

#### 4) Soil Test Result Tables and Graphs for Soil Properties with Depth

a) Reclamation Area (Terminal Area, Access Road Area) and Public Facility Area

















SUMMARY TABLE OF PHYSICO-MECHANICAL PROPERTIES OF SOIL SAMPLES

LACH HUYEN PORT INFRASTRUCTURE CONSTRUCTION PROJECT

No.	Test No.	Layer	Borehole	GL (m)	Sample No.	Depth (m)		Percent passed sieve size (mm)								Natural moisture content w (%)	Atterberg Limits			Bulk density (g/cm <sup>3</sup> )	Specific Gravity	Porosity n (%)	Degree of saturation S <sub>v</sub> (%)	Void ratio e <sub>v</sub>	Initial void ratio e <sub>0</sub>	Consolidation Test (Loading Plan 12.5, 25, 50, 100, 200, 400, 800, 12.5 for the sample of SPT N ≤ 4, and 25, 50, 100, 200, 400, 800, 1600, 25 for the sample of SPT N ≥ 5) Log Average means, for example, test values are 1, 2, 3, then in this case (Log1 + Log2 + Log3) ÷ 3 = Log(1.817) therefore Log average= 1.817)																Unconfined compression test				UU triaxial test (Cell Pressure is 100, 200, 300 for the sample of SPT N ≤ 4, and 100, 200, 300 for the sample of SPT N ≥ 5)		CU triaxial test (Cell Pressure is 50, 100, 200 for the sample of SPT N ≤ 4, and 100, 200, 300 for the sample of SPT N ≥ 5)		Soil group	Description
						GL (m)	D(m)	9.5	4.75	2.00	0.85	0.425	0.25	0.075	< 0.005		Liquid limit W <sub>L</sub> (%)	Plastic limit W <sub>P</sub> (%)	Plasticity index I <sub>p</sub> (%)							Natural	Dry	Void ratio e at ead P KN/m <sup>2</sup>				Cv (Coefficient of Consolidation) at ead P KN/m <sup>2</sup>				mv (Coeff. of Volume Compressibility) at ead P Dp/2 KN/m <sup>2</sup>				Log Average at Load increment 1-2 (10 <sup>-2</sup> / 10 <sup>-3</sup> / 10 <sup>-4</sup> / 10 <sup>-5</sup> / 10 <sup>-6</sup> / 10 <sup>-7</sup> / 10 <sup>-8</sup> / 10 <sup>-9</sup> / 10 <sup>-10</sup> / 10 <sup>-11</sup> / 10 <sup>-12</sup> / 10 <sup>-13</sup> / 10 <sup>-14</sup> / 10 <sup>-15</sup> / 10 <sup>-16</sup> / 10 <sup>-17</sup> / 10 <sup>-18</sup> / 10 <sup>-19</sup> / 10 <sup>-20</sup> / 10 <sup>-21</sup> / 10 <sup>-22</sup> / 10 <sup>-23</sup> / 10 <sup>-24</sup> / 10 <sup>-25</sup> / 10 <sup>-26</sup> / 10 <sup>-27</sup> / 10 <sup>-28</sup> / 10 <sup>-29</sup> / 10 <sup>-30</sup> / 10 <sup>-31</sup> / 10 <sup>-32</sup> / 10 <sup>-33</sup> / 10 <sup>-34</sup> / 10 <sup>-35</sup> / 10 <sup>-36</sup> / 10 <sup>-37</sup> / 10 <sup>-38</sup> / 10 <sup>-39</sup> / 10 <sup>-40</sup> / 10 <sup>-41</sup> / 10 <sup>-42</sup> / 10 <sup>-43</sup> / 10 <sup>-44</sup> / 10 <sup>-45</sup> / 10 <sup>-46</sup> / 10 <sup>-47</sup> / 10 <sup>-48</sup> / 10 <sup>-49</sup> / 10 <sup>-50</sup> / 10 <sup>-51</sup> / 10 <sup>-52</sup> / 10 <sup>-53</sup> / 10 <sup>-54</sup> / 10 <sup>-55</sup> / 10 <sup>-56</sup> / 10 <sup>-57</sup> / 10 <sup>-58</sup> / 10 <sup>-59</sup> / 10 <sup>-60</sup> / 10 <sup>-61</sup> / 10 <sup>-62</sup> / 10 <sup>-63</sup> / 10 <sup>-64</sup> / 10 <sup>-65</sup> / 10 <sup>-66</sup> / 10 <sup>-67</sup> / 10 <sup>-68</sup> / 10 <sup>-69</sup> / 10 <sup>-70</sup> / 10 <sup>-71</sup> / 10 <sup>-72</sup> / 10 <sup>-73</sup> / 10 <sup>-74</sup> / 10 <sup>-75</sup> / 10 <sup>-76</sup> / 10 <sup>-77</sup> / 10 <sup>-78</sup> / 10 <sup>-79</sup> / 10 <sup>-80</sup> / 10 <sup>-81</sup> / 10 <sup>-82</sup> / 10 <sup>-83</sup> / 10 <sup>-84</sup> / 10 <sup>-85</sup> / 10 <sup>-86</sup> / 10 <sup>-87</sup> / 10 <sup>-88</sup> / 10 <sup>-89</sup> / 10 <sup>-90</sup> / 10 <sup>-91</sup> / 10 <sup>-92</sup> / 10 <sup>-93</sup> / 10 <sup>-94</sup> / 10 <sup>-95</sup> / 10 <sup>-96</sup> / 10 <sup>-97</sup> / 10 <sup>-98</sup> / 10 <sup>-99</sup> / 10 <sup>-100</sup> / 10 <sup>-101</sup> / 10 <sup>-102</sup> / 10 <sup>-103</sup> / 10 <sup>-104</sup> / 10 <sup>-105</sup> / 10 <sup>-106</sup> / 10 <sup>-107</sup> / 10 <sup>-108</sup> / 10 <sup>-109</sup> / 10 <sup>-110</sup> / 10 <sup>-111</sup> / 10 <sup>-112</sup> / 10 <sup>-113</sup> / 10 <sup>-114</sup> / 10 <sup>-115</sup> / 10 <sup>-116</sup> / 10 <sup>-117</sup> / 10 <sup>-118</sup> / 10 <sup>-119</sup> / 10 <sup>-120</sup> / 10 <sup>-121</sup> / 10 <sup>-122</sup> / 10 <sup>-123</sup> / 10 <sup>-124</sup> / 10 <sup>-125</sup> / 10 <sup>-126</sup> / 10 <sup>-127</sup> / 10 <sup>-128</sup> / 10 <sup>-129</sup> / 10 <sup>-130</sup> / 10 <sup>-131</sup> / 10 <sup>-132</sup> / 10 <sup>-133</sup> / 10 <sup>-134</sup> / 10 <sup>-135</sup> / 10 <sup>-136</sup> / 10 <sup>-137</sup> / 10 <sup>-138</sup> / 10 <sup>-139</sup> / 10 <sup>-140</sup> / 10 <sup>-141</sup> / 10 <sup>-142</sup> / 10 <sup>-143</sup> / 10 <sup>-144</sup> / 10 <sup>-145</sup> / 10 <sup>-146</sup> / 10 <sup>-147</sup> / 10 <sup>-148</sup> / 10 <sup>-149</sup> / 10 <sup>-150</sup> / 10 <sup>-151</sup> / 10 <sup>-152</sup> / 10 <sup>-153</sup> / 10 <sup>-154</sup> / 10 <sup>-155</sup> / 10 <sup>-156</sup> / 10 <sup>-157</sup> / 10 <sup>-158</sup> / 10 <sup>-159</sup> / 10 <sup>-160</sup> / 10 <sup>-161</sup> / 10 <sup>-162</sup> / 10 <sup>-163</sup> / 10 <sup>-164</sup> / 10 <sup>-165</sup> / 10 <sup>-166</sup> / 10 <sup>-167</sup> / 10 <sup>-168</sup> / 10 <sup>-169</sup> / 10 <sup>-170</sup> / 10 <sup>-171</sup> / 10 <sup>-172</sup> / 10 <sup>-173</sup> / 10 <sup>-174</sup> / 10 <sup>-175</sup> / 10 <sup>-176</sup> / 10 <sup>-177</sup> / 10 <sup>-178</sup> / 10 <sup>-179</sup> / 10 <sup>-180</sup> / 10 <sup>-181</sup> / 10 <sup>-182</sup> / 10 <sup>-183</sup> / 10 <sup>-184</sup> / 10 <sup>-185</sup> / 10 <sup>-186</sup> / 10 <sup>-187</sup> / 10 <sup>-188</sup> / 10 <sup>-189</sup> / 10 <sup>-190</sup> / 10 <sup>-191</sup> / 10 <sup>-192</sup> / 10 <sup>-193</sup> / 10 <sup>-194</sup> / 10 <sup>-195</sup> / 10 <sup>-196</sup> / 10 <sup>-197</sup> / 10 <sup>-198</sup> / 10 <sup>-199</sup> / 10 <sup>-200</sup> / 10 <sup>-201</sup> / 10 <sup>-202</sup> / 10 <sup>-203</sup> / 10 <sup>-204</sup> / 10 <sup>-205</sup> / 10 <sup>-206</sup> / 10 <sup>-207</sup> / 10 <sup>-208</sup> / 10 <sup>-209</sup> / 10 <sup>-210</sup> / 10 <sup>-211</sup> / 10 <sup>-212</sup> / 10 <sup>-213</sup> / 10 <sup>-214</sup> / 10 <sup>-215</sup> / 10 <sup>-216</sup> / 10 <sup>-217</sup> / 10 <sup>-218</sup> / 10 <sup>-219</sup> / 10 <sup>-220</sup> / 10 <sup>-221</sup> / 10 <sup>-222</sup> / 10 <sup>-223</sup> / 10 <sup>-224</sup> / 10 <sup>-225</sup> / 10 <sup>-226</sup> / 10 <sup>-227</sup> / 10 <sup>-228</sup> / 10 <sup>-229</sup> / 10 <sup>-230</sup> / 10 <sup>-231</sup> / 10 <sup>-232</sup> / 10 <sup>-233</sup> / 10 <sup>-234</sup> / 10 <sup>-235</sup> / 10 <sup>-236</sup> / 10 <sup>-237</sup> / 10 <sup>-238</sup> / 10 <sup>-239</sup> / 10 <sup>-240</sup> / 10 <sup>-241</sup> / 10 <sup>-242</sup> / 10 <sup>-243</sup> / 10 <sup>-244</sup> / 10 <sup>-245</sup> / 10 <sup>-246</sup> / 10 <sup>-247</sup> / 10 <sup>-248</sup> / 10 <sup>-249</sup> / 10 <sup>-250</sup> / 10 <sup>-251</sup> / 10 <sup>-252</sup> / 10 <sup>-253</sup> / 10 <sup>-254</sup> / 10 <sup>-255</sup> / 10 <sup>-256</sup> / 10 <sup>-257</sup> / 10 <sup>-258</sup> / 10 <sup>-259</sup> / 10 <sup>-260</sup> / 10 <sup>-261</sup> / 10 <sup>-262</sup> / 10 <sup>-263</sup> / 10 <sup>-264</sup> / 10 <sup>-265</sup> / 10 <sup>-266</sup> / 10 <sup>-267</sup> / 10 <sup>-268</sup> / 10 <sup>-269</sup> / 10 <sup>-270</sup> / 10 <sup>-271</sup> / 10 <sup>-272</sup> / 10 <sup>-273</sup> / 10 <sup>-274</sup> / 10 <sup>-275</sup> / 10 <sup>-276</sup> / 10 <sup>-277</sup> / 10 <sup>-278</sup> / 10 <sup>-279</sup> / 10 <sup>-280</sup> / 10 <sup>-281</sup> / 10 <sup>-282</sup> / 10 <sup>-283</sup> / 10 <sup>-284</sup> / 10 <sup>-285</sup> / 10 <sup>-286</sup> / 10 <sup>-287</sup> / 10 <sup>-288</sup> / 10 <sup>-289</sup> / 10 <sup>-290</sup> / 10 <sup>-291</sup> / 10 <sup>-292</sup> / 10 <sup>-293</sup> / 10 <sup>-294</sup> / 10 <sup>-295</sup> / 10 <sup>-296</sup> / 10 <sup>-297</sup> / 10 <sup>-298</sup> / 10 <sup>-299</sup> / 10 <sup>-300</sup> / 10 <sup>-301</sup> / 10 <sup>-302</sup> / 10 <sup>-303</sup> / 10 <sup>-304</sup> / 10 <sup>-305</sup> / 10 <sup>-306</sup> / 10 <sup>-307</sup> / 10 <sup>-308</sup> / 10 <sup>-309</sup> / 10 <sup>-310</sup> / 10 <sup>-311</sup> / 10 <sup>-312</sup> / 10 <sup>-313</sup> / 10 <sup>-314</sup> / 10 <sup>-315</sup> / 10 <sup>-316</sup> / 10 <sup>-317</sup> / 10 <sup>-318</sup> / 10 <sup>-319</sup> / 10 <sup>-320</sup> / 10 <sup>-321</sup> / 10 <sup>-322</sup> / 10 <sup>-323</sup> / 10 <sup>-324</sup> / 10 <sup>-325</sup> / 10 <sup>-326</sup> / 10 <sup>-327</sup> / 10 <sup>-328</sup> / 10 <sup>-329</sup> / 10 <sup>-330</sup> / 10 <sup>-331</sup> / 10 <sup>-332</sup> / 10 <sup>-333</sup> / 10 <sup>-334</sup> / 10 <sup>-335</sup> / 10 <sup>-336</sup> / 10 <sup>-337</sup> / 10 <sup>-338</sup> / 10 <sup>-339</sup> / 10 <sup>-340</sup> / 10 <sup>-341</sup> / 10 <sup>-342</sup> / 10 <sup>-343</sup> / 10 <sup>-344</sup> / 10 <sup>-345</sup> / 10 <sup>-346</sup> / 10 <sup>-347</sup> / 10 <sup>-348</sup> / 10 <sup>-349</sup> / 10 <sup>-350</sup> / 10 <sup>-351</sup> / 10 <sup>-352</sup> / 10 <sup>-353</sup> / 10 <sup>-354</sup> / 10 <sup>-355</sup> / 10 <sup>-356</sup> / 10 <sup>-357</sup> / 10 <sup>-358</sup> / 10 <sup>-359</sup> / 10 <sup>-360</sup> / 10 <sup>-361</sup> / 10 <sup>-362</sup> / 10 <sup>-363</sup> / 10 <sup>-364</sup> / 10 <sup>-365</sup> / 10 <sup>-366</sup> / 10 <sup>-367</sup> / 10 <sup>-368</sup> / 10 <sup>-369</sup> / 10 <sup>-370</sup> / 10 <sup>-371</sup> / 10 <sup>-372</sup> / 10 <sup>-373</sup> / 10 <sup>-374</sup> / 10 <sup>-375</sup> / 10 <sup>-376</sup> / 10 <sup>-377</sup> / 10 <sup>-378</sup> / 10 <sup>-379</sup> / 10 <sup>-380</sup> / 10 <sup>-381</sup> / 10 <sup>-382</sup> / 10 <sup>-383</sup> / 10 <sup>-384</sup> / 10 <sup>-385</sup> / 10 <sup>-386</sup> / 10 <sup>-387</sup> / 10 <sup>-388</sup> / 10 <sup>-389</sup> / 10 <sup>-390</sup> / 10 <sup>-391</sup> / 10 <sup>-392</sup> / 10 <sup>-393</sup> / 10 <sup>-394</sup> / 10 <sup>-395</sup> / 10 <sup>-396</sup> / 10 <sup>-397</sup> / 10 <sup>-398</sup> / 10 <sup>-399</sup> / 10 <sup>-400</sup> / 10 <sup>-401</sup> / 10 <sup>-402</sup> / 10 <sup>-403</sup> / 10 <sup>-404</sup> / 10 <sup>-405</sup> / 10 <sup>-406</sup> / 10 <sup>-407</sup> / 10 <sup>-408</sup> / 10 <sup>-409</sup> / 10 <sup>-410</sup> / 10 <sup>-411</sup> / 10 <sup>-412</sup> / 10 <sup>-413</sup> / 10 <sup>-414</sup> / 10 <sup>-415</sup> / 10 <sup>-416</sup> / 10 <sup>-417</sup> / 10 <sup>-418</sup> / 10 <sup>-419</sup> / 10 <sup>-420</sup> / 10 <sup>-421</sup> / 10 <sup>-422</sup> / 10 <sup>-423</sup> / 10 <sup>-424</sup> / 10 <sup>-425</sup> / 10 <sup>-426</sup> / 10 <sup>-427</sup> / 10 <sup>-428</sup> / 10 <sup>-429</sup> / 10 <sup>-430</sup> / 10 <sup>-431</sup> / 10 <sup>-432</sup> / 10 <sup>-433</sup> / 10 <sup>-434</sup> / 10 <sup>-435</sup> / 10 <sup>-436</sup> / 10 <sup>-437</sup> / 10 <sup>-438</sup> / 10 <sup>-439</sup> / 10 <sup>-440</sup> / 10 <sup>-441</sup> / 10 <sup>-442</sup> / 10 <sup>-443</sup> / 10 <sup>-444</sup> / 10 <sup>-445</sup> / 10 <sup>-446</sup> / 10 <sup>-447</sup> / 10 <sup>-448</sup> / 10 <sup>-449</sup> / 10 <sup>-450</sup> / 10 <sup>-451</sup> / 10 <sup>-452</sup> / 10 <sup>-453</sup> / 10 <sup>-454</sup> / 10 <sup>-455</sup> / 10 <sup>-456</sup> / 10 <sup>-457</sup> / 10 <sup>-458</sup> / 10 <sup>-459</sup> / 10 <sup>-460</sup> / 10 <sup>-461</sup> / 10 <sup>-462</sup> / 10 <sup>-463</sup> / 10 <sup>-464</sup> / 10 <sup>-465</sup> / 10 <sup>-466</sup> / 10 <sup>-467</sup> / 10 <sup>-468</sup> / 10 <sup>-469</sup> / 10 <sup>-470</sup> / 10 <sup>-471</sup> / 10 <sup>-472</sup> / 10 <sup>-473</sup> / 10 <sup>-474</sup> / 10 <sup>-475</sup> / 10 <sup>-476</sup> / 10 <sup>-477</sup> / 10 <sup>-478</sup> / 10 <sup>-479</sup> / 10 <sup>-480</sup> / 10 <sup>-481</sup> / 10 <sup>-482</sup> / 10 <sup>-483</sup> / 10 <sup>-484</sup> / 10 <sup>-485</sup> / 10 <sup>-486</sup> / 10 <sup>-487</sup> / 10 <sup>-488</sup> / 10 <sup>-489</sup> / 10 <sup>-490</sup> / 10 <sup>-491</sup> / 10 <sup>-492</sup> / 10 <sup>-493</sup> / 10 <sup>-494</sup> / 10 <sup>-495</sup> / 10 <sup>-496</sup> / 10 <sup>-497</sup> / 10 <sup>-498</sup> / 10 <sup>-499</sup> / 10 <sup>-500</sup> / 10 <sup>-501</sup> / 10 <sup>-502</sup> / 10 <sup>-503</sup> / 10 <sup>-504</sup> / 10 <sup>-505</sup> / 10 <sup>-506</sup> / 10 <sup>-507</sup> / 10 <sup>-508</sup> / 10 <sup>-509</sup> / 10 <sup>-510</sup> / 10 <sup>-511</sup> / 10 <sup>-512</sup> / 10 <sup>-513</sup> / 10 <sup>-514</sup> / 10 <sup>-515</sup> / 10 <sup>-516</sup> / 10 <sup>-517</sup> / 10 <sup>-518</sup> / 10 <sup>-519</sup> / 10 <sup>-520</sup> / 10 <sup>-521</sup> / 10 <sup>-522</sup> / 10 <sup>-523</sup> / 10 <sup>-524</sup> / 10 <sup>-525</sup> / 10 <sup>-526</sup> / 10 <sup>-527</sup> / 10 <sup>-528</sup> / 10 <sup>-529</sup> / 10 <sup>-530</sup> / 10 <sup>-531</sup> / 10 <sup>-532</sup> / 10 <sup>-533</sup> / 10 <sup>-534</sup> / 10 <sup>-535</sup> / 10 <sup>-536</sup> / 10 <sup>-537</sup> / 10 <sup>-538</sup> / 10 <sup>-539</sup> / 10 <sup>-540</sup> / 10 <sup>-541</sup> / 10 <sup>-542</sup> / 10 <sup>-543</sup> / 10 <sup>-544</sup> / 10 <sup>-545</sup> / 10 <sup>-546</sup> / 10 <sup>-547</sup> / 10 <sup>-548</sup> / 10 <sup>-549</sup> / 10 <sup>-550</sup> / 10 <sup>-551</sup> / 10 <sup>-552</sup> / 10 <sup>-553</sup> / 10 <sup>-554</sup> / 10 <sup>-555</sup> / 10 <sup>-556</sup> / 10 <sup>-557</sup> / 10 <sup>-558</sup> / 10 <sup>-559</sup> / 10 <sup>-560</sup> / 10 <sup>-561</sup> / 10 <sup>-562</sup> / 10 <sup>-563</sup> / 10 <sup>-564</sup> / 10 <sup>-565</sup> / 10 <sup>-566</sup> / 10 <sup>-567</sup> / 10 <sup>-568</sup> / 10 <sup>-569</sup> / 10 <sup>-570</sup> / 10 <sup>-571</sup> / 10 <sup>-572</sup> / 10 <sup>-573</sup> / 10 <sup>-574</sup> / 10 <sup>-575</sup> / 10 <sup>-576</sup> / 10 <sup>-577</sup> / 10 <sup>-578</sup> / 10 <sup>-579</sup> / 10 <sup>-580</sup> / 10 <sup>-581</sup> / 10 <sup>-582</sup> / 10 <sup>-583</sup> / 10 <sup>-584</sup> / 10 <sup>-585</sup> / 10 <sup>-586</sup> / 10 <sup>-587</sup> / 10 <sup>-588</sup> / 10 <sup>-589</sup> / 10 <sup>-590</sup> / 10 <sup>-591</sup> / 10 <sup>-592</sup> / 10 <sup>-593</sup> / 10 <sup>-594</sup> / 10 <sup>-595</sup> / 10 <sup>-596</sup> / 10 <sup>-597</sup> / 10 <sup>-598</sup> / 10 <sup>-599</sup> / 10 <sup>-600</sup> / 10 <sup>-601</sup> / 10 <sup>-602</sup> / 10 <sup>-603</sup> / 10 <sup>-604</sup> / 10 <sup>-605</sup> / 10 <sup>-606</sup> / 10 <sup>-607</sup> / 10 <sup>-608</sup> / 10 <sup>-609</sup> / 10 <sup>-610</sup> / 10 <sup>-611</sup> / 10 <sup>-612</sup> / 10 <sup>-613</sup> / 10 <sup>-614</sup> / 10 <sup>-615</sup> / 10 <sup>-616</sup> / 10 <sup>-617</sup> / 10 <sup>-618</sup> / 10 <sup>-619</sup> / 10 <sup>-620</sup> / 10 <sup>-621</sup> / 10 <sup>-622</sup> / 10 <sup>-623</sup> / 10 <sup>-624</sup> / 10 <sup>-625</sup> / 10 <sup>-626</sup> / 10 <sup>-627</sup> / 10 <sup>-628</sup> / 10 <sup>-629</sup> / 10 <sup>-630</sup> / 10 <sup>-631</sup> / 10 <sup>-632</sup> / 10 <sup>-633</sup> / 10 <sup>-634</sup> / 10 <sup>-635</sup> / 10 <sup>-636</sup> / 10 <sup>-637</sup> / 10 <sup>-638</sup> / 10 <sup>-639</sup> / 10 <sup>-640</sup> / 10 <sup>-641</sup> / 10 <sup>-642</sup> / 10 <sup>-643</sup> / 10 <sup>-644</sup> / 10 <sup>-645</sup> / 10 <sup>-646</sup> / 10 <sup>-647</sup> / 10 <sup>-648</sup> / 10 <sup>-649</sup> / 10 <sup>-650</sup> / 10 <sup>-651</sup> / 10 <sup>-652</sup> / 10 <sup>-653</sup> / 10 <sup>-654</sup> / 10 <sup>-655</sup> / 10 <sup>-656</sup> / 10 <sup>-657</sup> / 10 <sup>-658</sup> / 10 <sup>-659</sup> / 10 <sup>-660</sup> / 10 <sup>-661</sup> / 10 <sup>-662</sup> / 10 <sup>-663</sup> / 10 <sup>-664</sup> / 10 <sup>-665</sup> / 10 <sup>-666</sup> / 10 <sup>-667</sup> / 10 <sup>-668</sup> / 10 <sup>-669</sup> / 10 <sup>-670</sup> / 10 <sup>-671</sup> / 10 <sup>-672</sup> / 10 <sup>-673</sup> / 10 <sup>-674</sup> / 10 <sup>-675</sup> / 10 <sup>-676</sup> / 10 <sup>-677</sup> / 10 <sup>-678</sup> / 10 <sup>-679</sup> / 10 <sup>-680</sup> / 10 <sup>-681</sup> / 10 <sup>-682</sup> / 10 <sup>-683</sup> / 10 <sup>-684</sup> / 10 <sup>-685</sup> / 10 <sup>-686</sup> / 10 <sup>-687</sup> / 10 <sup>-688</sup> / 10 <sup>-689</sup> / 10 <sup>-690</sup> / 10 <sup>-691</sup> / 10 <sup>-692</sup> / 10 <sup>-693</sup> / 10 <sup>-694</sup> / 10 <sup>-695</sup> / 10 <sup>-696</sup> / 10 <sup>-697</sup> / 10 <sup>-698</sup> / 10 <sup>-699</sup> / 10 <sup>-700</sup> / 10 <sup>-701</sup> / 10 <sup>-702</sup> / 10 <sup>-703</sup> / 10 <sup>-704</sup> / 10 <sup>-705</sup> / 10 <sup>-706</sup> / 10 <sup>-707</sup> / 10 <sup>-708</sup> / 10 <sup>-709</sup> / 10 <sup>-710</sup> / 10 <sup>-711</sup> / 10 <sup>-712</sup> / 10 <sup>-713</sup> / 10 <sup>-714</sup> / 10 <sup>-715</sup> / 10 <sup>-716</sup> / 10 <sup>-717</sup> / 10 <sup>-718</sup> / 10 <sup>-719</sup> / 10 <sup>-720</sup> / 10 <sup>-721</sup> / 10 <sup>-722</sup> / 10 <sup>-723</sup> / 10 <sup>-724</sup> / 10 <sup>-725</sup> / 10 <sup>-726</sup> / 10 <sup>-727</sup> / 10 <sup>-728</sup> / 10 <sup>-729</sup> / 10 <sup>-730</sup> / 10 <sup>-731</sup> / 10 <sup>-732</sup> / 10 <sup>-733</sup> / 10 <sup>-734</sup> / 10 <sup>-735</sup> / 10 <sup>-736</sup> / 10 <sup>-737</sup> / 10 <sup>-738</sup> / 10 <sup>-739</sup> / 10 <sup>-740</sup> / 10 <sup>-741</sup> / 10 <sup>-742</sup> / 10 <sup>-743</sup> / 10 <sup>-744</sup> / 10 <sup>-745</sup> / 10 <sup>-746</sup> / 10 <sup>-747</sup> / 10 <sup>-748</sup> / 10 <sup>-749</sup> / 10 <sup>-750</sup> / 10 <sup>-751</sup> / 10 <sup>-752</sup> / 10 <sup>-753</sup> / 10 <sup>-754</sup> / 10 <sup>-755</sup> / 10 <sup>-756</sup> / 10 <sup>-757</sup> / 10 <sup>-758</sup> / 10 <sup>-759</sup> / 10 <sup>-760</sup> / 10 <sup>-761</sup> / 10 <sup>-762</sup> / 10 <sup>-763</sup> / 10 <sup>-764</sup> / 10 <sup>-765</sup> / 10 <sup>-766</sup> / 10 <sup>-767</sup> / 10 <sup>-768</sup> / 10 <sup>-769</sup> / 10 <sup>-770</sup> / 10 <sup>-771</sup> / 10 <sup>-772</sup> / 10 <sup>-773</sup> / 10 <sup>-774</sup> / 10 <sup>-775</sup> / 10 <sup>-776</sup> / 10 <sup>-777</sup> / 10 <sup>-778</sup> / 10 <sup>-779</sup> / 10 <sup>-780</sup> / 10 <sup>-781</sup> / 10 <sup>-782</sup> / 10 <sup>-783</sup> / 10 <sup>-784</sup> / 10 <sup>-785</sup> / 10 <sup>-786</sup> / 10 <sup>-787</sup> / 10 <sup>-788</sup> / 10 <sup>-789</sup> / 10 <sup>-790</sup> / 10 <sup>-791</sup> / 10 <sup>-792</sup> / 10 <sup>-793</sup> / 10 <sup>-794</sup> / 10 <sup>-795</sup> / 10 <sup>-796</sup> / 10 <sup>-797</sup> / 10 <sup>-798</sup> / 10 <sup>-799</sup> / 10 <sup>-800</sup> / 10 <sup>-801</sup> / 10 <sup>-802</sup> / 10 <sup>-803</sup> / 10 <sup>-804</sup> / 10 <sup>-805</sup> / 10 <sup>-806</sup> / 10 <sup>-807</sup> / 10 <sup>-808</sup> / 10 <sup>-809</sup> / 10 <sup>-810</sup> / 10 <sup>-811</sup> / 10 <sup>-812</sup> / 10 <sup>-813</sup> / 10 <sup>-814</sup> / 10 <sup>-815</sup> / 10 <sup>-816</sup> / 10 <sup>-817</sup> / 10 <sup>-818</sup> / 10 <sup>-819</sup> / 10 <sup>-820</sup> / 10 <sup>-821</sup> / 10 <sup>-822</sup> / 10 <sup>-823</sup> / 10 <sup>-824</sup> / 10 <sup>-825</sup> / 10 <sup>-826</sup> / 10 <sup>-827</sup> / 10 <sup>-828</sup> / 10 <sup>-829</sup> / 10 <sup>-830</sup> / 10 <sup>-831</sup> / 10 <sup>-832</sup> / 10 <sup>-833</sup> / 10 <sup>-834</sup> / 10 <sup>-835</sup> / 10 <sup>-836</sup> / 10 <sup>-837</sup> / 10 <sup>-838</sup> / 10 <sup>-839</sup> / 10 <sup>-840</sup> / 10 <sup>-841</sup> / 10 <sup>-842</sup> / 10 <sup>-843</sup> / 10 <sup>-844</sup> / 10 <sup>-845</sup> / 10 <sup>-846</sup> / 10 <sup>-847</sup> / 10 <sup>-848</sup> / 10 <sup>-849</sup> / 10 <sup>-850</sup> / 10 <sup>-851</sup> / 10 <sup>-852</sup> / 10 <sup>-853</sup> / 10 <sup>-854</sup> / 10 <sup>-855</sup> / 10 <sup>-856</sup> / 10 <sup>-857</sup> / 10 <sup>-858</sup> / 10 <sup>-859</sup> / 10 <sup>-860</sup> / 10 <sup>-861</sup> / 10 <sup>-862</sup> / 10 <sup>-863</sup> / 10 <sup>-864</sup> / 10 <sup>-865</sup> / 10 <sup>-866</sup> / 10 <sup>-867</sup> / 10 <sup>-868</sup> / 10 <sup>-869</sup> / 10 <sup>-870</sup> / 10 <sup>-871</sup> / 10 <sup>-872</sup> / 10 <sup>-873</sup> / 10 <sup>-874</sup> / 10 <sup>-875</sup> / 10 <sup>-876</sup> / 10 <sup>-877</sup> / 10 <sup>-878</sup> / 10 <sup>-879</sup> / 10 <sup>-880</sup> / 10 <sup>-881</sup> / 10 <sup>-882</sup> / 10 <sup>-883</sup> / 10 <sup>-884</sup> / 10 <sup>-885</sup> / 10 <sup>-886</sup> / 10											

















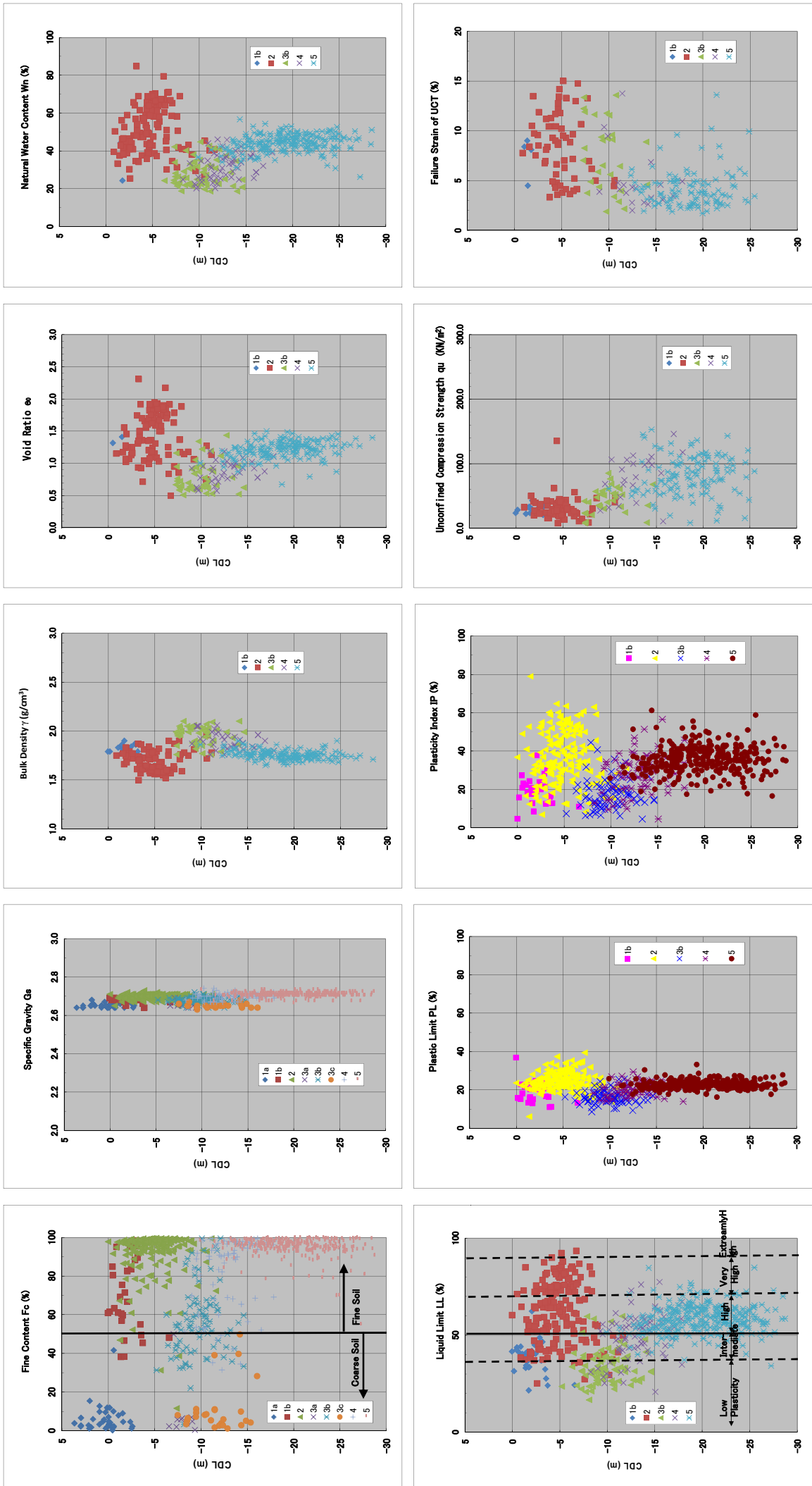




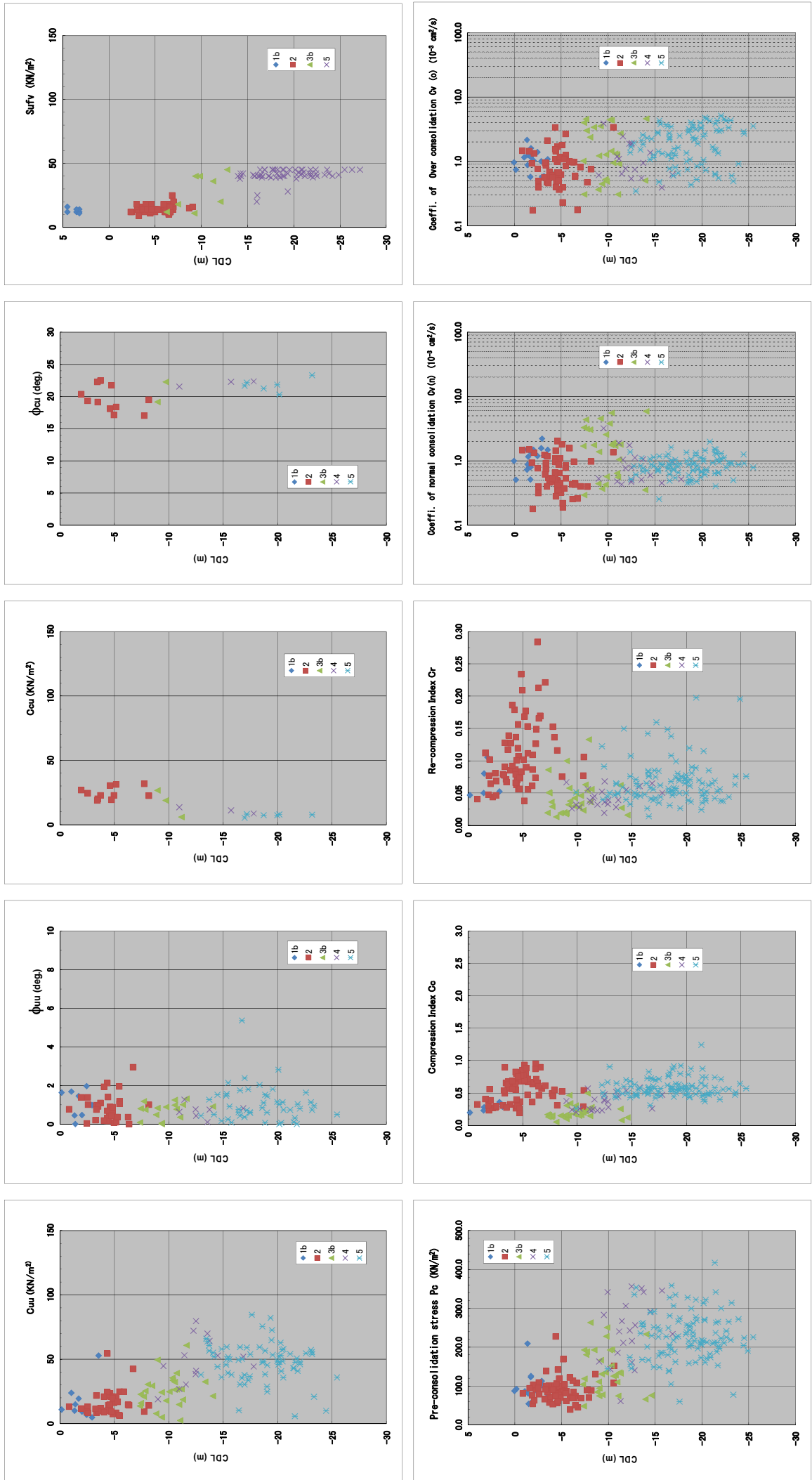




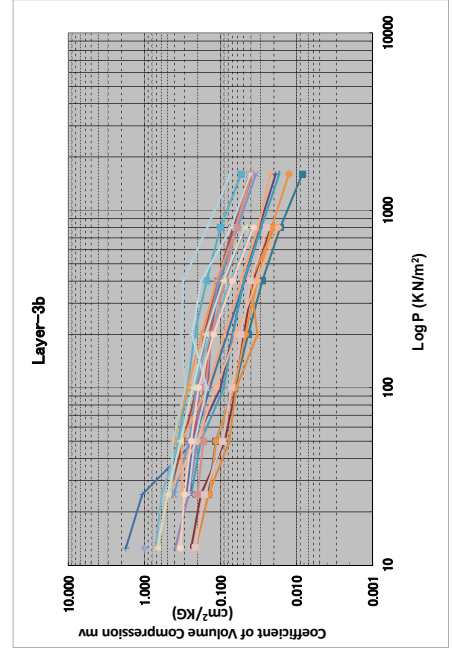
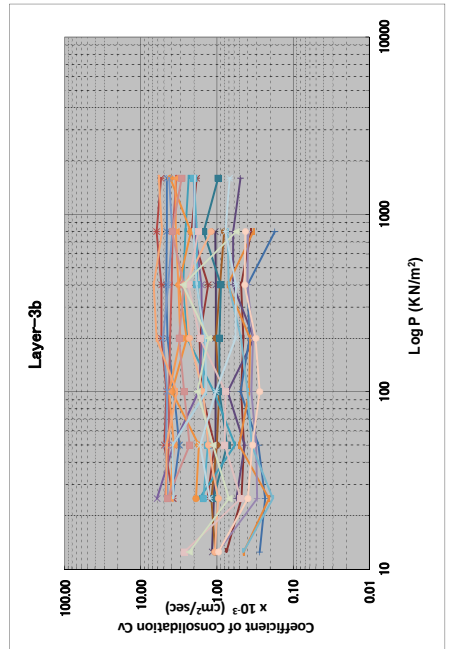
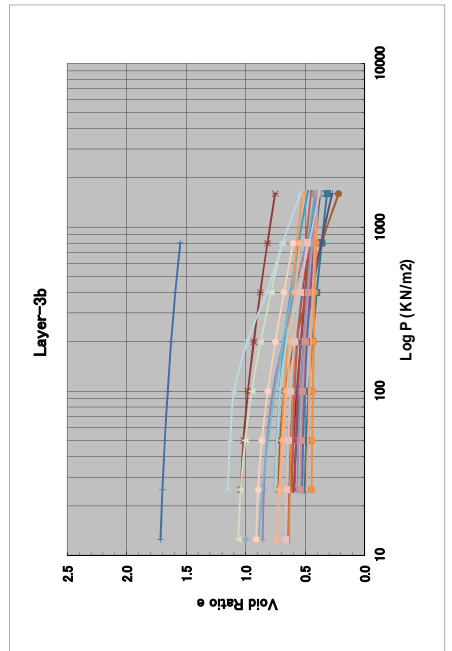
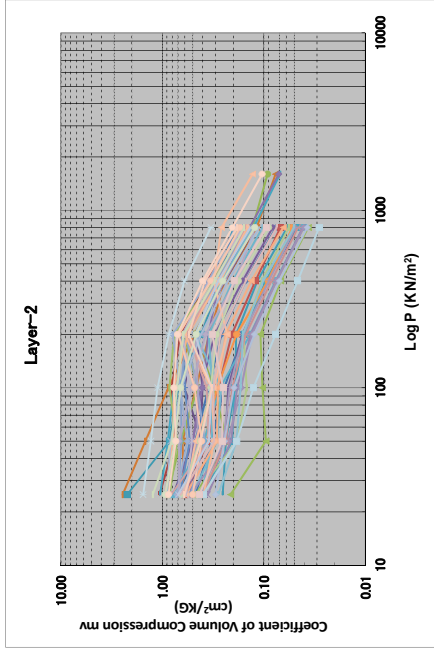
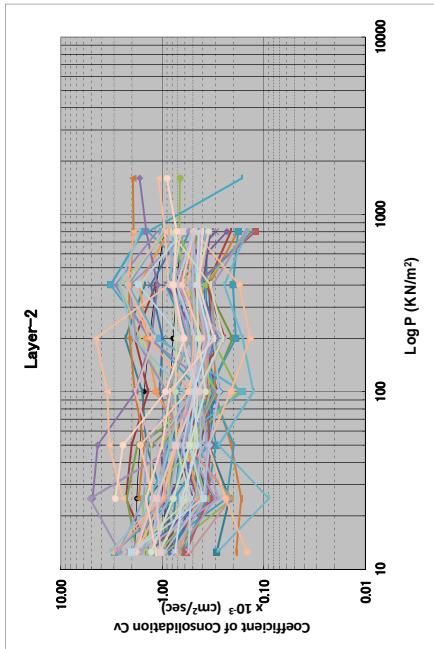
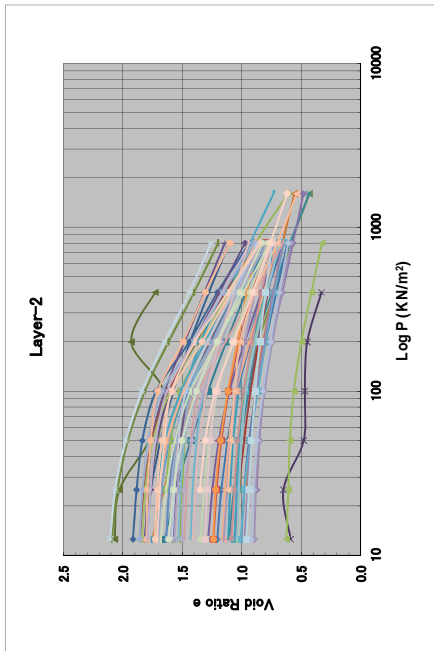
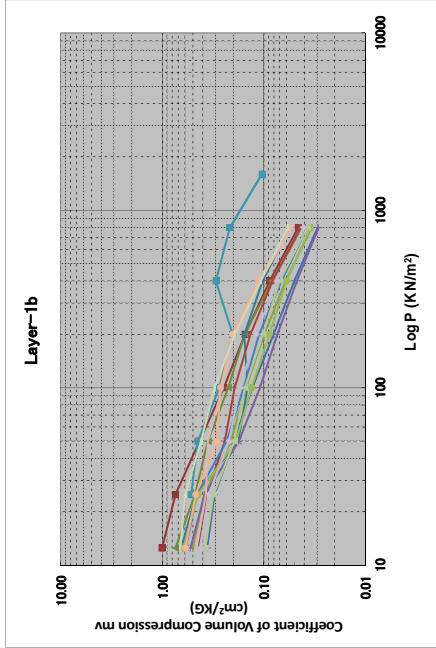
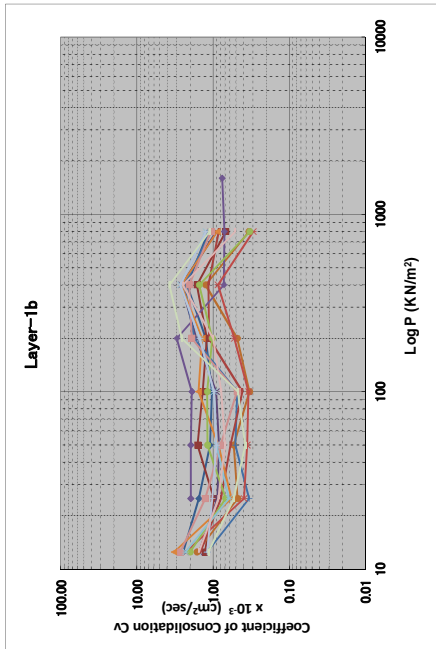
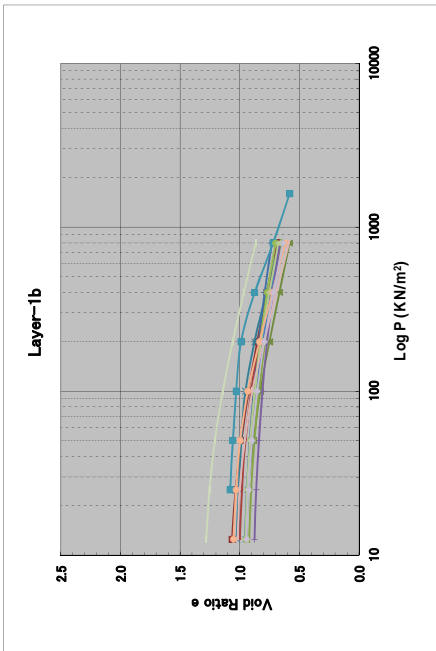
Reclamation Area (Terminal Area, Access Road Area and Public Facility Area)



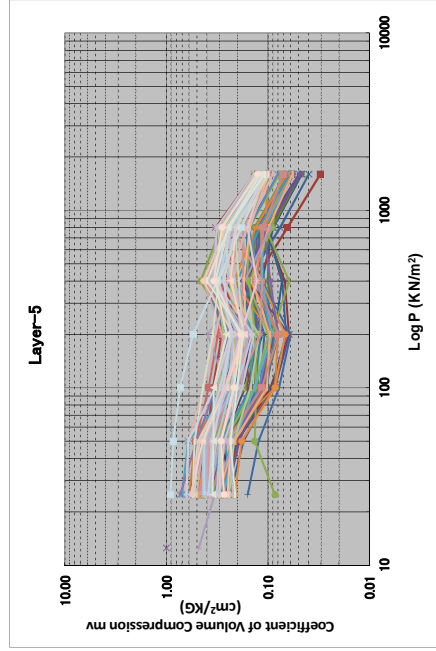
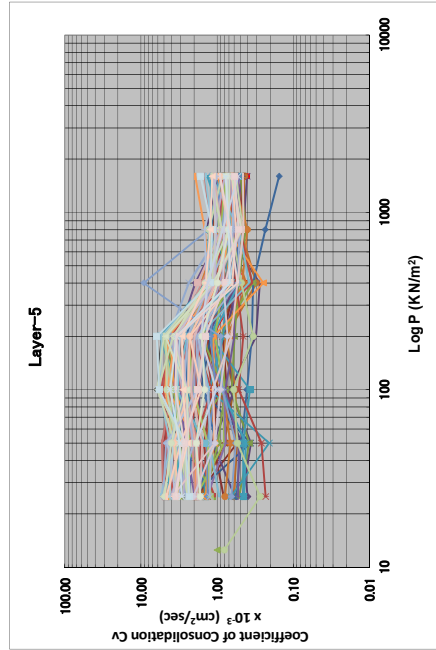
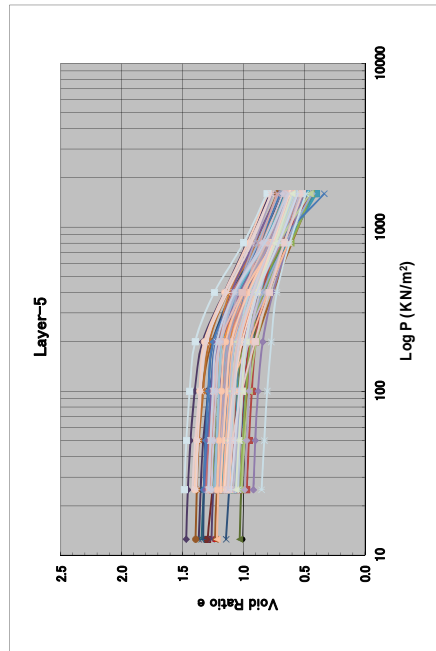
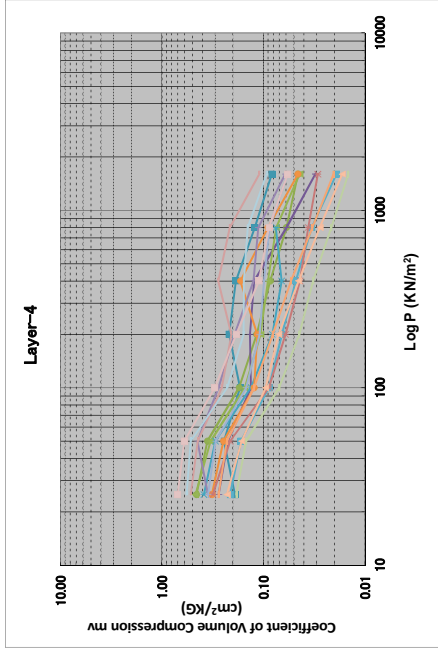
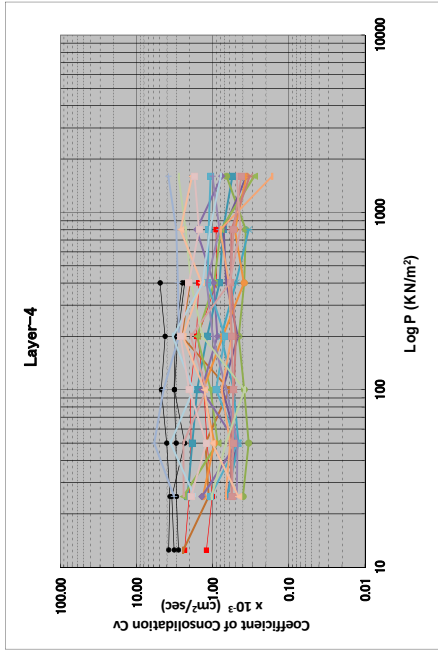
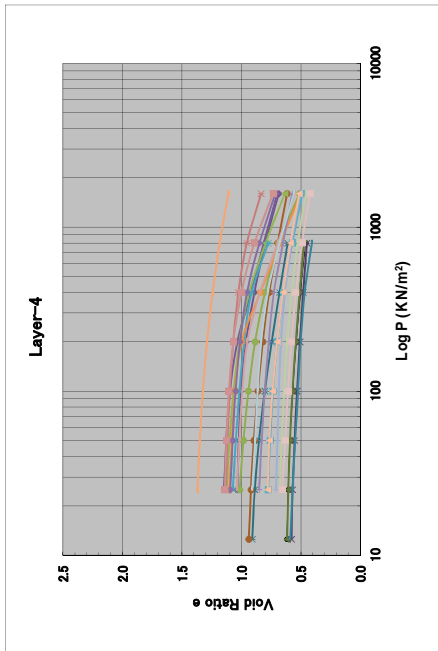
Reclamation Area (Terminal Area, Access Road Area and Public Facility Area)



Reclamation Area (Terminal Area, Access Road Area and Public Facility Area)



Reclamation Area (Terminal Area, Access Road Area and Public Facility Area)





b) Outer Revetment B Area

SUMMARY TABLE OF PHYSICO - MECHANICAL PROPERTIES OF SOIL SAMPLES

Table with columns for Test No., Layer, Borehole, Depth (m), Field Test Result, Percent passed sieve size (mm), Atterberg Limits, Bulk density, Specific Gravity, Degree of saturation, Initial void ratio, Consolidation Test (e, Cv, mv), Unconfined compression test (qu, qc, etc.), and Description. The table contains multiple rows of data for various soil samples, including average values for boreholes O-01 through O-06.



Project: THE DETAILED DESIGN SURVEY ON LACH HUYEN PORT INFRASTRUCTURE CONSTRUCTION IN VIETNAM  
Item: Soil Investigation for Port Portion - Part B  
Volume 2.1: The appendices of Outer Revetment Area  
Date: 27/07/2011

SUMMARY TABLE OF PHYSICO - MECHANICAL PROPERTIES OF SOIL SAMPLES

No	Test No.	Layer	Borehole	GL (m)	Depth (m)	Field Test Result		Percent passed sieve size (mm)										Atterberg Limits			Bulk density (KN/m <sup>3</sup> )	Specific Gravity	Porosity (%)	Degree of saturation (%)	Water content (%)	Initial void ratio	Consolidation Test (Loading Plan 12.5, 25, 50, 100, 200, 400, 800, 12.5 for the sample of SPT N ≤ 4, and 25, 50, 100, 200, 400, 800, 1600, 25 for the sample of SPT N > 5) Log Average means, for example, test values are 1, 2, 3, then in this case (Log1 + Log2 + Log3)/3 = Log(1.817) therefore Log average= 1.817)																								Unconfined compression test	UU triaxial test (Cell Pressure is 50, 100, 200 for the sample of SPT N ≤ 4, and 200, 300, 400, 600 for the sample of SPT N > 5)	CU triaxial test (Cell Pressure is 50, 100, 200 for the sample of SPT N ≤ 4, and 100, 200, 300 for the sample of SPT N > 5)	Soil group	Description																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
						From	To	From	To	N	qu (KN/m <sup>2</sup> )	25	75	9.5	4.75	2.00	0.85	0.425	0.075	0.0075							Liquid limit Wp (%)	Plastic limit Wp (%)	Plasticity index Ip (%)	Na	Nu	Ne	Uc	Ue	Uf	Ug	Uh	Ui	Uj	Uk	Ul	Um	Un	Uo	Up	Uq	Ur	Us	Ut	Uv						Uw	Ux	Uy	Uz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq	Uar	Uas	Uat	Uau	Uav	Uaw	Uax	Uay	Uaz	Uaa	Uab	Uac	Uad	Uae	Uaf	Uag	Uah	Uai	Uaj	Uak	Ual	Uam	Uan	Uao	Uap	Uaq</











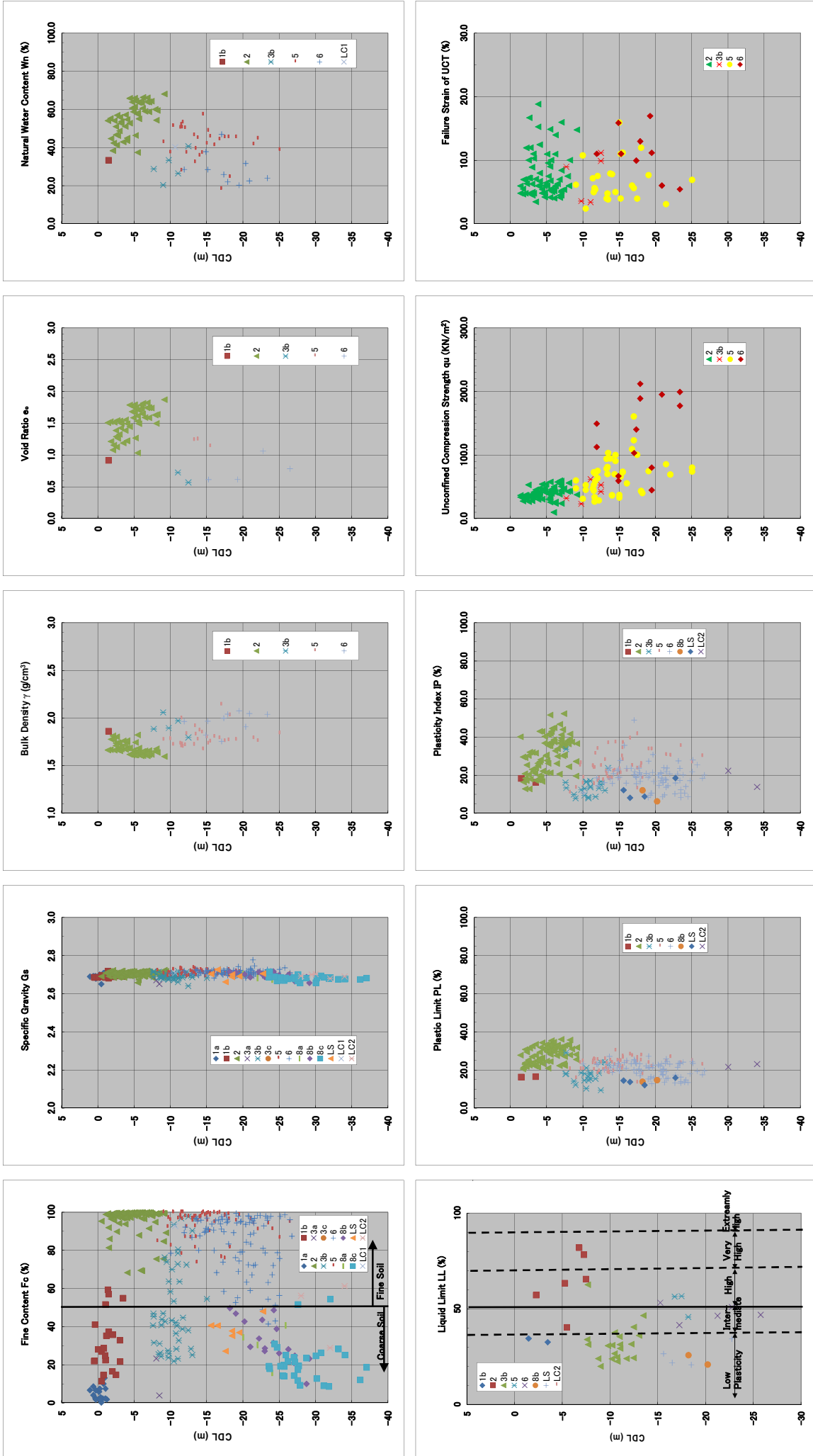




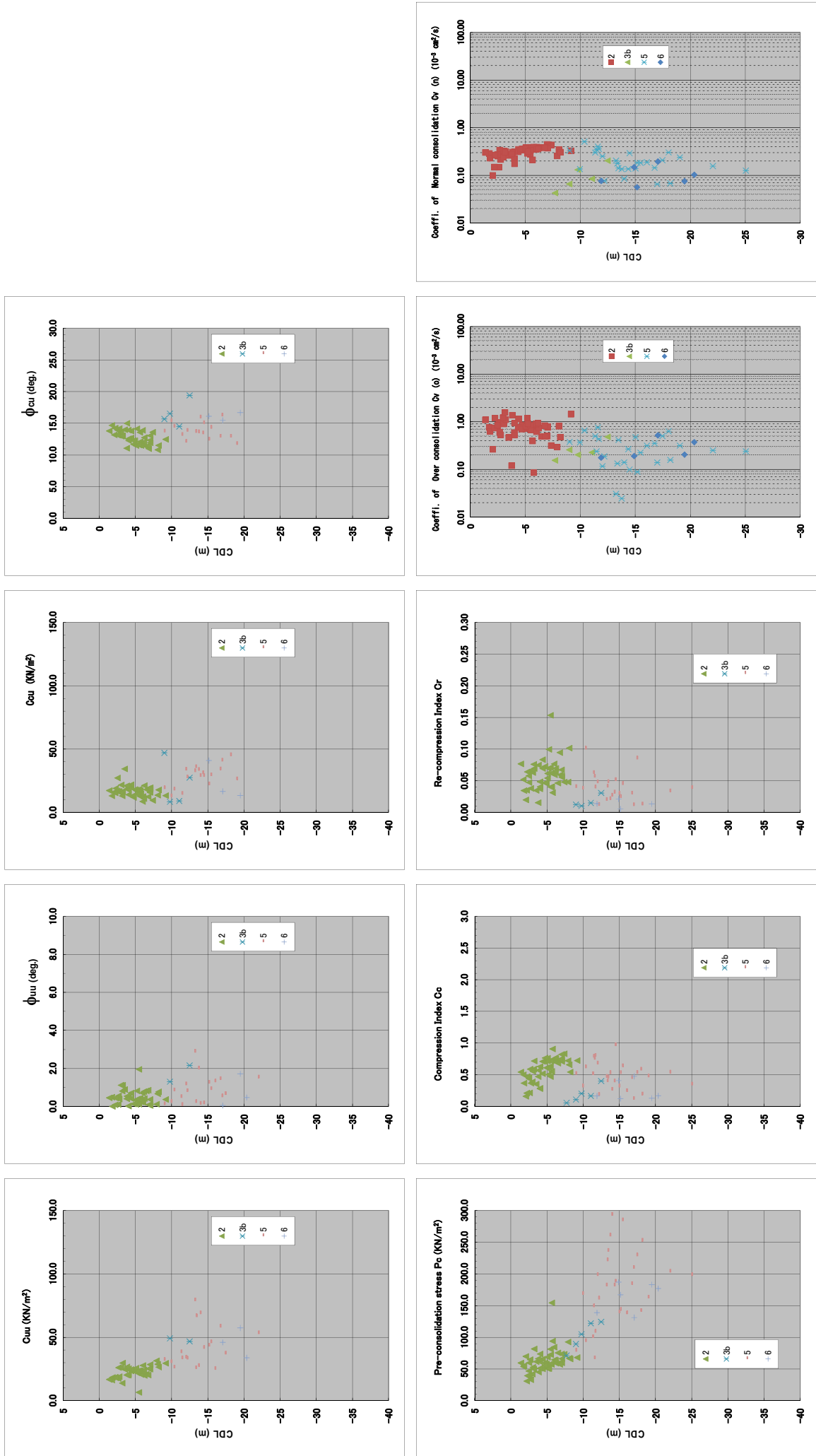




### Outer Revetment B Area

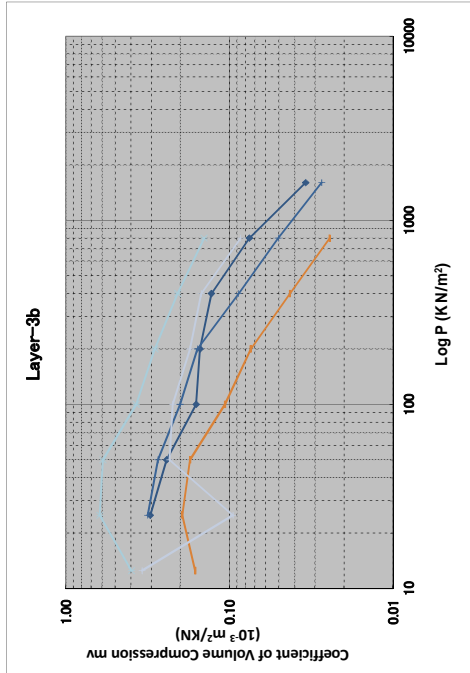
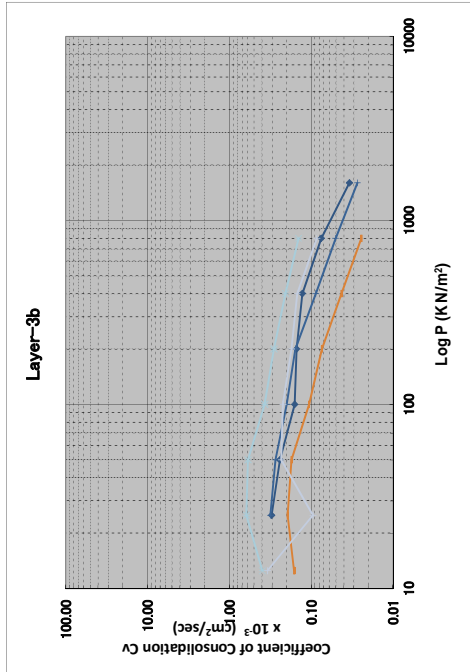
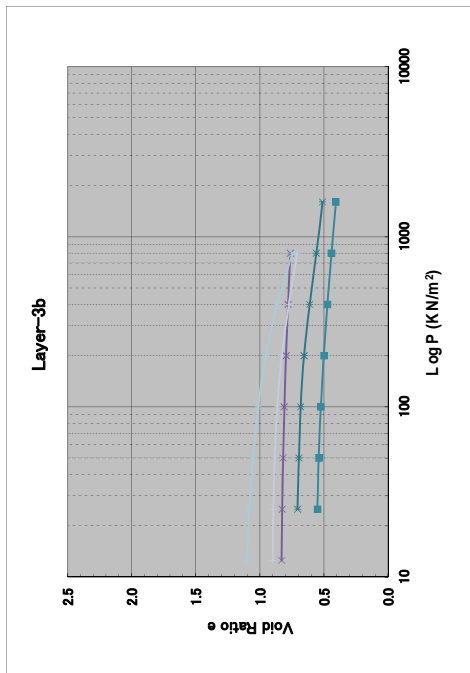
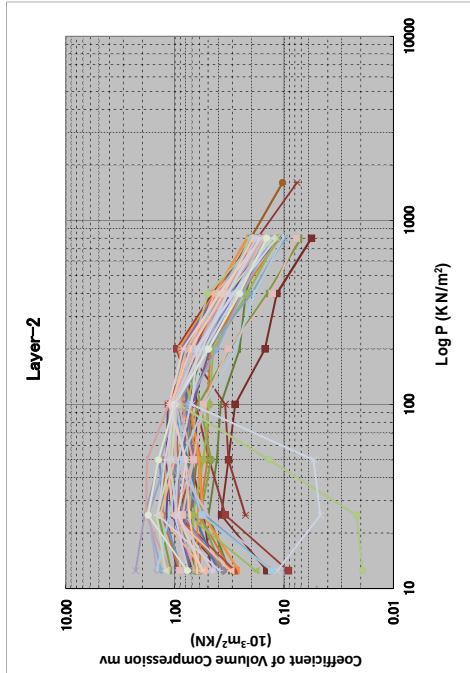
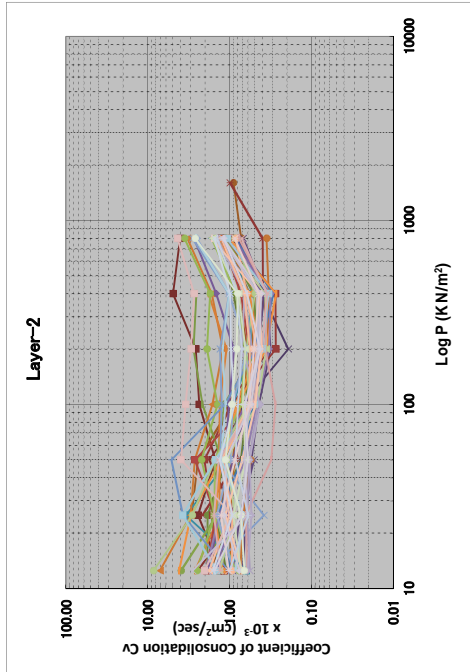
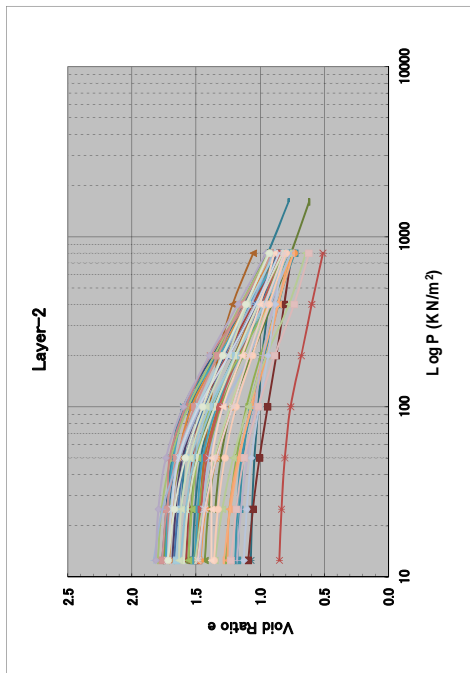


### Outer Revetment B Area

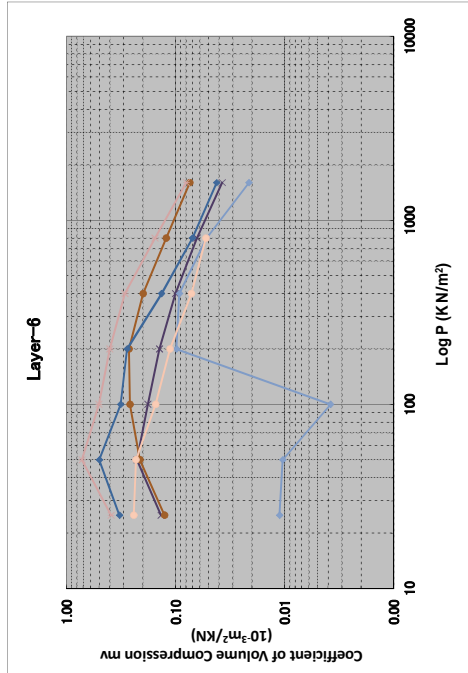
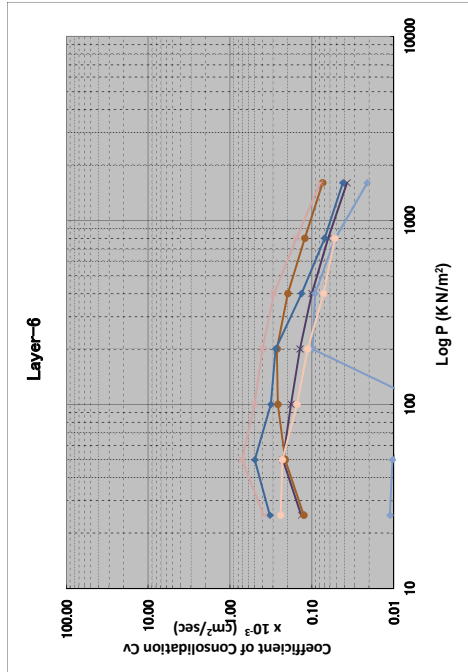
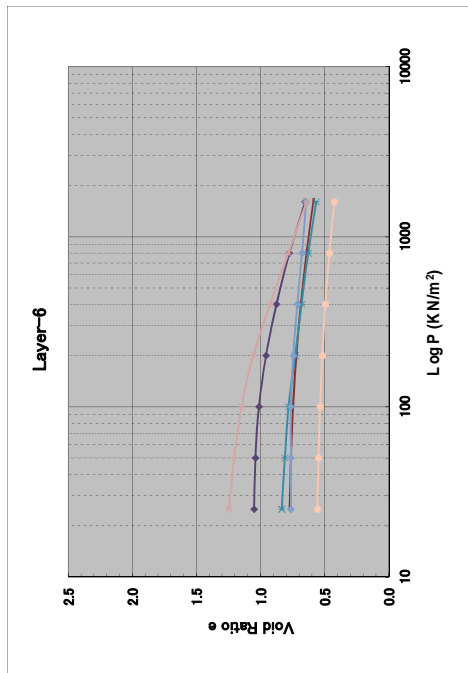
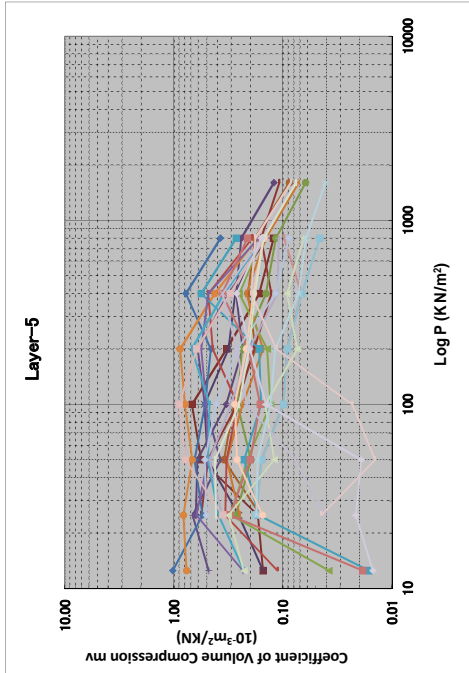
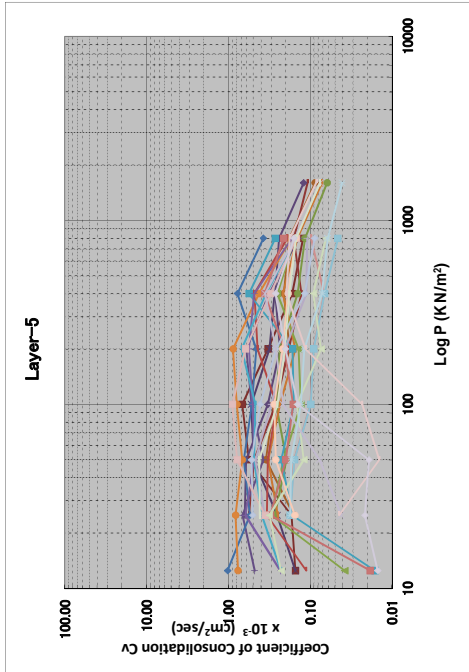
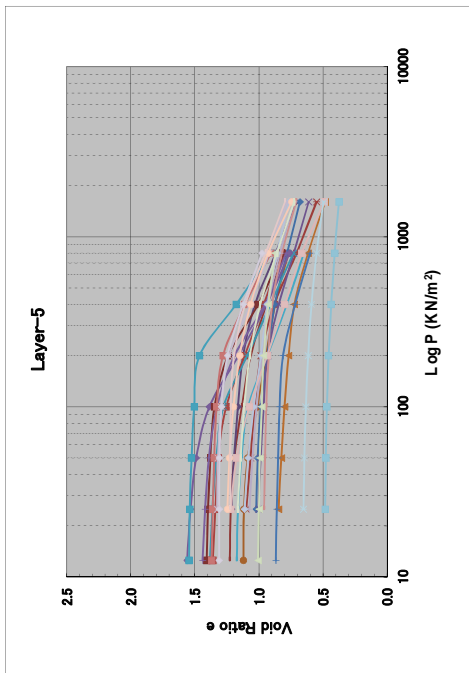




Outer Revetment B Area



Outer Revetment B Area



c) Sand Protection Dyke Area

SUMMARY TABLE OF PHYSICO - MECHANICAL PROPERTIES OF SOIL SAMPLES

Table with columns for No., Test No., Layer, Borehole, Sample No., Depth (m), Field Test Result, Percent passed sieve size (mm), Atterberg Limits, Bulk density (KN/m³), Specific Gravity, Degree of saturation, Void ratio, Cv, mv, and various unconfined compression test results (qu, failure strain, etc.).







Project: THE DETAILED DESIGN SURVEY ON LACH HUYEN PORT INFRASTRUCTURE CONSTRUCTION IN VIETNAM  
Item: Soil Investigation for Port Portion - Part B  
Volume 2.1: The appendices of Sand Protection Dyke area  
Date: 27/07/2011

SUMMARY TABLE OF PHYSICAL - MECHANICAL PROPERTIES OF SOIL SAMPLES

Table with columns for No., Test No., Layer, Boronide, Sample No., Depth (m), SPT, Percent passed sieve size (mm), Atterberg Limits, Bulk density, Specific Gravity, Degree of saturation, Void ratio, Cv, mv, and Unconfined compression test results. The table contains multiple rows of data for various soil samples, including test results for consolidation, compression, and shear tests.



SUMMARY TABLE OF PHYSICAL - MECHANICAL PROPERTIES OF SOIL SAMPLES

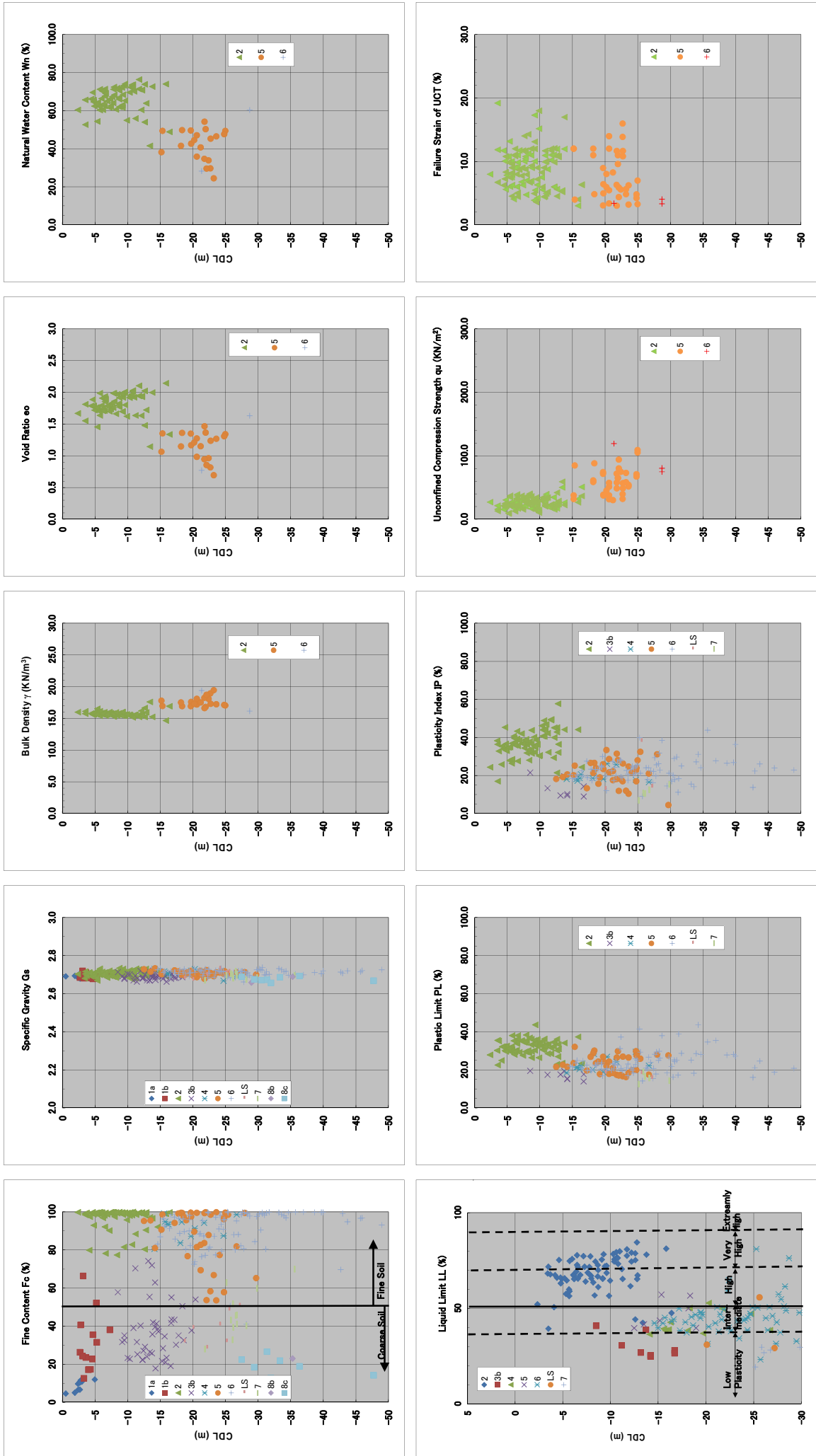
Table with columns: No., Treat No., Layer, Borehole, Depth (m), Field Test Result, SPT, Percent passed sieve size (mm), Natural moisture content, Atterberg Limits, Bulk density, Specific Gravity, Porosity, Degree of saturation, Void ratio, Initial void ratio, Consolidation Test (Loading Plan 12.5, 25, 50, 100, 200, 400, 800, 12.5 for the sample of SPT N ≤ 4, and 25, 50, 100, 200, 400, 800, 1600, 25 for the sample of SPT N > 5), Log Average means, for example, test values are 1, 2, 3, then in this case (Log1 + Log2 + Log3)/3, Unconfined compression test, UU triaxial test, CU triaxial test, Soil group, and Description.



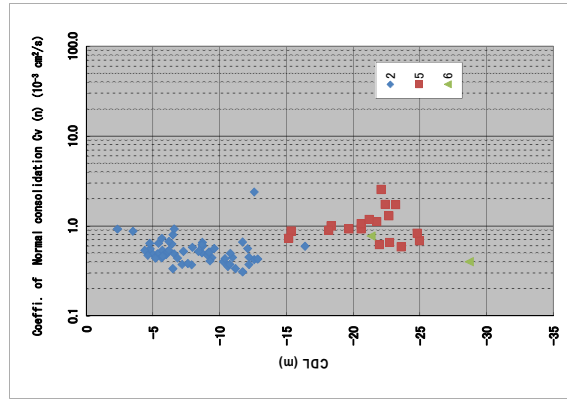
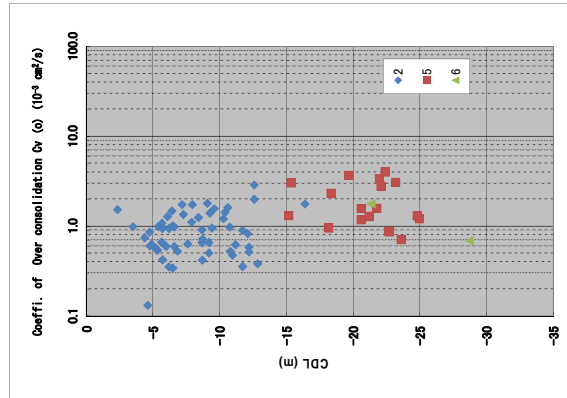
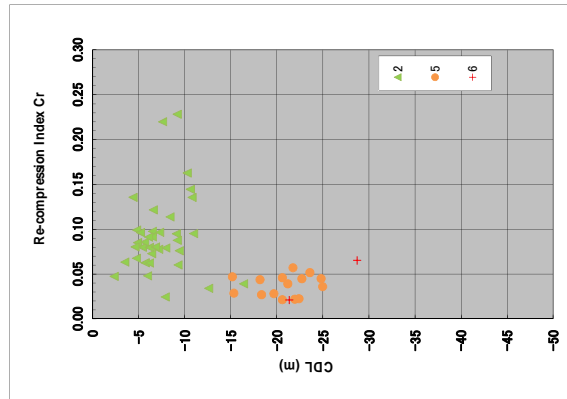
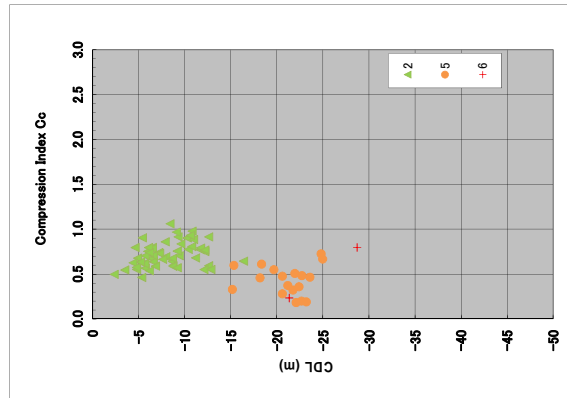
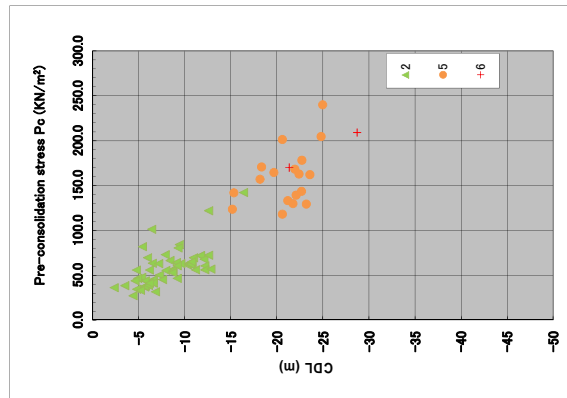
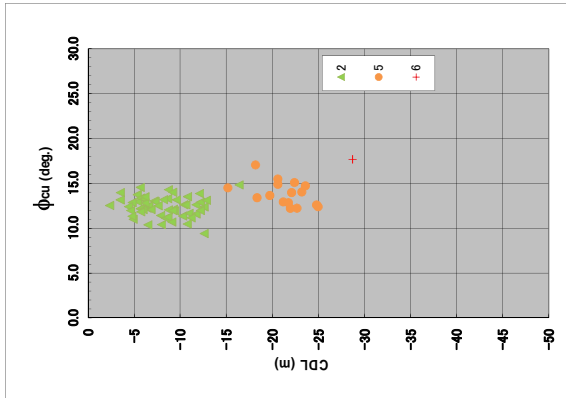
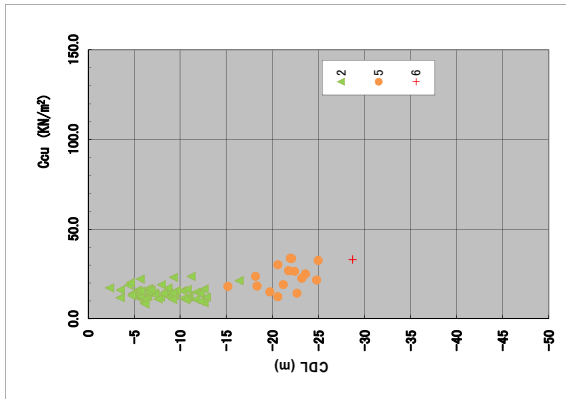
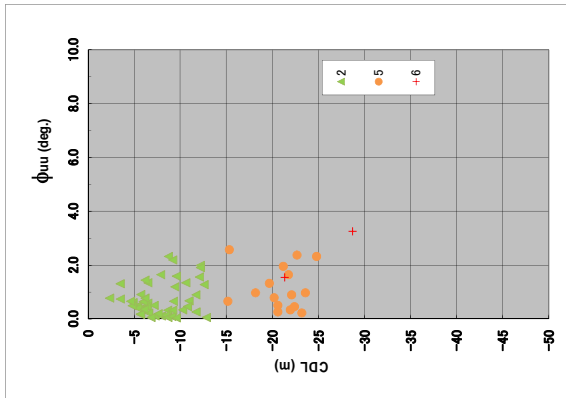
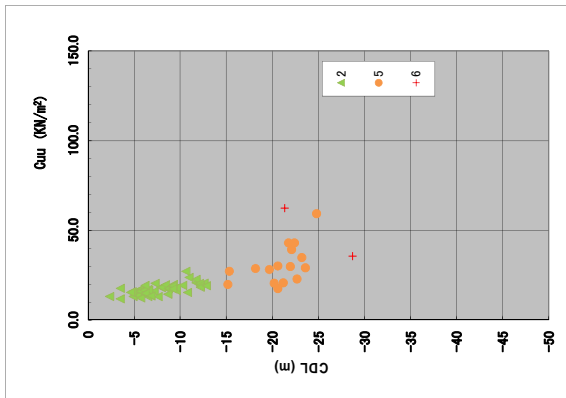




**Sand protection Dyke Area**

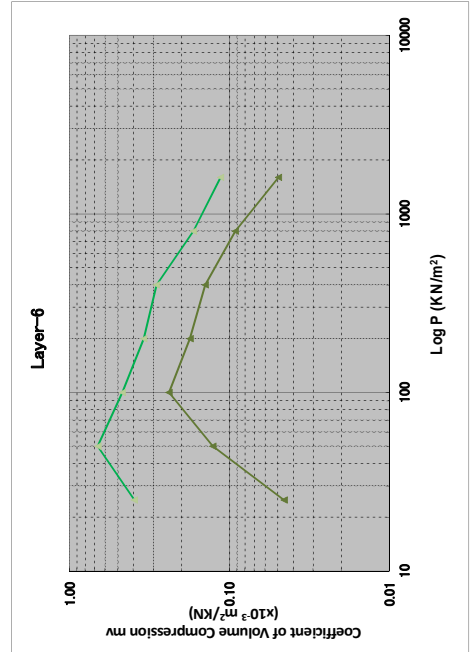
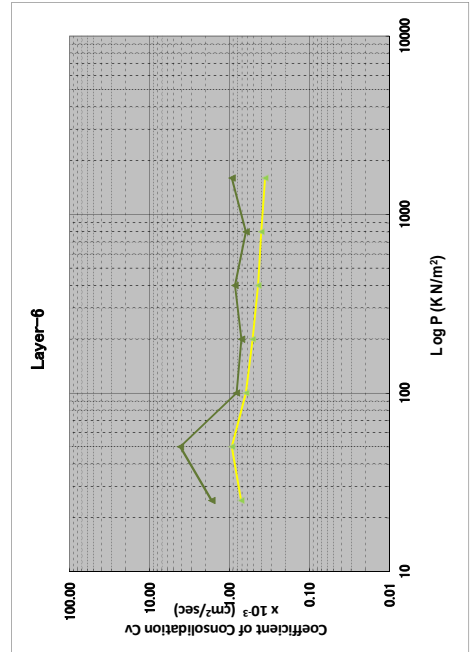
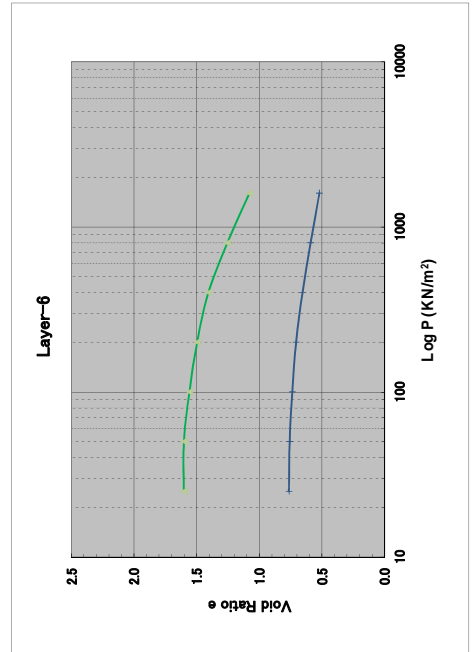
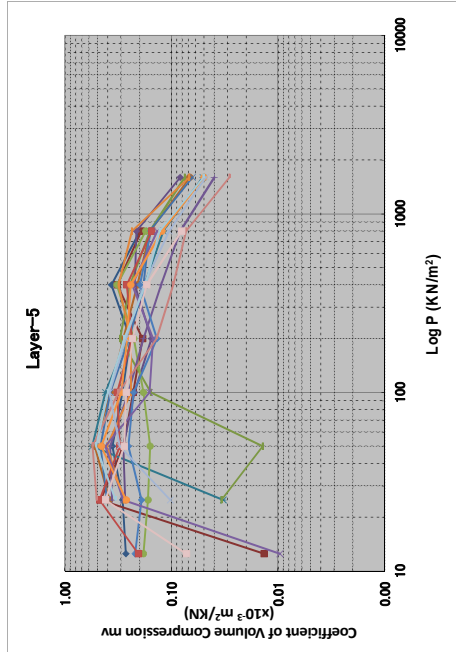
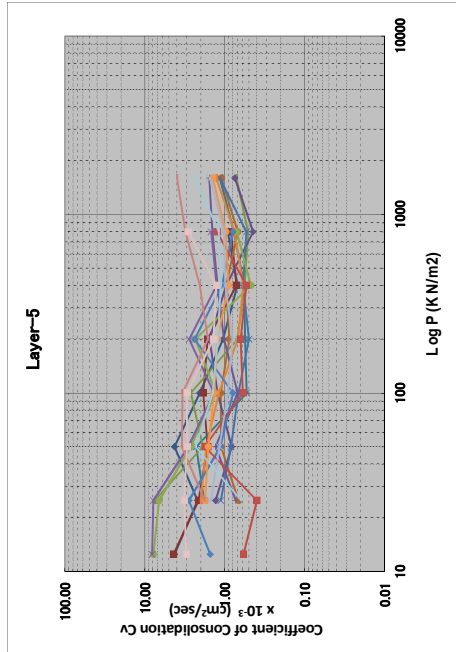
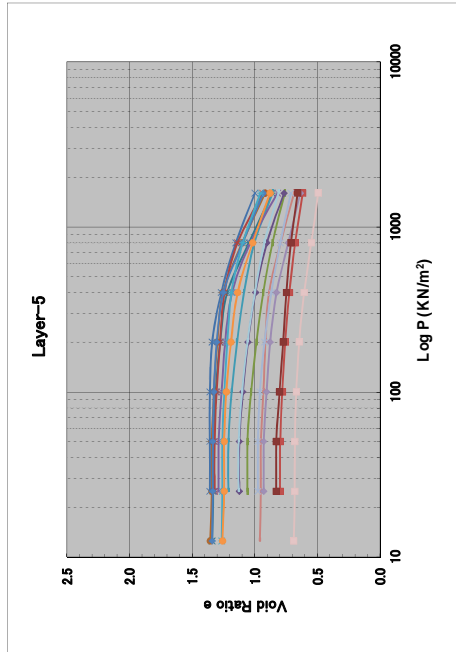
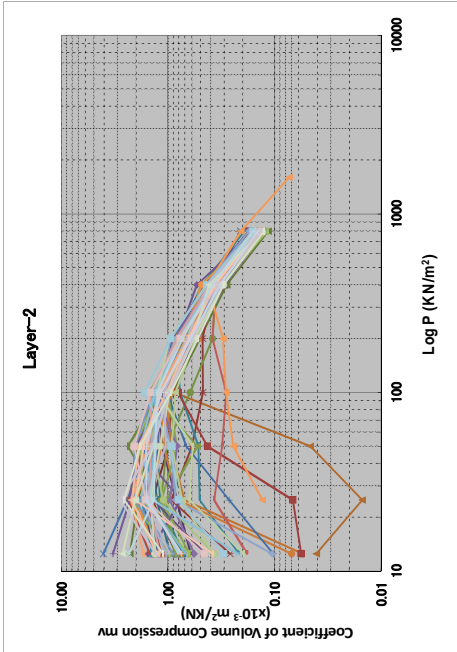
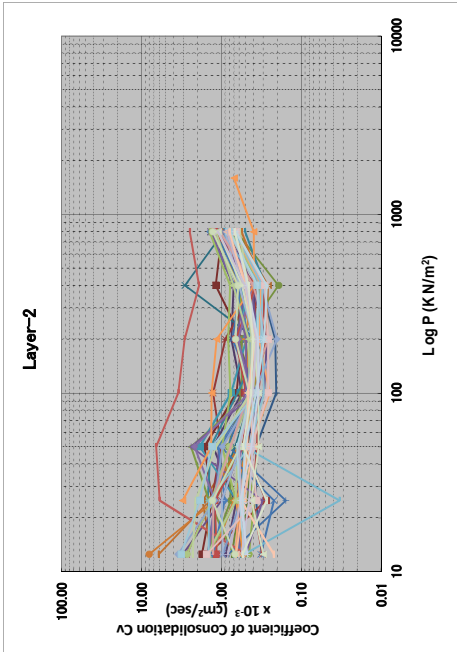
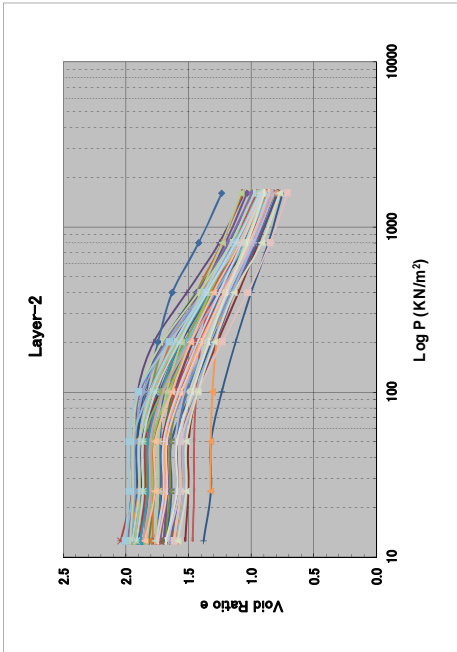


Sand protection Dyke Area





Sand protection Dyke Area



d) Navigation Channel and Turning Basin Area



**SUMMARY TABLE OF PHYSICO - MECHANICAL PROPERTIES OF SOIL SAMPLES**

No.	Test No.	Layer	Borehole	GL (m)	Sample No.	Depth (m)			Field Test Result	Percent passed sieve size (mm)							Natural moisture content w (%)	Atterberg Limits			Bulk density (KN/m <sup>3</sup> )		Specific Gravity	Porosity n (%)	Degree of saturation G (%)	Void ratio eo	Unconfined compression test				Soil group	Description			
						GL-(m)		DL(m)		N	9.5	4.75	2.00	0.85	0.425	0.3		0.075	<0.005	Liquid limit W <sub>L</sub> (%)	Plastic limit W <sub>p</sub> (%)	Plasticity index I <sub>p</sub> (%)					Natural	Dry	Sample	Failure Strain ε (%)					
						From	To	From																						To			A	B	A
						Average value of borehole																													
43	1607	LC2	C-10	-7.19	D4	4.00 - 4.45	-11.19 - -11.64	1			100.0	98.3	96.8	93.8	51.1	27.3		26.9	18.5	8.4			2.71											CL	Dark grey, sandy lean clay
44	1608	4a	C-10	-7.19	U5	5.00 - 5.80	-12.19 - -12.99							100.0	98.3	66.3	39.5	42.9	21.9	21.0	18.1	13.0	2.72	52.2	98.1	1.094	47.0	46.6	11.2	18.9	CL	Bluish grey, lean clay			
45	1610	4a	C-10	-7.19	D7	7.00 - 7.45	-14.19 - -14.64	5					100.0	99.9	91.9	60.4							2.71										CL	Bluish grey, silty clay	
46	1611	4a	C-10	-7.19	U8	8.00 - 8.80	-15.19 - -15.99							100.0	93.4	60.4	42.1	39.9	20.7	19.2	17.9	12.6	2.72	53.8	98.3	1.164	29.8	30.1	14.9	11.9	CL	Bluish grey, lean clay			
Average value of borehole									2.0			100.0	97.9	97.2	97.2	82.7	51.4	43.9	39.4	20.8	18.5	17.7	12.3	2.71	54.6	98.4	1.209	30.3	27.8	12.3	14.6				
47	1526	3b	C-11	-7.31	D1	1.00 - 1.45	-8.31 - -8.76	6			100.0	99.8	98.8	92.4	32.7	17.6							2.69										SC-SM	Yellowish grey, silty, clayey sand	
48	1528	3b	C-11	-7.31	D3	3.00 - 3.45	-10.31 - -10.76	5			100.0	99.0	97.4	95.0	49.6	25.6		23.4	14.5	8.8			2.71										SC	Grey, yellowish grey, clayey sand	
49	1530	3b	C-11	-7.31	D5	5.00 - 5.45	-12.31 - -12.76	11			100.0	99.9	98.6	90.2	33.3	19.3							2.68										SC-SM	Grey, yellowish grey, silty, clayey sand	
50	1532	3b	C-11	-7.31	D7	7.00 - 7.45	-14.31 - -14.76	14			100.0	98.1	95.4	86.2	35.2	16.6							2.70										SC-SM	Grey, yellowish grey, silty, clayey sand	
Average value of borehole									9.0			100.0	99.2	97.6	90.9	37.7	19.8		23.4	14.5	8.8			2.69											
51	1612	2	C-12	-6.51	U0	0.00 - 0.80	-6.51 - -7.31				100.0	98.6	97.8	96.5	81.3	44.1	48.3	38.0	21.8	16.2	17.0	11.5	2.68	57.3	96.6	1.341	9.0	9.7	10.9	17.9	CL	Dark grey, lean clay with sand			
52	1614	2	C-12	-6.51	D2	2.00 - 2.45	-8.51 - -8.96	0					100.0	99.8	83.8	51.4		48.8	27.9	20.8			2.69										ML	Dark grey, silt with sand	
53	1615	4a	C-12	-6.51	U3	3.00 - 3.80	-9.51 - -10.31				100.0	99.6	99.1	98.4	92.5	55.3	31.7	51.4	20.8	30.6	19.0	14.4	2.71	46.8	97.8	0.881	59.8	53.1	11.9	11.2	CH	Bluish grey, fat clay			
54	1617	4a	C-12	-6.51	D5	5.00 - 5.45	-11.51 - -11.96	7					100.0	99.9	94.7	65.5		51.1	28.5	22.6			2.71										MH	Bluish grey, elastic silt	
55	1618	4a	C-12	-6.51	U6	6.00 - 6.80	-12.51 - -13.31				100.0	99.3	98.4	97.3	87.2	56.1	35.9	43.3	19.9	23.4	18.7	13.7	2.72	49.4	100.0	0.976	58.6	71.8	7.2	10.9	CL	Bluish grey, lean clay			
56	1620	4a	C-12	-6.51	D8	8.00 - 8.45	-14.51 - -14.96	5					100.0	97.3	86.8	46.8		44.3	23.0	21.3			2.71										CL	Bluish grey, lean clay	
Average value of borehole									4.0			100.0	99.2	99.2	98.2	87.7	53.2	38.7	46.1	23.7	22.5	18.2	13.2	2.71	51.2	98.2	1.066	42.5	44.9	10.0	13.3				
57	1621	2	C-13	-6.96	D1	1.00 - 1.45	-7.96 - -8.41	0				100.0	99.8	84.5	45.7			47.8	23.3	24.5			2.69										CL	Dark grey, lean clay with sand	
58	1622	2	C-13	-6.96	U2	2.00 - 2.80	-8.96 - -9.76				100.0	99.6	99.3	98.6	88.2	49.8	56.9	47.4	26.2	21.2	16.7	10.6	2.71	60.8	99.5	1.548	14.6	13.6	8.0	4.4	CL	Dark grey, silty clay			
59	1624	LC2	C-13	-6.96	D4	4.00 - 4.45	-10.96 - -11.41	0			100.0	96.6	93.6	89.7	53.3	27.4		28.7	19.2	9.5			2.73										CL	Dark grey, sandy lean clay	
60	1625	4a	C-13	-6.96	U5	5.00 - 5.80	-11.96 - -12.76						100.0	99.9	97.8	63.5	40.1	41.3	20.2	21.1	18.0	12.8	2.71	52.6	97.9	1.111	37.7	29.6	15.9	11.9	CL	Bluish grey, lean clay			
61	1627	4a	C-13	-6.96	D7	7.00 - 7.45	-13.96 - -14.41	5			100.0	99.7	99.4	98.8	93.4	58.6		37.5	20.5	17.0			2.72										CL	Bluish grey, lean clay	
62	1628	4a	C-13	-6.96	U8	8.00 - 8.80	-14.96 - -15.76						100.0	93.7	66.0	38.3	41.7	19.7	22.0	18.2	13.2	2.71	51.5	97.9	1.061	34.4	34.9	13.4	8.9	CL	Bluish grey, lean clay				
Average value of borehole									1.7			100.0	98.7	98.5	97.8	85.2	51.8	45.1	40.7	21.5	19.2	17.6	12.2	2.71	55.0	98.4	1.240	28.9	26.0	12.5	8.4				
63	1630	2	C-14	-5.97	U0	0.00 - 0.80	-5.97 - -6.77						100.0	94.9	60.2	63.7	54.0	25.1	28.9	16.2	9.9	2.69	63.2	99.8	1.716							CH	Dark grey, fat clay		
64	1632	2	C-14	-5.97	D2	2.00 - 2.45	-7.97 - -8.42	0					100.0	99.8	86.0	56.4		52.7	22.6	30.1			2.70										CH	Dark grey, fat clay	
65	1633	2	C-14	-5.97	U3	3.00 - 3.80	-8.97 - -9.77						100.0	99.9	91.3	52.9	58.3	40.8	25.0	15.8	16.5	10.4	2.70	61.4	98.9	1.593	13.9	8.7	11.9	15.9	CL	Dark grey, lean clay			
66	1635	2	C-14	-5.97	D5	5.00 - 5.45	-10.97 - -11.42	0					100.0	99.9	96.0	64.3		45.3	27.7	17.6			2.71										ML	Dark grey, silty clay	
67	1636	4a	C-14	-5.97	U6	6.00 - 6.80	-11.97 - -12.77						100.0	99.8	92.8	60.6	39.8	42.6	19.6	23.0	18.2	13.0	2.72	52.2	99.1	1.091	32.7	35.4	11.9	18.7	CL	Bluish grey, lean clay			
68	1638	4a	C-14	-5.97	D8	8.00 - 8.45	-13.97 - -14.42	6				100.0	99.9	99.8	91.5	56.8		40.6	21.5	19.1			2.71										CL	Bluish grey, lean clay	
Average value of borehole									2.0			100.0	99.9	99.8	99.8	91.7	58.5	53.9	46.0	23.6	22.4	17.0	11.1	2.70	58.9	99.3	1.467	23.3	22.1	11.9	17.3				
69	1534	2	C-15	-6.10	U0	0.00 - 0.80	-6.10 - -6.90						100.0	99.3	59.5	67.6	64.6	29.8	34.8	16.0	9.5	2.69	64.5	100.0	1.820	18.7	14.8	12.8	10.9	CH	Dark grey, fat clay				
70	1535	2	C-15	-6.10	D1	1.00 - 1.45	-7.10 - -7.55	0					100.0	99.7	96.2	65.3		57.6	29.2	28.5			2.69										CH	Dark grey, fat clay	
71	1537	2	C-15	-6.10	U3	3.00 - 3.80	-9.10 - -9.90						100.0	91.4	46.8	52.7	44.8	24.8	20.1	16.9	11.1	2.71	59.2	98.6	1.450	7.6	6.5	12.0	10.7	CL	Dark grey, lean clay				
72	1538	2	C-15	-6.10	D4	4.00 - 4.45	-10.10 - -10.55	0					100.0	99.9	93.3	57.9		48.0	23.3	24.7			2.69										CL	Dark grey, lean clay	
73	1540	2	C-15	-6.10	U6	6.00 - 6.80	-12.10 - -12.90						100.0	95.7	56.5	56.8	50.7	27.6	23.1	16.7	10.7	2.71	60.7	99.7	1.543	8.2	10.4	10.9	11.0	CH	Dark grey, fat clay				
74	1541	4a	C-15	-6.10	D7	7.20 - 7.65	-13.30 - -13.75	5				100.0	99.9	99.7	86.6	60.9		36.7	20.8	15.9			2.70										CL	Bluish and yellowish grey, lean clay	
75	1543	4	C-15	-6.10	D9	9.50 - 9.95	-15.60 - -16.05	10					100.0	97.3	90.3	58.3		40.3	22.2	18.1			2.72										CL	Bluish and yellowish grey, lean clay	
Average value of borehole									3.8			100.0	99.9	99.5	93.3	57.9	59.0	49.0	25.4	23.6	16.5	10.4	2.70	61.5	99.4	1.605	11.5	10.6	11.9	10.9					
76	1639	2	C-16	-7.39	D1	1.00 - 1.45	-8.39 - -8.84	0					100.0	99.4	98.9	98.1	80.9	40.9		46.1	23.1	23.0		2.69									CL	Dark grey, silty clay with sand	
77	1640	2	C-16	-7.39	U2	2.00 - 2.80	-9.39 - -10.19						100.0	99.8	81.2	41.3	48.3	46.1	24.0	22.1	17.3	11.7	2.69	56.6	99.6	1.303	12.9	13.2	14.9	11.9	CL	Dark grey, silty clay with sand			
78	1641	2	C-16	-7.39	D3	3.00 - 3.45	-10.39 - -10.84	0					100.0	98.8	97.5	95.4	68.2	33.6		48.1	23.0	25.1		2.71									CL	Dark grey, sandy, silty clay	
79	1642	2	C-16	-7.39	D4	4.00 - 4.45	-11.39 - -11.84	0					100.0	99.9	99.8	97.1	63.0		60.8	30.8	30.0			2.70									CH	Dark grey, fat clay	
80	1643	4	C-16	-7.39	D5	5.00 - 5.45	-12.39 - -12.84	11					100.0	99.5	97.7	96.3	88.2	51.1		42.8	20.4	22.3		2.72									CL	Reddish and yellowish grey, lean clay	
81	1644	4	C-16	-7.39	D6	6.00 - 6.45	-13.39 - -13.84	13					100.0	97.0	94.2	79.0	55.8		39.8	22.1	17.6			2.72									CL	Reddish and yellowish grey, lean clay with sand	
82</																																			



















**SUMMARY TABLE OF PHYSICO - MECHANICAL PROPERTIES OF SOIL SAMPLES**

No.	Test No.	Layer	Borehole	GL (m)	Sample No.	Depth (m)		Field Test Result	Percent passed sieve size (mm)							Natural moisture content w (%)	Atterberg Limits			Bulk density (KN/m <sup>3</sup> )		Specific Gravity	Porosity n (%)	Degree of saturation G (%)	Void ratio eo	Unconfined compression test				Soil group	Description		
						GL-(m)	DL(m)		SPT	9.5	4.75	2.00	0.85	0.425	0.3		0.075	<0.005	Liquid limit W <sub>L</sub> (%)	Plastic limit W <sub>p</sub> (%)	Plasticity index I <sub>p</sub> (%)					Natural	Dry	A	B			A	B
						A	B		A	B																							
366	2117	2	C-44	-5.26	U7	7.00 - 7.80	-12.26 - -13.06							100.0	99.6	75.2	73.5	79.0	32.6	46.4	15.7	9.0	2.70	66.5	99.9	1.985	13.9	16.1	13.0	9.0	CH	Dark grey, silty clay	
367	2118	2	C-44	-5.26	D8	8.00 - 8.45	-13.26 - -13.71	3						100.0	98.8	30.7							2.68									CH	Dark grey, silty clay
368	2119	2	C-44	-5.26	D9	9.00 - 9.45	-14.26 - -14.71	5						100.0	91.6	88.9	65.3	34.3	31.0				2.70									MH	Dark grey, elastic silt with sand
369	2120	LS4	C-44	-5.26	D10	10.40 - 10.85	-15.66 - -16.11	19	100.0	97.5	95.7	94.8	94.5	92.8	15.0	4.8							2.68									SC-SM	Yellowish grey, silty, clayey sand
<b>Average value of borehole</b>								<b>5.1</b>	<b>100.0</b>	<b>97.5</b>	<b>95.7</b>	<b>98.7</b>	<b>95.1</b>	<b>87.4</b>	<b>72.6</b>	<b>30.8</b>	<b>68.9</b>	<b>66.5</b>	<b>33.2</b>	<b>33.3</b>	<b>15.9</b>	<b>9.5</b>	<b>2.69</b>	<b>65.0</b>	<b>99.9</b>	<b>1.859</b>	<b>15.2</b>	<b>17.5</b>	<b>12.5</b>	<b>10.5</b>			
370	2121	2	C-45	-4.77	U0	0.00 - 0.80	-4.77 - -5.57							100.0	98.5	58.6	60.0	61.0	30.1	30.8	16.4	10.3	2.69	61.8	99.7	1.620	10.6	13.0	10.3	12.0	CH	Dark grey, silty clay	
371	2122	2	C-45	-4.77	D1	1.00 - 1.45	-5.77 - -6.22	0						100.0	93.1	53.6							2.69									CH	Dark grey, silty clay
372	2123	2	C-45	-4.77	D2	2.00 - 2.45	-6.77 - -7.22	0						100.0	90.7	33.6		42.5	31.8	10.7			2.69									ML	Dark grey, silty clay
373	2124	2	C-45	-4.77	U3	3.00 - 3.80	-7.77 - -8.57							100.0	99.2	61.5	60.5	66.5	27.8	38.7	16.4	10.2	2.69	62.0	99.7	1.629	22.2	22.7	12.0	13.0	CH	Dark grey, silty clay	
374	2125	2	C-45	-4.77	D4	4.00 - 4.45	-8.77 - -9.22	0						100.0	88.1	45.4							2.68									CH	Dark grey, silty clay
375	2126	2	C-45	-4.77	D5	5.00 - 5.45	-9.77 - -10.22	0						100.0	93.2	48.9		54.4	28.7	25.7			2.69									CH	Dark grey, silty clay
376	2127	2	C-45	-4.77	U6	6.00 - 6.80	-10.77 - -11.57							100.0	98.9	62.4	60.8	66.8	33.2	33.6	16.4	10.2	2.69	62.2	99.3	1.648	11.4	11.3	11.9	11.2	MH	Dark grey, silty clay	
377	2128	2	C-45	-4.77	D7	7.00 - 7.45	-11.77 - -12.22	0						100.0	99.1	59.8							2.69									CH	Dark grey, silty clay
378	2129	2	C-45	-4.77	D8	8.00 - 8.45	-12.77 - -13.22	0						100.0	99.5	52.0		55.0	30.9	24.1			2.69									MH	Dark grey, silty clay
379	2130	2	C-45	-4.77	U9	9.00 - 9.80	-13.77 - -14.57							100.0	99.7	73.0	64.2	79.7	32.9	46.8	16.2	9.9	2.70	63.4	99.9	1.734	11.1	10.3	12.9	13.1	CH	Dark grey, silty clay	
380	2131	2	C-45	-4.77	D10	10.00 - 10.45	-14.77 - -15.22	0						100.0	93.2	48.0							2.70									CH	Dark grey, silty clay
381	2132	2	C-45	-4.77	D11	11.00 - 11.45	-15.77 - -16.22	0						100.0	99.7	57.2		73.5	34.9	38.6			2.70									MH	Dark grey, silty clay
<b>Average value of borehole</b>								<b>0.0</b>						<b>100.0</b>	<b>96.1</b>	<b>54.5</b>	<b>61.4</b>	<b>62.4</b>	<b>31.3</b>	<b>31.1</b>	<b>16.3</b>	<b>10.1</b>	<b>2.69</b>	<b>62.4</b>	<b>99.7</b>	<b>1.658</b>	<b>13.8</b>	<b>14.3</b>	<b>11.8</b>	<b>12.3</b>			
382	2133	1b	C-46	-6.46	D0	0.00 - 0.45	-6.46 - -6.91	4				100.0	97.1	95.7	26.1	4.5							2.67									SC-SM	Dark grey, silty, clayey sand
383	2134	1b	C-46	-6.46	D1	1.00 - 1.45	-7.46 - -7.91	4						100.0	31.7	5.8							2.68									SC-SM	Dark grey, silty, clayey sand
384	2135	1b	C-46	-6.46	D2	2.00 - 2.45	-8.46 - -8.91	5				100.0	97.3	96.4	22.1	3.0							2.67									SC-SM	Dark grey, silty, clayey sand
385	2136	2	C-46	-6.46	D3	3.00 - 3.45	-9.46 - -9.91	0						100.0	76.0	24.0		51.6	35.5	16.1			2.70									MH	Dark grey, elastic silt with sand
386	2137	2	C-46	-6.46	U4	4.00 - 4.80	-10.46 - -11.26							100.0	98.9	69.6	68.3	68.1	29.8	38.3	15.9	9.4	2.69	64.8	99.5	1.844	8.1	11.6	17.9	13.5	CH	Dark grey, fat clay	
387	2138	2	C-46	-6.46	D5	5.00 - 5.45	-11.46 - -11.91	1						100.0	82.4	24.9							2.70									CH	Dark grey, silty clay with sand
388	2139	2	C-46	-6.46	D6	6.00 - 6.45	-12.46 - -12.91	1						100.0	97.6	36.0		69.1	35.5	33.6			2.68									MH	Dark grey, elastic silt
389	2140	2	C-46	-6.46	U7	7.00 - 7.80	-13.46 - -14.26							100.0	99.5	69.2	63.2	73.1	33.4	39.7	16.0	9.8	2.69	63.5	97.6	1.741	22.2		12.0		CH	Dark grey, silty clay	
390	2141	2	C-46	-6.46	D8	8.20 - 8.65	-14.66 - -15.11	4	100.0	94.6	93.2	91.6	88.4	70.3	34.3								2.70									CH	Bluish grey, elastic silt
391	2142	2	C-46	-6.46	D9	9.00 - 9.45	-15.46 - -15.91	5				100.0	95.0	93.4	90.4	75.5	36.1		58.0	30.9	27.1		2.69									MH	Bluish grey, elastic silt with sand
<b>Average value of borehole</b>								<b>3.0</b>	<b>100.0</b>	<b>97.3</b>	<b>97.1</b>	<b>94.9</b>	<b>97.1</b>	<b>68.0</b>	<b>30.7</b>	<b>65.7</b>	<b>64.0</b>	<b>33.0</b>	<b>31.0</b>	<b>16.0</b>	<b>9.6</b>	<b>2.69</b>	<b>64.2</b>	<b>98.5</b>	<b>1.793</b>	<b>15.1</b>	<b>11.6</b>	<b>14.9</b>	<b>13.5</b>				
392	2143	2	C-47	-5.42	D1	1.00 - 1.45	-6.42 - -6.87	0						100.0	92.1	50.8		50.8	23.8	26.9			2.67									CH	Dark grey, silty clay
393	2144	2	C-47	-5.42	U2	2.00 - 2.80	-7.42 - -8.22					100.0	99.6	96.4	63.2	65.6	66.9	29.1	37.9	16.1	9.7	2.70	64.0	99.9	1.776	9.7	15.2	9.9	12.0		CH	Dark grey, silty clay	
394	2145	2	C-47	-5.42	D3	3.00 - 3.45	-8.42 - -8.87	0						100.0	99.6	57.5							2.69									CH	Dark grey, silty clay
395	2146	2	C-47	-5.42	D4	4.00 - 4.45	-9.42 - -9.87	0						100.0	99.7	70.1		79.0	36.0	43.0			2.69									MH	Dark grey, silty clay
396	2147	2	C-47	-5.42	U5	5.00 - 5.80	-10.42 - -11.22							100.0	99.7	77.3	63.7	69.5	34.1	35.3	16.2	9.9	2.70	63.4	99.4	1.733	18.6	19.7	13.9	11.9	MH	Dark grey, silty clay	
397	2148	2	C-47	-5.42	D6	6.00 - 6.45	-11.42 - -11.87	0						100.0	99.6	72.8							2.69									CH	Dark grey, silty clay
398	2149	2	C-47	-5.42	D7	7.00 - 7.45	-12.42 - -12.87	0						100.0	98.6	62.7		56.9	27.5	29.4			2.69									CH	Dark grey, silty clay
399	2150	2	C-47	-5.42	U8	8.00 - 8.80	-13.42 - -14.22					100.0	99.0	98.2	85.9	66.7	56.3	60.8	29.1	31.8	16.5	10.6	2.70	60.8	98.0	1.552	19.1	17.1	12.0	12.0	CH	Dark grey, silty clay	
400	2151	2	C-47	-5.42	D9	9.00 - 9.45	-14.42 - -14.87	0						100.0	99.8	54.2							2.69									CH	Dark grey, silty clay
401	2152	2	C-47	-5.42	D10	10.00 - 10.45	-15.42 - -15.87	1						100.0	99.6	66.5		69.9	22.4	47.5			2.69									CH	Dark grey, silty clay
<b>Average value of borehole</b>								<b>0.1</b>				<b>100.0</b>	<b>99.5</b>	<b>99.8</b>	<b>97.1</b>	<b>64.2</b>	<b>61.9</b>	<b>64.8</b>	<b>28.8</b>	<b>36.0</b>	<b>16.3</b>	<b>10.1</b>	<b>2.69</b>	<b>62.7</b>	<b>99.1</b>	<b>1.687</b>	<b>15.8</b>	<b>17.4</b>	<b>11.9</b>	<b>12.0</b>			
402	2153	2	C-48	-6.80	UD0	0.00 - 0.80	-6.80 - -7.60							1																			

















**Project:** THE DETAILED DESIGN SURVEY ON LACH HUYEN PORT INFRASTRUCTURE CONSTRUCTION IN VIETNAM  
**Item:** Soil Investigation for Port Portion - Part B  
**Volume 2.3:** The appendices of Navigation Channel area  
**Date:** 27/07/2011

**SUMMARY TABLE OF PHYSICO - MECHANICAL PROPERTIES OF SOIL SAMPLES**

No.	Test No.	Layer	Borehole	GL (m)	Sample No.	Depth (m)		Field Test Result	Percent passed sieve size (mm)								Natural moisture content w (%)	Atterberg Limits			Bulk density (KN/m <sup>3</sup> )		Specific Gravity	Porosity n (%)	Degree of saturation G (%)	Void ratio e <sub>0</sub>	Unconfined compression test				Soil group	Description			
						GL-(m)	DL(m)		SPT	9.5	4.75	2.00	0.85	0.425	0.3	0.075		< 0.005	Liquid limit W <sub>L</sub> (%)	Plastic limit W <sub>p</sub> (%)	Plasticity index I <sub>p</sub> (%)	Natural					Dry	Sample	Sample	qu (KN/m <sup>2</sup> )			Failure Strain ε (%)		
																																		From	To
43	1547	2	C-17	-5.72	U3	3.00	- 3.80	-8.72	- 9.52					100.0	99.7	90.9	44.1	53.4	56.2	29.6	26.6	15.6	10.2	2.72	62.5	87.2	1.664	13.4	10.2	15.9	9.0	CH	Dark grey, fat clay		
44	1548	2	C-17	-5.72	D4	4.00	- 4.45	-9.72	- 10.17	0				100.0	99.5	93.1	51.6	53.4	51.0	27.0	24.1			2.70								CH	Dark grey, fat clay		
45	1550	2	C-17	-5.72	U6	6.00	- 6.80	-11.72	- 12.52					100.0	99.5	93.7	44.8	65.3	52.4	25.1	27.3	16.1	9.7	2.70	63.9	99.6	1.768	16.5	14.0	13.5	15.3	CH	Dark grey, fat clay		
46	1647	2	C-18	-5.77	D1	1.00	- 1.45	-6.77	- 7.22	0				100.0	99.9	93.3	61.1		53.2	24.4	28.9			2.69								CH	Dark grey, fat clay		
47	1648	2	C-18	-5.77	U2	2.00	- 2.80	-7.77	- 8.57				100.0	99.6	98.8	97.6	77.0	40.9	47.0	41.3	23.6	17.7	17.0	11.5	2.68	56.9	95.2	1.322	12.5	19.2	15.2	8.0	CL	Dark grey, silty clay with sand	
48	1649	2	C-18	-5.77	D3	3.00	- 3.45	-8.77	- 9.22	0				100.0	99.8	93.5	46.5		47.6	23.9	23.7			2.70								CL	Dark grey, lean clay		
49	1650	2	C-18	-5.77	D4	4.00	- 4.45	-9.77	- 10.22	0				100.0	99.5	81.4	42.6		48.3	25.9	22.4			2.70								CL	Dark grey, lean clay with sand		
50	1651	2	C-18	-5.77	U5	5.00	- 5.80	-10.77	- 11.57				100.0	98.6	97.6	97.0	79.0	38.2	57.3	47.8	26.0	21.8			2.68			7.6	11.4	12.0	11.9	CL	Dark grey, silty clay with sand		
51	1657	2	C-19	-5.27	D1	1.00	- 1.45	-6.27	- 6.72	0				100.0	99.6	93.4	54.9		45.5	25.9	19.7			2.69								CL	Dark grey, lean clay		
52	1658	2	C-19	-5.27	U2	2.00	- 2.80	-7.27	- 8.07				100.0	99.6	98.9	97.2	72.2	39.1	53.1	49.7	23.5	26.3	16.9	11.0	2.69	58.9	99.5	1.433					CL	Dark grey, silty clay with sand	
53	1660	2	C-19	-5.27	D4	4.00	- 4.45	-9.27	- 9.72	0				100.0	99.8	96.0	70.8		39.3	25.5	13.8			2.69								ML	Dark grey, silty		
54	1661	2	C-19	-5.27	U5	5.00	- 5.80	-10.27	- 11.07				100.0	99.8	99.5	99.0	82.7	39.9	51.0	46.1	22.1	24.0	17.0	11.3	2.68	57.9	99.4	1.378					CL	Dark grey, silty clay with sand	
55	1666	2	C-20	-5.96	D1	1.00	- 1.45	-6.96	- 7.41	0				100.0	99.9	96.1	65.7		52.5	26.2	26.3			2.69								CH	Dark grey, fat clay		
56	1667	2	C-20	-5.96	U2	2.00	- 2.80	-7.96	- 8.76				100.0	99.9	99.7	99.4	94.0	57.7	67.4	53.2	27.5	25.7	16.0	9.6	2.69	64.5	100.0	1.813					CH	Dark grey, silty clay	
57	1669	2	C-20	-5.96	D4	4.00	- 4.45	-9.96	- 10.41	0				100.0	99.5	99.1	98.7	91.1	58.6		52.5	29.1	23.4			2.70						MH	Dark grey, elastic silt		
58	1676	2	C-21	-6.60	U0	0.00	- 0.80	-6.60	- 7.40					100.0	99.8	99.7	97.5	56.4	67.0	51.4	23.8	27.6	16.0	9.6	2.68	64.3	99.9	1.800	6.3		15.3		CH	Dark grey, silty clay	
59	1677	2	C-21	-6.60	D1	1.00	- 1.45	-7.60	- 8.05	0				100.0	99.7	91.8	58.7		59.5	29.0	30.5			2.69								CH	Dark grey, fat clay		
60	1678	2	C-21	-6.60	D2	2.00	- 2.45	-8.60	- 9.05	0				100.0	99.8	95.3	65.2		54.5	25.5	29.0			2.69								CH	Dark grey, fat clay		
61	1679	2	C-21	-6.60	U3	3.00	- 3.80	-9.60	- 10.40				100.0	99.6	99.1	98.8	82.5	51.8	54.8	48.0	22.8	25.2	16.8	10.9	2.68	59.5	100.0	1.467	12.5	14.8	14.9	14.8	CL	Dark grey, silty clay with sand	
62	1680	2	C-21	-6.60	D4	4.00	- 4.45	-10.60	- 11.05	0				100.0	99.8	95.8	63.7		55.0	31.1	24.0			2.70								MH	Dark grey, elastic silt		
63	1686	2	C-22	-5.94	D1	1.00	- 1.45	-6.94	- 7.39	0				100.0	99.9	90.0	54.7		47.5	24.4	23.0			2.69								CL	Dark grey, silty clay		
64	1687	2	C-22	-5.94	U2	2.00	- 2.80	-7.94	- 8.74					100.0	99.8	93.8	49.3	63.4	50.3	26.2	24.1	16.2	9.9	2.69	63.1	99.6	1.711	6.5	5.0	11.7	16.0	CH	Dark grey, silty		
65	1696	2	C-23	-5.66	D1	1.00	- 1.45	-6.66	- 7.11	0			100.0	99.1	98.2	96.7	73.6	36.3		38.1	22.3	15.7			2.69								CL	Dark grey, lean clay with sand	
66	1697	2	C-23	-5.66	U2	2.00	- 2.80	-7.66	- 8.46					100.0	99.9	99.7	92.2	56.0	69.0	56.1	24.9	31.2	15.9	9.4	2.69	65.0	99.7	1.858	9.3	7.2	14.3	7.0	CH	Dark grey, silty clay	
67	1698	2	C-23	-5.66	D3	3.00	- 3.45	-8.66	- 9.11	0				100.0	99.8	98.6	97.2	52.3		62.3	29.9	32.4			2.70								CH	Dark grey, fat clay	
68	1699	2	C-23	-5.66	D4	4.00	- 4.45	-9.66	- 10.11	0				100.0	99.7	99.5	92.3	57.0		54.5	27.4	27.2			2.69								CH	Dark grey, fat clay	
69	1899	2	C-24	-4.99	D1	1.00	- 1.45	-5.99	- 6.44	0				100.0	99.7	62.2	29.9		39.1	20.5	18.6			2.68								CL	Dark grey, sandy lean clay		
70	1900	2	C-24	-4.99	U2	2.00	- 2.80	-6.99	- 7.79					100.0	99.5	90.5	54.7	63.0	55.1	29.1	26.0	16.2	9.9	2.68	62.9	99.6	1.696	8.2	21.7	12.7	13.9	CH	Dark grey, silty clay		
71	1901	2	C-24	-4.99	D3	3.00	- 3.45	-7.99	- 8.44	0				100.0	99.5	98.7	58.4	26.3		36.3	21.9	14.4			2.70								CL	Dark grey, sandy lean clay	
72	1902	2	C-24	-4.99	D4	4.00	- 4.45	-8.99	- 9.44	0				100.0	99.0	97.4	94.8	73.4	53.5		52.6	26.0	26.5			2.70								CH	Dark grey, silty clay with sand
73	1903	2	C-24	-4.99	U5	5.00	- 5.80	-9.99	- 10.79					100.0	99.8	98.9	81.8	76.8	78.7	35.5	43.2	15.5	8.8	2.69	67.4	99.9	2.067	14.5	12.9	12.6	10.4	CH	Dark grey, silty clay		
74	1904	2	C-24	-4.99	D6	6.00	- 6.45	-10.99	- 11.44	3				100.0	98.8	97.9	91.3	79.3		76.8	30.8	46.0			2.70								CH	Dark grey, fat clay	
75	1706	2	C-25	-4.46	U0	0.00	- 0.80	-4.46	- 5.26					100.0	97.5	42.0	56.5		41.6	22.9	18.7	16.7	10.7	2.69	60.3	100.0	1.519					CL	Dark grey, silty clay		
76	1707	2	C-25	-4.46	D1	1.00	- 1.45	-5.46	- 5.91	0				100.0	96.1	60.9			61.9	25.9	36.1			2.69								CH	Dark grey, fat clay		
77	1709	2	C-25	-4.46	U3	3.00	- 3.80	-7.46	- 8.26					100.0	95.8	55.1	60.8		54.0	26.8	27.2	16.4	10.2	2.69	62.0	100.0	1.634					CH	Dark grey, silty clay		
78	1711	2	C-25	-4.46	D5	5.00	- 5.45	-9.46	- 9.91	0				100.0	99.5	82.2	46.1		48.1	26.0	22.1			2.69								CL	Dark grey, silty clay with sand		
79	1712	2	C-25	-4.46	U6	6.00	- 6.80	-10.46	- 11.26					100.0	99.0	91.1	49.6	59.8	51.4	23.9	27.4	16.4	10.3	2.69	61.8	99.3	1.616					CH	Dark grey, silty clay		
80	1910	2	C-26	-5.15	D1	1.00	- 1.45	-6.15	- 6.60	0				100.0	99.8	99.6	85.7	36.1		36.3	22.1	14.1			2.68								CL	Dark grey, lean clay	
81	1911	2	C-26	-5.15	U2	2.00	- 2.80	-7.15	- 7.95					100.0	99.7	99.0	87.0	46.6	65.1	48.7	32.3	16.4	9.8	2.68	63.7	99.7	1.752	12.2	28.8	15.2	13.9	ML	Dark grey, sandy silt		
82	1912	2	C-26	-5.15	D3	3.00	- 3.45	-8.15	- 8.60	0				100.0	99.8	99.7	94.5	44.2		31.1	19.7	11.3			2.69								CL	Dark grey, silty clay	
83	1913	2	C-26	-5.15	D4	4.00	- 4.45	-9.15	- 9.60	0				100.0	99.8	99.6	92.6	48.5		45.3	24.4	20.9			2.69								CL	Dark grey, silty clay	
84	1914	2	C-26	-5.15	U5	5.00	- 5.80	-10.15	- 10.95					100.0	98.8	96.2	74.4	60.9	56.7	57.0	25.0	32.0	16.7	10.7	2.69	60.4	100.0	1.526	18.4	14.0	11.9	11.7	CH	Dark grey, silty with sand	
85	1915	2	C-26	-5.15	D6	6.00	- 6.45	-11.15	- 11.60	3				100.0	99.8	99.7	98.6	58.6		77.7	33.9	43.9			2.69								CH	Dark grey, silty clay	
86	1920	2	C-27	-5.76	D1	1.00	- 1.45	-6.76	- 7.21	0				100.0	99.9	99.8	97.6	61.7		53.9	24.4	29.5</													







**Project:** THE DETAILED DESIGN SURVEY ON LACH HUYEN PORT INFRASTRUCTURE CONSTRUCTION IN VIETNAM  
**Item:** Soil Investigation for Port Portion - Part B  
**Volume 2.3:** The appendices of Navigation Channel area  
**Date:** 27/07/2011

**SUMMARY TABLE OF PHYSICO - MECHANICAL PROPERTIES OF SOIL SAMPLES**

No.	Test No.	Layer	Borehole	GL (m)	Sample No.	Depth (m)		Field Test Result	Percent passed sieve size (mm)								Natural moisture content w (%)	Atterberg Limits			Bulk density (KN/m <sup>3</sup> )		Specific Gravity	Porosity n (%)	Degree of saturation G (%)	Void ratio e <sub>0</sub>	Unconfined compression test				Soil group	Description							
						GL-(m)	DL(m)		SPT	9.5	4.75	2.00	0.85	0.425	0.3	0.075		< 0.005	Liquid limit W <sub>L</sub> (%)	Plastic limit W <sub>p</sub> (%)	Plasticity index I <sub>p</sub> (%)	Natural					Dry	Sample	Sample	qu (KN/m <sup>2</sup> )			Failure Strain ε (%)						
																																		From	To	From	To	N	A
175	2068	2	C-40	-5.26	U2	2.00	- 2.80	-7.26	- -8.06						100.0	99.5	64.8	62.2	66.3	31.0	35.3	16.3	10.0	2.70	62.9	99.2	1.694	16.9	15.3	11.7	11.7	CH	Dark grey, silty clay						
176	2069	2	C-40	-5.26	D3	3.00	- 3.45	-8.26	- -8.71	0					100.0	85.5	26.1							2.70									CH	Dark grey, silty clay					
177	2070	2	C-40	-5.26	D4	4.00	- 4.45	-9.26	- -9.71	0					100.0	82.0	20.0		45.7	27.7	18.0			2.69									ML	Dark grey, silt with sand					
178	2071	2	C-40	-5.26	U5	5.00	- 5.80	-10.26	- -11.06						100.0	99.5	72.6	65.1	69.8	29.2	40.6	16.1	9.8	2.70	63.8	99.4	1.765	17.5	15.4	13.0	10.9	CH	Dark grey, silty clay						
179	2072	2	C-40	-5.26	D6	6.00	- 6.45	-11.26	- -11.71	1					100.0	43.9								2.67										CH	Dark grey, silty clay				
180	2073	2	C-40	-5.26	D7	7.00	- 7.45	-12.26	- -12.71	1					100.0	45.6			69.4	35.1	34.3			2.68										MH	Dark grey, elastic silt				
181	2074	2	C-40	-5.26	U8	8.00	- 8.80	-13.26	- -14.06						100.0	99.5	76.2	75.2	78.4	32.8	45.6	15.6	8.9	2.70	67.1	99.8	2.037	20.1	17.4	13.9	13.5	CH	Dark grey, silty clay						
182	2075	2	C-40	-5.26	D9	9.00	- 9.45	-14.26	- -14.71	2					100.0	42.6								2.68											CH	Dark grey, silty clay			
183	2076	2	C-40	-5.26	D10	10.30	- 10.75	-15.56	- -16.01	2					100.0	43.5			74.2	37.3	36.9			2.67											MH	Dark grey, elastic silt			
184	2079	2	C-41	-4.25	D3	3.00	- 3.45	-7.25	- -7.70	0				100.0	99.8	63.1	34.2	36.4	19.2	17.2			2.69												CL	Dark grey, sandy, silty clay			
185	2082	2	C-41	-4.25	D6	6.00	- 6.80	-10.25	- -11.05	1			100.0	99.4	98.9	92.7	62.2	58.5	26.9	31.7			2.70												CH	Dark grey, silty clay			
186	2083	2	C-41	-4.25	U7	7.00	- 7.80	-11.25	- -12.05						100.0	99.7	72.7	67.5	70.4	29.9	40.5	16.0	9.6	2.69	64.5	99.9	1.820	17.5	16.5	13.4	16.0	CH	Dark grey, silty clay						
187	2084	2	C-41	-4.25	D8	8.00	- 8.45	-12.25	- -12.70	2					100.0	99.3	86.9							2.68												CL	Dark grey, lean clay		
188	2085	2	C-41	-4.25	D9	9.00	- 9.45	-13.25	- -13.70	3					100.0	99.2	89.8		80.2	34.5	45.7			2.69											CH	Dark grey, lean clay			
189	2086	2	C-41	-4.25	U10	10.00	- 10.80	-14.25	- -15.05				100.0	98.5	98.2	94.6	80.4	77.2	78.0	37.1	41.0	15.5	8.7	2.69	67.5	100.0	2.079	20.1	17.4	14.8	13.5	MH	Dark grey, lean clay						
190	2087	2	C-41	-4.25	D11	11.30	- 11.75	-15.55	- -16.00	4			100.0	97.3	96.0	76.9	55.2						2.71													CH	Dark grey, silty clay with sand		
191	2088	2	C-42	-5.63	D1	1.00	- 1.45	-6.63	- -7.08	0				100.0	98.3	80.4	20.3		46.6	27.4	19.2			2.70											ML	Dark grey, silt with sand			
192	2089	2	C-42	-5.63	U2	2.00	- 2.80	-7.63	- -8.43						100.0	98.0	50.2	64.5	70.4	31.1	39.3	16.2	9.8	2.70	63.5	100.0	1.739	10.4	13.0	10.9	9.8	CH	Dark grey, silty clay						
193	2090	2	C-42	-5.63	D3	3.00	- 3.45	-8.63	- -9.08	0					100.0	80.4	25.2							2.70												CH	Dark grey, silty clay with sand		
194	2091	2	C-42	-5.63	D4	4.00	- 4.45	-9.63	- -10.08	0					100.0	30.4			57.4	36.8	20.6			2.68												MH	Dark grey, elastic silt		
195	2092	2	C-42	-5.63	U5	5.00	- 5.80	-10.63	- -11.43						100.0	99.7	40.7	61.0	64.0	29.1	34.9	16.4	10.2	2.70	62.3	99.8	1.652	11.0	14.0	11.6	12.0	CH	Dark grey, silty clay						
196	2093	2	C-42	-5.63	D6	6.00	- 6.45	-11.63	- -12.08	1					100.0	42.9								2.68													CH	Dark grey, silty clay	
197	2094	2	C-42	-5.63	D7	7.00	- 7.45	-12.63	- -13.08	1					100.0	45.8			69.9	35.7	34.2			2.68												MH	Dark grey, elastic silt		
198	2095	2	C-42	-5.63	U8	8.00	- 8.80	-13.63	- -14.43						100.0	99.7	69.2	65.8	67.4	28.2	39.2	16.1	9.7	2.71	64.1	99.6	1.789	16.5	20.3	12.0	12.0	CH	Dark grey, silty clay						
199	2096	2	C-42	-5.63	D9	9.00	- 9.45	-14.63	- -15.08	2					100.0	47.1								2.68													CH	Dark grey, silty clay	
200	2097	2	C-42	-5.63	D10	10.00	- 10.45	-15.63	- -16.08	2					100.0	44.1			69.2	36.2	33.0			2.68													MH	Dark grey, elastic silt	
201	2099	2	C-43	-4.02	D1	1.00	- 1.45	-5.02	- -5.47	0			100.0	99.8	96.3	47.4							2.69														CH	Dark grey, silty clay	
202	2100	2	C-43	-4.02	D2	2.00	- 2.45	-6.02	- -6.47	0			100.0	99.4	85.5	37.5		46.3	22.8	23.5			2.69													CL	Dark grey, lean clay		
203	2102	2	C-43	-4.02	D4	4.00	- 4.45	-8.02	- -8.47	0					100.0	99.2	59.3		68.6	30.5	38.1			2.69													CH	Dark grey, silty clay	
204	2103	2	C-43	-4.02	D5	5.00	- 5.45	-9.02	- -9.47	0					100.0	99.7	68.8							2.69														CH	Dark grey, silty clay
205	2104	2	C-43	-4.02	U6	6.00	- 6.80	-10.02	- -10.82						100.0	99.3	86.1	74.8	79.3	36.2	43.1	15.5	8.9	2.70	67.2	98.7	2.046	18.4	22.1	10.9	9.9	MH	Dark grey, lean clay						
206	2105	2	C-43	-4.02	D7	7.00	- 7.45	-11.02	- -11.47	0					100.0	96.0	48.6		74.8	37.7	37.1			2.69													MH	Dark grey, silty clay	
207	2106	2	C-43	-4.02	D8	8.00	- 8.45	-12.02	- -12.47	0					100.0	99.5	67.9							2.70														CH	Dark grey, silty clay
208	2107	2	C-43	-4.02	U9	9.00	- 9.80	-13.02	- -13.82						100.0	99.6	80.4	74.4	72.0	31.9	40.1	15.6	8.9	2.69	66.8	99.7	2.012	13.6	13.0	15.9	14.3	CH	Dark grey, silty clay						
209	2108	2	C-43	-4.02	D10	10.00	- 10.45	-14.02	- -14.47	0					100.0	99.8	60.9		75.4	35.1	40.3			2.70													MH	Dark grey, silty clay	
210	2109	2	C-43	-4.02	D11	11.00	- 11.45	-15.02	- -15.47	1					100.0	98.7	62.9							2.70														CH	Dark grey, silty clay
211	2113	2	C-44	-5.26	D3	3.00	- 3.45	-8.26	- -8.71	1					100.0	87.1	16.4		55.5	31.5	24.0			2.69													MH	Dark grey, elastic silt	
212	2114	2	C-44	-5.26	U4	4.00	- 4.80	-9.26	- -10.06						100.0	98.7	53.7	64.2	62.7	32.3	30.4	16.2	9.9	2.70	63.4	99.9	1.733	16.5	19.0	12.0	12.0	MH	Dark grey, silty clay						
213	2115	2	C-44	-5.26	D5	5.00	- 5.45	-10.26	- -10.71	1					100.0	97.4	40.1							2.68														CH	Dark grey, silty clay
214	2116	2	C-44	-5.26	D6	6.00	- 6.45	-11.26	- -11.71	1					100.0	42.9			70.0	35.3	34.7			2.68													MH	Dark grey, elastic silt	
215	2117	2	C-44	-5.26	U7	7.00	- 7.80	-12.26	- -13.06						100.0	99.6	75.2	73.5	79.0	32.6	46.4	15.7	9.0	2.70	66.5	99.9	1.985	13.9	16.1	13.0	9.0	CH	Dark grey, silty clay						
216	2118	2	C-44	-5.26	D8	8.00	- 8.45	-13.26	- -13.71	3					100.0	98.8	30.7							2.68														CH	Dark grey, silty clay
217	2119	2	C-44	-5.26	D9	9.00	- 9.45	-14.26	- -14.71	5			100.0	91.6	88.9	71.6	32.9		65.3	34.3	31.0			2.70													MH	Dark grey, elastic silt with sand	
218	2121	2	C-45	-4.77	U0	0.00	- 0.80	-4.77	- -5.57						100.0	98.5	58.6	60.0	61.0	30.1	30.8	16.4	10.3	2.69	61.8	99.7	1.620	10.6	13.0	10.3	12.0	CH	Dark grey, silty clay						









**Project:** THE DETAILED DESIGN SURVEY ON LACH HUYEN PORT INFRASTRUCTURE CONSTRUCTION IN VIETNAM  
**Item:** Soil Investigation for Port Portion - Part B  
**Volume 2.3:** The appendices of Navigation Channel area  
**Date:** 27/07/2011

**SUMMARY TABLE OF PHYSICO - MECHANICAL PROPERTIES OF SOIL SAMPLES**

No.	Test No.	Layer	Borehole	GL (m)	Sample No.	Depth (m)		Field Test Result	Percent passed sieve size (mm)								Natural moisture content w (%)	Atterberg Limits			Bulk density (KN/m <sup>3</sup> )		Specific Gravity	Porosity n (%)	Degree of saturation G (%)	Void ratio e <sub>0</sub>	Unconfined compression test				Soil group	Description					
						GL-(m)	DL(m)		SPT	9.5	4.75	2.00	0.85	0.425	0.3	0.075		< 0.005	Liquid limit W <sub>L</sub> (%)	Plastic limit W <sub>p</sub> (%)	Plasticity index I <sub>p</sub> (%)	Natural					Dry	qu (KN/m <sup>2</sup> )		Failure Strain ε (%)							
																												Sample		Sample							
						From	To		From	To	N																										
351	2241	2	C-59	-8.81	U5	5.00	- 5.80	-13.81	- 14.61						100.0	99.4	74.0	72.0	73.6	31.0	42.6	15.7	9.1	2.69	66.0	99.7	1.945	9.5	11.4	17.0	10.9	CH	Dark grey, silty clay				
352	2242	2	C-59	-8.81	D6	6.00	- 6.45	-14.81	- 15.26	0					100.0	40.1								2.68											CH	Dark grey, silty clay	
353	2243	2	C-59	-8.81	D7	7.00	- 7.45	-15.81	- 16.26	0					100.0	44.0								2.67											CH	Dark grey, silty clay	
354	2244	2	C-60	-9.31	D1	1.00	- 1.45	-10.31	- 10.76	0					100.0	94.9	32.5							2.67												CH	Dark grey, silty clay
355	2245	2	C-60	-9.31	U2	2.00	- 2.80	-11.31	- 12.11						100.0	98.4	70.6	71.1	70.5	31.4	39.0	15.8	9.2	2.70	65.8	99.7	1.927	8.3	7.2	12.9	9.0	CH	Dark grey, fat clay				
356	2246	2	C-60	-9.31	D3	3.00	- 3.45	-12.31	- 12.76	0					100.0	94.2	49.0							2.66												CH	Dark grey, silty clay
357	2247	2	C-60	-9.31	D4	4.00	- 4.45	-13.31	- 13.76	0					100.0	42.3								2.67												CH	Dark grey, silty clay
358	2248	2	C-60	-9.31	U5	5.00	- 5.80	-14.31	- 15.11						100.0	99.4	69.8	79.9	79.2	36.5	42.7	15.3	8.5	2.69	68.4	99.3	2.166	8.9	10.2	11.9	12.0	MH	Dark grey, elastic silt				
359	2249	2	C-60	-9.31	D6	6.30	- 6.75	-15.61	- 16.06	1					100.0	98.3	97.7							2.67												CH	Dark grey, silty clay
360	2250	2	C-61	-9.14	D1	1.00	- 1.45	-10.14	- 10.59	0					100.0	45.3								2.67												CH	Dark grey, silty clay
361	2251	2	C-61	-9.14	U2	2.00	- 2.80	-11.14	- 11.94						100.0	98.3	61.6	62.3	58.6	27.4	31.3	16.2	10.0	2.69	62.8	99.3	1.687	8.5	5.6	9.9	9.9	CH	Dark grey, silty clay				
362	2252	2	C-61	-9.14	D3	3.00	- 3.45	-12.14	- 12.59	0					100.0	42.8								2.67												CH	Dark grey, silty clay
363	2253	2	C-61	-9.14	D4	4.00	- 4.45	-13.14	- 13.59	0					100.0	98.0	38.3							2.69												CH	Dark grey, silty clay
364	2254	2	C-61	-9.14	U5	5.00	- 5.80	-14.14	- 14.94						100.0	98.9	73.0	69.4	71.6	30.1	41.5	15.9	9.4	2.69	65.1	100.0	1.867	11.7	11.4	16.9	11.9	CH	Dark grey, silty clay				
365	2255	2	C-61	-9.14	D6	6.00	- 6.45	-15.14	- 15.59	0					100.0	40.5								2.68												CH	Dark grey, silty clay
366	2256	2	C-61	-9.14	D7	7.00	- 7.45	-16.14	- 16.59	0					100.0	97.2	34.9							2.68												CH	Dark grey, silty clay
367	2258	2	C-62	-9.54	U2	2.00	- 2.80	-11.54	- 12.34						100.0	99.1	66.3	82.4	81.1	37.3	43.8	15.2	8.3	2.69	69.0	99.5	2.226	12.8	11.6	9.9	10.9	MH	Dark grey, elastic silt				
368	2259	2	C-62	-9.54	D3	3.00	- 3.45	-12.54	- 12.99	0					100.0	95.2	34.0							2.68												CH	Dark grey, silty clay
369	2260	2	C-62	-9.54	D4	4.00	- 4.45	-13.54	- 13.99	0					100.0	97.9	40.6							2.67												CH	Dark grey, silty clay
370	2261	2	C-62	-9.54	U5	5.00	- 5.80	-14.54	- 15.34						100.0	97.8	70.1	80.4	79.6	36.6	43.0	15.3	8.5	2.70	68.6	99.4	2.183	9.1	9.9	16.0	14.0	MH	Dark grey, elastic silt				
371	2262	2	C-62	-9.54	D6	6.00	- 6.45	-15.54	- 15.99	1					100.0	94.7	48.8							2.66												CH	Dark grey, silty clay
372	2263	2	C-63	-9.57	D1	1.00	- 1.45	-10.57	- 11.02	0					100.0	98.5	41.9							2.69												CH	Dark grey, silty clay
373	2264	2	C-63	-9.57	U2	2.00	- 2.80	-11.57	- 12.37						100.0	99.4	67.0	67.7	70.5	30.0	40.5	15.9	9.5	2.70	64.9	98.8	1.852	10.3	10.2	12.8	14.0	CH	Dark grey, fat clay				
374	2265	2	C-63	-9.57	D3	3.00	- 3.45	-12.57	- 13.02	0					100.0	44.1								2.67												CH	Dark grey, silty clay
375	2266	2	C-63	-9.57	D4	4.00	- 4.45	-13.57	- 14.02	0					100.0	42.6								2.67												CH	Dark grey, silty clay
376	2267	2	C-63	-9.57	U5	5.00	- 5.80	-14.57	- 15.37						100.0	98.2	69.8	77.7	79.6	36.4	43.3	15.5	8.7	2.70	67.7	99.9	2.099	7.7		12.9					MH	Dark grey, silty clay	
377	2268	2	C-63	-9.57	D6	6.00	- 6.45	-15.57	- 16.02	0					100.0	39.6								2.65												CH	Dark grey, silty clay
378	2269	2	C-64	-10.02	D1	1.00	- 1.45	-11.02	- 11.47	0					100.0	97.3	88.3	29.3						2.69												CH	Dark grey, silty clay
379	2270	2	C-64	-10.02	U2	2.00	- 2.80	-12.02	- 12.82						100.0	98.7	77.1	73.0	70.7	32.1	38.6	15.7	9.1	2.70	66.4	99.8	1.976	8.2	9.6	12.0	10.9	CH	Dark grey, fat clay				
380	2271	2	C-64	-10.02	D3	3.00	- 3.45	-13.02	- 13.47	0					100.0	45.6								2.68												CH	Dark grey, silty clay
381	2272	2	C-64	-10.02	D4	4.00	- 4.45	-14.02	- 14.47	0					100.0	47.2								2.67												CH	Dark grey, silty clay
382	2273	2	C-64	-10.02	U5	5.10	- 5.90	-15.12	- 15.92						100.0	99.6	76.0	74.3	73.2	34.3	38.9	15.6	9.0	2.69	66.7	99.6	2.007	10.3	9.2	10.9	15.0	CH	Dark grey, fat clay				
383	2274	2	C-65	-10.64	D1	1.00	- 1.45	-11.64	- 12.09	0					100.0	95.8	39.6							2.66												CH	Dark grey, silty clay
384	2275	2	C-65	-10.64	U2	2.00	- 2.80	-12.64	- 13.44						100.0	98.8	67.8	72.5	71.7	28.8	42.9	15.7	9.1	2.69	66.1	99.8	1.949	9.5	11.5	11.9	14.9	CH	Dark grey, silty clay				
385	2276	2	C-65	-10.64	D3	3.00	- 3.45	-13.64	- 14.09	0					100.0	95.9	40.8							2.67												CH	Dark grey, silty clay
386	2277	2	C-65	-10.64	D4	4.00	- 4.45	-14.64	- 15.09	0					100.0	96.9	42.4							2.70												CH	Dark grey, silty clay
387	2278	2	C-65	-10.64	U5	5.00	- 5.80	-15.64	- 16.44						100.0	99.5	70.0	71.7	73.8	30.0	43.8	15.6	9.1	2.70	66.5	97.8	1.981	12.7	10.9	12.0	11.0	CH	Dark grey, silty clay				
388	2279	2	C-66	-11.98	D1	1.00	- 1.45	-12.98	- 13.43	0					100.0	41.0								2.67												CH	Dark grey, silty clay
389	2280	2	C-66	-11.98	U2	2.00	- 2.80	-13.98	- 14.78						100.0	99.3	64.7	73.3	73.4	33.5	39.9	15.7	9.1	2.70	66.4	100.0	1.978	8.6	7.0	7.9	12.0	CH	Dark grey, fat clay				
390	2281	2	C-66	-11.98	D3	3.00	- 3.45	-14.98	- 15.43	0					100.0	42.3								2.68												CH	Dark grey, silty clay
391	2282	2	C-66	-11.98	D4	4.00	- 4.45	-15.98	- 16.43	0					100.0	43.9								2.68												CH	Dark grey, silty clay
392	2283	2	C-67	-11.54	D1	1.00	- 1.45	-12.54	- 12.99	0					100.0	45.0								2.68												CH	Dark grey, silty clay
393	2284	2	C-67	-11.54	U2	2.00	- 2.80	-13.54	- 14.34						100.0	97.7	65.8	71.0	67.1	25.2	41.9	15.8	9.2	2.69	65.7	99.5	1.919	6.0	7.1	10.0	10.0	CH	Dark grey, fat clay				
394	2285	2	C-67	-11.54	D3	3.00	- 3.45	-14.54	- 14.99	0					100.0	96.3	45.2							2.68												CH	Dark grey, silty clay















**Project:** THE DETAILED DESIGN SURVEY ON LACH HUYEN  
**PORT INFRASTRUCTURE CONSTRUCTION IN VIETNAM**

**Item:** Soil Investigation for Port Portion - Part B

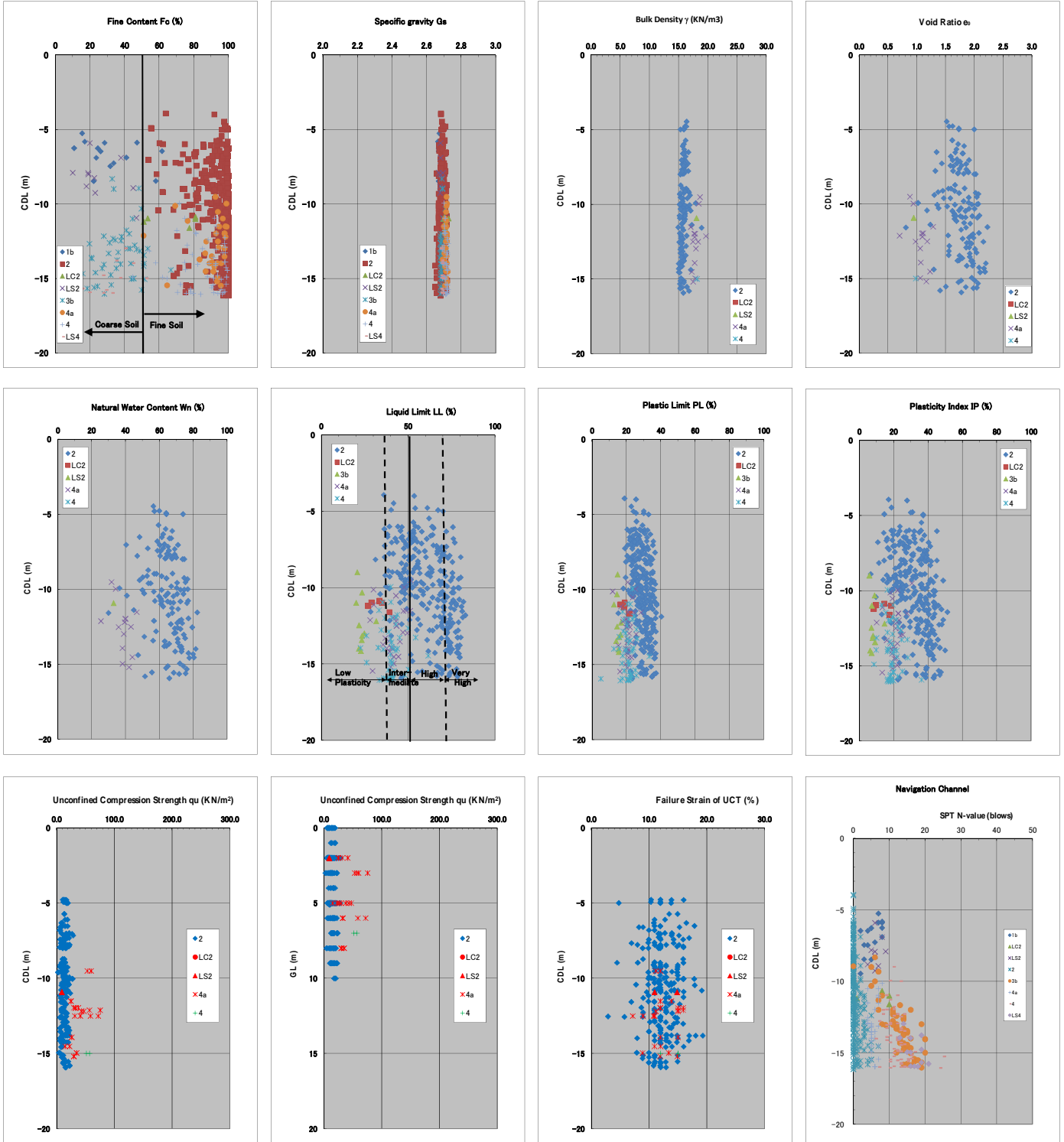
**Volume 2.3:** The appendices of Navigation Channel area

**Date:** 27/07/2011

### SUMMARY TABLE OF PHYSICO - MECHANICAL PROPERTIES OF SOIL SAMPLES

Layer No.	Soil Type		SPT N-value	Specific Gravity	Fine Content (%)	Natural moisture content w (%)	Atterberg Limits			Bulk density (KN/m <sup>3</sup> )		Void ratio eo	Unconfined compression test	
							Liquid limit W <sub>L</sub> (%)	Plastic limit W <sub>p</sub> (%)	Plasticity index I <sub>p</sub> (%)	Natural	Dry		q <sub>u</sub> (KN/m <sup>2</sup> )	ef (%)
1b	Grey, silty, clayey sand with trace of shell (SC-SM)	Max	8	2.70	61.6	-	-	-	-	-	-	-	-	-
		Min	2	2.67	10.8	-	-	-	-	-	-	-	-	-
		Average	5.5	2.68	31.5	-	-	-	-	-	-	-	-	-
2	Dark grey, bluish grey, fat clay, silty clay with sand (CH)	Max	5	2.72	100.0	82.4	82.9	40.4	51.2	19.3	14.9	2.226	28.8	19.3
		Min	0	2.65	53.8	30.0	28.3	15.3	6.6	15.2	8.3	0.811	2.1	2.9
		Average	2.1	2.69	94.2	64.9	61.6	29.3	32.4	16.1	9.8	1.768	13.2	12.3
3b	Grey, yellowish grey, silty, clayey sand (SC-SM)	Max	25	2.71	66.7	-	31.5	16.9	14.6	-	-	-	-	-
		Min	0	2.68	15.8	-	20.0	12.7	5.8	-	-	-	-	-
		Average	13.9	2.69	37.5	-	23.3	15.1	8.2	-	-	-	-	-
4a	Bluish and yellowish grey, reddish brown, reddish grey, silty, lean clay with sand and trace of shell (CL)	Max	8	2.72	99.0	46.6	51.4	28.5	30.6	20.1	16.0	1.283	75.5	22.3
		Min	4	2.69	50.9	25.5	28.0	12.0	10.1	17.4	11.9	0.700	14.8	7.2
		Average	5.6	2.71	90.1	38.3	41.3	20.8	20.4	18.3	13.3	1.055	41.0	13.3
4	Bluish and yellowish grey, reddish brown, light grey, silty, lean clay with sand (CL)	Max	24	2.73	99.3	-	61.4	33.3	36.1	-	-	-	-	-
		Min	7	2.69	44.7	-	22.5	5.1	8.5	-	-	-	-	-
		Average	12.2	2.71	85.3	-	39.9	20.9	19.0	-	-	-	-	-
LC2	Yellowish and bluish grey, reddish brown, grey, silty, sandy, lean clay (CL)	Max	10	2.73	80.9	-	39.1	21.6	18.3	-	-	-	-	-
		Min	0	2.70	51.1	-	26.9	16.5	8.4	-	-	-	-	-
		Average	7.3	2.71	68.7	-	32.6	19.0	13.6	-	-	-	-	-
LS2	Dark grey, yellowish and bluish grey, silty, clayey sand with trace of shell (SC-SM)	Max	9	2.69	46.8	33.0	-	-	-	18.4	13.8	0.945	9.1	14.8
		Min	4	2.67	10.0	33.0	-	-	-	18.4	13.8	0.945	8.9	10.9
		Average	6.3	2.68	26.1	33.0	-	-	-	18.4	13.8	0.945	9.0	12.9
LS4	Grey, light grey, silty, clayey sand (SC-SM)	Max	21	2.69	52.1	-	-	-	-	-	-	-	-	-
		Min	14	2.68	15.0	-	-	-	-	-	-	-	-	-
		Average	17.3	2.68	32.5	-	-	-	-	-	-	-	-	-

### Navigation Channel and Turning Basin Area



## 5) Material Test Result for Reclamation Sand

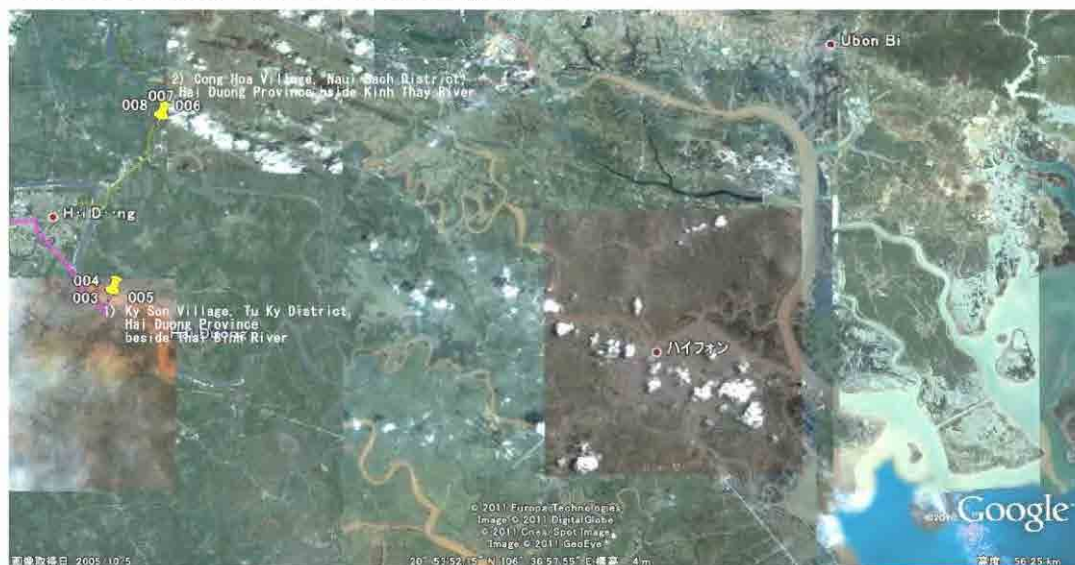
# Material Sampling and Testing for Reclamation Work

## Material Sampling

All samples were taken by auger boring under instruction by the specialist from OC at site. Samples were kept in the sealed plastic bags right after sampling for keeping the water content.

08 samples were taken at 02 sites, in there: (04) samples were taken at the sand mine located at Ky Son Village, Tu Ky District, Hai Duong Province beside Thai Binh River, (04) samples were taken at the sand mine where located at Cong Hoa Village, Nam Sach District, Hai Duong Province beside Kinh Thay River.

Location of both sites are shown in the flowing **Figure 1**



**Figure 1 – Location map of sampling site**

## Field Density Test

Field density test was carried out by sand replacement method at a depth of 0.5m from GL. Detail method is show in Appendix 1.1 – Photos.

All samples taken at 02 sites are Dark grey, poorly grade Sand (SP), their permeability have large range, varies from  $0.31 \times 10^{-13} \text{ cm/s}$  (TB-2, D1) to  $2.09 \times 10^{-3} \text{ cm/s}$  (KT-1, D2). The maximum dry unit weight value retrieved from compaction test (Modified Proctor method) varies from  $1.528 \text{ g/cm}^3$  (KT-2, D1) to  $1.656 \text{ g/cm}^3$  (TB-2, D1).



## Actual Quantity

Actual quantity of the all work is shown in table 1.1 below.

Table 1.1 Actual Quantities of Material Sampling, Field Test and Laboratory Test

No	Item and Property/Test	Unit	Total
<b>I</b>	<b>Material sampling and testing for reclamation sand for the port potion</b>		
1	Sampling of material by Auger boring	No	4
2	Field density test (Sand replacement test)	No	4
3	Grain Size Analysis	No	8
4	Water content	No	8
5	Specific gravity	No	8
6	Proctor test (Modified Proctor method)	No	8
7	Permeability test	No	8
<b>II</b>	<b>Soil mixing cement test</b>		
1	Mixing and making specimens	No	36
2	Unconfined compression test	No	36
3	PH test	No	36

# Test Results

## SUMMARY TABLE OF PHYSICO-MECHANICAL PROPERTIES OF MATERIAL SAMPLES

### LACH HUYEN PORT INFRASTRUCTURE CONSTRUCTION PROJECT

Test No.	Borehole	Sample No.	Depth (m)		Percent (%) passed sieve size (mm)						Natural moisture content w (%)	Specific gravity $\Delta$ ( $g/cm^3$ )	Sand replacement test		Compaction test		Permeability K ( $10^{-3} cm/s$ )	Group soil	Description
			From	To	4.75	2.00	0.85	0.425	0.25	0.075			Wet unit weight ( $g/cm^3$ )	Dry unit weight ( $g/cm^3$ )	Optimum moisture content (%)	Maximum dry unit weight ( $g/cm^3$ )			
1	TB-1	D1	0.50	- 1.00	100.00	98.3	83.33	52.13	1.96	10.52	2.66	1.550	1.402	9.02	1.614	1.39	SP	Dark grey, poorly graded sand	
2	TB-1	D2	1.00	- 1.50	100.00	99.52	40.68	15.75	1.43	12.36	2.66			8.02	1.607	0.59	SP	Dark grey, poorly graded sand	
3	TB-2	D1	0.50	- 1.00	100.00	98.23	57.42	25.65	1.31	17.11	2.64	1.631	1.393	8.64	1.656	0.31	SP	Dark grey, poorly graded sand	
4	TB-2	D2	1.00	- 1.50	100.00	99.84	77.01	33.48	1.89	18.48	2.66			9.05	1.623	0.48	SP	Dark grey, poorly graded sand	
5	KT-1	D1	0.50	- 1.00	100.00	99.5	80.19	42.09	1.33	21.46	2.65	1.648	1.357	10.32	1.577	1.19	SP	Dark grey, poorly graded sand	
6	KT-1	D2	1.00	- 1.50	100.00	99.41	63.24	23.88	1.02	25.67	2.65			7.31	1.558	2.09	SP	Dark grey, poorly graded sand	
7	KT-2	D1	0.50	- 1.00	100.00	99.76	93.19	59.26	1.91	31.75	2.66	1.796	1.363	8.70	1.528	1.89	SP	Dark grey, poorly graded sand	
8	KT-2	D2	1.00	- 1.50	100.00	99.2	95.76	49.93	1.53	33.92	2.65			9.88	1.543	0.48	SP	Dark grey, poorly graded sand	

## 6) Soil and Cement Mixing Test Result

# Soil Mixing Cement Test

## Equipment and Preparation of Samples for test

### Equipment

All equipment for mixing test were prepared by laboratory of Port & Waterway Engineering Consultant JSC and approved by OC geotechnical specialist as following:

- 36 plastic molds with inside diameter of 45mm and height of 90mm;
- Soil material what saved from laboratory test of Lach Huyen Port Infrastructure Construction Project consists of layer 2 and layer 5;
- Sea water taken from Lach Huyen site;
- Type of cement PCB30 with Chinfon manufacture;
- Mixer made in UK with Controls manufacture;
- Balance, knife and other accessory for test.....

### Preparation of Samples for Test

Before mixing, the water content of soil was adjusted to natural water content. The mixing process is as follow:

- Measure the weight of soil, cement and water for mixing under the instruction ratio from specialist from OC;
- Checking the PH value of soil;
- At the beginning mix the mixture consists of sea water, soil and cement by handy in 2 minutes, then mix them by mixer machine in low speed in 3 minutes, continuing 1 minute with handy mixing, at final mix with normal speed in 4 minutes. So the total time for mixing is 10 minutes.
- After mixing, fill up the mixture in to the plastic molds and curing all samples in the curing box same as natural condition. All samples were cured until 7 days and 28 days for each period of compression.

### Test Result

Base on the unconfined compression result of all samples at 03 ratios between cement and soils ( $\text{kg}/\text{m}^3$ ) present that:

- **Layer 2** on 07<sup>th</sup> day, the minimum value of unconfined compression test is  $1.15\text{kgf}/\text{cm}^2$  (test No. 20, cement/ soil =  $100\text{kg}/\text{m}^3$ ), the maximum value of unconfined compression test is  $3.80\text{kgf}/\text{cm}^2$  (test No. 33, cement/ soil =  $200\text{kg}/\text{m}^3$ ).



On 28<sup>th</sup> day, the minimum value of unconfined compression test is 1.45kgf/cm<sup>2</sup> (test No. 24, cement/soil = 100kg/m<sup>3</sup>), the maximum value of unconfined compression test is 7.20kgf/m<sup>3</sup> (test No. 35, cement/ soil = 200kg/ m<sup>3</sup>).

- **Layer 5:** on 07<sup>th</sup> day, the minimum value of unconfined compression test is 1.81kgf/cm<sup>2</sup> (test No. 3, cement/soil = 100kg/ cm<sup>3</sup>), the maximum value of unconfined compression test is 5.80kgf/cm<sup>2</sup> (test No. 14, cement/soil = 200kgf/cm<sup>3</sup>).

On 28<sup>th</sup> day, the minimum value of unconfined compression test is 3.38kgf/cm<sup>2</sup> (test No. 6, cement/soil = 100kg/ m<sup>3</sup>), the maximum value of unconfined compression test is 9.16kgf/ cm<sup>2</sup> (test No. 16, cement/soil = 200kg/ m<sup>3</sup>)

## Test Result Summary

### SUMMARY TABLE PROPERTIES OF SOIL MIXING CEMENT TEST

#### LACH HUYEN PORT INFRASTRUCTURE CONSTRUCTION PROJECT

No.	Layer	Cement/soil (kg/m <sup>3</sup> )	Age (days)	Test No.	Type of Cement: PCB30 W/C(%): 1/1	
					Unconfined Compression test	
					q <sub>u</sub> (kgf/cm <sup>2</sup> )	ε (%)
1	2	100	7	19	1.20	2.90
2				20	1.15	3.00
3				21	1.17	3.00
4			28	22	1.52	2.70
5				23	1.50	3.40
6				24	1.45	4.40
7		150	7	25	2.73	2.60
8				26	2.78	2.90
9				27	2.75	2.90
10			28	28	4.25	3.00
11				29	4.23	3.40
12				30	4.28	3.10
13		200	7	31	3.73	2.90
14				32	3.68	3.40
15				33	3.80	2.80
16			28	34	7.14	3.20
17				35	7.20	4.00
18				36	7.01	4.10
19	5	100	7	1	2.09	2.20
20				2	2.32	2.10
21				3	1.81	2.80
22			28	4	3.58	2.30
23				5	3.44	3.00
24				6	3.38	3.00
25		150	7	7	4.92	2.90
26				8	4.82	2.90
27				9	4.05	2.60
28			28	10	6.45	3.10
29				11	6.43	3.40
30				12	5.84	3.20
31		200	7	13	5.76	2.80
32				14	5.80	2.60
33				15	5.67	2.90
34			28	16	9.16	3.40
35				17	8.64	3.50
36				18	8.94	3.30

*Note:*

\* Type of cement: Chinfor  
\* PH value

Layer	PH
2	8.0
5	7.8

## Appendix 2-2

### Equipment Used For Topographic / Bathymetric Survey

In accordance with the requirements of the time schedule and quality of survey works, the following latest model equipment was used:

- Single frequency Global Positioning System (GPS) equipment Trimble R3, which is made in the USA, was used to establish the fourth order horizontal and grade two traverse control points.

The accuracy of Trimble R3 GPS equipment is as follows:

Horizontal accuracy:  $\pm (5 \text{ mm} + 0.5 \text{ ppm})^2 \text{ RMS}$

Vertical accuracy:  $\pm (5 \text{ mm} + 1 \text{ ppm})^2 \text{ RMS}$

- Dual frequency Differential Global Positioning System (DGPS) Seastar HP8200, which is made by Furgo, has a horizontal accuracy of less than 10 cm.



**Photo of DGPS Seastar HP8200**

- Dual frequency Elac Hydrostar 4300 (200 KHz and 30 KHz), which is made by ELAC Nautik, has a measuring accuracy of  $\pm 0.5\% \text{ H}$  (H is the measured depth). This echo sounder was used for carrying out the bathymetric survey for the channel and basin area.



**Photo of Odom Hydro Track and Elac Hydrostar 4300**

- Single frequency echo sounder Odom Hydrotrack (200 KHz), which is made in the USA, was used for the remaining bathymetric survey areas.

The accuracy is 1 cm (0.1% of depth value).



- Heave correction equipment called TSS DMS25 (Dynamic Motion Sensor), which is made in the USA.



**Photo of Dynamic Motion Sensor DMS25**

- Sound velocimeter Digibar Pro™, which is made by Odom, has a velocity accuracy of  $\pm 0.3$  m/s.



**Photo of Digibar Pro and Dynamic Motion Sensor DMS25**

- Leveling equipment SOKKIA C320i, which is made in Japan, was used for establishing the vertical control network.
- Total station SOKKIA Set 210, which is made in Japan, was used for the topographic survey.
- Automatic self-recording tide gauge SEBA ALPHA, which is made in Holland, was used for tide observation.



**Photo of Tide Gauge SEBA ALPHA**

- Laptop computers, printers, and plotters.
- The following software were used for data processing:
  - GEOMEX93 Version 3.3 software, which is provided by the Hanoi University of Mining and Geology was used for the adjustment of the IV order vertical control network.
  - Geomatic Trimble Office was used for the adjustment of the fourth order horizontal network.
  - Navigation and data collection software Hypack Max version 2009 was used for the bathymetric survey.
  - Topographic software provided by Hai Hoa Company Ltd. was used for the processing and plotting of maps.
  - Microsoft Office, and computer assisted drawing software such as AutoCAD and Softdesk were used for editing the maps and making the report.

Appendix 2-3

Horizontal and Vertical Control Networks

## 1) Establishing the fourth order and grade two traverse network

The networks are designed based on the project site and map with a scale of 1/25000 and national control points near the survey area. The location of the control points meets the following requirements:

- Located at a stable and convenient place for GPS measurement.
- Easy to use for developing traverse networks and other survey works.

Information of points, such as name, date of construction and project name, are written on the top.

### • Field survey

The GPS static measurement method was used for establishing the fourth order and grade two traverse networks. The network was measured in three sessions using four sets of Trimble R3 equipment. The network was connected to two third order national control points, i.e. 118528 and 118511.



**Photo of GPS Measurement National Control Point.**

All survey information of each measured point such as weather condition, antenna's height and the number of satellites were recorded in the daily report.

All data collected at each point was recorded into an internal memory, with 10 seconds interval, separately by names for post-processing.

### • Post-processing and network adjustment

The Trimble Geomatic Office software was used for baseline processing and network adjustment. The processing module was used for processing all baselines.

A check of the measured data was performed through geometric misclosure.

#### *Network adjustment*

An adjustment module was used for the control network adjustment. In order to reduce the effect of scale factor in accordance with the technical specification, the network was adjusted in the VN2000 coordinate system, central meridian 105<sup>0</sup>45', zone 3<sup>0</sup> (Ko=0.9999).

The weighting value of all GPS solutions is calculated based on an alternative method. After calculating, the received result of root means square of weighting unit error is 1.0 and tested result of  $\chi^2$  with  $\alpha=95\%$  is PASS. The maximum position error is  $mp = \pm 0.003$  m (Point LH3).

## 2) Fourth order vertical control network

The fourth order vertical control network was established by using closed geometry leveling



method with leveling equipment SOKKIA C320 and leveling staffs in accordance with the standards of VNLAD.

The fourth order leveling route was carried out through all GPS and traverse points with misclosure of  $f_h \leq 20\sqrt{L}$  ( $L$  is the length of leveling route in km) based on AKS6 benchmark. This point is a third order benchmark with an elevation of 5.238 m in the chart datum, which is used for all Haiphong Port projects.

A special software was used for the adjustment of the fourth order vertical control network. The result shows that the achieved accuracy is within the allowable limit.

Appendix 2-4

Harmonic Analysis Results

### Results Of Harmonic Analysis At Ben Got Station

BEN GOT                      Units in cm  
 Station 98                      Time Zone = 105,                      Latitude = 2048,                      Longitude = 10654  
 Number of Valid Data = 726                      Average = 197.4                      Standard Deviation = 7.76  
 Theoretical Rms = 0.97                      Matrix Condition = 0.78  
 Analysis of Hourly Tidal Heights                      Stn 998                      16H 12/ 4/11 to 23H 12/ 5/11  
 No. Obs. = 728                      No. Pts. Anal.= 728                      Midpt. = 19H 27/ 4/11                      Separation = 1.00

NO	NAME	FREQUENCY	STN	M-Y/ M-Y	A	G	AL	GL
1	Z0	0.00000000	998	411/ 511	196.993	0.00	196.993	0.00
2	MSF	0.00282193	998	411/ 511	4.787	148.62	4.787	272.69
3	2Q1	0.03570635	998	411/ 511	9.696	344.13	9.931	8.89
4	Q1	0.03721850	998	411/ 511	17.545	350.84	17.798	226.82
5	O1	0.03873065	998	411/ 511	79.396	42.58	79.779	129.81
6	NO1	0.04026859	998	411/ 511	1.993	79.21	2.666	177.04
7	K1	0.04178075	998	411/ 511	69.141	91.46	69.618	32.19
8	J1	0.04329290	998	411/ 511	2.669	30.03	2.719	179.45
9	OO1	0.04483084	998	411/ 511	1.496	179.66	1.731	150.33
10	UPS1	0.04634299	998	411/ 511	0.349	343.44	0.377	162.90
11	N2	0.07899925	998	411/ 511	0.950	96.96	0.956	270.23
12	M2	0.08051140	998	411/ 511	5.921	105.76	5.939	129.48
13	S2	0.08333334	998	411/ 511	3.160	155.12	3.160	305.24
14	ETA2	0.08507364	998	411/ 511	0.658	217.56	0.661	117.39
15	MO3	0.11924210	998	411/ 511	1.446	308.15	1.458	59.09
16	M3	0.12076710	998	411/ 511	2.141	227.16	2.153	82.84
17	MK3	0.12229210	998	411/ 511	1.959	14.86	1.978	339.31
18	SK3	0.12511410	998	411/ 511	1.046	111.66	1.053	202.51
19	MN4	0.15951060	998	411/ 511	0.191	201.43	0.193	38.41
20	M4	0.16102280	998	411/ 511	1.685	292.95	1.695	340.38
21	MS4	0.16384470	998	411/ 511	0.582	7.77	0.584	181.60
22	S4	0.16666670	998	411/ 511	0.282	106.85	0.282	47.09
23	2MK5	0.20280360	998	411/ 511	0.517	178.12	0.524	166.28
24	2SK5	0.20844740	998	411/ 511	0.856	251.72	0.862	132.69
25	2MN6	0.24002200	998	411/ 511	0.029	274.89	0.029	135.59
26	M6	0.24153420	998	411/ 511	0.399	297.22	0.402	8.36
27	2MS6	0.24435610	998	411/ 511	0.321	27.76	0.323	225.31
28	2SM6	0.24717810	998	411/ 511	0.135	312.95	0.135	276.90
29	3MK7	0.28331490	998	411/ 511	0.254	63.48	0.258	75.35
30	M8	0.32204560	998	411/ 511	0.123	324.31	0.124	59.16

Appendix 2-5

Detailed Procedure on Survey and Data Processing



- **Coordinate System**

VN2000 coordinate system with central Meridian  $105^{\circ}45'$ , zone 3<sup>0</sup> ( $K_0=0.9999$ ). The detailed parameters of coordinate system are as follows:

Spheroid	:	WGS 84
Semi major axis	:	6378137m
1/ flattening	:	298.25723563
Projection	:	UTM
Central Meridian	:	$105^{\circ} 45' E$
False Easting	:	500 km
False Northing	:	0.000
Scale factor at C.M:		0.9999

*Elevation system:* Chart Datum. (*Lowest Low Water Level*)

- **Sounding Methodology**

Before installing the equipment on survey boat, the DGPS system HP8200 was tested at National control point named 118528 and GPS point named GPS17 (*established in 2004 for Hai Phong port rehabilitation project Phase 2*), Position check for 2 minutes operating in the static mode confirmed that a mean error on fixes of *less than 0.1m was maintained*.

A computerized data gathering and navigation system was added to the DGPS system and Echo sounder to enable all survey operations to be accurately positioned and to log all horizontal and sounding data.

In accordance with standard practice bar checks were carried out at the start and finish of each sounding day.

In order to reduce an affect of wave to sounding data, the heave correction equipment named TSSDMS 25 was installed on boat in combination with the sounding system.



*Photo of sounding system on boat*

The dynamic screen display provided the user with continuously updated information on water depth, grid coordinates, quality of fix, heading, speed and other course guidance data.

**For vertical control**, the water levels observed by using self - recording tide gauge located at Ben Got Jetty and water levels collected at Hon Dau National hydrological station were used to reduce the surveyed depths to Chart Datum. The water level data with recording interval of 10 minutes was input for data processing.

- **Data Processing.**

***Data processing for channel and basin area.***

The processing of bathymetric surveyed data for Lach Huyen channel in this project is divided into two segments with using water level observed at Ben Got and water level collected at Hon Dau National Tide gauge.

Detailed execution of data processing in this project is described as follows:

- Along the Lach Huyen channel from station Km 26+000 to Km 34+800 the both water level observed at Ben Got and Hon Dau were used to process the surveyed depth to Chart Datum.
- The bathymetric surveyed data of segment from station Km 34+800 to the end of Lach Huyen channel (Km 42+000) was processed basing on water level of Hon Dau station only.

Both surveyed data of dual frequency (200KHz and 30 KHz) were input to Single Beam Editor Module in HyPack Max for processing.

***Data processing for Sand dyke and Dumping site areas.***

The bathymetric surveyed data for Sand dyke and Dumping sites were processed basing on water level observed at Ben Got and Hon Dau.

The Hypack Max scans a number of successive depth values dependent on the scale of the eventual chart and selects the minimum reading for plotting.

Hypack Max is then used to sort and convert the XYZ values into a suitable format for final chart presentation by AUTOCAD.