CHAPTER 4. BRIDGE DESIGN

4.1 DESIGN CONDITIONS

4.1.1 Design Standard

The bridge design standard of the Project, including Bago River Bridge with the on-ramp bridge and flyover, complies with the JSHB. However, the calculations of the live load and the collision force were referred to the AASHTO LRFD Design Standard as a conventional bridge design load in Myanmar. Natural conditions related to the criteria such as meteorological issues were considered independently in this section.

4.1.1.1 Seismic Force and Design

The Bago River Bridge and flyover were designed based on the JSHB. Although, seismic design would be a different issue because the return period of the strong earthquakes in Myanmar is much longer than that of Japan. If the same design methods are applied to the design of the Project, then the bearing force will be excessive.

The application of the seismic coefficient method is deemed to be suitable for the seismic design of the Project. However, multiple seismic performance shall be defined if a stronger earthquake than the expected occurs.

Table 4.1.1 Seismic Performance Level

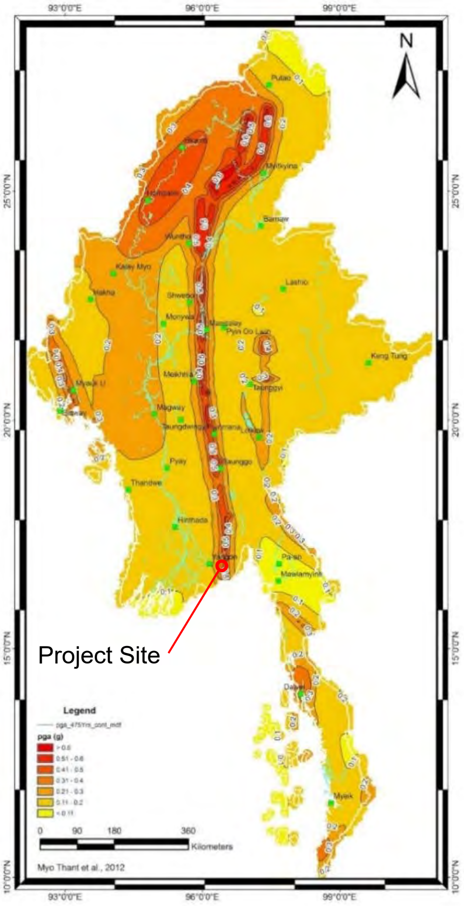
Seismic Performance Level 1	Possible maximum seismic force during service period The bridge is expected to have no damage caused by the earthquake.
Seismic Performance Level 2	Very few chances The bridge is not expected to collapse.

Source: JICA Study Team

(1) Design Horizontal Ground Acceleration (Seismic Coefficient)

The design horizontal ground acceleration for seismic performance level 1 around the project site is set to 0.30 from the Peak Ground Acceleration map made by the Myanmar Earthquake Committee (“Seismic Hazards Assessment for Myanmar”, Myo Thant et al., 2012), which reflects a 475-year return period.

For seismic performance level 2, the design horizontal ground acceleration is set as 0.45, 1.5 times larger than the abovementioned value, because the Myanmar Building Code 2012 uses the same multiplication factor for the maximum considered earthquake.



Source: Seismic Hazards Assessment for Myanmar, Myo Thant et al., 2012

Figure 4.1.1 Peak Ground Acceleration Map (475-year return period)

(2) Required Seismic Performance and Seismic Design

To meet the seismic performance defined in Item (1) above, the seismic design shown in Table 4.1.2 below was conducted.

Table 4.1.2 Relationship Between Seismic Performance and Seismic Design

	Seismic Performance 1	Seismic Performance 2
Seismic coefficient	$k_{h1} = 0.30$	$k_{h2} = 1.5 \text{ x } k_{h1} = 1.5 \text{ x } 0.3 = 0.45$
Superstructure	Design to verify if unbreakable	Expect not to be unbreakable by safety factor and ductility
Substructure	Design to verify if unbreakable	Expect not to be unbreakable by safety factor and ductility
Bearing	Design to verify if unbreakable	(no design if other anti-collapse structure is installed)
Anti-collapse structure	(no design)	Design to verify if unbreakable
Expansion joint	Design to verify function	(no design)

Source: JICA Study Team

In the table, the "anti-collapse structure" was assumed to be the structure which connects the superstructure and substructure, and was expected not to break due to the level 2 seismic force, so that the superstructure will not collapse as well. Anchor bars on the substructure and bearings that are designed based on level 2 seismic coefficient are deemed as anti-collapse structures.

(3) Other Issues for Seismic Design

Seating length and bearing edge distance will be secured in accordance with the JSHB regulations. Reinforcement of superstructures and substructures will consider ductility and robustness.

4.1.1.2 Collision Force by Vessel

Collision force is calculated based on AASHTO.

(1) Design Vessel

The largest vessel running in Bago River is a barge ship with specifications indicated below, as researched by the Directorate of Water Resources and Improvement of River Systems (DWIR).

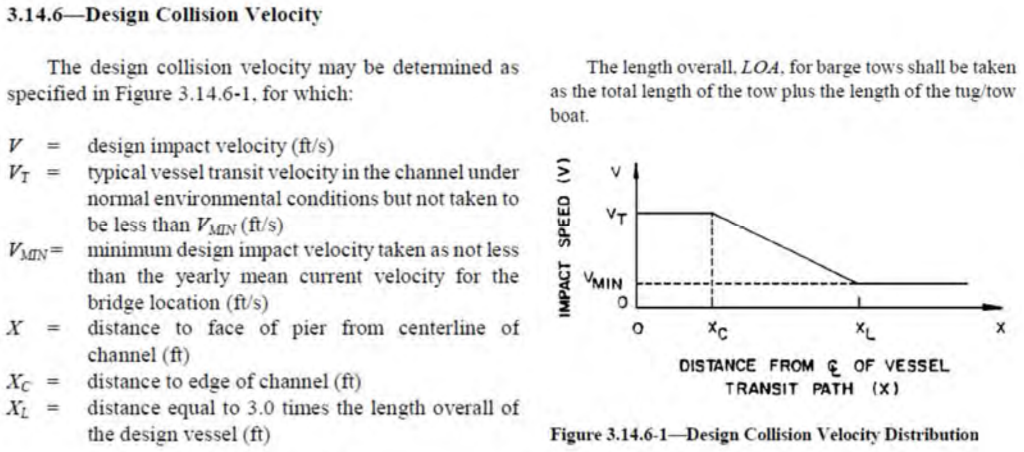
Size: 65.5 m x 15.9 m x 3.0 m (barge vessel)

Deadweight tonnage: 1,118 tons

Maximum vessel speed: 10 knot (5.14 m/s)

Draught height was assumed as 2.2 m by general barge ship with similar size.

(2) Impact Speed was Calculated based on the AASHTO LRFD 3.14.6.



3.14.6—Design Collision Velocity

The design collision velocity may be determined as specified in Figure 3.14.6-1, for which:

V = design impact velocity (ft/s)

V_T = typical vessel transit velocity in the channel under normal environmental conditions but not taken to be less than V_{MIN} (ft/s)

V_{MIN} = minimum design impact velocity taken as not less than the yearly mean current velocity for the bridge location (ft/s)

X = distance to face of pier from centerline of channel (ft)

X_C = distance to edge of channel (ft)

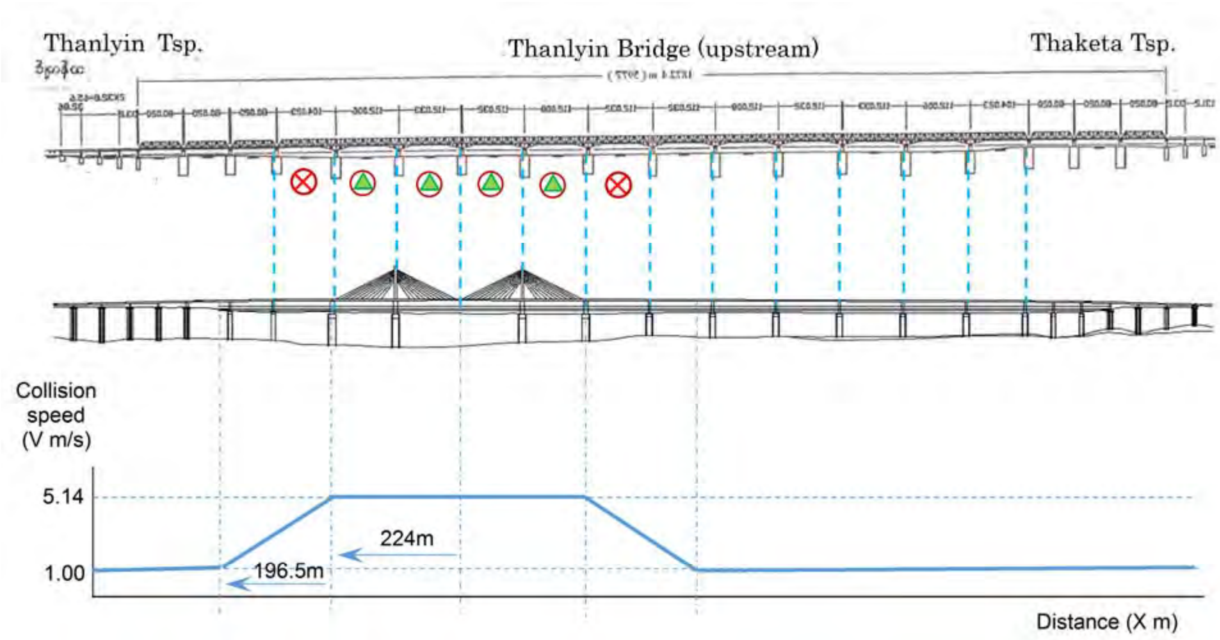
X_L = distance equal to 3.0 times the length overall of the design vessel (ft)

The length overall, *LOA*, for barge tows shall be taken as the total length of the tow plus the length of the tug/tow boat.

Figure 3.14.6-1—Design Collision Velocity Distribution

Source: AASHTO LRFD

Figure 4.1.2 Definition of Impact Speed



Source: JICA Study Team

Figure 4.1.3 Configuration of Impact Speed on Bago River

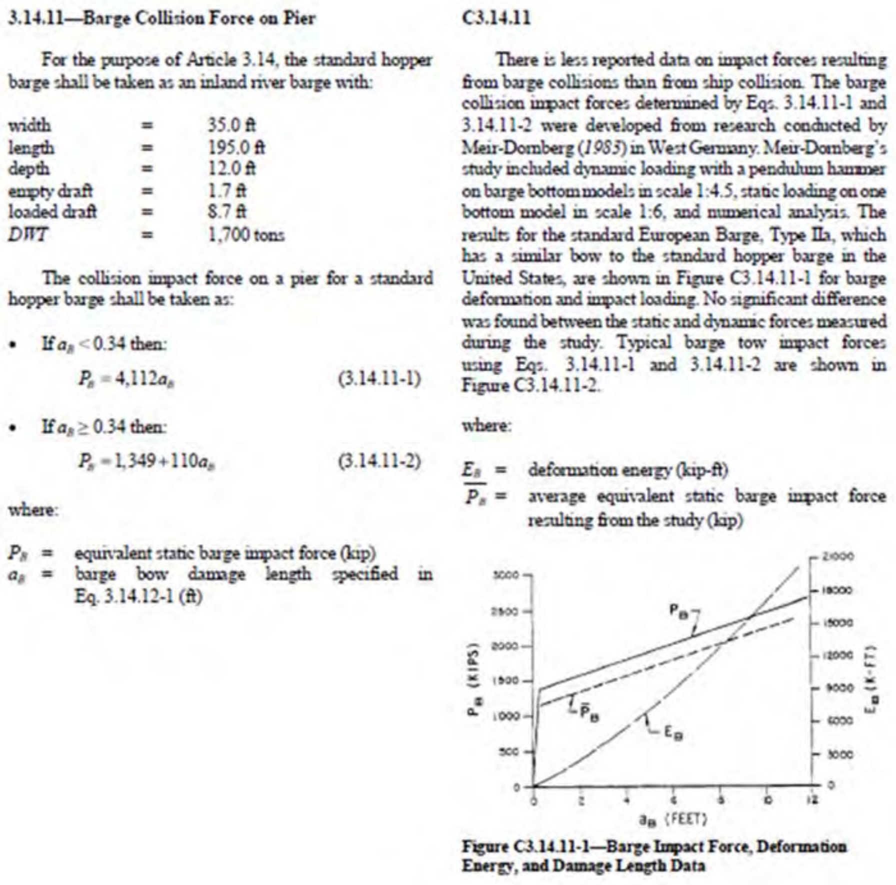
Table 4.1.3 Impact Speed for the Pier

Pier	Impact Speed (V)	Remarks
P10, P11, P12, P13	5.14 m/s	Maximum vessel speed
P6	1.34 m/s	
P7	2.95 m/s	
P14	1.84 m/s	
P6, P15-P21	1.00 m/s	Mean current speed

Source: JICA Study Team

It is noted that the depth of the river at Pier P5 and P22 is shallow for running the vessel, and that these piers will not affect the collision force. In other words, P5 and P22 were not designed with a collision force.

(3) Collision Force was Calculated based on the AASHTO LRFD 3.14.11.



3.14.11—Barge Collision Force on Pier

For the purpose of Article 3.14, the standard hopper barge shall be taken as an inland river barge with:

width = 35.0 ft
length = 195.0 ft
depth = 12.0 ft
empty draft = 1.7 ft
loaded draft = 8.7 ft
DWT = 1,700 tons

The collision impact force on a pier for a standard hopper barge shall be taken as:

- If $a_B < 0.34$ then:

$$P_B = 4{,}112 a_B \qquad (3.14.11\text{-}1)$$

- If $a_B \geq 0.34$ then:

$$P_B = 1{,}349 + 110 a_B \qquad (3.14.11\text{-}2)$$

where:

P_B = equivalent static barge impact force (kip)
a_B = barge bow damage length specified in Eq. 3.14.12-1 (ft)

C3.14.11

There is less reported data on impact forces resulting from barge collisions than from ship collision. The barge collision impact forces determined by Eqs. 3.14.11-1 and 3.14.11-2 were developed from research conducted by Meir-Dornberg (*1983*) in West Germany. Meir-Dornberg's study included dynamic loading with a pendulum hammer on barge bottom models in scale 1:4.5, static loading on one bottom model in scale 1:6, and numerical analysis. The results for the standard European Barge, Type IIa, which has a similar bow to the standard hopper barge in the United States, are shown in Figure C3.14.11-1 for barge deformation and impact loading. No significant difference was found between the static and dynamic forces measured during the study. Typical barge tow impact forces using Eqs. 3.14.11-1 and 3.14.11-2 are shown in Figure C3.14.11-2.

where:

E_B = deformation energy (kip-ft)
$\overline{P_B}$ = average equivalent static barge impact force resulting from the study (kip)

Figure C3.14.11-1—Barge Impact Force, Deformation Energy, and Damage Length Data

Source: AASHTO LRFD

Figure 4.1.4 Collision Force on Piers by Barge Ship

Table 4.1.4 Impact force to the pier

Pier	Impact Speed (m/s)	Impact Speed (ft/s)	KE (kip-ft)	aB (ft)	P_B (kip)	P_B (kN)
P9, P10, P11, P12	5.14	16.9	11,4333	7.51	2,175	9,658
P7	2.08	6.8	1,872	1.56	1,521	6,752
P8	3.60	11.8	5,608	4.18	1,809	8,032
P13	1.84	6.0	1,465	1.24	1,486	6,595
P6, P14-P21	1.00	3.3	433	0.38	1,391	6,175

Source: JICA Study Team

Impact force P_B has 100% effect on the transverse direction to the bridge, and 50% on the longitudinal direction.

(4) Water Level and Impact Height

As shown in Figure 4-5, impact force affects the pier from the Mean High Water level (MHW = +3.18 m) with 0.8 m (barge height from water surface).

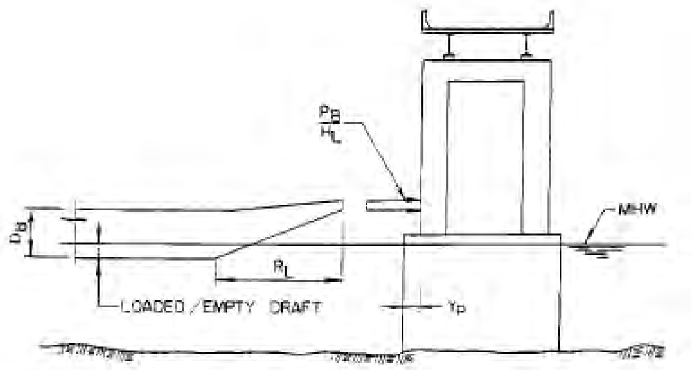


Figure 3.14.14.1-3—Barge Impact Force on Pier

Source: AASHTO LRFD

Figure 4.1.5 Impact Height of Barge Ship

Table 4.1.5 Impact Force and Height

Pier		P5,P6	P7	P8	P9,P10, P11,P12	P13	P14,P15,P16,P17,P18, P19,P20,P21P22
Impact force (kN)	Trans.	6,175	6,752	8,032	9,658	6,595	6,175
	Long.	3,088	3,376	4,016	4,829	3,298	3,088
Impact height (m)		3.98	3.98	3.98	3.98	3.98	3.98

Source: JICA Study Team

4.1.1.3 Verification Study of Flight Track

Since the construction site of the Bago River Bridge is slightly near the Yangon International Airport, and the pylon of the cable-stayed bridge is high, clearance between flight track and pylon was verified.

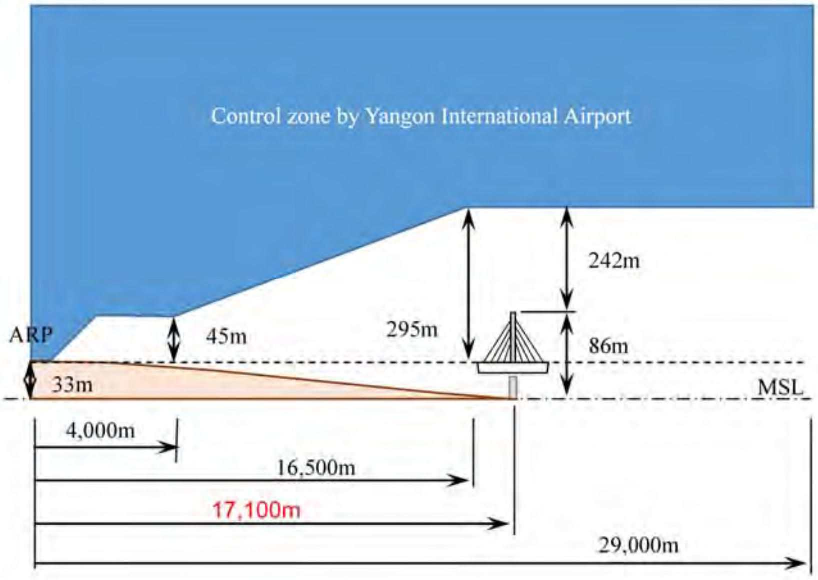
(1) Condition of Verification

- The Airport Reference Point (ARP) was assumed to exist at the center of the landing field.

- The distance between the ARP of the airport and P12 (pylon of the cable-stayed bridge) was measured on a web-based map service.

- Control zone of the airport was assumed to be the same as the definition of the International Civil Aviation Organization (ICAO).

(2) Result



Source: JICA Study Team

Figure 4.1.6 Control Zone by ICAO and Bago River Bridge Pylon

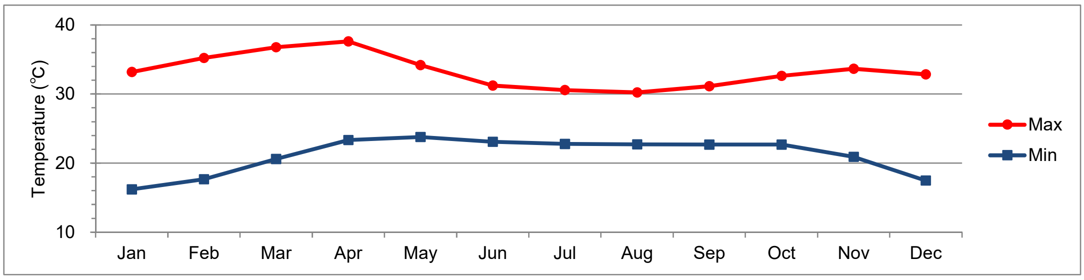
Pier P12 was allocated at 17.1 km from the ARP. The area farther than 16.5 km was assigned as the "outer horizontal plane", in which general structures should secure a height of less than 295 m.

ARP is from 33 m above MSL, while the P12 pylon is 86 m above MSL. This means that the pylon leaves 242 m under the control zone (295 + 33 - 86 = 242). If the high crane exceeds several meters above the top of the pylon, then there is an ample height allowance above the pylon.

It is noted that ICAO regulates to install the Aircraft Warning Light for high structures from 200 ft to 650 ft (60 m to 200 m). Since the pylon has an 86 m height, then the Aircraft Warning Light is installed at the top of the pylon.

4.1.1.4 Meteorological Conditions in Yangon

(1) Temperature

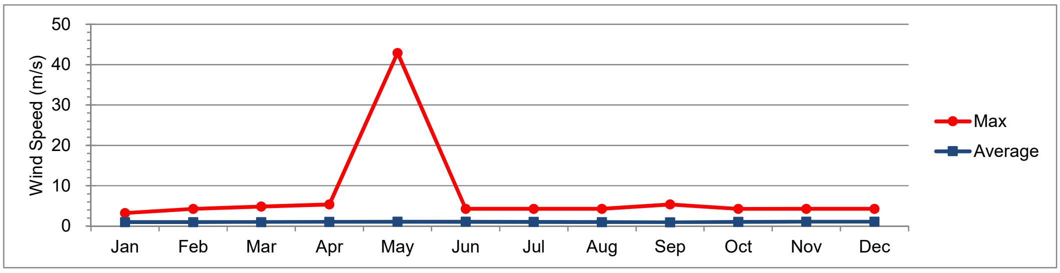


Source: DMH

Figure 4.1.7 Monthly Average Temperature at Kaba-Aye Station in Yangon (1991 to 2015)

Monthly average temperature is from 39.2 to 11.3 °C. For the design temperature change, reference temperature is set at 25 °C and was assigned with a rise-fall ratio of 15 degrees.

(2) Wind



Source: DMH

Figure 4.1.8 Maximum and Average Wind Speed at Kaba-Aye Station in Yangon (1991 to 2015)

Fastest recorded wind speed in Yangon was 96.5 mph (42.9 m/s) by Cyclone Nargis that descended on 27 April 2008. The MOC assigned the design wind speed for bridges in Yangon region as 100 mph (44.4 m/s).

(3) Rainfall Intensity

Return Period (Probability) (Year, %) Kaba Aye		Dairy Rainfall: R_{24} (mm/day)	Rainfall intensity each rainfall duration (mm/hr): $It = R_{24}/24*(24/t)^{m}$, m=2/3											
		24 hour	24	12	8	6	3	2	1.5	1	0.75	0.5	0.333	0.167
		1,440 min.	1,440	720	480	360	180	120	90	60	45	30	20	10
2	50.0%	112.9	4.7	7.5	9.8	11.9	18.8	24.7	29.9	39.1	47.4	62.1	81.4	129.2
3	33.3%	130.1	5.4	8.6	11.3	13.7	21.7	28.4	34.4	45.1	54.6	71.6	93.8	148.9
5	20.0%	152.1	6.3	10.1	13.2	16.0	25.4	33.2	40.2	52.7	63.9	83.7	109.7	174.1
10	10.0%	184.3	7.7	12.2	16.0	19.4	30.7	40.3	48.8	63.9	77.4	101.4	132.9	211.0
20	5.0%	220.4	9.2	14.6	19.1	23.1	36.7	48.1	58.3	76.4	92.6	121.3	158.9	252.3
25	4.0%	233.0	9.7	15.4	20.2	24.5	38.8	50.9	61.6	80.8	97.9	128.2	168.0	266.7
30	3.33%	243.7	10.2	16.1	21.1	25.6	40.6	53.2	64.5	84.5	102.3	134.1	175.7	279.0
50	2.0%	275.5	11.5	18.2	23.9	28.9	45.9	60.2	72.9	95.5	115.7	151.6	198.7	315.4
80	1.25%	307.3	12.8	20.3	26.6	32.3	51.2	67.1	81.3	106.5	129.1	169.1	221.6	351.8
100	1.0%	323.4	13.5	21.4	28.0	34.0	53.9	70.6	85.6	112.1	135.8	178.0	233.2	370.2
150	0.667%	354.1	14.8	23.4	30.7	37.2	59.0	77.3	93.7	122.8	148.7	194.9	255.4	405.3
200	0.5%	377.1	15.7	24.9	32.7	39.6	62.9	82.4	99.8	130.7	158.4	207.5	271.9	431.7
300	0.33%	411.4	17.1	27.2	35.7	43.2	68.6	89.8	108.8	142.6	172.8	226.4	296.7	470.9
400	0.25%	436.9	18.2	28.9	37.9	45.9	72.8	95.4	115.6	151.5	183.5	240.4	315.1	500.1
500	0.2%	457.5	19.1	30.3	39.7	48.0	76.3	99.9	121.0	158.6	192.1	251.8	329.9	523.7
		Calculation formula of Probable rainfall = Generalized extreme value distribution												

Source: JICA Study Team based on DMH

Figure 4.1.9 Rainfall Intensity at Kaba-Aye Station in Yangon (1968 to 2015)

For the design of drainage, a 10-minute rainfall intensity with three-year return period was used. In Yangon, 149 mm/h is the design rainfall intensity.

4.1.2 Materials to be Used

Materials to be used for the Project are based on the Japanese Industrial Standard (JIS) since JSHB is based on JIS, and is applied to the design of the bridge.

However, “equivalent” materials and/or products will be allowed in the technical specifications for the international procurement.

4.1.3 Conditions of Design Load and Load Combination

The design load is mentioned in the design criteria.

4.1.4 Concept of Comparative Study for Structure Optimization

In the F/S and Supplemental Survey, general bridge and structural types were selected for the determination of the project scope and scale. In this basic design (B/D), design items were examined and considered for the optimization of the structural types.

Table 4.1.6 Contents of the Comparative Study

Item	Design Issue
Steel cable-stayed bridge	Height of the pylon
	Cross section of the girder (girder depth, bracket, rib, etc.)
	Type of the pylon (reverse-Y, H, single)
	Arrangement of the stayed cable
	Numbers of the cable
	Types of the cable
	Supporting condition and bearing types
	Shape of the pier
	Shape of the SPSP
Steel box girder	Cross section of the girder (girder depth, bracket, rib, etc.)
	Substructure
	Foundation
	Bridge accessories
PC box girder (span by span erection method)	Bridge length
	Span arrangement
	Superstructure
	Substructure
	Foundation
	Bridge accessories
On-ramp bridge	Span arrangement and bridge length
	Superstructure
	Erection method
	Main girder
	Substructure
	Foundation
	Bridge accessories
Flyover	Bridge length
	Span arrangement
	Superstructure
	Foundation

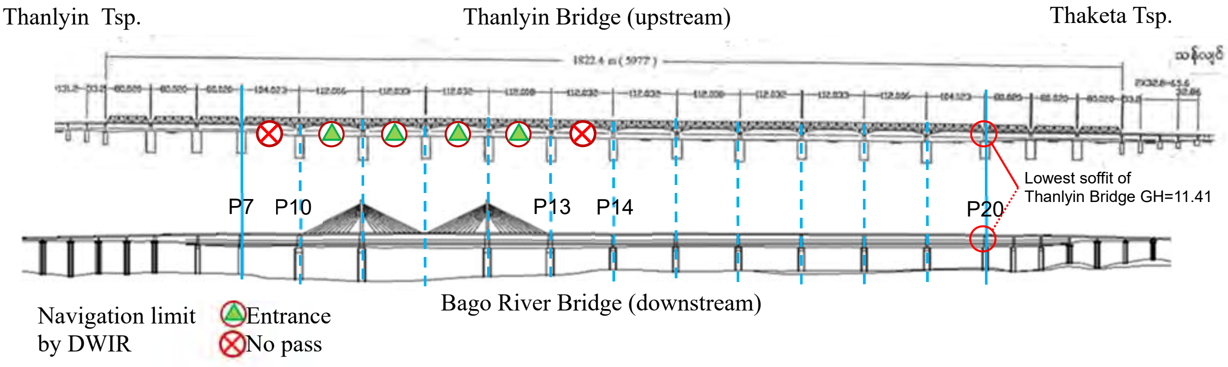
Source: JICA Study Team

4.1.5 Span Arrangement in River Bridge Section

In consideration of the hydrological advantage and safety for the vessel, the pier arrangement of Bago River Bridge was allocated on the line-of-sight of the existing Thanlyin Bridge. Although Bago River is relatively shallow, middle-class vessel runs through the abyss near the Thanlyin side assigned by DWIR.

Four spans with green triangular signs indicated in Figure 4.1.10 are the current navigation route, which was designed to allocate space for the cable-stayed bridge for the new Bago River Bridge. Even though "no pass" was allocated for the other spans, the same span length is allocated for more than 100 m of the span of Thanlyin Bridge.

Navigation height is determined by the lowest soffit of Thanlyin Bridge at the P20 pier location of Bago River Bridge where the vertical alignment is lowest at navigation channel.



Source: JICA Study Team

Figure 4.1.10 Pier Arrangement of Bago River Bridge

4.1.6 Design Conditions for the Bridge Design

The design conditions are shown in the tables found in the next few pages.

Table 4.1.7 General Conditions

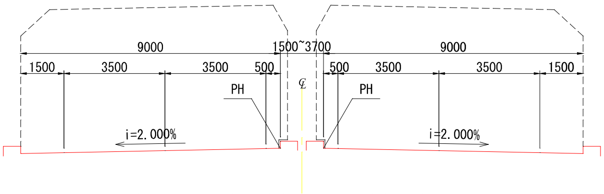
<table>
<tr><th>Item</th><th colspan="3">Design Conditions</th><th>Remark</th></tr>
<tr><td rowspan="18">Design objective</td><td colspan="3">Construction of new bridges and improvement of Thanlyin Chin Kat Road</td><td rowspan="18"></td></tr>
<tr><td>Project length</td><td colspan="2">3,644.341 m</td></tr>
<tr><td rowspan="4">River bridge</td><td>Length</td><td>2031.000 m</td></tr>
<tr><td>Superstructure</td><td>Steel cable-stayed bridge 448.000 m
Steel box girder bridge 1,033.000 m
(257 m, 776 m)
PC box girder Bridge 550.000 m
(250 m, 300 m)</td></tr>
<tr><td>Substructure</td><td>Wall pier, hammerhead pier, reverse-T abutment</td></tr>
<tr><td>Foundation</td><td>Steel pipe sheet pile (SPSP), cast-in-situ pile</td></tr>
<tr><td rowspan="4">Flyover</td><td>Length</td><td>602.000 m</td></tr>
<tr><td>Superstructure</td><td>Steel box girder bridge180.000 m
Steel I girder bridge 122.000 m
PC I girder bridge 300.000 m
(60 m, 180 m, 60 m)</td></tr>
<tr><td>Substructure</td><td>Hammerhead pier, reverse-T abutment</td></tr>
<tr><td>Foundation</td><td>Cast-in-situ pile</td></tr>
<tr><td rowspan="4">On-ramp bridge</td><td>Length</td><td>115.200 m</td></tr>
<tr><td>Superstructure</td><td>PC I girder bridge 115.200 m</td></tr>
<tr><td>Substructure</td><td>Hammerhead pier, reverse-T abutment</td></tr>
<tr><td>Foundation</td><td>Cast-in-situ pile</td></tr>
<tr><td rowspan="2">Road improvement</td><td colspan="2">Approach road
Thanlyin side 357 m, Thaketa side 430 m</td></tr>
<tr><td colspan="2">Arterial road 834.341 m</td></tr>
<tr><td>Intersection</td><td colspan="2">Star City intersection, Shukinthar intersection, Yadanar intersection</td></tr>
<tr><td>Toll collection</td><td colspan="2">Thaketa side (both northbound and southbound)</td></tr>
<tr><td>Bridge name</td><td colspan="3">Bago River Bridge</td><td></td></tr>
<tr><td>Line name</td><td colspan="3">Thanlyin Chin Kat Road</td><td></td></tr>
<tr><td>Road design standards</td><td colspan="3">Specifications for Road Design (Japan), June 2015, Japan Road Association (JRA)
AASHTO A Policy on Geometric Design of Highways and Streets, 6th Edition (2011) for vertical clearance 5.0 m
ASEAN Highway standard for traffic lane width 3.5 m
Road Design Criteria in Myanmar, Department of Highway, Ministry of Construction (2015) for general reference</td><td></td></tr>
<tr><td>Structural design standards</td><td colspan="3">AASHTO LRFD Bridge Design 7th Edition (2014) for calculations of live load and collision force
Specifications for Highway Bridge, March 2012, JRA
Specifications for Earthwork for Road, June 2009, JRA
Guidelines for Road Embankment, April 2010, JRA
Guidelines for Road Revetment, July 2012, JRA
Guidelines for Soft Soil Treatment, August 2012, JRA
Guidelines for Design of Pile Foundations, March 2015, JRA
Guidelines for Construction of Steel Pipe Pile Foundations, December 1997, JRA
Other Relevant Standards and/or Documents</td><td></td></tr>
</table>

Source: JICA Study Team

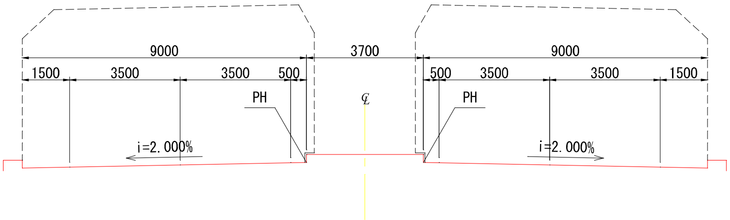
Table 4.1.8 Road Design Conditions

<table>
<tr><th>Item</th><th>Design conditions</th><th>Remark</th></tr>
<tr><td>Road classification</td><td>Bago River Bridge Equivalent to Class 2-1
Flyover Equivalent to Class 4-1
On-ramp Equivalent to Class C
Improvement of Thanlyin Chin Kat Road Equivalent to Class 4-1</td><td>Based on Japanese Road Structure Ordinance</td></tr>
<tr><td>Design speed</td><td>Bago River Bridge, Flyover 60 km/h
On-ramp 30 km/h
Thanlyin Chin Kat Road 40 km/h</td><td></td></tr>
<tr><td>Design traffic volume</td><td>Bago River Bridge
44,356 vehicle/day (northbound 25,352 v/d, southbound 19,004 v/d)
Trucks 6,173 vehicle/day (northbound 2,829 v/d, southbound 3,344 v/d)
Flyover
21,723 vehicle/day (northbound 12,061 v/d, southbound 9,662 v/d)
Trucks 3,639 vehicle/day (northbound 1,549 v/d, southbound 2,090 v/d)</td><td>Supplemental survey results, YUTRA Master Plan Case, 2035 time point</td></tr>
<tr><td>Planar road alignments</td><td>Bago River Bridge to Flyover
<table>
<tr><td>SP</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>0+000.000</td><td>0+024.970</td><td>0+076.170</td><td>0+161.513</td><td>0+212.713</td><td>0+521.900</td></tr>
<tr><td>R=∞</td><td>A=160</td><td>R=-500</td><td>A=160</td><td>R=∞</td><td>R=-2000</td></tr>
<tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr>
<tr><td>0+857.522</td><td>2+627.420</td><td>2+680.992</td><td>2+724.080</td><td>2+777.651</td><td>2+782.486</td></tr>
<tr><td>R=∞</td><td>A=150</td><td>R=-420</td><td>A=150</td><td>R=∞</td><td>A=130</td></tr>
<tr><td>12</td><td>13</td><td>14</td><td>EP</td><td></td><td></td></tr>
<tr><td>2+835.298</td><td>2+961.571</td><td>3+014.383</td><td>3+644.341</td><td></td><td></td></tr>
<tr><td>R=320</td><td>A=130</td><td>R=∞</td><td>-</td><td></td><td></td></tr>
</table>
On-ramp
<table>
<tr><td>SP</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>0+000.000</td><td>0+004.472</td><td>0+058.045</td><td>0+105.007</td><td>0+148.111</td><td>0+367.483</td></tr>
<tr><td>R=∞</td><td>R=-140</td><td>R=∞</td><td>A=50</td><td>R=-58</td><td>A=50</td></tr>
<tr><td>6</td><td>7</td><td>EP</td><td></td><td></td><td></td></tr>
<tr><td>0+410.587</td><td>0+535.778</td><td>0+643.083</td><td></td><td></td><td></td></tr>
<tr><td>R=∞</td><td>R=-1000</td><td>-</td><td></td><td></td><td></td></tr>
</table></td><td></td></tr>
<tr><td>Profiles</td><td>Bago River Bridge to Flyover
<table>
<tr><td>0+0.000</td><td>0+228.000</td><td>0+700.000</td><td>1+88.000</td><td>2+140.000</td><td>2+517.727</td></tr>
<tr><td>5.695</td><td>5.467</td><td>17.267</td><td>18.431</td><td>15.275</td><td>5.832</td></tr>
<tr><td>-0.100</td><td>2.500</td><td>0.300</td><td>-0.300</td><td>-2.500</td><td>3.000</td></tr>
<tr><td>2+830.000</td><td>2+960.000</td><td>3+160.000</td><td>3+475.000</td><td>3+500.000</td><td></td></tr>
<tr><td>15.200</td><td>15.850</td><td>14.420</td><td>4.970</td><td>4.895</td><td></td></tr>
<tr><td>0.500</td><td>-0.715</td><td>-3.000</td><td>-0.300</td><td>-</td><td></td></tr>
</table>
On-ramp
<table>
<tr><td>0+0.000</td><td>0+150.000</td><td>0.329.942</td><td>0+490.000</td><td>0+540.000</td><td></td></tr>
<tr><td>4.470</td><td>4.470</td><td>5.010</td><td>13.780</td><td>14.878</td><td></td></tr>
<tr><td>level</td><td>0.300</td><td>5.479</td><td>2.197</td><td>-</td><td></td></tr>
</table></td><td></td></tr>
<tr><td>Cant</td><td>Bago River Bridge 2% crossfall (Max. 4% camber)
Flyover 2% crossfall (Max. 6% camber)
On-ramp 2% camber (Max. 9% camber)</td><td></td></tr>
</table>

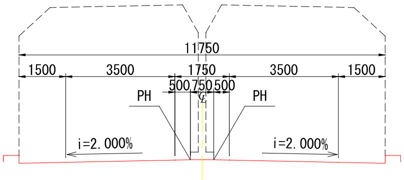
<table>
<tr><td>Cross section</td><td>Bago River Bridge (PC box girder and Steel box girder)

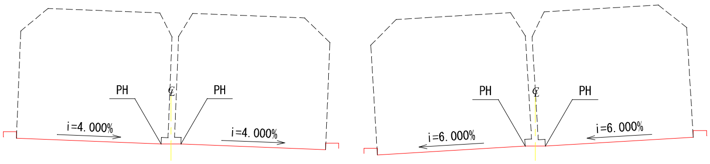


Bago River Bridge (Steel cable-stayed bridge)

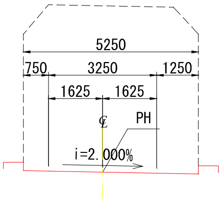


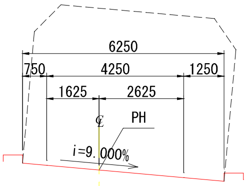
Flyover (crossfall, 4% camber and 6% camber)





On-ramp (2% camber and 9% camber)

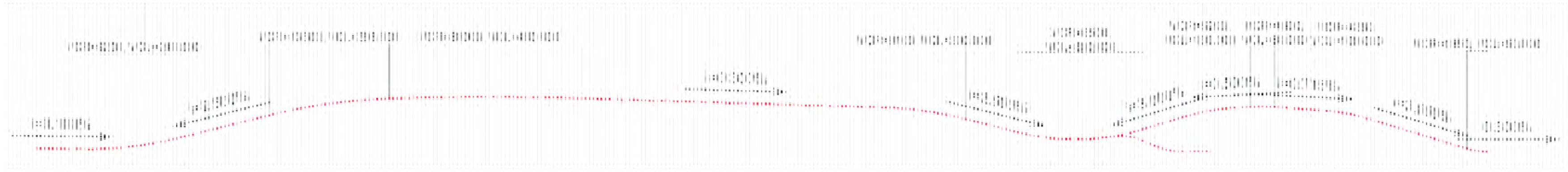



</td><td></td></tr>
<tr><td>Widening</td><td>Bago River Bridge no widening but median
Flyover no widening
On-ramp 1.00 m widening at R = 58 section</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Source: JICA Study Team

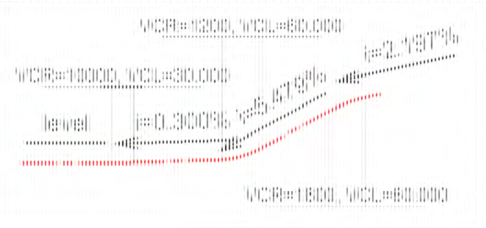
Figure 4.1.12 Planar Alignment

Source: JICA Study Team



Source: JICA Study Team

Figure 4.1.13 Vertical Alignment (Main Road)



Source: JICA Study Team

Figure 4.1.11 Vertical Alignment (On-ramp)

Table 4.1.9 River Conditions

<table>
<tr><th>Item</th><th>Design Conditions</th><th>Remark</th></tr>
<tr><td>River name</td><td>Bago River</td><td></td></tr>
<tr><td>Navigation</td><td>Pier P10 to P13 will be the navigation after construction.
Pier P7 to P20 will also be the navigation in the future.</td><td>Agreement with DWIR</td></tr>
<tr><td>Clearance</td><td>Vertical height and width shall be secured between Pier P7 to P20 as Thanlyin Bridge</td><td>Agreement with DWIR</td></tr>
<tr><td>Design discharge</td><td>16,169 m^3/s (100-year return period)</td><td></td></tr>
<tr><td>Design high water level (HWL)</td><td>
<table>
<tr><th>Load combination</th><th>Supposition</th><th>Water level (MSL＋m)</th><th>River flow (m/s)</th></tr>
<tr><td>Normal</td><td>Full/low tide of spring tide</td><td>+3.18／-2.39</td><td>0</td></tr>
<tr><td>Wind</td><td>Highest HWL</td><td>+4.99</td><td>0</td></tr>
<tr><td>Collision at navigation span</td><td>Full tide of spring tide</td><td>+3.18</td><td>0</td></tr>
<tr><td>Collision at side span</td><td>Maximum river flow at flood of 100year return period</td><td>+2.53</td><td>1.19</td></tr>
<tr><td>Earthquake</td><td>Normal water level</td><td>+0.29</td><td>0.60</td></tr>
<tr><td>During construction</td><td>5year return period</td><td>+4.34</td><td>0.65</td></tr>
</table>
</td><td></td></tr>
<tr><td>Design riverbed and scouring depth</td><td colspan="2">
<table>
<tr><th></th><th>P6</th><th>P7</th><th>P8</th><th>P9</th><th>P10</th></tr>
<tr><td>Riverbed height</td><td>0.41</td><td>-3.59</td><td>-5.35</td><td>-4.82</td><td>-4.55</td></tr>
<tr><td>Foundation height</td><td>-2.48</td><td>-6.38</td><td>-6.34</td><td>-6.35</td><td>-9.10</td></tr>
<tr><td>Maximum scouring depth</td><td>-3.41</td><td>-8.91</td><td>-9.42</td><td>-9.31</td><td>-11.27</td></tr>
</table>
<table>
<tr><th>P11</th><th>P12</th><th>P13</th><th>P14</th><th>P15</th><th>P16</th><th>P17</th><th>P18</th></tr>
<tr><td>-5.41</td><td>-7.96</td><td>-8.02</td><td>-6.28</td><td>-5.09</td><td>-5.26</td><td>-6.70</td><td>-6.99</td></tr>
<tr><td>-9.10</td><td>-9.10</td><td>-9.10</td><td>-8.06</td><td>-8.06</td><td>-8.06</td><td>-8.06</td><td>-8.06</td></tr>
<tr><td>-12.13</td><td>-13.67</td><td>-13.48</td><td>-11.43</td><td>-10.84</td><td>-10.36</td><td>-9.70</td><td>-10.00</td></tr>
</table>
<table>
<tr><th>P19</th><th>P20</th><th>P21</th><th>P22</th><th>P23</th><th>P24</th><th>P25</th></tr>
<tr><td>-6.88</td><td>-6.55</td><td>-6.15</td><td>-4.61</td><td>-0.05</td><td>4.11</td><td>4.04</td></tr>
<tr><td>-8.06</td><td>-7.28</td><td>-7.55</td><td>-7.59</td><td>-2.39</td><td>3.73</td><td>3.78</td></tr>
<tr><td>-9.78</td><td>-9.53</td><td>-8.56</td><td>-7.48</td><td>-2.07</td><td>3.98</td><td>3.92</td></tr>
</table>
Half of the maximum scouring depth is used for the seismic design of substructures and foundations.</td></tr>
<tr><td>Reference height</td><td>Benchmark survey result at Monkey Point
MSL = CDL + 2.814 m
All the height in the Project will be expressed as the height from MSL</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Source: JICA Study Team

Table 4.1.10 Soil Conditions

Item	Design Conditions	Remark
Survey outlines	Shown in Figure 4.1.15	
Profile	Shown in Figure 4.1.14	
Design soil parameters	1. Thanlyin side (A1 to P6 and On-ramp bridge) 2. Riverbed (P7 to P22) 3. Thaketa side (P23 to A2) 4. Flyover bridge	

1. Thanlyin side (A1 to P6 and On-ramp bridge)

No.	Soil name	N-value	Unit weight (kN/m^3)			Internal friction angle	Cohesive strength	Deformation Modulus
			γ_t	γ_{sat}	γ'	φ (°)	c (kN/m^2)	E_{50} (kN/m^2)
1	Filled Soil	1	18.0	18.0	8.0	-	6	700
2	CLAY-I	1	17.5	17.5	7.5	-	15	900
3	Sandy CLAY-I	3	17.5	17.5	7.5	-	15	2,000
4	Silty CLAY-I	15	16.5	17.5	7.5	33	-	6,000
5	Clayey SAND-A	3	17.0	18.0	8.0	28	-	1,200
6	CLAY-AII	5	17.5	17.5	7.5	-	30	3,200
7	Clayey SAND-B	17	17.0	18.0	8.0	33	-	11,900
8	CLAY-AIII	7	17.6	17.6	7.6	-	42	4,900
9	Clayey SAND-C	20	17.0	18.0	8.0	32	-	14,000
10	Clayey SAND-I	22	17.0	18.0	8.0	31	-	15,400
11	Clayey SAND-II	50	19.0	20.0	10.0	34	-	35,000

2. Riverbed (P7 to P22)

No.	Soil name	N-value	Unit weight (kN/m^3)			Internal friction angle	Cohesive strength	Deformation Modulus
			γ_t	γ_{sat}	γ'	φ (°)	c (kN/m^2)	E_{50} (kN/m^2)
1	River sediments	3	17.0	18.0	8.0	29	-	1,200
2	CLAY-I	1	17.5	17.5	7.5	-	10	900
3	Clayey SAND-A	3	17.5	18.5	8.5	28	-	1,200
4	Silty SAND-I	13	17.0	18.0	8.0	33	-	5,200
5	Sandy CLAY-II	9	17.5	17.5	7.5	-	54	6,300
6	CLAY-AII	7	17.5	17.5	7.5	-	42	4,900
7	Clayey SAND-B	13	17.0	18.0	8.0	32	-	9,100
8	Silty SAND-A	25	17.0	18.0	8.0	33	-	17,500
9	CLAY-AIII	18	18.0	18.0	8.0	-	108	12,600
10	Clayey SAND-C	20	17.0	18.0	8.0	33	-	14,000
11	Silty SAND-II	30	17.0	18.0	8.0	34	-	21,000
12	Clayey SAND-I	35	19.0	20.0	10.0	34	-	24,500
13	Clayey SAND-II	50	19.0	20.0	10.0	35	-	35,000

3. Thaketa side (P23 to A2)

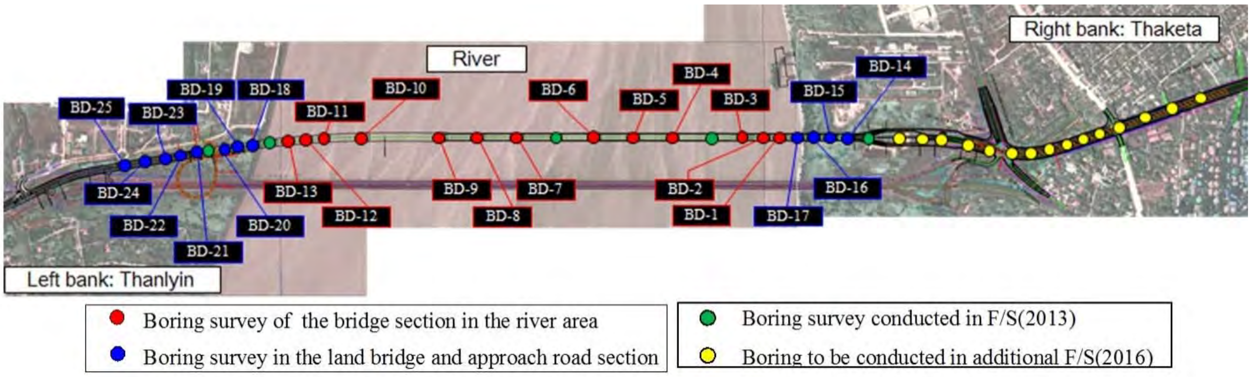
No.	Soil name	N-value	Unit weight (kN/m^3)			Internal friction angle	Cohesive strength	Deformation Modulus
			γ_t	γ_{sat}	γ'	φ (°)	c (kN/m^2)	E_{50} (kN/m^2)
1	Filled Soil	3	19.0	20.0	10.0	-	18	2,100
2	CLAY-I	1	17.5	17.5	7.5	-	15	900
3	Silty SAND-I	13	17.0	18.0	8.0	33	-	6,500
4	Sandy SILT	5	17.0	17.0	7.0	-	30	3,500
5	Silty SAND-II	25	17.0	18.0	8.0	35	-	17,500
6	Clayey SAND-I	30	17.0	18.0	8.0	34	-	21,000
7	Clayey SAND-II	50	19.0	20.0	10.0	35	-	35,000

4. Flyover bridge

No.	Soil name	N-value	Unit weight (kN/m^3)			Internal friction angle	Cohesive strength	Deformation Modulus
			γ_t	γ_{sat}	γ'	φ (°)	c (kN/m^2)	E_{50} (kN/m^2)
1	Filled Soil	4	18.0	18.0	8.0	-	24	1,300
2	CLAY-I	4	18.0	18.0	8.0	-	24	1,300
3	Silty SAND-I	10	18.0	18.0	8.0	32	-	5,000
4	Sandy SILT	8	17.0	17.0	7.0	-	48	5,600
5	Silty SAND-II	22	17.0	19.0	9.0	33	-	15,400
6	CLAY-II	21	18.0	18.0	8.0	-	126	14,700
7	Clayey SAND-I	35	17.0	19.0	9.0	33	-	24,500
8	CLAY-III	35	18.0	18.0	8.0	-	210	24,500
9	Clayey SAND-II	50	19.0	19.0	9.0	37	-	35,000
10	CLAY-IV	50	18.0	18.0	8.0	-	300	35,000

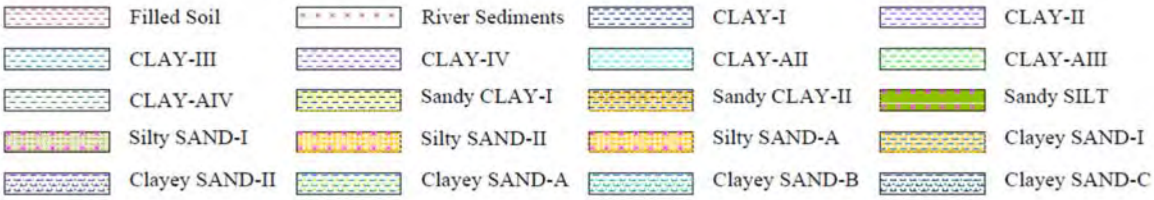
Bearing layer	Stable sand layer of more than 30 SPT value or clay layer of more than 20 SPT value	
Liquefaction	Considered	
Regional subsidence	Not considered in the Project	

Source: JICA Study Team



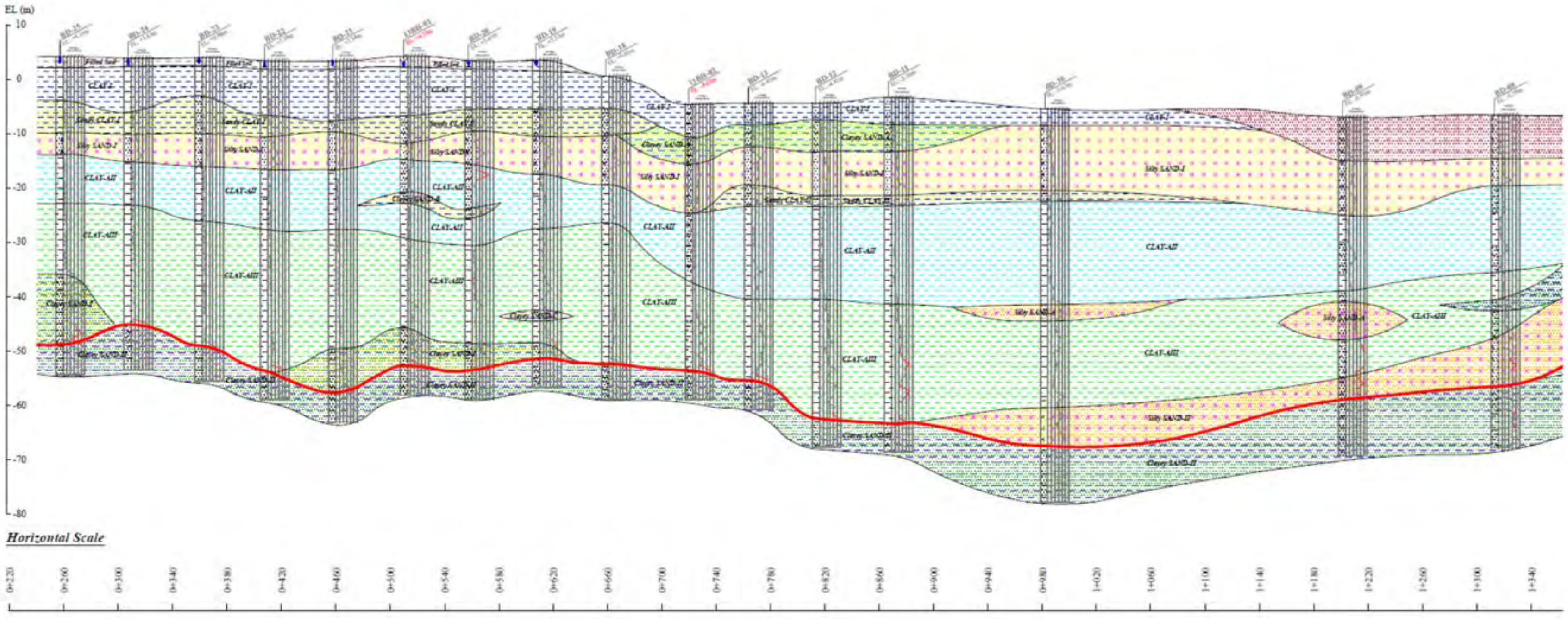
Source: JICA Study Team

Figure 4.1.14 Survey Points



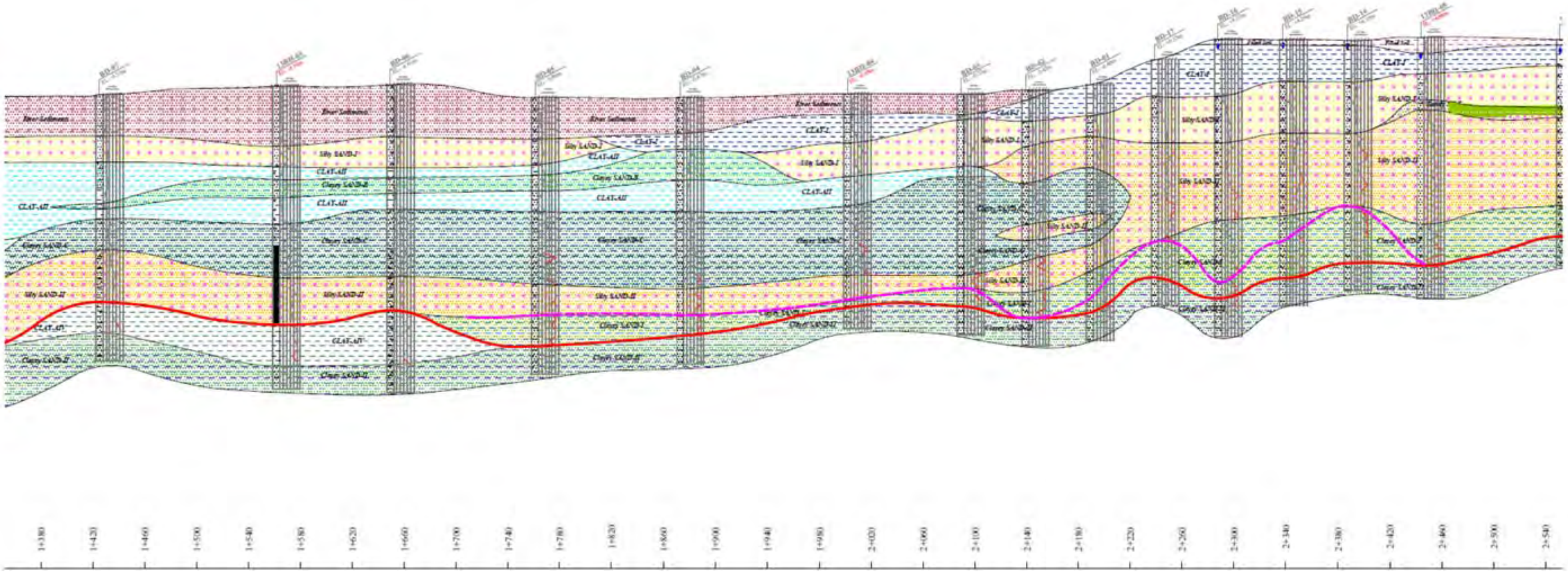
Source: JICA Study Team

Figure 4.1.15 Legend of the Borehole Log



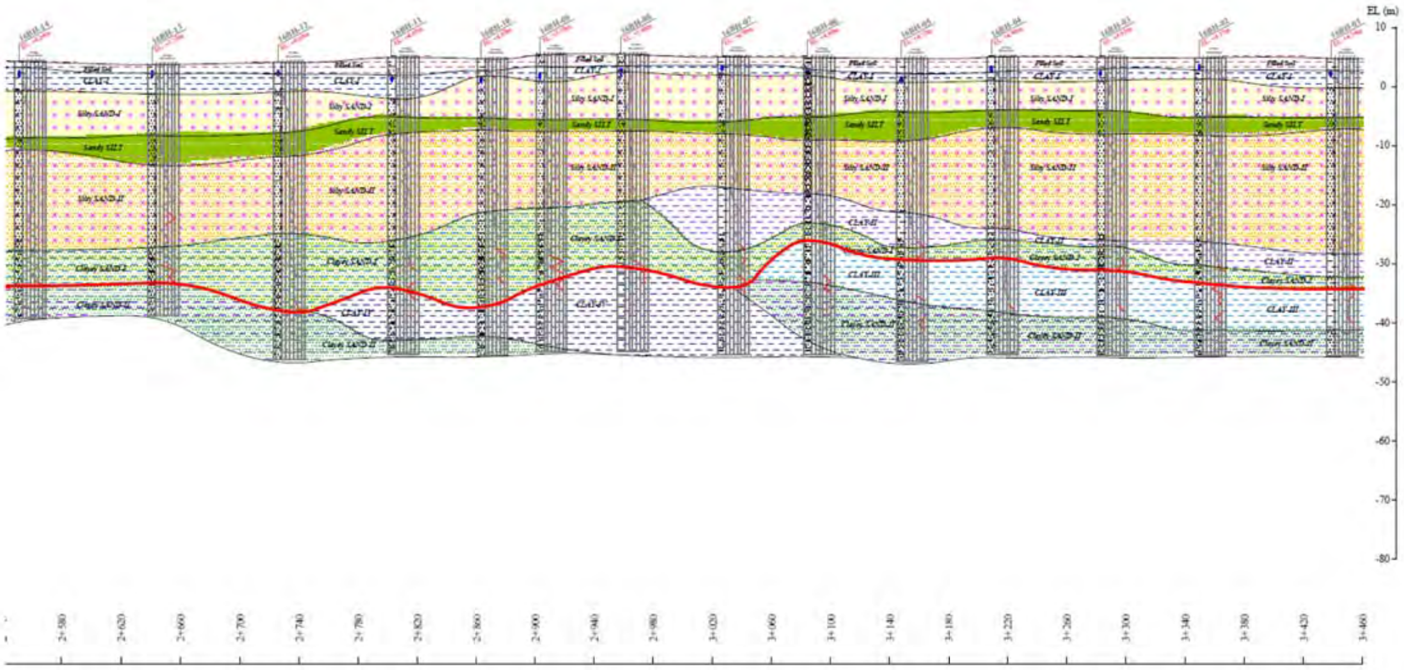
Source

Figure 4.1.16 Profile of Soil Layer at Left Bank (Thanlyin)



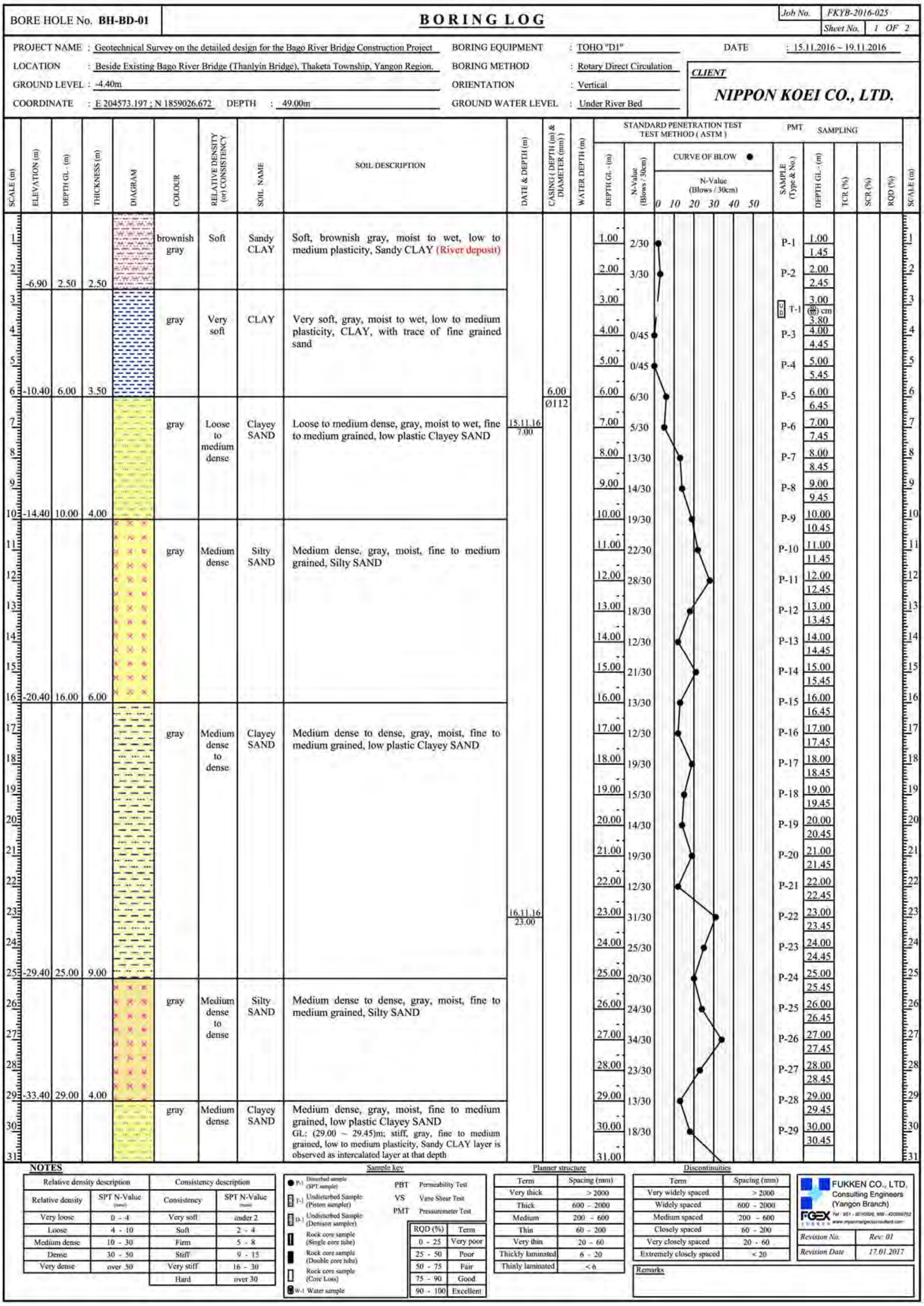
Source: JICA Study Team

Figure 4.1.17 Profile of Soil Layer in Bago River



Source: JICA Study Team

Figure 4.1.18 Profile of Soil Layer at Right Bank (Thaketa)



BORE HOLE No. **BH-BD-01**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -4.40m
COORDINATE : E 204573.197 ; N 1859026.672 DEPTH : 49.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 15.11.2016 ~ 19.11.2016
CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-6.90	2.50	2.50	brownish gray	Soft	Sandy CLAY	Soft, brownish gray, moist to wet, low to medium plasticity, Sandy CLAY (River deposit)
-10.40	6.00	3.50	gray	Very soft	CLAY	Very soft, gray, moist to wet, low to medium plasticity, CLAY, with trace of fine grained sand
-14.40	10.00	4.00	gray	Loose to medium dense	Clayey SAND	Loose to medium dense, gray, moist to wet, fine to medium grained, low plastic Clayey SAND
-20.40	16.00	6.00	gray	Medium dense	Silty SAND	Medium dense, gray, moist, fine to medium grained, Silty SAND
-29.40	25.00	9.00	gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, low plastic Clayey SAND
-33.40	29.00	4.00	gray	Medium dense to dense	Silty SAND	Medium dense to dense, gray, moist, fine to medium grained, Silty SAND
			gray	Medium dense	Clayey SAND	Medium dense, gray, moist, fine to medium grained, low plastic Clayey SAND GL: (29.00 ~ 29.45)m; stiff, gray, fine to medium grained, low to medium plasticity, Sandy CLAY layer is observed as intercalated layer at that depth

DATE & DEPTH (m): 15.11.16 7.00; 16.11.16 23.00
CASING (DEPTH (m) & DIAMETER (mm)): 6.00 Ø112

STANDARD PENETRATION TEST TEST METHOD (ASTM) — CURVE OF BLOW ● N-Value (Blows / 30cm) 0 10 20 30 40 50

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1.00	2/30	P-1	1.00 1.45
2.00	3/30	P-2	2.00 2.45
3.00		UD T-1	3.00 $(\frac{80}{80})$ cm 3.80
4.00	0/45	P-3	4.00 4.45
5.00	0/45	P-4	5.00 5.45
6.00	6/30	P-5	6.00 6.45
7.00	5/30	P-6	7.00 7.45
8.00	13/30	P-7	8.00 8.45
9.00	14/30	P-8	9.00 9.45
10.00	19/30	P-9	10.00 10.45
11.00	22/30	P-10	11.00 11.45
12.00	28/30	P-11	12.00 12.45
13.00	18/30	P-12	13.00 13.45
14.00	12/30	P-13	14.00 14.45
15.00	21/30	P-14	15.00 15.45
16.00	13/30	P-15	16.00 16.45
17.00	12/30	P-16	17.00 17.45
18.00	19/30	P-17	18.00 18.45
19.00	15/30	P-18	19.00 19.45
20.00	14/30	P-19	20.00 20.45
21.00	19/30	P-20	21.00 21.45
22.00	12/30	P-21	22.00 22.45
23.00	31/30	P-22	23.00 23.45
24.00	25/30	P-23	24.00 24.45
25.00	20/30	P-24	25.00 25.45
26.00	24/30	P-25	26.00 26.45
27.00	34/30	P-26	27.00 27.45
28.00	23/30	P-27	28.00 28.45
29.00	13/30	P-28	29.00 29.45
30.00	18/30	P-29	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value (max)	Consistency	SPT N-Value (max)
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

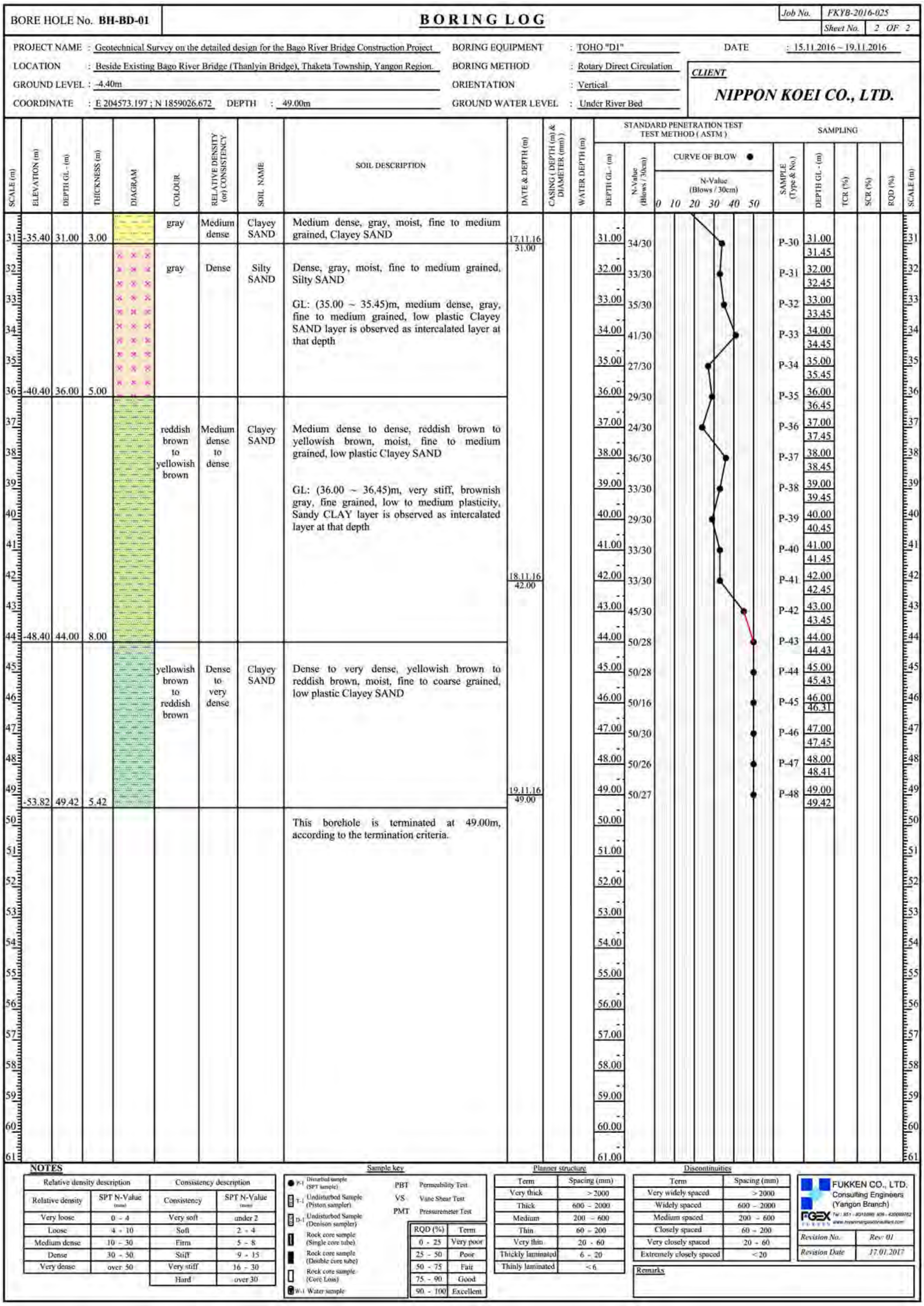
FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 01*
Revision Date	*17.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.19 Boring log BH-BD-01 (1)



BORE HOLE No. **BH-BD-01**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -4.40m
COORDINATE : E 204573.197 ; N 1859026.672 DEPTH : 49.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 15.11.2016 ~ 19.11.2016
CLIENT **NIPPON KOEI CO., LTD.**

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-35.40	31.00	3.00	gray	Medium dense	Clayey SAND	Medium dense, gray, moist, fine to medium grained, Clayey SAND
-40.40	36.00	5.00	gray	Dense	Silty SAND	Dense, gray, moist, fine to medium grained, Silty SAND GL: (35.00 ~ 35.45)m, medium dense, gray, fine to medium grained, low plastic Clayey SAND layer is observed as intercalated layer at that depth
-48.40	44.00	8.00	reddish brown to yellowish brown	Medium dense to dense	Clayey SAND	Medium dense to dense, reddish brown to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND GL: (36.00 ~ 36,45)m, very stiff, brownish gray, fine grained, low to medium plasticity, Sandy CLAY layer is observed as intercalated layer at that depth
-53.82	49.42	5.42	yellowish brown to reddish brown	Dense to very dense	Clayey SAND	Dense to very dense, yellowish brown to reddish brown, moist, fine to coarse grained, low plastic Clayey SAND
						This borehole is terminated at 49.00m, according to the termination criteria.

DATE & DEPTH (m): 17.11.16 / 31.00; 18.11.16 / 42.00; 19.11.16 / 49.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
31.00	34/30	P-30	31.00 31.45
32.00	33/30	P-31	32.00 32.45
33.00	35/30	P-32	33.00 33.45
34.00	41/30	P-33	34.00 34.45
35.00	27/30	P-34	35.00 35.45
36.00	29/30	P-35	36.00 36.45
37.00	24/30	P-36	37.00 37.45
38.00	36/30	P-37	38.00 38.45
39.00	33/30	P-38	39.00 39.45
40.00	29/30	P-39	40.00 40.45
41.00	33/30	P-40	41.00 41.45
42.00	33/30	P-41	42.00 42.45
43.00	45/30	P-42	43.00 43.45
44.00	50/28	P-43	44.00 44.43
45.00	50/28	P-44	45.00 45.43
46.00	50/16	P-45	46.00 46.31
47.00	50/30	P-46	47.00 47.45
48.00	50/26	P-47	48.00 48.41
49.00	50/27	P-48	49.00 49.42
50.00			
51.00			
52.00			
53.00			
54.00			
55.00			
56.00			
57.00			
58.00			
59.00			
60.00			
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

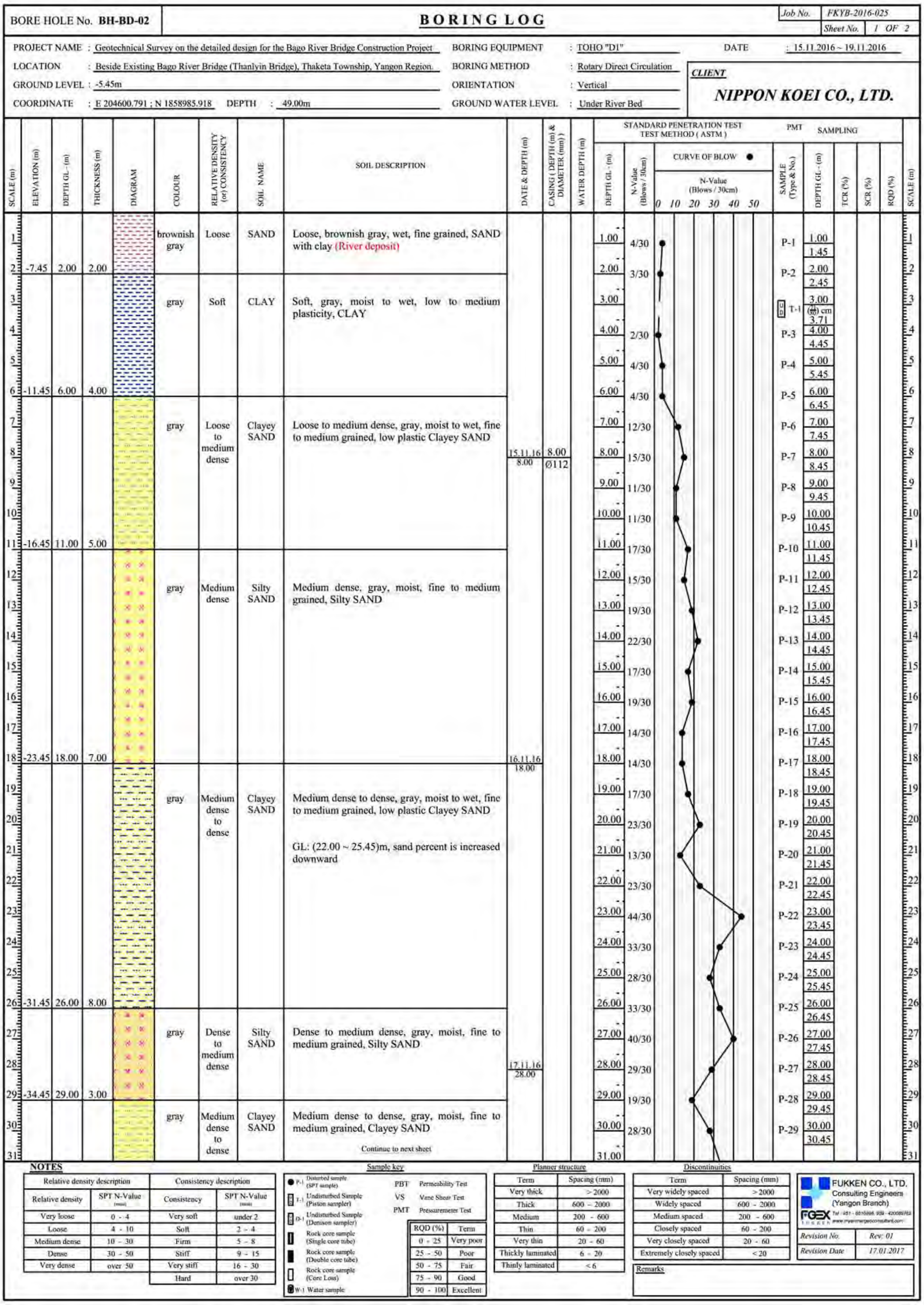
FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 01*
Revision Date	*17.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.20 Boring log BH-BD-01 (2)



BORE HOLE No. **BH-BD-02**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -5.45m
COORDINATE : E 204600.791 ; N 1858985.918 DEPTH : 49.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 15.11.2016 ~ 19.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-7.45	2.00	2.00	brownish gray	Loose	SAND	Loose, brownish gray, wet, fine grained, SAND with clay (River deposit)
-11.45	6.00	4.00	gray	Soft	CLAY	Soft, gray, moist to wet, low to medium plasticity, CLAY
-16.45	11.00	5.00	gray	Loose to medium dense	Clayey SAND	Loose to medium dense, gray, moist to wet, fine to medium grained, low plastic Clayey SAND
-23.45	18.00	7.00	gray	Medium dense	Silty SAND	Medium dense, gray, moist, fine to medium grained, Silty SAND
-31.45	26.00	8.00	gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist to wet, fine to medium grained, low plastic Clayey SAND GL: (22.00 ~ 25.45)m, sand percent is increased downward
-34.45	29.00	3.00	gray	Dense to medium dense	Silty SAND	Dense to medium dense, gray, moist, fine to medium grained, Silty SAND
			gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, Clayey SAND Continue to next sheet

DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))
15.11.16 8.00	8.00 Ø112
16.11.16 18.00	
17.11.16 28.00	

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1.00	4/30	P-1	1.00 1.45
2.00	3/30	P-2	2.00 2.45
3.00		T-1	3.00 (71/90) cm 3.71
4.00	2/30	P-3	4.00 4.45
5.00	4/30	P-4	5.00 5.45
6.00	4/30	P-5	6.00 6.45
7.00	12/30	P-6	7.00 7.45
8.00	15/30	P-7	8.00 8.45
9.00	11/30	P-8	9.00 9.45
10.00	11/30	P-9	10.00 10.45
11.00	17/30	P-10	11.00 11.45
12.00	15/30	P-11	12.00 12.45
13.00	19/30	P-12	13.00 13.45
14.00	22/30	P-13	14.00 14.45
15.00	17/30	P-14	15.00 15.45
16.00	19/30	P-15	16.00 16.45
17.00	14/30	P-16	17.00 17.45
18.00	14/30	P-17	18.00 18.45
19.00	17/30	P-18	19.00 19.45
20.00	23/30	P-19	20.00 20.45
21.00	13/30	P-20	21.00 21.45
22.00	23/30	P-21	22.00 22.45
23.00	44/30	P-22	23.00 23.45
24.00	33/30	P-23	24.00 24.45
25.00	28/30	P-24	25.00 25.45
26.00	33/30	P-25	26.00 26.45
27.00	40/30	P-26	27.00 27.45
28.00	29/30	P-27	28.00 28.45
29.00	19/30	P-28	29.00 29.45
30.00	28/30	P-29	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

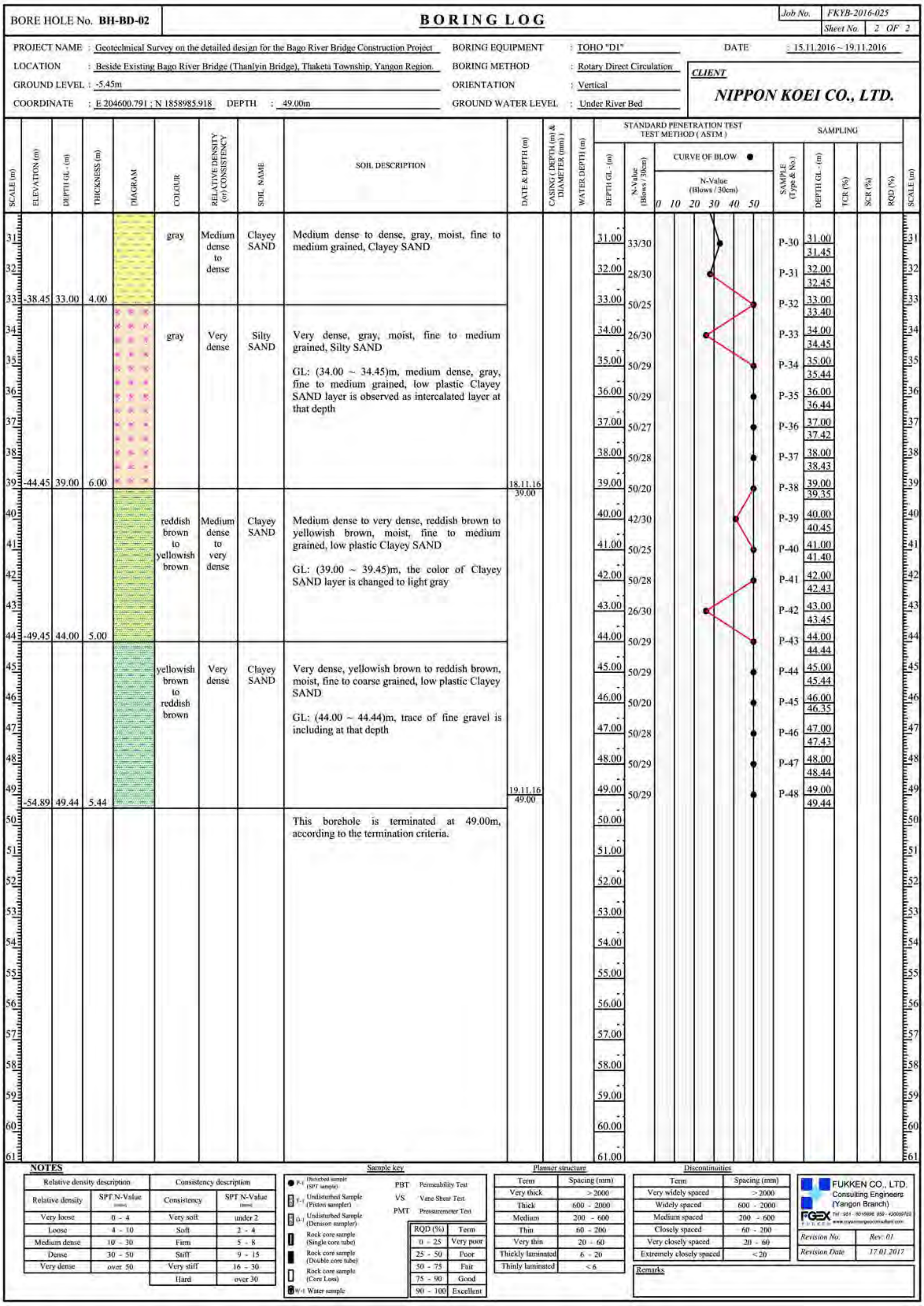
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 01*
Revision Date	*17.01.2017*

Source: JICA Study Team

Figure 4.1.21 Boring log BH-BD-02 (1)



BORE HOLE No. **BH-BD-02**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -5.45m
COORDINATE : E 204600.791 ; N 1858985.918 DEPTH : 49.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 15.11.2016 ~ 19.11.2016
CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-38.45	33.00	4.00	gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, Clayey SAND
-44.45	39.00	6.00	gray	Very dense	Silty SAND	Very dense, gray, moist, fine to medium grained, Silty SAND GL: (34.00 ~ 34.45)m, medium dense, gray, fine to medium grained, low plastic Clayey SAND layer is observed as intercalated layer at that depth
-49.45	44.00	5.00	reddish brown to yellowish brown	Medium dense to very dense	Clayey SAND	Medium dense to very dense, reddish brown to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND GL: (39.00 ~ 39.45)m, the color of Clayey SAND layer is changed to light gray
-54.89	49.44	5.44	yellowish brown to reddish brown	Very dense	Clayey SAND	Very dense, yellowish brown to reddish brown, moist, fine to coarse grained, low plastic Clayey SAND GL: (44.00 ~ 44.44)m, trace of fine gravel is including at that depth
						This borehole is terminated at 49.00m, according to the termination criteria.

DATE & DEPTH (m): 18.11.16 39.00; 19.11.16 49.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

SAMPLING

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
31.00	33/30	P-30	31.00 31.45
32.00	28/30	P-31	32.00 32.45
33.00	50/25	P-32	33.00 33.40
34.00	26/30	P-33	34.00 34.45
35.00	50/29	P-34	35.00 35.44
36.00	50/29	P-35	36.00 36.44
37.00	50/27	P-36	37.00 37.42
38.00	50/28	P-37	38.00 38.43
39.00	50/20	P-38	39.00 39.35
40.00	42/30	P-39	40.00 40.45
41.00	50/25	P-40	41.00 41.40
42.00	50/28	P-41	42.00 42.43
43.00	26/30	P-42	43.00 43.45
44.00	50/29	P-43	44.00 44.44
45.00	50/29	P-44	45.00 45.44
46.00	50/20	P-45	46.00 46.35
47.00	50/28	P-46	47.00 47.43
48.00	50/29	P-47	48.00 48.44
49.00	50/29	P-48	49.00 49.44

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

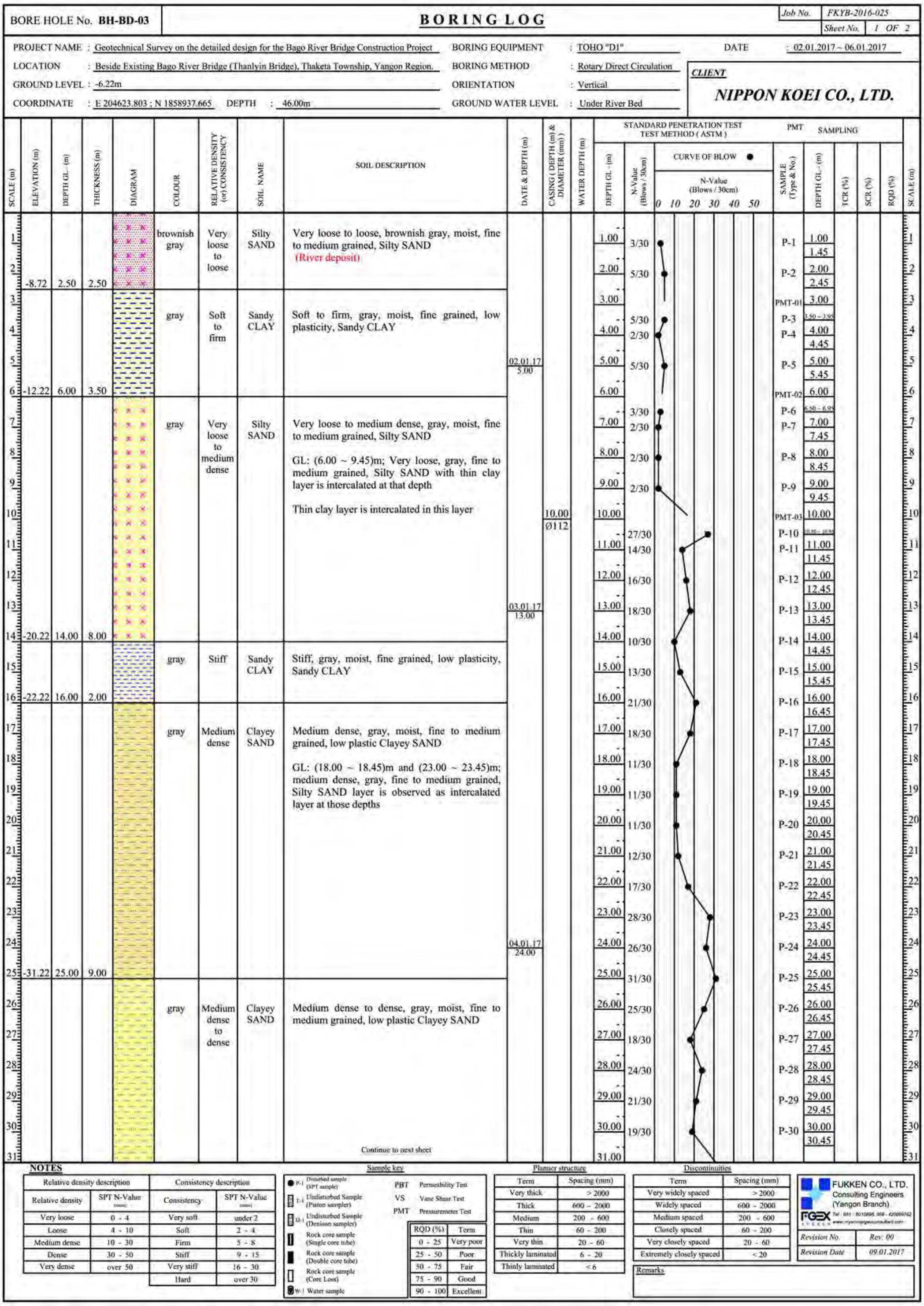
FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 01*
Revision Date	*17.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.22 Boring log BH-BD-02 (2)



BORE HOLE No. **BH-BD-03**	**BORING LOG**	Job No.	FKYB-2016-025
		Sheet No.	1 OF 2

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.22m
COORDINATE : E 204623.803 ; N 1858937.665 DEPTH : 46.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 02.01.2017 ~ 06.01.2017
CLIENT **NIPPON KOEI CO., LTD.**

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-8.72	2.50	2.50	brownish gray	Very loose to loose	Silty SAND	Very loose to loose, brownish gray, moist, fine to medium grained, Silty SAND (River deposit)
-12.22	6.00	3.50	gray	Soft to firm	Sandy CLAY	Soft to firm, gray, moist, fine grained, low plasticity, Sandy CLAY
-20.22	14.00	8.00	gray	Very loose to medium dense	Silty SAND	Very loose to medium dense, gray, moist, fine to medium grained, Silty SAND GL: (6.00 ~ 9.45)m; Very loose, gray, fine to medium grained, Silty SAND with thin clay layer is intercalated at that depth Thin clay layer is intercalated in this layer
-22.22	16.00	2.00	gray	Stiff	Sandy CLAY	Stiff, gray, moist, fine grained, low plasticity, Sandy CLAY
-31.22	25.00	9.00	gray	Medium dense	Clayey SAND	Medium dense, gray, moist, fine to medium grained, low plastic Clayey SAND GL: (18.00 ~ 18.45)m and (23.00 ~ 23.45)m; medium dense, gray, fine to medium grained, Silty SAND layer is observed as intercalated layer at those depths
			gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, low plastic Clayey SAND

Continue to next sheet

DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))
02.01.17 5.00	
	10.00 Ø112
03.01.17 13.00	
04.01.17 24.00	

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
1.00	3/30	P-1	1.00 1.45
2.00	5/30	P-2	2.00 2.45
3.00		PMT-01	3.00
	5/30	P-3	3.50 ~ 3.95
4.00	2/30	P-4	4.00 4.45
5.00	5/30	P-5	5.00 5.45
6.00		PMT-02	6.00
	3/30	P-6	6.50 ~ 6.95
7.00	2/30	P-7	7.00 7.45
8.00	2/30	P-8	8.00 8.45
9.00	2/30	P-9	9.00 9.45
10.00		PMT-03	10.00
	27/30	P-10	10.50 ~ 10.95
11.00	14/30	P-11	11.00 11.45
12.00	16/30	P-12	12.00 12.45
13.00	18/30	P-13	13.00 13.45
14.00	10/30	P-14	14.00 14.45
15.00	13/30	P-15	15.00 15.45
16.00	21/30	P-16	16.00 16.45
17.00	18/30	P-17	17.00 17.45
18.00	11/30	P-18	18.00 18.45
19.00	11/30	P-19	19.00 19.45
20.00	11/30	P-20	20.00 20.45
21.00	12/30	P-21	21.00 21.45
22.00	17/30	P-22	22.00 22.45
23.00	28/30	P-23	23.00 23.45
24.00	26/30	P-24	24.00 24.45
25.00	31/30	P-25	25.00 25.45
26.00	25/30	P-26	26.00 26.45
27.00	18/30	P-27	27.00 27.45
28.00	24/30	P-28	28.00 28.45
29.00	21/30	P-29	29.00 29.45
30.00	19/30	P-30	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key
- ● P-(Disturbed sample (SPT sample)
- T-(Undisturbed Sample (Piston sampler)
- D-(Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-(Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

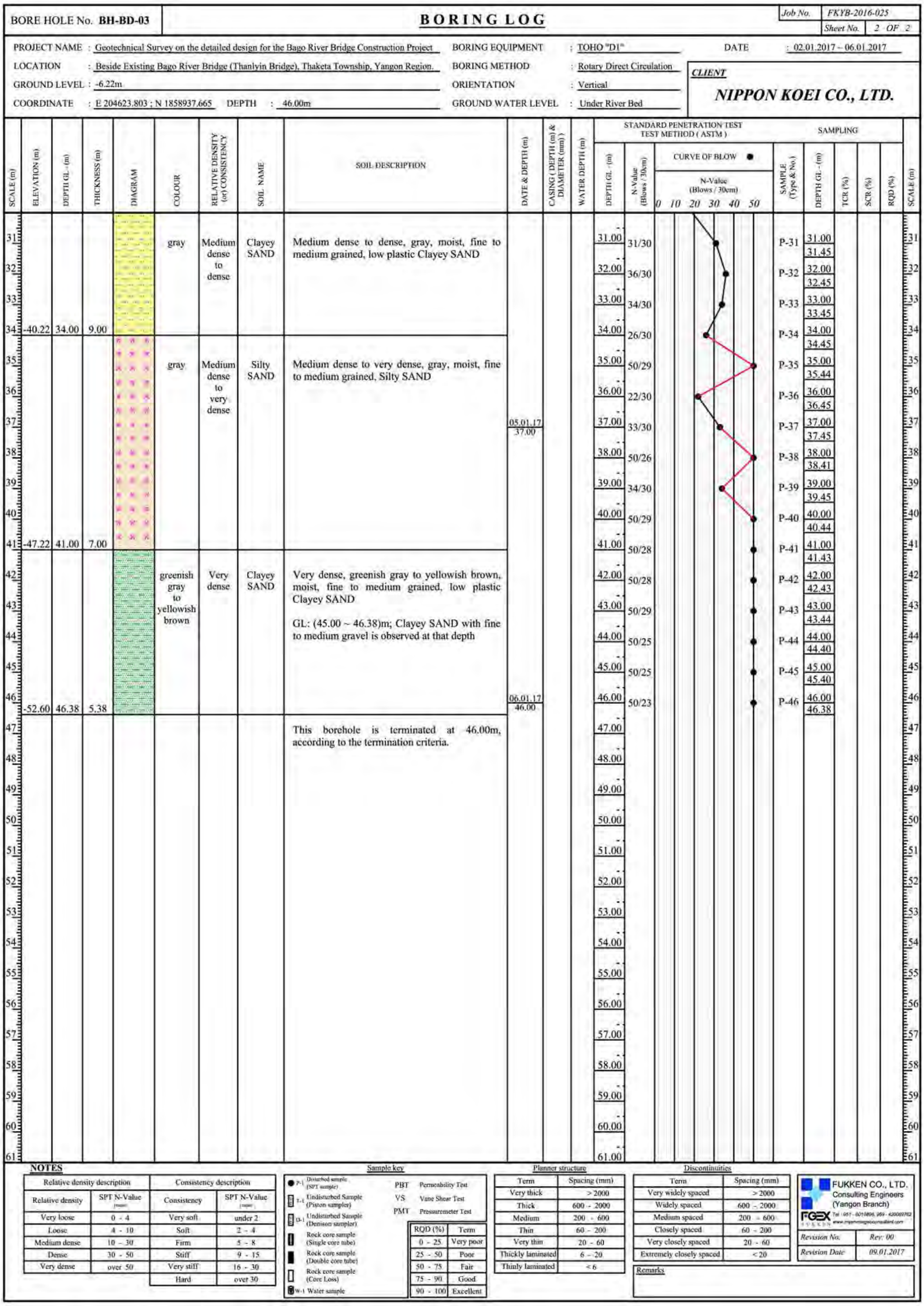
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	Rev: 00
Revision Date	09.01.2017

Source: JICA Study Team

Figure 4.1.23 Boring log BH-BD-03 (1)



BORE HOLE No. **BH-BD-03**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.22m
COORDINATE : E 204623.803 ; N 1858937.665 DEPTH : 46.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 02.01.2017 ~ 06.01.2017

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-40.22	34.00	9.00	gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, low plastic Clayey SAND
-47.22	41.00	7.00	gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND
-52.60	46.38	5.38	greenish gray to yellowish brown	Very dense	Clayey SAND	Very dense, greenish gray to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND GL: (45.00 ~ 46.38)m; Clayey SAND with fine to medium gravel is observed at that depth
						This borehole is terminated at 46.00m, according to the termination criteria.

DATE & DEPTH (m)
05.01.17 37.00
06.01.17 46.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

CURVE OF BLOW ●

N-Value (Blows / 30cm)
0 10 20 30 40 50

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
31.00	31/30	P-31	31.00 31.45
32.00	36/30	P-32	32.00 32.45
33.00	34/30	P-33	33.00 33.45
34.00	26/30	P-34	34.00 34.45
35.00	50/29	P-35	35.00 35.44
36.00	22/30	P-36	36.00 36.45
37.00	33/30	P-37	37.00 37.45
38.00	50/26	P-38	38.00 38.41
39.00	34/30	P-39	39.00 39.45
40.00	50/29	P-40	40.00 40.44
41.00	50/28	P-41	41.00 41.43
42.00	50/28	P-42	42.00 42.43
43.00	50/29	P-43	43.00 43.44
44.00	50/25	P-44	44.00 44.40
45.00	50/25	P-45	45.00 45.40
46.00	50/23	P-46	46.00 46.38
47.00			
48.00			
49.00			
50.00			
51.00			
52.00			
53.00			
54.00			
55.00			
56.00			
57.00			
58.00			
59.00			
60.00			
61.00			

SAMPLING: TCR (%) SCR (%) RQD (%)

NOTES

Relative density description	
Relative density	SPT N-Value
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

Consistency description	
Consistency	SPT N-Value
Very soft	under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
T-1 Undisturbed Sample (Piston sampler)
D-1 Undisturbed Sample (Denison sampler)
Rock core sample (Single core tube)
Rock core sample (Double core tube)
Rock core sample (Core Loss)
W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

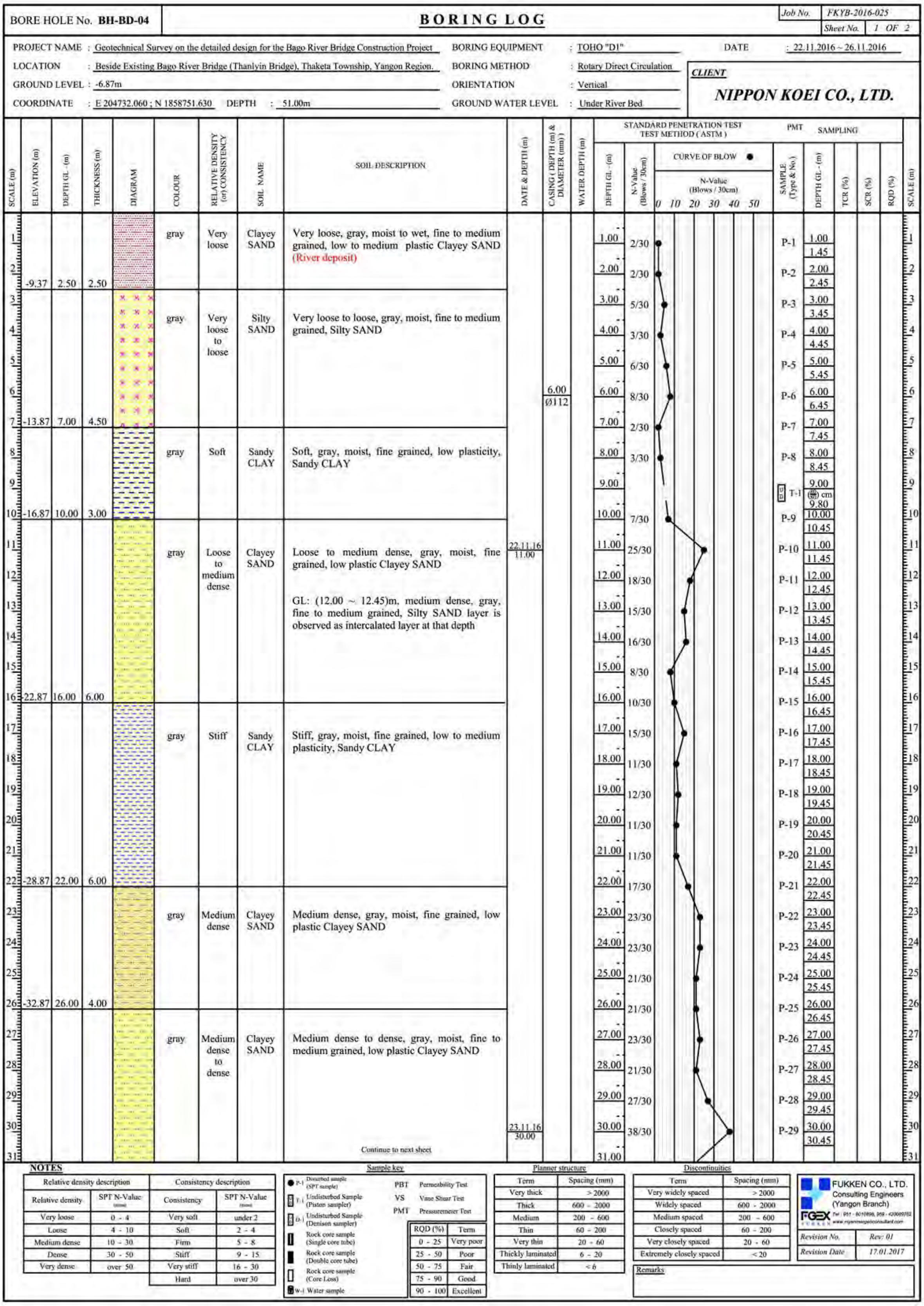
FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 00*
Revision Date	*09.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.24 Boring log BH-BD-03 (2)



BORE HOLE No. **BH-BD-04**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.87m
COORDINATE : E 204732.060 ; N 1858751.630 DEPTH : 51.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 22.11.2016 ~ 26.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-9.37	2.50	2.50	gray	Very loose	Clayey SAND	Very loose, gray, moist to wet, fine to medium grained, low to medium plastic Clayey SAND (River deposit)
-13.87	7.00	4.50	gray	Very loose to loose	Silty SAND	Very loose to loose, gray, moist, fine to medium grained, Silty SAND
-16.87	10.00	3.00	gray	Soft	Sandy CLAY	Soft, gray, moist, fine grained, low plasticity, Sandy CLAY
-22.87	16.00	6.00	gray	Loose to medium dense	Clayey SAND	Loose to medium dense, gray, moist, fine grained, low plastic Clayey SAND GL: (12.00 ~ 12.45)m, medium dense, gray, fine to medium grained, Silty SAND layer is observed as intercalated layer at that depth
-28.87	22.00	6.00	gray	Stiff	Sandy CLAY	Stiff, gray, moist, fine grained, low to medium plasticity, Sandy CLAY
-32.87	26.00	4.00	gray	Medium dense	Clayey SAND	Medium dense, gray, moist, fine grained, low plastic Clayey SAND
			gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, low plastic Clayey SAND

Continue to next sheet

DATE & DEPTH (m): 22.11.16 / 11.00; 23.11.16 / 30.00

CASING (DEPTH (m) & DIAMETER (mm)): 6.00 / Ø112

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1.00	2/30	P-1	1.00 1.45
2.00	2/30	P-2	2.00 2.45
3.00	5/30	P-3	3.00 3.45
4.00	3/30	P-4	4.00 4.45
5.00	6/30	P-5	5.00 5.45
6.00	8/30	P-6	6.00 6.45
7.00	2/30	P-7	7.00 7.45
8.00	3/30	P-8	8.00 8.45
9.00		T-1	9.00 ([illegible]) cm 9.80
10.00	7/30	P-9	10.00 10.45
11.00	25/30	P-10	11.00 11.45
12.00	18/30	P-11	12.00 12.45
13.00	15/30	P-12	13.00 13.45
14.00	16/30	P-13	14.00 14.45
15.00	8/30	P-14	15.00 15.45
16.00	10/30	P-15	16.00 16.45
17.00	15/30	P-16	17.00 17.45
18.00	11/30	P-17	18.00 18.45
19.00	12/30	P-18	19.00 19.45
20.00	11/30	P-19	20.00 20.45
21.00	11/30	P-20	21.00 21.45
22.00	17/30	P-21	22.00 22.45
23.00	23/30	P-22	23.00 23.45
24.00	23/30	P-23	24.00 24.45
25.00	21/30	P-24	25.00 25.45
26.00	21/30	P-25	26.00 26.45
27.00	23/30	P-26	27.00 27.45
28.00	21/30	P-27	28.00 28.45
29.00	27/30	P-28	29.00 29.45
30.00	38/30	P-29	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)
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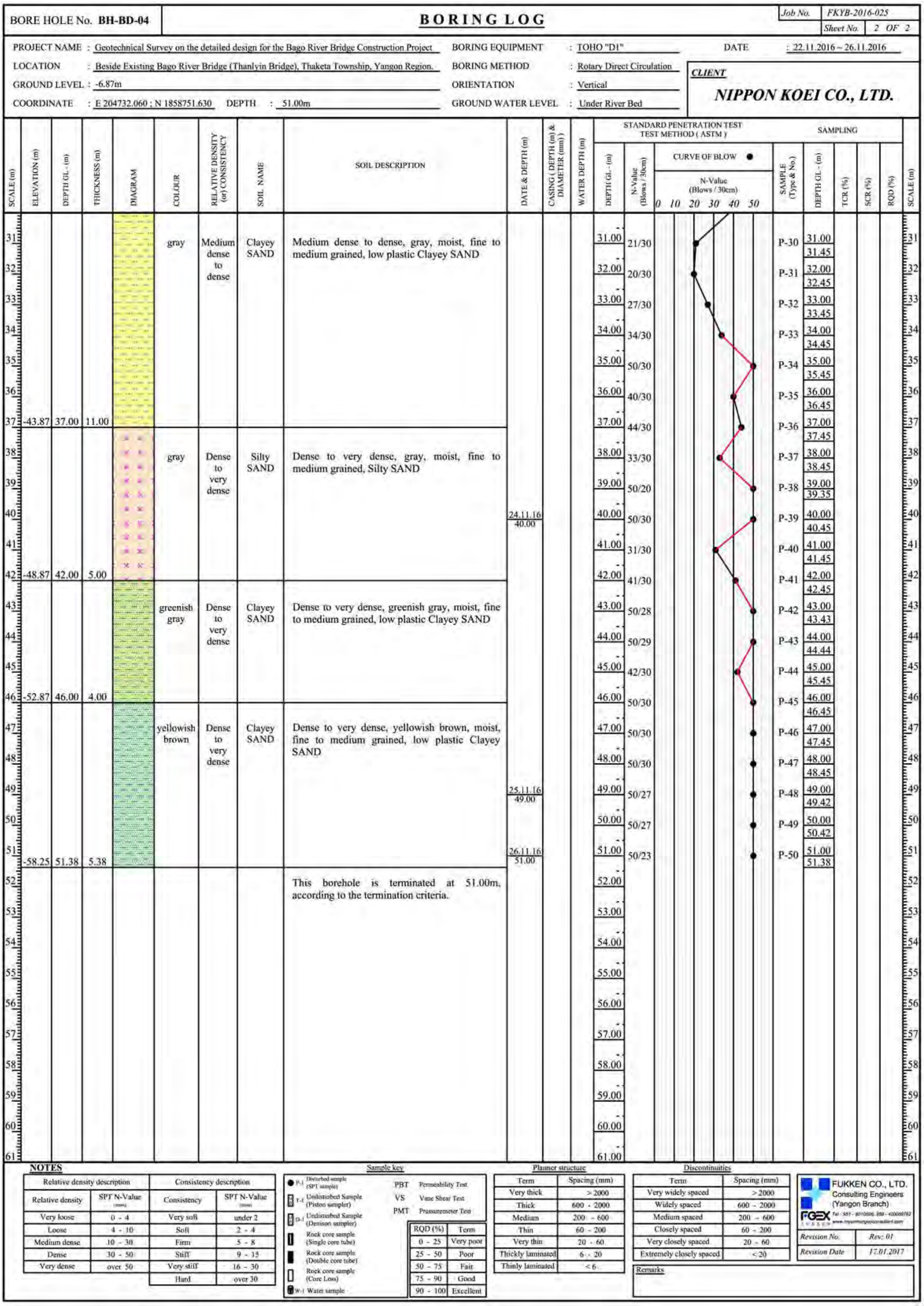
www.myanmargeoconsultant.com

Revision No.	*Rev: 01*
Revision Date	*17.01.2017*

Source: JICA Study Team

Figure 4.1.25 Boring log BH-BD-04 (1)



BORE HOLE No. **BH-BD-04**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.87m
COORDINATE : E 204732.060 ; N 1858751.630 DEPTH : 51.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 22.11.2016 ~ 26.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-43.87	37.00	11.00	gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, low plastic Clayey SAND
-48.87	42.00	5.00	gray	Dense to very dense	Silty SAND	Dense to very dense, gray, moist, fine to medium grained, Silty SAND
-52.87	46.00	4.00	greenish gray	Dense to very dense	Clayey SAND	Dense to very dense, greenish gray, moist, fine to medium grained, low plastic Clayey SAND
-58.25	51.38	5.38	yellowish brown	Dense to very dense	Clayey SAND	Dense to very dense, yellowish brown, moist, fine to medium grained, low plastic Clayey SAND
						This borehole is terminated at 51.00m, according to the termination criteria.

DATE & DEPTH (m)
24.11.16 40.00
25.11.16 49.00
26.11.16 51.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

SAMPLING

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
31.00	21/30	P-30	31.00 31.45
32.00	20/30	P-31	32.00 32.45
33.00	27/30	P-32	33.00 33.45
34.00	34/30	P-33	34.00 34.45
35.00	50/30	P-34	35.00 35.45
36.00	40/30	P-35	36.00 36.45
37.00	44/30	P-36	37.00 37.45
38.00	33/30	P-37	38.00 38.45
39.00	50/20	P-38	39.00 39.35
40.00	50/30	P-39	40.00 40.45
41.00	31/30	P-40	41.00 41.45
42.00	41/30	P-41	42.00 42.45
43.00	50/28	P-42	43.00 43.43
44.00	50/29	P-43	44.00 44.44
45.00	42/30	P-44	45.00 45.45
46.00	50/30	P-45	46.00 46.45
47.00	50/30	P-46	47.00 47.45
48.00	50/30	P-47	48.00 48.45
49.00	50/27	P-48	49.00 49.42
50.00	50/27	P-49	50.00 50.42
51.00	50/23	P-50	51.00 51.38
52.00			
53.00			
54.00			
55.00			
56.00			
57.00			
58.00			
59.00			
60.00			
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
T-1	Undisturbed Sample (Piston sampler)
D-1	Undisturbed Sample (Denison sampler)
▯	Rock core sample (Single core tube)
▮	Rock core sample (Double core tube)
▯	Rock core sample (Core Loss)
W-1	Water sample
PBT	Permeability Test
VS	Vane Shear Test
PMT	Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

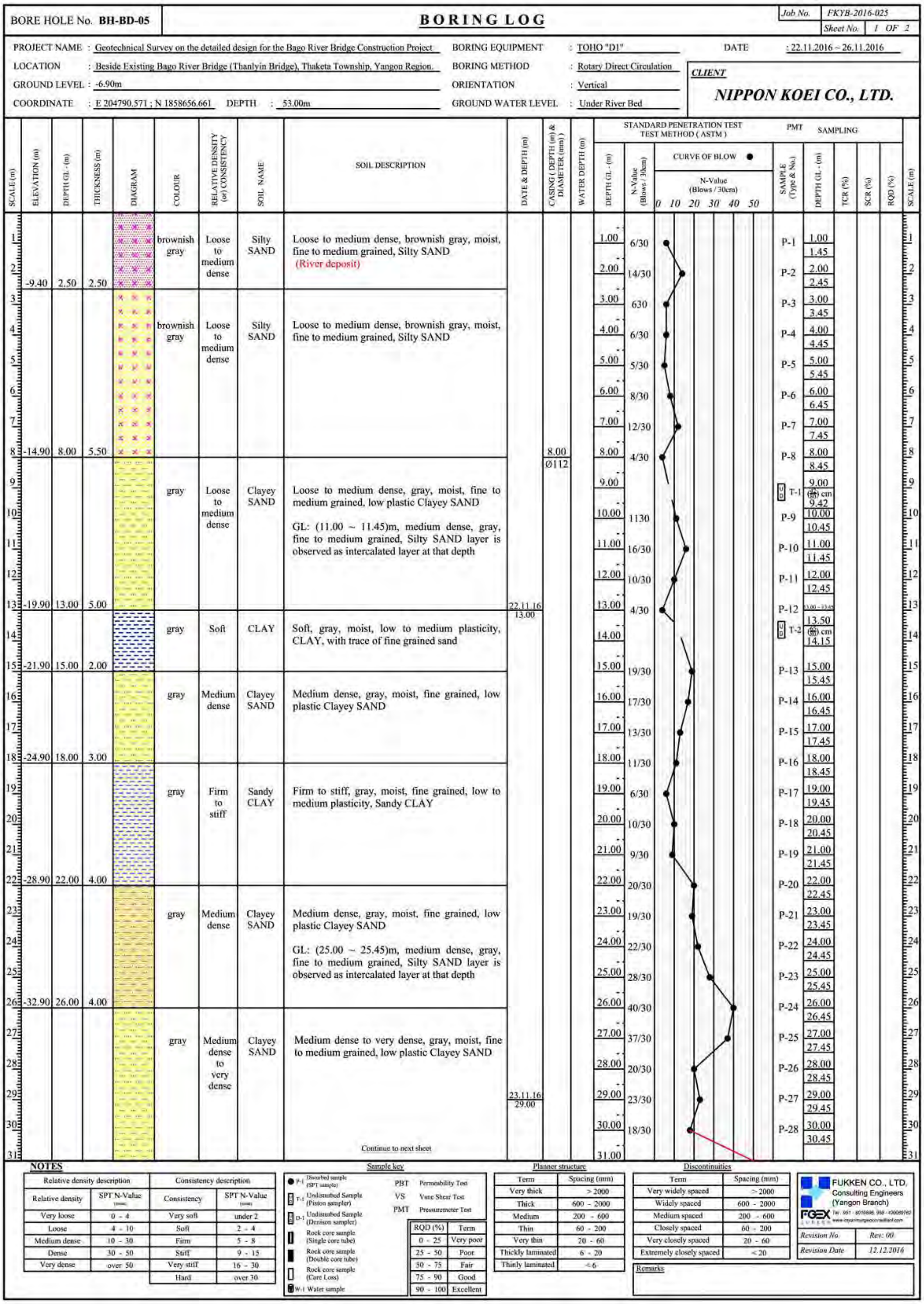
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)
Tel : 951 - 8010506, 959 - 420069782

Revision No.	*Rev: 01*
Revision Date	*17.01.2017*

Source: JICA Study Team

Figure 4.1.26 Boring log BH-BD-04 (2)



BORE HOLE No. **BH-BD-05**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 1 OF 2

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.90m
COORDINATE : E 204790.571 ; N 1858656.661 DEPTH : 53.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 22.11.2016 ~ 26.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-9.40	2.50	2.50	brownish gray	Loose to medium dense	Silty SAND	Loose to medium dense, brownish gray, moist, fine to medium grained, Silty SAND (River deposit)
-14.90	8.00	5.50	brownish gray	Loose to medium dense	Silty SAND	Loose to medium dense, brownish gray, moist, fine to medium grained, Silty SAND
-19.90	13.00	5.00	gray	Loose to medium dense	Clayey SAND	Loose to medium dense, gray, moist, fine to medium grained, low plastic Clayey SAND GL: (11.00 ~ 11.45)m, medium dense, gray, fine to medium grained, Silty SAND layer is observed as intercalated layer at that depth
-21.90	15.00	2.00	gray	Soft	CLAY	Soft, gray, moist, low to medium plasticity, CLAY, with trace of fine grained sand
-24.90	18.00	3.00	gray	Medium dense	Clayey SAND	Medium dense, gray, moist, fine grained, low plastic Clayey SAND
-28.90	22.00	4.00	gray	Firm to stiff	Sandy CLAY	Firm to stiff, gray, moist, fine grained, low to medium plasticity, Sandy CLAY
-32.90	26.00	4.00	gray	Medium dense	Clayey SAND	Medium dense, gray, moist, fine grained, low plastic Clayey SAND GL: (25.00 ~ 25.45)m, medium dense, gray, fine to medium grained, Silty SAND layer is observed as intercalated layer at that depth
			gray	Medium dense to very dense	Clayey SAND	Medium dense to very dense, gray, moist, fine to medium grained, low plastic Clayey SAND

Continue to next sheet

DATE & DEPTH (m): 22.11.16 13.00; 23.11.16 29.00

CASING (DEPTH (m) & DIAMETER (mm)): 8.00 Ø112

STANDARD PENETRATION TEST TEST METHOD (ASTM) / PMT / SAMPLING

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1.00	6/30	P-1	1.00 1.45
2.00	14/30	P-2	2.00 2.45
3.00	630	P-3	3.00 3.45
4.00	6/30	P-4	4.00 4.45
5.00	5/30	P-5	5.00 5.45
6.00	8/30	P-6	6.00 6.45
7.00	12/30	P-7	7.00 7.45
8.00	4/30	P-8	8.00 8.45
9.00		UD T-1	9.00 (42/80) cm 9.42
10.00	1130	P-9	10.00 10.45
11.00	16/30	P-10	11.00 11.45
12.00	10/30	P-11	12.00 12.45
13.00	4/30	P-12	13.00 ~ 13.45
14.00		UD T-2	13.50 (65/80) cm 14.15
15.00	19/30	P-13	15.00 15.45
16.00	17/30	P-14	16.00 16.45
17.00	13/30	P-15	17.00 17.45
18.00	11/30	P-16	18.00 18.45
19.00	6/30	P-17	19.00 19.45
20.00	10/30	P-18	20.00 20.45
21.00	9/30	P-19	21.00 21.45
22.00	20/30	P-20	22.00 22.45
23.00	19/30	P-21	23.00 23.45
24.00	22/30	P-22	24.00 24.45
25.00	28/30	P-23	25.00 25.45
26.00	40/30	P-24	26.00 26.45
27.00	37/30	P-25	27.00 27.45
28.00	20/30	P-26	28.00 28.45
29.00	23/30	P-27	29.00 29.45
30.00	18/30	P-28	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
▯ T-1 Undisturbed Sample (Piston sampler)
▯ D-1 Undisturbed Sample (Denison sampler)
▯ Rock core sample (Single core tube)
▮ Rock core sample (Double core tube)
▯ Rock core sample (Core Loss)
▯ W-1 Water sample
PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

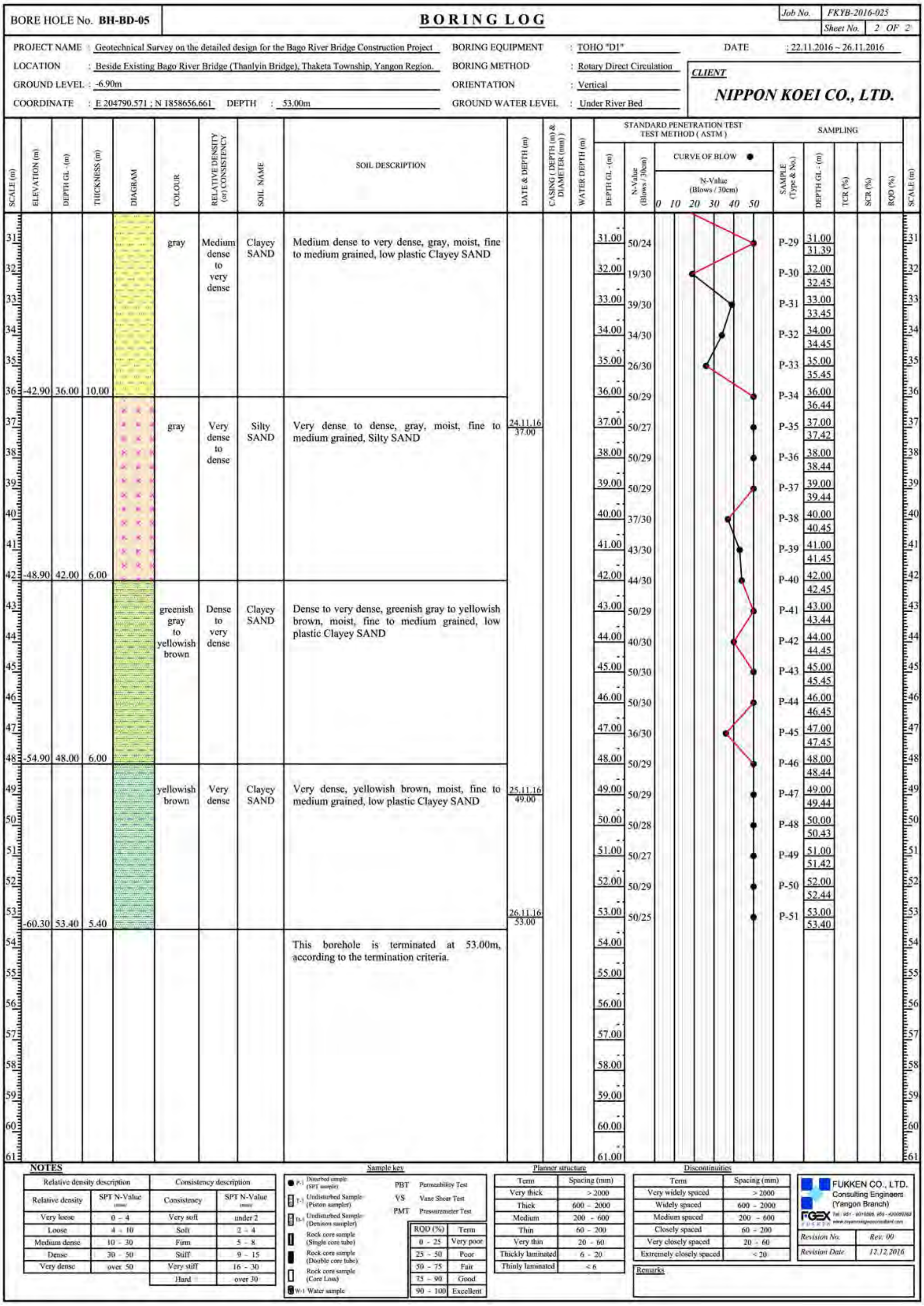
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	Rev: 00
Revision Date	12.12.2016

Source: JICA Study Team

Figure 4.1.27 Boring log BH-BD-05 (1)



BORE HOLE No. **BH-BD-05**	**BORING LOG**	Job No.	FKYB-2016-025
		Sheet No.	2 OF 2

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project

LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.

GROUND LEVEL : -6.90m

COORDINATE : E 204790.571 ; N 1858656.661 DEPTH : 53.00m

BORING EQUIPMENT : TOHO "D1"

BORING METHOD : Rotary Direct Circulation

ORIENTATION : Vertical

GROUND WATER LEVEL : Under River Bed

DATE : 22.11.2016 ~ 26.11.2016

CLIENT

NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)
-42.90	36.00	10.00	gray	Medium dense to very dense	Clayey SAND	Medium dense to very dense, gray, moist, fine to medium grained, low plastic Clayey SAND	
-48.90	42.00	6.00	gray	Very dense to dense	Silty SAND	Very dense to dense, gray, moist, fine to medium grained, Silty SAND	24.11.16 37.00
-54.90	48.00	6.00	greenish gray to yellowish brown	Dense to very dense	Clayey SAND	Dense to very dense, greenish gray to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND	
-60.30	53.40	5.40	yellowish brown	Very dense	Clayey SAND	Very dense, yellowish brown, moist, fine to medium grained, low plastic Clayey SAND	25.11.16 49.00 26.11.16 53.00
						This borehole is terminated at 53.00m, according to the termination criteria.	

STANDARD PENETRATION TEST TEST METHOD (ASTM) / SAMPLING

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
31.00	50/24	P-29	31.00 31.39
32.00	19/30	P-30	32.00 32.45
33.00	39/30	P-31	33.00 33.45
34.00	34/30	P-32	34.00 34.45
35.00	26/30	P-33	35.00 35.45
36.00	50/29	P-34	36.00 36.44
37.00	50/27	P-35	37.00 37.42
38.00	50/29	P-36	38.00 38.44
39.00	50/29	P-37	39.00 39.44
40.00	37/30	P-38	40.00 40.45
41.00	43/30	P-39	41.00 41.45
42.00	44/30	P-40	42.00 42.45
43.00	50/29	P-41	43.00 43.44
44.00	40/30	P-42	44.00 44.45
45.00	50/30	P-43	45.00 45.45
46.00	50/30	P-44	46.00 46.45
47.00	36/30	P-45	47.00 47.45
48.00	50/29	P-46	48.00 48.44
49.00	50/29	P-47	49.00 49.44
50.00	50/28	P-48	50.00 50.43
51.00	50/27	P-49	51.00 51.42
52.00	50/29	P-50	52.00 52.44
53.00	50/25	P-51	53.00 53.40
54.00			
55.00			
56.00			
57.00			
58.00			
59.00			
60.00			
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test

VS Vane Shear Test

PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

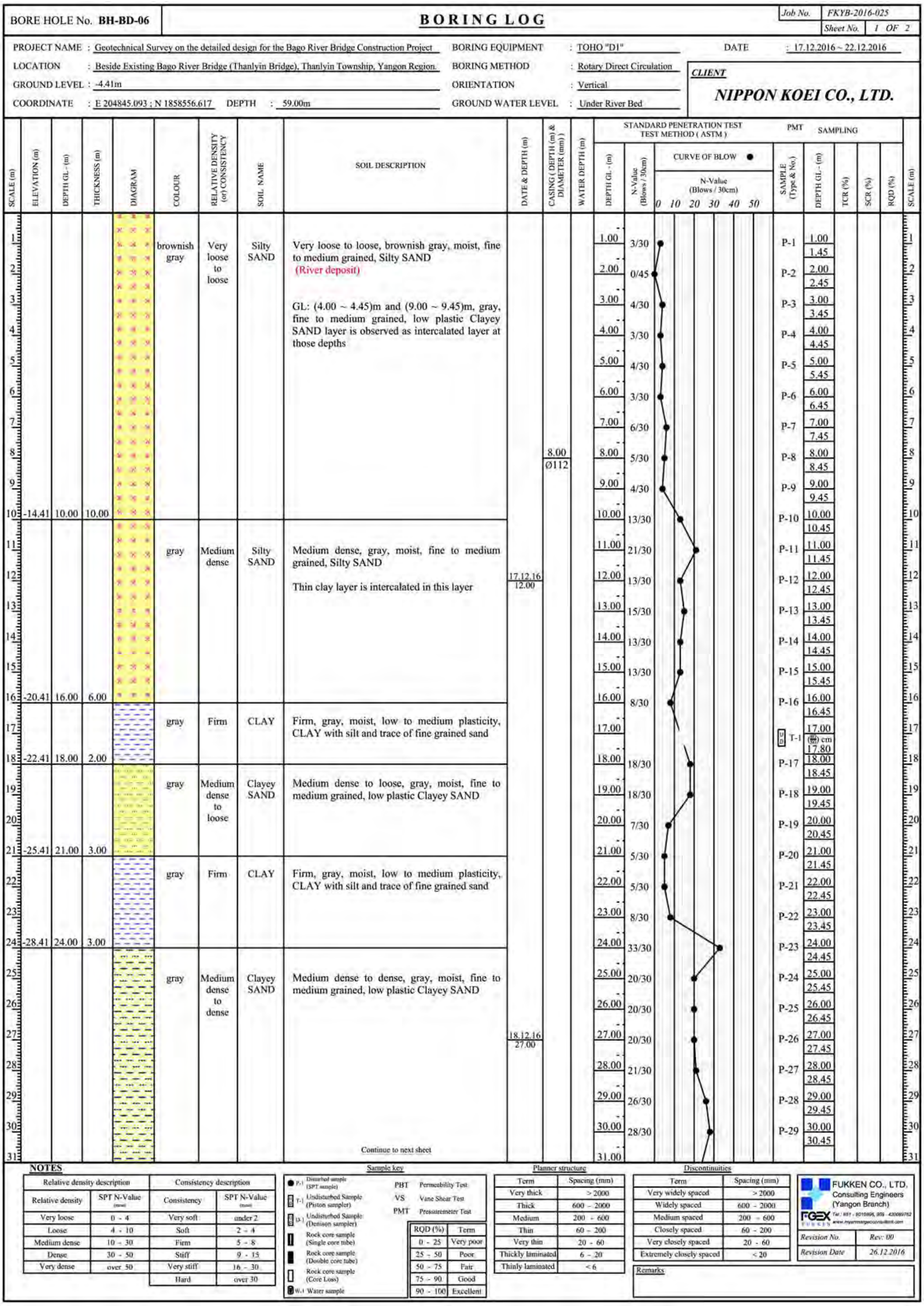
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	Rev: 00
Revision Date	12.12.2016

Source: JICA Study Team

Figure 4.1.28 Boring log BH-BD-05 (2)



BORE HOLE No. **BH-BD-06**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -4.41m
COORDINATE : E 204845.093 ; N 1858556.617 DEPTH : 59.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 17.12.2016 ~ 22.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-14.41	10.00	10.00	brownish gray	Very loose to loose	Silty SAND	Very loose to loose, brownish gray, moist, fine to medium grained, Silty SAND (River deposit) GL: (4.00 ~ 4.45)m and (9.00 ~ 9.45)m, gray, fine to medium grained, low plastic Clayey SAND layer is observed as intercalated layer at those depths
-20.41	16.00	6.00	gray	Medium dense	Silty SAND	Medium dense, gray, moist, fine to medium grained, Silty SAND Thin clay layer is intercalated in this layer
-22.41	18.00	2.00	gray	Firm	CLAY	Firm, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand
-25.41	21.00	3.00	gray	Medium dense to loose	Clayey SAND	Medium dense to loose, gray, moist, fine to medium grained, low plastic Clayey SAND
-28.41	24.00	3.00	gray	Firm	CLAY	Firm, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand
			gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, low plastic Clayey SAND

DATE & DEPTH (m): 17.12.16 12.00; 18.12.16 27.00

CASING (DEPTH (m) & DIAMETER (mm)): 8.00 Ø112

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
1.00	3/30	P-1	1.00 1.45
2.00	0/45	P-2	2.00 2.45
3.00	4/30	P-3	3.00 3.45
4.00	3/30	P-4	4.00 4.45
5.00	4/30	P-5	5.00 5.45
6.00	3/30	P-6	6.00 6.45
7.00	6/30	P-7	7.00 7.45
8.00	5/30	P-8	8.00 8.45
9.00	4/30	P-9	9.00 9.45
10.00	13/30	P-10	10.00 10.45
11.00	21/30	P-11	11.00 11.45
12.00	13/30	P-12	12.00 12.45
13.00	15/30	P-13	13.00 13.45
14.00	13/30	P-14	14.00 14.45
15.00	13/30	P-15	15.00 15.45
16.00	8/30	P-16	16.00 16.45
17.00		UD T-1	17.00 [illegible] cm 17.80
18.00	18/30	P-17	18.00 18.45
19.00	18/30	P-18	19.00 19.45
20.00	7/30	P-19	20.00 20.45
21.00	5/30	P-20	21.00 21.45
22.00	5/30	P-21	22.00 22.45
23.00	8/30	P-22	23.00 23.45
24.00	33/30	P-23	24.00 24.45
25.00	20/30	P-24	25.00 25.45
26.00	20/30	P-25	26.00 26.45
27.00	20/30	P-26	27.00 27.45
28.00	21/30	P-27	28.00 28.45
29.00	26/30	P-28	29.00 29.45
30.00	28/30	P-29	30.00 30.45
31.00			

Continue to next sheet

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

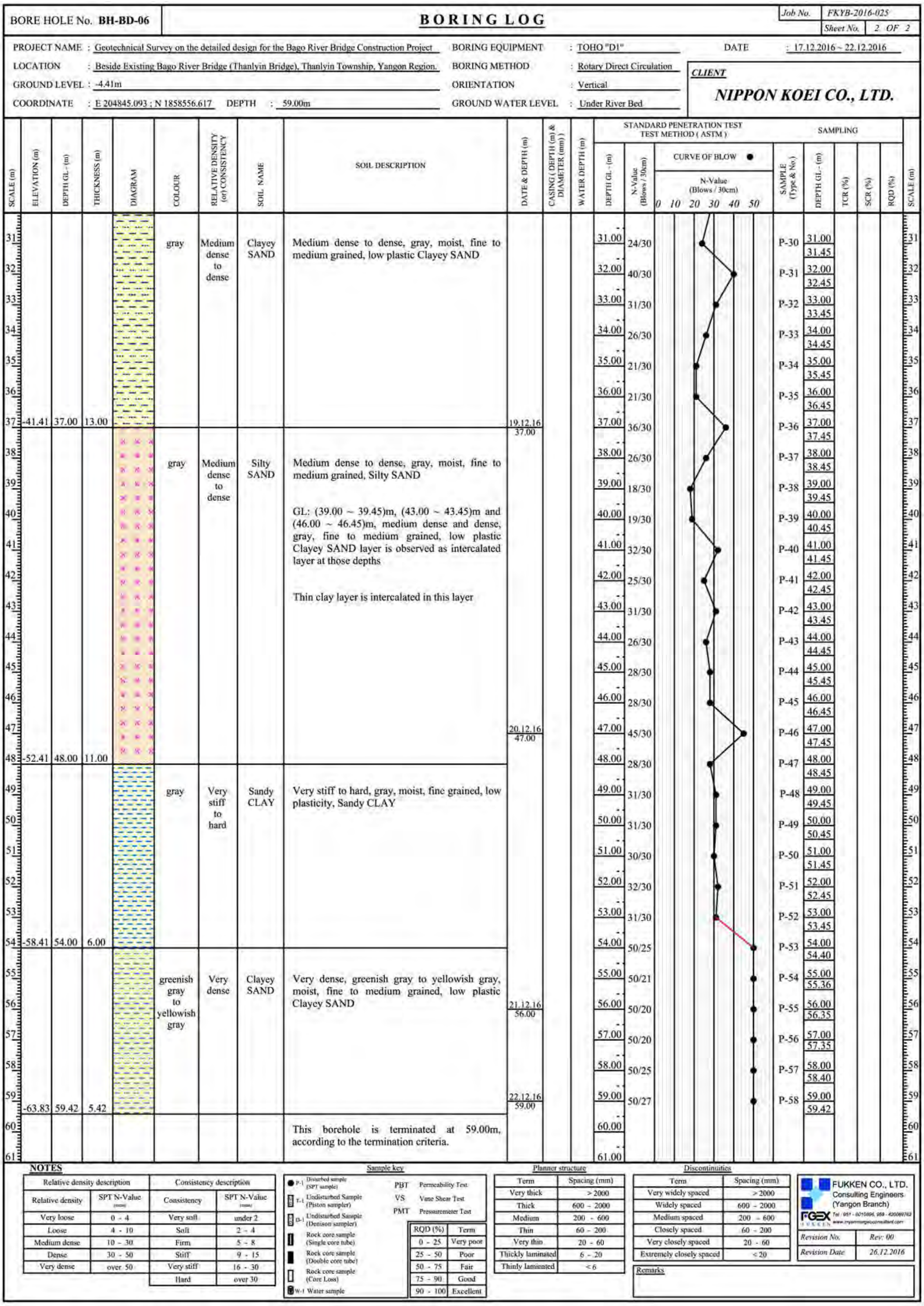
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 00*
Revision Date	*26.12.2016*

Source: JICA Study Team

Figure 4.1.29 Boring log BH-BD-06 (1)



BORE HOLE No. **BH-BD-06**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -4.41m
COORDINATE : E 204845.093 ; N 1858556.617 DEPTH : 59.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 17.12.2016 ~ 22.12.2016

CLIENT
NIPPON KOEI CO., LTD.

SCALE (m)	ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	DIAGRAM	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)	STANDARD PENETRATION TEST TEST METHOD (ASTM) DEPTH GL- (m)	N-Value (Blows / 30cm)	CURVE OF BLOW ● N-Value (Blows / 30cm) 0 10 20 30 40 50	SAMPLING SAMPLE (Type & No.)	DEPTH GL- (m)	TCR (%)	SCR (%)	RQD (%)	SCALE (m)
31					gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, low plastic Clayey SAND				31.00	24/30		P-30	31.00 31.45				31
32												32.00	40/30		P-31	32.00 32.45				32
33												33.00	31/30		P-32	33.00 33.45				33
34												34.00	26/30		P-33	34.00 34.45				34
35												35.00	21/30		P-34	35.00 35.45				35
36												36.00	21/30		P-35	36.00 36.45				36
37	-41.41	37.00	13.00						19.12.16 37.00			37.00	36/30		P-36	37.00 37.45				37
38					gray	Medium dense to dense	Silty SAND	Medium dense to dense, gray, moist, fine to medium grained, Silty SAND GL: (39.00 ~ 39.45)m, (43.00 ~ 43.45)m and (46.00 ~ 46.45)m, medium dense and dense, gray, fine to medium grained, low plastic Clayey SAND layer is observed as intercalated layer at those depths Thin clay layer is intercalated in this layer				38.00	26/30		P-37	38.00 38.45				38
39												39.00	18/30		P-38	39.00 39.45				39
40												40.00	19/30		P-39	40.00 40.45				40
41												41.00	32/30		P-40	41.00 41.45				41
42												42.00	25/30		P-41	42.00 42.45				42
43												43.00	31/30		P-42	43.00 43.45				43
44												44.00	26/30		P-43	44.00 44.45				44
45												45.00	28/30		P-44	45.00 45.45				45
46												46.00	28/30		P-45	46.00 46.45				46
47									20.12.16 47.00			47.00	45/30		P-46	47.00 47.45				47
48	-52.41	48.00	11.00									48.00	28/30		P-47	48.00 48.45				48
49					gray	Very stiff to hard	Sandy CLAY	Very stiff to hard, gray, moist, fine grained, low plasticity, Sandy CLAY				49.00	31/30		P-48	49.00 49.45				49
50												50.00	31/30		P-49	50.00 50.45				50
51												51.00	30/30		P-50	51.00 51.45				51
52												52.00	32/30		P-51	52.00 52.45				52
53												53.00	31/30		P-52	53.00 53.45				53
54	-58.41	54.00	6.00									54.00	50/25		P-53	54.00 54.40				54
55					greenish gray to yellowish gray	Very dense	Clayey SAND	Very dense, greenish gray to yellowish gray, moist, fine to medium grained, low plastic Clayey SAND				55.00	50/21		P-54	55.00 55.36				55
56									21.12.16 56.00			56.00	50/20		P-55	56.00 56.35				56
57												57.00	50/20		P-56	57.00 57.35				57
58												58.00	50/25		P-57	58.00 58.40				58
59	-63.83	59.42	5.42						22.12.16 59.00			59.00	50/27		P-58	59.00 59.42				59
60								This borehole is terminated at 59.00m, according to the termination criteria.				60.00								60
61												61.00								61

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

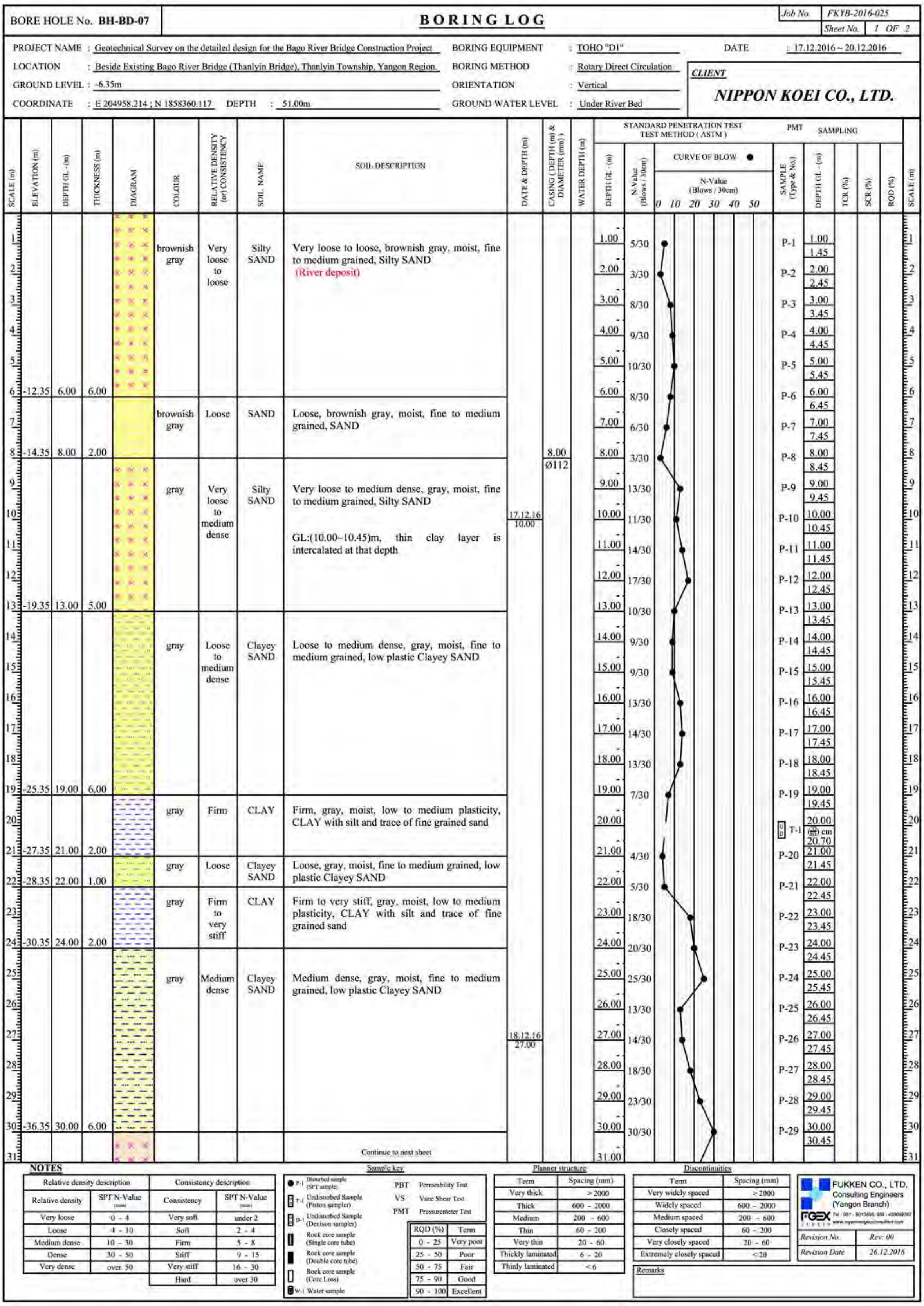
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)
Tel : 951 - 9010896, 959 - 420069762
www.myanmargeoconsultant.com

Revision No.	*Rev: 00*
Revision Date	*26.12.2016*

Source: JICA Study Team

Figure 4.1.30 Boring log BH-BD-06 (2)



BORE HOLE No. **BH-BD-07**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -6.35m
COORDINATE : E 204958.214 ; N 1858360.117 DEPTH : 51.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 17.12.2016 ~ 20.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-12.35	6.00	6.00	brownish gray	Very loose to loose	Silty SAND	Very loose to loose, brownish gray, moist, fine to medium grained, Silty SAND (River deposit)
-14.35	8.00	2.00	brownish gray	Loose	SAND	Loose, brownish gray, moist, fine to medium grained, SAND
-19.35	13.00	5.00	gray	Very loose to medium dense	Silty SAND	Very loose to medium dense, gray, moist, fine to medium grained, Silty SAND GL:(10.00~10.45)m, thin clay layer is intercalated at that depth
-25.35	19.00	6.00	gray	Loose to medium dense	Clayey SAND	Loose to medium dense, gray, moist, fine to medium grained, low plastic Clayey SAND
-27.35	21.00	2.00	gray	Firm	CLAY	Firm, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand
-28.35	22.00	1.00	gray	Loose	Clayey SAND	Loose, gray, moist, fine to medium grained, low plastic Clayey SAND
-30.35	24.00	2.00	gray	Firm to very stiff	CLAY	Firm to very stiff, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand
-36.35	30.00	6.00	gray	Medium dense	Clayey SAND	Medium dense, gray, moist, fine to medium grained, low plastic Clayey SAND

Continue to next sheet

DATE & DEPTH (m): 17.12.16 10.00; 18.12.16 27.00
CASING (DEPTH (m) & DIAMETER (mm)): 8.00 Ø112

STANDARD PENETRATION TEST TEST METHOD (ASTM) — PMT — SAMPLING

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1.00	5/30	P-1	1.00 1.45
2.00	3/30	P-2	2.00 2.45
3.00	8/30	P-3	3.00 3.45
4.00	9/30	P-4	4.00 4.45
5.00	10/30	P-5	5.00 5.45
6.00	8/30	P-6	6.00 6.45
7.00	6/30	P-7	7.00 7.45
8.00	3/30	P-8	8.00 8.45
9.00	13/30	P-9	9.00 9.45
10.00	11/30	P-10	10.00 10.45
11.00	14/30	P-11	11.00 11.45
12.00	17/30	P-12	12.00 12.45
13.00	10/30	P-13	13.00 13.45
14.00	9/30	P-14	14.00 14.45
15.00	9/30	P-15	15.00 15.45
16.00	13/30	P-16	16.00 16.45
17.00	14/30	P-17	17.00 17.45
18.00	13/30	P-18	18.00 18.45
19.00	7/30	P-19	19.00 19.45
20.00		UD T-1	20.00 ([illegible]) cm 20.70
21.00	4/30	P-20	21.00 21.45
22.00	5/30	P-21	22.00 22.45
23.00	18/30	P-22	23.00 23.45
24.00	20/30	P-23	24.00 24.45
25.00	25/30	P-24	25.00 25.45
26.00	13/30	P-25	26.00 26.45
27.00	14/30	P-26	27.00 27.45
28.00	18/30	P-27	28.00 28.45
29.00	23/30	P-28	29.00 29.45
30.00	30/30	P-29	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

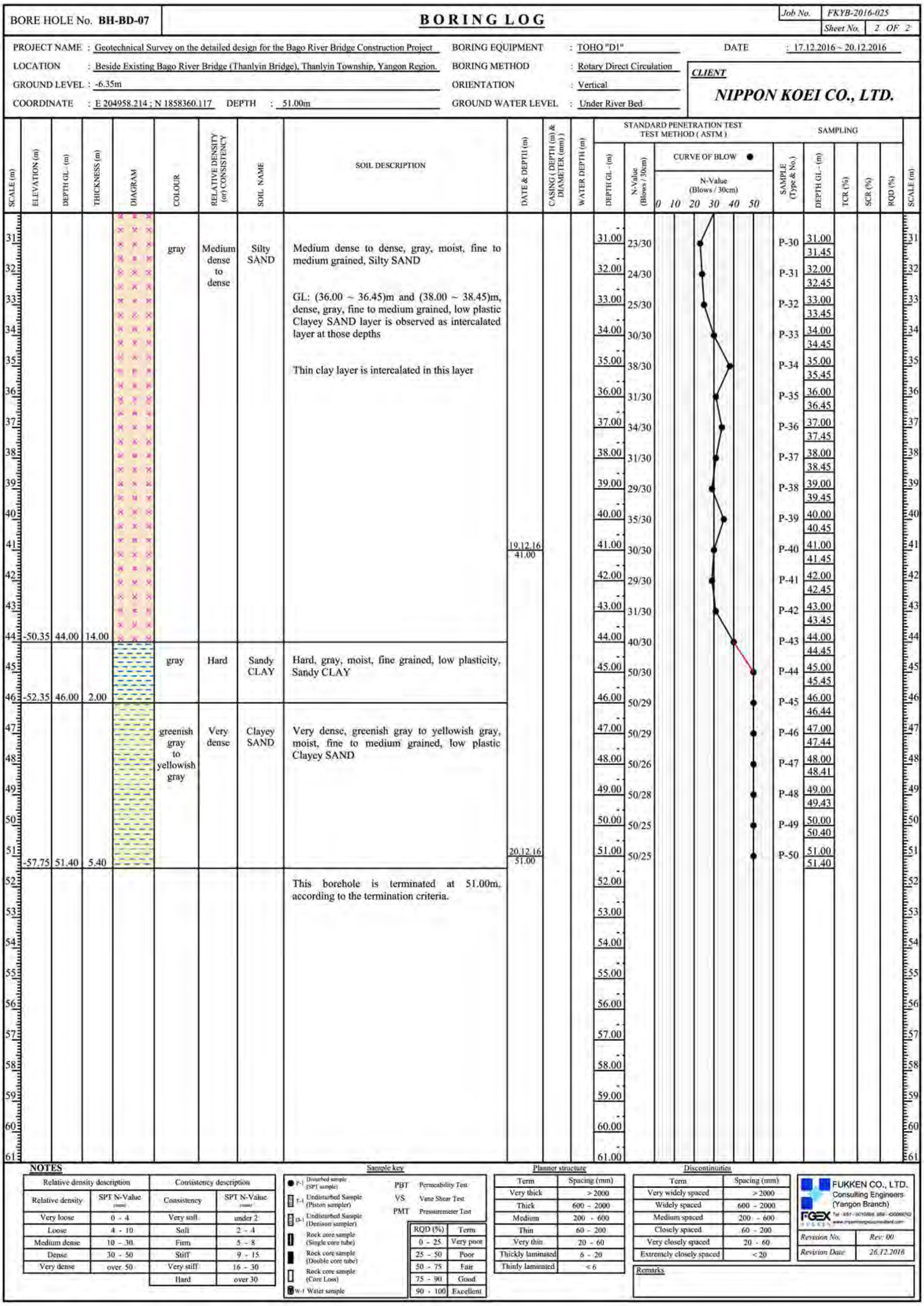
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 00*
Revision Date	*26.12.2016*

Source: JICA Study Team

Figure 4.1.31 Boring log BH-BD-07 (1)



BORE HOLE No. **BH-BD-07**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 2 OF 2

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -6.35m
COORDINATE : E 204958.214 ; N 1858360.117 DEPTH : 51.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 17.12.2016 ~ 20.12.2016
CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-50.35	44.00	14.00	gray	Medium dense to dense	Silty SAND	Medium dense to dense, gray, moist, fine to medium grained, Silty SAND GL: (36.00 ~ 36.45)m and (38.00 ~ 38.45)m, dense, gray, fine to medium grained, low plastic Clayey SAND layer is observed as intercalated layer at those depths Thin clay layer is intercalated in this layer
-52.35	46.00	2.00	gray	Hard	Sandy CLAY	Hard, gray, moist, fine grained, low plasticity, Sandy CLAY
-57.75	51.40	5.40	greenish gray to yellowish gray	Very dense	Clayey SAND	Very dense, greenish gray to yellowish gray, moist, fine to medium grained, low plastic Clayey SAND
						This borehole is terminated at 51.00m, according to the termination criteria.

DATE & DEPTH (m): 19.12.16 41.00; 20.12.16 51.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

SAMPLING

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
31.00	23/30	P-30	31.00 31.45
32.00	24/30	P-31	32.00 32.45
33.00	25/30	P-32	33.00 33.45
34.00	30/30	P-33	34.00 34.45
35.00	38/30	P-34	35.00 35.45
36.00	31/30	P-35	36.00 36.45
37.00	34/30	P-36	37.00 37.45
38.00	31/30	P-37	38.00 38.45
39.00	29/30	P-38	39.00 39.45
40.00	35/30	P-39	40.00 40.45
41.00	30/30	P-40	41.00 41.45
42.00	29/30	P-41	42.00 42.45
43.00	31/30	P-42	43.00 43.45
44.00	40/30	P-43	44.00 44.45
45.00	50/30	P-44	45.00 45.45
46.00	50/29	P-45	46.00 46.44
47.00	50/29	P-46	47.00 47.44
48.00	50/26	P-47	48.00 48.41
49.00	50/28	P-48	49.00 49.43
50.00	50/25	P-49	50.00 50.40
51.00	50/25	P-50	51.00 51.40
52.00			
53.00			
54.00			
55.00			
56.00			
57.00			
58.00			
59.00			
60.00			
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key
- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

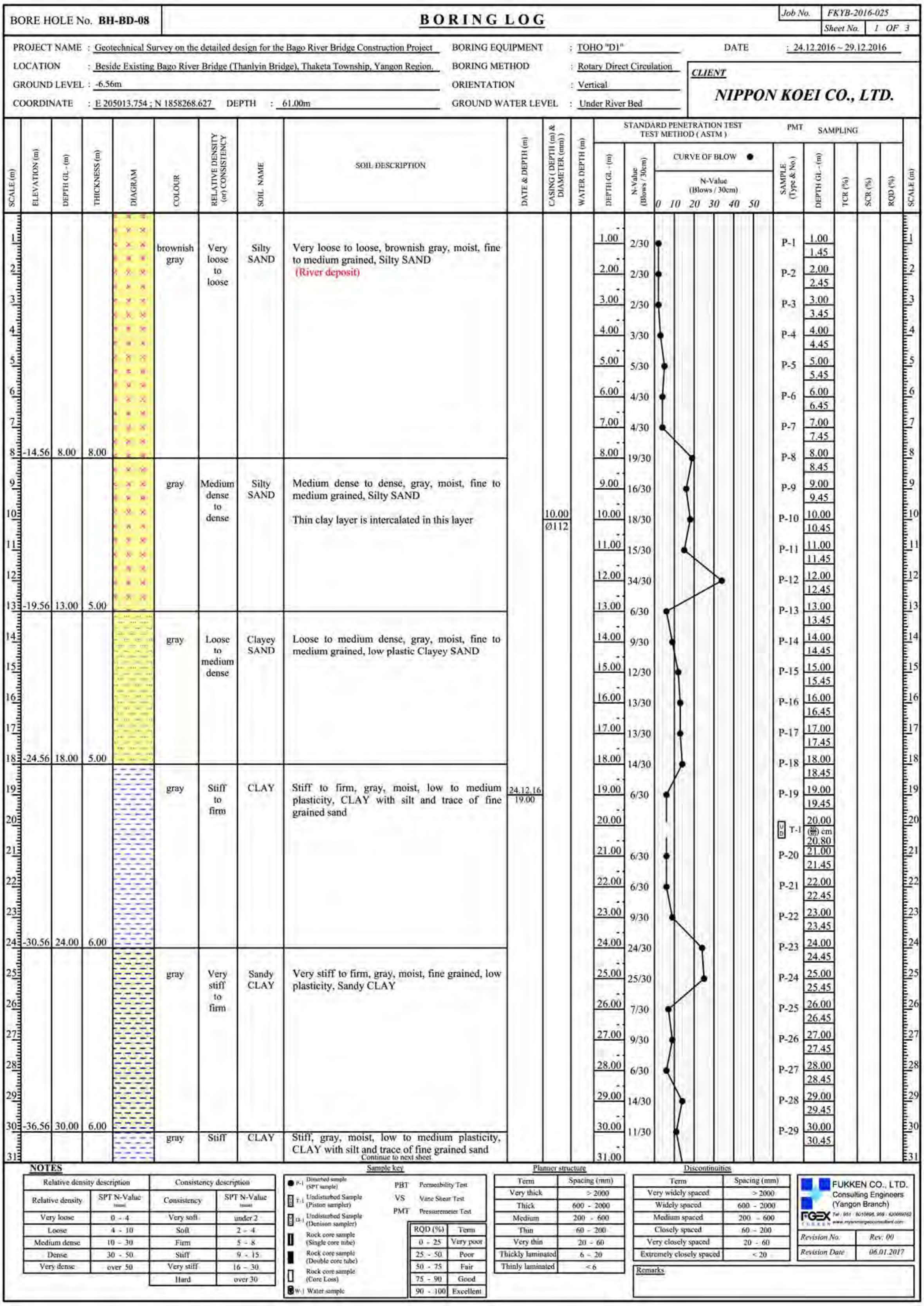
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No. Rev: 00
Revision Date 26.12.2016

Source: JICA Study Team

Figure 4.1.32 Boring log BH-BD-07 (2)



BORE HOLE No. **BH-BD-08**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 1 OF 3

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.56m
COORDINATE : E 205013.754 ; N 1858268.627 DEPTH : 61.00m
BORING EQUIPMENT ; TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 24.12.2016 ~ 29.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-14.56	8.00	8.00	brownish gray	Very loose to loose	Silty SAND	Very loose to loose, brownish gray, moist, fine to medium grained, Silty SAND (River deposit)
-19.56	13.00	5.00	gray	Medium dense to dense	Silty SAND	Medium dense to dense, gray, moist, fine to medium grained, Silty SAND Thin clay layer is intercalated in this layer
-24.56	18.00	5.00	gray	Loose to medium dense	Clayey SAND	Loose to medium dense, gray, moist, fine to medium grained, low plastic Clayey SAND
-30.56	24.00	6.00	gray	Stiff to firm	CLAY	Stiff to firm, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand
-36.56	30.00	6.00	gray	Very stiff to firm	Sandy CLAY	Very stiff to firm, gray, moist, fine grained, low plasticity, Sandy CLAY
			gray	Stiff	CLAY	Stiff, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand

Continue to next sheet

DATE & DEPTH (m): 24.12.16 / 19.00
CASING (DEPTH (m) & DIAMETER (mm)): 10.00 / Ø112

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1.00	2/30	P-1	1.00 1.45
2.00	2/30	P-2	2.00 2.45
3.00	2/30	P-3	3.00 3.45
4.00	3/30	P-4	4.00 4.45
5.00	5/30	P-5	5.00 5.45
6.00	4/30	P-6	6.00 6.45
7.00	4/30	P-7	7.00 7.45
8.00	19/30	P-8	8.00 8.45
9.00	16/30	P-9	9.00 9.45
10.00	18/30	P-10	10.00 10.45
11.00	15/30	P-11	11.00 11.45
12.00	34/30	P-12	12.00 12.45
13.00	6/30	P-13	13.00 13.45
14.00	9/30	P-14	14.00 14.45
15.00	12/30	P-15	15.00 15.45
16.00	13/30	P-16	16.00 16.45
17.00	13/30	P-17	17.00 17.45
18.00	14/30	P-18	18.00 18.45
19.00	6/30	P-19	19.00 19.45
20.00		T-1	20.00 ([illegible]) cm 20.80
21.00	6/30	P-20	21.00 21.45
22.00	6/30	P-21	22.00 22.45
23.00	9/30	P-22	23.00 23.45
24.00	24/30	P-23	24.00 24.45
25.00	25/30	P-24	25.00 25.45
26.00	7/30	P-25	26.00 26.45
27.00	9/30	P-26	27.00 27.45
28.00	6/30	P-27	28.00 28.45
29.00	14/30	P-28	29.00 29.45
30.00	11/30	P-29	30.00 30.45
31.00			

NOTES

Relative density description

Relative density	SPT N-Value
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

Consistency description

Consistency	SPT N-Value
Very soft	under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

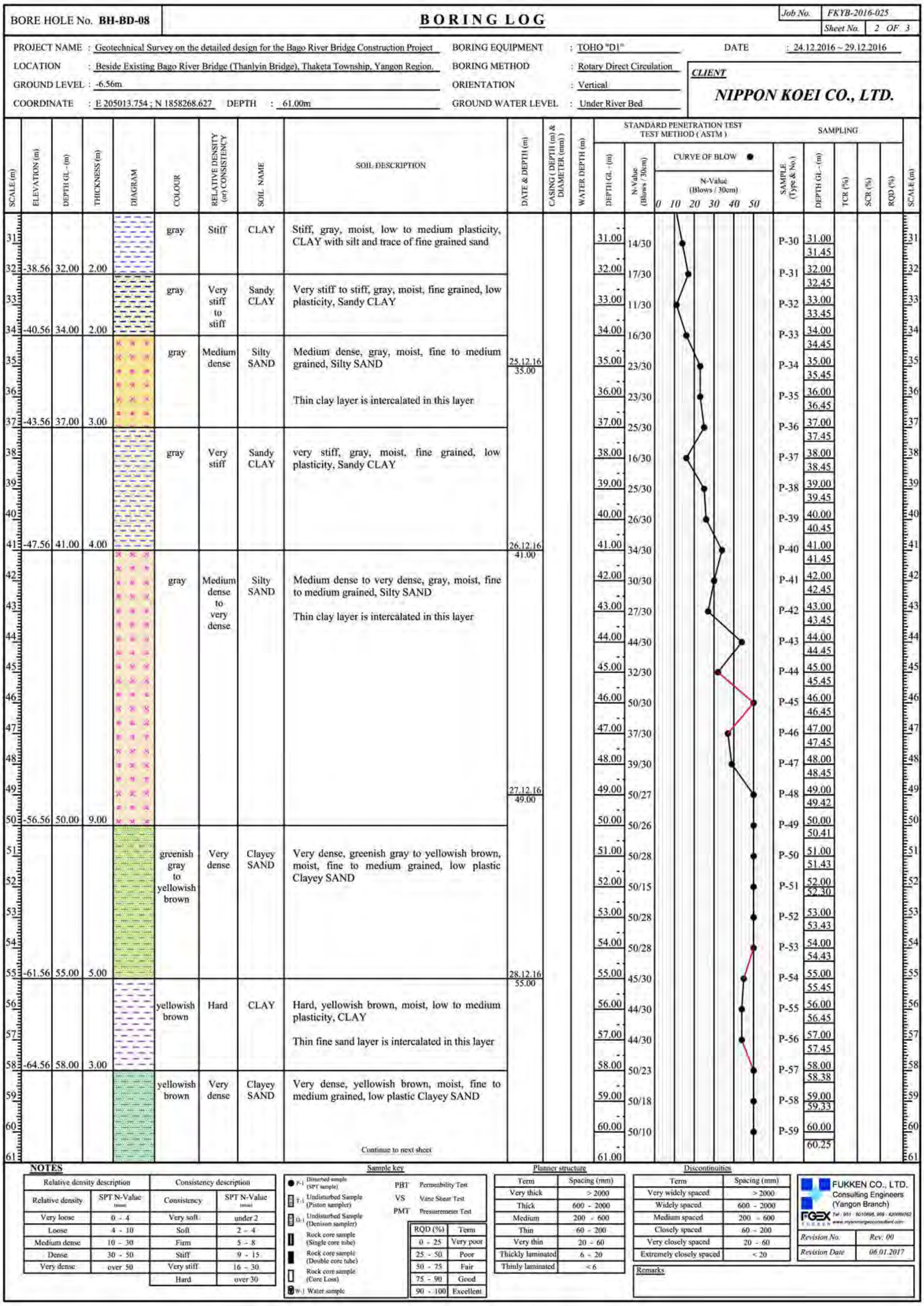
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	Rev. 00
Revision Date	06.01.2017

Source: JICA Study Team

Figure 4.1.33 Boring log BH-BD-08 (1)



BORE HOLE No. **BH-BD-08**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 2 OF 3

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.56m
COORDINATE : E 205013.754 ; N 1858268.627 DEPTH : 61.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 24.12.2016 ~ 29.12.2016
CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL.-(m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)
-38.56	32.00	2.00	gray	Stiff	CLAY	Stiff, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand	
-40.56	34.00	2.00	gray	Very stiff to stiff	Sandy CLAY	Very stiff to stiff, gray, moist, fine grained, low plasticity, Sandy CLAY	
-43.56	37.00	3.00	gray	Medium dense	Silty SAND	Medium dense, gray, moist, fine to medium grained, Silty SAND Thin clay layer is intercalated in this layer	25.12.16 35.00
-47.56	41.00	4.00	gray	Very stiff	Sandy CLAY	very stiff, gray, moist, fine grained, low plasticity, Sandy CLAY	26.12.16 41.00
-56.56	50.00	9.00	gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND Thin clay layer is intercalated in this layer	27.12.16 49.00
-61.56	55.00	5.00	greenish gray to yellowish brown	Very dense	Clayey SAND	Very dense, greenish gray to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND	28.12.16 55.00
-64.56	58.00	3.00	yellowish brown	Hard	CLAY	Hard, yellowish brown, moist, low to medium plasticity, CLAY Thin fine sand layer is intercalated in this layer	
			yellowish brown	Very dense	Clayey SAND	Very dense, yellowish brown, moist, fine to medium grained, low plastic Clayey SAND	

Continue to next sheet

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL.-(m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL.-(m)
31.00	14/30	P-30	31.00 31.45
32.00	17/30	P-31	32.00 32.45
33.00	11/30	P-32	33.00 33.45
34.00	16/30	P-33	34.00 34.45
35.00	23/30	P-34	35.00 35.45
36.00	23/30	P-35	36.00 36.45
37.00	25/30	P-36	37.00 37.45
38.00	16/30	P-37	38.00 38.45
39.00	25/30	P-38	39.00 39.45
40.00	26/30	P-39	40.00 40.45
41.00	34/30	P-40	41.00 41.45
42.00	30/30	P-41	42.00 42.45
43.00	27/30	P-42	43.00 43.45
44.00	44/30	P-43	44.00 44.45
45.00	32/30	P-44	45.00 45.45
46.00	50/30	P-45	46.00 46.45
47.00	37/30	P-46	47.00 47.45
48.00	39/30	P-47	48.00 48.45
49.00	50/27	P-48	49.00 49.42
50.00	50/26	P-49	50.00 50.41
51.00	50/28	P-50	51.00 51.43
52.00	50/15	P-51	52.00 52.30
53.00	50/28	P-52	53.00 53.43
54.00	50/28	P-53	54.00 54.43
55.00	45/30	P-54	55.00 55.45
56.00	44/30	P-55	56.00 56.45
57.00	44/30	P-56	57.00 57.45
58.00	50/23	P-57	58.00 58.38
59.00	50/18	P-58	59.00 59.33
60.00	50/10	P-59	60.00 60.25
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- ▯ T-1 Undisturbed Sample (Piston sampler)
- ▯ D-1 Undisturbed Sample (Denison sampler)
- ▮ Rock core sample (Single core tube)
- ■ Rock core sample (Double core tube)
- ▯ Rock core sample (Core Loss)
- ▮ W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

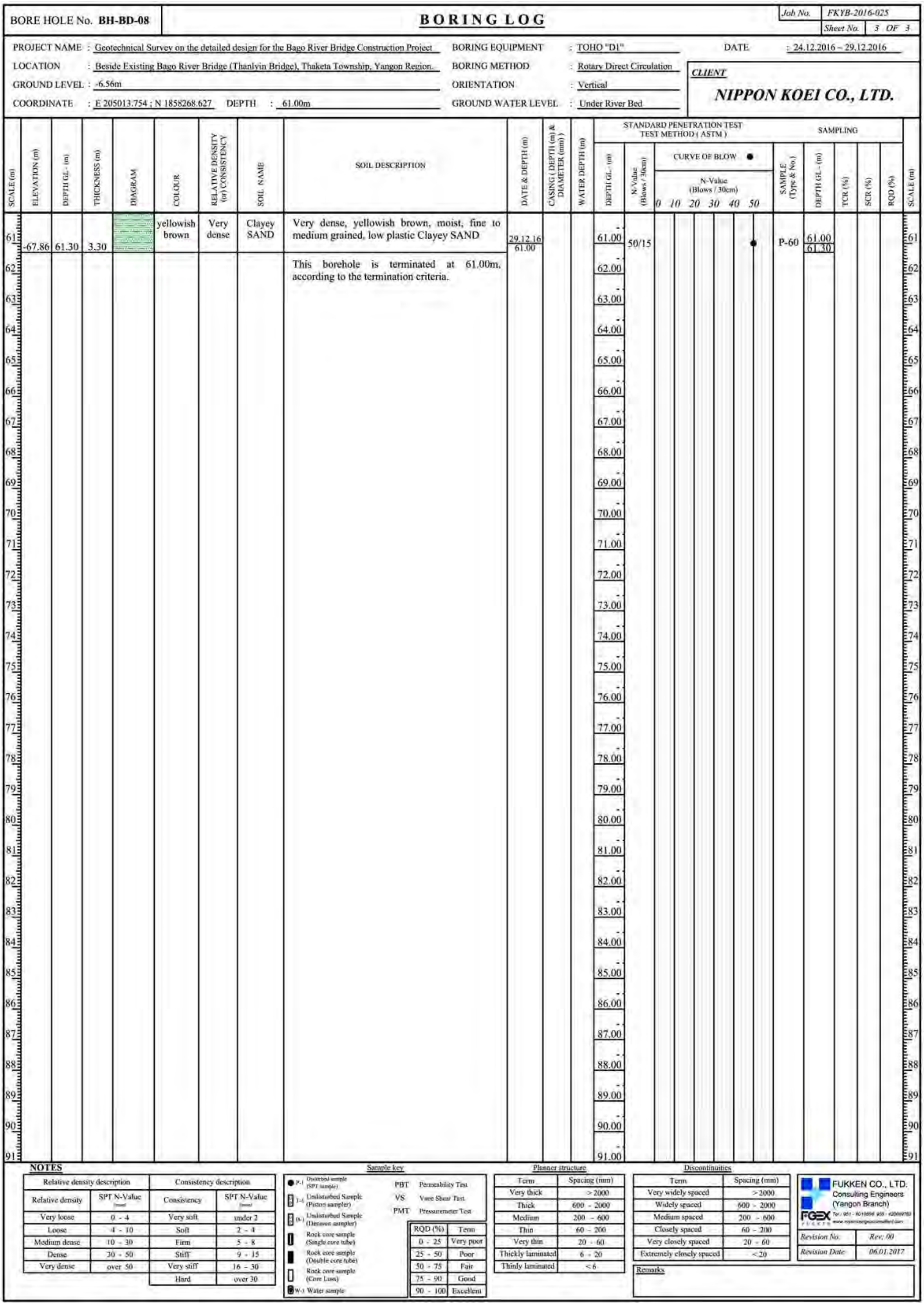
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)
Tel : 951 - 8010898, 959 - 420089762
www.myanmargeoconsultant.com

Revision No.	Rev: 00
Revision Date	06.01.2017

Source: JICA Study Team

Figure 4.1.34 Boring log BH-BD-08 (2)



BORE HOLE No. **BH-BD-08**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*3 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.56m
COORDINATE : E 205013.754 ; N 1858268.627 DEPTH : 61.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 24.12.2016 ~ 29.12.2016

CLIENT
NIPPON KOEI CO., LTD.

SCALE (m)	ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	DIAGRAM	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)	STANDARD PENETRATION TEST TEST METHOD (ASTM) DEPTH GL- (m)	N-Value (Blows / 30cm)	CURVE OF BLOW ● N-Value (Blows / 30cm) 0 10 20 30 40 50	SAMPLING SAMPLE (Type & No.)	DEPTH GL- (m)	TCR (%)	SCR (%)	RQD (%)	SCALE (m)
61	-67.86	61.30	3.30	🟩	yellowish brown	Very dense	Clayey SAND	Very dense, yellowish brown, moist, fine to medium grained, low plastic Clayey SAND	29.12.16 61.00			61.00	50/15	●	P-60	61.00 61.30				61
62								This borehole is terminated at 61.00m, according to the termination criteria.				62.00								62
63												63.00								63
64												64.00								64
65												65.00								65
66												66.00								66
67												67.00								67
68												68.00								68
69												69.00								69
70												70.00								70
71												71.00								71
72												72.00								72
73												73.00								73
74												74.00								74
75												75.00								75
76												76.00								76
77												77.00								77
78												78.00								78
79												79.00								79
80												80.00								80
81												81.00								81
82												82.00								82
83												83.00								83
84												84.00								84
85												85.00								85
86												86.00								86
87												87.00								87
88												88.00								88
89												89.00								89
90												90.00								90
91												91.00								91

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
▯ T-1 Undisturbed Sample (Piston sampler)
▯ D-1 Undisturbed Sample (Denison sampler)
▯ Rock core sample (Single core tube)
▮ Rock core sample (Double core tube)
▯ Rock core sample (Core Loss)
▮ W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

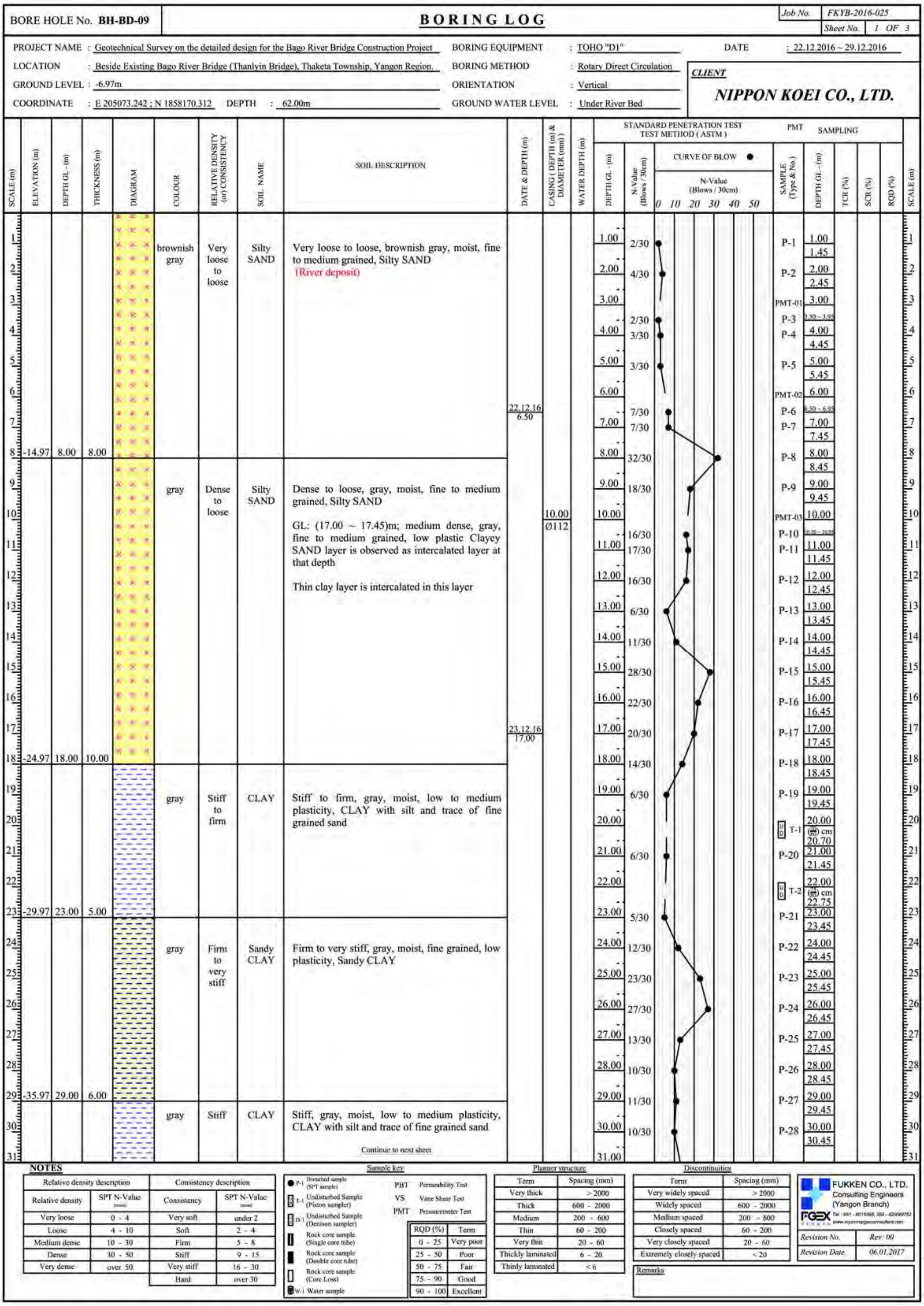
FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 00*
Revision Date	*06.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.35 Boring log BH-BD-08 (3)



BORE HOLE No. **BH-BD-09**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *1 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.97m
COORDINATE : E 205073.242 ; N 1858170.312 DEPTH : 62.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 22.12.2016 ~ 29.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL.- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-14.97	8.00	8.00	brownish gray	Very loose to loose	Silty SAND	Very loose to loose, brownish gray, moist, fine to medium grained, Silty SAND (River deposit)
-24.97	18.00	10.00	gray	Dense to loose	Silty SAND	Dense to loose, gray, moist, fine to medium grained, Silty SAND GL: (17.00 ~ 17.45)m; medium dense, gray, fine to medium grained, low plastic Clayey SAND layer is observed as intercalated layer at that depth Thin clay layer is intercalated in this layer
-29.97	23.00	5.00	gray	Stiff to firm	CLAY	Stiff to firm, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand
-35.97	29.00	6.00	gray	Firm to very stiff	Sandy CLAY	Firm to very stiff, gray, moist, fine grained, low plasticity, Sandy CLAY
			gray	Stiff	CLAY	Stiff, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand

Continue to next sheet

DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))
22.12.16 6.50	10.00 Ø112
23.12.16 17.00	

STANDARD PENETRATION TEST
TEST METHOD (ASTM)
CURVE OF BLOW ●
N-Value (Blows / 30cm) 0 10 20 30 40 50

DEPTH GL.- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL.- (m)
1.00	2/30	P-1	1.00 1.45
2.00	4/30	P-2	2.00 2.45
3.00		PMT-01	3.00
	2/30	P-3	3.50 ~ 3.95
4.00	3/30	P-4	4.00 4.45
5.00	3/30	P-5	5.00 5.45
6.00		PMT-02	6.00
	7/30	P-6	6.50 ~ 6.95
7.00	7/30	P-7	7.00 7.45
8.00	32/30	P-8	8.00 8.45
9.00	18/30	P-9	9.00 9.45
10.00		PMT-03	10.00
	16/30	P-10	10.50 ~ 10.95
11.00	17/30	P-11	11.00 11.45
12.00	16/30	P-12	12.00 12.45
13.00	6/30	P-13	13.00 13.45
14.00	11/30	P-14	14.00 14.45
15.00	28/30	P-15	15.00 15.45
16.00	22/30	P-16	16.00 16.45
17.00	20/30	P-17	17.00 17.45
18.00	14/30	P-18	18.00 18.45
19.00	6/30	P-19	19.00 19.45
20.00		T-1	20.00 cm 20.70
21.00	6/30	P-20	21.00 21.45
22.00		T-2	22.00 cm 22.75
23.00	5/30	P-21	23.00 23.45
24.00	12/30	P-22	24.00 24.45
25.00	23/30	P-23	25.00 25.45
26.00	27/30	P-24	26.00 26.45
27.00	13/30	P-25	27.00 27.45
28.00	10/30	P-26	28.00 28.45
29.00	11/30	P-27	29.00 29.45
30.00	10/30	P-28	30.00 30.45
31.00			

NOTES

Relative density description

Relative density	SPT N-Value
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

Consistency description

Consistency	SPT N-Value
Very soft	under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
T-1	Undisturbed Sample (Piston sampler)
D-1	Undisturbed Sample (Denison sampler)
▯	Rock core sample (Single core tube)
▮	Rock core sample (Double core tube)
☐	Rock core sample (Core Loss)
W-1	Water sample
PBT	Permeability Test
VS	Vane Shear Test
PMT	Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

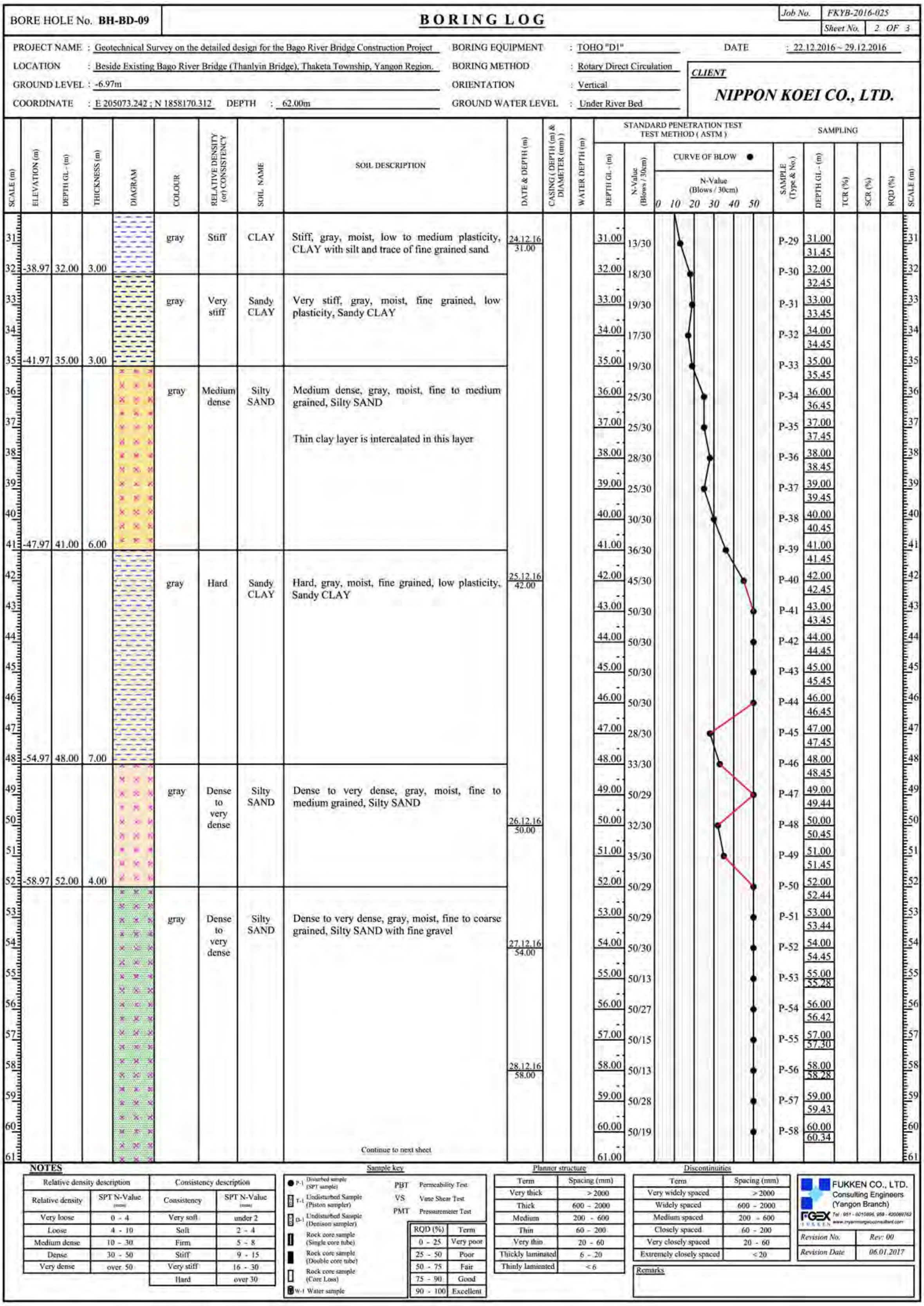
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 00*
Revision Date	*06.01.2017*

Source: JICA Study Team

Figure 4.1.36 Boring log BH-BD-09 (1)



BORE HOLE No. **BH-BD-09**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *2 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.97m
COORDINATE : E 205073.242 ; N 1858170.312 DEPTH : 62.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 22.12.2016 ~ 29.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL.- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-38.97	32.00	3.00	gray	Stiff	CLAY	Stiff, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand
-41.97	35.00	3.00	gray	Very stiff	Sandy CLAY	Very stiff, gray, moist, fine grained, low plasticity, Sandy CLAY
-47.97	41.00	6.00	gray	Medium dense	Silty SAND	Medium dense, gray, moist, fine to medium grained, Silty SAND Thin clay layer is intercalated in this layer
-54.97	48.00	7.00	gray	Hard	Sandy CLAY	Hard, gray, moist, fine grained, low plasticity, Sandy CLAY
-58.97	52.00	4.00	gray	Dense to very dense	Silty SAND	Dense to very dense, gray, moist, fine to medium grained, Silty SAND
			gray	Dense to very dense	Silty SAND	Dense to very dense, gray, moist, fine to coarse grained, Silty SAND with fine gravel

Continue to next sheet

DATE & DEPTH (m)	DEPTH GL.- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL.- (m)
24.12.16 31.00	31.00	13/30	P-29	31.00 31.45
	32.00	18/30	P-30	32.00 32.45
	33.00	19/30	P-31	33.00 33.45
	34.00	17/30	P-32	34.00 34.45
	35.00	19/30	P-33	35.00 35.45
	36.00	25/30	P-34	36.00 36.45
	37.00	25/30	P-35	37.00 37.45
	38.00	28/30	P-36	38.00 38.45
	39.00	25/30	P-37	39.00 39.45
	40.00	30/30	P-38	40.00 40.45
	41.00	36/30	P-39	41.00 41.45
25.12.16 42.00	42.00	45/30	P-40	42.00 42.45
	43.00	50/30	P-41	43.00 43.45
	44.00	50/30	P-42	44.00 44.45
	45.00	50/30	P-43	45.00 45.45
	46.00	50/30	P-44	46.00 46.45
	47.00	28/30	P-45	47.00 47.45
	48.00	33/30	P-46	48.00 48.45
	49.00	50/29	P-47	49.00 49.44
26.12.16 50.00	50.00	32/30	P-48	50.00 50.45
	51.00	35/30	P-49	51.00 51.45
	52.00	50/29	P-50	52.00 52.44
	53.00	50/29	P-51	53.00 53.44
27.12.16 54.00	54.00	50/30	P-52	54.00 54.45
	55.00	50/13	P-53	55.00 55.28
	56.00	50/27	P-54	56.00 56.42
	57.00	50/15	P-55	57.00 57.30
28.12.16 58.00	58.00	50/13	P-56	58.00 58.28
	59.00	50/28	P-57	59.00 59.43
	60.00	50/19	P-58	60.00 60.34
	61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
T-1 Undisturbed Sample (Piston sampler)
D-1 Undisturbed Sample (Denison sampler)
Rock core sample (Single core tube)
Rock core sample (Double core tube)
Rock core sample (Core Loss)
W-1 Water sample
PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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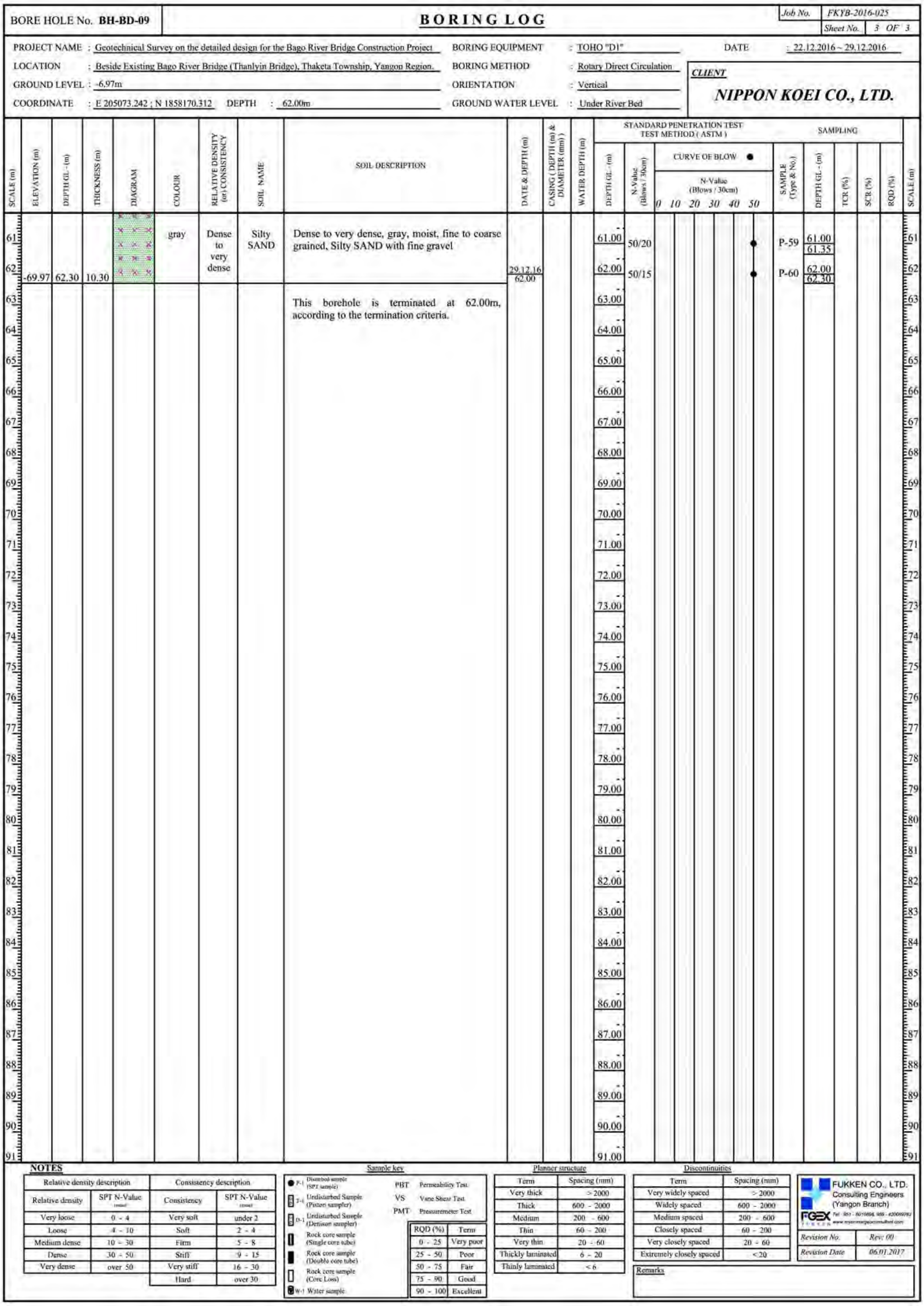
Revision No.	*Rev: 00*
Revision Date	*06.01.2017*

Source: JICA Study Team

Figure 4.1.37 Boring log BH-BD-09 (2)



BORE HOLE No. **BH-BD-09**	**BORING LOG**	*Job No.*	*FKYB-2016-025*
		Sheet No.	*3 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : -6.97m
COORDINATE : E 205073.242 ; N 1858170.312 DEPTH : 62.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 22.12.2016 ~ 29.12.2016
CLIENT
NIPPON KOEI CO., LTD.

SCALE (m)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	DIAGRAM	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)	STANDARD PENETRATION TEST TEST METHOD (ASTM) DEPTH GL - (m)	N-Value (Blows / 30cm)	CURVE OF BLOW ● N-Value (Blows / 30cm) 0 10 20 30 40 50	SAMPLING SAMPLE (Type & No.)	DEPTH GL - (m)	TCR (%)	SCR (%)	RQD (%)	SCALE (m)
61				▨	gray	Dense to very dense	Silty SAND	Dense to very dense, gray, moist, fine to coarse grained, Silty SAND with fine gravel				61.00	50/20	●	P-59	61.00 61.35				61
62	-69.97	62.30	10.30						29.12.16 62.00			62.00	50/15	●	P-60	62.00 62.30				62
63								This borehole is terminated at 62.00m, according to the termination criteria.				63.00								63
64												64.00								64
65												65.00								65
66												66.00								66
67												67.00								67
68												68.00								68
69												69.00								69
70												70.00								70
71												71.00								71
72												72.00								72
73												73.00								73
74												74.00								74
75												75.00								75
76												76.00								76
77												77.00								77
78												78.00								78
79												79.00								79
80												80.00								80
81												81.00								81
82												82.00								82
83												83.00								83
84												84.00								84
85												85.00								85
86												86.00								86
87												87.00								87
88												88.00								88
89												89.00								89
90												90.00								90
91												91.00								91

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- ▯ T-1 Undisturbed Sample (Piston sampler)
- ▯ D-1 Undisturbed Sample (Denison sampler)
- ▯ Rock core sample (Single core tube)
- ▮ Rock core sample (Double core tube)
- ▯ Rock core sample (Core Loss)
- ▮ W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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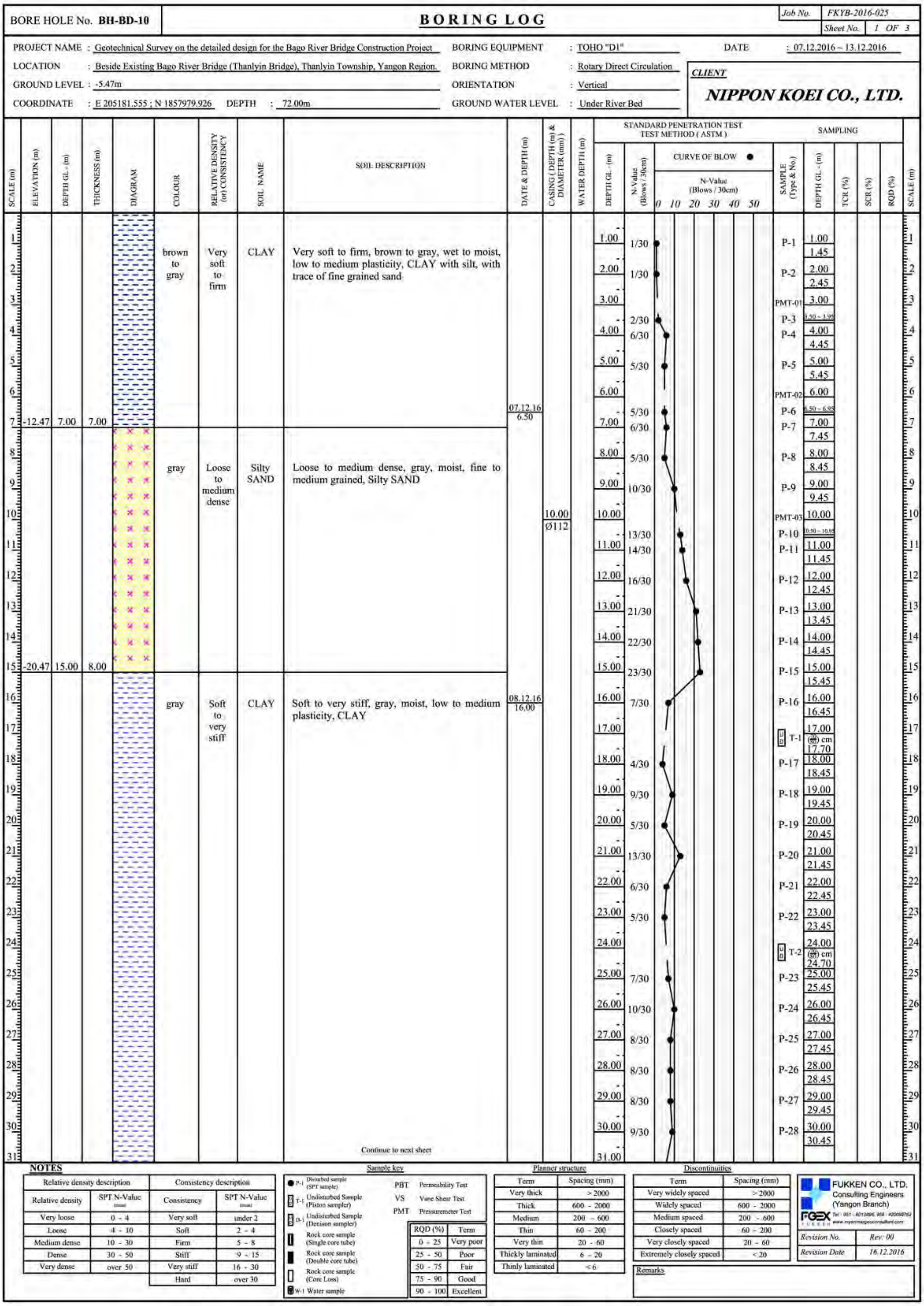
Revision Date	*06.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.38 Boring log BH-BD-09 (3)



BORE HOLE No. **BH-BD-10**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*1 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -5.47m
COORDINATE : E 205181.555 ; N 1857979.926 DEPTH : 72.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 07.12.2016 ~ 13.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))
-12.47	7.00	7.00	brown to gray	Very soft to firm	CLAY	Very soft to firm, brown to gray, wet to moist, low to medium plasticity, CLAY with silt, with trace of fine grained sand	07.12.16 6.50	
-20.47	15.00	8.00	gray	Loose to medium dense	Silty SAND	Loose to medium dense, gray, moist, fine to medium grained, Silty SAND		10.00 Ø112
			gray	Soft to very stiff	CLAY	Soft to very stiff, gray, moist, low to medium plasticity, CLAY	08.12.16 16.00	

Continue to next sheet

STANDARD PENETRATION TEST TEST METHOD (ASTM) / SAMPLING

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1.00	1/30	P-1	1.00 1.45
2.00	1/30	P-2	2.00 2.45
3.00		PMT-01	3.00
	2/30	P-3	3.50 ~ 3.95
4.00	6/30	P-4	4.00 4.45
5.00	5/30	P-5	5.00 5.45
6.00		PMT-02	6.00
	5/30	P-6	6.50 ~ 6.95
7.00	6/30	P-7	7.00 7.45
8.00	5/30	P-8	8.00 8.45
9.00	10/30	P-9	9.00 9.45
10.00		PMT-03	10.00
	13/30	P-10	10.50 ~ 10.95
11.00	14/30	P-11	11.00 11.45
12.00	16/30	P-12	12.00 12.45
13.00	21/30	P-13	13.00 13.45
14.00	22/30	P-14	14.00 14.45
15.00	23/30	P-15	15.00 15.45
16.00	7/30	P-16	16.00 16.45
17.00		T-1	17.00 $(\frac{70}{80})$ cm 17.70
18.00	4/30	P-17	18.00 18.45
19.00	9/30	P-18	19.00 19.45
20.00	5/30	P-19	20.00 20.45
21.00	13/30	P-20	21.00 21.45
22.00	6/30	P-21	22.00 22.45
23.00	5/30	P-22	23.00 23.45
24.00		T-2	24.00 $(\frac{70}{80})$ cm 24.70
25.00	7/30	P-23	25.00 25.45
26.00	10/30	P-24	26.00 26.45
27.00	8/30	P-25	27.00 27.45
28.00	8/30	P-26	28.00 28.45
29.00	8/30	P-27	29.00 29.45
30.00	9/30	P-28	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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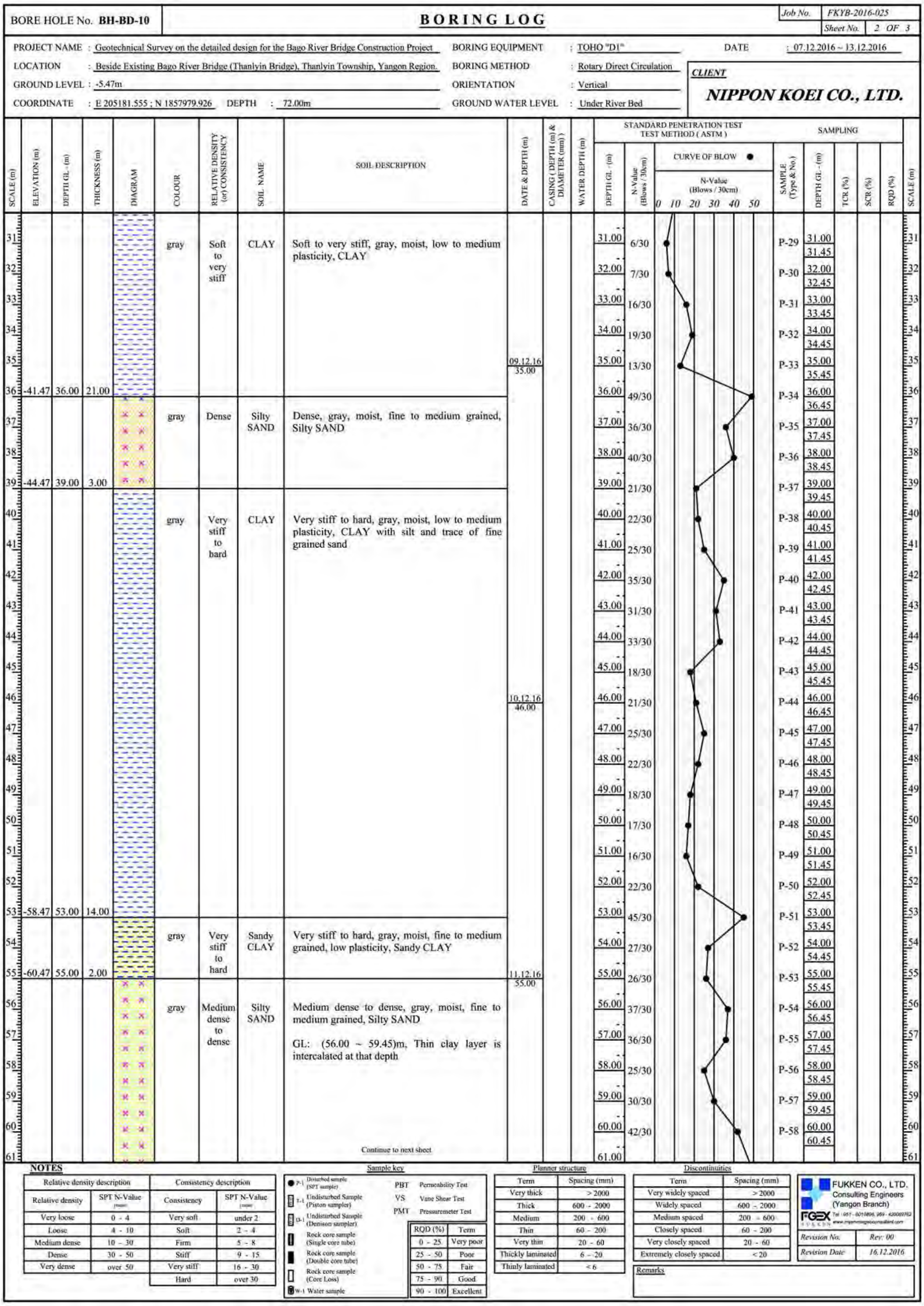
Revision Date	*16.12.2016*

Remarks

Source: JICA Study Team

Figure 4.1.39 Boring log BH-BD-10 (1)



BORE HOLE No. **BH-BD-10**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. 2 OF 3

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -5.47m
COORDINATE : E 205181.555 ; N 1857979.926 DEPTH : 72.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 07.12.2016 ~ 13.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-41.47	36.00	21.00	gray	Soft to very stiff	CLAY	Soft to very stiff, gray, moist, low to medium plasticity, CLAY
-44.47	39.00	3.00	gray	Dense	Silty SAND	Dense, gray, moist, fine to medium grained, Silty SAND
-58.47	53.00	14.00	gray	Very stiff to hard	CLAY	Very stiff to hard, gray, moist, low to medium plasticity, CLAY with silt and trace of fine grained sand
-60.47	55.00	2.00	gray	Very stiff to hard	Sandy CLAY	Very stiff to hard, gray, moist, fine to medium grained, low plasticity, Sandy CLAY
			gray	Medium dense to dense	Silty SAND	Medium dense to dense, gray, moist, fine to medium grained, Silty SAND GL: (56.00 ~ 59.45)m, Thin clay layer is intercalated at that depth

Continue to next sheet

DATE & DEPTH (m)
09.12.16 35.00
10.12.16 46.00
11.12.16 55.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

SAMPLING

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
31.00	6/30	P-29	31.00 31.45
32.00	7/30	P-30	32.00 32.45
33.00	16/30	P-31	33.00 33.45
34.00	19/30	P-32	34.00 34.45
35.00	13/30	P-33	35.00 35.45
36.00	49/30	P-34	36.00 36.45
37.00	36/30	P-35	37.00 37.45
38.00	40/30	P-36	38.00 38.45
39.00	21/30	P-37	39.00 39.45
40.00	22/30	P-38	40.00 40.45
41.00	25/30	P-39	41.00 41.45
42.00	35/30	P-40	42.00 42.45
43.00	31/30	P-41	43.00 43.45
44.00	33/30	P-42	44.00 44.45
45.00	18/30	P-43	45.00 45.45
46.00	21/30	P-44	46.00 46.45
47.00	25/30	P-45	47.00 47.45
48.00	22/30	P-46	48.00 48.45
49.00	18/30	P-47	49.00 49.45
50.00	17/30	P-48	50.00 50.45
51.00	16/30	P-49	51.00 51.45
52.00	22/30	P-50	52.00 52.45
53.00	45/30	P-51	53.00 53.45
54.00	27/30	P-52	54.00 54.45
55.00	26/30	P-53	55.00 55.45
56.00	37/30	P-54	56.00 56.45
57.00	36/30	P-55	57.00 57.45
58.00	25/30	P-56	58.00 58.45
59.00	30/30	P-57	59.00 59.45
60.00	42/30	P-58	60.00 60.45
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key
- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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(Yangon Branch)

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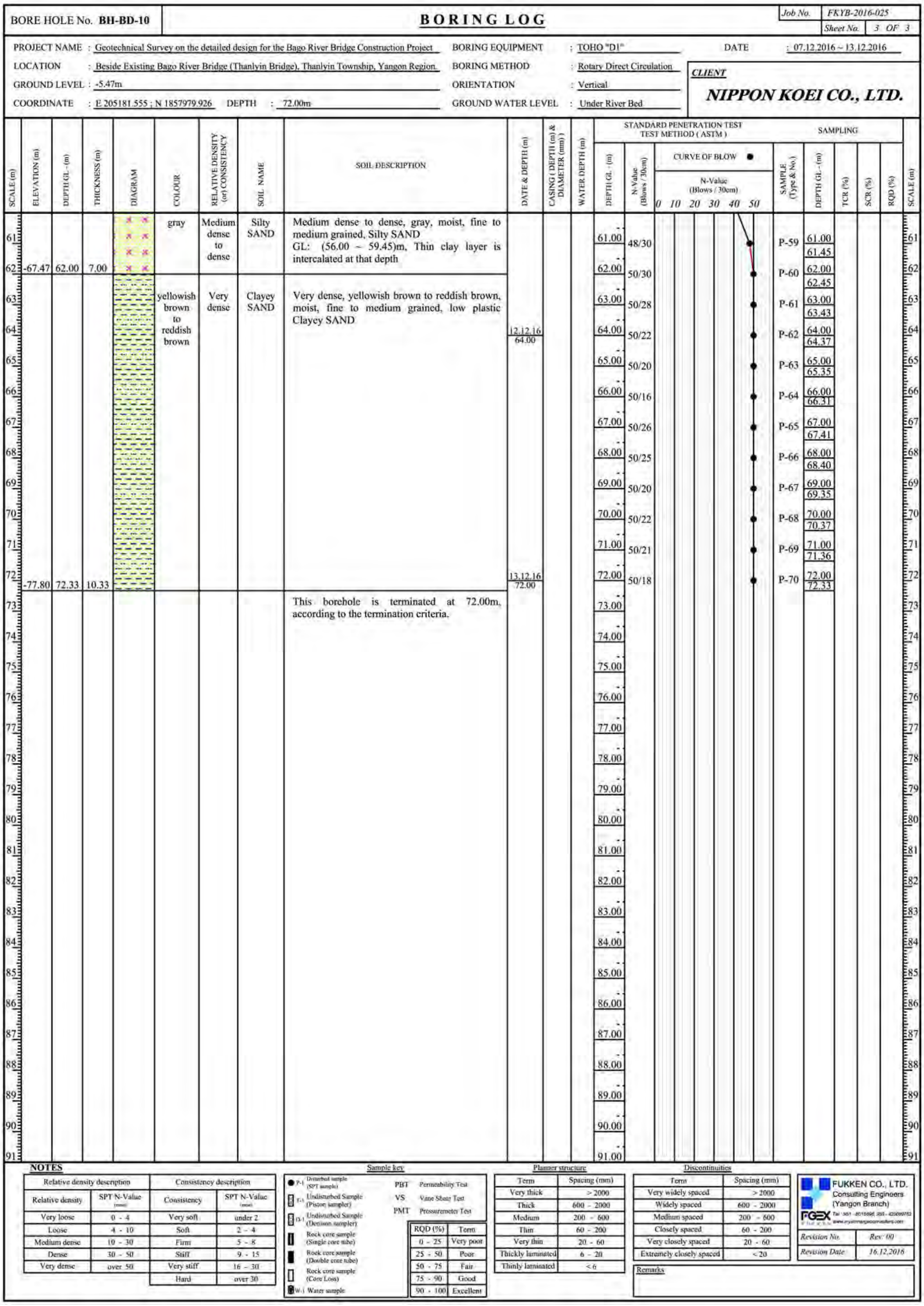
Revision Date	*16.12.2016*

Source: JICA Study Team

Figure 4.1.40 Boring log BH-BD-10 (2)



BORE HOLE No. **BH-BD-10**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*3 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -5.47m
COORDINATE : E 205181.555 ; N 1857979.926 DEPTH : 72.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 07.12.2016 ~ 13.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-67.47	62.00	7.00	gray	Medium dense to dense	Silty SAND	Medium dense to dense, gray, moist, fine to medium grained, Silty SAND GL: (56.00 ~ 59.45)m, Thin clay layer is intercalated at that depth
-77.80	72.33	10.33	yellowish brown to reddish brown	Very dense	Clayey SAND	Very dense, yellowish brown to reddish brown, moist, fine to medium grained, low plastic Clayey SAND
						This borehole is terminated at 72.00m, according to the termination criteria.

DATE & DEPTH (m)
12.12.16 64.00
13.12.16 72.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
61.00	48/30	P-59	61.00 61.45
62.00	50/30	P-60	62.00 62.45
63.00	50/28	P-61	63.00 63.43
64.00	50/22	P-62	64.00 64.37
65.00	50/20	P-63	65.00 65.35
66.00	50/16	P-64	66.00 66.31
67.00	50/26	P-65	67.00 67.41
68.00	50/25	P-66	68.00 68.40
69.00	50/20	P-67	69.00 69.35
70.00	50/22	P-68	70.00 70.37
71.00	50/21	P-69	71.00 71.36
72.00	50/18	P-70	72.00 72.33
73.00			
74.00			
75.00			
76.00			
77.00			
78.00			
79.00			
80.00			
81.00			
82.00			
83.00			
84.00			
85.00			
86.00			
87.00			
88.00			
89.00			
90.00			
91.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
T-1	Undisturbed Sample (Piston sampler)
D-1	Undisturbed Sample (Denison sampler)
	Rock core sample (Single core tube)
	Rock core sample (Double core tube)
	Rock core sample (Core Loss)
W-1	Water sample
PBT	Permeability Test
VS	Vane Shear Test
PMT	Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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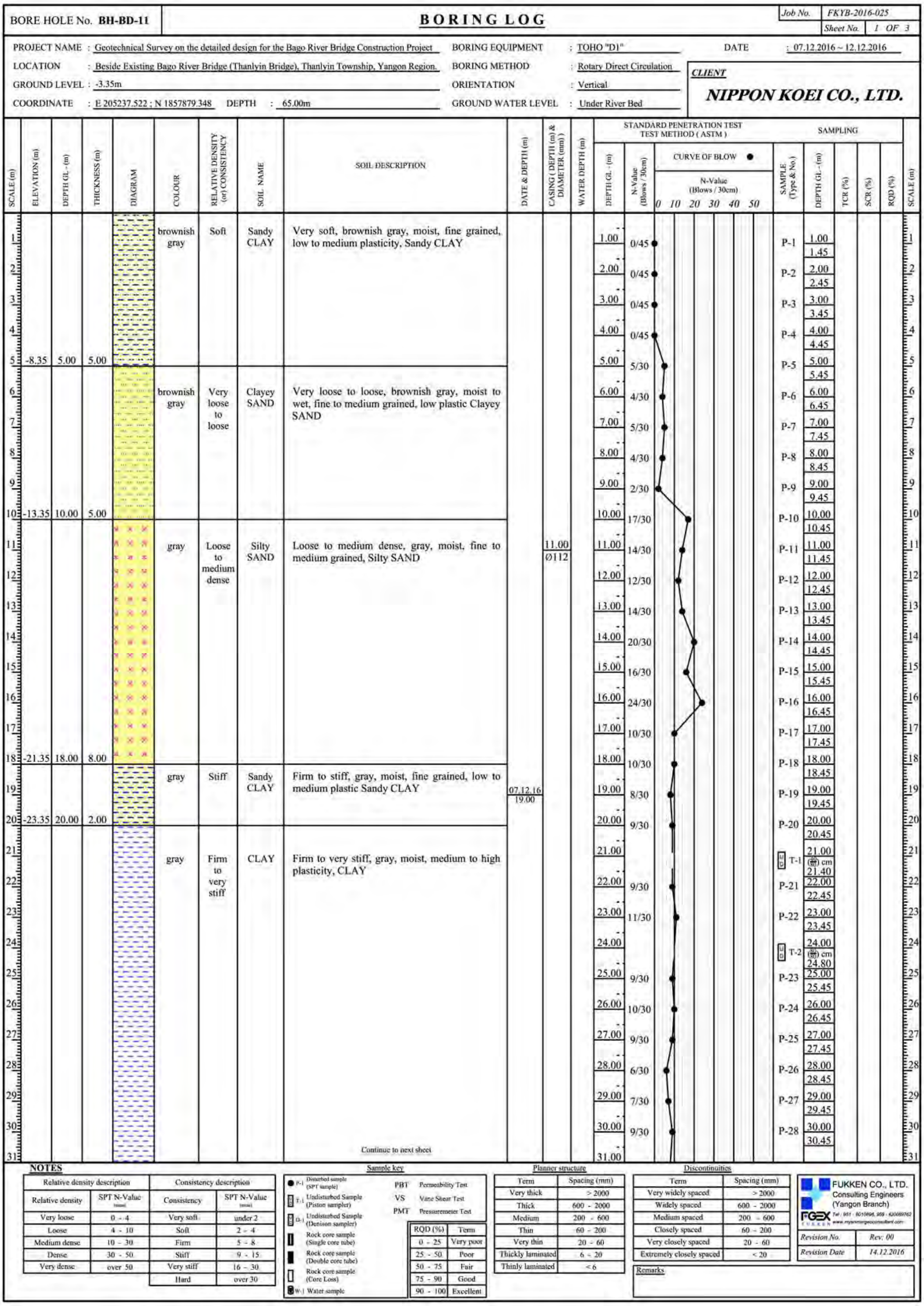
(Yangon Branch)

Revision No.	*Rev: 00*
Revision Date	*16.12.2016*

Remarks

Source: JICA Study Team

Figure 4.1.41 Boring log BH-BD-10 (3)



BORE HOLE No. **BH-BD-11**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*1 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -3.35m
COORDINATE : E 205237.522 ; N 1857879.348 DEPTH : 65.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 07.12.2016 ~ 12.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-8.35	5.00	5.00	brownish gray	Soft	Sandy CLAY	Very soft, brownish gray, moist, fine grained, low to medium plasticity, Sandy CLAY
-13.35	10.00	5.00	brownish gray	Very loose to loose	Clayey SAND	Very loose to loose, brownish gray, moist to wet, fine to medium grained, low plastic Clayey SAND
-21.35	18.00	8.00	gray	Loose to medium dense	Silty SAND	Loose to medium dense, gray, moist, fine to medium grained, Silty SAND
-23.35	20.00	2.00	gray	Stiff	Sandy CLAY	Firm to stiff, gray, moist, fine grained, low to medium plastic Sandy CLAY
			gray	Firm to very stiff	CLAY	Firm to very stiff, gray, moist, medium to high plasticity, CLAY

Continue to next sheet

DATE & DEPTH (m): 07.12.16 / 19.00
CASING (DEPTH (m) & DIAMETER (mm)): 11.00 / Ø112
WATER DEPTH (m):

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1.00	0/45	P-1	1.00 - 1.45
2.00	0/45	P-2	2.00 - 2.45
3.00	0/45	P-3	3.00 - 3.45
4.00	0/45	P-4	4.00 - 4.45
5.00	5/30	P-5	5.00 - 5.45
6.00	4/30	P-6	6.00 - 6.45
7.00	5/30	P-7	7.00 - 7.45
8.00	4/30	P-8	8.00 - 8.45
9.00	2/30	P-9	9.00 - 9.45
10.00	17/30	P-10	10.00 - 10.45
11.00	14/30	P-11	11.00 - 11.45
12.00	12/30	P-12	12.00 - 12.45
13.00	14/30	P-13	13.00 - 13.45
14.00	20/30	P-14	14.00 - 14.45
15.00	16/30	P-15	15.00 - 15.45
16.00	24/30	P-16	16.00 - 16.45
17.00	10/30	P-17	17.00 - 17.45
18.00	10/30	P-18	18.00 - 18.45
19.00	8/30	P-19	19.00 - 19.45
20.00	9/30	P-20	20.00 - 20.45
21.00		T-1	21.00 - 21.40 ([illegible]) cm
22.00	9/30	P-21	22.00 - 22.45
23.00	11/30	P-22	23.00 - 23.45
24.00		T-2	24.00 - 24.80 ([illegible]) cm
25.00	9/30	P-23	25.00 - 25.45
26.00	10/30	P-24	26.00 - 26.45
27.00	9/30	P-25	27.00 - 27.45
28.00	6/30	P-26	28.00 - 28.45
29.00	7/30	P-27	29.00 - 29.45
30.00	9/30	P-28	30.00 - 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- ▯ T-1 Undisturbed Sample (Piston sampler)
- ▯ D-1 Undisturbed Sample (Denison sampler)
- ▮ Rock core sample (Single core tube)
- ▮ Rock core sample (Double core tube)
- ▯ Rock core sample (Core Loss)
- ▮ W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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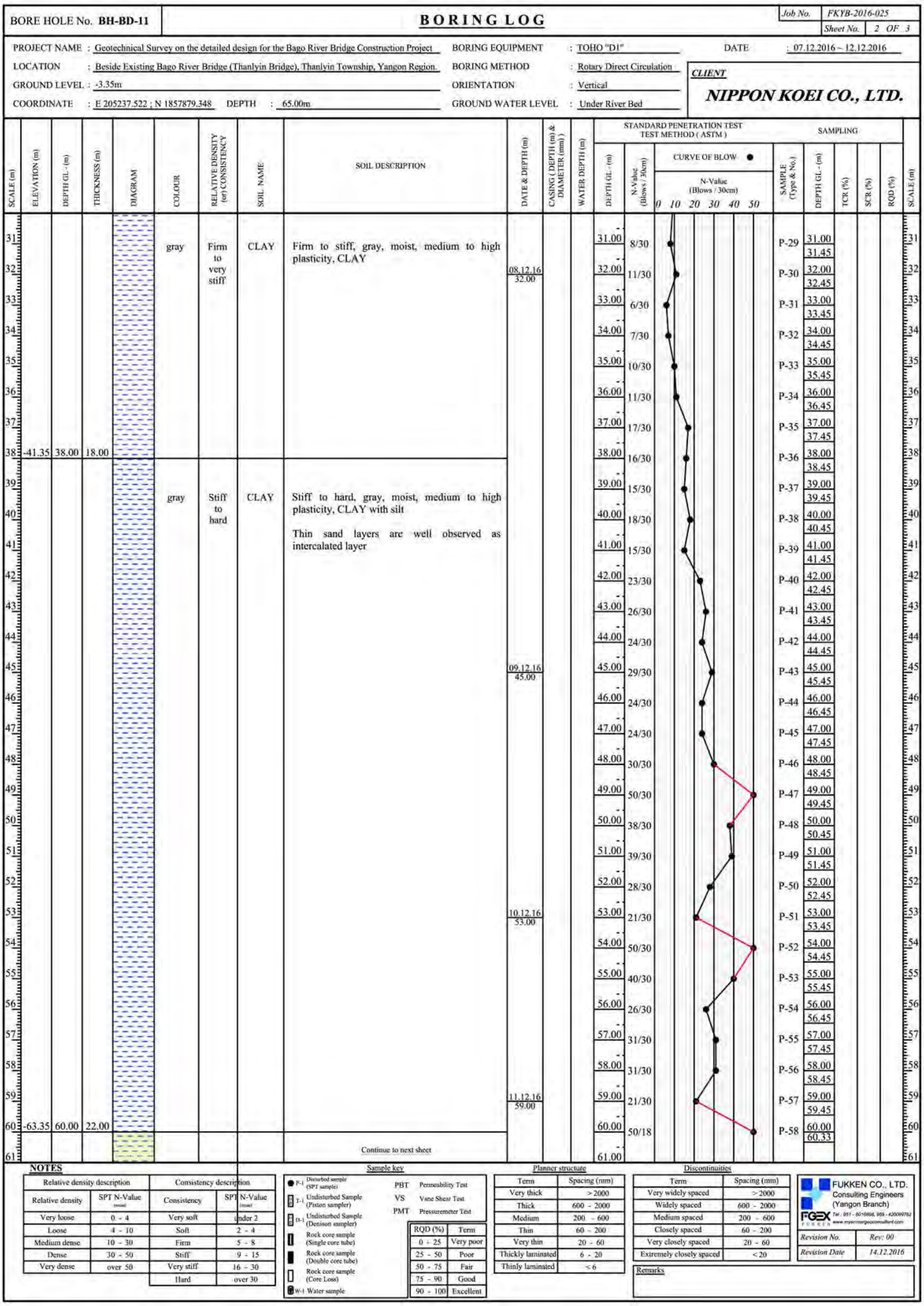
Revision Date	*14.12.2016*

Remarks

Source: JICA Study Team

Figure 4.1.42 Boring log BH-BD-11 (1)



BORE HOLE No. **BH-BD-11**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*2 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -3.35m
COORDINATE : E 205237.522 ; N 1857879.348 DEPTH : 65.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 07.12.2016 ~ 12.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-41.35	38.00	18.00	gray	Firm to very stiff	CLAY	Firm to stiff, gray, moist, medium to high plasticity, CLAY
-63.35	60.00	22.00	gray	Stiff to hard	CLAY	Stiff to hard, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer

Continue to next sheet

DATE & DEPTH (m): 08.12.16 / 32.00; 09.12.16 / 45.00; 10.12.16 / 53.00; 11.12.16 / 59.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
31.00	8/30	P-29	31.00 31.45
32.00	11/30	P-30	32.00 32.45
33.00	6/30	P-31	33.00 33.45
34.00	7/30	P-32	34.00 34.45
35.00	10/30	P-33	35.00 35.45
36.00	11/30	P-34	36.00 36.45
37.00	17/30	P-35	37.00 37.45
38.00	16/30	P-36	38.00 38.45
39.00	15/30	P-37	39.00 39.45
40.00	18/30	P-38	40.00 40.45
41.00	15/30	P-39	41.00 41.45
42.00	23/30	P-40	42.00 42.45
43.00	26/30	P-41	43.00 43.45
44.00	24/30	P-42	44.00 44.45
45.00	29/30	P-43	45.00 45.45
46.00	24/30	P-44	46.00 46.45
47.00	24/30	P-45	47.00 47.45
48.00	30/30	P-46	48.00 48.45
49.00	50/30	P-47	49.00 49.45
50.00	38/30	P-48	50.00 50.45
51.00	39/30	P-49	51.00 51.45
52.00	28/30	P-50	52.00 52.45
53.00	21/30	P-51	53.00 53.45
54.00	50/30	P-52	54.00 54.45
55.00	40/30	P-53	55.00 55.45
56.00	26/30	P-54	56.00 56.45
57.00	31/30	P-55	57.00 57.45
58.00	31/30	P-56	58.00 58.45
59.00	21/30	P-57	59.00 59.45
60.00	50/18	P-58	60.00 60.33
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
T-1 Undisturbed Sample (Piston sampler)
D-1 Undisturbed Sample (Denison sampler)
Rock core sample (Single core tube)
Rock core sample (Double core tube)
Rock core sample (Core Loss)
W-1 Water sample
PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	>2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	<6

Discontinuities

Term	Spacing (mm)
Very widely spaced	>2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	<20

Remarks

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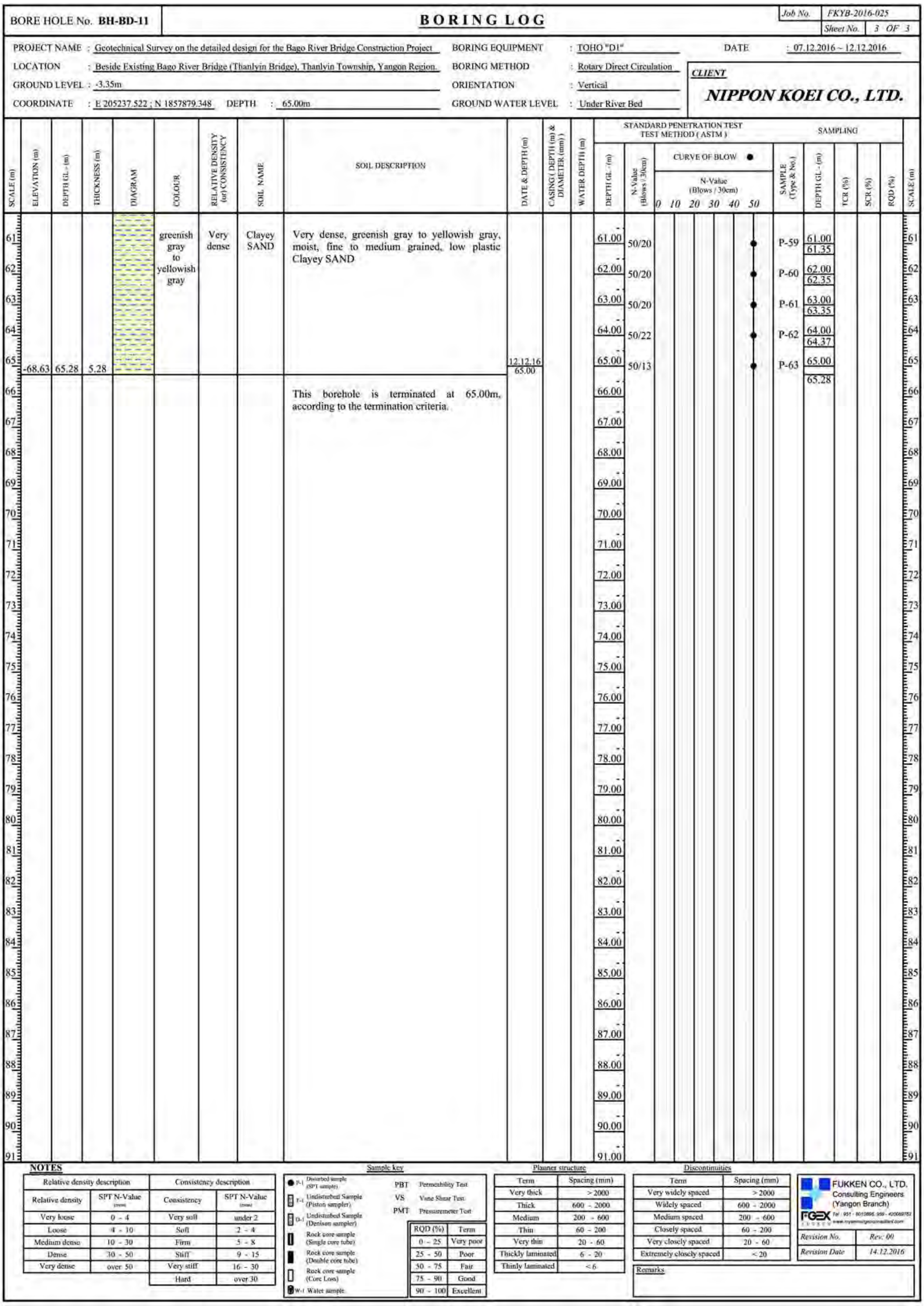
Revision Date	*14.12.2016*

Source: JICA Study Team

Figure 4.1.43 Boring log BH-BD-11 (2)



BORE HOLE No. **BH-BD-11**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *3 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -3.35m
COORDINATE : E 205237.522 ; N 1857879.348 DEPTH : 65.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 07.12.2016 ~ 12.12.2016

CLIENT
NIPPON KOEI CO., LTD.

STANDARD PENETRATION TEST TEST METHOD (ASTM) — CURVE OF BLOW ● — N-Value (Blows / 30cm) 0 10 20 30 40 50

SCALE (m)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	DIAGRAM	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)	DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)	TCR (%)	SCR (%)	RQD (%)	SCALE (m)
61					greenish gray to yellowish gray	Very dense	Clayey SAND	Very dense, greenish gray to yellowish gray, moist, fine to medium grained, low plastic Clayey SAND				61.00	50/20	P-59	61.00 61.35				61
62												62.00	50/20	P-60	62.00 62.35				62
63												63.00	50/20	P-61	63.00 63.35				63
64												64.00	50/22	P-62	64.00 64.37				64
65	-68.63	65.28	5.28						12.12.16 65.00			65.00	50/13	P-63	65.00 65.28				65
66								This borehole is terminated at 65.00m, according to the termination criteria.				66.00							66
67												67.00							67
68												68.00							68
69												69.00							69
70												70.00							70
71												71.00							71
72												72.00							72
73												73.00							73
74												74.00							74
75												75.00							75
76												76.00							76
77												77.00							77
78												78.00							78
79												79.00							79
80												80.00							80
81												81.00							81
82												82.00							82
83												83.00							83
84												84.00							84
85												85.00							85
86												86.00							86
87												87.00							87
88												88.00							88
89												89.00							89
90												90.00							90
91												91.00							91

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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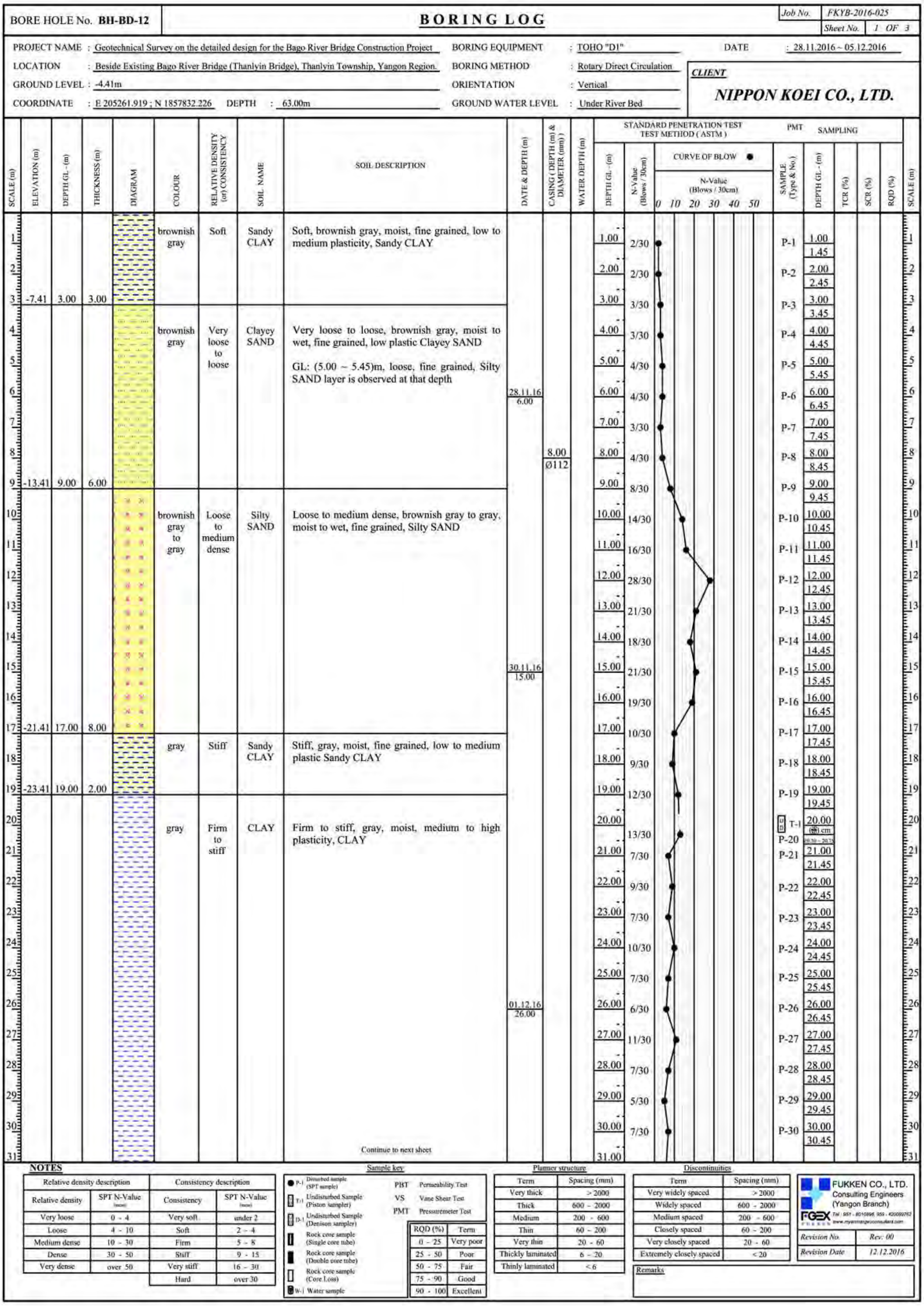
Revision Date	*14.12.2016*

Source: JICA Study Team

Figure 4.1.44 Boring log BH-BD-11 (3)



BORE HOLE No. **BH-BD-12**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*1 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -4.41m
COORDINATE : E 205261.919 ; N 1857832.226 DEPTH : 63.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 28.11.2016 ~ 05.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-7.41	3.00	3.00	brownish gray	Soft	Sandy CLAY	Soft, brownish gray, moist, fine grained, low to medium plasticity, Sandy CLAY
-13.41	9.00	6.00	brownish gray	Very loose to loose	Clayey SAND	Very loose to loose, brownish gray, moist to wet, fine grained, low plastic Clayey SAND GL: (5.00 ~ 5.45)m, loose, fine grained, Silty SAND layer is observed at that depth
-21.41	17.00	8.00	brownish gray to gray	Loose to medium dense	Silty SAND	Loose to medium dense, brownish gray to gray, moist to wet, fine grained, Silty SAND
-23.41	19.00	2.00	gray	Stiff	Sandy CLAY	Stiff, gray, moist, fine grained, low to medium plastic Sandy CLAY
			gray	Firm to stiff	CLAY	Firm to stiff, gray, moist, medium to high plasticity, CLAY

Continue to next sheet

DATE & DEPTH (m): 28.11.16 / 6.00; 30.11.16 / 15.00; 01.12.16 / 26.00

CASING (DEPTH (m) & DIAMETER (mm)): 8.00 / Ø112

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1.00	2/30	P-1	1.00 1.45
2.00	2/30	P-2	2.00 2.45
3.00	3/30	P-3	3.00 3.45
4.00	3/30	P-4	4.00 4.45
5.00	4/30	P-5	5.00 5.45
6.00	4/30	P-6	6.00 6.45
7.00	3/30	P-7	7.00 7.45
8.00	4/30	P-8	8.00 8.45
9.00	8/30	P-9	9.00 9.45
10.00	14/30	P-10	10.00 10.45
11.00	16/30	P-11	11.00 11.45
12.00	28/30	P-12	12.00 12.45
13.00	21/30	P-13	13.00 13.45
14.00	18/30	P-14	14.00 14.45
15.00	21/30	P-15	15.00 15.45
16.00	19/30	P-16	16.00 16.45
17.00	10/30	P-17	17.00 17.45
18.00	9/30	P-18	18.00 18.45
19.00	12/30	P-19	19.00 19.45
20.00		T-1	20.00 [illegible] cm
	13/30	P-20	20.30 ~ 20.75
21.00	7/30	P-21	21.00 21.45
22.00	9/30	P-22	22.00 22.45
23.00	7/30	P-23	23.00 23.45
24.00	10/30	P-24	24.00 24.45
25.00	7/30	P-25	25.00 25.45
26.00	6/30	P-26	26.00 26.45
27.00	11/30	P-27	27.00 27.45
28.00	7/30	P-28	28.00 28.45
29.00	5/30	P-29	29.00 29.45
30.00	7/30	P-30	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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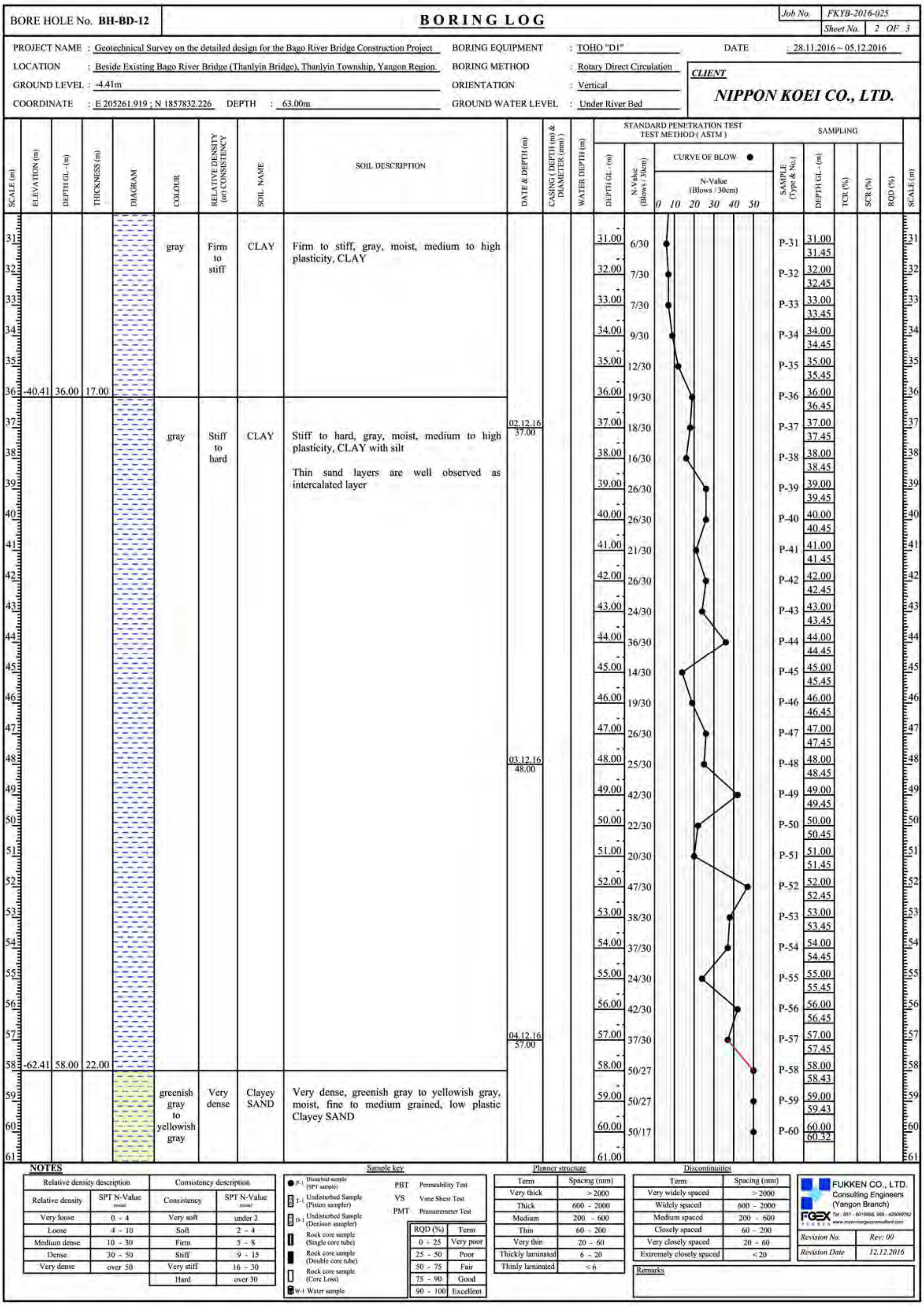
Revision Date	*12.12.2016*

Source: JICA Study Team

Figure 4.1.45 Boring log BH-BD-12 (1)



BORE HOLE No. **BH-BD-12**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 2 OF 3

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -4.41m
COORDINATE : E 205261.919 ; N 1857832.226 DEPTH : 63.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 28.11.2016 ~ 05.12.2016
CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-40.41	36.00	17.00	gray	Firm to stiff	CLAY	Firm to stiff, gray, moist, medium to high plasticity, CLAY
-62.41	58.00	22.00	gray	Stiff to hard	CLAY	Stiff to hard, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer
			greenish gray to yellowish gray	Very dense	Clayey SAND	Very dense, greenish gray to yellowish gray, moist, fine to medium grained, low plastic Clayey SAND

DATE & DEPTH (m)
02.12.16 37.00
03.12.16 48.00
04.12.16 57.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

SAMPLING

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
31.00	6/30	P-31	31.00 31.45
32.00	7/30	P-32	32.00 32.45
33.00	7/30	P-33	33.00 33.45
34.00	9/30	P-34	34.00 34.45
35.00	12/30	P-35	35.00 35.45
36.00	19/30	P-36	36.00 36.45
37.00	18/30	P-37	37.00 37.45
38.00	16/30	P-38	38.00 38.45
39.00	26/30	P-39	39.00 39.45
40.00	26/30	P-40	40.00 40.45
41.00	21/30	P-41	41.00 41.45
42.00	26/30	P-42	42.00 42.45
43.00	24/30	P-43	43.00 43.45
44.00	36/30	P-44	44.00 44.45
45.00	14/30	P-45	45.00 45.45
46.00	19/30	P-46	46.00 46.45
47.00	26/30	P-47	47.00 47.45
48.00	25/30	P-48	48.00 48.45
49.00	42/30	P-49	49.00 49.45
50.00	22/30	P-50	50.00 50.45
51.00	20/30	P-51	51.00 51.45
52.00	47/30	P-52	52.00 52.45
53.00	38/30	P-53	53.00 53.45
54.00	37/30	P-54	54.00 54.45
55.00	24/30	P-55	55.00 55.45
56.00	42/30	P-56	56.00 56.45
57.00	37/30	P-57	57.00 57.45
58.00	50/27	P-58	58.00 58.43
59.00	50/27	P-59	59.00 59.43
60.00	50/17	P-60	60.00 60.32
61.00			

NOTES

Relative density description	
Relative density	SPT N-Value
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

Consistency description	
Consistency	SPT N-Value
Very soft	under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
T-1	Undisturbed Sample (Piston sampler)
D-1	Undisturbed Sample (Denison sampler)
	Rock core sample (Single core tube)
	Rock core sample (Double core tube)
	Rock core sample (Core Loss)
W-1	Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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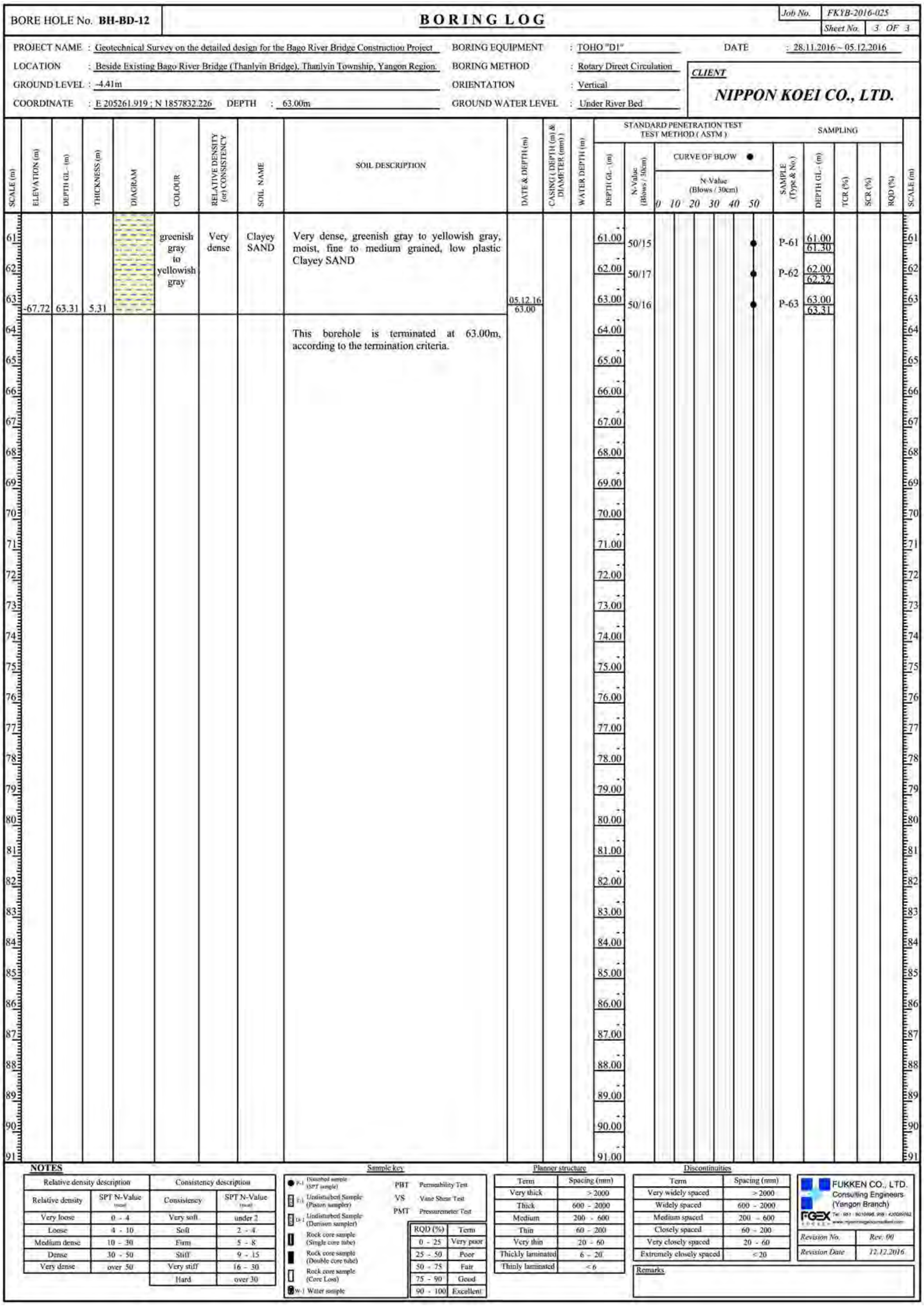
Revision Date	12.12.2016

Remarks

Source: JICA Study Team

Figure 4.1.46 Boring log BH-BD-12 (2)



BORE HOLE No. **BH-BD-12**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 3 OF 3

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -4.41m
COORDINATE : E 205261.919 ; N 1857832.226 DEPTH : 63.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 28.11.2016 ~ 05.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)
-67.72	63.31	5.31	greenish gray to yellowish gray	Very dense	Clayey SAND	Very dense, greenish gray to yellowish gray, moist, fine to medium grained, low plastic Clayey SAND	05.12.16 63.00
						This borehole is terminated at 63.00m, according to the termination criteria.	

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
61.00	50/15	P-61	61.00 61.30
62.00	50/17	P-62	62.00 62.32
63.00	50/16	P-63	63.00 63.31
64.00			
65.00			
66.00			
67.00			
68.00			
69.00			
70.00			
71.00			
72.00			
73.00			
74.00			
75.00			
76.00			
77.00			
78.00			
79.00			
80.00			
81.00			
82.00			
83.00			
84.00			
85.00			
86.00			
87.00			
88.00			
89.00			
90.00			
91.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- ▯ T-1 Undisturbed Sample (Piston sampler)
- ▯ D-1 Undisturbed Sample (Denison sampler)
- ▯ Rock core sample (Single core tube)
- ▮ Rock core sample (Double core tube)
- ▯ Rock core sample (Core Loss)
- ▮ W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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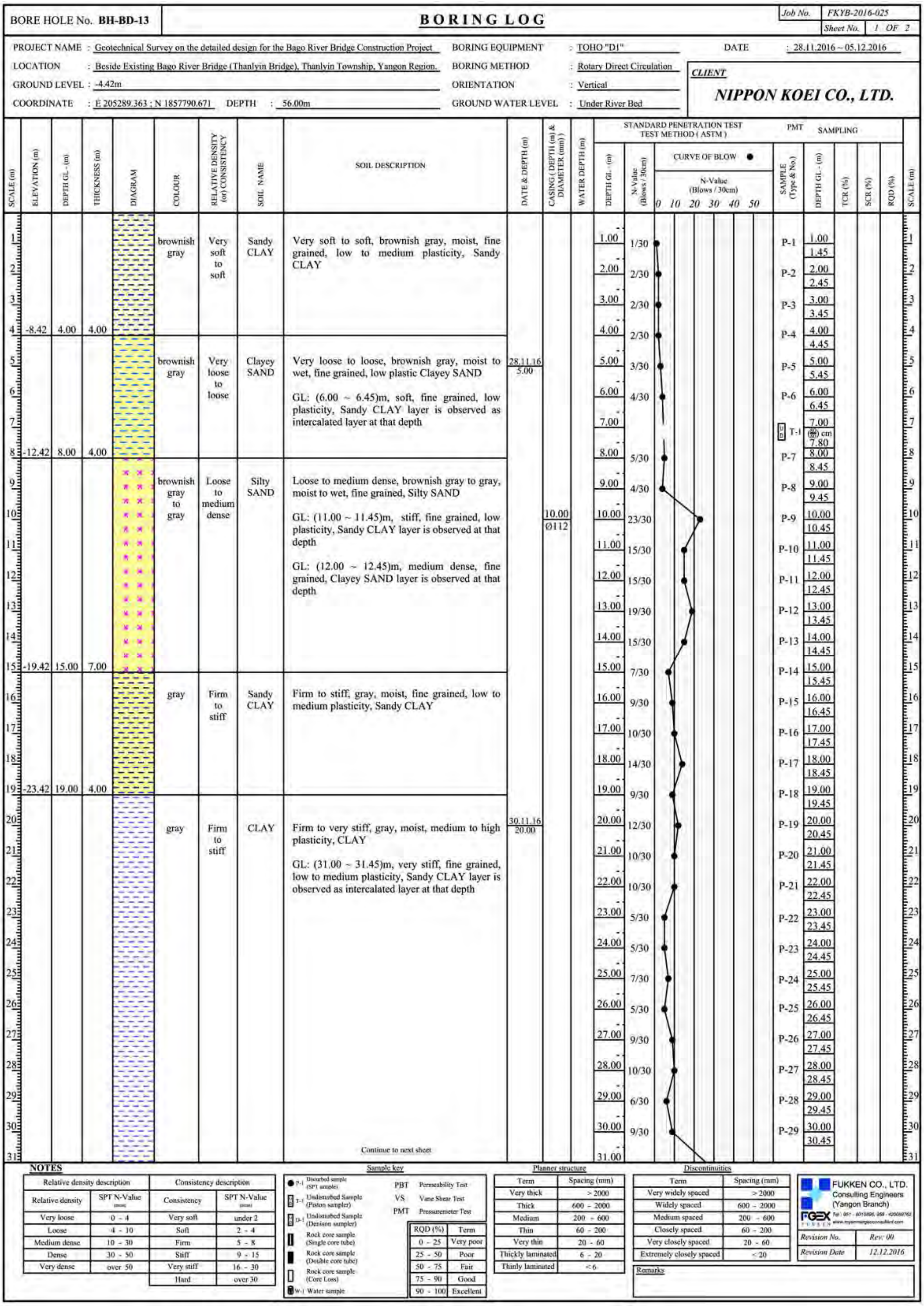
(Yangon Branch)

Revision No.	Rev: 00
Revision Date	12.12.2016

Remarks

Source: JICA Study Team

Figure 4.1.47 Boring log BH-BD-12 (3)



BORE HOLE No. **BH-BD-13**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -4.42m
COORDINATE : E 205289.363 ; N 1857790.671 DEPTH : 56.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 28.11.2016 ~ 05.12.2016

CLIENT
NIPPON KOEI CO., LTD.

SCALE (m)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
4	-8.42	4.00	4.00	brownish gray	Very soft to soft	Sandy CLAY	Very soft to soft, brownish gray, moist, fine grained, low to medium plasticity, Sandy CLAY
8	-12.42	8.00	4.00	brownish gray	Very loose to loose	Clayey SAND	Very loose to loose, brownish gray, moist to wet, fine grained, low plastic Clayey SAND GL: (6.00 ~ 6.45)m, soft, fine grained, low plasticity, Sandy CLAY layer is observed as intercalated layer at that depth
15	-19.42	15.00	7.00	brownish gray to gray	Loose to medium dense	Silty SAND	Loose to medium dense, brownish gray to gray, moist to wet, fine grained, Silty SAND GL: (11.00 ~ 11.45)m, stiff, fine grained, low plasticity, Sandy CLAY layer is observed at that depth GL: (12.00 ~ 12.45)m, medium dense, fine grained, Clayey SAND layer is observed at that depth
19	-23.42	19.00	4.00	gray	Firm to stiff	Sandy CLAY	Firm to stiff, gray, moist, fine grained, low to medium plasticity, Sandy CLAY
				gray	Firm to stiff	CLAY	Firm to very stiff, gray, moist, medium to high plasticity, CLAY GL: (31.00 ~ 31.45)m, very stiff, fine grained, low to medium plasticity, Sandy CLAY layer is observed as intercalated layer at that depth

Continue to next sheet

DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)
28.11.16 5.00	10.00 Ø112	
30.11.16 20.00		

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)	TCR (%)	SCR (%)	RQD (%)
1.00	1/30	P-1	1.00 1.45			
2.00	2/30	P-2	2.00 2.45			
3.00	2/30	P-3	3.00 3.45			
4.00	2/30	P-4	4.00 4.45			
5.00	3/30	P-5	5.00 5.45			
6.00	4/30	P-6	6.00 6.45			
7.00		T-1	7.00 [illegible] cm 7.80			
8.00	5/30	P-7	8.00 8.45			
9.00	4/30	P-8	9.00 9.45			
10.00	23/30	P-9	10.00 10.45			
11.00	15/30	P-10	11.00 11.45			
12.00	15/30	P-11	12.00 12.45			
13.00	19/30	P-12	13.00 13.45			
14.00	15/30	P-13	14.00 14.45			
15.00	7/30	P-14	15.00 15.45			
16.00	9/30	P-15	16.00 16.45			
17.00	10/30	P-16	17.00 17.45			
18.00	14/30	P-17	18.00 18.45			
19.00	9/30	P-18	19.00 19.45			
20.00	12/30	P-19	20.00 20.45			
21.00	10/30	P-20	21.00 21.45			
22.00	10/30	P-21	22.00 22.45			
23.00	5/30	P-22	23.00 23.45			
24.00	5/30	P-23	24.00 24.45			
25.00	7/30	P-24	25.00 25.45			
26.00	5/30	P-25	26.00 26.45			
27.00	9/30	P-26	27.00 27.45			
28.00	10/30	P-27	28.00 28.45			
29.00	6/30	P-28	29.00 29.45			
30.00	9/30	P-29	30.00 30.45			
31.00						

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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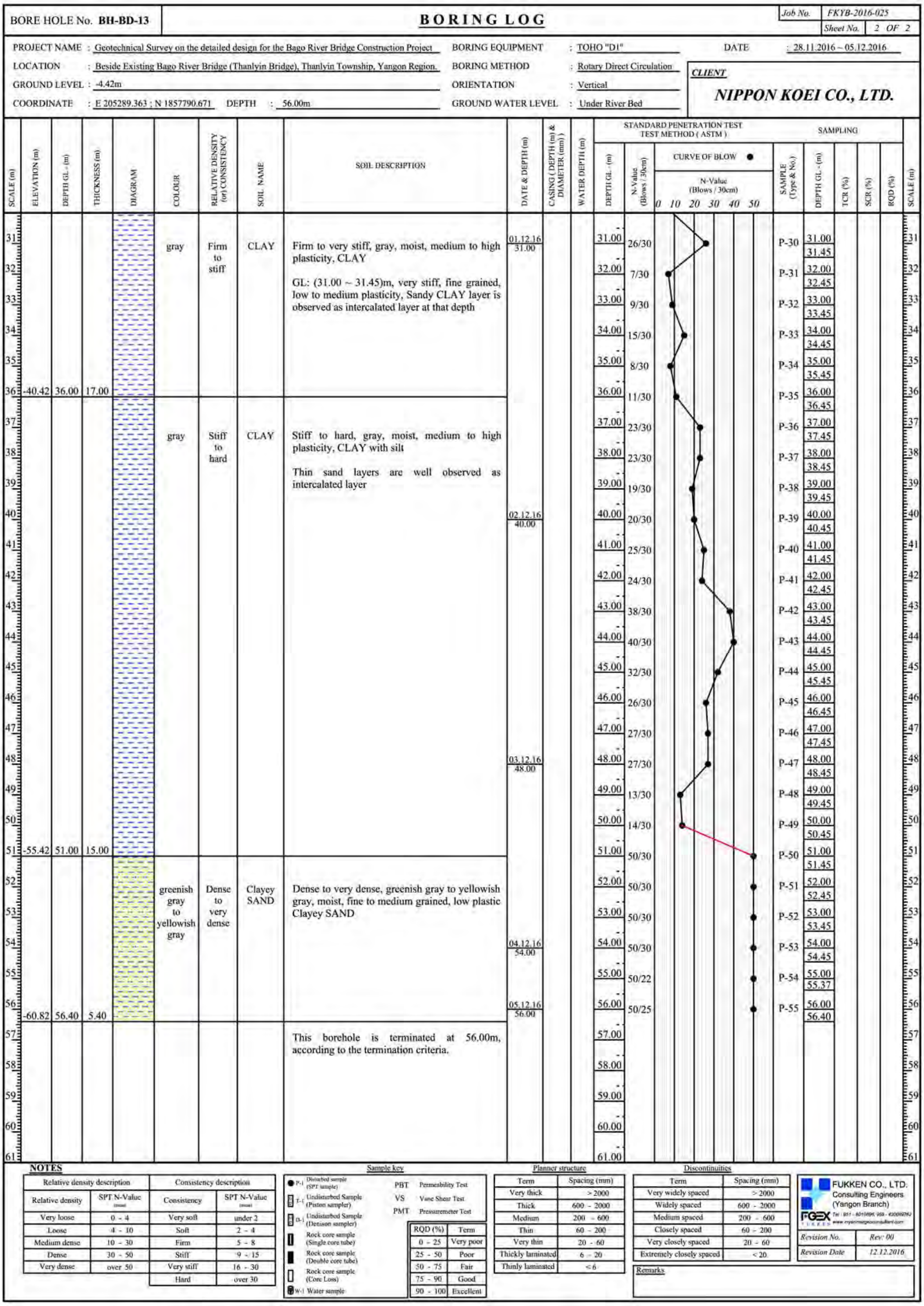
Revision No. *Rev: 00*
Revision Date *12.12.2016*

Source: JICA Study Team

Figure 4.1.48 Boring log BH-BD-13 (1)



BORE HOLE No. **BH-BD-13**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : -4.42m
COORDINATE : E 205289.363 ; N 1857790.671 DEPTH : 56.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 28.11.2016 ~ 05.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL.- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-40.42	36.00	17.00	gray	Firm to stiff	CLAY	Firm to very stiff, gray, moist, medium to high plasticity, CLAY GL: (31.00 ~ 31.45)m, very stiff, fine grained, low to medium plasticity, Sandy CLAY layer is observed as intercalated layer at that depth
-55.42	51.00	15.00	gray	Stiff to hard	CLAY	Stiff to hard, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer
-60.82	56.40	5.40	greenish gray to yellowish gray	Dense to very dense	Clayey SAND	Dense to very dense, greenish gray to yellowish gray, moist, fine to medium grained, low plastic Clayey SAND
						This borehole is terminated at 56.00m, according to the termination criteria.

DATE & DEPTH (m)	
01.12.16	31.00
02.12.16	40.00
03.12.16	48.00
04.12.16	54.00
05.12.16	56.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

CURVE OF BLOW ●

DEPTH GL.- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL.- (m)
31.00	26/30	P-30	31.00 31.45
32.00	7/30	P-31	32.00 32.45
33.00	9/30	P-32	33.00 33.45
34.00	15/30	P-33	34.00 34.45
35.00	8/30	P-34	35.00 35.45
36.00	11/30	P-35	36.00 36.45
37.00	23/30	P-36	37.00 37.45
38.00	23/30	P-37	38.00 38.45
39.00	19/30	P-38	39.00 39.45
40.00	20/30	P-39	40.00 40.45
41.00	25/30	P-40	41.00 41.45
42.00	24/30	P-41	42.00 42.45
43.00	38/30	P-42	43.00 43.45
44.00	40/30	P-43	44.00 44.45
45.00	32/30	P-44	45.00 45.45
46.00	26/30	P-45	46.00 46.45
47.00	27/30	P-46	47.00 47.45
48.00	27/30	P-47	48.00 48.45
49.00	13/30	P-48	49.00 49.45
50.00	14/30	P-49	50.00 50.45
51.00	50/30	P-50	51.00 51.45
52.00	50/30	P-51	52.00 52.45
53.00	50/30	P-52	53.00 53.45
54.00	50/30	P-53	54.00 54.45
55.00	50/22	P-54	55.00 55.37
56.00	50/25	P-55	56.00 56.40
57.00			
58.00			
59.00			
60.00			
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
T-1 Undisturbed Sample (Piston sampler)
D-1 Undisturbed Sample (Denison sampler)
Rock core sample (Single core tube)
Rock core sample (Double core tube)
Rock core sample (Core Loss)
W-1 Water sample
PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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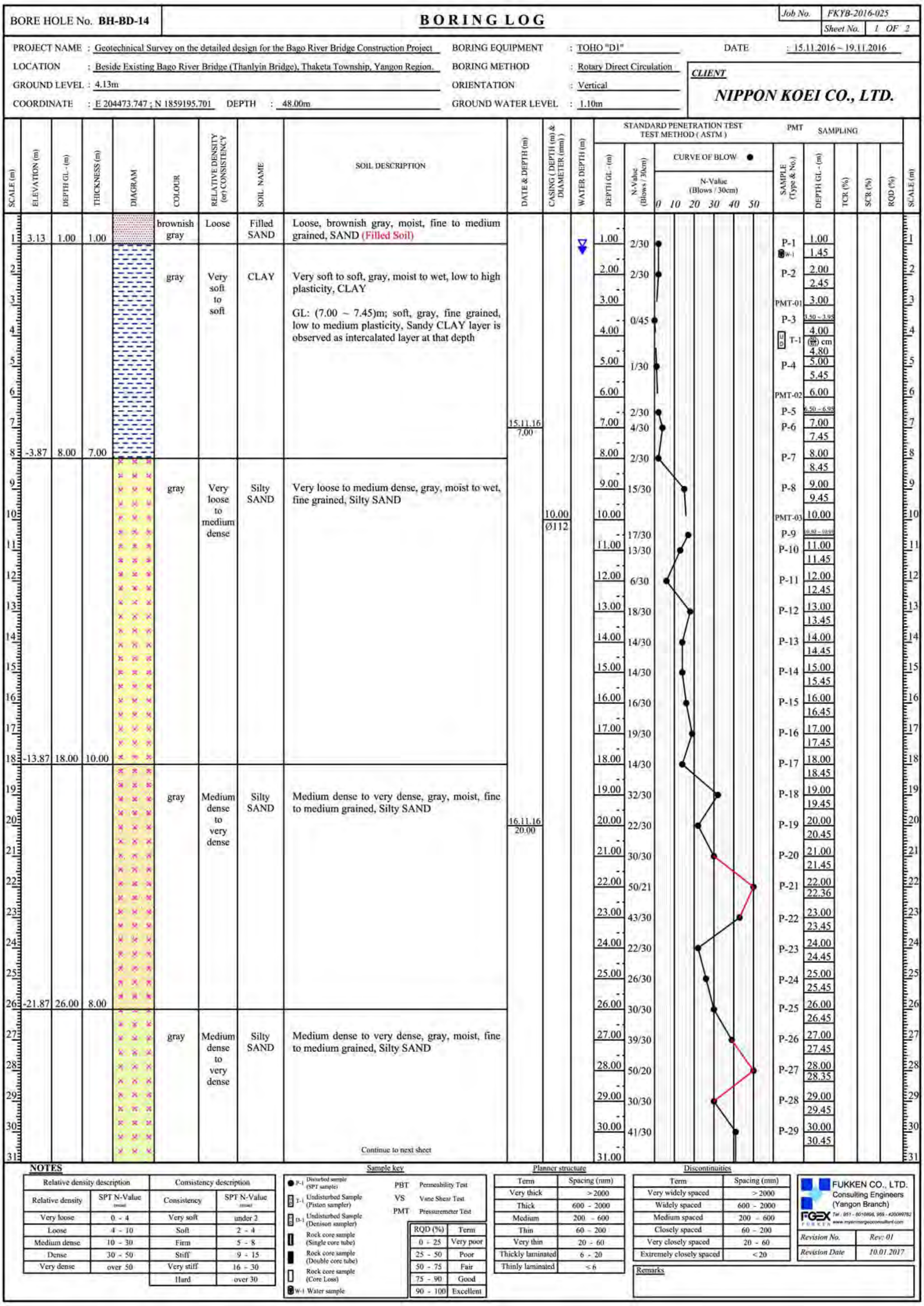
(Yangon Branch)

Revision No.	*Rev: 00*
Revision Date	*12.12.2016*

Remarks

Source: JICA Study Team

Figure 4.1.49 Boring log BH-BD-13 (2)



BORE HOLE No. **BH-BD-14**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : 4.13m
COORDINATE : E 204473.747 ; N 1859195.701 DEPTH : 48.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 1.10m
DATE : 15.11.2016 ~ 19.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
3.13	1.00	1.00	brownish gray	Loose	Filled SAND	Loose, brownish gray, moist, fine to medium grained, SAND (Filled Soil)
-3.87	8.00	7.00	gray	Very soft to soft	CLAY	Very soft to soft, gray, moist to wet, low to high plasticity, CLAY GL: (7.00 ~ 7.45)m; soft, gray, fine grained, low to medium plasticity, Sandy CLAY layer is observed as intercalated layer at that depth
-13.87	18.00	10.00	gray	Very loose to medium dense	Silty SAND	Very loose to medium dense, gray, moist to wet, fine grained, Silty SAND
-21.87	26.00	8.00	gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND
			gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND

Continue to next sheet

DATE & DEPTH (m): 15.11.16 7.00; 16.11.16 20.00
CASING (DEPTH (m) & DIAMETER (mm)): 10.00 Ø112

STANDARD PENETRATION TEST
TEST METHOD (ASTM)
CURVE OF BLOW ●
N-Value (Blows / 30cm) 0 10 20 30 40 50

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
1.00	2/30	P-1 W-1	1.00 1.45
2.00	2/30	P-2	2.00 2.45
3.00		PMT-01	3.00
	0/45	P-3	3.50 ~ 3.95
4.00		T-1	4.00 (80/80) cm 4.80
5.00	1/30	P-4	5.00 5.45
6.00		PMT-02	6.00
	2/30	P-5	6.50 ~ 6.95
7.00	4/30	P-6	7.00 7.45
8.00	2/30	P-7	8.00 8.45
9.00	15/30	P-8	9.00 9.45
10.00		PMT-03	10.00
	17/30	P-9	10.50 ~ 10.95
11.00	13/30	P-10	11.00 11.45
12.00	6/30	P-11	12.00 12.45
13.00	18/30	P-12	13.00 13.45
14.00	14/30	P-13	14.00 14.45
15.00	14/30	P-14	15.00 15.45
16.00	16/30	P-15	16.00 16.45
17.00	19/30	P-16	17.00 17.45
18.00	14/30	P-17	18.00 18.45
19.00	32/30	P-18	19.00 19.45
20.00	22/30	P-19	20.00 20.45
21.00	30/30	P-20	21.00 21.45
22.00	50/21	P-21	22.00 22.36
23.00	43/30	P-22	23.00 23.45
24.00	22/30	P-23	24.00 24.45
25.00	26/30	P-24	25.00 25.45
26.00	30/30	P-25	26.00 26.45
27.00	39/30	P-26	27.00 27.45
28.00	50/20	P-27	28.00 28.35
29.00	30/30	P-28	29.00 29.45
30.00	41/30	P-29	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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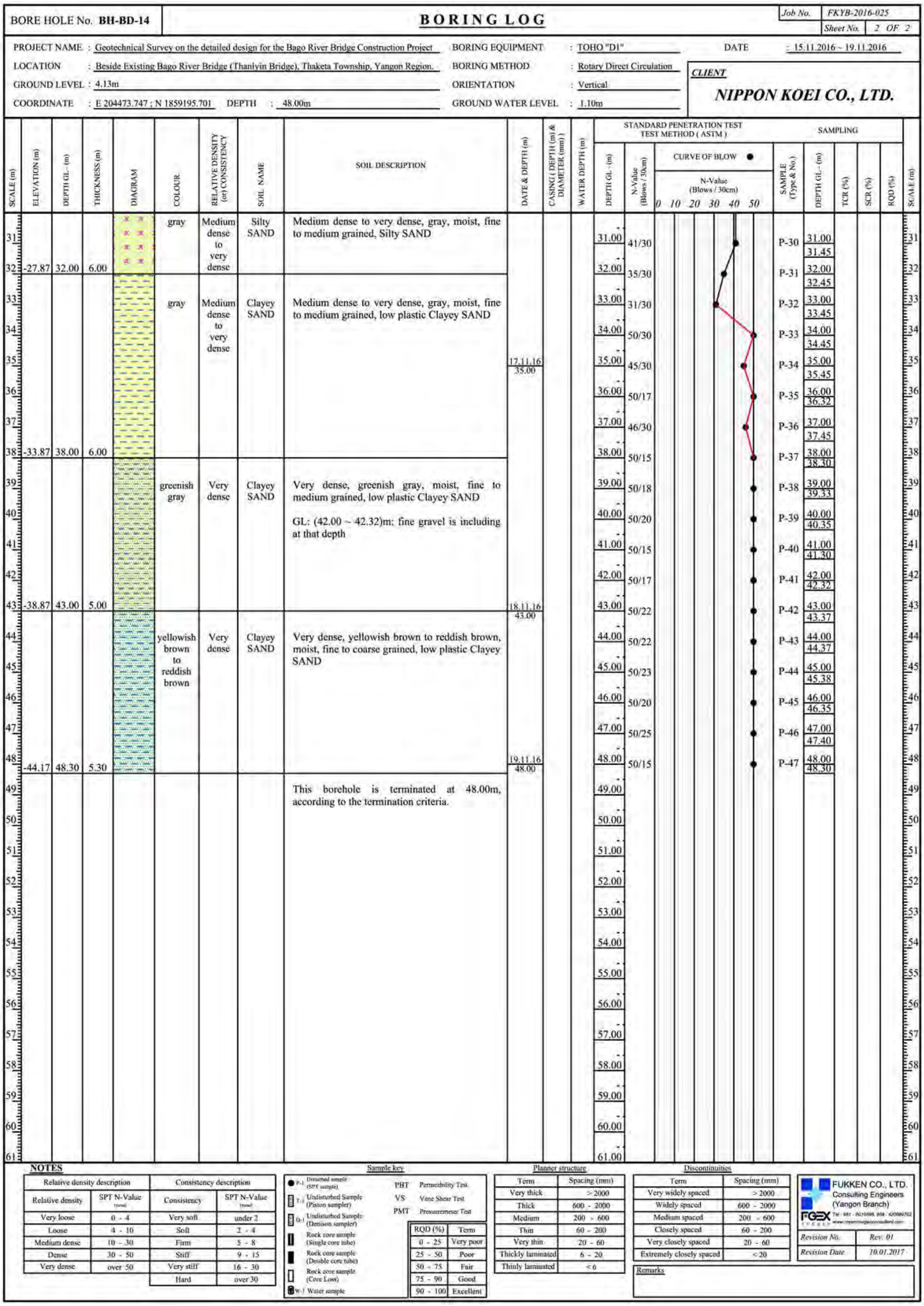
(Yangon Branch)

Revision No.	*Rev: 01*
Revision Date	*10.01.2017*

Source: JICA Study Team

Figure 4.1.50 Boring log BH-BD-14 (1)



BORE HOLE No. **BH-BD-14**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 2 OF 2

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : 4.13m
COORDINATE : E 204473.747 ; N 1859195.701 DEPTH : 48.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 1.10m
DATE : 15.11.2016 ~ 19.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL.- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)
-27.87	32.00	6.00	gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND	
-33.87	38.00	6.00	gray	Medium dense to very dense	Clayey SAND	Medium dense to very dense, gray, moist, fine to medium grained, low plastic Clayey SAND	17.11.16 35.00
-38.87	43.00	5.00	greenish gray	Very dense	Clayey SAND	Very dense, greenish gray, moist, fine to medium grained, low plastic Clayey SAND GL: (42.00 ~ 42.32)m: fine gravel is including at that depth	18.11.16 43.00
-44.17	48.30	5.30	yellowish brown to reddish brown	Very dense	Clayey SAND	Very dense, yellowish brown to reddish brown, moist, fine to coarse grained, low plastic Clayey SAND	19.11.16 48.00
						This borehole is terminated at 48.00m, according to the termination criteria.	

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL.- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL.- (m)
31.00	41/30	P-30	31.00 31.45
32.00	35/30	P-31	32.00 32.45
33.00	31/30	P-32	33.00 33.45
34.00	50/30	P-33	34.00 34.45
35.00	45/30	P-34	35.00 35.45
36.00	50/17	P-35	36.00 36.32
37.00	46/30	P-36	37.00 37.45
38.00	50/15	P-37	38.00 38.30
39.00	50/18	P-38	39.00 39.33
40.00	50/20	P-39	40.00 40.35
41.00	50/15	P-40	41.00 41.30
42.00	50/17	P-41	42.00 42.32
43.00	50/22	P-42	43.00 43.37
44.00	50/22	P-43	44.00 44.37
45.00	50/23	P-44	45.00 45.38
46.00	50/20	P-45	46.00 46.35
47.00	50/25	P-46	47.00 47.40
48.00	50/15	P-47	48.00 48.30
49.00			
50.00			
51.00			
52.00			
53.00			
54.00			
55.00			
56.00			
57.00			
58.00			
59.00			
60.00			
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key
- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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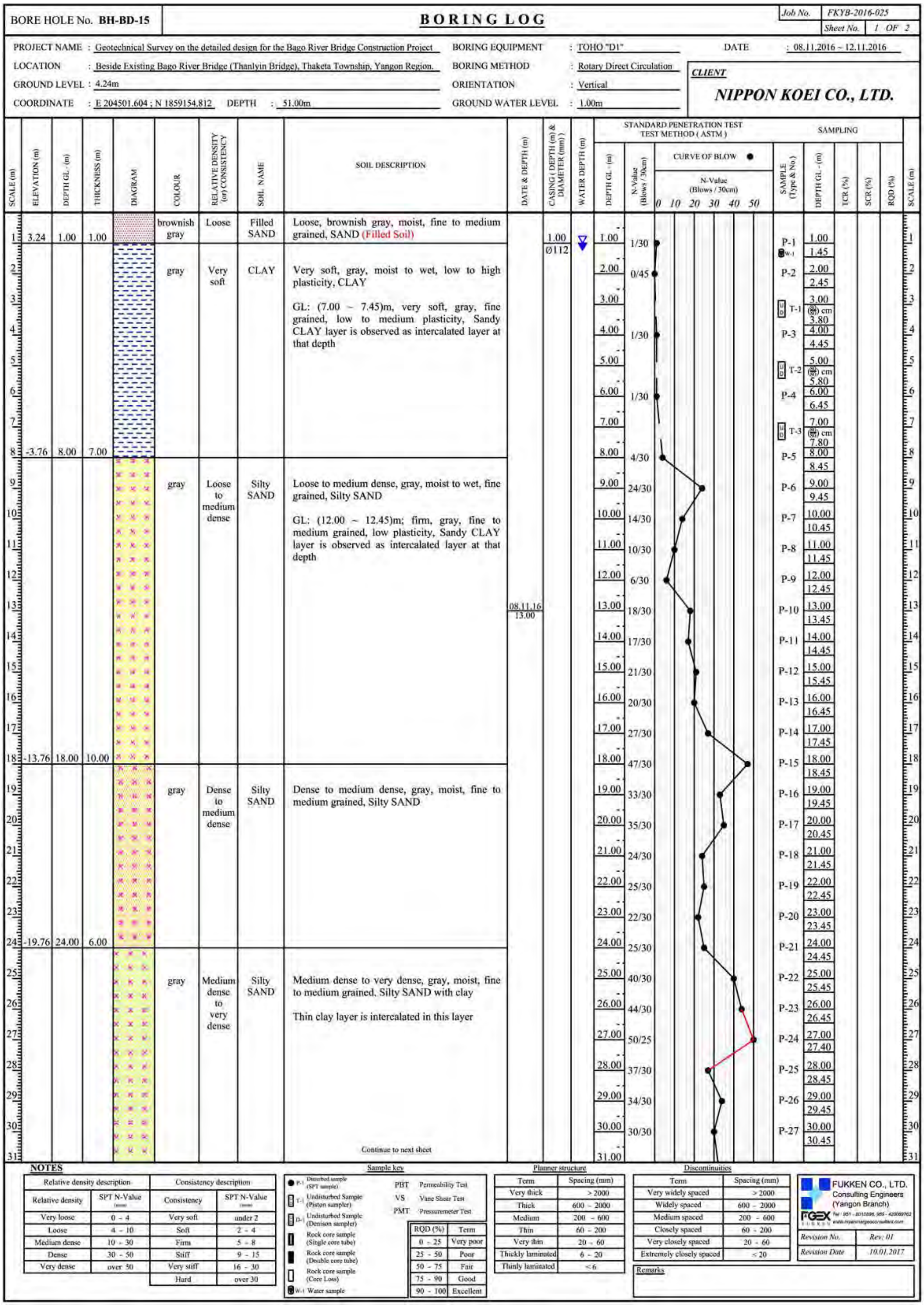
Consulting Engineers
(Yangon Branch)
FGEX

Revision No.	Rev. 01
Revision Date	10.01.2017

Source: JICA Study Team

Figure 4.1.51 Boring log BH-BD-14 (2)



BORE HOLE No. **BH-BD-15**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 1 OF 2

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : 4.24m
COORDINATE : E 204501.604 ; N 1859154.812 DEPTH : 51.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 1.00m
DATE : 08.11.2016 ~ 12.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL.- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
3.24	1.00	1.00	brownish gray	Loose	Filled SAND	Loose, brownish gray, moist, fine to medium grained, SAND (Filled Soil)
-3.76	8.00	7.00	gray	Very soft	CLAY	Very soft, gray, moist to wet, low to high plasticity, CLAY GL: (7.00 ~ 7.45)m, very soft, gray, fine grained, low to medium plasticity, Sandy CLAY layer is observed as intercalated layer at that depth
-13.76	18.00	10.00	gray	Loose to medium dense	Silty SAND	Loose to medium dense, gray, moist to wet, fine grained, Silty SAND GL: (12.00 ~ 12.45)m; firm, gray, fine to medium grained, low plasticity, Sandy CLAY layer is observed as intercalated layer at that depth
-19.76	24.00	6.00	gray	Dense to medium dense	Silty SAND	Dense to medium dense, gray, moist, fine to medium grained, Silty SAND
			gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND with clay Thin clay layer is intercalated in this layer

Continue to next sheet

DATE & DEPTH (m): 08.11.16 13.00

CASING (DEPTH (m) & DIAMETER (mm)): 1.00 Ø112

WATER DEPTH (m): 1.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

SAMPLING

DEPTH GL.- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL.- (m)
1.00	1/30	P-1 W-1	1.00 1.45
2.00	0/45	P-2	2.00 2.45
3.00		T-1	3.00 (80) cm 3.80
4.00	1/30	P-3	4.00 4.45
5.00		T-2	5.00 (80) cm 5.80
6.00	1/30	P-4	6.00 6.45
7.00		T-3	7.00 (80) cm 7.80
8.00	4/30	P-5	8.00 8.45
9.00	24/30	P-6	9.00 9.45
10.00	14/30	P-7	10.00 10.45
11.00	10/30	P-8	11.00 11.45
12.00	6/30	P-9	12.00 12.45
13.00	18/30	P-10	13.00 13.45
14.00	17/30	P-11	14.00 14.45
15.00	21/30	P-12	15.00 15.45
16.00	20/30	P-13	16.00 16.45
17.00	27/30	P-14	17.00 17.45
18.00	47/30	P-15	18.00 18.45
19.00	33/30	P-16	19.00 19.45
20.00	35/30	P-17	20.00 20.45
21.00	24/30	P-18	21.00 21.45
22.00	25/30	P-19	22.00 22.45
23.00	22/30	P-20	23.00 23.45
24.00	25/30	P-21	24.00 24.45
25.00	40/30	P-22	25.00 25.45
26.00	44/30	P-23	26.00 26.45
27.00	50/25	P-24	27.00 27.40
28.00	37/30	P-25	28.00 28.45
29.00	34/30	P-26	29.00 29.45
30.00	30/30	P-27	30.00 30.45
31.00			

NOTES

Relative density description	
Relative density	SPT N-Value
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

Consistency description	
Consistency	SPT N-Value
Very soft	under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)
FGEX

Revision No.	Rev: 01
Revision Date	10.01.2017

Source: JICA Study Team

Figure 4.1.52 Boring log BH-BD-15 (1)

BORE HOLE No. **BH-BD-15**	**BORING LOG**	Job No.	*FKYB-2016-025*
		Sheet No.	*2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : 4.24m
COORDINATE : E 204501.604 ; N 1859154.812 DEPTH : 51.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 1.00m
DATE : 08.11.2016 ~ 12.11.2016

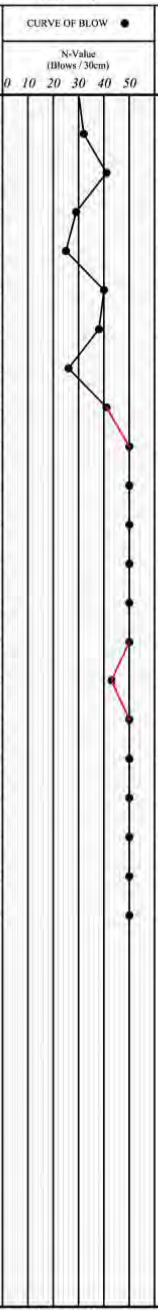
CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-29.76	34.00	10.00	gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND with clay Thin clay layer is intercalated in this layer
-38.76	43.00	9.00	gray	Medium dense to very dense	Clayey SAND	Medium dense to very dense, gray, moist, fine to medium grained, low plastic Clayey SAND
-41.76	46.00	3.00	reddish brown	Very dense to dense	Clayey SAND	Very dense to dense, reddish brown, moist, fine to medium grained, low plastic Clayey SAND
-47.06	51.30	5.30	yellowish brown to reddish brown	Dense to very dense	Clayey SAND	Dense to very dense, yellowish brown to reddish brown, moist, fine to coarse grained, low plastic Clayey SAND
						This borehole is terminated at 51.00m, according to the termination criteria.

DATE & DEPTH (m)
09.11.16 31.00
10.11.16 42.00
11.11.16 49.00
12.11.16 51.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
31.00	32/30	P-28	31.00 31.45
32.00	41/30	P-29	32.00 32.45
33.00	29/30	P-30	33.00 33.45
34.00	25/30	P-31	34.00 34.45
35.00	40/30	P-32	35.00 35.45
36.00	38/30	P-33	36.00 36.45
37.00	26/30	P-34	37.00 37.45
38.00	41/30	P-35	38.00 38.45
39.00	50/28	P-36	39.00 39.43
40.00	50/20	P-37	40.00 40.35
41.00	50/25	P-38	41.00 41.40
42.00	50/25	P-39	42.00 42.40
43.00	50/29	P-40	43.00 43.44
44.00	50/30	P-41	44.00 44.45
45.00	43/30	P-42	45.00 45.45
46.00	50/30	P-43	46.00 46.45
47.00	50/28	P-44	47.00 47.43
48.00	50/24	P-45	48.00 48.39
49.00	50/27	P-46	49.00 49.42
50.00	50/22	P-47	50.00 50.37
51.00	50/15	P-48	51.00 51.30
52.00			
53.00			
54.00			
55.00			
56.00			
57.00			
58.00			
59.00			
60.00			
61.00			



Column headings: SCALE (m), CASING (DEPTH (m) & DIAMETER (mm)), WATER DEPTH (m), DIAGRAM, SAMPLING, TCR (%), SCR (%), RQD (%)

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
T-1 Undisturbed Sample (Piston sampler)
D-1 Undisturbed Sample (Denison sampler)
Rock core sample (Single core tube)
Rock core sample (Double core tube)
Rock core sample (Core Loss)
W-1 Water sample

PBT	Permeability Test
VS	Vane Shear Test
PMT	Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

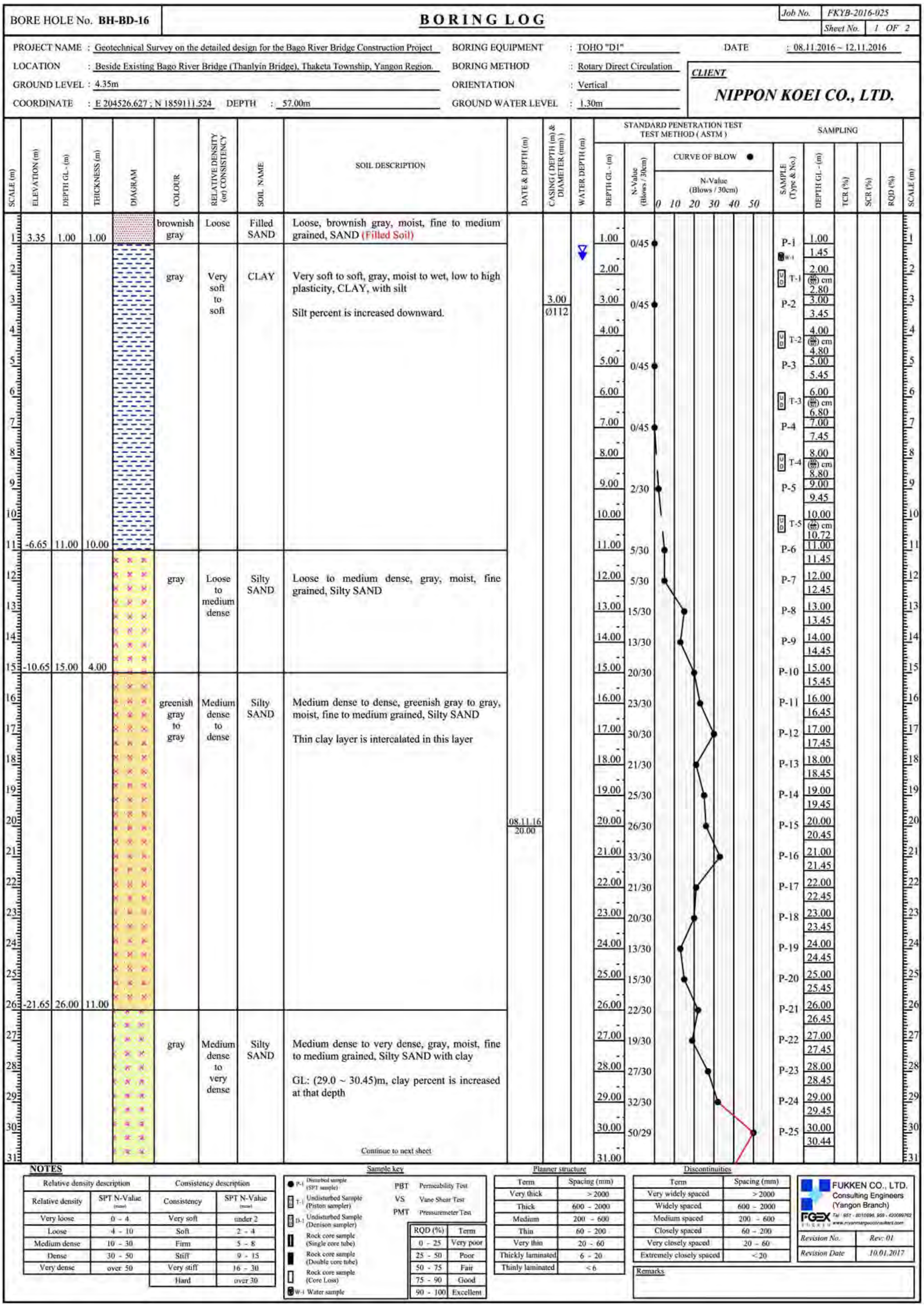
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)
FGEX

Revision No.	*Rev: 01*
Revision Date	*10.01.2017*

Source: JICA Study Team

Figure 4.1.53 Boring log BH-BD-15 (2)



BORE HOLE No. **BH-BD-16**

BORING LOG

Job No.	FKYB-2016-025
Sheet No.	1 OF 2

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : 4.35m
COORDINATE : E 204526.627 ; N 1859111.524 DEPTH : 57.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 1.30m
DATE : 08.11.2016 ~ 12.11.2016
CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
3.35	1.00	1.00	brownish gray	Loose	Filled SAND	Loose, brownish gray, moist, fine to medium grained, SAND (Filled Soil)
-6.65	11.00	10.00	gray	Very soft to soft	CLAY	Very soft to soft, gray, moist to wet, low to high plasticity, CLAY, with silt Silt percent is increased downward.
-10.65	15.00	4.00	gray	Loose to medium dense	Silty SAND	Loose to medium dense, gray, moist, fine grained, Silty SAND
-21.65	26.00	11.00	greenish gray to gray	Medium dense to dense	Silty SAND	Medium dense to dense, greenish gray to gray, moist, fine to medium grained, Silty SAND Thin clay layer is intercalated in this layer
			gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND with clay GL: (29.0 ~ 30.45)m, clay percent is increased at that depth

Continue to next sheet

DATE & DEPTH (m): 08.11.16 20.00
CASING (DEPTH (m) & DIAMETER (mm)): 3.00 Ø112

STANDARD PENETRATION TEST TEST METHOD (ASTM) / SAMPLING

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
1.00	0/45	P-1	1.00 1.45
		W-1	
2.00		T-1	2.00 (80/80) cm 2.80
3.00	0/45	P-2	3.00 3.45
4.00		T-2	4.00 (80/80) cm 4.80
5.00	0/45	P-3	5.00 5.45
6.00		T-3	6.00 (80/80) cm 6.80
7.00	0/45	P-4	7.00 7.45
8.00		T-4	8.00 (80/80) cm 8.80
9.00	2/30	P-5	9.00 9.45
10.00		T-5	10.00 (72/72) cm 10.72
11.00	5/30	P-6	11.00 11.45
12.00	5/30	P-7	12.00 12.45
13.00	15/30	P-8	13.00 13.45
14.00	13/30	P-9	14.00 14.45
15.00	20/30	P-10	15.00 15.45
16.00	23/30	P-11	16.00 16.45
17.00	30/30	P-12	17.00 17.45
18.00	21/30	P-13	18.00 18.45
19.00	25/30	P-14	19.00 19.45
20.00	26/30	P-15	20.00 20.45
21.00	33/30	P-16	21.00 21.45
22.00	21/30	P-17	22.00 22.45
23.00	20/30	P-18	23.00 23.45
24.00	13/30	P-19	24.00 24.45
25.00	15/30	P-20	25.00 25.45
26.00	22/30	P-21	26.00 26.45
27.00	19/30	P-22	27.00 27.45
28.00	27/30	P-23	28.00 28.45
29.00	32/30	P-24	29.00 29.45
30.00	50/29	P-25	30.00 30.44
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

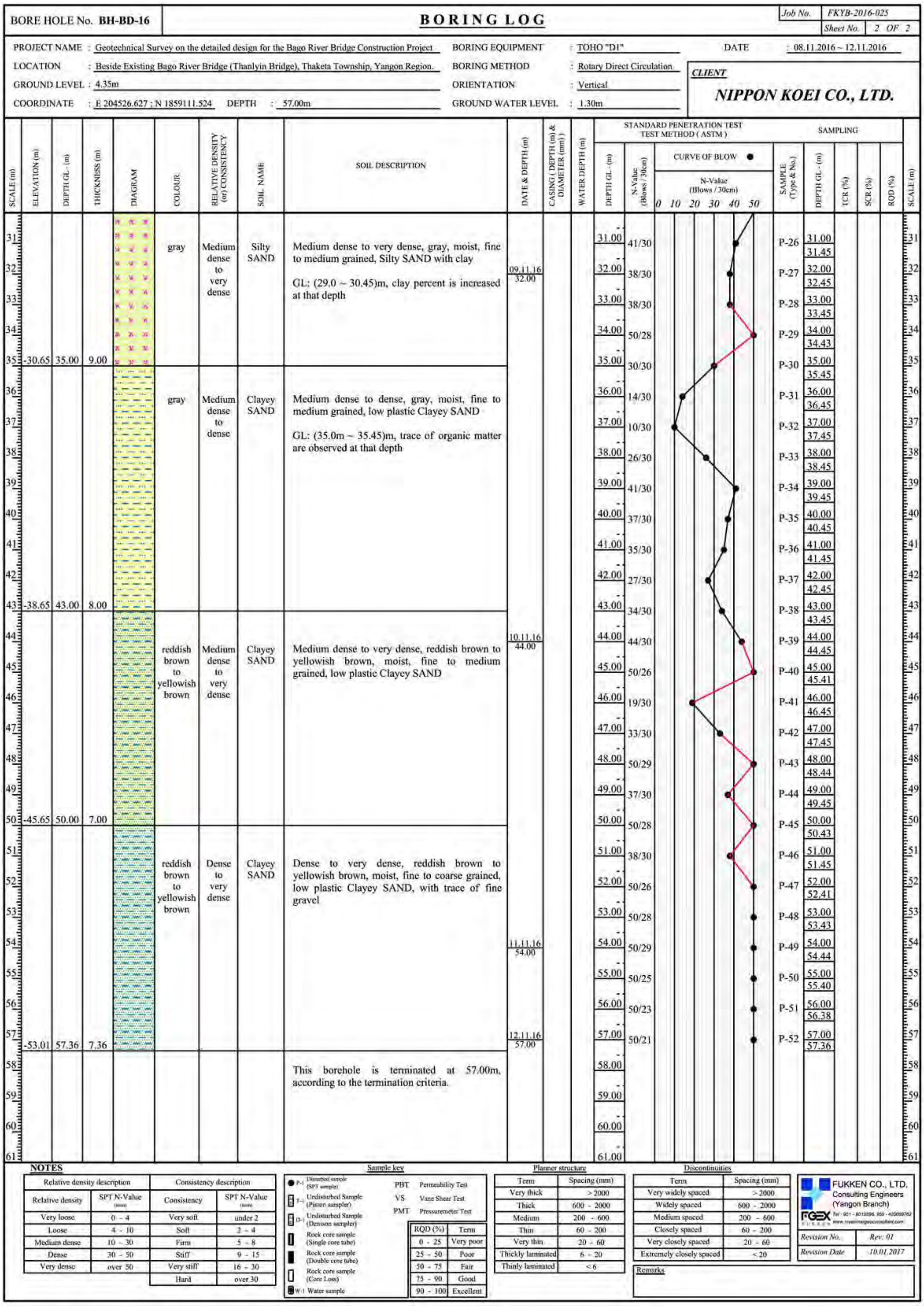
FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	Rev: 01
Revision Date	10.01.2017

Remarks

Source: JICA Study Team

Figure 4.1.54 Boring log BH-BD-16 (1)



BORE HOLE No. **BH-BD-16**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : 4.35m
COORDINATE : E 204526.627 ; N 1859111.524 DEPTH : 57.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 1.30m
DATE : 08.11.2016 ~ 12.11.2016

CLIENT

NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)
-30.65	35.00	9.00	gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND with clay GL: (29.0 ~ 30.45)m, clay percent is increased at that depth	09.11.16 32.00
-38.65	43.00	8.00	gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, low plastic Clayey SAND GL: (35.0m ~ 35.45)m, trace of organic matter are observed at that depth	
-45.65	50.00	7.00	reddish brown to yellowish brown	Medium dense to very dense	Clayey SAND	Medium dense to very dense, reddish brown to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND	10.11.16 44.00
-53.01	57.36	7.36	reddish brown to yellowish brown	Dense to very dense	Clayey SAND	Dense to very dense, reddish brown to yellowish brown, moist, fine to coarse grained, low plastic Clayey SAND, with trace of fine gravel	11.11.16 54.00 12.11.16 57.00
						This borehole is terminated at 57.00m, according to the termination criteria.	

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

SAMPLING

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
31.00	41/30	P-26	31.00 31.45
32.00	38/30	P-27	32.00 32.45
33.00	38/30	P-28	33.00 33.45
34.00	50/28	P-29	34.00 34.43
35.00	30/30	P-30	35.00 35.45
36.00	14/30	P-31	36.00 36.45
37.00	10/30	P-32	37.00 37.45
38.00	26/30	P-33	38.00 38.45
39.00	41/30	P-34	39.00 39.45
40.00	37/30	P-35	40.00 40.45
41.00	35/30	P-36	41.00 41.45
42.00	27/30	P-37	42.00 42.45
43.00	34/30	P-38	43.00 43.45
44.00	44/30	P-39	44.00 44.45
45.00	50/26	P-40	45.00 45.41
46.00	19/30	P-41	46.00 46.45
47.00	33/30	P-42	47.00 47.45
48.00	50/29	P-43	48.00 48.44
49.00	37/30	P-44	49.00 49.45
50.00	50/28	P-45	50.00 50.43
51.00	38/30	P-46	51.00 51.45
52.00	50/26	P-47	52.00 52.41
53.00	50/28	P-48	53.00 53.43
54.00	50/29	P-49	54.00 54.44
55.00	50/25	P-50	55.00 55.40
56.00	50/23	P-51	56.00 56.38
57.00	50/21	P-52	57.00 57.36
58.00			
59.00			
60.00			
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
T-1 Undisturbed Sample (Piston sampler)
D-1 Undisturbed Sample (Denison sampler)
Rock core sample (Single core tube)
Rock core sample (Double core tube)
Rock core sample (Core Loss)
W-1 Water sample
PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

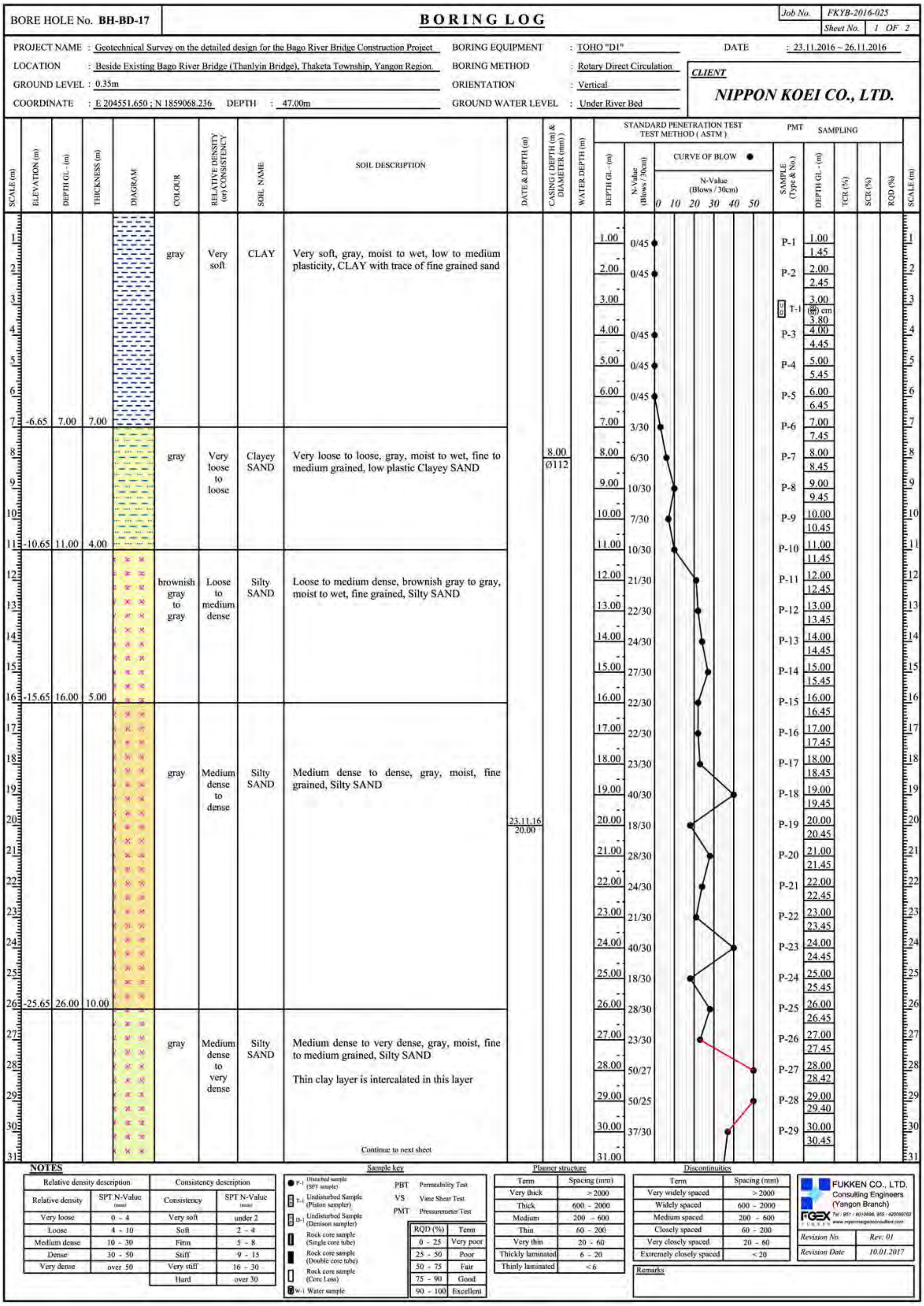
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)
Tel : 951 - 8010896, 959 - 420069762

Revision No.	*Rev: 01*
Revision Date	*10.01.2017*

Source: JICA Study Team

Figure 4.1.55 Boring log BH-BD-16 (2)



BORE HOLE No. **BH-BD-17**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : 0.35m
COORDINATE : E 204551.650 ; N 1859068.236 DEPTH : 47.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 23.11.2016 ~ 26.11.2016
CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-6.65	7.00	7.00	gray	Very soft	CLAY	Very soft, gray, moist to wet, low to medium plasticity, CLAY with trace of fine grained sand
-10.65	11.00	4.00	gray	Very loose to loose	Clayey SAND	Very loose to loose, gray, moist to wet, fine to medium grained, low plastic Clayey SAND
-15.65	16.00	5.00	brownish gray to gray	Loose to medium dense	Silty SAND	Loose to medium dense, brownish gray to gray, moist to wet, fine grained, Silty SAND
-25.65	26.00	10.00	gray	Medium dense to dense	Silty SAND	Medium dense to dense, gray, moist, fine grained, Silty SAND
			gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND Thin clay layer is intercalated in this layer

DATE & DEPTH (m): 23.11.16 20.00
CASING (DEPTH (m) & DIAMETER (mm)): 8.00 Ø112

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1.00	0/45	P-1	1.00 1.45
2.00	0/45	P-2	2.00 2.45
3.00		T-1	3.00 (80/80) cm 3.80
4.00	0/45	P-3	4.00 4.45
5.00	0/45	P-4	5.00 5.45
6.00	0/45	P-5	6.00 6.45
7.00	3/30	P-6	7.00 7.45
8.00	6/30	P-7	8.00 8.45
9.00	10/30	P-8	9.00 9.45
10.00	7/30	P-9	10.00 10.45
11.00	10/30	P-10	11.00 11.45
12.00	21/30	P-11	12.00 12.45
13.00	22/30	P-12	13.00 13.45
14.00	24/30	P-13	14.00 14.45
15.00	27/30	P-14	15.00 15.45
16.00	22/30	P-15	16.00 16.45
17.00	22/30	P-16	17.00 17.45
18.00	23/30	P-17	18.00 18.45
19.00	40/30	P-18	19.00 19.45
20.00	18/30	P-19	20.00 20.45
21.00	28/30	P-20	21.00 21.45
22.00	24/30	P-21	22.00 22.45
23.00	21/30	P-22	23.00 23.45
24.00	40/30	P-23	24.00 24.45
25.00	18/30	P-24	25.00 25.45
26.00	28/30	P-25	26.00 26.45
27.00	23/30	P-26	27.00 27.45
28.00	50/27	P-27	28.00 28.42
29.00	50/25	P-28	29.00 29.40
30.00	37/30	P-29	30.00 30.45
31.00			

Continue to next sheet

NOTES

Relative density description	
Relative density	SPT N-Value
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

Consistency description	
Consistency	SPT N-Value
Very soft	under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	over 30

Sample key
● P-1 Disturbed sample (SPT sample)
T-1 Undisturbed Sample (Piston sampler)
D-1 Undisturbed Sample (Denison sampler)
Rock core sample (Single core tube)
Rock core sample (Double core tube)
Rock core sample (Core Loss)
W-1 Water sample
PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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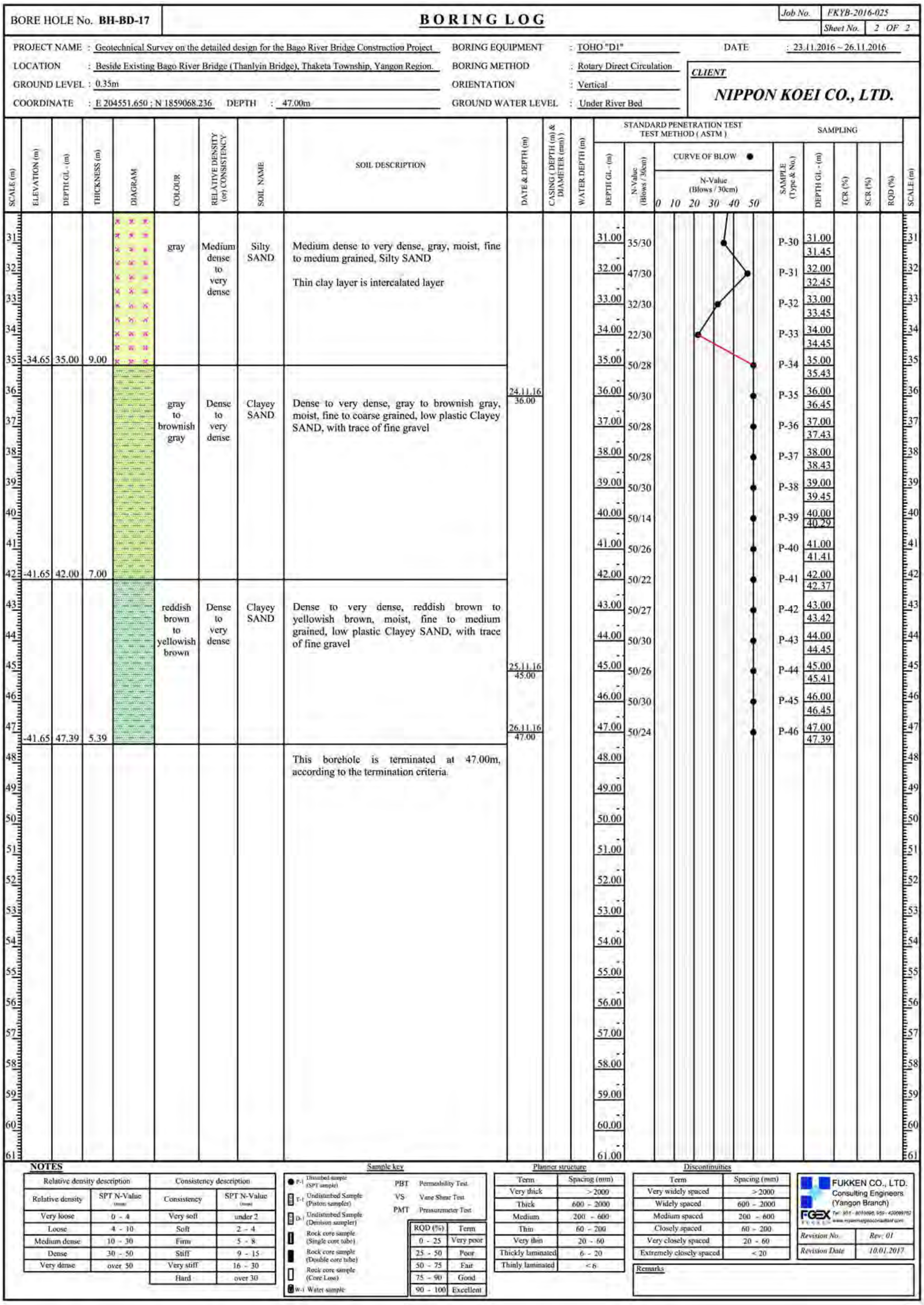
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 01*
Revision Date	*10.01.2017*

Source: JICA Study Team

Figure 4.1.56 Boring log BH-BD-17 (1)



BORE HOLE No. **BH-BD-17**

BORING LOG

Job No.	FKYB-2016-025
Sheet No.	2 OF 2

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thaketa Township, Yangon Region.
GROUND LEVEL : 0.35m
COORDINATE : E 204551.650 ; N 1859068.236 DEPTH : 47.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 23.11.2016 ~ 26.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL.- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-34.65	35.00	9.00	gray	Medium dense to very dense	Silty SAND	Medium dense to very dense, gray, moist, fine to medium grained, Silty SAND Thin clay layer is intercalated layer
-41.65	42.00	7.00	gray to brownish gray	Dense to very dense	Clayey SAND	Dense to very dense, gray to brownish gray, moist, fine to coarse grained, low plastic Clayey SAND, with trace of fine gravel
-41.65	47.39	5.39	reddish brown to yellowish brown	Dense to very dense	Clayey SAND	Dense to very dense, reddish brown to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND, with trace of fine gravel
						This borehole is terminated at 47.00m, according to the termination criteria.

DATE & DEPTH (m): 24.11.16 36.00; 25.11.16 45.00; 26.11.16 47.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL.- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL.- (m)
31.00	35/30	P-30	31.00 31.45
32.00	47/30	P-31	32.00 32.45
33.00	32/30	P-32	33.00 33.45
34.00	22/30	P-33	34.00 34.45
35.00	50/28	P-34	35.00 35.43
36.00	50/30	P-35	36.00 36.45
37.00	50/28	P-36	37.00 37.43
38.00	50/28	P-37	38.00 38.43
39.00	50/30	P-38	39.00 39.45
40.00	50/14	P-39	40.00 40.29
41.00	50/26	P-40	41.00 41.41
42.00	50/22	P-41	42.00 42.37
43.00	50/27	P-42	43.00 43.42
44.00	50/30	P-43	44.00 44.45
45.00	50/26	P-44	45.00 45.41
46.00	50/30	P-45	46.00 46.45
47.00	50/24	P-46	47.00 47.39

NOTES

Relative density description	
Relative density	SPT N-Value
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

Consistency description	
Consistency	SPT N-Value
Very soft	under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
T-1	Undisturbed Sample (Piston sampler)
D-1	Undisturbed Sample (Denison sampler)
▮	Rock core sample (Single core tube)
■	Rock core sample (Double core tube)
▯	Rock core sample (Core Loss)
W-1	Water sample
PBT	Permeability Test
VS	Vane Shear Test
PMT	Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	>2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	>2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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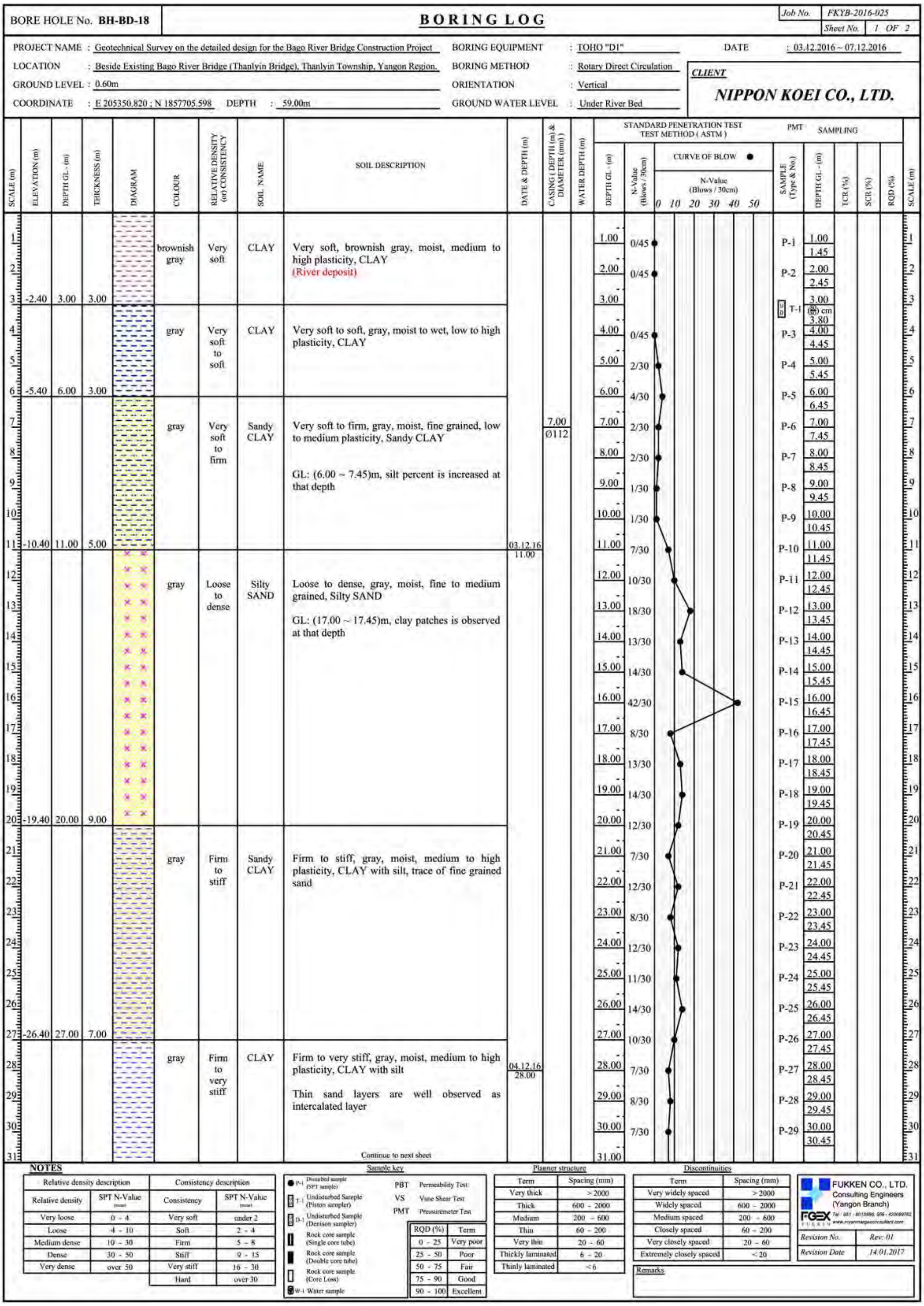
Revision No.	Rev: 01
Revision Date	10.01.2017

Remarks

Source: JICA Study Team

Figure 4.1.57 Boring log BH-BD-17 (2)



BORE HOLE No. **BH-BD-18**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 0.60m
COORDINATE : E 205350.820 ; N 1857705.598 DEPTH : 59.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 03.12.2016 ~ 07.12.2016
CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-2.40	3.00	3.00	brownish gray	Very soft	CLAY	Very soft, brownish gray, moist, medium to high plasticity, CLAY (River deposit)
-5.40	6.00	3.00	gray	Very soft to soft	CLAY	Very soft to soft, gray, moist to wet, low to high plasticity, CLAY
-10.40	11.00	5.00	gray	Very soft to firm	Sandy CLAY	Very soft to firm, gray, moist, fine grained, low to medium plasticity, Sandy CLAY GL: (6.00 ~ 7.45)m, silt percent is increased at that depth
-19.40	20.00	9.00	gray	Loose to dense	Silty SAND	Loose to dense, gray, moist, fine to medium grained, Silty SAND GL: (17.00 ~ 17.45)m, clay patches is observed at that depth
-26.40	27.00	7.00	gray	Firm to stiff	Sandy CLAY	Firm to stiff, gray, moist, medium to high plasticity, CLAY with silt, trace of fine grained sand
			gray	Firm to very stiff	CLAY	Firm to very stiff, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer

Continue to next sheet

DATE & DEPTH (m): 03.12.16 11.00; 04.12.16 28.00
CASING (DEPTH (m) & DIAMETER (mm)): 7.00 Ø112

STANDARD PENETRATION TEST TEST METHOD (ASTM) / PMT / SAMPLING

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
1.00	0/45	P-1	1.00 1.45
2.00	0/45	P-2	2.00 2.45
3.00		T-1	3.00 (80/80) cm 3.80
4.00	0/45	P-3	4.00 4.45
5.00	2/30	P-4	5.00 5.45
6.00	4/30	P-5	6.00 6.45
7.00	2/30	P-6	7.00 7.45
8.00	2/30	P-7	8.00 8.45
9.00	1/30	P-8	9.00 9.45
10.00	1/30	P-9	10.00 10.45
11.00	7/30	P-10	11.00 11.45
12.00	10/30	P-11	12.00 12.45
13.00	18/30	P-12	13.00 13.45
14.00	13/30	P-13	14.00 14.45
15.00	14/30	P-14	15.00 15.45
16.00	42/30	P-15	16.00 16.45
17.00	8/30	P-16	17.00 17.45
18.00	13/30	P-17	18.00 18.45
19.00	14/30	P-18	19.00 19.45
20.00	12/30	P-19	20.00 20.45
21.00	7/30	P-20	21.00 21.45
22.00	12/30	P-21	22.00 22.45
23.00	8/30	P-22	23.00 23.45
24.00	12/30	P-23	24.00 24.45
25.00	11/30	P-24	25.00 25.45
26.00	14/30	P-25	26.00 26.45
27.00	10/30	P-26	27.00 27.45
28.00	7/30	P-27	28.00 28.45
29.00	8/30	P-28	29.00 29.45
30.00	7/30	P-29	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value (mean)	Consistency	SPT N-Value (mean)
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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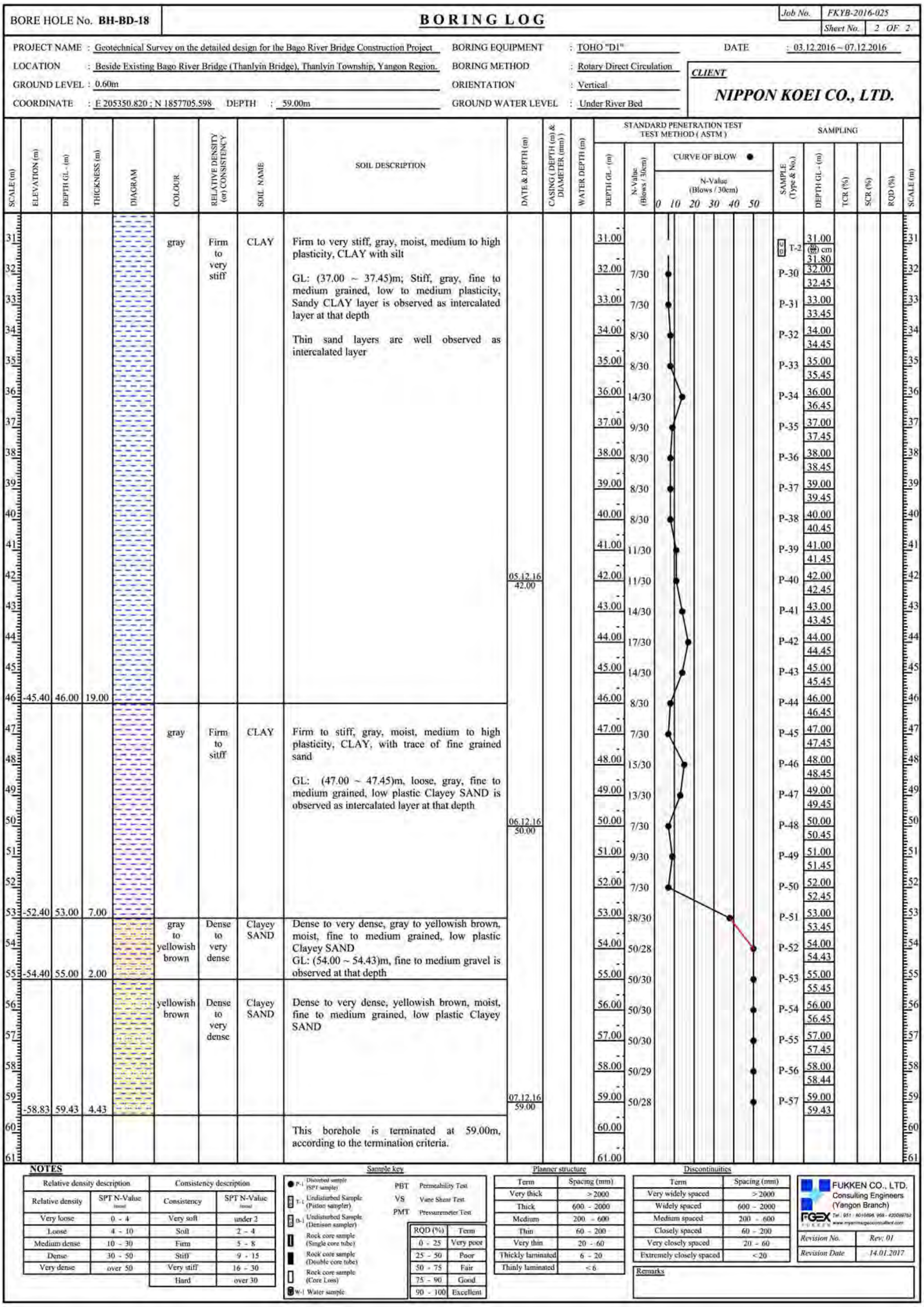
Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Source: JICA Study Team

Figure 4.1.58 Boring log BH-BD-18 (1)



BORE HOLE No. **BH-BD-18**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 0.60m
COORDINATE : E 205350.820 ; N 1857705.598 DEPTH : 59.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : Under River Bed
DATE : 03.12.2016 ~ 07.12.2016
CLIENT ***NIPPON KOEI CO., LTD.***

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-45.40	46.00	19.00	gray	Firm to very stiff	CLAY	Firm to very stiff, gray, moist, medium to high plasticity, CLAY with silt GL: (37.00 ~ 37.45)m; Stiff, gray, fine to medium grained, low to medium plasticity, Sandy CLAY layer is observed as intercalated layer at that depth Thin sand layers are well observed as intercalated layer
-52.40	53.00	7.00	gray	Firm to sitff	CLAY	Firm to stiff, gray, moist, medium to high plasticity, CLAY, with trace of fine grained sand GL: (47.00 ~ 47.45)m, loose, gray, fine to medium grained, low plastic Clayey SAND is observed as intercalated layer at that depth
-54.40	55.00	2.00	gray to yellowish brown	Dense to very dense	Clayey SAND	Dense to very dense, gray to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND GL: (54.00 ~ 54.43)m, fine to medium gravel is observed at that depth
-58.83	59.43	4.43	yellowish brown	Dense to very dense	Clayey SAND	Dense to very dense, yellowish brown, moist, fine to medium grained, low plastic Clayey SAND
						This borehole is terminated at 59.00m, according to the termination criteria.

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DATE & DEPTH (m)	DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
	31.00		T-2	31.00 (80/80) cm 31.80
	32.00	7/30	P-30	32.00 32.45
	33.00	7/30	P-31	33.00 33.45
	34.00	8/30	P-32	34.00 34.45
	35.00	8/30	P-33	35.00 35.45
	36.00	14/30	P-34	36.00 36.45
	37.00	9/30	P-35	37.00 37.45
	38.00	8/30	P-36	38.00 38.45
	39.00	8/30	P-37	39.00 39.45
	40.00	8/30	P-38	40.00 40.45
	41.00	11/30	P-39	41.00 41.45
05.12.16 42.00	42.00	11/30	P-40	42.00 42.45
	43.00	14/30	P-41	43.00 43.45
	44.00	17/30	P-42	44.00 44.45
	45.00	14/30	P-43	45.00 45.45
	46.00	8/30	P-44	46.00 46.45
	47.00	7/30	P-45	47.00 47.45
	48.00	15/30	P-46	48.00 48.45
	49.00	13/30	P-47	49.00 49.45
06.12.16 50.00	50.00	7/30	P-48	50.00 50.45
	51.00	9/30	P-49	51.00 51.45
	52.00	7/30	P-50	52.00 52.45
	53.00	38/30	P-51	53.00 53.45
	54.00	50/28	P-52	54.00 54.43
	55.00	50/30	P-53	55.00 55.45
	56.00	50/30	P-54	56.00 56.45
	57.00	50/30	P-55	57.00 57.45
	58.00	50/29	P-56	58.00 58.44
07.12.16 59.00	59.00	50/28	P-57	59.00 59.43
	60.00			
	61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value (usual)	Consistency	SPT N-Value (usual)
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
T-1	Undisturbed Sample (Piston sampler)
D-1	Undisturbed Sample (Denison sampler)
▯	Rock core sample (Single core tube)
▮	Rock core sample (Double core tube)
▯	Rock core sample (Core Loss)
W-1	Water sample
PBT	Permeability Test
VS	Vane Shear Test
PMT	Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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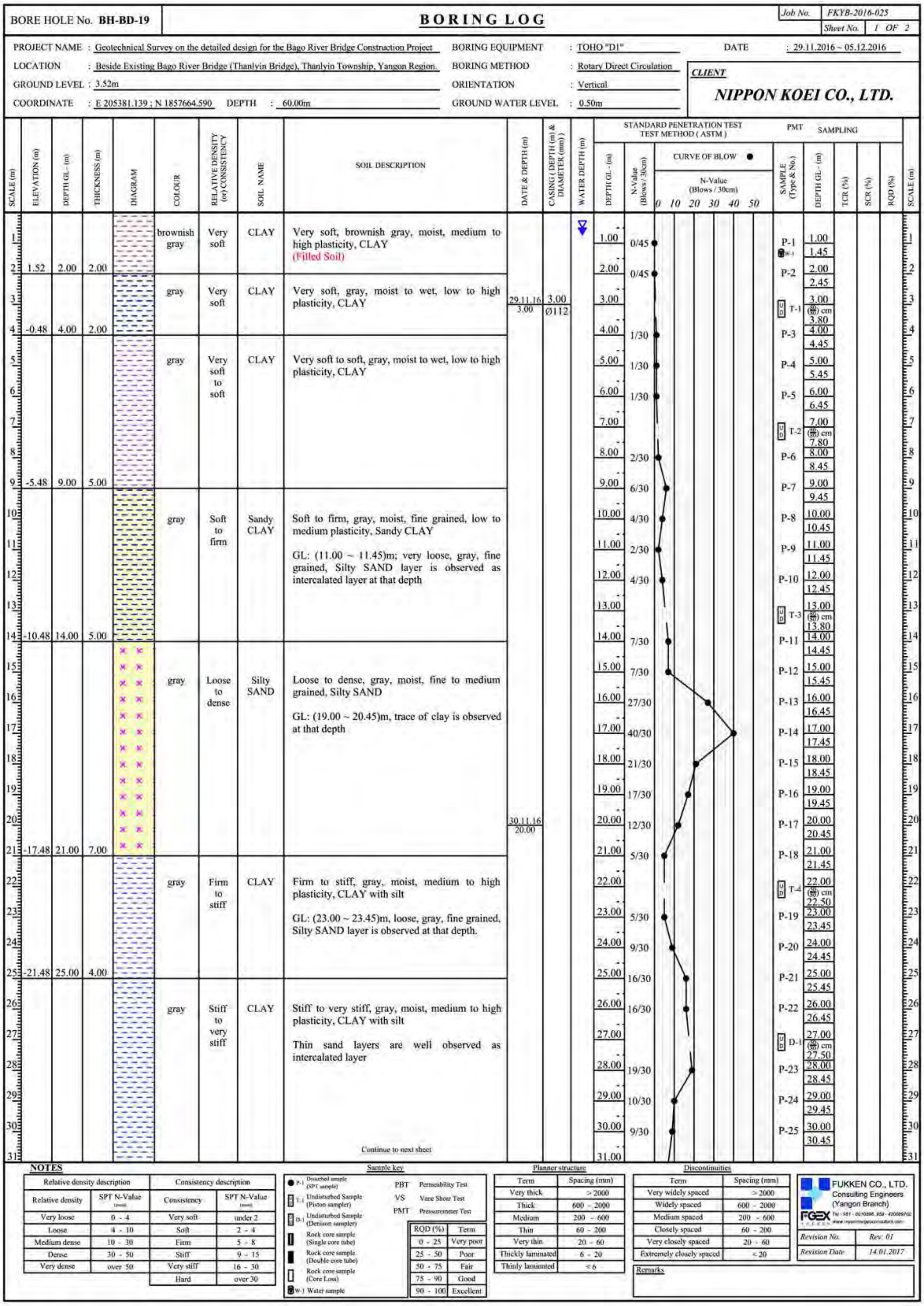
Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.59 Boring log BH-BD-18 (2)



BORE HOLE No. **BH-BD-19**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.52m
COORDINATE : E 205381.139 ; N 1857664.590 DEPTH : 60.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.50m
DATE : 29.11.2016 ~ 05.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
1.52	2.00	2.00	brownish gray	Very soft	CLAY	Very soft, brownish gray, moist, medium to high plasticity, CLAY (Filled Soil)
-0.48	4.00	2.00	gray	Very soft	CLAY	Very soft, gray, moist to wet, low to high plasticity, CLAY
-5.48	9.00	5.00	gray	Very soft to soft	CLAY	Very soft to soft, gray, moist to wet, low to high plasticity, CLAY
-10.48	14.00	5.00	gray	Soft to firm	Sandy CLAY	Soft to firm, gray, moist, fine grained, low to medium plasticity, Sandy CLAY GL: (11.00 ~ 11.45)m; very loose, gray, fine grained, Silty SAND layer is observed as intercalated layer at that depth
-17.48	21.00	7.00	gray	Loose to dense	Silty SAND	Loose to dense, gray, moist, fine to medium grained, Silty SAND GL: (19.00 ~ 20.45)m, trace of clay is observed at that depth
-21.48	25.00	4.00	gray	Firm to stiff	CLAY	Firm to stiff, gray, moist, medium to high plasticity, CLAY with silt GL: (23.00 ~ 23.45)m, loose, gray, fine grained, Silty SAND layer is observed at that depth.
			gray	Stiff to very stiff	CLAY	Stiff to very stiff, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer

Continue to next sheet

DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))
29.11.16 3.00	3.00 Ø112
30.11.16 20.00	

WATER DEPTH (m): ▽

STANDARD PENETRATION TEST
TEST METHOD (ASTM)
CURVE OF BLOW ●

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
1.00	0/45	P-1	1.00 1.45
		W-1	
2.00	0/45	P-2	2.00 2.45
3.00		T-1	3.00 cm 3.80
4.00	1/30	P-3	4.00 4.45
5.00	1/30	P-4	5.00 5.45
6.00	1/30	P-5	6.00 6.45
7.00		T-2	7.00 cm 7.80
8.00	2/30	P-6	8.00 8.45
9.00	6/30	P-7	9.00 9.45
10.00	4/30	P-8	10.00 10.45
11.00	2/30	P-9	11.00 11.45
12.00	4/30	P-10	12.00 12.45
13.00		T-3	13.00 cm 13.80
14.00	7/30	P-11	14.00 14.45
15.00	7/30	P-12	15.00 15.45
16.00	27/30	P-13	16.00 16.45
17.00	40/30	P-14	17.00 17.45
18.00	21/30	P-15	18.00 18.45
19.00	17/30	P-16	19.00 19.45
20.00	12/30	P-17	20.00 20.45
21.00	5/30	P-18	21.00 21.45
22.00		T-4	22.00 cm 22.50
23.00	5/30	P-19	23.00 23.45
24.00	9/30	P-20	24.00 24.45
25.00	16/30	P-21	25.00 25.45
26.00	16/30	P-22	26.00 26.45
27.00		D-1	27.00 cm 27.50
28.00	19/30	P-23	28.00 28.45
29.00	10/30	P-24	29.00 29.45
30.00	9/30	P-25	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
T-1	Undisturbed Sample (Piston sampler)
D-1	Undisturbed Sample (Denison sampler)
▯	Rock core sample (Single core tube)
▮	Rock core sample (Double core tube)
▯	Rock core sample (Core Loss)
W-1	Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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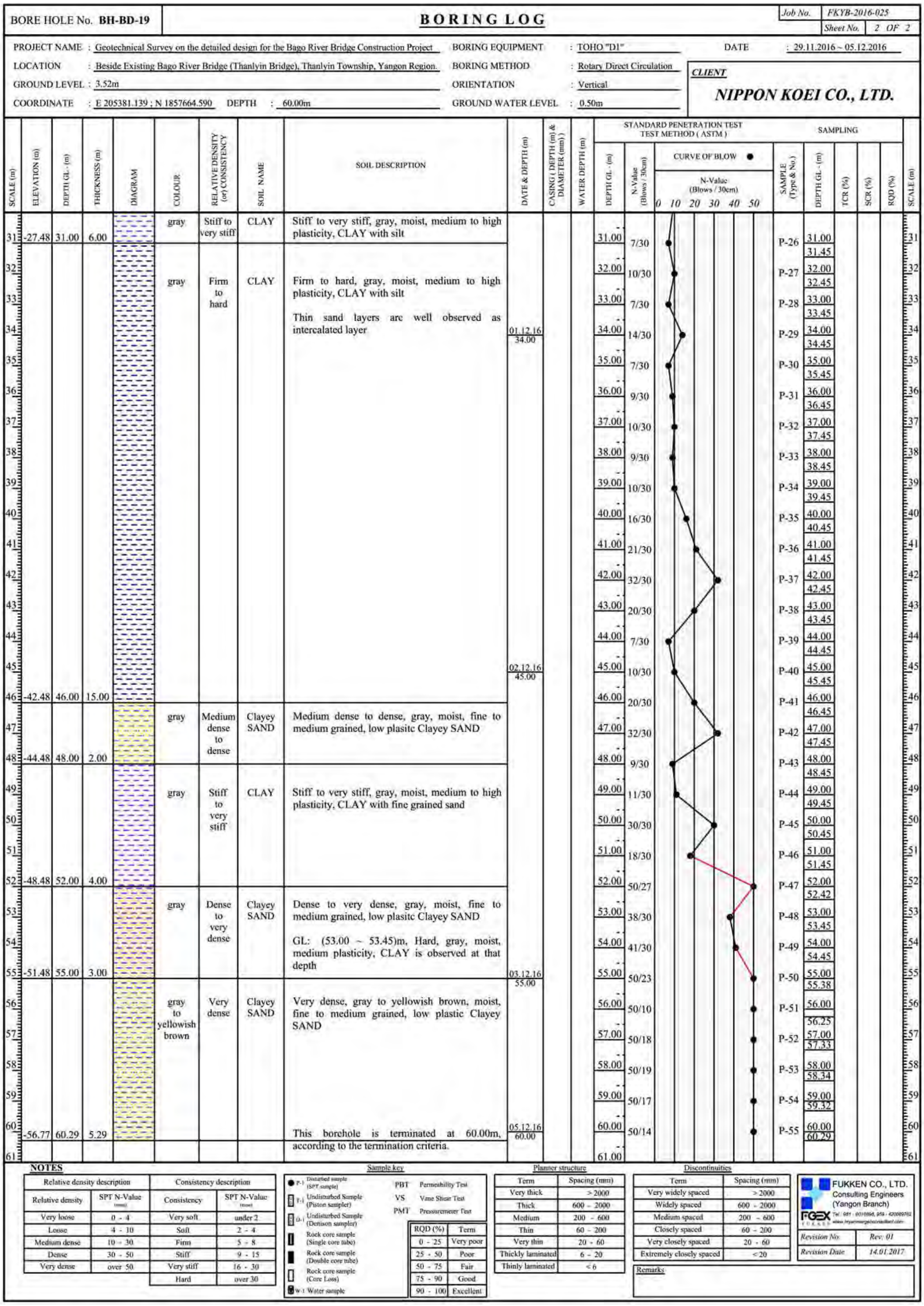
Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.60 Boring log BH-BD-19 (1)



BORE HOLE No. **BH-BD-19**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.52m
COORDINATE : E 205381.139 ; N 1857664.590 DEPTH : 60.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.50m
DATE : 29.11.2016 ~ 05.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-27.48	31.00	6.00	gray	Stiff to very stiff	CLAY	Stiff to very stiff, gray, moist, medium to high plasticity, CLAY with silt
-42.48	46.00	15.00	gray	Firm to hard	CLAY	Firm to hard, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer
-44.48	48.00	2.00	gray	Medium dense to dense	Clayey SAND	Medium dense to dense, gray, moist, fine to medium grained, low plasitc Clayey SAND
-48.48	52.00	4.00	gray	Stiff to very stiff	CLAY	Stiff to very stiff, gray, moist, medium to high plasticity, CLAY with fine grained sand
-51.48	55.00	3.00	gray	Dense to very dense	Clayey SAND	Dense to very dense, gray, moist, fine to medium grained, low plasitc Clayey SAND GL: (53.00 ~ 53.45)m, Hard, gray, moist, medium plasticity, CLAY is observed at that depth
-56.77	60.29	5.29	gray to yellowish brown	Very dense	Clayey SAND	Very dense, gray to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND This borehole is terminated at 60.00m, according to the termination criteria.

DATE & DEPTH (m)
01.12.16 34.00
02.12.16 45.00
03.12.16 55.00
05.12.16 60.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
31.00	7/30	P-26	31.00 31.45
32.00	10/30	P-27	32.00 32.45
33.00	7/30	P-28	33.00 33.45
34.00	14/30	P-29	34.00 34.45
35.00	7/30	P-30	35.00 35.45
36.00	9/30	P-31	36.00 36.45
37.00	10/30	P-32	37.00 37.45
38.00	9/30	P-33	38.00 38.45
39.00	10/30	P-34	39.00 39.45
40.00	16/30	P-35	40.00 40.45
41.00	21/30	P-36	41.00 41.45
42.00	32/30	P-37	42.00 42.45
43.00	20/30	P-38	43.00 43.45
44.00	7/30	P-39	44.00 44.45
45.00	10/30	P-40	45.00 45.45
46.00	20/30	P-41	46.00 46.45
47.00	32/30	P-42	47.00 47.45
48.00	9/30	P-43	48.00 48.45
49.00	11/30	P-44	49.00 49.45
50.00	30/30	P-45	50.00 50.45
51.00	18/30	P-46	51.00 51.45
52.00	50/27	P-47	52.00 52.42
53.00	38/30	P-48	53.00 53.45
54.00	41/30	P-49	54.00 54.45
55.00	50/23	P-50	55.00 55.38
56.00	50/10	P-51	56.00 56.25
57.00	50/18	P-52	57.00 57.33
58.00	50/19	P-53	58.00 58.34
59.00	50/17	P-54	59.00 59.32
60.00	50/14	P-55	60.00 60.29
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
T-1 Undisturbed Sample (Piston sampler)
D-1 Undisturbed Sample (Denison sampler)
Rock core sample (Single core tube)
Rock core sample (Double core tube)
Rock core sample (Core Loss)
W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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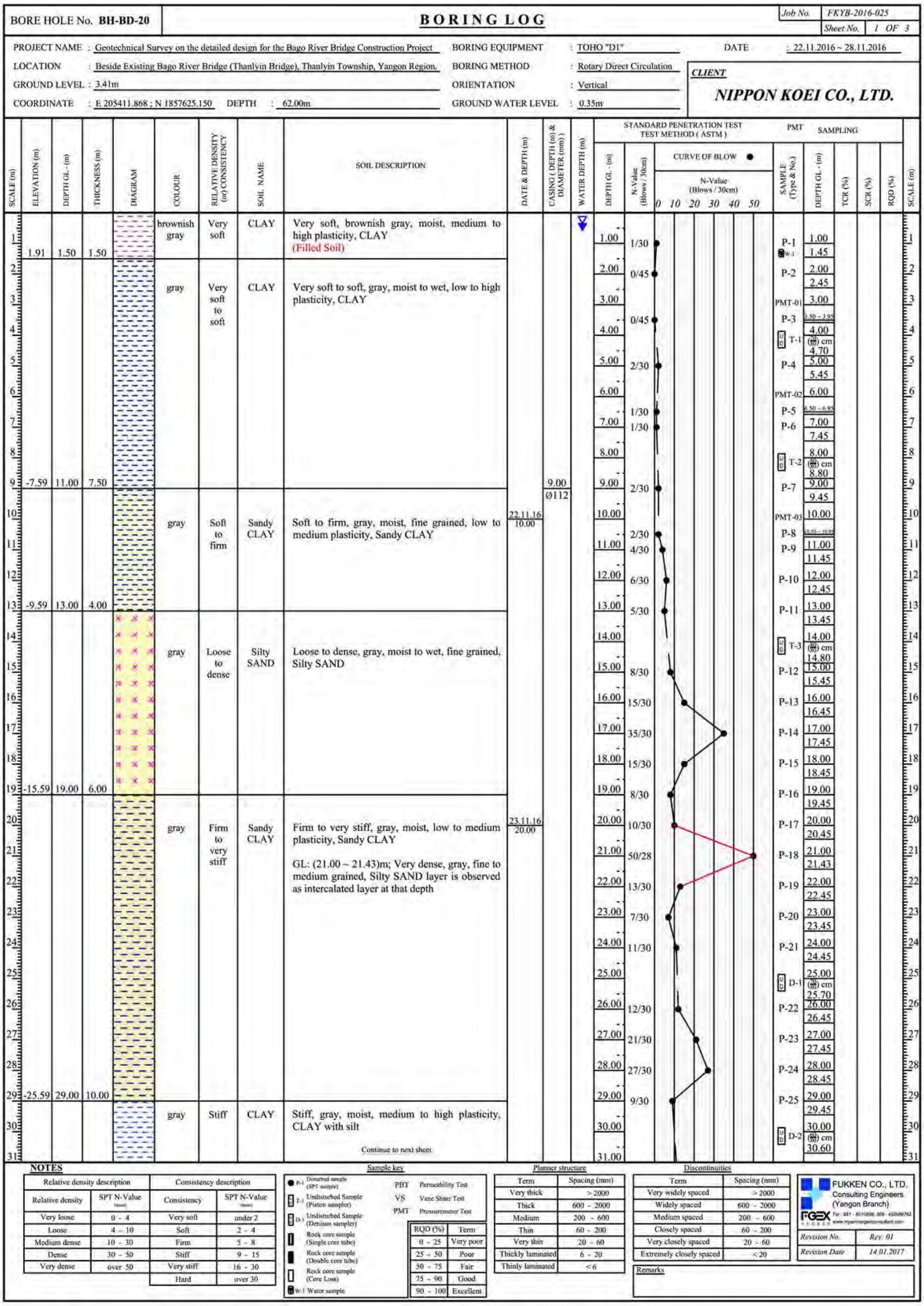
(Yangon Branch)

Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Source: JICA Study Team

Figure 4.1.61 Boring log BH-BD-19 (2)



BORE HOLE No. **BH-BD-20**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*1 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.41m
COORDINATE : E 205411.868 ; N 1857625.150 DEPTH : 62.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.35m
DATE : 22.11.2016 ~ 28.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))
1.91	1.50	1.50	brownish gray	Very soft	CLAY	Very soft, brownish gray, moist, medium to high plasticity, CLAY (Filled Soil)		
-7.59	11.00	7.50	gray	Very soft to soft	CLAY	Very soft to soft, gray, moist to wet, low to high plasticity, CLAY		9.00 Ø112
-9.59	13.00	4.00	gray	Soft to firm	Sandy CLAY	Soft to firm, gray, moist, fine grained, low to medium plasticity, Sandy CLAY	22.11.16 10.00	
-15.59	19.00	6.00	gray	Loose to dense	Silty SAND	Loose to dense, gray, moist to wet, fine grained, Silty SAND		
-25.59	29.00	10.00	gray	Firm to very stiff	Sandy CLAY	Firm to very stiff, gray, moist, low to medium plasticity, Sandy CLAY GL: (21.00 ~ 21.43m); Very dense, gray, fine to medium grained, Silty SAND layer is observed as intercalated layer at that depth	23.11.16 20.00	
			gray	Stiff	CLAY	Stiff, gray, moist, medium to high plasticity, CLAY with silt		

Continue to next sheet

STANDARD PENETRATION TEST
TEST METHOD (ASTM)
PMT SAMPLING

N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
1/30	P-1	1.00 1.45
	W-1	
0/45	P-2	2.00 2.45
	PMT-01	3.00
0/45	P-3	3.50 ~ 3.95
	T-1	4.00 (70/80) cm 4.70
2/30	P-4	5.00 5.45
	PMT-02	6.00
1/30	P-5	6.50 ~ 6.95
1/30	P-6	7.00 7.45
	T-2	8.00 (80/80) cm 8.80
2/30	P-7	9.00 9.45
	PMT-03	10.00
2/30	P-8	10.50 ~ 10.95
4/30	P-9	11.00 11.45
6/30	P-10	12.00 12.45
5/30	P-11	13.00 13.45
	T-3	14.00 (80/80) cm 14.80
8/30	P-12	15.00 15.45
15/30	P-13	16.00 16.45
35/30	P-14	17.00 17.45
15/30	P-15	18.00 18.45
8/30	P-16	19.00 19.45
10/30	P-17	20.00 20.45
50/28	P-18	21.00 21.43
13/30	P-19	22.00 22.45
7/30	P-20	23.00 23.45
11/30	P-21	24.00 24.45
	D-1	25.00 (70/80) cm 25.70
12/30	P-22	26.00 26.45
21/30	P-23	27.00 27.45
27/30	P-24	28.00 28.45
9/30	P-25	29.00 29.45
	D-2	30.00 (60/80) cm 30.60

NOTES

Relative density description

Relative density	SPT N-Value
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

Consistency description

Consistency	SPT N-Value
Very soft	under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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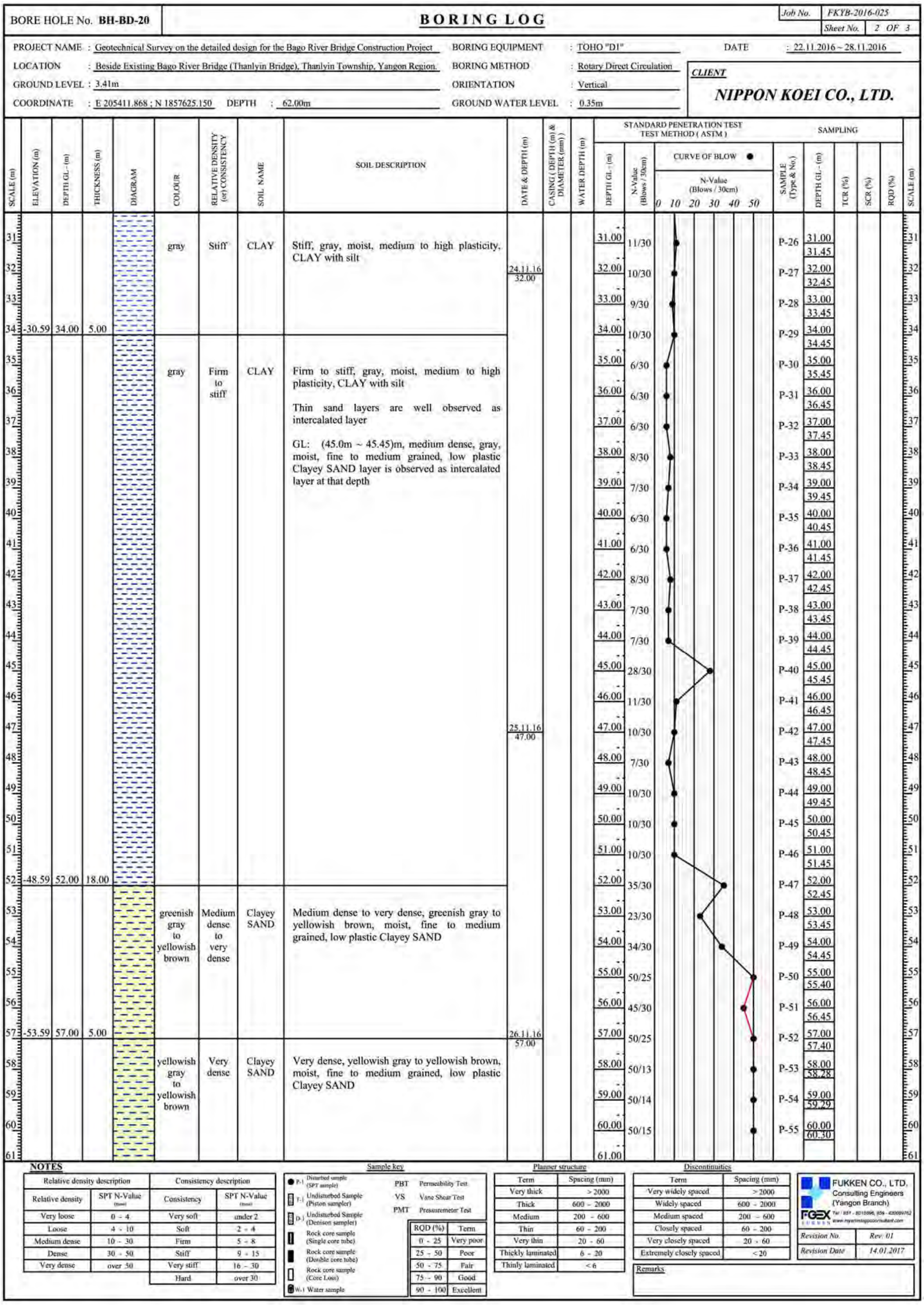
Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Source: JICA Study Team

Figure 4.1.62 Boring log BH-BD-20 (1)



BORE HOLE No. **BH-BD-20**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 2 OF 3

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.41m
COORDINATE : E 205411.868 ; N 1857625.150 DEPTH : 62.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.35m
DATE : 22.11.2016 ~ 28.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-30.59	34.00	5.00	gray	Stiff	CLAY	Stiff, gray, moist, medium to high plasticity, CLAY with silt
-48.59	52.00	18.00	gray	Firm to stiff	CLAY	Firm to stiff, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer GL: (45.0m ~ 45.45)m, medium dense, gray, moist, fine to medium grained, low plastic Clayey SAND layer is observed as intercalated layer at that depth
-53.59	57.00	5.00	greenish gray to yellowish brown	Medium dense to very dense	Clayey SAND	Medium dense to very dense, greenish gray to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND
			yellowish gray to yellowish brown	Very dense	Clayey SAND	Very dense, yellowish gray to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND

DATE & DEPTH (m): 24.11.16 32.00; 25.11.16 47.00; 26.11.16 57.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
31.00	11/30	P-26	31.00 31.45
32.00	10/30	P-27	32.00 32.45
33.00	9/30	P-28	33.00 33.45
34.00	10/30	P-29	34.00 34.45
35.00	6/30	P-30	35.00 35.45
36.00	6/30	P-31	36.00 36.45
37.00	6/30	P-32	37.00 37.45
38.00	8/30	P-33	38.00 38.45
39.00	7/30	P-34	39.00 39.45
40.00	6/30	P-35	40.00 40.45
41.00	6/30	P-36	41.00 41.45
42.00	8/30	P-37	42.00 42.45
43.00	7/30	P-38	43.00 43.45
44.00	7/30	P-39	44.00 44.45
45.00	28/30	P-40	45.00 45.45
46.00	11/30	P-41	46.00 46.45
47.00	10/30	P-42	47.00 47.45
48.00	7/30	P-43	48.00 48.45
49.00	10/30	P-44	49.00 49.45
50.00	10/30	P-45	50.00 50.45
51.00	10/30	P-46	51.00 51.45
52.00	35/30	P-47	52.00 52.45
53.00	23/30	P-48	53.00 53.45
54.00	34/30	P-49	54.00 54.45
55.00	50/25	P-50	55.00 55.40
56.00	45/30	P-51	56.00 56.45
57.00	50/25	P-52	57.00 57.40
58.00	50/13	P-53	58.00 58.28
59.00	50/14	P-54	59.00 59.29
60.00	50/15	P-55	60.00 60.30
61.00			

NOTES

Relative density description	
Relative density	SPT N-Value
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

Consistency description	
Consistency	SPT N-Value
Very soft	under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	over 30

Sample key
- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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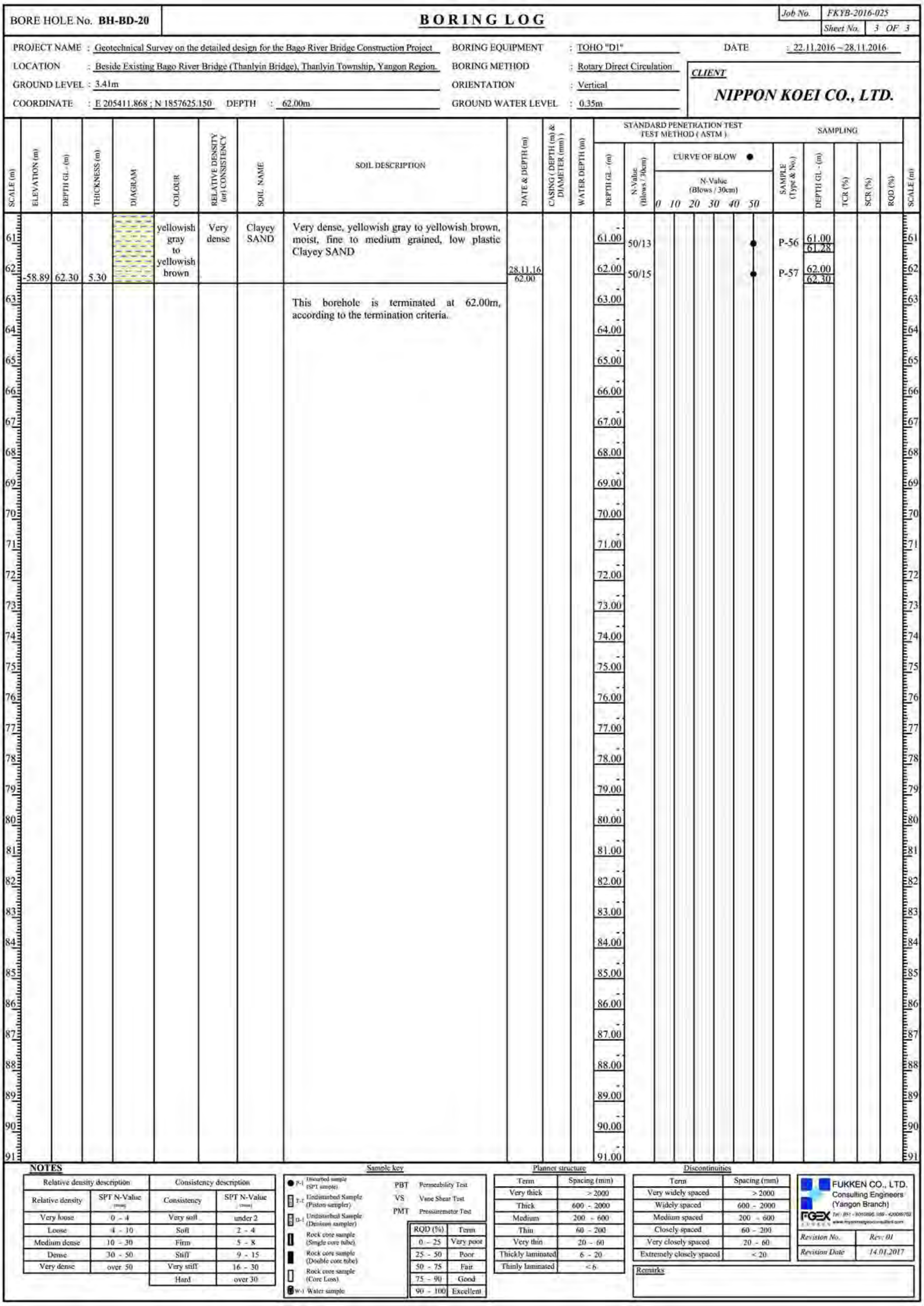
Consulting Engineers
(Yangon Branch)

Revision No. Rev: 01
Revision Date 14.01.2017

Source: JICA Study Team

Figure 4.1.63 Boring log BH-BD-20 (2)



BORE HOLE No. **BH-BD-20**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *3 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.41m
COORDINATE : E 205411.868 ; N 1857625.150 DEPTH : 62.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.35m
DATE : 22.11.2016 ~ 28.11.2016

CLIENT
NIPPON KOEI CO., LTD.

SCALE (m)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	DIAGRAM	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)	STANDARD PENETRATION TEST TEST METHOD (ASTM) DEPTH GL - (m)	N-Value (Blows / 30cm)	CURVE OF BLOW ● N-Value (Blows / 30cm) 0 10 20 30 40 50	SAMPLING SAMPLE (Type & No.)	DEPTH GL - (m)	TCR (%)	SCR (%)	RQD (%)	SCALE (m)
61					yellowish gray to yellowish brown	Very dense	Clayey SAND	Very dense, yellowish gray to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND				61.00	50/13	●	P-56	61.00 61.28				61
62	-58.89	62.30	5.30						28.11.16 62.00			62.00	50/15	●	P-57	62.00 62.30				62
63								This borehole is terminated at 62.00m, according to the termination criteria.				63.00								63
64												64.00								64
65												65.00								65
66												66.00								66
67												67.00								67
68												68.00								68
69												69.00								69
70												70.00								70
71												71.00								71
72												72.00								72
73												73.00								73
74												74.00								74
75												75.00								75
76												76.00								76
77												77.00								77
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86												86.00								86
87												87.00								87
88												88.00								88
89												89.00								89
90												90.00								90
91												91.00								91

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
T-1	Undisturbed Sample (Piston sampler)
D-1	Undisturbed Sample (Denison sampler)
▯	Rock core sample (Single core tube)
▮	Rock core sample (Double core tube)
▯	Rock core sample (Core Loss)
W-1	Water sample
PBT	Permeability Test
VS	Vane Shear Test
PMT	Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

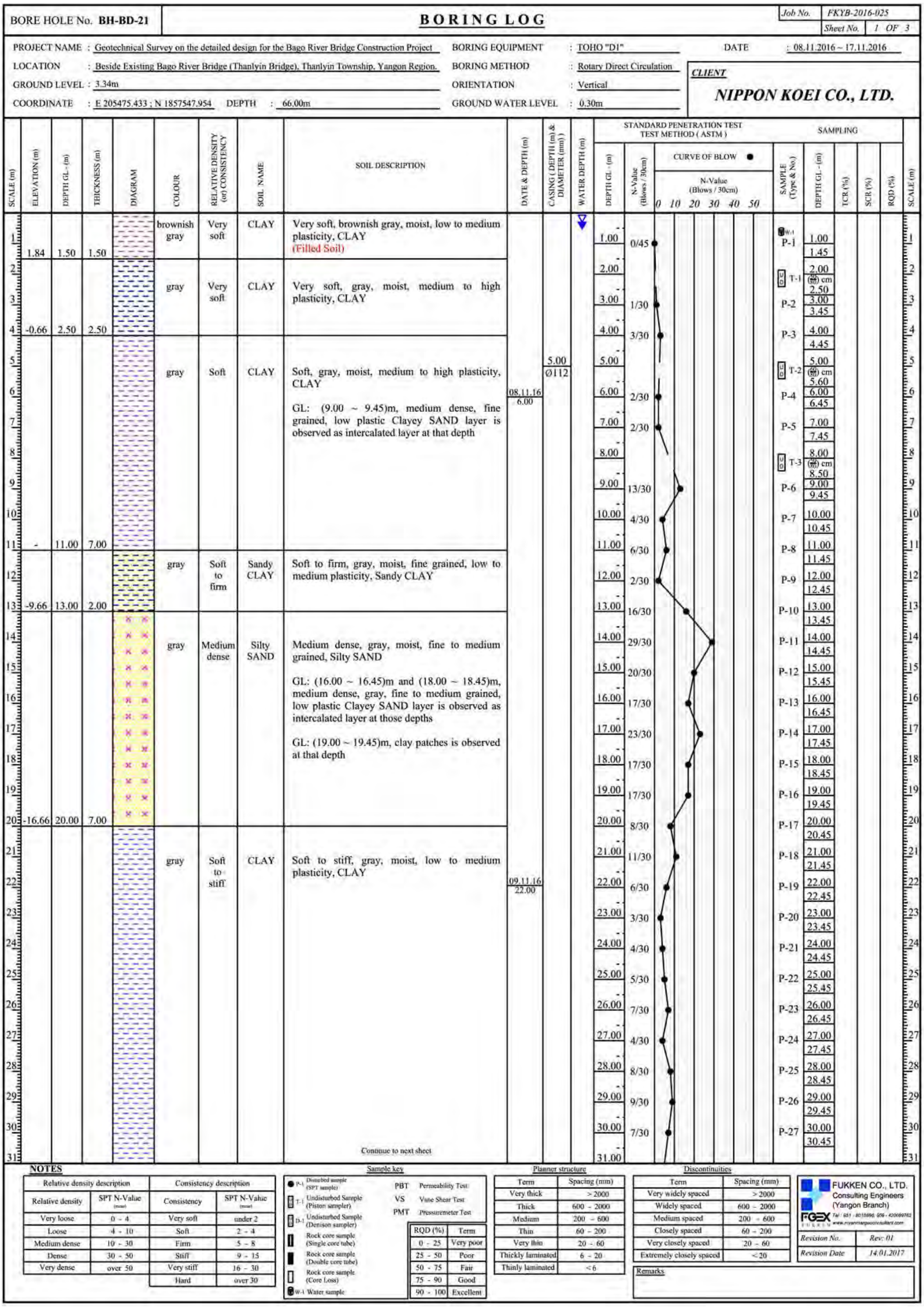
FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.64 Boring log BH-BD-20 (3)



BORE HOLE No. **BH-BD-21**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 1 OF 3

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.34m
COORDINATE : E 205475.433 ; N 1857547.954 DEPTH : 66.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.30m
DATE : 08.11.2016 ~ 17.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
1.84	1.50	1.50	brownish gray	Very soft	CLAY	Very soft, brownish gray, moist, low to medium plasticity, CLAY (Filled Soil)
-0.66	2.50	2.50	gray	Very soft	CLAY	Very soft, gray, moist, medium to high plasticity, CLAY
-	11.00	7.00	gray	Soft	CLAY	Soft, gray, moist, medium to high plasticity, CLAY GL: (9.00 ~ 9.45)m, medium dense, fine grained, low plastic Clayey SAND layer is observed as intercalated layer at that depth
-9.66	13.00	2.00	gray	Soft to firm	Sandy CLAY	Soft to firm, gray, moist, fine grained, low to medium plasticity, Sandy CLAY
-16.66	20.00	7.00	gray	Medium dense	Silty SAND	Medium dense, gray, moist, fine to medium grained, Silty SAND GL: (16.00 ~ 16.45)m and (18.00 ~ 18.45)m, medium dense, gray, fine to medium grained, low plastic Clayey SAND layer is observed as intercalated layer at those depths GL: (19.00 ~ 19.45)m, clay patches is observed at that depth
			gray	Soft to stiff	CLAY	Soft to stiff, gray, moist, low to medium plasticity, CLAY

Continue to next sheet

DATE & DEPTH (m): 08.11.16 6.00; 09.11.16 22.00
CASING (DEPTH (m) & DIAMETER (mm)): 5.00 Ø112
WATER DEPTH (m): ▽

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

CURVE OF BLOW ●
N-Value (Blows / 30cm) 0 10 20 30 40 50

SAMPLING

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)	TCR (%)	SCR (%)	RQD (%)
1.00	0/45	W-1 P-1	1.00 1.45			
2.00		T-1	2.00 ([illegible]) cm 2.50			
3.00	1/30	P-2	3.00 3.45			
4.00	3/30	P-3	4.00 4.45			
5.00		T-2	5.00 ([illegible]) cm 5.60			
6.00	2/30	P-4	6.00 6.45			
7.00	2/30	P-5	7.00 7.45			
8.00		T-3	8.00 ([illegible]) cm 8.50			
9.00	13/30	P-6	9.00 9.45			
10.00	4/30	P-7	10.00 10.45			
11.00	6/30	P-8	11.00 11.45			
12.00	2/30	P-9	12.00 12.45			
13.00	16/30	P-10	13.00 13.45			
14.00	29/30	P-11	14.00 14.45			
15.00	20/30	P-12	15.00 15.45			
16.00	17/30	P-13	16.00 16.45			
17.00	23/30	P-14	17.00 17.45			
18.00	17/30	P-15	18.00 18.45			
19.00	17/30	P-16	19.00 19.45			
20.00	8/30	P-17	20.00 20.45			
21.00	11/30	P-18	21.00 21.45			
22.00	6/30	P-19	22.00 22.45			
23.00	3/30	P-20	23.00 23.45			
24.00	4/30	P-21	24.00 24.45			
25.00	5/30	P-22	25.00 25.45			
26.00	7/30	P-23	26.00 26.45			
27.00	4/30	P-24	27.00 27.45			
28.00	8/30	P-25	28.00 28.45			
29.00	9/30	P-26	29.00 29.45			
30.00	7/30	P-27	30.00 30.45			
31.00						

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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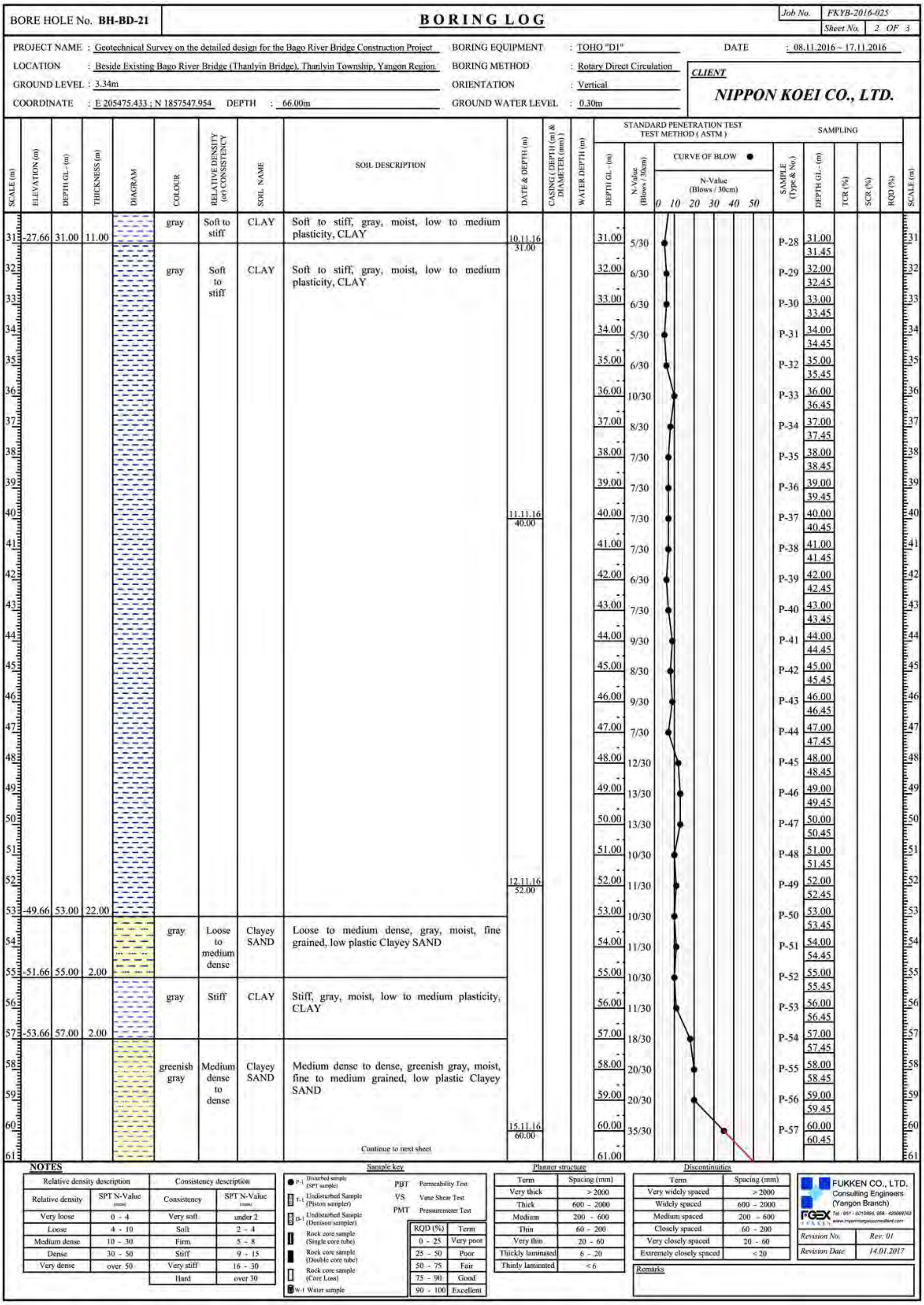
(Yangon Branch)

Revision No.	Rev: 01
Revision Date	14.01.2017

Source: JICA Study Team

Figure 4.1.65 Boring log BH-BD-21 (1)



BORE HOLE No. **BH-BD-21**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *2 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.34m
COORDINATE : E 205475.433 ; N 1857547.954 DEPTH : 66.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.30m
DATE : 08.11.2016 ~ 17.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-27.66	31.00	11.00	gray	Soft to stiff	CLAY	Soft to stiff, gray, moist, low to medium plasticity, CLAY
-49.66	53.00	22.00	gray	Soft to stiff	CLAY	Soft to stiff, gray, moist, low to medium plasticity, CLAY
-51.66	55.00	2.00	gray	Loose to medium dense	Clayey SAND	Loose to medium dense, gray, moist, fine grained, low plastic Clayey SAND
-53.66	57.00	2.00	gray	Stiff	CLAY	Stiff, gray, moist, low to medium plasticity, CLAY
			greenish gray	Medium dense to dense	Clayey SAND	Medium dense to dense, greenish gray, moist, fine to medium grained, low plastic Clayey SAND

Continue to next sheet

DATE & DEPTH (m)
10.11.16 31.00
11.11.16 40.00
12.11.16 52.00
15.11.16 60.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

CURVE OF BLOW ●

N-Value (Blows / 30cm)

0 10 20 30 40 50

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
31.00	5/30	P-28	31.00 31.45
32.00	6/30	P-29	32.00 32.45
33.00	6/30	P-30	33.00 33.45
34.00	5/30	P-31	34.00 34.45
35.00	6/30	P-32	35.00 35.45
36.00	10/30	P-33	36.00 36.45
37.00	8/30	P-34	37.00 37.45
38.00	7/30	P-35	38.00 38.45
39.00	7/30	P-36	39.00 39.45
40.00	7/30	P-37	40.00 40.45
41.00	7/30	P-38	41.00 41.45
42.00	6/30	P-39	42.00 42.45
43.00	7/30	P-40	43.00 43.45
44.00	9/30	P-41	44.00 44.45
45.00	8/30	P-42	45.00 45.45
46.00	9/30	P-43	46.00 46.45
47.00	7/30	P-44	47.00 47.45
48.00	12/30	P-45	48.00 48.45
49.00	13/30	P-46	49.00 49.45
50.00	13/30	P-47	50.00 50.45
51.00	10/30	P-48	51.00 51.45
52.00	11/30	P-49	52.00 52.45
53.00	10/30	P-50	53.00 53.45
54.00	11/30	P-51	54.00 54.45
55.00	10/30	P-52	55.00 55.45
56.00	11/30	P-53	56.00 56.45
57.00	18/30	P-54	57.00 57.45
58.00	20/30	P-55	58.00 58.45
59.00	20/30	P-56	59.00 59.45
60.00	35/30	P-57	60.00 60.45
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
T-1	Undisturbed Sample (Piston sampler)
D-1	Undisturbed Sample (Denison sampler)
▯	Rock core sample (Single core tube)
▮	Rock core sample (Double core tube)
▯	Rock core sample (Core Loss)
W-1	Water sample
PBT	Permeability Test
VS	Vane Shear Test
PMT	Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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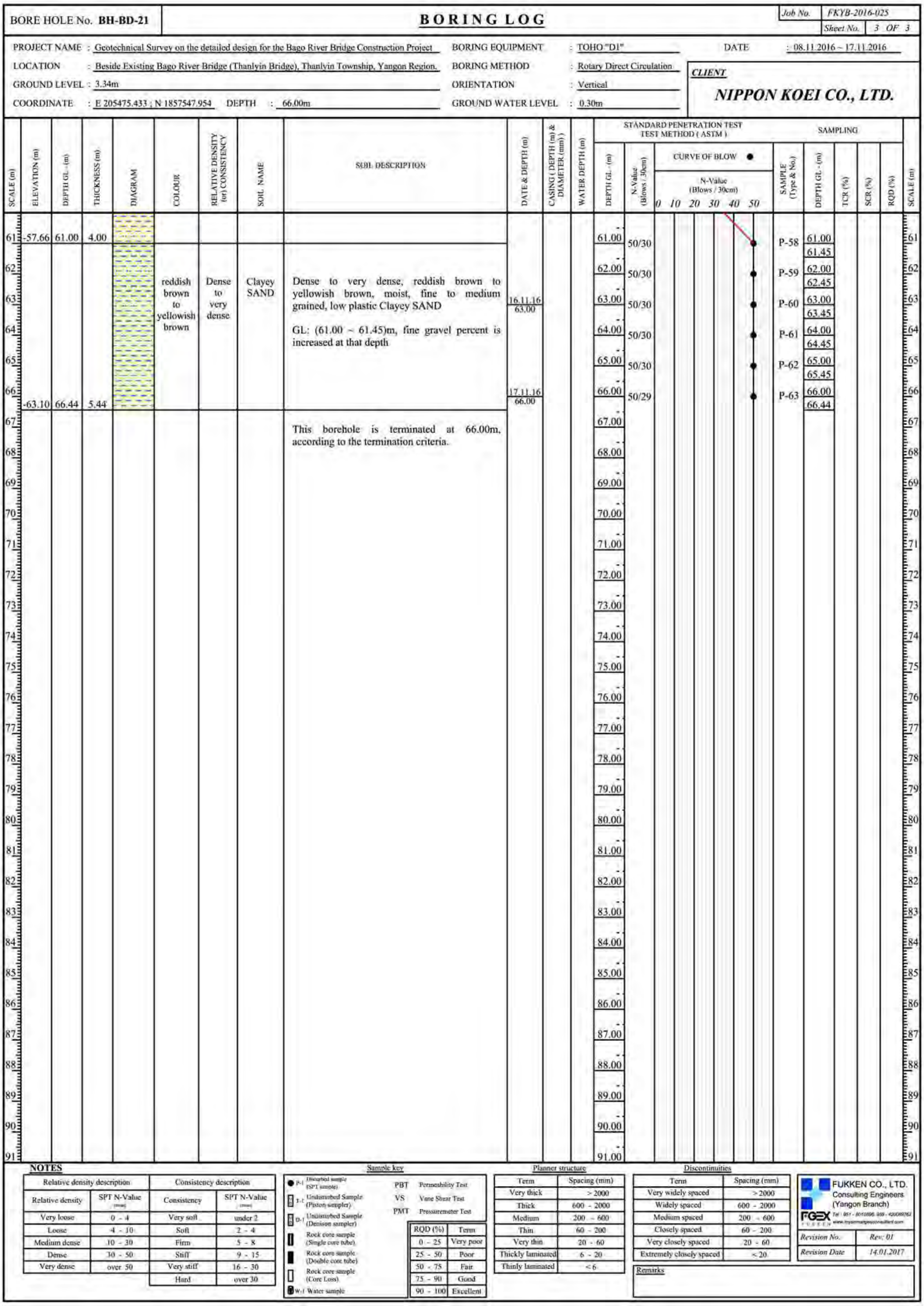
Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Source: JICA Study Team

Figure 4.1.66 Boring log BH-BD-21 (2)



BORE HOLE No. **BH-BD-21**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 3 OF 3

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.34m
COORDINATE : E 205475.433 ; N 1857547.954 DEPTH : 66.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.30m
DATE : 08.11.2016 ~ 17.11.2016

CLIENT
NIPPON KOEI CO., LTD.

SCALE (m)	ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
61	-57.66	61.00	4.00						61.00	50/30	P-58	61.00 61.45
62				reddish brown to yellowish brown	Dense to very dense	Clayey SAND	Dense to very dense, reddish brown to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND GL: (61.00 ~ 61.45)m, fine gravel percent is increased at that depth		62.00	50/30	P-59	62.00 62.45
63								16.11.16 63.00	63.00	50/30	P-60	63.00 63.45
64									64.00	50/30	P-61	64.00 64.45
65									65.00	50/30	P-62	65.00 65.45
66	-63.10	66.44	5.44					17.11.16 66.00	66.00	50/29	P-63	66.00 66.44
67							This borehole is terminated at 66.00m, according to the termination criteria.		67.00			

STANDARD PENETRATION TEST TEST METHOD (ASTM)
CURVE OF BLOW ●
N-Value (Blows / 30cm)
0 10 20 30 40 50

SAMPLING
CASING (DEPTH (m) & DIAMETER (mm)) WATER DEPTH (m) TCR (%) SCR (%) RQD (%)

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
T-1	Undisturbed Sample (Piston sampler)
D-1	Undisturbed Sample (Denison sampler)
	Rock core sample (Single core tube)
	Rock core sample (Double core tube)
	Rock core sample (Core Loss)
W-1	Water sample
PBT	Permeability Test
VS	Vane Shear Test
PMT	Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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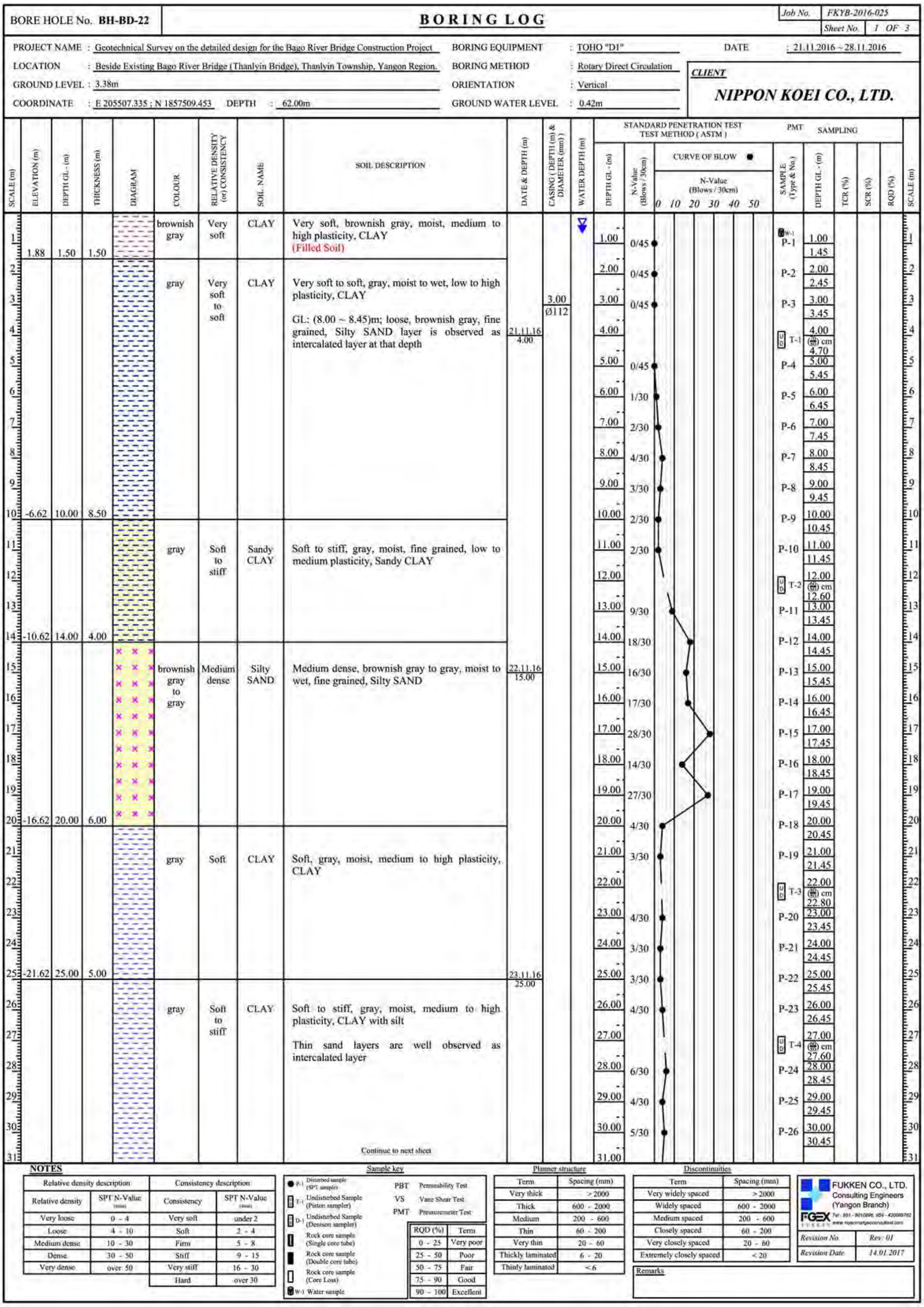
Remarks

Source: JICA Study Team

Figure 4.1.67 Boring log BH-BD-21 (3)



BORE HOLE No. **BH-BD-22**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *1 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.38m
COORDINATE : E 205507.335 ; N 1857509.453 DEPTH : 62.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.42m
DATE : 21.11.2016 ~ 28.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
1.88	1.50	1.50	brownish gray	Very soft	CLAY	Very soft, brownish gray, moist, medium to high plasticity, CLAY (Filled Soil)
-6.62	10.00	8.50	gray	Very soft to soft	CLAY	Very soft to soft, gray, moist to wet, low to high plasticity, CLAY GL: (8.00 ~ 8.45)m; loose, brownish gray, fine grained, Silty SAND layer is observed as intercalated layer at that depth
-10.62	14.00	4.00	gray	Soft to stiff	Sandy CLAY	Soft to stiff, gray, moist, fine grained, low to medium plasticity, Sandy CLAY
-16.62	20.00	6.00	brownish gray to gray	Medium dense	Silty SAND	Medium dense, brownish gray to gray, moist to wet, fine grained, Silty SAND
-21.62	25.00	5.00	gray	Soft	CLAY	Soft, gray, moist, medium to high plasticity, CLAY
			gray	Soft to stiff	CLAY	Soft to stiff, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer

Continue to next sheet

DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))
21.11.16 4.00	3.00 Ø112
22.11.16 15.00	
23.11.16 25.00	

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

PMT SAMPLING

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
1.00	0/45	W-1 P-1	1.00 1.45
2.00	0/45	P-2	2.00 2.45
3.00	0/45	P-3	3.00 3.45
4.00		T-1	4.00 cm 4.70
5.00	0/45	P-4	5.00 5.45
6.00	1/30	P-5	6.00 6.45
7.00	2/30	P-6	7.00 7.45
8.00	4/30	P-7	8.00 8.45
9.00	3/30	P-8	9.00 9.45
10.00	2/30	P-9	10.00 10.45
11.00	2/30	P-10	11.00 11.45
12.00		T-2	12.00 cm 12.60
13.00	9/30	P-11	13.00 13.45
14.00	18/30	P-12	14.00 14.45
15.00	16/30	P-13	15.00 15.45
16.00	17/30	P-14	16.00 16.45
17.00	28/30	P-15	17.00 17.45
18.00	14/30	P-16	18.00 18.45
19.00	27/30	P-17	19.00 19.45
20.00	4/30	P-18	20.00 20.45
21.00	3/30	P-19	21.00 21.45
22.00		T-3	22.00 cm 22.80
23.00	4/30	P-20	23.00 23.45
24.00	3/30	P-21	24.00 24.45
25.00	3/30	P-22	25.00 25.45
26.00	4/30	P-23	26.00 26.45
27.00		T-4	27.00 cm 27.60
28.00	6/30	P-24	28.00 28.45
29.00	4/30	P-25	29.00 29.45
30.00	5/30	P-26	30.00 30.45
31.00			

NOTES

Relative density description	
Relative density	SPT N-Value
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

Consistency description	
Consistency	SPT N-Value
Very soft	under 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very stiff	16 - 30
Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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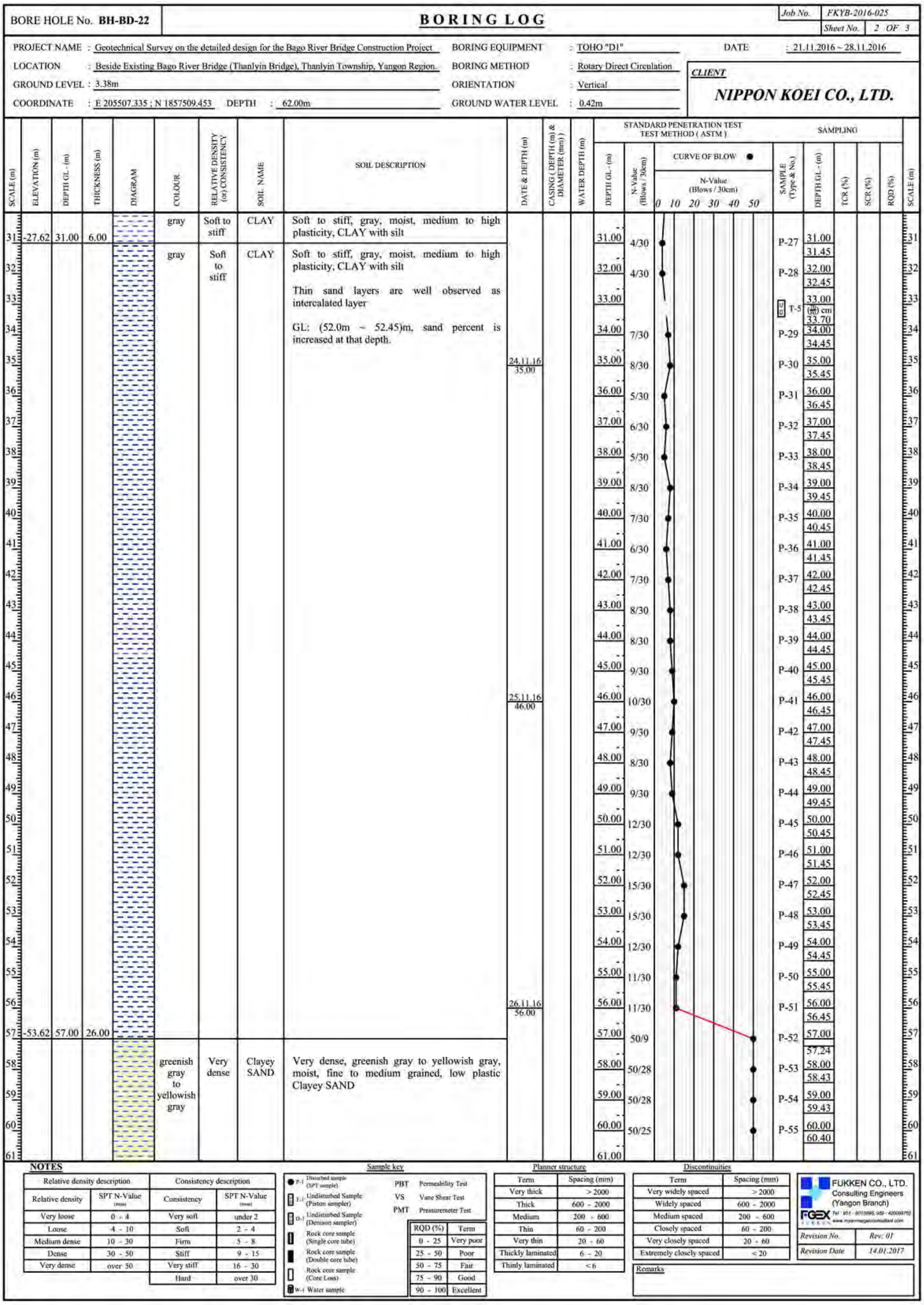
Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Source: JICA Study Team

Figure 4.1.68 Boring log BH-BD-22 (1)



BORE HOLE No. **BH-BD-22**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 2 OF 3

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.38m
COORDINATE : E 205507.335 ; N 1857509.453 DEPTH : 62.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.42m
DATE : 21.11.2016 ~ 28.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL.- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-27.62	31.00	6.00	gray	Soft to stiff	CLAY	Soft to stiff, gray, moist, medium to high plasticity, CLAY with silt
-53.62	57.00	26.00	gray	Soft to stiff	CLAY	Soft to stiff, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer GL: (52.0m ~ 52.45)m, sand percent is increased at that depth.
			greenish gray to yellowish gray	Very dense	Clayey SAND	Very dense, greenish gray to yellowish gray, moist, fine to medium grained, low plastic Clayey SAND

DATE & DEPTH (m): 24.11.16 35.00; 25.11.16 46.00; 26.11.16 56.00

STANDARD PENETRATION TEST TEST METHOD (ASTM)		SAMPLING	
DEPTH GL.- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL.- (m)
31.00	4/30	P-27	31.00 31.45
32.00	4/30	P-28	32.00 32.45
33.00		T-5	33.00 (70) cm 33.70
34.00	7/30	P-29	34.00 34.45
35.00	8/30	P-30	35.00 35.45
36.00	5/30	P-31	36.00 36.45
37.00	6/30	P-32	37.00 37.45
38.00	5/30	P-33	38.00 38.45
39.00	8/30	P-34	39.00 39.45
40.00	7/30	P-35	40.00 40.45
41.00	6/30	P-36	41.00 41.45
42.00	7/30	P-37	42.00 42.45
43.00	8/30	P-38	43.00 43.45
44.00	8/30	P-39	44.00 44.45
45.00	9/30	P-40	45.00 45.45
46.00	10/30	P-41	46.00 46.45
47.00	9/30	P-42	47.00 47.45
48.00	8/30	P-43	48.00 48.45
49.00	9/30	P-44	49.00 49.45
50.00	12/30	P-45	50.00 50.45
51.00	12/30	P-46	51.00 51.45
52.00	15/30	P-47	52.00 52.45
53.00	15/30	P-48	53.00 53.45
54.00	12/30	P-49	54.00 54.45
55.00	11/30	P-50	55.00 55.45
56.00	11/30	P-51	56.00 56.45
57.00	50/9	P-52	57.00 57.24
58.00	50/28	P-53	58.00 58.43
59.00	50/28	P-54	59.00 59.43
60.00	50/25	P-55	60.00 60.40
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
T-1 Undisturbed Sample (Piston sampler)
D-1 Undisturbed Sample (Denison sampler)
Rock core sample (Single core tube)
Rock core sample (Double core tube)
Rock core sample (Core Loss)
W-1 Water sample
PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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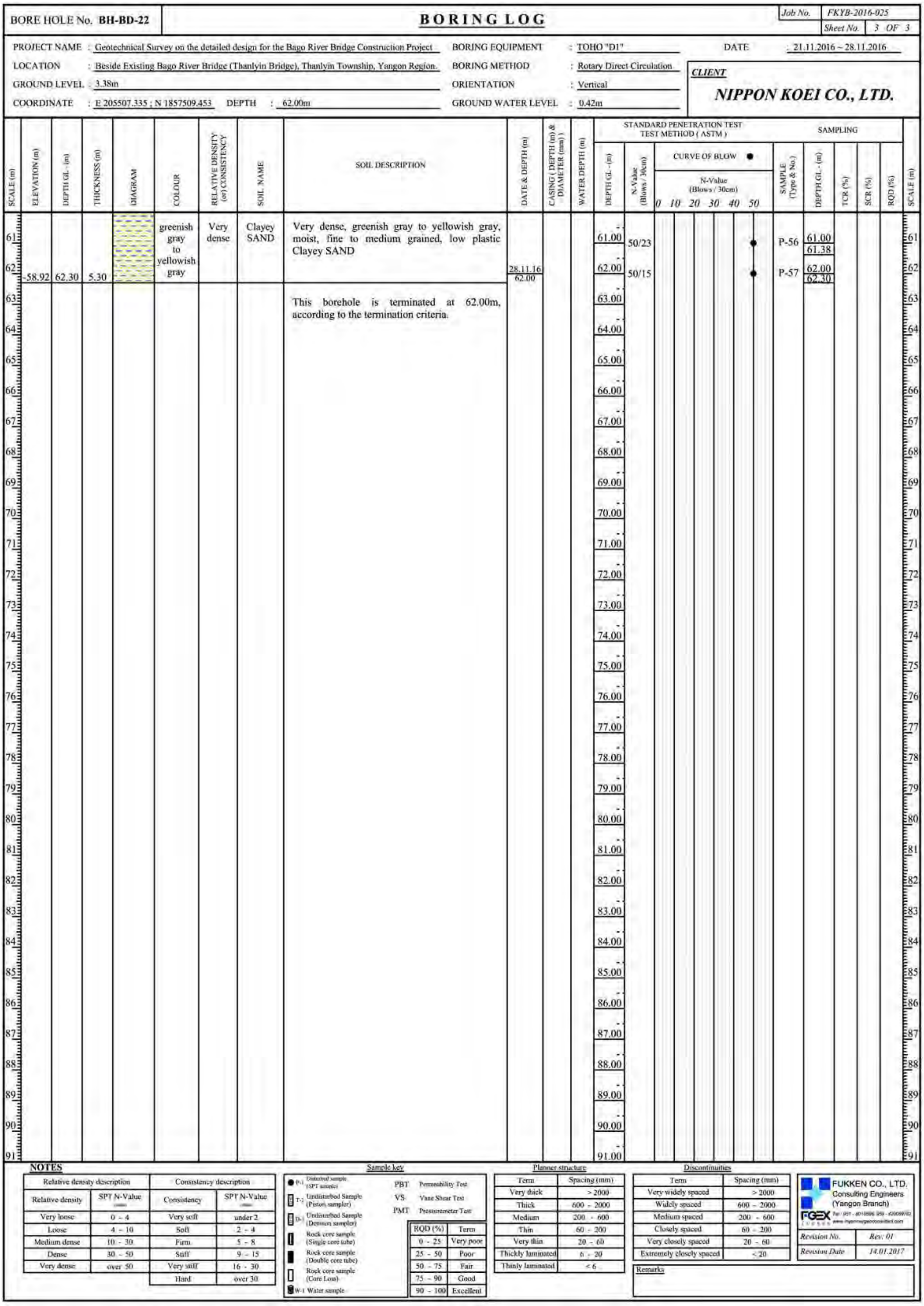
(Yangon Branch)

Revision No.	Rev: 01
Revision Date	14.01.2017

Source: JICA Study Team

Figure 4.1.69 Boring log BH-BD-22 (2)



BORE HOLE No. **BH-BD-22**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *3 OF 3*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.38m
COORDINATE : E 205507.335 ; N 1857509.453 DEPTH : 62.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.42m
DATE : 21.11.2016 ~ 28.11.2016

CLIENT
NIPPON KOEI CO., LTD.

SCALE (m)	ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	DIAGRAM	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION	DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))	WATER DEPTH (m)	STANDARD PENETRATION TEST TEST METHOD (ASTM) DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLING SAMPLE (Type & No.)	DEPTH GL- (m)	TCR (%)	SCR (%)	RQD (%)	SCALE (m)
61					greenish gray to yellowish gray	Very dense	Clayey SAND	Very dense, greenish gray to yellowish gray, moist, fine to medium grained, low plastic Clayey SAND				61.00	50/23	P-56	61.00 61.38				61
62	-58.92	62.30	5.30						28.11.16 62.00			62.00	50/15	P-57	62.00 62.30				62
63								This borehole is terminated at 62.00m, according to the termination criteria.				63.00							63
64												64.00							64
65												65.00							65
66												66.00							66
67												67.00							67
68												68.00							68
69												69.00							69
70												70.00							70
71												71.00							71
72												72.00							72
73												73.00							73
74												74.00							74
75												75.00							75
76												76.00							76
77												77.00							77
78												78.00							78
79												79.00							79
80												80.00							80
81												81.00							81
82												82.00							82
83												83.00							83
84												84.00							84
85												85.00							85
86												86.00							86
87												87.00							87
88												88.00							88
89												89.00							89
90												90.00							90
91												91.00							91

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
▯ T-1 Undisturbed Sample (Piston sampler)
▯ D-1 Undisturbed Sample (Denison sampler)
▯ Rock core sample (Single core tube)
▮ Rock core sample (Double core tube)
▯ Rock core sample (Core Loss)
▮ W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

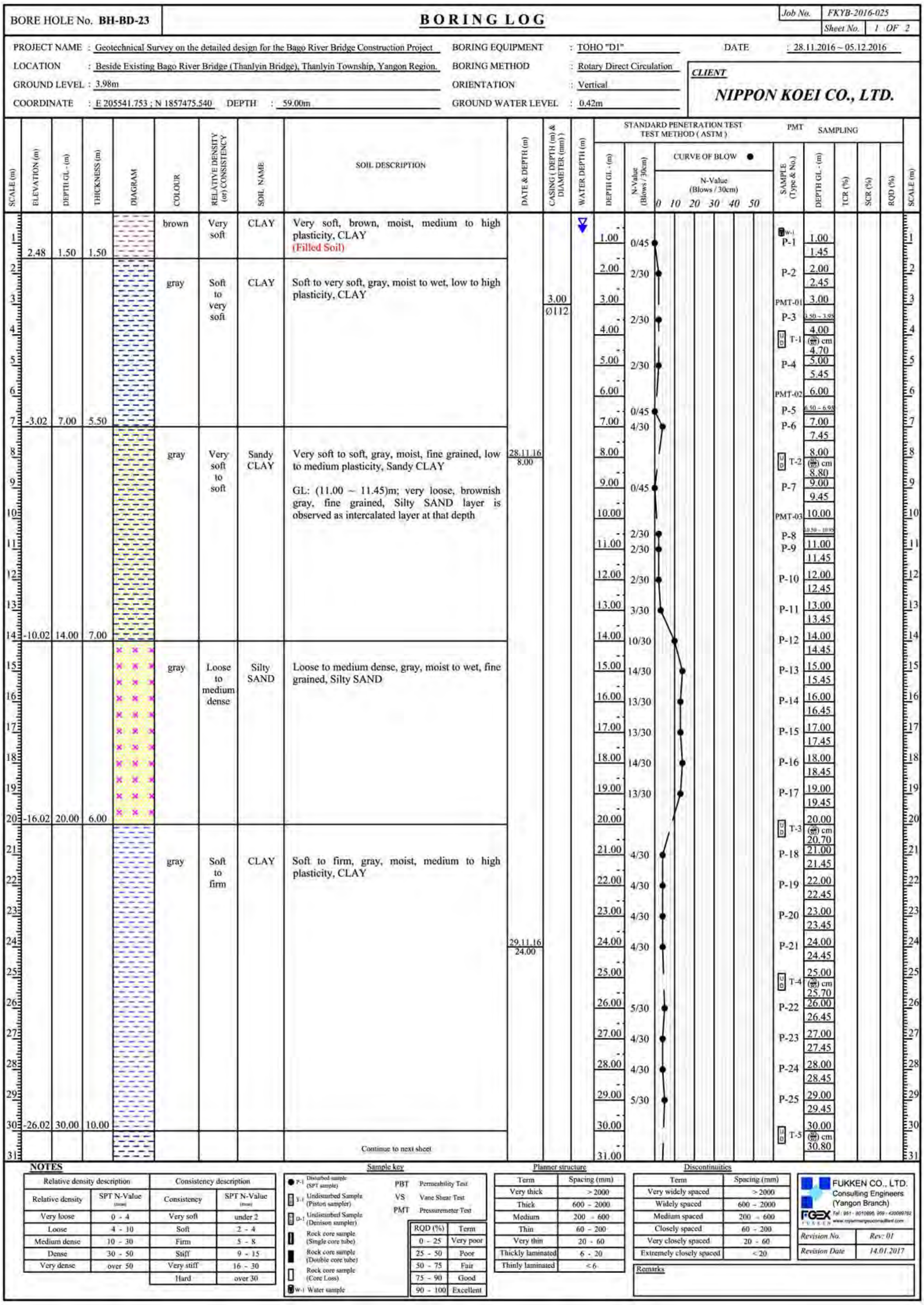
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)
FGEX

Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Source: JICA Study Team

Figure 4.1.70 Boring log BH-BD-22 (3)



BORE HOLE No. **BH-BD-23**

BORING LOG

Job No. *FKYB-2016-025*
Sheet No. *1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.98m
COORDINATE : E 205541.753 ; N 1857475.540 DEPTH : 59.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.42m
DATE : 28.11.2016 ~ 05.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
2.48	1.50	1.50	brown	Very soft	CLAY	Very soft, brown, moist, medium to high plasticity, CLAY (Filled Soil)
-3.02	7.00	5.50	gray	Soft to very soft	CLAY	Soft to very soft, gray, moist to wet, low to high plasticity, CLAY
-10.02	14.00	7.00	gray	Very soft to soft	Sandy CLAY	Very soft to soft, gray, moist, fine grained, low to medium plasticity, Sandy CLAY GL: (11.00 ~ 11.45)m; very loose, brownish gray, fine grained, Silty SAND layer is observed as intercalated layer at that depth
-16.02	20.00	6.00	gray	Loose to medium dense	Silty SAND	Loose to medium dense, gray, moist to wet, fine grained, Silty SAND
-26.02	30.00	10.00	gray	Soft to firm	CLAY	Soft to firm, gray, moist, medium to high plasticity, CLAY

Continue to next sheet

DATE & DEPTH (m): 28.11.16 8.00; 29.11.16 24.00
CASING (DEPTH (m) & DIAMETER (mm)): 3.00 Ø112

STANDARD PENETRATION TEST
TEST METHOD (ASTM)
CURVE OF BLOW ●
N-Value (Blows / 30cm)
0 10 20 30 40 50

DEPTH GL - (m)	N-Value (Blows / 30cm)
1.00	0/45
2.00	2/30
3.00	
4.00	2/30
5.00	2/30
6.00	
7.00	0/45 4/30
8.00	
9.00	0/45
10.00	
11.00	2/30 2/30
12.00	2/30
13.00	3/30
14.00	10/30
15.00	14/30
16.00	13/30
17.00	13/30
18.00	14/30
19.00	13/30
20.00	
21.00	4/30
22.00	4/30
23.00	4/30
24.00	4/30
25.00	
26.00	5/30
27.00	4/30
28.00	4/30
29.00	5/30
30.00	
31.00	

PMT SAMPLING

SAMPLE (Type & No.)	DEPTH GL - (m)
W-1	
P-1	1.00 1.45
P-2	2.00 2.45
PMT-01	3.00
P-3	3.50 ~ 3.95
T-1	4.00 cm 4.70
P-4	5.00 5.45
PMT-02	6.00
P-5	6.50 ~ 6.95
P-6	7.00 7.45
T-2	8.00 cm 8.80
P-7	9.00 9.45
PMT-03	10.00
P-8	10.50 ~ 10.95
P-9	11.00 11.45
P-10	12.00 12.45
P-11	13.00 13.45
P-12	14.00 14.45
P-13	15.00 15.45
P-14	16.00 16.45
P-15	17.00 17.45
P-16	18.00 18.45
P-17	19.00 19.45
T-3	20.00 cm 20.70
P-18	21.00 21.45
P-19	22.00 22.45
P-20	23.00 23.45
P-21	24.00 24.45
T-4	25.00 cm 25.70
P-22	26.00 26.45
P-23	27.00 27.45
P-24	28.00 28.45
P-25	29.00 29.45
T-5	30.00 cm 30.80

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1 Disturbed sample (SPT sample)
T-1 Undisturbed Sample (Piston sampler)
D-1 Undisturbed Sample (Denison sampler)
Rock core sample (Single core tube)
Rock core sample (Double core tube)
Rock core sample (Core Loss)
W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

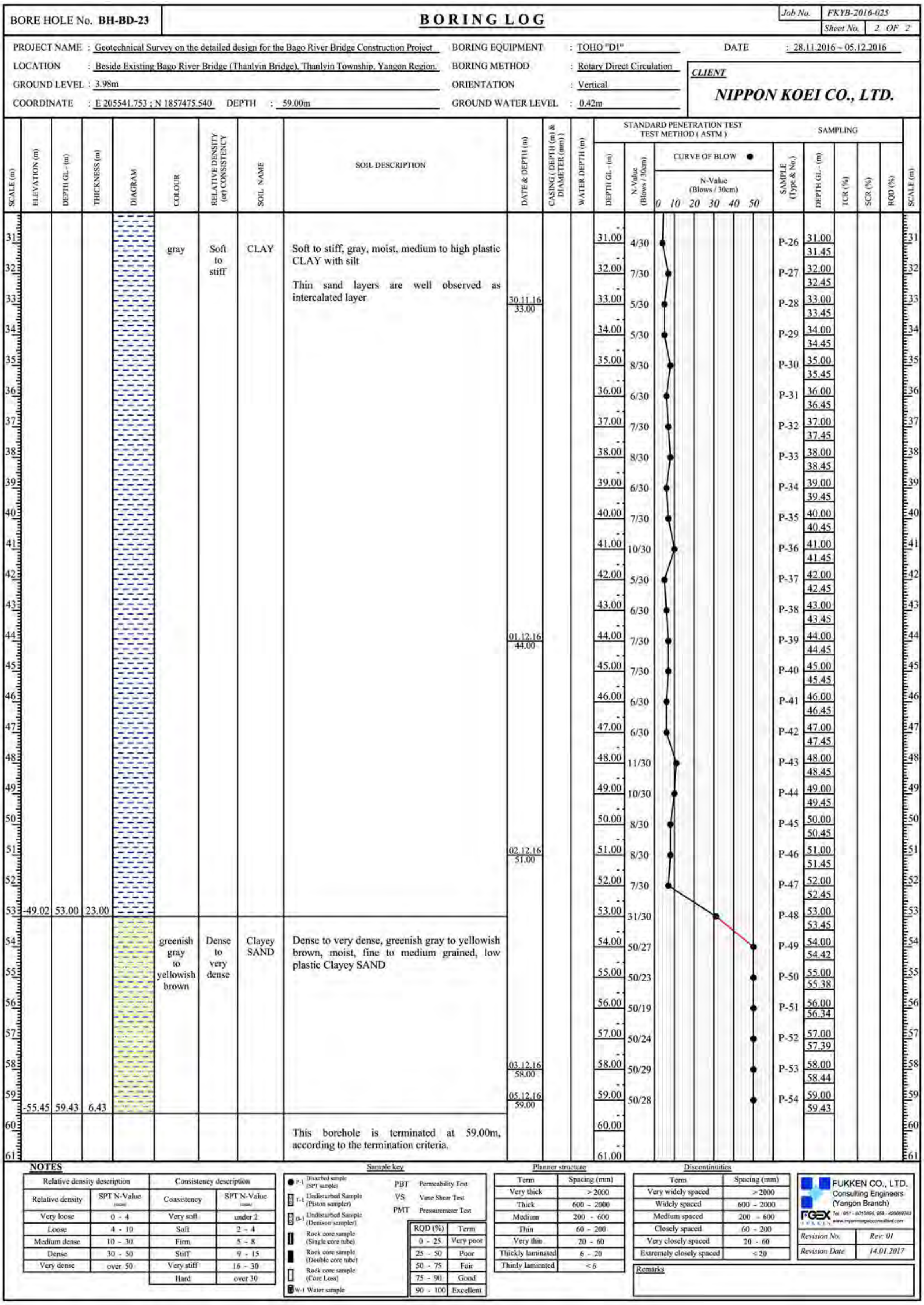
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Source: JICA Study Team

Figure 4.1.71 Boring log BH-BD-23 (1)



BORE HOLE No. **BH-BD-23**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.98m
COORDINATE : E 205541.753 ; N 1857475.540 DEPTH : 59.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.42m
DATE : 28.11.2016 ~ 05.12.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-49.02	53.00	23.00	gray	Soft to stiff	CLAY	Soft to stiff, gray, moist, medium to high plastic CLAY with silt Thin sand layers are well observed as intercalated layer
-55.45	59.43	6.43	greenish gray to yellowish brown	Dense to very dense	Clayey SAND	Dense to very dense, greenish gray to yellowish brown, moist, fine to medium grained, low plastic Clayey SAND
						This borehole is terminated at 59.00m, according to the termination criteria.

DATE & DEPTH (m)	
30.11.16	33.00
01.12.16	44.00
02.12.16	51.00
03.12.16	58.00
05.12.16	59.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
31.00	4/30	P-26	31.00 31.45
32.00	7/30	P-27	32.00 32.45
33.00	5/30	P-28	33.00 33.45
34.00	5/30	P-29	34.00 34.45
35.00	8/30	P-30	35.00 35.45
36.00	6/30	P-31	36.00 36.45
37.00	7/30	P-32	37.00 37.45
38.00	8/30	P-33	38.00 38.45
39.00	6/30	P-34	39.00 39.45
40.00	7/30	P-35	40.00 40.45
41.00	10/30	P-36	41.00 41.45
42.00	5/30	P-37	42.00 42.45
43.00	6/30	P-38	43.00 43.45
44.00	7/30	P-39	44.00 44.45
45.00	7/30	P-40	45.00 45.45
46.00	6/30	P-41	46.00 46.45
47.00	6/30	P-42	47.00 47.45
48.00	11/30	P-43	48.00 48.45
49.00	10/30	P-44	49.00 49.45
50.00	8/30	P-45	50.00 50.45
51.00	8/30	P-46	51.00 51.45
52.00	7/30	P-47	52.00 52.45
53.00	31/30	P-48	53.00 53.45
54.00	50/27	P-49	54.00 54.42
55.00	50/23	P-50	55.00 55.38
56.00	50/19	P-51	56.00 56.34
57.00	50/24	P-52	57.00 57.39
58.00	50/29	P-53	58.00 58.44
59.00	50/28	P-54	59.00 59.43
60.00			
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

FUKKEN CO., LTD.
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(Yangon Branch)
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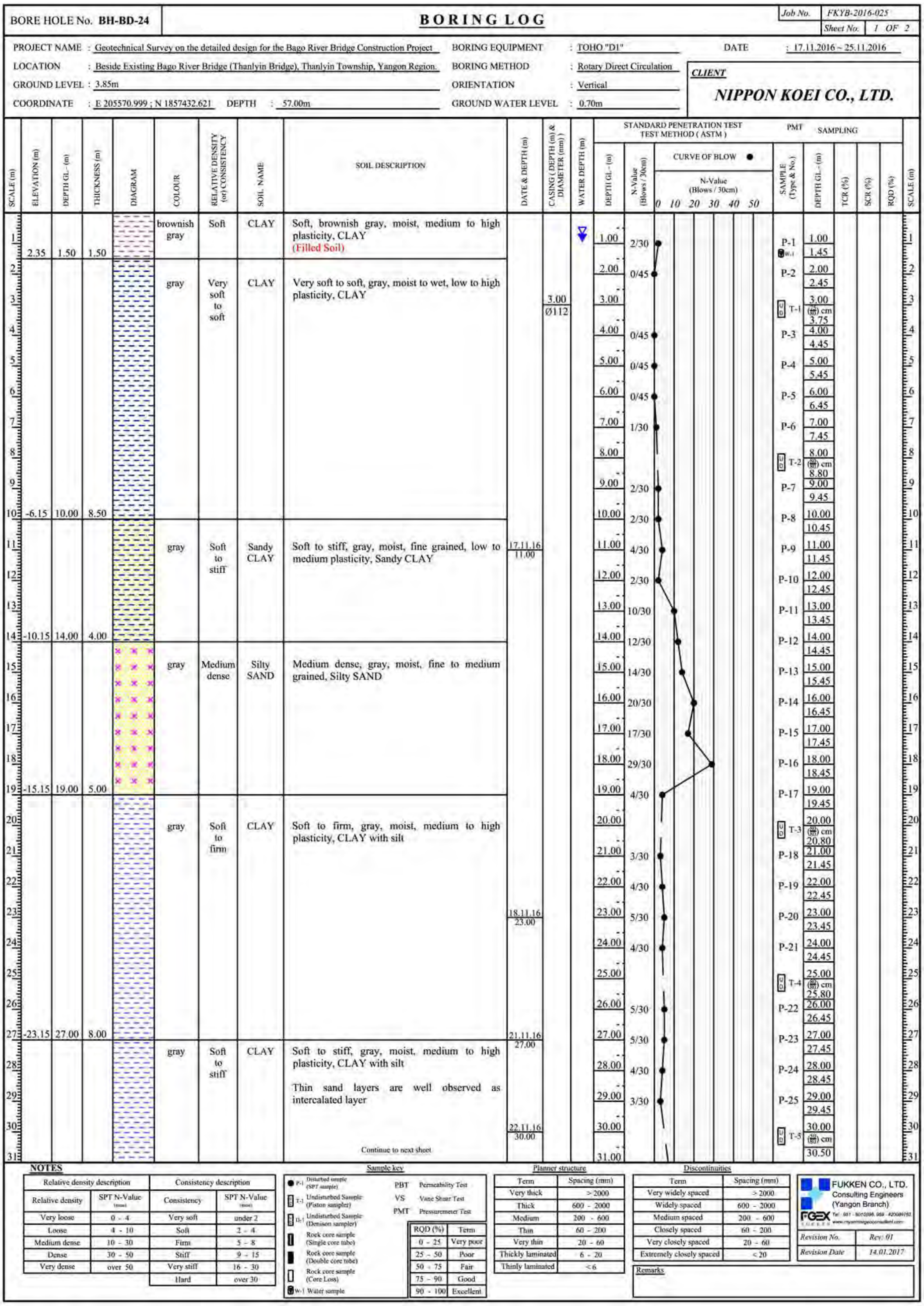
Revision No.	*Rev: 01*
Revision Date	*14.01.2017*

Source: JICA Study Team

Figure 4.1.72 Boring log BH-BD-23 (2)



BORE HOLE No. **BH-BD-24**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 1 OF 2

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.85m
COORDINATE : E 205570.999 ; N 1857432.621 DEPTH : 57.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.70m
DATE : 17.11.2016 ~ 25.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
2.35	1.50	1.50	brownish gray	Soft	CLAY	Soft, brownish gray, moist, medium to high plasticity, CLAY (Filled Soil)
-6.15	10.00	8.50	gray	Very soft to soft	CLAY	Very soft to soft, gray, moist to wet, low to high plasticity, CLAY
-10.15	14.00	4.00	gray	Soft to stiff	Sandy CLAY	Soft to stiff, gray, moist, fine grained, low to medium plasticity, Sandy CLAY
-15.15	19.00	5.00	gray	Medium dense	Silty SAND	Medium dense, gray, moist, fine to medium grained, Silty SAND
-23.15	27.00	8.00	gray	Soft to firm	CLAY	Soft to firm, gray, moist, medium to high plasticity, CLAY with silt
			gray	Soft to stiff	CLAY	Soft to stiff, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer

Continue to next sheet

DATE & DEPTH (m)	CASING (DEPTH (m) & DIAMETER (mm))
17.11.16 11.00	3.00 Ø112
18.11.16 23.00	
21.11.16 27.00	
22.11.16 30.00	

STANDARD PENETRATION TEST TEST METHOD (ASTM) / SAMPLING

DEPTH GL- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL- (m)
1.00	2/30	P-1 W-1	1.00 1.45
2.00	0/45	P-2	2.00 2.45
3.00		T-1	3.00 cm 3.75
4.00	0/45	P-3	4.00 4.45
5.00	0/45	P-4	5.00 5.45
6.00	0/45	P-5	6.00 6.45
7.00	1/30	P-6	7.00 7.45
8.00		T-2	8.00 cm 8.80
9.00	2/30	P-7	9.00 9.45
10.00	2/30	P-8	10.00 10.45
11.00	4/30	P-9	11.00 11.45
12.00	2/30	P-10	12.00 12.45
13.00	10/30	P-11	13.00 13.45
14.00	12/30	P-12	14.00 14.45
15.00	14/30	P-13	15.00 15.45
16.00	20/30	P-14	16.00 16.45
17.00	17/30	P-15	17.00 17.45
18.00	29/30	P-16	18.00 18.45
19.00	4/30	P-17	19.00 19.45
20.00		T-3	20.00 cm 20.80
21.00	3/30	P-18	21.00 21.45
22.00	4/30	P-19	22.00 22.45
23.00	5/30	P-20	23.00 23.45
24.00	4/30	P-21	24.00 24.45
25.00		T-4	25.00 cm 25.80
26.00	5/30	P-22	26.00 26.45
27.00	5/30	P-23	27.00 27.45
28.00	4/30	P-24	28.00 28.45
29.00	3/30	P-25	29.00 29.45
30.00		T-5	30.00 cm 30.50
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

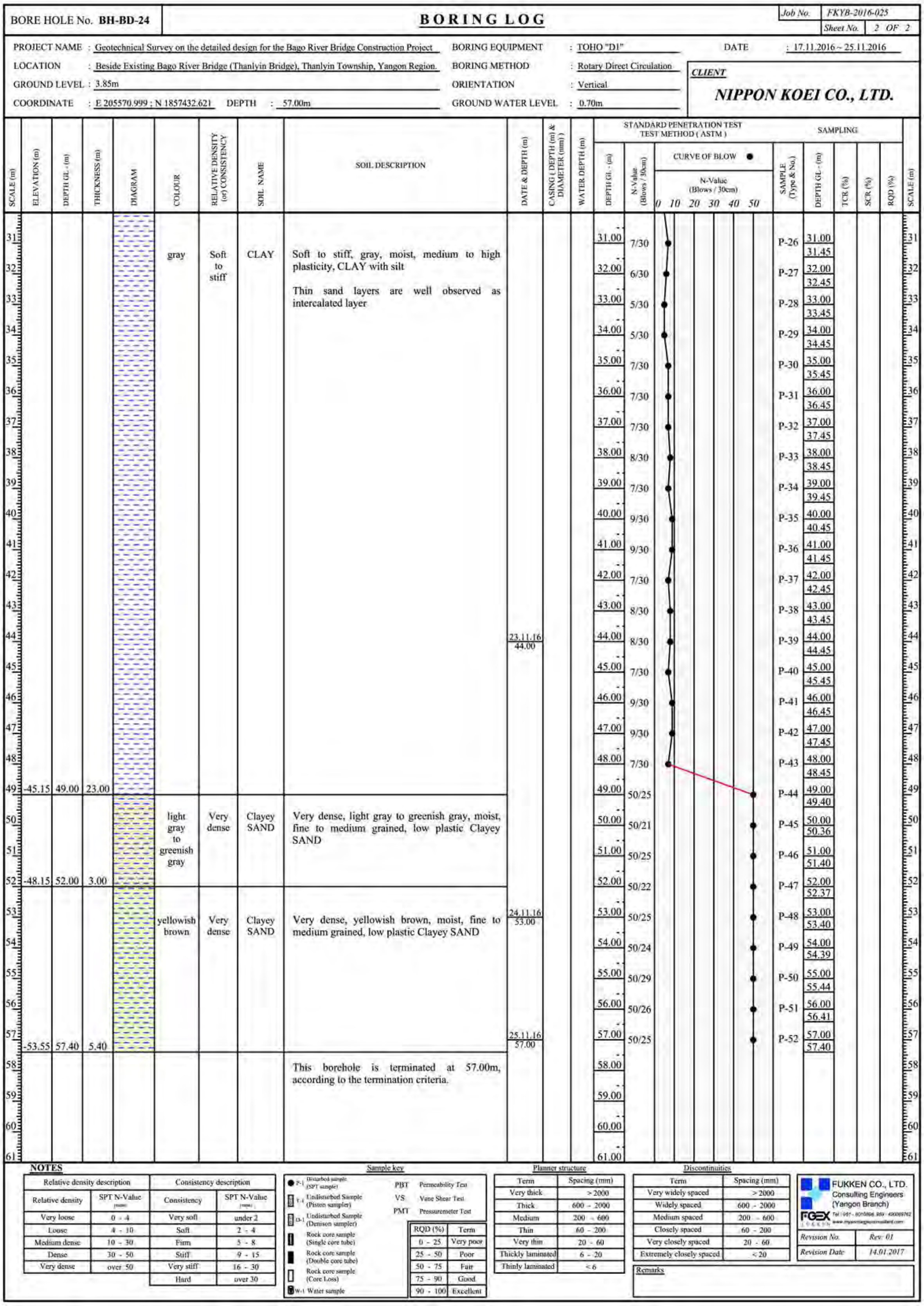
Remarks

FUKKEN CO., LTD.
Consulting Engineers
(Yangon Branch)

Revision No.	Rev: 01
Revision Date	14.01.2017

Source: JICA Study Team

Figure 4.1.73 Boring log BH-BD-24 (1)



BORE HOLE No. **BH-BD-24**

BORING LOG

Job No. FKYB-2016-025
Sheet No. 2 OF 2

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 3.85m
COORDINATE : E 205570.999 ; N 1857432.621 DEPTH : 57.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.70m
DATE : 17.11.2016 ~ 25.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-45.15	49.00	23.00	gray	Soft to stiff	CLAY	Soft to stiff, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer
-48.15	52.00	3.00	light gray to greenish gray	Very dense	Clayey SAND	Very dense, light gray to greenish gray, moist, fine to medium grained, low plastic Clayey SAND
-53.55	57.40	5.40	yellowish brown	Very dense	Clayey SAND	Very dense, yellowish brown, moist, fine to medium grained, low plastic Clayey SAND
						This borehole is terminated at 57.00m, according to the termination criteria.

DATE & DEPTH (m)
23.11.16 44.00
24.11.16 53.00
25.11.16 57.00

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
31.00	7/30	P-26	31.00 31.45
32.00	6/30	P-27	32.00 32.45
33.00	5/30	P-28	33.00 33.45
34.00	5/30	P-29	34.00 34.45
35.00	7/30	P-30	35.00 35.45
36.00	7/30	P-31	36.00 36.45
37.00	7/30	P-32	37.00 37.45
38.00	8/30	P-33	38.00 38.45
39.00	7/30	P-34	39.00 39.45
40.00	9/30	P-35	40.00 40.45
41.00	9/30	P-36	41.00 41.45
42.00	7/30	P-37	42.00 42.45
43.00	8/30	P-38	43.00 43.45
44.00	8/30	P-39	44.00 44.45
45.00	7/30	P-40	45.00 45.45
46.00	9/30	P-41	46.00 46.45
47.00	9/30	P-42	47.00 47.45
48.00	7/30	P-43	48.00 48.45
49.00	50/25	P-44	49.00 49.40
50.00	50/21	P-45	50.00 50.36
51.00	50/25	P-46	51.00 51.40
52.00	50/22	P-47	52.00 52.37
53.00	50/25	P-48	53.00 53.40
54.00	50/24	P-49	54.00 54.39
55.00	50/29	P-50	55.00 55.44
56.00	50/26	P-51	56.00 56.41
57.00	50/25	P-52	57.00 57.40
58.00			
59.00			
60.00			
61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)	
T-1	Undisturbed Sample (Piston sampler)	
D-1	Undisturbed Sample (Denison sampler)	
▯	Rock core sample (Single core tube)	
▮	Rock core sample (Double core tube)	
▯	Rock core sample (Core Loss)	
W-1	Water sample	

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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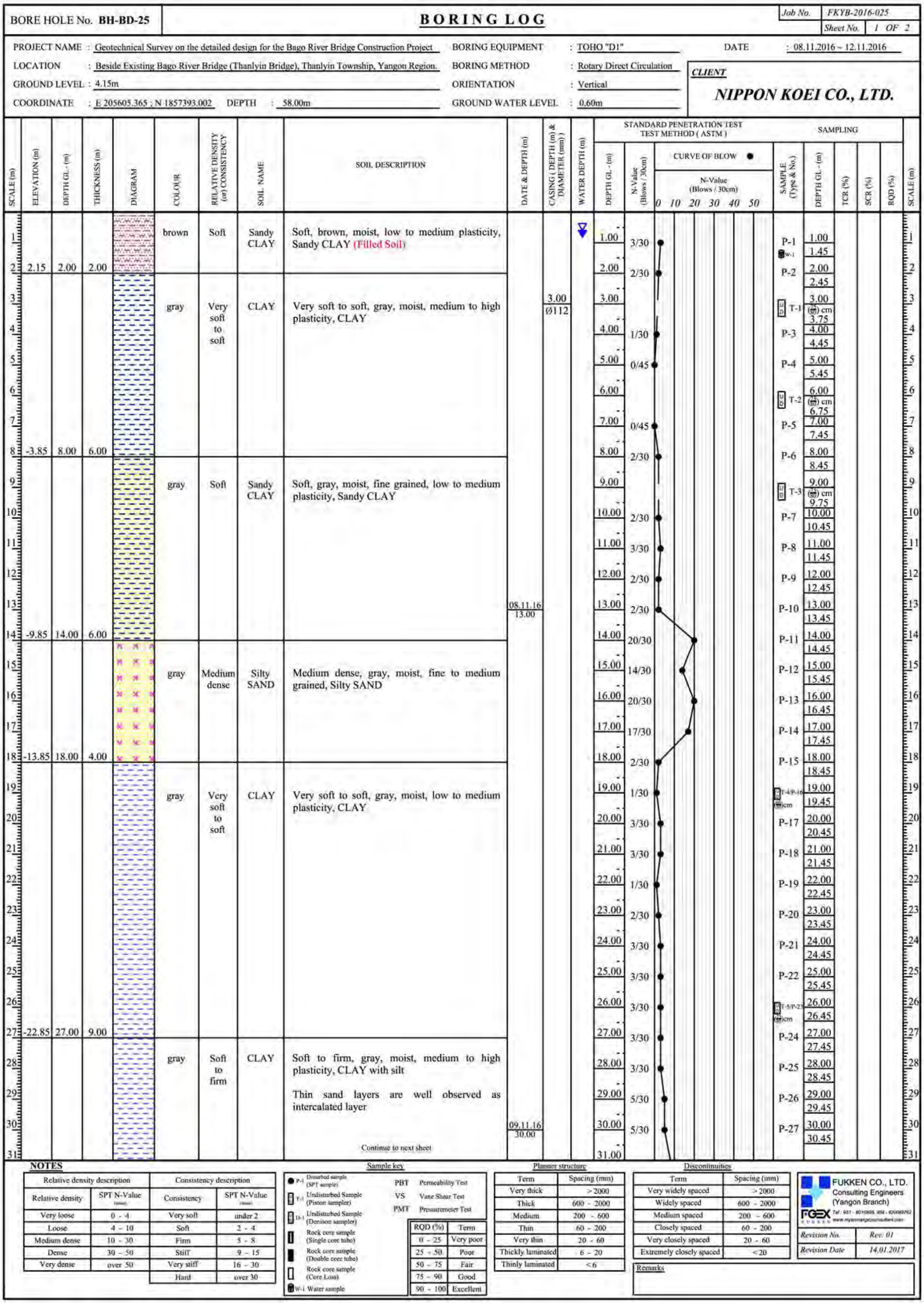
Revision Date	*14.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.74 Boring log BH-BD-24 (2)



BORE HOLE No. **BH-BD-25**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*1 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 4.15m
COORDINATE : E 205605.365 ; N 1857393.002 DEPTH : 58.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.60m
DATE : 08.11.2016 ~ 12.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL.- (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
2.15	2.00	2.00	brown	Soft	Sandy CLAY	Soft, brown, moist, low to medium plasticity, Sandy CLAY (Filled Soil)
-3.85	8.00	6.00	gray	Very soft to soft	CLAY	Very soft to soft, gray, moist, medium to high plasticity, CLAY
-9.85	14.00	6.00	gray	Soft	Sandy CLAY	Soft, gray, moist, fine grained, low to medium plasticity, Sandy CLAY
-13.85	18.00	4.00	gray	Medium dense	Silty SAND	Medium dense, gray, moist, fine to medium grained, Silty SAND
-22.85	27.00	9.00	gray	Very soft to soft	CLAY	Very soft to soft, gray, moist, low to medium plasticity, CLAY
			gray	Soft to firm	CLAY	Soft to firm, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer

Continue to next sheet

DATE & DEPTH (m): 08.11.16 13.00; 09.11.16 30.00
CASING (DEPTH (m) & DIAMETER (mm)): 3.00 Ø112

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DEPTH GL.- (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL.- (m)
1.00	3/30	P-1 W-1	1.00 1.45
2.00	2/30	P-2	2.00 2.45
3.00		T-1	3.00 ([illegible]) cm 3.75
4.00	1/30	P-3	4.00 4.45
5.00	0/45	P-4	5.00 5.45
6.00		T-2	6.00 ([illegible]) cm 6.75
7.00	0/45	P-5	7.00 7.45
8.00	2/30	P-6	8.00 8.45
9.00		T-3	9.00 ([illegible]) cm 9.75
10.00	2/30	P-7	10.00 10.45
11.00	3/30	P-8	11.00 11.45
12.00	2/30	P-9	12.00 12.45
13.00	2/30	P-10	13.00 13.45
14.00	20/30	P-11	14.00 14.45
15.00	14/30	P-12	15.00 15.45
16.00	20/30	P-13	16.00 16.45
17.00	17/30	P-14	17.00 17.45
18.00	2/30	P-15	18.00 18.45
19.00	1/30	T-4/P-16 ([illegible])cm	19.00 19.45
20.00	3/30	P-17	20.00 20.45
21.00	3/30	P-18	21.00 21.45
22.00	1/30	P-19	22.00 22.45
23.00	2/30	P-20	23.00 23.45
24.00	3/30	P-21	24.00 24.45
25.00	3/30	P-22	25.00 25.45
26.00	3/30	T-5/P-23 ([illegible])cm	26.00 26.45
27.00	3/30	P-24	27.00 27.45
28.00	3/30	P-25	28.00 28.45
29.00	5/30	P-26	29.00 29.45
30.00	5/30	P-27	30.00 30.45
31.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

- ● P-1 Disturbed sample (SPT sample)
- T-1 Undisturbed Sample (Piston sampler)
- D-1 Undisturbed Sample (Denison sampler)
- Rock core sample (Single core tube)
- Rock core sample (Double core tube)
- Rock core sample (Core Loss)
- W-1 Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

Remarks

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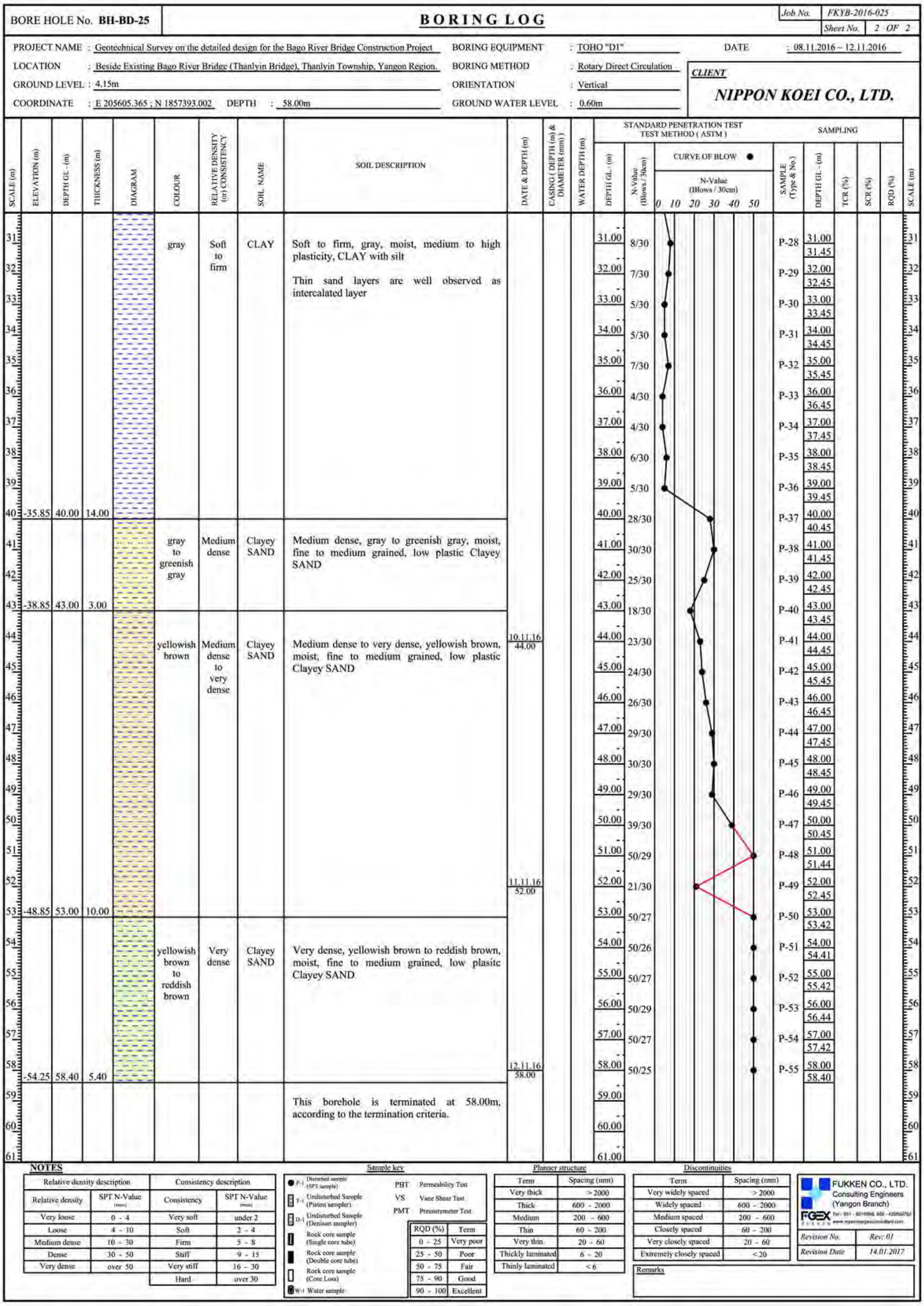
Source: JICA Study Team

Figure 4.1.75 Boring log BH-BD-25 (1)



BORE HOLE No. **BH-BD-25**

BORING LOG

Job No.	*FKYB-2016-025*
Sheet No.	*2 OF 2*

PROJECT NAME : Geotechnical Survey on the detailed design for the Bago River Bridge Construction Project
LOCATION : Beside Existing Bago River Bridge (Thanlyin Bridge), Thanlyin Township, Yangon Region.
GROUND LEVEL : 4.15m
COORDINATE : E 205605.365 ; N 1857393.002 DEPTH : 58.00m
BORING EQUIPMENT : TOHO "D1"
BORING METHOD : Rotary Direct Circulation
ORIENTATION : Vertical
GROUND WATER LEVEL : 0.60m
DATE : 08.11.2016 ~ 12.11.2016

CLIENT
NIPPON KOEI CO., LTD.

ELEVATION (m)	DEPTH GL - (m)	THICKNESS (m)	COLOUR	RELATIVE DENSITY (or) CONSISTENCY	SOIL NAME	SOIL DESCRIPTION
-35.85	40.00	14.00	gray	Soft to firm	CLAY	Soft to firm, gray, moist, medium to high plasticity, CLAY with silt Thin sand layers are well observed as intercalated layer
-38.85	43.00	3.00	gray to greenish gray	Medium dense	Clayey SAND	Medium dense, gray to greenish gray, moist, fine to medium grained, low plastic Clayey SAND
-48.85	53.00	10.00	yellowish brown	Medium dense to very dense	Clayey SAND	Medium dense to very dense, yellowish brown, moist, fine to medium grained, low plastic Clayey SAND
-54.25	58.40	5.40	yellowish brown to reddish brown	Very dense	Clayey SAND	Very dense, yellowish brown to reddish brown, moist, fine to medium grained, low plasitc Clayey SAND
						This borehole is terminated at 58.00m, according to the termination criteria.

STANDARD PENETRATION TEST
TEST METHOD (ASTM)

DATE & DEPTH (m)	DEPTH GL - (m)	N-Value (Blows / 30cm)	SAMPLE (Type & No.)	DEPTH GL - (m)
	31.00	8/30	P-28	31.00 31.45
	32.00	7/30	P-29	32.00 32.45
	33.00	5/30	P-30	33.00 33.45
	34.00	5/30	P-31	34.00 34.45
	35.00	7/30	P-32	35.00 35.45
	36.00	4/30	P-33	36.00 36.45
	37.00	4/30	P-34	37.00 37.45
	38.00	6/30	P-35	38.00 38.45
	39.00	5/30	P-36	39.00 39.45
	40.00	28/30	P-37	40.00 40.45
	41.00	30/30	P-38	41.00 41.45
	42.00	25/30	P-39	42.00 42.45
	43.00	18/30	P-40	43.00 43.45
10.11.16 44.00	44.00	23/30	P-41	44.00 44.45
	45.00	24/30	P-42	45.00 45.45
	46.00	26/30	P-43	46.00 46.45
	47.00	29/30	P-44	47.00 47.45
	48.00	30/30	P-45	48.00 48.45
	49.00	29/30	P-46	49.00 49.45
	50.00	39/30	P-47	50.00 50.45
	51.00	50/29	P-48	51.00 51.44
11.11.16 52.00	52.00	21/30	P-49	52.00 52.45
	53.00	50/27	P-50	53.00 53.42
	54.00	50/26	P-51	54.00 54.41
	55.00	50/27	P-52	55.00 55.42
	56.00	50/29	P-53	56.00 56.44
	57.00	50/27	P-54	57.00 57.42
12.11.16 58.00	58.00	50/25	P-55	58.00 58.40
	59.00			
	60.00			
	61.00			

NOTES

Relative density description		Consistency description	
Relative density	SPT N-Value	Consistency	SPT N-Value
Very loose	0 - 4	Very soft	under 2
Loose	4 - 10	Soft	2 - 4
Medium dense	10 - 30	Firm	5 - 8
Dense	30 - 50	Stiff	9 - 15
Very dense	over 50	Very stiff	16 - 30
		Hard	over 30

Sample key

● P-1	Disturbed sample (SPT sample)
▯ T-1	Undisturbed Sample (Piston sampler)
▯ D-1	Undisturbed Sample (Denison sampler)
▯	Rock core sample (Single core tube)
▮	Rock core sample (Double core tube)
▯	Rock core sample (Core Loss)
▮ W-1	Water sample

PBT Permeability Test
VS Vane Shear Test
PMT Pressuremeter Test

RQD (%)	Term
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Planner structure

Term	Spacing (mm)
Very thick	> 2000
Thick	600 - 2000
Medium	200 - 600
Thin	60 - 200
Very thin	20 - 60
Thickly laminated	6 - 20
Thinly laminated	< 6

Discontinuities

Term	Spacing (mm)
Very widely spaced	> 2000
Widely spaced	600 - 2000
Medium spaced	200 - 600
Closely spaced	60 - 200
Very closely spaced	20 - 60
Extremely closely spaced	< 20

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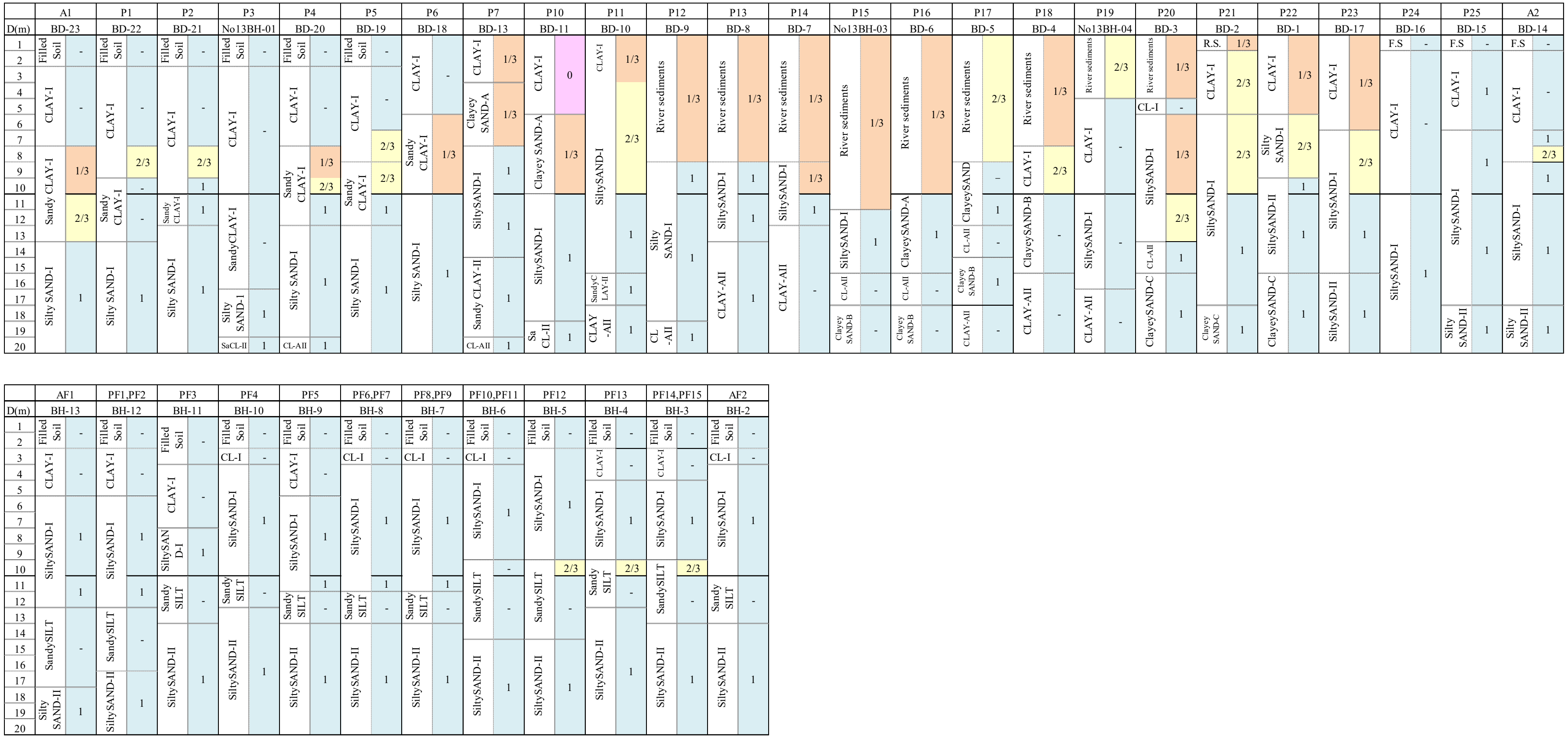
Revision Date	*14.01.2017*

Remarks

Source: JICA Study Team

Figure 4.1.76 Boring log BH-BD-25 (2)



Source: JICA Study Team

Figure 4.1.77 Reduction coefficient by liquefaction

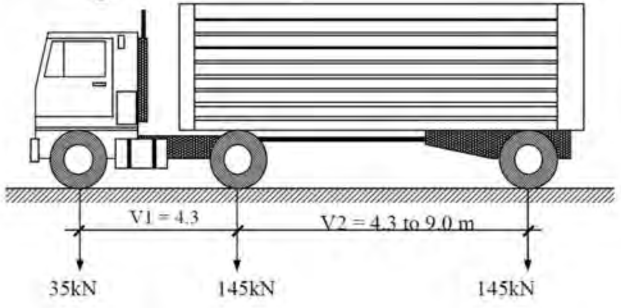
Table 4.1.11 Natural Conditions

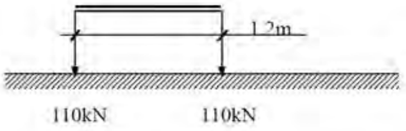
Item	Design Conditions	Remark
Temperature	39.2 to 11.3 (Celsius) at Kaba-Aye metrological station, 1991 to 2015	
Wind speed	42.9 m/s (Cyclone Nargis, 27 April 2008)	
Rainfall amount	149 mm/h (3-year return period, 10-minute rainfall intensity)	

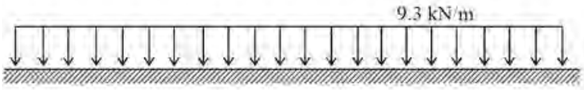
Source: JICA Study Team

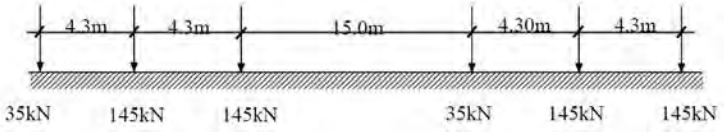
Table 4.1.12 Design Conditions

<table>
<tr><th>Item</th><th>Design Conditions</th><th>Remark</th></tr>
<tr><td>Dead load</td><td>These values are used for unit self-weight of the materials.
<table>
<tr><th>Materials</th><th>Unit Self-weight (kN/m^3)</th></tr>
<tr><td>Steels</td><td>77.0</td></tr>
<tr><td>Cast steel</td><td>71.0</td></tr>
<tr><td>Aluminum</td><td>27.5</td></tr>
<tr><td>Reinforced concrete</td><td>24.5</td></tr>
<tr><td>Prestressed concrete</td><td>24.5</td></tr>
<tr><td>Concrete</td><td>23.0</td></tr>
<tr><td>Mortar, cement</td><td>21.0</td></tr>
<tr><td>Timber</td><td>8.0</td></tr>
<tr><td>Bitumen</td><td>11.0</td></tr>
<tr><td>Asphalt concrete</td><td>22.5</td></tr>
</table></td><td>JSHB 2.2.1</td></tr>
<tr><td>Live load</td><td>1. AASHTO HL-93
Combination of these two different types of loads is considered.
(1) design truck or design tandem
(2) design lane load

(1)-1 Design truck (HS20-44)


(1)-2 Design tandem


(2) Design lane load


(3) Two design trucks for negative moment

</td><td>AASHTO LRFD Bridge design specifications, 3.6.1

3.6.1.3

3.6.1.1</td></tr>
</table>

<table>
<tr>
<td></td>
<td>Types of combination
1) (1)-1 + (2)
2) (1)-2 + (2)
3) (3)×0.9 + (2)×0.9

Multiple presence factor

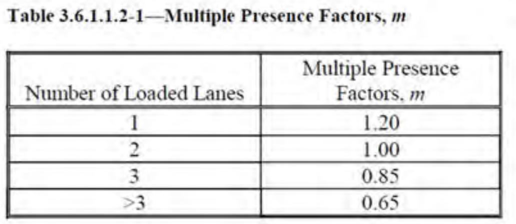
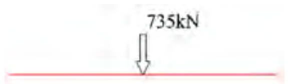
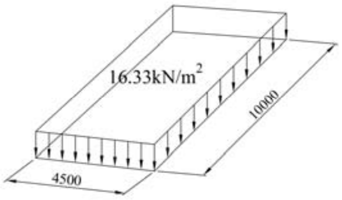
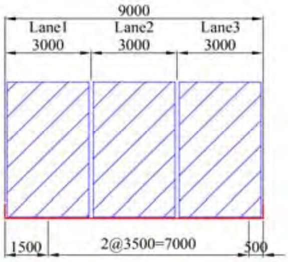
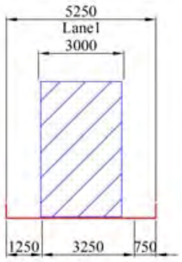



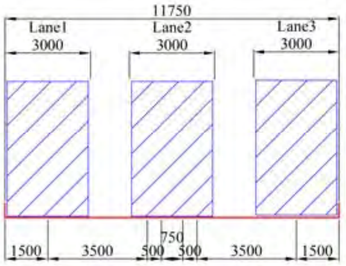
Table 3.6.1.1.2-1—Multiple Presence Factors, *m*
<table>
<tr><th>Number of Loaded Lanes</th><th>Multiple Presence Factors, *m*</th></tr>
<tr><td>1</td><td>1.20</td></tr>
<tr><td>2</td><td>1.00</td></tr>
<tr><td>3</td><td>0.85</td></tr>
<tr><td>>3</td><td>0.65</td></tr>
</table>
Nominal lane width shall be 3.0 m.

2. Special vehicular load (735kN concentrated load or equivalent distribution load) for main girder


(a) Concentrated load


(b) Distribution load</td>
<td>MOC direction</td>
</tr>
<tr>
<td>Design lane</td>
<td>The width of the design lanes should be taken as 3.0m. The number of design lanes should be determined by taking the integer part of the ratio w/3.0, where w is the clear roadway width in feet between curbs and/or barriers.


(a) Main road


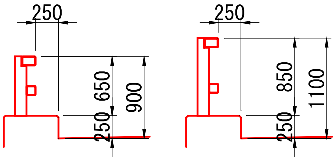
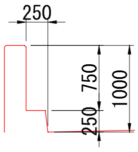
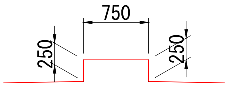
(b) Onramp


(c) Flyover (median is deemed as "clear roadway")</td>
<td>AASHTO 3.6.1.1.1</td>
</tr>
<tr>
<td>Calculation method of inertia force</td>
<td>Calculation method of inertia force shall comply with JSHB.</td>
<td>JSHB V 6.3.2</td>
</tr>
<tr>
<td>Impact coefficient</td>
<td>Equivalent to L-load in JSHB.
Steel bridge i = 20/(50+L)
PC bridge i = 10/(25+L)
Impact coefficients of pylon and cable of the cable-stayed bridge are applied based on the result of experiments.</td>
<td>JSHB I 2.2.3</td>
</tr>
</table>

	pylon: i = 0.15, cable: i = 0.20	
Effect of temperature change	Reference temperature: 25 °C Main structure RC, PC: +10 °C to +40 °C (25 °C ± 15 °C), relative difference between members: 5 °C Steel: +10 °C to +40 °C (25 °C ± 15 °C), relative difference between members: 15 °C Bearings, expansion joints RC, PC: +5 °C to +45 °C (25 °C ± 20 °C) Steel: 0 °C to +50 °C (25 °C ± 25 °C)	
Effect on concrete	Prestressed force, Influence of creep and drying shrinkage shall be considered.	JSHB I 2.2.4, 2.2.5
Wind load	100 mph (44.7 m/s), Basic wind speed in Yangon City (This expression is “3-second gust wind speed”) $U_{10}=U_{max}/G=44.7/1.51=29.6(m/s)$ -> 30.0 (m/s) Here, U_{10}: 10-minutes average wind speed (m/s) U_{max}: 3-second gust wind speed (m/s) G: Gust factor $G=1+k(\sigma/U_{10})=1+3x(7.6/44.7)=1.51$ k: Peak factor, k=3 σ : Standard deviation of wind speed, $\sigma=7.6$	MOC instruction
Flowing water pressure	Flowing water pressure shall be considered.	JSHB I 2.2.7
Hydrodynamic pressure	Hydrodynamic pressure during earthquake shall be considered.	JSHB I 2.2.7
Collision force	Collision force by barge shall be considered.	
Effect of earthquake	Effect of earthquake shall be considered. $k_h = 0.30$ at project site, $k_{hgL0} = 0.24$	

Source: JICA Study Team

Table 4.1.13 Bridge Attachments

Item	Design Conditions	Remark
Railings	Bago River Bridge Steel railing Road side H = 1,100 mm Median side H = 900 mm Design force: more than 130 kJ (Class A) Shapes  Flyover Concrete barrier Roadside H = 1,000 mm Design force: more than 160 kJ (Class Sc) Median side H = 250 mm (raised median)   On-ramp Steel railing H = 900 (same as Bago River Bridge median)	
Noise barrier	Not considered	
Guard fence	Not considered	
Lighting	Considered	
Equipment	Bago River Bridge Water pipe (φ45 cm × 2 lanes) W = 6.0 kN/m 0.7 kN/m^2 for all width is considered as future installation plan Flyover and On-ramp bridge Not installed	YCDC water resources department
Inspection ladder	Bago River Bridge (steel girder) Installation of inspection ladder in steel box girder Flyover, On-ramp bridge, PC girder of Bago River Bridge Not installed	
Drainage	Steel catch pit (manufactured product) will collect surface water. Discharged water will be drained directly to the river where the drainage pipe is on the river, and will be gathered and drained to the channel where the drainage pipe is on land. Design rainfall intensity: 149 mm/h	
Pavement	Steel cable-stayed girder, steel box girder Polymer-modified asphalt pavement, t = 80 mm PC box girder, Flyover Normal asphalt, t = 80 mm	
Waterproofing layer	Install under pavement (liquid coating)	

Source: JICA Study Team