

Table (3.10): The weights of sample (S1) & Tests carried out

Serial No.	Test	Weight of sample to be tested (gm)
1	Sieve Analysis	4000
2	Atterbergs Limits	4000
3	Proctor (Soil Compaction)	10000
4	Californian Bearing Ratio (CBR)	18000

Table (3.11): The weights and Tests carried out of the samples

Serial No.	Test	Weight of sample to be tested (gm)	Weight of natural gravel added (15%) (gm)	Weight of sand added (10%) (gm)	Total Weight of Sample
1	Sieve Analysis	3000	600	400	4000
2	Atterbergs Limits	3000	600	400	4000

Table (3.12): The weights and Tests carried out of the samples

Serial No.	Test	Weight of sample to be tested (gm)	Weight of natural gravel added (15%) (gm)	Weight of sand added (10%) (gm)	Total Weight of Sample
1	Sieve Analysis	3000	600	400	4000
2	Atterbergs Limits	3000	600	400	4000
3	Proctor (Soil Compaction)	7500	1500	1000	10000
4	Californian Bearing Ratio (CBR)	13500	2700	1800	18000

Table (3.13): The weights and Tests carried out of the samples

Serial No.	Test	Weight of sample to be tested (gm)	Weight of crushed stone added (10%) (gm)	Weight of sand added (10%) (gm)	Total Weight of Sample
1	Sieve Analysis	3120	480	400	4000
2	Atterbergs Limits	3120	480	400	4000
3	Proctor (Soil Compaction)	7800	1200	1000	10000
4	Californian Bearing Ratio (CBR)	14040	2160	1800	18000

Table (3.14): The weights and Tests carried out of the samples

Serial No.	Test	Weight of sample to be tested (gm)
1	Sieve Analysis	4000
2	Atterbergs Limits	4000
3	Proctor (Soil Compaction)	10000
4	Californian Bearing Ratio (CBR)	18000

Table (3.15): The weights and Tests carried out of the samples

Serial No.	Test	Weight of sample to be tested (gm)	Weight of natural gravel added (17%) (gm)	Weight of sand added (10%) (gm)	Total Weight of Sample
1	Sieve Analysis	2920	680	400	4000
2	Atterbergs Limits	2920	680	400	4000
3	Proctor (Soil Compaction)	7300	1700	1000	10000
4	Californian Bearing Ratio (CBR)	13140	3060	1800	18000

Table (3.16): The weights and Tests carried out of the samples

Serial No.	Test	Weight of sample to be tested (gm)	Weight of crushed stone added (12%) (gm)	Weight of sand added (10%) (gm)	Total Weight of Sample
1	Sieve Analysis	3120	480	400	4000
2	Atterbergs Limits	3120	480	400	4000
3	Proctor (Soil Compaction)	7800	1200	1000	10000
4	Californian Bearing Ratio (CBR)	14040	2160	1800	18000

Table (3.17): The weights and Tests carried out of the samples

Serial No.	Test	Weight of sample to be tested (gm)	Total Weight of Sample
1	Sieve Analysis	4000	4000
2	Atterbergs Limits	4000	4000
3	Proctor (Soil Compaction)	10000	10000
4	Californian Bearing Ratio (CBR)	18000	18000

Table (3.18): The weights and Tests carried out of the samples

Serial No.	Test	Weight of sample to be tested (gm)	Weight of natural gravel added (17%) (gm)	Weight of sand added (10%) (gm)	Total Weight of Sample
1	Sieve Analysis	2920	680	400	4000
2	Atterbergs Limits	2920	680	400	4000
3	Proctor (Soil Compaction)	7300	1700	1000	10000
4	Californian Bearing Ratio (CBR)	13140	3060	1800	18000

Sieve Analysis for Granular Materials
Based on AASHTO Desig. (T27-84)

Description of sample : **Sample (S1)**

Table 3.19

Sample	1	2
Sample Total Weight (g)	1569.6	1750.3
Sample Weight after Washing	1273.0	1447.9
Sum of Retained Weight (g)	1569.6	1750.3

B.S seive	Retained					%age Passing
	Sample (1)		Sample (2)		Average	
(mm)	Wt. (g)	(%)	Wt. (g)	(%)	(%)	
37.5	0		0			100
25	53.6	3.4	85.7	4.9	4.2	96
19.0	78.1	5.0	132.6	7.6	6.3	90
12.5	179.8	11.5	215.5	12.3	11.9	78
9.50	103.7	6.6	109.5	6.3	6.4	71
4.75	199.2	12.7	218.8	12.5	12.6	59
2.00	286.6	18.3	307.2	17.6	17.9	41
0.425	265.4	16.9	278.2	15.9	16.4	24
0.075	105.5	6.7	99.5	5.7	6.2	18
Pan	297.7	19.0	303.3	17.3	18.1	0

Sieve Analysis for Granular Materials
Based on AASHTO Desig. (T27-84)

Sample (S1)

Treatment Trial (1): 15% Natural Gravel-10% Sand

Table 3.20

Sample	1	2
Sample Total Weight (g)	1985.4	2051.5
Sample Weight after Washing	1770.9	1803.6
Sum of Retained Weight (g)	1985.4	2051.5

B.S seive (mm)	Retained					%age Passing
	Sample (1)		Sample (2)		Average	
	Wt. (g)	(%)	Wt. (g)	(%)	(%)	
37.5	0	0.0	0	0.0	0.0	100
25	125.6	6.3	44.5	2.2	4.2	96
19.0	130	6.5	58.9	2.9	4.7	91
12.5	195.9	9.9	248.4	12.1	11.0	80
9.50	171.1	8.6	227.8	11.1	9.9	70
4.75	345.7	17.4	361.8	17.6	17.5	53
2.00	300.3	15.1	324.6	15.8	15.5	37
0.425	341.1	17.2	369.9	18.0	17.6	20
0.075	160.8	8.1	167.2	8.2	8.1	11
Pan	214.9	10.8	248.4	12.1	11.5	0

Sieve Analysis for Granular Materials
Based on AASHTO Desig. (T27-84)

Sample (S1)

Treatment Trial (2): 15% Natural Gravel-10% Sand

Table 3.21

Sample	1	2
Sample Total Weight (g)	2066.5	1954.9
Sample Weight after Washing	1834.7	1694.6
Sum of Retained Weight (g)	2066.5	1954.9

B.S seive (mm)	Retained					%age Passing
	Sample (1)		Sample (2)		Average	
	Wt. (g)	(%)	Wt. (g)	(%)	(%)	
37.5	0	0.0	0	0.0	0.0	100
25	100.9	4.9	65.5	3.4	4.1	96
19.0	217.3	10.5	87.7	4.5	7.5	88
12.5	195.8	9.5	269.5	13.8	11.6	77
9.50	195.6	9.5	149.7	7.7	8.6	68
4.75	284.3	13.8	315.8	16.2	15.0	53
2.00	298.2	14.4	272.5	13.9	14.2	35
0.425	245	11.9	263.4	13.5	12.7	20
0.075	294.4	14.2	269.9	13.8	14.0	10
Pan	235.0	11.4	260.9	13.3	10.0	0

Sieve Analysis for Granular Materials

Based on AASHTO Desig. (T27-84)

Sample (S1)

Treatment Trial (3):

12% Crushed Stone-10% Sand

Table 3.22

Sample	1	2
Sample Total Weight (g)	1875.7	2155.4
Sample Weight after Washing	1603.3	1881.6
Sum of Retained Weight (g)	1875.7	2155.4

B.S seive (mm)	Retained					%age Passing
	Sample (1)		Sample (2)		Average	
	Wt. (g)	(%)	Wt. (g)	(%)	(%)	
37.5	0	0.0	0	0.0	0.0	100
25	52	2.8	60.6	2.8	2.8	85
19.0	26	1.4	171.2	7.9	4.7	83
12.5	185	9.9	195	9.0	9.5	65
9.50	175.5	9.4	179	8.3	8.8	52
4.75	352.4	18.8	371.9	17.3	18.0	45
2.00	285.2	15.2	314.8	14.6	14.9	33
0.425	257.3	13.7	287.8	13.4	13.5	16
0.075	267.7	14.3	299.7	13.9	14.1	14
Pan	274.6	14.6	275.4	12.8	13.7	0

Sieve Analysis for Granular Materials
Based on AASHTO Desig. (T27-84)

Sample (S2)

Table 3.23

Sample	1	2
Sample Total Weight (g)	2161.6	2071.0
Sample Weight after Washing	1756.3	1674.4
Sum of Retained Weight (g)	2161.6	2071.0

B.S seive	Retained					%age Passing
	Sample (1)		Sample (2)		Average	
(mm)	Wt. (g)	(%)	Wt. (g)	(%)	(%)	
37.5	0		0			100
25	82.8	3.8	75.2	3.6	3.7	96
19.0	182.8	8.5	105.5	5.1	6.8	89
12.5	179	8.3	148.5	7.2	7.7	82
9.50	113.9	5.3	132.8	6.4	5.8	76
4.75	326.7	15.1	346.3	16.7	15.9	60
2.00	380.8	17.6	378.6	18.3	17.9	42
0.425	348.4	16.1	345.3	16.7	16.4	26
0.075	141	6.5	141.1	6.8	6.7	19
Pan	406.2	18.8	397.7	19.2	19.0	0

Sieve Analysis for Granular Materials
Based on AASHTO Desig. (T27-84)

Sample (S2)

Treatment Trial (1):

17% Natural Gravel-10% Sand

Table 3.24

Sample	1	2
Sample Total Weight (g)	1890.0	2135.8
Sample Weight after Washing	1770.4	2003.2
Sum of Retained Weight (g)	1890.0	2135.8

B.S seive	Retained					%age Passing
	Sample (1)		Sample (2)		Average	
(mm)	Wt. (g)	(%)	Wt. (g)	(%)	(%)	
37.5	0	0.0	0	0.0	0.0	100
25	28.4	1.5	95.1	4.5	3.0	97
19.0	164.1	8.7	219	10.3	9.5	88
12.5	322.5	17.1	309.5	14.5	15.8	72
9.50	185.7	9.8	235.7	11.0	10.4	61
4.75	364.8	19.3	356.3	16.7	18.0	43
2.00	257.1	13.6	279.2	13.1	13.3	30
0.425	292.9	15.5	317.5	14.9	15.2	15
0.075	152.7	8.1	188.4	8.8	8.5	6
Pan	121.8	6.4	135.1	6.3	6.4	0

Sieve Analysis for Granular Materials

Based on AASHTO Desig. (T27-84)

Sample (S2)

Treatment Trial (2):

12% Crushed Stone-10% Sand

Table 3.25

Sample	1	2
Sample Total Weight (g)	1978.8	2051.7
Sample Weight after Washing	1836.8	1920.1
Sum of Retained Weight (g)	1978.8	2051.7

B.S seive	Retained					%age Passing
	Sample (1)		Sample (2)		Average	
(mm)	Wt. (g)	(%)	Wt. (g)	(%)	(%)	
37.5	0	0.0	0	0.0	0.0	100
25	85.9	4.3	218.9	10.7	7.5	92
19.0	237.8	12.0	179.6	8.8	10.4	82
12.5	206.3	10.4	190.8	9.3	9.9	72
9.50	206.5	10.4	207.3	10.1	10.3	62
4.75	347.1	17.5	376.3	18.3	17.9	44
2.00	265	13.4	258.3	12.6	13.0	31
0.425	312.8	15.8	308.3	15.0	15.4	16
0.075	174.4	8.8	178.1	8.7	8.7	7
Pan	143.0	7.2	134.1	6.5	6.9	0

Sieve Analysis for Granular Materials
Based on AASHTO Desig. (T27-84)

Sample (S3)

Table 3.26

Sample	1	2
Sample Total Weight (g)	1573.9	2020.4
Sample Weight after Washing	1301.7	1616.4
Sum of Retained Weight (g)	1573.9	2020.4

B.S seive	Retained					%age Passing
	Sample (1)		Sample (2)		Average	
(mm)	Wt. (g)	(%)	Wt. (g)	(%)	(%)	
37.5	0		0			100
25	33.5	2.1	27.8	1.4	1.8	98
19.0	165.3	10.5	58.1	2.9	6.7	92
12.5	139.3	8.9	253.7	12.6	10.7	81
9.50	85.2	5.4	147.9	7.3	6.4	74
4.75	186.4	11.8	217.9	10.8	11.3	63
2.00	215.3	13.7	292.2	14.5	14.1	49
0.425	277.7	17.6	379.3	18.8	18.2	31
0.075	194.1	12.3	235.7	11.7	12.0	19
Pan	277.1	17.6	407.8	20.2	18.9	0

Sieve Analysis for Granular Materials

Based on AASHTO Desig. (T27-84)

Sample (S3)

Treatment Trial (1): 17% Natural Gravel-10% Sand

Table 3.27

Sample	1	2
Sample Total Weight (g)	1925.1	1983.2
Sample Weight after Washing	1738.9	1742.9
Sum of Retained Weight (g)	1925.1	1983.2

B.S seive	Retained					%age Passing
	Sample (1)		Sample (2)		Average	
(mm)	Wt. (g)	(%)	Wt. (g)	(%)	(%)	
37.5	0		0			100
25	139.3	7.2	68.8	3.5	5.4	95
19.0	178.5	9.3	151.5	7.6	8.5	86
12.5	283.4	14.7	286.2	14.4	14.6	72
9.50	175.7	9.1	158.7	8.0	8.6	63
4.75	330	17.1	343.4	17.3	17.2	46
2.00	308.7	16.0	327.8	16.5	16.3	30
0.425	238.8	12.4	295.7	14.9	13.7	16
0.075	83.2	4.3	110.2	5.6	4.9	11
Pan	187.5	9.7	240.9	12.1	10.9	0

**Determination of Liquid Limit & Plastic Limits of soil
Based on AASHTO Desig. (T89-86) & (T90-86)**

Description of sample :

Sample (S1)

Table 3.28

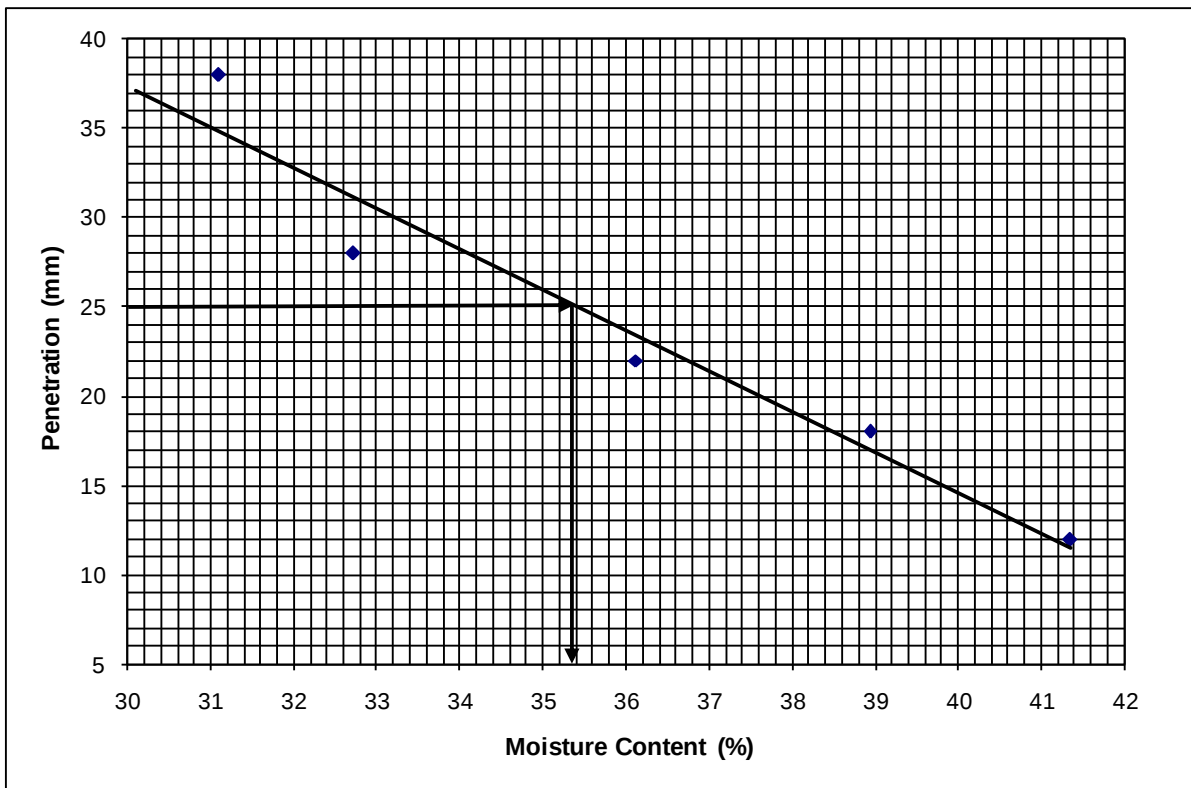
Test	LIQUID LIMIT					PLASTIC LIMIT			
	1	2	3	4	5	1	2	3	4
sample									
Penetration (mm)	12	18	22	28	38	0	0	0	0
Wt. of wet soil +container (g)	39.1	40	39.3	38.2	47.8	40.2	39.8	40.6	0
Wt. of dry soil +container (g)	34.8	35.6	35.4	34.7	44.1	39.1	38.7	39.4	0
Wt. of container (g)	24.4	24.3	24.6	24	32.2	32.8	32.7	32.7	0
M.C%	41.3	38.9	36.1	32.7	31.1	17.5	18.3	17.9	

LIQUID LIMIT (%) 35

PLASTIC LIMIT (%) 18

PLASTICITY INDEX (%) 17

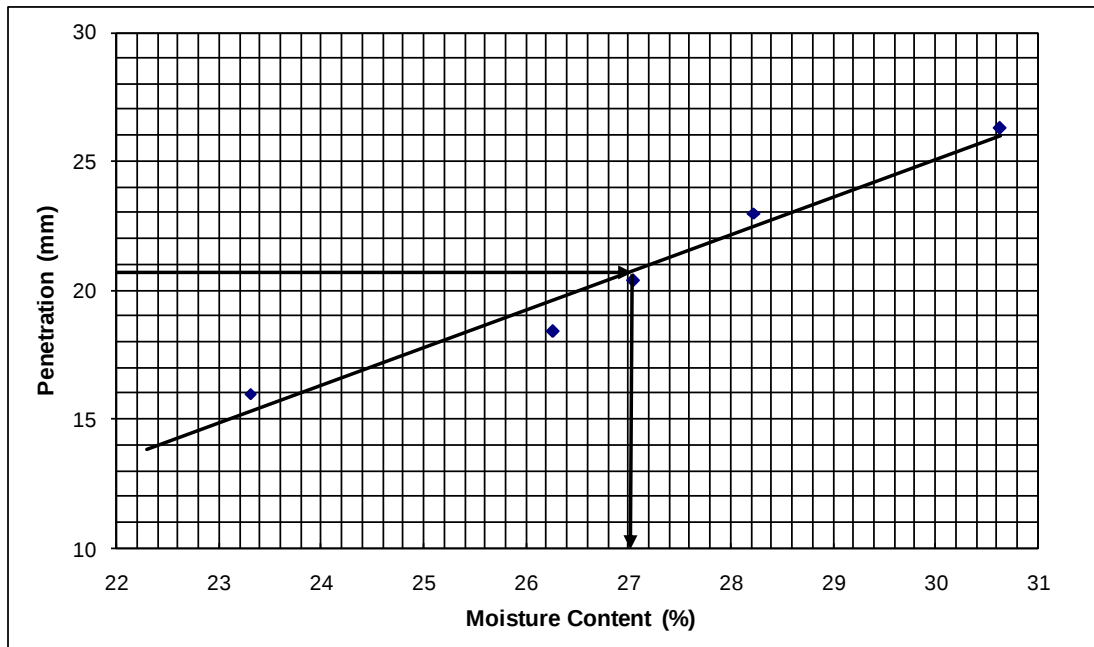
Figure 3.10: Sample (1) – Moisture Content vs. Penetration



Treatment Trial (1): **Sample (S1)**
15% Natural Gravel-10% Sand

Test	LIQUID LIMIT					PLASTIC LIMIT			
sample	1	2	3	4	5	1	2	3	4
Penetration (mm)	16	18.4	20.4	23	26.3	0	0	0	0
Wt. of wet soil +container (g)	33.8	33.2	36	37	35.5	26	26.6	27.1	26.4
Wt. of dry soil +container (g)	31.4	30.6	32.7	33.5	32.1	25.1	25.7	26.1	25.5
Wt. of container (g)	21.1	20.7	20.5	21.1	21	18.8	18.8	19.2	19.2
M.C%	23.3	26.3	27.0	28.2	30.6	14.3	13.0	14.5	14.3

Figure 3.11: Sample (1) – Moisture Content vs. Penetration



**Determination of Liquid Limit & Plastic Limits of soil
Based on AASHTO Desig. (T89-86) & (T90-86)**

Sample (S1)

Treatment Trial (2): 15% Natural Gravel-10% Sand

Table 3.30

Test	LIQUID LIMIT	PLASTIC LIMIT
sample	N.P.	N.P.
Penetration (mm)		
Wt. of wet soil +container (g)		
Wt. of dry soil +container (g)		
Wt. of container (g)		
M.C%		

LIQUID LIMIT (%) N.P.

PLASTIC LIMIT (%) N.P.

PLASTICITY INDEX (%) N.P.

**Determination of Liquid Limit & Plastic Limits of soil
Based on AASHTO Desig. (T89-86) & (T90-86)**

Sample (S1)

Treatment Trial (3): 12% Crushed Stone-10% Sand

Table 3.31

Test	LIQUID LIMIT					PLASTIC LIMIT			
sample	1	2	3	4	5	1	2	3	4
Penetration (mm)	N.P.					N.P.			
Wt. of wet soil +container (g)									
Wt. of dry soil +container (g)									
Wt. of container (g)									
M.C%									

LIQUID LIMIT (%)	N.P.
PLASTIC LIMIT (%)	N.P.
PLASTICITY INDEX (%)	N.P.

**Determination of Liquid Limit & Plastic Limits of soil
Based on AASHTO Desig. (T89-86) & (T90-86)**

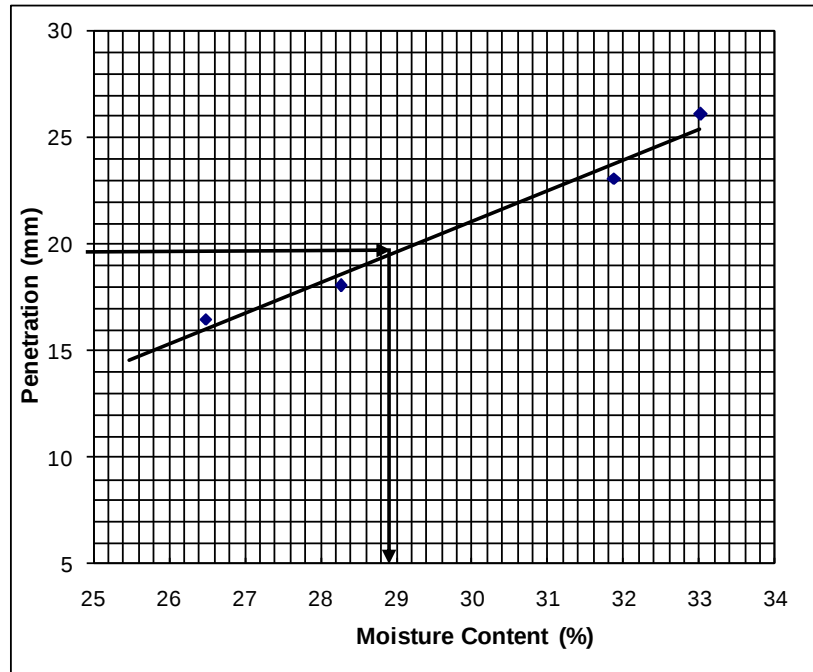
Sample (S2)

Table 3.32

Test	LIQUID LIMIT					PLASTIC LIMIT			
sample	1	2	3	4	5	1	2	3	4
Penetration (mm)	16.5	18.1	20.1	23.1	26.1	0	0	0	0
Wt. of wet soil +container (g)	33.5	32.9	32.9	32.7	34.9	25.1	26.4	25.2	26.1
Wt. of dry soil +container (g)	30.8	30.3	30.4	29.8	31.5	24	25.3	24.3	25
Wt. of container (g)	20.6	21.1	21.2	20.7	21.2	18.7	18.9	19.1	18.7
M.C%	26.5	28.3		31.9	33.0		17.2	17.3	17.5

LIQUID LIMIT (%) 29
 PLASTIC LIMIT (%) 17
 PLASTICITY INDEX (%) 12

Figure 3.12: Sample (2) – Moisture Content vs. Penetration



**Determination of Liquid Limit & Plastic Limits of soil
Based on AASHTO Desig. (T89-86) & (T90-86)**

Sample (S2)

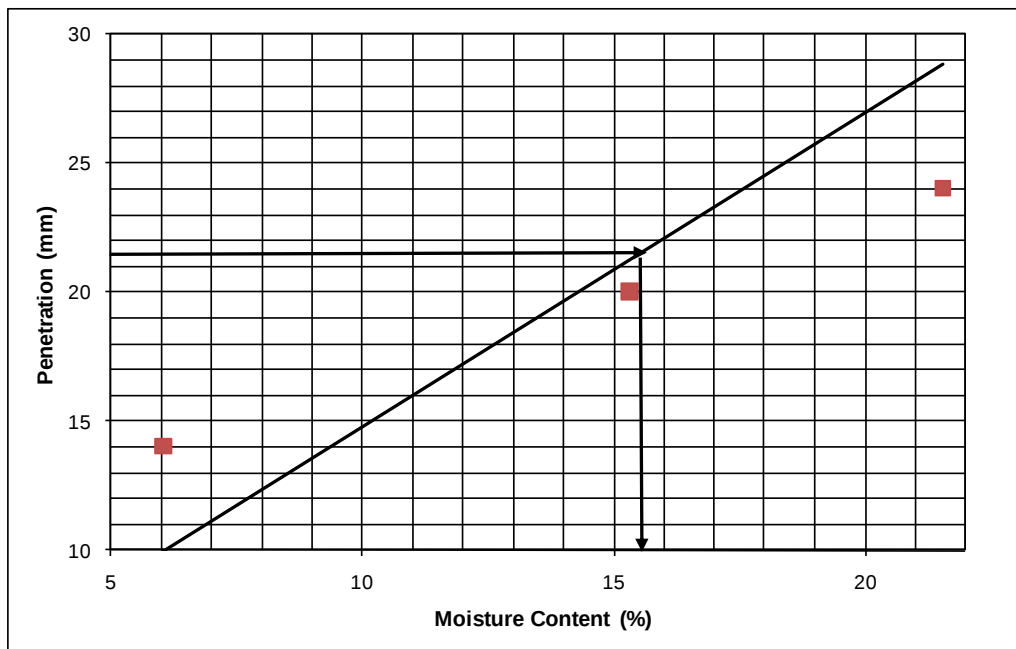
Treatment Trial (1): 17% Natural Gravel-10% Sand

Table 3.33

Test	LIQUID LIMIT					PLASTIC LIMIT			
sample	1	2	3	4	5	1	2	3	4
Penetration (mm)	14	20	24	33	-	-	-	0	0
Wt. of wet soil +container (g)	38	38.3	38.4	38.8	-	30	30.9	-	-
Wt. of dry soil +container (g)	37.2	36.4	35.9	36.3	-	28.9	29.8	-	-
Wt. of container (g)	24	24	24.3	24.4	-	20.1	20.4	-	-
M.C%	6.1	15.3	21.6	21.0	0.0	12.5	11.7	-	-

LIQUID LIMIT (%) 16
 PLASTIC LIMIT (%) 12
 PLASTICITY INDEX (%) 4

Figure 3.13: Sample (2) – Moisture Content vs. Penetration



**Determination of Liquid Limit & Plastic Limits of soil
Based on AASHTO Desig. (T89-86) & (T90-86)**

Sample (S2)

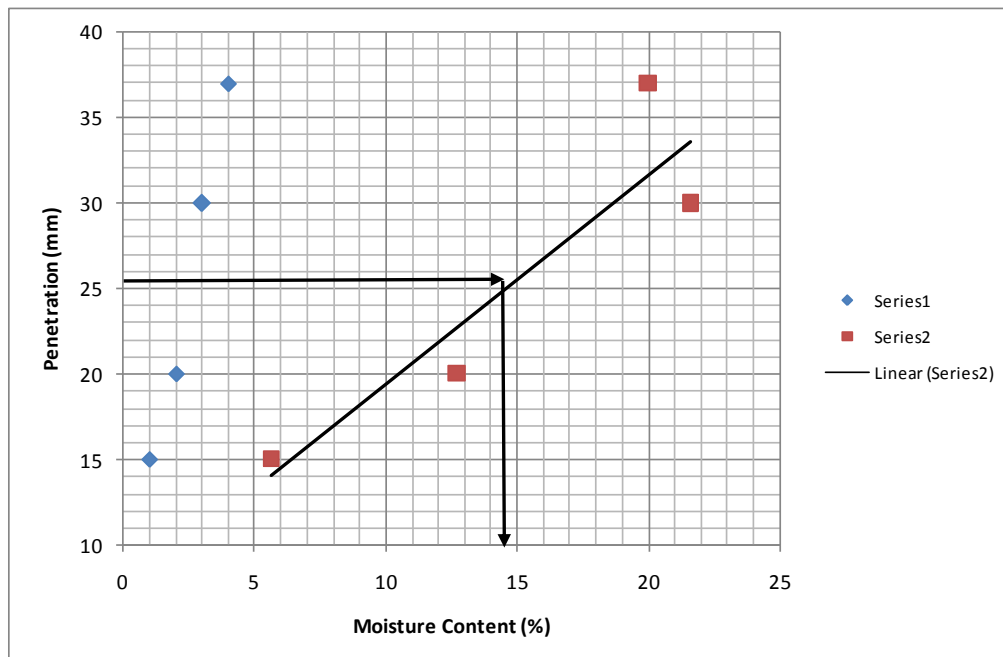
Treatment Trial (2): 12% Crushed Stone-10% Sand

Table 3.34

Test	LIQUID LIMIT					PLASTIC LIMIT			
sample	1	2	3	4	5	1	2	3	4
Penetration (mm)	15	20	30	37	-	-	-	-	-
Wt. of wet soil +container (g)	34.4	34.5	34.7	34.7	-	28.5	28.4	-	-
Wt. of dry soil +container (g)	33.7	33.1	32.3	32.7	-	28.1	27.6	-	-
Wt. of container (g)	21.3	22.1	21.2	22.7	-	20.2	21.3	-	-
M.C%	5.6	12.7	21.6	20.0	-	5.1	12.7	-	-

LIQUID LIMIT (%) 15
 PLASTIC LIMIT (%) 9
 PLASTICITY INDEX (%) 6

Figure 3.14: Sample (2) – Moisture Content vs. Penetration



**Determination of Liquid Limit & Plastic Limits of soil
Based on AASHTO Desig. (T89-86) & (T90-86)**

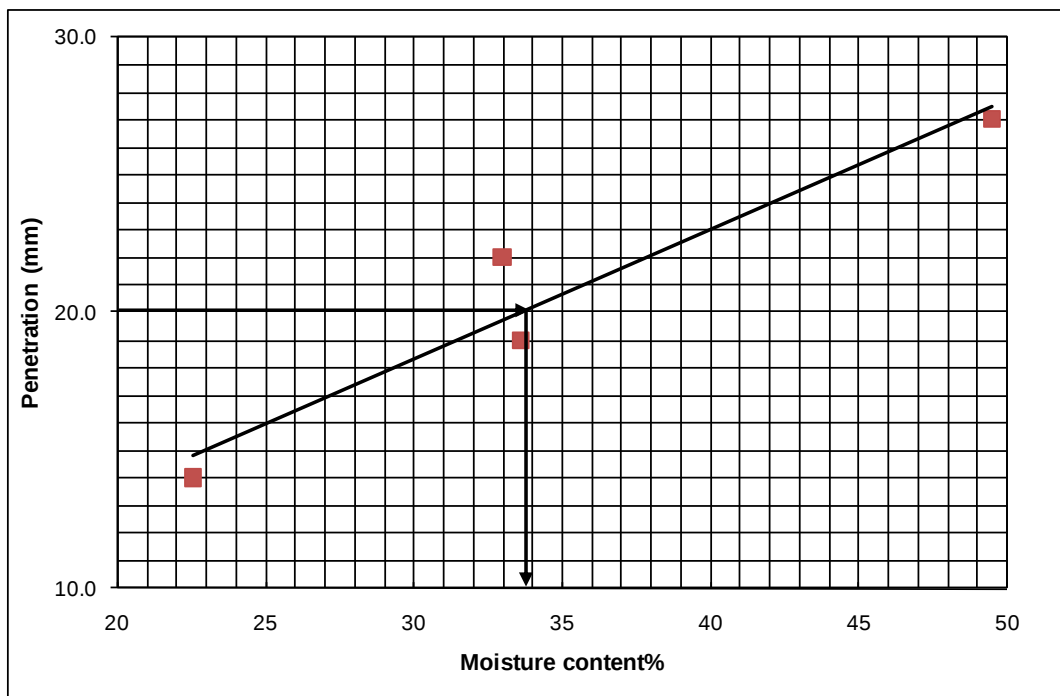
Sample (S3)

Table 3.35

Test	LIQUID LIMIT					PLASTIC LIMIT			
sample	1	2	3	4	5	1	2	3	4
No of blows	14	19	22	27	33	0	0	0	0
Wt. of wet soil +container (g)	32.4	32.3	33.4	34.8	32.1	36	46	44.4	
Wt. of dry soil +container (g)	30.3	28.9	29.8	29.5	28.7	34.4	44.2	42.9	
Wt. of container (g)	21	18.8	18.9	18.8	18.5	24	32.7	32.5	
M.C%	22.6	33.7	33.0	49.5		15.4	15.7		

LIQUID LIMIT (%) 35
 PLASTIC LIMIT (%) 16
 PLASTICITY INDEX (%) 19

Figure 3.15: Sample (3) – moisture Content vs. penetration



**Determination of Liquid Limit & Plastic Limits of soil
Based on AASHTO Desig. (T89-86) & (T90-86)**

Sample (S3)

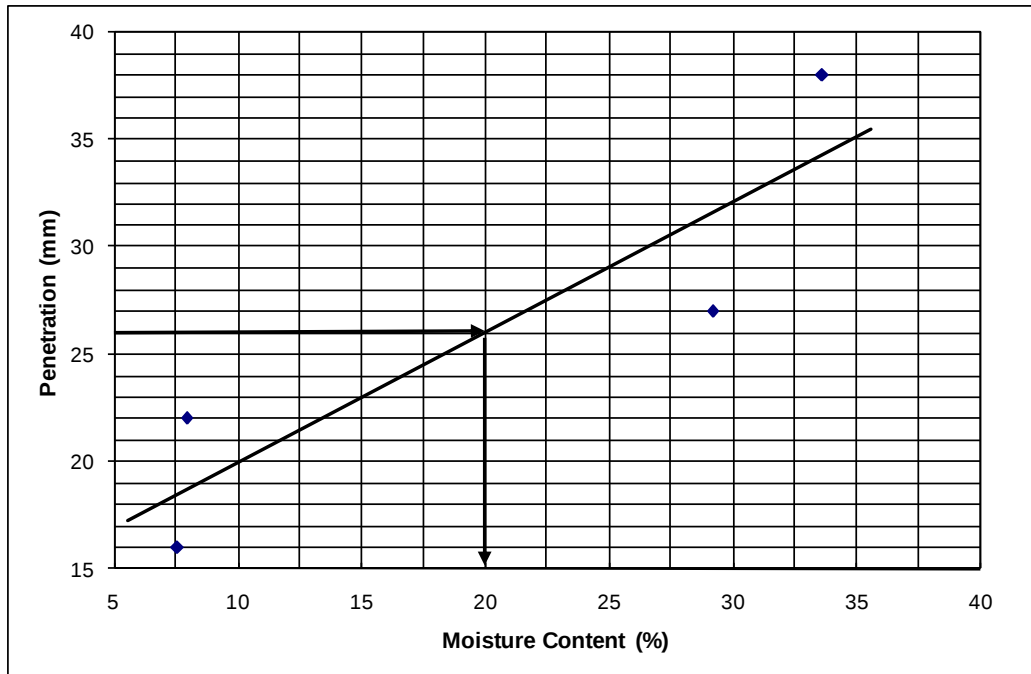
Treatment Trial (1): 17% Natural Gravel-10% Sand

Table 3.36

Test	LIQUID LIMIT					PLASTIC LIMIT			
sample	1	2	3	4	5	1	2	3	4
Penetration (mm)	16	22	27	38	0	0	0	0	0
Wt. of wet soil +container (g)	32.8	32.6	33.6	33.9	0	26.2	26.7	0	0
Wt. of dry soil +container (g)	31.8	31.6	30.3	30.2	0	25.8	25.7	0	0
Wt. of container (g)	18.6	19	19	19.2	0	18.8	19	0	0
M.C%	7.6	7.9	29.2	33.6		5.7	14.9		

LIQUID LIMIT (%) 20
 PLASTIC LIMIT (%) 10
 PLASTICITY INDEX (%) 9

Figure 3.16: Sample (3) – Moisture Content vs. Penetration



Soil Compaction
Based on AASHTO Desig. (T180-86)

Description of sample : Sample (S1)

Table 3.37

Density determination

Sample	1	2	3	4	5	6
wt.of wet soil+mould(g)	10245	10883	11040	10770	10670	
wt.of mould(g)	5859	5859	5859	5859	5859	
wt.of wet soil(g)	4386	5024	5181	4911	4811	
volume of mould(cc)	2149	2149	2149	2149	2149	
wet density(g/cc)	2.041	2.338	2.411	2.285	2.239	

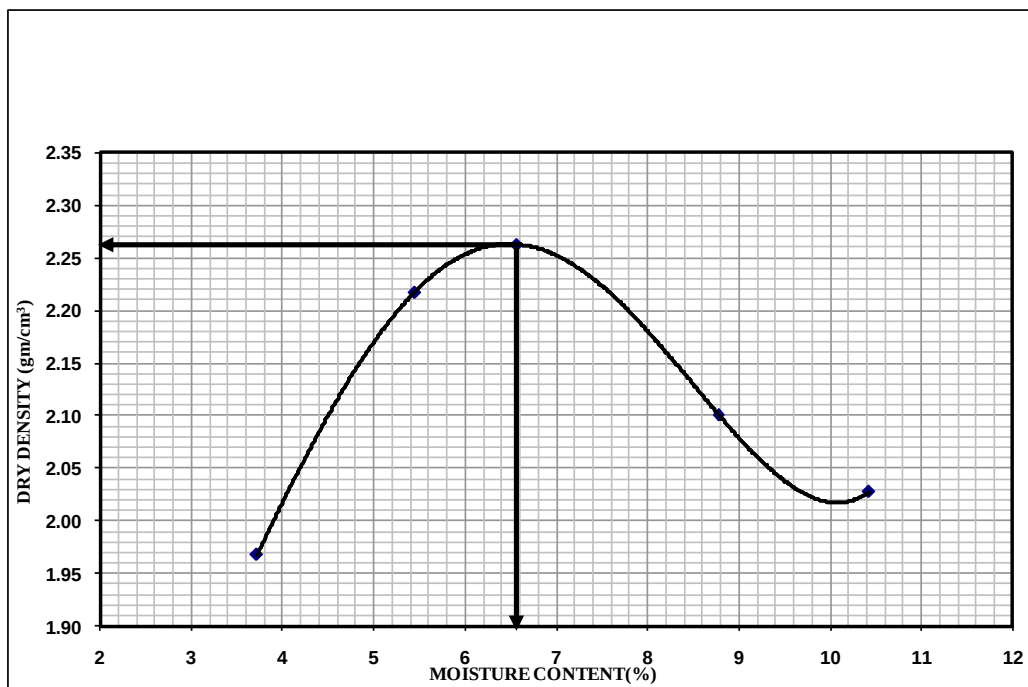
Moisture determination

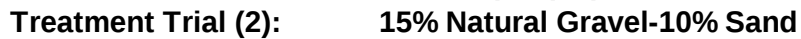
wt.of wet soil+cont(g)	586.8	542.2	520.1	517.9	531.9	
wt.of dry soil+cont(g)	567.5	516.9	491.2	480	487.2	
wt.of cont(g)	47.7	52	50.9	48.1	58.5	
moisture content(%)	3.7	5.4	6.6	8.8	10.4	
dry density(g/cc)	1.968	2.217	2.262	2.101	2.027	

M.D.D= 2.26 g/cc

O.M.C = 6.6 %

Figure 3.17: Sample (1) – Moisture Content vs. Dry Density





Soil Compaction
Based on AASHTO Desig. (T180-86)
Sample (S1)

Treatment Trial (3): 12% Crushed Stone-10% Sand

Table 3.39

Density determination

Sample	1	2	3	4	5	6
wt.of wet soil+mould(g)	10138	10671	10766	10544	10390	
wt.of mould(g)	5620	5620	5620	5620	5620	
wt.of wet soil(g)	4518	5051	5146	4924	4770	
volume of mould(cc)	2107	2107	2107	2107	2107	
wet density(g/cc)	2.144	2.397	2.442	2.337	2.264	

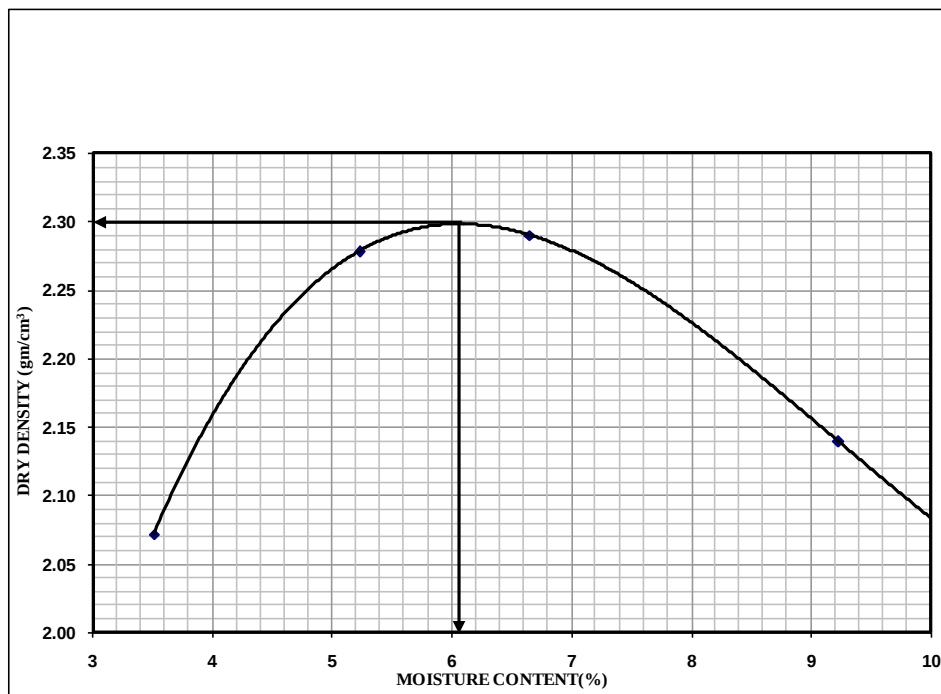
Moisture determination

wt.of wet soil+cont(g)	527.7	525.1	588.1	612.2	595.1	
wt.of dry soil+cont(g)	511.4	501.4	554.6	564.3	542.6	
wt.of cont(g)	46.4	48.1	51	45.1	43.6	
moisture content(%)	3.5	5.2	6.7	9.2	10.5	
dry density(g/cc)	2.072	2.278	2.290	2.140	2.048	

M.D.D= 2.30 g/cc

O.M.C = 6.1 %

Figure 3.19: Sample (1) – Moisture Content vs. Dry Density



Soil Compaction
Based on AASHTO Desig. (T180-86)

Sample (S2)

Table 3.40

Density determination

Sample	1	2	3	4	5	6
wt.of wet soil+mould(g)	10147	10640	10821	10471	10384	
wt.of mould(g)	5621	5621	5621	5621	5621	
wt.of wet soil(g)	4526	5019	5200	4850	4763	
volume of mould(cc)	2107	2107	2107	2107	2107	
wet density(g/cc)	2.148	2.382	2.468	2.302	2.261	

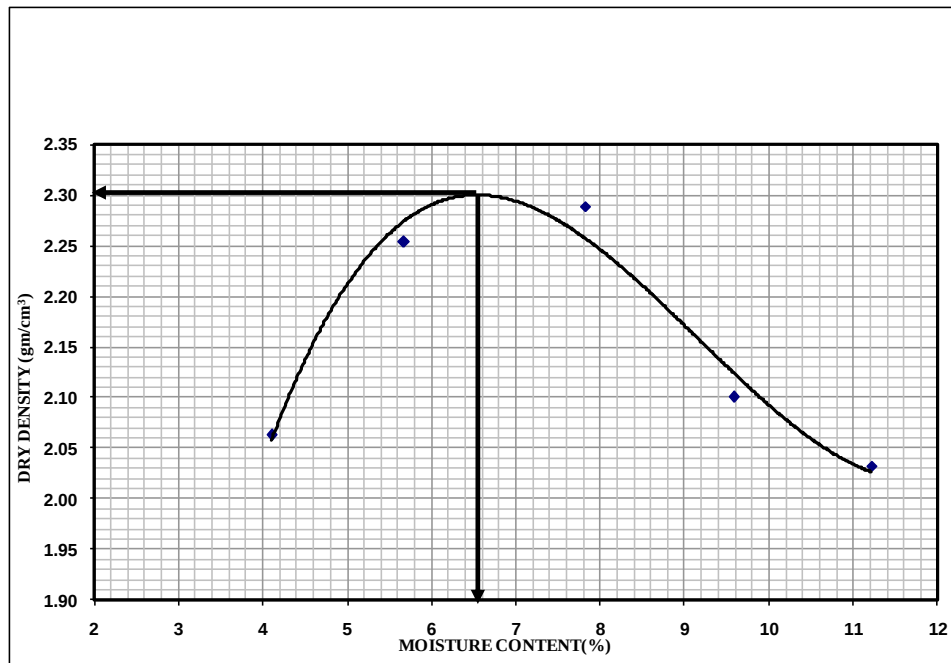
Moisture determination

wt.of wet soil+cont(g)	547.1	577.4	591.9	542.6	537.7	
wt.of dry soil+cont(g)	527.3	548.9	552.6	499.2	488.3	
wt.of cont(g)	44.8	46.4	50.1	46.4	48	
moisture content(%)	4.1	5.7	7.8	9.6	11.2	
dry density(g/cc)	2.063	2.254	2.289	2.101	2.033	

M.D.D= 2.30 g/cc

O.M.C = 6.8 %

Figure 3.20: Sample (2) – Moisture Content vs. Dry Density



Soil Compaction
Based on AASHTO Desig. (T180-86)
Sample (S2)

Treatment Trial (1): 17% Natural Gravel-10% Sand

Table 3.41

Density determination

Sample	1	2	3	4	5	6
wt.of wet soil+mould(g)	10031	10437	10690	10633	10520	
wt.of mould(g)	5619	5619	5619	5619	5619	
wt.of wet soil(g)	4412	4818	5071	5014	4901	
volume of mould(cc)	2107	2107	2107	2107	4901	
wet density(g/cc)	2.094	2.287	2.407	2.380	1.000	

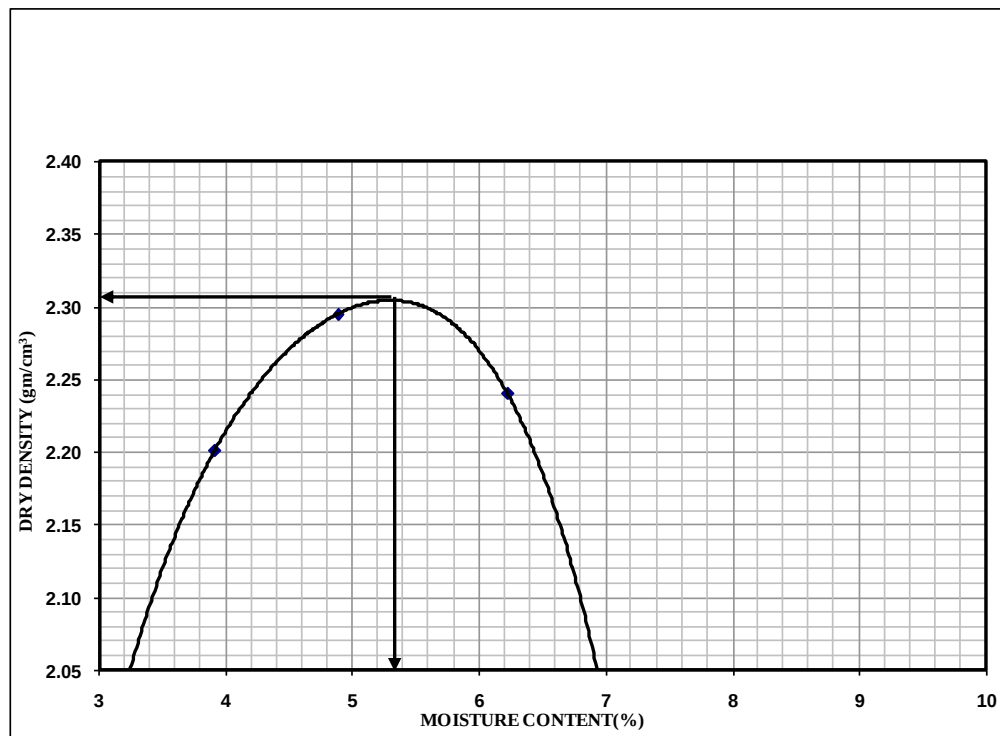
Moisture determination

wt.of wet soil+cont(g)	548.2	560.7	579.4	589.6	576.9	
wt.of dry soil+cont(g)	533	541.4	554.8	557.9	536.5	
wt.of cont(g)	54.8	47.9	50.8	48.5	50.3	
moisture content(%)	3.2	3.9	4.9	6.2	8.3	
dry density(g/cc)	2.029	2.201	2.295	2.240	0.923	

M.D.D= 2.35 g/cc

O.M.C = 5.7 %

Figure 3.21: Sample (2) – Moisture Content vs. Dry Density



Soil Compaction
Based on AASHTO Desig. (T180-86)
Sample (S2)

Treatment Trial (2): 12% Crushed Stone-10% Sand

Table 3.42

Density determination						
Sample	1	2	3	4	5	6
wt.of wet soil+mould(g)	10091	10484	10766	10544	10390	
wt.of mould(g)	5619	5619	5619	5619	5619	
wt.of wet soil(g)	4472	4865	5147	4925	4771	
volume of mould(cc)	2107	2107	2107	2107	2107	
wet density(g/cc)	2.122	2.309	2.443	2.337	2.264	
Moisture determination						
wt.of wet soil+cont(g)	574.2	542.2	520.1	569.9	613.21	
wt.of dry soil+cont(g)	557.2	522.2	496	532.9	562.6	
wt.of cont(g)	52.4	48.6	48.4	50	46.2	
moisture content(%)	3.4	4.2	5.4	7.7	9.8	
dry density(g/cc)	2.053	2.215	2.318	2.171	2.062	

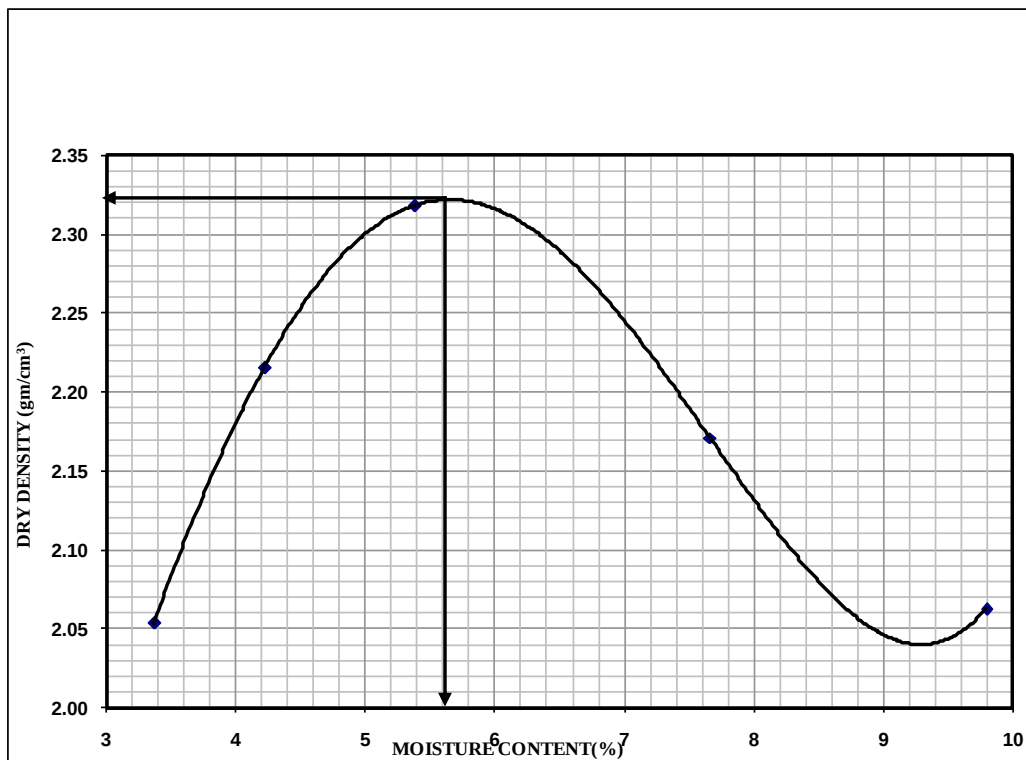
M.D.D=

2.30 g/cc

O.M.C =

6.1 %

Figure 3.22: Sample (2) – Moisture Content vs. Dry Density



Soil Compaction
Based on AASHTO Desig. (T180-86)

Sample (S3)

Table 3.43

Density determination

Sample	1	2	3	4	5	6
wt.of wet soil+mould(g)	9908	10414	10648	10482	10292	
wt.of mould(g)	5511	5511	5511	5511	5511	
wt.of wet soil(g)	4397	4903	5137	4971	4781	
volume of mould(cc)	2138	2138	2138	2138	2138	
wet density(g/cc)	2.057	2.293	2.403	2.325	2.236	

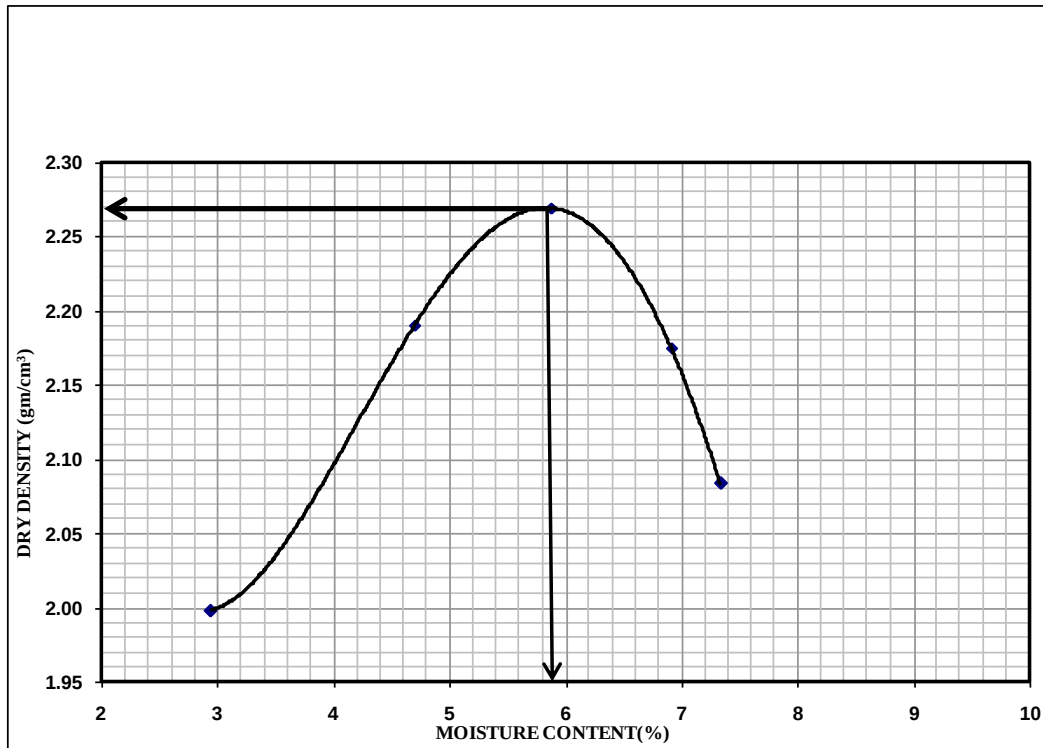
Moisture determination

wt.of wet soil+cont(g)	593	595.6	578.2	573.9	545.9	
wt.of dry soil+cont(g)	577.4	572.2	548.8	539.7	512	
wt.of cont(g)	47.8	74.4	48.6	45.1	50	
moisture content(%)	2.9	4.7	5.9	6.9	7.3	
dry density(g/cc)	1.998	2.190	2.269	2.175	2.083	

M.D.D= 2.27 g/cc

O.M.C = 5.9 %

Figure 3.232: Sample (3) – Moisture Content vs. Dry Density



Soil Compaction
Based on AASHTO Desig. (T180-86)

Sample (S3)

Treatment Trial (1): 17% Natural Gravel-10% Sand

Table 3.44

Density determination

Sample	1	2	3	4	5	6
wt.of wet soil+mould(g)	10056	10376	10588	10651	10612	
wt.of mould(g)	5619	5619	5619	5619	5619	
wt.of wet soil(g)	4437	4757	4969	5032	4993	
volume of mould(cc)	2107	2107	2107	2107	2107	
wet density(g/cc)	2.106	2.258	2.358	2.388	2.370	

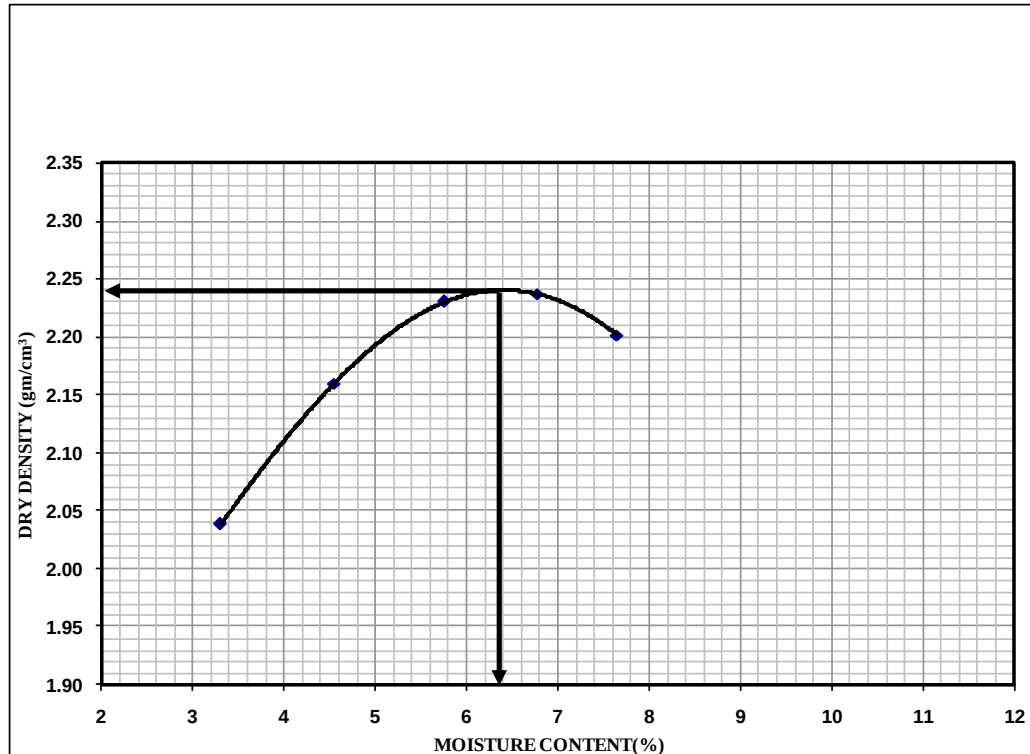
Moisture determination

wt.of wet soil+cont(g)	529.5	567.6	555.1	553.9	517.5	
wt.of dry soil+cont(g)	513.9	545.2	527.6	521.7	483.9	
wt.of cont(g)	41.2	52	50.2	46.3	44.6	
moisture content(%)	3.3	4.5	5.8	6.8	7.6	
dry density(g/cc)	2.039	2.160	2.230	2.237	2.201	

M.D.D= 2.24 g/cc

O.M.C = 6.4 %

Figure 3.24: Sample (3) – Moisture Content vs. Dry Density



CBR TEST Based on AASHTO Desig. (T180-86)**Description of sample : Sample (S1)****Table 3.45.1**

Penetration (mm)	forces(Kg)			Proving Ring Reading(Div.)		
	F56	F56	F56	56blows	56blows	56blows
0.000	0.00	0.00	0.00	0	0	0
0.635	3.84	2.16	2.16	16	9	9
1.270	10.56	5.52	4.80	44	23	20
1.905	16.32	10.80	8.88	68	45	37
2.540	21.12	18.48	14.16	88	77	59
3.175	26.16	29.28	20.64	109	122	86
3.810	29.52	39.12	28.32	123	163	118
4.445	33.12	46.32	37.92	138	193	158
5.080	39.60	53.52	48.24	165	223	201
6.350	44.16	67.20	64.80	184	280	270
7.620	47.76	79.20	77.28	199	330	322

Number of blows	56	56	56
C.B.R @ 2.5mm(%)	30.17	26.40	20.23
C.B.R @ 5.0mm(%)	37.71	50.97	61.71

Number of blows	56	56	56
Initial Reading (mm)	6.05	5.89	5.50
Final Reading(mm)	6.39	6.45	6.36
Swell(%)	0.303	0.486	0.735

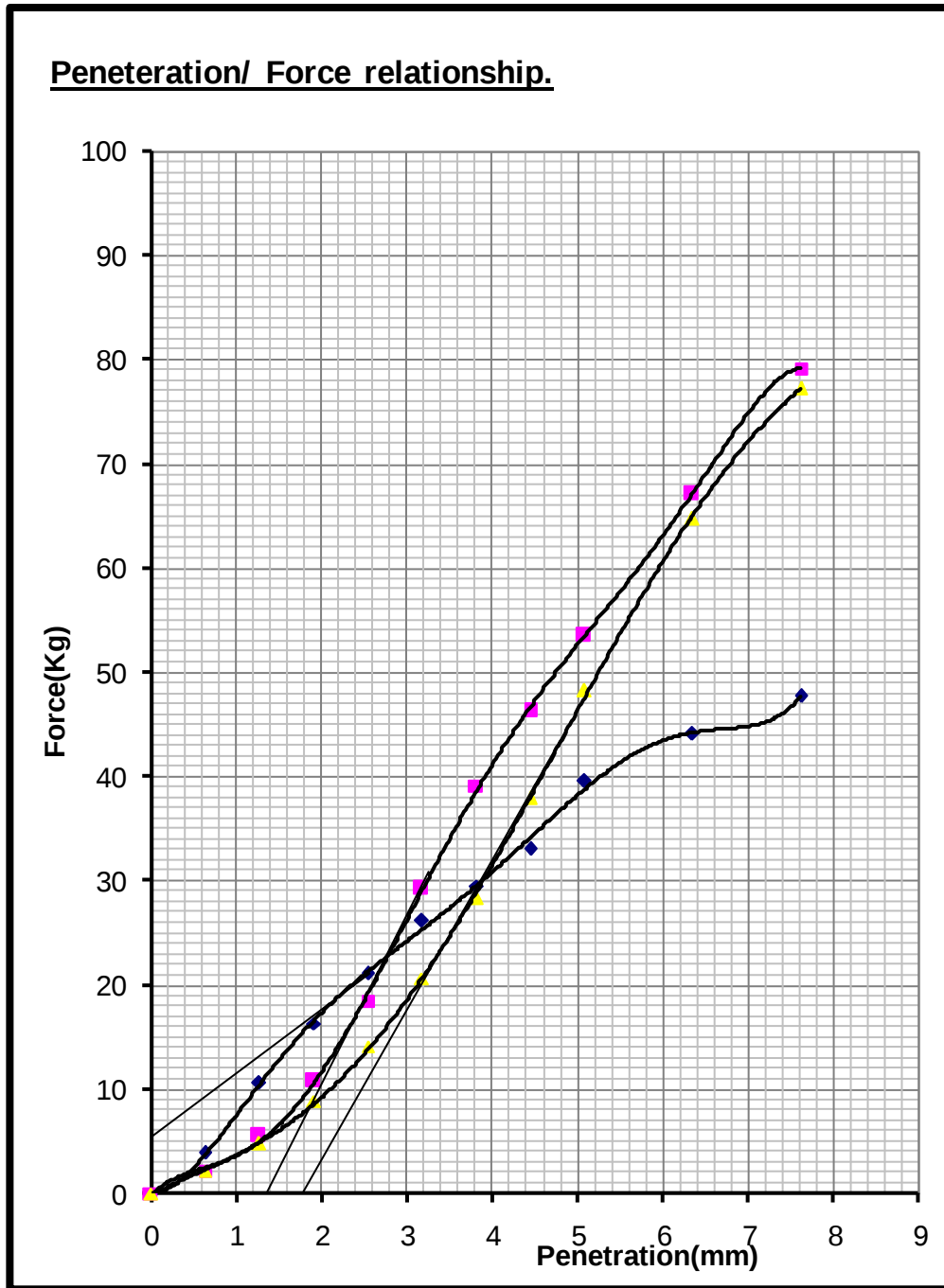
Table 3.45.2

Mould Dimentions	D (cm)	H (cm)	D (cm)	H (cm)	D (cm)	H (cm)
	15.17	11.215	15.24	11.53	15.2	11.7
No.of blows/layer	56	56	56	56	56	56
Mould No.	0		0		0	
Wt.of Mold+w.soil(g)	10694		11214		11620	
Wt.of Mold (g)	5911		5977		6268	
Wt. Of wet soil (g)	4783.0		5237.0		5352.0	
Volume of Mold(cc)	2026.0		2102.2		2122.0	
Wet Density g/cc	2.361		2.491		2.522	
Dry Density g/cc	2.223		2.353		2.385	
Container No.	0		0		0	
Wt.Of wet soil+cont(g)	518.80		512.10		510.20	
Wt. Of dry soil +Cont(g)	491.80		486.30		485.00	
Wt.of container (g)	55.90		46.00		45.90	
Moisture Content	0.062		0.059		0.057	
C.B.R (%)	37.7		51.0		61.7	

M.D.D (from compaction test)= 2.26 g/cm³ O.M.C 6.6 %

at 98 of M.D.D= 2.21 g/cm³ CBR @ 98% of M.D.D= 61 %

Figure 3.25: Sample (1) – Penetration vs. Force



CBR TEST
Based on AASHTO Desig. (T180-86)
Sample (S1)

Treatment Trial (2): 15% Natural Gravel-10% Sand

Table 3.46.1

Penetration (mm)	forces(Kg)			Proving Ring Reading(Div.)		
	F56	F56	F56	56blows	56blows	56blows
0.000	0.00	0.00	0.00	0	0	0
0.635	2.99	3.22	2.53	13	14	11
1.270	7.59	5.29	9.43	33	23	41
1.905	12.88	8.05	17.94	56	35	78
2.540	20.01	14.72	25.76	87	64	112
3.175	25.07	20.24	36.34	109	88	158
3.810	40.71	28.29	48.53	177	123	211
4.445	48.99	60.95	65.32	213	265	284
5.080	74.29	72.22	69.46	323	314	302
6.350	91.77	81.65	74.75	399	355	325
7.620	110.40	86.94	87.17	480	378	379

Number of blows	56	56	56
C.B.R @ 2.5mm(%)	28.59	21.03	36.80
C.B.R @ 5.0mm(%)	70.75	68.78	66.15

Number of blows	56	56	56
Initial Reading (mm)	2.39	11.68	12.61
Final Reading(mm)	2.41	11.73	12.70
Swell(%)	0.017	0.044	0.079

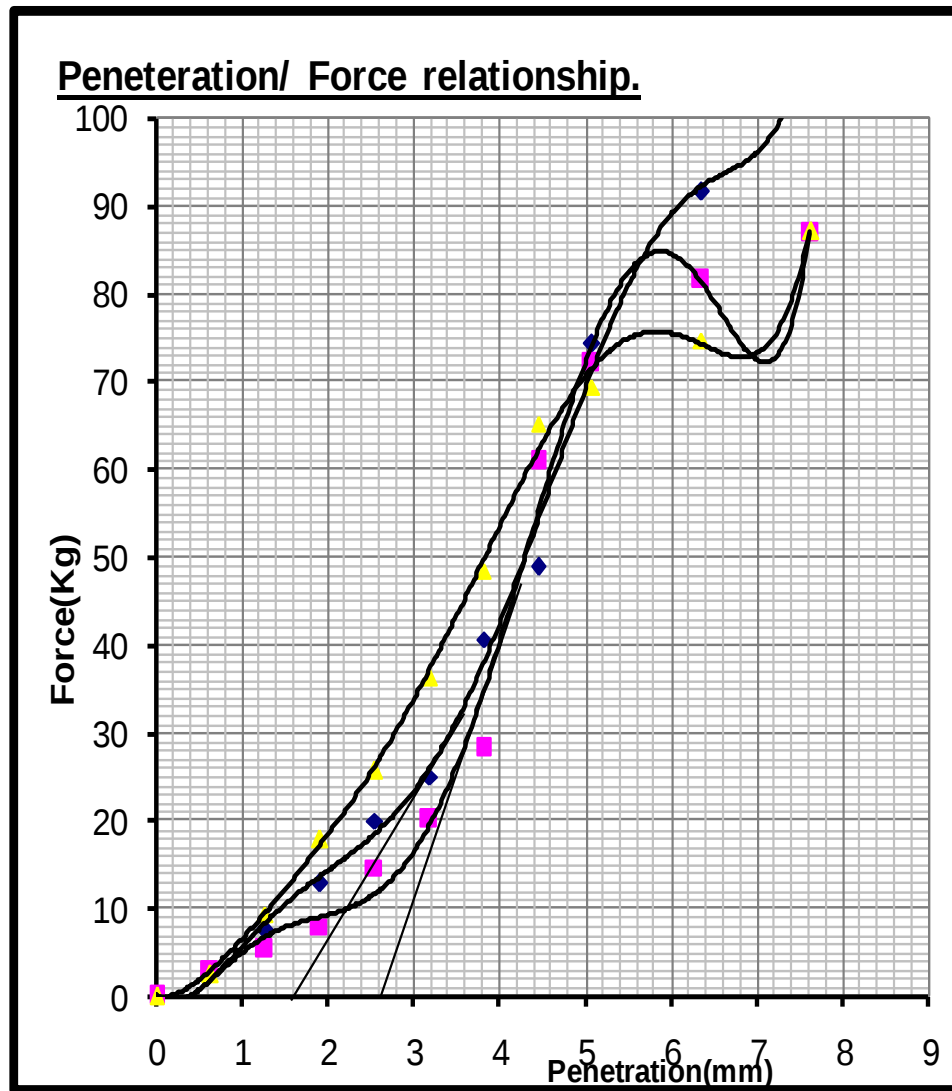
Table 3.46.2

Mould Dimensions	D (cm)	H (cm)	D (cm)	H (cm)	D (cm)	H (cm)
	15.21	11.54	15.17	11.47	15.25	11.42
No.of blows/layer	56	56	56	56	56	56
Mould No.	4		16		19	
Wt.of Mold+w.soil(g)	12098		11348		11627	
Wt.of Mold (g)	6878		6203		6473	
Wt. Of wet soil (g)	5220.0		5145.0		5154.0	
Volume of Mold(cc)	2095.7		2072.1		2084.9	
Wet Density g/cc	2.491		2.483		2.472	
Dry Density g/cc	2.350		2.339		2.331	
Container No.	AB		K1		G11	
Wt.Of wet soil+cont(g)	552.10		558.30		565.30	
Wt. Of dry soil +Cont(g)	0.00		528.80		535.90	
Wt.of container (g)	47.20		48.90		48.90	
Moisture Content	0.060		0.061		0.060	
C.B.R (%)		70.8		68.8		66.2

M.D.D (from compaction test)= 2.345 g/cm³ O.M.C 5.72 %

at 98% of M.D.D= 2.30 g/cm³ CBR @ 98% of M.D.D= 68.6 %

Figure 3.26: Sample (1) – Penetration vs. Force



CBR TEST Based on AASHTO Desig. (T180-86)**Sample (S1)****Treatment Trial (3): 12% Crushed Stone-10% Sand**

Table 3.47.1

Penetration (mm)	forces(Kg)			Proving Ring Reading(Div.)		
	F56	F56	F56	56blows	56blows	56blows
0.000	0.00	0.00	0.00	0	0	0
0.635	8.28	7.59	5.98	36	33	26
1.270	17.71	15.41	12.65	77	67	55
1.905	28.98	23.92	21.39	126	104	93
2.540	42.78	33.12	31.05	186	144	135
3.175	57.27	43.93	44.85	249	191	195
3.810	70.15	53.36	57.73	305	232	251
4.445	80.73	60.49	69.69	351	263	303
5.080	91.54	83.49	86.02	398	363	374
6.350	111.32	85.33	99.82	484	371	434
7.620	128.57	100.28	117.53	559	436	511

Number of blows	56	56	56
C.B.R @ 2.5mm(%)	61.11	47.31	44.36
C.B.R @ 5.0mm(%)	87.18	79.51	81.92

Number of blows	56	56	56
Initial Reading (mm)	10.71	7.31	4.09
Final Reading(mm)	10.75	7.36	4.11
Swell(%)	0.035	0.044	0.018

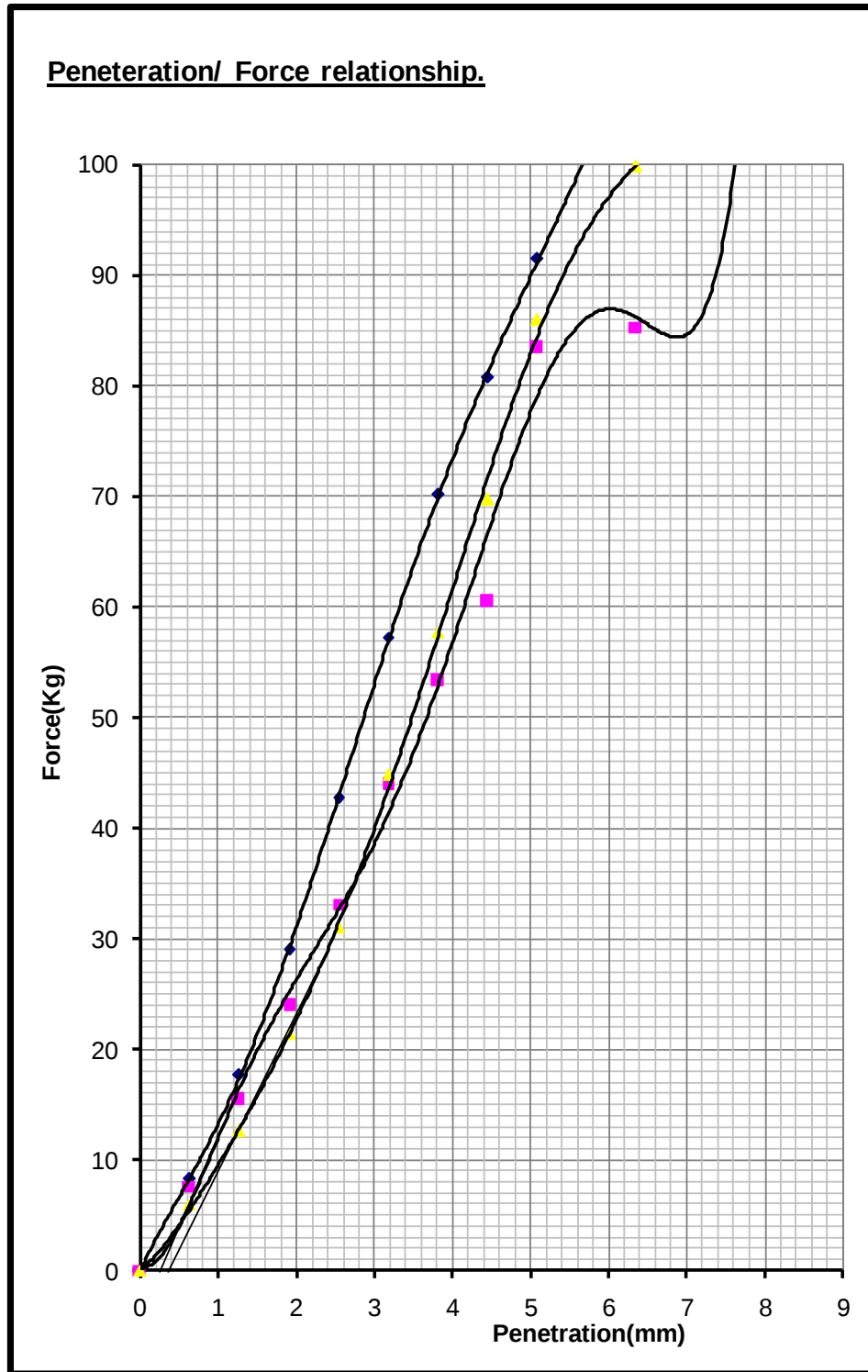
Table 3.47.2

Mould Dimentions	D (cm)	H (cm)	D (cm)	H (cm)	D (cm)	H (cm)
	15.21	11.54	15.17	11.47	15.25	11.42
No.of blows/layer	56	56	56	56	56	56
Mould No.	170		10		7	
Wt.of Mold+w.soil(g)	10832		10881		12027	
Wt.of Mold (g)	5828		5911		6839	
Wt. Of wet soil (g)	5004.0		4970.0		5188.0	
Volume of Mold(cc)	2095.7		2072.1		2084.9	
Wet Density g/cc	2.388		2.399		2.488	
Dry Density g/cc	2.253		2.274		2.357	
Container No.	95		CB		X12	
Wt.Of wet soil+cont(g)	536.30		541.80		536.90	
Wt. Of dry soil +Cont(g)	511.10		516.00		511.30	
Wt.of container (g)	44.90		45.70		50.90	
Moisture Content	0.060		0.055		0.056	
C.B.R (%)	87.2		79.5		81.9	

M.D.D (from compaction test)= 2.30 g/cm³ O.M.C 6.05 %

at 98 of M.D.D= 2.25 g/cm³ CBR @ 98% of M.D.D= 80.7 %

Figure 3.27: Sample (1) – Penetration vs. Force



CBR TEST Based on AASHTO Desig. (T180-86)

Sample (S2)

Table 3.48.1

Penetration (mm)	forces(Kg)			Proving Ring Reading(Div.)		
	F56	F56	F56	56blows	56blows	56blows
0.000	0.00	0.00	0.00	0	0	0
0.635	5.28	2.16	4.32	22	9	18
1.270	8.88	5.04	7.44	37	21	31
1.905	11.52	8.88	10.56	48	37	44
2.540	12.96	13.20	14.40	54	55	60
3.175	13.92	18.48	18.00	58	77	75
3.810	15.12	23.52	21.36	63	98	89
4.445	16.08	28.80	24.72	67	120	103
5.080	16.80	33.84	28.56	70	141	119
6.350	18.72	42.72	37.68	78	178	157
7.620	20.64	49.68	47.52	86	207	198

Number of blows	56	56	56
C.B.R @ 2.5mm(%)	18.51	18.86	20.57
C.B.R @ 5.0mm(%)	16.00	40.69	35.89

Number of blows	56	56	56
Initial Reading (mm)	3.82	0.47	5.06
Final Reading(mm)	4.01	1.36	5.42
Swell(%)	0.172	0.774	0.316

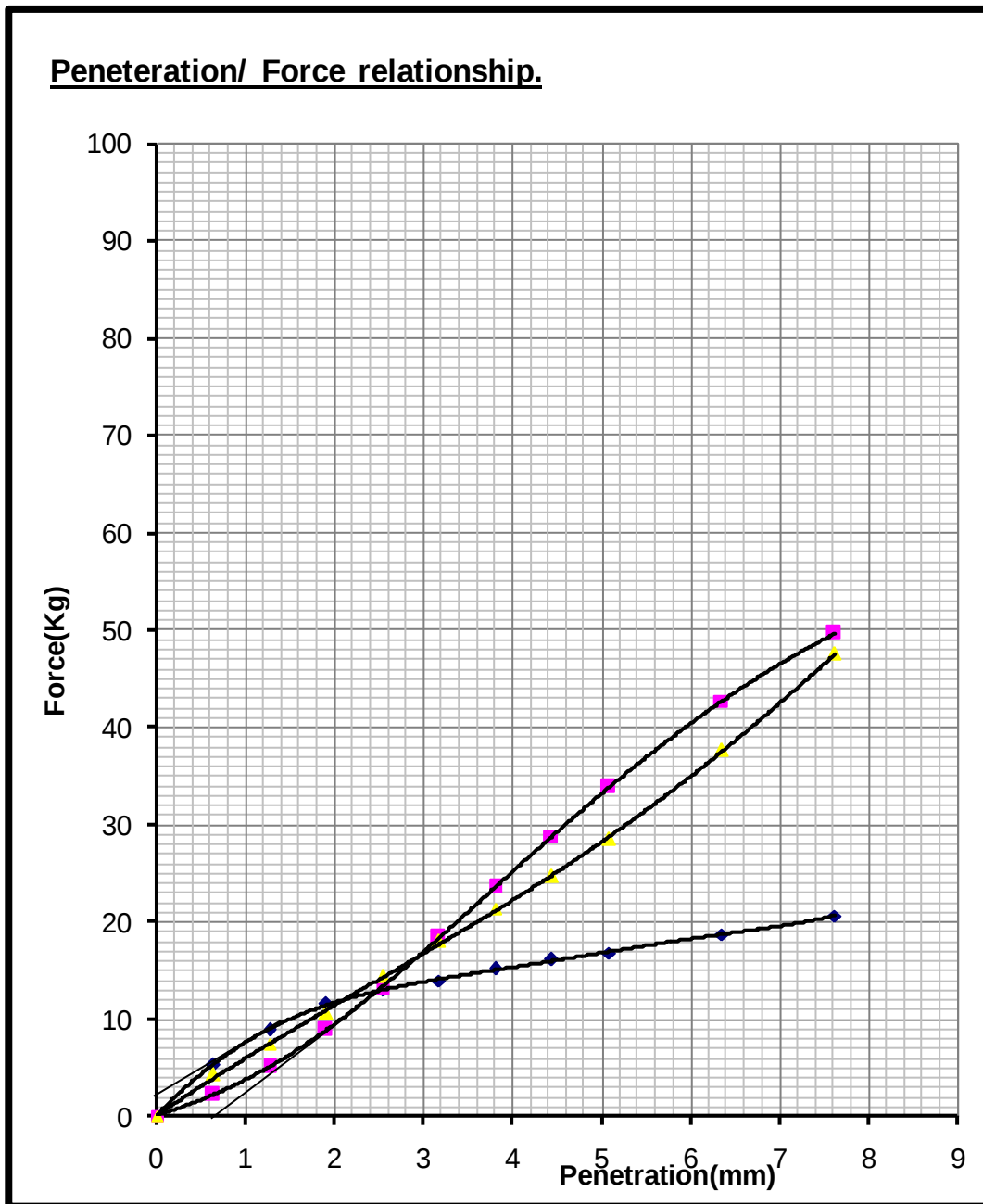
Table 3.48.2

Mould Dimentions	D (cm)	H (cm)	D (cm)	H (cm)	D (cm)	H (cm)
	15.27	11.06	15.2	11.5	15.24	11.41
No.of blows/layer	56	56	56	56	56	56
Mould No.	0		0		0	
Wt.of Mold+w.soil(g)	10453		10986		11362	
Wt.of Mold (g)	5983		5996		6090	
Wt. Of wet soil (g)	4470.0		4990.0		5272.0	
Volume of Mold(cc)	2024.4		2085.7		2080.3	
Wet Density g/cc	2.208		2.392		2.534	
Dry Density g/cc	2.070		2.247		2.373	
Container No.	0		0		0	
Wt.Of wet soil+cont(g)	560.40		562.70		538.40	
Wt. Of dry soil +Cont(g)	528.70		531.30		507.00	
Wt.of container (g)	52.70		47.30		45.70	
Moisture Content	0.067		0.065		0.068	
C.B.R (%)	18.5		40.7			

M.D.D (from compaction test)= 2.3 g/cm³ O.M.C 6.75 %

at 98 of M.D.D= 2.25 g/cm³ CBR @ 98% of M.D.D= 50 %

Figure 3.28: Sample (2) – Penetration vs. Force



CBR TEST Based on AASHTO Desig. (T180-86)**Sample (S2)****Treatment Trial(1): 17% Natural Gravel-10% Sand**

Table 3.49.1

Penetration (mm)	forces(Kg)			Proving Ring Reading(Div.)		
	F56	F56	F56	56blows	56blows	56blows
0.000	0.00	0.00	0.00	0	0	0
0.635	18.40	14.49	8.28	80	63	36
1.270	36.11	38.41	19.55	157	167	85
1.905	47.61	46.69	33.58	207	203	146
2.540	57.73	56.35	51.06	251	245	222
3.175	70.38	77.97	66.24	306	339	288
3.810	82.57	87.86	80.27	359	382	349
4.445	90.62	92.00	89.01	394	400	387
5.080	94.07	94.30	92.00	409	410	400
6.350	102.12	94.30	95.91	444	410	417
7.620	109.25	94.30	100.05	475	410	435

Number of blows	56	56	56
C.B.R @ 2.5mm(%)	82.47	80.50	72.94
C.B.R @ 5.0mm(%)	89.59	89.81	87.62

Number of blows	56	56	56
Initial Reading (mm)	17.43	2.26	14.78
Final Reading(mm)	17.45	2.28	14.80
Swell(%)	0.017	0.017	0.018

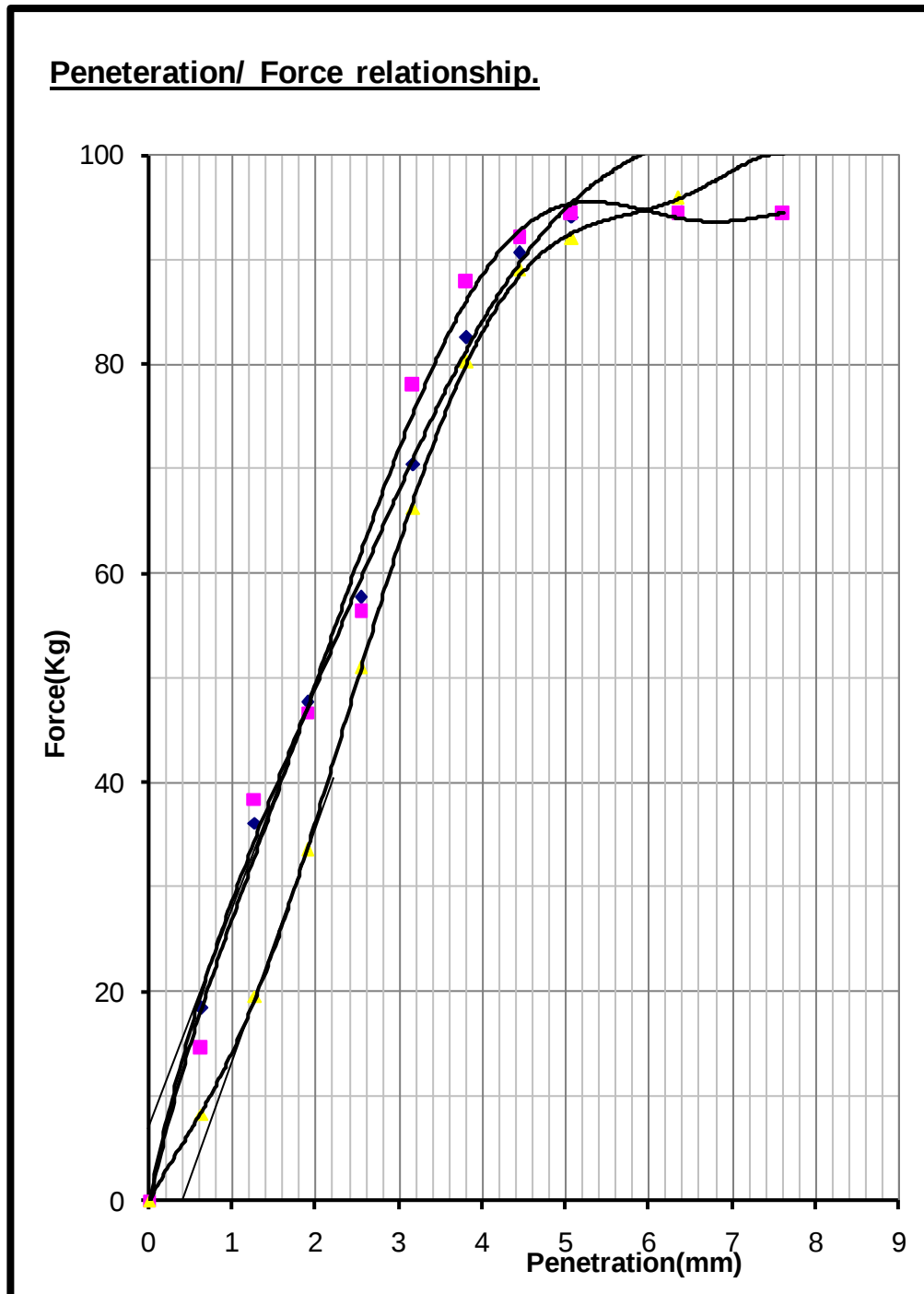
Table 3.49.2

Mould Dimentions	D (cm)	H (cm)	D (cm)	H (cm)	D (cm)	H (cm)
	15.21	11.54	15.17	11.47	15.25	11.42
No.of blows/layer	56	56	56	56	56	56
Mould No.	13		150		159	
Wt.of Mold+w.soil(g)	11184		11625		11325	
Wt.of Mold (g)	6090		6555		6355	
Wt. Of wet soil (g)	5094.0		5070.0		4970.0	
Volume of Mold(cc)	2095.7		2072.1		2084.9	
Wet Density g/cc	2.431		2.447		2.384	
Dry Density g/cc	2.293		2.344		2.288	
Container No.	X12		B18		B12	
Wt.Of wet soil+cont(g)	513.60		556.00		519.10	
Wt. Of dry soil +Cont(g)	493.70		534.80		500.30	
Wt.of container (g)	51.00		50.80		50.00	
Moisture Content	0.060		0.044		0.042	
C.B.R (%)	89.6		89.8		87.6	

M.D.D (from compaction test)= 2.345 g/cm³ O.M.C 5.72 %

at 98 of M.D.D= 2.30 g/cm³ CBR @ 98% of M.D.D= 89.0 %

Figure 3.29: Sample (2) – Penetration vs. Force



CBR TEST Based on AASHTO Desig. (T180-86)**Sample (S2)****Treatment Trial(2): 12% Crushed Stone-10% Sand**

Table 3.50.1

Penetration (mm)	forces(Kg)			Proving Ring Reading(Div.)		
	F56	F56	F56	56blows	56blows	56blows
0.000	0.00	0.00	0.00	0	0	0
0.635	20.70	12.19	15.41	90	53	67
1.270	27.37	25.53	28.29	119	111	123
1.905	41.63	32.89	35.88	181	143	156
2.540	56.35	57.50	52.44	245	250	228
3.175	65.78	69.00	58.88	286	300	256
3.810	74.06	83.72	68.54	322	364	298
4.445	81.42	92.00	71.53	354	400	311
5.080	89.70	101.66	89.01	390	442	387
6.350	89.70	119.37	89.01	390	519	387
7.620	89.70	119.37	89.01	390	519	387

Number of blows	56	56	56
C.B.R @ 2.5mm(%)	80.50	82.14	74.91
C.B.R @ 5.0mm(%)	85.43	96.82	84.77

Number of blows	56	56	56
Initial Reading (mm)	3.79	5.36	11.03
Final Reading(mm)	3.80	5.37	11.09
Swell(%)	0.009	0.009	0.053

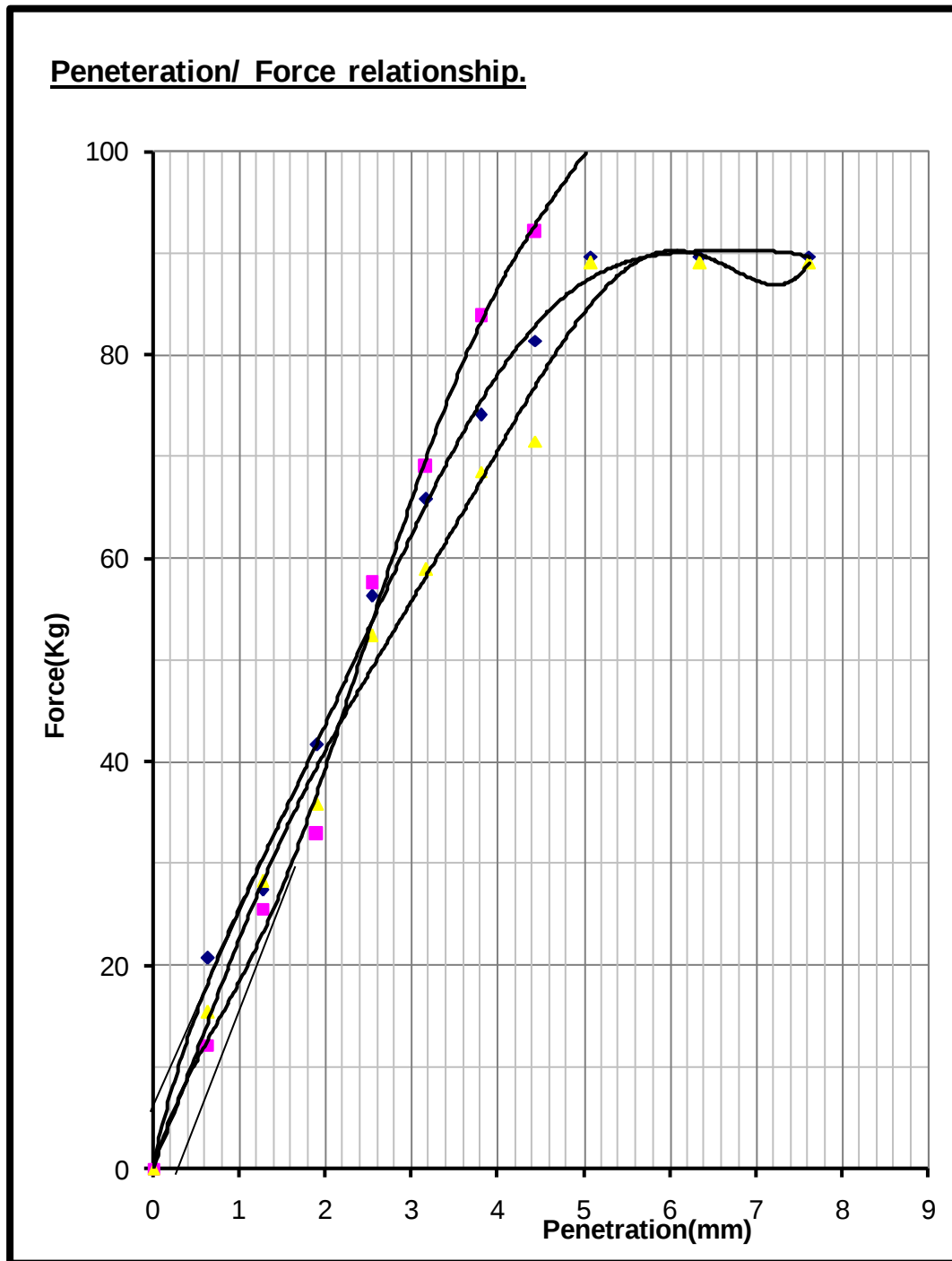
Table 3.50.2

Mould Dimentions	D (cm)	H (cm)	D (cm)	H (cm)	D (cm)	H (cm)
	15.21	11.54	15.17	11.47	15.25	11.42
No.of blows/layer	56	56	56	56	56	56
Mould No.	20	18	6			
Wt.of Mold+w.soil(g)	11267	11614	11025			
Wt.of Mold (g)	6200	6649	5921			
Wt. Of wet soil (g)	5067.0	4965.0	5104.0			
Volume of Mold(cc)	2095.7	2072.1	2084.9			
Wet Density g/cc	2.418	2.396	2.448			
Dry Density g/cc	2.281	2.287	2.347			
Container No.	95	118	G7			
Wt.Of wet soil+cont(g)	509.10	528.20	549.10			
Wt. Of dry soil +Cont(g)	488.30	506.60	528.10			
Wt.of container (g)	44.90	52.40	41.30			
Moisture Content	0.060	0.048	0.043			
C.B.R (%)	85.4	96.8	84.8			

M.D.D (from compaction test)= 2.30 g/cm³ O.M.C 6.05 %

at 98 of M.D.D= 2.25 g/cm³ CBR @ 98% of M.D.D= 90.8 %

Figure 3.30: Sample (2) – Penetration vs. Force



CBR TEST Based on AASHTO Desig. (T180-86)**Sample (S3)**

Table 3.51.1

Penetration (mm)	forces(Kg)			Proving Ring Reading(Div.)		
	F56	F56	F56	56blows	56blows	56blows
0.000	0.00	0.00	0.00	0	0	0
0.635	0.96	3.84	2.16	4	16	9
1.270	1.44	7.44	5.52	6	31	23
1.905	2.40	9.36	10.08	10	39	42
2.540	3.84	10.80	16.56	16	45	69
3.175	5.28	12.00	24.24	22	50	101
3.810	6.24	12.96	31.68	26	54	132
4.445	7.44	13.92	39.84	31	58	166
5.080	7.92	14.88	47.52	33	62	198
6.350	8.88	16.56	59.04	37	69	246
7.620	9.60	18.24	67.68	40	76	282

Number of blows	56	56	56
C.B.R @ 2.5mm(%)	5.49	15.43	45.26
C.B.R @ 5.0mm(%)	7.54	14.17	45.26

Number of blows	56	56	56
Initial Reading (mm)	1.60	1.52	1.66
Final Reading(mm)	1.79	1.65	1.79
Swell(%)	0.165	0.116	0.113

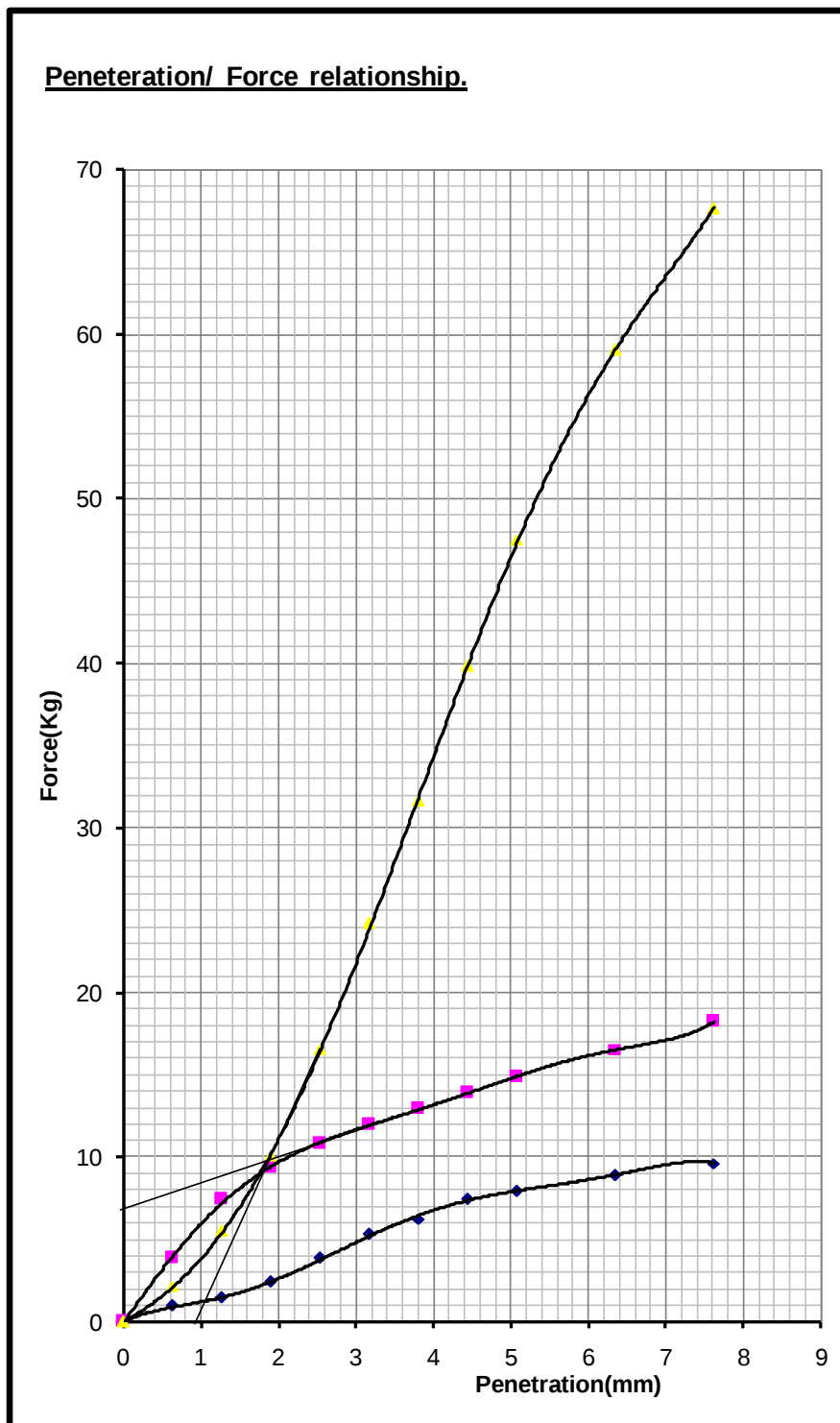
Table 3.51.2

Mould Dimentions	D (cm)	H (cm)	D (cm)	H (cm)	D (cm)	H (cm)
	15.24	11.53	15.21	11.19	15.3	11.49
No.of blows/layer	56	56	56	56	56	56
Mould No.	30	170	150			
Wt.of Mold+w.soil(g)	10038	10891	11659			
Wt.of Mold (g)	5966	6423	6472			
Wt. Of wet soil (g)	4072.0	4468.0	5187.0			
Volume of Mold(cc)	2102.2	2032.2	2111.4			
Wet Density g/cc	1.937	2.199	2.457			
Dry Density g/cc	1.809	2.077	2.315			
Container No.	3	2	1			
Wt.Of wet soil+cont(g)	544.60	550.70	521.30			
Wt. Of dry soil +Cont(g)	518.40	522.90	494.10			
Wt.of container (g)	63.00	46.20	50.10			
Moisture Content	0.071	0.058	0.061			
C.B.R (%)	7.5	15.4	45.3			

M.D.D (from compaction test)= 2.27 g/cm³ O.M.C 5.9 %

at 98 of M.D.D= 2.16 g/cm³ CBR @ 98% of M.D.D= 34 %

Figure 3.31: Sample (3) – Penetration vs. Force



CBR TEST Based on AASHTO Desig. (T180-86)**Sample (S3)**Treatment Trial(1): **17% Natural Gravel-10% Sand**

Table 3.52.1

Penetration (mm)	forces(Kg)			Proving Ring Reading(Div.)		
	F56	F56	F56	56blows	56blows	56blows
0.000	0.00	0.00	0.00	0	0	0
0.635	5.28	16.08	21.60	22	67	90
1.270	10.32	40.80	44.40	43	170	185
1.905	13.20	64.08	85.44	55	267	356
2.540	14.88	80.64	123.36	62	336	514
3.175	17.28	98.16	148.80	72	409	620
3.810	18.72	109.20	173.76	78	455	724
4.445	19.68	122.40	186.96	82	510	779
5.080	20.64	129.84	211.20	86	541	880
6.350	22.08	144.96	254.16	92	604	1059
7.620	21.84	169.92	254.16	91	708	1059

Number of blows	56	56	56
C.B.R @ 2.5mm(%)	21.26	115.20	176.23
C.B.R @ 5.0mm(%)	19.66	123.66	201.14

Number of blows	56	56	56
Initial Reading (mm)	3.26	10.58	12.34
Final Reading(mm)	3.39	10.82	12.47
Swell(%)	0.113	0.207	0.112

Table 3.52.2

Mould Dimentions	D (cm)	H (cm)	D (cm)	H (cm)	D (cm)	H (cm)
	15.2	11.5	15.2	11.6	15.25	11.64
No.of blows/layer	56	56	56	56	56	56
Mould No.	0		0		0	
Wt.of Mold+w.soil(g)	11996		11011		11996	
Wt.of Mold (g)	6703		6223		6703	
Wt. Of wet soil (g)	5293.0		4788.0		5293.0	
Volume of Mold(cc)	2085.7		2103.9		2125.0	
Wet Density g/cc	2.538		2.276		2.491	
Dry Density g/cc	2.419		2.171		2.386	
Container No.	0		0		0	
Wt.Of wet soil+cont(g)	542.90		577.30		570.00	
Wt. Of dry soil +Cont(g)	519.70		552.80		548.20	
Wt.of container (g)	48.40		46.40		52.00	
Moisture Content	0.049		0.048		0.044	
C.B.R (%)	21.3		123.7		201.1	

M.D.D (from compaction test)= 2.24 g/cm³ O.M.C 6.4 %

at 98 of M.D.D= 2.20 g/cm³ CBR @ 98% of M.D.D= 81 %

Figure 3.32: Sample (3) – Penetration vs. Force

