216	500	885
100	LHS	88+000	44	118	209	500	871
101	RHS	88+500	48	111	199	500	858
102	LHS	89+000	49	108	192	500	849
103	RHS	89+500	52	113	183	500	848
104	RHS	90+000	50	110	180	500	840
105	RHS	90+500	51	115	183	500	849

Table: Summary of Existing Pavement Composition for Small Pit

S.NO	Side	Chainage (KM)	Crust Composition (mm)				Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	SUBGRADE	
106	LHS	91+000	59	119	192	500	870
107	RHS	91+500	64	123	208	500	895
108	LHS	92+000	68	128	215	500	911
109	RHS	92+500	73	131	223	500	927
110	LHS	93+000	79	134	228	500	941
111	RHS	93+500	82	139	236	500	957
112	LHS	94+000	89	138	234	500	961
113	RHS	94+500	95	141	239	500	975
114	RHS	95+000	110	140	240	500	990
115	RHS	95+500	101	131	235	500	967
116	LHS	96+000	97	127	216	500	940
117	RHS	96+500	94	124	197	500	915
118	LHS	97+000	88	118	189	500	895
119	RHS	97+500	85	115	182	500	882
120	LHS	98+000	81	111	169	500	861
121	RHS	98+500	83	113	164	500	860
122	LHS	99+000	85	115	159	500	859
123	RHS	99+500	84	114	151	500	849
124	RHS	100+000	80	110	140	500	830
125	RHS	100+500	78	115	153	500	846
126	LHS	101+000	79	119	172	500	870
127	RHS	101+500	73	128	192	500	893
128	LHS	102+000	65	134	234	500	933
129	RHS	102+500	61	131	251	500	943
130	LHS	103+000	58	139	266	500	963
131	RHS	103+500	56	136	264	500	956
132	RHS	104+000	55	140	270	500	965
133	RHS	104+500	53	138	268	500	959
134	LHS	105+000	57	142	264	500	963
135	RHS	105+500	51	136	270	500	957
136	LHS	106+000	54	139	267	500	960

Table: Summary of Existing Pavement Composition for Small Pit

S.NO	Side	Chainage (KM)	Crust Composition (mm)				Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	SUBGRADE	
137	RHS	106+500	53	138	258	500	949
138	LHS	107+000	55	140	249	500	944
139	RHS	107+500	47	132	235	500	914
140	LHS	108+000	48	133	216	500	897
141	RHS	108+500	46	131	197	500	874
142	LHS	109+000	45	130	189	500	864
143	RHS	109+500	48	133	182	500	863
144	LHS	110+000	49	134	175	500	858
145	RHS	110+500	44	129	173	500	846
146	LHS	111+000	46	126	169	500	841
147	RHS	111+500	51	119	164	500	834
148	LHS	112+000	53	115	159	500	827
149	RHS	112+500	49	113	151	500	813
150	LHS	113+000	50	110	140	500	800
151	RHS	113+500	51	112	141	500	804
152	LHS	114+000	53	121	143	500	817
153	RHS	114+500	49	129	139	500	817
154	LHS	115+000	46	134	137	500	817
155	RHS	115+500	43	128	132	500	803
156	LHS	116+000	48	139	135	500	822
157	RHS	116+500	44	129	129	500	802
158	LHS	117+000	46	131	131	500	808
159	RHS	117+500	44	135	133	500	812
160	RHS	118+000	45	140	130	500	815
161	RHS	118+500	46	143	128	500	817
162	LHS	119+000	45	147	126	500	818
163	RHS	119+500	48	144	125	500	817
164	LHS	120+000	49	149	131	500	829
165	RHS	120+500	44	145	127	500	816
166	LHS	121+000	46	152	119	500	817
167	RHS	121+500	51	148	115	500	814

Table: Summary of Existing Pavement Composition for Small Pit

S.NO	Side	Chainage (KM)	Crust Composition (mm)				Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	SUBGRADE	
168	LHS	122+000	53	153	109	500	815
169	RHS	122+500	49	151	105	500	805
170	RHS	123+000	50	150	100	500	800
171	RHS	123+500	51	155	95	500	801
172	LHS	124+000	53	157	99	500	809
173	RHS	124+500	55	161	98	500	814
174	LHS	125+000	54	168	101	500	823
175	RHS	125+500	60	173	102	500	835
176	LHS	126+000	59	178	106	500	843
177	RHS	126+500	57	182	105	500	844
178	LHS	127+000	55	185	108	500	848
179	RHS	127+500	58	186	109	500	853
180	RHS	128+000	50	190	110	500	850
181	LHS	128+500	20	280	100	500	900
182	LHS	129+000	25	275	111	500	911
183	RHS	129+500	29	276	108	500	913
184	LHS	130+000	34	271	119	500	924
185	RHS	130+500	39	269	126	500	934
186	LHS	131+000	44	264	134	500	942
187	RHS	131+500	45	268	139	500	952
188	LHS	132+000	48	263	142	500	953
189	RHS	132+500	51	261	149	500	961
190	LHS	133+000	50	260	150	500	960
191	RHS	133+500	53	259	153	500	965
192	LHS	134+000	55	251	155	500	961
193	RHS	134+500	59	243	161	500	963
194	LHS	135+000	62	238	168	500	968
195	RHS	135+500	68	231	172	500	971
196	LHS	136+000	71	229	173	500	973
197	RHS	136+500	73	218	175	500	966
198	LHS	137+000	75	215	177	500	967

Table: Summary of Existing Pavement Composition for Small Pit

S.NO	Side	Chainage (KM)	Crust Composition (mm)				Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	SUBGRADE	
199	RHS	137+500	78	213	179	500	970
200	LHS	138+000	80	210	180	500	970
201	RHS	138+500	81	211	172	500	964
202	LHS	139+000	83	216	168	500	967
203	RHS	139+500	77	218	164	500	959
204	LHS	140+000	76	223	158	500	957
205	RHS	140+500	79	228	151	500	958
206	LHS	141+000	75	239	143	500	957
207	RHS	141+500	78	248	137	500	963
208	LHS	142+000	75	251	129	500	955
209	RHS	142+500	72	255	118	500	945
210	LHS	143+000	70	260	110	500	940
211	RHS	143+500	68	257	95	500	920
212	LHS	144+000	69	251	98	500	918
213	RHS	144+500	66	243	102	500	911
214	LHS	145+000	64	236	101	500	901
215	RHS	145+500	62	220	100	500	882
216	LHS	146+000	61	205	103	500	869
217	RHS	146+500	58	196	105	500	859
218	LHS	147+000	55	184	100	500	839
219	RHS	147+500	53	161	109	500	823
220	LHS	148+000	50	160	110	500	820
221	RHS	148+500	51	163	115	500	829
222	LHS	149+000	53	166	113	500	832
223	RHS	149+500	55	169	118	500	842
224	LHS	150+000	54	178	121	500	853
225	RHS	150+500	60	182	125	500	867
226	LHS	151+000	59	191	114	500	864
227	RHS	151+500	57	210	119	500	886
228	LHS	152+000	55	238	114	500	907
229	RHS	152+500	58	244	115	500	917

Table: Summary of Existing Pavement Composition for Small Pit

S.NO	Side	Chainage (KM)	Crust Composition (mm)				Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	SUBGRADE	
230	RHS	153+000	50	250	118	500	918
231	RHS	153+500	51	220	100	500	871
232	LHS	154+000	49	205	121	500	875
233	RHS	154+500	48	196	137	500	881
234	LHS	155+000	47	184	144	500	875
235	RHS	155+500	49	161	183	500	893
236	LHS	156+000	45	140	210	500	895

Table : Summary of Existing Pavement Composition for Large Pit

S.NO	Side	Chainage (KM)	Crust Composition (mm)			Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	
Stretch-1 (NH-29)						
1	RHS	38+600	60	110	160	330
2	RHS	43+000	45	90	140	275
3	RHS	49+000	20	110	160	290
4	LHS	53+000	35	160	110	305
5	RHS	57+000	50	100	160	310
6	RHS	65+000	50	220	200	470
7	RHS	70+000	35	110	100	245
8	LHS	75+000	50	130	110	290
9	RHS	80+000	65	140	110	315
10	RHS	85+000	43	150	250	443
11	RHS	90+000	50	110	180	340
12	RHS	95+000	110	140	240	490
13	RHS	100+000	80	110	140	330
14	RHS	104+000	55	140	270	465
15	LHS	113+000	50	110	140	300

Table : Summary of Existing Pavement Composition for Large Pit						
S.NO	Side	Chainage (KM)	Crust Composition (mm)			Total Thickness (mm)
			Bituminous	SUB-BASE COARSE	BASE COARSE	
16	RHS	118+000	45	140	130	315
17	RHS	123+000	50	150	100	300
18	RHS	128+000	50	190	110	240
19	LHS	128+500	20	280	100	400
20	LHS	133+000	50	260	150	460
21	LHS	138+000	80	210	180	470
22	LHS	143+000	70	260	110	440
23	LHS	148+000	50	160	110	210
24	RHS	153+000	50	250	118	300
25	LHS	156+000	45	140	210	395

2.1.3 Existing Pavement Composition (for Large Pit)

The existing pavement structure mostly comprises of two and three layers, namely bituminous layer, base course and sub-base course. Summary of existing pavement composition has been provided in **Table 2.1**.

NAME OF ROAD: -MANJA TO LAHORIJAN: -

Table 2.1a: Summary of Existing Pavement Composition							
S.NO	Side	Chainage (KM)	Crust Composition (mm)		Total Thickness (mm)	DCPT CBR 200mm	DCPT CBR 400mm
			Bituminous	BASE COARSE			
1	LHS	128+00	20	380	400	2.06	2.10
2	LHS	133+000	50	410	460	7.62	6.65
3	LHS	138+000	80	390	470	2.10	3.55
4	LHS	143+000	70	370	440	8.97	10.15
5	LHS	148+000	30	160	190	4.18	4.66
6	RHS	153+000	50	250	300	6.59	8.55
7	LHS	156+000	45	350	395	3.81	3.99

NAME OF ROAD: -DABOKA TO MANJA: -

Table 2.1b: Summary of Existing Pavement Composition							
S.NO	Side	Chainage (KM)	Crust Composition (mm)		Total Thickness (mm)	DCPT CBR 200mm	DCPT CBR 400mm
			Bituminous	BASE COARSE			
1	RHS	38+600	60	270	330	8.39	8.38
2	RHS	43+000	45	230	275	3.60	4.10
3	RHS	49+000	20	270	290	6.01	5.23
4	LHS	53+500	35	270	305	2.08	3.31
5	RHS	57+500	50	270	320	5.03	6.97
6	RHS	65+000	50	420	470	1.68	1.97
7	RHS	70+000	35	210	245	1.80	3.30
8	LHS	75+000	50	340	390	3.32	3.18
9	RHS	80+000	65	250	315	5.26	7.71
10	RHS	85+000	43	400	443	23.66	32.16
11	RHS	90+000	50	290	340	1.77	2.11
12	RHS	95+000	110	380	490	6.72	7.69
13	RHS	100+000	80	240	320	1.57	2.13
14	RHS	104+000	5	410	465	15.48	16.94
15	LHS	113+000	50	250	300	3.74	3.25
16	RHS	118+000	45	270	315	3.94	4.72
17	RHS	123+000	50	250	300	6.23	8.03
18	RHS	128+000	50	190	240	2.80	5.78

2.1.4 Field Dry Density

NAME OF ROAD:-MANJA TO LAHORIJAN:-

Table 2.2a Summary Field Dry Density					
S.NO.	CHAINAGE (KM)	SIDE	MOISTURE CONTENT (%)	DRY DENSITY (gm/cc)	MDD (gm/cc)
1	128+500	LHS	7.00	1.690	1.831
2	133+000	LHS	6.00	1.764	1.883
3	138+000	LHS	8.00	1.704	1.822
4	143+000	LHS	6.00	1.734	1.865
5	148+000	LHS	4.00	1.699	1.809
6	153+000	RHS	5.00	1.732	1.853
7	156+000	LHS	6.00	1.724	1.848

NAME OF ROAD:-DABOKA TO MANJA :-

Table 2.2b Summary Field Dry Density

S.NO.	CHAINAGE (KM)	SIDE	MOISTURE CONTENT (%)	DRY DENSITY (gm/cc)	MDD (gm/cc)
1	38+600	RHS	7.00	1.736	1.846
2	43+000	RHS	6.00	1.715	1.816
3	49+000	RHS	8.00	1.695	1.810
4	53+500	LHS	5.00	1.706	1.825
5	57+500	RHS	7.00	1.714	1.840
6	65+000	RHS	4.00	1.738	1.878
7	70+000	RHS	5.00	1.697	1.832
8	75+000	LHS	4.50	1.717	1.827
9	80+000	RHS	5.50	1.734	1.887
10	85+000	RHS	4.50	1.726	1.865
11	90+000	RHS	6.00	1.704	1.835
12	95+000	RHS	5.00	1.719	1.829
13	100+000	RHS	5.50	1.696	1.821
14	104+000	RHS	8.00	1.709	1.844
15	113+000	LHS	9.00	1.735	1.859
16	118+000	RHS	8.00	1.742	1.854
17	123+000	RHS	6.00	1.704	1.831
18	128+000	RHS	4.00	1.714	1.839

2.1.5 Laboratory Properties of Sub-grade Soil

The laboratory test results consist of gradation, Atterberg limits, field moisture content, Field dry density (FDD), compaction characteristics (maximum dry density and optimum moisture content relationship as per heavy compaction), CBR (soaked) etc. for the subgrade soils underneath the existing pavement

2.1.6 Grain Size

The fraction of the materials of the sub-grade soils passing 75µ sieve is 13.06% to 15.05 % on an average,

Stretch I– The soil is CL and SC type soil.

2.1.7 Atterberg Limit

The liquid limits for existing pavement of the soil are NP to plastic.Plasticity index for existing

pavement soils are5 to 20

2.1.8 Moisture Content vs. Dry Unit Weight Relationship (Heavy Compaction)

Soil samples obtained by test pits have been compacted in the laboratory at various moisture contents to derive moisture content vs. dry unit weight relationship. The method of heavy compaction in accordance with IS 2720 (Part 8) has been used. The results of heavy compaction test carried out on sub-grade samples of existing pavement to determine the maximum dry density (MDD) and optimum moisture content (OMC) relationship.

Forexisting sub-grade soil the maximum dry density (MDD) of ranges between 17.5kN/ $m^3$and 18.5 kN/m^3. The optimum moisture content varies between 9.5 % and 17%. The result indicatesthat the maximum dry density of existing sub-grade soil is greater than 17.5 kN/ m^3 at all chainages which satisfies the unit weight requirement of sub-grade soil as specified by MORT&H.

2.1.9 CBR of existing sub-grade soil

California Bearing Ratio (CBR) tests were carried out on the pit samples in the laboratory as per standard procedures. At optimum moisture content (OMC) soil samples were compacted at three different energy levels corresponding to 10 blows, 35 blows, 65 blows as per IS:2720 (Part 8). These compacted soils at different compaction levels were tested after immersion in water for four days. Soaked CBR at 97% maximum dry density (MDD) has been interpolated from CBR-dry density curve. The Stretch I soil,soaked CBR value at 97% MDU ranges from 4 % to 8 % .

NAME OF ROAD:-MANJA TO LAHORIJAN:-

SL. No	SIDE	Chainage (Km.)	Grain size analysis			Heavy Compaction		Atterberg Limits			FSI	AT 97 % SHOAKED CBR
			Gravel (%)	Sand (%)	Silt & Clay (%)	MDD (gm/cc)	OMC (%)	LL (%)	PL (%)	PI (%)		
1	LHS	128+00	1.60	29.80	68.60	1.831	12.00	33.70	23.20	10.50	25.00	8.9
2	LHS	133+000	4.90	49.30	45.80	1.883	10.50	28.20	20.40	7.80	10.00	11.0

SL. No	SIDE	Chainage (Km.)	Grain size analysis			Heavy Compaction		Atterberg Limits			FSI	AT 97 % SHOAKED CBR
			Gravel (%)	Sand (%)	Silt & Clay (%)	MDD (gm/cc)	OMC (%)	LL (%)	PL (%)	PI (%)		
3	LHS	138+000	0.00	26.60	73.40	1.822	12.40	34.20	23.60	10.60	27.50	8.3
4	LHS	143+000	4.20	40.50	55.30	1.865	11.00	29.90	21.70	8.20	12.50	10.4
5	LHS	148+000	0.00	20.20	79.80	1.809	12.90	35.60	24.00	11.60	30.00	7.7
6	RHS	153+000	3.50	35.90	60.60	1.853	11.30	31.20	22.40	8.80	17.50	10.2
7	LHS	156+000	2.80	34.00	63.20	1.848	11.60	32.10	22.90	9.20	20.00	9.8

NAME OF ROAD:-DABOKA TO MANJA:-

SL. No	SIDE	Chainage (Km.)	Grain size analysis			Heavy Compaction		Atterberg Limits			FSI	AT 97 % SHOAKED CBR
			Gravel (%)	Sand (%)	Silt & Clay (%)	MDD (gm/cc)	OMC (%)	LL (%)	PL (%)	PI (%)		
1	RHS	38+600	3.10	43.80	53.10	1.846	11.10	32.20	21.70	10.50	15.00	10.2
2	RHS	43+000	0.00	22.30	77.70	1.816	12.50	35.20	23.60	11.60	30.00	7.6
3	RHS	49+000	0.00	21.40	78.60	1.810	12.70	35.30	23.70	11.60	30.00	7.5
4	LHS	53+500	0.00	24.20	75.80	1.825	12.30	34.60	23.60	11.00	25.00	8.1
5	RHS	57+500	1.80	40.30	57.90	1.840	11.50	32.70	22.10	10.60	17.50	10.1
6	RHS	65+000	4.70	49.10	46.20	1.878	10.10	30.20	20.90	9.30	7.50	10.9
7	RHS	70+000	0.00	34.30	65.70	1.832	12.10	33.10	22.70	10.40	20.00	9.0
8	LHS	75+000	0.00	26.70	73.30	1.827	12.30	34.20	23.20	11.00	22.50	8.4
9	RHS	80+000	5.30	51.00	43.70	1.887	10.00	29.70	20.60	9.10	7.50	11.1
10	RHS	85+000	4.50	48.00	47.50	1.865	10.30	30.60	21.10	9.50	10.00	10.5
11	RHS	90+000	1.10	35.30	63.60	1.835	12.00	32.90	22.50	10.40	20.00	9.3
12	RHS	95+000	0.00	28.60	71.40	1.829	12.20	33.70	23.10	10.60	22.50	8.7

SL. No	SIDE	Chainage (Km.)	Grain size analysis			Heavy Compaction		Atterberg Limits			FSI	AT 97 % SHOAKED CBR
			Gravel (%)	Sand (%)	Silt & Clay (%)	MDD (gm/cc)	OMC (%)	LL (%)	PL (%)	PI (%)		
13	RHS	100+000	0.00	23.50	76.50	1.821	12.40	34.90	23.60	11.30	27.50	7.9
14	RHS	104+000	2.60	41.90	55.50	1.844	11.20	32.50	21.90	10.60	15.00	10.2
15	LHS	113+000	3.60	47.20	49.20	1.859	10.70	31.90	21.30	10.60	12.50	10.4
16	RHS	118+000	4.10	45.00	50.90	1.854	10.80	32.10	21.40	10.70	12.50	10.4
17	RHS	123+000	0.00	30.80	69.20	1.831	12.10	33.50	22.70	10.80	20.00	8.8
18	RHS	128+000	1.40	37.80	60.80	1.839	11.80	32.70	22.20	10.50	17.50	9.7

2.2 Borrow Area Material Survey

The Consultants has conducted necessary survey to find out the general characteristics of earth materials available in the area. The objective of this investigation is mainly to assess the general availability of soil required for construction of sub-grade and embankment as per design CBR recommended for design of new pavement.

2.2.1 Grain Size

The fraction of the materials of the Borrow area soils passing 75µ sieve is 14.05 % on an average, indicating highersand andclay content in the borrow area soil and that the soils are predominantly Gravely sandy Clay. (mix with moorum)

2.2.2 Atterberg Limit

The liquid limit for borrow soil areplastic to NP. Plasticity index for Borrow area soils are 06 to 14

2.2.3 Moisture Content vs. Dry Unit Weight Relationship (Heavy Compaction)

For borrow area soil the maximum dry density (MDD) of ranges between 17.5kN/ $m^3$and 1.9kN/. The optimum moisture content varies between 9.0. % and 16%. The result indicates that the maximum dry density of borrow area soil is greater than 17.5 kN/m^3 at all chainages which satisfies the unit weight requirement of sub-grade soil as specified by MORT&H.

2.2.4 CBR of borrow area soil

The Stretch I soil, soaked CBR value at 97% MDU ranges from 4 % to 8 %

NAME OF ROAD- DABOKA TO MANJA:-

SL. No	SAMPLE NO.	Grain Size Analysis			Heavy Compaction		Atterberg's Limit			FSI (%)	AT 97 %SHOAKED CBR
		Gravel (%)	Sand (%)	Silt & Clay (%)	MDD (gm/cc)	OMC (%)	LL (%)	PL (%)	PI (%)		
1	BA-1	3.80	37.40	58.80	1.852	10.40	33.10	22.80	10.30	20.00	9.2
2	BA-2	0.00	25.80	74.20	1.826	11.70	35.10	24.10	11.00	27.50	8.1
3	BA-3	2.30	31.70	66.00	1.844	10.60	33.90	23.20	10.70	22.50	8.8
4	BA-4	0.00	18.70	81.30	1.813	12.50	36.10	24.70	11.40	30.00	7.6
5	BA-5	7.60	47.20	45.20	1.891	9.40	29.40	20.30	9.10	10.00	11.9
6	BA-6	2.00	28.70	69.30	1.837	11.40	34.40	23.60	10.80	25.00	8.5
7	BA-7	6.30	44.10	49.60	1.875	9.70	30.30	20.90	9.40	12.50	10.7
8	BA-8	4.70	41.40	53.90	1.856	10.00	32.40	22.10	10.30	15.00	9.6
9	BA-9	1.60	27.00	71.40	1.831	11.90	34.60	23.80	10.80	25.00	8.4
10	BA-10	5.80	43.20	51.00	1.863	9.90	31.80	21.40	10.40	15.00	10.1
11	BA-11	0.00	23.40	76.60	1.818	12.10	35.70	24.30	11.40	30.00	7.9

2.3 Quarry Material Survey

The material investigation for road construction has been carried out to identify the potential sources of construction materials and to assess their general availability, engineering properties and quantities. This is one of the most important factors for stable, economic and successful implementation of the road program within the stipulated time. The material investigation is quite representative, but more exhaustive search may surely be explored by the contractors at the time of construction. For improvement work as well as for new construction the list of materials includes the following:

- *Granular materials for sub-base works*
- *Crushed stone aggregates for base , bituminous surfacing and cement concrete works*
- *Sand for bituminous and cement concrete works, sub-base, filter materials and filling materials etc.*
- *Borrow earthmaterials for embankment, sub-grade and filling*

2.3.1 Objective

The following are the basic objective to make material investigation:

- Source locations indicating places, kilometerage, availability and the status whether in operation or new source.
- Access to source, indicating the direction and nature of the access road i.e. left/ right of project road, approximate lead distance from the gravity center and type of access road.
- Ownership of land/ quarries, either government or private.
- Test results, indicating the quality of materials with respect to their suitability in construction.
- Probable use indicating the likely use of materials at various stages of construction work i.e. fill material, sub-grade, sub-base, base, bituminous surfacing and cross drainage structures.

The potential sources of construction materials were selected from consideration of the availability and suitability of the materials, easy access to the source and minimum hauling distance from the source in order to make the construction economical and feasible as far as possible. The samples from various identified sources have been collected for laboratory testing as per IRC/MORT&H/BIS standards.

A) Coarse Aggregate

Coarse aggregates such as trap rocks consisting of mainly basalt, black and grey in color, are available in the vicinity of the project road. Stone quarries have been primarily identified as stone aggregate source for construction of various components of road, namely, Bituminous Concrete, Semi dense Bituminous concrete (SDBC), Dense Bituminous Macadam (DBM), Wet Mix Macadam (WMM),Granular sub-Base (GSB) as well as for the cement concrete works. The sources identified including their location details, lead distance and availability of the stones are tabulated in **Table 2.3.**

Table 2.3: Details of Coarse and fine Aggregates Quarry Sources

Sl. No.	Sample No	Crusher plant location/Village Name	Side	Lead (km)
1	Coarse Aggregate-1	SATYAM DAS,BOKAJAN	LHS	LEAD 4.5 KM FROM EXT. CHAINAGE 93+500 Km ON NUMALIGARH TO KHATKHATI ROAD
2	Coarse Aggregate-2	SAMUL BASUNO,MANJA	RHS	LEAD 0.050 KM FROM EXT. CHAINAGE 126+000 Km ON DABOKA TO MANJA ROAD

2.3.2 Laboratory Test Results of Coarse Aggregate Samples

Laboratory tests carried out for the above-mentioned samples are presented in **Table 2.4**to**Table 2.7** respectively.

Table 2.4: Test results of Aggregate samples of size 20mm(1)

Description	% of passing of Quarry Sample
Passing through 40MM	100
Passing through 20MM	90.60
Passing through 10MM	3.80
Passing through 4.75MM	1.10

Table 2.5: Test results of Aggregate samples of size 20mm(2)

Description	% of passing of Quarry Sample
Passing through 40MM	100
Passing through 20MM	94.60
Passing through 10MM	6.80
Passing through 4.75MM	2.30

Table 2.6: Test results of Aggregate samples of size 10 mm(1)

Description	% of passing of Quarry Sample
Passing through 12.5MM	100
Passing through 10 MM	86.70
Passing through 4.75MM	7.10
Passing through 2.36MM	3.60

Table 2.7: Test results of Aggregate samples of size 10 mm(2)

Description	% of passing of Quarry Sample
Passing through 12.5MM	100
Passing through 10 MM	89.50
Passing through 4.75MM	12.40
Passing through 2.36MM	3.90

Laboratory test results summary of coarse aggregates has been presented in **Table 2.8**

Table 2.8:Summary of Laboratory Test Result of Aggregates-1

Sample No	Crusher plant location/Village Name	AIV (%)	LAV (%)	Specification	FI+EI (%)	Specific-ation	Specific Gravity	Water Absorption (%)	Specific-ation
CA-1(20 MM)	**SATYAM DAS,BOKAJAN**	16.9	23.8	Not more than 30% for non-bituminous work, 27% & 24% for DBM and BC work respectively	26.8	Not more than 35%	2.676	0.68	Not more than 2%
CA-1(10 MM)	**SATYAM DAS,BOKAJAN**	19.3	25.4	Not more than 30% for non-bituminous work, 27% & 24% for DBM and BC work respectively	28.3	Not more than 35%	2.662	0.75	Not more than 2%

Table 2.9: Summary of Laboratory Test Result of Aggregates-2

Sample No	Crusher plant location/Village Name	AIV (%)	LAV (%)	Specification	FI+EI (%)	Specific-ation	Specific Gravity	Water Absorption (%)	Specific-ation
CA-2(20 MM)	SAMUL BASUNO,MANJA	15.7	23.1	Not more than 30% for non-bituminous work, 27% & 24% for DBM and BC work respectively	24.6	Not more than 35%	2.698	0.57	Not more than 2%

Sample No	Crusher plant location/Village Name	AIV (%)	LAV (%)	Specification	FI+EI (%)	Specific-ation	Specific Gravity	Water Absorption (%)	Specific-ation
CA-2(10 MM)	SAMUL BASUNO,MANJA	19.3	24.3	Not more than 30% for non-bituminous work, 27% & 24% for DBM and BC work respectively	26.8	Not more than 35%	2.694	0.63	Not more than 2%

The results from **Table 2.8&2.9** indicate that all the quarry samples are of approved standard and can be used for Road construction.

B) Fine Aggregate

Many sources have been identified are available in the vicinity of the project road. The quarry location and approximate lead distance from project is given in **Table 2.10**

Table 2.10: Details of Fine Aggregate Sources

S. No.	Sample No	Crusher plant location/Village Name Village Name	Side	Lead (km)
1	FA-1	SUBHAM TANKU,DIOPANI	RHS	LEAD 1.50 KM FROM EXT. CHAINAGE 69+200 Km ON NUMALIGARH TO KHATKHATI ROAD
2	FA-2	SAMUL BASUNO,MANJA	RHS	LEAD 0.050 KM FROM EXT. CHANAIGE 39+500 Km ON DABOKA TO MANJA ROAD

2.3.3 Laboratory Test Results of Fine Aggregate Samples

Laboratory tests were conducted on the sand samples collected from the Riverand are summarized below in **Table 2.11&2.12.**

Table 2.11: Gradation of Fine aggregate (1)

Sl. No.	Sieve Size (mm)	% of passing	FA Zone I	FA Zone II	FA Zone III	FA ZONE IV
1	10	99.54	100	100	100	100
2	4.75	98.15	90 - 100	90 - 100	90 - 100	95-100

Sl. No.	Sieve Size (mm)	% of passing	FA Zone I	FA Zone II	FA Zone III	FA ZONE IV
3	2.36	93.44	60 - 95	75 - 100	85 - 100	95-100
4	1.18	71.26	30 - 70	55 - 90	75 - 100	90-100
5	600 mic	45.19	15 - 34	35 - 59	60 - 79	80-100
6	300 mic	10.81	5-20	8-30	12-40	15-50
7	150 mic	1.85	0 - 10	0 - 10	0 - 10	0-15
8	Fineness Modulus (F.M) of FA	2.798				
9	Specific Gravity	2.615				
10	Water absorption	1.37				

Table 2.12: Gradation of Fine aggregate (2)

Sl. No.	Sieve Size (mm)	% of passing	FA Zone I	FA Zone II	FA Zone III	FA ZONE IV
1	10	99.12	100	100	100	100
2	4.75	97.66	90 - 100	90 - 100	90 - 100	95-100
3	2.36	89.42	60 - 95	75 - 100	85 - 100	95-100
4	1.18	68.47	30 - 70	55 - 90	75 - 100	90-100
5	600 mic	43.20	15 - 34	35 - 59	60 - 79	80-100
6	300 mic	13.62	5-20	8-30	12-40	15-50
7	150 mic	2.08	0 - 10	0 - 10	0 - 10	0-15
8	Fineness Modulus (F.M) of FA	2.864				
9	Specific Gravity	2.628				
10	Water absorption	1.14				

Table 2.11&2.12 shows that fine medium coarse sand is available from the above river. The grading zone and fineness modulus of above stone chursher Zone II & Zone II(IS 383 2016) and 2.798 & 2.864 respectively, indicating that it is suitable for road pavement and structural concreting works.

2.4 Manufactured Materials

2.4.1 General

Cement, bitumen, steel are the manufactured materials. Cement and steel with I.S. certification are indigenously available in abundance from the manufacturers. Bitumen of VG-10,VG-20,VG-30&VG-40 viscosity grade and emulsion are available from IOCL, within the vicinity of project

road.The regular supply of bitumen and cement can be satisfactorily met by advance agreements with the manufacturers. The grades of bitumen should be selected as per the guidelines of the MORT&H Specifications for Road and Bridge Works.

2.4.2 Cement

Cement to be used in the construction work shall be any of the following types with the prior approval of the Engineer:

- Ordinary Portland cement, 33 Grade, conforming to IS: 269
- Rapid Hardening Portland Cement, conforming to IS: 8041
- Ordinary Portland cement, 43 Grade, conforming to IS: 8112
- Ordinary Portland cement, 53 Grade, conforming to IS: 12269
- Sulphate Resistance Cement, Conforming tfo IS: 12330

The chloride content in cement shall in no case exceed 0.05 percent by mass of cement. Also, total sulphur content calculated as sulphuric anhydride (SO_3) shall in no case exceed 2.5 percent and 3.0 percent when tri-calcium aluminates present by mass is upto 5 or greater than 5 respectively. Good quality Cement is locally available.

2.4.3 Steel

For plain and reinforced concrete (PCC and RCC) or pre-stressed concrete (PSC) works, the reinforcement/un-tensioned steel as the case may be shall consists of the following grades of reinforcing bars as shown in **Table 2.13**are available with local stockists. Before incorporation into the work, steel shall be got approved by the engineer.

Table 2.13: Characteristic strength of reinforcement steel

Grade Designation	Bar Type conforming to governing IS Specification	Characteristic Strength f_y(MP_a)	Elastic Modulus GP_a
S 240	IS:432 Part I, Mild Steel Bar	240	200
S 415	IS:1786 High Yield Strength Deformed Bars (HYSD)	415	200

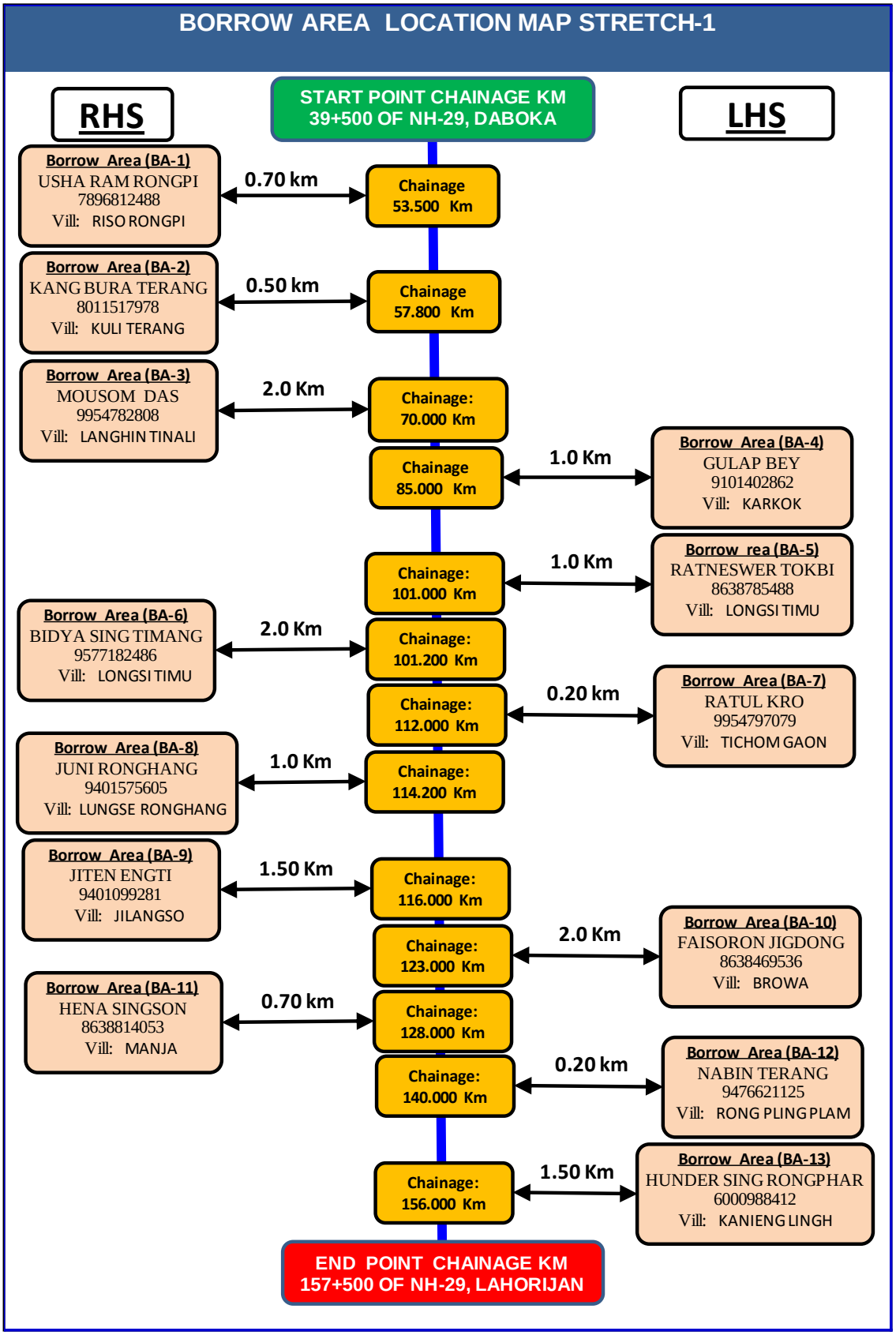
2.4.4 Bitumen

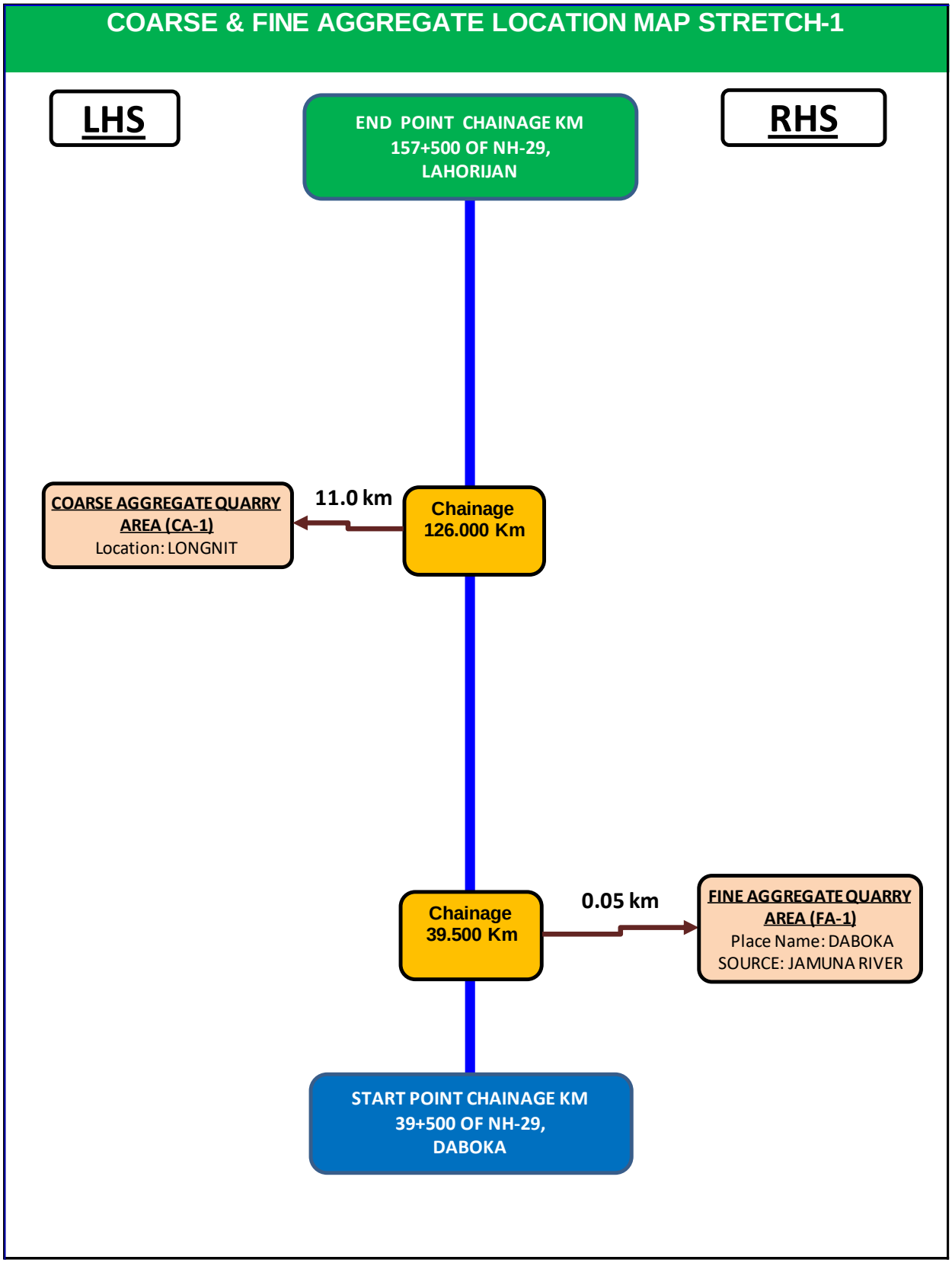
Bitumen of viscosity grade VG-10 and VG-30 is available from IOCL, Haldiawithin the vicinity of project road,either in bulk tanker or in drums. It is advised that Polymer Modified Bitumen / Crumb Rubber Bitumen to be used for construction of bituminous layer.

Sl.NO	Name of Cement Company	Location
1	IOCL	Haldia

2.4.5 Water

Detailed survey for locating water sources for the use in concrete works and for construction of road works were carried out in the vicinity of the project road. The most suitable source of water was which are in close proximity to some points of the alignment of the rivers,along with numerous nallas and irrigation canals cross the alignment at suitable intervals. However to facilitate construction works it is always advisable to install wells with due permission from authority at suitable places for obtaining water for construction purposes.


BORROW AREA LOCATION MAP STRETCH-1
RHS
LHS
START POINT CHAINAGE KM 39+500 OF NH-29, DABOKA
Borrow Area (BA-1)
USHA RAM RONGPI
7896812488
Vill: RISO RONGPI
0.70 km
Chainage 53.500 Km
Borrow Area (BA-2)
KANG BURA TERANG
8011517978
Vill: KULI TERANG
0.50 km
Chainage 57.800 Km
Borrow Area (BA-3)
MOUSOM DAS
9954782808
Vill: LANGHIN TINALI
2.0 Km
Chainage: 70.000 Km
Chainage 85.000 Km
1.0 Km
Borrow Area (BA-4)
GULAP BEY
9101402862
Vill: KARKOK
Chainage: 101.000 Km
1.0 Km
Borrow rea (BA-5)
RATNESWER TOKBI
8638785488
Vill: LONGSI TIMU
Borrow Area (BA-6)
BIDYA SING TIMANG
9577182486
Vill: LONGSI TIMU
2.0 Km
Chainage: 101.200 Km
Chainage: 112.000 Km
0.20 km
Borrow Area (BA-7)
RATUL KRO
9954797079
Vill: TICHOM GAON
Borrow Area (BA-8)
JUNI RONGHANG
9401575605
Vill: LUNGSE RONGHANG
1.0 Km
Chainage: 114.200 Km
Borrow Area (BA-9)
JITEN ENGTI
9401099281
Vill: JILANGSO
1.50 Km
Chainage: 116.000 Km
Chainage: 123.000 Km
2.0 Km
Borrow Area (BA-10)
FAISORON JIGDONG
8638469536
Vill: BROWA
Borrow Area (BA-11)
HENA SINGSON
8638814053
Vill: MANJA
0.70 km
Chainage: 128.000 Km
Chainage: 140.000 Km
0.20 km
Borrow Area (BA-12)
NABIN TERANG
9476621125
Vill: RONG PLING PLAM
Chainage: 156.000 Km
1.50 Km
Borrow Area (BA-13)
HUNDER SING RONGPHAR
6000988412
Vill: KANIENG LINGH
END POINT CHAINAGE KM 157+500 OF NH-29, LAHORIJAN


COARSE & FINE AGGREGATE LOCATION MAP STRETCH-1
LHS
RHS
END POINT CHAINAGE KM 157+500 OF NH-29, LAHORIJAN
COARSE AGGREGATE QUARRY AREA (CA-1)
Location: LONGNIT
11.0 km
Chainage 126.000 Km
Chainage 39.500 Km
0.05 km
FINE AGGREGATE QUARRY AREA (FA-1)
Place Name: DABOKA
SOURCE: JAMUNA RIVER
START POINT CHAINAGE KM 39+500 OF NH-29, DABOKA

2.14 Gradation of Granular Sub-base

GRADATION OF GSB						
NAME OF ROAD:- MANJA TO LAHORIJAN(NH-29)						
LOCATION: -		**133+000 LHS**				
			TOTAL WT.	**11800**	**gm**	
S.NO.	**IS SIEVE SIZE (mm)**	**Retained weight(gm)**	**Cumulative Ret.Wt.(gm)**	**Cumulative % Retained**	**% Passing**	**REMARKS**
1	75 mm	0	0	0	100	
2	53 mm	731.6	731.6	6.20	93.80	
3	26.5 mm	1935.2	2666.8	22.60	77.40	
4	9.5 mm	1958.8	4625.6	39.20	60.80	
5	4.75 mm	1439.6	6065.2	51.40	48.60	
6	2.36 mm	1829	7894.2	66.90	33.10	
7	0.850 mm	1451.4	9345.6	79.20	20.80	
8	0.425 mm	979.4	10325	87.50	12.50	
9	0.075 mm	1038.4	11363.4	96.30	3.70	
10	pan	436.6	11800	100.00		

GRADATION OF GSB						
NAME OF ROAD:- MANJA TO LAHORIJAN(NH-29)						
LOCATION:-		**156+000 LHS**				
			TOTAL WT.	**12600**	**gm**	
S.NO.	**IS SIEVE SIZE(mm)**	**Retained weight(gm)**	**Cumulative Ret.Wt.(gm)**	**Cumulative % Retained**	**% Passing**	**REMARKS**
1	75 mm	0	0	0	100	
2	53 mm	604.8	604.8	4.80	95.20	
3	26.5 mm	1877.4	2482.2	19.70	80.30	
4	9.5 mm	2016	4498.2	35.70	64.30	
5	4.75 mm	1839.6	6337.8	50.30	49.70	
6	2.36 mm	1814.4	8152.2	64.70	35.30	
7	0.850 mm	1600.2	9752.4	77.40	22.60	
8	0.425 mm	1045.8	10798.2	85.70	14.30	
9	0.075 mm	1272.6	12070.8	95.80	4.20	
10	pan	529.2	12600	100.00		

2.15 Gradation of Wet Mix Macadam

GRADATION OF WMM						
NAME OF ROAD:- MANJA TO LAHORIJAN(NH-29)						
LOCATION:-		133+000 LHS				
			TOTAL WT.	15400	gm	
S.NO.	IS SIEVE SIZE(mm)	Retained weight(gm)	Cumulative Ret.Wt.(gm)	Cumulative % Retained	% Passing	REMARKS
1	53 mm	0	0	0	100	
2	45 mm	323.4	323.4	2.10	97.90	
3	22.4 mm	2741.2	3064.6	19.90	80.10	
4	11.2 mm	3665.2	6729.8	43.70	56.30	
5	4.75 mm	2541	9270.8	60.20	39.80	
6	2.36 mm	2833.6	12104.4	78.60	21.40	
7	0.600 mm	1401.4	13505.8	87.70	12.30	
8	0.075 mm	1570.8	15076.6	97.90	2.10	
10	pan	323.4	15400	100.00		

GRADATION OF WMM						
NAME OF ROAD:- MANJA TO LAHORIJAN(NH-29)						
LOCATION:-		156+000 LHS				
			TOTAL WT.	13600	gm	
S.NO.	IS SIEVE SIZE(mm)	Retained weight(gm)	Cumulative Ret.Wt.(gm)	Cumulative % Retained	% Passing	REMARKS
1	53 mm	0	0	0	100	
2	45 mm	190.4	190.4	1.40	98.60	
3	22.4 mm	2216.8	2407.2	17.70	82.30	
4	11.2 mm	2924	5331.2	39.20	60.80	
5	4.75 mm	2271.2	7602.4	55.90	44.10	
6	2.36 mm	2543.2	10145.6	74.60	25.40	
7	0.600 mm	1441.6	11587.2	85.20	14.80	
8	0.075 mm	1591.2	13178.4	96.90	3.10	
10	pan	421.6	13600	100.00		

2.16 Gradation of Granular Sub-base

GRADATION OF GSB						
NAME OF ROAD:- DABOKA TO MANJA(NH-29)						
LOCATION:-		**38+600 RHS**				
			TOTAL WT.	**11400**	**gm**	
S.NO.	**IS SIEVE SIZE(mm)**	**Retained weight(gm)**	**Cumulative Ret.Wt.(gm)**	**Cumulative % Retained**	**% Passing**	**REMARKS**
1	75 mm	0	0	0	100	
2	53 mm	421.8	421.8	3.70	96.30	
3	26.5 mm	1242.6	1664.4	14.60	85.40	
4	9.5 mm	2120.4	3784.8	33.20	66.80	
5	4.75 mm	1995	5779.8	50.70	49.30	
6	2.36 mm	1892.4	7672.2	67.30	32.70	
7	0.850 mm	1299.6	8971.8	78.70	21.30	
8	0.425 mm	843.6	9815.4	86.10	13.90	
9	0.075 mm	1060.2	10875.6	95.40	4.60	
10	pan	524.4	11400	100.00		

GRADATION OF GSB						
NAME OF ROAD:- DABOKA TO MANJA(NH-29)						
LOCATION:-		**65+000 RHS**				
			TOTAL WT.	**15600**	**gm**	
S.NO.	**IS SIEVE SIZE(mm)**	**Retained weight(gm)**	**Cumulative Ret.Wt.(gm)**	**Cumulative % Retained**	**% Passing**	**REMARKS**
1	75 mm	0	0	0	100	
2	53 mm	1263.6	1263.6	8.10	91.90	
3	26.5 mm	1918.8	3182.4	20.40	79.60	
4	9.5 mm	2464.8	5647.2	36.20	63.80	
5	4.75 mm	2683.2	8330.4	53.40	46.60	
6	2.36 mm	1840.8	10171.2	65.20	34.80	
7	0.850 mm	1794	11965.2	76.70	23.30	
8	0.425 mm	1279.2	13244.4	84.90	15.10	
9	0.075 mm	1794	15038.4	96.40	3.60	
10	pan	561.6	15600	100.00		

GRADATION OF GSB						
NAME OF ROAD:- DABOKA TO MANJA(NH-29)						
LOCATION:-		95+000 RHS				
			TOTAL WT.	13300	gm	
S.NO.	IS SIEVE	Retained	Cumulative	Cumulative	% Passing	
	SIZE(mm)	weight(gm)	Ret.Wt.(gm)	% Retained		REMARKS
1	75 mm	0	0	0	100	
2	53 mm	611.8	611.8	4.60	95.40	
3	26.5 mm	2500.4	3112.2	23.40	76.60	
4	9.5 mm	1888.6	5000.8	37.60	62.40	
5	4.75 mm	1742.3	6743.1	50.70	49.30	
6	2.36 mm	2154.6	8897.7	66.90	33.10	
7	0.850 mm	1369.9	10267.6	77.20	22.80	
8	0.425 mm	1077.3	11344.9	85.30	14.70	
9	0.075 mm	1436.4	12781.3	96.10	3.90	
10	pan	518.7	13300	100.00		

GRADATION OF GSB						
NAME OF ROAD:- DABOKA TO MANJA(NH-29)						
LOCATION:-		123+000 RHS				
			TOTAL WT.	12200	gm	
S.NO.	IS SIEVE	Retained	Cumulative	Cumulative	% Passing	
	SIZE(mm)	weight(gm)	Ret.Wt.(gm)	% Retained		REMARKS
1	75 mm	0	0	0	100	
2	53 mm	1171.2	1171.2	9.60	90.40	
3	26.5 mm	1354.2	2525.4	20.70	79.30	
4	9.5 mm	1464	3989.4	32.70	67.30	
5	4.75 mm	1952	5941.4	48.70	51.30	
6	2.36 mm	1781.2	7722.6	63.30	36.70	
7	0.850 mm	2171.6	9894.2	81.10	18.90	
8	0.425 mm	939.4	10833.6	88.80	11.20	
9	0.075 mm	1024.8	11858.4	97.20	2.80	
10	pan	341.6	12200	100.00		

2.17 Gradation of Wet Mix Macadam

GRADATION OF WMM						
NAME OF ROAD:- DABOKA TO MANJA(NH-29)						
LOCATION:-		38+600 RHS				
			TOTAL WT.	13500	gm	
S.NO.	IS SIEVE	Retained	Cumulative	Cumulative	% Passing	
	SIZE(mm)	weight(gm)	Ret.Wt.(gm)	% Retained		REMARKS
1	53 mm	0	0	0	100	
2	45 mm	351	351	2.60	97.40	
3	22.4 mm	2740.5	3091.5	22.90	77.10	
4	11.2 mm	2902.5	5994	44.40	55.60	
5	4.75 mm	1998	7992	59.20	40.80	
6	2.36 mm	1822.5	9814.5	72.70	27.30	
7	0.600 mm	1242	11056.5	81.90	18.10	
8	0.075 mm	1957.5	13014	96.40	3.60	
10	pan	486	13500	100.00		

GRADATION OF WMM						
NAME OF ROAD:- DABOKA TO MANJA(NH-29)						
LOCATION:-		65+000 RHS				
			TOTAL WT.	14100	gm	
S.NO.	IS SIEVE	Retained	Cumulative	Cumulative	% Passing	
	SIZE(mm)	weight(gm)	Ret.Wt.(gm)	% Retained		REMARKS
1	53 mm	0	0	0	100	
2	45 mm	155.1	155.1	1.10	98.90	
3	22.4 mm	3313.5	3468.6	24.60	75.40	
4	11.2 mm	2326.5	5795.1	41.10	58.90	
5	4.75 mm	2721.3	8516.4	60.40	39.60	
6	2.36 mm	2044.5	10560.9	74.90	25.10	
7	0.600 mm	1339.5	11900.4	84.40	15.60	
8	0.075 mm	1889.4	13789.8	97.80	2.20	
10	pan	310.2	14100	100.00		

GRADATION OF WMM						
NAME OF ROAD:- DABOKA TO MANJA(NH-29)						
LOCATION:-		95+000 RHS				
			TOTAL WT.	12400	gm	
S.NO.	IS SIEVE	Retained	Cumulative	Cumulative	% Passing	
	SIZE(mm)	weight(gm)	Ret.Wt.(gm)	% Retained		REMARKS
1	53 mm	0	0	0	100	
2	45 mm	434	434	3.50	96.50	
3	22.4 mm	2393.2	2827.2	22.80	77.20	
4	11.2 mm	2120.4	4947.6	39.90	60.10	
5	4.75 mm	2232	7179.6	57.90	42.10	
6	2.36 mm	2170	9349.6	75.40	24.60	
7	0.600 mm	892.8	10242.4	82.60	17.40	
8	0.075 mm	1748.4	11990.8	96.70	3.30	
10	pan	409.2	12400	100.00		

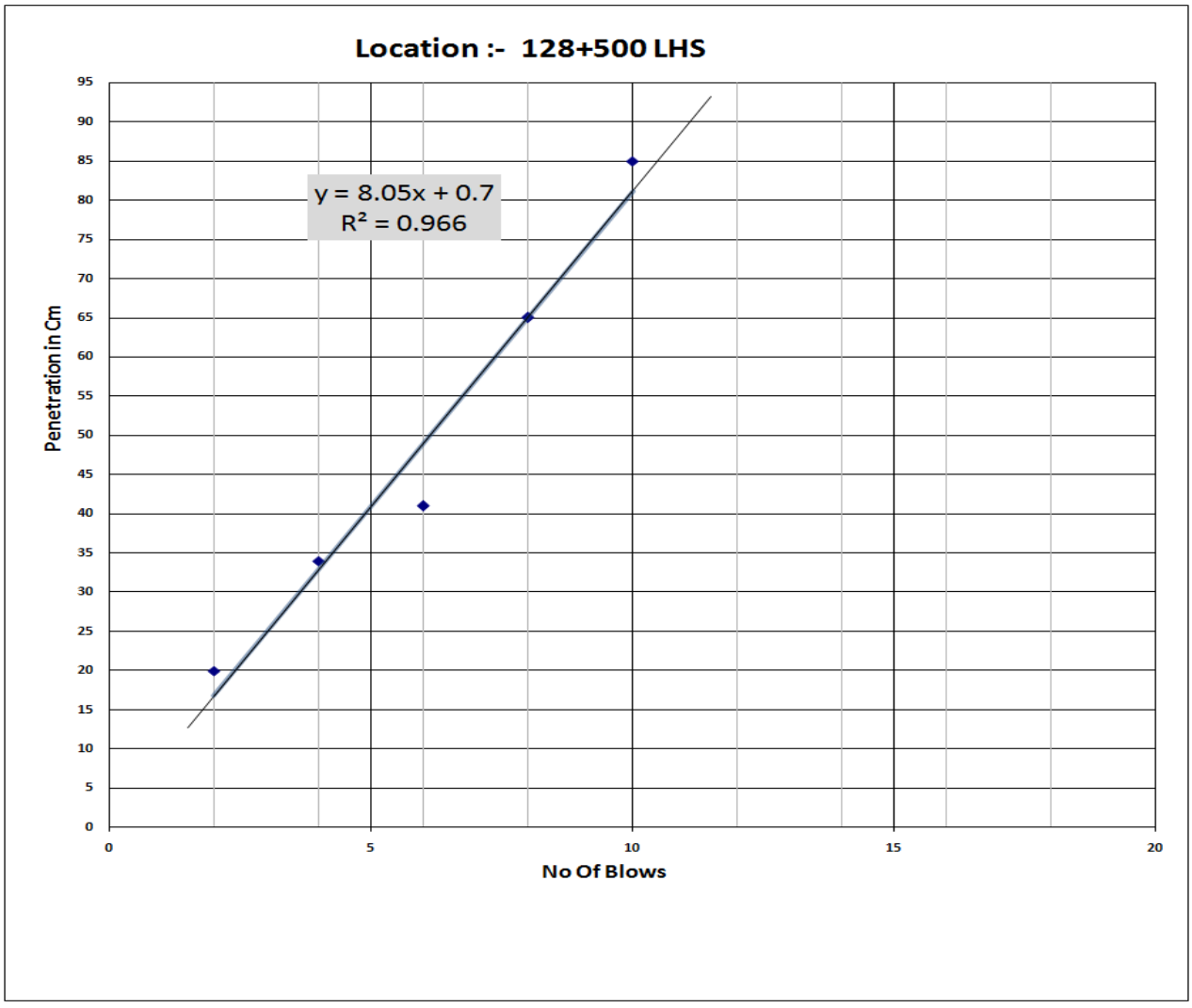
GRADATION OF WMM						
NAME OF ROAD:- DABOKA TO MANJA(NH-29)						
LOCATION:-		123+000 RHS				
			TOTAL WT.	14100	gm	
S.NO.	IS SIEVE	Retained	Cumulative	Cumulative	% Passing	
	SIZE(mm)	weight(gm)	Ret.Wt.(gm)	% Retained		REMARKS
1	53 mm	0	0	0	100	
2	45 mm	126.9	126.9	0.90	99.10	
3	22.4 mm	2791.8	2918.7	20.70	79.30	
4	11.2 mm	3299.4	6218.1	44.10	55.90	
5	4.75 mm	2538	8756.1	62.10	37.90	
6	2.36 mm	2227.8	10983.9	77.90	22.10	
7	0.600 mm	1170.3	12154.2	86.20	13.80	
8	0.075 mm	1607.4	13761.6	97.60	2.40	
10	pan	338.4	14100	100.00		

2.18 DCPT CBR VALUE CALCULATION

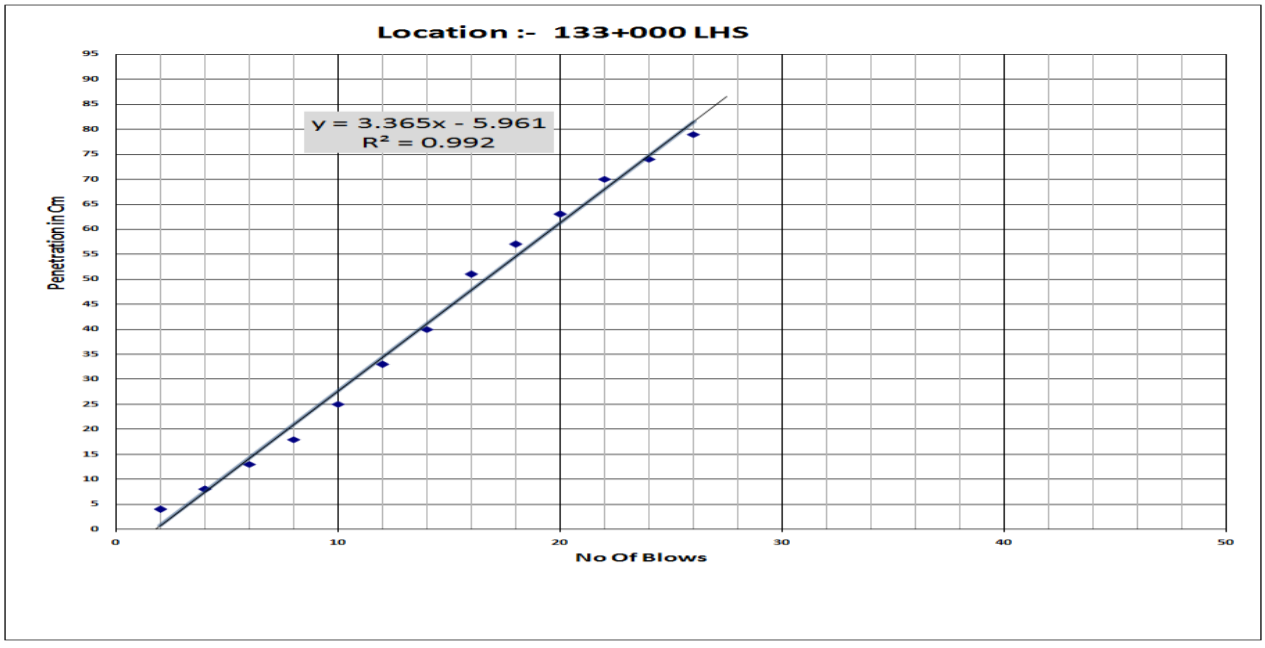
NAME OF ROAD- MANJA TO LAHORIJAN: -

SR.NO	Location	Graph Equation	Depth of Penetration in mm.	No.of Blows Corresponding to depth of Penetration.	Penetration in mm/blow.	CBR as per IRC 37 Clause 5.1
			y	x	N=y/x	Log_{10} CBR
1	128+500 LHS	y = 8.05x + 0.7	200	2.40	83.42	2.06
			400	4.88	81.93	2.10
2	133+000 LHS	y = 3.365x - 5.961	200	7.72	25.92	7.62
			400	13.66	29.29	6.65
3	138+000 LHS	y = 3.739x + 10.86	200	2.44	81.82	2.10
			400	7.79	51.32	3.55
4	143+000 LHS	y = 1.819x + 3.771	200	8.92	22.42	8.97
			400	19.92	20.08	10.15
5	148+000 LHS	y = 3.677x + 3.418	200	4.51	44.35	4.18
			400	9.95	40.21	4.66
6	153+000 RHS	y = 1.937x + 6.875	200	6.78	29.52	6.59
			400	17.10	23.39	8.55
7	156+000 LHS	y = 4.45x + 1.5	200	4.16	48.11	3.81
			400	8.65	46.23	3.99

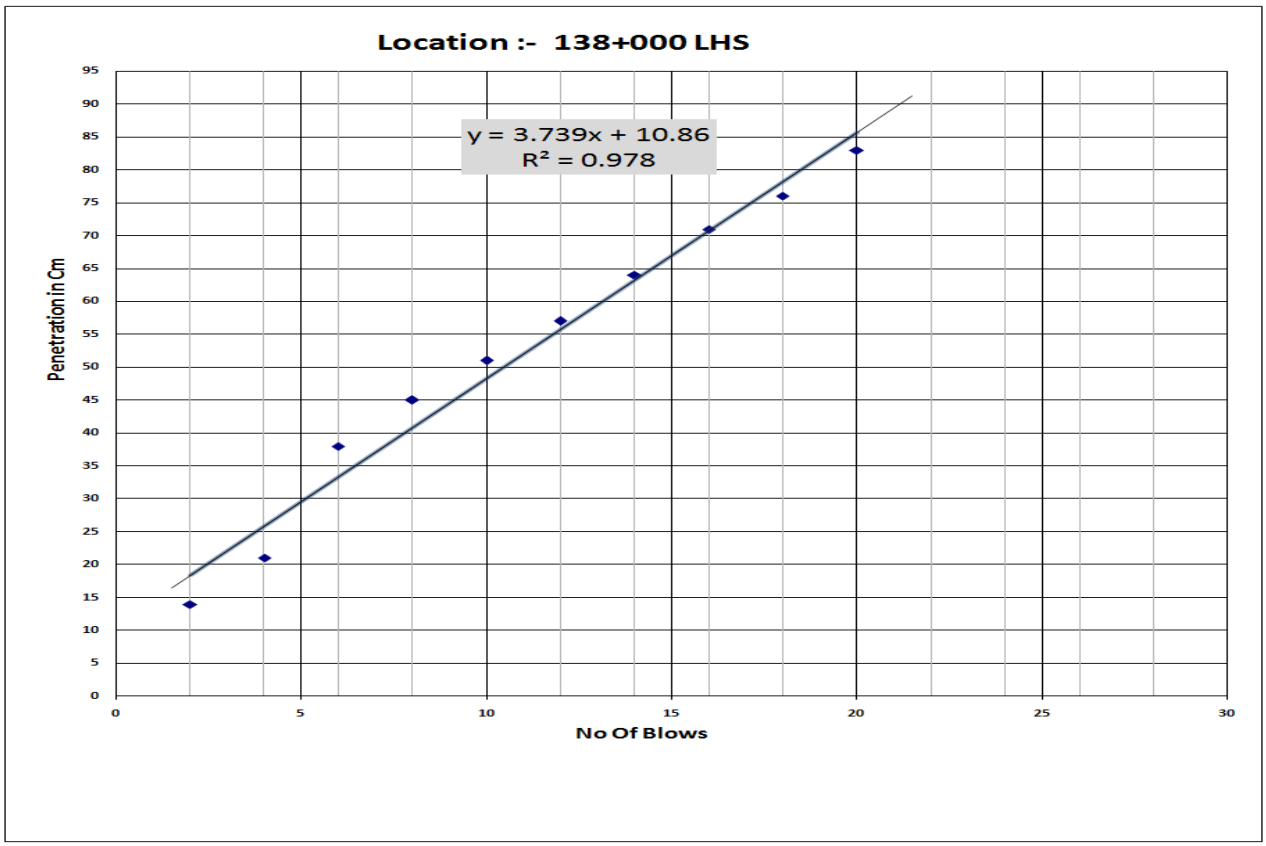
Location :- 128+500 LHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**20**
2	4	**34**
2	6	**41**
2	8	**65**
2	10	**85**



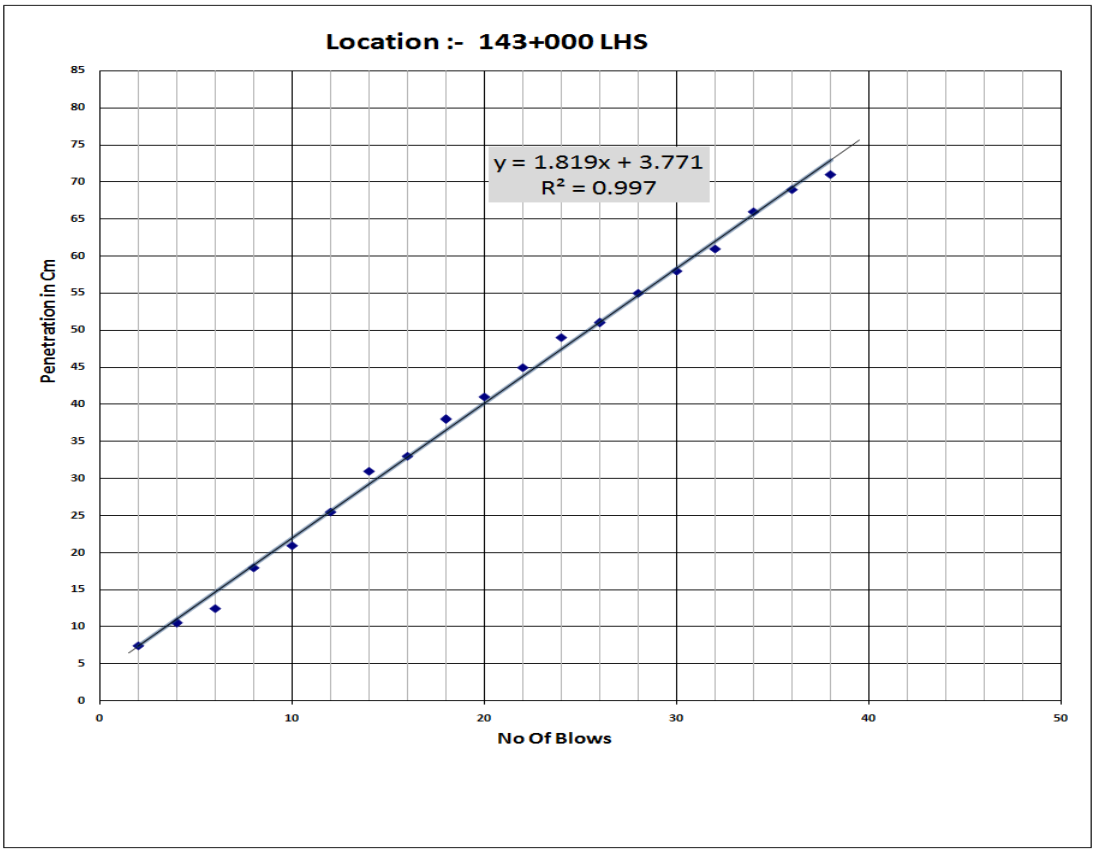
Location :- 133+000 LHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**4**
2	4	**8**
2	6	**13**
2	8	**18**
2	10	**25**
2	12	**33**
2	14	**40**
2	16	**51**
2	18	**57**
2	20	**63**
2	22	**70**
2	24	**74**
2	26	**79**



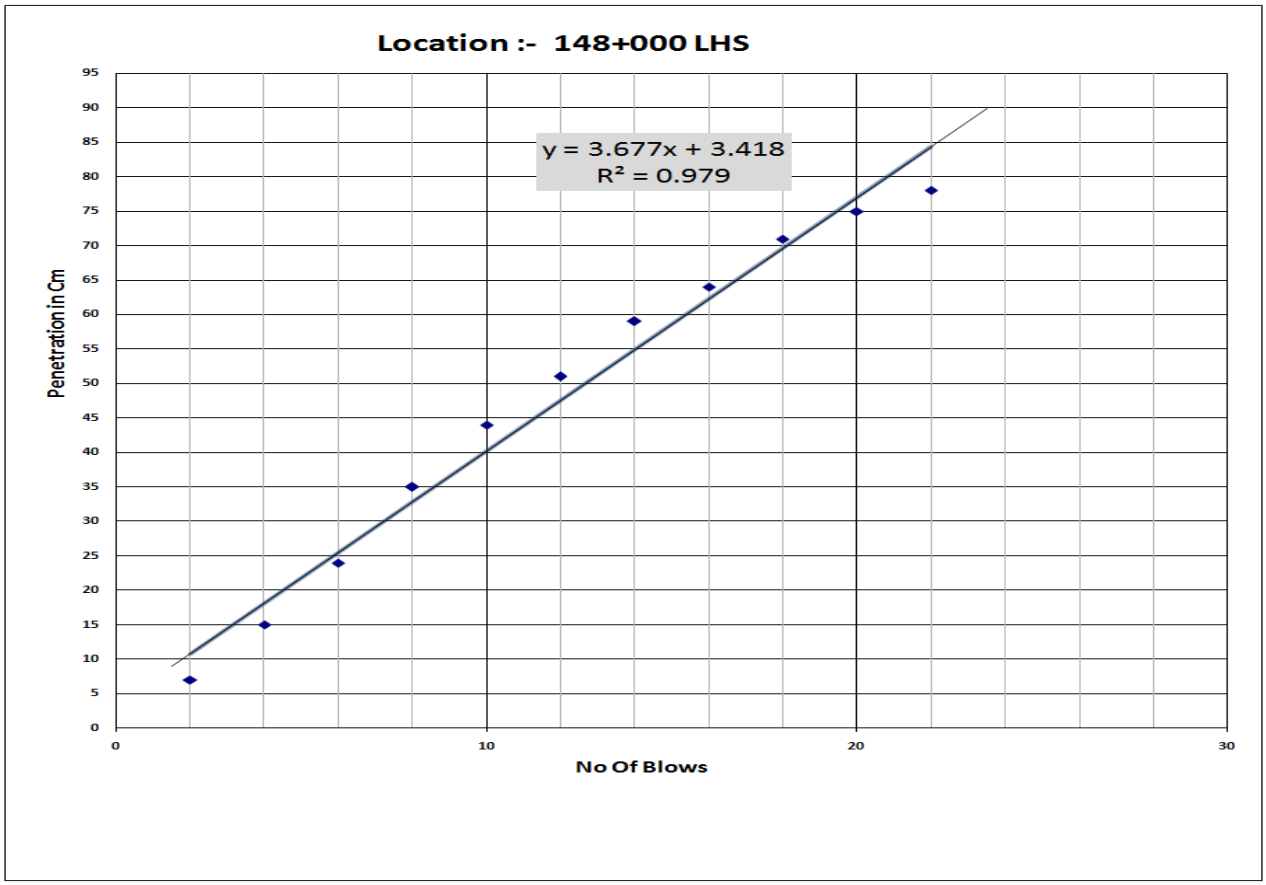
Location :- 138+000 LHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**14**
2	4	**21**
2	6	**38**
2	8	**45**
2	10	**51**
2	12	**57**
2	14	**64**
2	16	**71**
2	18	**76**
2	20	**83**



Location :- 143+000 LHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**7.5**
2	4	**10.5**
2	6	**12.5**
2	8	**18**
2	10	**21**
2	12	**25.5**
2	14	**31**
2	16	**33**
2	18	**38**
2	20	**41**
2	22	**45**
2	24	**49**
2	26	**51**
2	28	**55**
2	30	**58**
2	32	**61**
2	34	**66**
2	36	**69**
2	38	**71**

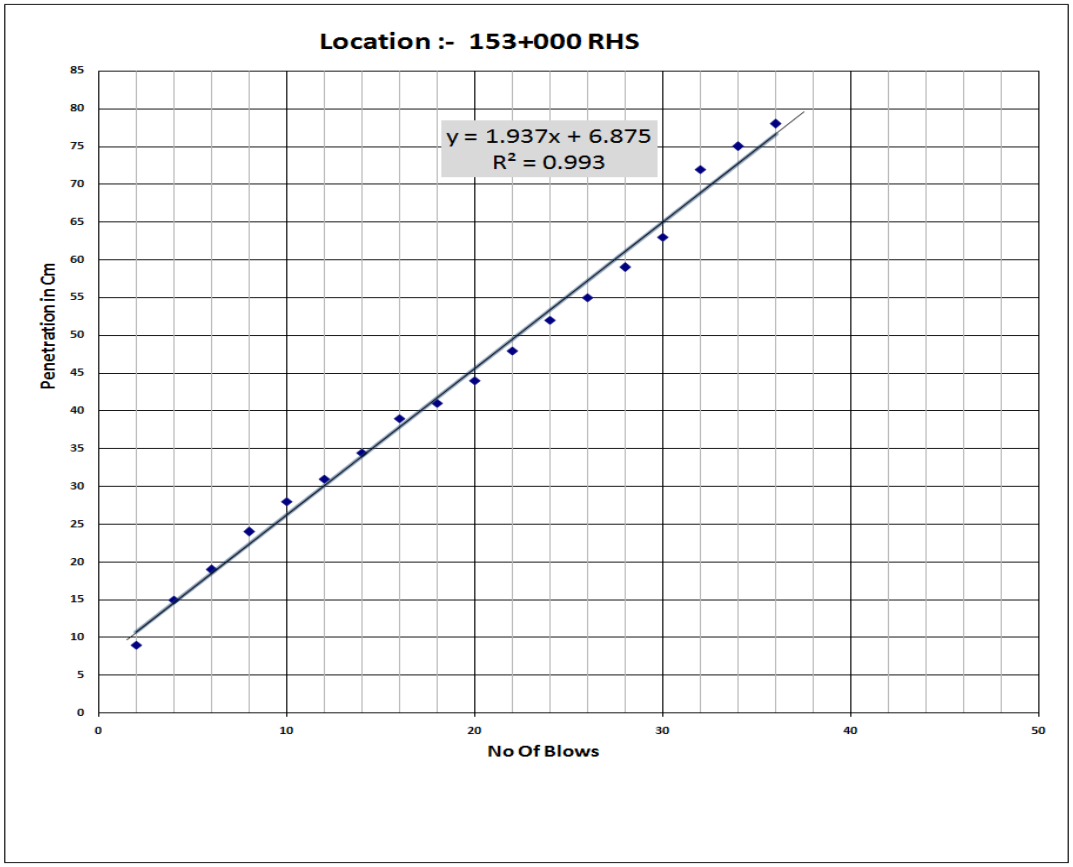


Location :- 148+000 LHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**7**
2	4	**15**
2	6	**24**
2	8	**35**
2	10	**44**
2	12	**51**
2	14	**59**
2	16	**64**
2	18	**71**
2	20	**75**
2	22	**78**

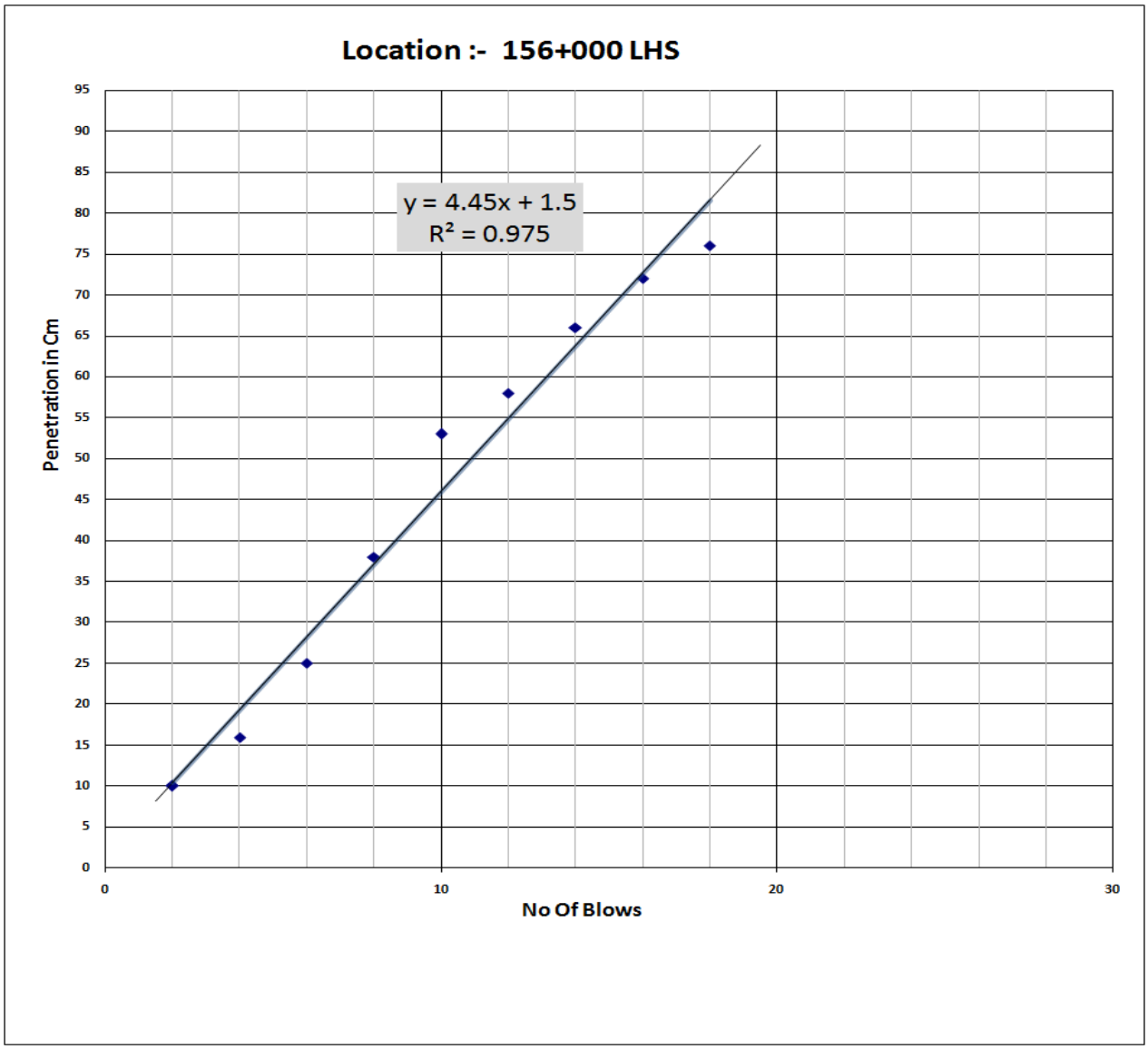


Location :- 153+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**9**
2	4	**15**
2	6	**19**
2	8	**24**
2	10	**28**
2	12	**31**
2	14	**34.5**
2	16	**39**
2	18	**41**
2	20	**44**
2	22	**48**

2	24	**52**
2	26	**55**
2	28	**59**
2	30	**63**
2	32	**72**
2	34	**75**
2	36	**78**



Location :- 156+000 LHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**10**
2	4	**16**
2	6	**25**
2	8	**38**
2	10	**53**
2	12	**58**
2	14	**66**
2	16	**72**
2	18	**76**


Location :- 156+000 LHS
y = 4.45x + 1.5
R² = 0.975
Penetration in Cm
No Of Blows
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
0
10
20
30

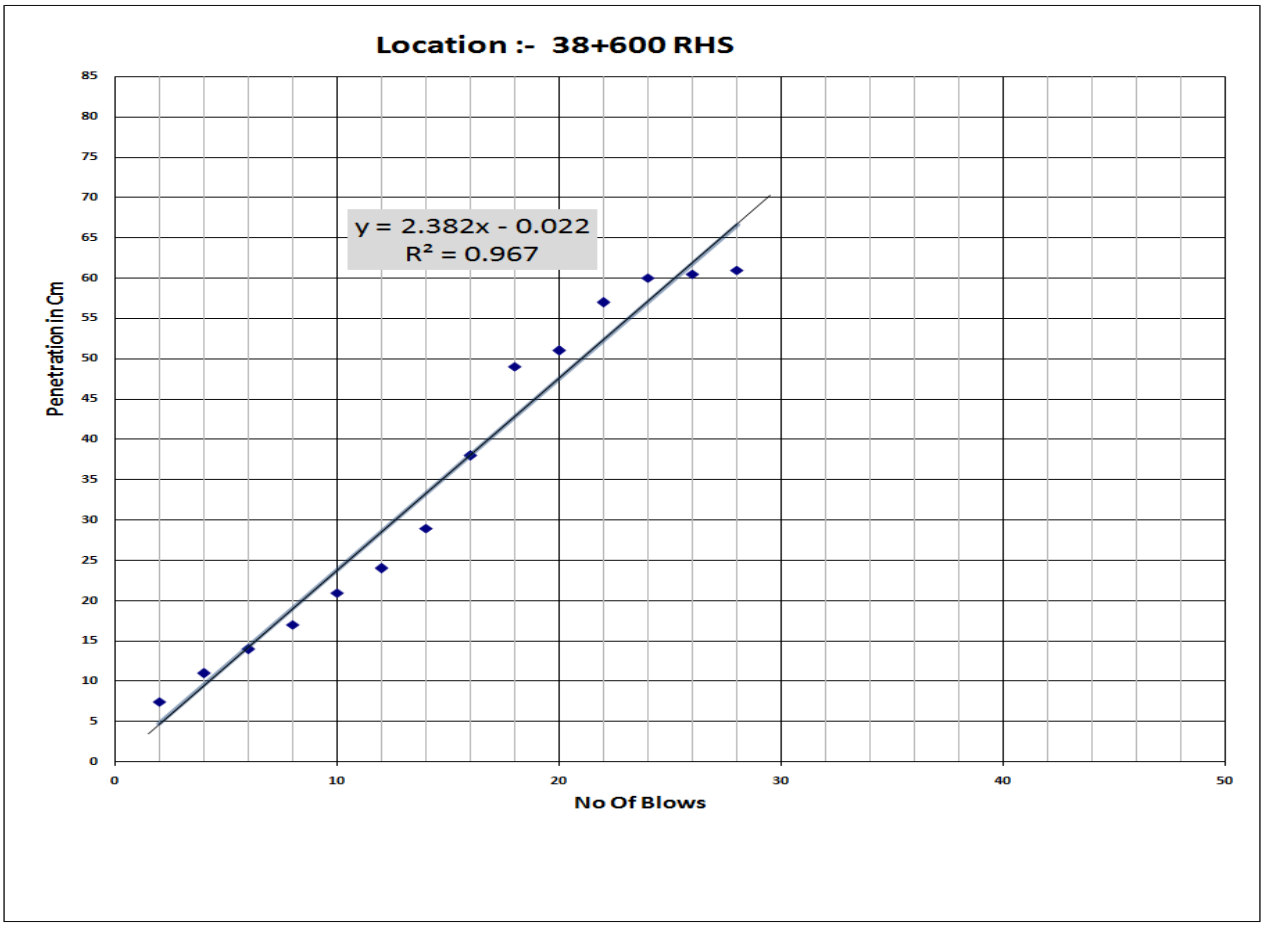
2.20 DCPT CBR VALUE CALCULATION

NAME OF ROAD- DABOKA TO MANJA:-

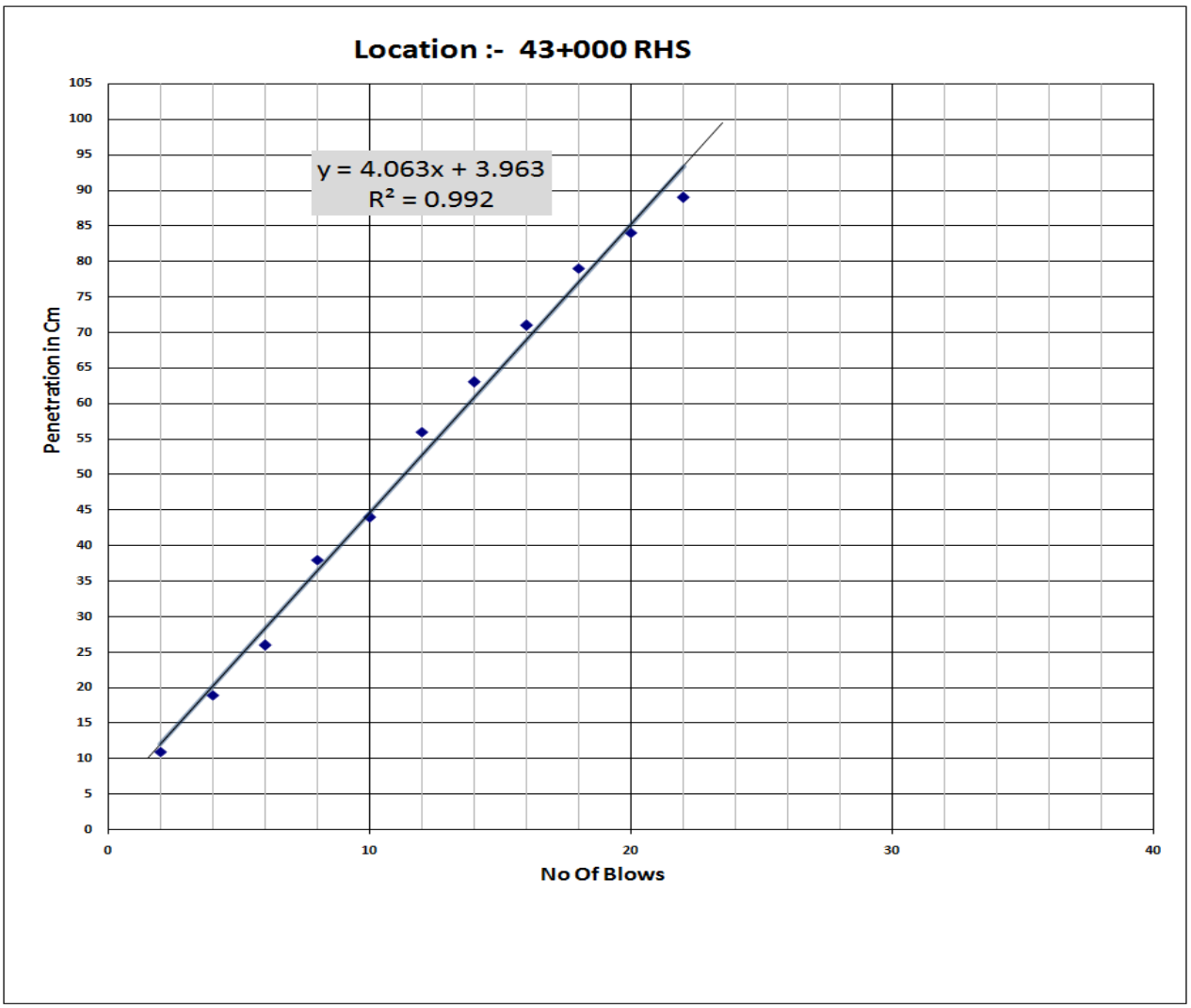
SR.NO	Location	Graph Equation	Depth of Penetration in mm.	No.of Blows Corresponding to depth of Penetration.	Penetration in mm/blow.	CBR as per IRC 37 Clause 5.1
			y	x	N=y/x	Log_{10} CBR
1	38+600 RHS	y = 2.382x - 0.022	200	8.41	23.79	8.39
			400	16.80	23.81	8.38
2	43+000 RHS	y = 4.063x + 3.963	200	3.95	50.67	3.60
			400	8.87	45.10	4.10
3	49+000 RHS	y = 4.172x - 6.027	200	6.24	32.06	6.01
			400	11.03	36.26	5.23
4	53+500 LHS	y = 4.071x + 10.14	200	2.42	82.58	2.08
			400	7.33	54.53	3.31
5	57+500 RHS	y = 2.241x + 8.060	200	5.33	37.54	5.03
			400	14.25	28.07	6.97
6	65+000 RHS	y = 7.65x + 4.7	200	2.00	100.00	1.68
			400	4.61	86.69	1.97
7	70+000 RHS	y = 3.854x + 11.8	200	2.13	94.00	1.80
			400	7.32	54.67	3.30
8	75+000 LHS	y = 5.875x - 1.571	200	3.67	54.47	3.32
			400	7.08	56.53	3.18
9	80+000 RHS	y = 1.990x + 8.980	200	5.54	36.12	5.26

SR.NO	Location	Graph Equation	Depth of Penetration in mm.	No.of Blows Corresponding to depth of Penetration.	Penetration in mm/blow.	CBR as per IRC 37 Clause 5.1
			y	x	N=y/x	Log_{10} CBR
			400	15.59	25.66	7.71
10	85+000 RHS	y = 0.579x + 7.719	200	21.21	9.43	23.66
			400	55.75	7.17	32.16
11	90+000 RHS	y = 7.1x + 5.133	200	2.09	95.51	1.77
			400	4.91	81.45	2.11
12	95+000 RHS	y = 2.311x + 4.075	200	6.89	29.02	6.72
			400	15.55	25.73	7.69
13	100+000 RHS	y = 6.514x + 7.733	200	1.88	106.20	1.57
			400	4.95	80.75	2.13
14	104+000 RHS	y = 1.181x + 2.844	200	14.53	13.77	15.48
			400	31.46	12.71	16.94
15	113+000 LHS	y = 6.392x - 6.142	200	4.09	48.90	3.74
			400	7.22	55.41	3.25
16	118+000 RHS	y = 3.463x + 5.163	200	4.28	46.68	3.94
			400	10.06	39.76	4.72
17	123+000 RHS	y = 2.058x + 6.735	200	6.45	31.03	6.23
			400	16.16	24.75	8.03
18	128+000 RHS	y = 2.249x + 12.90	200	3.16	63.35	2.80
			400	12.05	33.20	5.78

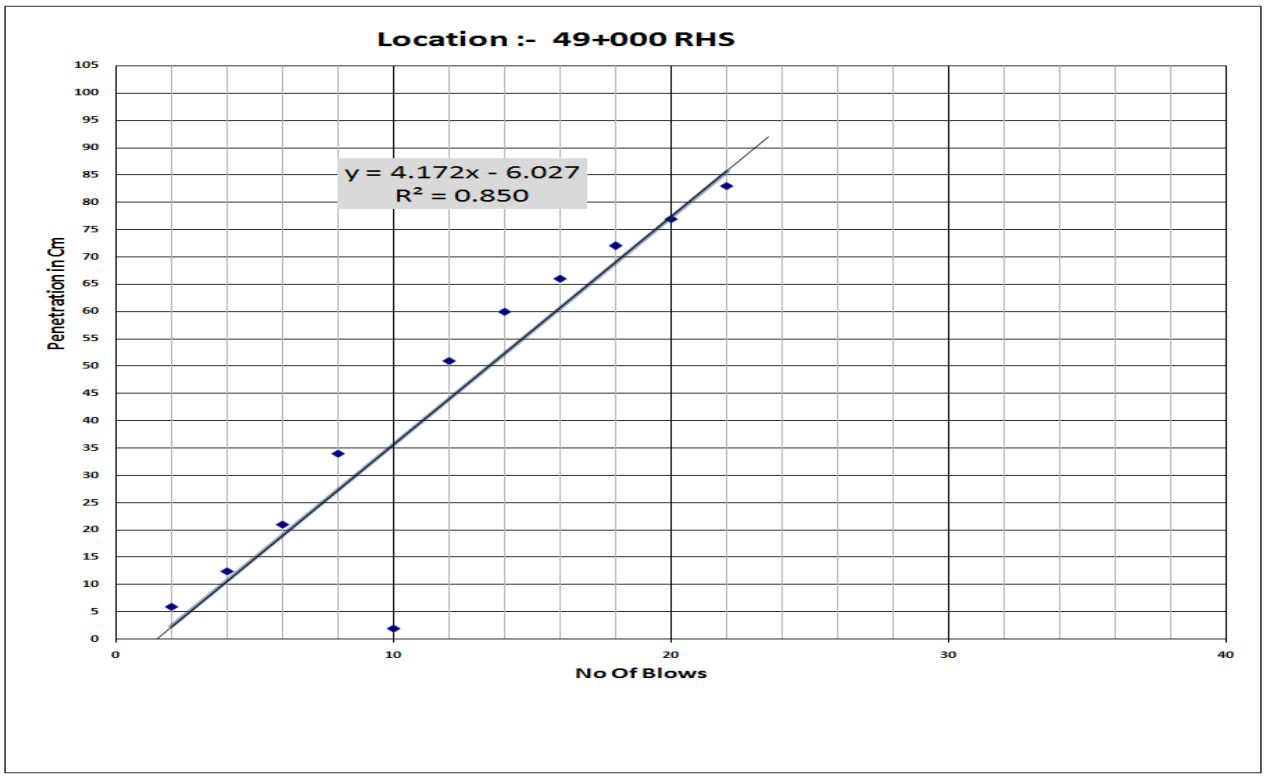
Location :- 38+600 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**7.5**
2	4	**11**
2	6	**14**
2	8	**17**
2	10	**21**
2	12	**24**
2	14	**29**
2	16	**38**
2	18	**49**
2	20	**51**
2	22	**57**
2	24	**60**
2	26	**60.5**
2	28	**61**



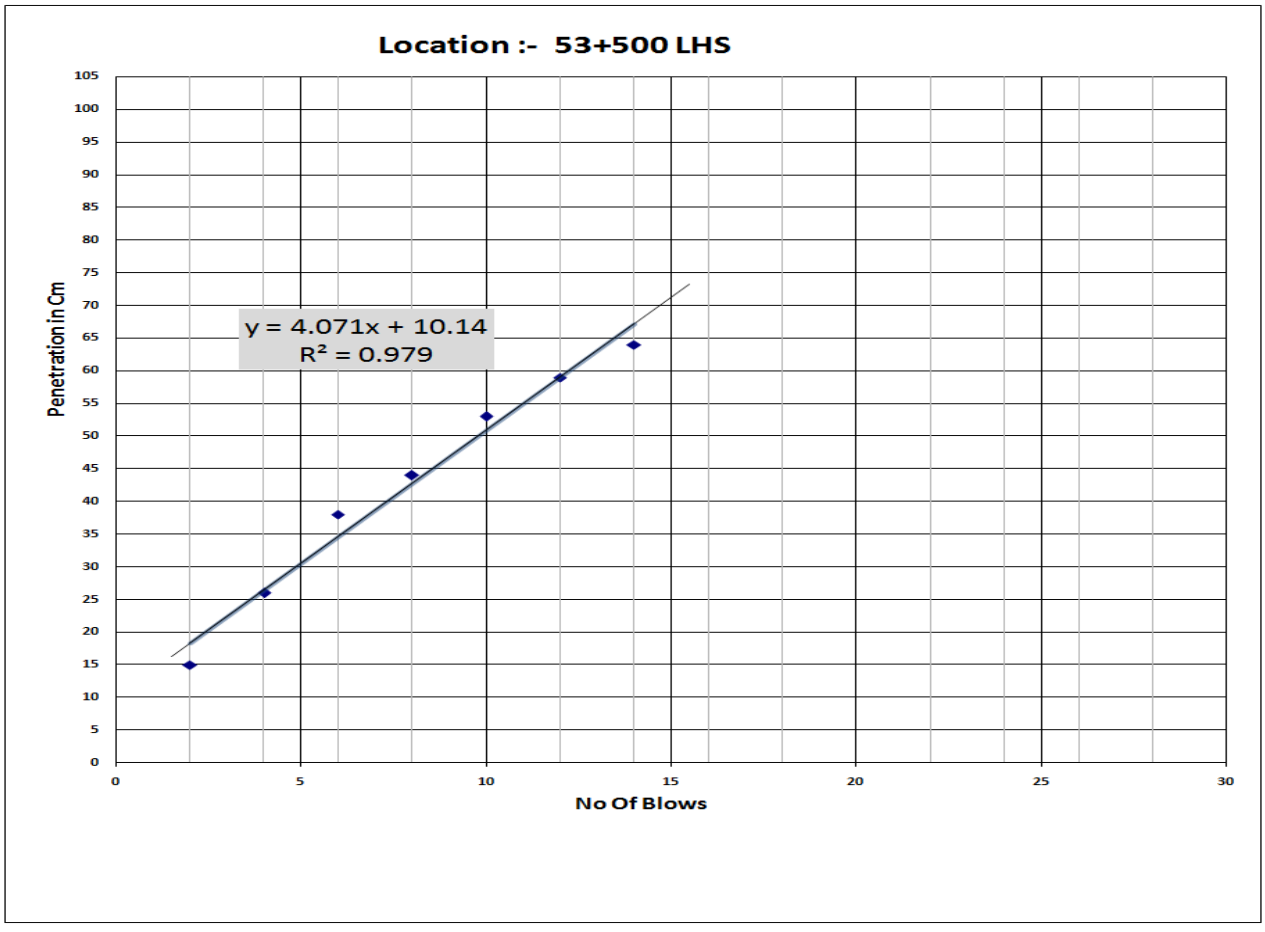
Location :- 43+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**11**
2	4	**19**
2	6	**26**
2	8	**38**
2	10	**44**
2	12	**56**
2	14	**63**
2	16	**71**
2	18	**79**
2	20	**84**
2	22	**89**



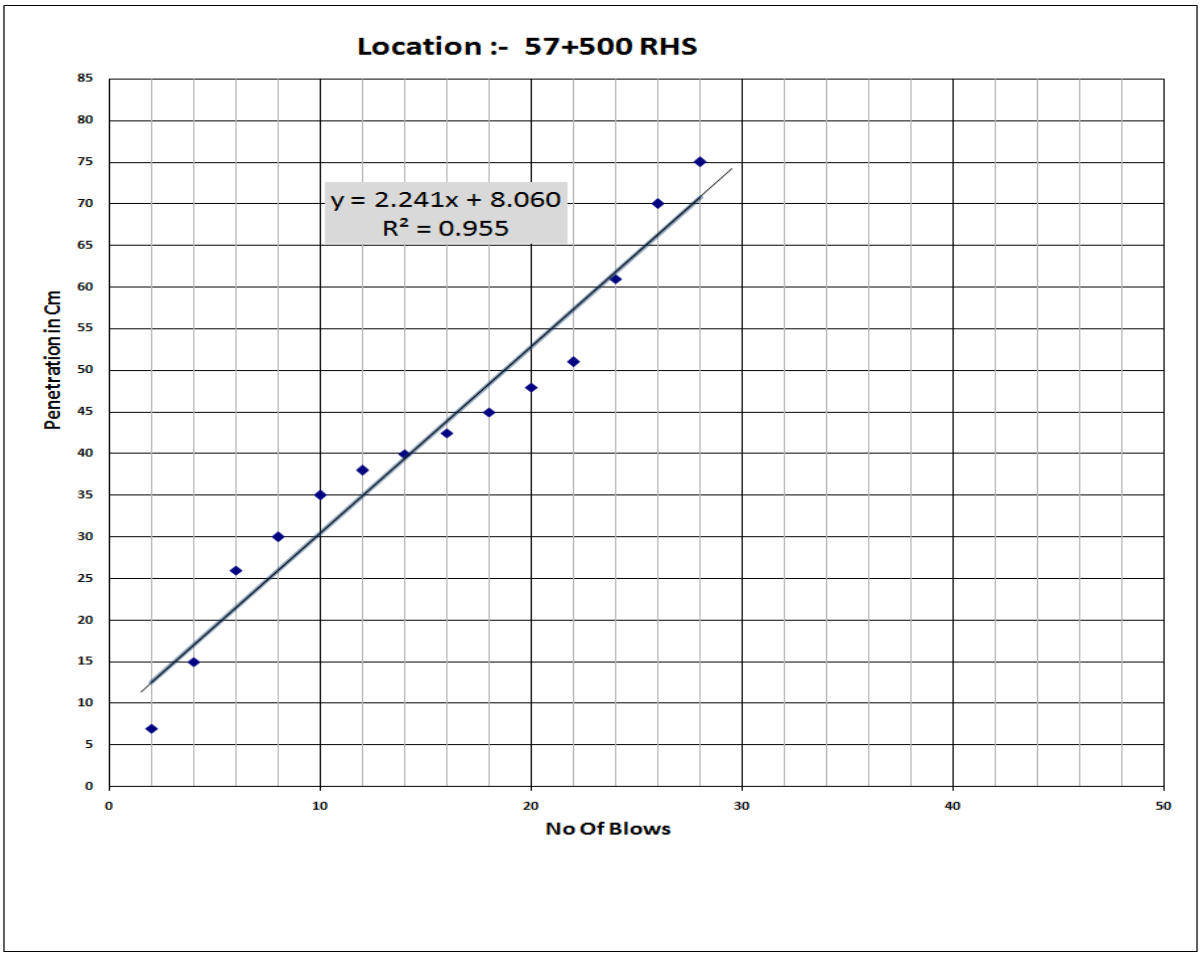
Location :- 49+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**6**
2	4	**12.5**
2	6	**21**
2	8	**34**
2	10	**2**
2	12	**51**
2	14	**60**
2	16	**66**
2	18	**72**
2	20	**77**
2	22	**83**



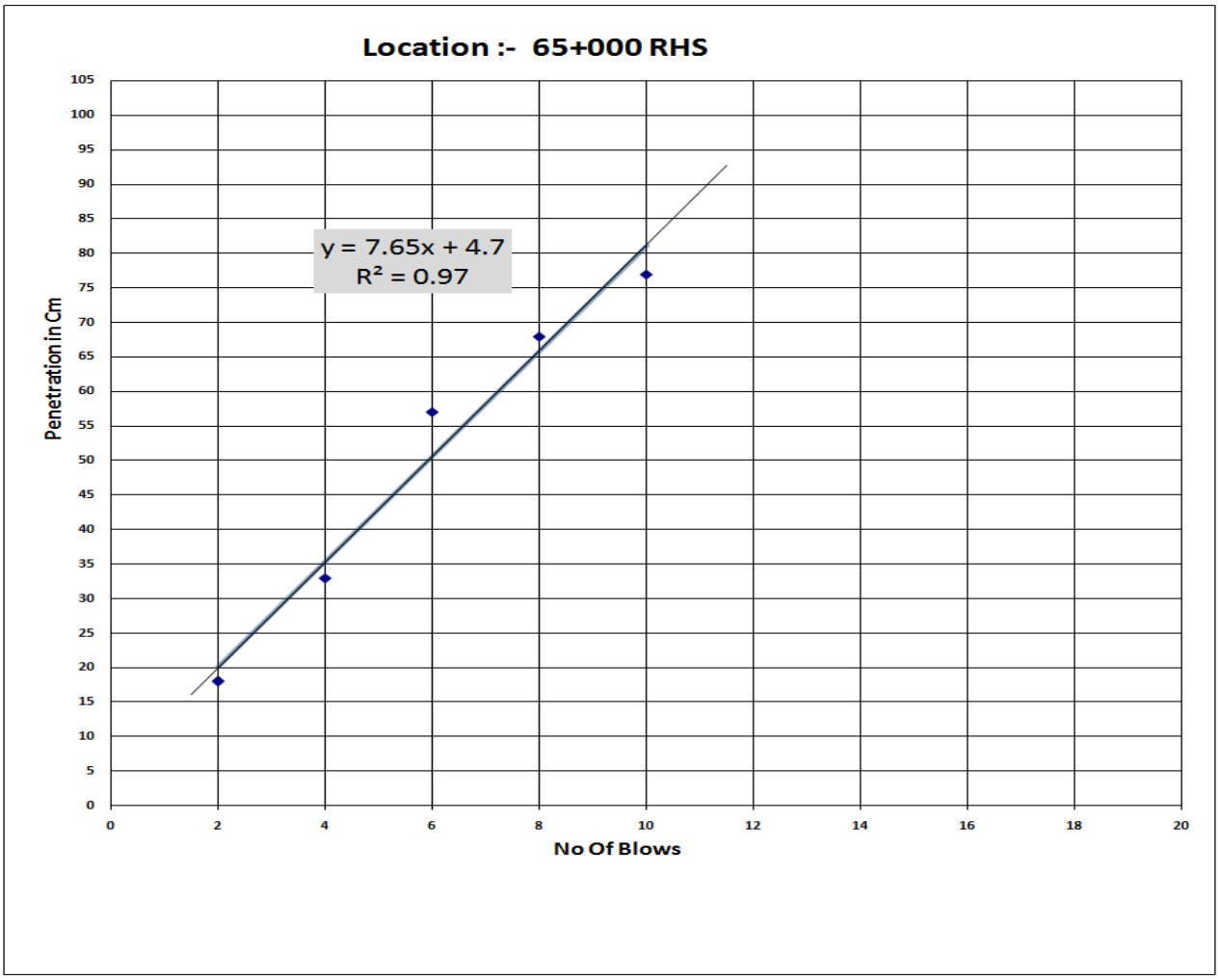
Location :- 53+500 LHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**15**
2	4	**26**
2	6	**38**
2	8	**44**
2	10	**53**
2	12	**59**
2	14	**64**



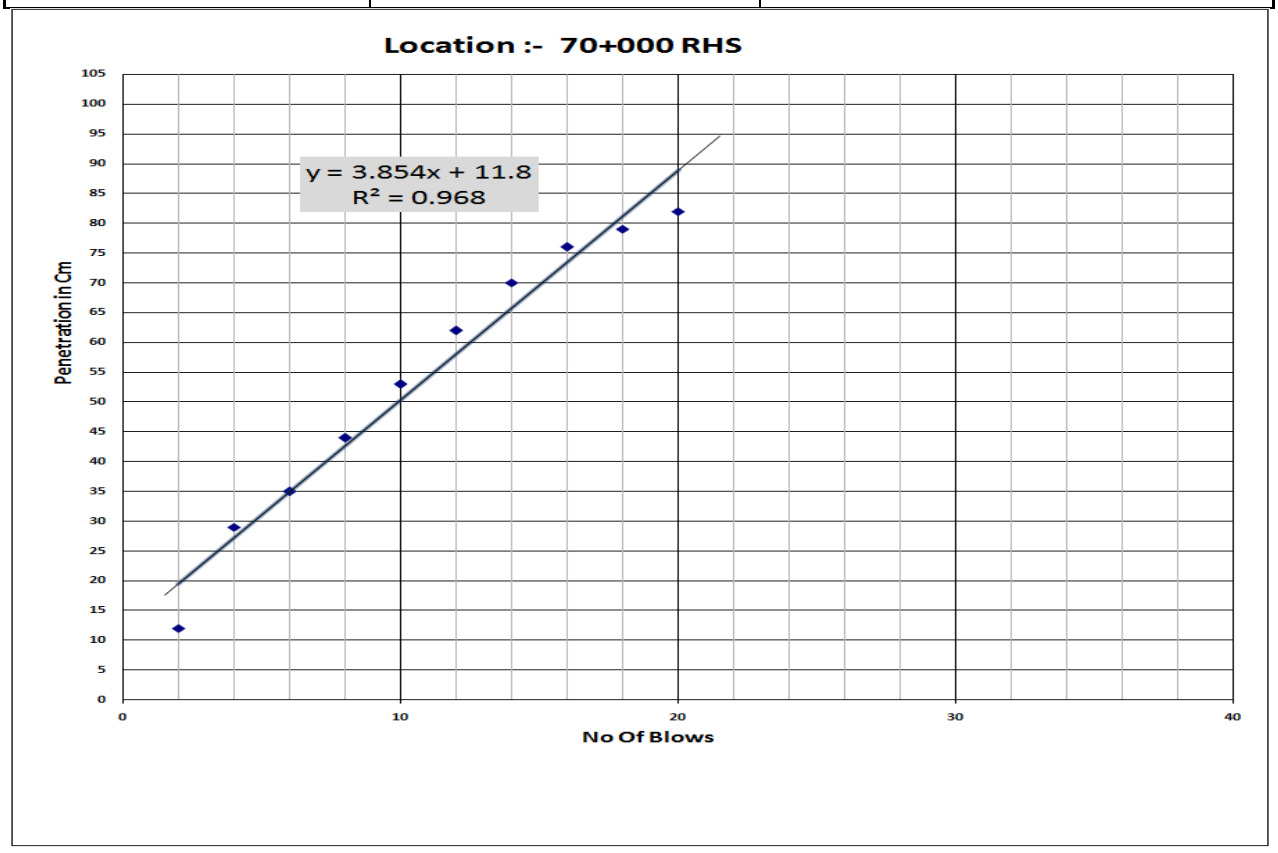
Location :- 57+500 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**7**
2	4	**15**
2	6	**26**
2	8	**30**
2	10	**35**
2	12	**38**
2	14	**40**
2	16	**42.5**
2	18	**45**
2	20	**48**
2	22	**51**
2	24	**61**
2	26	**70**
2	28	**75**



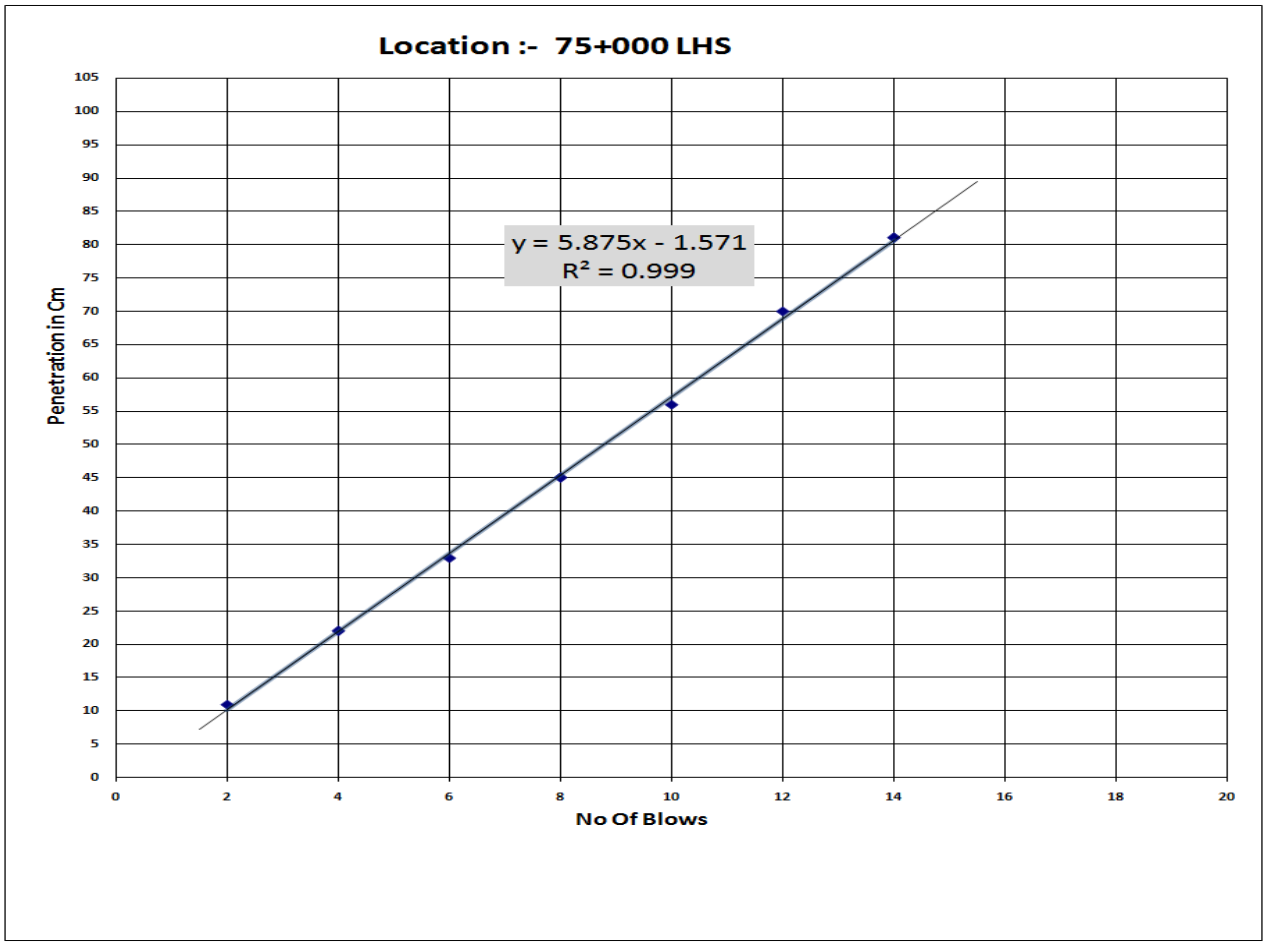
Location :- 65+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**18**
2	4	**33**
2	6	**57**
2	8	**68**
2	10	**77**



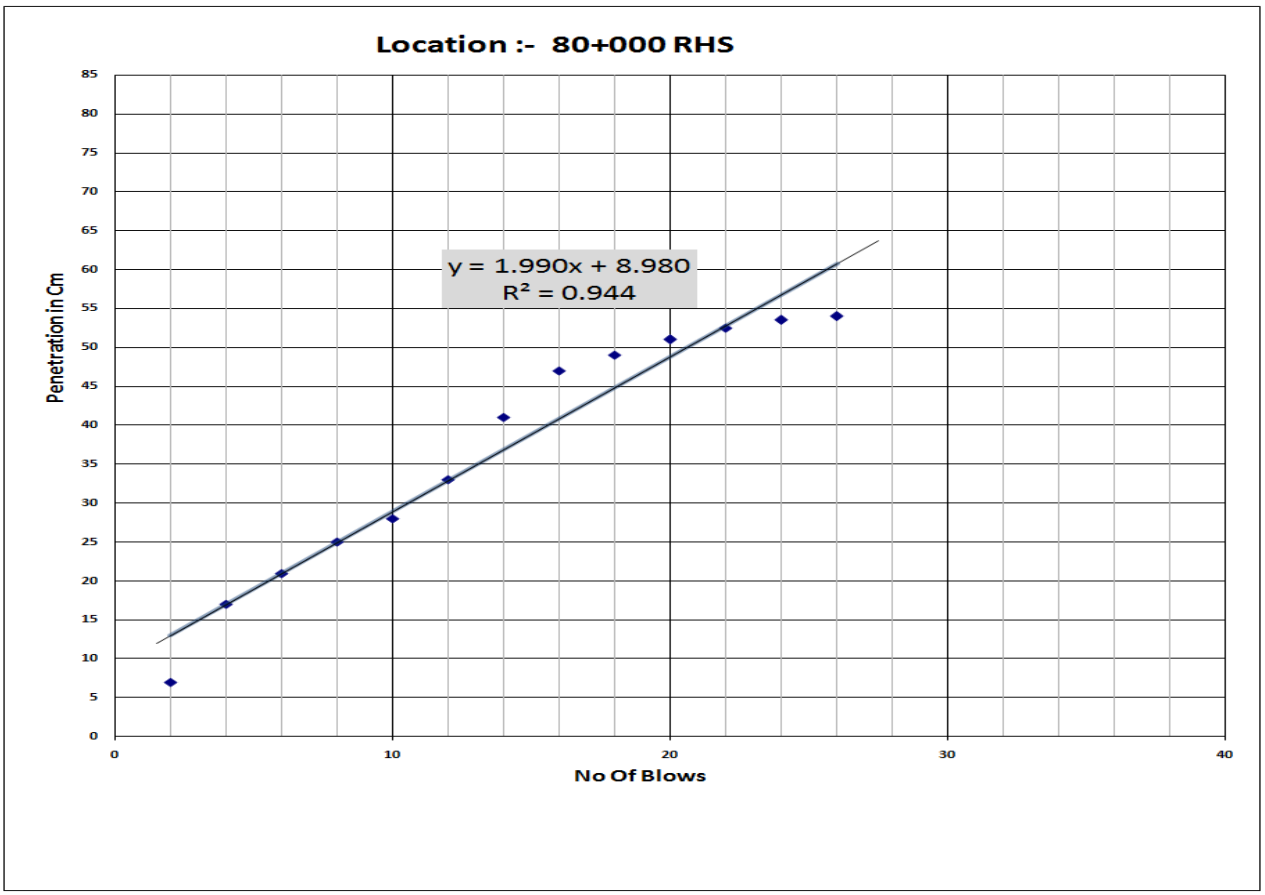
Location :- 70+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**12**
2	4	**29**
2	6	**35**
2	8	**44**
2	10	**53**
2	12	**62**
2	14	**70**
2	16	**76**
2	18	**79**
2	20	**82**



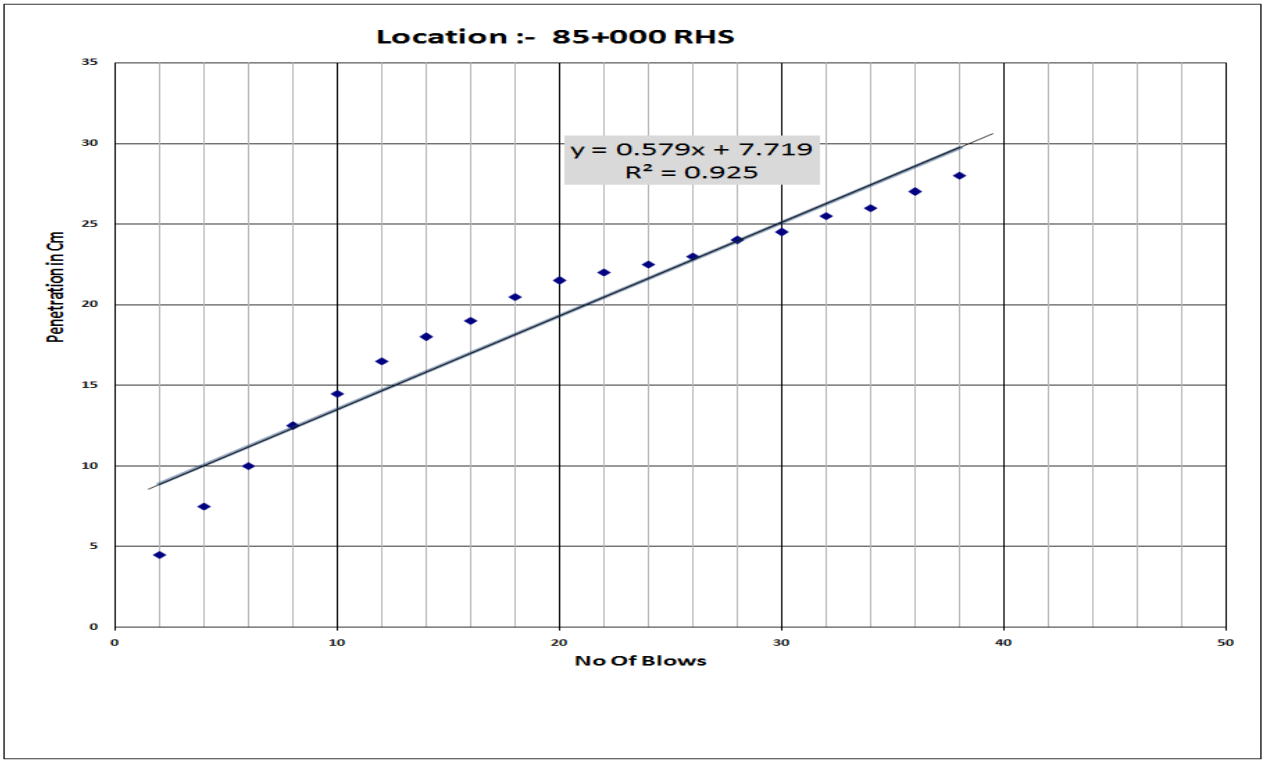
Location :- 75+000 LHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**11**
2	4	**22**
2	6	**33**
2	8	**45**
2	10	**56**
2	12	**70**
2	14	**81**



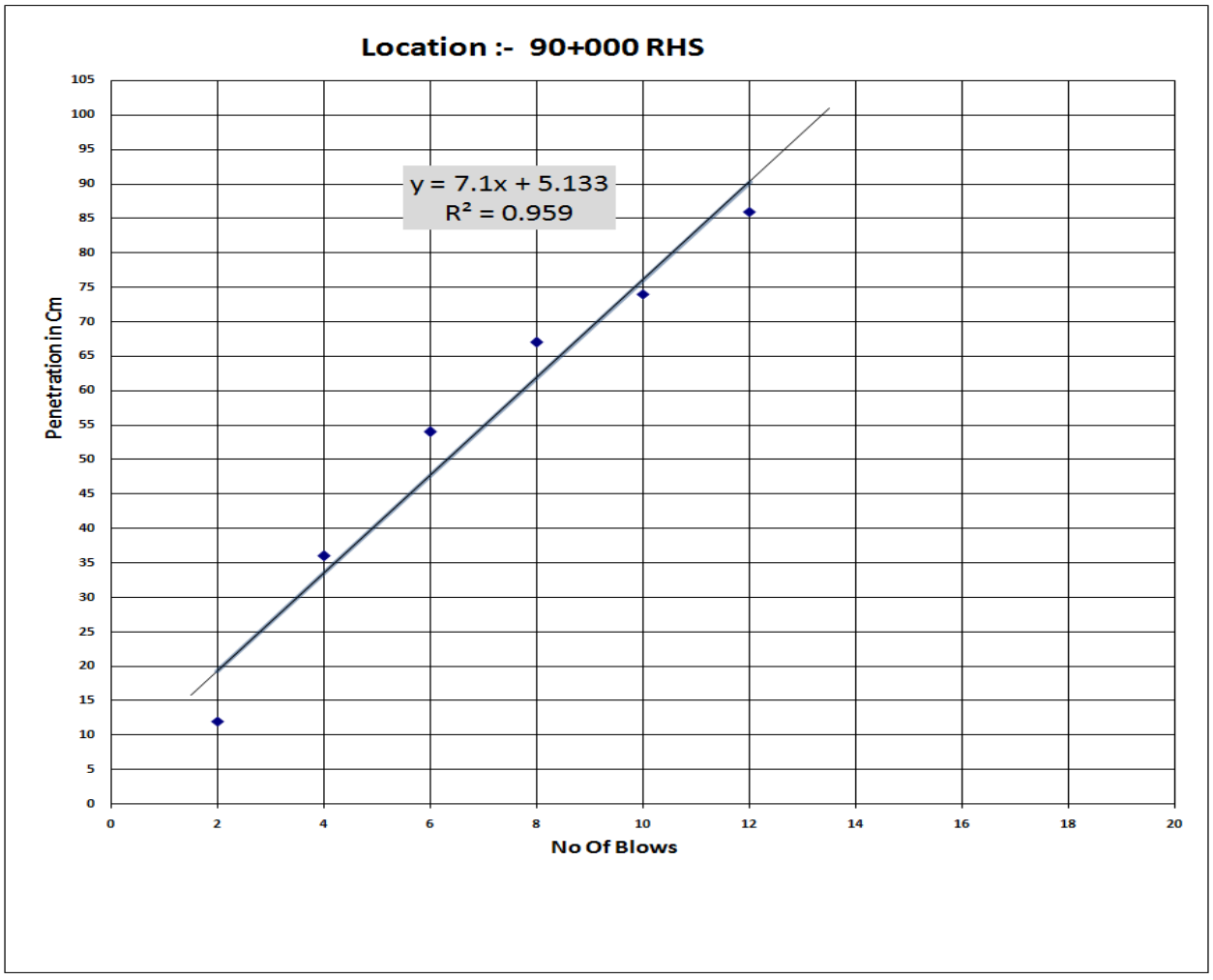
Location :- 80+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**7**
2	4	**17**
2	6	**21**
2	8	**25**
2	10	**28**
2	12	**33**
2	14	**41**
2	16	**47**
2	18	**49**
2	20	**51**
2	22	**52.5**
2	24	**53.5**
2	26	**54**



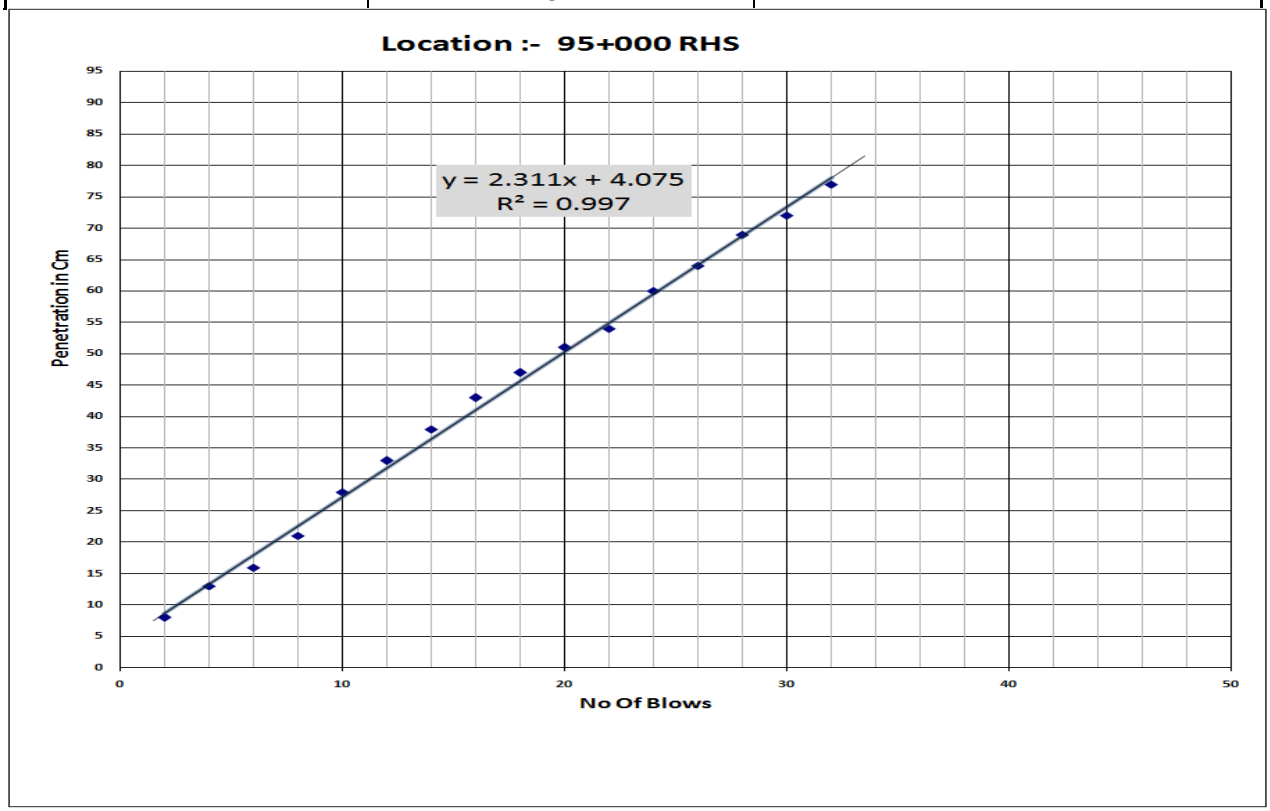
Location :- 85+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**4.5**
2	4	**7.5**
2	6	**10**
2	8	**12.5**
2	10	**14.5**
2	12	**16.5**
2	14	**18**
2	16	**19**
2	18	**20.5**
2	20	**21.5**
2	22	**22**
2	24	**22.5**
2	26	**23**
2	28	**24**
2	30	**24.5**
2	32	**25.5**
2	34	**26**
2	36	**27**
2	38	**28**



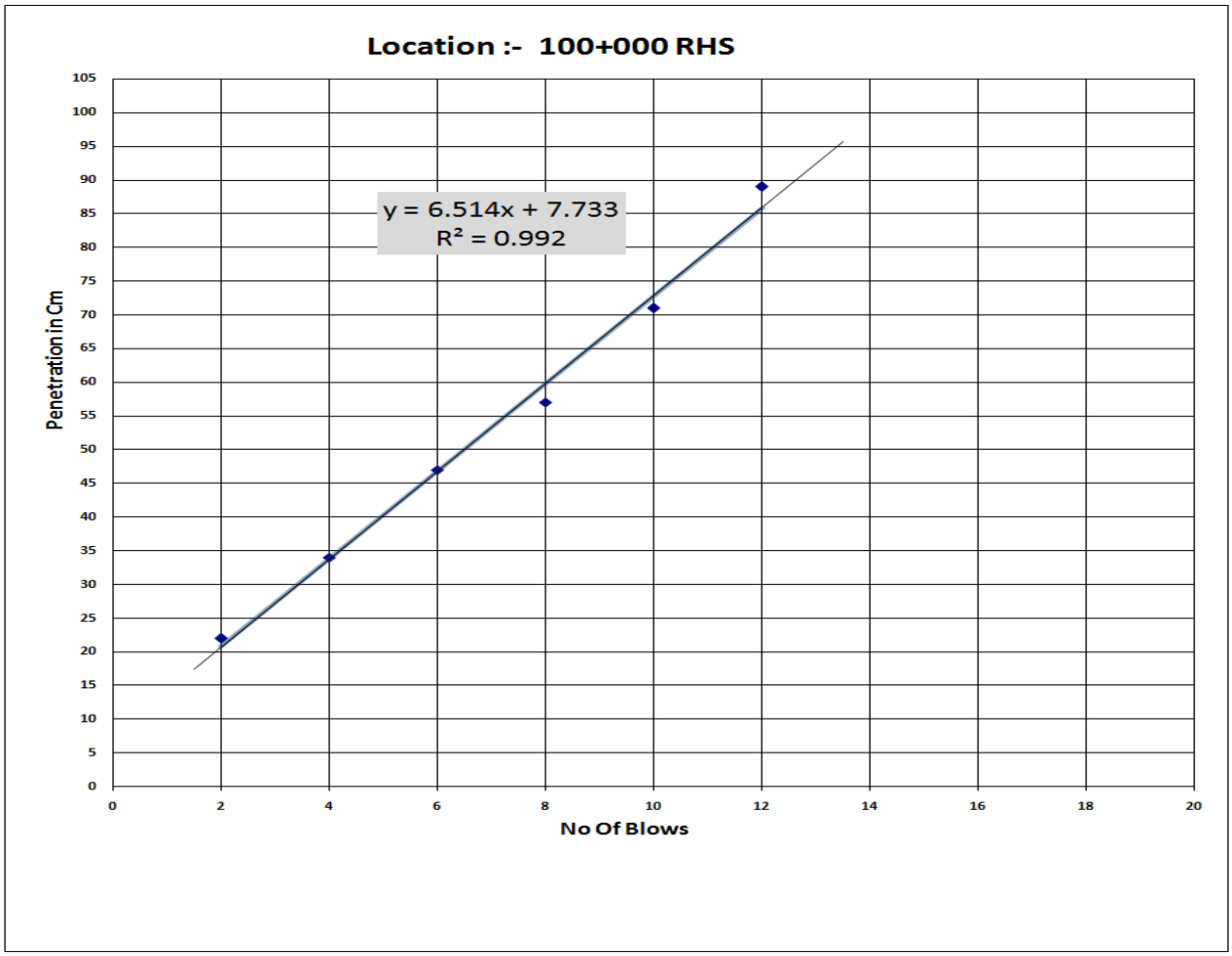
Location :- 90+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**12**
2	4	**36**
2	6	**54**
2	8	**67**
2	10	**74**
2	12	**86**



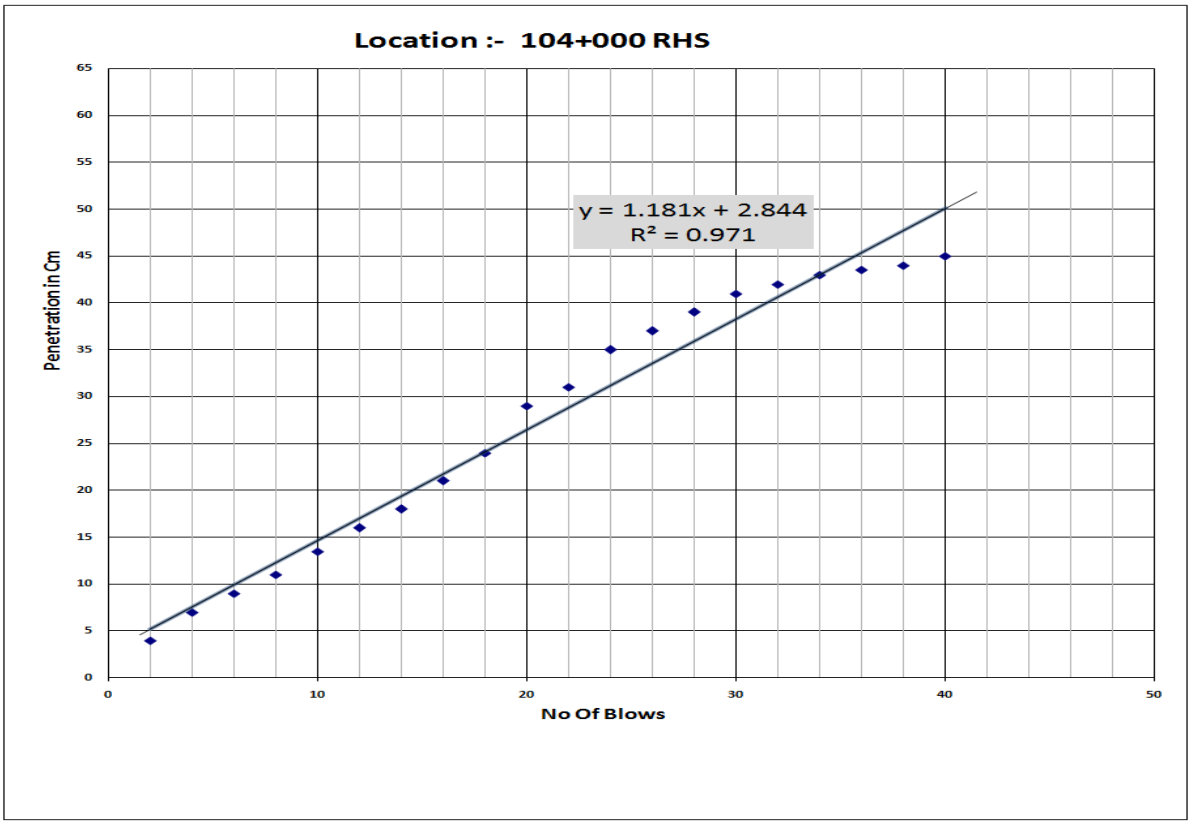
Location :- 95+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**8**
2	4	**13**
2	6	**16**
2	8	**21**
2	10	**28**
2	12	**33**
2	14	**38**
2	16	**43**
2	18	**47**
2	20	**51**
2	22	**54**
2	24	**60**
2	26	**64**
2	28	**69**
2	30	**72**
2	32	**77**



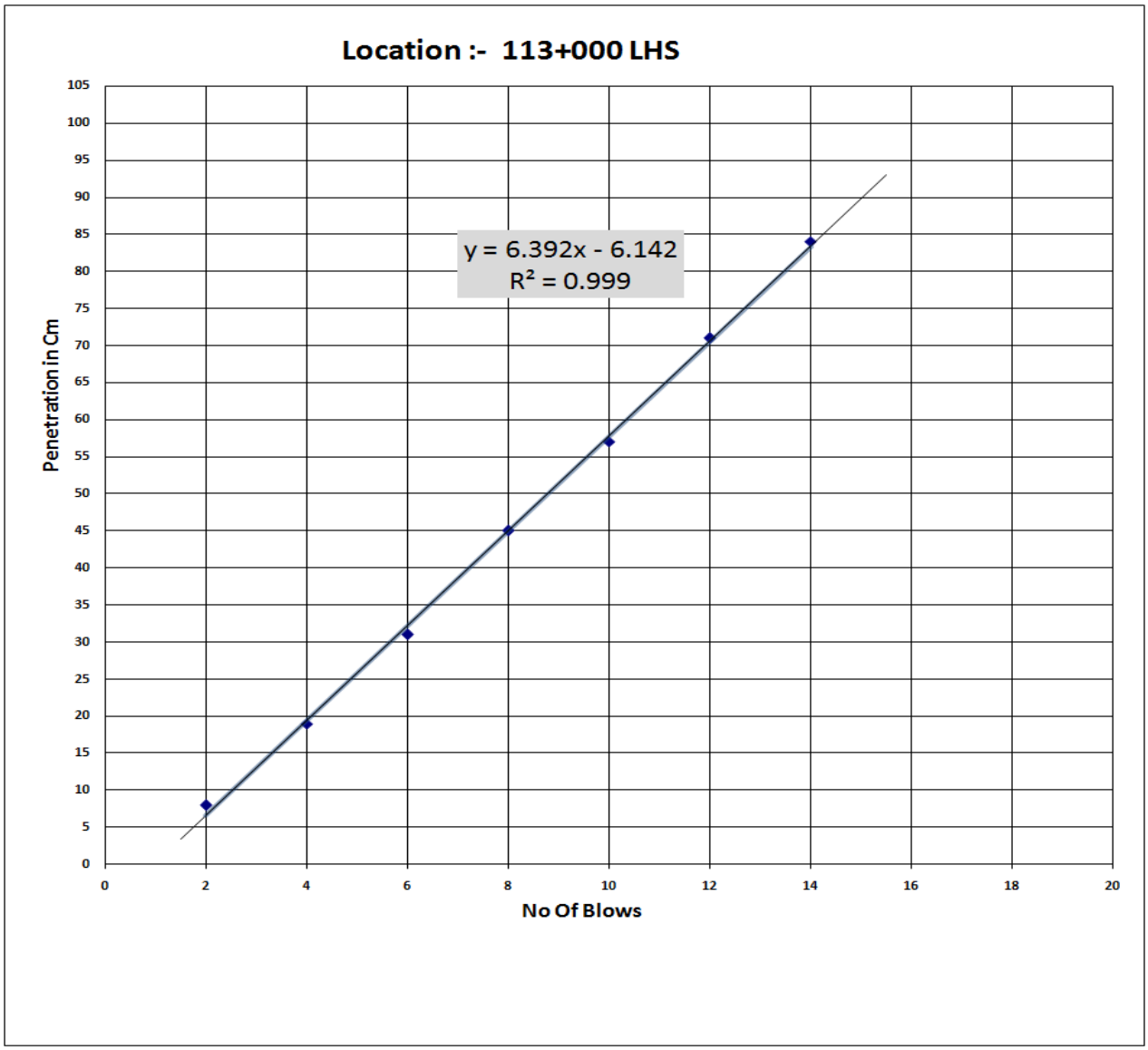
Location :- 100+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**22**
2	4	**34**
2	6	**47**
2	8	**57**
2	10	**71**
2	12	**89**



Location :- 104+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**4**
2	4	**7**
2	6	**9**
2	8	**11**
2	10	**13.5**
2	12	**16**
2	14	**18**
2	16	**21**
2	18	**24**
2	20	**29**
2	22	**31**
2	24	**35**
2	26	**37**
2	28	**39**
2	30	**41**
2	32	**42**
2	34	**43**
2	36	**43.5**
2	38	**44**
2	40	**45**

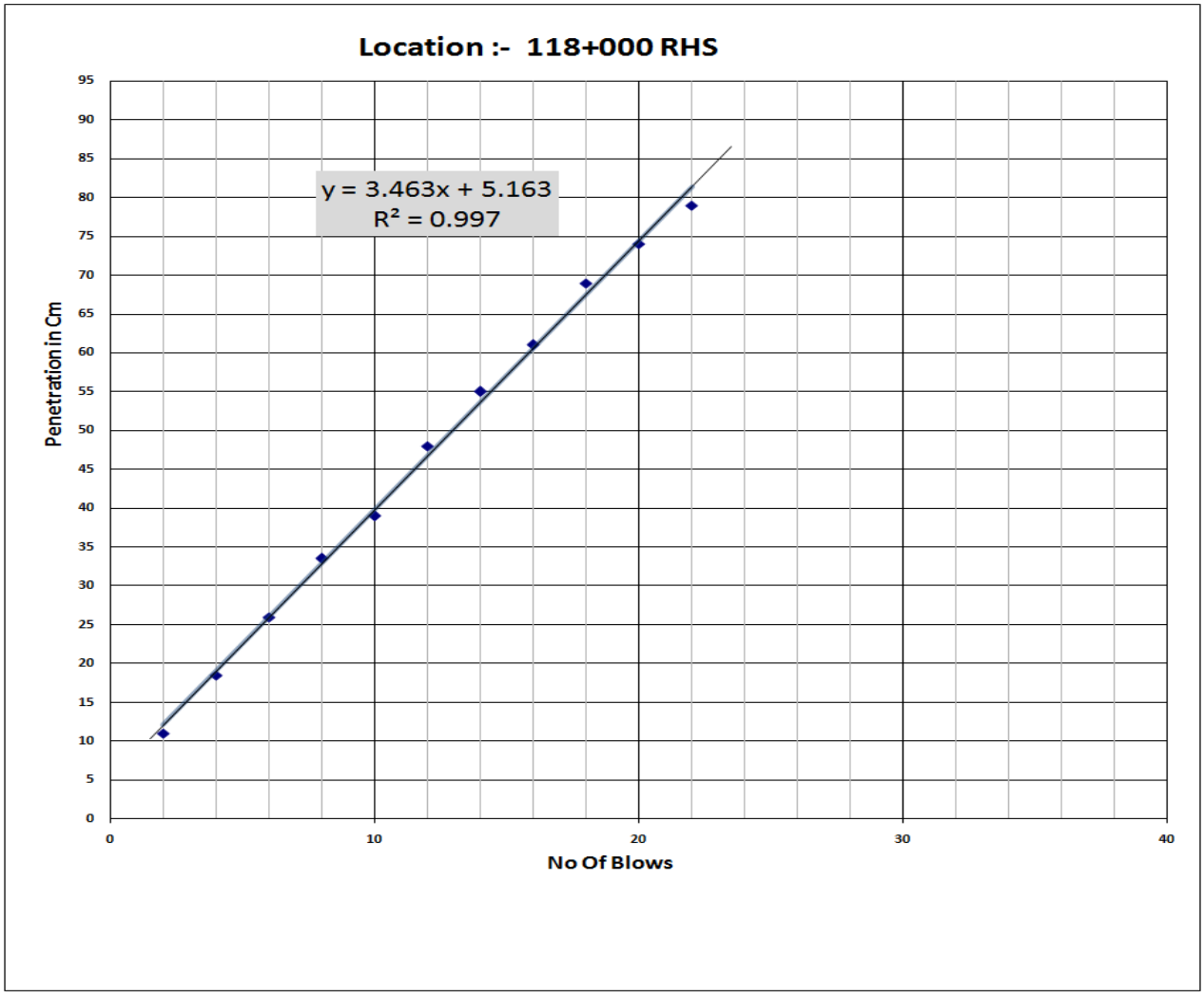


Location :- 113+000 LHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**8**
2	4	**19**
2	6	**31**
2	8	**45**
2	10	**57**
2	12	**71**
2	14	**84**



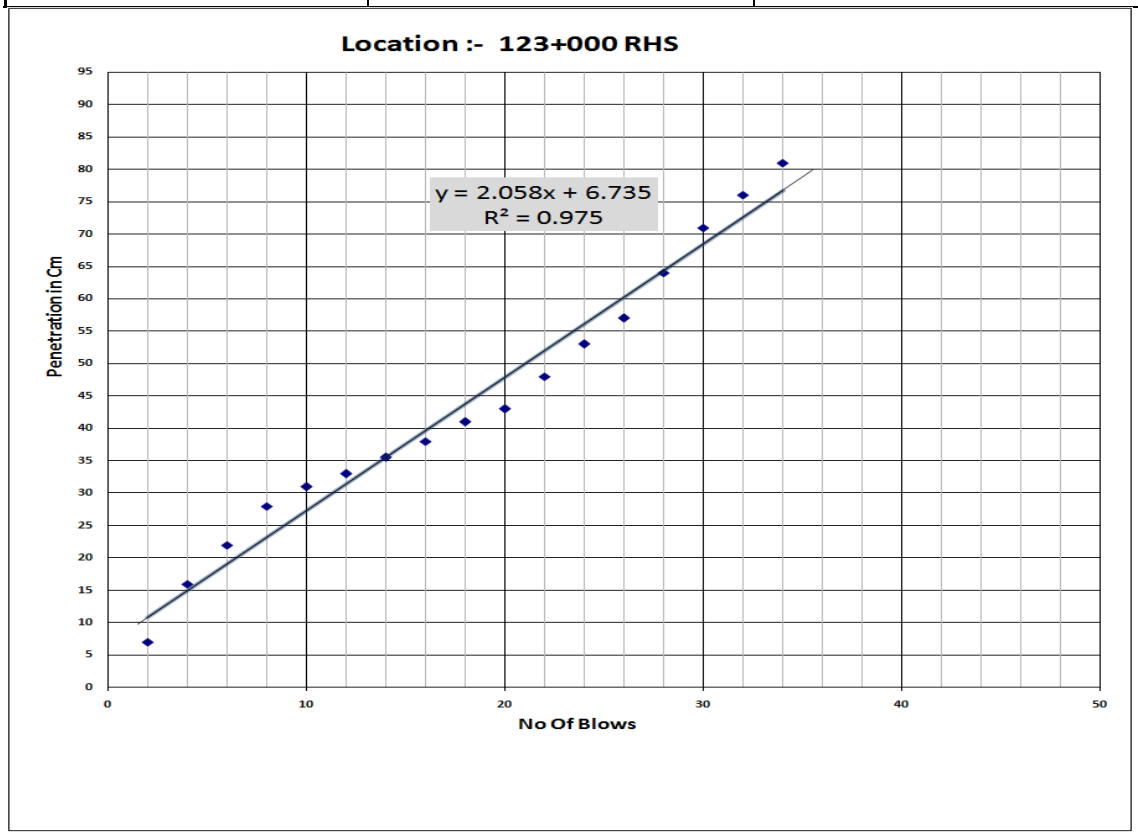
Location :- 118+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**11**
2	4	**18.5**
2	6	**26**
2	8	**33.5**
2	10	**39**
2	12	**48**
2	14	**55**
2	16	**61**

Location :- 118+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	18	**69**
2	20	**74**
2	22	**79**

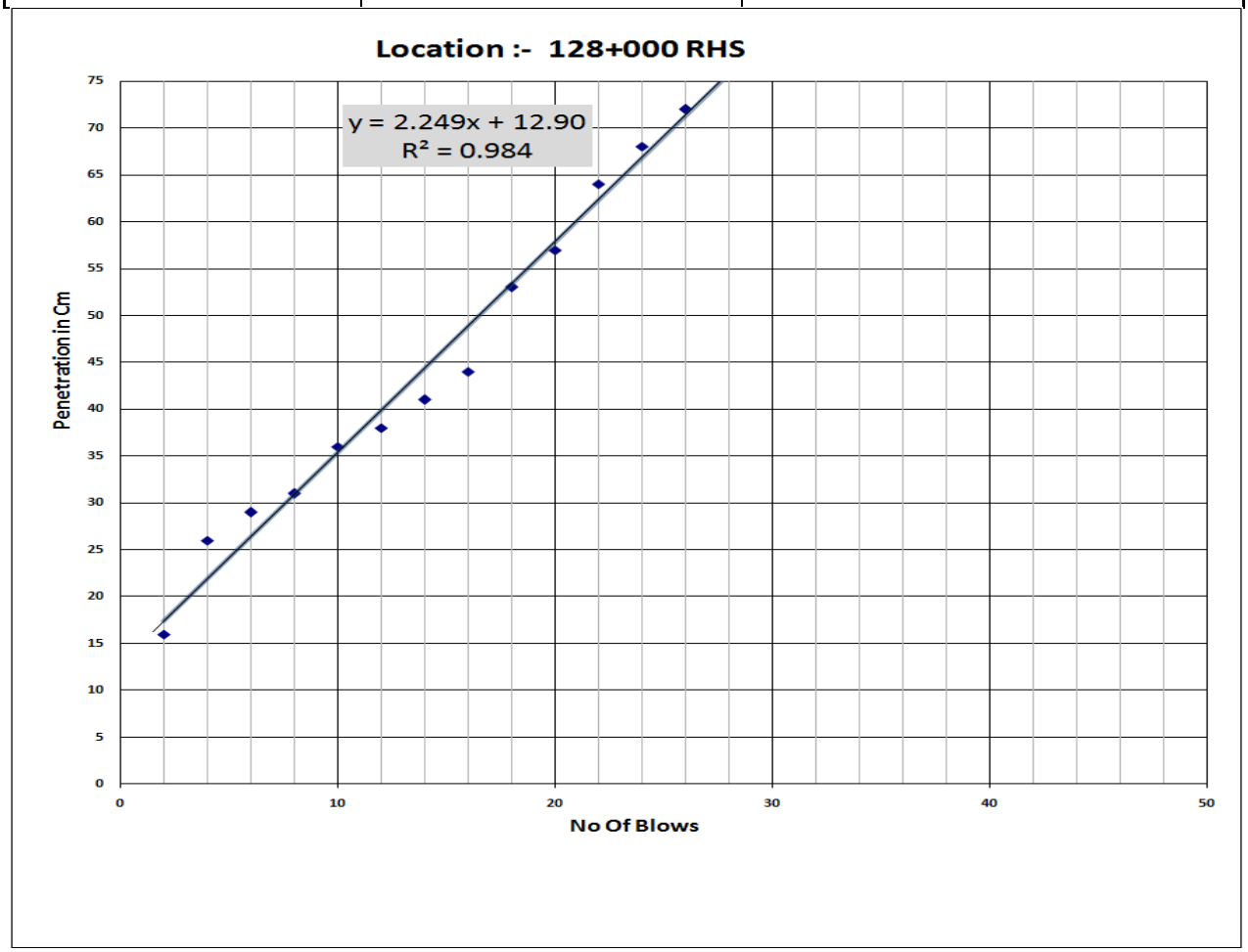


Location :- 123+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**7**
2	4	**16**
2	6	**22**
2	8	**28**
2	10	**31**

Location :- 123+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	12	**33**
2	14	**35.5**
2	16	**38**
2	18	**41**
2	20	**43**
2	22	**48**
2	24	**53**
2	26	**57**
2	28	**64**
2	30	**71**
2	32	**76**
2	34	**81**



Location :- 128+000 RHS		
No. of Blows	**Sum of Blows**	**Penetration in cm**
2	2	**16**
2	4	**26**
2	6	**29**
2	8	**31**
2	10	**36**
2	12	**38**
2	14	**41**
2	16	**44**
2	18	**53**
2	20	**57**
2	22	**64**
2	24	**68**
2	26	**72**
2	28	**78**



PHOTO

PHOTOGRAPHS TRIAL PIT:-

123+000 LHS OF NH-29

65+000 RHS OF NH-29

BORROW AREA PHOTOS:-

BORROW AREA

BORROW AREA

AGGREGATE SOURCE

AGGREGATE SOURCE