

Data used to support the findings of the study

1. Raw data for grain size distribution of coarse-grained portion

Grain size (mm)	Percent passing by weight (%)
30	100
20	73.7
10	57.9
5	42.1
2	26.3
0.075	0

2. Raw data for grain size distribution of fine-grained portion

Particle size (mm)	Percent passing by weight (%)
0.075	100
0.057	82.6
0.026	77.1
0.011	68.9
0.006	37.2
0.002	8.2

3. Compaction curves for graded gravel sample with 5% fine contents

Moisture content (%)	Saturation degree (%)	Dry density (g/cm ³)
1.42	17.18	2.24
2.88	39.43	2.29
3.20	47.40	2.32
4.57	76.08	2.36
4.88	89.06	2.39
6.01	97.13	2.35

4. Compaction curves for graded gravel sample with 10% fine contents

Moisture content (%)	Saturation degree (%)	Dry density (g/cm ³)
1.38	19.98	2.31
2.88	47.93	2.36
3.07	56.09	2.39
4.53	98.01	2.44
5.14	93.77	2.39
5.26	99.11	2.40

5. Compaction curves for graded gravel sample with 20% fine contents

Moisture content (%)	Saturation degree (%)	Dry density (g/cm ³)
1.56	19.31	2.25
3.52	50.82	2.31
3.69	56.29	2.33
5.49	88.70	2.35
5.63	96.56	2.37
6.84	94.88	2.30

6. Compaction curves for graded gravel sample with 30% fine contents

Moisture content (%)	Saturation degree (%)	Dry density (g/cm ³)
1.59	18.75	2.23
3.26	39.38	2.24
3.42	42.32	2.25
5.83	77.77	2.28
5.92	76.99	2.27
7.16	84.44	2.23

7. Compaction curves for graded gravel sample with 40% fine contents

Moisture content (%)	Saturation degree (%)	Dry density (g/cm ³)
1.47	12.55	2.08
1.88	16.70	2.10
3.49	35.14	2.16
5.20	58.52	2.21
5.75	66.23	2.22
7.20	86.96	2.24
8.86	93.19	2.18

8. Compaction curves for graded gravel sample with 50% fine contents

Moisture content (%)	Saturation degree (%)	Dry density (g/cm ³)
1.36	7.69	1.85
3.40	26.86	2.04
5.57	48.51	2.09
7.76	74.86	2.14
7.83	78.83	2.16
9.65	82.39	2.08
11.41	90.16	2.04

9. The relationship between S_r-S_{ropt} and ρ_d/ρ_{dmax} for graded gravel samples

5% fine content		10% fine content		20% fine content	
S_r-S_{ropt}	ρ_d/ρ_{dmax}	S_r-S_{ropt}	ρ_d/ρ_{dmax}	S_r-S_{ropt}	ρ_d/ρ_{dmax}
-71.82	0.94	-75.02	0.95	-66.70	0.95
-49.57	0.96	-47.07	0.97	-35.18	0.97
-41.60	0.97	-38.91	0.98	-29.71	0.98
-12.92	0.99	3.01	1.00	2.70	0.99
0.06	1.00	-1.23	0.98	10.56	1.00
8.13	0.99	4.11	0.98	8.88	0.97
30% fine content		40% fine content		50% fine content	
S_r-S_{ropt}	ρ_d/ρ_{dmax}	S_r-S_{ropt}	ρ_d/ρ_{dmax}	S_r-S_{ropt}	ρ_d/ρ_{dmax}
-61.25	0.98	-66.45	0.92	-70.31	0.86
-40.62	0.98	-62.30	0.93	-51.14	0.94
-37.68	0.99	-43.86	0.96	-29.49	0.97
-2.23	1.00	-20.48	0.98	-3.14	0.99
-3.01	1.00	-12.77	0.98	0.83	1.00
4.44	0.98	7.96	0.99	4.39	0.96
/	/	14.19	0.96	12.16	0.94

10. The relationship between deviatoric stress and axial strain for SWC graded gravels under the confining pressure of 20kPa

5% fine content		10% fine content		20% fine content	
Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)
0	0	0	0	0	0
0.1319	27.5287	0.2479	42.2828	0.1326	41.4422
0.3056	89.9982	0.4948	90.4939	0.3057	129.9549
0.4707	149.683	0.7513	157.5572	0.4713	235.6372
0.6369	206.8507	0.9981	239.1454	0.6359	323.3428
0.802	249.2198	1.2461	316.9282	0.8004	368.1182
0.9682	287.1688	1.5015	381.0536	0.8828	377.3107
1.1419	314.7253	1.7494	425.8073	0.9661	375.0265
1.3081	337.7999	1.9973	461.6169	1.3871	347.1929
1.4732	352.2406	2.2442	483.073	1.7986	327.419
1.6383	360.59	2.4675	494.0898	2.2207	319.8257
1.8045	368.7096	2.7229	505.6177	2.6332	319.4217
1.9782	372.8282	2.9719	507.6507	3.02	316.5227
2.0607	370.7266	3.2177	514.3367	3.4411	311.0645
2.4746	368.8137	3.4667	518.76	3.8536	307.8692
2.8638	354.5717	3.721	519.9663	4.2746	309.0608
3.2863	353.0281	3.97	522.7437	4.6871	304.8183
3.7001	352.1022	4.2169	518.4384	5.1082	305.2127

4.1225	341.8908	4.4723	520.4797	5.5207	300.2242
4.5364	337.5064	4.7202	521.1977	5.9075	300.0497
4.9589	329.3053	4.8036	527.2319	6.3296	299.041
5.3717	326.194	4.8859	524.4642	6.7411	296.4372
5.7609	330.5019	5.2738	516.4356	7.1621	302.059
6.1833	323.9725	5.6948	498.6959	7.5746	296.003
6.5972	330.408	6.1073	486.7802	7.9957	293.9045
7.0196	335.7147	6.5262	473.2231	8.4082	293.3818
7.4335	339.8576	6.9387	471.3135	8.7961	295.8126
7.8559	344.4864	7.3608	467.6737	9.2161	296.9486
8.2708	346.3385	7.7723	458.3133	9.6296	299.054
8.659	340.6953	8.1602	451.558	10.0507	299.0792
9.0803	336.8624	8.5823	443.5153	10.4631	300.3105
9.4953	338.8647	8.9948	444.8215	10.8842	299.2152
9.9167	339.8904	9.4159	432.8688	11.2956	300.8665
10.3305	333.9615	9.8284	427.7925	11.6835	300.4084
10.7529	327.8556	10.2473	418.2746	12.1046	301.9712
11.1668	324.2145	10.6608	411.5105	12.5171	303.0568
11.556	326.832	11.0477	399.5194	12.9381	305.1454
11.9784	320.3566	11.4687	393.3326	13.3506	304.4044
12.3913	318.4574	11.8812	387.5279	13.7717	296.5999
12.8148	314.8352	12.3023	385.6226	14.1842	301.1759
13.2286	312.7715	12.7158	384.196	14.5721	301.9917
13.65	308.1362	13.1369	385.6263	14.9921	301.7191
14.0639	307.3122	13.5483	382.3486	/	/
14.453	305.1413	13.9373	385.5343	/	/
14.8755	306.1833	14.3562	383.3614	/	/
14.958	306.1868	14.7687	382.0604	/	/

11. The relationship between deviatoric stress and axial strain for OWC graded gravels under the confining pressure of 20kPa

5% fine content		10% fine content		20% fine content	
Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)
0	0	0	0	0	0
0.1409	76.9718	0.1405	42.7787	0.1329	85.8937
0.3066	132.343	0.3056	111.6701	0.3227	180.2243
0.4723	156.262	0.4707	173.3755	0.4889	215.8999
0.6465	181.9061	0.6369	242.5251	0.654	266.084
0.8133	224.5654	0.8106	384.5965	0.7945	291.5484
0.9789	239.4951	0.9757	443.7796	0.9607	303.2296
1.1457	246.0288	1.1419	474.0711	1.1344	308.0203
1.3124	255.9953	1.307	528.1541	1.3006	314.071

1.4856	268.6248	1.4732	581.8998	1.4657	320.5967
1.6524	272.5213	1.6469	603.1417	1.6308	323.1036
1.8191	276.0452	1.8131	618.2276	1.7144	323.5839
1.9848	272.296	1.9782	625.8737	1.797	321.4155
2.1504	277.9556	2.1433	630.3733	2.2183	317.4523
2.2913	274.6219	2.3095	632.1176	2.6322	309.5831
2.3742	280.2929	2.3674	631.7979	3.0547	305.7785
2.4581	280.0104	2.7898	607.5991	3.4685	295.6516
2.8809	272.1732	3.2026	575.8092	3.8577	289.8248
3.2961	270.5208	3.6251	563.384	4.2802	289.4767
3.7199	267.5206	4.04	527.8687	4.694	276.9424
4.1352	260.5729	4.4614	493.0393	5.1165	272.5821
4.559	256.0683	4.8752	470.5745	5.5303	271.5884
4.9743	249.9805	5.2644	443.464	5.9528	263.687
5.3734	241.3282	5.6858	430.3629	6.3666	260.4854
5.7886	238.6924	6.1007	432.8913	6.7558	262.0059
6.2114	240.2359	6.5221	423.7091	7.1772	255.8246
6.6277	237.1331	6.936	397.0883	7.5922	251.4412
7.0515	230.3355	7.3595	396.4085	8.0135	253.1481
7.4668	232.5104	7.7733	397.9036	8.4284	247.8646
7.8573	222.8576	8.1615	383.8581	8.8498	244.8295
8.28	220.0181	8.5839	385.2437	9.2637	248.0482
8.6953	211.0846	8.9978	383.3103	9.6529	248.5427
9.1191	208.6725	9.4202	376.3067	10.0753	248.4313
9.5344	203.3009	9.8341	360.887	10.4892	247.9226
9.9582	205.8747	10.2555	342.6116	10.9106	257.57
10.3734	209.4321	10.6693	329.4076	11.3255	252.9025
10.7629	205.4878	11.0596	328.959	11.7469	252.4185
11.1878	203.5603	11.481	340.6726	12.1607	254.7587
11.6019	203.0634	11.8948	341.3514	12.5499	249.0575
12.0258	204.1925	12.3173	345.3967	12.9724	248.3381
12.441	208.6556	12.7311	357.9114	13.3862	248.6964
12.8649	204.7688	13.1536	352.5302	13.8087	250.0671
13.2801	206.5696	13.6328	343.4541	14.2225	246.2049
13.6706	208.006	14.0639	349.923	14.6439	251.4592
14.0945	210.3083	14.4777	343.8201	14.9752	249.7886
14.5097	205.9861	14.8916	340.9421	/	/
14.9335	206.5661	14.9495	341.9286	/	/

12. The relationship between deviatoric stress and axial strain for SWC graded gravels under the confining pressure of 40kPa

5% fine content		10% fine content		20% fine content	
Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)
0	0	0	0	0	0
0.1646	40.3124	0.2546	77.7473	0.1319	42.2293
0.3302	129.8246	0.5017	162.6165	0.2981	158.1748
0.5023	228.6958	0.7488	257.8042	0.4718	318.278
0.6679	300.4941	0.9948	347.719	0.6369	447.1615
0.8336	356.8009	1.2494	431.3935	0.8031	514.1288
0.9981	397.5407	1.4965	492.6825	0.9682	533.4834
1.1627	429.8908	1.7447	539.7244	1.1344	536.4387
1.3369	449.7941	1.9982	564.8242	1.2244	534.4553
1.5014	466.8824	2.2453	580.8596	1.6383	519.0157
1.666	476.5958	2.4913	590.7509	2.0532	499.3157
1.8327	485.3227	2.7384	597.4271	2.4746	483.4365
1.915	487.3444	2.9611	599.6895	2.8885	476.566
1.9962	485.3996	3.2156	600.4204	3.2863	464.0824
2.3938	481.6844	3.4627	598.7408	3.7012	461.2124
2.8063	468.32	3.6278	602.8375	4.1225	441.2317
3.2177	450.0567	3.7088	593.8523	4.5364	431.5983
3.6387	431.2087	4.1295	589.606	4.9503	430.3059
4.0512	424.9765	4.5396	576.0627	5.3727	423.9794
4.4712	415.8954	4.9603	569.389	5.7866	420.5998
4.8848	411.1387	5.3715	561.9912	6.1833	413.65
5.2802	414.2089	5.7581	546.8121	6.5972	411.2145
5.6927	417.9708	6.1756	534.5166	7.0196	404.3157
6.1052	397.1692	6.5868	530.8929	7.4335	398.5768
6.5262	394.329	7.0064	522.5812	7.8473	397.635
6.9387	396.0042	7.4176	519.0925	8.2698	391.6778
7.3598	389.5082	7.8372	514.9251	8.6836	389.6297
7.7723	384.1204	8.2484	513.5025	9.0803	385.9181
8.1677	381.6191	8.6361	512.9548	9.4942	385.6201
8.5802	369.1049	9.0547	510.0927	9.9167	376.8404
8.9927	368.6202	9.4669	501.7349	10.3305	373.1159
9.4137	357.5483	9.8844	498.2296	10.7444	369.7657
9.8262	358.0928	10.2966	501.1305	11.1668	364.9986
10.2473	353.8554	10.7152	498.1078	11.5807	362.63
10.6598	352.0791	11.1264	501.3496	11.9784	362.6922
11.0562	353.7334	11.513	492.2695	12.3923	361.5624
11.4698	350.997	11.9327	481.909	12.8148	356.2901

11.8802	342.4395	12.3449	482.7162	13.2286	353.7176
12.3023	340.4277	12.7635	476.3433	13.6425	353.779
12.7148	338.4102	13.1757	473.7423	14.0639	351.7084
13.1347	338.3026	13.5953	474.0714	14.4777	351.3133
13.5473	338.5983	14.0054	462.6828	14.8755	349.8943
13.9437	337.6388	14.3921	467.4442	14.958	348.4305
14.3562	329.4148	14.8106	472.5335	/	/
14.7687	323.5802	14.8927	470.8703	/	/
14.9418	323.2198	/	/	/	/

13. The relationship between deviatoric stress and axial strain for OWC graded gravels under the confining pressure of 40kPa

5% fine content		10% fine content		20% fine content	
Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)
0	0	0	0	0	0
0.142	31.4395	0.1651	40.314	0.1383	59.2312
0.3066	110.2521	0.3313	98.3033	0.3034	129.94
0.4809	160.3905	0.4964	252.7409	0.4782	210.8835
0.6465	239.7271	0.6615	357.4434	0.6433	340.8348
0.8133	268.3324	0.8352	432.2499	0.8084	379.3539
0.98	301.9181	1.0014	491.739	0.9735	398.943
1.1457	313.9609	1.1665	590.3577	1.1397	415.4864
1.3199	337.1608	1.3327	635.8521	1.3134	429.5312
1.4856	348.0489	1.4978	668.5857	1.4796	432.7663
1.6524	359.2471	1.664	703.6847	1.6447	433.694
1.818	360.8824	1.8366	727.3318	1.7273	431.8304
1.9848	370.4205	2.0028	740.8792	2.1165	425.285
2.1257	374.2096	2.169	745.0606	2.5389	408.2171
2.2924	379.2819	2.2527	752.2419	2.9528	401.3418
2.4656	374.3992	2.3342	741.132	3.3741	384.9426
2.6324	373.3657	2.7223	740.592	3.788	376.1405
2.7991	379.9327	3.1458	719.5153	4.2115	368.0034
2.8819	382.3146	3.5586	685.3983	4.6243	365.7854
2.9648	379.6744	3.9821	676.6457	5.0146	361.1922
3.3875	366.1012	4.396	642.2709	5.436	359.921
3.8039	357.1485	4.8173	617.3711	5.8498	353.513
4.2277	357.5679	5.2312	601.7315	6.2722	345.772
4.6419	353.5532	5.6204	578.1389	6.6861	340.7736
5.0334	343.8067	6.0428	566.6998	7.1075	340.6513
5.4562	335.6049	6.4567	566.5608	7.5214	338.3844
5.8714	334.3199	6.8792	548.3457	7.9106	333.9109
6.2953	322.7765	7.293	526.6604	8.333	337.2772

6.7105	309.8871	7.7154	527.6168	8.7479	334.8232
7.1344	313.7134	8.1282	512.0009	9.1693	328.2378
7.5485	300.3403	8.5174	503.7115	9.5832	330.5635
7.9401	297.5761	8.9399	501.1924	10.0056	325.304
8.3629	295.8801	9.3538	478.6303	10.4195	321.847
8.7781	288.5188	9.7762	471.4592	10.8087	325.8979
9.202	280.0293	10.19	469.3792	11.2301	321.1081
9.6172	287.0124	10.6114	465.9468	11.6439	320.8663
10.041	279.2296	11.0253	454.6826	12.0663	324.302
10.4563	277.1645	11.4166	459.6746	12.4802	323.1775
10.8468	283.3341	11.838	437.8413	12.9026	319.4897
11.2706	282.5265	12.2508	435.7418	13.3176	321.325
11.6848	273.8551	12.6732	435.4051	13.7057	313.8659
12.1086	277.4483	13.0871	451.3193	14.1282	308.1718
12.5239	264.3683	13.5096	432.5534	14.542	309.3903
12.9477	257.0761	13.9234	431.8094	14.9645	303.6115
13.3629	265.0442	14.3126	436.0622	/	/
13.7534	265.6838	14.734	432.8892	/	/
14.1773	262.3779	14.9001	435.4555	/	/
14.5925	258.5036	/	/	/	/
15.0163	260.2463	/	/	/	/

14. The relationship between deviatoric stress and axial strain for SWC graded gravels under the confining pressure of 60kPa

5% fine content		10% fine content		20% fine content	
Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)
0	0	0	0	0	0
0.1651	72.6465	0.164	42.9999	0.1315	47.3855
0.3313	177.9024	0.328	93.4698	0.296	174.793
0.4964	283.2252	0.4931	144.6356	0.4702	337.7392
0.6615	369.1364	0.6572	201.4109	0.6348	464.3784
0.8363	441.292	0.8308	271.4718	0.8004	549.8062
1.0014	489.114	0.9948	343.1736	0.965	590.1194
1.1665	520.7874	1.1588	418.8868	1.1306	604.5013
1.3327	548.6287	1.3229	489.7056	1.2129	605.6498
1.4978	567.6061	1.488	556.7365	1.3038	605.0369
1.664	581.6033	1.6605	612.3	1.7162	585.7397
1.8388	592.306	1.8256	661.5524	2.1373	559.6942
2.0028	589.327	1.9897	698.8925	2.5498	544.0539
2.169	593.3031	2.1548	733.3129	2.9366	530.6879
2.2516	598.2244	2.3188	758.8254	3.3577	522.3695
2.3341	597.8697	2.4828	778.0797	3.7702	521.2094

2.7233	591.2728	2.6234	784.4539	4.1912	516.6472
3.1458	573.9257	2.797	791.5133	4.6037	512.7337
3.5596	562.0486	2.878	783.579	5.0258	510.273
3.9821	555.5779	3.2891	783.0034	5.4384	511.2706
4.3959	542.1386	3.7098	770.5749	5.8252	507.2637
4.8184	529.5728	4.121	757.5369	6.2452	506.713
5.2322	527.6053	4.5406	746.6794	6.6577	503.3496
5.6204	517.9544	4.9518	735.4304	7.0787	499.7609
6.0428	487.4229	5.3629	710.2117	7.4912	498.9508
6.4578	486.701	5.757	693.6609	7.9123	495.2333
6.8791	468.9168	6.1682	675.8211	8.3258	495.8873
7.293	459.0071	6.5868	666.0898	8.7127	492.0832
7.7154	455.689	6.9979	656.0936	9.1348	488.244
8.1293	445.0417	7.4176	647.6021	9.5462	480.6751
8.5185	437.1028	7.8298	640.4265	9.9662	478.3047
8.9398	428.0963	8.2409	624.3354	10.3798	476.5178
9.3537	426.2913	8.635	612.4474	10.7997	475.0532
9.7762	427.4686	9.0461	596.7173	11.2122	477.0811
10.19	421.0297	9.4648	587.2729	11.6002	478.1781
10.6125	411.1779	9.8759	583.2375	12.0212	472.8252
11.0263	407.0117	10.2955	573.0729	12.4337	477.9662
11.4155	410.3177	10.7067	566.5152	12.8548	473.0648
11.839	411.7654	11.1178	561.1173	13.2673	478.6901
12.2518	403.8109	11.513	557.4108	13.6883	480.0764
12.6732	396.4032	11.9241	552.814	14.1008	480.4831
13.0871	394.3484	12.3438	543.5657	14.4887	483.8136
13.5095	392.0785	12.7549	533.1627	14.9087	479.6247
13.9234	396.9889	13.1746	526.2848	14.991	480.5843
14.3126	395.9322	13.5857	522.787	/	/
14.735	394.9323	13.9969	521.8205	/	/
14.9001	395.9028	14.391	516.5711	/	/
/	/	14.8021	516.0708	/	/
/	/	14.8841	518.1151	/	/

15. The relationship between deviatoric stress and axial strain for OWC graded gravels under the confining pressure of 60kPa

5% fine content		10% fine content		20% fine content	
Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)	Axial strain (%)	Deviatoric stress (kPa)
0	0	0	0	0	0
0.1651	45.3606	0.1405	50.8657	0.1409	69.06
0.3302	157.0633	0.3056	141.5057	0.3066	183.9525
0.4964	293.1462	0.4707	192.2253	0.4723	256.5216

0.6615	347.6728	0.6369	325.1387	0.639	374.5975
0.8363	388.5886	0.8031	447.0127	0.8133	485.494
1.0014	437.2423	0.9757	539.3575	0.98	536.0141
1.1665	476.9481	1.1419	589.3101	1.1457	550.977
1.3327	496.5737	1.307	702.9304	1.3113	574.5556
1.4978	514.1411	1.4732	756.2795	1.4781	583.5912
1.6715	526.6539	1.6383	784.4459	1.6524	588.2452
1.8377	538.364	1.8131	827.6999	1.7352	585.8058
2.0028	539.0874	1.9782	866.9114	2.1504	571.5081
2.169	547.5549	2.1433	888.444	2.5409	552.4005
2.2516	540.2872	2.3095	895.8401	2.9648	543.5483
2.6397	541.7782	2.3931	910.3517	3.38	522.4808
3.0632	533.141	2.4746	892.1049	3.8039	508.4606
3.476	516.1969	2.8638	898.7291	4.2202	505.0475
3.8995	515.5662	3.2863	879.6357	4.6419	492.9439
4.3123	499.8674	3.7001	849.4428	5.0571	484.2873
4.7347	493.3392	4.1225	842.9016	5.4487	480.6624
5.1486	488.1335	4.5353	803.5444	5.8714	476.4123
5.5378	479.1096	4.9578	779.5865	6.2867	467.3655
5.9592	473.8402	5.3727	777.4245	6.7105	456.9123
6.3741	473.484	5.7609	752.3807	7.1257	466.1956
6.7966	466.0243	6.1833	720.3106	7.5496	460.8272
7.2093	453.8996	6.5972	715.1486	7.9649	455.4844
7.6328	457.0102	7.0196	699.1984	8.3553	463.371
8.0467	444.1117	7.4335	677.9472	8.7781	453.2242
8.4359	435.7917	7.8559	669.5329	9.1934	445.7202
8.8573	435.1469	8.2698	662.6272	9.6172	451.3491
9.2712	424.9493	8.6579	654.5482	10.0324	448.1782
9.6936	416.2954	9.0814	650.1774	10.4563	440.3364
10.1074	411.8087	9.4942	639.8479	10.8715	440.4255
10.5288	413.0794	9.9167	628.0151	11.262	439.306
10.9427	407.8853	10.3305	607.5971	11.6858	430.4769
11.3329	406.2552	10.7529	616.3474	12.1011	433.5437
11.7543	417.3348	11.1668	614.3015	12.5239	434.1226
12.1693	412.4481	11.556	598.8956	12.9391	434.4053
12.5906	408.4911	11.9774	600.4506	13.364	434.6174
13.0045	416.6435	12.3913	590.3058	13.7782	435.4702
13.427	416.1313	12.8137	570.9042	14.1687	436.6816
13.8408	418.4896	13.2275	564.1118	14.5925	431.9681
14.23	428.2903	13.65	553.9316	15.0077	434.2735
14.6514	428.1478	14.0639	544.7034	/	/
14.8175	428.3813	14.453	540.3779	/	/
/	/	14.8755	527.4902	/	/

/	/	14.958	527.0201	/	/
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16. Optimum saturation degree plotted against FC for gravel samples

Group 1		Group 2		Group 3		Group 4	
Fine content (%)	$(S_r)_{opt}$ (%)	Fine content (%)	$(S_r)_{opt}$ (%)	Fine content (%)	$(S_r)_{opt}$ (%)	Fine content (%)	$(S_r)_{opt}$ (%)
5	89	2.5	93	6.4	83	4.0	87
10	95	5.7	95	1.3	70	4.0	86
20	86	8.6	93	17	80	4.0	86
30	80	25	91	17	76	14.2	89
40	79	26	88	4	94	14.2	85
50	78	37	85	9.3	78	14.2	85
/	/	/	/	18.6	73	14.2	83
/	/	/	/	18.7	84	14.2	83
/	/	/	/	8.8	87	14.2	84
/	/	/	/	8.3	76	14.2	84
/	/	/	/	/	/	14.2	85

17. Grain size distribution for five soil types around Miboro dam site

1		2		3	
D(mm)	小于某粒径颗粒含量百分比	D(mm)	小于某粒径颗粒含量百分比	D(mm)	小于某粒径颗粒含量百分比
181.072	80.10	74.482	98.81	120.122	99.17
153.773	77.20	64.001	97.31	96.994	97.20
132.636	74.40	53.725	95.13	72.181	94.92
115.292	71.04	45.098	92.64	55.413	93.16
106.654	68.86	38.896	88.96	44.741	90.41
93.074	66.37	33.419	85.91	39.505	88.65
81.540	63.89	31.520	82.90	37.410	87.62
65.834	60.62	28.373	79.38	35.565	86.68
57.004	57.36	25.940	76.01	32.522	85.70
50.131	54.15	24.847	72.07	26.465	83.73
43.407	50.83	21.266	69.02	21.037	80.00
35.874	48.13	18.702	66.01	16.919	76.74
30.943	45.34	16.704	62.44	14.147	74.09
26.689	42.38	15.154	59.02	12.014	70.98
22.667	40.31	13.694	55.65	9.776	68.08
18.806	37.62	12.327	52.38	8.048	65.13
14.777	34.35	10.758	49.84	6.677	61.87
12.500	31.24	9.498	46.68	5.370	58.76
10.616	29.12	7.879	43.11	4.403	54.72
8.808	26.68	6.823	40.26	3.541	51.30
7.112	24.20	5.977	37.56	2.996	47.98

5.855	21.71	4.845	35.08	2.514	45.23
4.357	19.27	4.083	32.33	2.144	42.44
3.384	17.41	3.335	30.10	1.772	39.17
2.588	15.54	2.778	27.41	1.470	36.53
1.994	13.73	2.323	24.92	1.205	33.63
1.502	12.54	1.935	23.37	0.992	31.14
1.199	10.57	1.532	20.98	0.839	28.19
0.935	9.64	1.232	18.96	0.673	25.34
0.755	8.50	0.942	17.20	0.560	22.69
0.605	7.46	0.752	15.39	0.461	19.84
0.492	6.99	0.580	13.42	0.365	17.93
0.365	6.11	0.456	12.23	0.304	15.96
0.283	5.08	0.343	10.83	0.251	13.99
0.223	4.72	0.269	9.74	0.190	12.38
0.177	4.35	0.205	8.65	0.141	10.62
0.141	3.94	0.160	7.77	0.105	9.74
0.108	3.58	0.122	7.20	0.078	8.86
0.080	2.69	0.095	6.48	0.059	8.03
0.063	2.33	0.074	5.70	0.044	7.62
0.049	2.07	0.057	5.08	0.033	6.53
0.039	1.61	0.042	4.72	0.024	5.49
0.030	1.66	0.032	4.40	0.017	4.72
0.024	1.66	0.023	3.73	0.012	4.51
0.017	1.24	0.016	3.26	0.009	4.25
0.014	1.24	0.012	3.16	0.007	3.68
0.010	1.19	0.009	2.80	0.005	3.58
0.008	0.93	0.007	2.33	/	/
0.006	0.62	0.005	1.87	/	/
0.005	0.41	/	/	/	/

4		5	
D(mm)	小于某粒径颗粒含量百分比	D(mm)	小于某粒径颗粒含量百分比
50.868	99.80	3.905	99.38
41.719	98.45	3.129	97.61
35.158	96.22	2.567	95.80
29.286	94.62	1.955	93.88
23.925	92.65	1.561	91.39
18.872	89.18	1.171	89.37
15.179	86.33	0.968	86.93
12.448	83.58	0.788	83.97
10.248	80.37	0.664	81.02
8.307	77.32	0.522	77.59

6.866	74.99	0.423	73.81
5.543	71.52	0.355	70.95
4.600	69.44	0.297	67.27
3.891	66.85	0.243	63.38
3.046	64.16	0.212	60.22
2.356	61.26	0.180	56.90
1.903	57.95	0.149	53.32
1.560	55.51	0.132	49.69
1.310	52.77	0.111	45.95
1.017	50.54	0.091	42.63
0.857	47.95	0.079	38.95
0.690	45.62	0.062	35.32
0.570	43.08	0.051	32.83
0.434	40.18	0.045	29.88
0.328	38.06	0.038	27.75
0.255	35.67	0.031	25.31
0.204	33.08	0.026	23.44
0.149	30.86	0.021	21.58
0.108	28.68	0.017	18.83
0.083	27.23	0.012	17.63
0.064	25.78	0.009	15.92
/	/	0.007	14.26
/	/	0.005	12.86
/	/	0.003	11.83
/	/	0.003	10.68

18. Compaction data for soil type 1

1				
w (%)	S_r (%)	ρ_d (g/cm ³)	$S_r - S_{ropt}$	ρ_d / ρ_{dmax}
4.22	22.29	1.765	-70.71	0.910
4.88	24.80	1.741	-68.20	0.898
6.71	35.94	1.773	-57.06	0.914
7.18	41.23	1.813	-51.77	0.935
8.64	52.16	1.842	-40.84	0.949
10.53	65.83	1.861	-27.17	0.959
11.17	75.44	1.903	-17.56	0.981
11.94	85.96	1.937	-7.04	0.998
14.20	96.41	1.906	3.41	0.983
17.23	96.31	1.798	3.31	0.927

19. Compaction data for soil type 2

2				
w (%)	S_r (%)	ρ_d (g/cm ³)	$S_r - S_{ropt}$	ρ_d / ρ_{dmax}

4.11	28.18	1.911	-66.82	0.901
6.31	51.64	2.002	-43.36	0.944
6.75	58.84	2.032	-36.16	0.959
7.42	70.73	2.074	-24.27	0.978
7.89	76.28	2.080	-18.72	0.981
8.73	91.32	2.114	-3.68	0.997
10.16	97.13	2.075	2.13	0.979
11.26	96.67	2.025	1.67	0.955

20. Compaction data for soil type 3

3				
w (%)	S_r (%)	ρ_d (g/cm ³)	$S_r - S_{ropt}$	ρ_d / ρ_{dmax}
7.36	39.05	1.767	-53.95	0.911
9.14	54.59	1.835	-38.41	0.946
10.53	65.87	1.861	-27.13	0.959
11.51	79.12	1.913	-13.88	0.986
12.30	88.77	1.938	-4.23	0.999
13.29	93.90	1.927	0.90	0.993
13.72	91.87	1.898	-1.13	0.979

21. Compaction data for soil type 4

4				
w (%)	S_r (%)	ρ_d (g/cm ³)	$S_r - S_{ropt}$	ρ_d / ρ_{dmax}
6.04	20.34	1.483	-67.66	0.867
7.03	23.83	1.487	-64.17	0.870
9.49	33.34	1.511	-54.66	0.883
11.42	42.07	1.542	-45.93	0.901
14.32	58.69	1.609	-29.31	0.941
15.38	63.91	1.618	-24.09	0.946
15.08	65.68	1.648	-22.32	0.964
16.68	75.20	1.669	-12.80	0.976
17.08	78.32	1.679	-9.68	0.982
18.03	85.92	1.703	-2.08	0.996
18.88	89.25	1.698	1.25	0.993
19.62	88.06	1.666	0.06	0.974
20.47	91.31	1.662	3.31	0.972

22. Compaction data for soil type 5

5				
w (%)	S_r (%)	ρ_d (g/cm ³)	$S_r - S_{ropt}$	ρ_d / ρ_{dmax}
9.74	29.98	1.424	-55.02	0.885
13.80	44.98	1.462	-40.02	0.908
14.36	48.82	1.489	-36.18	0.925

15.92	55.36	1.504	-29.64	0.934
17.75	65.33	1.541	-19.67	0.957
19.60	78.47	1.594	-6.53	0.990
20.60	84.18	1.608	-0.82	0.999
22.11	87.76	1.589	2.76	0.987
22.92	87.20	1.562	2.20	0.970
24.80	89.11	1.525	4.11	0.947

23. Grading curves for core material and sieved core material of Miboro dam site

Raw material		Seived material	
Diameter (mm)	Percent passing by weight (%)	Diameter (mm)	Percent passing by weight (%)
140.13	99.55	4.733	99.90
118.39	97.62	4.402	97.95
88.29	94.38	3.584	92.19
65.60	91.11	2.771	83.89
57.81	89.47	2.143	75.28
39.99	83.29	1.544	65.72
26.00	74.77	1.041	54.88
15.88	65.22	0.713	45.35
9.91	56.31	0.510	36.98
5.34	44.88	0.355	29.88
3.48	37.31	0.245	23.99
1.71	27.00	0.166	20.18
0.79	17.95	0.118	17.20
0.52	13.31	0.069	13.84
0.27	9.15	0.034	11.03
0.15	6.10	0.015	8.26
0.08	4.12	0.008	6.85
0.05	3.67	0.004	6.44
0.03	3.75	/	/

24. Field compaction curves for core material and sieved core material of Miboro dam site

N=16				
w (%)	S_r (%)	ρ_d (g/cm ³)	$S_r - (S_r)_{opt}$	$\rho_d / (\rho_d)_{max}$
7.16	73.28	2.105	-13.72	0.98
7.48	80.42	2.126	-6.58	0.99
7.98	87.46	2.134	0.46	1.00
8.35	90.42	2.129	3.42	0.99
8.61	91.70	2.122	4.70	0.99
N=12				
w (%)	S_r (%)	ρ_d (g/cm ³)	$S_r - (S_r)_{opt}$	$\rho_d / (\rho_d)_{max}$
7.13	64.00	2.046	-22.00	0.97
7.32	65.57	2.045	-20.43	0.97

7.35	66.84	2.052	-19.16	0.97
8.33	84.28	2.100	-1.72	1.00
9.01	90.54	2.097	4.54	0.99
9.08	89.40	2.088	3.40	0.99
9.36	91.33	2.084	5.33	0.99
9.40	88.32	2.067	2.32	0.98
9.90	81.39	2.004	-4.61	0.95
N=8				
<i>w</i> (%)	<i>S_r</i> (%)	ρ_d (g/cm ³)	<i>S_r</i> -(<i>S_r</i>) _{opt}	$\rho_d/(\rho_d)_{max}$
6.93	55.04	1.987	-30.96	0.96
7.22	57.34	1.987	-28.66	0.96
7.52	61.07	1.998	-24.93	0.97
7.89	66.35	2.015	-19.65	0.97
8.34	72.21	2.029	-13.79	0.98
9.09	85.78	2.069	-0.22	1.00
9.36	83.48	2.043	-2.52	0.99
9.67	84.44	2.033	-1.56	0.98

25. Lab compaction curves for core material and sieved core material of Miboro dam site

4.0Ec				
<i>w</i> (%)	<i>S_r</i> (%)	ρ_d (g/cm ³)	<i>S_r</i> -(<i>S_r</i>) _{opt}	$\rho_d/(\rho_d)_{max}$
6.94	40.90	1.828	-42.10	0.92
8.46	56.06	1.893	-26.94	0.96
9.56	68.82	1.937	-14.18	0.98
10.63	81.77	1.971	-1.23	1.00
10.91	84.26	1.973	1.26	1.00
12.33	89.11	1.939	6.11	0.98
13.53	90.66	1.899	7.66	0.96
2.4Ec				
<i>w</i> (%)	<i>S_r</i> (%)	ρ_d (g/cm ³)	<i>S_r</i> -(<i>S_r</i>) _{opt}	$\rho_d/(\rho_d)_{max}$
6.56	35.93	1.786	-47.07	0.93
8.44	50.27	1.834	-32.73	0.95
9.70	62.53	1.878	-20.47	0.97
10.44	70.48	1.903	-12.52	0.99
11.82	84.77	1.935	1.77	1.00
11.97	85.35	1.932	2.35	1.00
13.56	88.71	1.886	5.71	0.98
1.6Ec				
<i>w</i> (%)	<i>S_r</i> (%)	ρ_d (g/cm ³)	<i>S_r</i> -(<i>S_r</i>) _{opt}	$\rho_d/(\rho_d)_{max}$
7.15	36.84	1.750	-47.16	0.92
8.97	51.04	1.808	-32.96	0.95
10.50	64.69	1.853	-19.31	0.97
11.27	73.19	1.882	-10.81	0.99

12.32	84.58	1.912	0.58	1.00
12.40	84.50	1.908	0.50	1.00
13.26	86.58	1.885	2.58	0.99
1.0Ec				
w (%)	S_r (%)	ρ_d (g/cm ³)	$S_r - (S_r)_{opt}$	$\rho_d / (\rho_d)_{max}$
8.93	47.04	1.763	-36.96	0.94
10.45	57.74	1.791	-26.26	0.95
11.20	65.20	1.821	-18.80	0.97
13.14	83.63	1.871	-0.37	1.00
13.43	85.63	1.872	1.63	1.00
14.45	88.55	1.850	4.55	0.98
15.89	91.05	1.812	7.05	0.96
0.6Ec				
w (%)	S_r (%)	ρ_d (g/cm ³)	$S_r - (S_r)_{opt}$	$\rho_d / (\rho_d)_{max}$
8.95	40.75	1.675	-44.25	0.91
10.27	49.84	1.714	-35.16	0.93
12.16	65.15	1.773	-19.85	0.96
13.05	73.62	1.803	-11.38	0.98
14.32	85.44	1.835	0.44	1.00
14.47	85.88	1.832	0.88	1.00
15.91	88.82	1.797	3.82	0.98