Republic of the Union of Myanmar Ministry of Construction, PW

# The Project for Improvement of Road Technology in Disaster Affected Area in Myanmar

# Soil Investigation Report (PP-I)

December 2013

Japan International Cooperation Agency (JICA)

Pegasus Engineering Corporation Oriental Consultants Global Co., Ltd.



# PUBLIC WORKS MINISRTRY OF CONSTRUCTION

## REPORT

## ON

## SOIL INVESTIGATION

## FOR

# ROAD IMPROVEMENT ALONG PYAPON – KYONKADUN – DAWNYEIN – AMAR, PYAPON TOWNSHIP, AYEYARWADDY REGION UNION OF MYANMAR

**DECEMBER, 2013** 

Submitted by-





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Pyapon – Amar Road, Pyapon Township, Ayeyarwaddy Region

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# REPORT ON SOIL INVESTIGATION FOR ROAD IMPROVEMENT ALONG PYAPON – KYONKADUN – DAWNYEIN – AMAR ROAD

#### **1.0 INTRODUCTION**

Geotechnical investigation is essential to determine substratum of ground where to do proper design required structure of building. The soil investigation is essential for construction of infrastructures because the stability of those structures mainly depends on foundation sub soil stability. The Public Work is trying to improve the road along Pyapone to Amar. Saramari - Fuji Co., Ltd. is assigned to conduct soil investigation works near Dawnyein Village.

#### 1.1 Objective of Project

The soil investigation conducted during this project phase intends to -

- To evaluate the long term stability of existing road condition
- To identify the thickness and extension of sub stratum around proposed structures
- To evaluate the physical and mechanical properties of soil strata lying proposed area
- To recognized the soil design parameter for foundation work and soil improvement work.

#### 1.2 Scope of Work

The scope of investigation works includes three portion; field investigation work, laboratory testing and report preparation. The field investigation work includes soil boring, Standard Penetration Test (SPT) and field density test. There are two boring points and the depth of borehole is 30m. Standard penetration tests were performed in all the boreholes of designated locations in comply with ASTM Standard. Two soil field density tests are carried out along the road. The collected disturbed and undisturbed soil samples from the boreholes were tested at Saramayri – Fuji Co., Ltd. Laboratory.

#### (1) Field Works

Boring is carried out by TOHO-D1 drilling machines.

- Boring in soil
- Standard Penetration Test
- Soil sampling
- Water level measuring
- Field density testing
- (2) Laboratory Test
  - Physical and mechanical property test of soil
- (3) Reports
  - 1. Geotechnical Assessment Report



All the field investigation works were carried out in accordance with ASTM Code of Standard and the units are applied Metric System.

#### **1.3 Project Location**

The project area is located along Pyapon – Amar Road, near Dawneyin Village, Pyapon Township, Ayeyarwaddy Region. The location of project area is indicated as figure (1-1) and detail location of project site.

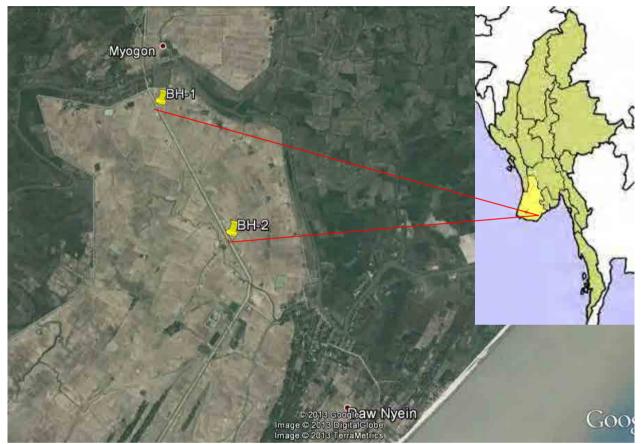


Figure - 1.1 Location Map of Project Area

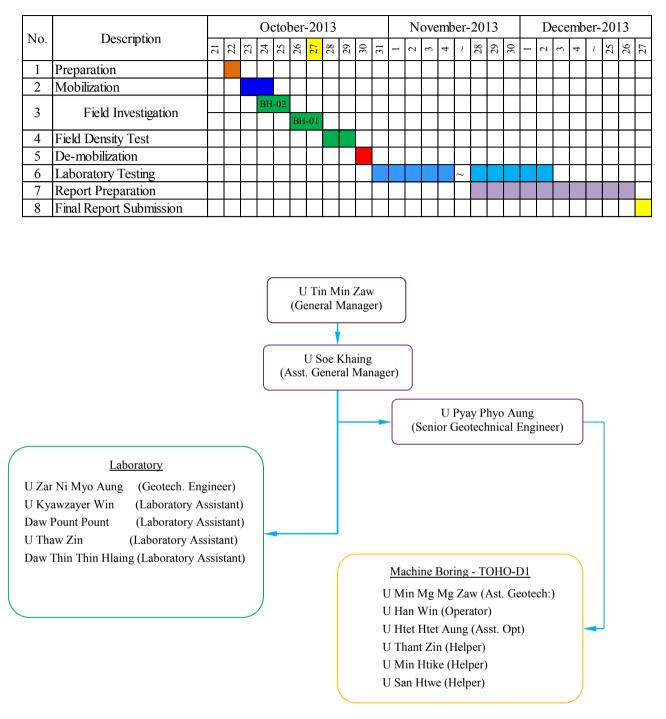
#### **1.4 Project Duration and Personnel**

The investigation works was started from  $23^{rd}$  October, 2013 and completed two Boreholes on  $27^{th}$  October, 2013.

The executed detailed actual working schedule is illustrated in table (1-1) respectively, indicating the organization chart of personnel of the operation and their responsibilities, including list of geotechnical engineers, drilling crews for one boring machine, technicians and the entire person involved in this operation.



#### Table - 1.1 Actual Working Schedule of Geotechnical Investigation Work



Flow Chart - 1.1 Organization Chart of Responsible Person



## **1.5** Equipment Applied in the Project

#### **1.5.1** Boring Equipments

The boring equipment, TOHO-D-1 was applied in the soil investigation work of project area, to study general condition of soil layers under planned area for future construction. The specification and the type of boring equipment were presented in following table.

Parts of Equipment	Particulars
Brand of Boring machine	ТОНО- "D-1"
Boring Type	Rotary
Feeding Type	Hydraulic Feed Type
Drilling Capacity	150m
Spindle Stroke	400mm
Spindle Inner Dia.	43mm
Hoisting Speed	10~59m/min
Weight	476kgf
Oil Pump Delivery Capacity	19 l/min
Oil Pump Working Pressure	45~70kgf/cm <sup>2</sup>
Attached Water Pump Type	Toho "BG-3B"
Discharge Capacity	54 l/min
Working Pressure	15 kgf/cm <sup>2</sup>
Engine	Yamar Engine 110
Power	11.0 HP

Table -	1.2 Specification	of Boring Equipment
I uolo	1.2 Specification	or borning Equipment



Photo - 1-7 TOHO D-1 Drilling Machine



## 1.5.2 Laboratory Instruments

The principal instrument applied for soil laboratory tests are as shown in the following table.

Instrument Name	Manufacturer and Type
1. Electric Balance	SARTORIUS 1404B (MP8-1)
2. Atterberg's Limit Test Apparatus	MARUI 1115013
3. Test Sieve	TOKYO SAITAMA (JIS Z 8801)
4. Unconfined Compressive test Apparatus	MARYI 19047 (Automatic recording type)
5. Direct Shear Test (CU or UU)	YF – STZ JY – 6
6. Consolidation Test	YF – WG – 1B

 Table - 1.3 Applied Laboratory Instruments



Photo - 1.1 Laboratory Instruments for Physical Properties Tests



## 2.0 SITE CHARACTERIZATION

#### 2.1 Topography

As the project area located at the delta region of Ayeyarwaddy Region, flat lying flood plain feature is dominated. Very low relief levee are observed near river or creek. In general the topography of the project area is flat with very thick soil deposit.

The typical drainage pattern is braded channel. The channels are meandering and it show old age state of river.



Photo - 2.1 Topographic feature of the project area

#### 2.2 Regional Geologic Setting

The Ayeyarwaddy Delta is mainly composed of interfacies of flood plain deposit and marine deposit. Silt and clay is flood plain deposit and sand is marine deposit. In project area, the flood plain deposit covers the whole area and thicker than 30 m. The ayeyarwaddy delta is located between Western fold belt and Central Burma Basin. The bed rock is difficult to estimate, because the deposits are very thick in this region. There are two active fault which run more than 100 km away from project area; the Sagaing Fault and the Andaman Trust.

Pyapon – Amar Raod, Pyapon Township, Ayeyarwaddy Region



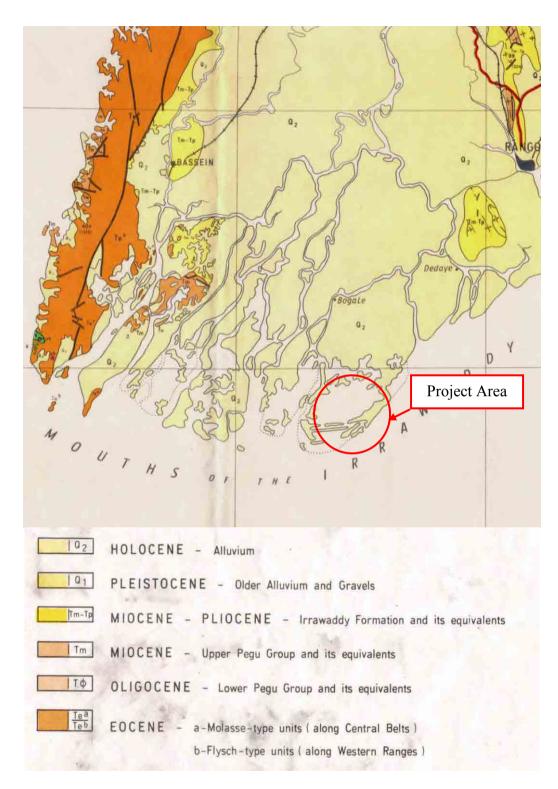


Figure - 2.1 Regional Geological Map of Project Area

## 2.3 Natural Vegetation and Landuse

The natural vegetation grows along the channels. The natural vegetation is tidal plants, mostly are bushes and small trees. The land almost covers with paddy fields, and residential area is sparsely located where the good accessible area.



## **3.0 FIELD INVESTIGATION**

## 3.1 Investigation Works

The objective of the present investigation is to identify the general stratification of the ground and the nature of the soil. Two boring points were planned to investigate by the client's requirement. The field investigation included soil boring with the performing of the test associated with Standard Penetration Test (SPT), disturbed soil sampling, Undisturbed soil sampling and water level measuring. In addition field density test is carried out in test pit of 0.5m depth at selected area. Total boring length is 60 m and the total quantity of investigation work is listed in Table - 3.1.

	BH. No.	S	Soil drilling (m)					
No		Diame	ter (ø)		Standard	Undisturbed	Water	Water
No.		115 mm	64 mm	Sub- total	penetration test (No.s)	sampling (No.s)	level measure	sample (No.s)
1	BH-1	3	27	30	27	3	1	-
2	BH-2	3	27	30	27	3	1	
To	tal	6	54	60	54	6	2	-

Table - 3.1 : Total Quantity of Boring Work

## 3.2 Location of Boring Points

The locations of investigation points of boring points were designated by Client. The first point is located near Myogone Village and another one is located north of Dawnyein Village. The boring point is shown in Table-3.2.

Borehole	Easting (m)	Northing (m)	Zone	Elevation (m)
BH-01	777313	1763141	46P	99.917
BH-02	778178	1761613	46P	99.772
SF	777312	1763142	46P	100.000

Table - 3.2 : The Location of Boring Points



Photo - 3.1 Temporary Bench Mark (SF) near BH-01



## **3.3 Boring Works**

In boring, rotary direct circulation method is appropriately applied using metal crown bits attached to casings of 115mm and metal crown bits of  $\emptyset$  64 mm in diameter setting with single core tube are properly applied depending on soil condition to drilling process. The drilling machines are operated by setting on the stage with maintaining horizontal level of drilling machine and vertical position of drilling direction while drilling on field investigation works. Boring and SPT testing in all the points are operated from drilling stage maintaining the stability of boring machine. In the way of direct circulation of drilling fluid, water and betonies slurry was inevitably utilized to control the circulation of the sludge. The schematic diagram of boring equipment is shown in following Figure – 3.1.

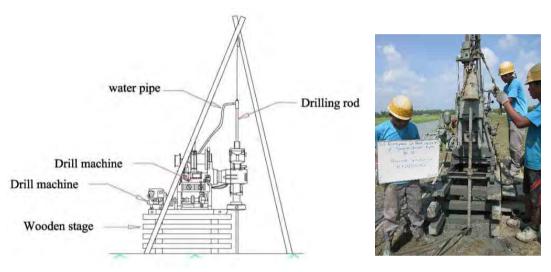


Figure - 3.1 : Schematic View of Drilling Machine setting

## 3.4 Standard Penetration Test (SPT)

The standard penetration test was done in accordance with *(American Society of Testing and Material; ASTM) Standard D1586.* The test was performed using a spilt barrel sampler (50mm diameter) connected to the end of boring rods. The sampler was driven into the soil by means of a 63.4 kg (140 lbs) hammer falling freely through the height of 76 cm on to the anvil attached to the rod. The sampler is driven 450 mm into the soil. SPT N value is recorded for each 150 mm penetration of the sampling tube. In this case, seating drive of 150mm is first reached and the blow count for the seating drive is not applied because the bottom of the hole may be apart from natural condition at a certain extent. The resistance, N-value, is taken as number of blow for the penetration of test drive of next 300 mm. When 50 blows are reached before the full penetration 300 mm, no other blows are applied but final penetration is recorded. At the conclusion of the test, the retained soil sample is extracted and stored in plastic bag for further analysis. In which, Figure – 3.2 indicates the procedure and apparatus of standard penetration test. The distribution of N-value for each stratum is summarized in Graph - 3.1.









Photo - 3.2 : View of Standard Penetration Test and SPT Sample

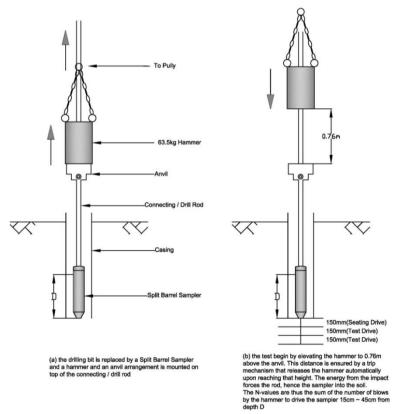
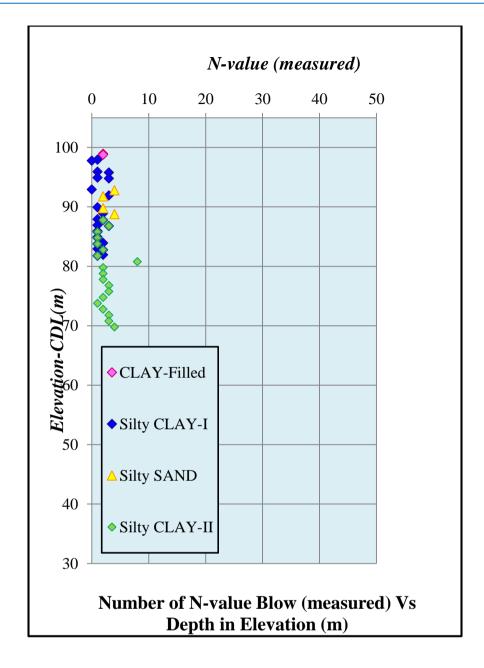


Figure - 3.2 : Procedure and Apparatus of Standard Penetration Test

Pyapon – Amar Raod, Pyapon Township, Ayeyarwaddy Region





Graph - 3.1 : Number of N-Value (measured) vs Depth in elevation level relationship

Soil Nome	SPT – N					
Soil Name	Minimum	Maximum	Average	Represented N		
Clay (Filled)	2	2	2	2		
Silty Clay 1	0	3	1	1		
Silty Sand	2	4	3	3		
Silty Clay 2	1	8	2	2		

Table - 3.3 : The List of SPT N value in Specific Soil Layer

Pyapon – Amar Raod, Pyapon Township, Ayeyarwaddy Region



	T4	he Commend	US A 1210	ACTM D 1596 94	DS 1277 Test 10
	items to	be Compared	JIS A 1219	ASTM D 1586-84	BS 1377 Test 19
			(1995)	(1992)	(1990)
		Length Less than 15m	JIS Rod (Outer diameter	A Rod (Outer Diameter 41.2mm,Inner Diameter 28.5mm)	AW Rod (Outer Diameter 41.3mm, Mass 5.7kg/m)
	Rod	Length More than 15m	40.5/42mm)	Recommend to use more rigid rod.	BW Rod or centerizer in every 3 m shall be installed with of AW Rod.
		Bend	-	-	-
ient		Outer Diameter	51mm	50.8±1.3mm	50±0.15mm
ipr		Inner Diameter	35mm	35.0mm 482~812mm	35±0.15mm
Testing Equipment	Sampler			(Sampler head is not included)	685mm
stin		Angle of Shoe edge	19°47 <b>′</b>	16~23°	17°15′
Те		Thickness of Shoe edge	1.15mm	2.54mm	1.6mm
		Drain Hole	4 Hole	Ø9.2mm×2 holes	Ø13.0mm x 4 holes Hole: Ø22.3mm, Ball:
		Ball Value	-	Hole Ø22.2mm, Ball : Ø25mm	Ø25mm
	Hammer	Mass	63.5 kg 75 cm	63.5±1.0kg 76±2.5cm	65kg 76cm
		Drop	h:60mm	/0±2.5cm	/0cm
		Anvil	D:75mm	-	-
	Applicable	e Diameter of Borehole	65~150mm	56~162mm	-
ole		Level in Borehole		Ground water level shall be kept above the water table when the SPT is carried out under water table.	Ground water level shall be kept above the water table when the SPT is carried out under water table.
Boreho	Di	rilling Bit Type		Water jet type bit shall not be used.	Water jet type bit shall not be used.
sting	Appropri	ateness for Drilling by Sampler		Sampler with water jet shall not be used for drilling.	-
Remarks on Testing Borehole	Points to no	ote when casing pipes are used	Pay attention not to disturb the soil below the bottom of the hole	Casing Pipe shall not be below than bottom of hole.	Casing Pipe shall not be below than bottom of hole. Clearance between casing pipe and core tube shall be more than 10% of inner area of casing pipe section.
	Gushed	water and water loss		Pump pressure during drilling shall be recorded if water loss is found.	Pay attention on gushing and water loss.
		Seating Drive	15cm	15cm	15cm
	Penetration	Test Drive	30cm	30cm	30cm
		Finishing Drive	0~5cm	-	-
	Maximum bl	low Counts	50 blows for Test Drive	100 times including seating drive	50 times excluding seating drive.
Penetration Test	Record of blow counts	Blow Counts during test Drive	Total penetration for Test Drive. However, in case penetration per blow is less than 2 cm, blow counts every 10 cm. Shall be recorded.	Blow counts in every 15cm penetration including seating drive.	Blows counts in every 7.5cm penetration for test drive.
Pen		In Case 30cm penetration cannot be achieved.	penetration for 50 blow counts	Blow counts equivalent blow counts for last 30cm penetration including seating drive.	
	Way t	to drop the hammer	Free drop	Full Automatic or semi automatic drop system or Cone pulley (Pulley Diameter : 150~200mm, number of wind of rope : Less than 2-1/4)	Recommend the free drop. Pay attention on friction between winch and rope.
	Soil	Types for the Test	All kinds of soils	All kinds of Soils	Mainly for Sandy Soil.
Applicable		on for gravel and sandy gravel layer	-	-	Test shall be done by replacing the shoe to cone with 60° of edge angle.
Apŗ	Testi	ng Interval in deep	Generally 1.0m interval is adapted but not prescribed in the standard.	-	-

Table - 3.4 : Comparison for SPT in different standards	Table -	- 3.4 : Com	parison fo	or SPT in	different standards
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## 3.5 Filed Density Test

The sand cone method is applied for filed density test for existing embankment. The pit was excavated up to 0.5 m depth for conducting field density test. Two points near boreholes are carried out for field density test. The test was conducted according to ASTM D 1556 - 00; Standard test method for density and unit weight of soil in place by the sand-cone method.

The test is carried out as following method. Firstly, a test hole is hand excavated in soil to be tested and all the material from the hole is saved in a container. The hole is filled with free flowing sand of known density, and the volume is determined. The in-place wet density of the soil is determined by dividing the wet mass of removed material by the volume of the hole. The water content of the material from the hole is determined and the dry mass of material and the in-place dry density are calculated using the wet mass of the soil, the water content and the volume of the hole. The detail test result is indicated in Appendix-B. The table 3.5 indicates the summary of field density test result.

Table -	3.5 :	Summary	of Field	Density	Test Result
---------	-------	---------	----------	---------	-------------

Location	<b>Moisture Content</b>	<b>Bulk Density</b>	Dry Density
Location	(%)	kN/m <sup>3</sup>	kN/m <sup>3</sup>
Start Point (near BH-01)	30.40	17.06	13.04
End Point (near BH-02)	31.50	18.24	11.18



Photo - 3.3 : View of Carrying out Filed Density Test

## 3.6 Characteristics of Soil Strata Relying on Field Test

There has been carried out two boreholes which is maximum depth of 60 m with the performance of Standard Penetration Tests. In this operation, total four numbers of different layers have been recognized. The soil layers are classified in accordance with their physical properties and/or their relative density. The boring logs are attached at Appendix-A. The four different layers observed in project area are described from top to bottom as follows.

- 1. Clay (Filled Material)
- 2. Silty Clay 1
- 3. Silty Sand



4. Silty Clay 2

#### **Clay (Filled Material)**

As the soil investigation is carried out on the unpaved road, the filled layer is firstly observed. The filling material is almost composed of clay. It is soft, mottled brown and gray, wet to moist, low to medium plastic clay with traced of wood fragments. The thickness is 2m.

#### Silty Clay 1

Silty Clay 1 layer is observed in both BH-01 and BH-02. The thickeness of silty clay in BH-01 is about 17 m. In BH-02, two layers of silty clay 1 is observed. The silty sand layer is interbedded between upper and lower layer. The upper layer is 5m thick whereas the lower layer is about 7m thick. It is very soft to soft, gray, wet to moist, low to medium plastic silty clay with organic matter. It is flood plain deposit and some lamination of sand layers are observed among the silty clay layer.

#### **Silty Sand**

This layer is found only in borehole BH-02. It is interbedded within Silty Clay 1 layer. The thickness about 5 meter. It is very loose, gray, moist, fine grained silty sand with clay patches.









### Silty Clay 2

The silty clay 2 layer is observed in both BH-01 and BH-02. The thickness is difficult to estimate, because the borehole is terminated at that layer. It is very soft to firm, gray, moist, low to medium plastic silty clay with traced of fine sand and mica mineral. It is differ from Clay 1 is its consistency.





## 4.0 LABORATORY TEST

There has two number of investigations boring points, total 54 numbers of standard penetration tests (disturbed samples) and 6 numbers of undisturbed sample (thin wall piston sample) were collected in this field investigation at project site. The undisturbed samples and some selected numbers of disturbed samples were sent to office laboratory to test for physical property tests, as well as mechanical property tests. The total quantities and results of laboratory tests carried out are listed in the table, below and detail laboratory results are expressed in Appendix - C. The entire tests were carried out in accordance with *(American Society of Testing and Material; ASTM)*.

The physical properties tests include the following items.

- Natural Moisture Content Test
- Specific Gravity Test
- Particle Size Analysis Test
  - Grain Size Distribution Test
  - ➢ Hydrometer Test
  - Atterberg's Limits Test
    - Liquid Limit Test
    - Plastic Limit Test

The mechanical properties tests consist of -

- Unconfined Compression Test
- Direct Shear Test
- One Dimensional Consolidation Test

Total quantity of laboratory tests are described in Table -4.1 and summary of laboratory test results for each borehole are illustrated in Table -4.2.

Bore Hole			Physical Pro	Engineeri	Chemical Test					
	Natural Moisture	Specific	Particle Size Analysis Test			g's Limit est	lfined ession st	idation st	Shear (UU)	Duality
	Content Test	Test	Sieve Analysis	Hydrometer Analysis	Liquid Limit	Plastic Limit	Unconfined Compression Test	Consolidation Test	Direct Test (	Water Quality Test
			Test	Test	Test	Test		•		F
BH-01	9	9	9	9	9	9	3	3	2	1
BH-02	9	9	9	9	9	9	3	3	2	1
Total	18	18	18	18	18	18	6	6	4	2

Table - 4.1 : Total Quantity of Laboratory Tests



Table -	
4.2 :	
Summary of Laboratory Test Result	
st Result	

	Sample	De	Depth		Water Content		Grain Size Distribution			tion	Atte	rberg's l	g's Limit Bulk Density		Direct Shear Test		One Dimensional Consolidation Test			Compression Test	
BH No.	No.	cL-		Sail Type	W	Gs	Gravel	Sand	Silt	Clay	LL	FL.	Я	P	Cuu	<b>¢</b> uu		Py		Ē	g
		(m) F	EL; (m)		(%%)		(%%)	(%6)	(%%)	(%)	(%))	(%)	(%))	g/m <sup>2</sup>	kN/m <sup>2</sup>	Degree	e∘ kN/i	kN/m <sup>2</sup>	Cc	kNm <sup>2</sup> (	(%)
	P-1	1.00	98.92	9	43.45	2.776	-	025	\$7.35	42.40	6950	2686	4264	-	-	-	-	-	•		
	T-1	3.00	96.92	ML	48.89	2.736	-	16.90	58.80	24.30	4827	3036	1791	1.738	34.52	16.96	1.56	111.21	0.64	33.78	466
	T-2	600	93.917	LIM(10)LD	44.40	2.741	-	204	76.26	21.70	3610	23.52	1258	1758			1.34	37.76	0.31	37.27	694
	T-3	900	90.92	8	55.45	2.748	-	1.05	48.95	50.00	5980	2398	3582	1.705	6.28	35.75	1.32	254.58	0.35	48.15	486
EH-01	9-9	12.00	87.92	8	48.23	2.742	-	185	S8.45	39.70	5007	2223	2784	-	-	•	-	-	-	-	-
	P-13	16.00	83.92	a	37.52	2.742	-	18.88	\$2.13	29.00	4330	1953	23.77	-	-	•	-	-	-	-	-
	P-18	21.00	78.92	CH	49.99	2.759	-	198	48.73	49.30	6244	23.68	3876	-	-	-	-	-	-	-	-
	P-23	26.00	73.92	SC	30.79	2.745	-	51.32	30.58	18.10	3572	1894	1678	-	-	-	-	-	-	-	-
	P-26	29.00	70.92	a	41.01	2.755	-	13.38	\$2.63	34.00	49.07	21.00	2807	-	-	•	-	-	-	-	-
	P-1	1.00	98.77	CH	43.07	2.806	-	0.72	60.58	38.70	6828	2565	4263	-	-	-	-	-	-	-	-
	T-1	3.00	96.77	CH CH	54.99	2.747	-	153	54.68	43.80	65.70	27.53	3817	1677	11.67	12.24	1.81	58.84	0.75	32.31	790
	T-2	600	<b>93</b> .77	8	54.39	2.756	-	092	53.08	46.00	6820	2690	4130	1.708			1.51	223.49	0.46	43.64	3.70
	T-3	900	90.77	MH	60.57	2.639	-	195	S8.45	39.60	7534	3911	3623	1.587	19.81	8.53	1.52	102.97	0.57	63.55	7.19
EH-02	P-10	13.00	86.77	a	41.47	2.748	-	685	62.05	311	45.3	2235	2295	-	-	-	-	-	-	-	-
	P-13	16.00	83.77	ß	43.40	2.760	-	10.75	57.A5	31.80	5078	2253	2825	-	-	-	-	-	-		-
	P-16	19.00	80.77	д	34.13	2.726	-	35.54	\$2.06	124	3218	2228	99	-	-	-	-	-	-	-	-
	P-20	23.00	76.77	а	36.60	2.747	-	19.48	48.43	32.10	4820	2133	2687	-	-	-	-	-	-	-	-
	P-25	28.00	71.77	a	40.98	2.763	-	10.18	\$8.73	31.10	5792	2428	33.64	-	-	-	-	-	-	-	-

#### **Index Property of Soil** 4.1

Physical property tests are done for investigation. The detail laboratory test results are illustrated in Appendix – C.

## 4.1.1 Natural Moisture Content Test

18 numbers of natural moisture content tests have been carried out on soil samples for required four different soil layers at our laboratory in accordance with ASTM Standard. The table-4.3 illustrates the summary of natural moisture content in each soil layers. The photograph of testing natural moisture content is shown in Photo-4.1 and the variation of water content with depth in elevation can be seen in Graph-4.1. The detail laboratory test results are illustrated in Appendix - C.

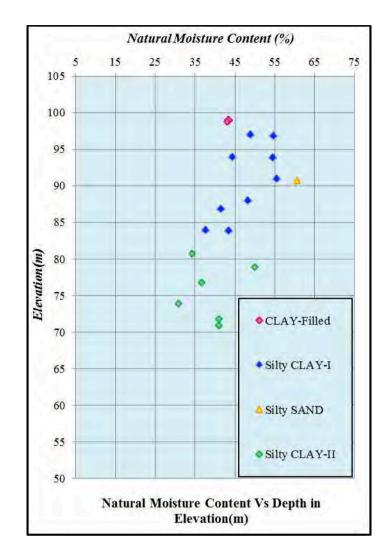
Photo - 4.1 Natural Moisture Content Test

	No.	Soil Tuna	Natural Water Content (%)				
		Soil Type	Range	Average			
	1	Clay (filled)	43.10~43.50	43.30			
	2	Silty Clay 1	37.50 ~ 55.50	47.60			
	3	Silty Sand	60.57	60.57			
	4	Silty Clay 2	$30.80 \sim 50.00$	38.90			

Table - 4.3 Summary of Natural Moisture Content of Test Results







Graph - 4.1 : Natural moisture content (%) vs Depth in elevation level relationship

## 4.1.2 Specific Gravity Test

The specific gravity tests in this project were carried out in accordance with ASTM Standard at office laboratory. There have been (18) numbers of specific gravity tests. The table - 4.4 illustrates the summary of specific gravity for each soil layers. The photograph of testing specific gravity is shown in Photo-4.2, and the relationship between specific gravity and depth in elevation of each soil layer is shown in Graph-4.2. The detail test results were described in Appendix-C.

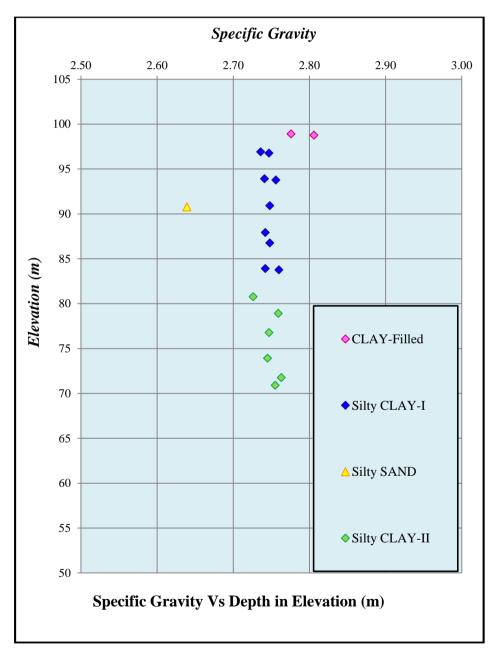


Photo - 4.2 Specific Gravity Test



No.	Soil Type	Specific Gravity				
INO.	Soil Type	Range	Average			
1	Clay (filled)	2.776 ~ 2.806	2.791			
2	Silty Clay 1	2.736 ~ 2.760	2.747			
3	Silty Sand	2.639	2.639			
4	Silty Clay 2	2.726 ~ 2.763	2.749			

Table - 4.4 Summary of Specific Gravity Test Results



Graph - 4.2 : Specific Gravity vs Depth in elevation level relationship



## 4.1.3 Atterberg's Limit Test

The Atterberg's Limit tests were made on (18) numbers for liquid limit tests and (18) numbers for plastic limit tests of specimens from disturb and undisturbed samples by ASTM Standard at office laboratory. The summary of Atterberg's Limit Test result is shown in Table - 4.5. Graph-4.3 illustrate the Plastic Limit, Liquid Limit and Plasticity Index of each soil layer versus depth in elevation and Graph-4.4 shows condition of soil in project area by ranges in plasticity chart. The photograph of testing is shown in Photo-4.3. The details of test results were shown in Appendix – D.



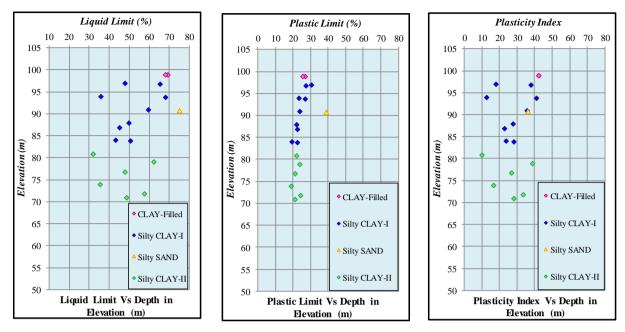
Photo - 4.3 Atterberg's Limit Test

	Soil Type		Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
	Class (filled)	Range	68.28 ~ 69.50	25.65~26.86	42.63 ~ 42.64
	Clay (filled)	Average	68.89	26.26	42.64
		Range	36.10~68.20	19.53 ~ 30.36	12.58 ~ 41.30
Atterberg's Limit Test	Silty Clay 1	Average	51.90	24.33	27.62
		Range	75.34	39.11	36.23
	Silty Sand	Average	75.34	39.11	36.23
	Silty Clay 2	Range	32.20 ~ 64.40	18.94 ~ 24.28	9.90 ~ 38.76
	Silty Clay 2	Average	47.60	21.92	25.67

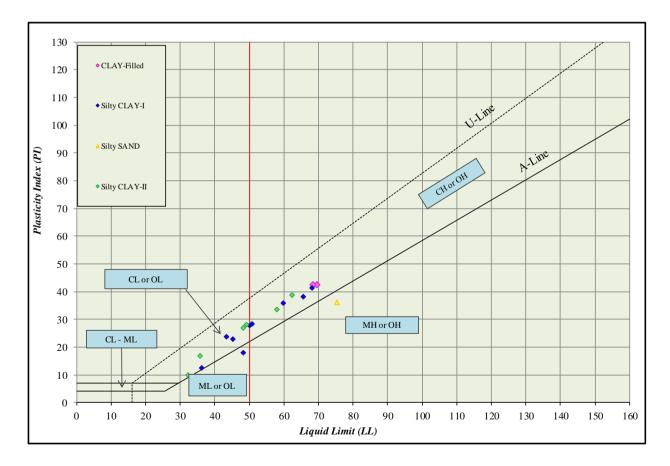
Table -	4.5 Summary	of Atterberg's	Limit Test Result
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Graph - 4.3 Plastic Limit, Liquid Limit and Plasticity Index vs Depth in Elevation (m)



Graph - 4.4 Condition of Atterberg's Limit Test Results



## 4.1.4 Grain Size Analysis Test

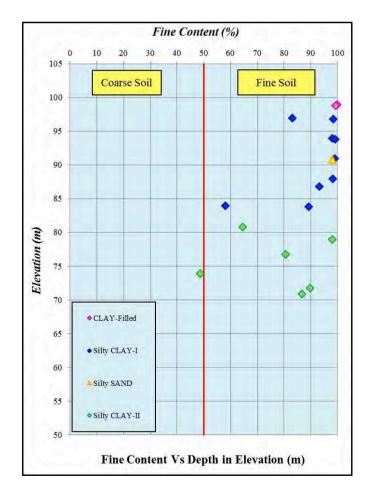
Soil classifications or grain size distribution test were done by ASTM Standard. In this project, (18) numbers of sieve analysis tests including (18) numbers of hydrometer tests were carried out in laboratory of Saramayri-Fuji Co., Ltd. Grain size analysis testing and hydrometer testing are shown in Photo- 4.4 and 4.5. Graph-4.5 is illustrated the grain size distribution of each soil layer versus depth in elevation. The details of grain size analysis test results were shown in Appendix-C.



Photo - 4.4 Grain Size Distribution Test



Photo - 4.5 Hydrometer Test



Graph - 4.5 Fine Content vs Depth in Elevation (m)



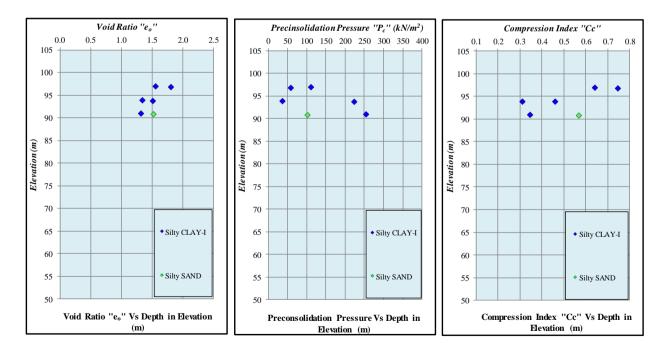
## 4.2 Mechanical Properties of Soil

In order to get the mechanical or engineering properties of soils, three kinds of test were carried out; one dimensional consolidation test, unconfined compressive strength test and direct shear test. All mechanical tests were carried out in office laboratory.

#### 4.2.1 One Dimensional Consolidation Test

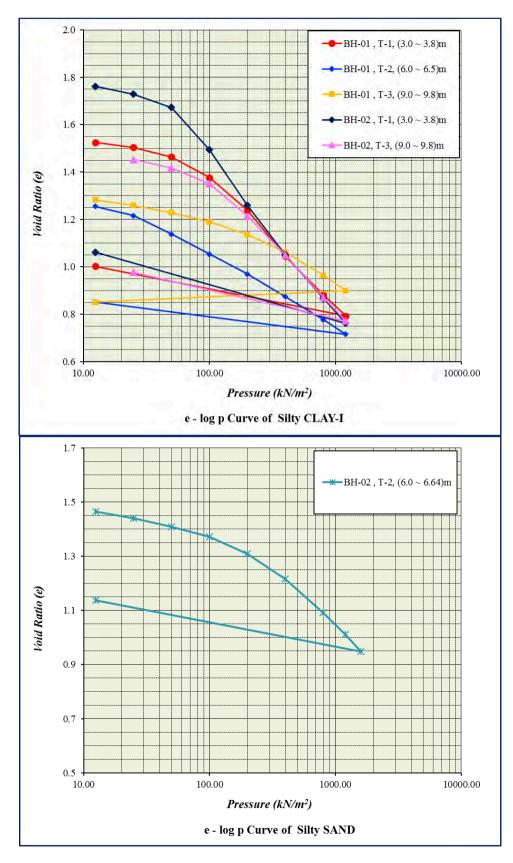
The one dimensional consolidation tests were carried out in undisturbed sampeles taken from Silty Clay 1 layer and Silty Sand layer. There are (4) numbers of tests were carried out in accordance with ASTM Standard. Table 4.6 summarized some results of one dimensional consolidation tests such as initial void ratio (e<sub>0</sub>), Pre-consolidation Pressure (Pc) and compression index (Cc). Graph-4.6 indicate the relationship between (e<sub>0</sub>), (Pc) and (Cc) versus their depth in elevation at investigation area. Moreover,Graph-4.7 show the e-log-P curve results from one dimensional consolidation tests of soil from the investigation area, and Graph-4.8 shows the relationship between coefficients of condsolidation (Cv) versus pressure of that soil.

No.	Soil Type	Initial Void Ratio (e <sub>0</sub> )		Consolidation Yield Stress Pc (kN/m <sup>2</sup> )		Compression Index (Cc)	
		Range	Average	Range	Average	Range	Average
1	Silty Clay 1	1.32 ~ 1.81	1.508	37.76 ~ 254.58	137.18	0.31 ~ 0.74	0.50
2	Silty Sand	1.520	1.520	102.97	102.97	0.57	0.57



Graph - 4.6 Void Ratio, Pre-consolidation Pressure and Compression Index vs Depth in Elevation (m)

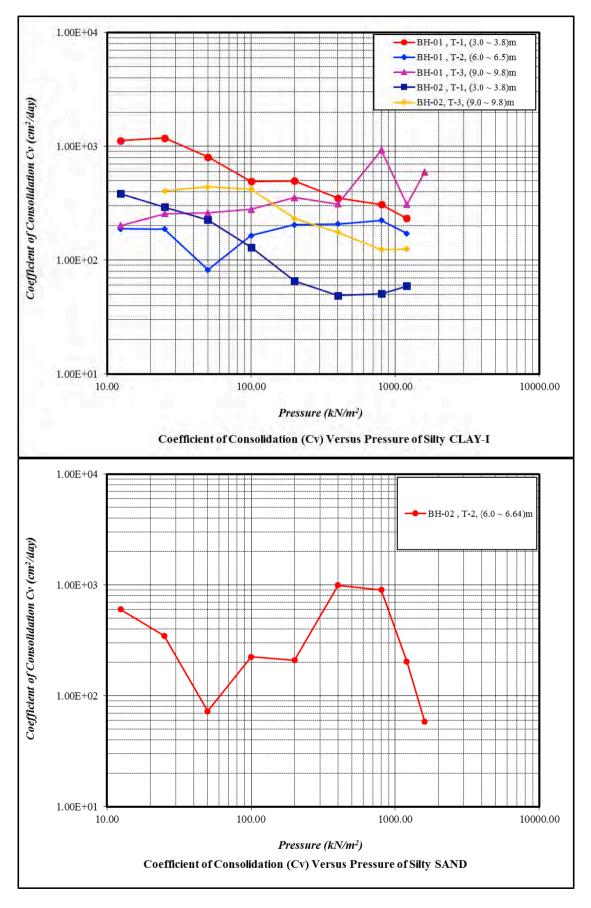


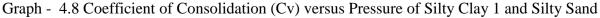


Graph - 4.7 e – log p Curve of Silty Clay 1 and Silty Sand



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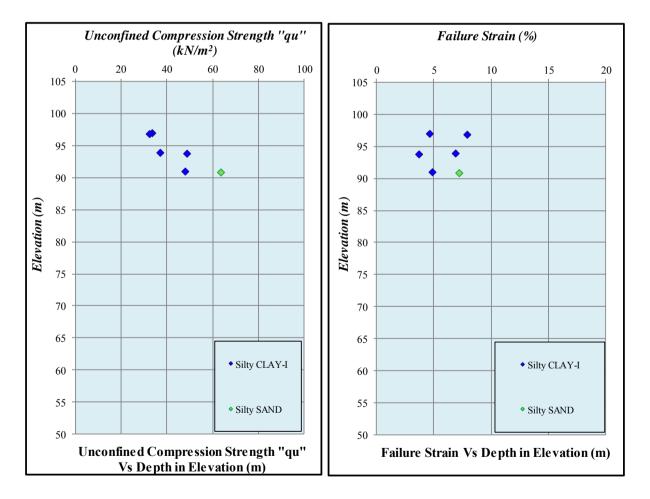
#### 4.2.2 Unconfined Compressive Strength Test

The total (6) numbers of undisturbed sample from the project area were carried out for unconfined compression test at office laboratory in accordance with ASTM Standard. Summary of unconfined comperssion test results are described in Table -4.7.

The relationship between the unconfined compressive strength and failure strain vs depth in elevation is presented in Graph-4.9.

Na	o. Soil Type	Compression St	trength (kN/m <sup>2</sup> )	Failure Strain (%)		
INO.		Range	Average	Range	Average	
1	Silty Clay 1	32.31 ~ 48.64	40.03	3.70 ~ 7.90	5.61	
2	Silty Sand	63.55	63.55	7.19	7.19	

Table - 4.7 Summary of Unconfined Compressive Strength Test Results



Graph - 4.9 Unconfined Compressive Strength and Failure Strain vs Depth in Elevation (m)

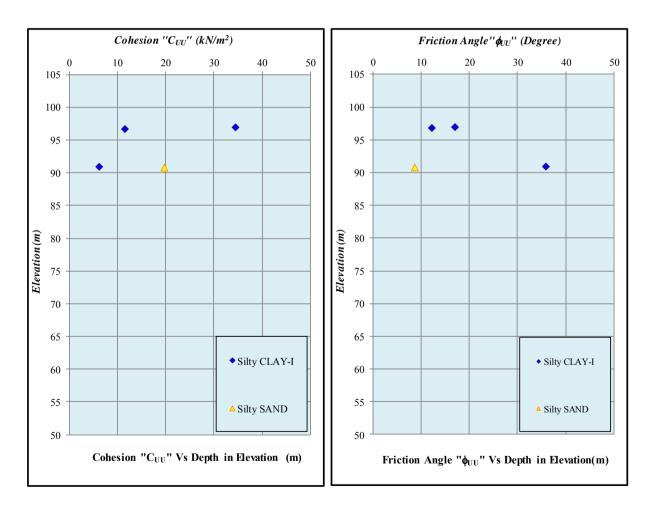


## 4.2.3 Direct Shear Test

The direct shear tests were carried out from (4) numbers of undisturbed samples by undisturbed piston sampler from Silty Clay 1 and Silty Sand layers of unequal consistency. There are total (4) numbers of direct shear (UU) tests from ten boreholes were carried out in accordance with ASTM Standard. Table 4.8 indicates the summary of direct shear test results.

Graph-4.10 indicate the relationship between cohesion (C) and phi angle ( $\phi$ ) versus their depth in elevation at investigation area.

No.	Soil Type		ion $C_{UU}$	Phi Angle φ <sub>UU</sub> (degree)		
		Range	Average	Range	Average	
1	Silty Clay 1	6.28 ~ 34.52	17.49	12.24 ~ 35.75	21.65	
2	Silty Sand	19.81	19.81	8.51	8.53	



Graph - 4.10 Cohesion "C<sub>uu</sub>" and Friction Angle " $\phi_{uu}$ " vs Depth in Elevation (m)



#### 4.3 Standard Proctor Compaction Test

The bulk sample from test pits are collected for standard proctor compaction test. The standard proctor compaction test is carried out according to ASTM standard. The soil sample is collected at filled material of existing embankment. The following table indicates the maximum dry density and optimum moisture content of embankment material.

Location	Maximum dry density	Optimum moisture content	
Location	$(t/m^3)$	(%)	
Start Point (near BH-01)	1.586	22.00	
End Point (near BH-02)	1,666	19.00	

#### 4.4 Water Quality Test

Water sampling is carried out by using water delivery sampler made of stainless steel with an outer diameter of 50 mm and length of 1 meter. On the day prior to sampling after completion of the drilling works, the borehole was flushed with water to be able to remove the remnants left at the bottom of the borehole, and left overnight. And then, in the morning of the next day water sample was taken before withdrawal casing pipes.

Water samples from all investigated holes of the project area have been sent to ISO Tech laboratory and then tested in order to inspect pH value, Sulphate and Chloride contents. All of the test items are listed below as-

- 1) pH value
- 2) Color (true)
- 3) Turbidity
- 4) Conductivity
- 5) Total hardness
- 6) Total alkalinity
- 7) Phenolphthalein alkalinity
- 8) Calcium hardness
- 9) Iron
- 10) Magnesium hardness

- 11) Carbonate (NaCo<sub>3</sub>)
- 12) Chloride (as CL)
- 13) Sodium chloride (as NaCL)
- 14) Bicarbonate (HCO<sub>3</sub>)
- 15) Sulphate (as SO<sub>4</sub>)
- 16) Total solids
- 17) Suspended solids
- 18) Dissolved solids

The result of water quality test is attached in Appendix -D



### 5.0 GEOTECHNICAL ASSESSMENT

The geotechnical assessment report is prepared for choosing suitable foundation design for proposed building and infra structures, evaluating adverse effects of ground response to loading of structures during and after construction, and recognized the potential hazards to the proposed structures. In order to evaluate above mentioned factors, the relevant geotechnical design parameter such as cohesion (C), angle of internal friction (Ø), modulus of elasticity (E) and poison ratio ( $\upsilon$ ') have to be evaluated primarily. Moreover, the dry unit weight and saturated unit weight of soil and ground material should be evaluated.

#### 5.1 Geotechnical Design Parameters

The geotechnical parameters can be directly evaluated from many ways such as field in situ testing, laboratory testing and so on. Some of the design parameters cannot be evaluated directly neither from field tests nor laboratory tests due to the unfavorable of nature of deposit or investigation methods. However, some parameters would be derived from the other instrumental testing of past events and some mechanical and physical properties obtained from field and laboratory tests. For evaluating the stability of ground, the shear strength parameters are significant. The geotechnical design parameters required for foundation design analysis are listed as below-

- $C_u$  Cohesion of soil (kN/m<sup>2</sup>)
- $\phi$  Friction angle of soil (angle of internal friction in degree)
- $\gamma_d$  Dry unit weight of soil (kN/m<sup>3</sup>)
- $\gamma_{\rm w}$  Saturated unit weight of soil (kN/m<sup>3</sup>)
- $\gamma'$  Effective unit weight of soil below water table (kN/m<sup>3</sup>)

#### a) Dry Unit Weight of Soil (yd)

The dry soil defines as the soil located above the water table. The dry unit weight of soil can be evaluated from the field density test. However, field density test cannot be carried out. Hence the unit weight of dry soil can be derived from the unit weight of saturated soil using the following equation-

$$\gamma_d = \gamma_{sat} / (1+w)$$

Where - $\gamma_d$ = unit weight of dry soil (kN/m³) $\gamma_{sat}$ = unit weigh of saturated soil (kN/m³)w= natural moisture content (%)

The natural moisture content (w) can be resulted from the laboratory tests (of collected Disturbed Samples).

#### b) Saturated Unit Weight of Soil (ysat)

The saturated soil defines as the soil located below the water table. The saturated unit weight of soil can be evaluated directly from the field density test or equation.-

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$$\gamma_{\text{sat}} = \left(G_{\text{s}}\gamma_{\text{w}} + e\gamma_{\text{w}}\right) / (1 + e)$$

Where-  $\gamma_{sat}$  = saturated unit weight of soil (kN/m<sup>3</sup>)  $\gamma_w$  = saturated unit weight of water (kN/m<sup>3</sup>)  $G_s$  = specific gravity of soil e = void ratio of soil ( $e = wG_s$  for saturated soil)

The G<sub>s</sub> and w can be resulted from laboratory tests of collected "Disturbed Samples".

The unit weight of soil can be also taken from the determination of bulk density of soil from undisturbed sample.

#### c) Effective Unit Weight of Soil (γ')

The effective unit weight of soil under water table can be evaluated from the equation-

 $\gamma' = \gamma_{sat}$  -  $\gamma_{w}$ 

Where- $\gamma^2$ = effective unit weight of soil (kN/m³) $\gamma_{sat}$ = saturated unit weight of soil (kN/m³) $\gamma_w$ = unit weight of water (kN/m³)

The unit weight of water in SI unit is 9.8 kN/m<sup>3</sup> (or) 10 kN/m<sup>3</sup>.

In this report, the unit of soil can also be referred from the recommended design parameters by *Japan Highway Cooperation (J.H.C)*, see table 5.1.

#### d) Cohesion (Cu)

The cohesive strength also known as undrained shear strength of cohesive soil is normally evaluated from the unconfined compression test. The cohesive strength Cu can be derived from -

$$Cu = q_u / 2$$

Where- Cu = cohesive strength  $(kN/m^2)$  $q_u$  = unconfined compressive strength  $(kN/m^2)$ 

However, the undrained cohesive strength can also be determined from direct shear test of undisturbed sample and remolded samples.

For granular soil, as the undisturbed sample cannot be easily collected, the cohesive strength can be reliably derived from SPT N-value, or referred from previous experiences; i.e. from Table 5.1. In case of cohesive strength derived from SPT N value the following equation is used-

$$Cu = 20N/3 (kN/m^2)$$



#### e) Friction angle ( $\emptyset$ )

The friction angle of the granular soil can be directly evaluated from the SPT N-value. The friction angle of such deposits can be also evaluated from equation and the recommended design parameters by *Japan Highway Cooperation (J.H.C)* (See Table 5.1). In case of granular soil, the friction angle of soil can be derived from following equation.

$$\emptyset = \sqrt{20N} + 15$$

The friction angle for cohesive soil can be also determined from direct shear test.

#### f) Modulus of Elasticity (E)

The modulus of elasticity of soil can be derived from the SPT N-value. In general, the modulus of elasticity of soil can be evaluated by multiplying SPT N-value. The modulus of elasticity of soil for granular soil is evaluated from the equation -

$$E = 700N (KN/m^2)$$

However the modulus of elasticity of cohesive soil can be derived from undrained cohesive strength; in following eqution-

$$E = 100 Cu$$
,

#### g) Poisson's Ratio (v')

The poisson's ratio is the ratio of axial strain versus lateral strain. In this report poisson's ratio of the soil can be estimated from experts' options described in following table.

No	Type of Soil	υ'
1	Saturated clay	$0.4 \sim 0.5$
2	Unsaturated or sandy clay	$0.2 \sim 0.4$
3	Sand: $\emptyset = 40^{\circ}$	0.2
4	Sand: $\emptyset = 20^{\circ}$	0.5

Table - 5.1 Typical Values of Poisson's Ratio

The table 5.3 indicates the geotechnical design parameters evaluated from various method for the road improvement project.



So	il Type	Conditi	ion of Soil	Bulk Density γt (tf/m <sup>3</sup> )	Internal Friction Angle φ (°)	Cohesion Cu (tf/m <sup>2</sup> )	Remarks (Soil Name)
	Gravel Gravelly Sand	Compa	cted one.	2.0	40	0	(GW), (GP)
	Sand	Compacted	Well graded one.	2.0	35	0	(CW/) (CD)
Fill Material	Sand	one.	Poor graded one.	1.9	30	0	(SW), (SP)
1	Silty Sand Clayey Sand	Compacted one.		1.9	25	Less than 3	(SM), (SC)
	Silt, Clay	Compa	cted one.	1.8	15	Less than 5	(ML), (CL) (MH), (CH)
	Kanto Loam	Compa	cted one.	1.4	20	Less than 1	(VH)
	C l	Dense or W	ell graded one.	2.0	40	0	
	Gravel		e and Poorly ed one.	1.8	35	0	(GW), (GP)
		Den	se one.	2.1	40	0	
	Gravelly Sand	Not de	ense one.	1.9	35	0	(GW), (GP)
		Dense or W	ell graded one.	2.0	35	0	
	Sand		e and Poorly ed one.	1.8	30	0	(SW), (SP)
	Silty Sand	Den	se one.	1.9	30	Less than 3	
Natural Ground	Clayey Sand	Not de	ense one.	1.7	25	0	(SM), (SC)
		Stif	ff one.	1.8	25	Less than 5	
	Sandy Silt Sandy Clay	Firr	none.	1.7	20	Less than 3	(ML), (CL)
		Sof	ft one.	1.6	15	Less than 1.5	
		Stif	ff one.	1.7	20	Less than 5	
	Silt Clay	Firr	none.	1.6	15	Less than 3	(CH), (MH), (ML)
	, j	Sof	ft one.	1.4	10	Less than 1.5	
	Kanto Loam			1.4	5	Less than 3	(VH)

Table - 5.2 Recommended Soil Parameter by J.H.C



# Table - 5.3 Geotechnical design parameters from various derivation methods

		N-Value	Cohesion Cu			Fr	iction ar	ngle	Bu	lk Dens	sity (kN	/m <sup>3</sup> )	Modulus of							
No	Soil Name	(Average)	kN/m <sup>2</sup>				(degree)			Test	by J	HС	Elasticity (kN/m <sup>2</sup> )							
		Ν	SPT	Lab	by JHC	SPT	Lab	by JHC	γd	$\gamma_{sat}$	γd	$\gamma_{sat}$								
1	Clay (filled)	2	13	N/A	<50	0	N/A	15	<mark>12.1</mark>	<mark>17.7</mark>	N/A	18.0	1300							
2	Silty Clay 1	1	6	20	<15	0	0	10	10.6	16.5	N/A	14.0	600							
3	Silty Sand	3	0	32	0	22	9	15	9.7	15.6	N/A	17.0	2100							
4	Silty Clay 2	3	20	N/A	<15	0	0	10	13.1	18.2	N/A	14.0	2000							
]	Remark : The	bulk densit	y for C	lay (fi	lled) la	yer is	estima	ted from	n field	Remark : The bulk density for Clay (filled) layer is estimated from field density tes										

		N-Value	Cohesion	Friction angle	Bu	lk Dens	sity	Modulus of	Poission's
No.	Soil Name	(Average)	Cu	φ	(kN/m <sup>3</sup> )			Elasticity (kN/m <sup>2</sup> )	Ratio
		Ν	kN/m <sup>2</sup>	(degree)	$\gamma_d$	$\gamma_{sat}$	γ'		υ
1	Clay (filled)	2	10	0	12	17	7	1300	0.4
2	Silty Clay 1	1	5	0	10	16	6	600	0.4
3	Silty Sand	3	0	20	9	15	5	2100	0.5
4	Silty Clay 2	3	20	0	13 18 8		2000	0.4	



### 6.0 CONCLUSION

### 6.1 Ground Condition

As the project area is located on the deltaic region of Ayeyarwaddy River near off shore, the quaternary deposit is mainly dominated. In project area, the marine deposit is underlain by fluvial deposit. As the river and marine dynamism is still progress on the area, the erosion, sedimentation process is still progressed on.

According to investigation result, the clayey soil is dominated the whole area. Among them the sandy soil interbedded. The clayey soil are very soft to soft in consistency while the sandy soil is very loose in density. The drilling work is carried out up to 30 m from ground surface. It is observed that the soil in an area is soft for foundation works for road and other infrastructures construction. The succession of soil layer from top to bottom are -

- 1. Clay (filled material)
- 2. Silty Clay 1
- 3. Silty Sand
- 4. Silty Clay 2

The ground water table is detected very shallow about 1 m from embankment. It is regarded that the groundwater is fully saturated during rainy season. Moreover, the road will be fully inundated during rain storm and high tide.

#### 6.2 Foundation Work

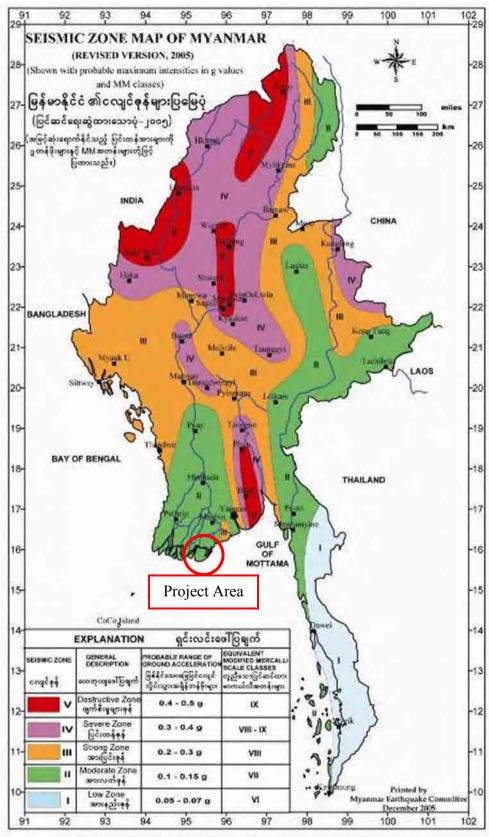
The foundation work for road, bridge and building construction should not be done without ground improvement work, because the ground is too soft to rest for heavy or light load structures. Moreover, the ground is mainly composed of saturated soft clay. Therefore, the consolidation settlement will occur when the load is applied to that soil layer. As the permeability of the soil is very low, the dewatering work is not difficult for excavation work.

#### 6.3 Seismicity of the Area

According to Seismic Zone Map of Myanmar, the project area is belonged to Zone II, moderate zone, where the modified Mercalli scale classes is 7, and peak ground acceleration is 0.15g. Although the ground material is very soft in consistency and shallow groundwater table, the liquefaction potential is very low, because the whole area is made up of cohesive soil and low peak ground acceleration.

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Revised by Dr. Maung Thein, U Tint Lwin Swe and Dr. Sone Han (December 2005)

Figure - 6.1 Earthquake zoning map of Myanmar



Zone	MM Class	Probable Damage	Examples of Damage
V	IX	Major damage	Considerable damage in specially designed
			structures
			Major damage in good RC buildings
IV	VIII-IX	Considerable damage	Considerable damage in good RC buildings
			Major damage in ordinary brick buildings
III	VII	Moderate damage	Moderate damage in good RC buildings
			Considerable damage in ordinary brick
			buildings
Π	VII	Minor damage	Minor damage in good RC buildings
			Moderate damage in ordinary brick
			buildings
Ι	VI	Slight damage	Minor damage in ordinary brick buildings

Table - 6.1 The Level of Probable Damage and Destruction

# APPENDICES

# **APPENDIX "A"**

# **BORING LOGS**

в	ORE H	OLE N	[o. <b>B</b> ]	H-01				BO	RING	LOG								Job N		20 eet No.	13-032	9 OF 1
PF	ROJECT	NAME	: <u>S</u>	oil Investigat	ion for Roa	id Improve	ement Project		BORING EQ	UIPMENT	ſ	: TOH	10 " D1	"	_	DA	ATE	: 26	.10.2013			
LO	CATIC	DN	: <u>D</u>	awnyein-An	ar road, Py	apon Tow	nship, Ayeya	rwaddy Region	BORING ME	THOD		: Rota	ary Direc	t Circulation		IENT						
G	ROUND	LEVEL	: 9	9.917m					ORIENTATI	ON		: Vert	ical		_		ORIEN	TAL C	CONSU	TTAN	T	
С	JORDI	NATE	: <u>E</u>	777313.000	; N 176314	1.000	DEPTH :	30.00m	GROUND W	ATER LE	VEL	: <u>1.00</u>			_							
						X X				(	m) &	)		STANDARD TEST M	PENETRAT ETHOD ( A	FION TES STM )	ST		SAM	PLING		
	(ii	â	(m)			RELATIVE DENSITY (or) CONSISTENCY				DATE & DEPTH (m)	CASING ( DEPTH (m) & DIAMETER (mm) )	WATER DEPTH (m)	(II)	÷	CURVE C	OF BLOW	. •		(II)			
3 (m)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	MAX	ЦК	TIVE I	NAME	SOIL DESCRIPTION		& DEI	IG ( DI METE	R DEF	DEPTH GL - (m)	Value s / 30cn	N	-Value		SAMPLE (Type & No.)	- 19 I	(%)	()	(m)
SCALE (m)	ELEV.	DEPTI	THICK	DIAGRAM	COLOUR	RELA' (or) C	SOIL			DATE	CASIN	WATE	DEPTI	N-Value (Blows/30cm)	(Blov 10 20	vs/30cm 30 4		SA (Typ	DEPTH GL - (m)	TCR (%)	SCR (%)	RQD (%) SCALE (m)
					mottled	Soft	CLAY	Soft, mottled brown and gray, m	oist. medium													
1					brown and		Filled	plasticity, CLAY, with trace of d fragments				¥	1.00	2/30				P-1	1.00 1.50			_1
2	97.917	2.00	2.00		gray		materials	Filled materials					2.00	1/30				P-2	2.00			2
3				* * * * * *							3.00		3.00	Ĩ					2.50			3
5				x x x							Ø115		3.00					₿T-1	$\frac{3.00}{\binom{80}{80}}$ cm 3.80			F
4				x x x v v v	gray	Very soft	Silty CLAY-I	Very soft to soft, gray, wet to medium plasticity, Silty CLAY	noist, low to				4.00	1/30				P-3	4.00 4.50			4
5				× * *		to soft		Fine sand and mica minerals are	observed as				5.00	1/30				P-4	5.00			_5
6				x x x				trace in this layer					6.00						5.50			6
				× × ×				GL-(8.00~8.50)m and (11.0~11.5 matter are observed as traces	0)m; organic	1								₿Т-2	$(\frac{50}{80})$ cm			F
7				* * ×						1			7.00	0/30				P-5	6.50 7.00 7.50			-7
8				x x x x x x						1			8.00	3/30				В w-1 Р-6	8.00			8
9				x x x						1			9.00						8.50 9.00			- 9
				× × × × × ×						1								₿т-3	$(\frac{80}{80})$ cm 9.80			F
1 <u>0</u>				x x x									10.00	1/30				<b>P-</b> 7	10.00 10.50			10
11				x x x									11.00	2/30				P-8	11.00			11
12				* * *									12.00	1/30				P-9	11.50 12.00			12
1				<u>x x x</u>										1/30					12.50			E
1 <u>3</u>				× × × × × *									13.00	1/30				P-10	13.00 13.50			13
14				x x x									14.00	1/30				P-11	14.00			14
- 1 <u>5</u>				x x x x x x									 15.00	1/30				P-12	14.50 15.00			15
-				× × ×									16.00						15.50			16
1 <u>6</u>				* * *									16.00	2/30				P-13	16.00 16.50			
1 <u>7</u>				x									17.00	1/30				P-14	17.00 17.50			17
18				× × ×									18.00	2/30				P-15	18.00			18
19	80.917	19.00	17.00	~ ^ ^ x x x									 19.00					P-16	18.50 19.00			19
-				x x x										4/30				P-10	19.50			F
2 <u>0</u>				× × ×						26.10.13 20.00			20.00	2/30				P-17	20.00			20
21				x_x_x	gray	Very	Silty	Very soft to firm, gray, moist, low	v to medium	1			21.00	3/30				P-18	21.00			21
22				× × × × × ×		soft to	CLAY-II	plasticity, Silty CLAY	_	1			22.00	3/30				P-19	21.50 22.00			22
-				x x x		firm		Fine sand and mica minerals are traces in each layer	observed as	1									22.50			_
2 <u>3</u>				x x x									23.00	3/30				P-20	23.00 23.50			23
2 <u>4</u>				x x x				GL-(26.00~26.50)m and (27.00~2 SAND layer are observed as interc		1			24.00	2/30				P-21	24.00 24.50			24
25				× × × × × ×						1			25.00	2/30				P-22	24.50			25
26				x x x						1			26.00						25.50 26.00			26
				x-x-x x-x-x						1				6/30				P-23	26.50			-
27				x x x									27.00	4/30				P-24	27.00 27.50			27
28				x x x									28.00	1/30				P-25	28.00			28
- 29				× × ×						1			29.00	2/45				P-26	28.50 29.00			29
				x_x_x						1									29.50			F
30	<u>69.4</u> 17	30.50	<u>11.5</u> 0	x x x x x x				This borehole is terminated at after confirmation	30.00m,	27.10.13 30.00	1		30.00	2/30				P-27	30.00 30.50			30
31	NOT							Sample key		pi.	anner stru	Icture	31.00		Discon	tinuities						31
		lative den		-	Consis	tency descrip			e sample	Term Very thick	_	Spacing	(mm) 2000		Ferm idely spaced		Spacing (m > 200		Γ	A	4	
		ve density y loose		N-Value     (meas)     0 - 4	Consistenc Very soft	y	I N-Value (meas) under 2	Undisturbed Sample Water sat (Piston sampler) Water sat		Thick Medium		600 - 200 -	2000	Wide	ly spaced im spaced		> 200 600 - 20 200 - 60	00		ramayı		
	L	.oose		4 - 10	Soft		2 - 4	Undisturbed Sample D-1 (Denison sampler)		Thin		60 -	200	Close	ly spaced		60 - 20	0	Const Revision N	truction	1 Co., ] Rev:	
	Ľ	um dense Dense	3	0 - 30	Firm Stiff		5 - 8 9 - 15	Rock core sample (Single core tube) 0 - 25 25 - 50		Very thin hickly lamin	ated	20 - 6 -	20	Extremely	closely spaced		20 - 60 < 20		Revision D			1.2013
		y dense rzaghi et a		over 50	Very stiff Hard		.6 - 30 over 30	Rock core sample50 - 75(Double core tube)75 - 90	Good	hinly lamin	ated	< (	6	Remarks								
								90 - 100	) Excellent									A	<u> 2p 3</u>			

вс	RE H	OLE N	o. B	H-02				<u>B O</u>	RING	LOG	Ţ							Job N		20 eet No.	13-03	2 OF 1
PR	OJECT	NAME	: <u>S</u>	oil Investiga	tion for Roa	ad Improv	ement Project		BORING EQ	UIPMENT		: <u>tof</u>	10 " D1	"		D	ATE	: 24.	10.2013			
	CATIO		_		nar road, Py	apon Tow	nship, Ayeya	rwaddy Region	BORING ME			_		et Circulat	ion <u>c</u>	LIENT				_		
	OUND	LEVEL		9.772m	• N 176161	3 000	DEPTH :	30.00m	ORIENTATIO			: <u>Ver</u>			[		ORIE	NTAL C	ONSU	LTAN	T	
		AIE	: <u>E</u>	//81/8.000	; N 1/0101			50.0011	GROUND WATER LEVEL : 0.50m				EST		SAM	PLING						
	(ii)	Ê	(II)			RELATIVE DENSITY (or) CONSISTENCY				DATE & DEPTH (m)	CASING ( DEPTH (m) & DIAMETER (mm) )	WATER DEPTH (m)	(î			OF BLO	w •	2	â			_
(II)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	RAM	UR	TIVE D	NAME	SOIL DESCRIPTION		& DEP	dG ( DE	SR DEP	DEPTH GL - (m)	Value s / 30cm		N-Value		SAMPLE (Type & No.)	DEPTH GL - (m)	(%	(%)	%) E (m)
SCALE (m)	ELEV/	DEPTH	THICK	DIAGRAM	COLOUR	RELA' (or) C	SOIL			DATE	CASIN	WATE	DEPTH	N-Value (Blows / 30cm)	(B) 10 20	ows / 30ci	m)	SA (Typ	DEPTH	TCR (%)	SCR (%)	RQD (%) SCALE (m)
-					mottled brown	Soft	CLAY	Soft, mottled brown and gray, which low to medium plasticity, CLAM				¥	1.00	- 2/30				P-1	1.00			
	777	2.00	2.00		and gray		Filled materials	of decayed wood fragments Filled materials	,				2.00	2/30					1.50 2.00			Ę
	/1.//2	2.00	2.00	X X						1				0/30				P-2	2.50			F.
3				x x							3.00 Ø115		3.00					₿T-1	$\frac{3.00}{\binom{80}{80}}$ cm 3.80			
4				- x - x - x - x	gray	Soft	Silty CLAY-I	Soft, gray, wet to moist, low plasticity, Silty CLAY, with trac					4.00	3/30				P-3	4.00			4
5				× *				matter Fine sand and mica minerals are	observed as				5.00	3/30				P-4	5.00			5
6				x x x x				trace in this layer	observed as				6.00					₿т-2	5.50 6.00 (64/80) cm			6
7	2.772	7.00	5.00	× × × ×									7.00	4/30				P-5	( <u>80</u> ) cm 6.64 7.00			_7
8				××									8.00					P-6	7.50			8
- 9				× × × ×	gray	Very loose	Silty SAND	Very loose, gray, moist, low pl grained, Silty SAND, with clay pat					9.00	2/30					8.50			F
				× × × ×														₿Т-3				F
1 <u>0</u>				××						24.10.13 10.00			10.00	2/30				P-7	10.00 10.50			10
11				× × × ×									11.00	4/30	<b>}</b>			P-8	11.00 11.50			<u>1</u> 1
1 <u>2</u>	7.772	12.00	5.00	××						-			12.00	2/30				P-9	12.00			12
1 <u>3</u>				x x									13.00	3/30				P-10	12.50 13.00			13
- 1 <u>4</u>				- × - × - × - ×	gray	Very soft	Silty CLAY-I	Very soft to soft, gray, moist, lov plasticity, Silty CLAY, with trace					14.00	1/30				P-11	13.50 14.00			14
15				х х		to soft		and mica minerals					15.00	. [				P-12	14.50 15.00			15
16				××										1150					15.50			16
10				×× ××									16.00	1/30				P-13	16.00 16.50			-
1 <u>7</u>				хх									17.00	2/30				P-14	17.00 17.50			17
1 <u>8</u>				* * * *									18.00	1/30				P-15	18.00 18.50			18
1 <u>9</u>	0.772	19.00	7.00	x x						-			19.00	8/30	) I			P-16	19.00			<u>1</u> 9
2 <u>0</u>				× ×									20.00	2/30				P-17	19.50 20.00			20
21				_X_X_ _X_X_	gray	Very soft	Silty CLAY-II	Very soft to firm, gray, moist, low plasticity, Silty CLAY, with trace					21.00	2/30				P-18	20.50 21.00			21
22				x x		to firm		and mica minerals					22.00	2/30					21.50 22.00			22
				× ×										2/30				P-19	22.50			-
2 <u>3</u>				x x x x									23.00	3/30				P-20	23.00 23.50			23
2 <u>4</u>				× ×									24.00	3/30				P-21	24.00 24.50			24
2 <u>5</u>				× ×									25.00	2/30				P-22	25.00 25.50			25
2 <u>6</u>				- X - X - - X - X -									26.00	1/30				P-23	26.00			26
27				× *									27.00	2/30				P-24	26.50 27.00			27
28				× × × ×									28.00					P-25	27.50 28.00			28
				× × × ×									29.00	5,50					28.50 29.00			29
2 <u>9</u>				× ×										5/50				P-26	29.50			F
30	9.272	30.50	11.50	_ X _ X _				This borehole is terminated at after confirmation	30.00m,	<u>25.10.13</u> 30.00	1		30.00	4/30	•			P-27	30.00 30.50			30
31	NOT	<u>es</u>						Sample key			anner stru		31.00			ontinuities						31
		ative den ve density		ription N-Value	Consist Consistenc	tency descri	ption T N-Value	●P-1 Disturbed sample (SPT sample) Core los	it)	Term Very thick			2000		Term widely space		Spacing (1 > 20	00		À	4	
	Ver	y loose		(meas) 0 - 4	Very soft		(meas) under 2	Undisturbed Sample T-1 (Piston sampler) Undisturbed Sample RQD (%		Thick Medium	+	600 - 200 -	600	М	idely spaced edium spaced	i	600 - 20 200 - 60	0		ramayı tructioi		
	Mediu	oose um dense ense	1	4 - 10 0 - 30 0 - 50	Soft Firm Stiff		2 - 4 5 - 8 9 - 15	D-1 (Denison sampler)       0 - 25       Rock core sample	Very poor	Thin Very thin hickly lamin		60 - 20 - 6 -	60	Very	losely spaced closely spaced rely closely :	ed	60 - 20 20 - 60 < 20		Revision N Revision D		Rev: 06.1	00 1.2013
	Ver	/ dense	c	0 - 50 over 50	Stiff Very stiff Hard		9 - 15 16 - 30 over 30	(Single core tube)     25 - 50       Rock core sample     50 - 75       (Double core tube)     75 - 90	Fair T	hinly lamin		6 -		Remark		paceu	< 20			I		
	Kef : Tei	zaghi et a	l., 1996	L		1			) Excellent									A	pp 4			

# **APPENDIX "B"**

# FIELD DENSITY TEST RESULTS

	DENSITY OF SOIL IN PLACE BY SAND - CONE	METHOD	(1)
Project Name	Subsurface Soil Investigation for The Project for Improvement	Date	31.10.13
	of Road Technology in Disaster Affected Area in Myanma		
Location	Near Myogone Village, Pyapon Township, Irrawaddy Region	Operator	ТН&КНА

Apparatus No.

3

#### 1.Determination of volume of apparatus

Point No. & Depth: Start Point (GL-0.50 m)

Test No.			1	2	3	4	5
Mass of apparatus with water	m <sub>2</sub>	đđ	6856	6856	6856		
Mass of apparatus	m <sub>1</sub>	đ	2528	2528	2528		
Mass of water in apparatus	m <sub>2</sub> -m <sub>1</sub>	g	4328	4328	4328		
Water temperature	t	°C	29	29	29		
Volume of water of 1g at t °C	К	cm <sup>3</sup> /g	1.00405	1.00405	1.00405		
Volume of apparatus <sup>(1)</sup>	$V_1$	cm <sup>3</sup>	4346	4346	4346		
Mean value				V <sub>1 =</sub>	4346	cm <sup>3</sup>	

2.Determination of bulk density of sand for test

Test No.			1	2	3	4	5
Mass of apparatus with sand	m <sub>3</sub>	<b>e</b> t)	8520	8522	8520		
Mass of apparatus	m <sub>1</sub>	(ta	2528	2528	2528		
Mass of sand in apparatus	$m_4 = m_3 - m_1$	Qa	5992	5994	5992		
Bulk density of sand for testing <sup>(2)</sup>	$\rho_s$	g/cm <sup>3</sup>	1.379	1.379	1.379		
Mean value				$\rho_{s=}$	1.379	g/cm <sup>3</sup>	

3.Determination of mass of sand required to fill the funnel

Test No.		1	2	3	4	5
Mass of apparatus and sand	$m_3$ g	8508	8516	8508		
Mass of apparatus and remaining sand	m <sub>5</sub> g	7044	7050	7042		
Mass of sand required to fill funnel	$m_6 = m_3 - m_5$ g	1464	1466	1466		
Mean value			m <sub>s</sub> =	1465	g	
Remarks:						

Density Check by 2000cm<sup>3</sup> Container

Mass of apparatus and sand	8504 g
Mass of apparatus and remaining sand	4280 g
Mass of sand required to fill funnel	1465 g
Volume of container	$2000 \text{ cm}^3$
Bulk density of sand for testing	1.380 g/cm <sup>3</sup>

(1)  $V_1 = K (m_2 - m_1) cm^3$ 

(2)  $\rho_s = m_4 / V_1 g/cm^3$ 

#### DENSITY OF SOIL IN PLACED BY SAND - CONE METHOD (2)

 Project Name
 Subsurface Soil Investigation for The Project for Improvement of Road Technology in Disaster Affected Area in Myanmar
 Date
 31.10.13

 Location
 Near Myogone Village, Pyapon Township, Irrawaddy Region
 Operator
 T H & K H A

Point No. & Depth: Start Point (GL- 0.5 m)

Apparatus No.	3	s	oil r	name			Silty	clay		Weather	r clou	dy
Bulk density of sand $\rho_s$	=1.	379		g/cm <sup>3</sup>		Mass of sand required to fill the			funnel m <sub>6</sub> =	= 146	5 g	
Test hole N	0.		No	). Т-	1		No. T-2		No. T-3		No.	
Container No.					-		-			-		
Mass ( removed soil + container )		g	-					-		-		
Mass of container		g			-			-		-		
Mass of removed soil	m <sub>r</sub>	g		27	10			2580		2464		
Dry mass of removed soil $m_o = \frac{100 m_r}{W+100} g$				20	74			1995		1877		
Max. grain size		mm			2			2		2		
Mass of apparatus with sand	m <sub>3</sub>	g		75	28			7528		7528		
Mass of apparatus with remaining	sand m <sub>s</sub>	g			98			4074		3954		
Mass of sand in hole & funnel	m9=m3-m8				30			3454		3574		
Mass of sand in test hole	m <sub>10</sub> =m <sub>9</sub> -m <sub>6</sub>	g			65			1989		2109		
Volume of test hole	$v_0 = \frac{m_{10}}{\rho_c}$	- cm <sup>3</sup>	1497.2						1529.1			
Bulk density	$\rho_t = \frac{m_r}{v_o}$	g /cm <sup>3</sup>			81				1.61			
Dry density	$\rho_d = \frac{m_o}{v_o}$	g /cm <sup>3</sup>		1.39				1.38		1.23		
Sketch of testing point	.0		N		BD	-21	No.	M-1	No.	CB-37	No.	
		-	ma	g	199	.83	m <sub>a</sub> g	181.09	m <sub>a</sub> g	194.11	m <sub>a</sub> g	
		-	mb	g	159	.11	m <sub>b</sub> g	147.49	m <sub>b</sub> g	155.73	m <sub>b</sub> g	
		-	mc	g	27.	21	m <sub>c</sub> g	32.64	m <sub>c</sub> g	33.06	m <sub>c</sub> g	
			w	%	30.	87	w %	29.26	w %	31.29	w %	
		, t	N	D.	E-1	31	No.	C-5	No.	E-140	No.	
		content	ma	g	198	.54	m <sub>a</sub> g	206.69	m <sub>a</sub> g	202.33	m <sub>a</sub> g	
			mb	g	162	.18	m <sub>b</sub> g	165.42	m <sub>b</sub> g	163.72	m <sub>b</sub> g	
		Moisture	m	g	42.	83	m <sub>c</sub> g	24.72	m <sub>c</sub> g	40.19	m <sub>c</sub> g	
		2	w	%	30.	47	w %	29.33	w %	31.26	w %	
		-	Me				Mean		Mean		Mean	
Sketch of test hole			W	= 30	.668	%	w =	29.294 %	w =	31.3 % w =	w = 30.4	%
o. No.	No.		No.			lue	Bulk d					
		+				Mean val				$\rho_t =$	1.74	g/cm
							Dry de	-		$\rho_d =$	1.33	g/cm
						Ma	ax. Grain size		2 m		mm	
						Metho	d of mois	sture content tes	t	(	Oven drying	

Remarks:

	DENSITY OF S	SOIL IN P	PLAC	E BY SA	ND - CON	E METHO	DD (1)	
Project Name	Subsurface Soil Inves	he Proje	ect for Impro	vement	Date	31.10	).13	
	of Road Technolog							
Location	Near Dawnyein Villa	ige, Pyapon To	ownship	, Irrawaddy	Region	Operator	ТН&	КНА
Point No. & De	epth: End Point (GL	- 0.50 m )	Ap	paratus No.	3	-		
1.Determination	n of volume of apparatu	IS						
	Test No.			1	2	3	4	5
Mass of apparatus v	with water	m <sub>2</sub>	g	6856	6856	6856		
Mass of apparatus		$m_1$	g	2528	2528	2528		
Mass of water in ap	pparatus	m <sub>2</sub> -m <sub>1</sub>	g	4328	4328	4328		
Water temperature		t	°C	29	29	29		
Volume of water of	1g at t°C	K	cm <sup>3</sup> /g	1.00405	1.00405	1.00405		
Volume of apparatu	IS <sup>(1)</sup>	$\mathbf{V}_1$	cm <sup>3</sup>	4346	4346	4346		
	Mean value				V <sub>1 =</sub>	4346	cm <sup>3</sup>	
2.Determination	n of bulk density of san	d for test	•					
	Test No.			1	2	3	4	5
Mass of apparatus v	with sand	m <sub>3</sub>	g	8520	8522	8520		
Mass of apparatus		$m_1$	g	2528	2528	2528		
Mass of sand in app	paratus	$m_4 = m_3 - m_1$	g	5992	5994	5992		
Bulk density of san	d for testing <sup>(2)</sup>	$\rho_s$	g/cm <sup>3</sup>	1.379	1.379	1.379		
	Mean value				$\rho_{s=}$	1.379	g/cm <sup>3</sup>	
3.Determination	n of mass of sand requi	red to fill the f	unnel					
	Test No.			1	2	3	4	5
Mass of apparatus a	and sand	m3	g	8508	8516	8508		
Mass of apparatus a	and remaining sand	m <sub>5</sub>	g	7044	7050	7042		
Mass of sand requir	red to fill funnel	$m_6 = m_3 - m_5$	g	1464	1466	1466		
	Mean value				m <sub>s</sub> =	1465	g	
Remarks:								
	by 2000cm <sup>3</sup> Container							
Mass of appara		8504	-					
~ ~	tus and remaining sand	4280	-					
	equired to fill funnel	1465	-					
Volume of cont	tainer		) cm <sup>3</sup>					
Bulk density of	sand for testing	1.380	) $g/cm^3$					
						(1)		、 3

(1)  $V_1 = K (m_2 - m_1) cm^3$ 

(2)  $\rho_s = m_4 / V_1 g/cm^3$ 

	DEN	<b>ISI</b>	ГҮ	OF	SO	II	. IN	PI	LAC	ED	BY	SAN	D - CONF	E ME	THOD (	2)	
Project Name												provem Myanı		Date	31.10	.13	
Location	Near	r Da	wny	ein V	illage	e, 1	Pyapo	n_T_	ownsh	nip, l	rrawa	ddy Re	gion O	perator	T H	<u>I &amp; K I</u>	I A
Point No. & De																	
Apparatus	No.			3			S	oil	name			Silty	v clay		Weather	r cl	oudy
Bulk densi	ity of sa	ınd	$\rho_s$	=		1.3	79		g/cm	3	Mass	of san	d required to	fill the	funnel m <sub>6</sub>	= 1	.465 g
	Test	hol	e No	э.				No	э. Т	-1		No.	T-2	No.	T-3	No.	
Container No.										-			-		-		
Mass ( remove	d soil + c	ontai	ner )				g			-			-		-		
Mass of contai	ner						g			-			-		-		
Mass of remov	ed soil					n <sub>r</sub>	g		2	366			2532		2774		
Dry mass of	removed s	soil		m <sub>o</sub> =	100 r w+1	n <sub>r</sub> 00	g		1	802			1919		2111		
Max. grain size	e						mm			2			2		2		
Mass of appara	atus with s	sand			n	n <sub>3</sub>	g		7	528					7528		
Mass of appara	atus with 1	remai	ining s	sand	n	n <sub>8</sub>	g	4286				4172		4034			
Mass of sand in	n hole & f	funne	l	m <sub>9</sub> =	=m <sub>3</sub> -m	8	g		3	242			3356		3494		
Mass of sand in	n test hole	e		m <sub>10</sub>	)=m9-r	n <sub>6</sub>	g		1	777			1891		2029		
Volume of test	hole			v <sub>o</sub> =	$\frac{m_{10}}{\rho_s}$	)	cm <sup>3</sup>		12	88.3	;		1371.0		1471.1		
Bulk density				$\rho_t =$	mr		g /cm <sup>3</sup>		1	.84			1.85		1.89		
Dry density				$\rho_d =$			g /cm <sup>3</sup>	1.40					1.40		1.44		
Sketch of t	testing po	int		r				N	o.	С	-2	No.	M-3	No.	E-107	No.	
								m	<sub>a</sub> g	186	5.02	m <sub>a</sub> g	214.82	m <sub>a</sub> g	197.36	m <sub>a</sub> g	
								m	b g	149	9.42	m <sub>b</sub> g	171.09	m <sub>b</sub> g	158.07	m <sub>b</sub> g	
								m	c g	31	.85	m <sub>c</sub> g	33.20	m <sub>c</sub> g	33.38	m <sub>c</sub> g	
								w	%	31	.13	w %	31.71	w %	31.51	w %	
							ant	N	o.	E-	109	No.	C-508	No.	B-10	No.	
							content	m	<sub>a</sub> g	173	3.69	m <sub>a</sub> g	231.96	m <sub>a</sub> g	214.73	m <sub>a</sub> g	
						-		m	<sub>b</sub> g	139	9.56	m <sub>b</sub> g	182.83	m <sub>b</sub> g	173.38	m <sub>b</sub> g	
							Moisture	m	<sub>c</sub> g	30	.94	m <sub>c</sub> g	30.18	m <sub>c</sub> g	41.28	m <sub>c</sub> g	
							4	w	%	31	.42	w %	32.18	w %	31.30	w %	
				_					ean	1 276	0/	Mean	21.040 0/	Mean	21.4 0/	Mean	0/
Sketch of f	Sketch of test hole			W	= 3	1.276	%	w =	31.949 %	w =	31.4 %	w = 31.5	%				
No.				No.			lue	Bulk d			$\rho_t =$	1.86	g/cm <sup>3</sup>				
											Mean value	Dry de	•		$\rho_t = \rho_d =$	1.41	g/cm
															2	g/cm mm	
														+			
Remarks:											wietho	u 01 111018	sture content tes	ı		Oven dryi	шg

Remarks:

Project Name	: Subsurface Soil Investigati	on for The Project f	for Improvement	of Road Techno	logy in Disaster	Affected Area in	Myanmar
Borehole No.	-	Location : Near	Myogone and	Dawnyein Vill	age, Pyapon T	ownship, Irrawa	addy Region
	Sample No.		Start Point	End Point			
	Depth (m)		GL - 0.50 m ~ -	GL - 0.50 m ~ -	~	~	~
Moisture Content	;	w %	30.41	31.54			
Bulk Density		$\rho_t g/cm^3$	1.737	1.856			
Atterberg's	Liquid Limit	WL %	56.65	40.00			
Limit	Plastic Limit	WP %	22.65	21.88			
	Plasticity Index	IP %	34.00	18.12			
Grain	Gravel, (76.20 ~ 4.75) mm	%	-	-			
Size	Sand, (4.75 ~ 0.075) mm	%	0.88	1.30			
Analysis	Silt, (0.075 ~ 0.005) mm	%	52.33	62.30			
·	Clay, (< 0.005 mm)	%	46.80	36.40			
Specific Gravity	of Soil	Gs (20°C)	2.721	2.706			
Unconfined Compression	Unconfined Compressive Strength	q <sub>u</sub> kgf/cm <sup>2</sup>					
	Failure Strain	ε <sub>f</sub> %	-	-			
Compaction Test	Maximun Dry Density Optimun Moisture Conten	$\begin{array}{c c} \rho_d & t/m^3 \\ t & W_{opt} & \% \end{array}$	1.586 22.00	1.666 19.00			
Direct Shear Test	Cohesion Phi Angle	$\begin{array}{cc} C_{UU} & kgf/cm^2 \\ \phi_{UU} & Degree \end{array}$	-	-		0	
California Bearing Ratio Test	CBR Value	%	-	-			
	Initial Void Ratio	e <sub>0</sub>	-	-			
Consolidation	Conso. Yield Stress Compression Index	$P_y kgf/cm^2$ $C_c$	-	-			
		Group Symbol	СН	CL			
Soil Classification ( ASTM D 2487 - 06 )		Group Name	Fat clay	Lean clay			
<u>NOTE</u>	Data used for refer	ence are show	m by red co	lor.		1	1

Project Name	Subsurface Soil Investigation	on for The Project for Improve	ment of Date	1.11.13
	Road Technology in D	isaster Affected Area in Myanı	mar	
Location	Near Myogone Village, I	yapon Township, Irrawaddy R	egion Operator H M	IA, CMA
Test Point No.		Start Point		
Sample No.				Mean
& Depth	Me	easurement of Moisture Conte	ent	moisture
No T 1	No. M.4	No. BD-21	No. E 121	content
No.T-1	No M-4 m <sub>a</sub> 207.46 m <sub>b</sub> 167.05	$m_a = 199.83 m_b = 159.11$	No. E-131 m <sub>a</sub> 198.54 m <sub>b</sub> 162.18	
GL-0.5 m	$m_{\rm h} = 167.05$ $m_{\rm c} = 32.28$	$m_b$ 159.11 $m_c$ 27.21	$m_{\rm h}$ 162.18 $m_{\rm c}$ 42.83	
	m <sub>w</sub> 40.41 m <sub>s</sub> 134.77	$m_w = 40.72$ $m_s = 131.90$	$m_w = 36.36$ $m_s = 119.35$	w = 30.44 %
~ <sup>m</sup>	$w = -\frac{29.98}{\%}$	$w = -\frac{30.87}{}$	$w = -\frac{30.47}{\%}$	
No.T-2	$\begin{array}{ccc} & \text{No.} & \underline{\text{M-1}} \\ m_a & 181.09 & m_b & 147.49 \end{array}$	No. <u>C-5</u> m <sub>a</sub> 206.69 m <sub>b</sub> 165.42	No. C-521	
GL-0.5 m	$\begin{array}{cccc} m_a & 181.09 & m_b & 147.49 \\ m_b & 147.49 & m_c & 32.64 \\ \end{array}$	$\begin{array}{cccc} m_a & 206.69 & m_b & 165.42 \\ m_b & \overline{165.42} & m_c & \overline{24.72} \end{array}$	$\begin{array}{cccc} m_a & 203.48 & m_b & 16\overline{4.23} \\ m_b & \overline{1}\overline{64.23} & m_c & \overline{3}\overline{1.19} \\ \end{array}$	
	m <sub>w</sub> 33.60 m <sub>s</sub> 114.85	$m_w 41.27 m_s 140.70$	$m_w$ 39.25 $m_s$ 133.04	w = 29.36 %
~ <b></b> <sup>m</sup>	$w = -\frac{29.26}{$	$w = \frac{29.33}{\%}$	$w = \frac{29.50}{\%}$	
No.T-3	No. BD-23	No. CB-37	No. E-140	
GL-0.5 m	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$m_a = 202.33$ $m_b = 163.72$	
GL- 0.5 III	$\begin{array}{cccc} m_b & 159.56 & m_c & 25.42 \\ m_w & 41.66 & m_s & 134.14 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccc} m_b & \overline{163.72} & m_c & 40.19 \\ m_w & \overline{38.61} & m_s & \overline{123.53} \end{array}$	w = 31.20%
~ <sup>m</sup>	$w = -\frac{31.06}{31.06}$	$w = \frac{31.29}{6}$	$w = \frac{31.26}{6}$	w = <u>31.20</u> //
No.	w – – – – – – . % No.	W _ + % No.	w – – – – – 70 No.	
	m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> m <sub>b</sub>	
<sup>m</sup>	$m_b = m_c$	m <sub>b</sub> m <sub>c</sub>	m <sub>b</sub> m <sub>c</sub>	0/
~ m	m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	w = %
No.	$w = \cdot \%$ No.	w = %No.	w =% No	
110	$m_a \qquad m_b$	$m_a \qquad m_b$	m <sub>a</sub> m <sub>b</sub>	
m	m <sub>b</sub> m <sub>c</sub>	m <sub>b</sub> m <sub>c</sub>	m <sub>b</sub> m <sub>c</sub>	
	m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	w = %
~ <sup>m</sup>	w =%	w = · %	w =%	
No	m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> Mo.	m <sub>a</sub> Mo.	
m	$m_a = m_b = m_c$	$m_a = m_b = m_c$	$m_a = m_b = m_c$	
	m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	w = %
~m	w =%	w = •••••%	w =%	
No.	No.	No.	No.	
m	$m_a m_b$	$m_a m_b$	$m_a m_b$	
<sup>m</sup>	$\begin{array}{ccc} m_b & m_c & m_c & m_m & m_s & m_s$	$\begin{array}{ccc} m_b & m_c & m_c & m_w & m_s & m_s & m_s \end{array}$	$\begin{array}{ccc} m_b & m_c \\ m_w & m_s \end{array}$	w =%
~m	$w = \cdot \%$	w = %	w =%	,
No.	w =/0 No.	No.	w =/0 No.	
	m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> m <sub>b</sub>	1
<sup>m</sup>	<sup>m</sup> <sub>b</sub> <sup>m</sup> <sub>c</sub>	m <sub>b</sub> m <sub>c</sub>	m <sub>b</sub> m <sub>c</sub>	<u>0</u> /
~ m	<sup>m</sup> <sub>w</sub> <sup>m</sup> <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	w = %
~ <sup>m</sup>	w =%	$\mathbf{w} = \cdot \%$	w =%	<u> </u>

### TEST FOR MOISTURE CONTENT OF SOIL

 $\mbox{Remark:} \quad \mbox{Moisture Content} \qquad \mbox{w} = \frac{m_a - m_b}{m_b - m_c} \ \mbox{x} \ 100 \ =$ 

 $m_a\!\!=\!mass\;of\;moist\;soil\;and\;container\;\;(g)$ 

$$m_b$$
= mass of dried soil and container (g)

- m<sub>c</sub>= mass of container (g)
- $m_w$ = mass of moisture in soil (g)
- $m_s$ = mass of dried soil (g)

Project Name	Subsurface Soil Investigation	on for The Project for Improve	ment of Date	1.11.13
	Road Technology in D	isaster Affected Area in Myanı	mar	
Location	Near Myogone Village, I	yapon Township, Irrawaddy R	Region Operator H M	Í A , C M A
Test Point No.		Start Point		
Sample No.	Me	easurement of Moisture Conte	ent	Mean moisture
& Depth	IVIC	astrement of Moisture Cond	ent	content
No.T-1	No M-4	No. BD-21	No. E-131	
CL 0.5 m	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
GL-0.5 m	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$m_b = \frac{139.11}{40.72}$ $m_s = \frac{27.21}{131.90}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$w = 30.44$ _%
~ <sup>m</sup>	$w = -\frac{29.98}{$	$w = -\frac{30.87}{.000}$	$w = -\frac{30.47}{.000}$	w = <u>50.11</u> /*
~ No.T-2	$w = \frac{1}{2}$ No. M-1	w = % No. C-5	w =% No. C-521	
	m <sub>a</sub> 181.09 m <sub>b</sub> 147.49	m <sub>a</sub> 206.69 m <sub>b</sub> 165.42	$m_a = 203.48 m_b = 164.23$	
GL-0.5 m	$m_{b} = 147.49 m_{c} = 32.64$	$m_b = \overline{1}6\overline{5}.\overline{4}2 = m_c = \overline{2}4.\overline{7}2$	$m_b = 164.23$ $m_c = 31.19$	_
~	m <sub>w</sub> 33.60 m <sub>s</sub> 114.85	$m_w 41.27 m_s 140.70$	$m_w = 39.25 = m_s = 133.04$	w = 29.36 %
~ <sup>m</sup>	$w = -\frac{29.26}{$	$w = -\frac{29.33}{\%}$	$w = -\frac{29.50}{6}$	
No.T-3	No. BD-23 m <sub>a</sub> 201.22 m <sub>b</sub> 159.56	No. <u>CB-37</u> m <sub>a</sub> 194.11 m <sub>b</sub> 155.73	No. <u>E-140</u> m <sub>a</sub> 202.33 m <sub>b</sub> 163.72	
GL-0.5 m	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	
	m <sub>w</sub> 41.66 m <sub>s</sub> 134.14	$m_w = 38.38 = m_s = 122.67$	$m_w = 38.61 = m_s = 123.53$	w = 31.20%
~ <sup>m</sup>	$w = -\frac{31.06}{\%}$	$w = \frac{31.29}{\%}$	$w = -\frac{31.26}{6}$	
No.	No	No.	No.	
m	$\begin{array}{ccc} m_a \\ m_b \end{array}$	$\begin{array}{ccc} m_a & m_b & m_b \\ m_b & m_c & m_c \end{array}$	m <sub>a</sub> m <sub>b</sub>	
<sup>III</sup>	$     \begin{array}{c}       m_b \\       m_w     \end{array}     $ $     \begin{array}{c}       m_c \\       m_s     \end{array}     $ $     \begin{array}{c}       m_c \\       m_s     \end{array}     $	$m_b = m_c = m_c$	$egin{array}{c} m_b & m_c \ m_w & m_s \end{array}$	w = %
~m	$w = \cdot \%$	w =%	w =%	
No.	No.	No.	No.	
	m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> m <sub>b</sub>	
<sup>m</sup>	$m_b$ $m_c$ $m_c$	$m_b m_c$	m <sub>b</sub> m <sub>c</sub>	0/
~ m	m <sub>w</sub> m <sub>s</sub>	<sup>m</sup> <sub>w</sub> <sup>m</sup> <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	w = %
$\frac{\sim m}{No.}$	$w = \cdot \%$ No.	w = %No.	w = %No.	
INU	$m_a \qquad m_b$	$m_a m_b$	$m_a m_b$	
m	m <sub>b</sub> m <sub>c</sub>	$m_b^a$ $m_c^b$	m <sub>b</sub> m <sub>c</sub>	
	m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	w = %
~m	w =%	w =%	w =%	
No.	" <sup>No.</sup>	m <sup>No.</sup>	m No.	
m	$\begin{array}{ccc} m_a & m_b & m_c \\ m_b & m_c \end{array}$	$\begin{array}{ccc} m_a & m_b & \hline m_b & \hline m_b & m_c \end{array}$	$\begin{array}{ccc} m_a & m_b \\ m_b & m_c \end{array}$	
	$\begin{array}{ccc} m_b & m_c & m_c & m_m & m_s & m_s$	$\begin{array}{ccc} m_b & m_c & m_c & m_w & m_s & m_s & m_s \end{array}$	$\begin{array}{ccc} m_b & m_c \\ m_w & m_s \end{array}$	w =%
~m	$w = \cdot \%$	w =%	w =%	
No.	No.	No.	No.	
	m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> m <sub>b</sub>	
<sup>m</sup>	<sup>m</sup> <sub>b</sub> <sup>m</sup> <sub>c</sub>	m <sub>b</sub> m <sub>c</sub>	m <sub>b</sub> m <sub>c</sub>	
~ m	m <sub>w</sub> m <sub>s</sub>	<sup>m</sup> <sub>w</sub> <sup>m</sup> <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	w =%
~ <sup>m</sup>	$W = \cdot \%$	w = • %	w =%	

### TEST FOR MOISTURE CONTENT OF SOIL

 $\mbox{Remark:} \quad \mbox{Moisture Content} \qquad \mbox{w} = \frac{m_a \mbox{-} m_b}{m_b \mbox{-} m_c} \mbox{x} \ 100 \ =$ 

$$\frac{m_w}{m_s} \ge 100 (\%)$$

 $m_{a}\!\!=\!mass$  of moist soil and container (g)

$$m_b$$
= mass of dried soil and container (g)

m<sub>c</sub>= mass of container (g)

 $m_w$ = mass of moisture in soil (g)

 $m_s$ = mass of dried soil (g)

#### SPECIFIC GRAVITY TEST

Project Name	Subsurface Soil Investigation for The Project for Improvement of	Date	6.11.13	
	Road Technology in Disaster Affected Area in Myanmar			
Location	Near Myogon and Dawnyein Village, Pyapon Township,	Operator	H S, C M A	
	Irrawaddy Region			

I Calibration of Pycnometer Number of measurement 2 3 2 3 1 1 Number of Pycnometer 4 8 10 198 199 200 Mass of Pycnometer 47.492 46.917 46.341 44.551 57.258 48.967  $m_{\rm f}$ g Mass of  $m_{a'}$ g 150.697 151.273 148.677 138.357 154.163 149.308 (distilled water + pycnometer) T' °C 27.5 27.5 27.5 27.5 27.5 27.5 Temperature of water  $G_T^{(Table)}$ Density of water at T' °C 1.00067 1.00067 1.00067 1.00067 1.000671.00067 = GT Density of water at T °C ma' - mf 103.205 104.356 102.336 93.806 96.905 100.341 g 103.275 102.405 93.869 96.970 100.409  $(1) \ G_T \ _{\times} \ (m_a{'} \text{-} m_f \,)$ 104.426 g G<sub>T</sub> Convert mass of  $m_a = (1) + m_f g$ 150.767 151.343 148.746 138.420 154.228 149.376 (water + pycnometer) at T '  $^{\circ}C$ 

#### **II** Specific Gravity Test

Sample No. & Depth			No. Start	Point (GL	2-0.50) m	No. End Point (GL-0.50) m			
Number of measurement			1	2	3	1	2	3	
Number of pycnometer			4	8	10	198	199	200	
Mass of (oven-dried or									
wet soil + water +			158.843	159.262	156.373	146.269	162.298	157.414	
pycnometer)	m <sub>b</sub>	g							
Temperature of contents in pycnometer	T°C		25.0	25.0	25.0	25.0	25.0	25.0	
Mass of oven - dried	No. of container		-	-	-	-	-	-	
soil in pycnometer	Mass of (oven-dri soil + container )		-	-	-	-	-	-	
m <sub>s</sub> g	Mass of container		-	-	-	-	-	-	
	m <sub>s</sub>	g	12.767	12.505	12.049	12.444	12.798	12.735	
Converted mass of (water + pycnometer ) at T ' °C	m <sub>a</sub>	g	150.767	151.343	148.746	138.420	154.228	149.376	
$m_{s} + (m_{a} - m_{b})$	u	g	4.691	4.586	4.422	4.595	4.728	4.697	
$Gs \text{ at } T^{\circ}C ,$ $Gs (T^{\circ}C/T^{\circ}C) = \underline{m_s} .$	m <sub>s</sub> + ( m <sub>a</sub> - m <sub>b</sub> )		2.722	2.727	2.725	2.708	2.707	2.712	
Correction factor ( Table )	K		0.99790	0.99790	0.99790	0.99790	0.99790	0.99790	
Gs at 15 °C Gs (T °C / 15 °C) =	K.Gs(T°C/T°	°C)	2.716	2.721	2.719	2.702	2.701	2.706	
Mean Value			Gs ( T °C	/ 15 °C ) =	2.719	Gs ( T °C	/ 15 °C ) =	2.703	
Correction factor 20 $^{\circ}C$ ( $_{Table}$ )	Κ'		0.99884	0.99884	0.99884	0.99884	0.99884	0.99884	
$\frac{Gs \text{ at } 20 °C}{Gs (T °C / 20 °C)} =$	K'.Gs ( T °C / T °C	)	2.719	2.723	2.722	2.705	2.704	2.708	
Mean Value			Gs ( T °C	$(20  ^{\circ}C) =$	2.721	Gs ( T °C	/ 20 °C ) =	2.706	
Remarks :									

Project Name		for The Project for Improvement of ster Affected Area in Myanmar		Date	7.11.13
Location Sample No.	Near Myogon Village, Pyap Start Poin	Operator TTH, ASN			
	Mass of (Air-Dried Soil + Cont:)	=	g	Specific Gravity	Gs
	Mass of Container No. ( )	=	g	Plasticity Index	Ip <sub>=</sub> 34.00
	Mass of Air - Dried Soil $m_s$	=	g	Dispersing Agen	t 100ml of Na 2 SiO 3
	Mass of Air - Dried Soli $m_s$	=	g	Dispersing Agen	$\frac{m_2}{m_o} = -$

#### PARTICLE SIZE ANALYSIS TEST (For Hydrometer Test)

#### 1. Measurement of Moisture Content of Air - Dried Soil

	No	No.	No.	Mean Moisture
ma		m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> m <sub>b</sub>	Content
m <sub>b</sub>	m	m <sub>b</sub> m <sub>c</sub>	m <sub>b</sub> m <sub>c</sub>	
$m_w$		m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	w =%
	w=%	w= %	w=%	

Mass of Dry Soil 
$$m_{so} = \frac{100 m_s}{100 + w} = \frac{40.00}{9}$$

2. Hydrometer Test	Container No.	BO-2	C	ylinder No.	G	Hydrometer No.	198
v				· ·		•	

1	l	2	3	4	5	6	7	8	9	10	11	12	13
Measured Time	Elapsed	Reading	of Hydro:	Water Temp:	Effective Depth L	L 60t	$\sqrt{\frac{L}{60t}}$	$\sqrt{\frac{0.018 \eta}{(Gs-1) \rho_w}}$	Particle Size 7 x 8	Correct: factor F	r' + F	P (11) x M	Corrected P P x m <sub>2</sub> /m <sub>0</sub>
9:30	Time min	Decimal Place	r' 2 + Cm	°C	mm	mm/s			mm			%	%
9:31	1	0.0235	0.0221	25.0	130.7112	2.17852	1.47598	0.03088	0.04558	0.0018	0.0239	94.24	
9:32	2	0.0222	0.0208	25.0	133.0343	1.10862	1.05291	0.03088	0.03252	0.0018	0.0226	89.11	
9:35	5	0.0200	0.0186	25.0	136.9657	0.45655	0.67569	0.03088	0.02087	0.0018	0.0204	80.44	
9:45	15	0.0175	0.0161	25.0	141.4332	0.15715	0.39642	0.03088	0.01224	0.0018	0.0179	70.58	
10:00	30	0.0155	0.0141	25.0	145.0072	0.08056	0.28383	0.03088	0.00877	0.0018	0.0159	62.69	
10:30	60	0.0130	0.0116	25.0	149.4747	0.04152	0.20377	0.03088	0.00629	0.0018	0.0134	52.84	
13:30	240	0.0090	0.0076	25.0	156.6227	0.01088	0.10429	0.03088	0.00322	0.0018	0.0094	37.06	
9:30	1440	0.0054	0.0040	25.0	163.0559	0.00189	0.04344	0.03088	0.00134	0.0018	0.0058	22.87	

$$\frac{1}{m_{so}/V} = -\frac{25.000}{m_{so}/V} - \frac{\text{cm}^3/\text{g}}{(\text{Gs}-1)} \times \rho_{\text{w}} = -\frac{1.5772}{m_{so}/V} - \frac{\text{g/cm}^3}{\text{M}} = \frac{100}{m_{so}/V} \times \frac{\text{Gs}}{(\text{Gs}-1)} \times \rho_{\text{w}} = -\frac{3943.001}{m_{so}/V} - \frac{100}{m_{so}/V} \times \frac{\text{Gs}}{(\text{Gs}-1)} \times \rho_{\text{w}} = -\frac{3943.001}{m_{so}/V} - \frac{100}{m_{so}/V} \times \frac{\text{Gs}}{(\text{Gs}-1)} \times \rho_{\text{w}} = -\frac{3943.001}{m_{so}/V} - \frac{100}{m_{so}/V} \times \frac{100}{m_{so}/V}$$

#### 3. Sieve Analysis

Sieve Size (µm)	Container No.	(Retained Soil + Cont :) Mass (g)	Container Mass (g)	Retained Soil Mass (g)	Retained (%)	Accumulative (%)	Accumulative P (%)	Corrected P P x m <sub>2</sub> /m <sub>0</sub> (%)
							100.00	
850				0.01	0.03	0.03	99.98	
425				0.02	0.05	0.08	99.93	
250				0.03	0.08	0.15	99.85	
105				0.22	0.55	0.70	99.30	
75				0.07	0.18	0.88	99.13	

**Remarks:** 

		106µm	42	5 µm	2.0 mm	9.50 mm	25.0 mm	50.0 mm
	SIEVES		250	050				
100		75 μm	250 μm	850 μm	Δ	4.75mm	19.0 mm 37	7.5 mm
GRADING CURVE	B							
90								
80								
70								
60								
50								
40								
30								
30								
20								
10								
0								10
	.010	0.100		1.000		10.000		100.00
BY ASTM		Particl	e Size D	(mm)				
Is Fines (Clay)	Fines (Silt)	Fine	Sand	Medium Sa	nd Coa Sai		Coars	se Gravel Co
0.005	(	0.075	0.	425	2.0	4.75	19.00	75.00

SAMPLE No.

PARTICLE SIZE ANALYSIS TEST (Grain Size Distribution Curve)

DATE: 7.11.13

Start Point, (GL-0.5 m)

Project Name	Subsurface Soil Investigation Road Technology in Disa	Date	7.11.13		
Location Sample No.	Near Dawnyein Village, Pya End Poin	Operator TTH, HMA			
	Mass of (Air-Dried Soil + Cont:)	=	g	Specific Gravity	Gs _ 2.703
	Mass of Container No. ( )	=	g	Plasticity Index	Ip <sub>=</sub> 18.12
	Mass of Air - Dried Soil $m_s$	=	g	Dispersing Agent	100ml of Na $_2$ SiO $_3$
					$\frac{m_2}{m_o} =$

#### PARTICLE SIZE ANALYSIS TEST (For Hydrometer Test)

#### 1. Measurement of Moisture Content of Air - Dried Soil

	No	No.	No.	Mean Moisture
ma		m <sub>a</sub> m <sub>b</sub>	m <sub>a</sub> m <sub>b</sub>	Content
m <sub>b</sub>	m	m <sub>b</sub> m <sub>c</sub>	m <sub>b</sub> m <sub>c</sub>	
$m_w$		m <sub>w</sub> m <sub>s</sub>	m <sub>w</sub> m <sub>s</sub>	w =%
	w=%	w= %	w=%	

Mass of Dry Soil 
$$m_{so} = \frac{100 m_s}{100 + w} = \frac{40.00}{9}$$

2. Hydrometer Test Container No. BO-16 Cylinder No. H Hydrometer No. 198

1	l	2	3	4	5	6	7	8	9	10	11	12	13
Measured Time	Elapsed	Reading	of Hydro:	Water Temp:	Effective Depth L	L 60t	$\sqrt{\frac{L}{60t}}$	$\sqrt{\frac{0.018 \eta}{(Gs-1) \rho_w}}$	Particle Size 7 x 8	Correct: factor F	r' + F	P (11) x M	Corrected P P x m <sub>2</sub> /m <sub>0</sub>
9:36	Time min	Decimal Place	r' 2 + Cm	°C	mm	mm/s			mm			%	%
9:37	1	0.0215	0.0201	25.0	134.3345	2.23891	1.49630	0.03102	0.04642	0.0018	0.0219	86.64	
9:38	2	0.0190	0.0176	25.0	138.8020	1.15668	1.07549	0.03102	0.03337	0.0018	0.0194	76.75	
9:41	5	0.0160	0.0146	25.0	144.1630	0.48054	0.69321	0.03102	0.02151	0.0018	0.0164	64.88	
9:51	15	0.0130	0.0116	25.0	149.5240	0.16614	0.40760	0.03102	0.01265	0.0018	0.0134	53.01	
10:06	30	0.0110	0.0096	25.0	153.0980	0.08505	0.29164	0.03102	0.00905	0.0018	0.0114	45.10	
10:36	60	0.0100	0.0086	25.0	154.8850	0.04302	0.20742	0.03102	0.00644	0.0018	0.0104	41.15	
13:36	240	0.0070	0.0056	25.0	160.2460	0.01113	0.10549	0.03102	0.00327	0.0018	0.0074	29.28	
9:36	1440	0.0045	0.0031	25.0	164.7135	0.00191	0.04366	0.03102	0.00135	0.0018	0.0049	19.39	

$$\frac{1}{m_{so}/V} = -\frac{25.000}{m_{so}/V} - \frac{\text{cm}^3/\text{g}}{(\text{Gs}-1)} \times \rho_w = -\frac{1.5825}{m_{so}/V} - \frac{\text{g/cm}^3}{m_{so}/V} M = \frac{100}{m_{so}/V} \times \frac{\text{Gs}}{(\text{Gs}-1)} \times \rho_w = -\frac{3956.319}{m_{so}/V} - \frac{100}{m_{so}/V} \times \frac{\text{Gs}}{(\text{Gs}-1)} \times \rho_w = -\frac{3956.319}{m_{so}/V} - \frac{100}{m_{so}/V} \times \frac{\text{Gs}}{(\text{Gs}-1)} \times \rho_w = -\frac{3956.319}{m_{so}/V} - \frac{100}{m_{so}/V} \times \frac{100}{m_{so$$

#### 3. Sieve Analysis

Sieve Size (µm)	Container No.	(Retained Soil + Cont :) Mass (g)	Container Mass (g)	Retained Soil Mass (g)	Retained (%)	Accumulative (%)	Accumulative P (%)	Corrected P P x $m_2/m_0$ (%)
							100.00	
850				0.02	0.05	0.05	99.95	
425				0.02	0.05	0.10	99.90	
250				0.03	0.08	0.18	99.83	
105				0.22	0.55	0.73	99.28	
75				0.23	0.58	1.30	98.70	

**Remarks:** 

			106µm	425 μn	n	2.0 mm	9.50 mm	25.0 mm	50.0 mm	
		SIEVES								
100			75 μm	250 μm	850 μm	4.75m	m	19.0 mm 37.	.5 mm	_
GRADING CURV	'E									-
90										
80										-
80										
70										
										-
60										
50	×									
										-
40										
30										
										-
20										
10										
										-
0 0.001	0.010		0.100		1.000		10.000		10	10 0.00
BY ASTM	0.010			le Size D	(mm)		10.000		100	0.00
ds Fines (Clay)	Fine	es (Silt)	Fine	e Sand	Medium Sand	Coarse Sand	Fine Gravel	Coarse	e Gravel	С
10	0.005		0.075	0.425		2.0 4.75	5	19.00	75.00	0

SAMPLE No.

PARTICLE SIZE ANALYSIS TEST (Grain Size Distribution Curve)

DATE: 7.11.13

End Point, (GL-0.5 m)

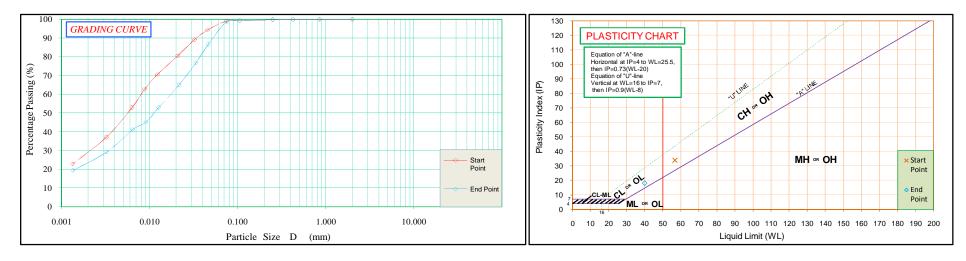
#### ATTERBERG'S LIMITS TEST

 
 Project Name
 Subsurface Soil Investigation for The Project for Improvement of Road Technology in Disaster Affected Area in Myanmar

 Location
 Near Myogone and Dawnyein Village, Pyapon Township, Irrawaddy Region
 Date 7.11.13 Operator YYS

Sample N	Sample No. & Depth Start point (GL- 0.50 m)													
LIOU	JID LIMIT T	EST				-							low Cur	ve
Number		Number	24	Number		66								
of blows	43	of blows	34	of blows	27	_								
	No. A123		No. A80		No. A-111	64								
m <sub>a</sub> 31.30	m <sub>b</sub> 23.85	m <sub>a</sub> 33.49	m <sub>b</sub> 25.51	m <sub>a</sub> 28.99	m <sub>b</sub> 22.53									
m <sub>b</sub> 23.85	m <sub>c</sub> 9.97	m <sub>b</sub> 25.51	m <sub>c</sub> 11.04	m <sub>b</sub> 22.53		62								
m <sub>w</sub> 7.45	m <sub>s</sub> 13.88	m <sub>w</sub> 7.98	m <sub>s</sub> 14.47	m <sub>w</sub> 6.46		-			×.					
w= <b></b>	53.67 %	w=,	55.15%	w= <b></b>	55.69 %	8 60			*					
Number of blows	22	Number of blows	17	Number of blows	13	-× t				A				
	No. A-84		No. A-17		No. A-6	- 58 -								
m <sub>a</sub> 28.06	m <sub>b</sub> 21.40	m <sub>a</sub> 36.41	m <sub>b</sub> 28.53	m <sub>a</sub> 36.28		nie c								
	m <sub>c</sub> 9.82		m <sub>c</sub> 15.15	m <sub>b</sub> 28.80		Moisture 99								
	m <sub>s</sub> 11.58		m <sub>s</sub> 13.38		m <sub>s</sub> 12.36	2						<b>^</b>	4	
	57.51 %		58.89		60.52 %	54							$\mathbf{X}$	
			%	w=• -	%	-								*
PLAS	TIC LIMIT T	EST				52								
	No. 22		No.		No.									
m <sub>a</sub> 42.66	m <sub>b</sub> 38.26	m <sub>a</sub>		m <sub>a</sub>		50								
m <sub>b</sub> 38.26	m <sub>c</sub> 18.83	m <sub>b</sub>	m <sub>c</sub>	m <sub>b</sub>		50								
m <sub>w</sub> 4.40	m <sub>s</sub> 19.43	m <sub>w</sub>	m	m <sub>w</sub>	m <sub>s</sub>	40								
w= <b></b>	22.65 %	w=,	%	w= <b>.</b>	%	48 5	567	891	0 Numbe	15 2 erofblov	0 25 NS	5 30	40	50
Liquid lin				ty index IP			Remark	s:						
56.6	55 %	22.65	%	34.00										
Sample N	lo. & Depth	End po	oint ( GL- 0.50	m )		45						- Cr	low Cu	ve
	-													ve
1.101		<b>B</b> G <b>T</b>		,		-							iow cu	
	JID LIMIT T					44							low Cd	
Number of blows	JID LIMIT T	EST Number of blows	30	Number of blows	27	44								
Number		Number	<b>30</b> No. A-47	Number	27 No. A-20	44 -								
Number of blows	<b>38</b> No. A-38	Number of blows	No. A-47	Number	No. A-20	-						Ľ		
Number of blows m <sub>a</sub> 35.93	<b>38</b> No. A-38 m <sub>b</sub> 31.01	Number of blows m <sub>a</sub> 35.04	No. A-47 m <sub>b</sub> 28.97	Number of blows m <sub>a</sub> _37.14	No. A-20 m <sub>b</sub> 31.22	-				•				
Number of blows m <sub>a</sub> 35.93 m <sub>b</sub> 31.01	38           No.         A-38           mb         31.01           mc         18.20	Number of blows m <sub>a</sub> 35.04 m <sub>b</sub> 28.97	No. A-47 m <sub>b</sub> 28.97 m <sub>c</sub> 13.46	Number of blows m <sub>a</sub> 37.14 m <sub>b</sub> 31.22	No. A-20 m <sub>b</sub> 31.22 m <sub>c</sub> 16.35	43 -								
Number of blows           m <sub>a</sub> 35.93           m <sub>b</sub> 31.01           m <sub>w</sub> 4.92	38           No.         A-38           mb         31.01           mc         18.20           ms         12.81	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	No. A-47 $m_b$ 28.97 $m_c$ 13.46 $m_s$ 15.51	$\begin{array}{c} Number\\ of blows \end{array}$ $\begin{array}{c} m_a & 37.14\\ m_b & 31.22\\ m_w & 5.92 \end{array}$	$\begin{array}{c c} No. & A-20 \\ m_b & 31.22 \\ m_c & 16.35 \\ m_s & 14.87 \end{array}$	- 43 - 42 - 42 - 60 - 60 - 60 - 60 - 60 - 60 - 60 - 6								
Number of blows $m_a$ 35.93 $m_b$ 31.01 $m_w$ 4.92 $w= -$ 92           Number         93	38 No. A-38 m <sub>b</sub> 31.01 m <sub>c</sub> 18.20 m <sub>s</sub> 12.81 38.41 %	Number of blows $m_a$ 35.04 $m_b$ 28.97 $m_w$ 6.07 $w=$ 2           Number         Number	No. A-47 m <sub>b</sub> 28.97 m <sub>c</sub> 13.46 m <sub>s</sub> 15.51 39.14 %	Number of blows m <sub>a</sub> 37.14 m <sub>b</sub> 31.22 m <sub>w</sub> 5.92 w=. Number	No.         A-20           mb         31.22           mc         16.35           ms         14.87           39.81         %	43 · 42 · (%) 41 ·								
Number of blows           m <sub>a</sub> 35.93           m <sub>b</sub> 31.01           m <sub>w</sub> 4.92           w=         -	38           No.         A-38           m <sub>b</sub> 31.01           m <sub>c</sub> 18.20           m <sub>s</sub> 12.81           38.41         %           23	Number of blows $m_a$ 35.04 $m_b$ 28.97 $m_w$ 6.07 $w=$ -	No. A-47 m <sub>b</sub> 28.97 m <sub>c</sub> 13.46 m <sub>s</sub> 15.51 39.14 % <b>21</b>	Number of blows $m_a  37.14$ $m_b  31.22$ $m_w  5.92$ $w=.$	$\begin{array}{c cccc} No. & A-20 \\ m_b & 31.22 \\ m_c & 16.35 \\ m_s & 14.87 \\ \hline 39.81 & \% \\ \hline 15 \\ \end{array}$	43 · 42 · (%) 41 ·					A			
$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	38           No.         A-38           mb         31.01           mc         18.20           ms         12.81           38.41         %           23         No.	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	$\begin{array}{c cccc} No. & A-47 \\ \hline m_b & 28.97 \\ \hline m_c & 13.46 \\ \hline m_s & 15.51 \\ \hline 39.14 & -\% \\ \hline & 21 \\ \hline No. & A-22 \\ \end{array}$	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ m_a  37.14 \\ m_b  31.22 \\ \\ m_w  5.92 \\ \\ \hline \\ \text{W=}  - \\ \\ \text{Number} \\ \text{of blows} \end{array}$	No.         A-20           mb         31.22           mc         16.35           ms         14.87           39.81         %           15         No.         A-127	43 - 42 - % 41 - % 41 - 40 -					Ax	e.		
$\begin{array}{c} \mbox{Number} & \mbox{of blows} \\ \mbox{m}_{a} & 35.93 \\ \mbox{m}_{b} & 31.01 \\ \mbox{m}_{w} & 4.92 \\ \mbox{w}= - \\ \mbox{Number} \\ \mbox{of blows} \\ \mbox{m}_{a} & 36.87 \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Number of blows           m <sub>a</sub> 35.04           m <sub>b</sub> 28.97           m <sub>w</sub> 6.07           w=.         2           Number         0           of blows         m <sub>a</sub> m <sub>a</sub> 39.08	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Number of blows           m <sub>a</sub> 37.14           m <sub>b</sub> 31.22           m <sub>w</sub> 5.92           w=           Number of blows           m <sub>a</sub> 39.47	$\begin{array}{c cccc} No. & A-20 \\ m_b & 31.22 \\ m_c & 16.35 \\ m_s & 14.87 \\ \hline 39.81 & -\% \\ \hline 15 \\ No. & A-127 \\ m_b & 32.96 \\ \hline \end{array}$	43 - 43 - 42 - 42 - 42 - 43 - 43 - 44 - 44					AA			
Number of blows           m <sub>a</sub> 35.93           m <sub>b</sub> 31.01           m <sub>w</sub> 4.92           w=         -           Number of blows         -           m <sub>a</sub> 36.87           m <sub>b</sub> 31.09	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} Number \\ of blows \\ \\ m_{a}  37.14 \\ m_{b}  31.22 \\ \\ m_{w}  5.92 \\ \\ \hline w= & - \\ Number \\ of blows \\ \\ \\ m_{a}  39.47 \\ \\ m_{b}  32.96 \end{array}$	$\begin{array}{c cccc} No. & A-20 \\ m_b & 31.22 \\ m_c & 16.35 \\ m_s & 14.87 \\ \hline 39.81 & -96 \\ \hline 15 \\ No. & A-127 \\ m_b & 32.96 \\ m_c & 17.47 \\ \end{array}$	43 - 42 - % 41 - % 41 - 40 -					A	e a		
Number of blows           m <sub>a</sub> 35.93           m <sub>b</sub> 31.01           m <sub>w</sub> 4.92           w=         2           Number of blows         36.87           m <sub>b</sub> 31.09           m <sub>w</sub> 5.78	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} Number \\ of blows \\ \hline m_a & 35.04 \\ m_b & 28.97 \\ m_w & 6.07 \\ \hline w=. & 28.97 \\ \hline m_w & 6.07 \\ \hline m_a & 39.08 \\ \hline m_b & 32.47 \\ \hline m_w & 6.61 \\ \hline \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} Number \\ of blows \\ \\ m_a & 37.14 \\ m_b & 31.22 \\ \\ m_w & 5.92 \\ \\ w= & - \\ \hline Number \\ of blows \\ \\ \\ m_a & 39.47 \\ \\ m_b & 32.96 \\ \\ m_w & 6.51 \\ \end{array}$	$\begin{array}{c cccc} No. & A-20 \\ m_b & 31.22 \\ m_c & 16.35 \\ m_s & 14.87 \\ \hline 39.81 & 96 \\ \hline 15 \\ No. & A-127 \\ m_b & 32.96 \\ m_c & 17.47 \\ m_s & 15.49 \\ \end{array}$	43 - 42 - 42 - 42 - 42 - 43 - 42 - 42 -					A	e A		
Number of blows           m <sub>a</sub> 35.93           m <sub>b</sub> 31.01           m <sub>w</sub> 4.92           w=         2           Number of blows         36.87           m <sub>b</sub> 31.09           m <sub>w</sub> 5.78	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} Number \\ of blows \\ \hline m_a & 35.04 \\ m_b & 28.97 \\ m_w & 6.07 \\ \hline w=. & 28.97 \\ \hline m_w & 6.07 \\ \hline m_a & 39.08 \\ \hline m_b & 32.47 \\ \hline m_w & 6.61 \\ \hline \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} Number \\ of blows \\ \\ m_{a}  37.14 \\ m_{b}  31.22 \\ \\ m_{w}  5.92 \\ \\ \hline w= & - \\ Number \\ of blows \\ \\ \\ m_{a}  39.47 \\ \\ m_{b}  32.96 \end{array}$	$\begin{array}{c cccc} No. & A-20 \\ m_b & 31.22 \\ m_c & 16.35 \\ m_s & 14.87 \\ \hline 39.81 & 96 \\ \hline 15 \\ No. & A-127 \\ m_b & 32.96 \\ m_c & 17.47 \\ m_s & 15.49 \\ \end{array}$	43 - 43 - 42 - 42 - 42 - 43 - 42 - 43 - 44 - 44					Ay	e s	A.	
$\begin{array}{c} \mbox{Number} & \mbox{of blows} \\ \mbox{$m_a$} & 35.93 \\ \mbox{$m_b$} & 31.01 \\ \mbox{$m_w$} & 4.92 \\ \mbox{$w=-$} \\ \mbox{$w=-$} \\ \mbox{Number} \\ \mbox{$of blows$} \\ \mbox{$m_a$} & 36.87 \\ \mbox{$m_b$} & 31.09 \\ \mbox{$m_w$} & 5.78 \\ \mbox{$w=-$} \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	$\begin{array}{c ccccc} No. & A-47 \\ m_b & 28.97 \\ m_c & 13.46 \\ m_s & 15.51 \\ \hline 39.14 & -96 \\ \hline & 21 \\ No. & A-22 \\ m_b & 32.47 \\ m_c & 16.18 \\ m_s & 16.29 \\ \end{array}$	$\begin{array}{c} Number \\ of blows \\ \\ m_a & 37.14 \\ m_b & 31.22 \\ \\ m_w & 5.92 \\ \\ w= & - \\ \hline Number \\ of blows \\ \\ \\ m_a & 39.47 \\ \\ m_b & 32.96 \\ \\ m_w & 6.51 \\ \end{array}$	$\begin{array}{c cccc} No. & A-20 \\ m_b & 31.22 \\ m_c & 16.35 \\ m_s & 14.87 \\ \hline 39.81 & 96 \\ \hline 15 \\ No. & A-127 \\ m_b & 32.96 \\ m_c & 17.47 \\ m_s & 15.49 \\ \end{array}$	43 - 42 - 42 - 41 - 41 - 40 - 41 - 40 - 41 - 40 - 43 - 43 - 43 - 43 - 43 - 43 - 43 - 43					A	4		
$\begin{array}{c} \mbox{Number} & \mbox{of blows} \\ \mbox{$m_a$} & 35.93 \\ \mbox{$m_b$} & 31.01 \\ \mbox{$m_w$} & 4.92 \\ \mbox{$w=-$} \\ \mbox{$w=-$} \\ \mbox{$v=-$} \\ \mbox{$m_a$} & 36.87 \\ \mbox{$m_b$} & 31.09 \\ \mbox{$m_w$} & 5.78 \\ \mbox{$w=-$} \\ $w=$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	No. $A-47$ $m_b = 28.97$ $m_c = 13.46$ $m_s = 15.51$ 39.14 = -96 <b>21</b> No. $A-22$ $m_b = 32.47$ $m_c = 16.18$ $m_s = 16.29$ 40.58 = -96	$\begin{array}{c} Number \\ of blows \\ \\ m_a & 37.14 \\ m_b & 31.22 \\ \\ m_w & 5.92 \\ \\ w= & - \\ \hline Number \\ of blows \\ \\ \\ m_a & 39.47 \\ \\ m_b & 32.96 \\ \\ m_w & 6.51 \\ \end{array}$	$\begin{array}{c cccc} No. & A-20 \\ m_b & 31.22 \\ m_c & 16.35 \\ m_s & 14.87 \\ \hline 39.81 & \% \\ \hline 15 \\ No. & A-127 \\ m_b & 32.96 \\ m_c & 17.47 \\ m_s & 15.49 \\ \hline 42.03 & \% \\ \end{array}$	43 - 42 - 42 - 42 - 42 - 43 - 42 - 42 -					Av	A A		
$\begin{array}{c} \mbox{Number} & \mbox{of blows} \\ \mbox{$m_a$} & 35.93 \\ \mbox{$m_b$} & 31.01 \\ \mbox{$m_w$} & 4.92 \\ \mbox{$w= -$} \\ \mbox{$w= -$} \\ \mbox{$w= -$} \\ \mbox{$m_b$} & 31.09 \\ \mbox{$m_b$} & 31.01 \\ \mbox{$m_b$} & 31.01 \\ \mbox{$m_b$} & 31.02 \\ \mbox{$m_b$} & 31.02 \\ \mbox{$m_b$} & 31.01 \\ \mb$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	$\begin{array}{c ccccc} No. & A-47 \\ m_b & 28.97 \\ m_c & 13.46 \\ m_s & 15.51 \\ \hline 39.14 & -96 \\ \hline & 21 \\ No. & A-22 \\ m_b & 32.47 \\ m_c & 16.18 \\ m_s & 16.29 \\ \end{array}$	$\begin{array}{c} Number \\ of blows \\ m_a & 37.14 \\ m_b & 31.22 \\ m_w & 5.92 \\ w=. & - \\ Number \\ of blows \\ m_a & 39.47 \\ m_b & 32.96 \\ m_w & 6.51 \\ w=. & - \\ \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	43 - 42 - (%) 41 - N tueuco anniso W 40 - 38 - 38 - 37 -					Ax	4		
$\begin{array}{c} \mbox{Number} & \mbox{of blows} \\ \mbox{$m_a$} & 35.93 \\ \mbox{$m_b$} & 31.01 \\ \mbox{$m_w$} & 4.92 \\ \mbox{$w=-$} \\ \mbox{$w=-$} \\ \mbox{$w=-$} \\ \mbox{$m_a$} & 36.87 \\ \mbox{$m_b$} & 31.09 \\ \mbox{$m_w$} & 5.78 \\ \mbox{$w=-$} \\ \mbox{$p_{LAS'}$} \\ \mbox{$m_a$} & 39.04 \\ \end{tabular}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	No. $A-47$ $m_b = 28.97$ $m_c = 13.46$ $m_s = 15.51$ 39.14 = -96 <b>21</b> No. $A-22$ $m_b = 32.47$ $m_c = 16.18$ $m_s = 16.29$ 40.58 = -96	$\begin{array}{c} Number \\ of blows \\ \\ m_a & 37.14 \\ m_b & 31.22 \\ \\ m_w & 5.92 \\ \\ w= & - \\ \hline Number \\ of blows \\ \\ \\ m_a & 39.47 \\ \\ m_b & 32.96 \\ \\ m_w & 6.51 \\ \end{array}$	$\begin{array}{c ccccc} No. & A-20 \\ m_b & 31.22 \\ m_c & 16.35 \\ m_s & 14.87 \\ \hline 39.81 & -96 \\ \hline 15 \\ No. & A-127 \\ m_b & 32.96 \\ m_c & 17.47 \\ m_s & 15.49 \\ \hline 42.03 & -96 \\ \hline No. \\ m_b \\ \hline No. \\ m_b \\ \hline \end{array}$	43 - 42 - 42 - 41 - 41 - 40 - 41 - 40 - 41 - 40 - 43 - 43 - 43 - 43 - 43 - 43 - 43 - 43					Àx	e A		
$\begin{array}{c} \mbox{Number} & \mbox{of blows} \\ \mbox{$m_a$} & \mbox{$35.93$} \\ \mbox{$m_b$} & \mbox{$31.01$} \\ \mbox{$m_w$} & \mbox{$4.92$} \\ \mbox{$w=$} \\ \mbox{$w=$} \\ \mbox{$v=$} \\ \mbox{$m_a$} & \mbox{$36.87$} \\ \mbox{$m_b$} & \mbox{$31.09$} \\ \mbox{$m_w$} & \mbox{$5.78$} \\ \mbox{$w=$} \\ \mbox{$PLAS'$} \\ \mbox{$m_a$} & \mbox{$39.04$} \\ \mbox{$m_b$} & \mbox{$35.24$} \\ $3$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	No. $A-47$ $m_b = 28.97$ $m_c = 13.46$ $m_s = 15.51$ 39.14 = -96 <b>21</b> No. $A-22$ $m_b = 32.47$ $m_c = 16.18$ $m_s = 16.29$ 40.58 = -96	$\begin{array}{c} Number \\ of blows \\ m_a & 37.14 \\ m_b & 31.22 \\ m_w & 5.92 \\ w=. & - \\ Number \\ of blows \\ m_a & 39.47 \\ m_b & 32.96 \\ m_w & 6.51 \\ w=. & - \\ \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	43 - 42 - (%) Multiple Molistrue courter Molistrue courter 38 - 37 - 36 -					A 4	e a	A.	
Number of blows           m <sub>a</sub> 35.93 m <sub>b</sub> m <sub>b</sub> 31.01 m <sub>w</sub> m <sub>w</sub> 4.92 w= -           w= -         -           Number of blows         -           m <sub>a</sub> 36.87 m <sub>b</sub> m <sub>w</sub> 5.78 w= -           W= -         -           PLAS           m <sub>a</sub> 39.04 m <sub>b</sub> m <sub>b</sub> 35.24 m <sub>w</sub> m <sub>w</sub> 3.80	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \hline m_a & 35.04 \\ m_b & 28.97 \\ m_w & 6.07 \\ \hline w_{=} & 28.97 \\ \hline m_w & 6.07 \\ \hline w_{=} & 28.97 \\ \hline m_a & 32.47 \\ m_b & 32.47 \\ m_w & 6.61 \\ \hline w_{=} & -2 \\ \hline \textbf{EST} \\ \hline \hline m_a & m_b \\ m_w & -1 \\ \hline \end{array}$	No. $A-47$ $m_b = 28.97$ $m_c = 13.46$ $m_s = 15.51$ 39.14 = -96 <b>21</b> No. $A-22$ $m_b = 32.47$ $m_c = 16.18$ $m_s = 16.29$ 40.58 = -96	Number of blows           m <sub>a</sub> _ 37.14 m <sub>b</sub> _ 31.22 m <sub>w</sub> _ 5.92 w=	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	43 - 42 - (%) 41 - (%		7 8 9 1	0	15 2	20 22	e	Å	
$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \\ m_a & 35.93 \\ m_b & 31.01 \\ m_w & 4.92 \\ w_{-} & - 2 \\ \hline \\ \text{Number} \\ \text{of blows} \\ \\ m_a & 36.87 \\ m_b & 31.09 \\ m_w & 5.78 \\ \hline \\ \textbf{W} \\ W$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Number of blows           ma         35.04           mb         28.97           mw         6.07           w=.         2           Number         0           of blows         0           ma         39.08           mb         32.47           mw         6.61           w=.         2           EST         0           mb            mb            mb            mb            mb            w=.	No. A-47 m <sub>b</sub> 28.97 m <sub>c</sub> 13.46 m <sub>s</sub> 15.51 39.14% <b>21</b> No. A-22 m <sub>b</sub> 32.47 m <sub>c</sub> 16.18 m <sub>s</sub> 16.29 10.58% No m <sub>b</sub> m <sub>c</sub> m <sub>b</sub> m <sub>b</sub>	Number of blows           ma         37.14           mb         31.22           mw         5.92           w=         -           Number         of blows           ma         39.47           mb         32.96           mw         6.51           w=         -           mb         32.96           mw         6.51           w=         -           mb            mb            mb            mb            mw	$\begin{array}{c ccccc} No. & A-20 \\ m_b & 31.22 \\ m_c & 16.35 \\ m_s & 14.87 \\ \hline 39.81 & -96 \\ \hline 15 \\ No. & A-127 \\ m_b & 32.96 \\ m_c & 17.47 \\ m_s & 15.49 \\ \hline 42.03 & -96 \\ \hline No. \\ m_b \\ \hline No. \\ m_b \\ \hline \end{array}$	43 - 42 - (%) 41 - (%	-	7 8 9 1	0 Numb	15 2 ler of blov	200 2:20 2:20 2:20 2:20 2:20 2:20 2:20		Å	
$\begin{array}{c} \mbox{Number} & \mbox{of blows} \\ \mbox{$m_a$} & \mbox{$35.93$} \\ \mbox{$m_b$} & \mbox{$31.01$} \\ \mbox{$m_w$} & \mbox{$4.92$} \\ \mbox{$w=$} \\ \mbox{$w=$} \\ \mbox{$Number$} \\ \mbox{$m_a$} & \mbox{$36.87$} \\ \mbox{$m_b$} & \mbox{$31.09$} \\ \mbox{$m_w$} & \mbox{$5.78$} \\ \mbox{$w=$} \\ \mbox{$PLAS$} \\ \mbox{$m_a$} & \mbox{$35.24$} \\ \mbox{$m_b$} & \mbox{$35.24$} \\ \mbox{$m_w$} & \mbox{$3.80$} \\ \mbox{$3.80$} \\ \mbox{$M_w$} & \mbox{$M_w$} & \mbox{$M_w$} & \mbox{$M_w$} \\ \mbox{$M_w$} & \mbox{$M_w$} & \mbox{$M_w$}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} \text{Number} \\ \text{of blows} \\ \hline m_a & 35.04 \\ m_b & 28.97 \\ m_w & 6.07 \\ \hline w_{=} & 28.97 \\ \hline m_w & 6.07 \\ \hline w_{=} & 28.97 \\ \hline m_a & 32.47 \\ m_b & 32.47 \\ m_w & 6.61 \\ \hline w_{=} & -2 \\ \hline \textbf{EST} \\ \hline \hline m_a & m_b \\ m_w & -1 \\ \hline \end{array}$	No. A-47 m <sub>b</sub> 28.97 m <sub>c</sub> 13.46 m <sub>s</sub> 15.51 39.14% <b>21</b> No. A-22 m <sub>b</sub> 32.47 m <sub>c</sub> 16.18 m <sub>s</sub> 16.29 10.58% No m <sub>b</sub> m <sub>c</sub> m <sub>b</sub> m <sub>b</sub>	Number of blows           m <sub>a</sub> _ 37.14 m <sub>b</sub> _ 31.22 m <sub>w</sub> _ 5.92 w=	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	43 - 42 - (%) 41 - (%	5 6 7		0 Numb	15 2 re of blow	200 2:	e	Å	) 50

				SOIL	CLASSIFICA	TION				
Project Name:	Subsurface Soil Investig					Sheet No	. <u>1</u> of <u>1</u>		Date	
	of Road Technology in	Disaste	r Affected Area ir	Myanmar	Soil Clas	sification System	Unified Soil Clas	ssification	Classified by	/ <u>T</u> H
Location:	Near Myogone and Dawnyein	Village, l	Pyapon <u>Town</u> ship,	Irrawaddy Region			System of ASTM	I D 2487 - 06	Check by	/ <u>T</u> H
	Sample No. & Depth		Start Point	End Point						
	Sample No. & Depth		(GL - 0.50)m	(GL - 0.50)m						
Gravel	<u>(75.00 ~ 4.75) mm</u>	(%)								
Sand	$(4.75 \sim 0.075) \text{ mm}$	(%)	0.88	1.30						
Silt	(0.075 ~ 0.005) mm	(%)	52.33	62.30						
Clay	< 0.005 mm	(%)	46.80	36.40						
Maximum Part	ticle Diameter	(mm)	2.00	2.00						
Coefficient of	Uniformity (Cu	)								
Coefficient of (	Curvature (Cc	)	-	-						
Liquid Limit	(WL	) (%)	56.65	40.00		L		$\bot$ $\_$ $\_$ $\_$ $\_$		
Plastic Limit	(WP	) (%)	22.65	21.88		L		$\bot$ $\_$ $\_$ $\_$ $\_$		
Plasticity Index	x (IP)		34.00	18.12						
Classified Soil	Name (Group Name)		Fat clay	Lean clay						
Classified sym	bol (Group Symbol)		СН		1					<u> </u>



# **COMPACTION TESTS**

	001			
Project Name Subs	urface Soil Investigation fo Technology in Disaste	r The Project for Improvem er Affected Area in Myanm		16.11.13
Location	Near Myogone Village, Py	apon Township, Irrawaddy	Region	
	Start Pc			T.H & S.O.P
Test Purpose :	Compaction Test , CBR	Test	Testing Method :	
Compaction Method :	$Class \ 1 \ , \ Class \ 2 \ , \ Other$		Preparation : Dr	ied, Non-dried
Moisture Content :	Before dried 30.41 %	After dried 2.64 %	Sample Use : Re	peating Non - repeating
Mold :	No 1 Mass: (Mo	old , <del>Baseplate , Spacer disc</del>	) Total	2.102 kg
	Volume : 10 cm Mold 10	<b>00 cm<sup>3</sup></b> , 15 cm Mold 220	$9 \text{ cm}^3$ , Other cm	Mold cm <sup>3</sup>
Test Number	1	2	3	4
Mass ( sample+mold ) kg	3.828	3.932	4.034	4.040
Mass of specimen kg	1.726	1.830	1.932	1.938
Bulk density $\rho$ t t/m <sup>3</sup>	1.726	1.830	1.932	1.938
	$\begin{array}{ccc} & \text{No.} & \underline{\text{D-8}} \\ m_a & 104.60 & m_b & 91.71 \\ m_b & 91.71 & m_c & 8.91 \end{array}$	$\begin{array}{ccc} & \text{No.} & \underline{D-1} \\ m_a & 97.08 & m_b & 83.29 \\ m_b & 83.29 & m_c & 9.56 \end{array}$	$\begin{array}{c} & \text{No.}  \underline{D\text{-}14} \\ m_a  \underline{105.81}  m_b  \underline{88.65} \\ m_b  \underline{88.65}  m_c  \underline{9.82} \end{array}$	$\begin{array}{c c} & \text{No.} & \underline{D}\text{-4} \\ \hline m_a & \underline{99.35} & m_b & \underline{81.18} \\ m_b & \underline{81.18} & m_c & \underline{9.02} \end{array}$
Moisture Content	$m_{\rm w}$ 12.89 $m_{\rm s}$ 82.80 W 15.57 %	<sup>m</sup> <sub>w</sub> . <u>13.79</u> m <sub>s</sub> <u>73.73</u> W <u>18.70</u> % No. D-10	$m_{\rm w} = 17.16 \qquad m_{\rm s} = 78.83 \ W = 21.77 \qquad \%$	$m_{w}$ 18.17 $m_{s}$ 72.16 W 25.18 %
	$\begin{array}{cccccc} & & \text{No.} & \underline{D-19} \\ m_a & 109.83 & m_b & 96.36 \\ m_b & 96.36 & m_c & 9.67 \\ m_w & 13.47 & m_s & 86.69 \\ \hline & W & 15.54 & \% \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccc} & & \text{No.} & \underline{D-22} \\ m_a & 104.66 & m_b & 87.57 \\ m_b & 87.57 & m_c & 9.60 \\ m_w & 17.09 & m_s & 77.97 \\ \hline W & 21.92 & \% \end{array}$	$\begin{array}{c ccccc} & No. & D-18 \\ \hline m_a & 96.76 & m_b & 79.26 \\ \hline m_b & 79.26 & m_c & 9.94 \\ \hline m_w & 17.50 & m_s & 69.32 \\ \hline W & 25.25 & \% \end{array}$
Mean value w %	15.55	18.75	21.84	25.21
Dry density $\rho$ d t/m <sup>3</sup>	1.494	1.541	1.586	1.548
Test Number	5	6	7	8
Mass (sample+mold) kg	4.018	3.990	1	0
Mass of specimen kg	1.916	1.888		
Bulk density $\rho$ t t/m <sup>3</sup>	1.916	1.888		
	$\begin{array}{cccccccc} & & \text{No.} & D-2 \\ \hline \text{M}_a & 92.30 & \text{m}_b & 74.43 \\ \hline \text{m}_b & 74.43 & \text{m}_c & 9.79 \\ \hline \text{m}_w & 17.87 & \text{m}_s & 64.64 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	No. m <sub>a</sub> m <sub>b</sub> m <sub>b</sub> m <sub>c</sub> m <sub>w</sub> m <sub>s</sub>	No.           m <sub>a</sub> m <sub>b</sub> m <sub>b</sub> m <sub>c</sub> m <sub>w</sub> m <sub>s</sub>
Moisture Content	$\begin{array}{cccc} W & 27.65 & \% \\ \hline & No. & D-3 \\ m_a & 95.42 & m_b & 76.76 \\ m_b & 76.76 & m_b & 0.47 \\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	W	W
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	m <sub>b</sub> m <sub>c</sub> m <sub>s</sub>

 $\frac{\text{Dry density } \rho \text{ d}}{\text{Remarks}}$ 

Mean value

1 Other Compaction Method Mass of rammer Kg, Drop height cm, Blows per layer( \_\_\_\_\_)Layers

W 29.55 %

29.60

1.457

W ....%

2 Dry Density  $\rho_d = \frac{\rho t}{w + 100} \times 100 t/m^3$ 

w %

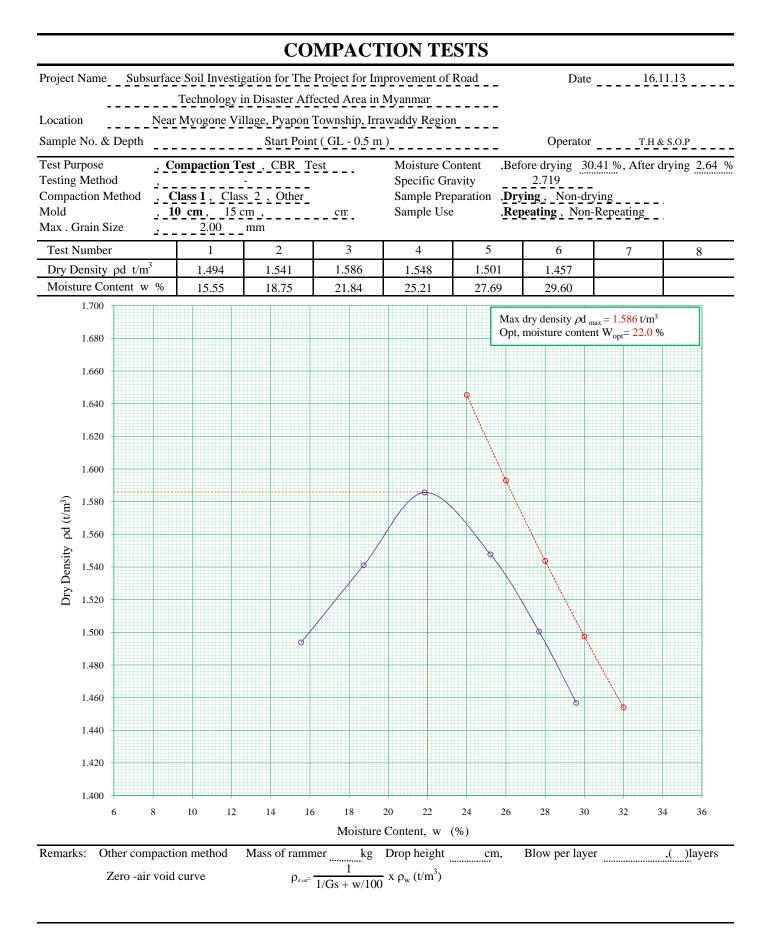
 $t\,/\,m^3$ 

W <u>27.73</u>%

27.69

1.501

W ....%



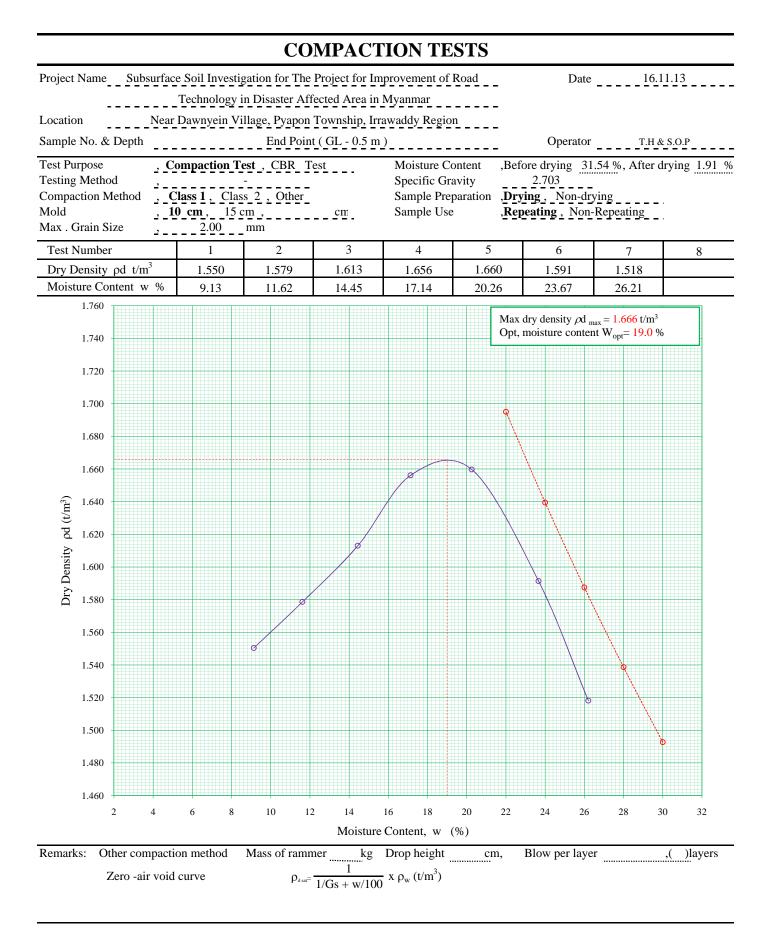
## **COMPACTION TESTS**

	001	MIACHON IE	515	
Project Name Subs	surface Soil Investigation fo Technology in Disaste	r The Project for Improvem er Affected Area in Myanma		16.11.13
Location	Near Dawnyein Village, Py	apon Township, Irrawaddy	Region	
	End Po			T.H & S.O.P
Test Purpose :	Compaction Test , CBR	Test	Testing Method:	
Compaction Method :	Class 1, Class 2, Other		Preparation : Dr	ied, Non - dried
Moisture Content :	Before dried 31.54 %	After dried 1.91 %	Sample Use : Re	peating Non - repeating
	No_1_Mass: (Mo			2.102 kg
		<b>00 cm<sup>3</sup></b> , 15 cm Mold 2209		
Test Number	1	2	3	4
Mass ( sample+mold ) kg	3.794	3.864	3.948	4.042
Mass of specimen kg	1.692	1.762	1.846	1.940
Bulk density $\rho$ t t/m <sup>3</sup>	1.692	1.762	1.846	1.940
Moisture Content	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
Mean value w %	9.13	11.62	14.45	17.14
Dry density $\rho d = t/m^3$	1.550	1.579	1.613	1.656
	1	1	1	
Test Number	5	6	7	8
Mass ( sample+mold ) kg	4.098	4.070	4.018	
Mass of specimen kg	1.996	1.968	1.916	
Bulk density $\rho$ t t/m <sup>3</sup>	1.996	1.968	1.916	
Moisture Content	$\begin{array}{c cccc} & & No. & V-75 \\ \hline m_a & 80.97 & m_b & 68.24 \\ m_b & 68.24 & m_c & 5.57 \\ m_w & 12.73 & m_s & 62.67 \\ \hline & W & 20.31 & \% \end{array}$	$\begin{array}{c cccc} & & No. & V-1 \\ m_a & 89.40 & m_b & 73.48 \\ m_b & 73.48 & m_c & 6.08 \\ m_w & 15.92 & m_s & 67.40 \\ & W & 23.62 & \% \end{array}$	$\begin{array}{ccccccccc} & & & & No. & V-24 \\ m_a & 107.76 & m_b & 86.52 \\ m_b & 86.52 & m_c & 5.56 \\ m_w & 21.24 & m_s & 80.96 \\ & & & & & & & & \\ & & & & & & & & & $	No. m <sub>a</sub> m <sub>b</sub> m <sub>c</sub> m <sub>w</sub> m <sub>s</sub> %
	$\begin{array}{c ccccc} & No. & 211 \\ m_a & 80.66 & m_b & 68.63 \\ m_b & 68.63 & m_c & 9.07 \\ m_w & 12.03 & m_s & 59.56 \\ \hline W & 20.20 & \% \end{array}$	$\begin{array}{c ccccc} & No. & V-3 \\ m_a & 94.77 & m_b & 77.82 \\ m_b & 77.82 & m_c & 6.36 \\ m_w & 16.95 & m_s & 71.46 \\ \hline W & 23.72 & \% \end{array}$	$\begin{array}{c cccccc} & No. & V-44 \\ m_a & 106.82 & m_b & 85.91 \\ m_b & 85.91 & m_c & 6.03 \\ m_w & 20.91 & m_s & 79.88 \\ & W & 26.18 & \% \end{array}$	No. m <sub>a</sub> m <sub>b</sub> m <sub>b</sub> m <sub>c</sub> m <sub>w</sub> m <sub>s</sub> %
Mean value w %	20.26	23.67	26.21	
Dry density $\rho$ d t / m <sup>3</sup>	1.660	1.591	1.518	
Remarks :				

 $\frac{\text{Dry density } \rho \text{ d}}{\text{Remarks}}$ 

1 Other Compaction Method Mass of rammer \_\_\_\_Kg, Drop height \_\_\_\_cm, Blows per layer( \_\_\_\_\_)Layers

2 Dry Density  $\rho_{d} = \frac{\rho t}{w + 100} \times 100 t/m^{3}$ 



# **APPENDIX "C"**

# LABORATORY TEST RESULTS

Borehole No. BH-01			Location : Dawnyein-Amar road, Pyapon Township, Ayeyarwaddy Division								
Sample No. Depth (m) Moisture Content				P-1	T-1	T <b>-</b> 2	T-3	P-9			
				1.00	3.00	6.00 ~	9.00 ~	12.00			
			%	1.50 43.45	3.80 48.89	6.50 44.40	9.80 55.45	12.50 48.23			
Bulk Density		w ρ <sub>t</sub>	g/cm <sup>3</sup>	_	1.738	1.758	1.703	-			
	Liquid Limit	WL	%	69.50	48.27	36.10	59.80	50.07			
Atterberg's	Plastic Limit	WP	%	26.86	30.36	23.52	23.98	22.23			
Limit	Plasticity Index	IP	%	42.64	17.91	12.58	35.82	27.84			
	-	IP		42.04	17.91	12.38	33.82	27.84			
Grain	Gravel, (76.20 ~ 4.75) mm		%	-	-	-	-	-			
Size	Sand, (4.75 ~ 0.075) mm		%	0.25	16.90	2.04	1.05	1.85			
Analysis	Silt, (0.075 ~ 0.005) mm	%		57.35	58.80	76.26	48.95	58.45			
Clay, (< 0.005 mm)		%		42.40	24.30	21.70	50.00	39.70			
Specific Gravity of Soil		Gs (20°C	C)	2.776	2.736	2.741	2.748	2.742			
	Unconfined Compressive	q <sub>u</sub>	kgf/cm <sup>2</sup>	-	0.315	0.373	0.501	-			
Unconfined Compression	Strength			-	0.374	0.387	0.481	-			
	Failure Strain	ε <sub>f</sub>	%	-	4.54	6.27	5.14	-			
	i unulo Strum			-	4.78	7.61	4.57	-			
Direct Shear Test	Cohesion	C <sub>UU</sub>	kgf/cm <sup>2</sup>	-	0.352	-	0.064	-			
	Phi Angle	$\phi_{UU}$	Degree	-	16.96	-	35.75	-			
Unconsolidated Undrained Triaxial	Cohesion	C <sub>UU</sub>	kgf/cm <sup>2</sup>	-	-	-	-	-			
Compression Test	Phi Angle	$\phi_{UU}$	Degree	-	-	-	-	-			
Consolidated	Cohesion	C'	kgf/cm <sup>2</sup>	-	-	-	-	-			
Undrained Triaxial Compression Test	Phi Angle	φ'	Degree	-	-	-	-	-			
(Measurement of	Cohesion	С	kgf/cm <sup>2</sup>	-	-	-	-	-			
Pore Pressure)	Phi Angle	¢	Degree	-	-	-	-	-			
	Initial Void Ratio	e <sub>0</sub>		-	1.560	1.340	1.320	-			
Consolidation	Conso. Yield Stress	$P_y$	kgf/cm <sup>2</sup>	-	1.134	0.385	2.596	-			
	Compression Index	C <sub>c</sub>		-	0.640	0.310	0.345	-			
Soil Classification ( ASTM D 2487 - 06 )		Group Symbol Group Name		СН	ML	CL (or) ML	СН	СН			
				Fat clay	Silt with sand	Lean clay (or) Elastic silt	Fat clay	Fat clay			
NOTE											

Bulk Density $\rho_{+}$ g/cm <sup>3</sup> -         - <th colspan="3">Borehole No. BH-01</th> <th colspan="8">Location : Dawnyein-Amar road, Pyapon Township, Ayeyarwaddy Division</th>	Borehole No. BH-01			Location : Dawnyein-Amar road, Pyapon Township, Ayeyarwaddy Division							
Depth (m) $\sim$ <		Sample No.			P-13	P-18	P-23	P-26			
Initial Strength         Initial Strength <thinitial strength<="" th=""> <thinitial <="" strength<="" td=""><td colspan="4"></td><td>16.00</td><td>21.00</td><td>26.00</td><td>29.00</td><td></td></thinitial></thinitial>					16.00	21.00	26.00	29.00			
Moisture Content         w         %         37.52         49.99         30.79         41.01           Muk Density $\rho_1$ g/cm <sup>3</sup> -         -		Depth (m)				~			~		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $					16.50	21.50	26.50	29.50			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Moisture Content		W	%	37.52	49.99	30.79	41.01			
	Bulk Density		$\rho_t$	g/cm <sup>3</sup>	-	-	-	-			
Limit         WP         %         19.53         23.68         18.94         21.00           Plasticity Index         IP         %         23.77         38.76         16.78         28.07           Grain         Gravel, (76.20 ~ 4.75) mm         %         -         -         -         -           Size         Sand, (4.75 ~ 0.075) mm         %         18.88         1.98         51.32         13.38           Analysis         Silt, (0.075 ~ 0.005) mm         %         52.13         48.73         30.58         52.63           Clay, (< 0.005 mm)	Atterberg's	Liquid Limit	WL	%	43.30	62.44	35.72	49.07			
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	-	Plastic Limit	WP	%	19.53	23.68	18.94	21.00			
	Linit	Plasticity Index	IP	%	23.77	38.76	16.78	28.07			
	Grain	Gravel, (76.20 ~ 4.75) mm		%	-	-	-	-			
Size       Number of the second				%	18.88	1.98	51.32	13.38			
Allarysis         <					52.13	48.73					
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Analysis										
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $											
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			GS (20 C	.)	2.742	2.139	2.745	2.133			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Unconfined		$q_{u}$	kgf/cm <sup>2</sup>	-	- -	-	-			
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$					-	-	-	-			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		Failure Strain	$\epsilon_{\rm f}$	%	-	-	-	-			
Phi Angle $\phi_{UU}$ DegreeUnconsolidated Undrained Triaxia Compression TestCohesion $C_{UU}$ $kgf/cm^2$	Direct Sheer Test	Cohesion	C <sub>UU</sub>	kgf/cm <sup>2</sup>	-	-	-	-			
Undrained Triaxia Compression TestConestionCould kg/remPhi Angle $\phi_{UU}$ DegreeConsolidated Undrained Triaxia Compression Test (Measurement of Pore Pressure)CohesionC'kgf/cm² <t< td=""><td>Jirect Shear Test</td><td>Phi Angle</td><td>φ<sub>UU</sub></td><td>Degree</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></t<>	Jirect Shear Test	Phi Angle	φ <sub>UU</sub>	Degree	-	-	-	-			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		Cohesion	C <sub>UU</sub>	kgf/cm <sup>2</sup>	-	-	-	-			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Compression Test	Phi Angle	φ <sub>UU</sub>		-	-	-	-			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			C'	kgf/cm <sup>2</sup>	-	-	-	-			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Undrained Triaxial	Phi Angle	φ'			-	-	-			
Pore Pressure)Phi Angle $\phi$ DegreeInitial Void Ratio $e_0$ ConsolidationConso. Yield Stress $P_y$ kgf/cm²Compression Index $C_c$		Cohesion	С	kgf/cm <sup>2</sup>	-	-	-	-			
Consolidation       Consol. Yield Stress       Py kgf/cm <sup>2</sup> -       -       -       -         Compression Index       C <sub>c</sub> -       -       -       -       -       -	Pore Pressure)	Phi Angle	<u> </u>			<u> </u>			<u> </u>		
Compression Index     C <sub>c</sub> -     -     -		Initial Void Ratio	e <sub>0</sub>		-	-	-	-			
			$\mathbf{P}_{\mathbf{y}}$	kgf/cm <sup>2</sup>	-	-	-	-			
Group Symbol CL CH SC CL			C <sub>c</sub>		-	-	-	-			
			Group Symbol		CL	СН	SC	CL			
Soil Classification (ASTM D 2487 - 06)       Group Name       Lean clay with sand       Fat clay       Clayey sand       Lean clay			Group Name			Fat clay	Clayey sand	Lean clay			

Borehole No.	Location : Dawnyein-Amar road, Pyapon Township, Ayeyarwaddy Division							
			P-1	T-1	T-2	T-3	P-10	
				1.00	3.00	6.00	9.00	13.00
	Depth (m)			~	~	~	~	~
			1.50	3.80	6.64	9.80	13.50	
Moisture Content			%	43.07	54.59	54.39	60.57	41.47
Bulk Density		ρ <sub>t</sub>	g/cm <sup>3</sup>	-	1.677	1.708	1.587	-
Atterberg's	Liquid Limit	WL g	%	68.28	65.70	68.20	75.34	45.30
Limit	Plastic Limit	WP g	%	25.65	27.53	26.90	39.11	22.35
	Plasticity Index	IP g	%	42.63	38.17	41.30	36.23	22.95
Grain	Gravel, (76.20 ~ 4.75) mm	Q	%	-	-	-	-	-
Size	Sand, (4.75 ~ 0.075) mm	C	%	0.72	1.53	0.92	1.95	6.85
	Silt, (0.075 ~ 0.005) mm	%		60.58	54.68	53.08	58.45	62.05
Analysis	Clay, (< 0.005 mm)	%		38.70	43.80	46.00	39.60	31.10
Specific Gravity of Soil		Gs (20°C)		2.806	2.747	2.756	2.639	2.748
Unconfined Compressive		33 (20 C)		-	0.350	0.508	0.669	-
Unconfined Compression	Strength	$q_u$	kgf/cm <sup>2</sup>	-	0.309	0.484	0.627	-
				-	6.79	3.69	8.40	_
	Failure Strain	ε <sub>f</sub> %		-	9.01	3.71	5.98	-
	Cohesion	C <sub>UU</sub>	kgf/cm <sup>2</sup>	-	0.119	-	0.202	-
Direct Shear Test	Phi Angle	φ <sub>UU</sub>	Degree	-	12.24	-	8.53	-
Unconsolidated	Cohesion	C <sub>UU</sub>	kgf/cm <sup>2</sup>	-	-	-	-	-
Undrained Triaxial Compression Test	Phi Angle	φυυ	Degree	-	-	-	-	-
	Cohesion		kgf/cm <sup>2</sup>	-	-	-	-	-
<b>Undrained Triaxial</b>	Phi Angle	φ'	Degree	-	-	-	-	-
Compression Test ( Measurement of	Cohesion	C	kgf/cm <sup>2</sup>	-	-	-	-	-
Pore Pressure)	Phi Angle	¢	Degree	-	-	-	-	-
	Initial Void Ratio	e <sub>0</sub>		-	1.810	1.510	1.520	-
Consolidation	Conso. Yield Stress	Py	kgf/cm <sup>2</sup>	-	0.600	2.279	1.050	-
	Compression Index	C <sub>c</sub>		-	0.745	0.459	0.566	-
Soil Classification ( ASTM D 2487 - 06 )		Group Symbol Group Name		СН	СН	СН	МН	CL
				Fat clay	Fat clay	Fat clay	Elastic silt	Lean clay
NOTE								

Borehole No. BH-02			Location : Dawnyein-Amar road, Pyapon Township, Ayeyarwaddy Division							
	Sample No.			P-13	P-13 P-16 P-20 P-25					
		16.00	19.00	23.00	28.00					
	Depth (m)			~	~	~	~	~		
				16.50	19.50	23.50	28.50	<u> </u>		
Moisture Content			%	43.40	34.13	36.60	40.98			
Bulk Density		$\rho_{t}$	g/cm <sup>3</sup>	-	-	-	-			
Atterberg's	Liquid Limit	WL	%	50.78	32.18	48.20	57.92			
Limit	Plastic Limit	WP	%	22.53	22.28	21.33	24.28			
	Plasticity Index	IP	%	28.25	9.90	26.87	33.64			
Grain	Gravel, (76.20 ~ 4.75) mm		%	-	-	-	-	<u> </u>		
Size	Sand, (4.75 ~ 0.075) mm		%	10.75	35.54	19.48	10.18			
Analysis	Silt, (0.075 ~ 0.005) mm	%		57.45	52.06	48.43	58.73	<u> </u>		
Allalysis	Clay, (< 0.005 mm)	%		31.80	12.40	32.10	31.10			
		Gs (20°C)		2.760	2.726	2.747	2.763	<u> </u>		
Unconfined Compressive			- /	-	-	-	-	<u>I</u>		
Unconfined	Strength	$q_u$	kgf/cm <sup>2</sup>	-	-	-	-			
Compression	Failure Strain	C .	%	-	-	-	-			
	Fanure Strain	ε <sub>f</sub>		-	-	-	-			
Cohesion		C <sub>UU</sub>	kgf/cm <sup>2</sup>	-	-	-	-			
	Phi Angle	$\phi_{UU}$	Degree	-	-	-	-			
Unconsolidated Jndrained Triaxial	Cohesion	C <sub>UU</sub>	kgf/cm <sup>2</sup>	-	-	-	-			
Compression Test	Phi Angle	$\phi_{\rm UU}$	Degree	-	-	-	-			
	Cohesion	C'	kgf/cm <sup>2</sup>	-	-	-	-			
Jndrained Triaxial	Phi Angle	φ'	Degree	-	-	-	-			
Compression Test ( Measurement of	Cohesion	С	kgf/cm <sup>2</sup>	-	-	-	-			
Pore Pressure)	Phi Angle	¢	Degree	-	-	-	-			
	Initial Void Ratio	e <sub>0</sub>		-	-	-	-	Í		
Consolidation Conso. Yield Stress		Py	kgf/cm <sup>2</sup>	-	-	-	-	1		
Compression Index		C <sub>c</sub>	<u> </u>	-	-	-	-			
Soil Classification ( ASTM D 2487 - 06 )		Group Symbol Group Name		СН	CL	CL	СН			
				Fat clay	Sandy lean clay	Lean clay with sand	Fat clay			

# Detailed Test Results SEE IN ATTACHED CD

## **APPENDIX "D"**

# WATER QUALITY TEST RESULTS





B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd), Consultant (Y.C.D.C), LWSE 001 Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar) W1113 228 WTL-RE-001 Issue Date - 01-12-2012

Effective Date - 01-12-2012 Issue No - 1.0/Page 1 of 1

#### WATER QUALITY TEST RESULTS FORM

Saramayri - Fuji Construction Co.,Ltd.
BH - 02 (Soil Investigation For Road Improvement)
Dawnyein - Amar Road, Pyapon Township, Ayeyarwaddy Region
20.11.2013
21.11.2013
22.11.2013

#### **Results of Water Analysis**

# WHO Drinking Water Guideline

10	er	<u>ie</u>	/d	-	1993)
				_	

Phosphate		mg/l	
рН	8.2		6.5 - 8.5
Colour (True)	180	TCU	15 TCU
Turbidity	528	NTU	5 NTU
Conductivity	39700	micro S/cm	51110
Total Hardness	5200	mg/l as CaCO <sub>3</sub>	500 mg/l as CaCO <sub>3</sub>
Total Alkalinity	940	mg/l as CaCO <sub>3</sub>	
Phenolphthalein Alkalinity	Nil	mg/l as CaCO <sub>3</sub>	
Calcium Hardness	3466	mg/l as CaCO <sub>3</sub>	
Iron	12.80	mg/l	0.3 mg/l
Magnesium Hardness	1734	mg/l as CaCO <sub>3</sub>	0.0 mg/
Manganese		mg/l	0.05 mg/l
Carbonate (CaCO <sub>3</sub> )	Nil	mg/l as CaCO <sub>3</sub>	0.03 mg/l
Chloride (as CL)	13200	mg/l	250 mg/l
Sodium chloride (as NaCL)	21780	mg/l	230 mg/i
Bicarbonate (HCO <sub>3</sub> )	940	mg/l as CaCO <sub>3</sub>	
Sulphate (as SO <sub>4</sub> )	680	mg/l	200 mg/l
Total Solids	25185	mg/l	1500 mg/l
Suspended Solids	885	mg/l	1500 mg/
Dissolved Solids	24300	mg/l	1000 mg/l
Phenolphthalein Acidity		mg/l	
Nethyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by Signature: Name: Ame: Signature: Signature: Signature: <u>Aww Hein Oo</u> <u>B.Sc (Chemistry)</u> Chemist (a division of WEG Co.,Ltd.) ISO TECH Laboratory

Approved by Signature: Name:



No.18, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar. Ph: 01-640955, 09-73225175, 09-73242162, Fax: 01-644506, E-mail: isotechlaboratory@gmail.com, Website: weg-myanAppc31





WTL-RE-001

B Sc Engg: (Civil), Dip S E (Delft) Lecturer of YIT (Retd), Consultant (Y.C.D.C), LWSE 001 Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar) W1113 227

Issue Date - 01-12-2012 Effective Date - 01-12-2012 Issue No - 1.0/Page 1 of 1

#### WATER QUALITY TEST RESULTS FORM

Client	Saramayri - Fuji Construction Co.,Ltd.
Nature of Water	BH - 01 (Soil Investigation For Road Improvement)
Location	Dawnyein - Amar Road, Pyapon Township, Ayeyarwaddy Region
Date and Time of collection	
Date and Time of arrival at Laboratory	20.11.2013
Date and Time of commencing examination	21.11.2013
Date and Time of completing	22.11.2013

#### **Results of Water Analysis**

#### WHO Drinking Water Guideline (Geneva - 1993)

Phosphate		mg/l	
рН	6.8		6.5 - 8.5
Colour (True)	120	TCU	15 TCU
Turbidity	480	NTU	5 NTU
Conductivity	39400	micro S/cm	
Total Hardness	3100	mg/l as CaCO <sub>3</sub>	500 mg/l as CaCO <sub>3</sub>
Total Alkalinity	920	mg/I as CaCO <sub>3</sub>	
Phenolphthalein Alkalinity	Nil	mg/l as CaCO <sub>3</sub>	
Calcium Hardness	2066	mg/l as CaCO <sub>3</sub>	
Iron	10.20	mg/l	0.3 mg/l
Magnesium Hardness	1034	mg/I as CaCO <sub>3</sub>	
Manganese		mg/l	0.05 mg/l
Carbonate (CaCO <sub>3</sub> )	Nil	mg/l as CaCO <sub>3</sub>	
Chloride (as CL)	13900	mg/l	250 mg/l
Sodium chloride (as NaCL)	22935	mg/l	
Bicarbonate (HCO3)	920	mg/l as CaCO <sub>3</sub>	
Sulphate (as SO <sub>4</sub> )	650	mg/l	200 mg/l
Total Solids	24920	mg/l	1500 mg/l
Suspended Solids	720	mg/l	
Dissolved Solids	24200	mg/l	1000 mg/l
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity		ppt	

Remark: This certificate is issued only for the receipt of the test sample.

**Tested** by

Signature: Zaw Hein Uo B.Sc (Chemistry) Name: Chemist (a division of WEG Co.,Ltd.) ISO TECH Laboratory

Approved by Signature: Name:

Win Myig B.E (Civil) 1980. M.MES **Technical Officer ISO TECH Laboratory** 

No.18, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar. Ph: 01-640955, 09-73225175, 09-73242162, Fax: 01-644506, E-mail: isotechlaboratory@gmail.com, Website: weg-myaAppr 32m

## **APPENDIX "E"**

## **DAILY RECORDS FOR BORING WORKS**

BORE	HOLE	E No. B	H-01					<u>B</u>	ORING	LOG R	RECORD				Job No Sheet N	
Project Na	ame	: Soil In	vestigatio	on for R	oad Improvement Project			Boring	, Equipm	nent	: TOHO -"D1"				Date	26.10.13
Location					yapon Township, Ayeyarwaddy R	legion			g Method		: Rotary (Direct Circulation)	_				
Ground Le	evel	: 99.917						Orient			: Vertical	_	Client			
Coordinat	e	:E 7773	313.000;	N 1763	141.000		•	Groun	d Water	Level	: 1.00m	_		ODIEN	TAL CO	DNSULTANT
Method for	or SPT	: ASTM	[					Casing	g Diamet	er	: Ø115mm			OKIEN	IAL CO	JNSULIANI
	-															
Date	Ca	asing	Total	Depth						Se	bil Sample	Stand	dard Pen	etration	Гest	
&		т (1	Casing		Description of Drilling Work				T ( 1	т (1		Blows	Blows	Blows		Remarks
Time	No.	Length		Casing	Description of Drining Work	Depth (m)	Туре	No.	Total Blows	Length	Soil Description	per	per	per	N Value	rtomarko
1		(m)	(m)	(m)					DIOWS	(m)		15 cm	15 cm	15 cm	value	
26.10.13																
7:00	-	-	-	-	Arrived at site and Preparation											
7:10					Move machine from BH-02 to											
					BH-01											
9:30	1	1	1		Install casing Ø-115mm	0.0 ~ 1.0										
9:40	1	1	1	1	Drilling with TC bit	$0.0 \sim 1.0$										
					-		CDT	D 1	2	0.41		0	1	1	2/20	
9:50					SPT at GL- 1.0 m	1.0 ~ 1.5	SPT	P-1	2	0.41	CLAY, with trace of decayed wood fragments,	0	1	1	2/30	
											mottled brown and gray, moist, medium					
											plasticity, soft (Filled materials)					
9:55	1	1	2	2	Install casing Ø-115mm	$1.0 \sim 2.0$										
10:00					Drilling with TC bit	1.0 ~ 2.0										
10:10					SPT at GL- 2.0 m	2.0~2.5	SPT	P-2	1	0.43	Silty CLAY, with trace of organic matter, gray,	0	1	0	1/30	
											wet, low to medium plasticity, very soft					
											Final Provide State Provide State St					
10:15	1	1	3	3	Install casing Ø-115mm	2.0 ~ 3.0										
	1	1	3		-											
10:25					Drilling with TC bit	2.0 ~ 3.0										
10:30					UD at GL- 3.0 m	3.0 ~ 3.8	UD	T-1	-	-	Recovery ratio = 80/80cm	-	-	-	-	
			Date	Depth	Depth Depth Note										^	•
			&	of	of of Undisturbed Sa	mple (UD -	T : Thi	n wall s	sampler,	D : Den	ison sampler)					
Cro	und Wo	tor	Time	Casing	BH Water Standard Penet	ration Test S	Sample	(SPT :	P)					/		A survey and
	und Wa servatic		26.10.13	GL-	GL- GL- Water Sample (	(W)									3	
	sei vatit		7:00	-												
			26.10.13	1	GL- GL-										<b>F</b> 6	
			18:00	3.0m	20.0m 1.8m								Sara	mayri -	Fuji Co	nstruction Co., Ltd.

BORE I	IOLE	No. B	H-01					B	ORING	LOG R	ECORD				Job No Sheet No	
Project Na	me	: Soil In	vestigatio	on for R	oad Improvement Project			Boring	g Equipm	ent	: TOHO -"D1"				Date	26.10.13
Location		: Dawny	ein-Ama	ır road, I	yapon Township, Ayeyarwaddy F	Region		-	g Method		: Rotary (Direct Circulation)	-				
Ground Le	vel	: 99.917						Orient			: Vertical		<u>Client</u>			
Coordinate			313.000;	N 1763	141.000		-	Groun	d Water		: 1.00m	_		ORIEN	TAL CO	NSULTANT
Method fo	r SPT	: ASTM	[				-	Casing	g Diamet	er	: Ø115mm	_		UNILI	IALCO	
						1										
Date	Ca	sing	Total	Depth						Sc	bil Sample	Stand	dard Pene	etration	Гest	
&		Lanath	Casing		Description of Drilling Work				Tatal	Lanath		Blows	Blows	Blows	N	Remarks
Time	No.	Length (m)	Length		2 comption of 2 mining (1 offi	Depth (m)	Туре	No.	Total Blows	Length (m)	Soil Description	per	per	per	Value	
		(III)	(m)	(m)					DIOWS	(III)		15 cm	15 cm	15 cm	value	
26.10.13																
10:40	-	_	3	3	Drilling with TC bit	3.0~4.0						-				
10:45					SPT at GL- 4.0 m	$4.0 \sim 4.5$	SPT	P-3	1	0.42	Silty CLAY, with trace of organic matter, gray,	0	1	0/30	1/45	
											wet, low to medium plasticity, very soft					
10:50		<u> </u>	3	3	Drilling with TC bit	4.0 ~ 5.0										
11:00		-	5	5	SPT at GL- 5.0 m	$5.0 \sim 5.5$	SPT	P-4	1	0.42	Cilta CI AV with trace of encode method and	0	1	0	1/30	
11.00					SFT at GL- 5.0 III	3.0~3.5	SPT	P-4	1	0.43	Silty CLAY, with trace of organic matter, gray,	0	1	0	1/30	
											wet, low to medium plasticity, very soft	_				
11:10	-	-	3	3	Drilling with TC bit	5.0~6.0						_				
11:20					UD at GL- 6.0 m	6.0 ~ 6.8	UD	T-1	-	-	Recovery ratio = $50/80$ cm	-	-	-	-	
11:30	-	-	3	3	Drilling with TC bit	6.0 ~ 7.0										
11:45					SPT at GL- 7.0 m	7.0 ~ 7.5	SPT	P-5	0	0.44	Silty CLAY, with trace of organic matter, gray,	0	0	0	0/45	
											wet, low to medium plasticity, trace of fine					
											sand and mica, very soft	-				
											sund und mod, vory sore					
11:50			3	2	Drilling with TC bit	7.0~8.0										
	-	-	3	3		$7.0 \sim 8.0$ $8.0 \sim 8.5$	CDT	D	3	0.42		0	1	2	2/20	
12:00					SPT at GL- 8.0 m	8.0~8.5	SPT	P-0	3		Silty CLAY, with trace of fine sand and mica,	0	1	2	3/30	
											gray, low to medium plasticity, moist, soft					
12:15	-	-	-	-	Lunch break											
			Date	Depth	Depth Depth Note										$\wedge$	
			&	of	of of Undisturbed Sa	ample (UD -	T : Thi	n wall :	sampler,	D : Deni	son sampler)					
Grou	ınd Wa	ter		Casing	BH Water Standard Penet		Sample	(SPT:	P)							Andthan
	servatio		26.10.13	GL-	GL- GL- Water Sample	(W)										
00.	, , uti0		7:00	-	 -											
			26.10.13		GL- GL-								G		E C	
			18:00	3.0m	20.0m 1.8m								Sara	mayrı -	r uji Con	struction Co., Ltd.

BORE I	HOLE	E No. B	H-01		n for Road Improvement Project Boring Equipment : TOHO - "D1"										Job N Sheet N	
Project Na	ime	: Soil In	vestigatio	on for R	oad Improvement Project		_	Boring	, Equipm	ent	: TOHO -"D1"				Date	26.10.13
Location				ır road, I	yapon Township, Ayeyarwaddy H	Region			g Method		: Rotary (Direct Circulation)	_				
Ground Le		: 99.917					-	Orient			: Vertical	_	<u>Client</u>			
Coordinat			313.000;	N 1763	141.000		-		d Water I		: 1.00m	_		ORIEN	NTAL C	ONSULTANT
Method fo	r SPT	: ASTM	[				-	Casing	, Diamet	er	:Ø115mm	_		ond		
	~					<u> </u>				~		-				
Date	Ca	ising		Depth			•			Sc	pil Sample	Stand	dard Pen	etration '	Гest	
&		Length	Casing		Description of Drilling Work				Total	Length		Blows	Blows	Blows	N	Remarks
Time	No.	(m)	-	Casing		Depth (m)	Туре	No.	Blows	(m)	Soil Description	per	per	per	Value	
		· · ·	(m)	(m)		ļ				. ,		15 cm	15 cm	15 cm		
26.10.13																
13:00	-	-	3		Drilling with TC bit	8.0~9.0										
13:15					UD at GL- 9.0 m	9.0~9.8	UD	T-3	-	-	Recovery ratio = 80/80cm	-	-	-	-	
13:30	-	-	3	3	Drilling with TC bit	8.0 ~ 9.0										
13:45					SPT at GL- 10.0 m	10.0~10.5	SPT	P-7	1	0.34	Silty CLAY, with trace of fine sand and mica,	0	0	1	1/30	
											gray, low to medium plasticity, moist, very soft					
13:50	-	-	3	3	Drilling with TC bit	10.0~11.0										
14:00			5	-	SPT at GL- 11.0 m	11.0~11.5	SPT	P-8	2	0.41	Silty CLAY, with trace of fine sand and mica,	0	1	1	2/30	
14.00						11.0 11.5	511	1 0	2	0.41	gray, low to medium plasticity, moist, soft	0	1	1	2/30	
14.10			2	2	Deillie a suide TC bit	11.0.12.0					gray, low to medium plasticity, moist, soft					
14:10	-	-	3		Drilling with TC bit	11.0~12.0	ODT	D O	1	0.42		0	1	0	1/20	
14:25					SPT at GL- 12.0 m	12.0~12.5	SPT	P-9	1	0.42	Silty CLAY, with trace of fine sand and mica,	0	1	0	1/30	
											gray, low to medium plasticity, moist, very soft					
14:35	-	-	3		Drilling with TC bit	12.0~13.0										
14:45					SPT at GL- 13.0 m	13.0~13.5	SPT	P-10	1	0.44	Silty CLAY, with trace of fine sand and mica,	0	1	0	1/30	
											gray, low to medium plasticity, moist, very soft					
14:50	-	-	3	3	Drilling with TC bit	13.0~14.0										
15:00					SPT at GL- 14.0 m	14.0~14.5	SPT	P-11	1	0.43	Silty CLAY, with trace of fine sand and mica,	0	1	0	1/30	
											gray, low to medium plasticity, moist, very soft					
15:10	-	-	3	3	Drilling with TC bit	14.0~15.0										
15:30					SPT at GL- 15.0 m	15.0~15.5	SPT	P-12	1	0.40	Silty CLAY, with trace of fine sand and mica,	0	1	0	1/30	
											gray, low to medium plasticity, moist, very soft					
	und Wa servatio	on	Date & Time 26.10.13 7:00 26.10.13 18:00	-	DepthDepthNoteofofUndisturbed SaBHWaterStandard PenetGL-GL-Water SampleGL-GL-20.0m1.8m	ration Test S			1 /	D : Deni	ison sampler)	I	Sara	mavri -	Fuji Co	nstruction Co., Ltd.

BORE HOLE No. BH-01         Project Name       : Soil Investigation for Road Improvement Project								B	ORING	LOG R	ECORD				Job No Sheet N	
Project Na	ame	: Soil In	vestigatio	on for R	oad Improvement Project			Boring	, Equipm	ent	: TOHO -"D1"				Date	26.10.13
Location					Pyapon Township, Ayeyarwac	dy Region	-	-	Method		: Rotary (Direct Circulation)	_			<i>Buie</i> –	
Ground Le	evel	: 99.917		,	51 17 55	, ,	-	Orient			: Vertical	-	Client			
Coordinat	e	:E 7773	313.000;	N 1763	141.000		-		d Water 1	Level	: 1.00m	-		ODIEL		
Method fo	or SPT	: ASTM	[				-	Casing	, Diamet	er	:Ø115mm	-		OKIEN	TAL CO	NSULTANT
Date	Ca	sing	Total	Depth						Se	bil Sample	Stand	dard Pen	etration 7	Гest	
&		Length	Casing	of	Description of Drilling Wo	rk			Total	Length		Blows	Blows	Blows	N	Remarks
Time	No.	(m)	Length	Casing	1 0	Depth (m)	Туре	No.	Blows	(m)	Soil Description	per	per	per	Value	
		(III)	(m)	(m)					DIOWS	(III)		15 cm	15 cm	15 cm	vuide	
26.10.13																
15:40	-	-	3	3	Drilling with TC bit	15.0~16.0										
16:00					SPT at GL- 16.0 m	16.0~16.5	SPT	P-13	2	0.39	Silty CLAY, with trace of fine sand and mica,	0	1	1	2/30	
											gray, low to medium plasticity, moist, soft					
16:10	-	-	3	3	Drilling with TC bit	16.0~17.0										
16:30					SPT at GL- 17.0 m	17.0~17.5	SPT	P-14	1	0.42	Silty CLAY, with trace of fine sand and mica,	0	1	0	1/30	
							~				gray, low to medium plasticity, moist, very soft		-	-	-,	
16:40			3	3	Drilling with TC bit	17.0~18.0					gray, low to median plasticity, moist, very soft					
	-	-	5	5	SPT at GL- 18.0 m		SPT	P-15	2	0.44	Silter CLAN with trace of fine could and mice	0	1	1	2/20	
16:50					SP1 at GL- 18.0 m	18.0~18.5	SPT	P-15	Z	0.44	Silty CLAY, with trace of fine sand and mica,	0	1	1	2/30	
											gray, low to medium plasticity, moist, soft					
17:10	-	-	3	3	Drilling with TC bit	18.0~19.0										
17:30					SPT at GL- 19.0 m	19.0~19.5	SPT	P-16	6	0.41	Silty CLAY, with trace of fine sand and mica,	2	2	2	4/30	
											gray, low to medium plasticity, moist, soft					
17:40	-	-	3	3	Drilling with TC bit	19.0~20.0										
17:55					SPT at GL- 20.0 m	20.0~20.5	SPT	P-17	2	0.42	Silty CLAY, with trace of fine sand and mica,	0	1	1	2/30	
											gray, low to medium plasticity, moist, soft					
18:00					Housekeeping and Stop Worl	τ										
					1 0 1											
			Date	Depth				. 11	,		1 \				$\wedge$	
			& Time	of Coging		ed Sample (UD -			- ·	D : Den	(son sampler)			/		
	und Wa		Time 26.10.13	Casing GL-	GL- GL- Water Standard F	enetration Test S	sampie	(511)	r )							
Ob	servatio	n	7:00	- 01		·Pro ( 11 )								-		
			26.10.13		GL- GL-											
			18:00	3.0m	20.0m 1.8m								Sara	mayri -	Fuji Cor	struction Co., Ltd.

BORE I	HOLE	No. B	H-01					B	ORING	LOG R	ECORD				Job N Sheet N	
Project Na	ame				oad Improvement Project Pyapon Township, Ayeyarwaddy I	Danian		-	; Equipm		: TOHO -"D1"	_			Date	27.10.13
Location	1	: 99.917		ir road, i	yapon Township, Ayeyarwaddy I	Region	•	-	Method		: Rotary (Direct Circulation)	_	Clima			
Ground Le Coordinate			m 313.000 ;	N 1762	141.000		-	Orient	ation d Water I	F arra1	: Vertical : 1.00m	_	<u>Client</u>			
Method fo		: ASTM		IN 1703	141.000		•		Diamete		: Ø115mm	_		ORIEN	TAL CO	ONSULTANT
Method 10	0 51 1	. ASTM	L				-	Casing	, Diamen		. 011511111	-				
Date	Ca	sing	Total	Depth						So	bil Sample	Stand	dard Pen	etration 7	Гest	
&		Longth	Casing	of	Description of Drilling Work				Total	Longth		Blows	Blows	Blows	N	Remarks
Time	No.	Length (m)	Length	Casing		Depth (m)	Туре	No.	Blows	Length (m)	Soil Description	per	per	per	Value	
		(III)	(m)	(m)					DIOWS	(III)		15 cm	15 cm	15 cm	value	
27.10.13																
7:30	-	-	-	-	Arrived at site and Preparation											
					1											
8:00	-	-	3	3	Drilling with TC bit	20.0~21.0										
8:20					SPT at GL- 21.0 m	21.0~21.5	SPT	P-18	3	0.41	Silty CLAY, with trace of fine sand and mica,	0	1	2	3/30	
											gray, low to medium plasticity, moist, soft	-				
8:30	_	_	3	3	Drilling with TC bit	21.0~22.0										
8:50			5	5	SPT at GL- 22.0 m	22.0~22.5	SPT	P-19	3	0.20	Silty CLAY, with trace of fine sand and mica,	0	1	2	3/30	
0.30					SF 1 at OL- 22.0 III	22.0~22.3	51 1	F-19	3	0.39	•	0	1	2	3/30	
											gray, low to medium plasticity, moist, soft					
9:00	-	-	3	3	Drilling with TC bit	22.0~23.0										
9:25					SPT at GL- 23.0 m	23.0~23.5	SPT	P-20	3	0.43	Silty CLAY, with trace of fine sand and mica,	0	1	2	3/30	
											gray, low to medium plasticity, moist, soft					
9:35	-	-	3	3	Drilling with TC bit	23.0~24.0										
10:00					SPT at GL- 24.0 m	24.0~24.5	SPT	P-21	3	0.42	Silty CLAY, with trace of fine sand and mica,	1	1	1	2/30	
											gray, low to medium plasticity, moist, soft					
10:10	_	_	3	3	Drilling with TC bit	24.0~25.0										
10:30				2	SPT at GL- 25.0 m	25.0~25.5	SPT	P-22	3	0.42	Silty CLAY, with trace of fine sand and mica,	1	1	1	2/30	
10.50					511 at 61 25.0 m	20.0 20.0	511	1 22	5	0.42	gray, low to medium plasticity, moist, soft	1	1	1	2/30	
10.40			2	2		25.0.26.0					gray, low to medium plasticity, moist, soft					
10:40	-	-	3	3	Drilling with TC bit	25.0~26.0	ODT	D 22							(100	
10:55					SPT at GL- 26.0 m	26.0~26.5	SPT	P-23	9	0.42	Silty CLAY, with trace of fine sand and mica,	3	3	3	6/30	
											gray, low to medium plasticity, moist, firm					
11:05	-	-	3	3	Drilling with TC bit	26.0~27.0										
11:20					SPT at GL- 27.0 m	27.0~27.5	SPT	P-24	5	0.44	Silty CLAY, with trace of fine sand and mica,	1	2	2	4/30	
											gray, low to medium plasticity, moist, soft					
	•	-	Date	Depth	Depth Depth Note	-	•	•							$\wedge$	
			&	of	of of Undisturbed S					D : Deni	son sampler)				And	
Grou	und Wa	ter		Casing	BH Water Standard Pene		Sample	(SPT:	P)							And Market
	servatio		27.10.13		GL- GL- Water Sample	(W)								1		
			7:30	3.0m	21.0m 1.3m									1		
			27.10.13	1	GL- GL-								5	· · · ·	E	
			13:30	3.0m	30.0m 2.0m								Sara	mayrı -	ruji Co	nstruction Co., Ltd.

BORE I	HOLE	No. B	H-01							B	ORING	LOG R	RECORD				Job N Sheet 1	
Project Na	me	· Soil In	vestigati	on for R	oad Impr	ovement I	Project			Poring	g Equipm	ont	: TOHO -"D1"				Date	No. 6 Of 6 27.10.13
Location			0		1		Ayeyarwaddy I	Region	-	-	g Method		: Rotary (Direct Circulation)	_			Date	27.10.15
Ground Le	evel	: 99.917		ii 10 <b>uu</b> , 1	r yupon r	ownship,	riyeyur wuddy i	CC BIOII	-	Orient			: Vertical	_	Client			
Coordinate				N 1763	141.000				-		d Water	[ evel	: 1.00m	_	<u>enem</u>			
Method fo		: ASTM							-		g Diamet		: Ø115mm	_		ORIEN	TAL C	ONSULTANT
									-	· ·				_				
Date	Ca	ising	Total	Depth								Se	oil Sample	Stand	lard Pen	etration 7	Гest	
&		Longth	Casing		Descri	iption of I	Drilling Work				Total	Longth		Blows	Blows	Blows	Ν	Remarks
Time	No.	Length (m)	Length	Casing		I	0	Depth (m)	Туре	No.	Blows	Length (m)	Soil Description	per	per	per	Value	
		(111)	(m)	(m)							DIOWS	(111)		15 cm	15 cm	15 cm	value	
27.10.13																		
11:30	-	-	3	3	Drilling	with TC b	oit	27.0~28.0										
11:40					SPT at G	GL- 28.0 n	n	28.0~28.5	SPT	P-25	1	0.43	Silty CLAY, with trace of fine sand and mica,	1	0	0	1/45	
													gray, low to medium plasticity, moist, very soft					
11:50			3	3	Drilling	with TC b		28.0~29.0					gray, to we to measure prasterty, moise, very sort					
12:05	-	-	5	5	-	GL- 29.0 n		29.0~29.5	SPT	P-26	2	0.45	Silts CLAV with trace of fine and and mice	0	1	1	2/30	
12:05					SPT at C	3L- 29.0 h	n	29.0~29.5	SPT	P-20	Z	0.45	Silty CLAY, with trace of fine sand and mica,	0	1	1	2/30	
													gray, low to medium plasticity, moist, soft	_				
12:15	-	-	3	3	1	with TC b		29.0~30.0										
12:30					SPT at C	GL- 30.0 n	n	30.0~30.5	SPT	P-27	3	0.43	Silty CLAY, with trace of fine sand and mica,	1	1	1	2/30	
													gray, low to medium plasticity, moist, soft					
12:40	-	-	-	_	Lunch br	reak												
														-				
13:30					Mahilina	tion of du	-illing machine							-				
15.50	-	-	-	-	WIODIIIZa		ming machine											
														_				
					BH-01 is	s terminat	ed at 30.00m											
	<u> </u>																	
														1				
														+				
			Data	Donth	Donth	Donth	Noto											
			Date &	Depth of	Depth of	Depth of	Undisturbed Sa	ample (UD -	$T \cdot Th$	n wall	ampler	D · Den	icon campler)				$\wedge$	
				Casing			Standard Penet	- ·			- ·	D. Den	ison sampler)			1		Autor
	und Wa		27.10.13	-	GL-		Water Sample			.~	- )							
Obs	servatio	on	7:30	3.0m		1.3m	F	× /								-		
27.10.13 GL- GL- GL-																		
	13:30 3.0m 30.0m 2.0m													Sara	mayri -	Fuji Co	nstruction Co., Ltd.	

BORE I	HOLE	No. B	H-02					B	ORING	LOG R	ECORD				Job N Sheet N	
Project Na Location		: Dawny	vein-Ama		oad Improvement Project Pyarpon Township, Ayeyarwaddy I	Region			g Equipm g Method		: TOHO -"D1" : Rotary (Direct Circulation)	-			Date	24.10.13
Ground Le		: 99.772						Orient			: Vertical	_	<u>Client</u>			
Coordinate			78.000;	N 1761	613.000				d Water 1		: 0.5 m	_		ORIEN	TAL C	ONSULTANT
Method fo	or SPT	: ASTM						Casing	g Diamet	er	: Ø115mm	_		ond		
Date	Ca	sing	Total	Depth						Sc	bil Sample	Stand	dard Pen	etration	Гest	
&		Longth	Casing		Description of Drilling Work				Total	Longth		Blows	Blows	Blows	N	Remarks
Time	No.	Length (m)	Length	Casing		Depth (m)	Туре	No.	Total Blows	Length (m)	Soil Description	per	per	per	Value	
		(111)	(m)	(m)					DIOWS	(III)		15 cm	15 cm	15 cm	value	
24.10.13																
7:00	-	-	-	-	Transportation the drilling											
					machine from Pyapon											
					Juli 1 Juli											
14:00	1	1	1	1	Install casing Ø115mm	0.0 ~ 1.0										
14:10					Drilling with TC bit	0.0 ~ 1.0										
14:20					SPT at GL- 1.0 m	1.0 ~ 1.5	SPT	P-1	2	0.42	CLAY, with trace of decayed wood fragments,	0	1	1	2/30	
11.20						1.0 1.0	511				mottled brown and gray, moist, medium	Ŭ	1	1	2,50	
											plasticity, soft (Filled materials)					
14:35	1	1	2	2	Install casing Ø115mm	1.0 ~ 2.0										
14:40					Drilling with TC bit	1.0 ~ 2.0										
14:50					SPT at GL- 2.0 m	2.0~2.5	SPT	P-2	0	0.44	Silty CLAY, with trace of organic matter, gray,	0	0	0	0/45	
											wet, low to medium plasticity, very soft					
14:55	1	1	3	3	Install casing Ø115mm	2.0 ~ 3.0										
15:05					Drilling with TC bit	2.0 ~ 3.0										
15:10					UD at GL- 3.0 m	3.0 ~ 3.8	UD	T-1	_	_	Recovery ratio = 80/80cm	_	-	-	_	
15:15	-	-	3	3	Drilling with TC bit	3.0 ~ 4.0										
15:25					SPT at GL- 4.0 m	4.0 ~ 4.5	SPT	P-3	3	0.40	Silty CLAY, with trace of organic matter, gray,	0	1	2	3/30	
											wet, low to medium plasticity, trace of fine sand					
											and mica, soft					
			Date	Depth	Depth Depth Note			1				I			^	
			&	of	of of Undisturbed Sa	mple (UD -	T : Thi	n wall :	sampler,	D : Deni	son sampler)					
	1 ***	,		Casing	BH Water Standard Penetr						L /			1		Autor
	und Wa		24.10.13		GL- GL- Water Sample (											
Ob	servatio		7:30	-												
			24.10.13	GL-	GL- GL-											
			17:50	3.0m	10.0m 1.8m								Sara	mayri -	Fuji Co	nstruction Co., Ltd.

BORE HOLE No. BH-02					BORING LOG RECORD											D.         2013-032           Vo.         2         Of         5		
Project Name : Soil Investigation for Roa			oad Improvement Project			Boring Equipment : TOHO -"D1"							Date 24.10.13					
		: Dawny	yein-Ama	r road, I	Pyarpon Township, Ayeyarwaddy	Region	-	-	g Method		: Rotary (Direct Circulation)	-			_			
Ground Le		: 99.772					-	Orient			: Vertical	_	<u>Client</u>					
Coordinate			178.000;	N 1761	613.000		_		d Water		: 0.5 m	_		ORIEN	ITAL CO	ONSULTANT		
Method fo	or SPT	: ASTM					-	Casing	g Diamet	er	:Ø115mm	_		•				
Date	Ca	sing		Depth			-	-	-	So	pil Sample	Stand	dard Pen	etration				
& Time	No.	Length (m)	Casing Length (m)	of Casing (m)	Description of Drilling Work	Depth (m)	Туре	No.	Total Blows	Length (m)	Soil Description	Blows per 15 cm	Blows per 15 cm	per	N Value	Remarks		
24.10.13																		
15:30	-	-	3	3	Drilling with TC bit	4.0 ~ 5.0												
15:40					SPT at GL- 5.0 m	5.0 ~ 5.5	SPT	P-4	4	0.43	Silty CLAY, with trace of organic matter, gray,	1	1	2	3/30			
											moist, trace of fine sand and mica, low to							
											medium plasticity, soft							
15:50	_	-	3	3	Drilling with TC bit	5.0~6.0					r				-			
16:10					UD at GL- 6.0 m	6.0 ~ 6.8	UD	T-1	_	-	Recovery ratio = 64/80cm		-	_	-			
16:20	-	-	3	3	Drilling with TC bit	6.0 ~ 7.0												
16:30				_	SPT at GL- 7.0 m	7.0 ~ 7.5	SPT	P-5	5	0.41	Silty SAND, with clay patches, gray, moist,	1	2	2	4/30			
									-		trace of fine sand and mica, soft			_				
											,							
16:40	-	-	3	3	Drilling with TC bit	7.0~8.0												
17:00			2		SPT at GL- 8.0 m	8.0 ~ 8.5	SPT	P-6	3	0.42	Silty SAND, with clay patches, gray, moist,	1	1	1	2/30			
17.00						0.0 0.0	511	10	5	0.12	trace of fine sand and mica, soft	-	-	-	2/30			
											fuel of the sund and med, soft							
17:10	_	_	3	3	Drilling with TC bit	8.0~9.0												
17:10			5	5	UD at GL- 9.0 m	9.0 ~ 9.8	UD	T-3	_		Recovery ratio = 80/80cm	_	<u> </u>	_	_			
17.20						7.0 7.0		1-5										
17.20			2	2	Delline and TOLY	0.0.10.0												
17:30	-	-	3	3	Drilling with TC bit	9.0~10.0	ODT	D 7	2			1	1	1	2/20			
17:40					SPT at GL- 10.0 m	10.0~10.5	SPT	P-7	3		Silty SAND, with clay patches, gray, moist,	1		1	2/30			
17.50											trace of fine sand and mica, soft							
17:50			D (		Housekeeping and Stop work													
Ground Wat Observatio		n	24.10.13 7:30	Depth of Casing GL-	ofofUndisturbed SaBHWaterStandard PenetGL-GL-Water Sample	tration Test S			1 /	D : Deni	son sampler)			ļ				
24.10				GL- 3.0m	GL-     GL-     GL-       3.0m     10.0m     1.8m										Saramayri - Fuji Construction Co., Ltd.			

BORE HOLE No. BH-02						Job No.         2013-032           Sheet No.         3         Of         5										
Project Name : Soil Investigation for Road Improvement Project							Boring	Equipm	ent		Date 25.10.13					
Location	: Dawnyein-Amar road, Pyarpon Township, Ayeyarwaddy Region												-			
	round Level : 99.772 m					Orienta			: Vertical	_	<u>Client</u>					
Coordinate			178.000;	N 1761	613.000				d Water		: 0.5 m	_		ORIEN	TAL C	ONSULTANT
Method fo	r SPT	: ASTM	[					Casing	Diamete	er	: Ø115mm	_		011121		
Data	Са	Casing Total Depth								So	bil Sample	Standard Penetration Test				
Date &		<b>.</b> .	Casing		Description of Drilling Work				<b>T</b> 1	т1.		Blows	Blows	Blows		Remarks
Time	No.	Length		Casing	Description of Drining Work	Depth (m)	Туре	No.	Total Blows	Length	Soil Description	per	per	per	N Value	Remarks
1		(m)	(m)	(m)					DIOWS	(m)		15 cm	15 cm	15 cm	value	
25.10.13																
7:30	-	-	-	-	Arrived at site and Preparation											
8:00	-	-	3	3	Drilling with TC bit	10.0~11.0										
8:10					SPT at GL- 11.0 m	11.0~11.5	SPT	P-8	5	0.38	Silty SAND, with clay patches, gray, moist,	1	2	2	4/30	
											trace of fine sand and mica, soft					
8:15	-	-	3	3	Drilling with TC bit	11.0~12.0										
8:25					SPT at GL- 12.0 m	12.0~12.5	SPT	P-9	2	0.37	Silty CLAY, with trace of fine sand and mica	0	1	1	2/30	
											gray, low to medium plasticity, soft					
8:35	-	-	3	3	Drilling with TC bit	12.0~13.0										
8:50					SPT at GL- 13.0 m	13.0~13.5	SPT	P-10	4	0.41	Silty CLAY, with trace of fine sand and mica	1	1	2	3/30	
											gray, low to medium plasticity, soft					
9:00	-	-	3	3	Drilling with TC bit	13.0~14.0										
9:15					SPT at GL- 14.0 m	14.0~14.5	SPT	P-11	1	0.43	Silty CLAY, with trace of fine sand and mica	0	0	1	1/30	
											gray, low to medium plasticity, very soft					
9:30	-	-	3	3	Drilling with TC bit	14.0~15.0										
10:00					SPT at GL- 15.0 m	15.0~15.5	SPT	P-12	1	0.37	Silty CLAY, with trace of fine sand and mica	0	0	1	1/30	
											gray, low to medium plasticity, very soft					
10:15	-	-	3	3	Drilling with TC bit	15.0~16.0										
10:25					SPT at GL- 16.0 m	16.0~16.5	SPT	P-13	1	0.43	Silty CLAY, with trace of fine sand and mica	0	0	1	1/30	
											gray, low to medium plasticity, very soft					
10:35	-	-	3	3	Drilling with TC bit	16.0~17.0										
10:50					SPT at GL- 17.0 m	17.0~17.5	SPT	P-14	2	0.46	Silty CLAY, with trace of fine sand and mica	0	1	1	2/30	
											gray, low to medium plasticity, soft					
											8-0,					
Date Depth Depth Note														$\wedge$	•	
			&	of	of of Undisturbed Sa	mple (UD -	T : Thi	n wall s	ampler,	D : Deni	son sampler)					
Grou	ind Wa	ter	Time	Casing	BH Water Standard Penetr		ample	(SPT : I	P)						-	Auge to the second second
	servatio		25.10.13	GL-	GL- GL- Water Sample (	W)										
			8:00 25.10.13	3.0m GL-	11.0m 0.8m GL- GL-											
										Saramayri - Fuji Construction Co., Ltd.						
ļ			17:00	3.0m	55.0m 2.0m									···J	- J- C0	

BORE I	HOLE	No. B	H-02		BORING LOG RECORD											o. 2013-032 No. 4 Of 5		
Project Name : Soil Investigation for Road Improvement Project						Boring Equipment : TOHO - "D1"								Sheet No.         4         Of         5           Date         25.10.13				
Location	Location : Dawnyein-Amar road, Pyarpon Township, Ayeyarwaddy Region														-			
Ground Level : 99.772 m						-	Orient			: Vertical	_	<u>Client</u>						
Coordinate		: E 7781	,	N 1761	613.000		-		d Water		: 0.5 m	_		ORIEN	TAL C	ONSULTANT		
Method fo	r SPT	: ASTM					-	Casing	Diamete	er	:Ø115mm	_		UNIL				
						1												
Date	Ca	sing		Depth			-			So	bil Sample	Stanc	lard Pen	etration	Гest			
&		Length	Casing		Description of Drilling Work				Total	Length		Blows	Blows	Blows	Ν	Remarks		
Time	No.	(m)	Length	-		Depth (m)	Туре	No.	Blows	(m)	Soil Description	per	per	per	Value			
		~ /	(m)	(m)						. ,		15 cm	15 cm	15 cm				
25.10.13																		
11:00	-	-	3	3	Drilling with TC bit	17.0~18.0												
11:10					SPT at GL- 18.0 m	18.0~18.5	SPT	P-15	1	0.43	Silty CLAY, with trace of fine sand and mica	0	0	1	1/30			
											gray, low to medium plasticity, very soft							
11:15	-	-	3	3	Drilling with TC bit	18.0~19.0												
11:25					SPT at GL- 19.0 m	19.0~19.5	SPT	P-16	9	0.39	Silty CLAY, with trace of fine sand and mica	1	2	6	8/30			
											gray, low to medium plasticity, firm							
11:30	-	_	3	3	Drilling with TC bit	19.0~20.0												
11:40					SPT at GL- 20.0 m	20.0~20.5	SPT	P-17	3	0.43	Silty CLAY, with trace of fine sand and mica	1	1	1	2/30			
11.40						20.0 20.5	511	1 1 /	5	0.45	gray, low to medium plasticity, soft	1	1	1	2/30			
11.45			2	2		20.0.21.0					gray, low to medium plasticity, soft							
11:45	-	-	3		Drilling with TC bit	20.0~21.0	(D)T	D 10		0.45					<b>a</b> /a a			
12:00					SPT at GL- 21.0 m	21.0~21.5	SPT	P-18	3	0.45	Silty CLAY, with trace of fine sand and mica	1	1	1	2/30			
											gray, low to medium plasticity, soft							
12:05	-	-	3	3	Drilling with TC bit	21.0~22.0												
12:15					SPT at GL- 22.0 m	22.0~22.5	SPT	P-19	3	0.46	Silty CLAY, with trace of fine sand and mica	1	1	1	2/30			
											gray, low to medium plasticity, soft							
12:30	-	-	-	-	Lunch break													
										_								
13:30	-	-	3	3	Drilling with TC bit	22.0~23.0												
13:40					SPT at GL- 23.0 m	23.0~23.5		P-20	3	0.40	Silty CLAY, with trace of fine sand and mica	0	1	2	3/30			
						2010 2010					gray, low to medium plasticity, soft	<u> </u>	-		2,20			
13:45			3	3	Drilling with TC bit	23.0~24.0					gruy, low to medium plusticity, solt							
	-	-	5				SPT	P-21	3	0.42	Silty CLAY, with trace of fine sand and mica	0	1	2	2/20			
13:50					SPT at GL- 24.0 m	24.0~24.5	SPT	P-21	3	0.42	5 ,	0	1	2	3/30			
			<b>D</b> .	<b>D</b> 1							gray, low to medium plasticity, soft							
			Date	Depth of	Depth Depth <u>Note</u> of of Undisturbed Sa	mula (LID	т.ть:	n	omnlor		an complex)				$\wedge$			
			& Time	Casing	of of Undisturbed Sa BH Water Standard Penet	- ·			- ·	D. Dem	son sampler)			/		A		
	und Wa		25.10.13	GL-	GL- GL- Water Sample		Jumpie	(511.	• )									
Obs	servatio	n	8:00	3.0m	11.0m 0.8m													
			25.10.13	GL-	GL- GL-													
			17:00	3.0m	30.0m 2.0m								Sara	mayri -	Fuji Co	nstruction Co., Ltd.		

BORE HOLE No. BH-02			H-02	BORING LOG RECORD												Job No.         2013-032           Sheet No.         5         Of         5				
Project Name : Soil Investigation for Road Improvement Project							Boring Equipment : TOHO - "D1"									Date 25.10.13				
Location	cation : Dawnyein-Amar road, Pyarpon Township, Ayeyarwaddy Region												•							
	Ground Level : 99.772 m				-	Orient			: Vertical	_	<u>Client</u>									
Coordinate			178.000;	N 1761	613.000		-		d Water		: 0.5 m	_		ORIEN	TAL C	ONSULTANT				
Method fo	r SPT	: ASTM					-	Casing	g Diamete	er	:Ø115mm	_		-	_					
Dete	Са	Casing Total Depth								Sc	bil Sample	Stand	lard Pen	etration 7						
Date &			Casing		Description of Drilling Work							Blows	Blows	Blows		Remarks				
Time	No.	Length (m)		Casing (m)	Description of Drining work	Depth (m)	Туре	No.	Total Blows	Length (m)	Soil Description	per 15 cm	per 15 cm	per 15 cm	N Value	ixemarks				
25.10.13			(111)	()								10 0111	10 0111	10 0111						
13:55	-	-	3	3	Drilling with TC bit	24.0~25.0														
14:10					SPT at GL- 25.0 m	25.0~25.5	SPT	P-22	3	0.43	Silty CLAY, with trace of fine sand and mica	1	1	1	2/30					
											gray, low to medium plasticity, soft									
14:20	-	-	3	3	Drilling with TC bit	25.0~26.0														
14:30					SPT at GL- 26.0 m	26.0~26.5	SPT	P-23	2	0.42	Silty CLAY, with trace of fine sand and mica	1	1	0	1/30					
											gray, low to medium plasticity, very soft									
14:40	-	-	3	3	Drilling with TC bit	26.0~27.0														
14:55					SPT at GL- 27.0 m	27.0~27.5	SPT	P-24	2	0.41	Silty CLAY, with trace of fine sand and mica	0	1	1	2/30					
											gray, low to medium plasticity, soft									
15:10	-	-	3	3	Drilling with TC bit	27.0~28.0														
15:30					SPT at GL- 28.0 m	28.0~28.5	SPT	P-25	4	0.42	Silty CLAY, with trace of fine sand and mica	1	1	2	3/30					
											gray, low to medium plasticity, soft									
15:40	-	-	3	3	Drilling with TC bit	28.0~29.0														
15:55					SPT at GL- 29.0 m	29.0~29.5	SPT	P-26	4	0.44	Silty CLAY, with trace of fine sand and mica	0	1	2	3/30					
											gray, low to medium plasticity, soft									
16:00	-	-	3	3	Drilling with TC bit	29.0~30.0														
16:25					SPT at GL- 30.0 m	30.0~30.5	SPT	P-27	5	0.43	Silty CLAY, with trace of fine sand and mica	1	2	2	4/30					
											gray, low to medium plasticity, soft									
16:30					Measurement of water level and															
17:00					Housekeeping															
					BH-02 is terminated at 30.00 m															
Date				Depth	Depth Depth Note	1 (175	т. т. <sup>1</sup> .	- 11	1						$\wedge$					
		&ofofofUndisturbed Sample (UDTimeCasingBHWaterStandard Penetration Test							- ·	D : Deni	son sampler)									
Ground Water			25.10.13	GL-	GL- GL- Water Standard Tenet		ampie	(511.	• /											
Obs	servatio		8:00	3.0m	11.0m 0.8m															
			25.10.13	GL-	GL- GL-															
			17:00	3.0m	30.0m 2.0m								Sara	mayri -	Fuji Co	nstruction Co., Ltd.				

## **APPENDIX "F"**

## SITE PHOTOGRAPHS



Before commencement of drilling work



Drilling Condition



Standard Penetration Test



S.P.T Sample



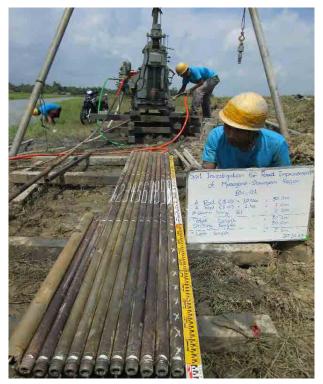
Piston Undisturbed Sampling



Piston Undisturbed Sample



Drilling & Left Length (A)



Drilling & Left Length (B)



Water Sampling



Water Sample



Panoramic View



After completion of drilling work



Before commencement of drilling work



Drilling Condition



Standard Penetration Test



S.P.T Sample



Piston Undisturbed Sampling



Piston Undisturbed Sample



Drilling & Left Length (A)



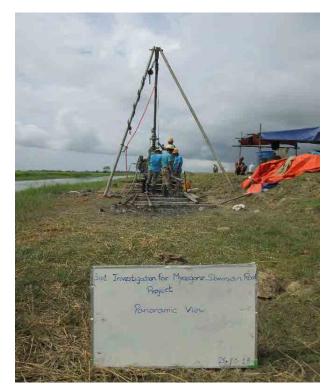
Drilling & Left Length (B)



Water Sampling



Water Sample



Panoramic View



After completion of drilling work

### SOIL INVESTIGATION FOR ROAD IMPROVEMENT PROJECT DAWNYEIN-AMAR ROAD, PYAPON TOWNSHIP, AYEYARWADDY REGION FIELD DENSITY TEST (START POINT)



Excavation for Field Density Test



Preparation for Field Density Test



Field Density Testing

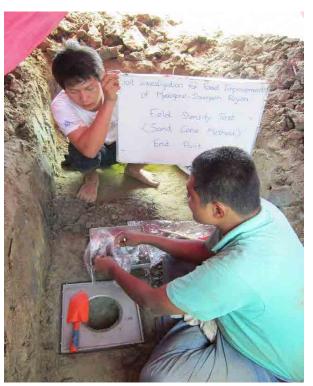


After completion of Field Density Test

### SOIL INVESTIGATION FOR ROAD IMPROVEMENT PROJECT DAWNYEIN-AMAR ROAD, PYAPON TOWNSHIP, AYEYARWADDY REGION FIELD DENSITY TEST (END POINT)



Excavation for Field Density Test



Preparation for Field Density Test



Field Density Testing



After completion of Field Density Test