5.3.2. Criteria and Distribution of Bearing Strata

The load bearing capacity of the strata is assessed depending on the importance of the structure and the lateral loads imposed by the structure.

In general, the required bearing capacity for spread or piled foundations of bridge abutment and piers is defined by the following N-values:

Sandy soil.....N > 30
Cohesive soil.....N > 20

And b the case of especially important structure
Sandy soil.....N > 50
Cohesive soil.....N > 50

5.3.3. Soil Value of Quaternary Deposit

Boreholes were drilled at both abutments at all bridge sites except bridge Nos.7, 8, 9 and 10.

Soil suitable as a foundation material for bridge abutment loads is found in the diluvial deposits. These are Greenish brown to dark grey cohesive soil and brownish grey fine sandstone, siltstone and tuff (soft rock).

The top of the cohesive soil stratum is located at a depth from 10 to 20 meters below ground level in Manggarai to Jatinegara and 5 to 20 meters below ground level in Jatinegara to Bekasi. This layer has an SPT blow-count of more than 50.

The diluvium deposit overlays an alluvial fan deposit that consists of red to reddish brown lateritic clay.

The results of the machine boring survey and laboratory soil tests are shown as the geological longitudinal profile. The recommended design based on the soil parameters for use in the project are shown as Table 3.3.5, Table 5.3.3 and Table 5.3.4

Table 5.3.3 Design Soil Parameters

Stratum	Average SPT Blowcount	Wet Density γt (t/m^3)	Cohesion of Initial Condition C (t/m^2)	Internal Angle of Friction Φ (degree)	Coef. of Soil Reaction Km (Kg/cm^3)	Modulus of Deformation E50 (Kg/cm^2)
Ac	2-10	1.66	1.00-3.00	-	1.5-20.0	10.7-115.0
As	10-20	1.70	-	30-33	-	28N
Dc	>50	1.80	30.0	-	-	28N
Ds	>50	1.90	-	40°	-	28N

Note: 1. N-Value: Please see Boring Log and Geological Longitudinal Profile

2 Internal Angle of Friction Φ (degree): Using Peck's Formula ϕ =0.3N+27

3 Cohesion of Initial Condition: Using Terzaghi-Peck's Formula qu=1.25N (t/m^2) C=qu/2(t/m^2) ϕ = 0 (N>10)

Table 5.3.4 (a) Summary of Machine Boring Survey (Stage 2, Manggarai-Jatinegara-Bekasi)

Location	Survey Location					Result of Machine Boring Survey & Test												
	Bridge/Overpass	Location				Boring NO.	Locat. L/R Side	Ground Height (m)	Boring Depth (m)	Thick of Soft Ground (m)	Thickness of Medium to Stiff Soil (m)	Thickness of Soft Rock (m)	Depth from G.Surface to Bearing Strata		Bearing Strata	N-Value of Bearing Strata	Ground Water Level	
		Km AGE	x	y	Height (m)								Depth (m)	Elevation (m)			Elevation (m)	Depth GL-(m)
Ciliwung River	Bridge	0-349.59	4,283.253	-880.638	13.241	BH-1	L/S	13.24	15.15	-	10.00	5.15	10.00	0.24	Tuffaceous Sand	50/18	7.99	-5.25
	Bridge	0-269.03	4,320.805	-953.328	13.550	BH-2	R/S	13.55	13.20	-	8.00	5.20	8.00	5.55	Tuffaceous Silt	60	7.55	-6.00
Manggarai Station	Elevated Structure	0-222.35	4,346.157	-992.766	13.531	BH-3	S/S	13.53	16.45	-	11.20	5.25	11.20	2.33	Silty Sand	50	4.73	-8.80
		0-140.80	4,387.537	-1,063.852	13.590	BH-1'	S/S	13.59	30.00	-	20.00	10.00	20.00	-7.16	Sandy Silt	60	10.59	-3.00
		0-085.98	4,430.025	-1,100.201	13.467	BH-4	S/S	13.47	20.45	-	15.00	5.45	15.00	-1.53	Silty Sand /Silt	50	4.97	-8.50
		0-052.70	4,449.268	-1,127.377	13.501	BH-5	S/S	13.50	20.45	-	15.20	5.25	15.20	-1.70	Sandstone	52	4.30	-9.20
		0-022.58	4,460.661	-1,156.773	13.269	BH-2'	S/S	13.27	25.23	-	13.15	12.08	13.15	1.19	Silty Clay	62	9.27	-4.00
		0-001.42	4,484.809	-1,168.329	13.527	BH-6	S/S	13.53	20.45	-	12.15	8.30	12.15	1.38	Tuff	60	5.08	-8.45
		0+116.75	4,570.047	-1,247.441	13.453	BH-7	S/S	13.45	15.45	-	10.00	5.45	10.00	3.45	Silty Sand	50	9.45	-4.00
		0+218.17	4,587.446	-1,362.670	13.397	BH-8	S/S	13.40	18.45	-	10.00	8.45	10.00	3.40	Sandy Silt	52	7.65	-5.75
		0+288.72	4,652.287	-1,401.955	13.490	BH-9	S/S	13.49	20.25	-	14.00	6.25	14.00	-0.51	Tuff	51	6.74	-6.75
		0+348.39	4,727.418	-1,419.536	13.364	BH-10	N/S	13.36	18.24	-	14.15	4.09	14.15	-0.79	Silty Sand	52	7.96	-5.40
		0+494.41	4,821.504	-1,527.329	12.802	BH-11	N/S	12.80	25.38	-	11.15	14.23	11.15	1.65	Silty Sand	52	8.00	-4.80
		0+560.31	4,855.355	-1,590.443	10.616	BH-12	S/S	10.62	22.85	-	16.70	6.15	16.70	-6.18	Silty Sand	74	6.12	-4.50
		0+613.38	4,915.059	-1,589.333	12.040	BH-13	N/S	12.04	13.77	1.50	8.15	4.12	9.65	2.39	Silty Sand	58	8.84	-3.20
		0+652.87	4,945.329	-1,621.576	11.659	BH-14	S/S	11.66	20.92	2.60	7.40	10.92	10.00	1.66	Silty Sand	70	8.26	-3.40
		0+672.47	4,966.274	-1,627.823	9.949	BH-15	S/S	9.95	20.45	-	7.45	13.00	7.45	2.50	Silty Sand	76	6.65	-3.30
		0+738.66	5,032.965	-1,627.653	12.542	BH-16	S/S	12.54	24.30	-	19.15	5.15	19.15	-6.70	Sandy Silt	50/15	8.50	-4.04
		0+780.90	5,073.399	-1,602.643	13.433	BH-17	N/S	13.43	20.75	-	16.50	4.25	16.50	-3.07	Silty Sand	50/15	7.23	-6.20
		0+830.92	5,124.170	-1,605.930	14.421	BH-18	S/S	14.42	19.30	-	14.00	5.30	14.00	0.42	Silty Sand	50/15	7.36	-7.06
		0+969.49	5,253.167	-1,559.256	12.843	BH-19	S/S	12.84	25.00	3.50	13.50	8.00	17.00	-4.16	Clay	60	9.34	-3.50
Ciliwung River	Bridge	1+113.94	5,387.714	-1,501.784	10.777	BH-20	L/S	10.78	30.00	7.45	7.75	14.80	15.20	-4.42	Sandy Clay	58	7.78	-3.00
	Bridge	1+170.10	5,440.359	-1,481.113	10.594	BH-21	R/S	10.59	30.00	5.45	10.55	14.00	16.00	-5.41	Claystone	64	7.44	-3.15
	Bridge	1+110.90	5,371.844	-1,472.231	10.928	BH-22	L/S	10.93	30.00	4.15	13.00	12.85	17.15	-6.20	Sandstone	64	7.93	-3.00
	Bridge	1+170.43	5,430.909	-1,457.715	10.799	BH-23	R/S	10.80	30.00	2.00	14.15	13.85	16.15	-5.35	Sandstone	61	8.30	-2.50
TOTAL																		
					25				546.49	26.65	312.30	207.54						

L/S: Left Side, R/S: Right Side,
N/S: North Side, S/S: South Side,

Table 5.3.4 (b) Summary of Machine Boring Survey (Stage 2, Manggarai-Jatinegara-Bekasi)

Location	Survey Location					Result of Machine Boring Survey & Test												
	Bridge/Overpass	Location				Boring NO.	Locat. L/R Side	Ground Height (m)	Boring Depth (m)	Thick. of soft Ground (m)	Thickness of Medium to Stiff Soil (m)	Thickness of Soft Rock (m)	Depth from G.Surface to Bearing Strata		Bearing Strata	N-Value of Bearing Strata	Ground Water Level	
		Km AGE	x	y	Height (m)								Depth (m)	Elevation (m)			Elevation (m)	Depth GL-(m)
Matraman Station	Elevated Structure	1+307.84	5,566.285	-1,426.386	13.699	BH-24	S/S	13.70	25.00	-	15.30	9.70	15.30	-1.60	Sandatone	66/15	9.70	-4.00
		1+430.63	5,663.634	-1,341.683	15.586	BH-25	N/S	15.59	25.00	-	14.15	10.85	14.15	1.44	Sandy Clay	65	9.59	-6.00
		1+491.38	4,735.405	-1,481.511	16.611	BH-26	S/S	16.61	22.00	-	13.45	8.55	13.45	3.16	Sand	62	11.91	-4.70
		1+590.98	5,817.670	-1,291.424	15.874	BH-27	N/S	15.87	25.15	-	10.15	15.00	10.15	5.72	Sand/Sandy Clay	50	13.37	-2.50
		1+711.56	5,940.498	-1,314.218	14.378	BH-28	S/S	14.38	25.15	-	14.00	11.15	14.00	0.38	Gravelly Sand	60	9.88	-4.50
Jatinegara Station	Elevated Structure	1+811.10	6,029.778	-1,352.782	16.717	BH-29	S/S	16.72	25.30	-	17.15	8.15	17.15	-0.43	Sand	50	11.72	-5.00
		1+782.91	6,024.433	-1,300.878	15.988	BH-30	N/S	15.99	25.15	-	17.15	8.00	17.15	-1.16	Sand/Sandy Clay	52	9.49	-6.50
		1+899.99	6,114.647	-1,385.625	15.571	BH-31	N/S	15.71	25.15	-	17.15	8.00	17.15	-1.44	Sand	60	9.71	-6.00
		1+994.08	6,183.676	-1,451.696	15.864	BH-32	N/S	15.86	19.15	-	11.15	8.00	11.15	4.71	Sand	50	9.86	-6.00
		2+097.18	6,262.295	-1,518.568	15.334	BH-33	N/S	15.33	24.12	-	13.15	10.97	13.15	2.18	Gravelly Sand	55	7.83	-7.50
		2+375.55	6,417.387	-1,631.495	15.341	BH-34	N/S	15.34	29.12	-	13.00	16.12	13.00	2.34	Sand	50	9.84	-5.50
		2+869.11	6,878.932	-1,659.945	15.625	BH-35	N/S	15.63	23.10	-	9.15	13.95	9.15	6.40	Silty Clay	50	12.13	-3.50
Cipinang Station	Building	12+895.68	7,899.076	-1,552.686	15.557	BH-36	N/S	15.56	25.00	-	16.45	8.55	16.45	-0.89	Sandstome	65	12.06	-3.50
		13+189.89	8,192.823	-1,530.189	14.901	BH-37	N/S	14.90	25.00	2.20	13.95	8.85	16.15	-1.25	Sandstome	62	11.45	-3.45
		13+490.89	8,495.111	-1,474.551	16.346	BH-38	N/S	16.35	25.00	-	17.15	7.85	17.15	-0.80	Sandstome	64/15	11.35	-5.00
		13+739.25	8,735.932	-1,529.485	13.465	BH-39	N/S	13.47	25.00	-	11.15	13.85	11.15	2.32	Sandstome	61/15	10.02	-3.45
Cipinang River	Bridge NO.67A	14+199.49	9,193.018	-1,466.988	8.792	BH-40	L/S	8.79	30.00	1.00	7.40	21.60	8.40	0.39	Silt	60	7.54	-1.25
		14+234.10	9,225.050	-1,467.561	8.592	BH-41	R/S	8.59	30.00	1.00	7.15	21.85	8.15	0.44	Silt	65/15	7.09	-1.50
Sunter River	Bridge NO.68	14+571.49	9,565.786	-1,472.475	8.432	BH-42	L/S	8.43	30.00	1.00	5.00	24.00	6.00	2.43	Claystone	60/15	6.93	-1.50
		14+597.43	9,591.461	-1,470.961	8.156	BH-43	R/S	8.17	30.00	-	5.40	24.60	5.40	2.77	Sandstome	61	6.97	-1.20
Klender Station	Overpass	15+089.30	10,083.053	-1,477.615	10.684	BH-44	N/S	10.68	25.45	-	11.15	14.30	11.15	-0.47	Siltysand	60	8.88	-1.80
	Small River Br.	16+149.07	11,141.729	-1,545.691	8.280	BH-45	N/S	8.28	25.40	-	3.15	22.25	3.15	5.13	Sandstome	60/15	7.28	-1.00
	Embankment	16+764.05	11,751.054	-1,628.513	9.315	BH-46	N/S	9.32	25.45	-	6.45	19.00	6.45	2.87	Sand stone	59	6.32	-3.00
Buarang Station	Overpass	17+612.62	12,592.397	-1,737.608	12.504	BH-47	N/S	12.50	25.40	-	11.45	13.95	11.45	1.05	Gravelly Sand	58	9.00	-3.50
Buarang River	Bridge NO.80	17+785.03	12,764.608	-1,750.950	8.636	BH-48	L/S	8.64	30.25	-	6.00	24.25	6.00	2.64	Gravelly Sand	50	6.64	-2.00
TOTAL					25				645.34	5.20	286.80	353.34						

L/S: Left Side, R/S: Right Side,
N/S: North Side, S/S: South Side,

Table 5.3.4 (c) Summary of Machine Boring Survey (Stage 2, Maggarai-Jatinegara-Bekasi)

Location	Survey Location					Result of Machine Boring Survey & Test												
	Bridge/Overpass	Location				Boring NO.	Locat. L/R Side	Ground Height (m)	Boring Depth (m)	Thick. of Soft Ground (m)	Thickness of Medium to Stiff Soil (m)	Thickness of Soft Rock (m)	Depth from G.Surface to Bearing Strata		Bearing Strata	N-Value of Bearing Strata	Ground Water Level	
		Km AGE	x	y	Height (m)								Depth (m)	Elevation (m)			Elevation (m)	Depth GL-(m)
Buarang River	Bridge NO.80	17+820.96	12,800.036	-1,756.006	8.402	BH-49	R/S	8.40	30.45	-	5.00	25.45	5.00	3.40	Sandstone	45-55	6.40	-2.00
	Embankment	18+927.43	13,898.152	-1,893.031	7.348	BH-50	N/S	7.35	25.45	-	7.00	18.45	7.00	0.35	Sandstone	68/15	5.85	-1.50
		19+056.57	14,027.337	-1,900.732	8.105	BH-51	N/S	8.11	25.15	3.50	3.50	18.15	7.15	0.96	Sandstone	51	6.11	-2.00
Klender Baru	Overpass	19+507.95	14,475.691	-1,953.528	10.926	BH-52	N/S	10.93	25.00	-	13.00	12.00	13.00	-2.07	Sandstone	40/15	5.93	-5.00
Bulakjaya	Embankment	19+902.92	14,867.584	-2,004.145	7.571	BH-53	N/S	7.57	25.42	3.00	9.00	13.42	12.00	-4.43	Sandstone	60/15	6.37	-1.20
Cakung Station	Overpass	20+850.88	15,803.717	-2,159.679	12.219	BH-54	S/S	12.22	25.15	-	14.65	10.50	14.65	-2.43	Sandyclay	60	8.82	-3.40
		21+189.68	16,144.336	-2,162.672	10.297	BH-55	N/S	10.30	25.00	-	4.00	21.00	4.00	6.30	Sandstone	110	8.30	-2.00
		21+628.95	16,581.413	-2,209.608	8.172	BH-56	N/S	8.17	25.13	-	4.00	21.13	4.00	4.17	Sandstone	60	6.37	-1.80
Cakung to	Embankment	21+680.35	16,632.907	-2,211.862	7.903	BH-57	N/S	7.90	25.15	-	4.00	21.15	4.00	3.90	Sandstone	60	6.40	-1.50
Kranji Station		21+805.03	16,757.090	-2,224.567	7.801	BH-58	N/S	7.80	25.13	-	6.50	18.63	6.50	1.30	Sandstone	60	6.50	-1.30
		21+933.56	16,884.620	-2,239.629	8.052	BH-74	N/S	8.05	25.10	-	7.45	17.65	7.45	0.60	Sandstone	60/15	6.45	-1.60
	River Bridge	22+908.69	17,851.913	-2,363.374	10.884	BH-59	L/S	10.88	30.27	-	7.00	23.27	7.00	3.88	Claystone	60	9.38	-1.50
	NO.110	22+922.73	17,866.666	-2,358.468	10.195	BH-60	R/S	10.20	30.27	-	6.00	24.27	6.00	4.20	Claystone	100/20	8.90	-1.30
Kranji Station	Overpass	23+908.48	18,794.989	-2,660.024	18.274	BH-61	N/S	18.27	25.12	-	15.15	9.97	15.15	3.12	Claystone	50	7.27	-11.00
	Bridge NO.117	24+122.96	18,951.980	-2,813.532	18.671	BH-62	L/S	18.67	30.00	-	18.15	11.85	18.15	0.52	Sand	70/25	11.67	-7.00
Kranji to		24+159.99	18,986.577	-2,828.112	17.743	BH-63	R/S	17.74	30.00	-	21.15	8.85	21.15	-3.40	Sand	60/25	11.24	-6.50
Bekasi Station	Box Culvert	25+117.14	19,819.001	-3,301.779	15.694	BH-64	N/S	15.69	25.25	-	15.15	10.10	15.15	0.54	Sandyclay	65	14.59	-1.10
Subtotal					17				453.04	6.50	160.70	285.84						
Total (Stage 2)	(a+b+c)				67				1644.87	38.35	759.80	846.72						
Total (Stage 1)					16				435.90	0.00	213.85	222.05						
Grand Total					83				2,080.77	38.35	973.65	1,068.77						

L/S: Left Side, R/S: Right Side,

N/S: North Side, S/S: South Side,